Abjad Documentation

Release 2.10

Trevor Bača, Josiah Oberholtzer, Víctor Adán

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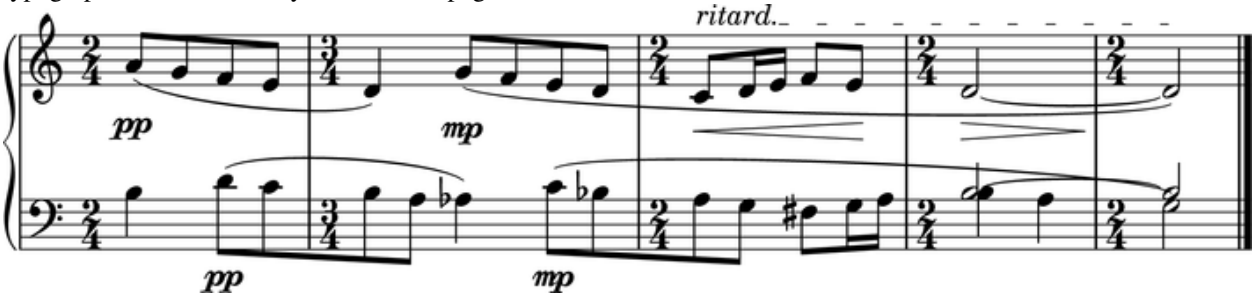
Abjad helps composers build up complex pieces of music notation in an iterative and incremental way. Use Abjad to create a symbolic representation of all the notes, rests, staves, tuplets, beams and slurs in any score. Because Abjad extends the Python programming language, you can use Abjad to make systematic changes to your music as you work. And because Abjad wraps the powerful LilyPond music notation package, you can use Abjad to control the typographic details of the symbols on the page.



CHAPTER

ONE

START HERE

1.1 Abjad?

Abjad is an interactive software system designed to help composers build up complex pieces of music notation in an iterative and incremental way. Use Abjad to create a symbolic representation of all the notes, rests, staves, tuplets, beams and slurs in any score. Because Abjad extends the Python programming language, you can use Abjad to make systematic changes to your music as you work. And because Abjad wraps the powerful LilyPond music notation package, you can use Abjad to control the typographic details of the symbols on the page.

1.1.1 Abjad extends LilyPond

LilyPond is an open-source music notation package invented by Han-Wen Nienhuys and Jan Niewenhuizen and extended by an international team of developers and musicians. LilyPond differs from other music engraving programs in a number of ways. LilyPond separates musical content from page layout. LiyPond affords typographic control over almost everything. And LilyPond implements a powerfully correct model of the musical score.

You can start working with Abjad right away because Abjad creates LilyPond files for you automatically. But you will work with Abjad faster and more effectively if you understand the structure of the LilyPond files Abjad creates. For this reason we recommend new users spend a couple of days learning LilyPond first.

Start by reading about text input in LilyPond. Then work the LilyPond tutorial. You can test your understanding of LilyPond by using the program to engrave of a Bach chorale. Use a grand staff and and include slurs, fermatas and so on. Once you can engrave a chorale in LilyPond you'll understand the way Abjad works with LilyPond behind the scenes.

1.1.2 Abjad extends Python

Python is an open-source programming language invented by Guido van Rossum and further developed by a team of programmers working in many countries around the world. Python is used to provision servers, process text, develop distributed systems and do much more besides. The dynamic language and interpreter features of Python are similar to Ruby while the syntax of Python resembles C, C++ and Java.

To get the most out of Abjad you need to know (or learn) the basics of programming in Python. Abjad extends Python because it makes no sense to reinvent the wheel modern programming langauges have developed to find, sort, store, model and encapsulate information. Abjad simply piggy-backs on the ways of doing these things that Python provides. So to use Abjad effectively you need to know the way these things are done in Python.

Start with the Python tutorial. The tutorial is structured in 15 chapters and you should work through the first 12. This will take a day or two and you'll be able to use all the information you read in the Python tutorial in Abjad. If you're an experienced programmer you should skip chapters 1 - 3 but read 4 - 12. When you're done you can give yourself

the equivlanent of the chorale test suggested above. First open a file and define a couple of classes and functions in it. Then open a second file and write some code to first import and then do stuff with the classes and functions you defined in the first file. Once you can easily do this without looking at the Python docs you'll be in a much better position to work with Abjad.

1.1.3 What next?

The most important parts of Abjad are the interlocking objects that structure the system. Read about the way Abjad models pitch, duration, leaves, containers, spanners and marks in the *Abjad reference manual*.

But note that important parts of the system are missing from the manual. The reason for this is that we completed the Abjad API months before we started the manual. This means that classes and functions you look up in the API may not yet be documented in the manual. The reference manual will eventually document all parts of the system. But until then check the API if the manual doesn't yet have what you need.

Once you understand the basics about how to work with Abjad you should spend some time with the *Abjad API*. The API documents all the functionality available in the system. Abjad comprises about 168,000 lines of code. About half of these implement the automated tests that check the correctness of Abjad. The rest of the code implements 39 packages comprising 221 classes and 1029 functions. All of these are documented in the API.

1.1.4 Mailing lists

As you begin working with Abjad please be in touch.

Questions, comments and contributions are welcomed from composers everywhere.

Questions or comments? Join the abjad-user list.

Want to contribute? Join the abjad-devel list.

1.2 Installation

1.2.1 Abjad depends on Python

You must have Python 2.7 installed to run Abjad.

Abjad does not yet support the Python 3.x series of releases.

To check the version of Python installed on your computer type the following:

```
python --version
```

You can download different versions of Python at http://www.python.org.

1.2.2 Abjad depends on LilyPond

You must have LilyPond 2.16 or greater installed for Abjad to work properly.

You can download LilyPond at http://www.lilypond.org.

After you have installed LilyPond you should type the following to see if LilyPond is callable from your commandline:

```
lilypond --version
```

If LilyPond is not callable from your commandline you should add the location of the LilyPond executable to your `PATH` environment variable.

If you are new to working with the commandline you should use Google to get a basic introduction to editing your profile and setting environment variables.

1.2.3 Installing the current packaged version of Abjad with `easy_install`

There are different ways to install Python packages on your computer. One of the most direct ways is with `easy_install`.

If you have `easy_install` installed on your computer then you can install Abjad with this command:

```
sudo easy_install -U abjad
```

Python will install Abjad in the site packages directory on your computer and you'll be ready to start using the system.

If you do not have `easy_install` installed on your computer then you should follow the instructions below to install the current packaged version of Abjad from the Python Package Index.

1.2.4 Installing the current packaged version of Abjad from the Python Package Index

If you do not have `easy_install` installed on your computer you should follow these steps to install the current packaged version of Abjad from the Python Package Index:

1. Download the current release of Abjad from http://pypi.python.org/pypi/Abjad.
2. Unarchive the downloaded file. Under MacOS and Windows you can double click the archived file.

   Under Linux execute the following command with `x.y` replaced by the current release of Abjad:

   ```
   tar xzvf Abjad-x.y.tar.gz
   ```

3. Change into the directory created in step 2:

   ```
   cd Abjad-x.y
   ```

4. Run the following under MacOS or Linux:

   ```
   sudo python setup.py install
   ```

5. Or run this command under Windows after starting up a command shell with administrator privileges:

   ```
   setup.py install
   ```

These commands will cause Python to install Abjad in your site packages directory. You'll then be ready to start using Abjad.

1.2.5 After install

When first run, Abjad creates an `.abjad` directory in your own `$HOME` directory. In `$HOME/.abjad` you will find the Abjad configuration file: `config.py`. Here you can tell Abjad about your preferred PDF file viewer, MIDI player, your preferred LilyPond language, etc. All relevant variables have defaults that you can change to suit your needs. In Linux, for example, you might want to set your `pdfviewer` to `evince` and your `MIDIplayer` to `tiMIDIty`.

`config.py` is a regular Python file, so you should make sure the file follows Python syntax.

1.2.6 Note for Linux users

Abjad defaults to `xdg-open` to display PDF files using your default PDF viewer. Most Linux distributions now come with `xdg-utils` installed.

If you do not have `xdg-utils` installed, you can download it from http://www.portland.freedsektop.org.

Alternatively you can set the `pdfviewer` variable in `$HOME/.abjad/config` to your favorite PDF viewer.

1.3 Version history

1.3.1 Abjad 2.10

Released 2012-10-05. Built from r7615. Implements 437 public classes and 982 functions totalling 179,000 lines of code.

The following packages now load by default when you start Abjad:

```
Abjad 2.10
>>> [x for x in dir() if x.endswith('tools')]
['abjadbooktools', 'beamtools', 'chordtools', 'componenttools', 'containertools', 'contexttools',
'developerscripttools', 'durationtools', 'formattools', 'gracetools', 'instrumenttools',
'introspectiontools', 'iotools', 'iterationtools', 'labeltools', 'layouttools', 'leaftools',
'lilypondfiletools', 'marktools', 'markuptools', 'mathtools', 'measuretools', 'notetools', '
'offsettools', 'pitcharraytools', 'pitchtools', 'resttools', 'rhythmtreetools', 'schemetools',
'scoretemplatetools', 'scoretools', 'sequencetools', 'sievetools', 'skiptools', 'spannertools',
'stafftools', 'stringtools', 'tempotools', 'tietools', 'timeintervaltools', 'timesignaturetools',
'timetokentools', 'tonalitytools', 'tuplettools', 'verticalitytools', 'voicetools']
```

Improved formatting engine. Scores now format approximately 30% faster.

Improved LilyPond parser.

Markup objects now parse input string input on initialization:

```
>>> markuptools.Markup(r'\bold \tiny { foo bar baz }')
Markup((MarkupCommand('bold', MarkupCommand('tiny', ['foo', 'bar', 'baz'])),))

>>> print _.indented_lilypond_format
\markup {
    \bold
        \tiny
            {
                foo
                bar
                baz
            }
    }
```

You can now context names to reference named contexts attached to any container:

```
>>> template = scoretemplatetools.StringQuartetScoreTemplate()
>>> score = template()

>>> score['First Violin Staff']
Staff-"First Violin Staff"{1}
```

```
>>> score['First Violin Voice']
Voice-"First Violin Voice"{}
```

Five new constants are available globally.

- The constants are `Left`, `Right`, `Up`, `Down` and `Center`.
- The constants function like Python's built-in `True` and `False`.
- Use the constants as keyword defaults.

A new configuration tool is available:

```
configurationtools.get_abjad_startup_string()
```

New context tools are available:

```
contexttools.all_are_contexts()
```

A new `iterationtools` package is available:

```
iterationtools.iterate_chords_in_expr()
iterationtools.iterate_components_and_grace_containers_in_expr()
iterationtools.iterate_components_depth_first()
iterationtools.iterate_components_in_expr()
iterationtools.iterate_containers_in_expr()
iterationtools.iterate_contexts_in_expr()
iterationtools.iterate_leaf_pairs_in_expr()
iterationtools.iterate_leaves_in_expr()
iterationtools.iterate_measures_in_expr()
iterationtools.iterate_namesakes_from_component()
iterationtools.iterate_notes_and_chords_in_expr()
iterationtools.iterate_notes_in_expr()
iterationtools.iterate_rests_in_expr()
iterationtools.iterate_scores_in_expr()
iterationtools.iterate_semantic_voices_in_expr()
iterationtools.iterate_skips_in_expr()
iterationtools.iterate_staves_in_expr()
iterationtools.iterate_thread_from_component()
iterationtools.iterate_thread_in_expr()
iterationtools.iterate_timeline_from_component()
iterationtools.iterate_timeline_in_expr()
iterationtools.iterate_tuplets_in_expr()
iterationtools.iterate_voices_in_expr()
```

New LilyPond file tools are available:

```
lilypondfiletools.make_floating_time_signature_lilypond_file()
```

New LilyPond parser tools are available:

```
lilypondparsertools.GuileProxy
lilypondparsertools.LilyPondDuration
lilypondparsertools.LilyPondEvent
lilypondparsertools.LilyPondFraction
lilypondparsertools.LilyPondLexicalDefinition
lilypondparsertools.LilyPondSyntacticalDefinition
lilypondparsertools.ReducedLyParser
lilypondparsertools.SchemeParser
lilypondparsertools.SyntaxNode
lilypondparsertools.lilypond_enharmonic_transpose()
```

A new `Ratio` class is available in the `mathtools` package:

```
>>> mathtools.Ratio(1, 2, -1)
Ratio(1, 2, -1)
```

New rhythm-tree tools are available.

- Implemented RTM expression parser:

  `rhythmtreetools.RhythmTreeParser`

- Implemented new classes for explicitly constructing rhythm-trees:

  `RhythmTreeNode`
  `RhythmTreeLeaf`
  `RhythmTreeContainer`

```
>>> from abjad import *
>>> rtm = '(1 (1 (2 (1 -1 1)) -2))'
>>> result = rhythmtreetools.RhythmTreeParser()(rtm)

>>> result[0]
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=1,
            pitched=True,
            ),
        RhythmTreeContainer(
            children=(
                RhythmTreeLeaf(
                    duration=1,
                    pitched=True,
                    ),
                RhythmTreeLeaf(
                    duration=1,
                    pitched=False,
                    ),
                RhythmTreeLeaf(
                    duration=1,
                    pitched=True,
                    ),
            ),
            duration=2
            ),
        RhythmTreeLeaf(
            duration=2,
            pitched=False,
            ),
    ),
    duration=1
    )

>>> _.rtm_format
'(1 (1 (2 (1 -1 1)) -2))'

>>> result[0]((1, 4))
FixedDurationTuplet(1/4, [c'16, {@ 3:2 c'16, r16, c'16 @}, r8])
```

```
>>> f(_)
\times 4/5 {
    c'16
    \times 2/3 {
        c'16
        r16
        c'16
    }
    r8
}
```

New Scheme tools are available.

- Added `force_quotes` boolean keyword to `schemetools.Scheme` and `schemetools.format_scheme_value()`:

  ```
  >>> schemetools.format_scheme_value('foo')
  'foo'

  >>> schemetools.format_scheme_value('foo', force_quotes=True)
  '"foo"'
  ```

  This allows you to force double quotes around strings which contain no spaces. This is necessary for some LilyPond grob overrides.

- A new Scheme formatting function is available:

  ```
  schemetools.format_scheme_value()
  ```

New score-template tools are available:

```
scoretemplatetools.GroupedStavesScoreTemplate
```

New sequence tools are available:

- Added `sequencetools.merge_duration_sequences()`:

  ```
  >>> sequencetools.merge_duration_sequences([10, 10, 10], [7])
  [7, 3, 10, 10]
  ```

- Added `sequencetools.pair_duration_sequence_elements_with_input_pair_values()`:

  ```
  >>> duration_sequence = [10, 10, 10, 10]
  >>> input_pairs = [('red', 1), ('orange', 18), ('yellow', 200)]
  >>> sequencetools.pair_duration_sequence_elements_with_input_pair_values(
  ... duration_sequence, input_pairs)
  [(10, 'red'), (10, 'orange'), (10, 'yellow'), (10, 'yellow')]
  ```

New tie tools are available:

```
tietools.get_tie_spanner_attached_to_component()
```

New time-interval tools are available:

```
timeintervaltools.make_voice_from_nonoverlapping_intervals()
```

New time-token tools are available:

- Added `SkipFilledTimeTokenMaker` to `timetokentools` package:

  ```
  >>> maker = timetokentools.SkipFilledTimeTokenMaker()
  ```

```
>>> duration_tokens = [(1, 5), (1, 4), (1, 6), (7, 9)]
>>> leaf_lists = maker(duration_tokens)
>>> leaves = sequencetools.flatten_sequence(leaf_lists)

>>> staff = Staff(leaves)

>>> f(staff)
\new Staff {
    s1 * 1/5
    s1 * 1/4
    s1 * 1/6
    s1 * 7/9
}
```

- Added `TupletMonadTimeTokenMaker` to `timetokentools` package:

```
>>> maker = timetokentools.TupletMonadTimeTokenMaker()

>>> duration_tokens = [(1, 5), (1, 4), (1, 6), (7, 9)]
>>> tuplets = maker(duration_tokens)
>>> staff = Staff(tuplets)

>>> f(staff)
\new Staff {
    \times 4/5 {
        c'4
    }
    {
        c'4
    }
    \times 2/3 {
        c'4
    }
    \times 8/9 {
        c'2..
    }
}
```

1.3.2 Abjad 2.9

Released 2012-06-05. Built from r5795. Implements 405 public classes and 1066 functions totalling 182,000 lines of code.

Extended markup handling is now available.

- The LilyPond parser accepts complex markup as input:

```
>>> f(p(r'''{ c'4 _ \markup { \put-adjacent #1 #-1 \bold \fontsize #2 \upright foo bar } }'''))
{
    c'4
        _ \markup {
            \put-adjacent
                #1
                #-1
                \bold
                    \fontsize
                        #2
                        \upright
```

```
                                foo
                    bar
                }
}
```

- Format routines allow for markup indentation:

```
>>> circle = markuptools.MarkupCommand('draw-circle', 2.5, 0.1, False)
>>> square = markuptools.MarkupCommand('rounded-box', 'hello?')
>>> line = markuptools.MarkupCommand('line', [square, 'wow!'])
>>> markup = markuptools.Markup(('X', square, 'Y', line, 'Z'), direction='up')

>>> print '\n'.join(markup._get_format_pieces(is_indented=True))
^ \markup {
    X
    \rounded-box
        hello?
    Y
    \line
        {
            \rounded-box
                hello?
            wow!
        }
    Z
    }
```

- Nontrivial markup format with indentation automatically:

```
>>> staff = Staff("c")
>>> m1 = markuptools.Markup('foo')(staff[0])
>>> m2 = markuptools.Markup('bar')(staff[0])
>>> m3 = markuptools.Markup('baz', 'up')(staff[0])
>>> m4 = markuptools.Markup('quux', 'down')(staff[0])
>>> accent = marktools.Articulation('accent')(staff[0])

>>> f(staff)
\new Staff {
    c4 -\accent
        ^ \markup { baz }
        _ \markup { quux }
        - \markup {
            \column
                {
                    foo
                    bar
                }
            }
}
```

- `Markup.contents` is now a tuple of strings or `MarkupCommand` instances.
- Removed the markup `style_string` property. Use `schemetools` classes for constructing Scheme-style formatting.
- Changed `Markup.contents_string` to `Markup.contents`.

An entirely new tuplet microlanguage is now available.

- This "reduced ly" syntax uses braces to show tuplet nesting and represents rhythm without pitch:

```
>>> from abjad.tools import rhythmtreetools

>>> container = rhythmtreetools.parse_reduced_ly_syntax('4 -4 8 5/3 { 2/3 { 8 8 8 } { 8 8 } -8 }

>>> f(container)
{
    c'4
    r4
    c'8
    \fraction \times 5/3 {
        \times 2/3 {
            c'8
            c'8
            c'8
        }
        {
            c'8
            c'8
        }
        r8
    }
    c'4
}
```

- Measures and dotted values are also available:

```
>>> container = rhythmtreetools.parse_reduced_ly_syntax('|2/4 8. 16 8. 16| |4/4 2/3 { 2 2 2 }|')

f(container)

{
    {
        \time 2/4
        c'8.
        c'16
        c'8.
        c'16
    }
    {
        \time 4/4
        \times 2/3 {
            c'2
            c'2
            c'2
        }
    }
}
```

Extended container input syntax.

- You can now pass strings directly to the `append()` and `extend()` methods of any container:

```
>>> container = Container()
>>> container
{}

>>> container.extend('a b c')
>>> container
{a4, b4, c4}
```

```
>>> container.append('d')
>>> container
{a4, b4, c4, d4}
```

- You can assign a string to any container item:

```
>>> container = Container("c' d' e'")
>>> container
{c'4, d'4, e'4}

>>> container[1] = 'r'
>>> container
{c'4, r4, e'4}
```

- You can assign a string to any container slice:

```
>>> container = Container("c' d' e'")
>>> container
{c'4, d'4, e'4}

>>> container[:2] = 'r8 r r'
>>> container
{r8, r8, r8, e'4}
```

- You can initialize containers from strings using alternate parsers.

  Use the `'abj'` prefix to initialize a container with the new reduced ly syntax:

```
>>> staff = Staff('abj: | 2/4 2/3 { 8 4 } 8 8 || 3/4 4 4 4 |')

>>> f(staff)
\new Staff {
    {
        \time 2/4
        \times 2/3 {
            c'8
            c'4
        }
        c'8
        c'8
    }
    {
        \time 3/4
        c'4
        c'4
        c'4
    }
}
```

- Use the `'rtm'` prefix to initialize a container with IRCAM RTM-style syntax:

```
>>> staff = Staff('rtm: (1 (1 (2 (1 1 1)) 1)) (1 (1 1))')

>>> f(staff)
\new Staff {
    c'16
    \times 2/3 {
        c'16
        c'16
        c'16
```

```
    }
    c'16
    c'8
    c'8
}
```

- Parallel contexts, such as Score, can be instantiated from strings which parse to a sequence of contexts:

```
Score(r'''\new Staff { c' } \new Staff = { c, }''')
```

- Added a new `FixedDurationContainer` class to the `containertools` package.

  Fixed-duration containers extend container behavior with format-time checking against a user-specified target duration:

```
>>> container = containertools.FixedDurationContainer((3, 8), "c'8 d'8 e'8")

>>> container
FixedDurationContainer(Duration(3, 8), [Note("c'8"), Note("d'8"), Note("e'8")])

>>> f(container)
{
    c'8
    d'8
    e'8
}

>>> container.is_misfilled
False

>>> container.pop()
Note("e'8")

>>> container
FixedDurationContainer(Duration(3, 8), [Note("c'8"), Note("d'8")])

>>> container.is_misfilled
True
```

  Misfilled fixed-duration containers will raise an exception at format-time. Fixed-duration containers share this behavior with measures.

Regularized measure modification behavior.

- By default measures do not automatically adjust time signature after contents modification:

```
>>> measure = Measure((3, 4), "c' d' e'")
>>> measure
Measure(3/4, [c'4, d'4, e'4])

>>> measure.append('r')
>>> measure
Measure(3/4, [c'4, d'4, e'4, r4])

>>> measure.is_overfull
True
```

- But it is now possible to cause measures to automatically adjust time signature after contents modification:

```
>>> measure = Measure((3, 4), "c' d' e'")
>>> measure.automatically_adjust_time_signature = True
>>> measure
Measure(3/4, [c'4, d'4, e'4])

>>> measure.append('r')
>>> measure
Measure(4/4, [c'4, d'4, e'4, r4])

>>> measure.is_misfilled
False
```

Previous implementations of measure `append()`, `extend()` and set-item never adjusted measure time signatures.

Now the behavior of such operations is controllable on a measure-by-measure basis by the end user.

New functionality is available for working with ties.

- Added a `TieChain` class to the `tietools` package. Tie chains now return as a custom `TieChain` object instead of tuple:

```
>>> staff = Staff("c' d' e' ~ e'")

>>> tietools.get_tie_chain(staff[2])
TieChain((Note("e'4"), Note("e'4")))
```

Reimplemented tie chain duration attributes as explicit class attributes. The following four functions have been removed:

```
tietools.get_preprolated_tie_chain_duration()
tietools.get_prolated_tie_chain_duration()
tietools.get_tie_chain_duration_in_seconds()
tietools.get_written_tie_chain_duration()
```

Use these read-only properties instead:

```
TieChain.preprolated_duration
TieChain.prolated_duration
TieChain.duration_in_seconds
TieChain.written_duration
```

The `TieChain` class inherits from the new `ScoreSelection` abstract base class.

Added new `tietools` functions:

```
tietools.iterate_pitched_tie_chains_forward_in_expr()
tietools.iterate_pitched_tie_chains_backward_in_expr()
tietools.iterate_nontrivial_tie_chains_forward_in_expr()
tietools.iterate_nontrivial_tie_chains_backward_in_expr()
```

Removed `tietools.is_tie_chain(expr)`. Use `isinstance(expr, tietools.TieChain)` instead.

Removed `tietools.get_leaves_in_tie_chain()`. Use `TieChain.leaves` instead.

Removed `tietools.group_leaves_in_tie_chain_by_immediate_parents()`. Use `TieChain.leaves_grouped_by_immediate_parents` instead.

Removed `tietools.is_tie_chain_with_all_leaves_in_same_parent()`. Use `TieChain.all_leaves_are_in_same_parent` instead.

Added a new `stringtools` package.

- The following functions all migrated from the `iotools` package:

```
stringtools.capitalize_string_start()
stringtools.format_input_lines_as_doc_string()
stringtools.format_input_lines_as_regression_test()
stringtools.is_lowercamelcase_string()
stringtools.is_space_delimited_lowercase_string()
stringtools.is_underscore_delimited_lowercase_file_name()
stringtools.is_underscore_delimited_lowercase_file_name_with_extension()
stringtools.is_underscore_delimited_lowercase_package_name()
stringtools.is_underscore_delimited_lowercase_string()
stringtools.is_uppercamelcase_string()
stringtools.space_delimited_lowercase_to_uppercamelcase()
stringtools.string_to_strict_directory_name()
stringtools.strip_diacritics_from_binary_string()
stringtools.underscore_delimited_lowercase_to_lowercamelcase()
stringtools.underscore_delimited_lowercase_to_uppercamelcase()
stringtools.uppercamelcase_to_space_delimited_lowercase()
stringtools.uppercamelcase_to_underscore_delimited_lowercase()
```

  The package also contains these new functions:

```
stringtools.arg_to_bidirectional_direction_string()
stringtools.arg_to_bidirectional_lilypond_symbol()
stringtools.arg_to_tridirectional_direction_string()
stringtools.arg_to_tridirectional_lilypond_symbol()
```

```
>>> stringtools.arg_to_bidirectional_lilypond_symbol(1)
'^'
>>> stringtools.arg_to_tridirectional_direction_string('-')
'neutral'
```

Added a new `beamtools` package.

- This release of the `beamtools` package contains the following classes and functions:

```
beamtools.BeamSpanner
beamtools.ComplexBeamSpanner
beamtools.DuratedComplexBeamSpanner
beamtools.MultipartBeamSpanner

beamtools.is_beamable_component
beamtools.apply_beam_spanner_to_measure
beamtools.apply_beam_spanners_to_measures_in_expr
beamtools.apply_complex_beam_spanner_to_measure
beamtools.apply_complex_beam_spanners_to_measures_in_expr
beamtools.apply_durated_complex_beam_spanner_to_measures
beamtools.beam_bottommost_tuplets_in_expr
beamtools.get_beam_spanner_attached_to_component
beamtools.is_beamable_component
beamtools.is_component_with_beam_spanner_attached
```

  Note that the following two functions have been removed:

```
beamtools.apply_beam_spanner_to_measure()
beamtools.apply_complex_beam_spanner_to_measure()
```

  Use these two functions instead:

```
beamtools.apply_beam_spanners_to_measures_in_expr()
beamtools.apply_complex_beam_spanners_to_measures_in_expr()
```

New `constrainttools` functionality is now available.

- Extended the `VariableLengthStreamSolver` class.

  The class now produces more randomly ordered solution sets than before, when in randomized mode. Note that the solution sets tend to increase in size. Also note that there is an increased performance hit for such PMC-style randomized constraint solving:

```
>>> from abjad.tools.constrainttools import *

>>> domain = Domain([1, 2, 3, 4], 1)
>>> boundary_sum = GlobalConstraint(lambda x: sum(x) < 6)
>>> target_sum = GlobalConstraint(lambda x: sum(x) == 5)
>>> random_solver = VariableLengthStreamSolver(domain,
... [boundary_sum], [target_sum], randomized=True)
>>> for x in random_solver: x
...
[1, 3, 1]
[4, 1]
[3, 2]
[2, 3]
[1, 4]
[3, 1, 1]
[2, 1, 2]
[1, 2, 1, 1]
[2, 1, 1, 1]
[2, 2, 1]
[1, 1, 1, 2]
[1, 2, 2]
[1, 1, 1, 1, 1]
[1, 1, 3]
[1, 1, 2, 1]
```

- Randomized the `FixedLengthStreamSolvers` class.

  The class now produces truly randomly ordered solution sets.

New sequence tools are available.

- Added new type- and form-checking predicates to the `sequencetools` package:

```
sequencetools.all_are_integer_equivalent_exprs
sequencetools.is_null_tuple(expr)
sequencetools.is_singleton(expr)
sequencetools.is_pair(expr)
sequencetools.is_n_tuple(expr, n)
sequencetools.is_integer_singleton(expr)
sequencetools.is_integer_pair(expr)
sequencetools.is_integer_n_tuple(expr, n)
sequencetools.is_integer_equivalent_n_tuple
sequencetools.is_integer_equivalent_pair
sequencetools.is_integer_equivalent_singleton
sequencetools.is_fraction_equivalent_pair
```

  Each function returns a boolean:

```
>>> sequencetools.is_integer_singleton((19,))
True
```

- Added a new `NonreducedFraction` class to the `sequencetools` package:

  ```
  >>> sequencetools.NonreducedFraction(3, 6)
  NonreducedFraction(3, 6)
  ```

  Like built-in fraction but numerator and denominator do NOT simplify.

  All six comparators are implemented on nonreduced fractions.

  Addition and subtraction are implemented on nonreduced fractions:

  ```
  >>> sequencetools.NonreducedFraction(3, 6) + sequencetools.NonreducedFraction(3, 6)
  NonreducedFraction(6, 6)
  ```

  Use nonreduced fractions to model arithmetic operations on time signature-like objects absent any of the special time signature features like partial-measure pick-ups.

New spanners and spanner handlers are now available.

- Added a `ComplexGlissandoSpanner` to the `spannertools` package.

  This spanner generates a glissando which skips over rests. It can be used in combination with spannertools.BeamSpanner and an override of the Stem grob to generate the appearance of durated glissandi:

  ```
  >>> staff = Staff("c'16 [ d' r e' r r r g' ]")

  >>> f(staff)
  \new Staff {
      c'16 [
      d'16
      r16
      e'16
      r16
      r16
      r16
      g'16 ]
  }

  >>> spannertools.ComplexGlissandoSpanner(staff[:])
  ComplexGlissandoSpanner(c'16, d'16, r16, e'16, r16, r16, r16, g'16)

  >>> staff.override.stem.stemlet_length = 2
  >>> f(staff)
  \new Staff \with {
      \override Stem #'stemlet-length = #2
  } {
      c'16 [ \glissando
      d'16 \glissando
      \once \override NoteColumn #'glissando-skip = ##t
      \once \override Rest #'transparent = ##t
      r16
      e'16 \glissando
      \once \override NoteColumn #'glissando-skip = ##t
      \once \override Rest #'transparent = ##t
      r16
      \once \override NoteColumn #'glissando-skip = ##t
      \once \override Rest #'transparent = ##t
      r16
  ```

```
    \once \override NoteColumn #'glissando-skip = ##t
    \once \override Rest #'transparent = ##t
    r16
    g'16 ]
}
```

- Added new `spannertools` function:

  ```
  spannertools.destory_spanners_attached_to_components_in_expr(expr, klass=None)
  ```

  The function can be useful for removing all spanners when debugging a complex expression.

- Spanners are now callable:

  ```
  >>> staff = Staff("c'8 d'8 e'8 f'8")

  >>> beam = spannertools.BeamSpanner()
  >>> beam(staff[:])
  Staff{4}

  >>> f(staff)
  \new Staff {
      c'8 [
      d'8
      e'8
      f'8 ]
  }
  ```

  This works the same way as marks:

  ```
  >>> marktools.Articulation('.')(staff[1])
  Articulation('.')(d'8)

  >>> f(staff)
  \new Staff {
      c'8 [
      d'8 -\staccato
      e'8
      f'8 ]
  }
  ```

  Callable spanners are provided as an experimental way of unifying the attachment syntax of spanners and marks.

Many new functions are available in the `componenttools` package.

- New getters:

  ```
  componenttools.get_proper_contents_of_component()
  componenttools.get_improper_contents_of_component()
  componenttools.get_improper_contents_of_component_that_start_with_component()
  componenttools.get_improper_contents_of_component_that_stop_with_component()
  componenttools.get_proper_descendents_of_component()
  componenttools.get_improper_descendents_of_component()
  componenttools.get_improper_descendents_of_component_that_cross_prolated_offset
  componenttools.get_improper_descendents_of_component_that_start_with_component
  componenttools.get_improper_descendents_of_component_that_stop_with_component
  componenttools.get_lineage_of_component()
  componenttools.get_lineage_of_component_that_start_with_component()
  componenttools.get_lineage_of_component_that_stop_with_component()
  componenttools.get_nth_sibling_from_component(component, n)
  componenttools.get_nth_component_from_component_in_time_order(component, n)
  ```

```
componenttools.get_nth_namesake_from_component
componenttools.get_most_distant_sequential_container_in_improper_parentage_of_component()
```

Use these functions to interrogate the structural relations of components resident inside arbitrarily complex pieces of score.

The functions are useful as primitive methods when implementing more complex operations designed to mutate the score tree.

- Note the difference between the 'contents' of a component and the 'descendents' of a component:

```
>>> componenttools.get_proper_contents_of_component(staff)
[Note("c'4"), Tuplet(2/3, [d'8, e'8, f'8])]
```

Versus:

```
>>> componenttools.get_proper_descendents_of_component(staff)
[Note("c'4"), Tuplet(2/3, [d'8, e'8, f'8]), Note("d'8"), Note("e'8"), Note("f'8")]
```

- Also add the following `componenttools` predicate:

```
componenttools.is_immediate_temporal_successor_of_component()
```

Further new functionality:

- Added new `gracetools` function:

```
gracetools.detach_grace_containers_attached_to_leaves_in_expr()
```

Use the function to strip all grace containers from an arbitrary piece of score.

- Added new `marktools` functions:

```
marktools.get_marks_attached_to_components_in_expr()
marktools.detach_marks_attached_to_components_in_expr()
marktools.move_marks(donor, recipient).
```

- Added new `pitchtools` function:

```
pitchtools.set_written_pitch_of_pitched_components_in_expr(expr, written_pitch=0)
```

Use the function to neutralize pitch information in an arbitrary piece of score.

- Added new `tuplettools` functions:

```
tuplettools.change_fixed_duration_tuplets_in_expr_to_tuplets()
tuplettools.change_tuplets_in_expr_to_fixed_duration_tuplets()
```

- Extended `lilypondfiletools.ContextBlock` with the following attributes:

```
ContextBlock.engraver_consists
ContextBlock.engraver_removals
ContextBlock.context_name
ContextBlock.name
ContextBlock.type
```

The attributes correspond to backslash-initiated LilyPond commands available in LilyPond context blocks.

- Updated `LilyPondLanguageToken` to format LilyPond `\language` command instead of LilyPond `\include` command.
- Extended `Duration` to initialize from LilyPond duration strings:

```
>>> Duration('8.')
Duration(3, 16)
```

Note that this means that `Duration('2')` now gives `Duration(1, 2)`. Previously `Duration('2')` gave `Duration(2, 1)` just like `Fraction('2')`.

Changes to end-user functionality:

- Changed:

  `componenttools.copy_components_and_remove_all_spanners()`

  `componenttools.copy_components_and_remove_spanners()`

- Changed:

  `componenttools.get_improper_contents_of_component_that_cross_prolated_offset()`

  `componenttools.get_leftmost_components_with_prolated_duration_at_most()`

- Changed:

  `componenttools.list_improper_contents_of_component_that_cross_prolated_offset()`

  `componenttools.list_leftmost_components_with_prolated_duration_at_most()`

- Changed:

  `configurationtool.set_default_accidental_spelling()`

  `pitchtools.set_default_accidental_spelling()`

- Changed:

  `gracetools.Grace`

  `gracetools.GraceContainer`

- Changed:

  `spannertools.destory_all_spanners_attached_to_component()`

  `spannertools.destory_spanners_attached_to_component()`

- Changed:

  `spannertools.fracture_all_spanners_attached_to_component()`

  `spannertools.fracture_spanners_attached_to_component()`

- Changed:

  `spannertools.report_as_string_format_contributions_of_all_spanners_attached_to_component()`

  `spannertools.report_as_string_format_contributions_of_spanners_attached_to_component()`

- Changed:

  `spannertools.report_as_string_format_contributions_of_all_spanners_attached_to_improper_parentag`

```
spannertools.report_as_string_format_contributions_of_spanners_attached_to_improper_parentage_of
```

- Changed:

  ```
  tietools.get_tie_chains_in_expr()

  tietools.get_nontrivial_tie_chains_masked_by_components()
  ```

- Changed:

  ```
  tietools.remove_all_leaves_in_tie_chain_except_first()

  tietools.remove_nonfirst_leaves_in_tie_chain()
  ```

- Changed:

  ```
  scr/devel/rename-public-helper

  scr/devel/rename-public-function
  ```

- Removed the `threadtools` package and moved all functions to `componenttools`.

  Instead of these:

  ```
  threadtools.iterate_thread_backward_from_component()
  threadtools.iterate_thread_backward_in_expr()
  threadtools.iterate_thread_forward_from_component()
  threadtools.iterate_thread_forward_in_expr()
  threadtools.component_to_thread_signature()
  ```

  Use these:

  ```
  componenttools.iterate_thread_backward_from_component()
  componenttools.iterate_thread_backward_in_expr()
  componenttools.iterate_thread_forward_from_component()
  componenttools.iterate_thread_forward_in_expr()
  componenttools.component_to_containment_signature()
  ```

- Removed the read-only `Component.marks` property entirely.
- Removed the top-level `abjad/exceptions` directory. Use the new `exceptiontools` package instead.
- Removed the top-level `abjad/templates` directory.

  Make sure to read the changes carefully.

  If you have been working with grace notes, for example, you will need to change all occurrences of `gracetools.Grace` to `gracetools.GraceContainer`.

1.3.3 Abjad 2.8

Released 2012-04-16. Built from r5421. Implements 306 public classes and 1037 functions totalling 178,000 lines of code.

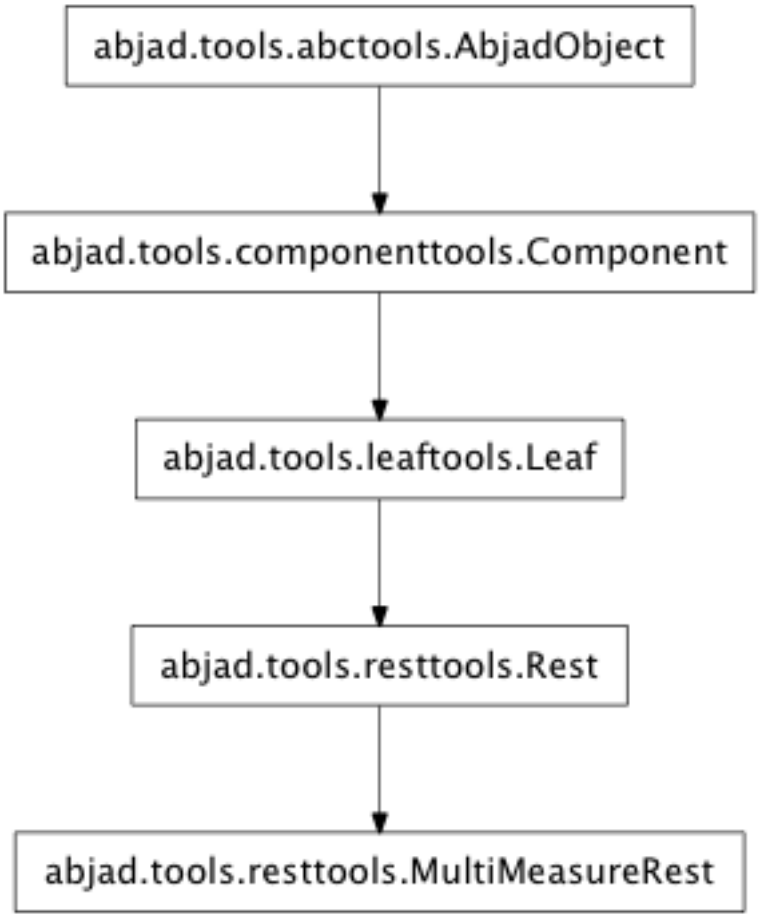
Many documentation improvements appear in this release.

- A source link now accompanies all classes and functions in the API:

Source code for abjad.tools.chordtools.arpeggiate_chord

```
from abjad.tools.chordtools.Chord import Chord
from abjad.tools.decoratortools import requires


@requires(Chord)
def arpeggiate_chord(chord):                                                    [docs]
    '''.. versionadded:: 1.1

    Arpeggiate `chord`::

        abjad> chord = Chord("<c' d'' ef''>8")

    ::

        abjad> chordtools.arpeggiate_chord(chord)
        [Note("c'8"), Note("d''8"), Note("ef''8")]

    Arpeggiated notes inherit `chord` written duration.

    Arpeggiated notes do not inherit other `chord` attributes.

    Return list of newly constructed notes.

    .. versionchanged:: 2.0
        renamed ``chordtools.arpeggiate()`` to
        ``chordtools.arpeggiate_chord()``.
    '''
    from abjad.tools.notetools.Note import Note

    result = []
    chord_written_duration = chord.written_duration
    for pitch in chord.written_pitches:
        result.append(Note(pitch, chord_written_duration))

    return result
```

- All parts of the Abjad codebase are now viewable through the HTML version of the API.
- Inheritance diagrams now accompany all classes:



- Inherited attributes now appear in the API entry of each class.
- Added new `documentationtools` package:

  ```
  documentationtools.APICrawler
  documentationtools.AbjadAPIGenerator
  documentationtools.ClassCrawler
  documentationtools.ClassDocumenter
  documentationtools.Documenter
  documentationtools.FunctionCrawler
  documentationtools.FunctionDocumenter
  documentationtools.InheritanceGraph
  documentationtools.ModuleCrawler
  documentationtools.Pipe
  ```

  The package houses custom code to build Abjad documentation.

Added the new `constrainttools` API.

- This release of the `constrainttools` package implements the following classes:

  ```
  constrainttools.AbsoluteIndexConstraint
  constrainttools.Domain
  constrainttools.FixedLengthStreamSolver
  constrainttools.GlobalConstraint
  constrainttools.GlobalCountsConstraint
  constrainttools.GlobalReferenceConstraint
  constrainttools.RelativeCountsConstraint
  ```

```
constrainttools.RelativeIndexConstraint
constrainttools.VariableLengthStreamSolver
```

- Example:

```
>>> from abjad.tools.constraintstools import *

>>> domain = Domain([1, 2, 3, 4], 4)

>>> all_unique = GlobalCountsConstraint(lambda x: all([y == 1 for y in x.values()]))
>>> max_interval = RelativeIndexConstraint([0, 1], lambda x, y: abs(x - y) < 3)
>>> solver = FiniteStreamSolver(domain, [all_unique, max_interval])

>>> for solution in solver: print solution
...
(1, 2, 3, 4)
(1, 2, 4, 3)
(1, 3, 2, 4)
(1, 3, 4, 2)
(2, 1, 3, 4)
(2, 4, 3, 1)
(3, 1, 2, 4)
(3, 4, 2, 1)
(4, 2, 1, 3)
(4, 2, 3, 1)
(4, 3, 1, 2)
(4, 3, 2, 1)
```

- The `constrainttools` package is considered unstable and will be subject to changes in the next releases of Abjad.

Added octave-transposition mapping model.

- This version of the system contains the following classes:

```
pitchtools.OctaveTranspositionMapping
pitchtools.OctaveTranspositionMappingComponent
pitchtools.OctaveTranspositionMappingInventory
```

- Octave-transposition mappings specify a way to maybe pitches from one registral space to another.
- Use octave-transposition mappings as input to `pitchtools.transpose_chromatic_pitch_number_ty_octave_tr`

Many Abjad classes are now implemented as abstract base classes.

- Abstract base classes provide functionality to child subclasses.
- Abstract base classes can not be instantiated directly.
- The Abjad API now lists abstract classes and concrete classes separately.
- See http://docs.python.org/library/abc.html for a description of ABCs in Python.

Added the new `abctools` package to house abstract classes that are core to the Abjad object model.

- This version of the package contains the following classes:

```
abctools.AbjadObject
abctools.AttributeEqualityAbjadObject
abctools.ImmutableAbjadObject
abctools.SortableAttributeEqualityAbjadObject
```

- All Abjad classes now inherit from `AbjadObject`.

Added object inventories for several classes.

- This release contains inventories for the following classes:

```
contexttools.ClefMarkInventory
contexttools.TempoMarkInventory
instrumenttools.InstrumentInventory
markuptools.MarkupInventory
pitchtools.OctaveTranspositionMappingInventory
pitchtools.PitchRangeInventory
scoretools.PerformerInventory
```

- Object inventories model ordered collections of system objects.

Add the new `datastructuretools` package.

- This version of the package includes the following classes:

```
datastructuretools.Digraph
datastructuretools.ImmutableDictionary
datastructuretools.ObjectInventory
```

- Use `datastructuretools.Digraph` to detect cycles in any collection of hashable objects:

```
>>> from abjad.tools.datastructuretools import Digraph

>>> edges = [('a', 'b'), ('a', 'c'), ('a', 'f'), ('c', 'd'), ('d', 'e'), ('e', 'c')]
>>> digraph = Digraph(edges)
>>> digraph
Digraph(edges=[('a', 'c'), ('a', 'b'), ('a', 'f'), ('c', 'd'), ('d', 'e'), ('e', 'c')])

>>> digraph.root_nodes
('a',)
>>> digraph.terminal_nodes
('b', 'f')
>>> digraph.cyclic_nodes
('c', 'd', 'e')
>>> digraph.is_cyclic
True
```

- Use `datastructuretools.ObjectInventory` as the base class for an ordered collection of system objects.
- Object inventories inherit from `list` and are mutable.
- Object inventories extend `append()`, `extend()` and `__contains__()` to allow token input.

Added new `wellformednesstools` package.

- This version of the package implements the following classes:

```
wellformednesstools.BeamedQuarterNoteCheck
wellformednesstools.DiscontiguousSpannerCheck
wellformednesstools.DuplicateIdCheck
wellformednesstools.EmptyContainerCheck
wellformednesstools.IntermarkedHairpinCheck
wellformednesstools.MisduratedMeasureCheck
wellformednesstools.MisfilledMeasureCheck
wellformednesstools.MispitchedTieCheck
wellformednesstools.MisrepresentedFlagCheck
wellformednesstools.MissingParentCheck
wellformednesstools.NestedMeasureCheck
```

```
wellformednesstools.OverlappingBeamCheck
wellformednesstools.OverlappingGlissandoCheck
wellformednesstools.OverlappingOctavationCheck
wellformednesstools.ShortHairpinCheck
```

- The classes check different aspects of score well-formedness.
- To call these classes use `componenttools.is_well_formed_component()` or `componenttools.tabulate_well_formedness_violations_in_expr()`.

Added new `decoratortools` package.

- This version of the package contains only the `requires` decorator.
- The `requires` decorator will be used in later versions of Abjad to specify the input and output types of functions explicitly.
- This will help in the construction of function- and class-population tools.

Added new `scoretemplatetools` package.

- This version of the package implements the following classes:

```
scoretemplatetools.StringQuartetScoreTemplate
scoretemplatetools.TwoStaffPianoScoreTemplate
```

- Example:

```
>>> from abjad.tools import scoretemplatetools

>>> template = scoretemplatetools.StringQuartetScoreTemplate()
>>> score = template()

>>> score
Score-"String Quartet Score"<<1>>

>>> f(score)
\context Score = "String Quartet Score" <<
    \context StaffGroup = "String Quartet Staff Group" <<
        \context Staff = "First Violin Staff" {
            \clef "treble"
            \context Voice = "First Violin Voice" {
            }
        }
        \context Staff = "Second Violin Voice" {
            \clef "treble"
        }
        \context Staff = "Viola Staff" {
            \clef "alto"
        }
        \context Staff = "Cello Staff" {
            \clef "bass"
        }
    >>
>>
```

- Class usage follows a two-step initialize-then-call pattern.

Added new `rhythmtreetools` package for parsing IRCAM-like RTM syntax.

- This version of the package implements the following function:

```
rhythmtreetools.parse_rtm_syntax.parse_rtm_syntax()
```

- Example:

```
>>> from abjad.tools.rhythmtreetools import parse_rtm_syntax

>>> rtm = '(1 (1 (1 (1 1)) 1))'
>>> result = parse_rtm_syntax(rtm)
>>> result
FixedDurationTuplet(1/4, [c'8, c'16, c'16, c'8])
```

- Use the `rhythmtreetools` package to turn nested lists of numbers into Abjad tuplets.

Added new `timetokentools` package.

- This version of the package contains the following concrete classes:

```
timetokentools.NoteFilledTimeTokenMaker
timetokentools.OutputBurnishedSignalFilledTimeTokenMaker
timetokentools.OutputIncisedNoteFilledTimeTokenMaker
timetokentools.OutputIncisedRestFilledTimeTokenMaker
timetokentools.RestFilledTimeTokenMaker
timetokentools.SignalFilledTimeTokenMaker
timetokentools.TokenBurnishedSignalFilledTimeTokenMaker
timetokentools.TokenIncisedNoteFilledTimeTokenMaker
timetokentools.TokenIncisedRestFilledTimeTokenMaker
```

- The `timetokentools` package implements a family of related rhythm-making classes.
- Class usage follows a two-step initialize-then-call pattern.

Added new classes to `instrumenttools`.

- Added human voice classes:

```
instrumenttools.BaritoneVoice
instrumenttools.BassVoice
instrumenttools.ContraltoVoice
instrumenttools.MezzoSopranoVoice
instrumenttools.SopranoVoice
instrumenttools.TenorVoice
```

Added new time-interval tree functionality:

- Extended `TimeIntervalTree` with the following public methods:

```
scale_by_rational()
scale_to_rational()
shift_by_rational()
shift_to_rational()
split_at_rationals()
```

- These methods allow time-interval trees to behave more similary to time-intervals.

All score components are now public.

- The following classes are now publically available for the first time:

```
componenttools.Component
contexttools.Context
leaftools.Leaf
```

Further new functionality:

- Added the `marktools.BendAfter` class to model LilyPond's `\bendAfter command`:

```
>>> n = Note(0, 1)
>>> marktools.BendAfter(8)(n)
BendAfter(8.0)(c'1)
>>> f(n)
c'1 - \bendAfter #'8.0
```

- Added public `pair` property to `contexttools.TimeSignatureMark`:

```
>>> time_signature = contexttools.TimeSignatureMark((3, 16))
>>> time_signature.pair
(3, 16)
```

- Added `is_hairpin_token()` to `spannertools.HairpinSpanner` class.

  Hairpin tokens are triples of the form `(x, y, z)` with dynamic tokens `x`, `y` and hairpin shape string `z`. For example `('p', '<', 'f')`.

- Added `resttools.replace_leaves_in_expr_with_rests()`.
- Added `leaftools.replace_leaves_in_expr_with_parallel_voices()`.
- Added `leaftools.replace_leaves_in_expr_with_named_parallel_voices()`.

  Use the functions listed above to replace leaves in an expression with parallel voices containing copies of those leaves in both voices. This is useful for generating stemmed-glissandi structures.

- Added `contexttools.list_clef_names()`:

```
>>> contexttools.list_clef_names()
['alto', 'baritone', 'bass', 'mezzosoprano', 'percussion', 'soprano', 'treble']
```

- Added `find-slots-implementation-inconsistencies` development script.

Changes to end-user functionality:

- Changed `intervaltreetools` to `timeintervaltools`.
- Changed `contexttools.Context.context` to `contexttools.Context.context_name`.
- Calling `bool(Container())` on empty containers now returns false. The previous behavior of the system was to return true. The new behavior better conforms to the Python iterable interface.
- Moved `abjad/docs/scr/make-abjad-api` to `abjad/scr/make-abjad-api`.

1.3.4 Abjad 2.7

Released 2012-02-27. Built from r5100. Implements 221 public classes and 1029 functions totalling 168,000 lines of code.

- Added `lilypondparsertools.LilyPondParser` class, which arses a subset of LilyPond input syntax:

```
>>> from abjad.tools.lilypondparsertools import LilyPondParser
>>> parser = LilyPondParser( )
>>> input = r"\new Staff { c'4 ( d'8 e' fs'2) \fermata }"
>>> result = parser(input)
>>> f(result)
\new Staff {
    c'4 (
    d'8
    e'8
```

```
    fs'2 -\fermata )
}
```

LilyPondParser defaults to English note names, but any of the other languages supported by LilyPond may be used:

```
>>> parser = LilyPondParser('nederlands')
>>> input = '{ c des e fis }'
>>> result = parser(input)
>>> f(result)
{
    c4
    df4
    e4
    fs4
}
```

Briefly, LilyPondParser understands theses aspects of LilyPond syntax:

- Notes, chords, rests, skips and multi-measure rests
- Durations, dots, and multipliers
- All pitchnames, and octave ticks
- Simple markup (i.e. `c'4 ^ "hello!"`)
- Most articulations
- Most spanners, including beams, slurs, phrasing slurs, ties, and glissandi
- Most context types via `\new` and `\context`, as well as context ids (i.e. `\new Staff = "foo" { }`)
- Variable assignment (i.e. `global = { \time 3/4 } \new Staff { \global }`)
- Many music functions: `- \acciaccatura - \appoggiatura - \bar - \breathe - \clef - \grace - \key - \transpose - \language - \makeClusters - \mark - \oneVoice - \relative - \skip - \slashedGrace - \time - \times - \transpose - \voiceOne`, `\voiceTwo`, `\voiceThree`, `\voiceFour`

LilyPondParser currently **DOES NOT** understand many other aspects of LilyPond syntax:

- `\markup`
- `\book`, `\bookpart`, `\header`, `\layout`, `\midi` and `\paper`
- `\repeat` and `\alternative`
- Lyrics
- `\chordmode`, `\drummode` or `\figuremode`
- Property operations, such as `\override`, `\revert`, `\set`, `\unset`, and `\once`
- Music functions which generate or extensively mutate musical structures
- Embedded Scheme statements (anything beginning with #)

- Added `iotools.p( )`, for conveniently parsing LilyPond syntax:

```
>>> result = p(r"\new Staff { c'4 d e f }")
>>> f(result)
\new Staff {
    c'4
```

```
    d4
    e4
    f4
}
```

- Added `schemetools.Scheme`, as a more robust replacement for nearly all other `schemetools` classes:

```
>>> from abjad.tools.schemetools import Scheme
>>> print Scheme(True).format
##t
>>> print Scheme('a', 'list', 'of', 'strings').format
#(a list of strings)
>>> print Scheme(('simulate', 'a', 'vector'), quoting="'#").format
#'#(simulate a vector)
>>> print Scheme('a', ('nested', ('data', 'structure'))).format
#(a (nested (data structure))
```

- Removed deprecated `schemetools` classes:
  - `SchemeBoolean`
  - `SchemeFunction`
  - `SchemeNumber`
  - `SchemeString`
  - `SchemeVariable`

  In all cases, simply use `schemetools.Scheme` instead.

- Reimplemented MarkupCommand.

  The new implementation is initialized from a command-name, and a variable-size list of arguments. Arguments which are lists or tuples will be enclosed in curly-braces:

```
>>> from abjad.tools.markuptools import MarkupCommand
>>> bold = MarkupCommand('bold', ['two', 'words'])
>>> rotate = MarkupCommand('rotate', 60, bold)
>>> triangle = MarkupCommand('triangle', False)
>>> concat = MarkupCommand('concat', ['one word', rotate, triangle])
>>> print concat.format
\concat { #"one word" \rotate #60 \bold { two words } \triangle ##f }
```

- Added `contexttools.TempoMarkInventory`, which models an ordered list of tempo marks:

```
>>> contexttools.TempoMarkInventory([('Andante', Duration(1, 8), 72), ('Allegro', Duration(1, 8)
TempoMarkInventory([TempoMark('Andante', Duration(1, 8), 72), TempoMark('Allegro', Duration(1, 8
```

  Inherits from list. Allows initialization, append and extent on tempo mark tokens.

- Added new `pitchtools.PitchRangeInventory` class.

  The class acts as an ordered list of PitchRange objects.

  The purpose of the class is to model something like palettes of different pitches available in all part of a score:

```
>>> pitchtools.PitchRangeInventory(['[C3, C6]', '[C4, C6]'])
PitchRangeInventory([PitchRange('[C3, C6]'), PitchRange('[C4, C6]')])
```

  The class inherits from list.

- Added `sequencetools.all_are_pairs()` predicate:

```
>>> from abjad.tools.sequencetools import all_are_pairs
>>> all_are_pairs([(1, 2), (3, 4), (5, 6)])
True
```

- Added `sequencetools.all_are_pairs_of_types()` predicate:

```
>>> from abjad.tools.sequencetools import all_are_pairs_of_types
>>> all_are_pairs_of_types([('a', 1.4), ('b', 2.3), ('c', 1.5)], str, float)
True
```

- Added `stringtools.is_underscore_delimited_lowercase_file_name_with_extension()` string predicate:

```
>>> stringtools.is_underscore_delimited_lowercase_file_name_with_extension('foo_bar.blah')
True
```

- Added `iotools.is_underscore_delimited_file_name()` string predicate.

  Returns true on any underscore-delimited lowercase string.

  Also returns trun on an underscore-delimtied lowercase string terminated with an extension.

```
>>> stringtools.is_underscore_delimited_lowercase_file_name('foo_bar.py')
True

>>> stringtools.is_underscore_delimited_lowercase_file_name('foo_bar')
True
```

- Added `ImpreciseTempoError` to exceptions.
- Added `LilyPondParserError` to exceptions.
- Added `scr/devel/fix-test-cases`. The script is a two-line wrapper around the following other two scripts:
  - `scr/devel/fix-test-case-names`
  - `scr/devel/fix-test-case-numbers`
- Extended `Container` to use `LilyPondParser` to parse input strings.
- Extended `contexttools.InstrumentMark`, `scoretools.Performer` and `markuptools.Markup` with `__hash__` equality.

  Now, if two instances compare equally (via ==), their hashes also compare equally, allowing for more intuitive use of these classes as dictionary keys.

- Extended `contexttools.TempoMark` with textual indications and tempo ranges You may instantiate as normal, or in some new combinations:

```
>>> from abjad.tools.contexttools import TempoMark
>>> t = TempoMark('Langsam', Duration(1, 4), (52, 57))
>>> t = TempoMark('Langsam')
>>> t = TempoMark((1, 4), (52, 57))
```

  In addition to its new read/write "textual_indication" attribute, TempoMark now also exposes a read-only "is_imprecise" property, which returns True if the mark cannot be expressed simply as duration=units_per_minute. Arithmetic operations on TempoMarks will now raise ImpreciseTempoErrors if any mark involved is imprecise.

- Extended tempo marks to be able to initialize from 'tempo mark tokens'. A tempo mark token is a length-2 or length-3 tuple of tempo mark arguments.

- Extended tempo mark with `is_tempo_mark_token()` method:

```
>>> tempo_mark = contexttools.TempoMark(Duration(1, 4), 72)
>>> tempo_mark.is_tempo_mark_token((Duration(1, 4), 84))
True
```

- Extended case-testing `iotools` string predicates to allow digits.

  Functions changed:

  - `stringtools.is_space_delimited_lowercase_string`
  - `stringtools.is_underscore_delimited_lowercase_file_name`
  - `stringtools.is_lowercamelcase_string`
  - `stringtools.is_uppercamelcase_string`
  - `stringtools.is_underscore_delimited_lowercase_string`
  - `stringtools.is_underscore_delimited_lowercase_file_name_with_extension`

- Extended `lilypondfiletools.NonattributedBlock` with `is_formatted_when_empty` read-write property. `lilypondfiletools.ScoreBlock` no longer formats when empty, by default.
- Extended `marktools.BarLine` with `format_slot` keyword.
- Extended `pitchtools.PitchRange` class with read-only `pitch_range_name` and `pitch_range_name_markup` attributes.
- Extended `scoretools.InstrumentationSpecifier` with read-only `performer_name_string` attribute.
- Extended all `beamtools.Beam-`, `Slur-` and `Hairpin-``related spanner classes, as well as ``tietools.TieSpanner` with an optional ``direction` keyword:

```
>>> c = Container("c'4 d'4 e'4 f'4")
>>> spanner = spannertools.SlurSpanner(c[:], 'up')
>>> f(c)
{
    c'4 ^ (
    d'4
    e'4
    f'4 )
}
```

  The direction options are exactly the same as for `Articulation` and `Markup`: `'up'`, `'^'`, `'down'`, `'_'`, `'neutral'`, `'-'` and `None`.

- Extended `tonalitytools.Scale` with `create_named_chromatic_pitch_set_in_pitch_range()` method.
- Changed `tuplettools.FixedDurationTuplet.multiplier` to return fraction instead of duration.
- Renamed attributes, methods and functions throughout `intervaltreetools`:
  - `centroid` => `center` (except where a weighted mean is actually used)
  - `high` => stop‘‘
  - `high_min` => earliest_stop‘‘
  - `high_max` => latest_stop‘‘
  - `low` => `start`
  - `low_min` => `earliest_start`

  - low_max => latest_start
  - magnitude => duration

  This both clarifies the API, and prevents shadowing of Python's builtin min() and max().

- Renamed marktools.Articulation.direction_string => marktools.Articulation.direction.
- Renamed markuptools.Markup.direction_string` => ``markuptools.Markup.direction.
- Renamed tuplettools.Tuplet.ratio to tuplettools.Tuplet.ratio_string.
- Renamed scr/devel/find-nonalphabetized-method-names to scr/devel/find-nonalphabetized-class-attributes.
- Improved scr/devel/find-nonalphabetzied-methods.
- Updated literature examples to match API changes.
- Removed ancient stafftools.make_invisible_staff().
- Added text_editor key to user config dictionary (in ~/.abjad/config.py).
- Improved __repr__ strings of tonalitytools.Mode and tonalitytools.Scale.
- contexttools.TempoMark __repr__ now shows __repr__ version of duration instead of string version of duration.
- scr/devel/abj-grp no longer excludes lines of code that include the string 'svn'.

1.3.5 Abjad 2.6

Released 2012-01-29. Built from r4979. Implements 197 public classes and 941 public functions totalling 153,000 lines of code.

- Added top-level decorators directory with requires decorator. The requires decorator renders the following two function definitions equivalent:

```
from abjad.tools.decoratortools import requires

@requires(int)
def foo(x):
    return x ** 2

def foo(x):
    assert isinstance(x, int)
    return x ** 2
```

- Added new classes to scoretools:

```
scoretools.InstrumentationSpecifier
scoretools.Performer
```

- Added scoretools.list_performer_names():

```
>>> for name in scoretools.list_performer_names()[:10]:
...     name
...
'accordionist'
'bassist'
'bassoonist'
'cellist'
'clarinetist'
```

```
'flutist'
'guitarist'
'harpist'
'harpsichordist'
'hornist'
```

- Added `scoretools.list_primary_performer_names()`.
- Added `measuretools.measure_to_one_line_input_string()`:

```
>>> measure = Measure((3, 4), "c4 d4 e4")

>>> measure
Measure(3/4, [c4, d4, e4])

>>> measuretools.measure_to_one_line_input_string(measure)
"Measure((3, 4), 'c4 d4 e4')"
```

- Added new classes to `instrumenttools`:

```
SopraninoSaxophone
SopranoSaxophone
AltoSaxophone
TenorSaxophone
BaritoneSaxophone
BassSaxophone
ContrabassSaxophone

ClarinetInA

AltoTrombone
BassTrombone

Harpsichord
```

- Added known untuned percussion:

```
>>> for name in instrumenttools.UntunedPercussion.known_untuned_percussion[:10]:
...     print name
...
agogô
anvil
bass drum
bongo drums
cabasa
cajón
castanets
caxixi
claves
conga drums
```

- Added `_Instrument.get_default_performer_name()`:

```
>>> bassoon = instrumenttools.Bassoon()

>>> bassoon.get_default_performer_name()
'bassoonist'
```

- Added `_Instrument.get_performer_names()`:

```
>>> bassoon.get_performer_names()
['instrumentalist', 'reed player', 'double reed player', 'bassoonist']
```

- Added read / write `_Instrument.pitch_range`:

```
>>> marimba.pitch_range = (-24, 36)
>>> marimba.pitch_range
PitchRange('[C2, C7]')
```

- Added read-only `_Instrument.traditional_pitch_range`:

```
>>> marimba = instrumenttools = instrumenttools.Marimba()
>>> marimba.traditional_pitch_range
PitchRange('[F2, C7]')
```

- Added `instrumenttools.list_instruments()`:

```
>>> for instrument_name in instrumenttools.list_instrument_names()[:10]:
...     instrument_name
...
'accordion'
'alto flute'
'alto saxophone'
'alto trombone'
'clarinet in B-flat'
'baritone saxophone'
'bass clarinet'
'bass flute'
'bass saxophone'
'bass trombone'
```

- Added other functions to `instrumenttools`:

```
instrumenttools.list_primary_instrument_names()
instrumenttools.list_secondary_instrument_names()
```

- Added new class to `lilypondfiletools`:

```
ContextBlock
```

- Added `pitchtools.is_symbolic_pitch_range_string()`:

```
>>> pitchtools.is_symbolic_pitch_range_string('[A0, C8]')
True
```

- Added `pitchtools.pitch_class_octave_number_string_to_chromatic_pitch_name()`:

```
>>> pitchtools.pitch_class_octave_number_string_to_chromatic_pitch_name('A#4')
"as'"
```

- Added `pitchtools.symbolic_accidental_string_to_alphabetic_accidental_string_abbreviation`

```
>>> pitchtools.alphabetic_accidental_abbreviation_to_symbolic_accidental_string('tqs')
'#+'
```

- Added other new functions to `pitchtools`:

```
pitchtools.alphabetic_accidental_abbreviation_to_symbolic_accidental_string()
pitchtools.is_smbolic_accidental_string()
pitchtools.is_pitch_class_octave_number_string()
```

- Added `stringtools.string_to_strict_directory_name()`:

```
>>> stringtools.string_to_strict_directory_name('Déja vu')
'deja_vu'
```

- Added `stringtools.strip_diacritics_from_binary_string()`:

```
>>> binary_string = 'Dvořák'
>>> stringtools.strip_diacritics_from_binary_string(binary_string)
'Dvorak'
```

- Added other new functions to `iotools`:

```
stringtools.capitalize_string_start()
iotools.is_space_delimited_lowercamelcase_string()
iotools.is_underscore_delimited_lowercamelcase_package_name()
iotools.is_underscore_delimited_lowercamelcase_string()
stringtools.is_lowercamelcase_string()
stringtools.is_uppercamelcase_string()
stringtools.space_delimited_lowercase_to_uppercamelcase()
stringtools.uppercamelcase_to_space_delimited_lowercase()
stringtools.uppercamelcase_to_underscore_delimited_lowercase()
```

- Added new functions to `mathtools`:

```
mathtools.is_positive_integer_power_of_two()
mathtools.is_integer_equivalent_expr()
```

- Added sequence type-checking predicates:

```
chordtools.all_are_chords()
containertools.all_are_containers()
durationtools.all_are_duration_tokens()
durationtools.all_are_durations()
gracetools.all_are_grace_containers()
leaftools.all_are_leaves()
markuptools.all_are_markup()
measuretools.all_are_measures()
notetools.all_are_notes()
pitcharraytools.all_are_pitch_arrays()
pitchtools.all_are_named_chromatic_pitch_tokens()
resttools.all_are_rests()
scoretools.all_are_scores()
sievetools.all_are_residue_class_expressions()
skiptools.all_are_skips()
spannertools.all_are_spanners()
stafftools.all_are_staves()
tuplettools.all_are_tuplets()
```

- Extended `NamedChromaticPitch` to allow initialization from pitch-class / octave number strings:

```
>>> pitchtools.NamedChromaticPitch('C#2')
NamedChromaticPitch('cs,')
```

- Extended `PitchRange` to allow initialization from symbolic pitch range strings:

```
>>> pitchtools.PitchRange('[A0, C8]')
PitchRange('[A0, C8]')
```

- Extended `PitchRange` to allow initialization from pitch-class / octave number strings:

```
>>> pitchtools.PitchRange('A0', 'C8')
PitchRange('[A0, C8]')
```

- Extended `leaftools.is_bar_line_crossing_leaf()` to work when no explicit time signature mark is found.
- Extended `Markup` to be able to function as a top-level `LilyPondFile` element.
- Extended instruments with `is_primary` and `is_secondary` attributes.
- Extended instruments with `instrument_name` and `instrument_name_markup` attributes.
- Extended instruments with `short_instrument_name` and `short_instrument_name_markup` attributes.
- Extended `iotools.write_expr_to_ly()` and `iotools.write_expr_to_pdf()` with `'tagline'` keyword.
- Extended `replace-in-files` script to skip `.text`, `.ly` and `.txt` files.
- Renamed `Accidental.symbolic_string` to `Accidental.symbolic_accidental_string`.
- Renamed `Accidental.alphabetic_string` to `Accidental.alphabetic_accidental_abbreviation`.
- Fixed bug in `iotools.play()`.
- Fixed bug in `quantizationtools` regarding quantizing a stream of `QEvents` directly.

1.3.6 Abjad 2.5

Released 2011-09-22. Built from r4803.

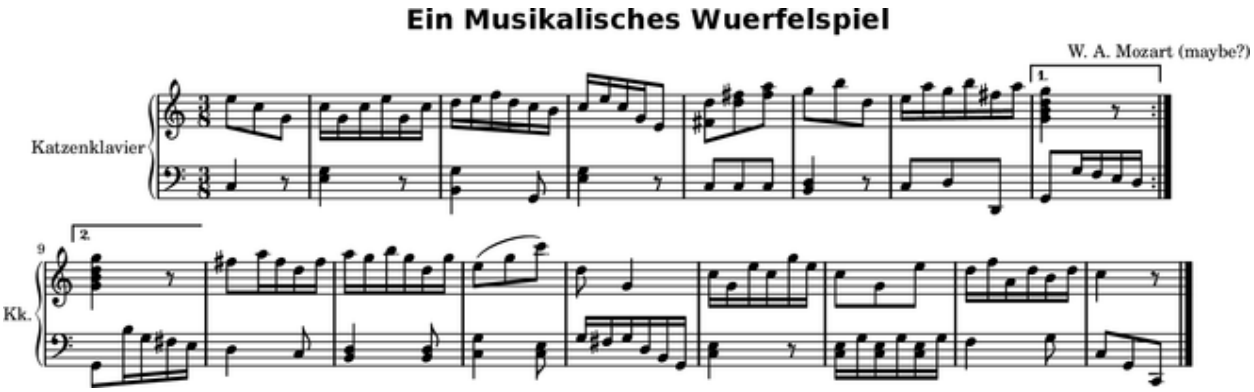
- Added `get_leaf_in_expr_with_minimum_prolated_duration()` function to `leaftools`.
- Added `get_leaf_in_expr_with_maximum_prolated_duration()` function to `leaftools`.
- Added `are_relatively_prime()` function to `mathtools`.
- Added `CyclicTree` class to `sequencetools`.
- Added `get_next_n_nodes_at_leve(n, level)` method to `sequencetools.Tree`.
- Extended spanners to sort by repr.
- Renamed `lilyfiletools` to `lilypondfiletools`.
- Renamed `lilyfiletools.LilyFile` to `lilypondfiletools.LilyPondFile`.
- Renamed `lilyfiletools.make_basic_lily_file()` to `lilypondfiletools.make_basic_lilypond_file`

Note that the three renames change user syntax. Composers working with the `lilypondfiletools` module should update their score code.

1.3.7 Abjad 2.4

Released 2011-09-12. Built from r4769.

- Added Mozart Musikalisches Wuerfelspiel.



- Added new `Tree` class to `sequencetools` to work with sequences whose elements have been grouped into arbitrarily many levels of containment.
- Added new `BarLine` class to `marktools` package.
- Added new `HorizontalBracketSpanner` to `spannertools` package.
- Improved `schemetools.SchemePair` handling.
- Extended `LilyPondFile` blocks with double underscore-delimited attributes.

1.3.8 Abjad 2.3

Released 2011-09-04. Built from r4747.

Filled out the API for working with marks:

```
marktools.attach_articulations_to_components_in_expr()
marktools.detach_articulations_attached_to_component()
marktools.get_articulations_attached_to_component()
marktools.get_articulation_attached_to_component()
marktools.is_component_with_articulation_attached()
```

These five type of functions are now implemented for the following marks:

```
marktools.Annotation
marktools.Articulation
marktools.LilyPondCommandMark
marktools.LilyPondComment
marktools.StemTremolo
```

The same type of functions are likewise implemented for the following context marks:

```
contexttools.ClefMark
contexttools.DynamicMark
contexttools.InstrumentMark
contexttools.KeySignatureMark
contexttools.StaffChangeMark
contexttools.TempoMark
contexttools.TimeSignatureMark
```

- Extended `Container.extend()` to allow for LilyPond input strings. You can now say `container.extend("c'4 d'4 e'4 f'4")`.
- Added public `parent` attribute to all components. You can now say `note.parent`. The attribute is read-only.

- Added `cfgtools.list_package_dependency_version()`.
- Added `py.test` and `Sphinx` dependencies to the Abjad package.
- Added LilyPond command mark chapter to reference manual
- Renamed `cfgtools` to `configurationtools`.
- Renamed `durtools` to `durationtools`.
- Renamed `metertools` to `timesignaturetools`.
- Renamed `seqtools` to `sequencetools`.
- Renamed `Mark.attach_mark()` to `Mark.attach()`.
- Renamed `Mark.detach_mark()` to `Mark.detach()`.
- Renamed `marktools.Comment` to `marktools.LilyPondComment`. This matches `marktools.LilyPondCommandMark`.
- Removed `contexttools.TimeSignatureMark(3, 8)` initialization. You must now say `contexttools.TimeSignatureMark((3, 8))` instead. This parallels the initialization syntax for rests, skips and measures.

1.3.9 Abjad 2.2

Released 2011-08-30. Built from r4677.

- Added articulations chapter to reference manual.
- Reordered the way in which Abjad determines the value of the `HOME` environment variable.
- Updated `scr/devel/replace-in-files` to avoid image files.
- Updated `iotools.log()` to call operating-specific text editor.

1.3.10 Abjad 2.1

Released 2011-08-21. Built from r4655.

- Updated instrument mark `repr` to display target context when instrument mark is attached.
- Extended `scr/abj` and `scr/abjad` to display Abjad version and revision numbers on startup.

1.3.11 Abjad 2.0

Released 2011-08-17. Built from r4638.

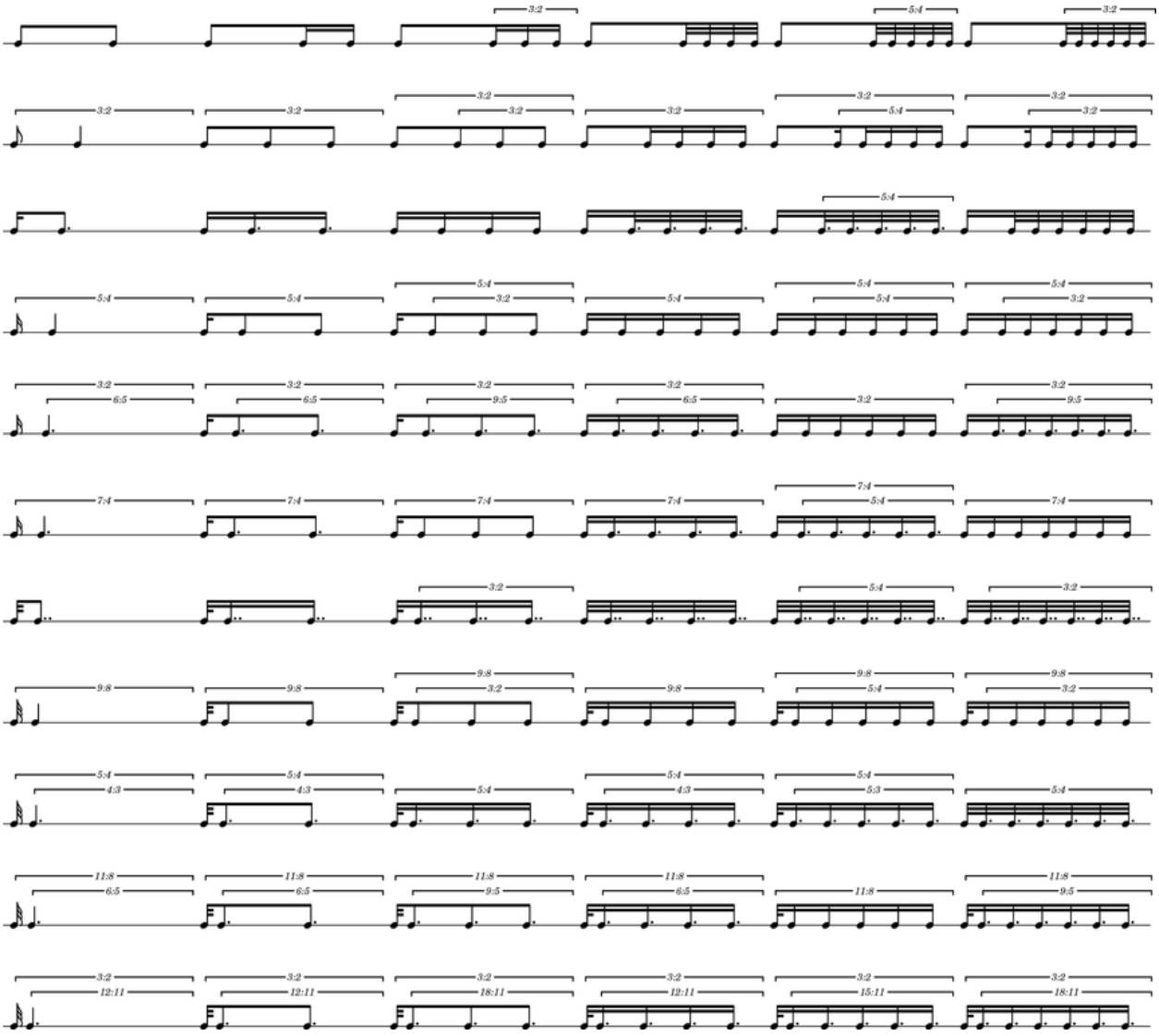
Abjad 2.0 is the first public release of Abjad in more than two years. The new release of the system more than doubles the number of classes, functions and packages available in Abjad.

- The API has been cleaned up and completely reorganized. Features have been organized into a collection of 39 different libraries:

```
cfgtools/          instrumenttools/   mathtools/         resttools/         tempotools/
chordtools/        intervaltreetools/ measuretools/      schemetools/       threadtools/
componenttools/    iotools/           metertools/        scoretools/        tietools/
containertools/    layouttools/       musicxmltools/     seqtools/          tonalitytools/
contexttools/      leaftools/         notetools/         sievetools/        tuplettools/
durtools/          lilyfiletools/     pitcharraytools/   skiptools/         verticalitytools/
```

```
gracetools/        marktools/         pitchtools/        spannertools/      voicetools/
importtools/       markuptools/       quantizationtools/ stafftools/
```

- The name of almost every function in the public API has been changed to better indication what the function does. While this has the effect of making Abjad 2.0 largely non-backwards compatible with code written in Abjad 1.x, the longer and much more explicit function names in Abjad 2.0 make code used to structure complex scores dramatically easier to maintain and understand.
- The `contexttools`, `instrumenttools`, `intervaltreetools`, `lilyfiletools`, `marktools`, `pitcharraytools`, `quantizationtools`, `sievetools`, `tonalitytools` and `verticalitytools` packages are completely new.
- The classes implemented in the `contexttools` and `marktools` packages provide an object-oriented interfaces to clefs, time signatures, key signatures, articulations, tempo marks and other symbols stuck to the outside of the hierarchical score tree. The classes implemented in `contexttools` and `marktools` model information outside the score tree much the way that the classes implemented in `spannertools` implement object-oriented interfaces to beams, brackets, hairpins, glissandi and other line-like symbols.
- The `instrumenttools` package provides an object-oriented model of most of the conventional instruments of the orchestra.
- The `intervaltreetools` package implements a custom way of working with chunks of score during composition.
- The `lilyfiletools` package implements an object-oriented interface to arbitrarily structured LilyPond input files.
- The `pitcharraytools` package implements an object-oriented way of composing with pitches, pitch-classes and other pitch-related objects independent of rhythmic context.
- The experimental `quantizationtools` package implements classes and functions for quantizing rhythmic events.
- The `sievetools` package implements an object-oriented interface to the basics of Xenakis's system of sieves.
- The `tonalitytools` package implements classes and methods to model the basics of functional harmonic analysis.
- The `verticalitytools` package provides vertical-moment-based iteration and analysis of any score.
- The `pitchtools` package has grown considerably in size and functionality. Classes now exist to model named and numbered chromatic pitches (and pitch-classes), named and numbered diatonic pitches (and pitch-classes), melodic and harmonic diatonic intervals (and interval-classes), melodic and harmonic chromatic intervals (and interval-classes), as well as ordered segments and unordered sets of these and related objects. The package contains dozens of functions to create, inspect, iterate, analyze and transpose these classes and their collections.
- The old `listtools` package has been renamed seqtools.
- Dozens of new functions for cutting, pasting, partitioning, breaking, arranging and reordering score components have been added to the system. See the new functions in `componenttools`, `containertools`, `leaftools`, `measuretools` and `scoretools` for details.
- The core component classes modeling notes, rests, chords, tuplets, measures, voices, staves and scores have been reimplemented to consume dramatically less memory, making it much easier to work with arrays of hundreds and thousands of components.
- Abjad core formatting logic has been optimized to make the formatting of scores with hundreds or thousands of events take much less time than before.
- The component duration interfaces have been replaced by more straightforward read-only component attributes.
- Added Ferneyhough Unsichbare Farben example.



CHAPTER

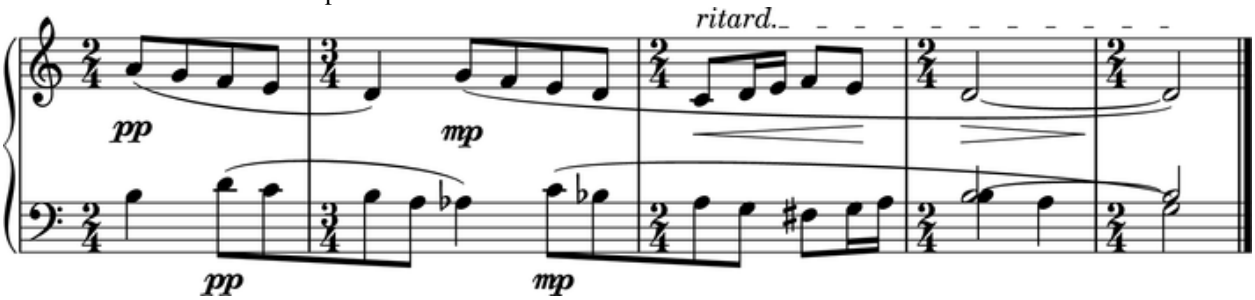
TWO

EXAMPLES

2.1 Bartók: *Mikrokosmos*

This example reconstructs the last five measures of Bartók's "Wandering" from *Mikrokosmos*, volume III. The end result is just a few measures long but covers the basic features you'll use most often in Abjad.

Here is what we want to end up with:



2.1.1 The score

We'll construct the fragment top-down from containers to notes. We could have done it the other way around but it will be easier to keep the big picture in mind this way. Later, you can rebuild the example bottom-up as an exercise.

First let's create an empty score with a pair of staves connected by a brace:

```
>>> score = Score([])
>>> piano_staff = scoretools.PianoStaff([])
>>> upper_staff = Staff([])
>>> lower_staff = Staff([])

>>> piano_staff.append(upper_staff)
>>> piano_staff.append(lower_staff)
>>> score.append(piano_staff)
```

Here we create an empty score and assign it to the `score` variable. Then we create an empty piano staff assigned to the `piano_staff` variable and two empty staves assigned to the `upper_staff` and `lower_staff` variables. Finally, we append the two staves to the piano staff and the piano staff to the score.

2.1.2 The measures

Now let's add some measures to our score:

```
>>> m1 = Measure((2, 4), [])
>>> m2 = Measure((3, 4), [])
>>> m3 = Measure((2, 4), [])
>>> m4 = Measure((2, 4), [])
>>> m5 = Measure((2, 4), [])

>>> upper_measures = [m1, m2, m3, m4, m5]
>>> lower_measures = componenttools.copy_components_and_covered_spanners(upper_measures)

>>> upper_staff.extend(upper_measures)
>>> lower_staff.extend(lower_measures)
```

The lower measures are copies of the upper measures.

Note that we add lists of measures to staves with `extend()`. This is because `extend()` is used for adding many objects to an iterable at once while `append()` is used to add only one object at a time.

2.1.3 The notes

Now let's add some notes. We begin with the upper staff:

```
>>> upper_measures[0].extend([Note(i, (1, 8)) for i in [9, 7, 5, 4]])

>>> upper_measures[1].extend(notetools.make_notes([2, 7, 5, 4, 2], [(1, 4)] + [(1, 8)] * 4))

>>> notes = notetools.make_notes([0, 2, 4, 5, 4], [(1, 8), (1, 16), (1, 16), (1, 8), (1, 8)])
>>> upper_measures[2].extend(notes)

>>> upper_measures[3].append(Note("d'2"))

>>> upper_measures[4].append(Note("d'2"))
```

Now let's add notes to the lower staff. This will be a more intricate process than that needed for the upper staff. We added notes directly to the measures of the upper staff. But this will not be possible for the lower staff because of the simultaneous voices the lower staff contains.

We add notes to the lower staff measure by measure:

```
>>> main_voice_m1 = Voice("b4 d'8 c'8")
>>> main_voice_m1.name = 'main_voice'
>>> lower_measures[0].append(main_voice_m1)

>>> main_voice_m2 = Voice("b8 a8 af4 c'8 bf8")
>>> main_voice_m2.name = 'main_voice'
>>> lower_measures[1].append(main_voice_m2)

>>> main_voice_m3 = Voice("a8 g8 fs8 g16 a16")
>>> main_voice_m3.name = 'main_voice'
>>> lower_measures[2].append(main_voice_m3)
```

Notice that we give the same name to the three voices contained in the first three measures of the lower staff.

It is in the last two measures of the lower staff where Bartók writes two voices at once. We'll name the second of these two voices the *appendix_voice*:

```
>>> appendix_voice_m4 = Voice([Note("b2")])
>>> appendix_voice_m4.name = 'appendix_voice'
>>> lilypond_command_mark = marktools.LilyPondCommandMark('voiceOne')
```

```
>>> lilypond_command_mark.attach(appendix_voice_m4)
LilyPondCommandMark('voiceOne')(Voice-"appendix_voice"{1})

>>> main_voice_m4 = Voice("b4 a4")
>>> main_voice_m4.name = 'main_voice'
>>> lilypond_command_mark = marktools.LilyPondCommandMark('voiceTwo')
>>> lilypond_command_mark.attach(main_voice_m4)
LilyPondCommandMark('voiceTwo')(Voice-"main_voice"{2})

>>> container = Container([appendix_voice_m4, main_voice_m4])
>>> container.is_parallel = True
>>> lower_measures[3].append(container)
```

The LilyPond `\voiceOne` and `\voiceTwo` commands determine the direction of the stems in different voices.

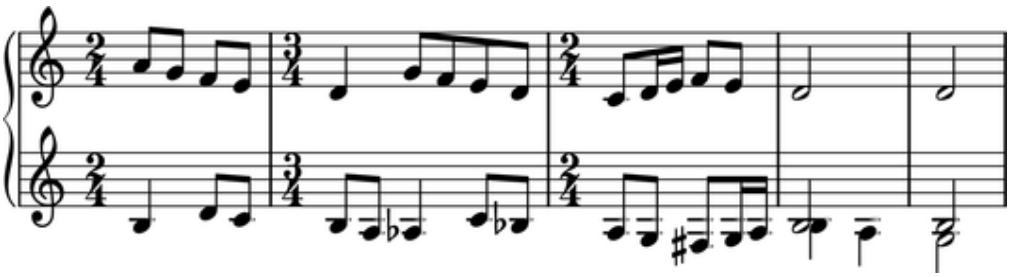
Note that we must put both voices in a parallel container because they occur at the same time in the score. We do this by creating an Abjad container and then setting the `is_parallel` attribute of the container to true.

We now do a similar thing for the last measure:

```
>>> appendix_voice_m5 = Voice("b2")
>>> appendix_voice_m5.name = 'appendix_voice'
>>> lilypond_command_mark = marktools.LilyPondCommandMark('voiceOne')
>>> lilypond_command_mark.attach(appendix_voice_m5)
LilyPondCommandMark('voiceOne')(Voice-"appendix_voice"{1})

>>> main_voice_m5 =  Voice("g2")
>>> main_voice_m5.name = 'main_voice'
>>> lilypond_command_mark = marktools.LilyPondCommandMark('voiceTwo')
>>> lilypond_command_mark.attach(main_voice_m5)
LilyPondCommandMark('voiceTwo')(Voice-"main_voice"{1})

>>> container = Container([appendix_voice_m5, main_voice_m5])
>>> container.is_parallel = True
>>> lower_measures[4].append(container)
```

Here's our work so far:

```
>>> show(score)
```



2.1.4 The details

Ok, let's add the details. First, notice that the bottom staff has a treble clef just like the top staff. Let's change that:

```
>>> contexttools.ClefMark('bass')(lower_staff)
ClefMark('bass')(Staff{5})
```

Now let's add dynamic marks. For the top staff, we'll add them to the first note of the first measure and the second note of the second measure. For the bottom staff, we'll add dynamic markings to the second note of the first measure and the fourth note of the second measure.

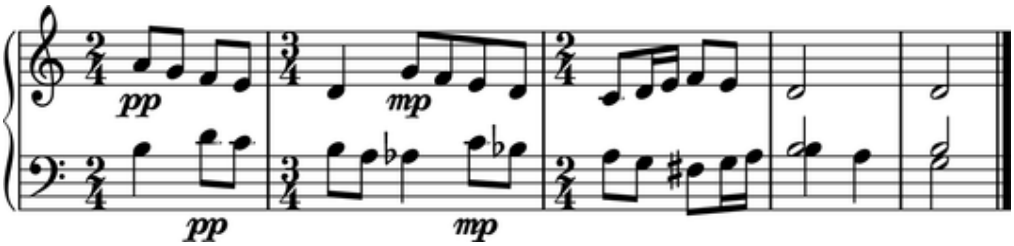
```
>>> contexttools.DynamicMark('pp')(upper_measures[0][0])
DynamicMark('pp')(a'8)
>>> contexttools.DynamicMark('mp')(upper_measures[1][1])
DynamicMark('mp')(g'8)
>>> contexttools.DynamicMark('pp')(lower_measures[0][0][1])
DynamicMark('pp')(d'8)
>>> contexttools.DynamicMark('mp')(lower_measures[1][0][3])
DynamicMark('mp')(c'8)
```

Let's add a double bar to the end of the piece:

```
>>> bar_line = marktools.BarLine('|.')
>>> bar_line.attach(lower_staff.leaves[-1])
BarLine('|.')(g2)
```

And see how things are coming out:

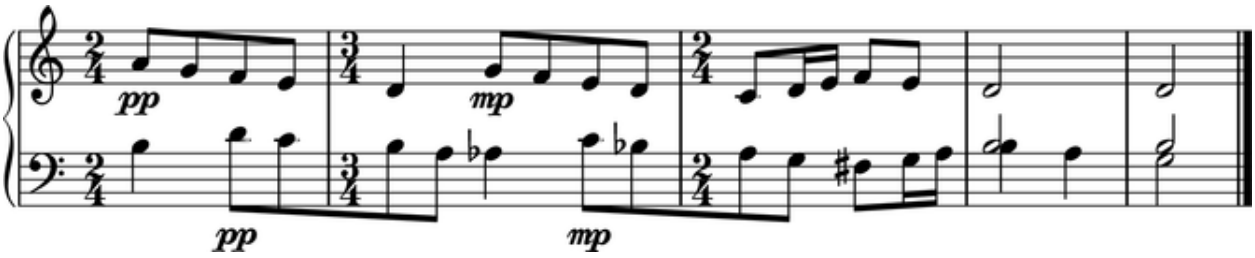
```
>>> show(score)
```



Notice that the beams of the eighth and sixteenth notes appear as you would usually expect: grouped by beat. We get this for free thanks to LilyPond's default beaming algorithm. But this is not the way Bartók notated the beams. Let's set the beams as Bartók did with some crossing the bar lines:

```
>>> beamtools.BeamSpanner(upper_measures[0])
BeamSpanner(|2/4(4)|)
>>> beamtools.BeamSpanner(lower_staff.leaves[1:5])
BeamSpanner(d'8, c'8, b8, a8)
>>> beamtools.BeamSpanner(lower_staff.leaves[6:10])
BeamSpanner(c'8, bf8, a8, g8)
```

```
>>> show(score)
```



Now some slurs:

```
>>> spannertools.SlurSpanner(upper_staff.leaves[0:5])
SlurSpanner(a'8, g'8, f'8, e'8, d'4)
>>> spannertools.SlurSpanner(upper_staff.leaves[5:])
SlurSpanner(g'8, f'8, ... [7] ..., d'2, d'2)
```

```
>>> spannertools.SlurSpanner(lower_staff.leaves[1:6])
SlurSpanner(d'8, c'8, b8, a8, af4)
>>> spannertools.SlurSpanner(lower_staff.leaves[6:13] + (main_voice_m4, main_voice_m5))
SlurSpanner(c'8, bf8, ... [5] ..., {b4, a4}, {g2})
```

Hairpins:

```
>>> spannertools.CrescendoSpanner(upper_staff.leaves[-7:-2])
CrescendoSpanner(c'8, d'16, e'16, f'8, e'8)
>>> spannertools.DecrescendoSpanner(upper_staff.leaves[-2:])
DecrescendoSpanner(d'2, d'2)
```

A ritardando marking above the last seven notes of the upper staff:

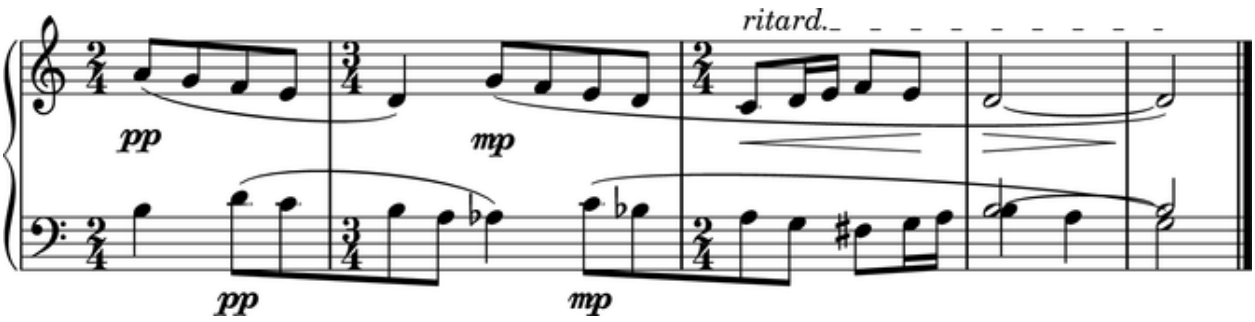
```
>>> text_spanner = spannertools.TextSpanner(upper_staff.leaves[-7:])
>>> text_spanner.override.text_spanner.bound_details__left__text = markuptools.Markup('ritard.')
```

And ties connecting the last two notes in each staff:

```
>>> tietools.TieSpanner(upper_staff[-2:])
TieSpanner(|2/4(1)|, |2/4(1)|)
>>> tietools.TieSpanner([appendix_voice_m4[0], appendix_voice_m5[0]])
TieSpanner(b2, b2)
```

The final result:

```
>>> show(score)
```



2.2 Ferneyhough: *Unsichtbare Farben*

Mikhïal Malt analyzes the rhythmic materials of Ferneyhough's *Unsichtbare Farben* in *The OM Composer's Book 2*.

Malt explains that Ferneyhough used OpenMusic to create an "exhaustive catalogue of rhythmic cells" such that:

1. They are subdivided into two pulses, with proportions from `1/1` to `1/11`.
2. The second pulse is subdivided successively by `1`, `2`, `3`, `4`, `5` and `6`.

Let's recreate Malt's results in Abjad.

2.2.1 The proportions

First we define proportions:

```
>>> proportions = [(1, n) for n in range(1, 11 + 1)]
```

```
>>> proportions
[(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (1, 7), (1, 8), (1, 9), (1, 10), (1, 11)]
```

2.2.2 The transforms

Then we make aliases to give shorter names to two functions with long names:

```
>>> make_tuplet = tuplettools.make_diminished_tuplet_from_duration_and_proportions_and_encourage_dots
>>> tie_chain_to_tuplet = tietools.tie_chain_to_diminished_tuplet_with_proportions_and_encourage_dots
```

And then define a helper function:

```
def divide_tuplet(tuplet, n):
    last_tie_chain = tietools.get_tie_chain(tuplet[-1])
    proportions = n * [1]
    tie_chain_to_tuplet(last_tie_chain, proportions)
```

2.2.3 The rhythms

We set the duration of each tuplet equal to a quarter note:

```
>>> duration = Fraction(1, 4)
```

And then we make the rhythms:

```
>>> music = []
>>> for proportion in proportions:
...     tuplets = []
...     for n in range(1, 6 + 1):
...         tuplet = make_tuplet(duration, proportion)
...         divide_tuplet(tuplet, n)
...         tuplets.append(tuplet)
...     music.extend(tuplets)
...
```

2.2.4 The score

Finally we make the score:

```
>>> staff = stafftools.RhythmicStaff(music)
>>> score = Score([staff])
>>> lilypond_file = lilypondfiletools.make_basic_lilypond_file(score)
```

Configure containers:

```
>>> contexttools.TimeSignatureMark((1, 4))(staff)
TimeSignatureMark((1, 4))(RhythmicStaff{66})
>>> score.override.bar_number.transparent = True
>>> score.set.proportional_notation_duration = schemetools.SchemeMoment(1, 56)
>>> score.set.tuplet_full_length = True
>>> score.override.spacing_spanner.uniform_stretching = True
>>> score.override.spacing_spanner.strict_note_spacing = True
>>> score.override.tuplet_bracket.padding = 2
>>> score.override.tuplet_bracket.staff_padding = 4
>>> score.override.tuplet_number.text = schemetools.SchemeFunction('tuplet-number::calc-fraction-text
```

```
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
AttributeError: 'module' object has no attribute 'SchemeFunction'
>>> score.override.time_signature.stencil = False
>>> score.override.bar_line.stencil = False
```

Import layout tools:

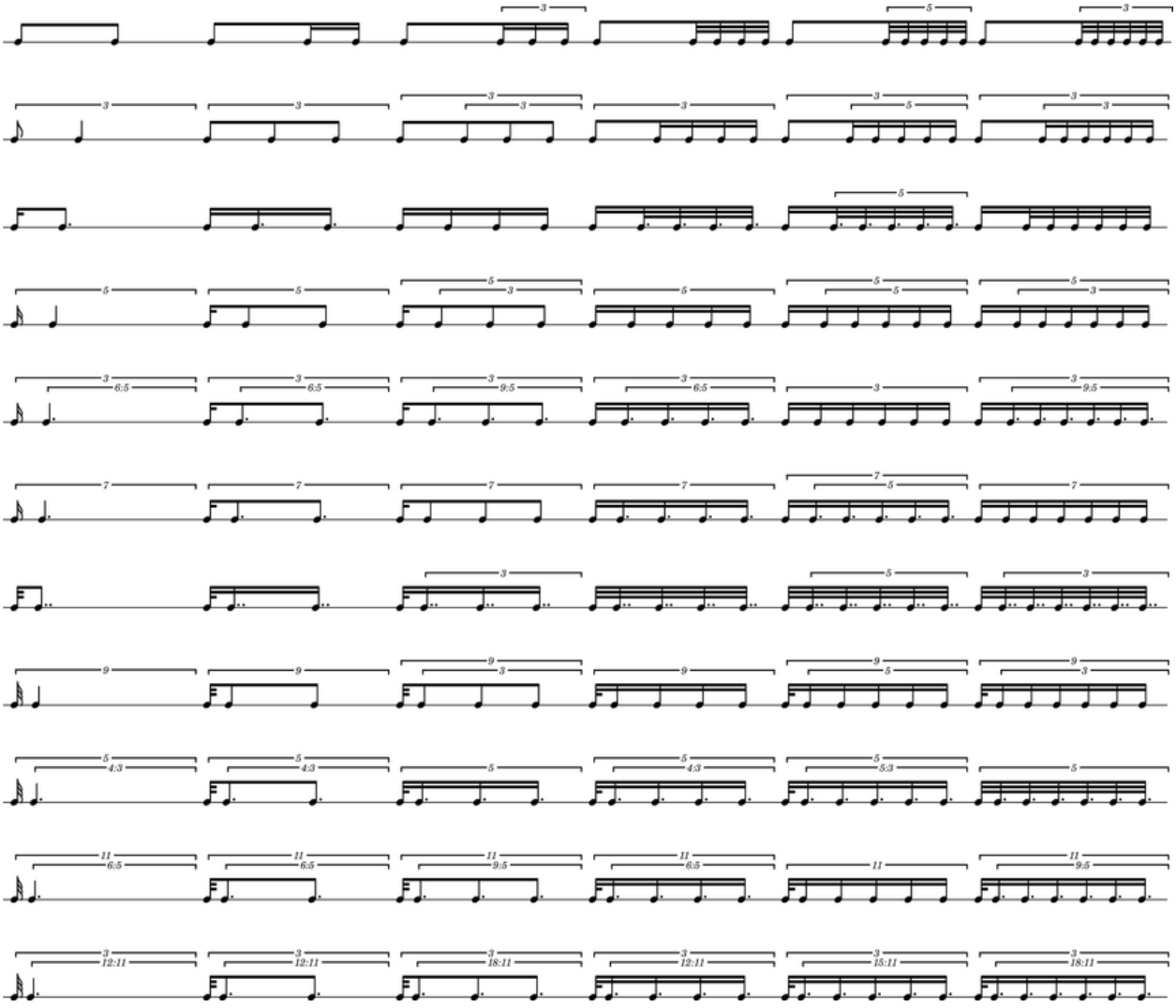
```
>>> from abjad.tools import layouttools
```

Configure the LilyPond file:

```
>>> lilypond_file.default_paper_size = '11x17', 'portrait'
>>> lilypond_file.global_staff_size = 12
>>> lilypond_file.layout_block.indent = 0
>>> lilypond_file.layout_block.ragged_right = True
>>> lilypond_file.paper_block.ragged_bottom = True
>>> lilypond_file.paper_block.system_system_spacing = layouttools.make_spacing_vector(0, 0, 8, 0)
```

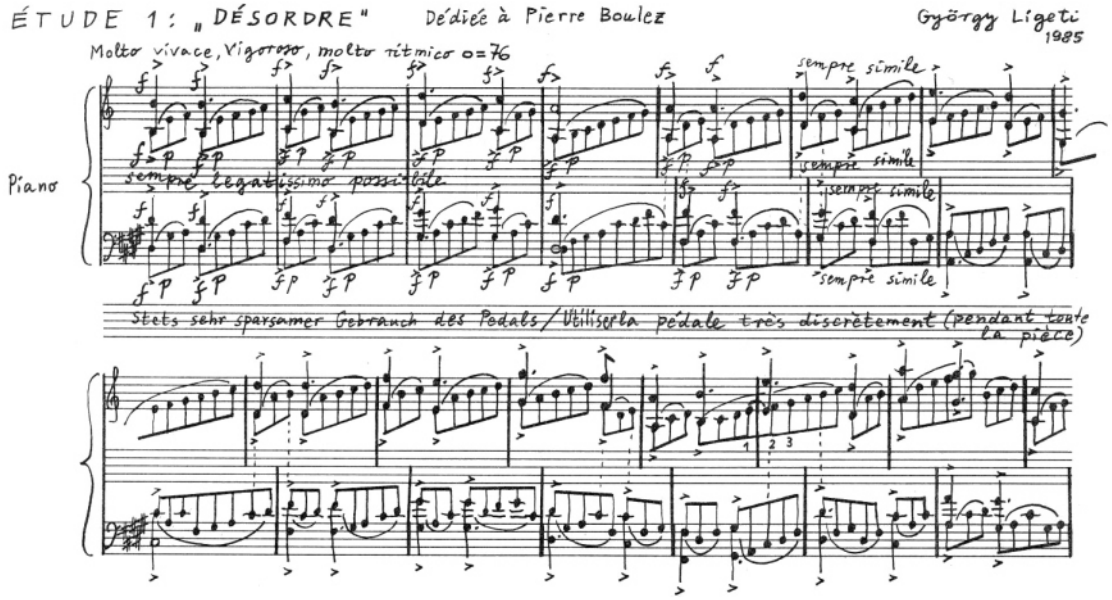
And show the result:

```
>>> show(lilypond_file)
```

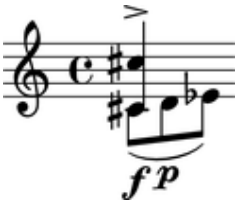


2.3 Ligeti: *Désordre*

This example demonstrates the power of exploiting redundancy to model musical structure. The piece that concerns us here is Ligeti's *Désordre*: the first piano study from Book I. Specifically, we will focus on modeling the first section of the piece:



The redundancy is immediately evident in the repeating pattern found in both staves. The pattern is hierarchical. At the smallest level we have what we will here call a *cell*:



There are two of these cells per measure. Notice that the cells are strictly contained within the measure (i.e., there are no cells crossing a bar line). So, the next level in the hierarchy is the measure. Notice that the measure sizes (the meters) change and that these changes occur independently for each staff, so that each staff carries it's own sequence of measures. Thus, the staff is the next level in the hierarchy. Finally there's the piano staff, which is composed of the right hand and left hand staves.

In what follows we will model this structure in this order (*cell*, measure, staff, piano staff), from bottom to top.

2.3.1 The cell

Before plunging into the code, observe the following characteristic of the *cell*:

1. It is composed of two layers: the top one which is an octave "chord" and the bottom one which is a straight eighth note run.
2. The total duration of the *cell* can vary, and is always the sum of the eight note funs.
3. The eight note runs are always stem down while the octave "chord" is always stem up.
4. The eight note runs are always beamed together and slurred, and the first two notes always have the dynamic markings 'f' 'p'.

The two "layers" of the *cell* we will model with two Voices inside a parallel Container. The top Voice will hold the octave "chord" while the lower Voice will hold the eighth note run. First the eighth notes:

```
>>> pitches = [1,2,3]
>>> notes = notetools.make_notes(pitches, [(1, 8)])
>>> beamtools.BeamSpanner(notes)
BeamSpanner(cs'8, d'8, ef'8)
>>> spannertools.SlurSpanner(notes)
SlurSpanner(cs'8, d'8, ef'8)
>>> contexttools.DynamicMark('f')(notes[0])
DynamicMark('f')(cs'8)
>>> contexttools.DynamicMark('p')(notes[1])
DynamicMark('p')(d'8)

>>> voice_lower = Voice(notes)
>>> voice_lower.name = 'rh_lower'
>>> marktools.LilyPondCommandMark('voiceTwo')(voice_lower)
LilyPondCommandMark('voiceTwo')(Voice-"rh_lower"{3})
```

The notes belonging to the eighth note run are first beamed and slurred. Then we add the dynamic marks to the first two notes, and finally we put them inside a Voice. After naming the voice we number it 2 so that the stems of the notes point down.

Now we construct the octave:

```
>>> import math
>>> n = int(math.ceil(len(pitches) / 2.))
>>> chord = Chord([pitches[0], pitches[0] + 12], (n, 8))
>>> marktools.Articulation('>')(chord)
Articulation('>')(<cs' cs''>4)

>>> voice_higher = Voice([chord])
>>> voice_higher.name = 'rh_higher'
>>> marktools.LilyPondCommandMark('voiceOne')(voice_higher)
LilyPondCommandMark('voiceOne')(Voice-"rh_higher"{1})
```

The duration of the chord is half the duration of the running eighth notes if the duration of the running notes is divisible by two. Otherwise the duration of the chord is the next integer greater than this half. We add the articulation marking and finally ad the Chord to a Voice, to which we set the number to 1, forcing the stem to always point up.

Finally we combine the two voices in a parallel Container:

```
>>> p = Container([voice_lower, voice_higher])
>>> p.is_parallel = True
```

This results in the complete *Désordre cell*:

```
>>> cell = Staff([p])
```

Because this *cell* appears over and over again, we want to reuse this code to generate any number of these *cells*. We here encapsulate it in a function that will take only a list of pitches:

```
def desordre_cell(pitches):
    '''The function constructs and returns a *Désordre cell*.
    `pitches` is a list of numbers or, more generally, pitch tokens.
    '''
    notes = [Note(p, (1, 8)) for p in pitches]
    beamtools.BeamSpanner(notes)
    spannertools.SlurSpanner(notes)
    contexttools.DynamicMark('f')(notes[0])
```

```
    contexttools.DynamicMark('p')(notes[1])
    # make the lower voice
    v_lower = Voice(notes)
    v_lower.name = 'rh_lower'
    marktools.LilyPondCommandMark('voiceTwo')(v_lower)
    n = int(math.ceil(len(pitches) / 2.))
    chord = Chord([pitches[0], pitches[0] + 12], (n, 8))
    marktools.Articulation('>')(chord)
    # make the upper voice
    v_higher = Voice([chord])
    v_higher.name = 'rh_higher'
    marktools.LilyPondCommandMark('voiceOne')(v_higher)
    # combine them together
    p = Container([v_lower, v_higher])
    p.is_parallel = True
    # make all 1/8 beats breakable
    for n in v_lower.leaves[:-1]:
        marktools.BarLine('')(n)
    return p
```

Now we can call this function to create any number of *cells*. That was actually the hardest part of reconstructing the opening of Ligeti's *Désordre*. Because the repetition of patters occurs also at the level of measures and staves, we will now define functions to create these other higher level constructs.

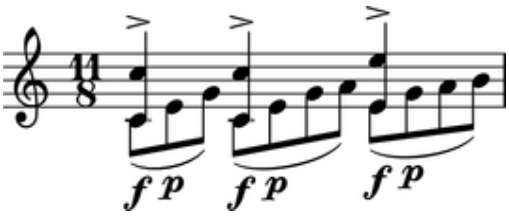
2.3.2 The measure

We define a function to create a measure from a list of lists of numbers:

```
def measure_build(pitches):
    '''Constructs a measure composed of *Désordre cells*.
    `pitches` is a list of lists of number (e.g., [[1, 2, 3], [2, 3, 4]])
    The function returns a DynamicMeasure.
    '''
    result = measuretools.DynamicMeasure([ ])
    for seq in pitches:
        result.append(desordre_cell(seq))
    # make denominator 8
    if contexttools.get_effective_time_signature(result).denominator == 1:
        result.denominator = 8
    return result
```

The function is very simple. It simply creates a DynamicMeasure and then populates it with *cells* that are created internally with the function previously defined. The function takes a list *pitches* which is actually a list of lists of pitches (e.g., `[[1,2,3], [2,3,4]]`. The list of lists of pitches is iterated to create each of the *cells* to be appended to the DynamicMeasures. We could have defined the function to take ready made *cells* directly, but we are building the hierarchy of functions so that we can pass simple lists of lists of numbers to generate the full structure. To construct a Ligeti measure we would call the function like so:

```
>>> measure = measure_build([[0, 4, 7], [0, 4, 7, 9], [4, 7, 9, 11]])
>>> show(Staff([measure]))
```



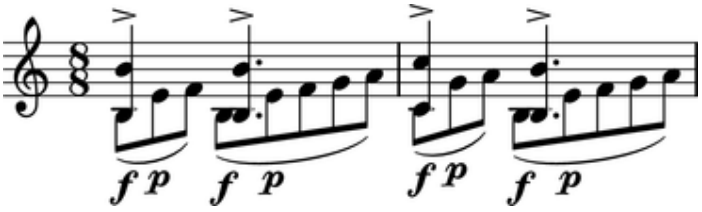
2.3.3 The staff

Now we move up to the next level, the staff:

```
def staff_build(pitches):
    '''Returns a Staff containing DynamicMeasures.'''
    result = Staff([])
    for seq in pitches:
        measure = measure_build(seq)
        result.append(measure)
    return result
```

The function again takes a plain list as argument. The list must be a list of lists (for measures) of lists (for cells) of pitches. The function simply constructs the Ligeti measures internally by calling our previously defined function and puts them inside a Staff. As with measures, we can now create full measure sequences with this new function:

```
>>> pitches = [[[-1, 4, 5], [-1, 4, 5, 7, 9]], [[0, 7, 9], [-1, 4, 5, 7, 9]]]
>>> staff = staff_build(pitches)
>>> show(staff)
```



2.3.4 The score

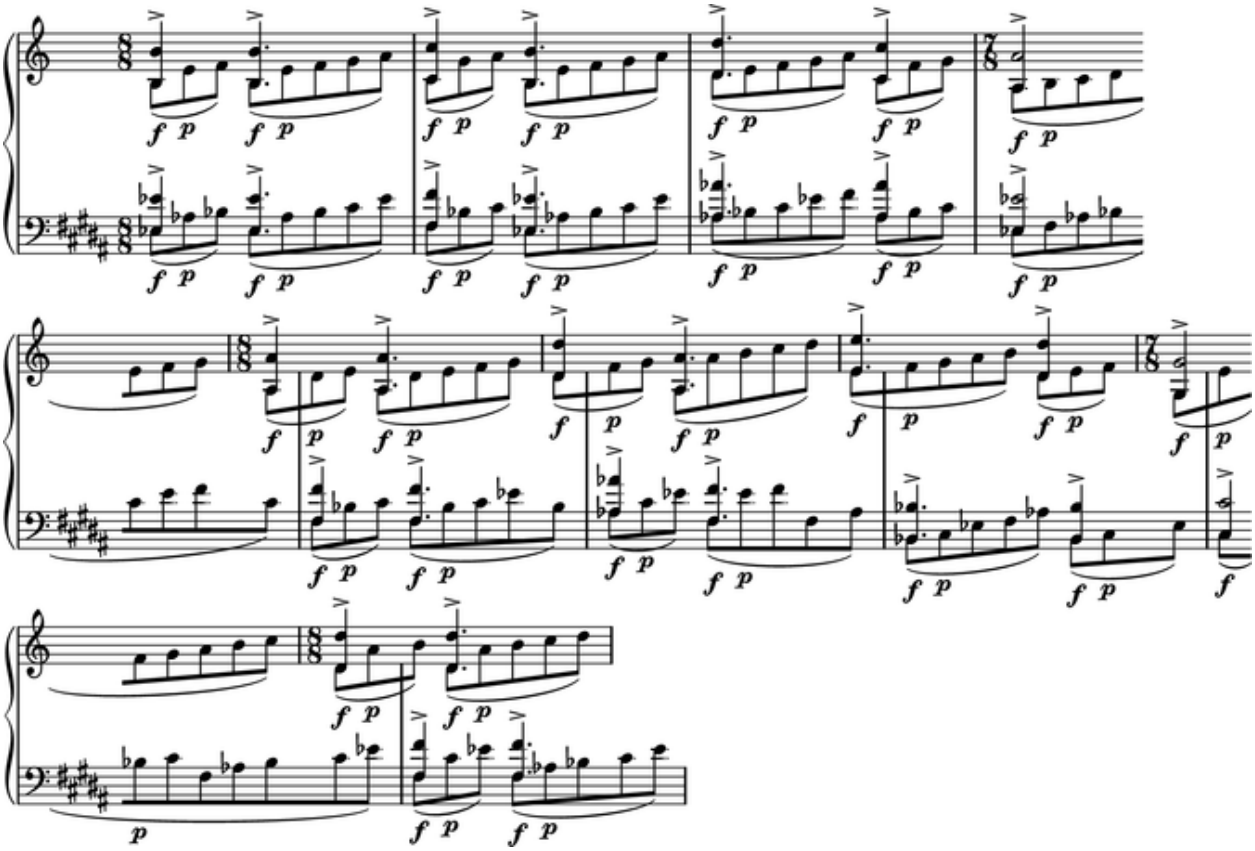
Finally a function that will generate the whole opening section of the piece *Désordre*:

```
def desordre_build(pitches):
    '''Returns a complete PianoStaff with Ligeti music!'''
    assert len(pitches) == 2
    piano = scoretools.PianoStaff([])
    # build the music...
    for hand in pitches:
        seq = staff_build(hand)
        piano.append(seq)
    # set clef and key signature to left hand staff...
    contexttools.ClefMark('bass')(piano[1])
    contexttools.KeySignatureMark('b', 'major')(piano[1])
    return piano
```

The function creates a PianoStaff, constructs Staves with Ligeti music and appends these to the empty PianoStaff. Finally it sets the clef and key signature of the lower staff to match the original score. The argument of the function is a list of length 2, depth 3. The first element in the list corresponds to the upper staff, the second to the lower staff.

The final result:

```
>>> top = [[[-1, 4, 5], [-1, 4, 5, 7, 9]], [[0, 7, 9], [-1, 4, 5, 7, 9]], [[2, 4, 5, 7, 9], [0, 5, 7
>>> bottom = [[[-9, -4, -2], [-9, -4, -2, 1, 3]], [[-6, -2, 1], [-9, -4, -2, 1, 3]], [[-4, -2, 1, 3,

>>> desordre = desordre_build([top, bottom])

>>> from abjad.tools import documentationtools
>>> lilypond_file = documentationtools.make_ligeti_example_lilypond_file(desordre)

>>> show(lilypond_file)
```



Now that we have the redundant aspect of the piece compactly expressed and encapsulated, we can play around with it by changing the sequence of pitches.

In order for each staff to carry its own sequence of independent measure changes, LilyPond requires some special setting up prior to rendering. Specifically, one must move the LilyPond `Timing_translator` out from the score context and into the staff context.

(You can refer to the LilyPond documentation on Polymetric notation to learn all about how this works.)

In this example we a custom `documentationtools` function to set up our LilyPond file automatically.

2.4 Mozart: *Musikalisches Würfelspiel*

Mozart's dice game is a method for aleatorically generating sixteen-measure-long minuets. For each measure, two six-sided dice are rolled, and the sum of the dice used to look up a measure number in one of two tables (one for each half of the minuet). The measure number then locates a single measure from a collection of musical fragments. The fragments are concatenated together, and "music" results.

Implementing the dice game in a composition environment is somewhat akin to (although also somewhat more complicated than) the ubiquitous hello world program which every programming language uses to demonstrate its basic syntax.

Note: The musical dice game in question (*k516f*) has long been attributed to Mozart, albeit inconclusively. Its actual provenance is a musicological problem with which we are unconcerned here.

2.4.1 The materials

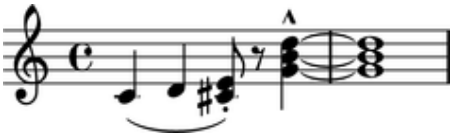
At the heart of the dice game is a large collection, *or corpus*, of musical fragments. Each fragment is a single 3/8 measure, consisting of a treble voice and a bass voice. Traditionally, these fragments are stored in a "score", or "table of measures", and located via two tables of measure numbers, which act as lookups, indexing into that collection.

Duplicate measures in the original corpus are common. Notably, the 8th measure - actually a pair of measures represent the first and second alternate ending of the first half of the minuet - are always identical. The last measure of the piece is similarly limited - there are only two possibilities rather than the usual eleven (for the numbers 2 to 12, being all the possible sums of two 6-sided dice).

How might we store this corpus compactly?

Some basic musical information in Abjad can be stored as strings, rather than actual collections of class instances. Abjad can parse simple LilyPond strings via `p`, which interprets a subset of LilyPond syntax, and understands basic concepts like notes, chords, rests and skips, as well as beams, slurs, ties, and articulations.

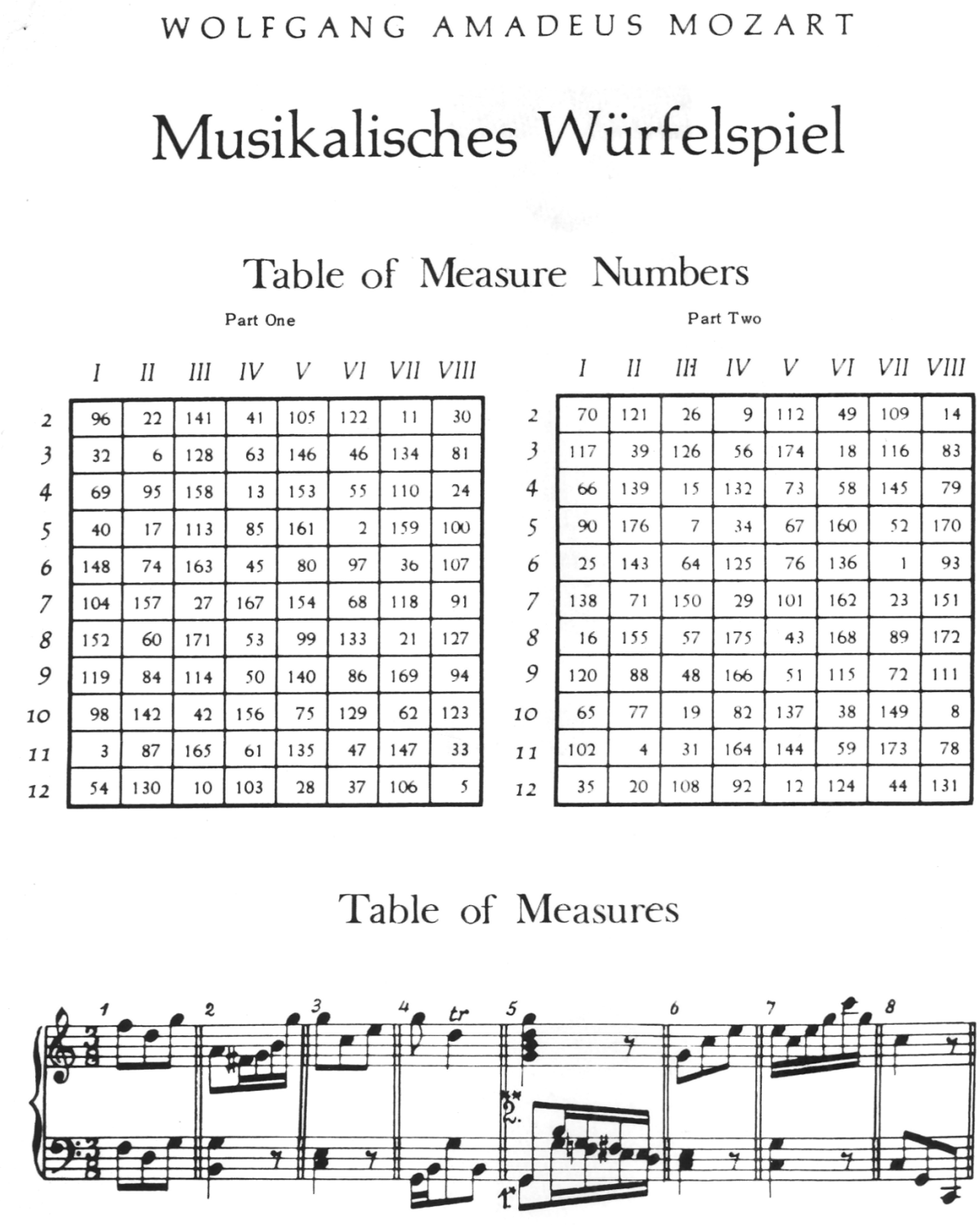
```
>>> lily_string = r"\new Staff { c'4 ( d'4 <cs' e'>8 ) -. r8 <g' b' d''>4 ^ \marcato ~ <g' b' d''>1 }"
>>> parsed_result = p(lily_string)
>>> f(parsed_result)
\new Staff {
    c'4 (
    d'4
    <cs' e'>8 -\staccato )
    r8
    <g' b' d''>4 ^\marcato ~
    <g' b' d''>1
}
>>> show(parsed_result)
```



So, instead of storing our musical information as Abjad components, we'll represent each fragment in the corpus as a pair of strings: one representing the bass voice contents, and the other representing the treble. This pair of strings can be packaged together into a collection. For this implementation, we'll package them into a dictionary. Python dictionaries are cheap, and often provide more clarity than lists; the composer does not have to rely on remembering a convention for what data should appear in which position in a list - they can simply label that data semantically. In our musical dictionary, the treble voice will use the key 't' and the bass voice will use the key 'b'.

```
>>> fragment = {'t': "g''8 ( e''8 c''8 )", 'b': '<c e>4 r8'}
```

Instead of relying on measure number tables to find our fragments - as in the original implementation, we'll package our fragment dictionaries into a list of lists of fragment dictionaries. That is to say, each of the sixteen measures in the piece will be represented by a list of fragment dictionaries. Furthermore, the 8th measure, which breaks the pattern, will simply be a list of two fragment dictionaries. Structuring our information in this way lets us avoid using measure



WOLFGANG AMADEUS MOZART

Musikalisches Würfelspiel

Table of Measure Numbers

Part One

	I	II	III	IV	V	VI	VII	VIII
2	96	22	141	41	105	122	11	30
3	32	6	128	63	146	46	134	81
4	69	95	158	13	153	55	110	24
5	40	17	113	85	161	2	159	100
6	148	74	163	45	80	97	36	107
7	104	157	27	167	154	68	118	91
8	152	60	171	53	99	133	21	127
9	119	84	114	50	140	86	169	94
10	98	142	42	156	75	129	62	123
11	3	87	165	61	135	47	147	33
12	54	130	10	103	28	37	106	5

Part Two

	I	II	III	IV	V	VI	VII	VIII
2	70	121	26	9	112	49	109	14
3	117	39	126	56	174	18	116	83
4	66	139	15	132	73	58	145	79
5	90	176	7	34	67	160	52	170
6	25	143	64	125	76	136	1	93
7	138	71	150	29	101	162	23	151
8	16	155	57	175	43	168	89	172
9	120	88	48	166	51	115	72	111
10	65	77	19	82	137	38	149	8
11	102	4	31	164	144	59	173	78
12	35	20	108	92	12	124	44	131

Table of Measures

Figure 2.1: *Part of a pen-and-paper implementation from the 20th century.*

number tables entirely; Python's list-indexing affordances will take care of that for us. The complete corpus looks like this:

```
mozart_measures = [
    [ # measure 1 choices
        {'b': 'c4 r8', 't': "e''8 c''8 g'8"},
        {'b': '<c e>4 r8', 't': "g'8 c''8 e''8"},
        {'b': '<c e>4 r8', 't': "g''8 ( e''8 c''8 )"},
        {'b': '<c e>4 r8', 't': "c''16 b'16 c''16 e''16 g'16 c''16"},
        {'b': '<c e>4 r8', 't': "c'''16 b''16 c'''16 g''16 e''16 c''16"},
        {'b': 'c4 r8', 't': "e''16 d''16 e''16 g''16 c'''16 g''16"},
        {'b': '<c e>4 r8', 't': "g''8 f''16 e''16 d''16 c''16"},
        {'b': '<c e>4 r8', 't': "e''16 c''16 g''16 e''16 c'''16 g''16"},
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "c''8 g'8 e''8"},
        {'b': '<c e>4 r8', 't': "g''8 c''8 e''8"},
        {'b': 'c8 c8 c8', 't': "<e' c''>8 <e' c''>8 <e' c''>8"},
    ],
    [ # measure 2 choices
        {'b': 'c4 r8', 't': "e''8 c''8 g'8"},
        {'b': '<c e>4 r8', 't': "g'8 c''8 e''8"},
        {'b': '<c e>4 r8', 't': "g''8 e''8 c''8"},
        {'b': '<e g>4 r8', 't': "c''16 g'16 c''16 e''16 g'16 c''16"},
        {'b': '<c e>4 r8', 't': "c'''16 b''16 c'''16 g''16 e''16 c''16"},
        {'b': 'c4 r8', 't': "e''16 d''16 e''16 g''16 c'''16 g''16"},
        {'b': '<c e>4 r8', 't': "g''8 f''16 e''16 d''16 c''16"},
        {'b': '<c e>4 r8', 't': "c''16 g'16 e''16 c''16 g''16 e''16"},
        {'b': '<c e>4 r8', 't': "c''8 g'8 e''8"},
        {'b': '<c e>4 <c g>8', 't': "g''8 c''8 e''8"},
        {'b': 'c8 c8 c8', 't': "<e' c''>8 <e' c''>8 <e' c''>8"},
    ],
    [ # measure 3 choices
        {'b': '<b, g>4 g,8', 't': "d''16 e''16 f''16 d''16 c''16 b'16"},
        {'b': 'g,4 r8', 't': "b'8 d''8 g''8"},
        {'b': 'g,4 r8', 't': "b'8 d''16 b'16 a'16 g'16"},
        {'b': '<g b>4 r8', 't': "f''8 d''8 b'8"},
        {'b': '<b, d>4 r8', 't': "g''16 fs''16 g''16 d''16 b'16 g'16"},
        {'b': '<g b>4 r8', 't': "f''16 e''16 f''16 d''16 c''16 b'16"},
        {'b': '<g, g>4 <b, g>8', 't': "b'16 c''16 d''16 e''16 f''16 d''16"},
        {'b': 'g8 g8 g8', 't': "<b' d''>8 <b' d''>8 <b' d''>8"},
        {'b': 'g,4 r8', 't': "b'16 c''16 d''16 b'16 a'16 g'16"},
        {'b': 'b,4 r8', 't': "d''8 ( b'8 g'8 )"},
        {'b': 'g4 r8', 't': "b'16 a'16 b'16 c''16 d''16 b'16"},
    ],
    [ # measure 4 choices
        {'b': '<c e>4 r8', 't': "c''16 b'16 c''16 e''16 g'8"},
        {'b': 'c4 r8', 't': "e''16 c''16 b'16 c''16 g'8"},
        {'b': '<e g>4 r8', 't': "c''8 ( g'8 e'8 )"},
        {'b': '<e g>4 r8', 't': "c''8 e''8 g'8"},
        {'b': '<e g>4 r8', 't': "c''16 b'16 c''16 g'16 e'16 c'16"},
        {'b': '<c e>4 r8', 't': "c''8 c''16 d''16 e''8"},
        {'b': 'c4 r8', 't': "<c'' e''>8 <c'' e''>16 <d'' f''>16 <e'' g''>8"},
        {'b': '<e g>4 r8', 't': "c''8 e''16 c''16 g'8"},
        {'b': '<e g>4 r8', 't': "c''16 g'16 e''16 c''16 g''8"},
        {'b': '<e g>4 r8', 't': "c''8 e''16 c''16 g''8"},
        {'b': '<e g>4 r8', 't': "c''16 e''16 c''16 g'16 e'8"},
    ],
    [ # measure 5 choices
        {'b': 'c4 r8', 't': "fs''8 a''16 fs''16 d''16 fs''16"},
        {'b': 'c8 c8 c8', 't': "<fs' d''>8 <d'' fs''>8 <fs'' a''>8"},
```

```
        {'b': 'c4 r8', 't': "d''16 a'16 fs''16 d''16 a''16 fs''16"},
        {'b': 'c8 c8 c8', 't': "<fs' d''>8 <fs' d''>8 <fs' d''>8"},
        {'b': 'c4 r8', 't': "d''8 a'8 ^\\turn fs''8"},
        {'b': 'c4 r8', 't': "d''16 cs''16 d''16 fs''16 a''16 fs''16"},
        {'b': '<c a>4 <c a>8', 't': "fs''8 a''8 d''8"},
        {'b': '<c fs>8 <c fs>8 <c a>8', 't': "a'8 a'16 d''16 fs''8"},
        {'b': 'c8 c8 c8', 't': "<d'' fs''>8 <d'' fs''>8 <d'' fs''>8"},
        {'b': '<c d>8 <c d>8 <c d>8', 't': "fs''8 fs''16 d''16 a''8"},
        {'b': '<c a>4 r8', 't': "fs''16 d''16 a'16 a''16 fs''16 d''16"},
    ],
    [ # measure 6 choices
        {'b': '<b, d>8 <b, d>8 <b, d>8', 't': "g''16 fs''16 g''16 b''16 d''8"},
        {'b': '<b, d>4 r8', 't': "g''8 b''16 g''16 d''16 b'16"},
        {'b': '<b, d>4 r8', 't': "g''8 b''8 d''8"},
        {'b': '<b, g>4 r8', 't': "a'8 fs'16 g'16 b'16 g''16"},
        {'b': '<b, d>4 <b, g>8', 't': "g''16 fs''16 g''16 d''16 b'16 g'16"},
        {'b': 'b,4 r8', 't': "g''8 b''16 g''16 d''16 g''16"},
        {'b': '<b, g>4 r8', 't': "d''8 g''16 d''16 b'16 d''16"},
        {'b': '<b, g>4 r8', 't': "d''8 d''16 g''16 b''8"},
        {'b': '<b, d>8 <b, d>8 <b, g>8', 't': "a''16 g''16 fs''16 g''16 d''8"},
        {'b': '<b, d>4 r8', 't': "g''8 g''16 d''16 b''8"},
        {'b': '<b, d>4 r8', 't': "g''16 b''16 g''16 d''16 b'8"},
    ],
    [ # measure 7 choices
        {'b': 'c8 d8 d,8', 't': "e''16 c''16 b'16 a'16 g'16 fs'16"},
        {'b': 'c8 d8 d,8', 't': "a'16 e''16 <b' d''>16 <a' c''>16 <g' b'>16 <fs' a'>16"},
        {'b': 'c8 d8 d,8', 't': "<b' d''>16 ( <a' c''>16 ) <a' c''>16 ( <g' b'>16 ) <g' b'>16 ( <fs'
        {'b': 'c8 d8 d,8', 't': "e''16 g''16 d''16 c''16 b'16 a'16"},
        {'b': 'c8 d8 d,8', 't': "a'16 e''16 d''16 g''16 fs''16 a''16"},
        {'b': 'c8 d8 d,8', 't': "e''16 a''16 g''16 b''16 fs''16 a''16"},
        {'b': 'c8 d8 d,8', 't': "c''16 e''16 g''16 d''16 a'16 fs''16"},
        {'b': 'c8 d8 d,8', 't': "e''16 g''16 d''16 g''16 a'16 fs''16"},
        {'b': 'c8 d8 d,8', 't': "e''16 c''16 b'16 g'16 a'16 fs'16"},
        {'b': 'c8 d8 d,8', 't': "e''16 c'''16 b''16 g''16 a''16 fs''16"},
        {'b': 'c8 d8 d,8', 't': "a'8 d''16 c''16 b'16 a'16"},
    ],
    [ # measure 8 choices (always using both)
        {'b': 'g,8 g16 f16 e16 d16', 't': "<g' b' d'' g''>4 r8"},
        {'b': 'g,8 b16 g16 fs16 e16', 't': "<g' b' d'' g''>4 r8"},
    ],
    [ # measure 9 choices
        {'b': 'd4 c8', 't': "fs''8 a''16 fs''16 d''16 fs''16"},
        {'b': '<d fs>4 r8', 't': "d''16 a'16 d''16 fs''16 a''16 fs''16"},
        {'b': '<d a>8 <d fs>8 <c d>8', 't': "fs''8 a''8 fs''8"},
        {'b': '<c a>4 <c a>8', 't': "fs''16 a''16 d'''16 a''16 fs''16 a''16"},
        {'b': 'd4 c8', 't': "d'16 fs'16 a'16 d''16 fs''16 a''16"},
        {'b': 'd,16 d16 cs16 d16 c16 d16', 't': "<a' d'' fs''>8 fs''4 ^\\tr"},
        {'b': '<d fs>4 <c fs>8', 't': "a''8 ( fs''8 d''8 )"},
        {'b': '<d fs>4 <c fs>8', 't': "d'''8 a''16 fs''16 d''16 a'16"},
        {'b': '<d fs>4 r8', 't': "d''16 a'16 d''8 fs''8"},
        {'b': '<c a>4 <c a>8', 't': "fs''16 d''16 a'8 fs''8"},
        {'b': '<d fs>4 <c a>8', 't': "a'8 d''8 fs''8"},
    ],
    [ # measure 10 choices
        {'b': '<b, g>4 r8', 't': "g''8 b''16 g''16 d''8"},
        {'b': 'b,16 d16 g16 d16 b,16 g,16', 't': "g''8 g'8 g'8"},
        {'b': 'b,4 r8', 't': "g''16 b''16 g''16 b''16 d''8"},
        {'b': '<b, d>4 <b, d>8', 't': "a''16 g''16 b''16 g''16 d''16 g''16"},
```

```
        {'b': '<b, d>4 <b, d>8', 't': "g''8 d''16 b'16 g'8"},
        {'b': '<b, d>4 <b, d>8', 't': "g''16 b''16 d'''16 b''16 g''8"},
        {'b': '<b, d>4 r8', 't': "g''16 b''16 g''16 d''16 b'16 g'16"},
        {'b': '<b, d>4 <b, d>8', 't': "g''16 d''16 g''16 b''16 g''16 d''16"},
        {'b': '<b, d>4 <b, g>8', 't': "g''16 b''16 g''8 d''8"},
        {'b': 'g,16 b,16 g8 b,8', 't': "g''8 d''4 ^\\tr"},
        {'b': 'b,4 r8', 't': "g''8 b''16 d'''16 d''8"},
    ],
    [ # measure 11 choices
        {'b': "c16 e16 g16 e16 c'16 c16", 't': "<c'' e''>8 <c'' e''>8 <c'' e''>8"},
        {'b': 'e4 e16 c16', 't': "c''16 g'16 c''16 e''16 g''16 <c'' e''>16"},
        {'b': '<c g>4 <c e>8', 't': "e''8 g''16 e''16 c''8"},
        {'b': '<c g>4 r8', 't': "e''16 c''16 e''16 g''16 c'''16 g''16"},
        {'b': '<c g>4 <c g>8', 't': "e''16 g''16 c'''16 g''16 e''16 c''16"},
        {'b': 'c16 b,16 c16 d16 e16 fs16', 't': "<g' c'' e''>8 e''4 ^\\tr"},
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "e''8 c''8 g'8"},
        {'b': '<c g>4 <c e>8', 't': "e''8 c''16 e''16 g''16 c'''16"},
        {'b': '<c g>4 <c e>8', 't': "e''16 c''16 e''8 g''8"},
        {'b': '<c g>4 <c g>8', 't': "e''16 c''16 g'8 e''8"},
        {'b': '<c g>4 <c e>8', 't': "e''8 ( g''8 c'''8 )"},
    ],
    [ # measure 12 choices
        {'b': 'g4 g,8', 't': "<c'' e''>8 <b' d''>8 r8"},
        {'b': '<g, g>4 g8', 't': "d''16 b'16 g'8 r8"},
        {'b': 'g8 g,8 r8', 't': "<c'' e''>8 <b' d''>16 <g' b'>16 g'8"},
        {'b': 'g4 r8', 't': "e''16 c''16 d''16 b'16 g'8"},
        {'b': 'g8 g,8 r8', 't': "g''16 e''16 d''16 b'16 g'8"},
        {'b': 'g4 g,8', 't': "b'16 d''16 g''16 d''16 b'8"},
        {'b': 'g8 g,8 r8', 't': "e''16 c''16 b'16 d''16 g''8"},
        {'b': '<g b>4 r8', 't': "d''16 b''16 g''16 d''16 b'8"},
        {'b': '<b, g>4 <b, d>8', 't': "d''16 b'16 g'8 g''8"},
        {'b': 'g16 fs16 g16 d16 b,16 g,16', 't': "d''8 g'4"},
    ],
    [ # measure 13 choices
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "e''8 c''8 g'8"},
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "g'8 c''8 e''8"},
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "g''8 e''8 c''8"},
        {'b': '<c e>4 <e g>8', 't': "c''16 b'16 c''16 e''16 g'16 c''16"},
        {'b': '<c e>4 <c g>8', 't': "c'''16 b''16 c'''16 g''16 e''16 c''16"},
        {'b': '<c g>4 <c e>8', 't': "e''16 d''16 e''16 g''16 c'''16 g''16"},
        {'b': '<c e>4 r8', 't': "g''8 f''16 e''16 d''16 c''16"},
        {'b': '<c e>4 r8', 't': "c''16 g'16 e''16 c''16 g''16 e''16"},
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "c''8 g'8 e''8"},
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "g''8 c''8 e''8"},
        {'b': 'c8 c8 c8', 't': "<e' c''>8 <e' c''>8 <e' c''>8"},
    ],
    [ # measure 14 choices
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "e''8 ( c''8 g'8 )"},
        {'b': '<c e>4 <c g>8', 't': "g'8 ( c''8 e''8 )"},
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "g''8 e''8 c''8"},
        {'b': '<c e>4 <c e>8', 't': "c''16 b'16 c''16 e''16 g'16 c''16"},
        {'b': '<c e>4 r8', 't': "c'''16 b''16 c'''16 g''16 e''16 c''16"},
        {'b': '<c g>4 <c e>8', 't': "e''16 d''16 e''16 g''16 c'''16 g''16"},
        {'b': '<c e>4 <e g>8', 't': "g''8 f''16 e''16 d''16 c''16"},
        {'b': '<c e>4 r8', 't': "c''16 g'16 e''16 c''16 g''16 e''16"},
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "c''8 g'8 e''8"},
        {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "g''8 c''8 e''8"},
        {'b': 'c8 c8 c8', 't': "<e' c''>8 <e' c''>8 <e' c''>8"},
```

```
    ],
    [ # measure 15 choices
        {'b': "<f a>4 <g d'>8", 't': "d''16 f''16 d''16 f''16 b'16 d''16"},
        {'b': 'f4 g8', 't': "d''16 f''16 a''16 f''16 d''16 b'16"},
        {'b': 'f4 g8', 't': "d''16 f''16 a'16 d''16 b'16 d''16"},
        {'b': 'f4 g8', 't': "d''16 ( cs''16 ) d''16 f''16 g'16 b'16"},
        {'b': 'f8 d8 g8', 't': "f''8 d''8 g''8"},
        {'b': 'f16 e16 d16 e16 f16 g16', 't': "f''16 e''16 d''16 e''16 f''16 g''16"},
        {'b': 'f16 e16 d8 g8', 't': "f''16 e''16 d''8 g''8"},
        {'b': 'f4 g8', 't': "f''16 e''16 d''16 c''16 b'16 d''16"},
        {'b': 'f4 g8', 't': "f''16 d''16 a'8 b'8"},
        {'b': 'f4 g8', 't': "f''16 a''16 a'8 b'16 d''16"},
        {'b': 'f4 g8', 't': "a'8 f''16 d''16 a'16 b'16"},
    ],
    [ # measure 16 choices
        {'b': 'c8 g,8 c,8', 't': "c''4 r8"},
        {'b': 'c4 c,8', 't': "c''8 c'8 r8"},
    ],
]
```

We can then use the `p()` function we saw earlier to "build" the treble and bass components of a measure like this:

```
def build_one_mozart_measure(measure_dict):
    # parse the contents of a measure definition dictionary
    # wrap the expression to be parsed inside a LilyPond { } block
    treble = p('{{ {} }}'.format(measure_dict['t']))
    bass = p('{{ {} }}'.format(measure_dict['b']))
    return treble, bass
```

Let's try with a measure-definition of our own:

```
>>> my_measure_dict = {'b': 'c4 ^\\tr r8', 't': "e''8 ( c''8 g'8 )"}
>>> treble, bass = build_one_mozart_measure(my_measure_dict)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  File "<stdin>", line 5, in build_one_mozart_measure
  File "/media/Work/dev/scores/abjad/trunk/abjad/tools/iotools/p.py", line 33, in p
    return LilyPondParser()(args[0])
  File "/media/Work/dev/scores/abjad/trunk/abjad/tools/lilypondparsertools/LilyPondParser/LilyPondPar
    lexer=self._lexer)
  File "/media/Work/dev/scores/abjad/trunk/abjad/tools/lilypondparsertools/_parse.py", line 66, in _p
    self.lookahead = get_token()      # Get the next token
  File "/usr/local/lib/python2.7/dist-packages/ply/lex.py", line 348, in token
    newtok = func(tok)
  File "/media/Work/dev/scores/abjad/trunk/abjad/tools/lilypondparsertools/_LilyPondLexicalDefinitio
    t.type = self.scan_escaped_word(t)
  File "/media/Work/dev/scores/abjad/trunk/abjad/tools/lilypondparsertools/_LilyPondLexicalDefinitio
    raise Exception('Unknown escaped word "%s".' % t.value)
Exception: Unknown escaped word "\tr".
>>> f(treble)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'treble' is not defined
>>> f(bass)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'bass' is not defined
```

Now with one from the Mozart measure collection defined earlier. We'll grab the very last choice for the very last

measure:

```
>>> my_measure_dict = mozart_measures[-1][-1]
>>> treble, bass = build_one_mozart_measure(my_measure_dict)
>>> f(treble)
{
    c''8
    c'8
    r8
}
>>> f(bass)
{
     c4
     c,8
}
```

2.4.2 The structure

After storing all of the musical fragments into a corpus, concatenating those elements into a musical structure is relatively trivial. We'll use the `choice()` function from Python's *random* module. `random.choice()` randomly selects one element from an input list.

```
>>> import random
>>> my_list = [1, 'b', 3]
>>> my_result = [random.choice(my_list) for i in range(20)]
>>> my_result
['b', 'b', 1, 3, 3, 1, 'b', 3, 1, 'b', 'b', 3, 'b', 'b', 1, 'b', 'b', 1, 3, 3]
```

Our corpus is a list comprising sixteen sublists, one for each measure in the minuet. To build our musical structure, we can simply iterate through the corpus and call *choice* on each sublist, appending the chosen results to another list. The only catch is that the *eighth* measure of our minuet is actually the first-and-second-ending for the repeat of the first phrase. The sublist of the corpus for measure eight contains *only* the first and second ending definitions, and both of those measures should appear in the final piece, always in the same order. We'll have to intercept that sublist while we iterate through the corpus and apply some different logic.

The easist way to intercept measure eight is to use the Python builtin *enumerate*, which allows you to iterate through a collection while also getting the index of each element in that collection:

```
def choose_mozart_measures():
    chosen_measures = []
    for i, choices in enumerate(mozart_measures):
        if i == 7: # get both alternative endings for mm. 8
            chosen_measures.extend(choices)
        else:
            choice = random.choice(choices)
            chosen_measures.append(choice)
    return chosen_measures
```

Note: In *choose_mozart_measures* we test for index *7*, rather then *8*, because list indices count from *0* instead of *1*.

The result will be a *seventeen*-item-long list of measure definitions:

```
>>> choices = choose_mozart_measures()
>>> for i, measure in enumerate(choices):
...     print i, measure
...
```

```
0 {'b': 'c4 r8', 't': "e''8 c''8 g'8"}
1 {'b': '<c e>4 r8', 't': "c''8 g'8 e''8"}
2 {'b': 'g,4 r8', 't': "b'8 d''8 g''8"}
3 {'b': '<e g>4 r8', 't': "c''16 e''16 c''16 g'16 e'8"}
4 {'b': '<c fs>8 <c fs>8 <c a>8', 't': "a'8 a'16 d''16 fs''8"}
5 {'b': '<b, g>4 r8', 't': "a'8 fs'16 g'16 b'16 g''16"}
6 {'b': 'c8 d8 d,8', 't': "e''16 c'''16 b''16 g''16 a''16 fs''16"}
7 {'b': 'g,8 g16 f16 e16 d16', 't': "<g' b' d'' g''>4 r8"}
8 {'b': 'g,8 b16 g16 fs16 e16', 't': "<g' b' d'' g''>4 r8"}
9 {'b': '<c a>4 <c a>8', 't': "fs''16 d''16 a'8 fs''8"}
10 {'b': '<b, d>4 r8', 't': "g''16 b''16 g''16 d''16 b'16 g'16"}
11 {'b': '<c g>4 <c e>8', 't': "e''8 g''16 e''16 c''8"}
12 {'b': 'g8 g,8 r8', 't': "<c'' e''>8 <b' d''>16 <g' b'>16 g'8"}
13 {'b': '<c e>16 g16 <c e>16 g16 <c e>16 g16', 't': "c''8 g'8 e''8"}
14 {'b': '<c e>4 <c g>8', 't': "g'8 ( c''8 e''8 )"}
15 {'b': 'f4 g8', 't': "d''16 f''16 a'16 d''16 b'16 d''16"}
16 {'b': 'c8 g,8 c,8', 't': "c''4 r8"}
```

2.4.3 The score

Now that we have our raw materials, and a way to organize them, we can start building our score. The tricky part here is figuring out how to implement LilyPond's repeat structure in Abjad. LilyPond structures its repeats something like this:

```
\repeat volta n {
    music to be repeated
}

\alternative {
    { ending 1 }
    { ending 2 }
    { ending n }
}

...music after the repeat...
```

What you see above is really just two containers, each with a little text ("repeat volta n" and "alternative") prepended to their opening curly brace. To create that structure in Abjad, we'll need to use the `LilyPondCommandMark` class, which allows you to place LilyPond commands like "break" relative to any score component:

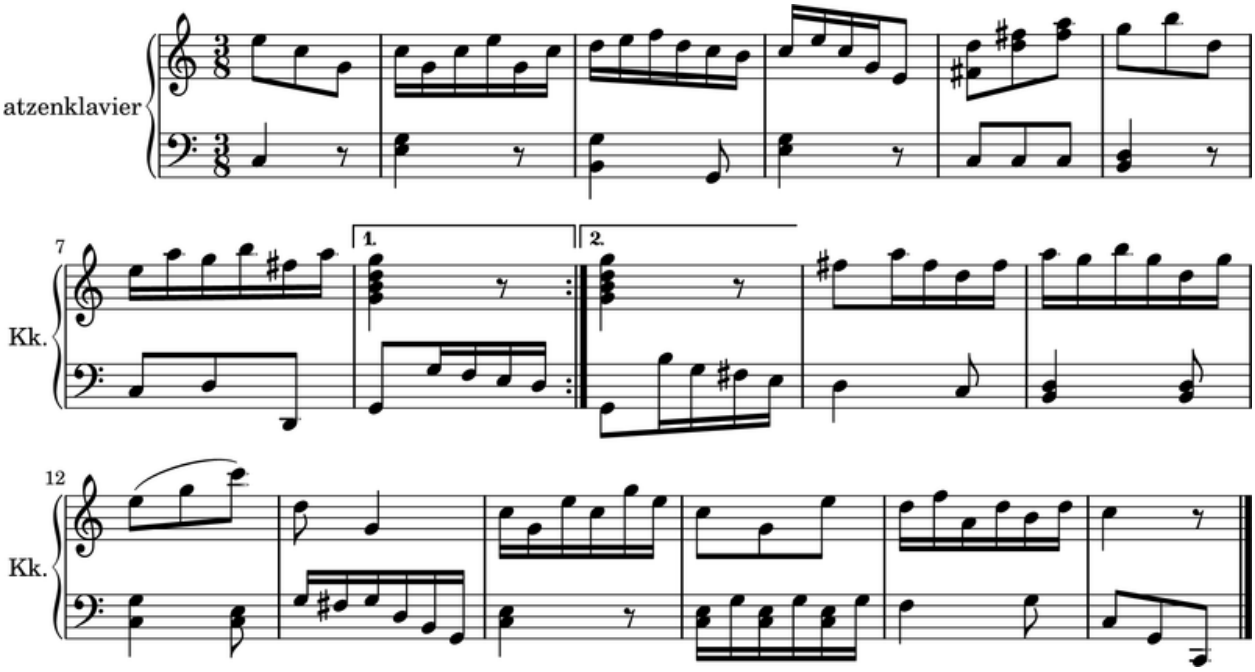
```
>>> con = Container("c'4 d'4 e'4 f'4")
>>> mark = marktools.LilyPondCommandMark('before-the-container', 'before')(con)
>>> mark = marktools.LilyPondCommandMark('after-the-container', 'after')(con)
>>> mark = marktools.LilyPondCommandMark('opening-of-the-container', 'opening')(con)
>>> mark = marktools.LilyPondCommandMark('closing-of-the-container', 'closing')(con)
>>> mark = marktools.LilyPondCommandMark('to-the-right-of-a-note', 'right')(con[2])
>>> f(con)
\before-the-container
{
     \opening-of-the-container
     c'4
     d'4
     e'4 \to-the-right-of-a-note
     f'4
     \closing-of-the-container
}
\after-the-container
```

Notice the second argument to each `LilyPondCommandMark` above, like *before* and *closing*. These are format slot indications, which control where the command is placed in the LilyPond code relative to the score element it is attached to. To mimic LilyPond's repeat syntax, we'll have to create two `LilyPondCommandMark` instances, both using the "before" format slot, insuring that their command is placed before their container's opening curly brace.

Now let's take a look at the code that puts our score together:

```
def build_mozart_piano_staff():
    treble_staff = Staff([])
    bass_staff = Staff([])
    # select the measures to use
    choices = choose_mozart_measures()
    # create and populate the volta containers
    treble_volta = Container([])
    bass_volta = Container([])
    for choice in choices[:7]:
        treble, bass = build_one_mozart_measure(choice)
        treble_volta.append(treble)
        bass_volta.append(bass)
    # add marks to the volta containers
    marktools.LilyPondCommandMark('repeat volta 2', 'before')(treble_volta)
    marktools.LilyPondCommandMark('repeat volta 2', 'before')(bass_volta)
    # add the volta containers to our staves
    treble_staff.append(treble_volta)
    bass_staff.append(bass_volta)
    # create and populate the alternative ending containers
    treble_alternative = Container([])
    bass_alternative = Container([])
    for choice in choices[7:9]:
        treble, bass = build_one_mozart_measure(choice)
        treble_alternative.append(treble)
        bass_alternative.append(bass)
    # add marks to the alternative containers
    marktools.LilyPondCommandMark('alternative', 'before')(treble_alternative)
    marktools.LilyPondCommandMark('alternative', 'before')(bass_alternative)
    # add the alternative containers to our staves
    treble_staff.append(treble_alternative)
    bass_staff.append(bass_alternative)
    # create the remaining measures
    for choice in choices[9:]:
        treble, bass = build_one_mozart_measure(choice)
        treble_staff.append(treble)
        bass_staff.append(bass)
    # add meter
    contexttools.TimeSignatureMark((3, 8))(treble_staff)
    # add bass clef
    contexttools.ClefMark('bass')(bass_staff)
    # add the final double bar line at the end of each final measure
    marktools.BarLine('|.')(treble_staff[-1])
    marktools.BarLine('|.')(bass_staff[-1])
    # combine into a PianoStaff
    piano_staff = scoretools.PianoStaff([treble_staff, bass_staff])
    # add an instrument name via contexttools.InstrumentMark
    contexttools.InstrumentMark('Katzenklavier', 'kk.',
        target_context = scoretools.PianoStaff)(piano_staff)
    return piano_staff

>>> piano_staff = build_mozart_piano_staff()
Traceback (most recent call last):
```

```
  File "<stdin>", line 1, in <module>
  File "<stdin>", line 34, in build_mozart_piano_staff
  File "<stdin>", line 4, in build_one_mozart_measure
  File "/media/Work/dev/scores/abjad/trunk/abjad/tools/iotools/p.py", line 33, in p
    return LilyPondParser()(args[0])
  File "/media/Work/dev/scores/abjad/trunk/abjad/tools/lilypondparsertools/LilyPondParser/LilyPondPar
    lexer=self._lexer)
  File "/media/Work/dev/scores/abjad/trunk/abjad/tools/lilypondparsertools/_parse.py", line 66, in _p
    self.lookahead = get_token()     # Get the next token
  File "/usr/local/lib/python2.7/dist-packages/ply/lex.py", line 348, in token
    newtok = func(tok)
  File "/media/Work/dev/scores/abjad/trunk/abjad/tools/lilypondparsertools/_LilyPondLexicalDefinitio
    t.type = self.scan_escaped_word(t)
  File "/media/Work/dev/scores/abjad/trunk/abjad/tools/lilypondparsertools/_LilyPondLexicalDefinitio
    raise Exception('Unknown escaped word "%s".' % t.value)
Exception: Unknown escaped word "\tr".
>>> show(piano_staff)
```




```
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'piano_staff' is not defined
```

Note: Our instrument name got cut off! Looks like we need to do a little formatting. Keep reading...

2.4.4 The document

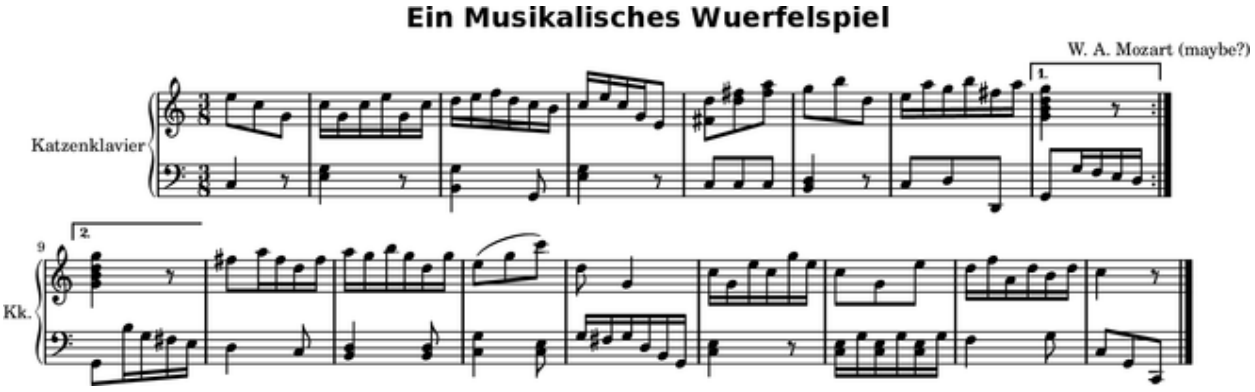
As you can see above, we've now got our randomized minuet. However, we can still go a bit further. LilyPond provides a wide variety of settings for controlling the overall *look* of a musical document, often through its *header*, *layout* and *paper* blocks. Abjad, in turn, gives us object-oriented access to these settings through the its *lilypondfiletools* module.

We'll use `abjad.tools.lilypondfiletools.make_basic_lilypond_file()` to wrap our `PianoStaff` inside a `LilyPondFile` instance. From there we can access the other "blocks" of our document to add a title, a composer's name, change the global staff size, paper size, staff spacing and so forth.

```
def build_mozart_lily(piano_staff):
    # wrap the PianoStaff with a LilyPondFile
    lily = lilypondfiletools.make_basic_lilypond_file(piano_staff)
    # create some markup to use in our header block
    title = markuptools.Markup('\\bold \\sans "Ein Musikalisches Wuerfelspiel"')
    composer = schemetools.Scheme("W. A. Mozart (maybe?)")
    # change various settings
    lily.global_staff_size = 12
    lily.header_block.title = title
    lily.header_block.composer = composer
    lily.layout_block.ragged_right = True
    lily.paper_block.markup_system_spacing__basic_distance = 8
    lily.paper_block.paper_width = 180
    return lily

>>> lily = build_mozart_lily(piano_staff)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'piano_staff' is not defined
>>> print lily
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'lily' is not defined

>>> print lily.header_block
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'lily' is not defined
>>> f(lily.header_block)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'lily' is not defined

>>> print lily.layout_block
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'lily' is not defined
>>> f(lily.layout_block)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'lily' is not defined

>>> print lily.paper_block
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'lily' is not defined
>>> f(lily.paper_block)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'lily' is not defined
```

And now the final result:

```
>>> show(lily)
```




```
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'lily' is not defined
```

CHAPTER

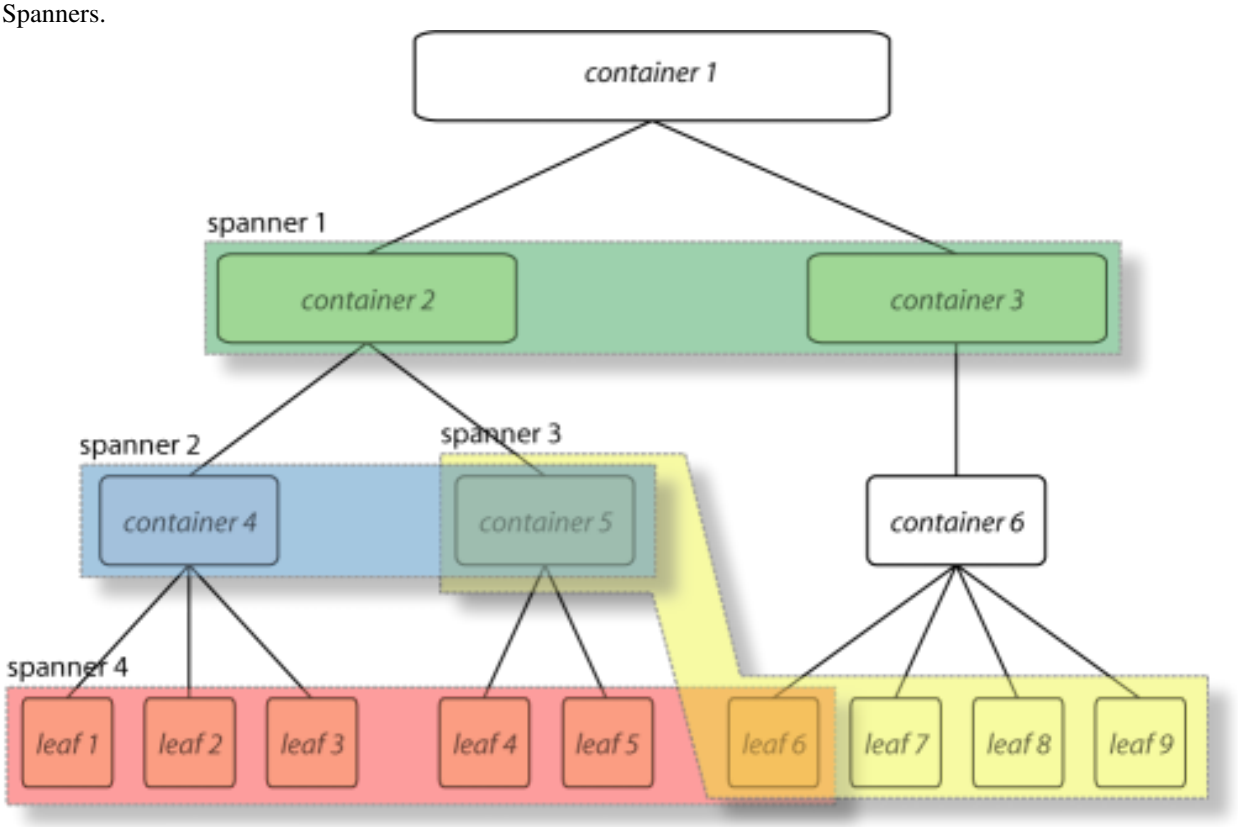
THREE

SYSTEM OVERVIEW

3.1 Leaf, Container, Spanner, Mark

At the heart of Abjad's Symbolic Score-Control lies a powerful model that we call the Leaf Container Spanner Mark, or LCSM, model of the musical score.

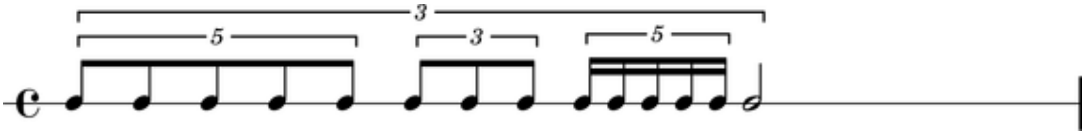
The LCSM model can be schematically visualized as a superposition of two complementary and completely independent layers of structure: a *tree* that includes the Containers and the Leaves, and a layer of free floating *connectors* or Spanners.



There can be any number of Spanners, they may overlap, and they may connect to different levels of the tree hierarchy. The spanner attach to the elements of the tree, so a tree structure must exist for spanners to be made manifest.

3.1.1 Example 1

To understand the whys and hows of the LCSM model implemented in Abjad, it is probably easier to base the discussion on concrete musical examples. Let's begin with a simple and rather abstract musical fragment: a measure with nested tuplets.



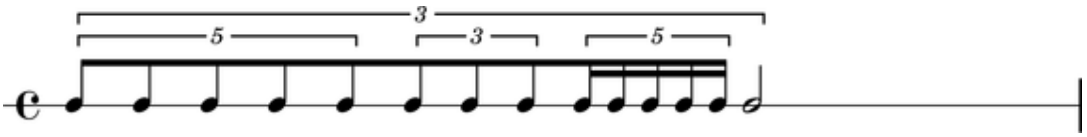
What we see in this little fragment is a measure with 4/4 meter, 14 notes and four tuplet brackets prolating the notes. The three bottom tuplets (with ratios 5:4, 3:2, 5:4) prolate all but the last note. The topmost tuplet prolates all the notes in the measure and combines with the bottom three tuplets to doubly prolate all but the last note. The topmost tuplet as thus prolates three tuplets, each of which in turn prolates a group of notes. We can think of a tuplet as *containing* notes or other tuplets or both. Thus, in our example, the topmost tuplet contains three tuplets and a half note. Each of the tuplets contained by the topmost tuplet in turn contains five, three, and five notes respectively. If we add the measure, then we have a measure that contains a tuplet that contains tuplets that contain notes. The structure of the measure with nested tuplets as we have just described it has two important properties:

1. It is a *hierarchical* structure.
2. It follows *exclusive membership*, meaning that each element in the hierarchy (a note, a tuplet or a measure) has one and only one *parent*. In other words a single note is not contained in more than one tuplet simultaneously, and no one tuplet is contained in more than one other tuplet at the same time.

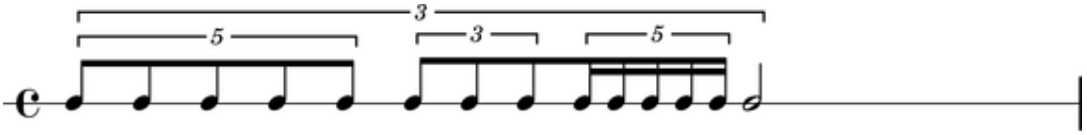
What we are describing here is a tree, and it is the structure of Abjad *containers*.

While this tree structure seem like the right way to represent the relationships between the elements of a score, it is not enough. Consider the tuplet example again with the following beaming alternatives:

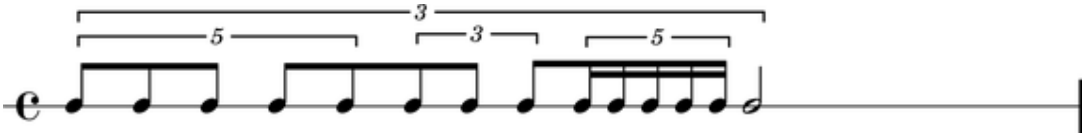
Beaming alternative 1:



Beaming alternative 2:



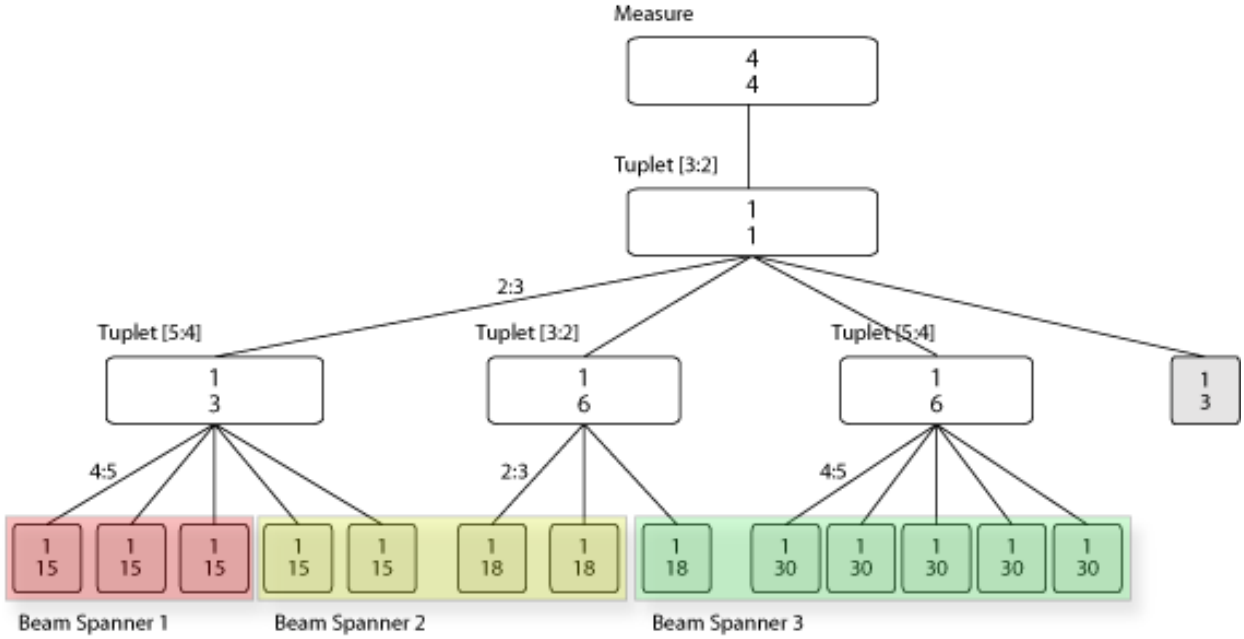
Beaming alternative 3:



Clearly the beaming of notes can be totally independent from the tuplet groupings. Beaming across tuplet groups implies beaming across nodes in the tree structure, which means that the beams do not adhere to the *exclusive (parenthood) membership* characteristic of the tree. Beams must then be modeled independently as a separate and complementary structure. These are the Abjad *spanners*.

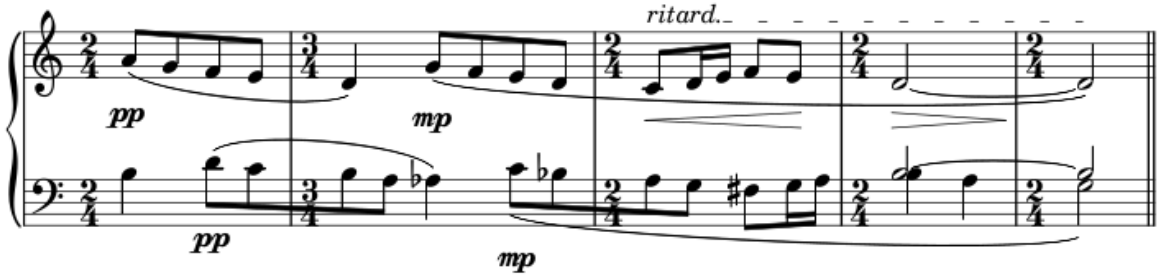
Below we have the score of our tuplet example with alternative beaming and its the Leaf-Container-Spanner graph. Notice that the colored blocks represent spanners.

Beaming alternative 3 (graph):



3.1.2 Example 2

As a second example let's look at the last five measures of Bartók's *Wandering* from Mikrokosmos vol. III. As simple as it may seem, these five measures carry with them a lot of information pertaining to musical notation.

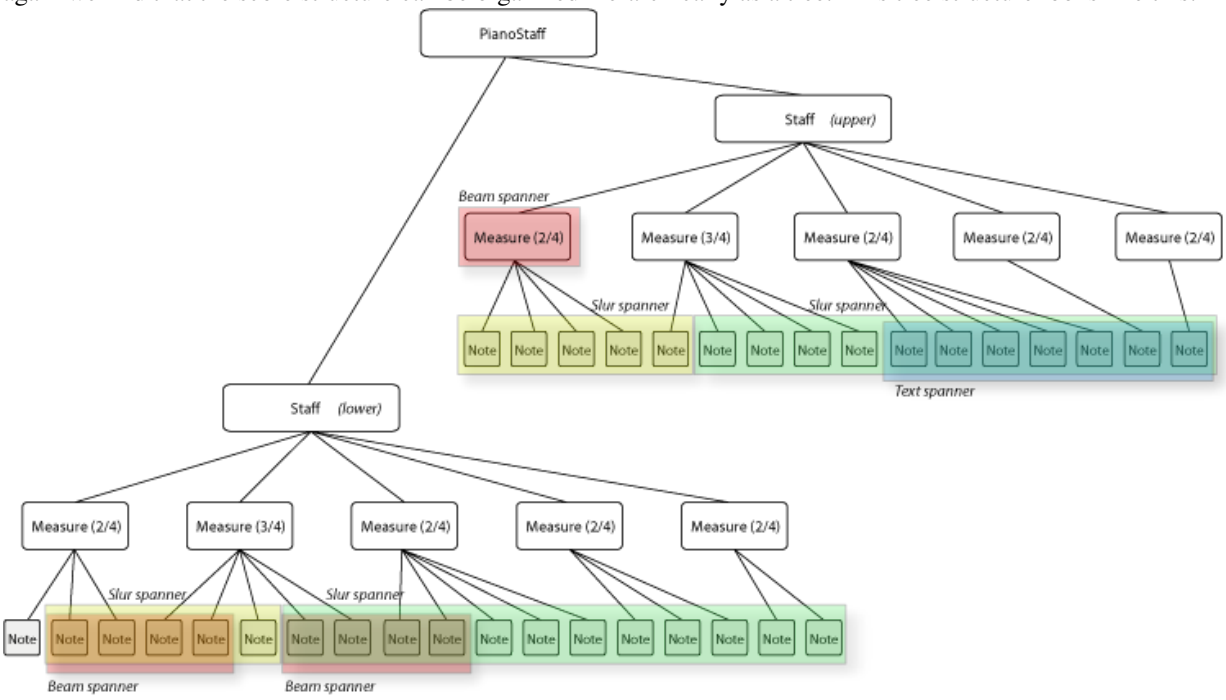


Note: Please refer to the *Bartok example* for a step by step construction of the musical fragment and its full Abjad code.

There are many musical signs of different types on the pages: notes, dynamic markings, clefs, staves, slurs, etc. These signs are structurally related to each other in different ways. Let's start by looking at the larger picture. The piano piece is written in two staves. As is customary, the staves are graphically grouped with a large curly brace attaching to them at the beginning or each system. Notice that each staff has a variety of signs associated with it. There are notes printed on the staff lines as well as meter indications and bar lines. Each note, for example, is in one and only one staff. A note is never in two staves at the same time. This is also true for measures. A measure in the top staff is not simultaneously drawn on the top staff and the bottom staff. It is better to think of each staff as having its own set of measures. Notice also that the notes in each staff fall within the region of one and only one measure, i.e. measures seem to contain notes. There is not one note that is at once in two measures (this is standard practice in musical notation, but it need not always be the case.)

As we continue describing the relationships between the musical signs in the page, we begin to discover a certain

structure, or a convenient way of structuring the score for conceptualization and manipulation. All the music in a piano score seems to be written in what we might call a *staff group*. The staff group is *composed of* two staves. Each staff in turn appears to be composed of a series or measures, and each measure is composed of a series of notes. So again we find that the score structure can be organized hierarchically as a tree. This tree structure looks like this:



Notice again though that there are elements in the score that imply and require a different kind of grouping. The two four eighth-note runs in the lower staff are beamed together across the bar line and, based on our tree structure, across tree nodes. So do the slurs, the dynamics markings and the ritardando indication at the top of the score. As we have seen in the tuplets example, all these groups running across the tree structure can be defined with *spanners*.

3.2 Parsing

Abjad provides a growing number of language parsers, including a sophisticated LilyPond parser,

3.2.1 LilyPond Parsing

`lilypondparsertools.LilyPondParser` parses a large, although incomplete, subset of LilyPond's syntax:

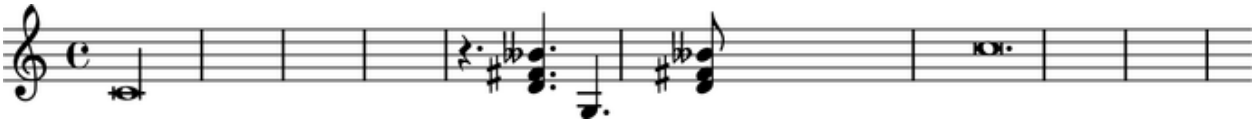
```
>>> from abjad.tools import lilypondparsertools
>>> parser = lilypondparsertools.LilyPondParser()
```

It understands notes, chords, skips and rests, including default durations and the `q` chord-repeat construct:

```
>>> string = r"{ c'\longa r4. <d' fs' bff'> g q8 s1 c''\breve. }"
>>> result = parser(string)

>>> f(result)
{
    c'\longa
    r4.
    <d' fs' bff'>4.
    g4.
```

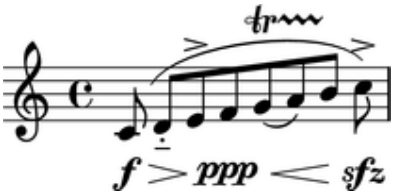
```
    <d' fs' bff'>8
    s1
    c''\breve.
}
```

```
>>> show(result)
```



It understands most spanners, articulations and dynamics too:

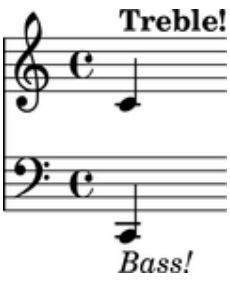
```
>>> string = r'''\new Staff {
...     c'8 \f \> (
...     d' -_ [
...     e' ^>
...     f' \ppp \<
...     g' \startTrillSpan \(
...     a' \)
...     b' ] \stopTrillSpan
...     c'' ) \accent \sfz
... }
... '''
>>> result = parser(string)

>>> f(result)
\new Staff {
    c'8 \f \> (
    d'8 -\portato [
    e'8 ^\accent
    f'8 \ppp \<
    g'8 \( \startTrillSpan
    a'8 \)
    b'8 ] \stopTrillSpan
    c''8 -\accent \sfz )
}

>>> show(result)
```



It understands contexts and markup:

```
>>> string = r'''\new Score <<
...     \new Staff = "Treble Staff" {
...         \new Voice = "Treble Voice" {
...             c' ^\markup { \bold Treble! }
...         }
...     }
...     \new Staff = "Bass Staff" {
...         \new Voice = "Bass Voice" {
...             \clef bass
...             c, _\markup { \italic Bass! }
```

```
...         }
...     }
... >>
... '''
>>> result = parser(string)

>>> f(result)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/iotools/f.py", line 19, in f
    print expr.lilypond_format
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/contexttools/Context/Context.py", li
    return self._format_component()
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/componenttools/Component/Component.p
    result.extend(self._format_contents_slot(format_contributions))
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/containertools/Container/Container.p
    result.append([('contents', '_contents'), self._format_content_pieces()])
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/containertools/Container/Container.p
    result.extend(m.lilypond_format.split('\n'))
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/contexttools/Context/Context.py", li
    return self._format_component()
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/componenttools/Component/Component.p
    result.extend(self._format_open_brackets_slot(format_contributions))
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/contexttools/Context/Context.py", li
    contributions = [context._format_invocation() + ' %s' % brackets_open[0]]
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/contexttools/Context/Context.py", li
    return r'\context %s = %s' % (self.context_name, schemetools.format_scheme_value(self.name))
NameError: global name 'schemetools' is not defined

>>> show(result)
```



It even understands certain aspects of LilyPond file layouts, like header blocks:

```
>>> string = r'''
... \header {
...     name = "Foo von Bar"
...     composer = \markup { by \bold \name }
...     title = \markup { The ballad of \name }
...     tagline = \markup { "" }
... }
... \score {
...     \new Staff {
...         \time 3/4
...         g' ( b' d'' )
...         e''4. ( c''8 c'4 )
...     }
... }
... '''
>>> result = parser(string)
```

```
>>> f(result)
% Abjad revision 6987
% 2012-08-31 22:05

\version "2.14.2"
\language "english"
\include "/Users/josiah/Documents/Projects/abjad/trunk/abjad/cfg/abjad.scm"

\header {
    composer = \markup { by \bold #"Foo von Bar" }
    name = #"Foo von Bar"
    tagline = \markup {  }
    title = \markup { The ballad of Foo von Bar }
}

\score {
    \new Staff {
        \time 3/4
        g'4 (
        b'4
        d''4 )
        e''4. (
        c''8
        c'4 )
    }
}

>>> show(result)
```

A small number of music functions are also supported, such as `\relative`. Music functions which mutate the score during compilation, result in a "normalized" Abjad score structure. That is, the resulting Abjad structure corresponds to the music as it appears on the page:

```
>>> string = r'''\new Staff \relative c { c32 d e f g a b c d e f g a b c d e f g a b c }'''
>>> result = parser(string)

>>> f(result)
\new Staff {
    c32
    d32
    e32
    f32
    g32
    a32
    b32
    c'32
    d'32
    e'32
    f'32
    g'32
    a'32
    b'32
```

```
    c''32
    d''32
    e''32
    f''32
    g''32
    a''32
    b''32
    c'''32
}
```

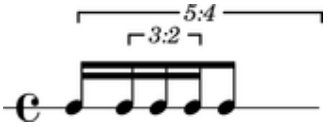
```
>>> show(result)
```

3.2.2 RhythmTree Parsing

`rhythmtreetools.RhythmTreeParser` parses a microlanguage resembling Ircam's RTM-style LISP syntax, and generates a sequence of RhythmTree structures, which can be furthered manipulated by composers, before being converted into Abjad score object:

```
>>> from abjad.tools import rhythmtreetools
>>> parser = rhythmtreetools.RhythmTreeParser()

>>> string = '(1 (1 (2 (1 1 1)) 2))'
>>> result = parser(string)
>>> result[0]
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=1,
            is_pitched=True,
            ),
        RhythmTreeContainer(
            children=(
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
            ),
            duration=2
            ),
        RhythmTreeLeaf(
            duration=2,
            is_pitched=True,
```

```
            ),
    ),
    duration=1
    )

>>> tuplet = result[0]((1, 4))[0]
>>> f(tuplet)
\times 4/5 {
    c'16
    \times 2/3 {
        c'16
        c'16
        c'16
    }
    c'8
}

>>> staff = stafftools.RhythmicStaff([tuplet])

>>> show(staff, docs=True)
```

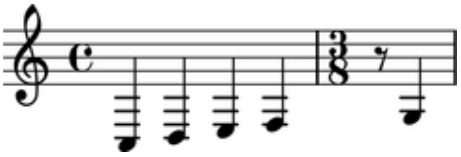


3.2.3 "Reduced-Ly" Parsing

`lilypondparsertools.ReducedLyParser` parses the "reduced-ly" microlanguage, whose syntax combines a very small subset of LilyPond syntax, along with affordances for generating various types of Abjad containers, and speedups for rapidly notating notes and rests without needing to specify pitches. It used mainly for creating Abjad documentation:

```
>>> from abjad.tools import rhythmtreetools
>>> parser = lilypondparsertools.ReducedLyParser()

>>> string = '| 4/4 c d e f || 3/8 r8 g4 |'
>>> result = parser(string)

>>> f(result)
{
    {
        \time 4/4
        c4
        d4
        e4
        f4
    }
    {
        \time 3/8
        r8
        g4
    }
}
```

```
>>> show(result)
```



CHAPTER

FOUR

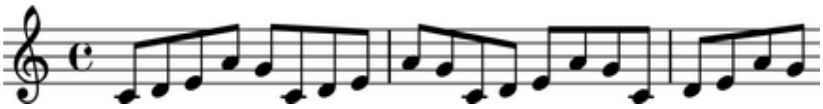
TUTORIALS

4.1 Changing notes to rests

4.1.1 A series of notes

It is easy to make a repeating pattern of notes.

```
>>> staff = Staff()
>>> staff.extend([Note(i, (1,8)) for i in [0, 2, 4, 9, 7] * 4 ])
>>> show(staff)
```



In the above example, a single list comprehension takes care of creating our notes.

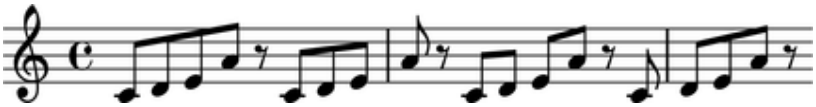
4.1.2 Notes belonging to a staff can be iterated

We will create our repeated pattern again. Note that you can do this in one line:

```
>>> staff = Staff([Note(i, (1,8)) for i in [0, 2, 4, 9, 7] * 4 ])
```

Now, iterate over the staff's contents, substituting an eighth rest for every fifth (count from zero!) Note element in the staff:

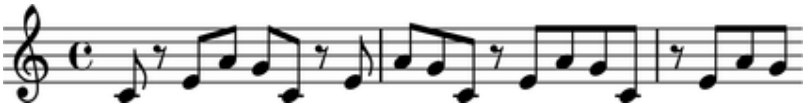
```
>>> for i, note in enumerate(staff):
...         if (i%5) == 4:
...                 staff[i] = Rest((1,8))
...
>>> show(staff)
```



4.1.3 Notes can be used directly.

In the previous example, we used an index (i) to keep track of where we are in the list of notes, and based our decision to flip on that index. We can also decide to flip a note to a rest based on the note iteself:

```
>>> staff = Staff([Note(i, (1,8)) for i in [0, 2, 4, 9, 7] * 4 ])
>>> for i, note in enumerate(staff):
...         if note.sounding_pitch == "d''":
...                 staff[i] = Rest((1,8))
...
>>> show(staff)
```

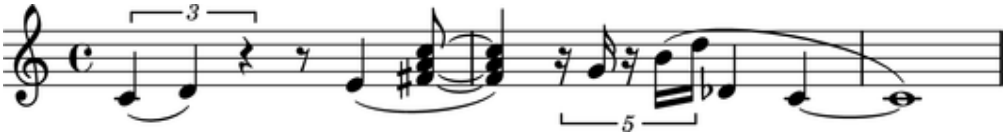


All the d's are now rests.

=tms

4.2 Creating rest-delimited slurs

Take a look at the slurs in the following example and notice that there is a pattern to how they arranged.

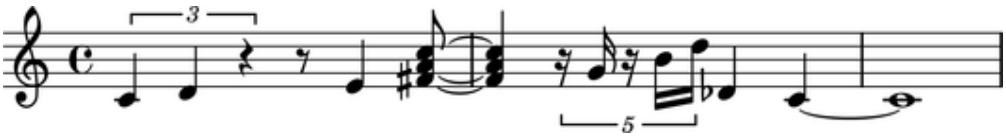


The pattern? Slurs in the example span groups of notes and chords separated by rests.

Abjad makes it easy to create such rest-delimited slurs in a structured way.

Let's start with the notes, rests and chords like this:

```
>>> string = r"\times 2/3 { c'4 d' r } r8 e'4 <fs' a' c''>8 ~ q4 \times 4/5 { r16 g' r b' d'' } df'4
>>> staff = Staff(string)
>>> show(staff)
```

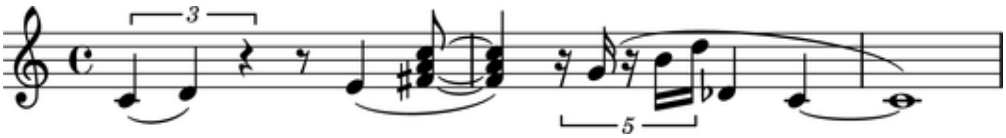


Next we'll group notes and chords together with one of the functions available in the `componenttools` package, and add slur spanners inside our loop:

```
>>> leaves = iterationtools.iterate_leaves_in_expr(staff)
>>> for group in componenttools.yield_groups_of_mixed_klasses_in_sequence(leaves, (Note, Chord)):
...     spannertools.SlurSpanner(group)
...
SlurSpanner(c'4, d'4)
SlurSpanner(e'4, <fs' a' c''>8, <fs' a' c''>4)
SlurSpanner(g'16)
SlurSpanner(b'16, d''16, df'4, c'4, c'1)
```

And now we can take a look at the result:

```
>>> show(staff)
```



Notice now that there's a little problem with the notation we just created.

Four SlurSpanners were generated, but only three slurs are shown.

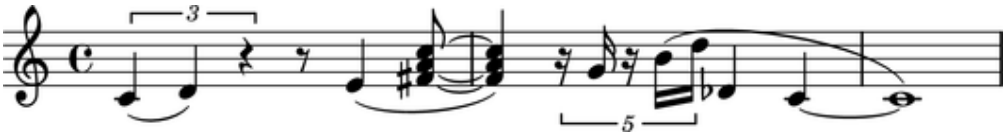
Why? LilyPond ignores slur terminators attached to the same note as the slur begins on.

Let's rewrite our example to prevent that from happening:

```
>>> staff = Staff(string)
>>> leaves = iterationtools.iterate_leaves_in_expr(staff)
>>> klasses = (Note, Chord)
>>> for group in componenttools.yield_groups_of_mixed_klasses_in_sequence(leaves, klasses):
...     if 1 < len(group):
...         spannertools.SlurSpanner(group)
...
SlurSpanner(c'4, d'4)
SlurSpanner(e'4, <fs' a' c''>8, <fs' a' c''>4)
SlurSpanner(b'16, d''16, df'4, c'4, c'1)
```

And now the corrected result:

```
>>> show(staff)
```



4.3 Making grob overrides

4.3.1 Grob-override component plug-ins

All Abjad containers have a grob-override plug-in:

```
>>> staff = Staff("c'4 d'4 e'4 f'4 g'4 a'4 g'2")

>>> staff.override.staff_symbol.color = 'blue'

>>> staff.override
LilyPondGrobOverrideComponentPlugIn(staff_symbol__color='blue')
```

All Abjad leaves have a grob-override plug-in, too:

```
>>> leaf = staff[-1]

>>> leaf.override.note_head.color = 'red'
>>> leaf.override.stem.color = 'red'

>>> leaf.override
LilyPondGrobOverrideComponentPlugIn(note_head__color='red', stem__color='red')
```

And so do Abjad spanners:

```
>>> slur = spannertools.SlurSpanner(staff[:])

>>> slur.override.slur.color = 'red'

>>> slur.override
LilyPondGrobOverrideComponentPlugIn(slur__color='red')
```

4.3.2 Grob proxies

Grob-override plug-ins contain grob proxies:

```
>>> leaf.override.note_head
LilyPondGrobProxy(color = 'red')

>>> leaf.override.stem
LilyPondGrobProxy(color = 'red')
```

4.3.3 Dot-chained override syntax

The's dot-chained grob override syntax shown here results from the special way that the Abjad grob-override plug-in and grob proxy set and get their attributes.

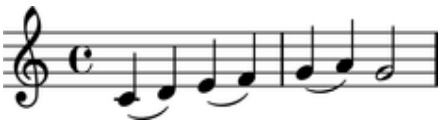
4.4 Understanding LilyPond grobs

LilyPond models music notation as a collection of graphic objects or grobs.

4.4.1 Grobs control typography

LilyPond grobs control the typographic details of the score:

```
>>> staff = Staff("c'4 ( d'4 ) e'4 ( f'4 ) g'4 ( a'4 ) g'2")

>>> f(staff)
\new Staff {
    c'4 (
    d'4 )
    e'4 (
    f'4 )
    g'4 (
    a'4 )
    g'2
}

>>> show(staff)
```

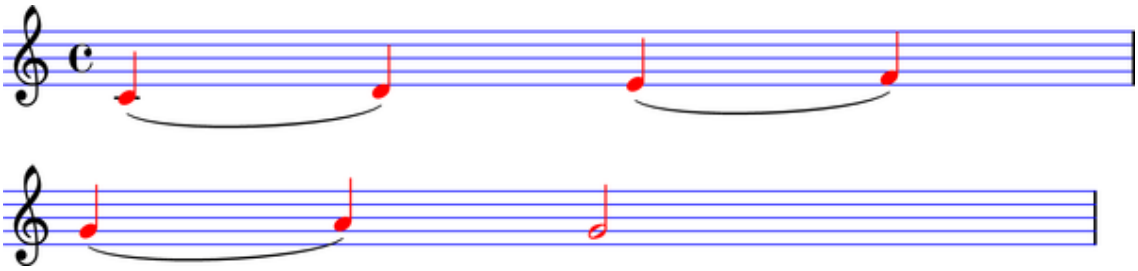


In the example above LilyPond creates a grob for every printed glyph. This includes the clef and time signature as well as the note heads, stems and slurs. If the example included beams, articulations or an explicit key signature then LilyPond would create grobs for those as well.

4.4.2 Grobs can be overridden

You can change the appearance of LilyPond grobs with grob overrides:

```
>>> staff.override.staff_symbol.color = 'blue'
>>> staff.override.note_head.color = 'red'
>>> staff.override.stem.color = 'red'

>>> f(staff)
\new Staff \with {
    \override NoteHead #'color = #red
    \override StaffSymbol #'color = #blue
    \override Stem #'color = #red
} {
    c'4 (
    d'4 )
    e'4 (
    f'4 )
    g'4 (
    a'4 )
    g'2
}

>>> show(staff, docs=True)
```



4.4.3 Nested Grob properties can be overriden

In the above example, *staff_symbol*, *note_head* and *stem* correspond to the LilyPond grobs *StaffSymbol*, *NoteHead* and *Stem*, while *color* in each case is the color properties of that graphic object.

It is not uncommon in LilyPond scores to see more complex overrides, consisting of a grob name and a list of two or more property names:

```
\override StaffGrouper #'staff-staff-spacing #'basic-distance = #7
```

To achieve the Abjad equivalent, simply concatenate the property names with double-underscores:

```
>>> staff = Staff()
>>> staff.override.staff_grouper.staff_staff_spacing__basic_distance = 7
>>> f(staff)
\new Staff \with {
    \override StaffGrouper #'staff-staff-spacing #'basic-distance = #7
} {
}
```

Abjad will explode the double-underscore delimited Python property into a LilyPond property list.

4.4.4 Check the LilyPond docs

New grobs are added to LilyPond from time to time.

For a complete list of LilyPond grobs see the LilyPond documentation.

4.5 Understanding time signature marks

In this tutorial is to take a deeper look at what happens when we attach time signature marks to staves and other score components. To work through the tutorial, enter each of the examples into the Abjad interpreter and study what comes back. At the end of the tutorial you'll understand how time signature marks are created. You'll also understand how the states of different objects change when time signature marks are attached and detached.

First we start by creating a staff full of notes:

```
>>> staff = Staff("c'4 d'4 e'4 f'4 g'2")
```

If we ask the Abjad interpreter about our staff reference Abjad will respond with the interpreter display of the object:

```
>>> staff
Staff{5}
```

The `5` in `Staff{5}` shows that the staff contains 5 top-level components. The curly braces in `Staff{5}` show that the contents of the staff are to be read sequentially through time rather than in parallel.

Before we get to time signature marks let's take a moment and examine the state of the staff we've created. We can motivate this a bit by asking two questions:

1. what time signature is currently in effect for the staff we have just created?
2. **what is the time signature currently in effect for** the five notes contained within the staff we have just created?

The answer to both questions is the same: there is no time signature currently in effect for either our staff or for the five notes it contains.

We can see that this is the case with tools from the API:

```
>>> contexttools.get_effective_time_signature(staff) is None
True
```

And:

```
>>> for leaf in staff:
...     contexttools.get_effective_time_signature(leaf) is None
...
True
True
True
True
True
```

If we want, we can iterate both the staff and its leaves at one and the same time like this:

```
>>> for component in iterationtools.iterate_components_in_expr(staff):
...     component, contexttools.get_effective_time_signature(component)
...
(Staff{5}, None)
(Note("c'4"), None)
(Note("d'4"), None)
```

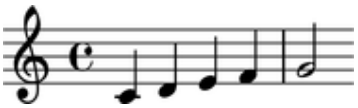
```
(Note("e'4"), None)
(Note("f'4"), None)
(Note("g'2"), None)
```

This confirms the answer to our questions that there is not yet any time signature in effect for any component in our staff because we have not yet attached a time signature mark to any component in our staff.

So what happens if we format our staff and send it off to LilyPond to render as a PDF? Will LilyPond render the staff with a time signature? Without a time signature? Will LilyPond refuse to render the example at all?

We find out like this:

```
>>> show(staff)
```



It turns out LilyPond defaults to a time signature of `4/4`.

What's important to note here is that because we have not yet attached a time signature mark any component in our staff Abjad says "no effective time signature here" while LilyPond says "OK, I'll default to `4/4` so we can get on with rendering your music."

We can further confirm that this is the case by asking Abjad for the LilyPond format of our staff:

```
>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
    g'2
}
```

The LilyPond format of our staff contains no LilyPond `\time` command. This is, again, because we have not yet attached a time signature mark to any component in our staff.

We can no practice attaching and detaching time signature marks to different components in our staff and study what happens as we do.

We'll start with `3/4`.

The easiest thing to do is to attach a time signature mark to the staff itself.

We'll do this in two separate steps and study each step to understand exactly what's going on.

First, we create a `3/4` time signature mark:

```
>>> time_signature_mark = contexttools.TimeSignatureMark((3, 4))
```

If we ask the Abjad interpreter for the interpreter dispaly of our time signature mark we get the following:

```
>>> time_signature_mark
TimeSignatureMark((3, 4))
```

All this tells us is that we have in fact created a `3/4` time signature mark. Nothing too exciting yet. At this point our `3/4` time signature is not yet attached to anything. We could say that the "state" of our time signature mark is "unattached." And we can see this like so:

```
>>> time_signature_mark.start_component is None
True
```

What does it mean for a time signature mark to have `'start_component'` equal to none? It means that the time signature isn't yet attached to any score component anywhere.

So now we attach our time signature mark to our staff:

```
>>> time_signature_mark.attach(staff)
TimeSignatureMark((3, 4))(Staff{5})
```

Abjad responds immediately by returning the time signature mark we have just attached.

Notice that our time signature mark's repr ha changed. The repr of our `3/4` time signature mark now includes the repr of the staff to which we have just attached the time signature mark. That is to say that the repr of our time signature mark is statal.

Our time signature mark has transitioned from an "unattached" state to an "attached" state. We can see this like so:

```
>>> time_signature_mark.start_component
Staff{5}
```

And our staff has likewise transitioned from a state of having no effective time signature to a state of having an effective time signature:

```
>>> contexttools.get_effective_time_signature(staff)
TimeSignatureMark((3, 4))(Staff{5})
```

And what about the leaves inside our staff? Do the leaves now "know" that they are governed by a `3/4` time signature?

Indeed they do:

```
>>> for leaf in staff.leaves:
...     leaf, contexttools.get_effective_time_signature(leaf)
...
(Note("c'4"), TimeSignatureMark((3, 4))(Staff{5}))
(Note("d'4"), TimeSignatureMark((3, 4))(Staff{5}))
(Note("e'4"), TimeSignatureMark((3, 4))(Staff{5}))
(Note("f'4"), TimeSignatureMark((3, 4))(Staff{5}))
(Note("g'2"), TimeSignatureMark((3, 4))(Staff{5}))
```

So to briefly resume:

What we just did was to:

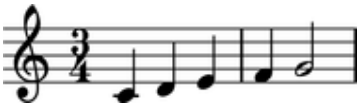
1. create a time signature mark
2. attach the time signature to a score component

This 2-step pattern is always the same when dealing with context marks: create then attach.

(We will find out later that there are short-cuts for different parts of this process. Right now we've chosen to create in a first step and attach in a second step so that we can examine the changing states of the objects involved.)

Before moving on let's look at the PDF corresponding to our staff:

```
>>> show(staff)
```



And let's confirm what we see in the PDF in the staff's format:

```
>>> f(staff)
\new Staff {
    \time 3/4
```

```
    c'4
    d'4
    e'4
    f'4
    g'2
}
```

The staff's format now contains a LilyPond `\time` command because we have attached an Abjad time signature mark to the staff.

What we've just been through above will cover over 80% of what you'll ever wind up doing with time signature marks: creating them and attaching them directly to staves. But what if we wanna get rid of a time signature mark? Or what if the time signature will be changing all over the place? We cover those cases next.

Detaching a time signature mark is easy:

```
>>> time_signature_mark.detach()
TimeSignatureMark((3, 4))
```

The Abjad returns the mark we have just detached. And, observing the repr of the time signature mark, we see that the time signature mark has again changed state: the time signature mark has transitioned from attached to unattached. We confirm this like so:

```
>>> time_signature_mark.start_component is None
True
```

And also like so:

```
>>> contexttools.get_effective_time_signature(staff) is None
True
```

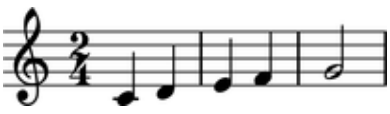
Yup: our time signature mark knows nothing about our staff. And vice versa. This is good.

So now what if we want to set up a time signature of 2/4? That fits our music, too.

We have a couple of options.

We can simply create and attach a new time signature mark:

```
>>> duple_time_signature_mark = contexttools.TimeSignatureMark((2, 4))
>>> duple_time_signature_mark.attach(staff)
TimeSignatureMark((2, 4))(Staff{5})

>>> f(staff)
\new Staff {
    \time 2/4
    c'4
    d'4
    e'4
    f'4
    g'2
}

>>> show(staff)
```



Yup. That works.

On the other hand, we could simply reuse our previous `3/4` time signature mark.

To do this we'll first detach our 2/4 time signature mark ...

```
>>> duple_time_signature_mark.detach()
TimeSignatureMark((2, 4))
```

... confirm that our staff is now time signatureless ...

```
>>> contexttools.get_effective_time_signature(staff) is None
True
```

```
>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
    g'2
}
```

... reattach our previous 3/4 time signature ...

```
>>> time_signature_mark.attach(staff)
TimeSignatureMark((3, 4))(Staff{5})
```

... change the numerator of our time signature mark ...

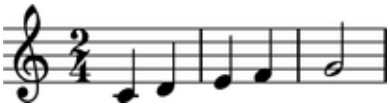
```
>>> time_signature_mark.numerator = 2
```

... and check to make sure that everything is as it should be:

```
>>> contexttools.get_effective_time_signature(staff)
TimeSignatureMark((2, 4))(Staff{5})
>>> time_signature_mark.start_component
Staff{5}
```

```
>>> f(staff)
\new Staff {
    \time 2/4
    c'4
    d'4
    e'4
    f'4
    g'2
}
```

```
>>> show(staff)
```



And everything works as it should.

To change to, for example, 4/4 we change just change the time signature mark's numerator again:

```
>>> time_signature_mark.numerator = 4
```

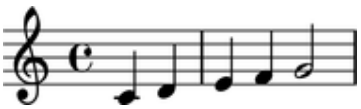
```
>>> f(staff)
\new Staff {
    \time 4/4
    c'4
```

```
    d'4
    e'4
    f'4
    g'2
}
```

But what if our time signature has a `2/4` pick-up?

The LilyPond command for pick-ups is `\partial`. Abjad time signature marks implement this as a read / write attribute:

```
>>> time_signature_mark.partial = Duration(2, 4)

>>> f(staff)
\new Staff {
    \partial 2
    \time 4/4
    c'4
    d'4
    e'4
    f'4
    g'2
}

>>> show(staff)
```



And what if time signature changes all over the place?

We'll use the trivial example of a measure in `4/4` followed by a measure in `2/4`.

To do this we will need two time signature marks.

We've already got a `4/4` time signature mark attached to our staff:

```
>>> f(staff)
\new Staff {
    \partial 2
    \time 4/4
    c'4
    d'4
    e'4
    f'4
    g'2
}
```

Let's get rid of the pick-up:

```
>>> time_signature_mark.partial = None

>>> f(staff)
\new Staff {
    \time 4/4
    c'4
    d'4
    e'4
    f'4
```

```
    g'2
}
```

Now what about the `2/4` time signature mark?

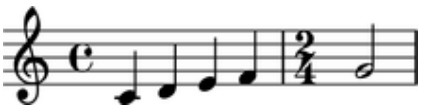
We create it in the usual way:

```
>>> duple_time_signature_mark = contexttools.TimeSignatureMark((2, 4))
>>> duple_time_signature_mark
TimeSignatureMark((2, 4))
```

But should we attach it? We can't attach our `2/4` time signature to our staff because we've already attached our `4/4` time signature to our staff. And it only makes sense to attach one time signature to any given score component.

Observe that we've built our score in a very straightforward way: we have a single staff that contains a (flat) sequence of notes. This means that we have only one choice for where to attach the new `2/4` time signature mark. And that is one the `g'2` that comes on the downbeat of the second measure. We do that like this:

```
>>> duple_time_signature_mark.attach(staff[4])
TimeSignatureMark((2, 4))(g'2)

>>> f(staff)
\new Staff {
    \time 4/4
    c'4
    d'4
    e'4
    f'4
    \time 2/4
    g'2
}

>>> show(staff)
```



And everything works as we would like.

Incidentally, `staff[4]` means the component sitting at index `4` inside our staff. Using the interpreter we can verify that this is `g'2`:

```
>>> staff[4]
Note("g'2")
```

Depending on how we had chosen to build our staff we would have had more options for where to attach our `2/4` time signature mark. If, for example, we had chosen to populate our staff with a series of measures then it's possible we could have attached our `2/4` time signature to a measure instead of a note.

That covers the vast majority of things you'll do with time signature marks.

But before we stop we should mention another useful API function and then talk about some short-cuts.

First an API function to detach ALL context marks attaching to a component:

We call the function a first time:

```
>>> contexttools.detach_context_marks_attached_to_component(staff)
(TimeSignatureMark((4, 4)),)
```

```
>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
    \time 2/4
    g'2
}
```

And then a second time:

```
>>> contexttools.detach_context_marks_attached_to_component(staff[4])
(TimeSignatureMark((2, 4)),)

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
    g'2
}
```

Now there are now context marks of any sort attached to our staff or to the notes in our staff.

Be careful with this function, though: it removes *all* context marks. So even though we just used the function to remove time signature marks, it also would have removed any clef marks or tempo marks if we had had those attached to our score, too.

And now for the short-cuts:

Our staff currently has no time signature marks attached:

```
>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
    g'2
}
```

So to recreate our `3/4` time signature we can do this ...

```
>>> time_signature_mark = contexttools.TimeSignatureMark((3, 4))
```

... and then use a short-cut to avoid calling `time_signature_mark.attach()` like this:

```
>>> time_signature_mark(staff)
TimeSignatureMark((3, 4))(Staff{5})

>>> f(staff)
\new Staff {
    \time 3/4
    c'4
    d'4
    e'4
    f'4
    g'2
}
```

What's going on here is that all context marks implement the special `__call__()` method as a short-cut for `attach()`. What is the special `__call__()` method? The `__call__()` method is what makes a function, class or any other Python object callable. The statement `time_signature_mark(staff)` has has parentheses in it because the time signature mark is callable; and the time signature mark is callable because all context marks implement the special `__call__()` method.

Note too that all context marks understand an *empty call* as a short-cut for `detach()`. Like this:

```
>>> time_signature_mark()
TimeSignatureMark((3, 4))

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
    g'2
}
```

The empty call made against the time signature mark causes the time signature mark to detach from its start component.

The fact that context marks implement the special `__call__()` method as a short-cut for attach() means that context marks can be created and attached in a single line:

```
>>> contexttools.TimeSignatureMark((2, 4))(staff)
TimeSignatureMark((2, 4))(Staff{5})

>>> f(staff)
\new Staff {
    \time 2/4
    c'4
    d'4
    e'4
    f'4
    g'2
}
```

What's going on here?

What's going on is that `contexttools.TimeSignatureMark((2, 4))` creates a time signature mark in the usual way and that – immediately after this – the newly created time signature mark is available for us to call it against our staff.

This last short-cut form of ...

```
>>> contexttools.TimeSignatureMark((2, 4))(staff)
```

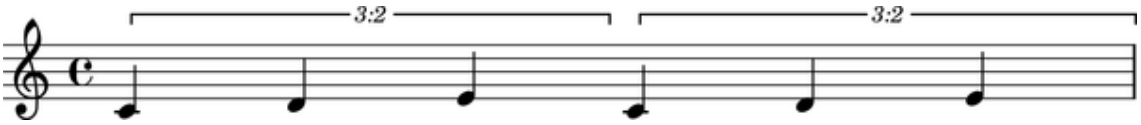
... is the usual way that you will see context marks of all sorts presented in the docs.

4.6 Working with component parentage

Many score objects contain other score objects.

```
>>> tuplet = Tuplet(Fraction(2, 3), "c'4 d'4 e'4")
>>> staff = Staff(2 * tuplet)
>>> score = Score([staff])
```

```
>>> show(score, docs=True)
```



Abjad uses the idea of parentage to model the way objects contain each other.

4.6.1 Improper parentage

The improper parentage of the first note in score begins with the note itself:

```
>>> note = score.leaves[0]
```

```
>>> componenttools.get_improper_parentage_of_component(note)
(Note("c'4"), Tuplet(2/3, [c'4, d'4, e'4]), Staff{2}, Score<<1>>)
```

4.6.2 Proper parentage

The proper parentage of the note begins with only the immediate parent of the note:

```
>>> componenttools.get_proper_parentage_of_component(note)
(Tuplet(2/3, [c'4, d'4, e'4]), Staff{2}, Score<<1>>)
```

Note: the length of the improper parentage of any component equals the length of the proper parentage of the component plus `1`.

4.6.3 Parentage attributes

Use component tools to find score depth:

```
>>> componenttools.component_to_score_depth(note)
3
```

Or score root:

```
>>> componenttools.component_to_score_root(note)
Score<<1>>
```

Or to find whether a component has no (proper) parentage at all:

```
>>> componenttools.is_orphan_component(note)
False
```

4.7 Working with threads

4.7.1 What is a thread?

A thread is a structural relationship binding a set of strictly sequential voice-level components.

Threads may be explicitly defined via voice instances:

```
>>> v = Voice()
```

Or they may exist implicitly in certain score constructs in the absence of voice containers:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
```

Two contiguous voices must have the same name in order to be part of the same thread.

Here a thread does **not** exist between notes in different voices:

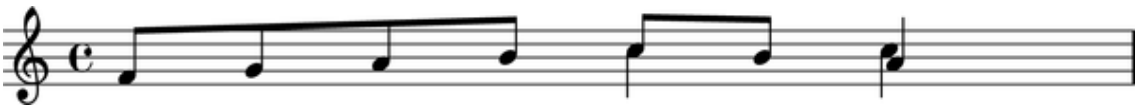
```
>>> v_one = Voice("c'16 d'16 e'16 f'16")
>>> v_two = Voice("c'8 d'8")
>>> staff = Staff([v_one, v_two])
>>> f(staff)
\new Staff {
    \new Voice {
        c'16
        d'16
        e'16
        f'16
    }
    \new Voice {
        c'8
        d'8
    }
}
```

Here a thread does exist:

```
>>> v_one.name = 'flute'
>>> v_two.name = 'flute'
>>> f(staff)
\new Staff {
    \context Voice = "flute" {
        c'16
        d'16
        e'16
        f'16
    }
    \context Voice = "flute" {
        c'8
        d'8
    }
}
```

4.7.2 What are threads for?

Consider the following situation:



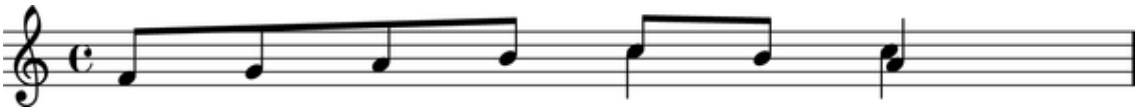
Are the two eighth notes in the second half of the measure the continuation of the ascending line in the first half, or is it the quarter note? Is the very last *C* the continuation of the top melodic line or is it the *A*? The stems might suggest an answer, but for Abjad, stem direction is not structural. What path should Abjad take to traverse this little score from the first note to the last *A*? This same problem appears when trying to apply spanners to parallel structures. Thus,

threads are important in both score navigation and the application of spanners. In fact, threads are a requirement for spanner application.

In Abjad, the ambiguity is resolved through the explicit use of named voices.

The musical fragment above is constructed with the following code:

```
>>> vA = Voice(notetools.make_notes([5, 7, 9, 11], [(1, 8)] * 4))
>>> vB = Voice(notetools.make_notes([12, 11, 9], [(1, 8), (1, 8), (1, 4)]))
>>> vC = Voice(Note(12, (1, 4)) * 2)
>>> mark = marktools.LilyPondCommandMark('voiceOne')(vA[0])
>>> mark = marktools.LilyPondCommandMark('voiceOne')(vB[0])
>>> mark = marktools.LilyPondCommandMark('voiceTwo')(vC[0])
>>> p = Container([vB, vC])
>>> p.is_parallel = True
>>> staff = Staff([vA, p])

>>> f(staff)
\new Staff {
    \new Voice {
        \voiceOne
        f'8
        g'8
        a'8
        b'8
    }
    <<
        \new Voice {
            \voiceOne
            c''8
            b'8
            a'4
        }
        \new Voice {
            \voiceTwo
            c''4
            c''4
        }
    >>
}

>>> show(staff, docs=True)
```



There's a staff that sequentially contains a voice and a parallel container. The container in turn holds two voices running simultaneously.

It is now clear from the code that the last *A* belongs with the two descending eighth notes. But there's still no indication about a relationship of continuity between the first voice in the sequence (*vA*) and any of the two following voices. Note that, while the LilyPond voice number commands setting may suggest that vA and vB belong together, this is not the case. The LilyPond voice number commands simply set the direction of stems in printed output.

To see this more clearly, suppose we want to add a slur spanner starting on the first note and ending on one of the last simultaneous notes. To attach the slur spanner to the voices we could try either:

```
>>> spannertools.SlurSpanner([vA, vB])
Traceback (most recent call last):
```

```
  File "<stdin>", line 1, in <module>
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/spannertools/SlurSpanner/SlurSpanner
    DirectedSpanner.__init__(self, components, direction)
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/spannertools/DirectedSpanner/Directe
```

```
    Spanner.__init__(self, components)
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/spannertools/Spanner/Spanner.py", li
```

```
    self._initialize_components(components)
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/spannertools/Spanner/Spanner.py", li
    assert componenttools.all_are_thread_contiguous_components(leaves)
AssertionError
```

... or ...

```
>>> spannertools.SlurSpanner([vA, vC])
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/spannertools/SlurSpanner/SlurSpanner
    DirectedSpanner.__init__(self, components, direction)
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/spannertools/DirectedSpanner/Directe
    Spanner.__init__(self, components)
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/spannertools/Spanner/Spanner.py", li
    self._initialize_components(components)
  File "/Users/josiah/Documents/Projects/abjad/trunk/abjad/tools/spannertools/Spanner/Spanner.py", li
    assert componenttools.all_are_thread_contiguous_components(leaves)
AssertionError
```

But both raise a contiguity error. Abjad needs to see an explicit connection between either *vA* and *vB* or between *vA* and *vC*.

Observe the behavior of the `iterate_thread_in_expr()` iterator on the *staff*:

```
>>> vA_thread_signature = componenttools.component_to_containment_signature(vA)
>>> notes = iterationtools.iterate_thread_in_expr(staff, Note, vA_thread_signature)
>>> print list(notes)
[Note("f'8"), Note("g'8"), Note("a'8"), Note("b'8")]

>>> vB_thread_signature = componenttools.component_to_containment_signature(vB)
>>> notes = iterationtools.iterate_thread_in_expr(staff, Note, vB_thread_signature)
>>> print list(notes)
[Note("c''8"), Note("b'8"), Note("a'4")]

>>> vC_thread_signature = componenttools.component_to_containment_signature(vC)
>>> notes = iterationtools.iterate_thread_in_expr(staff, Note, vC_thread_signature)
>>> print list(notes)
[Note("c''4"), Note("c''4")]
```

In each case we are passing a different **thread signature** to the `iterate_thread_in_expr()` iterator, so each case returns a different list of notes.

We can see that the thread signature of each voice is indeed different by printing it:

```
>>> vA_thread_signature = componenttools.component_to_containment_signature(vA)
>>> vA_thread_signature
ContainmentSignature(Voice-25493808, Voice-25493808, Staff-25494192)

>>> vB_thread_signature = componenttools.component_to_containment_signature(vB)
>>> vB_thread_signature
ContainmentSignature(Voice-25493936, Voice-25493936, Staff-25494192)

>>> vC_thread_signature = componenttools.component_to_containment_signature(vC)
>>> vC_thread_signature
ContainmentSignature(Voice-25494064, Voice-25494064, Staff-25494192)
```

And by comparing them with the binary equality operator:

```
>>> vA_thread_signature == vB_thread_signature
False
>>> vA_thread_signature == vC_thread_signature
False
>>> vB_thread_signature == vC_thread_signature
False
```

To allow Abjad to treat the content of, say, voices *vA* and *vB* as belonging together, we explicitly define a thread between them. To do this all we need to do is give both voices the same name:

```
>>> vA.name = 'piccolo'
>>> vB.name = 'piccolo'
```

Now *vA* and *vB* and all their content belong to the same thread:

```
>>> vA_thread_signature == vB_thread_signature
False
```

Note how the thread signatures have changed:

```
>>> vA_thread_signature = componenttools.component_to_containment_signature(vA)
>>> print vA_thread_signature
     staff: Staff-25494192
     voice: Voice-'piccolo'
      self: Voice-'piccolo'

>>> vB_thread_signature = componenttools.component_to_containment_signature(vB)
>>> print vB_thread_signature
     staff: Staff-25494192
     voice: Voice-'piccolo'
      self: Voice-'piccolo'

>>> vC_thread_signature = componenttools.component_to_containment_signature(vC)
>>> print vC_thread_signature
     staff: Staff-25494192
     voice: Voice-25494064
      self: Voice-25494064
```

And how the `iterationtools.iterate_thread_in_expr()` function returns all the notes belonging to both *vA* and *vB* when passing it the full staff and the thread signature of *vA*:

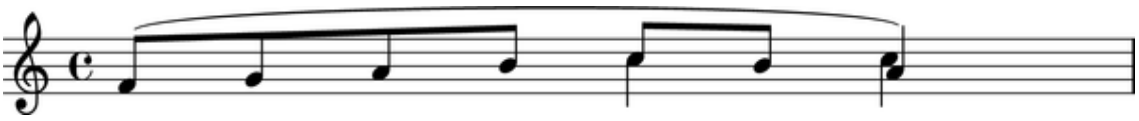
```
>>> notes = iterationtools.iterate_thread_in_expr(staff, Note, vA_thread_signature)
>>> print list(notes)
[Note("f'8"), Note("g'8"), Note("a'8"), Note("b'8"), Note("c''8"), Note("b'8"), Note("a'4")]
```

Now the slur spanner can be applied to voices *vA* and *vB*:

```
>>> spannertools.SlurSpanner([vA, vB])
SlurSpanner({f'8, g'8, a'8, b'8}, {c''8, b'8, a'4})
```

or directly to the notes returned by the `iterate_thread_in_expr()` iteration tool, which are the notes belonging to both *vA* and *vB*:

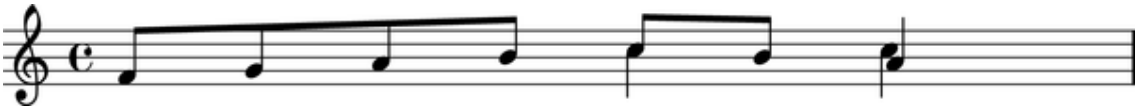
```
>>> notes = iterationtools.iterate_thread_in_expr(staff, Note, vA_thread_signature)
>>> spannertools.SlurSpanner(list(notes))
SlurSpanner(f'8, g'8, a'8, b'8, c''8, b'8, a'4)

>>> show(staff, docs=True)
```



4.7.3 Coda

We could have constructed this score in a simpler way with only two voices, one of them starting with a LilyPond skip:

```
>>> vX = Voice(notetools.make_notes([5, 7, 9, 11, 12, 11, 9], [(1, 8)] * 6 + [(1, 4)]))
>>> vY = Voice([skiptools.Skip((2, 4))] + Note(12, (1, 4)) * 2)
>>> mark = marktools.LilyPondCommandMark('voiceOne')(vX[0])
>>> mark = marktools.LilyPondCommandMark('voiceTwo')(vY[0])
>>> staff = Staff([vX, vY])
>>> staff.is_parallel = True

>>> f(staff)
\new Staff <<
    \new Voice {
        \voiceOne
        f'8
        g'8
        a'8
        b'8
        c''8
        b'8
        a'4
    }
    \new Voice {
        \voiceTwo
        s2
        c''4
        c''4
    }
>>

>>> show(staff, docs=True)
```



CHAPTER

FIVE

REFERENCE MANUAL

5.1 Annotations

Annotate components with user-specific information for future use.

Annotations do not impact formatting.

5.1.1 Creating annotations

Use mark tools to create annotations:

```
>>> annotation = marktools.Annotation('special pitch', pitchtools.NamedChromaticPitch('bs'))

>>> annotation
Annotation('special pitch', NamedChromaticPitch('bs'))
```

5.1.2 Attaching annotations to a component

Attach annotations to any component with `attach()`:

```
>>> note = Note("c'4")
>>> annotation.attach(note)
Annotation('special pitch', NamedChromaticPitch('bs'))(c'4)

>>> annotation
Annotation('special pitch', NamedChromaticPitch('bs'))(c'4)

>>> another_annotation = marktools.Annotation('special pitch', pitchtools.NamedChromaticPitch('bs'))
>>> another_annotation.attach(note)
Annotation('special pitch', NamedChromaticPitch('bs'))(c'4)

>>> another_annotation
Annotation('special pitch', NamedChromaticPitch('bs'))(c'4)
```

5.1.3 Getting the annotations attached to a component

Use mark tools to get all the annotations attached to a component:

```
>>> marktools.get_annotations_attached_to_component(note)
(Annotation('special pitch', NamedChromaticPitch('bs'))(c'4), Annotation('special pitch', NamedChroma
```

5.1.4 Detaching annotations from a component one at a time

Use `detach()` to detach annotations from a component one at a time:

```
>>> annotation.detach()
Annotation('special pitch', NamedChromaticPitch('bs'))

>>> annotation
Annotation('special pitch', NamedChromaticPitch('bs'))
```

5.1.5 Detaching all annotations attached to a component at once

Or use mark tools to detach all annotations attachd to a component at once:

```
>>> print marktools.detach_annotations_attached_to_component(note)
(Annotation('special pitch', NamedChromaticPitch('bs')),)

>>> marktools.get_annotations_attached_to_component(note)
()
```

5.1.6 Inspecting the component to which an annotation is attached

Use `start_component` to inspect the component to which an annotation is attached:

```
>>> annotation.attach(note)
Annotation('special pitch', NamedChromaticPitch('bs'))(c'4)

>>> annotation.start_component
Note("c'4")
```

5.1.7 Inspecting annotation name

Use `name` to get the name of any annotation:

```
>>> annotation.name
'special pitch'
```

5.1.8 Inspecting annotation value

And use `value` to get the value of any annotation:

```
>>> annotation.value
NamedChromaticPitch('bs')
```

5.2 Articulations

Articulations model staccati, marcati, tenuti and other symbols. Articulations attach notes, rests or chords.

5.2.1 Creating articulations

Use `marktools` to create articulations:

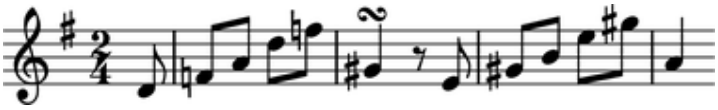
```
articulation = marktools.Articulation('turn')
```

```
>>> articulation
Articulation('turn')
```

5.2.2 Attaching articulations to a leaf

Use `attach()` to attach articulations to a leaf:

```
>>> staff = Staff([])
>>> key_signature = contexttools.KeySignatureMark('g', 'major')
>>> key_signature.attach(staff)
time_signature = contexttools.TimeSignatureMark((2, 4), partial = Duration(1, 8))
>>> time_signature.attach(staff)

>>> staff.extend("d'8 f'8 a'8 d''8 f''8 gs'4 r8 e'8 gs'8 b'8 e''8 gs''8 a'4")

>>> articulation.attach(staff[5])

>>> show(staff)
```

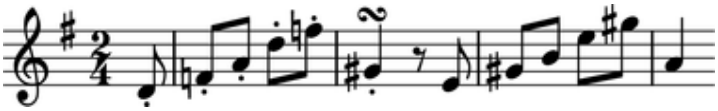


(The example is based on Haydn's piano sonata number 42, Hob. XVI/27.)

5.2.3 Attaching articulations to many notes and chords at once

Use `marktools` to attach articulations to many notes and chords at one time:

```
>>> marktools.attach_articulations_to_notes_and_chords_in_expr(staff[:6], ['.'])

>>> show(staff)
```



5.2.4 Getting the articulations attached to a leaf

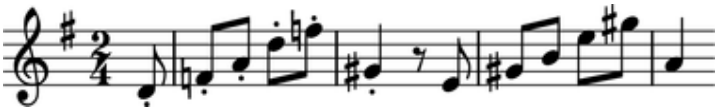
Use `marktools` to get the articulations attached to a leaf:

```
>>> marktools.get_articulations_attached_to_component(staff[5])
(Articulation('turn')(gs'4), Articulation('.')(gs'4))
```

5.2.5 Detaching articulations from a leaf one at a time

Detach articulations by hand with `detach()`:

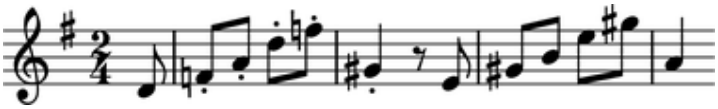
```
>>> articulation.detach()

>>> articulation
-\turn

>>> show(staff)
```



5.2.6 Detaching all articulations attached to a leaf at once

Use `marktools` to detach all articulations attached to a leaf at once:

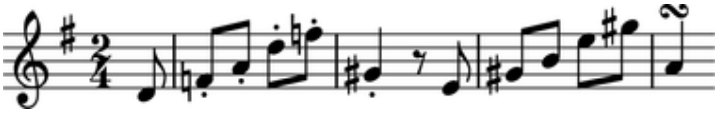
```
>>> staff[0]
Note("d'8")

>>> marktools.detach_articulations_attached_to_component(staff[0])

>>> show(staff)
```



5.2.7 Inspecting the leaf to which an articulation is attached

Use `start_component` to inspect the component to which an articulation is attached:

```
>>> articulation = marktools.Articulation('turn')
>>> articulation.attach(staff[-1])

>>> show(staff)
```



```
>>> articulation.start_component
Note("a'4")
```

5.2.8 Understanding the interpreter display of an articulation that is not attached to a leaf

The interpreter display of an articulation that is not attached to a leaf contains three parts:

```
>>> articulation = marktools.Articulation('staccato')

>>> articulation
>>> print repr(articulation)
Articulation('staccato')
```

`Articulation` tells you the articulation's class.

`'staccato'` tells you the articulation's name.

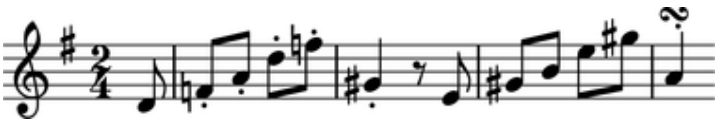
If you set the direction string of the articulation then that will appear, too:

```
>>> articulation.direction_string = '^'

>>> articulation
>>> print repr(articulation)
Articulation('staccato', '^')
```

5.2.9 Understanding the interpreter display of an articulation that is attached to a leaf

The interpreter display of an articulation that is attached to a leaf contains four parts:

```
>>> articulation.attach(staff[-1])

>>> articulation
>>> print repr(articulation)
Articulation('staccato', '^')(a'4)

>>> show(staff)
```



`Articulation` tells you the articulation's class.

`'staccato'` tells you the articulation's name.

`'^'` tells you the articulation's direction string.

`(a"4)` tells you the component to which the articulation is attached.

If you set the direction string of the articulation to none then the direction will no longer appear:

```
>>> articulation.direction_string = None

>>> articulation
Articulation('staccato')(a'4)
```

5.2.10 Understanding the string representation of an articulation

The string representation of an articulation comprises two parts:

```
>>> str(articulation)
'-\\staccato'
```

`-` tells you the articulation's direction string.

`staccato` tells you the articulation's name.

5.2.11 Inspecting the LilyPond format of an articulation

Get the LilyPond input format of an articulation with `format`:

```
>>> articulation.format
'-\\staccato'
```

Use `f()` as a short-cut to print the LilyPond format of an articulation:

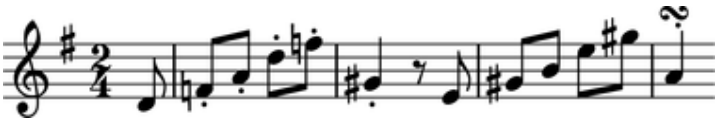
```
>>> f(articulation)
-\staccato
```

5.2.12 Controlling whether an articulation appears above or below the staff

Set `direction_string` to `'^'` to force an articulation to appear above the staff:

```
>>> articulation.direction_string = '^'
```

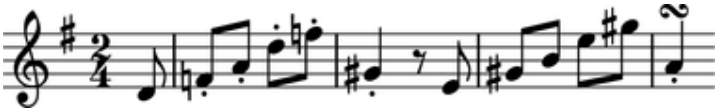
```
>>> show(staff)
```



Set `direction_string` to `'_'` to force an articulation to appear above the staff:

```
>>> articulation.direction_string = '_'
```

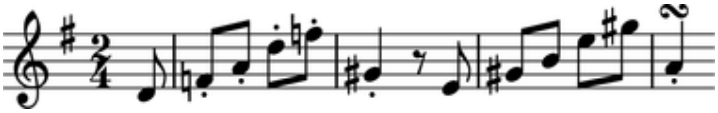
```
>>> show(staff)
```



Set `direction_string` to none to allow LilyPond to position an articulation automatically:

```
>>> articulation.direction_string = None
```

```
>>> show(staff)
```

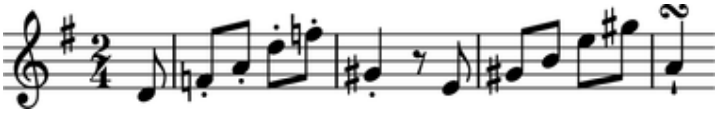


5.2.13 Getting and setting the name of an articulation

Set the `name` of an articulation to change the symbol an articulation prints:

```
>>> articulation.name = 'staccatissimo'
```

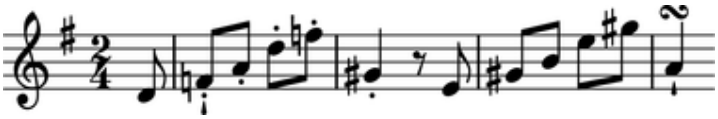
```
>>> show(staff)
```



5.2.14 Copying articulations

Use `copy.copy()` to copy an articulation:

```
>>> import copy

>>> articulation_copy_1 = copy.copy(articulation)

>>> articulation_copy_1
Articulation('staccatissimo')

>>> articulation_copy_1.attach(staff[1])

>>> show(staff)
```



Or use `copy.deepcopy()` to do the same thing.

5.2.15 Comparing articulations

Articulations compare equal with equal direction names and direction strings:

```
>>> articulation.name
'staccatissimo'
>>> articulation.direction_string
None

>>> articulation_copy_1.name
'staccatissimo'
>>> articulation_copy_1.direction_string
None

>>> articulation == articulation_copy_1
True
```

Otherwise articulations do not compare equal.

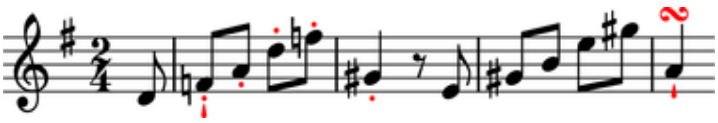
5.2.16 Overriding attributes of the LilyPond script grob

Override attributes of the LilyPond script grob like this:

```
>>> staff.override.script.color = 'red'

>>> f(staff)
\new Staff \with {
        \override Script #'color = #red
} {
        \key g \major
        \partial 8
        \time 2/4
        d'8
        f'8 -\staccatissimo -\staccato
        a'8 -\staccato
```

```
        d''8 -\staccato
        f''8 -\staccato
        gs'4 -\staccato
        r8
        e'8
        gs'8
        b'8
        e''8
        gs''8
        a'4 -\staccatissimo -\turn
}
```

```
>>> show(staff)
```



See the LilyPond documentation for a list of script grob attributes available.

5.3 Chords

5.3.1 Making chords from a LilyPond input string

You can make chords from a LilyPond input string:

```
>>> chord = Chord("<c' d' bf'>4")
```

```
>>> show(chord, docs=True)
```

5.3.2 Making chords from chromatic pitch numbers and duration

You can also make chords from chromatic pitch numbers and duration:

```
>>> chord = Chord([0, 2, 10], Duration(1, 4))
```

```
>>> show(chord, docs=True)
```

5.3.3 Getting all the written pitches of a chord at once

You can get all the written pitches of a chord at one time:

```
>>> chord.written_pitches
(NamedChromaticPitch("c'"), NamedChromaticPitch("d'"), NamedChromaticPitch("bf'"))
```

Abjad returns a read-only tuple of named chromatic pitches.

5.3.4 Getting the written pitches of a chord one at a time

You can get the written pitches of a chord one at a time:

```
>>> chord.written_pitches[0]
NamedChromaticPitch("c'")
```

Chords index the pitch they contain starting from `0` (just like tuples and lists).

5.3.5 Adding one pitch to a chord at a time

Use `append()` to add one note to a chord.

You can add a pitch to a chord with a chromatic pitch number:

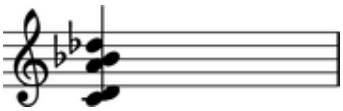
```
>>> chord.append(9)
```

```
>>> show(chord, docs=True)
```

Or you can add a pitch to a chord with a chromatic pitch name:

```
>>> chord.append("df''")
```

```
>>> show(chord, docs=True)
```



Chords sort their pitches every time you add a new one.

This means you can add pitches to your chord in any order.

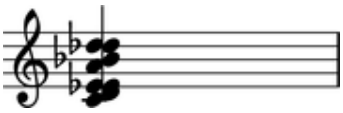
5.3.6 Adding many pitches to a chord at once

Use `extend()` to add many pitches to a chord.

You can use chromatic pitch numbers:

```
>>> chord.extend([3, 4, 14])
```

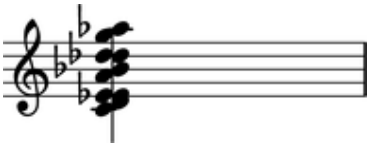
```
>>> show(chord, docs=True)
```



Or you can chromatic pitch names:

```
>>> chord.extend(["g''", "af''"])
```

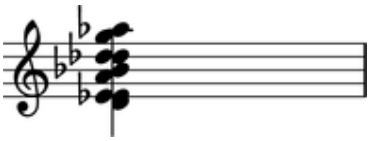
```
>>> show(chord, docs=True)
```



5.3.7 Deleting pitches from a chord

Delete pitches from a chord with `del()`:

```
>>> del(chord[0])

>>> show(chord, docs=True)
```



```
>>> del(chord[0])

>>> show(chord, docs=True)
```

Negative indices work too:

```
>>> del(chord[-1])

>>> show(chord, docs=True)
```

5.3.8 Formatting chords

Get the LilyPond input format of any Abjad object with `format`:

```
>>> chord.format
<ef' e' a' bf' df'' d'' g''>4
```

Use `f()` as a short-cut to print the LilyPond input format of any Abjad object:

```
>>> f(chord)
<ef' e' a' bf' df'' d'' g''>4
```

5.3.9 Working with note heads

Most of the time you will work with the pitches of a chord. But you can get the note heads of a chord, too:

```
>>> chord.note_heads
(NoteHead("ef'"), NoteHead("e'"), NoteHead("a'"), NoteHead("bf'"), NoteHead("df''"), NoteHead("d''"),
```

This is useful when you want to apply LilyPond overrides to note heads in a chord one at a time:

```
>>> chord[2].tweak.color = 'red'
>>> chord[3].tweak.color = 'blue'
>>> chord[4].tweak.color = 'green'

>>> f(chord)
<
        ef'
        e'
        \tweak #'color #red
        a'
        \tweak #'color #blue
        bf'
        \tweak #'color #green
        df''
        d''
        g''
>4

>>> show(chord, docs=True)
```

5.3.10 Working with empty chords

Abjad allows empty chords:

```
>>> chord = Chord([], Duration(1, 4))
Chord('<>4')
```

Abjad formats empty chords, too:

```
>>> f(chord)
<>4
```

But if you pass empty chords to `show()` LilyPond will complain because empty chords don't constitute valid LilyPond input.

When you are done working with an empty chord you can add pitches back into it chord in any of the ways described above:

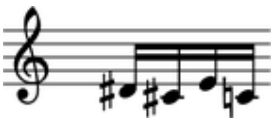
```
>>> chord.extend(["gf'", "df''", "g''"])

>>> show(chord, docs=True)
```

5.4 Containers

5.4.1 Creating containers

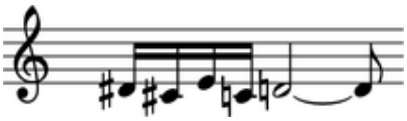
Create a container with components:

```
>>> container = Container([Note("ds'16"), Note("cs'16"), Note("e'16"), Note("c'16")])

>>> show(container)
```



Or with a note-entry string:

```
>>> container = Container("ds'16 cs'16 e'16 c'16 d'2 ~ d'8")

>>> show(container)
```



5.4.2 Inspecting music

Return the components in a container with `music`:

```
>>> container.music
(Note("ds'16"), Note("cs'16"), Note("e'16"), Note("c'16"), Note("d'2"), Note("d'8"))
```

Or with a special call to `__getslice__`:

```
>>> container[:]
[Note("ds'16"), Note("cs'16"), Note("e'16"), Note("c'16"), Note("d'2"), Note("d'8")]
```

5.4.3 Inspecting length

Get the length of a container with `len()`:

```
>>> len(container)
6
```

5.4.4 Inspecting duration

Contents duration equals the sum of the duration of everything inside the container:

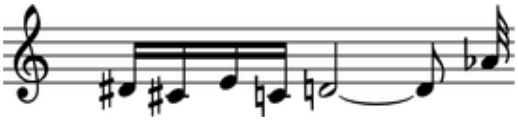
```
>>> container.contents_duration
Duration(7, 8)
```

5.4.5 Adding one component to the end of a container

Add one component to the end of a container with `append`:

```
>>> container.append(Note("af'32"))
```

```
>>> show(container)
```

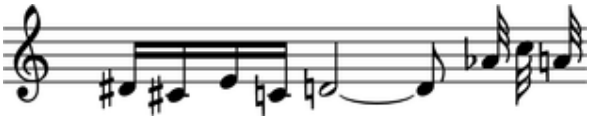


5.4.6 Adding many components to the end of a container

Add many components to the end of a container with `extend`:

```
>>> container.extend([Note("c''32"), Note("a'32")])
```

```
>>> show(container)
```



5.4.7 Finding the index of a component

Find the index of a component with `index`:

```
>>> note = container[7]
```

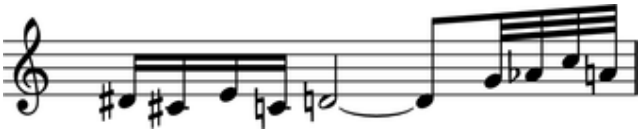
```
>>> container.index(note)
7
```

5.4.8 Inserting a component by index

Insert a component by index with `insert`:

```
>>> container.insert(-3, Note("g'32"))
```

```
>>> show(container)
```

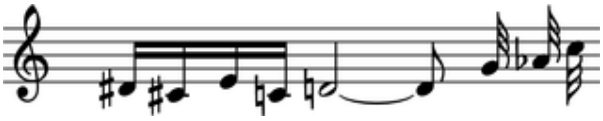


5.4.9 Removing a component by index

Remove a component by index with `pop`:

```
>>> container.pop(-1)
```

```
>>> show(container)
```

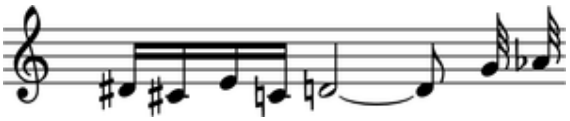


5.4.10 Removing a component by reference

Remove a component by reference with `remove`:

```
>>> container.remove(container[-1])
```

```
>>> show(container)
```



Note: `__getslice__`, `__setslice__` and `__delslice__` remain to be documented.

5.4.11 Naming containers

You can name Abjad containers:

```
>>> flute_staff = Staff("c'8 d'8 e'8 f'8")
>>> flute_staff.name = 'Flute'
>>> violin_staff = Staff("c'8 d'8 e'8 f'8")
>>> violin_staff.name = 'Violin'
>>> staff_group = scoretools.StaffGroup([flute_staff, violin_staff])
>>> score = Score([staff_group])
```

Container names appear in LilyPond input:

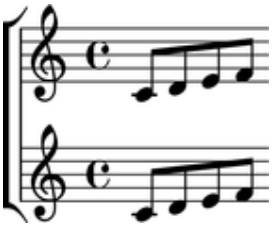
```
>>> f(score)
\new Score <<
        \new StaffGroup <<
                \context Staff = "Flute" {
                        c'8
                        d'8
                        e'8
                        f'8
                }
                \context Staff = "Violin" {
                        c'8
                        d'8
                        e'8
                        f'8
                }
        >>
>>
```

And make it easy to retrieve containers later:

```
>>> componenttools.get_first_component_in_expr_with_name(score, 'Flute')
Staff-"Flute"{4}
```

But container names do not appear in notational output:

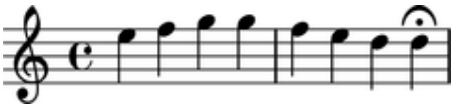
```
>>> show(score)
```



5.4.12 Understanding { } and << >> in LilyPond

LilyPond uses curly { } braces to wrap a stream of musical events that are to be engraved one after the other:

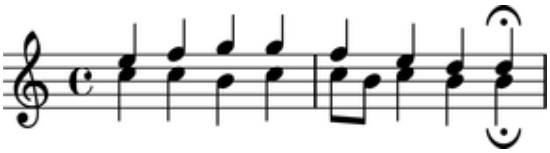
```
\new Voice {
    e''4
    f''4
    g''4
    g''4
    f''4
    e''4
    d''4
    d''4 \fermata
}
```



LilyPond uses skeleton << >> braces to wrap two or more musical expressions that are to be played at the same time:

```
\new Staff <<
    \new Voice {
        \voiceOne
        e''4
        f''4
        g''4
        g''4
        f''4
        e''4
        d''4
        d''4 \fermata
    }
    \new Voice {
        \voiceTwo
        c''4
        c''4
        b'4
        c''4
        c''8
        b'8
        c''4
```

```
        b'4
        b'4 \fermata
    }
>>
```



The examples above are both LilyPond input.

The most common use of LilyPond `{ }` is to group a potentially long stream of notes and rests into a single expression.

The most common use of LilyPond `<< >>` is to group a relatively smaller number of note lists together polyphonically.

5.4.13 Understanding sequential and parallel containers

Abjad implements LilyPond `{ }` and `<< >>` in the container `is_parallel` attribute.

Some containers set `is_parallel` to false at initialization:

```
staff = Staff([])
staff.is_parallel
False
```

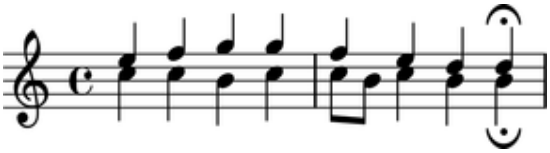
Other containers set `is_parallel` to true:

```
score = Score([])
score.is_parallel
True
```

5.4.14 Changing sequential and parallel containers

Set `is_parallel` by hand as necessary:

```
voice_1 = Voice(r"e''4 f''4 g''4 g''4 f''4 e''4 d''4 d''4  ermata")
voice_2 = Voice(r"c''4 c''4 b'4 c''4 c''8 b'8 c''4 b'4 b'4  ermata")
>>> staff = Staff([voice_1, voice_2])
>>> staff.is_parallel = True
>>> marktools.LilyPondCommandMark('voiceOne')(voice_1)
>>> marktools.LilyPondCommandMark('voiceTwo')(voice_2)
>>> show(staff)
```



The staff in the example above is set to parallel after initialization to create a type of polyphonic staff:

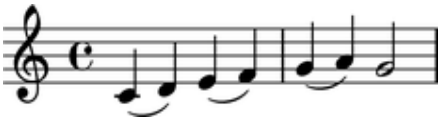
```
>>> f(staff)
\new Staff <<
        \new Voice {
                \voiceOne
                e''4
                f''4
```

```
                g''4
                g''4
                f''4
                e''4
                d''4
                d''4 -\fermata
        }
        \new Voice {
                \voiceTwo
                c''4
                c''4
                b'4
                c''4
                c''8
                b'8
                c''4
                b'4
                b'4 -\fermata
        }
>>
```

5.4.15 Overriding containers

The symbols below are black with fixed thickness and predetermined spacing:

```
>>> staff = Staff("c'4 d'4 e'4 f'4 g'4 a'4 g'2")
>>> slur_1 = spannertools.SlurSpanner(staff[:2])
>>> slur_2 = spannertools.SlurSpanner(staff[2:4])
>>> slur_3 = spannertools.SlurSpanner(staff[4:6])

>>> f(staff)
\new Staff {
        c'4 (
        d'4 )
        e'4 (
        f'4 )
        g'4 (
        a'4 )
        g'2
}

>>> show(staff)
```

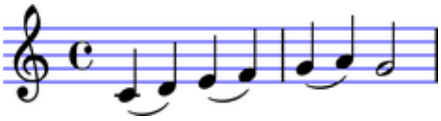


But you can override LilyPond grobs to change the look of Abjad containers:

```
>>> staff.override.staff_symbol.color = 'blue'

>>> f(staff)
\new Staff \with {
        \override StaffSymbol #'color = #blue
} {
        c'4 (
        d'4 )
```

```
        e'4 (
        f'4 )
        g'4 (
        a'4 )
        g'2
}
```

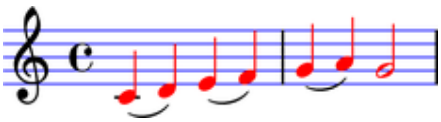
```
>>> show(staff)
```



5.4.16 Overriding containers' contents

You can override LilyPond grobs to change the look of containers' contents, too:

```
>>> staff.override.note_head.color = 'red'
>>> staff.override.stem.color = 'red'

>>> f(staff)
\new Staff \with {
        \override NoteHead #'color = #red
        \override StaffSymbol #'color = #blue
        \override Stem #'color = #red
} {
        c'4 (
        d'4 )
        e'4 (
        f'4 )
        g'4 (
        a'4 )
        g'2
}

>>> show(staff)
```



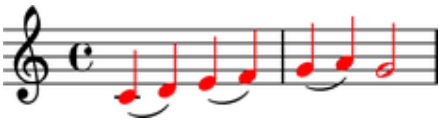
5.4.17 Removing container overrides

Delete grob overrides you no longer want:

```
>>> del(staff.override.staff_symbol)

>>> f(staff)
\new Staff \with {
        \override NoteHead #'color = #red
        \override Stem #'color = #red
} {
        c'4 (
        d'4 )
        e'4 (
```

```
        f'4 )
        g'4 (
        a'4 )
        g'2
}
```

```
>>> show(staff)
```



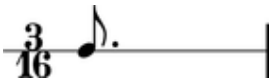
5.5 Durations

5.5.1 Introduction

Abjad publishes information about many durated score objects.

Notes, rests, chords and skips carry some duration attributes:

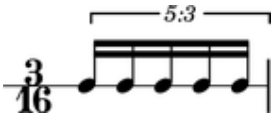
```
>>> note = Note(0, (3, 16))
>>> measure = Measure((3, 16), [note])
>>> staff = stafftools.RhythmicStaff([measure])

>>> show(staff, docs=True)
```



```
>>> note.written_duration
Duration(3, 16)
```

Tuplets, measures, voices, staves and the other containers carry duration attributes, too:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(3, 16), "c'16 c' c' c' c'")
>>> measure = Measure((3, 16), [tuplet])
>>> staff = stafftools.RhythmicStaff([measure])

>>> show(staff, docs=True)
```




```
>>> tuplet.multiplier
Fraction(3, 5)
```

The next chapters document core duration concepts in Abjad.

5.5.2 Assignability

Western notation readily admits rational values like `1/4`. But values like `1/5` notate only with tuplet brackets or special time signatures. Abjad formalizes the difference between rationals like `1/4` and `1/5` in the definition of rational assignability.

Rational values `n/d` are assignable when and only when numerator `n` is of the form `k(2**u-j)` and denominator `d` is of the form `2**v`. In this definition `u` and `v` must be nonnegative integers, `k` must be a positive integer, and `j` must be either `0` or `1`.

Abjad initializes notes, rests and chords with assignable durations only.

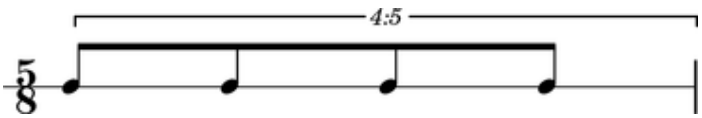
5.5.3 Prolation

Abjad uses prolation as a cover term for rhythmic augmentation and diminution. Augmentation increases the duration of notes, rests and chords. Diminution does the opposite. Western notation employs tuplet brackets and special types of time signature to effect prolation.

Tuplet prolation

Tuplets prolate their contents:

```
>>> tuplet = Tuplet(Fraction(5, 4), 'c8 c c c')
>>> staff = stafftools.RhythmicStaff([Measure((5, 8), [tuplet])])
>>> beam = beamtools.BeamSpanner(tuplet)

>>> show(staff, docs=True)
```




```
>>> note = tuplet[0]
>>> note.written_duration
Duration(1, 8)

>>> note.prolation
Fraction(5, 4)

>>> note.prolated_duration
Duration(5, 32)
```

Notes here with written duration `1/8` carry prolation factor `5/4` and prolated duration `5/32`.

Western notation does not recognize tuplet brackets carrying one-to-one ratios. Such trivial tuplets may, however, be useful during different stages of composition, and Abjad allows them for that reason. Trivial tuplets carry zero prolation. Zero-prolated tuplets neither augment nor diminish the music they contain.

Meter prolation

Time signatures in western notation usually carry a denominator equal to a nonnegative integer power of `2`. Abjad calls these conventional meters binary meters. Denominators equal to integers other than integer powers of `2` are also possible. Such nonbinary meters rhythmically diminish the contents of the measures they govern:

```
>>> measure = Measure((4, 10), 'c8 c c c')
>>> beam = beamtools.BeamSpanner(measure)
>>> staff = stafftools.RhythmicStaff([measure])

>>> show(staff, docs=True)
```

```
>>> note = staff.leaves[0]
>>> note.prolation
Fraction(4, 5)

>>> note.prolated_duration
Duration(1, 10)

>>> note.prolation
Fraction(4, 5)

>>> note.prolated_duration
Duration(1, 10)
```

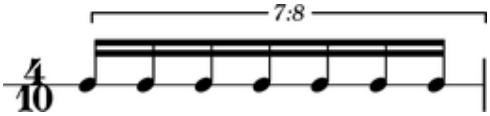
Notes here with written duration `1/8` carry prolation factor `4/5` and prolated duration `1/10`.

Abjad implements one of two competing nonbinary meter-interpretation schemes. The first, implicit meter-interpretation given here, follows, for example, Ferneyhough, in that nonbinary meters prolate the contents of the measures they govern implicitly, ie, without recourse to tuplet brackets. The second, explicit meter-interpretation, which we find in, for example, Sciarrino, insists instead on the presence of some tuplet bracket, usually engraved in some broken or incomplete way. The implicit meter-interpretation that Abjad implements differs from the explicit meter-interpretation native to LilyPond. Abjad will eventually implement both implicit and explicit meter-interpretation, settable on a container-by-container basis.

The prolation chain

Tuplets nest and combine freely with different types of meter. When two or more prolation donors conspire, the prolation factor they collectively bestow on leaf-level music equals the cumulative product of all prolation factors in the prolation chain. All durated components carry a prolation chain:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(4, 8), 'c16 c c c c c c')
>>> beamtools.BeamSpanner(tuplet)
BeamSpanner({c16, c16, c16, c16, c16, c16, c16})
>>> measure = Measure((4, 10), [tuplet])
>>> staff = stafftools.RhythmicStaff([measure])

>>> show(staff, docs=True)
```




```
>>> measure.multiplier
Fraction(4, 5)

>>> note = measure.leaves[0]
>>> note.prolation
Fraction(32, 35)

>>> note.prolated_duration
Duration(2, 35)
```

Notes here with written duration `1/16` carry prolated duration `2/35`.

5.5.4 Duration types

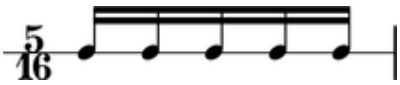
Abjad publishes duration information about all score components.

Written duration

Abjad uses written duration to refer to the face value of notes, rests and chords prior to prolation. Abjad written duration corresponds to the informal names most frequently used when talking about note duration.

These sixteenth notes are worth a sixteenth of a whole note:

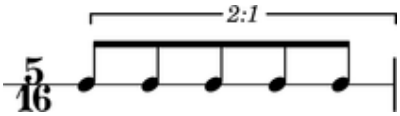
```
>>> measure = Measure((5, 16), "c16 c c c c")
>>> beam = beamtools.BeamSpanner(measure)
>>> staff = stafftools.RhythmicStaff([measure])

>>> show(staff, docs=True)
```



```
>>> note = measure[0]
>>> note.written_duration
Duration(1, 16)
```

These sixteenth notes are worth more than a sixteenth of a whole note:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(5, 16), "c8 c c c c")
>>> beam = beamtools.BeamSpanner(tuplet)
>>> measure = Measure((5, 16), [tuplet])
>>> staff = stafftools.RhythmicStaff([measure])

>>> show(staff, docs=True)
```




```
>>> note = tuplet[0]
>>> note.written_duration
Duration(1, 8)
```

The notes in these examples are 'sixteenth notes' that carry different prolated durations. Abjad written duration captures the fact that the note heads and flag counts of the two examples match.

Written duration is a user-assignable rational number. Users can assign and reassign the written duration of notes, rests and chords at initialization and at any time during the life of the note, rest or chord. Written durations must be assignable; see the chapter on *assignability* for details. Note that Abjad containers do not carry written duration.

Prolated duration

Prolation refers to the duration-scaling effects of tuplets and special types of time signature. Prolation is a way of thinking about the contribution that musical structure makes to the duration of score objects. All durated Abjad objects carry a prolated duration. Prolated duration is an emergent property of notes, tuplets and other durated objects. The prolated duration of notes, rests and chords equals the product of the written duration and prolation of those objects. The prolated duration of tuplets, measures and other containers equals the the container's duration interface multiplied by the container's prolation.

Contents duration

Abjad defines the contents duration of tuplets, measures, voices, staves and other containers equal to the sum of the preprolated duration of each of the elements in the container.

The measure here contains two eighth notes and tuplet. These elements carry preprolated durations equal to `1/8`, `1/8` and `2/8`, respectively:

```
>>> notes = 2 * Note("c'8")
>>> beam = beamtools.BeamSpanner(notes)
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 c c")
>>> beam = beamtools.BeamSpanner(tuplet)
>>> measure = Measure((4, 8), notes + [tuplet])
>>> staff = stafftools.RhythmicStaff([measure])

>>> show(staff, docs=True)
```


```
>>> measure.contents_duration
Duration(1, 2)
```

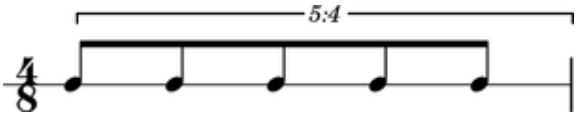
The contents duration of the measure here equals `1/8 + 1/8 + 2/8 = 4/8`.

Target duration

Abjad defines the target duration of fixed-duration tuplets equal to composer-settable duration to which the tuplet prolates its contents.

This fixed-duration tuplet carries a target duration equal to `4/8`:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(4, 8), "c'8 c c c c")
>>> beam = beamtools.BeamSpanner(tuplet)
>>> measure = Measure((4, 8), [tuplet])
>>> staff = stafftools.RhythmicStaff([measure])

>>> show(staff, docs=True)
```




```
>>> tuplet.target_duration
Duration(1, 2)
```

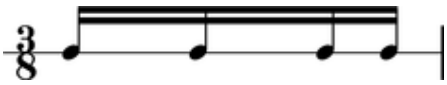
The tuplet contents sum to `5/8`. But tuplet target duration always equals `4/8`.

Multiplied duration

Abjad defines the multiplied duration of notes, rests and chords equal to the product of written duration and leaf multiplier.

The first two notes below carry leaf mulitipliers equal to `2/1`:

```
>>> notes = 4 * Note("c'16")
>>> notes[0].duration_multiplier = Fraction(2, 1)
>>> notes[1].duration_multiplier = Fraction(2, 1)
>>> measure = Measure((3, 8), notes)
>>> beam = beamtools.BeamSpanner(measure)
>>> staff = stafftools.RhythmicStaff([measure])

>>> show(staff, docs=True)
```



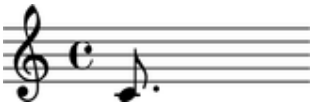
```
>>> note = measure[0]
>>> note.written_duration
Duration(1, 16)

>>> note.duration_multiplier
Fraction(2, 1)

>>> note.written_duration * note.duration_multiplier
Duration(1, 8)
>>> note.multiplied_duration
Duration(1, 8)
```

The written duration of these first two notes equals `1/16` and so the multiplied duration of these first two notes equals `1/16 * 2/1 = 1/8`.

5.5.5 Duration initialization

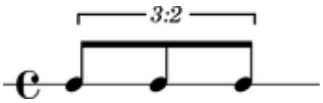
Durated Abjad classes initialize duration from arguments in the form *(n, d)* with numerator *n* and denominator *d*.

```
>>> note = Note("c'8.")

>>> show(note, docs=True)
```



Durated classes include notes, rests, chords, skips, tuplets and measures.

```
>>> tuplet = tuplettools.Tuplet((2, 3), "c'8 c'8 c'8")
>>> beamtools.BeamSpanner(tuplet)
>>> staff = stafftools.RhythmicStaff([tuplet])

>>> show(staff, docs=True)
```



Abjad restricts notes, rests, chords and skips to durations like `3/16` that can be written with dots, beams and flags without ties or brackets. Abjad allows arbitrary positive durations like `5/8` for tuplets and measures.

```
>>> tuplet = tuplettools.Tuplet((5, 4), "c'8 c'8 c'8 c'8")
>>> beamtools.BeamSpanner(tuplet)
>>> staff = stafftools.RhythmicStaff([tuplet])
```

```
>>> show(staff, docs=True)
```

Abjad supports breves.

```
>>> note = Note(0, (2, 1))

>>> show(note, docs=True)
```

And longas.

```
>>> note = Note(0, (4, 1))

>>> show(note, docs=True)
```

Note: The restriction that the written durations of notes, rests, chords and skips be expressible with some combination of dots, flags and beams without recourse to ties and brackets generalizes to the condition of note_head assignability. Values *(n, d)* are note_head-assignable when and only when (1) d is a nonnegative integer power of 2; (2) n is either a nonnegative integer power of 2 or is a nonnegative integer power of 2, minus 1; and (3) n/d is less than or equal to 8. Condition (3) captures the fact that LilyPond provides no glyph with greater duration than the maxima (equal to eight whole notes).

Note: Integer forms like `4` as a substitute for `(4, 1)` in `Note(0, (4, 1))` are undocumented but allowed.

Note: Abjad allows maxima note heads as in `Note(0, (8, 1))`. LilyPond implements a `\maxima` command but does not supply a corresponding glyph for the note head.

5.5.6 LilyPond multipliers

LilyPond provides an asterisk * operator to scale the durations of notes, rests and chords by arbitrarily positive rational values. LilyPond multipliers are inivisible and generate no typographic output of their own. However, while independent from the typographic output, LilyPond multipliers do factor in in calculations of duration and time.

Abjad implements LilyPond multpliers as the settable *duration.multiplier* attribute of notes, rests and chords.

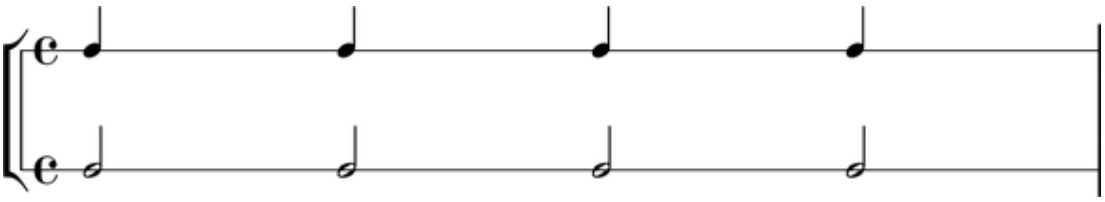
```
>>> note = Note("c'4")
>>> note.duration_multiplier = Fraction(1, 2)
>>> note.duration_multiplier
Fraction(1, 2)

>>> f(note)
c'4 * 1/2
```

Abjad also implements a *duration.multiplied* attribute to examine the duration of a note, rest or chord as affected by the multiplier.

```
>>> note.multiplied_duration
Duration(1, 8)
```

LilyPond multipliers give the half notes here multiplied durations equal to a quarter note.

```
>>> notes = Note("c'4") * 4
>>> multiplied_note = Note(0, (1, 2))
>>> multiplied_note.duration_multiplier = Fraction(1, 2)
>>> multiplied_notes = multiplied_note * 4
>>> top = stafftools.RhythmicStaff(notes)
>>> bottom = stafftools.RhythmicStaff(multiplied_notes)
>>> staves = scoretools.StaffGroup([top, bottom])

>>> show(staves)
```



Note: Abjad models multiplication fundamentally differently than prolation . See the chapter on *Prolation* for more information.

Note: The LilyPond multiplication * operator differs from the Abjad multiplication * operator. LilyPond multiplication scales duration of LilyPond notes, rests and chords. Abjad multiplication copies Abjad containers and leaves.

5.5.7 Duration interfaces compared

type	core	leaf	container	measure	tuplet	fd tuplet	fm tuplet
contents	–	–	R	R	R	R	R
multiplied	–	R	–	–	–	R	R
multiplier	–	RW	–	R	R	R	RW
preprolated	R	R	R	R	R	R	R
prolated	R	R	R	R	R	R	R
prolation	R	R	R	R	R	R	R
target	–	–	–	–	–	RW	–
written	–	RW	–	–	–	–	–

The table contains a total of only four settable duration attributes, divided among only three classes. Durated Abjad classes offer up many read-only duration attributes but very few read-write duration attributes.

All classes carry all three prolation-related attributes because all classes can nest inside containers. It is possible, for example, to nest an entire voice within a fixed-duration tuplet.

Note: Leaf multipliers and tuplet multipliers differ.

5.6 Instrument marks

Instrument marks appear as markup in the left margin of your score.

5.6.1 Creating instrument marks

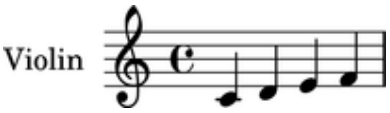
Use `contexttools` to create instrument marks:

```
>>> instrument_mark = contexttools.InstrumentMark('Violin ', 'Vn. ')

>>> instrument_mark
InstrumentMark('Violin ', 'Vn. ')
```

5.6.2 Attaching instrument marks to a component

Use `attach()` to attach any mark to a component:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")

>>> instrument_mark.attach(staff)

>>> show(staff)
```



5.6.3 Getting the instrument mark attached to a component

Use `contexttools` to get the instrument mark attached to a component:

```
>>> contexttools.get_instrument_mark_attached_to_component(staff)
InstrumentMark('Violin ', 'Vn. ')(Staff{4})
```

5.6.4 Getting the instrument in effect for a component

Or to get the instrument currently in effect for a component:

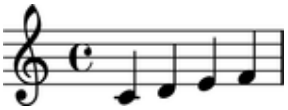
```
>>> contexttools.get_effective_instrument(staff[1])
InstrumentMark('Violin ', 'Vn. ')(Staff{4})
```

5.6.5 Detaching instrument marks from a component one at a time

Use `detach()` to detach instrument marks from a component one at a time:

```
>>> instrument_mark.detach()

>>> instrument_mark
InstrumentMark('Violin ', 'Vn. ')
```

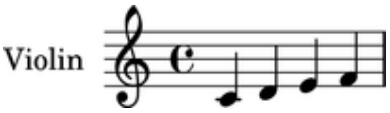
```
>>> show(staff)
```



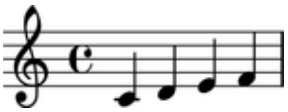
5.6.6 Detaching all instrument marks attached to a component at once

Or use `contexttools` to detach instrument marks all at once:

```
>>> instrument_mark = contexttools.InstrumentMark('Violin ', 'Vn. ')
>>> instrument_mark.attach(staff)

>>> instrument_mark
InstrumentMark('Violin ', 'Vn. ')(Staff{4})

>>> show(staff)
```



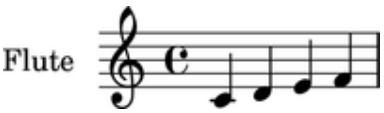

```
>>> contexttools.detach_instrument_marks_attached_to_component(staff)

>>> instrument_mark
InstrumentMark('Violin ', 'Vn. ')

>>> show(staff)
```



5.6.7 Inspecting the component to which an instrument mark is attached

Use `start_component` to inspect the component to which an instrument mark is attached:

```
>>> instrument_mark = contexttools.InstrumentMark('Flute ', 'Fl. ')
>>> instrument_mark.attach(staff)

>>> show(staff)
```




```
>>> instrument_mark.start_component
Staff{4}
```

5.6.8 Inspecting the instrument name of an instrument mark

Use `instrument_name_markup` to get the instrument name of any instrument mark:

```
>>> instrument_mark.instrument_name_markup
Markup('Flute ')
```

5.6.9 Inspecting the short instrument name of an instrument mark

And use `short_instrument_name_markup` to get the short instrument name of any instrument mark:

```
>>> instrument_mark.short_instrument_name_markup
Markup('Fl. ')
```

5.7 I/O

5.7.1 Reopening Abjad PDFs

After you build a piece of notation and open with `show()` you will usually close the resulting PDF and continue working, changing your output notation in an iterative and incremental way.

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")
>>> show(staff)
```

But what if you need to go back and open the resulting PDF again? Abjad provides `pdf()` for precisely this purpose. Type the following at the Abjad prompt to open the most recent PDF written by Abjad.

```
>>> pdf()
```

If you want to open not the next-to-most recent PDF generated by Abjad, pass in a `-1`. And for the next-to-next-to-most recent, pass in a `-2`, and so on.

5.7.2 Looking at LilyPond output

Abjad generates a LilyPond `.ly` file for every Abjad expression that you build and `show()`. To look at these LilyPond `.ly` files that Abjad builds behind the scenes, use `ly()`.

```
>>> ly()

% Abjad revision 2362
% 2009-06-25 10:30

\version "2.12.2"
\include "english.ly"
\include "/Users/trevorbaca/Documents/abjad/trunk/abjad/scm/abjad.scm"

\new Staff {
   c'8
   d'8
   e'8
   f'8
   g'8
   a'8
   b'8
   c''8
}
```

Abjad opens the LilyPond `.ly` file in your favorite text editor.

These LilyPond `.ly` files that Abjad generates all have the same basic structure. The current version of Abjad and the date appear first, followed by the mandatory LilyPond version string and LilyPond directives for English note names and the default Abjad `.scm` file. The remainder of the file is reserved for the LilyPond input code corresponding to the expression you just built in Abjad.

When you are done looking at the LilyPond `.ly` file quit your text editor to return to the Abjad interpreter.

5.7.3 Looking at the LilyPond log

If things go wrong when you call `show()` or one of the other Abjad functions that call LilyPond behind the scenes, if may be helpful to examine the output that LilyPond writes to the LilyPond log.

```
>>> log()

GNU LilyPond 2.12.2
Processing `1420.ly'
Parsing...
Interpreting music...
Preprocessing graphical objects...
Finding the ideal number of pages...
Fitting music on 1 page...
Drawing systems...
Layout output to `1420.ps'...
Converting to `./1420.pdf'...
```

This is the normal output that LilyPond generates every time you call the program behind. When you are done looking at the LilyPond log, quit your text editor to return to the Abjad interpreter.

5.8 LilyPond command marks

LilyPond command marks allow you to attach arbitrary LilyPond commands to Abjad score components.

5.8.1 Creating LilyPond command marks

Use `marktools` to create LilyPond command marks:

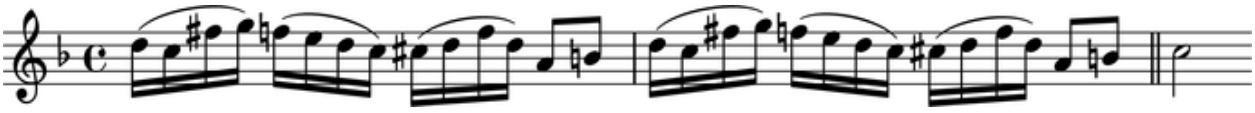
```
>>> lilypond_command_mark = marktools.LilyPondCommandMark('bar "||"', 'after')

>>> lilypond_command_mark
LilyPondCommandMark('bar "||"')
```

5.8.2 Attaching LilyPond command marks to Abjad components

Use `attach()` to attach a LilyPond command mark to any Abjad component:

```
>>> import copy
>>> staff = Staff([])
>>> key_signature = contexttools.KeySignatureMark('f', 'major')
>>> key_signature.attach(staff)
>>> staff.extend(iotools.parse_lilypond_input_string("d''16 ( c''16 fs''16 g''16 )"))
>>> staff.extend(iotools.parse_lilypond_input_string("f''16 ( e''16 d''16 c''16 )"))
```

```
>>> staff.extend(iotools.parse_lilypond_input_string("cs''16 ( d''16 f''16 d''16 )"))
>>> staff.extend(iotools.parse_lilypond_input_string("a'8 b'8"))
>>> staff.extend(iotools.parse_lilypond_input_string("d''16 ( c''16 fs''16 g''16 )"))
>>> staff.extend(iotools.parse_lilypond_input_string("f''16 ( e''16 d''16 c''16 )"))
>>> staff.extend(iotools.parse_lilypond_input_string("cs''16 ( d''16 f''16 d''16 )"))
>>> staff.extend(iotools.parse_lilypond_input_string("a'8 b'8 c''2"))

>>> lilypond_command_mark.attach(staff[-2])

>>> show(staff)
```



5.8.3 Getting the LilyPond command marks attached to an Abjad component

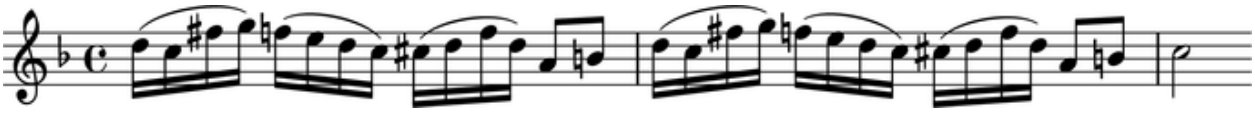
Use `marktools` to get the lilypond_command_marks attached to a leaf:

```
>>> marktools.get_lilypond_command_marks_attached_to_component(staff[-2])
(LilyPondCommandMark('bar "||"')(b'8),)
```

5.8.4 Detaching LilyPond command marks from components one at a time

Use `detach()` to detach LilyPond command marks one at a time:

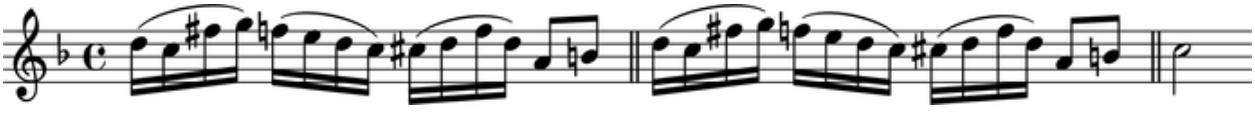
```
>>> lilypond_command_mark.detach()

>>> lilypond_command_mark
LilyPondCommandMark('bar "||"')

>>> show(staff)
```



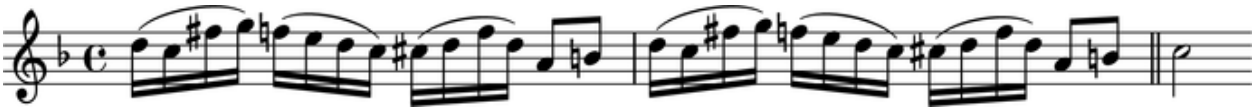
5.8.5 Detaching all LilyPond command marks attached to a component at once

Use `marktools` to detach all LilyPond command marks attached to a component at once:

```
>>> lilypond_command_mark_1 = marktools.LilyPondCommandMark('bar "||"', 'closing')
>>> lilypond_command_mark_1.attach(staff[-2])

>>> lilypond_command_mark_2 = marktools.LilyPondCommandMark('bar "||"', 'closing')
>>> lilypond_command_mark_2.attach(staff[-16])

>>> show(staff)
```



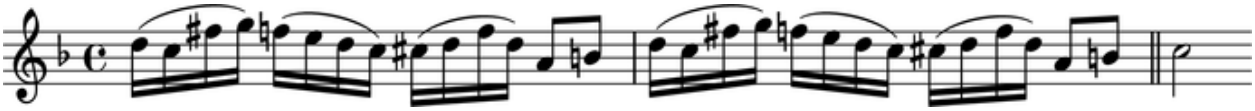
```
>>> marktools.detach_lilypond_command_marks_attached_to_component(staff[-16])

>>> show(staff)
```



5.8.6 Inspecting the component to which a LilyPond command mark is attached

Use `start_component` to inspect the component to which a LilyPond command mark is attached:

```
>>> lilypond_command_mark = marktools.LilyPondCommandMark('bar "||"', 'closing')
>>> lilypond_command_mark.attach(staff[-2])

>>> show(staff)
```

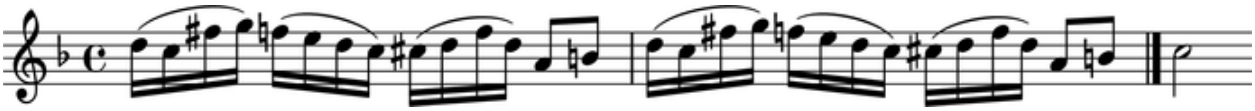


```
>>> lilypond_command_mark.start_component
Note("b'8")
```

5.8.7 Getting and setting the command name of a LilyPond command mark

Set the `command_name` of a LilyPond command mark to change the LilyPond command a LilyPond command mark prints:

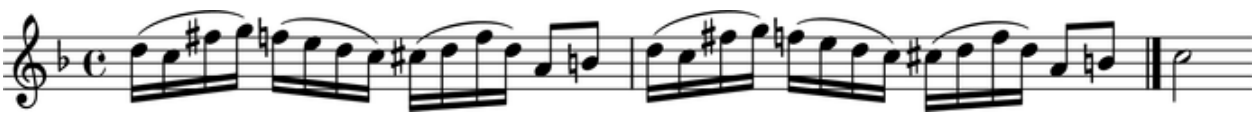
```
>>> lilypond_command_mark.command_name = 'bar "|."'

>>> show(staff)
```



5.8.8 Copying LilyPond commands

Use `copy.copy()` to copy a LilyPond command mark:

```
>>> import copy

>>> lilypond_command_mark_copy_1 = copy.copy(lilypond_command_mark)

>>> lilypond_command_mark_copy_1
LilyPondCommandMark('bar "|."')

>>> lilypond_command_mark_copy_1.attach(staff[-1])

>>> show(staff)
```



Or use `copy.deepcopy()` to do the same thing.

5.8.9 Comparing LilyPond command marks

LilyPond command marks compare equal with equal command names:

```
>>> lilypond_command_mark.command_name
'bar "|."'

>>> lilypond_command_mark_copy_1.command_name
'bar "|."'

>>> lilypond_command_mark == lilypond_command_mark_copy_1
True
```

Otherwise LilyPond command marks do not compare equal.

5.9 LilyPond comments

LilyPond comments begin with the `%` sign. Abjad models LilyPond comments as marks.

5.9.1 Creating LilyPond comments

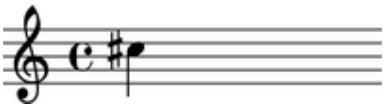
Use `marktools` to create LilyPond comments:

```
>>> comment_1 = marktools.LilyPondComment('This is a LilyPond comment before a note.', 'before')

>>> comment_1
LilyPondComment('This is a LilyPond comment before a note.')
```

5.9.2 Attaching LilyPond comments to leaves

Attach LilyPond comments to a note, rest or chord with `attach()`:

```
>>> note = Note("cs''4")

>>> show(note, docs=True)
```



```
>>> comment_1.attach(note)

>>> f(note)
% This is a LilyPond comment before a note.
cs''4
```

You can add LilyPond comments before, after or to the right of any leaf.

5.9.3 Attaching LilyPond comments to containers

Use `attach()` to attach LilyPond comments to a container:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> show(staff, docs=True)
```

```
>>> staff_comment_1 = marktools.LilyPondComment('Here is a LilyPond comment before the staff.', 'befo
>>> staff_comment_2 = marktools.LilyPondComment('Here is a LilyPond comment in the staff opening.', '
>>> staff_comment_3 = marktools.LilyPondComment('Here is another LilyPond comment in the staff openi
>>> staff_comment_4 = marktools.LilyPondComment('LilyPond comment in the staff closing.', 'closing')
>>> staff_comment_5 = marktools.LilyPondComment('LilyPond comment after the staff.', 'after')

>>> staff_comment_1.attach(staff)
>>> staff_comment_2.attach(staff)
>>> staff_comment_3.attach(staff)
>>> staff_comment_4.attach(staff)
>>> staff_comment_5.attach(staff)

>>> f(staff)
% Here is a LilyPond comment before the staff.
\new Staff {
        % Here is a LilyPond comment in the staff opening.
        % Here is another LilyPond comment in the staff opening.
        c'8
        d'8
        e'8
        f'8
        % LilyPond comment in the staff closing.
}
% LilyPond comment after the staff.
```

You can add LilyPond comments before, after, in the opening or in the closing of any container.

5.9.4 Getting the LilyPond comments attached to a component

Use `marktools` to get all the LilyPond comments attached to a component:

```
>>> marktools.get_lilypond_comments_attached_to_component(note)
(LilyPondComment('This is a LilyPond comment before a note.')(cs''4),)
```

Abjad returns a tuple of zero or more LilyPond comments.

5.9.5 Detaching LilyPond comments from a component one at a time

Use `detach()` to detach LilyPond comments from a component one at a time:

```
>>> comment_1 = marktools.get_lilypond_comments_attached_to_component(note)[0]

>>> comment_1.detach()
LilyPondComment('This is a LilyPond comment before a note.')
```

```
>>> f(note)
cs''4
```

5.9.6 Detaching all LilyPond comments attached to a component at once

Or use `marktools` to detach all LilyPond comments attached to a component at once:

```
>>> for comment in marktools.get_lilypond_comments_attached_to_component(staff): print comment
LilyPondComment('Here is a LilyPond comment before the staff.')(Staff{4})
LilyPondComment('Here is a LilyPond comment in the staff opening.')(Staff{4})
LilyPondComment('Here is another LilyPond comment in the staff opening.')(Staff{4})
LilyPondComment('LilyPond comment in the staff closing.')(Staff{4})
LilyPondComment('LilyPond comment after the staff.')(Staff{4})

>>> marktools.detach_lilypond_comments_attached_to_component(staff)

>>> f(staff)
\new Staff {
        c'8
        d'8
        e'8
        f'8
}
```

5.9.7 Inspecting the component to which a LilyPond comment is attached

Use `start_component` to inspect the component to which a LilyPond comment is attached:

```
>>> comment_1.attach(note)

>>> comment_1.start_component
Note("cs''4")
```

5.9.8 Inspecting contents string of a LilyPond comment

Use `contents_string` to inspect the written contents of a LiliyPond comment:

```
>>> comment_1.contents_string
'This is a LilyPond comment before a note.'
```

5.10 LilyPond files

5.10.1 Making LilyPond files

Make a basic LilyPond input file with the `lilyfiletools` package:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> lilypond_file = lilyfiletools.make_basic_lilypond_file(staff)

>>> lilypond_file
LilyPondFile(Staff{4})
```

5.10.2 Inspecting file output

LilyPond input files that you create this way come equipped with many attributes that appear in file output:

```
>>> f(lilypond_file)
% Abjad revision 4746
% 2011-09-04 17:36

\version "2.15.9"
\include "english.ly"
\include "/Users/trevorbaca/Documents/abjad/trunk/abjad/cfg/abjad.scm"

\score {
        \new Staff {
                c'8
                d'8
                e'8
                f'8
        }
}
```

5.10.3 Setting default paper size

Set default LilyPond paper size like this:

```
>>> lilypond_file.default_paper_size = '11x17', 'landscape'

>>> f(lilypond_file)
% Abjad revision 4746
% 2011-09-04 17:36

\version "2.15.9"
\include "english.ly"
\include "/Users/trevorbaca/Documents/abjad/trunk/abjad/cfg/abjad.scm"

#(set-default-paper-size "11x17" 'landscape)

\score {
        \new Staff {
                c'8
                d'8
                e'8
                f'8
        }
}
```

5.10.4 Setting global staff size

Set global staff size like this:

```
>>> lilypond_file.global_staff_size = 16

>>> f(lilypond_file)
% Abjad revision 4746
% 2011-09-04 17:36
```

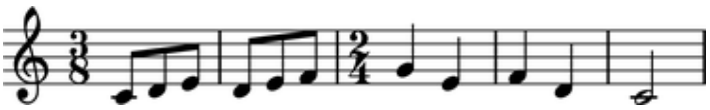
```
\version "2.15.9"
\include "english.ly"
\include "/Users/trevorbaca/Documents/abjad/trunk/abjad/cfg/abjad.scm"

#(set-default-paper-size "11x17" 'landscape)
#(set-global-staff-size 16)

\score {
        \new Staff {
                c'8
                d'8
                e'8
                f'8
        }
}
```

5.11 Measures

5.11.1 Understanding measures in LilyPond

In LilyPond you specify time signatures by hand and LilyPond creates measures automatically:

```
\new Staff {
    \time 3/8
    c'8
    d'8
    e'8
    d'8
    e'8
    f'8
    \time 2/4
    g'4
    e'4
    f'4
    d'4
    c'2
}
```



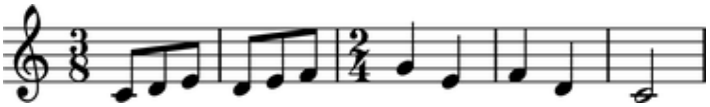
Here LilyPond creates five measures from two time signatures. This happens because behind-the-scenes LilyPond time-keeping tells the program when measures start and stop and how to draw the barlines that come between them.

5.11.2 Understanding measures in Abjad

Measures are optional in Abjad, too, and you may omit them in favor of time signatures:

```
>>> staff = Staff("c'8 d'8 e'8 d'8 e'8 f'8 g'4 e'4 f'4 d'4 c'2")

>>> contexttools.TimeSignatureMark((3, 8))(staff)
>>> contexttools.TimeSignatureMark((2, 4))(staff[6])
```

```
>>> show(staff)
```

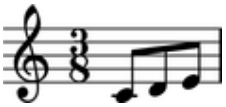


But you may also include explicit measures in the Abjad scores you build. The following sections explain how.

5.11.3 Creating measures

Create a measure with a meter and music:

```
>>> measure = Measure((3, 8), "c'8 d'8 e'8")

>>> f(measure)
{
        \time 3/8
        c'8
        d'8
        e'8
}

>>> show(measure)
```

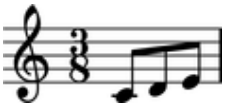


5.11.4 Working with dynamic measures

Dynamic measures adjust their time signatures on the fly as you add and remove music.

Create dynamic measures without a time signature:

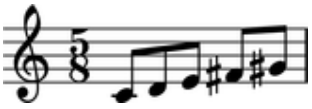
```
>>> measure = measuretools.DynamicMeasure("c'8 d'8 e'8")

>>> show(measure)
```



5.11.5 Adding music to dynamic measures

Add music to dynamic measures the same as to all containers:

```
>>> measure.extend([Note("fs'8"), Note("gs'8")])

>>> show(measure)
```

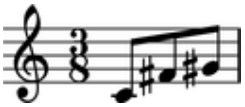


5.11.6 Removing music from dynamic measures

Remove music from dynamic measures the same as with other containers:

```
>>> del(measure[1:3])
```

```
>>> show(measure)
```

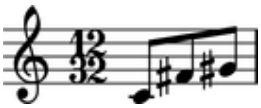


5.11.7 Setting the denominator of dynamic measures

You can set the denominator of dynamic measures to any integer power of 2:

```
>>> measure.denominator = 32
```

```
>>> show(measure)
```



5.11.8 Suppressing the meter of dynamic measures

You can temporarily suppress the meter of dynamic measures:

```
>>> measure.suppress_meter = True
```

```
>>> f(measure)
{
        c'8
        fs'8
        gs'8
}
```

LilyPond will engrave the last active meter.

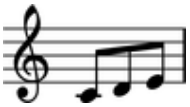
5.11.9 Working with anonymous measures

Anonymous determine their time signatures on the fly and then hide them at format time.

Create anonymous measures without a time signature:

```
>>> measure = measuretools.AnonymousMeasure("c'8 d'8 e'8")
```

```
>>> show(measure)
```

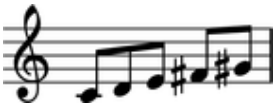


5.11.10 Adding music to anonymous measures

Add music to anonymous measures the same as to other containers:

```
>>> measure.extend([Note("fs'8"), Note("gs'8")])
```

```
>>> show(measure)
```

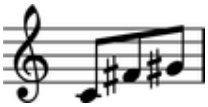


5.11.11 Removing music from anonymous measures

Remove music from anonymous measure the same as from other containers:

```
>>> del(measure[1:3])
```

```
>>> show(measure)
```



5.12 Notes

5.12.1 Making notes from a string

You can make notes from string:

```
>>> note = Note("c'4")
```

```
>>> show(note, docs=True)
```

5.12.2 Making notes from chromatic pitch number and duration

You can also make notes from chromatic pitch number and duration:

```
>>> note = Note(0, Duration(1, 4))
```

```
>>> show(note, docs=True)
```

(You even use `Note("c'4")` to create notes with numbers alone.)

5.12.3 Getting the written pitch of notes

You can get the written pitch of notes:

```
>>> note.written_pitch
NamedChromaticPitch("c'")
```

5.12.4 Changing the written pitch of notes

And you can change the written pitch of notes:

```
>>> note.written_pitch = "cs'"
```

(You can use `note.written_pitch = 1` to change pitch with numbers, too.)

5.12.5 Getting the duration attributes of notes

Get the written duration of notes like this:

```
>>> note.written_duration
Duration(1, 4)
```

Which is usually the same as preprolated duration:

```
>>> note.preprolated_duration
Duration(1, 4)
```

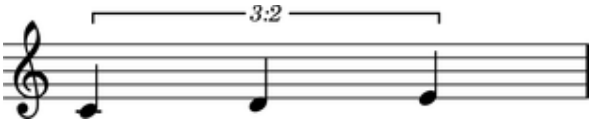
And prolated duration:

```
>>> note.prolated_duration
Duration(1, 4)
```

Except for notes inside a tuplet:

```
>>> tuplet = Tuplet(Fraction(2, 3), [Note("c'4"), Note("d'4"), Note("e'4")])
```

```
>>> show(tuplet, docs=True)
```




```
>>> note = tuplet[0]
```

Tupletted notes carry written duration:

```
>>> note.written_duration
Duration(1, 4)
```

Prolation:

```
>>> note.prolation
Fraction(2, 3)
```

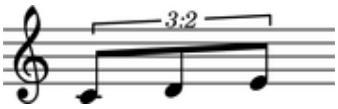
And prolated duration that is the product of the two:

```
>>> note.prolated_duration
Duration(1, 6)
```

5.12.6 Changing the written duration of notes

You can change the written duration of notes:

```
>>> tuplet[0].written_duration = Duration(1, 8)
>>> tuplet[1].written_duration = Duration(1, 8)
>>> tuplet[2].written_duration = Duration(1, 8)

>>> show(tuplet, docs=True)
```

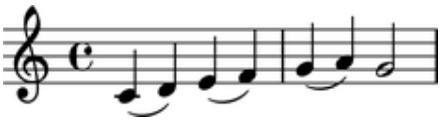


Other duration attributes are read-only.

5.12.7 Overriding notes

The notes below are black with fixed thickness and predetermined spacing:

```
>>> staff = Staff("c'4 d'4 e'4 f'4 g'4 a'4 g'2")
>>> slur_1 = spannertools.SlurSpanner(staff[:2])
>>> slur_2 = spannertools.SlurSpanner(staff[2:4])
>>> slur_3 = spannertools.SlurSpanner(staff[4:6])

>>> f(staff)
\new Staff {
        c'4 (
        d'4 )
        e'4 (
        f'4 )
        g'4 (
        a'4 )
        g'2
}

>>> show(staff)
```

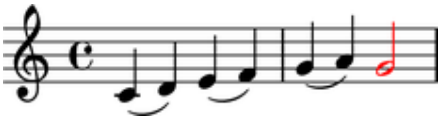


But you can override LilyPond grobs to change the look of notes, rests and chords:

```
>>> staff[-1].override.note_head.color = 'red'
>>> staff[-1].override.stem.color = 'red'

>>> f(staff)
\new Staff {
        c'4 (
        d'4 )
```

```
        e'4 (
        f'4 )
        g'4 (
        a'4 )
        \once \override NoteHead #'color = #red
        \once \override Stem #'color = #red
        g'2
}
```

```
>>> show(staff)
```



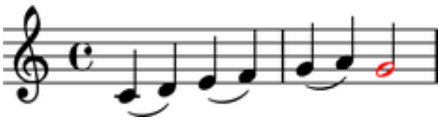
5.12.8 Removing note overrides

Delete grob overrides you no longer want:

```
>>> del(staff[-1].override.stem)
```

```
>>> f(staff)
\new Staff {
        c'4 (
        d'4 )
        e'4 (
        f'4 )
        g'4 (
        a'4 )
        \once \override NoteHead #'color = #red
        g'2
}
```

```
>>> show(staff)
```



5.13 Pitches

Named chromatic pitches are the everyday pitches attached to notes and chords:

```
>>> note = Note("cs''8")
```

```
>>> note.written_pitch
NamedChromaticPitch("cs''")
```

5.13.1 Creating pitches

Use pitch tools to create named chromatic pitches:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")

>>> named_chromatic_pitch
NamedChromaticPitch("cs''")
```

5.13.2 Inspecting the name of a pitch

Use `str()` to get the name of named chromatic pitches:

```
>>> str(named_chromatic_pitch)
cs''
```

5.13.3 Inspecting the octave of a pitch

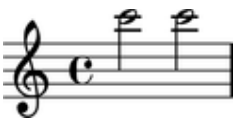
Get the octave number of named chromatic pitches with `octave_number`:

```
>>> named_chromatic_pitch.octave_number
5
```

5.13.4 Working with pitch deviation

Use deviation to model the fact that two pitches differ by a fraction of a semitone:

```
>>> note_1 = Note(24, (1, 2))
>>> note_2 = Note(24, (1, 2))
>>> staff = Staff([note_1, note_2])

>>> show(staff)
LilyPond file written to 'pitch-deviation-1.ly' ...
```



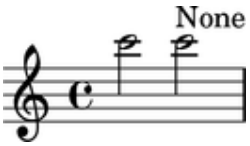
```
>>> note_2.written_pitch = pitchtools.NamedChromaticPitch(24, deviation = -31)
```

The pitch of the the first note is greater than the pitch of the second:

```
>>> note_1.written_pitch > note_2.written_pitch
False
```

Use markup to include indications of pitch deviation in your score:

```
>>> markuptools.Markup(note_2.written_pitch.deviation_in_cents, Up)(note_2)
LilyPond file written to 'pitch-deviation-2.ly' ...
```



5.13.5 Sorting pitches

Named chromatic pitches sort by octave, diatonic pitch-class and accidental, in that order:

```
>>> pitchtools.NamedChromaticPitch('es') < pitchtools.NamedChromaticPitch('ff')
True
```

5.13.6 Comparing pitches

Compare named chromatic pitches to each other:

```
>>> named_chromatic_pitch_1 = pitchtools.NamedChromaticPitch("c''")
>>> named_chromatic_pitch_2 = pitchtools.NamedChromaticPitch("d''")

>>> named_chromatic_pitch_1 == named_chromatic_pitch_2
False

>>> named_chromatic_pitch_1 != named_chromatic_pitch_2
True

>>> named_chromatic_pitch_1 > named_chromatic_pitch_2
False

>>> named_chromatic_pitch_1 < named_chromatic_pitch_2
True

>>> named_chromatic_pitch_1 >= named_chromatic_pitch_2
False

>>> named_chromatic_pitch_1 <= named_chromatic_pitch_2
True
```

5.13.7 Converting one type of pitch to another

Convert any named chromatic pitch to a named diatonic pitch:

```
>>> named_chromatic_pitch.named_diatonic_pitch
NamedDiatonicPitch("c''")
```

To a numbered chromatic pitch:

```
>>> named_chromatic_pitch.numbered_chromatic_pitch
NumberedChromaticPitch(13)
```

Or to a numbered diatonic pitch:

```
>>> named_chromatic_pitch.numbered_diatonic_pitch
NumberedDiatonicPitch(7)
```

5.13.8 Converting pitches to pitch-classes

Convert any named chromatic pitch to a named chromatic pitch-class:

```
>>> named_chromatic_pitch.named_chromatic_pitch_class
NamedChromaticPitchClass('cs')
```

To a named diatonic pitch-class:

```
>>> named_chromatic_pitch.named_diatonic_pitch_class
NamedDiatonicPitchClass('c')
```

To a numbered chromatic pitch-class:

```
>>> named_chromatic_pitch.numbered_chromatic_pitch_class
NumberedChromaticPitchClass(1)
```

Or to a numbered diatonic pitch-class:

```
>>> named_chromatic_pitch.numbered_diatonic_pitch_class
NumberedDiatonicPitchClass(0)
```

5.13.9 Copying pitches

Use `copy.copy()` to copy named chromatic pitches:

```
>>> import copy
```

```
>>> copy.copy(named_chromatic_pitch)
NamedChromaticPitch("cs''")
```

Or use `copy.deepcopy()` to do the same thing.

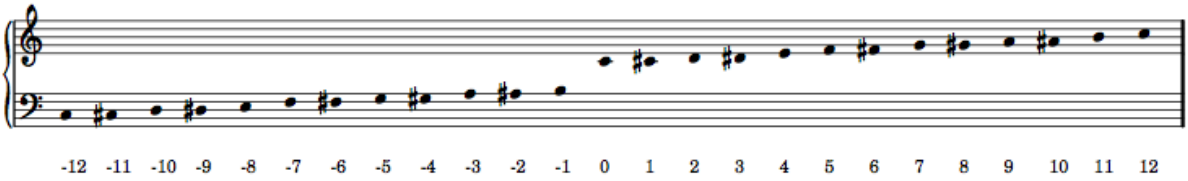
5.13.10 Accidental abbreviations

Abjad abbreviates accidentals according to the LilyPond `english.ly` module:

accidental name	abbreviation
quarter sharp	'qs'
quarter flat	'qf'
sharp	's'
flat	'f'
three-quarters sharp	'tqs'
three-quarters flat	'tqf'
double sharp	'ss'
double flat	'ff'

5.13.11 Chromatic pitch numbers

Abjad numbers chromatic pitches by semitone with middle C set equal to 0:

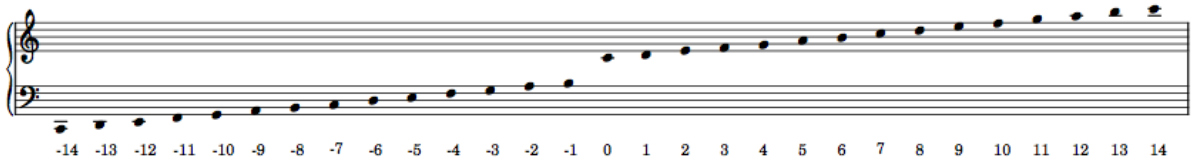


The code to generate this table is as follows:

```
score, treble_staff, bass_staff = scoretools.make_empty_piano_score()
duration = Fraction(1, 32)

treble = measuretools.AnonymousMeasure([])
bass = measuretools.AnonymousMeasure([])

treble_staff.append(treble)
bass_staff.append(bass)

pitches = range(-12, 12 + 1)

pitchtools.set_default_accidental_spelling('sharps')

for i in pitches:
    note = Note(i, duration)
    rest = Rest(duration)
    clef = pitchtools.suggest_clef_for_named_chromatic_pitches([note.pitch])
    if clef == contexttools.ClefMark('treble'):
        treble.append(note)
        bass.append(rest)
    else:
        treble.append(rest)
        bass.append(note)
    diatonic_pitch_number = str(note.pitch.numbered_chromatic_pitch)
    markuptools.Markup(diatonic_pitch_number, Down)(bass[-1])

score.override.rest.transparent = True
score.override.stem.stencil = False
```

5.13.12 Diatonic pitch numbers

Abjad numbers diatonic pitches by staff space with middle C set equal to 0:



The code to generate this table is as follows:

```
score, treble_staff, bass_staff = scoretools.make_empty_piano_score()
duration = Fraction(1, 32)

treble = measuretools.AnonymousMeasure([])
bass = measuretools.AnonymousMeasure([])

treble_staff.append(treble)
bass_staff.append(bass)

pitches = []
diatonic_pitches = [0, 2, 4, 5, 7, 9, 11]

pitches.extend([-24 + x for x in diatonic_pitches])
pitches.extend([-12 + x for x in diatonic_pitches])
pitches.extend([0 + x for x in diatonic_pitches])
```

```
pitches.extend([12 + x for x in diatonic_pitches])
pitches.append(24)
pitchtools.set_default_accidental_spelling('sharps')

for i in pitches:
    note = Note(i, duration)
    rest = Rest(duration)
    clef = pitchtools.suggest_clef_for_named_chromatic_pitches([note.pitch])
    if clef == contexttools.ClefMark('treble'):
        treble.append(note)
        bass.append(rest)
    else:
        treble.append(rest)
        bass.append(note)
    diatonic_pitch_number = abs(note.pitch.numbered_diatonic_pitch)
    markuptools.Markup(diatonic_pitch_number, Down)(bass[-1])

score.override.rest.transparent = True
score.override.stem.stencil = False
```

5.13.13 Octave designation

Abjad designates octaves with both numbers and ticks:

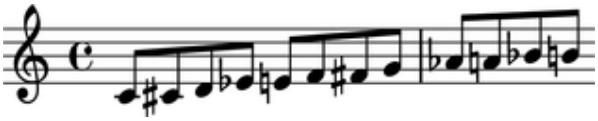
Octave notation	Tick notation
C7	c’‘‘
C6	c’‘
C5	c’‘
C4	c’
C3	c
C2	c,
C1	c,,

5.13.14 Accidental spelling

Abjad chooses between enharmonic spellings at pitch-initialization according to the following table:

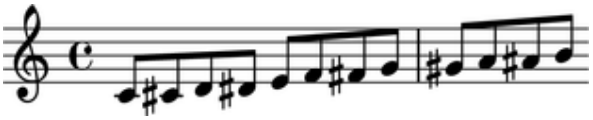
Chromatic pitch-class number	Chromatic pitch-class name (default)
0	C
1	C#
2	D
3	Eb
4	E
5	F
6	F#
7	G
8	Gb
9	A
10	Bb
11	B

```
>>> staff = Staff([Note(n, (1, 8)) for n in range(12)])
>>> show(staff)
LilyPond file written to 'pitch-conventions-1.ly' ...
```



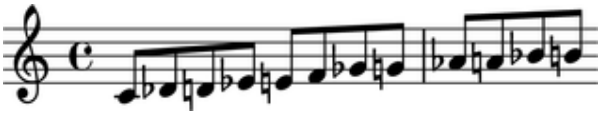
Use pitch tools to respell with sharps:

```
>>> pitchtools.respell_named_chromatic_pitches_in_expr_with_sharps(staff)
>>> show(staff)
LilyPond file written to 'pitch-conventions-2.ly' ...
```



Or flats:

```
>>> pitchtools.respell_named_chromatic_pitches_in_expr_with_flats(staff)
>>> show(staff)
LilyPond file written to 'pitch-conventions-3.ly' ...
```



5.14 Working with lists of numbers

Python provides a built-in `list` class that you can use to carry around almost anything. The examples here show how to create a list of numbers and then do things with the numbers in the list.

Create a list with square brackets.

```
>>> my_list = [23, 7, 10, 18, 13, 20, 3, 2, 18, 9, 14, 3]
>>> my_list
[23, 7, 10, 18, 13, 20, 3, 2, 18, 9, 14, 3]
```

Use `len()` to find the number of elements in any list.

```
>>> len(my_list)
12
```

Use `append()` to add one element to a list.

```
>>> my_list.append(5)
>>> my_list
[23, 7, 10, 18, 13, 20, 3, 2, 18, 9, 14, 3, 5]
```

Use `extend()` to extend one list with the contents of another.

```
>>> my_other_list = [19, 11, 4, 10, 12]
>>> my_list.extend(my_other_list)
>>> my_list
[23, 7, 10, 18, 13, 20, 3, 2, 18, 9, 14, 3, 5, 19, 11, 4, 10, 12]
```

Use `reverse()` to reverse the elements in a list.

```
>>> my_list.reverse()
>>> my_list
[12, 10, 4, 11, 19, 5, 3, 14, 9, 18, 2, 3, 20, 13, 18, 10, 7, 23]
```

You can return a single value from a list with a numeric index.

```
>>> my_list[0]
12
>>> my_list[1]
10
>>> my_list[2]
4
```

You can return many values from a list with slice notation.

```
>>> my_list[:4]
[12, 10, 4, 11]
```

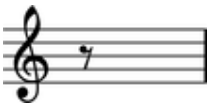
More information on these and all other operations defined on the built-in Python `list` is available in the Python tutorial.

5.15 Rests

5.15.1 Making rests from strings

You can make rests from a string:

```
>>> rest = Rest('r8')

>>> show(rest, docs=True)
```



5.15.2 Making rests from durations

You can also make rests from a duration:

```
>>> rest = Rest(Duration(1, 4))

>>> show(rest, docs=True)
```

(You can even use `Rest((1, 8))` to make rests from a duration pair.)

5.15.3 Getting the duration attributes of rests

Get the written duration of rests like this:

```
>>> rest.written_duration
Duration(1, 4)
```

Which is usually the same as preprolated duration:

```
>>> rest.preprolated_duration
Duration(1, 4)
```

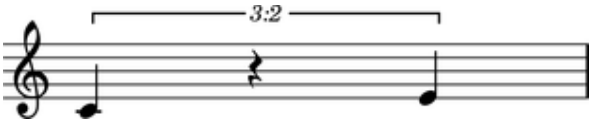
And prolated duration:

```
>>> rest.prolated_duration
Duration(1, 4)
```

Except for rests inside a tuplet:

```
>>> tuplet = Tuplet(Fraction(2, 3), [Note("c'4"), Rest('r4'), Note("e'4")])
```

```
>>> show(tuplet, docs=True)
```




```
>>> rest = tuplet[1]
```

Tupletted rests carry written duration:

```
>>> rest.written_duration
Duration(1, 4)
```

Prolation:

```
>>> rest.prolation
Fraction(2, 3)
```

And prolated duration that is the product of the two:

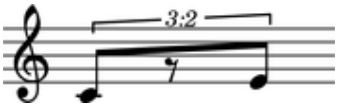
```
>>> rest.prolated_duration
Duration(1, 6)
```

5.15.4 Changing the written duration of rests

You can change the written duration of notes and rests:

```
>>> tuplet[0].written_duration = Duration(1, 8)
>>> tuplet[1].written_duration = Duration(1, 8)
>>> tuplet[2].written_duration = Duration(1, 8)
```

```
>>> show(tuplet, docs=True)
```



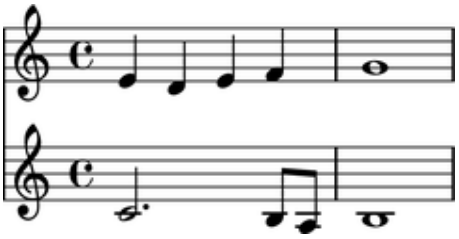
Other duration attributes are read-only.

5.16 Scores

5.16.1 Creating scores

Create a score like this:

```
>>> treble_staff_1 = Staff("e'4 d'4 e'4 f'4 g'1")
>>> treble_staff_2 = Staff("c'2. b8 a8 b1")

>>> score = Score([treble_staff_1, treble_staff_2])

>>> show(score)
```



5.16.2 Inspecting score music

Return score components with `music`:

```
>>> score.music
(Staff{5}, Staff{4})
```

5.16.3 Inspecting score length

Get score length with `len()`:

```
>>> len(score)
2
```

5.16.4 Inspecting score duration

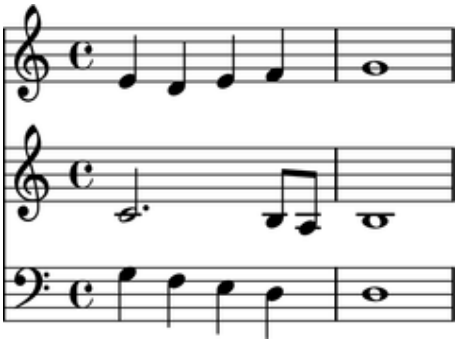
Score contents duration is equal to the duration of the longest component in score:

```
>>> score.contents_duration
Duration(2, 1)
```

5.16.5 Adding one component to the bottom of a score

Add one component to the bottom of a score with `append`:

```
>>> bass_staff = Staff("g4 f4 e4 d4 d1")
>>> contexttools.ClefMark('bass')(bass_staff)

>>> score.append(bass_staff)

>>> show(score)
```



5.16.6 Finding the index of a score component

Find the index of a score component with `index`:

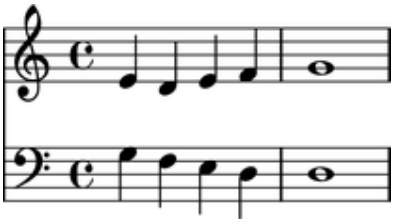
```
>>> score.index(treble_staff_1)
0
```

5.16.7 Removing a score component by index

Use `pop` to remove a score component by index:

```
>>> score.pop(1)
```

```
>>> show(score)
```

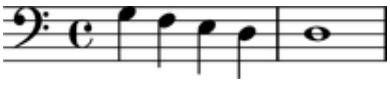


5.16.8 Removing a score component by reference

Remove a score component by reference with `remove`:

```
>>> score.remove(treble_staff_1)
```

```
>>> show(score)
```



5.16.9 Testing score containment

Use `in` to find out whether a score contains a given component:

```
>>> treble_staff_1 in score
False
```

```
>>> treble_staff_2 in score
False

>>> bass_staff in score
True
```

5.16.10 Naming scores

You can name Abjad scores:

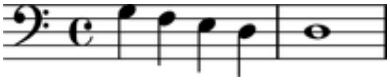
```
>>> score.name = 'Example Score'
```

Score names appear in LilyPond input:

```
>>> f(score)
\context Score = "Example Score" <<
        \new Staff {
                \clef "bass"
                g4
                f4
                e4
                d4
                d1
        }
>>
```

But do not appear in notational output:

```
>>> show(score)
```



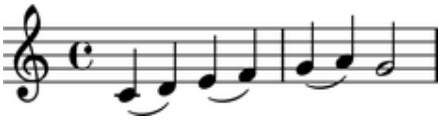
5.17 Spanners

5.17.1 Overriding spanners

The symbols below are black with fixed thickness and predetermined spacing:

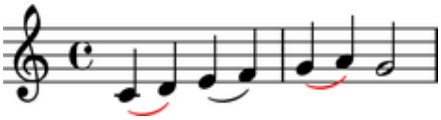
```
>>> staff = Staff("c'4 d'4 e'4 f'4 g'4 a'4 g'2")
>>> slur_1 = spannertools.SlurSpanner(staff[:2])
>>> slur_2 = spannertools.SlurSpanner(staff[2:4])
>>> slur_3 = spannertools.SlurSpanner(staff[4:6])

>>> f(staff)
\new Staff {
        c'4 (
        d'4 )
        e'4 (
        f'4 )
        g'4 (
        a'4 )
        g'2
}
```

```
>>> show(staff)
```



But you can override LilyPond grobs to change the look of spanners:

```
>>> slur_1.override.slur.color = 'red'
>>> slur_3.override.slur.color = 'red'

>>> f(staff)
\new Staff {
        \override Slur #'color = #red
        c'4 (
        d'4 )
        \revert Slur #'color
        e'4 (
        f'4 )
        \override Slur #'color = #red
        g'4 (
        a'4 )
        \revert Slur #'color
        g'2
}

>>> show(staff)
```



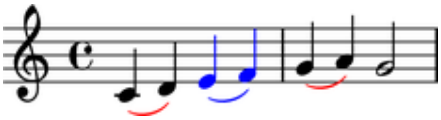
5.17.2 Overriding the components to which spanners attach

You can override LilyPond grobs to change spanners' contents:

```
>>> slur_2.override.slur.color = 'blue'
>>> slur_2.override.note_head.color = 'blue'
>>> slur_2.override.stem.color = 'blue'

>>> f(staff)
\new Staff {
        \override Slur #'color = #red
        c'4 (
        d'4 )
        \revert Slur #'color
        \override NoteHead #'color = #blue
        \override Slur #'color = #blue
        \override Stem #'color = #blue
        e'4 (
        f'4 )
        \revert NoteHead #'color
        \revert Slur #'color
        \revert Stem #'color
        \override Slur #'color = #red
        g'4 (
```

```
        a'4 )
        \revert Slur #'color
        g'2
}
```

```
>>> show(staff)
```



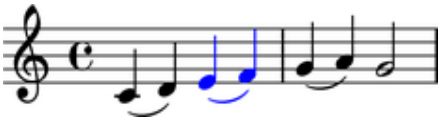
5.17.3 Removing spanner overrides

Delete grob overrides you no longer want:

```
>>> del(slur_1.override.slur)
>>> del(slur_3.override.slur)
```

```
>>> f(staff)
\new Staff {
        c'4 (
        d'4 )
        \override NoteHead #'color = #blue
        \override Slur #'color = #blue
        \override Stem #'color = #blue
        e'4 (
        f'4 )
        \revert NoteHead #'color
        \revert Slur #'color
        \revert Stem #'color
        g'4 (
        a'4 )
        g'2
}
```

```
>>> show(staff)
```



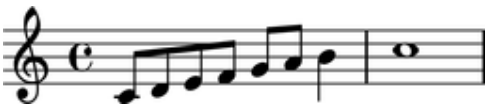
5.18 Staves

5.18.1 Creating staves

Create staves like this:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b'4 c''1")
```

```
>>> show(staff)
```



5.18.2 Inspecting staff music

Return staff components with `music`:

```
>>> staff.music
(Note("c'8"), Note("d'8"), Note("e'8"), Note("f'8"), Note("g'8"), Note("a'8"), Note("b'4"), Note("c''
```

5.18.3 Inspecting staff length

Get staff length with `len()`:

```
>>> len(staff)
8
```

5.18.4 Inspecting staff duration

Staff contents durations equals the sum of staff components' duration:

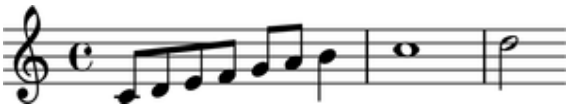
```
>>> staff.contents_duration
Duration(2, 1)
```

5.18.5 Adding one component to the end of a staff

Add one component to the end of a staff with `append`:

```
>>> staff.append(Note("d''2"))
```

```
>>> show(staff)
```

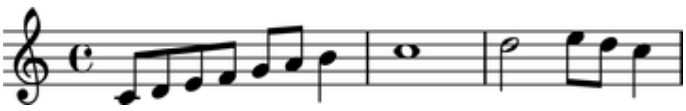


5.18.6 Adding many components to the end of a staff

Add many components to the end of a staff with `extend`:

```
>>> notes = [Note("e''8"), Note("d''8"), Note("c''4")]
>>> staff.extend(notes)
```

```
>>> show(staff)
```



5.18.7 Finding the index of a staff component

Find staff component index with `index`:

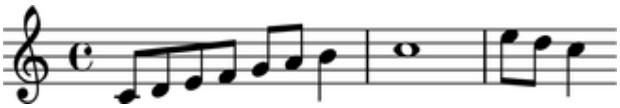
```
>>> notes[0]
Note("e''8")
```

```
>>> staff.index(notes[0])
9
```

5.18.8 Removing a staff component by index

Use `pop` to remove a staff component by index:

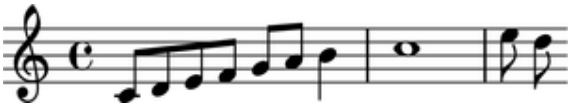
```
>>> staff[8]
Note("d''2")

>>> staff.pop(8)

>>> show(staff)
```



5.18.9 Removing a staff component by reference

Remove staff components by reference with `remove`:

```
>>> staff.remove(staff[-1])

>>> show(staff)
```



5.18.10 Naming staves

You can name Abjad staves:

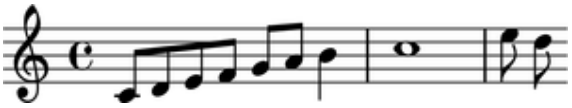
```
>>> staff.name = 'Example Staff'
```

Staff names appear in LilyPond input:

```
>>> f(staff)
\context Staff = "Example Staff" {
        c'8
        d'8
        e'8
        f'8
        g'8
        a'8
        b'4
        c''1
        e''8
        d''8
}
```

But not in notational output:

```
>>> show(staff)
```



5.18.11 Forcing context

Staff context equals `'Staff'` by default:

```
>>> staff.context
'Staff'
```

You can force staff context:

```
>>> staff.context = 'CustomUserStaff'

>>> staff.context
'CustomUserStaff'

>>> f(staff)
\context CustomUserStaff = "Example Staff" {
        c'8
        d'8
        e'8
        f'8
        g'8
        a'8
        b'4
        c''1
        e''8
        d''8
}
```

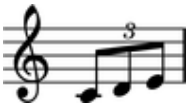
Force context when you have defined a new LilyPond context.

5.19 Tuplets

5.19.1 Making a tuplet from a LilyPond input string

You can make an Abjad tuplet from a multiplier and a LilyPond input string:

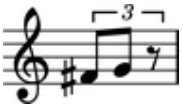
```
>>> tuplet = Tuplet(Fraction(2, 3), "c'8 d'8 e'8")

>>> show(tuplet)
```



5.19.2 Making a tuplet from a list of other Abjad components

You can also make a tuplet from a multiplier and a list of other Abjad components:

```
>>> leaves = [Note("fs'8"), Note("g'8"), Rest('r8')]

>>> tuplet = Tuplet(Fraction(2, 3), leaves)

>>> show(tuplet)
```



5.19.3 Understanding the interpreter display of a tuplet

The interprer display of an Abjad tuplet contains three parts:

```
>>> tuplet
Tuplet(2/3, [fs'8, g'8, r8])
```

`Tuplet` tells you the tuplet's class.

`2/3` tells you the tuplet's multiplier.

The list `[fs'8, g'8, r8]` shows the top-level components the tuplet contains.

5.19.4 Understanding the string representation of a tuplet

The string representation of a tuplet contains four parts:

```
>>> print tuplet
{* 3:2 fs'8, g'8, r8 *}
```

Curly braces `{` and `}` indicate that the tuplet's music is interpreted sequentially instead of in parallel.

The asterisks `*` denote a fixed-multiplier tuplet.

`3:2` tells you the tuplet's ratio.

The remaining arguments show the top-level components of tuplet.

5.19.5 Inspecting the LilyPond format of a tuplet

Get the LilyPond input format of any Abjad object with `format`:

```
>>> tuplet.format
"\\times 2/3 {\n\tfs'8\n\tg'8\n\tr8\n}"
```

Use `f()` as a short-cut to print the LilyPond format of any Abjad object:

```
>>> f(tuplet)
\times 2/3 {
        fs'8
        g'8
        r8
}
```

5.19.6 Inspecting the music in a tuplet

Get the music in any Abjad container with `music`:

```
>>> tuplet.music
(Note("fs'8"), Note("g'8"), Rest('r8'))
```

Abjad returns a read-only tuple of components.

5.19.7 Inspecting a tuplet's leaves

Get the leaves in any Abjad container with `leaves`:

```
>>> tuplet.leaves
(Note("fs'8"), Note("g'8"), Rest('r8'))
```

Abjad returns a read-only tuple of leaves.

5.19.8 Getting the length of a tuplet

Get the length of any Abjad container with `len()`:

```
>>> len(tuplet)
3
```

The length of every Abjad container is defined equal to the number of top-level components present in the container.

5.19.9 Getting the duration attributes of a tuplet

You set the multiplier of a tuplet at initialization:

```
>>> tuplet.multiplier
Fraction(2, 3)
```

The contents durations of a tuplet equals the sum of written durations of the components in the tuplet:

```
>>> tuplet.contents_duration
Duration(3, 8)
```

The multiplied duration of a tuplet equals the product of the tuplet's multiplier and the tuplet's contents duration:

```
>>> tuplet.multiplied_duration
Duration(1, 4)
```

5.19.10 Understanding rhythmic augmentation and diminution

A tuplet with a multiplier less than `1` constitutes a type of rhythmic diminution:

```
>>> tuplet.multiplier
Fraction(2, 3)

>>> tuplet.is_diminution
True
```

A tuplet with a multiplier greater than `1` is a type of rhythmic augmentation:

```
>>> tuplet.is_augmentation
False
```

5.19.11 Understanding binary and nonbinary tuplets

A tuplet is considered binary if the numerator of the tuplet multiplier is an integer power of `2`:

```
>>> tuplet.multiplier
Fraction(2, 3)

>>> tuplet.is_binary
True
```

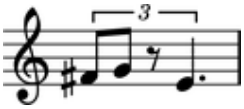
Other tuplets are nonbinary:

```
>>> tuplet.is_nonbinary
False
```

5.19.12 Adding one component to the end of a tuplet

Add one component to the end of a tuplet with `append`:

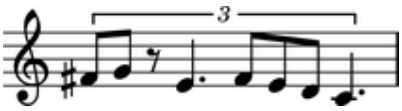
```
>>> tuplet.append(Note("e'4."))

>>> show(tuplet)
```



5.19.13 Adding many components to the end of a tuplet

Add many components to the end of a tuplet with `extend`:

```
>>> notes = [Note("fs'8"), Note("e'8"), Note("d'8"), Note("c'4.")]
>>> tuplet.extend(notes)

>>> show(tuplet)
```



5.19.14 Finding the index of a component in a tuplet

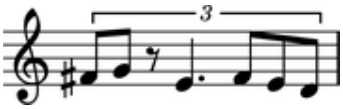
Find the index of a component in a tuplet with `index()`:

```
>>> notes[1]
Note("e'8")

>>> tuplet.index(notes[1])
5
```

5.19.15 Removing a tuplet component by index

Use `pop()` to remove a tuplet component by index:

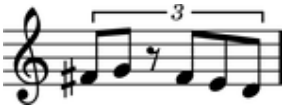
```
>>> tuplet[7]
Note("c'4.")

>>> tuplet.pop(7)

>>> show(tuplet)
```



5.19.16 Removing a tuplet component by reference

Remove tuplet components by reference with `remove()`:

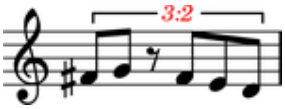
```
>>> tuplet.remove(tuplet[3])

>>> show(tuplet)
```



5.19.17 Overriding attributes of the LilyPond tuplet number grob

Override attributes of the LilyPond tuplet number grob like this:

```
>>> tuplet.override.tuplet_number.text = schemetools.SchemeFunction('tuplet-number::calc-fraction-tex
>>> tuplet.override.tuplet_number.color = 'red'

>>> f(tuplet)
\override TupletNumber #'color = #red
\override TupletNumber #'text = #tuplet-number::calc-fraction-text
\times 2/3 {
        fs'8
        g'8
        r8
        fs'8 [
        e'8
        d'8 ]
}
\revert TupletNumber #'color
\revert TupletNumber #'text

>>> show(tuplet)
```

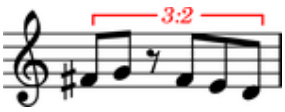


See the LilyPond docs for lists of grob attributes available.

5.19.18 Overriding attributes of the LilyPond tuplet bracket grob

Override attributes of the LilyPond tuplet bracket grob like this:

```
>>> tuplet.override.tuplet_bracket.color = 'red'

>>> f(tuplet)
\override TupletBracket #'color = #red
\override TupletNumber #'color = #red
\override TupletNumber #'text = #tuplet-number::calc-fraction-text
\times 2/3 {
        fs'8
        g'8
        r8
        fs'8 [
        e'8
        d'8 ]
}
\revert TupletBracket #'color
\revert TupletNumber #'color
\revert TupletNumber #'text

>>> show(tuplet)
```



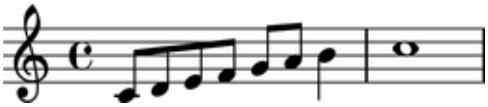
See the LilyPond docs for lists of grob attributes available.

5.20 Voices

5.20.1 Making a voice from a LilyPond input string

You can make an Abjad voice from a LilyPond input string:

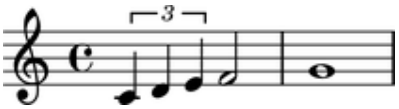
```
>>> voice = Voice("c'8 d'8 e'8 f'8 g'8 a'8 b'4 c''1")

>>> show(voice)
```



5.20.2 Making a voice from a list of other Abjad components

You can also make a voice from a list of other Abjad components:

```
>>> components = [Tuplet(Fraction(2, 3), "c'4 d'4 e'4"), Note("f'2"), Note("g'1")]

>>> voice = Voice(components)

>>> show(voice)
```



5.20.3 Understanding the `repr` of a voice

The `repr` of an Abjad voice contains three parts:

```
>>> voice
Voice{3}
```

`Voice` tells you the voice's class.

`3` tells you the voice's length (which is the number of top-level components the voice contains).

Curly braces `{` and `}` tell you that the music inside the voice is interpreted sequentially rather than in parallel.

5.20.4 Inspecting the LilyPond format of a voice

Get the LilyPond input format of any Abjad object with `format`:

```
>>> voice.format
"\\new Voice {\n\t\\times 2/3 {\n\t\tc'4\n\t\td'4\n\t\te'4\n\t}\n\tf'2\n\tg'1\n}"
```

Use `f()` as a short-cut to print the LilyPond format of any Abjad object:

```
>>> f(voice)
\new Voice {
        \times 2/3 {
                c'4
                d'4
                e'4
        }
        f'2
        g'1
}
```

5.20.5 Inspecting the music in a voice

Get voice components with `music`:

```
>>> voice.music
(Tuplet(2/3, [c'4, d'4, e'4]), Note("f'2"), Note("g'1"))
```

Abjad returns a read-only tuple of components.

5.20.6 Inspecting a voice's leaves

Get the leaves in a voice with `leaves`:

```
>>> voice.leaves
(Note("c'4"), Note("d'4"), Note("e'4"), Note("f'2"), Note("g'1"))
```

Abjad returns a read-only tuple of leaves.

5.20.7 Getting the length of a voice

Get voice length with `len()`:

```
>>> len(voice)
3
```

The length of a voice is defined equal to the number of top-level components the voice contains.

5.20.8 Getting the duration attributes of a voice

The contents durations of a voice equals the sum of durations of the components in the voice:

```
>>> voice.contents_duration
Duration(2, 1)
```

The preprolated duration of a voice is usually equal to the voice's contents duration:

```
>>> voice.preprolated_duration
Duration(2, 1)
```

The prolated duration of a voice is usually equal to the voice's contents duration, too:

```
>>> voice.preprolated_duration
Duration(2, 1)
```

Only when you nest a very small voice inside a tuplet will the prolated and preprolated duration of a voice differ.

Voices that are not nested inside a tuplet carry a prolation of `1`:

```
>>> voice.prolation
Fraction(1, 1)
```

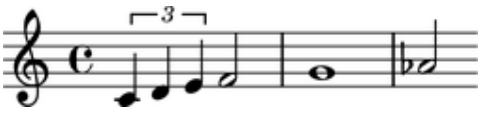
All voice duration attributes are read-only.

5.20.9 Adding one component to the end of a voice

Add one component to the end of a voice with `append`:

```
>>> voice.append(Note("af'2"))
```

```
>>> show(voice)
```

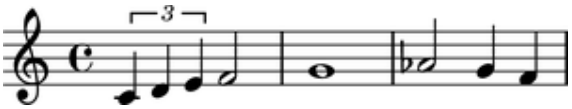


5.20.10 Adding many components to the end of a voice

Add many components to the end of a voice with `extend`:

```
>>> notes = [Note("g'4"), Note("f'4")]
>>> voice.extend(notes)
```

```
>>> show(voice)
```



5.20.11 Finding the index of a component in a voice

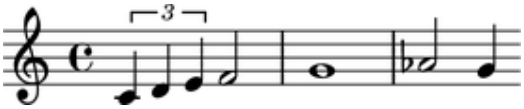
Find the index of a component in a voice with `index()`:

```
>>> notes[0]
Note("g'4")

>>> voice.index(notes[0])
4
```

5.20.12 Removing a voice component by index

Use `pop()` to remove a voice component by index:

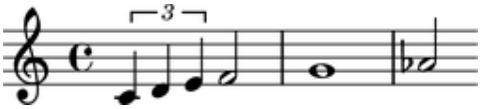
```
>>> voice[5]
Note("f'4")

>>> voice.pop(5)

>>> show(voice)
```



5.20.13 Removing a voice component by reference

Remove voice components by reference with `remove()`:

```
>>> voice.remove(voice[-1])

>>> show(voice)
```



5.20.14 Naming voices

You can name Abjad voices:

```
>>> voice.name = 'Upper Voice'
```

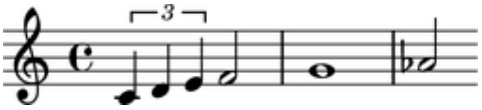
Voice names appear in LilyPond input:

```
>>> f(voice)
\context Voice = "Upper Voice" {
        \times 2/3 {
                c'4
```

```
                d'4
                e'4
        }
        f'2
        g'1
        af'2
}
```

But not in notational output:

```
>>> show(voice)
```



5.20.15 Changing the context of a voice

The context of a voice is set to `'Voice'` by default:

```
>>> voice.context
'Voice'
```

But you can change the context of a voice if you want:

```
>>> voice.context = 'SpeciallyDefinedVoice'

>>> voice.context
'SpeciallyDefinedVoice'

>>> f(voice)
\context SpeciallyDefinedVoice = "Upper Voice" {
        \times 2/3 {
                c'4
                d'4
                e'4
        }
        f'2
        g'1
        af'2
}
```

Change the context of a voice when you have defined a new LilyPond context based on a LilyPond voice.

CHAPTER

SIX

DEVELOPER DOCUMENTATION

6.1 Codebase

6.1.1 How the Abjad codebase is laid out

The Abjad codebase comprises twelve top-level directories.

```
abjad$ ls
__init__.py cfg         core        docs        interfaces  scr         tools
book        checks      demos       exceptions  opt         templates
```

Of these, it is in the `tools` directory that the bulk of the musical reasoning implemented in Abjad resides.

```
abjad$ ls tools/
__init__.py       importtools       markuptools       quantizationtools stafftools
configurationtools          instrumenttools   mathtools         resttools         tempotools
chordtools        intervaltreetools measuretools      schemetools       threadtools
componenttools    iotools           timesignaturetools        scoretools        tietools
containertools    layouttools       musicxmltools     sequencetools          tonalitytools
contexttools      leaftools         notetools         sievetools        tuplettools
durationtools          lilyfiletools     pitcharraytools   skiptools         verticalitytools
gracetools        marktools         pitchtools        spannertools      voicetools
```

The remaining sections of this chapter cover the topics necessary to familiarize developers coming to the project for the first time.

6.1.2 Removing prebuilt versions of Abjad before you check out

If you'd like to be at the cutting edge of the Abjad development then you should check out from Google Code and tell Python and your operating system about Abjad. You can do this by following the steps below.

But before you do this you should realize that there are two ways to get Abjad up and running on your computer. The first way is by downloading a compressed version of Abjad from the Python Package Index. You probably did this when you first discovered Abjad and started to use the system. The second way is by following the steps below to check out a copy of the most recent version of the Abjad repository hosted on Google Code. If you already have a version of Abjad running on your computer but you haven't yet followed the steps below to check out from Google Code, then you probably downloaded a compressed version of Abjad from the Python Package Index.

Before you check out from Google Code you should remove all prebuilt versions of Abjad from your machine. The reason you need to do this is that having both a prebuilt version of Abjad and a Subversion-managed version of Abjad on your machine can confuse your operating system and lead to weird results when you try to start Abjad.

You remove prebuilt versions of Abjad resident on your computer by finding your site packages directory and removing the so-called Abjad 'egg' that Python has installed there. After you remove the Abjad egg from your site packages directory you will also need to remove the `abj`, `abjad` and `abjad-book` scripts from `/usr/local/bin` or from the directory that is equivalent to `/usr/local/bin` under your opearting system.

First note the version of Python you're currently running.

```
$ python --version
Python 2.6.1
```

This is important because you may have more than one version of Python installed on your machine. (Which tends especially to be the case if you're running a Apple's OS X.)

Then note that the site packages directory is a part of your filesystem into which Python installs third-party Python packages like Abjad. The location of the site packages directory varies from one operating system to the next and you may have to Google to find the exact location of the site packages directory on your machine. Under OS X you can check `/Library/Python/2.x/site-packages/`. Under Linux the site packages directory is usually `/usr/lib/python2.x/site-packages`.

Once you've found your site packages directory you can list its contents to see if Python has installed an Abjad egg in it.

```
site-packages$ ls
Abjad-2.0-py2.6.egg         Sphinx-1.0.7-py2.6.egg      py-1.3.4-py2.6.egg
Jinja2-2.5-py2.6.egg        docutils-0.7-py2.6.egg      py-1.4.0-py2.6.egg
Pygments-1.3.1-py2.6.egg    easy-install.pth            py-1.4.4-py2.6.egg
README                      guppy                       pytest-2.0.0-py2.6.egg
Sphinx-1.0.1-py2.6.egg      guppy-0.1.9-py2.6.egg-info  pytest-2.1.0-py2.6.egg
Sphinx-1.0.4-py2.6.egg      py-1.3.1-py2.6.egg
```

Remove any Abjad eggs Python has installed in your site packages directory.

After you've done this you should check `/usr/local/bin` or equivalent to see if the `abj`, `abjad` or `abjad-book` scripts are installed there.

```
bin$ ls
abj      abjad    abjad-book
```

Remove any of the three scripts you find installed there so that you can use the new versions of the scripts you will download from Google Code instead.

```
bin$ sudo rm abj*
```

Now proceed to the steps below to check out from Google Code.

6.1.3 Installing the development version

Follow the steps listed above to remove prebuilt versions of Abjad from your machine. Then follow the steps below to check out from Google Code.

1. Make sure Subversion is installed on your machine.

   ```
   svn --version
   ```

   If Subversion responds then it is already installed. Otherwise visit the Subversion website.

2. Check out a copy of the main line of the Abjad codebase.

   ```
   svn checkout http://abjad.googlecode.com/svn/abjad/trunk abjad-trunk
   ```

3. Add the abjad trunk directory to your your `PYTHONPATH` environment variable.

   ```
   export PYTHONPATH="/path/to/abjad-trunk:"$PYTHONPATH
   ```

4. Alternatively you may symlink your Python site packages directory to the abjad trunk directory.

   ```
   ln -s /path/to/abjad-trunk /path/to/site-package/abjad
   ```

5. Finally, add `abjad-trunk/scr/` to your `PATH` environment variable.

   ```
     export PATH="/path/to/abjad-trunk/scr:"$PATH

   You will then be able to run Abjad with the ``abjad`` command.
   ```

You now have a copy of the main line of the most recent version of the Abjad repository checked out to your machine.

6.2 Docs

The reST-based sources for the Abjad documentation are included in their entirety in every installation of Abjad. You may add to and edit these reST-based sources as soon as you install Abjad. However, to build human-readable HTML or PDF versions of the docs you will first need to download and install Sphinx.

The remaining sections of this chapter describe how the Abjad docs are laid out and how to build the docs with Sphinx.

6.2.1 How the Abjad docs are laid out

The source files for the Abjad docs are included in the `docs` directory of every Abjad install. The `docs` directory contains everything required to build HTML, PDF and other versions of the Abjad docs.

```
abjad$ ls docs/
Makefile    _templates  chapters    index.rst  scr
_static     _themes     conf.py     make.bat
```

The bulk of the Abjad docs live in `docs/chapters`. The chapter directories mirror the main sections on Abjad documentation. What you'll find as you inspect the chapter directories are a collection of `.rst` files organized into groups. The `.rst` extension identifies files written in restructured text.

One example:

```
abjad$ ls docs/chapters/appendices/glossary
index.rst
```

6.2.2 Installing Sphinx

Sphinx is the automated documentation system used by Python, Abjad and other projects implemented in Python. Because Sphinx is not included in the Python standard library you will probably need to download and install it.

First check to see if Sphinx is already installed on your machine.

```
$ sphinx-build --version
```

If Sphinx responds then the program is already installed on your machine. Otherwise visit the Sphinx website.

6.2.3 Removing old builds of the docs

After installing Sphinx, change to the Abjad `docs` directory and use the Sphinx makefile to remove any existing `docs/_build` directory prior to making a new build of the docs.

```
abjad$ cd docs

docs$ make clean
rm -rf _build/*
```

6.2.4 Generating the Abjad API

The `docs/scr` directory includes a script to generate the Abjad API. Run this script before building the Abjad docs for the first time.

```
docs$ scr/make-abjad-api
Building TOC tree ...
Now making Sphinx TOC ...

... Done.

Now building the HTML docs ...

sphinx-build -b html -d _build/doctrees   . _build/html
Running Sphinx v1.0.7
loading pickled environment... done

... (many lines omitted) ...

Build finished. The HTML pages are in _build/html.
```

Rerun `make-abjad-api` any time you add or remove a public class, method or function from the codebase.

6.2.5 Building the HTML docs

Change to the Abjad `docs` directory and run `make html`.

```
abjad$ cd docs

docs$ make html
sphinx-build -b html -d _build/doctrees   . _build/html
Running Sphinx v1.0.7
loading pickled environment... not found
building [html]: targets for 568 source files that are out of date
updating environment: 568 added, 0 changed, 0 removed
reading sources... [ 13%] chapters/api/debug/debugghandlertoregatorsg
reading sources... [ 37%] chapters/api/tools/clonewp/by_leaf_counts_with_parenta
reading sources... [ 38%] chapters/api/tools/clonewp/by_leaf_range_with_parentag
reading sources... [ 38%] chapters/api/tools/componenttools/get_duration_crosser
reading sources... [ 38%] chapters/api/tools/componenttools/get_duration_preprol
reading sources... [ 39%] chapters/api/tools/componenttools/get_le_duration_prol

... (many more lines omitted) ...

writing output... [ 85%] chapters/api/tools/spannertools/give_attached_to_childr
writing output... [ 95%] chapters/fundamentals/duration/interfaces_compared/inde
```

```
writing output... [100%] index                          /indexdexexexng/indexxdexindex
writing additional files... genindex modindex search
copying images... done
copying static files... done
dumping search index... done
dumping object inventory... done
build succeeded.

Build finished. The HTML pages are in _build/html.
```

You will then find the complete HTML version of the docs in `docs/_build/html`.

```
docs$ ls _build/
doctrees html
```

The output from Sphinx is verbose the first time you build the docs. On sequent builds, Sphinx reports changes only.

```
docs$ make html
sphinx-build -b html -d _build/doctrees    . _build/html
Running Sphinx v1.0.7
loading pickled environment... done
building [html]: targets for 1 source files that are out of date
updating environment: 0 added, 1 changed, 0 removed
reading sources... [100%] chapters/devel/documentation/index
looking for now-outdated files... none found
pickling environment... done
checking consistency... done
preparing documents... done
writing output... [100%] index                          ation/index
writing additional files... genindex modindex search
copying static files... done
dumping search index... done
dumping object inventory... done
build succeeded.

Build finished. The HTML pages are in _build/html.
```

6.2.6 Building a PDF of the docs

Building a PDF of the docs is a two-step process. First you build a LaTeX version of the docs. Then you typeset the LaTeX docs as a PDF.

First change to the Abjad docs directory.

```
abjad$ docs
```

Then make LaTeX sources of the docs.

```
docs$ make latex
sphinx-build -b latex -d _build/doctrees   . _build/latex
Running Sphinx v1.0.7
loading pickled environment... done
building [latex]: all documents
updating environment: 0 added, 0 changed, 0 removed
looking for now-outdated files... none found
processing Abjad.tex... index chapters/start_here/abjad/index chapters/examples/bartok...

(... many lines omitted ...)
```

```
...ndices/pitch_conventions/images/example-3.png chapters/examples/ligeti/images/desordre.jpg
copying TeX support files... done
build succeeded.

Build finished; the LaTeX files are in _build/latex.
Run 'make all-pdf' or 'make all-ps' in that directory to run these through (pdf)latex.
```

Now follow the instructions provided by Sphinx and change to the LaTeX build directory.

```
docs$ cd _build/latex/
```

Then make a PDF version of the docs from the LaTeX sources.

```
latex$ make all-pdf

pdflatex  'Abjad.tex'
This is pdfTeXk, Version 3.141592-1.40.3 (Web2C 7.5.6)
 %&-line parsing enabled.
entering extended mode
(./Abjad.tex
LaTeX2e <2005/12/01>
Babel <v3.8h> and hyphenation patterns for english, usenglishmax, dumylang, noh
yphenation, arabic, basque, bulgarian, coptic, welsh, czech, slovak, german, ng
erman, danish, esperanto, spanish, catalan, galician, estonian, farsi, finnish,

(... many lines omitted ...)
```

The resulting docs will appear as `Abjad.pdf` in the LaTeX build directory you're currently in.

6.2.7 Building a coverage report

Change to the Abjad `docs` directory and call `sphinx-build` explicitly with the coverage builder, source directory and target directory.

```
docs$ sphinx-build -b coverage . _build/coverage
Making output directory...
Running Sphinx v1.0.7
loading pickled environment... not found
building [coverage]: coverage overview
updating environment: 568 added, 0 changed, 0 removed
reading sources... [ 37%] chapters/api/tools/clonewp/by_leaf_counts_with_parenta
reading sources... [ 38%] chapters/api/tools/clonewp/by_leaf_range_with_parentag
reading sources... [ 38%] chapters/api/tools/componenttools/get_duration_crosser

... (many lines omitted) ...

reading sources... [ 85%] chapters/api/tools/spannertools/withdraw_from_containe
reading sources... [ 95%] chapters/fundamentals/duration/interfaces_compared/ind
reading sources... [100%] index                      t/indexdexexexng/indexxdexindex
looking for now-outdated files... none found
pickling environment... done
checking consistency... done
build succeeded.
```

The coverage report is now available in the `docs/_build/coverage` directory.

```
docs$ ls _build/
coverage doctrees html
```

6.2.8 Building other versions of the docs

Examine the Sphinx makefile in the Abjad `docs/` directory or change to the `docs/` directory and type `make` with no arguments to see a list of the other versions of the Abjad docs that are available to build.

```
docs$ make
Please use `make <target>' where <target> is one of
    html        to make standalone HTML files
    dirhtml     to make HTML files named index.html in directories
    pickle      to make pickle files
    json        to make JSON files
    htmlhelp    to make HTML files and a HTML help project
    qthelp      to make HTML files and a qthelp project
    latex       to make LaTeX files, you can set PAPER=a4 or PAPER=letter
    changes     to make an overview of all changed/added/deprecated items
    linkcheck   to check all external links for integrity
    doctest     to run all doctests embedded in the documentation (if enabled)
```

6.2.9 Inserting images with `abjad-book`

Use *abjad-book* to insert snippets of notation in the docs you write in reST.

Embed Abjad code between open and close <abjad> </abjad> tags in your `.rst.raw` sourcefile and then call `abjad-book` to create a pure `.rst` file.

```
abjad-book foo.rst.raw foo.rst

Parsing file ...
Rendering "example-1.ly" ...
Rendering "example-2.ly" ...
```

You will need to build the HTML docs again to see your work.

```
make html
```

6.2.10 Updating Sphinx

It is important periodically to update your version of Sphinx. If you used `easy_install` to install Sphinx then the usual command to update Sphinx is this:

```
$ sudo easy_install -U Sphinx
```

This will usually work. But if Sphinx fails to update then it may be because you have multiple versions of Python installed on your computer. (This tends especially to be the case under Apple's OS X.)

To get around this first note the version of Python you're currently running:

```
$ python --version
Python 2.6.1
```

Then use a version-explicit form of `easy_install` to update Sphinx:

```
$ sudo easy_install-2.6 -U Sphinx
```

6.3 Tests

Abjad includes an extensive battery of tests. Abjad is in a state of rapid development and extension. Major refactoring efforts are common every six to eight months and are likely to remain so for several years. And yet Abjad continues to allow the creation of complex pieces of fully notated score in the midst of these changes. We believe this is due to the extensive coverage provided by the automated regression battery described in the following sections.

6.3.1 Automated regression?

A battery is any collection of tests. Regression tests differ from other types of test in that they are designed to be run again and again during many different stages of the development process. Regression tests help ensure that the system continues to function correctly as developers make changes to it. An automated regression battery is one that can be run automatically by some sort of driver with minimal manual intervention.

Several different test drivers are now in use in the Python community. Abjad uses py.test. The `py.test` distribution is not included in the Python standard library, so one of the first thing new contributors to Abjad should do is download and install `py.test`, and then run the existing battery.

6.3.2 Running the battery

Change to the directory where you have Abjad installed. Then run `py.test`.

```
abjad$ py.test
============================= test session starts ==================================
platform darwin -- Python 2.6.1 -- pytest-2.1.0
collected 4235 items

core/LilyPondContextProxy/test/test_LilypondContextProxy___eq__.py .
core/LilyPondContextProxy/test/test_LilypondContextProxy___repr__.py .
core/LilyPondContextProxy/test/test_LilypondContextProxy___setattr__.py ..

... (many lines omitted) ...

tools/voicetools/test/test_voicetools_iterate_semantic_voices_in_expr.py .
tools/voicetools/test/test_voicetools_iterate_voices_backward_in_expr.py .
tools/voicetools/test/test_voicetools_iterate_voices_in_expr.py .

========================== 4235 passed in 127.06 seconds ===========================
```

Abjad r4629 includes 4235 tests.

6.3.3 Reading test output

`py.test` crawls the entire directory structure from which you call it, running tests in alphabetical order. `py.test` prints the total number of tests per file in square brackets and prints test results as a single `.` dot for success or else an `F` for failure.

6.3.4 Writing tests

Project check-in standards ask that tests accompany all code committed to the Abjad repository. If you add a new function, class or method to Abjad, you should add a new test file for that function, class or method. If you fix or extend an existing function, class or method, you should find the existing test file that covers that code and then either add a completely new test to the test file or else update an existing test already present in the test file.

6.3.5 Test files start with `test_`

When `py.test` first starts up it crawls the entire directory structure from which you call it prior to running a single test. As `py.test` executes this preflight work, it looks for any files beginning or ending with the string `test` and then collects and alphabetizes these. Only after making such a catalog of tests does `py.test` begin execution. This collect-and-cache behavior leads to the important point about naming, below.

6.3.6 Avoiding name conflicts

Note that the names of **test functions** must be absolutely unique across the entire directory structure on which you call `py.test`. You must never share names between test functions. For example, you must not have two tests named `test_grob_handling_01()` **even if both tests live in different test files**. That is, a test named `test_grob_handling_01()` living in the file `test_accidental_grob_handling.py` and a second test named `test_grob_handling_01()` living in the file `test_notehead_grob_handling.py` will conflict with the each other when `py.test` runs. And, unfortunately, **‘‘py.test is silent about such conflicts when it runs**. That is, should you run `py.test` with the duplicate naming situation described here, what will happen is that `py.test` will correctly run and report results for the **first** such test it finds. However, when `py.test` encounters the second like-named test, `py.test` will incorrectly report cached results for the **first** test rather than the second. The take-away is to include some sort of namespacing indicators in every test name and not to be afraid of long test names. The `test_grob_handling_01()` example given here fixes easily when the two tests rename to `test_accidental_grob_handling_01()` and `test_notehead_grob_handling_01()`.

6.3.7 Updating `py.test`

It is important periodically to update `py.test`.

The usual command to do this is:

```
$ sudo easy_install -U pytest
```

Note that `pytest` is here spelled without the intervening period.

6.3.8 Running `doctest` on the `tools` directory

The Python standard library includes the `doctest` module as way of checking the correctness of examples included in Python docstrings. The module searches for instances of the Python interpreter prompt `'>>>'` and executes any code that follows. Abjad docs display the Abjad prompt `'abjad>'` instead of the Python prompt. This means that all instances of the Abjad prompt must be changed to Python prompts before running `doctest` on the Abjad codebase. Three scripts in `abjad/scr/devel` help do this.

First change to the subdirectory of the Abjad source tree on which you'd like to run `doctest`. Then run these scripts:

```
replace-abjad-prompts-with-python-prompts
```

```
run-doctest-on-all-modules-in-tree

replace-python-prompts-with-abjad-prompts
```

After running `run-doctest-on-all-modules-in-tree` you can inspect the results that come back from `doctest` and make any fixes as required.

6.4 Scripts

The `abjad/scr/devel` directory contains scripts for Abjad developers. Add `abjad/scr/devel` to your `PATH` to use the scripts described below.

```
abjad$ ls scr/devel
abj-grep                                        find-multifunction-modules
abj-grp                                         find-multiline-import-statements
abj-rmpycs                                      find-nonalphabetized-module-headers
abj-src-grp                                     find-nontrivial-subdirectories
abj-test-grp                                    find-public-helpers-without-docstrings
abj-update                                      find-undocumented-tools
capitalize-test-file-names                      fix-nonalphabetized-module-headers
conjoin-multiline-import-statements             fix-test-case-block-comments
count-source-lines                              fix-test-case-names
count-tools                                     fix-test-case-numbers
duplicate-test-file                             format-lilypond-context-names-with-underscores
find-and-fix-manual-class-package-initializers  list-private-modules
find-duplicate-module-names                     rebuild-docs
find-duplicate-tool-module-names                reindent-3-spaces-as-4
find-import-as-statements                       reindent-4-spaces-as-3
find-local-import-statements                    reindent-spaces-variably
find-lower-camel-case-definitions               remove-tmp-out-directories
find-lower-camel-case-modules                   rename-public-helper
find-manual-class-loads-in-initializers         replace-abjad-prompts-with-python-prompts
find-misnamed-private-modules                   replace-in-files
find-missing-test-modules                       replace-python-prompts-with-abjad-prompts
find-module-headers                             run-doctest-on-all-modules-in-tree
find-modules-with-chevrons
```

6.4.1 Searching the Abjad codebase with `abj-grep`

Abjad provides a wrapper around UNIX `grep` in the form of `abj-grep`. Use this script to recursively search the entire Abjad codebase, leaving out non-human-readable files, files located in special `.svn` Subversion subdirectories, and all files in the `abjad/documentation` directories. You can run `abj-grep` from any directory on your system; you needn't be in the Abjad source directories when you call `abj-grep`.

```
$ abj-grep 'is_assignable('
leaf/duration.py:111:            if not durationtools.is_assignable(rational):
tempo/indication.py:67:            assert durationtools.is_assignable(arg)
tools/check/are_scalable.py:12:            if not durationtools.is_assignable(candidate_duration):
tools/durationtools/is_assignable.py:5:def is_assignable(duration):
tools/durationtools/prolated_to_written.py:2:from abjad.tools.durationtools.is_assignable import is_a
tools/durationtools/prolated_to_written.py:15:    if is_assignable(prolated_duration):
tools/tietools/duration_change.py:28:    if durationtools.is_assignable(new_written_duration):
tools/tuplettools/contents_scale.py:30:    if durationtools.is_assignable(multiplier):
```

6.4.2 Removing old *.pyc files with abj-rmpycs

See the section on abj-update below for the reasons that it is a good idea to periodically remove the byte-compiled *.pyc files that Python generates for its own use behind the scenes. Abjad supplies abj-rmpycs to delete all the *.pyc in the Abjad codebase, leaving other *.pyc on your system untouched.

6.4.3 Updating your development copy of Abjad with abj-update

The normal way of updating your working copy of a Subversion repository is with the svn update or svn up command. You can update your working copy of Abjad in the usual way with svn up. But Abjad supplies an abj-update script as a wrapper around the usual Subversion update commands. In addition to updating your working copy of Abjad, abj-update populates the abjad/.version file with the most recent revision number of the system, and then removes all *.pyc files from your Abjad install. The benefits here are twofold. First, Abjad adds the most recent revision number of the system to all .ly files that you generate when working with Abjad. If you do not update the Abjad version file on a regular basis, the headers in your Abjad-generated .ly files will list the wrong version of the system. Second, as is the case in working with any substantial Python codebase, it is a good idea to periodically remove the byte-compiled *.pyc files that Python creates for its own use. The reason for this is inadvertant name aliasing. That is, if there was previously a module named foo.py somewhere in the system and if Python had at some point imported the module and created foo.pyc as a byprodct, this .pyc file will remain on the filesystem even if you later decide to remove, or rename, the source foo.py module. This lead to confusion because days or weeks after foo.py has been removed, Python will still find foo.pyc and seem to make the contents of foo.py available from beyond the grave. Updating with abj-update takes care of these two situations.

6.4.4 Counting lines of code with count-source-lines

Run count-source-lines for a count of lines of count divided between source and test files.

```
abjad$ count-source-lines

source_modules: 1703
test_modules:   1812

source_lines:   73942
test_lines:     76636

total lines:    150578
test-to-source ratio is 1 : 1
```

The script is directory-dependent so you can run it any the entire Abjad codebase or any subdirectory of the codebase.

6.4.5 Global search-and-replace with replace-in-files

You probably won't need to use replace-in-files very often. But if you are making changes to Abjad that will cause some name, such as FooBar, to be globally changed everywhere in the Abjad codebase to, say to foo_bar, then you can use replace-in-files to save lots of time.

```
$ replace-in-files --help

    Usage:

    replace-in-files DIR OLD_TEXT NEW_TEXT [CONFIRM=true/false]

    Crawl directory DIR and read every file in it recursively.
```

```
    Replace OLD_TEXT with NEW_TEXT in each file.

    Set CONFIRM to 'false' to replace without prompting.
```

6.4.6 Adding new development scripts

If you write and then find yourself using a certain script over and over again when you're developing new code for Abjad, consider contributing back to the project so we can include your script in the next public release of Abjad. Scripts in the the Abjad script directories end with no file extension and try to be as OS-portable as possible, which usually means writing the script in Python, rather than your operating system's shell, and relying heavily on Python's `os` module.

6.5 Using `abjad-book`

`abjad-book` is an independent application included in every installation of Abjad. `abjad-book` allows you to write Abjad code in the middle of documents written in HTML, LaTeX or ReST. We created `abjad-book` to help us document Abjad. Our work on `abjad-book` was inspired by `lilypond-book`, which does for LilyPond much what `abjad-book` does for Abjad.

6.5.1 HTML with embedded Abjad

To see `abjad-book` in action, open a file and write some HTML by hand. Add some Abjad code to your HTML between open and close <abjad> </abjad> tags.

```
<html>

<p>This is an <b>HTML</b> document.</p>

<p>The code is standard hypertext mark-up.</p>

<p>Here is some music notation generated automatically by Abjad:</p>

<abjad>
v = Voice("c'8 d' e' f' g' a' b' c''")
beam = beamtools.BeamSpanner(v)
show(v)
</abjad>

<p>And here is more ordinary <b>HTML</b>.</p>

</html>
```

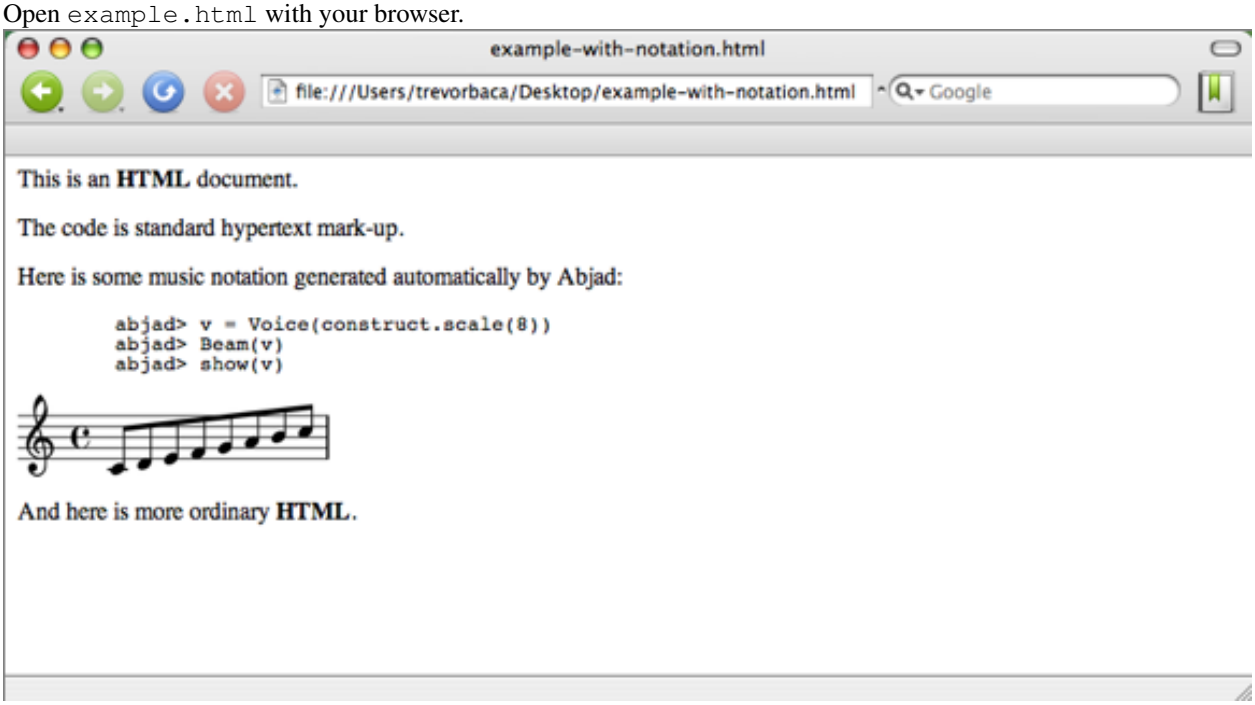
Save your the file with the name `example.html.raw`. You now have an HTML file with embedded Abjad code.

In the terminal, call `abjad-book` on `example.html.raw`.

```
$ abjad-book example.html.raw example.html

Parsing file...
Rendering "abjad-book-1.ly"...
```

The application opens `example.html.raw`, finds all Abjad code between <abjad> </abjad> tags, executes it, and then creates and inserts image files of music notation accordingly.

Open `example.html` with your browser.



That's all there is to it. `abjad-book` lets you open a file and type HTML by hand with Abjad sandwiched between the special <abjad> </abjad> tags described here. Run `abjad-book` on such a hybrid file to create pure HTML with images of music notation created by Abjad.

Note: `abjad-book` makes use of ImageMagick's convert application to crop and scale PNG images generated for HTML and ReST documents. For LaTeX documents, `abjad-book` uses `pdfcrop` for cropping PDFs.

6.5.2 LaTeX with embedded Abjad

You can use `abjad-book` to insert Abjad code and score excerpts into any LaTeX you create. Type the sample code below into a file.

```
\documentclass{article}
\usepackage{graphicx}
\usepackage{listings}
\begin{document}

This is a standard LaTeX document with embedded Abjad.

The code below creates an Abjad measure and then prints the measure
format string.

<abjad>
measure = Measure((5, 8), "c'8 d'8 e'8 f'8 g'8")
f(measure)
</abjad>

This next bit of code knows about the measure we defined earlier.

<abjad>
iotools.write_expr_to_ly(measure, 'abjad-book-1', docs=True) <hide
```

```
</abjad>

And this is the end of the our sample LaTeX document.

\end{document}
```

Save your file with the name `example.tex.raw`. You now have a LaTeX file with embedded Abjad code.

In the terminal, call `abjad-book` on `example.tex.raw`.

```
$ abjad-book example.tex.raw example.tex

Processing 'example.tex.raw'. Will write output to 'example.tex'...
Parsing file...
Rendering "abjad-book-1.ly"...
```

The application open `example.tex.raw`, finds all code between Abjad tags, executes it, and then creates and inserts Abjad interpreter output and PDF files of music notation. You can view the contents of the next LaTeX file `abjad-book` has created.

```
\documentclass{article}
\usepackage{graphicx}
\usepackage{listings}
\begin{document}

This is a standard LaTeX document with embedded Abjad.

The code below creates an Abjad measure and then prints the measure
format string.

\begin{lstlisting}[basicstyle=\footnotesize, tabsize=4, showtabs=false, showspaces=false]
   >>> measure = Measure((5, 8), "c'8 d'8 e'8 f'8 g'8")
   >>> f(measure)
   {
      \time 5/8
      c'8
      d'8
      e'8
      f'8
      g'8
   }
\end{lstlisting}

This next bit of code knows about the measure we defined earlier.
This code renders the measure as a PDF using a template suitable
for inclusion in LaTeX documents.

\includegraphics{images/abjad-book-1.pdf}

And this is the end of the our sample LaTeX document.

\end{document}
```

You can now process the file `example.tex` just like any other LaTeX file, using `pdflatex` or TexShop or whatever LaTeX compilation program you normally use on your computer.

```
$ pdflatex example.tex

This is pdfTeXk, Version 3.141592-1.40.3 (Web2C 7.5.6)
```

```
 %&-line parsing enabled.
entering extended mode
...
```

And then open the resulting PDF.

6.5.3 Using `abjad-book` on ReST documents

You can call `abjad-book` on ReST documents, too. Follow the examples given here for HTML and LaTeX documents and modify accordingly.

6.5.4 Using [hide = True]

You can add `[hide = True]` to any `abjad-book` example to show only music notation.

```
<abjad>[hide = True]
staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b''8")
iotools.write_expr_to_ly(staff, 'staff-example', docs=True)
</abjad>
```

6.6 Timing code

You can time code with Python's built-in `timeit` module:

```
from abjad import *
import timeit

timer = timeit.Timer('Note(0, (1, 4))', 'from __main__ import Note')
print timer.timeit(1000)
```

```
0.225436925888
```

These results show that 1000 notes take 0.23 seconds to create.

Other Python timing modules are available for download on the public Internet.

6.7 Profiling code

Profile code with `profile_expr()` in the `iotools` package:

```
>>> iotools.profile_expr('Note(0, (1, 4))')
Sun Aug 14 16:50:36 2011    _tmp_abj_profile

         327 function calls (312 primitive calls) in 0.001 CPU seconds

   Ordered by: cumulative time
   List reduced from 96 to 12 due to restriction <12>

   ncalls  tottime  percall  cumtime  percall filename:lineno(function)
        1    0.000    0.000    0.001    0.001 <string>:1(<module>)
        1    0.000    0.000    0.001    0.001 Note.py:18(__init__)
        1    0.000    0.000    0.001    0.001 Note.py:133(fset)
```

```
        1    0.000    0.000    0.001    0.001 NoteHead.py:18(__init__)
        1    0.000    0.000    0.001    0.001 NoteHead.py:121(fset)
        1    0.000    0.000    0.001    0.001 NamedChromaticPitch.py:28(__new__)
        1    0.000    0.000    0.000    0.000 Leaf.py:18(__init__)
        1    0.000    0.000    0.000    0.000 chromatic_pitch_name_to_diatonic_pitch_numbe
        1    0.000    0.000    0.000    0.000 octave_tick_string_to_octave_number.py:4(oct
        1    0.000    0.000    0.000    0.000 re.py:134(match)
        1    0.000    0.000    0.000    0.000 re.py:227(_compile)
        1    0.000    0.000    0.000    0.000 sre_compile.py:501(compile)
```

These results show 327 function calls to create a note.

The `profile_expr()` function wraps the Python `cProfile` and `pstats` modules.

6.8 Memory consumption

You can examine memory consumption with tools included in the `guppy` module:

```
from guppy import hpy
hp = hpy()
hp.setrelheap()
notes = [Note(0, (1, 4)) for x in range(1000)]
h = hp.heap()
print h
```

```
Partition of a set of 11024 objects. Total size = 586364 bytes.
 Index  Count   %     Size   % Cumulative  % Kind (class / dict of class)
     0   1000   9   124000  21    124000  21 abjad.tools.notetools.Note.Note.Note
     1   1004   9   116464  20    240464  41 __builtin__.set
     2   2003  18    76300  13    316764  54 list
     3   1000   9    52000   9    368764  63
                                             abjad.tools.pitchtools.NamedChromaticPitch.NamedChromat
                                             icPitch.NamedChromaticPitch
     4   1000   9    44000   8    412764  70
                                             abjad.interfaces._OffsetInterface._OffsetInterface._Off
                                             setInterface
     5   1000   9    44000   8    456764  78 abjad.tools.notetools.NoteHead.NoteHead.NoteHead
     6   1000   9    40000   7    496764  85 0x23add0
     7   1000   9    32000   5    528764  90
                                             abjad.interfaces.ParentageInterface.ParentageInterface.
                                             ParentageInterface
     8   1011   9    28568   5    557332  95 str
     9   1000   9    28000   5    585332 100
                                             abjad.interfaces._NavigationInterface._NavigationInterf
                                             ace._NavigationInterface
<6 more rows. Type e.g. '_.more' to view.>
```

These results show 586K for 1000 notes.

You must download `guppy` from the public Internet because the module is not included in the Python standard library.

6.9 Class attributes

Consider the definition of this class:

```
class FooWithInstanceAttribute(object):

   def __init__(self):
      self.constants = (
         'red', 'orange', 'yellow', 'green',
         'blue', 'indigo', 'violet',
         )
```

1000 objects consume 176k:

```
from guppy import hpy
hp = hpy()
hp.setrelheap()
objects = [FooWithInstanceAttribute() for x in range(1000)]
h = hp.heap()
print h
```

```
Partition of a set of 2004 objects. Total size = 176536 bytes.
 Index  Count   %     Size   % Cumulative  % Kind (class / dict of class)
     0   1000  50   140000  79    140000  79 dict of __main__.FooWithInstanceAttribute
     1   1000  50    32000  18    172000  97 __main__.FooWithInstanceAttribute
     2      1   0     4132   2    176132 100 list
     3      1   0      348   0    176480 100 types.FrameType
     4      1   0       44   0    176524 100 __builtin__.weakref
     5      1   0       12   0    176536 100 int
```

But consider the definition of this class:

```
class FooWithSharedClassAttribute(object):

   def __init__(self):
      pass

   self.constants = (
      'red', 'orange', 'yellow', 'green',
      'blue', 'indigo', 'violet',
      )
```

1000 objects consume only 36k:

```
from guppy import hpy
hp = hpy()
hp.setrelheap()
objects = [FooWithClassAttribute() for x in range(1000)]
h = hp.heap()
print h
```

```
Partition of a set of 1004 objects. Total size = 36536 bytes.
 Index  Count   %     Size   % Cumulative  % Kind (class / dict of class)
     0   1000 100    32000  88     32000  88 __main__.FooWithClassAttribute
     1      1   0     4132  11     36132  99 list
     2      1   0      348   1     36480 100 types.FrameType
     3      1   0       44   0     36524 100 __builtin__.weakref
     4      1   0       12   0     36536 100 int
```

Objects that share class attributes between them can consume less memory than objects that don't. But consider the usual provisions between class attributes and instance attributes when implementing custom classes. Class attributes make sense when objects will never modify the attribute in question. Class attributes also make sense when objects will modify the attribute in question and will desire to change the attribute in question for all other like objects at the

same time. Probably best to use instance attributes in most other cases.

6.10 Using slots

Consider the definition of this class:

```
class Foo(object)

   def __init__(self, a, b, c):
      self.a = a
      self.b = b
      self.c = c
```

1000 objects consume 176k:

```
from guppy import hpy
hp = hpy()
hp.setrelheap()
objects = [Foo(1, 2, 3) for x in range(1000)]
h = hp.heap()
print h

Partition of a set of 2004 objects. Total size = 176536 bytes.
 Index  Count   %     Size   % Cumulative  % Kind (class / dict of class)
     0   1000  50   140000  79    140000  79 dict of __main__.FooWithInstanceAttribute
     1   1000  50    32000  18    172000  97 __main__.FooWithInstanceAttribute
     2      1   0     4132   2    176132 100 list
     3      1   0      348   0    176480 100 types.FrameType
     4      1   0       44   0    176524 100 __builtin__.weakref
     5      1   0       12   0    176536 100 int
```

But consider the definition of this class:

```
class FooWithSlots(object):

   __slots__ = ('a', 'b', 'c')
   def __init__(self, a, b, c):
      self.a = a
      self.b = b
      self.c = c
```

1000 objects consume only 40k:

```
from guppy import hpy
hp = hpy()
hp.setrelheap()
objects = [FooWithSlots(1, 2, 3) for x in range(1000)]
h = hp.heap()
print h

Partition of a set of 1004 objects. Total size = 40536 bytes.
 Index  Count   %     Size   % Cumulative  % Kind (class / dict of class)
     0   1000 100    36000  89     36000  89 __main__.Bar
     1      1   0     4132  10     40132  99 list
     2      1   0      348   1     40480 100 types.FrameType
     3      1   0       44   0     40524 100 __builtin__.weakref
     4      1   0       12   0     40536 100 int
```

The example here confirms the Python Reference Manual 3.4.2.4: "By default, instances of both old and new-style classes have a dictionary for attribute storage. This wastes space for objects having very few instance variables. The space consumption can become acute when creating large numbers of instances."

6.11 Coding standards

Indent with spaces, not with tabs. Use four spaces at a time:

```
def foo(x, y):
    return x + y
```

Introduce comments with one pound sign and a single space:

```
# comment before foo
def foo(x, y):
    return x + y
```

Avoid `from`. Instead of `from fractions import Fraction` use:

```
import fractions
```

Favor early imports at the head of each module. Only one `import` per line.

Arrange standard library imports alphabetically at the head of each module:

```
import fractions
import types
```

Follow standard library imports with intrapackage Abjad imports arranged alphabetically:

```
import footools
import bartools
import blahtools
```

Include two blank lines after `import` statements before the rest of the module:

```
import fractions
import types
import footools
import bartools
import blahtools


class Foo(object):
    ...
    ...
```

Wrap docstrings with triple apostrophes and align like this:

```
def foo(x, y):
    '''This is the first line of the foo docstring.
    This is the second line of the foo docstring.
    And this is the last line of the foo docstring.
    '''
```

Use paired apostrophes to delimit strings:

```
s = 'foo'
```

Use paired quotation marks to delimit strings within a string:

```
s = 'foo and "bar"'
```

Name classes in upper camelcase:

```
def FooBar(object):
    ...
    ...
```

Name bound methods in underscore-delimited lowercase:

```
def Foo(object):

    def bar_blah(self):
        ...

    def bar_baz(self):
        ...
```

Name module-level functions in underscore-delimited lowercase:

```
def foo_bar():
    ...

def foo_blah():
    ...
```

Separate bound method definitions with a single empty line:

```
class FooBar(object):

    def __init__(self, x, y):
        ...

    def bar_blah(self):
        ...

    def bar_baz(self):
        ...
```

Organize the definitions of core classes into the nine following major sections:

```
class FooBar(object):

    ### CLASS ATTRIBUTES ###

    special_enumeration = ('foo', 'bar', 'blah')

    ### INITIALIZER ###

    def __init__(self, x, y):
        ...

    ### SPECIAL METHODS ###

    def __repr__(self):
        ...

    def __str__(self):
        ...
```

```
    ### READ-ONLY PRIVATE PROPERTIES ###

    @property
    def _foo(self):
        ...

    ### READ / WRITE PRIVATE PROPERTIES ###

    @apply
    def _bar():
        def fget(self):
            ...
        def fset(self, expr):
            ...
        return property(**locals())

    ### PRIVATE METHODS ###

    def _blah(self, x, y):
        ...

    ### READ-ONLY PUBLIC PROPERTIES ###

    @property
    def foo(self):
        ...

    ### READ / WRITE PUBLIC PROPERTIES ###

    @apply
    def bar():
        def fget(self):
            ...
        def fset(self, expr):
            ...
        return property(**locals())

    ### PUBLIC METHODS ###

    def blah(self, expr):
        ...
```

Use < less-than signs in preference to greater-than signs:

```
if x < y < z:
    ...
```

Preceed private class attributes with a single underscore.

Alphabetize method names.

Alphabetize keyword arguments.

Include keyword argument names explicitly in function calls.

Limit docstring lines to 99 characters.

Limit source lines to 110 characters and use `\` to break lines where necessary.

Eliminate trivial slice indices. Use `s[:4]` instead of `s[0:4]`.

Prefer new-style string formatting to old-style string interpolation. Use `'string {} content'.format(expr)` instead of `'string %s content' % expr`.

Prefer list comprehensions to `filter()`, `map()` and `apply()`.

Do not abbreviate variable names. (But use `expr` for 'expression' and use `i` or `j` for loop counters.)

Name variables that represent a list or other collection of objects in the plural.

Name functions beginning with a verb. (But use `noun_to_noun` for conversion functions and `mathtools.noun` for some `mathtools` functions.)

Avoid private classes.

Avoid private functions. (But use private class methods as necessary.)

Implement package-level functions in preference to `staticmethod` class methods.

Implement only one statement per line of code.

Implement only one class per module.

Implement only one function per module.

Author one `py.test` test file for every module-level function.

Author one `py.test` test file for every bound method in the public interface of a class.

CHAPTER

SEVEN

APPENDICES

7.1 From Trevor and Víctor

We are composers Trevor Bača and Víctor Adán, creators of Abjad, and our earliest collaborative work dates back to shared undergraduate years in Austin. It was the mid- to late-90s and we found ourselves interested in ways of building up ever larger sets of musical materials in our scores, with ever greater amounts of musical information.

Our work then began with pitch formalization, creating materials in C and then writing the results as MIDI to hear what we'd created. Turns out that this is a fairly common gateway into materials generation for many composers, and so it was for us. Probably this was, and is, due to the ever present availability of MIDI and, to a lesser extent, CSound. But even back then it was clear to us to finding ways to embody other aspects of the musical score – from nested rhythms to the different approaches to the musical measure to the arbitrarily complex structures possible with overlapping musical voices – would require a wholly different level of consideration, and different development techniques as well.

As an example, consider flat lists of floating-point values. This basic data structure, together with the constant need some type of quantification or rounding, feeds much of most composers' work with CSound, pd and the like. It is a good thing, therefore, that essentially all modern programming languages include tools for manipulating flat lists of floats out of the box, or in the standard library. But what happens when you want to think of pitch as something much more than integers for core values with, perhaps, floats for microtones? What if you want to work with pitches as fully-fledged objects? Objects capable of carrying arbitrarily large sets of attributes and values? Objects that might group together, first into sets, and then into larger assemblages, and then into still larger complexes of pitch information loaded, or even overloaded, with cross-relationships or textural implications? Carrying this surplus of information about pitch, or the potential uses of pitch, in data structures limited to, or centered around, the list-of-floats paradigm then becomes a burden.

And what of working with rhythms not only as offset values, as implied by the list-of-floats approach, but as arbitrarily nested, stretched, compressed and stacked sets of values, as allowed by the tupleting and measure structures of conventional score? A different approach is needed.

There was, and still is, no reason to believe that general purpose programming languages and development tools should come readily supplied with the objects and methods most suitable for composerly applications. And this means that the attributes of a domain-specific language that will best meet the needs of composes interested in working formally with the full complement of capabilities in traditional score remains an open question.

We continued our work in score formalization independenly until 2005, Trevor in a system that would come to be called Lascaux, and Víctor in a system dubbed Cuepatlahto. We experimented with C, Mathematica and Matlab as the core programming languages driving our systems before settling independently on Python, Víctor out of experinece at MIT, where he was working on his masters at the Media Lab with Berry Vercoe, and Trevor out of the working necessities of a professional developer and engineer.

We passed through indepedent experiences using Finale, Sibelius, Leland Smith's SCORE, and even Adobe Illustrator as the notational rendering engines for Lascaux and Cuepatlahto. Through all of this, both systems were designed to tackle a shared set of problems. These included:

1. The difficulty involved in transcribing larger scale and highly parameterized gestures and textures into traditional Western notation.
2. The general inflexbility of closed, commercial music notation software packages.
3. The relative inability of objects on the printed page in conventional score to point to each other — or, indeed, to other objects or ideas outside the printed page — in ways rich enough to help capture, model and develop long-range, nonlocal relationships throughout our scores.

Afer collaborating on a joint paper describing the two systems, and after discussing collaborative design and implementation at length, both online and in weekends' long review of our respective codebases, we decided to combine our efforts into a single, unified project. That project is now Abjad.

In our work on Abjad we strive to develop a powerful and flexible symbolic system. We picked the phrase 'formalized score control', or FSC, as a nod to Xenakis, who was so far ahead in so many ways, and also to highlight our primary project goal: to bring the full power of modern programming languages, and tools in mathematics, text processing, pattern recognition, and modular, iterative and incremental development to bear on all parts of the compositional process.

7.2 Why MIDI is not enough

Given that Abjad models written musical score, it might seem odd for MIDI to be even mentioned in this manual. Yet, until fairly recently, MIDI has played a role (sometimes tangential, other times fundamental) in a variety of software tools related to music notation and engraving.

7.2.1 A very brief overview of MIDI

MIDI (Musical Instrument Digital Interface) was first introduced in 1981 by Dave Smith, the founder of Sequential Circuits. The original purpose of MIDI was to allow the communication between different electronic musical instruments; more specifically, to allow one device to send **control** data to another device. Typical messages might be "note On" (play a *note*) "note Off" (turn off a *note*). A MIDI "note" message, for example, is composed of three bytes: the first byte (the Status byte) tells the device what kind of message this is (e.g. a Note On message). The second byte encodes key number (which key was pressed) and the third byte, velocity (how hard the key was pressed). It should be clear that a *Note* in this context means something very different than *Note* in the context of a traditional printed score. While the bias towards keyboard interfaces is clear in the definition of the MIDI Note control message, one can still give the MIDI note a more general use by reinterpreting "key number" as pitch and "velocity" as loudness, the usual perceptual correlates of these control changes as well as the most meaningful musical parameters in western music.

With the subsequent proliferation of music production software, the SMF (Standard Midi File) was introduced to allow the recording and storage of the control data from a MIDI stream. The SMF required a time stamp to keep track of when control messages took place. These are called "delta-times" in the SMF specification.

"The MTrk chunk type is where actual song data is stored. It is simply a stream of MIDI events (and non-MIDI events), preceded by delta-time values."

In combination with the MIDI Note message, the addition of duration now allowed one to have a minimal but sufficient **machine** representation–a machine score–of music requiring only these parameters: duration, pitch and loudness. Such is the case of most piano music.

7.2.2 Limitations of MIDI from the point of view of score modeling

But, alas, there is much more information in a printed score that can not be practically encoded in a SMF. Common musical notions such as meter, clef, key signature, articulation, to name only a few, are ignored. A desire to include some of these concepts in MIDI is evident in the inclusion of some so called *meta-events*. From the SMF specification:

" specifies non-MIDI information useful to this format or to sequencers." Examples of *meta-events* are *Time Signature* and *Key Signature*. In addition to the semantic elements just mentioned, there are also the typographical elements (such as line thickness, spacing, color, fonts, etc.) that all printed scores carry. This extra layer of information is completely absent in a SMF. However, from the point of view of encoding a printed score, the main limitation of MIDI is not the lack musical features or the absence of typographical data, but the assumption that musical durations, pitches and loudnesses can be each fully and efficiently encoded with integers or even fractions. In a printed score, this is not the case for any of them. MIDI encodes only *magnitudes*: time interval magnitudes, pitch interval magnitudes, velocity magnitudes. While these may be sufficient attributes for an automated piano performance, they are not all the attributes of notes in a printed score.

7.2.3 Written note durations vs. MIDI delta-times

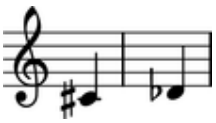
Assume a fixed tempo has been set. Assume that all magnitudes are represented with (and limited to) rational numbers. A time interval magnitude d = 1/4 has an infinity of equivalent representations in terms of magnitude: d = 1/4 = 1/8 * 2 = 1/8 + 1/16 * 2 ... etc. So, for example, while equivalent in magnitude, these are not the same notated durations:

```
>>> m1 = measuretools.AnonymousMeasure([Note("c'4")])
>>> m2 = measuretools.AnonymousMeasure(Note(0, (1, 8)) * 2)
>>> tietools.TieSpanner(m2)
TieSpanner(|1/4(2)|)
>>> m3 = measuretools.AnonymousMeasure([Note(0, (1, 8))] + Note(0, (1, 16)) * 2)
>>> tietools.TieSpanner(m3)
TieSpanner(|1/4(3)|)
>>> r = stafftools.RhythmicStaff([m1, m2, m3])

>>> show(r)
```

7.2.4 Written note pitch vs. MIDI note-on

A similar thing happens with pitches. In MIDI, key (pitch) number 61 is a half tone above middle C. But how is this pitch to be notated? As a C sharp or a B flat?

```
>>> m1 = measuretools.AnonymousMeasure([Note(1, (1, 4))])
>>> m2 = measuretools.AnonymousMeasure([Note(('df', 4), (1, 4))])
>>> r = Staff([m1, m2])

>>> show(r)
```



7.2.5 Conclusion

MIDI was not designed for score representation. MIDI is a simple communication protocol intended for real-time control. As such, it naturally lacks the adequate model to represent the full range of information found in printed scores.

7.3 Why LilyPond is right for Abjad

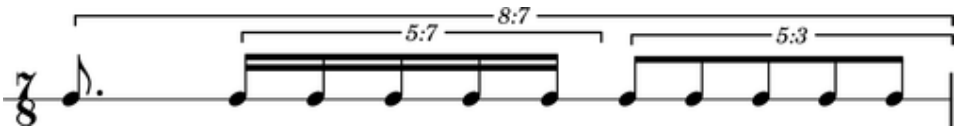
Early versions of Abjad wrote MIDI files for input to Finale and Sibelius. Later versions of Abjad wrote `.pbx` files for input into Leland Smith's SCORE. Over time we found LilyPond superior to Finale, Sibelius and SCORE.

7.3.1 Nested tuplets works out of the box

LilyPond uses a single construct to nest tuplets arbitrarily:

```
\new stafftools.RhythmicStaff {
    \time 7/8
    \times 7/8 {
        c8.
        \times 7/5 { c16 c16 c16 c16 c16 }
        \times 3/5 { c8 c8 c8 c8 c8 }
    }
}
```

```
>>> staff = stafftools.RhythmicStaff([Measure((7, 8), [])])
>>> measure = staff[0]
>>> measure.append(Note('c8.'))
>>> measure.append(Tuplet(Fraction(7, 5), 5 * Note('c16')))
>>> beamtools.BeamSpanner(measure[-1])
BeamSpanner({c16, c16, c16, c16, c16})
>>> measure.append(Tuplet(Fraction(3, 5), 5 * Note('c8')))
>>> beamtools.BeamSpanner(measure[-1])
BeamSpanner({c8, c8, c8, c8, c8})
>>> Tuplet(Fraction(7, 8), measure.music)
Tuplet(7/8, [c8., {* 5:7 c16, c16, c16, c16, c16 *}, {* 5:3 c8, c8, c8, c8, c8 *}])
>>> staff.override.tuplet_bracket.bracket_visibility = True
>>> staff.override.tuplet_bracket.padding = 1.6

>>> show(staff, docs=True)
```



LilyPond's tuplet input syntax works the same as any other recursive construct.

7.3.2 Broken tuplets work out of the box

LilyPond engraves tupletted notes interrupted by nontupletted notes correctly:

```
\new Staff {
    \times 4/7 { c'16 c'16 c'16 c'16 }
    c'8 c'8
    \times 4/7 { c'16 c'16 c'16 }
}
```

```
>>> t = Tuplet(Fraction(4, 7), Note(0, (1, 16)) * 4)
>>> notes = Note(0, (1, 8)) * 2
>>> u = Tuplet(Fraction(4, 7), Note(0, (1, 16)) * 3)
>>> beamtools.BeamSpanner(t)
BeamSpanner({c'16, c'16, c'16, c'16})
```

```
>>> beamtools.BeamSpanner(notes)
BeamSpanner(c'8, c'8)
>>> beamtools.BeamSpanner(u)
BeamSpanner({c'16, c'16, c'16})
>>> measure = Measure((4, 8), [t] + notes + [u])
>>> staff = stafftools.RhythmicStaff([measure])

>>> show(staff, docs=True)
```

7.3.3 Nonbinary meters work out of the box

The rhythm above rewrites with time signatures in place of tuplets:

```
\new Staff {
    \time 4/28 c'16 c'16 c'16 c'16 |
    \time 2/8  c'8  c'8 |
    \time 3/28 c'16 c'16 c'16 |
}
```

```
>>> t = Measure((4, 28), Note(0, (1, 16)) * 4)
>>> u = Measure((2, 8), Note(0, (1, 8)) * 2)
>>> v = Measure((3, 28), Note(0, (1, 16)) * 3)
>>> beamtools.BeamSpanner(t)
BeamSpanner(|4/28(4)|)
>>> beamtools.BeamSpanner(u)
BeamSpanner(|2/8(2)|)
>>> beamtools.BeamSpanner(v)
BeamSpanner(|3/28(3)|)
>>> staff = stafftools.RhythmicStaff([t, u, v])

>>> show(staff)
```

The time signatures `4/28` and `3/28` here have a denominator not equal to `4`, `8`, `16` or any other nonnegative integer power of two. Abjad calls such time signatures **nonbinary meters** and LilyPond engraves them correctly.

7.3.4 Lilypond models the musical measure correctly

Most engraving packages make the concept of the measure out to be more important than it should. We see evidence of this wherever an engraving package makes it difficult for either a long note or the notes of a tuplet to cross a barline. These difficulties come from working the idea of measure-as-container deep into object model of the package.

There is a competing way to model the musical measure that we might call the measure-as-background way of thinking about things. Western notation pratice started absent any concept of the barline, introduced the idea gradually, and has since retreated from the necessity of the convention. Engraving packages that pick out an understanding of the barline from the 18th or 19th centuries subscribe to the measure-as-container view of things and oversimplify the problem. One result of this is to render certain barline-crossing rhythmic figures either an inelegant hack or an outright impossibility. LilyPond eschews the measure-as-container model in favor of the measure-as-background model better able to handle both earlier and later notation practice.

7.4 LilyPond text alignment

LilyPond provides many ways to position text.

7.4.1 Default alignment

LilyPond left-aligns markup relative to the left edge of note heads by default.

```
>>> from abjad.tools import documentationtools

>>> staff = stafftools.RhythmicStaff('c')

>>> markuptools.Markup('XX', Up)(staff[0])

>>> lilypond_file = documentationtools.make_text_alignment_example_lilypond_file(staff)
>>> show(lilypond_file)
```

7.4.2 TextScript #'self-alignment-X

Use `#'self-alignment-X` to left-, center- or right-align markup relative to the left edge of note heads.

Note that changes to `#'self-alignment-X` do not change the fact that markup positioning is by default relative to the left edge of note heads.

```
>>> staff = stafftools.RhythmicStaff('c c c')

>>> markuptools.Markup('XX', Up)(staff[0])
>>> staff[0].override.text_script.self_alignment_X = 'left'
>>> markuptools.Markup('XX', Up)(staff[1])
>>> staff[1].override.text_script.self_alignment_X = 'center'
>>> markuptools.Markup('XX', Up)(staff[2])
>>> staff[2].override.text_script.self_alignment_X = 'right'

>>> lilypond_file = documentationtools.make_text_alignment_example_lilypond_file(staff)
>>> show(lilypond_file)
```

7.4.3 TextScript #'X-offset

Use `#'X-offset` to offset markup by some number of magic units in the horizontal direction.

Specify `#'X-offset` arguments as numbers like `#2.5`. Do not specify `#'X-offset` arguments as direction contstants like `#right`.

Note that changes to `#'X-offset` do not change the fact that markup positioning is by default relative to the left edge of note heads.

```
>>> staff = stafftools.RhythmicStaff('c c c c')
```

```
>>> markuptools.Markup('XX', Up)(staff[0])
>>> staff[0].override.text_script.X_offset = 0
>>> markuptools.Markup('XX', Up)(staff[1])
>>> staff[1].override.text_script.X_offset = 2
>>> markuptools.Markup('XX', Up)(staff[2])
>>> staff[2].override.text_script.X_offset = 4
>>> markuptools.Markup('XX', Up)(staff[3])
>>> staff[3].override.text_script.X_offset = 6

>>> lilypond_file = documentationtools.make_text_alignment_example_lilypond_file(staff)
>>> show(staff)
```

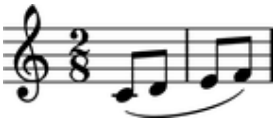
7.5 Score Snippet Gallery

Abjad uses a collection of score snippets in many places throughout the docs, tests and other parts of the codebase. Some of these are collected here.

7.5.1 Score snippet 1

This score features two measures with a beam spanner applied to each measure and a slur spanner applied to all the notes in the score:

```
>>> staff = Staff(r"abj: | 2/8 c'8 d'8 || 2/8 e'8 f'8 |")
>>> beamtools.apply_beam_spanners_to_measures_in_expr(staff)
[BeamSpanner(|2/8(2)|), BeamSpanner(|2/8(2)|)]
>>> spannertools.SlurSpanner(staff.leaves)
SlurSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8 [ (
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}

>>> show(staff)
```



Score snippet 1 is used widely in the component split tests.

7.6 Change log

7.6.1 Changes from 2.9 to 2.10

Renamed the read-only `format` property to `lilypond_format` on all system objects.

All iteration functions are now housed in the new `iterationtools` package:

- Renamed:

```
chordtools.iterate_chords_forward_in_expr()
chordtools.iterate_chords_backward_in_expr()

iterationtools.iterate_chords_in_expr(reverse=[True, False])
```

- Renamed:

```
componenttools.iterate_components_depth_first()
componenttools.iterate_components_forward_in_expr()
componenttools.iterate_components_backward_in_expr()
componenttools.iterate_namesakes_forward_from_component()
componenttools.iterate_namesakes_backward_from_component()
componenttools.iterate_thread_forward_from_component()
componenttools.iterate_thread_backward_from_component()
componenttools.iterate_thread_forward_in_expr()
componenttools.iterate_thread_backward_in_expr()
componenttools.iterate_timeline_forward_from_component()
componenttools.iterate_timeline_backward_from_component()
componenttools.iterate_timeline_forward_in_expr()
componenttools.iterate_timeline_backward_in_expr()

iterationtools.iterate_components_depth_first()
iterationtools.iterate_components_in_expr(reverse=[True, False])
iterationtools.iterate_namesakes_from_component(reverse=[True, False])
iterationtools.iterate_thread_from_component(reverse=[True, False])
iterationtools.iterate_thread_in_expr(reverse=[True, False])
iterationtools.iterate_timeline_from_component(reverse=[True, False])
iterationtools.iterate_timeline_in_expr(reverse=[True, False])
```

- Renamed:

```
containertools.iterate_containers_forward_in_expr()
containertools.iterate_containers_backward_in_expr()

iterationtools.iterate_containers_in_expr(reverse=[True, False])
```

- Renamed:

```
contexttools.iterate_contexts_forward_in_expr()
contexttools.iterate_contexts_backward_in_expr()

iterationtools.iterate_contexts_in_expr(reverse=[True, False])
```

- Renamed:

```
gracetools.iterate_components_and_grace_containers_forward_in_expr()

iterationtools.iterate_components_and_grace_containers_in_expr()
```

- Renamed:

```
leaftools.iterate_leaf_pairs_forward_in_expr()
leaftools.iterate_leaves_forward_in_expr()
leaftools.iterate_leaves_backward_in_expr()
leaftools.iterate_notes_and_chords_forward_in_expr()
leaftools.iterate_notes_and_chords_backward_in_expr()

iterationtools.iterate_leaf_pairs_in_expr()
iterationtools.iterate_leaves_in_expr(reverse=[True, False])
iterationtools.iterate_notes_and_chords_in_expr(reverse=[True, False])
```

- Renamed:

```
measuretools.iterate_measures_forward_in_expr()
measuretools.iterate_measures_backward_in_expr()

iterationtools.iterate_measures_in_expr(reverse=[True, False])
```

- Renamed:

```
notetools.iterate_notes_forward_in_expr()
notetools.iterate_notes_backward_in_expr()

iterationtools.iterate_notes_in_expr(reverse=[True, False])
```

- Renamed:

```
resttools.iterate_rests_forward_in_expr()
resttools.iterate_rests_backward_in_expr()

iterationtools.iterate_rests_in_expr(reverse=[True, False])
```

- Renamed:

```
scoretools.iterate_scores_forward_in_expr()
scoretools.iterate_scores_backward_in_expr()

iterationtools.iterate_scores_in_expr(reverse=[True, False])
```

- Renamed:

```
skiptools.iterate_skips_forward_in_expr()
skiptools.iterate_skips_backward_in_expr()

iterationtools.iterate_skips_in_expr(reverse=[True, False])
```

- Renamed:

```
stafftools.iterate_staves_forward_in_expr()
stafftools.iterate_staves_backward_in_expr()

iterationtools.iterate_staves_in_expr(reverse=[True, False])
```

- Renamed:

```
tuplettools.iterate_tuplets_forward_in_expr()
tuplettools.iterate_tuplets_backward_in_expr()
```

```
iterationtools.iterate_tuplets_in_expr(reverse=[True, False])
```

- Renamed:

```
voicetools.iterate_semantic_voices_forward_in_expr()
voicetools.iterate_semantic_voices_backward_in_expr()
voicetools.iterate_voices_forward_in_expr()
voicetools.iterate_voices_backward_in_expr()

voicetools.iterate_semantic_voices_in_expr(reverse=[True, False])
voicetools.iterate_voices_in_expr(reverse=[True, False])
```

All labeling functions are now housed in the new `labeltools` package:

- Renamed:

```
chordtools.color_chord_note_heads_in_expr_by_pitch_class_color_map()

labeltools.color_chord_note_heads_in_expr_by_pitch_class_color_map()
```

- Renamed:

```
containertools.color_contents_of_container()

labeltools.color_contents_of_container()
```

- Renamed:

```
leaftools.color_leaf()
leaftools.color_leaves_in_expr()
leaftools.label_leaves_in_expr_with_inversion_equivalent_chromatic_interval_classes()
leaftools.label_leaves_in_expr_with_leaf_depth()
leaftools.label_leaves_in_expr_with_leaf_durations()
leaftools.label_leaves_in_expr_with_leaf_indices()
leaftools.label_leaves_in_expr_with_leaf_numbers()
leaftools.label_leaves_in_expr_with_melodic_chromatic_interval_classes()
leaftools.label_leaves_in_expr_with_melodic_chromatic_intervals()
leaftools.label_leaves_in_expr_with_melodic_counterpoint_interval_classes()
leaftools.label_leaves_in_expr_with_melodic_counterpoint_intervals()
leaftools.label_leaves_in_expr_with_melodic_diatonic_interval_classes()
leaftools.label_leaves_in_expr_with_melodic_diatonic_intervals()
leaftools.label_leaves_in_expr_with_pitch_class_numbers()
leaftools.label_leaves_in_expr_with_pitch_numbers()
leaftools.label_leaves_in_expr_with_prolated_leaf_duration()
leaftools.label_leaves_in_expr_with_tuplet_depth()
leaftools.label_leaves_in_expr_with_written_leaf_duration()

labeltools.color_leaf()
labeltools.color_leaves_in_expr()
labeltools.label_leaves_in_expr_with_inversion_equivalent_chromatic_interval_classes()
labeltools.label_leaves_in_expr_with_leaf_depth()
labeltools.label_leaves_in_expr_with_leaf_durations()
labeltools.label_leaves_in_expr_with_leaf_indices()
labeltools.label_leaves_in_expr_with_leaf_numbers()
labeltools.label_leaves_in_expr_with_melodic_chromatic_interval_classes()
labeltools.label_leaves_in_expr_with_melodic_chromatic_intervals()
labeltools.label_leaves_in_expr_with_melodic_counterpoint_interval_classes()
labeltools.label_leaves_in_expr_with_melodic_counterpoint_intervals()
labeltools.label_leaves_in_expr_with_melodic_diatonic_interval_classes()
labeltools.label_leaves_in_expr_with_melodic_diatonic_intervals()
```

```
labeltools.label_leaves_in_expr_with_pitch_class_numbers()
labeltools.label_leaves_in_expr_with_pitch_numbers()
labeltools.label_leaves_in_expr_with_prolated_leaf_duration()
labeltools.label_leaves_in_expr_with_tuplet_depth()
labeltools.label_leaves_in_expr_with_written_leaf_duration()
```

- Renamed:

```
markuptools.remove_markup_from_leaves_in_expr()

labeltools.remove_markup_from_leaves_in_expr()
```

- Renamed:

```
measuretools.color_measure()
measuretools.color_nonbinary_measures_in_expr()

labeltools.color_measure()
labeltools.color_nonbinary_measures_in_expr()
```

- Renamed:

```
notetools.color_note_head_by_numbered_chromatic_pitch_class_color_map()
notetools.label_notes_in_expr_with_note_indices()

labeltools.color_note_head_by_numbered_chromatic_pitch_class_color_map()
labeltools.label_notes_in_expr_with_note_indices()
```

- Renamed:

```
tietools.label_tie_chains_in_expr_with_prolated_tie_chain_duration()
tietools.label_tie_chains_in_expr_with_tie_chain_durations()
tietools.label_tie_chains_in_expr_with_written_tie_chain_duration()

labeltools.label_tie_chains_in_expr_with_prolated_tie_chain_duration()
labeltools.label_tie_chains_in_expr_with_tie_chain_durations()
labeltools.label_tie_chains_in_expr_with_written_tie_chain_duration()
```

- Renamed:

```
verticalitytools.label_vertical_moments_in_expr_with_chromatic_interval_classes()
verticalitytools.label_vertical_moments_in_expr_with_chromatic_intervals()
verticalitytools.label_vertical_moments_in_expr_with_counterpoint_intervals()
verticalitytools.label_vertical_moments_in_expr_with_diatonic_intervals()
verticalitytools.label_vertical_moments_in_expr_with_interval_class_vectors()
verticalitytools.label_vertical_moments_in_expr_with_numbered_chromatic_pitch_classes()
verticalitytools.label_vertical_moments_in_expr_with_pitch_numbers()

labeltools.label_vertical_moments_in_expr_with_chromatic_interval_classes()
labeltools.label_vertical_moments_in_expr_with_chromatic_intervals()
labeltools.label_vertical_moments_in_expr_with_counterpoint_intervals()
labeltools.label_vertical_moments_in_expr_with_diatonic_intervals()
labeltools.label_vertical_moments_in_expr_with_interval_class_vectors()
labeltools.label_vertical_moments_in_expr_with_numbered_chromatic_pitch_classes()
labeltools.label_vertical_moments_in_expr_with_pitch_numbers()
```

Renamed all functions that contained `big_endian`:

```
durationtools.duration_token_to_big_endian_list_of_assignable_duration_pairs()
leaftools.fuse_leaves_big_endian()
leaftools.fuse_leaves_in_tie_chain_by_immediate_parent_big_endian()

durationtools.duration_token_to_assignable_duration_pairs()
leaftools.fuse_leaves()
leaftools.fuse_leaves_in_tie_chain_by_immediate_parent()
```

Renamed all functions that contained `prolated_offset` to simply `offset`:

```
componenttools.copy_governed_component_subtree_from_prolated_offset_to()
componenttools.get_improper_descendents_of_component_that_cross_prolated_offset()
containertools.delete_contents_of_container_starting_at_or_after_prolated_offset()
containertools.delete_contents_of_container_starting_before_or_at_prolated_offset()
containertools.delete_contents_of_container_starting_strictly_after_prolated_offset()
containertools.delete_contents_of_container_starting_strictly_before_prolated_offset()
containertools.get_element_starting_at_exactly_prolated_offset()
containertools.get_first_element_starting_at_or_after_prolated_offset()
containertools.get_first_element_starting_before_or_at_prolated_offset()
containertools.get_first_element_starting_strictly_after_prolated_offset()
containertools.get_first_element_starting_strictly_before_prolated_offset()
prolated_offsettools.update_offset_values_of_component()
verticalitytools.get_vertical_moment_at_prolated_offset_in_expr()

componenttools.copy_governed_component_subtree_from_offset_to()
componenttools.get_improper_descendents_of_component_that_cross_offset()
containertools.delete_contents_of_container_starting_at_or_after_offset()
containertools.delete_contents_of_container_starting_before_or_at_offset()
containertools.delete_contents_of_container_starting_strictly_after_offset()
containertools.delete_contents_of_container_starting_strictly_before_offset()
containertools.get_element_starting_at_exactly_offset()
containertools.get_first_element_starting_at_or_after_offset()
containertools.get_first_element_starting_before_or_at_offset()
containertools.get_first_element_starting_strictly_after_offset()
containertools.get_first_element_starting_strictly_before_offset()
offsettools.update_offset_values_of_component()
verticalitytools.get_vertical_moment_at_offset_in_expr()
```

Renamed `prolated_duration` to `offset` in some functions:

```
componenttools.split_component_at_prolated_duration()
componenttools.split_components_by_prolated_durations()
leaftools.split_leaf_at_prolated_duration()
leaftools.split_leaf_at_prolated_duration_and_rest_right_half()

componenttools.split_component_at_offset()
componenttools.split_components_by_offsets()
leaftools.split_leaf_at_offset()
leaftools.split_leaf_at_offset_and_rest_right_half()
```

Renamed all functions that contained `as_string`:

```
componenttools.report_component_format_contributions_as_string()
containertools.report_container_modifications_as_string()
measuretools.report_meter_distribution_as_string()

componenttools.report_component_format_contributions()
containertools.report_container_modifications()
measuretools.report_time_signature_distribution()
```

Changes to the `componenttools` package:

- The `componenttools.split_components_at_offsets()` function no longer implements a `tie_after` keyword. Use the new `tie_split_notes` and `tie_split_rests` keywords. Note that the new `tie_split_rests` keyword defaults to true where the old `tie_after` keyword defaulted to false. This changes the default behavior of the function.

- Renamed:

```
componenttools.extend_left_in_parent_of_component_and_grow_spanners()
componenttools.extend_left_in_parent_of_component_and_do_not_grow_spanners()

componenttools.extend_left_in_parent_of_component(grow_spanners=[True, False])
```

- Renamed:

```
componenttools.extend_in_parent_of_component_and_grow_spanners()
componenttools.extend_in_parent_of_component_and_do_not_grow_spanners()

componenttools.extend_in_parent_of_component(grow_spanners=[True, False])
```

- Renamed:

```
componenttools.number_is_between_prolated_start_and_stop_offsets_of_component()

componenttools.number_is_between_start_and_stop_offsets_of_component()
```

- Renamed:

```
componenttools.partition_components_cyclically_by_durations_in_seconds_exactly_with_overhang()
componenttools.partition_components_cyclically_by_durations_in_seconds_exactly_without_overhang(
componenttools.partition_components_cyclically_by_durations_in_seconds_ge_with_overhang()
componenttools.partition_components_cyclically_by_durations_in_seconds_ge_without_overhang()
componenttools.partition_components_cyclically_by_durations_in_seconds_le_with_overhang()
componenttools.partition_components_cyclically_by_durations_in_seconds_le_without_overhang()
componenttools.partition_components_cyclically_by_prolated_durations_exactly_with_overhang()
componenttools.partition_components_cyclically_by_prolated_durations_exactly_without_overhang()
componenttools.partition_components_cyclically_by_prolated_durations_ge_with_overhang()
componenttools.partition_components_cyclically_by_prolated_durations_ge_without_overhang()
componenttools.partition_components_cyclically_by_prolated_durations_le_with_overhang()
componenttools.partition_components_cyclically_by_prolated_durations_le_without_overhang()
componenttools.partition_components_once_by_durations_in_seconds_exactly_with_overhang()
componenttools.partition_components_once_by_durations_in_seconds_exactly_without_overhang()
componenttools.partition_components_once_by_durations_in_seconds_ge_with_overhang()
componenttools.partition_components_once_by_durations_in_seconds_ge_without_overhang()
componenttools.partition_components_once_by_durations_in_seconds_le_with_overhang()
componenttools.partition_components_once_by_durations_in_seconds_le_without_overhang()
componenttools.partition_components_once_by_prolated_durations_exactly_with_overhang()
componenttools.partition_components_once_by_prolated_durations_exactly_without_overhang()
componenttools.partition_components_once_by_prolated_durations_ge_with_overhang()
componenttools.partition_components_once_by_prolated_durations_ge_without_overhang()
componenttools.partition_components_once_by_prolated_durations_le_with_overhang()
componenttools.partition_components_once_by_prolated_durations_le_without_overhang()

componenttools.partition_components_by_durations_exactly()
componenttools.partition_components_by_durations_ge()
componenttools.partition_components_by_durations_le()
```

- Renamed:

```
componenttools.split_component_at_prolated_duration_and_do_not_fracture_crossing_spanners()
componenttools.split_component_at_prolated_duration_and_fracture_crossing_spanners()

componenttools.split_component_at_offset(fracture_spanners=[True, False])
```

- Renamed:

```
componenttools.split_components_cyclically_by_prolated_durations_and_do_not_fracture_crossing_sp
componenttools.split_components_cyclically_by_prolated_durations_and_fracture_crossing_spanners(
componenttools.split_components_once_by_prolated_durations_and_do_not_fracture_crossing_spanners
componenttools.split_components_once_by_prolated_durations_and_fracture_crossing_spanners()

componenttools.split_components_at_offsets(fracture_spanners=[True, False], cyclic=[True, False]
```

Changeds to the `continertools` package:

- Renamed:

```
containertools.remove_empty_containers_in_expr()

containertools.remove_leafless_containers_in_expr()
```

- Renamed:

```
containertools.replace_larger_left_half_of_elements_in_container_with_big_endian_rests()
containertools.replace_larger_left_half_of_elements_in_container_with_little_endian_rests()
containertools.replace_larger_right_half_of_elements_in_container_with_big_endian_rests()
containertools.replace_larger_right_half_of_elements_in_container_with_little_endian_rests()
containertools.replace_n_edge_elements_in_container_with_big_endian_rests()
containertools.replace_n_edge_elements_in_container_with_little_endian_rests()
containertools.replace_n_edge_elements_in_container_with_rests()
containertools.replace_smaller_left_half_of_elements_in_container_with_big_endian_rests()
containertools.replace_smaller_left_half_of_elements_in_container_with_little_endian_rests()
containertools.replace_smaller_right_half_of_elements_in_container_with_big_endian_rests()
containertools.replace_smaller_right_half_of_elements_in_container_with_little_endian_rests()

containertools.replace_container_slice_with_rests()
```

- Renamed:

```
containertools.split_container_at_index_and_do_not_fracture_crossing_spanners()
containertools.split_container_at_index_and_fracture_crossing_spanners()

containertools.split_container_at_index(fracture_spanners=[True, False])
```

- Renamed:

```
containertools.split_container_cyclically_by_counts_and_do_not_fracture_crossing_spanners()
containertools.split_container_cyclically_by_counts_and_fracture_crossing_spanners()
containertools.split_container_once_by_counts_and_do_not_fracture_crossing_spanners()
containertools.split_container_once_by_counts_and_fracture_crossing_spanners()

containertools.split_container_by_counts(fracture_spanners=[True, False], cyclic=[True, False])
```

Changes to the `durationtools` package:

- Renamed:

```
durationtools.yield_all_assignable_rationals_in_cantor_diagonalized_order()
durationtools.yield_all_positive_integer_pairs_in_cantor_diagonalized_order()
```

```
durationtools.yield_all_positive_rationals_in_cantor_diagonalized_order()
durationtools.yield_all_positive_rationals_in_cantor_diagonalized_order_uniquely()
durationtools.yield_all_prolation_rewrite_pairs_of_rational_in_cantor_diagonalized_order()

durationtools.yield_all_assignable_rationals()
durationtools.yield_all_positive_integer_pairs()
durationtools.yield_all_positive_rationals()
durationtools.yield_all_positive_rationals_uniquely()
durationtools.yield_prolation_rewrite_pairs()
```

Changes to the `instrumenttools` package:

- Renamed:

```
instrumenttools.transpose_notes_and_chords_in_expr_from_sounding_pitch_to_fingered_pitch()

instrumenttools.transpose_from_sounding_pitch_to_fingered_pitch()
```

- Renamed:

```
instrumenttools.transpose_notes_and_chords_in_expr_from_fingered_pitch_to_sounding_pitch()

instrumenttools.transpose_from_fingered_pitch_to_sounding_pitch()
```

Chnages to the `leaftools` package:

- Renamed:

```
leaftools.fuse_leaves_in_container_once_by_counts_into_big_endian_notes()
leaftools.fuse_leaves_in_container_once_by_counts_into_big_endian_rests()
leaftools.fuse_leaves_in_container_once_by_counts_into_little_endian_notes()
leaftools.fuse_leaves_in_container_once_by_counts_into_little_endian_rests()

leaftools.fuse_leaves_in_container_once_by_counts(big_endian=[True, False], klass=None)
```

- Renamed:

```
leaftools.leaf_to_augmented_tuplet_with_n_notes_of_equal_written_duration()
leaftools.leaf_to_augmented_tuplet_with_proportions()
leaftools.leaf_to_diminished_tuplet_with_n_notes_of_equal_written_duration()
leaftools.leaf_to_diminished_tuplet_with_proportions()

tuplettools.leaf_to_tuplet_with_n_notes_of_equal_written_duration()
tuplettools.leaf_to_tuplet_with_proportions()
```

- Renamed:

```
leaftools.split_leaf_at_offset_and_rest_right_half()

leaftools.rest_leaf_at_offset()
```

- Renamed:

```
leaftools.repeat_leaf_and_extend_spanners()
leaftools.repeat_leaves_in_expr_and_extend_spanners()

leaftools.repeat_leaf()
leaftools.repeat_leaves_in_expr()
```

Changes to the `mathtools` package.

- Removed `mathtools.partition_integer_into_thirds()`.

Changes to the `measuretools` package:

- Renamed:

```
measuretools.fill_measures_in_expr_with_meter_denominator_notes()
measuretools.move_prolation_of_full_measure_tuplet_to_meter_of_measure()
measuretools.multiply_contents_of_measures_in_expr_and_scale_meter_denominators()
measuretools.scale_measure_by_multiplier_and_adjust_meter()

measuretools.fill_measures_in_expr_with_time_signature_denominator_notes()
measuretools.move_full_measure_tuplet_prolation_to_measure_time_signature()
measuretools.multiply_contents_of_measures_in_expr_and_scale_time_signature_denominators()
measuretools.scale_measure_and_adjust_time_signature()
```

- Renamed:

```
measuretools.fill_measures_in_expr_with_big_endian_notes()
measuretools.fill_measures_in_expr_with_litte_endian_notes()

measuretools.measuretools.fill_measures_in_expr_with_minimal_number_of_notes(big_endian=[True, F
```

- Renamed:

```
measuretools.extend_measures_in_expr_and_apply_full_measure_tuplets_to_measure_contents()

measuretoools.extend_measures_in_expr_and_apply_full_measure_tuplets()
```

- Renamed:

```
measuretools.get_prev_measure_from_component()

measuretools.get_previous_measure_from_component()
```

- Renamed:

```
measuretools.multiply_contents_of_measures_in_expr_and_scale_time_signature_denominators()

measuretools.multiply_and_scale_contents_of_measures_in_expr()
```

- Renamed:

```
measuretools.pitch_array_row_to_measure()
measuretools.pitch_array_to_measures()

pitchtools.pitch_array_row_to_measure()
pitchtools.pitch_array_to_measures()
```

Changes to the `pitchtools` package:

- Renamed:

```
pitchtools.calculate_harmonic_chromatic_interval_class_from_pitch_carrier_to_pitch_carrier()
pitchtools.calculate_harmonic_chromatic_interval_from_pitch_carrier_to_pitch_carrier()
pitchtools.calculate_harmonic_counterpoint_interval_class_from_named_chromatic_pitch_to_named_ch
pitchtools.calculate_harmonic_counterpoint_interval_from_named_chromatic_pitch_to_named_chromati
pitchtools.calculate_harmonic_diatonic_interval_class_from_named_chromatic_pitch_to_named_chroma
pitchtools.calculate_harmonic_diatonic_interval_from_named_chromatic_pitch_to_named_chromatic_pi
```

```
pitchtools.calculate_harmonic_chromatic_interval_class()
pitchtools.calculate_harmonic_chromatic_interval()
pitchtools.calculate_harmonic_counterpoint_interval_class()
pitchtools.calculate_harmonic_counterpoint_interval()
pitchtools.calculate_harmonic_diatonic_interval_class()
pitchtools.calculate_harmonic_diatonic_interval()
```

- Renamed:

```
pitchtools.calculate_melodic_chromatic_interval_class_from_pitch_carrier_to_pitch_carrier()
pitchtools.calculate_melodic_chromatic_interval_from_pitch_carrier_to_pitch_carrier()
pitchtools.calculate_melodic_counterpoint_interval_class_from_named_chromatic_pitch_to_named_chr
pitchtools.calculate_melodic_counterpoint_interval_from_named_chromatic_pitch_to_named_chromatic
pitchtools.calculate_melodic_diatonic_interval_class_from_named_chromatic_pitch_to_named_chromat
pitchtools.calculate_melodic_diatonic_interval_from_named_chromatic_pitch_to_named_chromatic_pit

pitchtools.calculate_melodic_chromatic_interval_class()
pitchtools.calculate_melodic_chromatic_interval()
pitchtools.calculate_melodic_counterpoint_interval_class()
pitchtools.calculate_melodic_counterpoint_interval()
pitchtools.calculate_melodic_diatonic_interval_class()
pitchtools.calculate_melodic_diatonic_interval()
```

- Renamed:

```
pitchtools.chromatic_pitch_class_name_to_diatonic_pitch_class_name_alphabetic_accidental_abbrevi

pitchtools.split_chromatic_pitch_class_name()
```

- Renamed:

```
pitchtools.diatonic_interval_number_and_chromatic_interval_number_to_melodic_diatonic_interval()

pitchtools.spell_chromatic_interval_number()
```

- Renamed:

```
pitchtools.named_chromatic_pitches_to_harmonic_chromatic_interval_class_number_dictionary()

pitchtools.harmonic_chromatic_interval_class_number_dictionary()
```

- Renamed:

```
pitchtools.chromatic_pitch_number_diatonic_pitch_class_name_to_alphabetic_accidental_abbreviatic

pitchtools.chromatic_pitch_number_diatonic_pitch_class_name_to_accidental_octave_number_pair()
```

- Renamed:

```
pitchtools.list_named_chromatic_pitch_carriers_in_expr_sorted_by_numbered_chromatic_pitch_class(

pitchtools.sort_named_chromatic_pitch_carriers_in_expr()
```

- Renamed:

```
pitchtools.named_chromatic_pitches_to_inversion_equivalent_chromatic_interval_class_number_dicti

pitchtools.inversion_equivalent_chromatic_interval_class_number_dictionary()
```

- Renamed:

pitchtools.transpose_chromatic_pitch_class_number_by_octaves_to_nearest_neighbor_of_chromatic_pi

pitchtools.transpose_chromatic_pitch_class_number_to_neighbor_of_chromatic_pitch_number()

- Renamed:

pitchtools.ordered_chromatic_pitch_class_numbers_are_within_ordered_chromatic_pitch_numbers()

pitchtools.contains_subsegment()

- Renamed:

pitchtools.list_inversion_equivalent_chromatic_interval_classes_pairwise_between_pitch_carriers(

pitchtools.list_inversion_equivalent_chromatic_interval_classes_pairwise()

- Renamed:

pitchtools.list_melodic_chromatic_interval_numbers_pairwise_between_pitch_carriers()

pitchtools.list_melodic_chromatic_interval_numbers_pairwise()

- Renamed:

pitchtools.chromatic_pitch_number_to_diatonic_pitch_class_name_accidental_octave_number_triple()

pitchtools.chromatic_pitch_number_to_chromatic_pitch_triple()

- Renamed:

pitchtools.apply_octavation_spanner_to_pitched_components()

spannertools.apply_octavation_spanner_to_pitched_components()

- Renamed:

pitchtools.set_ascending_named_chromatic_pitches_on_nontied_pitched_components_in_expr()

pitchtools.set_ascending_named_chromatic_pitches_on_tie_chains_in_expr()

- Renamed:

pitchtools.set_ascending_diatonic_pitches_on_nontied_pitched_components_in_expr()

pitchtools.set_ascending_diatonic_pitches_on_tie_chains_in_expr()

- Renamed:

pitchtools.transpose_chromatic_pitch_class_number_to_neighbor_of_chromatic_pitch_number()

pitchtools.transpose_chromatic_pitch_class_number_chromatic_pitch_number_neighbor()

Changes to the `rhythmtreetools` package:

- Renamed:

rhythmtreetools.parse_reduced_ly_syntax()

lilypondparsertools.parse_reduced_ly_syntax()

Chnages to the `scoretemplatetools` package:

- Renamed:

```
scoretemplatetools.GroupedRhythmcStavesScoreTemplate.n

scoretemplatetools.GroupedRhythmcStavesScoreTemplate.staff_count
```

Changes to the `scoretools` package:

- Renamed:

```
scoretools.make_pitch_array_score_from_pitch_arrays()

pitchtools.make_pitch_array_score_from_pitch_arrays()
```

Changes to the `sequencetools` package:

- Renamed:

```
sequencetools.partition_sequence_cyclically_by_counts_with_overhang()
sequencetools.partition_sequence_cyclically_by_counts_without_overhang()
sequencetools.partition_sequence_once_by_counts_with_overhang()
sequencetools.partition_sequence_once_by_counts_without_overhang()

sequencetools.partition_sequence_by_counts(cyclic=[True, False], overhang=[True, False])
```

- Renamed:

```
sequencetools.partition_sequence_extended_to_counts_with_overhang()
sequencetools.partition_sequence_extended_to_counts_without_overhang()

sequencetools.partition_sequence_extended_to_counts(overhang=[True, False])
```

- Renamed:

```
sequencetools.partition_sequence_cyclically_by_weights_at_least_with_overhang()
sequencetools.partition_sequence_cyclically_by_weights_at_least_without_overhang()
sequencetools.partition_sequence_once_by_weights_at_least_with_overhang()
sequencetools.partition_sequence_once_by_weights_at_least_without_overhang()

sequencetools.partition_sequence_by_weights_at_least()
```

- Renamed:

```
sequencetools.partition_sequence_cyclically_by_weights_at_most_with_overhang()
sequencetools.partition_sequence_cyclically_by_weights_at_most_without_overhang()
sequencetools.partition_sequence_once_by_weights_at_most_with_overhang()
sequencetools.partition_sequence_once_by_weights_at_most_without_overhang()

sequencetools.partition_sequence_by_weights_at_most()
```

- Renamed:

```
sequencetools.partition_sequence_cyclically_by_weights_at_exactly_with_overhang()
sequencetools.partition_sequence_cyclically_by_weights_at_exactly_without_overhang()
sequencetools.partition_sequence_once_by_weights_at_exactly_with_overhang()
sequencetools.partition_sequence_once_by_weights_at_exactly_without_overhang()

sequencetools.partition_sequence_by_weights_at_exactly()
```

- Renamed:

```
sequencetools.split_sequence_cyclically_by_weights_with_overhang()
sequencetools.split_sequence_cyclically_by_weights_without_overhang()
sequencetools.split_sequence_once_by_weights_with_overhang()
sequencetools.split_sequence_once_by_weights_without_overhang()

sequencetools.split_sequence_by_weights()
```

- Renamed:

```
sequencetools.split_sequence_extended_to_weights_with_overhang()
sequencetools.split_sequence_extended_to_weights_without_overhang()

sequencetools.split_sequence_extended_to_weights()
```

Changes to the `tietools` package:

- Renamed:

```
tietools.tie_chain_to_augmented_tuplet_with_proportions_and_avoid_dots()
tietools.tie_chain_to_augmented_tuplet_with_proportions_and_encourage_dots()
tietools.tie_chain_to_diminished_tuplet_with_proportions_and_avoid_dots()
tietools.tie_chain_to_diminished_tuplet_with_proportions_and_encourage_dots()

tietools.tie_chain_to_tuplet_with_proportions()
```

- Renamed:

```
tietools.iterate_nontrivial_tie_chains_forward_in_expr()
tietools.iterate_nontrivial_tie_chains_backward_in_expr()
tietools.iterate_pitched_tie_chains_forward_in_expr()
tietools.iterate_pitched_tie_chains_backward_in_expr()
tietools.iterate_tie_chains_forward_in_expr()
tietools.iterate_tie_chains_backward_in_expr()

tietools.iterate_nontrivial_tie_chains_in_expr(reverse=[True, False])
tietools.iterate_pitched_tie_chains_in_expr(reverse=[True, False])
tietools.iterate_tie_chains_in_expr(reverse=[True, False])
```

Changes to the `tuplettools` package:

- Renamed:

```
tuplettools.is_proper_tuplet_multiplier()

durationtools.is_proper_tuplet_multiplier()
```

- Renamed:

```
tuplettools.make_augmented_tuplet_from_duration_and_proportions_and_avoid_dots()
tuplettools.make_diminished_tuplet_from_duration_and_proportions_and_avoid_dots()
tuplettools.make_augmented_tuplet_from_duration_and_proportions_and_encourage_dots()
tuplettools.make_diminished_tuplet_from_duration_and_proportions_and_encourage_dots()

tuplettools.make_tuplet_from_durations_and_proportions(big_endian=[True, False])
```

Removed three packages.

- Removed `constrainttools` package.
- Removed `lyricstools` package.
- Removed `quantizationtools` package.

7.7 Bibliography

CHAPTER

EIGHT

ABJAD API

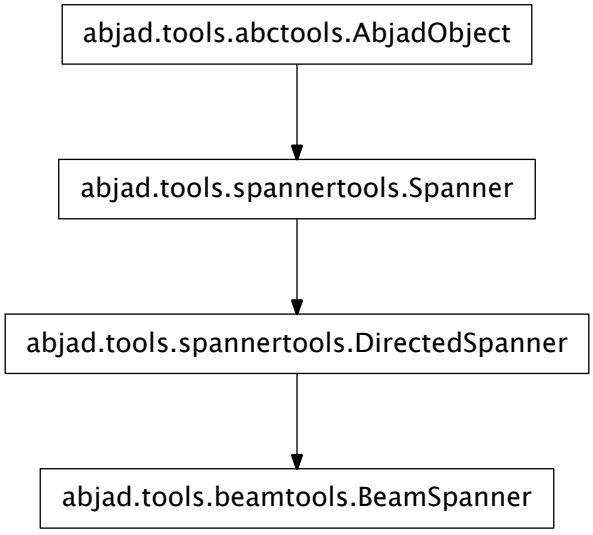
8.1 Abjad API

8.1.1 Composition packages

beamtools

concrete classes

beamtools.BeamSpanner



class beamtools.**BeamSpanner**(*components=None*, *direction=None*)

Abjad beam spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'2")

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
    g'2
}

>>> beamtools.BeamSpanner(staff[:4])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
    g'2
}
```

Return beam spanner.

Read-only Properties

BeamSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

BeamSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

BeamSpanner.**leaves**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

BeamSpanner.**override**

LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

BeamSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

BeamSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

BeamSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

BeamSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

BeamSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

BeamSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

BeamSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

BeamSpanner.**direction**
Inherited from spannertools.DirectedSpanner

Methods

BeamSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

BeamSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`BeamSpanner.`**`clear`**`()`

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from `spannertools.Spanner`

`BeamSpanner.`**`extend`**`(`*components*`)`

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`BeamSpanner.`**`extend_left`**`(`*components*`)`

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

BeamSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

BeamSpanner.**fuse**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

BeamSpanner.**index**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from spannertools.Spanner

BeamSpanner.**pop**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

BeamSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

BeamSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

BeamSpanner.**__contains__**(*expr*)
Inherited from spannertools.Spanner

BeamSpanner.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

BeamSpanner.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BeamSpanner.**__getitem__**(*expr*)
Inherited from spannertools.Spanner

BeamSpanner.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BeamSpanner.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BeamSpanner.**__len__**()
Inherited from spannertools.Spanner

BeamSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

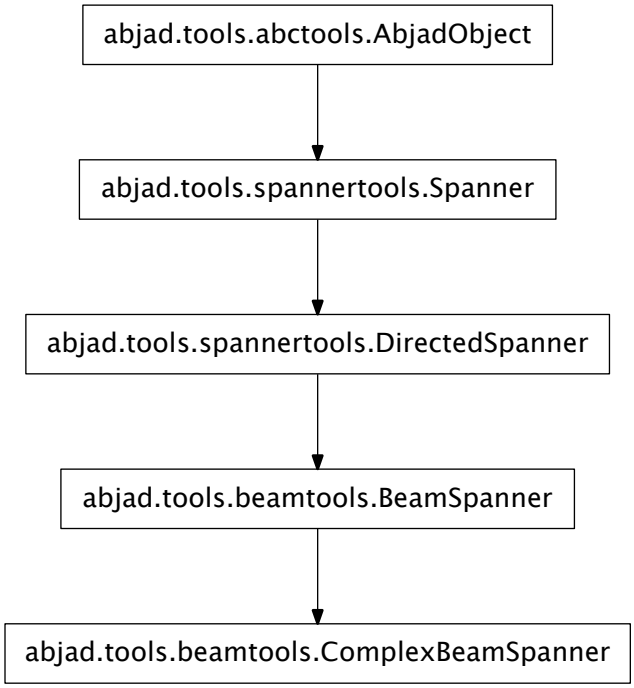
BeamSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

BeamSpanner.**__repr__**()
Inherited from spannertools.Spanner

beamtools.ComplexBeamSpanner



class beamtools.**ComplexBeamSpanner**(*components=None*, *lone=False*, *direction=None*)

Abjad complex beam spanner:

```
>>> staff = Staff("c'16 e'16 r16 f'16 g'2")

>>> f(staff)
\new Staff {
    c'16
    e'16
    r16
    f'16
    g'2
}

>>> beamtools.ComplexBeamSpanner(staff[:4])
ComplexBeamSpanner(c'16, e'16, r16, f'16)

>>> f(staff)
\new Staff {
    \set stemLeftBeamCount = #0
    \set stemRightBeamCount = #2
    c'16 [
    \set stemLeftBeamCount = #2
    \set stemRightBeamCount = #2
    e'16 ]
```

```
        r16
        \set stemLeftBeamCount = #2
        \set stemRightBeamCount = #0
        f'16 [ ]
        g'2
    }
```

Return complex beam spanner.

Read-only Properties

ComplexBeamSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

ComplexBeamSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**leaves**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**override**

LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**preprolated_duration**

Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**prolated_duration**

Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**set**

LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**start_offset**

Read-only start offset of spanner.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

ComplexBeamSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

ComplexBeamSpanner.**direction**
Inherited from spannertools.DirectedSpanner

ComplexBeamSpanner.**lone**
Beam lone leaf and force beam nibs to left:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone='left')

>>> f(note)
\set stemLeftBeamCount = #2
\set stemRightBeamCount = #0
c'16 [ ]
```

Beam lone leaf and force beam nibs to right:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone='right')

>>> f(note)
\set stemLeftBeamCount = #0
\set stemRightBeamCount = #2
c'16 [ ]
```

Beam lone leaf and force beam nibs to both left and right:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone='both')

>>> f(note)
\set stemLeftBeamCount = #2
\set stemRightBeamCount = #2
c'16 [ ]
```

Beam lone leaf and accept LilyPond default nibs at both left and right:

```
>>> note = Note("c'16")
```

```
>>> beam = beamtools.ComplexBeamSpanner([note], lone=True)

>>> f(note)
\set stemLeftBeamCount = #2
\set stemRightBeamCount = #2
c'16 [ ]
```

Do not beam lone leaf:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone=False)

>>> f(note)
c'16
```

Set to `'left'`, `'right'`, `'both'`, true or false as shown above.

Ignore this setting when spanner contains more than one leaf.

Methods

`ComplexBeamSpanner.`**`append`**`(`*component*`)`

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from `spannertools.Spanner`

`ComplexBeamSpanner.`**`append_left`**`(`*component*`)`

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`ComplexBeamSpanner.`**`clear`**`()`

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are Left, Right and None.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`ComplexBeamSpanner.`**`fuse`**`(`*`spanner`*`)`
Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`ComplexBeamSpanner.`**`index`**`(`*`component`*`)`
Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`ComplexBeamSpanner.`**`pop`**`()`
Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

ComplexBeamSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

ComplexBeamSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

ComplexBeamSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ComplexBeamSpanner.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ComplexBeamSpanner.**__getitem__**(*expr*)
Inherited from spannertools.Spanner

ComplexBeamSpanner.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ComplexBeamSpanner.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ComplexBeamSpanner.**__len__**()
Inherited from spannertools.Spanner

ComplexBeamSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

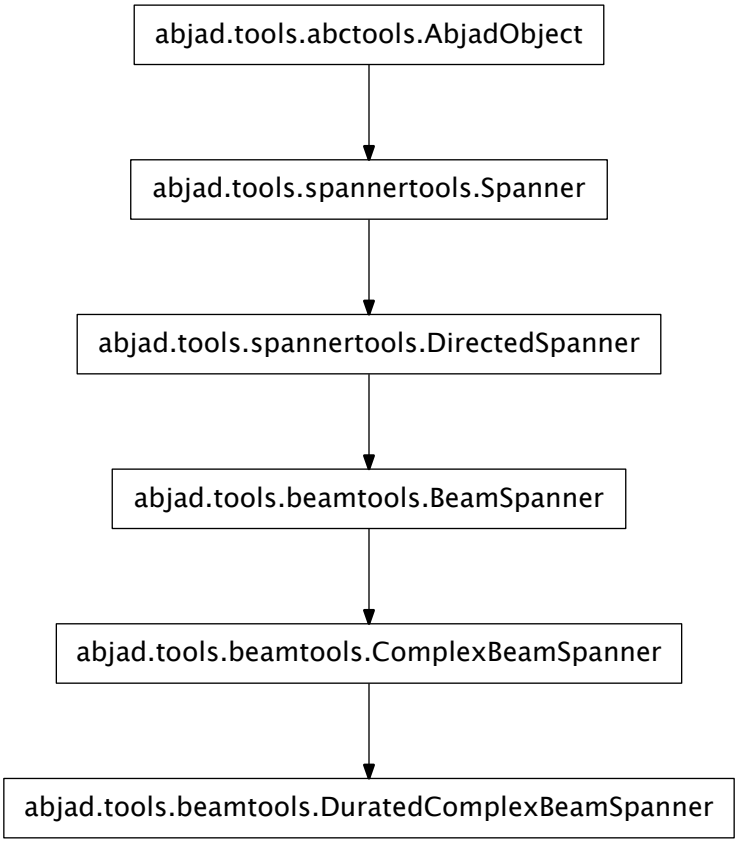
ComplexBeamSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ComplexBeamSpanner.**__repr__**()
Inherited from spannertools.Spanner

beamtools.DuratedComplexBeamSpanner



class beamtools.**DuratedComplexBeamSpanner**(*components=None*, *durations=None*, *span=1*, *lone=False*, *direction=None*)

Abjad durated complex beam spanner:

```
staff = Staff("c'16 d'16 e'16 f'16")

durations = [Duration(1, 8), Duration(1, 8)]
beam = beamtools.DuratedComplexBeamSpanner(staff[:], durations, 1)

f(staff)
\new Staff {
    \set stemLeftBeamCount = #0
    \set stemRightBeamCount = #2
    c'16 [
    \set stemLeftBeamCount = #2
    \set stemRightBeamCount = #1
    d'16
    \set stemLeftBeamCount = #1
    \set stemRightBeamCount = #2
    e'16
```

```
        \set stemLeftBeamCount = #2
        \set stemRightBeamCount = #0
        f'16 ]
    }
```

Beam all beamable leaves in spanner explicitly.

Group leaves in spanner according to *durations*.

Span leaves between duration groups according to *span*.

Return durated complex beam spanner.

Read-only Properties

DuratedComplexBeamSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**leaves**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**override**

LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**preprolated_duration**

Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**prolated_duration**

Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**set**

LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

DuratedComplexBeamSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

DuratedComplexBeamSpanner.**direction**
Inherited from spannertools.DirectedSpanner

DuratedComplexBeamSpanner.**durations**
Get spanner leaf group durations:

```
>>> staff = Staff("c'16 d'16 e'16 f'16")
>>> durations = [Duration(1, 8), Duration(1, 8)]
>>> beam = beamtools.DuratedComplexBeamSpanner(staff[:], durations)
>>> beam.durations
[Duration(1, 8), Duration(1, 8)]
```

Set spanner leaf group durations:

```
>>> staff = Staff("c'16 d'16 e'16 f'16")
>>> durations = [Duration(1, 8), Duration(1, 8)]
>>> beam = beamtools.DuratedComplexBeamSpanner(staff[:], durations)
>>> beam.durations = [Duration(1, 4)]
>>> beam.durations
[Duration(1, 4)]
```

Set iterable.

DuratedComplexBeamSpanner.**lone**
Beam lone leaf and force beam nibs to left:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone='left')

>>> f(note)
\set stemLeftBeamCount = #2
\set stemRightBeamCount = #0
c'16 [ ]
```

Beam lone leaf and force beam nibs to right:

```
>>> note = Note("c'16")
```

```
>>> beam = beamtools.ComplexBeamSpanner([note], lone='right')

>>> f(note)
\set stemLeftBeamCount = #0
\set stemRightBeamCount = #2
c'16 [ ]
```

Beam lone leaf and force beam nibs to both left and right:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone='both')

>>> f(note)
\set stemLeftBeamCount = #2
\set stemRightBeamCount = #2
c'16 [ ]
```

Beam lone leaf and accept LilyPond default nibs at both left and right:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone=True)

>>> f(note)
\set stemLeftBeamCount = #2
\set stemRightBeamCount = #2
c'16 [ ]
```

Do not beam lone leaf:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone=False)

>>> f(note)
c'16
```

Set to `'left'`, `'right'`, `'both'`, true or false as shown above.

Ignore this setting when spanner contains more than one leaf.

Inherited from `beamtools.ComplexBeamSpanner`

`DuratedComplexBeamSpanner.`**`span`**

Get top-level beam count:

```
>>> staff = Staff("c'16 d'16 e'16 f'16")
>>> durations = [Duration(1, 8), Duration(1, 8)]
>>> beam = beamtools.DuratedComplexBeamSpanner(staff[:], durations, 1)
>>> beam.span
1
```

Set top-level beam count:

```
>>> staff = Staff("c'16 d'16 e'16 f'16")
>>> durations = [Duration(1, 8), Duration(1, 8)]
>>> beam = beamtools.DuratedComplexBeamSpanner(staff[:], durations, 1)
>>> beam.span = 2
>>> beam.span
2
```

Set nonnegative integer.

Methods

DuratedComplexBeamSpanner.**append**(*component*)

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)
```

```
>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`DuratedComplexBeamSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`DuratedComplexBeamSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`DuratedComplexBeamSpanner.`**`fuse`**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])
```

```
>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`DuratedComplexBeamSpanner.`**`index`**`(`*component*`)`

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`DuratedComplexBeamSpanner.`**`pop`**`()`

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from `spannertools.Spanner`

`DuratedComplexBeamSpanner.`**`pop_left`**`()`

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
```

```
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from `spannertools.Spanner`

Special Methods

`DuratedComplexBeamSpanner.__call__(expr)`

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from `spannertools.Spanner`

`DuratedComplexBeamSpanner.__contains__(expr)`

Inherited from `spannertools.Spanner`

`DuratedComplexBeamSpanner.__eq__(arg)`

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`DuratedComplexBeamSpanner.__ge__(arg)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`DuratedComplexBeamSpanner.__getitem__(expr)`

Inherited from `spannertools.Spanner`

`DuratedComplexBeamSpanner.__gt__(arg)`

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

DuratedComplexBeamSpanner.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DuratedComplexBeamSpanner.__**len**__()
Inherited from spannertools.Spanner

DuratedComplexBeamSpanner.__**lt**__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

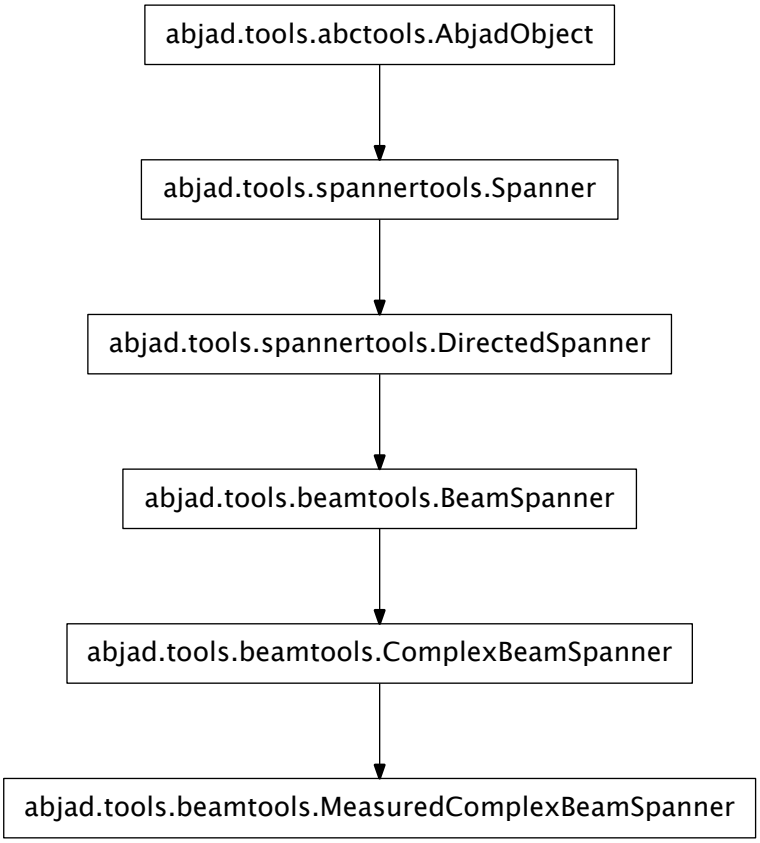
DuratedComplexBeamSpanner.__**ne**__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DuratedComplexBeamSpanner.__**repr**__()
Inherited from spannertools.Spanner

beamtools.MeasuredComplexBeamSpanner



class beamtools.**MeasuredComplexBeamSpanner**(*components=None*, *lone=False*, *span=1*, *direction=None*)

Abjad measured complex beam spanner:

```
>>> staff = Staff([Measure((2, 16), "c'16 d'16"), Measure((2, 16), "e'16 f'16")])

>>> beamtools.MeasuredComplexBeamSpanner(staff.leaves)
MeasuredComplexBeamSpanner(c'16, d'16, e'16, f'16)

>>> f(staff)
\new Staff {
    {
        \time 2/16
        \set stemLeftBeamCount = #0
        \set stemRightBeamCount = #2
        c'16 [
        \set stemLeftBeamCount = #2
        \set stemRightBeamCount = #1
        d'16
    }
```

```
        {
            \set stemLeftBeamCount = #1
            \set stemRightBeamCount = #2
            e'16
            \set stemLeftBeamCount = #2
            \set stemRightBeamCount = #0
            f'16 ]
        }
    }
```

Beam leaves in spanner explicitly.

Group leaves by measures.

Format top-level *span* beam between measures.

Return measured complex beam spanner.

Read-only Properties

MeasuredComplexBeamSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**leaves**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**override**

LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**preprolated_duration**

Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**prolated_duration**

Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

MeasuredComplexBeamSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

MeasuredComplexBeamSpanner.**direction**
Inherited from spannertools.DirectedSpanner

MeasuredComplexBeamSpanner.**lone**
Beam lone leaf and force beam nibs to left:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone='left')

>>> f(note)
\set stemLeftBeamCount = #2
\set stemRightBeamCount = #0
c'16 [ ]
```

Beam lone leaf and force beam nibs to right:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone='right')

>>> f(note)
\set stemLeftBeamCount = #0
\set stemRightBeamCount = #2
c'16 [ ]
```

Beam lone leaf and force beam nibs to both left and right:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone='both')
```

```
>>> f(note)
\set stemLeftBeamCount = #2
\set stemRightBeamCount = #2
c'16 [ ]
```

Beam lone leaf and accept LilyPond default nibs at both left and right:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone=True)

>>> f(note)
\set stemLeftBeamCount = #2
\set stemRightBeamCount = #2
c'16 [ ]
```

Do not beam lone leaf:

```
>>> note = Note("c'16")

>>> beam = beamtools.ComplexBeamSpanner([note], lone=False)

>>> f(note)
c'16
```

Set to `'left'`, `'right'`, `'both'`, true or false as shown above.

Ignore this setting when spanner contains more than one leaf.

Inherited from `beamtools.ComplexBeamSpanner`

`MeasuredComplexBeamSpanner.`**`span`**

Get top-level beam count:

```
>>> staff = Staff([Measure((2, 16), "c'16 d'16"), Measure((2, 16), "e'16 f'16")])
>>> beam = beamtools.MeasuredComplexBeamSpanner(staff.leaves)
>>> beam.span
1
```

Set top-level beam count:

```
>>> staff = Staff([Measure((2, 16), "c'16 d'16"), Measure((2, 16), "e'16 f'16")])
>>> beam = beamtools.MeasuredComplexBeamSpanner(staff.leaves)
>>> beam.span = 2
>>> beam.span
2
```

Set nonnegative integer.

Methods

`MeasuredComplexBeamSpanner.`**`append`**`(`*component*`)`

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)
```

```
>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)
```

```
>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`MeasuredComplexBeamSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`MeasuredComplexBeamSpanner.`**`fuse`**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
```

```
        d'8
        e'8
        f'8 ]
    }
```

Return list.

Inherited from `spannertools.Spanner`

`MeasuredComplexBeamSpanner.`**`index`**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`MeasuredComplexBeamSpanner.`**`pop`**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from `spannertools.Spanner`

`MeasuredComplexBeamSpanner.`**`pop_left`**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from `spannertools.Spanner`

Special Methods

MeasuredComplexBeamSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MeasuredComplexBeamSpanner.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MeasuredComplexBeamSpanner.**__getitem__**(*expr*)

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MeasuredComplexBeamSpanner.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MeasuredComplexBeamSpanner.**__len__**()

Inherited from spannertools.Spanner

MeasuredComplexBeamSpanner.**__lt__**(*other*)

Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

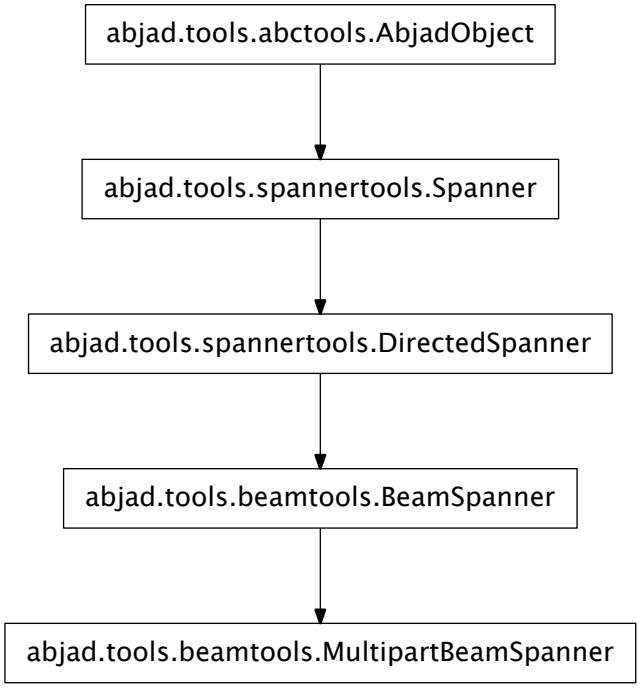
MeasuredComplexBeamSpanner.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

MeasuredComplexBeamSpanner.**__repr__**()
Inherited from `spannertools.Spanner`

beamtools.MultipartBeamSpanner



class `beamtools`.**`MultipartBeamSpanner`**(*components=None*, *direction=None*)
New in version 2.0. Abjad multipart beam spanner:

```
>>> staff = Staff("c'8 d'8 e'4 f'8 g'8 r4")

>>> beamtools.MultipartBeamSpanner(staff[:])
MultipartBeamSpanner(c'8, d'8, e'4, f'8, g'8, r4)

>>> f(staff)
\new Staff {
    c'8 [
    d'8 ]
    e'4
    f'8 [
    g'8 ]
```

```
        r4
    }
```

Avoid rests.

Avoid large-duration notes.

Return multipart beam spanner.

Read-only Properties

MultipartBeamSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

MultipartBeamSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**leaves**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**override**

LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**preprolated_duration**

Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**prolated_duration**

Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**set**

LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**start_offset**

Read-only start offset of spanner.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

MultipartBeamSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

MultipartBeamSpanner.**direction**
Inherited from spannertools.DirectedSpanner

Methods

MultipartBeamSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**clear**()
Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from `spannertools.Spanner`

`MultipartBeamSpanner.`**`extend`**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`MultipartBeamSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`MultipartBeamSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))
```

```
>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`MultipartBeamSpanner.`**`fuse`**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`MultipartBeamSpanner.`**`index`**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

MultipartBeamSpanner.**pop**()
Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**pop_left**()
Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

MultipartBeamSpanner.**__call__**(*expr*)
New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**__contains__**(*expr*)
Inherited from spannertools.Spanner

MultipartBeamSpanner.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MultipartBeamSpanner.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MultipartBeamSpanner.**__getitem__**(*expr*)
Inherited from spannertools.Spanner

MultipartBeamSpanner.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MultipartBeamSpanner.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MultipartBeamSpanner.**__len__**()
Inherited from spannertools.Spanner

MultipartBeamSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

MultipartBeamSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MultipartBeamSpanner.**__repr__**()
Inherited from spannertools.Spanner

functions

beamtools.apply_beam_spanners_to_measures_in_expr

beamtools.**apply_beam_spanners_to_measures_in_expr**(*expr*)
New in version 1.1. Apply beam spanners to measures in *expr*:

```
>>> staff = Staff(r"abj: | 2/8 c'8 d'8 || 2/8 e'8 f'8 |")
```

```
>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
}

>>> beamtools.apply_beam_spanners_to_measures_in_expr(staff)
[BeamSpanner(|2/8(2)|), BeamSpanner(|2/8(2)|)]

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8 [
        d'8 ]
    }
    {
        e'8 [
        f'8 ]
    }
}
```

Return list of beams created. Changed in version 2.0: renamed `measuretools.beam()` to `beamtools.apply_beam_spanners_to_measures_in_expr()`.Changed in version 2.9: renamed `measuretools.apply_beam_spanners_to_measures_in_expr()` to `beamtools.apply_beam_spanners_to_measures_in_expr()`.

beamtools.apply_complex_beam_spanners_to_measures_in_expr

beamtools.**apply_complex_beam_spanners_to_measures_in_expr**(*expr*)

New in version 2.0. Apply complex beam spanners to measures in *expr*:

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
}
```

```
>>> beamtools.apply_complex_beam_spanners_to_measures_in_expr(staff)
[ComplexBeamSpanner(|2/8(2)|), ComplexBeamSpanner(|2/8(2)|)]

>>> f(staff)
\new Staff {
    {
        \time 2/8
        \set stemLeftBeamCount = #0
        \set stemRightBeamCount = #1
        c'8 [
        \set stemLeftBeamCount = #1
        \set stemRightBeamCount = #0
        d'8 ]
    }
    {
        \set stemLeftBeamCount = #0
        \set stemRightBeamCount = #1
        e'8 [
        \set stemLeftBeamCount = #1
        \set stemRightBeamCount = #0
        f'8 ]
    }
}
```

Return list of beams created. Changed in version 2.9: renamed `measuretools.apply_complex_beam_spanners_to_measures_in_expr()` to `beamtools.apply_complex_beam_spanners_to_measures_in_expr()`.

beamtools.apply_durated_complex_beam_spanner_to_measures

beamtools.**apply_durated_complex_beam_spanner_to_measures**(*measures*)

New in version 1.1. Apply durated complex beam spanner to *measures*:

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
}

>>> measures = staff[:]
>>> beamtools.apply_durated_complex_beam_spanner_to_measures(measures)
DuratedComplexBeamSpanner(|2/8(2)|, |2/8(2)|)

>>> f(staff)
\new Staff {
    {
        \time 2/8
```

```
            \set stemLeftBeamCount = #0
            \set stemRightBeamCount = #1
            c'8 [
            \set stemLeftBeamCount = #1
            \set stemRightBeamCount = #1
            d'8
        }
        {
            \set stemLeftBeamCount = #1
            \set stemRightBeamCount = #1
            e'8
            \set stemLeftBeamCount = #1
            \set stemRightBeamCount = #0
            f'8 ]
        }
    }
```

Set beam spanner durations to preprolated measure durations.

Return beam spanner created. Changed in version 2.0: renamed `measuretools.beam_together()`.Changed in version 2.9: renamed `measuretools.apply_durated_complex_beam_spanner_to_measures()` to `beamtools.apply_durated_complex_beam_spanner_to_measures()`.

beamtools.apply_multipart_beam_spanner_to_bottommost_tuplets_in_expr

beamtools.**apply_multipart_beam_spanner_to_bottommost_tuplets_in_expr**(*expr*)

Beam bottommost tuplets in *expr*:

```
>>> staff = Staff(3 * Tuplet(Fraction(2, 3), "c'8 d'8 e'8"))

f(staff)
\new Staff {
    \times 2/3 {
        c'8
        d'8
        e'8
    }
    \times 2/3 {
        c'8
        d'8
        e'8
    }
    \times 2/3 {
        c'8
        d'8
        e'8
    }
}

>>> beamtools.apply_multipart_beam_spanner_to_bottommost_tuplets_in_expr(staff)

>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8 [
        d'8
```

```
            e'8 ]
        }
        \times 2/3 {
            c'8 [
            d'8
            e'8 ]
        }
        \times 2/3 {
            c'8 [
            d'8
            e'8 ]
        }
    }
```

Return none. Changed in version 2.9: renamed `tuplettools.beam_bottommost_tuplets_in_expr()` to `beamtools.apply_multipart_beam_spanner_to_bottommost_tuplets_in_expr()`.Changed in version 2.9: renamed `beamtools.beam_bottommost_tuplets_in_expr()` to `beamtools.apply_multipart_beam_spanner_to_bottommost_tuplets_in_expr()`.

beamtools.get_beam_spanner_attached_to_component

beamtools.**get_beam_spanner_attached_to_component**(*component*)

New in version 2.0. Get the only beam spanner attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> beamtools.get_beam_spanner_attached_to_component(staff[0])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> _ is beam
True
```

Return beam spanner.

Raise missing spanner error when no beam spanner attached to *component*.

Raise extra spanner error when more than one beam spanner attached to *component*. Changed in version 2.9: renamed `spannertools.get_beam_spanner_attached_to_component()` to `beamtools.get_beam_spanner_attached_to_component()`.

beamtools.is_beamable_component

beamtools.**is_beamable_component**(*expr*)

New in version 1.1. True when *expr* is a beamable component. Otherwise false:

```
>>> beamtools.is_beamable_component(Note(13, (1, 16)))
True
```

Return boolean. Changed in version 2.9: renamed `componenttools.is_beamable_component()` to `beamtools.is_beamable_component()`.

beamtools.is_component_with_beam_spanner_attached

`beamtools.`**`is_component_with_beam_spanner_attached`**`(`*expr*`)`

New in version 2.0. True when *expr* is component with beam spanner attached:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)

>>> beamtools.is_component_with_beam_spanner_attached(staff[0])
True
```

Otherwise false:

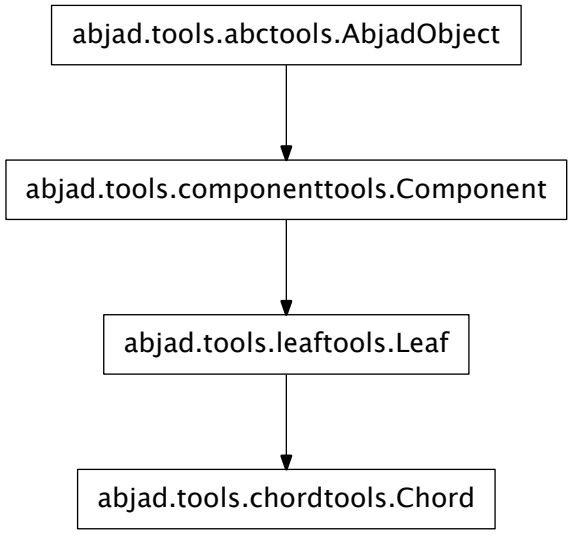
```
>>> note = Note("c'8")

>>> beamtools.is_component_with_beam_spanner_attached(note)
False
```

Return boolean. Changed in version 2.9: renamed `spannertools.is_component_with_beam_spanner_attached(` to `beamtools.is_component_with_beam_spanner_attached()`.

chordtools

concrete classes

chordtools.Chord



class chordtools.**Chord**(**args*, ***kwargs*)

Abjad model of a chord:

```
>>> Chord([4, 13, 17], (1, 4))
Chord("<e' cs'' f''>4")
```

Return chord instance.

Read-only Properties

Chord.**duration_in_seconds**

Inherited from leaftools.Leaf

Chord.**fingered_pitches**

Read-only fingered pitches:

```
>>> staff = Staff("<c''' e'''>4 <d''' fs'''>4")
>>> glockenspiel = instrumenttools.Glockenspiel()(staff)
>>> instrumenttools.transpose_from_sounding_pitch_to_fingered_pitch(staff)

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Glockenspiel }
    \set Staff.shortInstrumentName = \markup { Gkspl. }
    <c' e'>4
    <d' fs'>4
}

>>> staff[0].fingered_pitches
(NamedChromaticPitch("c'"), NamedChromaticPitch("e'"))
```

Return tuple of named chromatic pitches.

Chord.**leaf_index**

Inherited from leaftools.Leaf

Chord.**lilypond_format**

Inherited from componenttools.Component

Chord.**multiplied_duration**

Inherited from leaftools.Leaf

Chord.**override**

Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Chord.**parent**

Inherited from componenttools.Component

Chord.**preprolated_duration**

Inherited from leaftools.Leaf

Chord.**prolated_duration**

Inherited from componenttools.Component

Chord.**prolation**

Inherited from componenttools.Component

Chord.**set**

Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Chord.**sounding_pitches**
Read-only sounding pitches:

```
>>> staff = Staff("<c''' e'''>4 <d''' fs'''>4")
>>> glockenspiel = instrumenttools.Glockenspiel()(staff)
>>> instrumenttools.transpose_from_sounding_pitch_to_fingered_pitch(staff)

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Glockenspiel }
    \set Staff.shortInstrumentName = \markup { Gkspl. }
    <c' e'>4
    <d' fs'>4
}

>>> staff[0].sounding_pitches
(NamedChromaticPitch("c''''"), NamedChromaticPitch("e''''"))
```

Return tuple of named chromatic pitches.

Chord.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Chord.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Chord.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Chord.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Chord.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Chord.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Chord.**duration_multiplier**
Inherited from leaftools.Leaf

Chord.**note_heads**
Get read-only tuple of note heads in chord:

```
>>> chord = Chord([7, 12, 16], (1, 4))
>>> chord.note_heads
(NoteHead("g'"), NoteHead("c''"), NoteHead("e''"))
```

Set chord note heads from any iterable:

```
>>> chord = Chord([7, 12, 16], (1, 4))
>>> chord.note_heads = [0, 2, 6]
>>> chord
Chord("<c' d' fs'>4")
```

Chord.**written_duration**
Inherited from leaftools.Leaf

Chord.**written_pitch_indication_is_at_sounding_pitch**
Inherited from leaftools.Leaf

Chord.**written_pitch_indication_is_nonsemantic**
Inherited from leaftools.Leaf

Chord.**written_pitches**
Get read-only tuple of pitches in chord:

```
>>> chord = Chord([7, 12, 16], (1, 4))
>>> chord.written_pitches
(NamedChromaticPitch("g'"), NamedChromaticPitch("c''"), NamedChromaticPitch("e''"))
```

Set chord pitches from any iterable:

```
>>> chord = Chord([7, 12, 16], (1, 4))
>>> chord.written_pitches = [0, 2, 6]
>>> chord
Chord("<c' d' fs'>4")
```

Methods

Chord.**append**(*note_head_token*)
Append *note_head_token* to chord:

```
>>> chord = Chord([4, 13, 17], (1, 4))
>>> chord
Chord("<e' cs'' f''>4")

>>> chord.append(19)
>>> chord
Chord("<e' cs'' f'' g''>4")
```

Sort chord note heads automatically after append and return none.

Chord.**clear**()
Clear chord:

```
>>> chord = Chord("<e' cs'' f''>4")
>>> chord
Chord("<e' cs'' f''>4")

>>> chord.clear()
>>> chord
Chord('<>4')
```

Return none.

Chord.**extend**(*note_head_tokens*)
Extend chord with *note_head_tokens*:

```
>>> chord = Chord([4, 13, 17], (1, 4))
>>> chord
Chord("<e' cs'' f''>4")

>>> chord.extend([2, 12, 18])
>>> chord
Chord("<d' e' c'' cs'' f'' fs''>4")
```

Sort chord note heads automatically after extend and return none.

Chord.**pop**(*i=-1*)

Remove note head at index *i* in chord:

```
>>> chord = Chord([4, 13, 17], (1, 4))
>>> chord
Chord("<e' cs'' f''>4")

>>> chord.pop(1)
NoteHead("cs''")

>>> chord
Chord("<e' f''>4")
```

Return note head.

Chord.**remove**(*note_head*)

Remove *note_head* from chord:

```
>>> chord = Chord([4, 13, 17], (1, 4))
>>> chord
Chord("<e' cs'' f''>4")

>>> chord.remove(chord[1])
>>> chord
Chord("<e' f''>4")
```

Return none.

Special Methods

Chord.**__and__**(*arg*)

Inherited from leaftools.Leaf

Chord.**__contains__**(*arg*)

Chord.**__delitem__**(*i*)

Chord.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Chord.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Chord.**__getitem__**(*i*)

Chord.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Chord.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Chord.**__len__**()

Chord.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Chord.**__mul__**(*n*)
Inherited from componenttools.Component

Chord.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Chord.**__or__**(*arg*)
Inherited from leaftools.Leaf

Chord.**__repr__**()
Inherited from leaftools.Leaf

Chord.**__rmul__**(*n*)
Inherited from componenttools.Component

Chord.**__setitem__**(*i*, *arg*)

Chord.**__str__**()
Inherited from leaftools.Leaf

Chord.**__sub__**(*arg*)
Inherited from leaftools.Leaf

Chord.**__xor__**(*arg*)
Inherited from leaftools.Leaf

functions

chordtools.all_are_chords

chordtools.**all_are_chords**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad chords:

```
>>> chords = [Chord("<c' e' g'>4"), Chord("<c' f' a'>4")]
```

```
>>> chordtools.all_are_chords(chords)
True
```

True when *expr* is an empty sequence:

```
>>> chordtools.all_are_chords([])
True
```

Otherwise false:

```
>>> chordtools.all_are_chords('foo')
False
```

Return boolean.

Function wraps `componenttools.all_are_components()`.

chordtools.arpeggiate_chord

`chordtools.`**`arpeggiate_chord`**`(`*chord*`)`

New in version 1.1. Arpeggiate *chord*:

```
>>> chord = Chord("<c' d'' ef''>8")
```

```
>>> chordtools.arpeggiate_chord(chord)
[Note("c'8"), Note("d''8"), Note("ef''8")]
```

Arpeggiated notes inherit *chord* written duration.

Arpeggiated notes do not inherit other *chord* attributes.

Return list of newly constructed notes. Changed in version 2.0: renamed `chordtools.arpeggiate()` to `chordtools.arpeggiate_chord()`.

chordtools.change_defective_chord_to_note_or_rest

`chordtools.`**`change_defective_chord_to_note_or_rest`**`(`*chord*`)`

New in version 1.1. Change zero-length *chord* to rest:

```
>>> chord = Chord([], (3, 16))
```

```
>>> chord
Chord('<>8.')
```

```
>>> chordtools.change_defective_chord_to_note_or_rest(chord)
Rest('r8.')
```

Change length-one chord to note:

```
>>> chord = Chord("<cs''>8.")
```

```
>>> chord
Chord("<cs''>8.")
```

```
>>> chordtools.change_defective_chord_to_note_or_rest(chord)
Note("cs''8.")
```

Return chords with length greater than one unchanged:

```
>>> chord = Chord("<c' c'' cs''>8.")

>>> chord
Chord("<c' c'' cs''>8.")

>>> chordtools.change_defective_chord_to_note_or_rest(chord)
Chord("<c' c'' cs''>8.")
```

Return notes unchanged:

```
>>> note = Note("c'4")

>>> note
Note("c'4")

>>> chordtools.change_defective_chord_to_note_or_rest(note)
Note("c'4")
```

Return rests unchanged:

```
>>> rest = Rest('r4')

>>> rest
Rest('r4')

>>> chordtools.change_defective_chord_to_note_or_rest(rest)
Rest('r4')
```

Return note, rest, chord or none. Changed in version 2.0: renamed `chordtools.cast_defective()` to `chordtools.change_defective_chord_to_note_or_rest()`.

chordtools.divide_chord_by_chromatic_pitch_number

chordtools.**divide_chord_by_chromatic_pitch_number**(*chord*, *pitch=NamedChromaticPitch('b')*)

New in version 1.1. Divide *chord* by chromatic *pitch* number:

```
>>> chord = Chord(range(12), Duration(1, 4))

>>> chord
Chord("<c' cs' d' ef' e' f' fs' g' af' a' bf' b'>4")

>>> chordtools.divide_chord_by_chromatic_pitch_number(chord, pitchtools.NamedChromaticPitch(6))
(Chord("<fs' g' af' a' bf' b'>4"), Chord("<c' cs' d' ef' e' f'>4"))
```

Input *chord* may be a note, rest or chord but not a skip.

Zero-length parts return rests, length-one parts return notes and other parts return chords.

Return pair of newly constructed leaves. Changed in version 2.0: renamed `chordtools.split_by_pitch_number()` to `chordtools.divide_chord_by_chromatic_pitch_number(`

chordtools.divide_chord_by_diatonic_pitch_number

chordtools.**divide_chord_by_diatonic_pitch_number**(*chord*, *pitch=NamedChromaticPitch('b')*)

New in version 1.1. Divide *chord* by diatonic *pitch* number:

```
>>> chord = Chord(range(12), Duration(1, 4))

>>> chord
Chord("<c' cs' d' ef' e' f' fs' g' af' a' bf' b'>4")

>>> chordtools.divide_chord_by_diatonic_pitch_number(chord, pitchtools.NamedChromaticPitch(6))
(Chord("<f' fs' g' af' a' bf' b'>4"), Chord("<c' cs' d' ef' e'>4"))
```

Input *chord* may be a note, rest or chord but not a skip.

Zero-length parts return as rests, length-one parts return as notes and other parts return as chords.

Return pair of newly constructed leaves. Changed in version 2.0: renamed `chordtools.split_by_altitude()` to `chordtools.divide_chord_by_diatonic_pitch_number()`.

chordtools.get_arithmetic_mean_of_chord

`chordtools.`**`get_arithmetic_mean_of_chord`**(*chord*)

New in version 2.0. Get arithmetic mean of chromatic pitch number of pitches in *chord*:

```
>>> chord = Chord("<g' c'' e''>4")

>>> chordtools.get_arithmetic_mean_of_chord(chord)
11.666666666666666
```

Return none when *chord* is empty:

```
>>> chord = Chord("< >4")

>>> chordtools.get_arithmetic_mean_of_chord(chord) is None
True
```

Return number or none.

chordtools.get_note_head_from_chord_by_pitch

`chordtools.`**`get_note_head_from_chord_by_pitch`**(*chord*, *pitch*)

New in version 2.0. Get note head from *chord* by *pitch*:

```
>>> chord = Chord("<c'' d'' b''>4")

>>> chordtools.get_note_head_from_chord_by_pitch(chord, 14)
NoteHead("d''")
```

Raise missing note head error when *chord* contains no note head with pitch equal to *pitch*.

Raise extra note head error when *chord* contains more than one note head with pitch equal to *pitch*. Changed in version 2.0: renamed `chordtools.get_note_head()` to `chordtools.get_note_head_from_chord_by_pitch()`.

chordtools.make_tied_chord

`chordtools.`**`make_tied_chord`**(*pitches*, *duration*, *big_endian=True*)

Returns a list of chords to fill the given duration.

Chords returned are tie spanned.

chordtools.yield_all_subchords_of_chord

chordtools.**yield_all_subchords_of_chord**(*chord*)

New in version 2.0. Yield all subchords of *chord* in binary string order:

```
>>> chord = Chord("<c' d' af' a'>4")

>>> for subchord in chordtools.yield_all_subchords_of_chord(chord):
...     subchord
...
Rest('r4')
Note("c'4")
Note("d'4")
Chord("<c' d'>4")
Note("af'4")
Chord("<c' af'>4")
Chord("<d' af'>4")
Chord("<c' d' af'>4")
Note("a'4")
Chord("<c' a'>4")
Chord("<d' a'>4")
Chord("<c' d' a'>4")
Chord("<af' a'>4")
Chord("<c' af' a'>4")
Chord("<d' af' a'>4")
Chord("<c' d' af' a'>4")
```

Include empty chord as rest.

Return generator of newly constructed leaves. Changed in version 2.0: renamed `chordtools.subchords()` to `chordtools.yield_all_subchords_of_chord()`.

chordtools.yield_groups_of_chords_in_sequence

chordtools.**yield_groups_of_chords_in_sequence**(*sequence*)

New in version 2.0. Yield groups of chords in *sequence*:

```
>>> staff = Staff("c'8 d'8 r8 r8 <e' g'>8 <f' a'>8 g'8 a'8 r8 r8 <b' d''>8 <c'' e''>8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    r8
    r8
    <e' g'>8
    <f' a'>8
    g'8
    a'8
    r8
    r8
    <b' d''>8
    <c'' e''>8
}

>>> for chord in chordtools.yield_groups_of_chords_in_sequence(staff):
...     chord
```

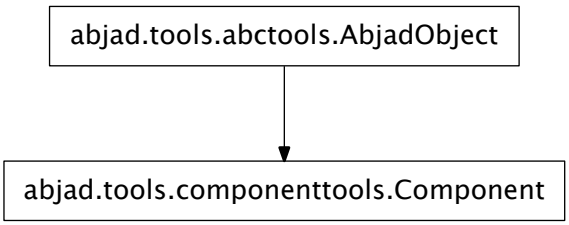
```
...
(Chord("<e' g'>8"), Chord("<f' a'>8"))
(Chord("<b' d''>8"), Chord("<c'' e''>8"))
```

Return generator.

componenttools

concrete classes

componenttools.Component



class componenttools.**Component**

Read-only Properties

Component.**lilypond_format**

Component.**override**

Read-only reference to LilyPond grob override component plug-in.

Component.**parent**

Component.**prolated_duration**

Component.**prolation**

Component.**set**

Read-only reference LilyPond context setting component plug-in.

Component.**spanners**

Read-only reference to unordered set of spanners attached to component.

Component.**start_offset**

Read-only start offset of component.

Component.**start_offset_in_seconds**

Read-only start offset of comonent in seconds.

Component.**stop_offset**

Read-only stop offset of component.

Component.**stop_offset_in_seconds**

Read-only stop offset of component in seconds.

Component.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

Component.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Component.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Component.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Component.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Component.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Component.**__mul__**(*n*)

Component.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

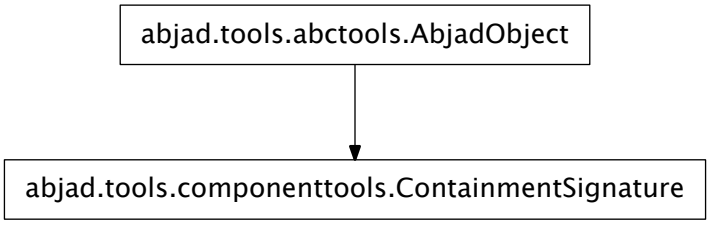
Component.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

Component.**__rmul__**(*n*)

componenttools.ContainmentSignature



class componenttools.**ContainmentSignature**

New in version 2.9. Containment signature of Abjad component:

```
>>> score = Score(r"""\context Staff = "CustomStaff" { """
...     r"""\context Voice = "CustomVoice" { c' d' e' f' } }""")
>>> score.name = 'CustomScore'

>>> f(score)
\context Score = "CustomScore" <<
    \context Staff = "CustomStaff" {
        \context Voice = "CustomVoice" {
            c'4
            d'4
            e'4
            f'4
        }
    }
>>

>>> componenttools.component_to_containment_signature(score.leaves[0])
ContainmentSignature(Note-..., Voice-'CustomVoice', Staff-..., Score-'CustomScore')
```

Returned only by componenttools.component_to_containment_signature().

Used for thread iteration behind the scenes.

Read-only Properties

ContainmentSignature.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ContainmentSignature.**__eq__**(*arg*)
ContainmentSignature.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContainmentSignature.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ContainmentSignature.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContainmentSignature.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContainmentSignature.**__ne__**(*arg*)

ContainmentSignature.**__repr__**()

ContainmentSignature.**__str__**()

functions

componenttools.all_are_components

componenttools.**all_are_components**(*expr*, *klasses=None*)

New in version 1.1. True when elements in *expr* are all components:

```
>>> componenttools.all_are_components(3 * Note("c'4"))
True
```

Otherwise false:

```
>>> componenttools.all_are_components(['foo', 'bar'])
False
```

True when elements in *expr* are all *klasses*:

```
>>> componenttools.all_are_components(3 * Note("c'4"), klasses = Note)
True
```

Otherwise false:

```
>>> componenttools.all_are_components(['foo', 'bar'], klasses = Note)
False
```

Return boolean.

componenttools.all_are_components_in_same_parent

componenttools.**all_are_components_in_same_parent**(*expr*, *klasses=None*, *allow_orphans=True*)

New in version 1.1. True when elements in *expr* are all components in same parent. Otherwise false:

```
>>> staff = Staff(notetools.make_notes([12, 14, 16], [(1, 8)]))
>>> componenttools.all_are_components_in_same_parent(staff.leaves)
True
```

True when elements in *expr* are all *klasses* in same parent. Otherwise false:

```
>>> staff = Staff(notetools.make_notes([12, 14, 16], [(1, 8)]))
>>> componenttools.all_are_components_in_same_parent(staff.leaves, klasses=(Note, ))
True
```

Return boolean.

componenttools.all_are_components_in_same_score

componenttools.**all_are_components_in_same_score**(*expr*, *klasses=None*, *allow_orphans=True*)

New in version 1.1. True when elements in *expr* are all components in same score. Otherwise false:

```
>>> score = Score([Staff("c'8 d'8 e'8")])
>>> componenttools.all_are_components_in_same_score(score.leaves)
True
```

True when elements in *expr* are all *klasses* in same score. Otherwise false:

```
>>> score = Score([Staff("c'8 d'8 e'8")])
>>> componenttools.all_are_components_in_same_score(score.leaves, klasses=(Note, ))
True
```

Return boolean.

componenttools.all_are_components_in_same_thread

componenttools.**all_are_components_in_same_thread**(*expr*, *klasses=None*, *allow_orphans=True*)

New in version 1.1. True when elements in *expr* are all components in same thread. Otherwise false:

```
>>> voice = Voice("c'8 d'8 e'8")
>>> componenttools.all_are_components_in_same_thread(voice.leaves)
True
```

True when elements in *expr* are all *klasses* in same thread. Otherwise false:

```
>>> voice = Voice("c'8 d'8 e'8")
>>> componenttools.all_are_components_in_same_thread(voice.leaves, klasses=Note)
True
```

Return boolean.

componenttools.all_are_components_scalable_by_multiplier

componenttools.**all_are_components_scalable_by_multiplier**(*components*, *multiplier*)

New in version 1.1. True when *components* are all scalable by *multiplier*:

```
>>> components = [Note(0, (1, 8))]
>>> componenttools.all_are_components_scalable_by_multiplier(components, Duration(3, 2))
True
```

Otherwise false:

```
>>> components = [Note(0, (1, 8))]
>>> componenttools.all_are_components_scalable_by_multiplier(components, Duration(2, 3))
False
```

Return boolean. Changed in version 2.0: renamed `durationtools.are_scalable()` to `componenttools.all_are_components_scalable_by_multiplier()`.

componenttools.all_are_contiguous_components

componenttools.**all_are_contiguous_components**(*expr*, *klasses=None*, *allow_orphans=True*)

New in version 1.1. True when elements in *expr* are all contiguous components. Otherwise false:

```
>>> staff = Staff("c'8 d'8 e'8")
>>> componenttools.all_are_contiguous_components(staff.leaves)
True
```

True when elements in *expr* are all contiguous *klasses*. Otherwise false:

```
>>> staff = Staff("c'8 d'8 e'8")
>>> componenttools.all_are_contiguous_components(staff.leaves, klasses=Note)
True
```

Return boolean.

componenttools.all_are_contiguous_components_in_same_parent

componenttools.**all_are_contiguous_components_in_same_parent**(*expr*, *klasses=None*, *allow_orphans=True*)

New in version 1.1. True when elements in *expr* are all contiguous components in same parent. Otherwise false:

```
>>> staff = Staff("c'8 d'8 e'8")
>>> componenttools.all_are_contiguous_components_in_same_parent(staff.leaves)
True
```

True when elements in *expr* are all contiguous *klasses* in same parent. Otherwise false:

```
>>> staff = Staff("c'8 d'8 e'8")
>>> componenttools.all_are_contiguous_components_in_same_parent(staff.leaves, klasses=Note)
True
```

Return boolean.

componenttools.all_are_contiguous_components_in_same_score

componenttools.**all_are_contiguous_components_in_same_score**(*expr*, *klasses=None*, *allow_orphans=True*)

New in version 1.1. True when elements in *expr* are all contiguous components in same score. Otherwise false:

```
>>> score = Score([Staff("c'8 d'8 e'8")])
>>> componenttools.all_are_contiguous_components_in_same_score(score.leaves)
True
```

True when elements in *expr* are all contiguous *klasses* in same score. Otherwise false:

```
>>> score = Score([Staff("c'8 d'8 e'8")])
>>> componenttools.all_are_contiguous_components_in_same_score(score.leaves, klasses=Note)
True
```

Return boolean.

componenttools.all_are_contiguous_components_in_same_thread

componenttools.**all_are_contiguous_components_in_same_thread**(*expr*, *klasses=None*, *allow_orphans=True*)

New in version 1.1. True when elements in *expr* are all contiguous components in same thread. Otherwise false:

```
>>> staff = Staff("c'8 d'8 e'8")
>>> componenttools.all_are_contiguous_components_in_same_thread(staff.leaves)
True
```

True when elements in *expr* are all contiguous *klasses* in same thread. Otherwise false:

```
>>> staff = Staff("c'8 d'8 e'8")
>>> componenttools.all_are_contiguous_components_in_same_thread(staff.leaves, klasses=Note)
True
```

Return boolean.

componenttools.all_are_orphan_components

componenttools.**all_are_orphan_components**(*expr*)

New in version 2.0. True when *expr* is an iterable of zero or more orphan components.

Othewise false.

componenttools.all_are_thread_contiguous_components

componenttools.**all_are_thread_contiguous_components**(*expr*, *klasses=None*, *allow_orphans=True*)

New in version 1.1. True when elements in *expr* are all thread-contiguous components:

```
t = Voice(notetools.make_repeated_notes(4))
t.insert(2, Voice(notetools.make_repeated_notes(2)))
Container(t[:2])
Container(t[-2:])
pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(t)
```

```
\new Voice {
    {
        c'8
        d'8
    }
    \new Voice {
        e'8
        f'8
    }
    {
        g'8
        a'8
```

```
        }
    }

    assert _are_thread_contiguous_components(t[0:1] + t[-1:])
    assert _are_thread_contiguous_components(t[0][:] + t[-1:])
    assert _are_thread_contiguous_components(t[0:1] + t[-1][:])
    assert _are_thread_contiguous_components(t[0][:] + t[-1][:])
```

Return boolean.

Thread-contiguous components are, by definition, spannable.

componenttools.component_to_containment_signature

componenttools.**component_to_containment_signature**(*component*)

New in version 1.1. Change *component* to containment signature:

```
>>> score = Score(
... r"""\context Staff = "CustomStaff" { """
...     r"""\context Voice = "CustomVoice" { c' d' e' f' } }""")
>>> score.name = 'CustomScore'

>>> f(score)
\context Score = "CustomScore" <<
    \context Staff = "CustomStaff" {
        \context Voice = "CustomVoice" {
            c'4
            d'4
            e'4
            f'4
        }
    }
>>

>>> componenttools.component_to_containment_signature(score.leaves[0])
ContainmentSignature(Note-..., Voice-'CustomVoice', Staff-..., Score-'CustomScore')
```

Containment signature gives first voice, staff, staff group and score in parentage. Changed in version 2.9: renamed `threadtools.component_to_thread_signature()` to `componenttools.component_to_containment_signature()`.

componenttools.component_to_parentage_signature

componenttools.**component_to_parentage_signature**(*component*)

New in version 1.1. Change *component* to parentage signature:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> staff = Staff([tuplet])
>>> note = staff.leaves[0]
>>> print componenttools.component_to_parentage_signature(note)
    staff: Staff-...
    self: Note-...
```

Return parentage signature.

componenttools.component_to_pitch_and_rhythm_skeleton

componenttools.**component_to_pitch_and_rhythm_skeleton**(*component*)

New in version 2.0. Change *component* to pitch and rhythm skeleton:

```
>>> tuplet = Tuplet(Fraction(3, 4), "c'8 d'8 e'8 f'8")
>>> measure = Measure((6, 16), [tuplet])
>>> staff = Staff([measure])
>>> score = Score(staff * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(score)

>>> skeleton = componenttools.component_to_pitch_and_rhythm_skeleton(score)
>>> print skeleton
Score([
    Staff([
        Measure((6, 16), [
            Tuplet(Fraction(3, 4), [
                Note(('c', 4), Duration(1, 8)),
                Note(('d', 4), Duration(1, 8)),
                Note(('e', 4), Duration(1, 8)),
                Note(('f', 4), Duration(1, 8))
            ])
        ])
    ]),
    Staff([
        Measure((6, 16), [
            Tuplet(Fraction(3, 4), [
                Note(('g', 4), Duration(1, 8)),
                Note(('a', 4), Duration(1, 8)),
                Note(('b', 4), Duration(1, 8)),
                Note(('c', 5), Duration(1, 8))
            ])
        ])
    ])
])

>>> new = eval(skeleton)
>>> new
Score<<2>>

>>> f(new)
\new Score <<
    \new Staff {
        {
            \time 6/16
            \fraction \times 3/4 {
                c'8
                d'8
                e'8
                f'8
            }
        }
    }
    \new Staff {
        {
            \time 6/16
            \fraction \times 3/4 {
                g'8
```

```
                    a'8
                    b'8
                    c''8
                }
            }
        }
    >>
```

Return string.

componenttools.component_to_score_depth

componenttools.**component_to_score_depth**(*component*)

New in version 1.1. Change *component* to score depth:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> staff = Staff([tuplet])
>>> componenttools.component_to_score_depth(staff.leaves[0])
2
```

Return nonnegative integer.

componenttools.component_to_score_index

componenttools.**component_to_score_index**(*component*)

New in version 2.0. Change *component* to score index:

```
>>> staff_1 = Staff(r"\times 2/3 { c'8 d'8 e'8 } \times 2/3 { f'8 g'8 a'8 }")
>>> staff_2 = Staff(r"\times 2/3 { b'8 c''8 d''8 }")
>>> score = Score([staff_1, staff_2])

>>> f(score)
\new Score <<
    \new Staff {
        \times 2/3 {
            c'8
            d'8
            e'8
        }
        \times 2/3 {
            f'8
            g'8
            a'8
        }
    }
    \new Staff {
        \times 2/3 {
            b'8
            c''8
            d''8
        }
    }
>>

>>> for leaf in score.leaves:
...     leaf, componenttools.component_to_score_index(leaf)
```

```
...
(Note("c'8"), (0, 0, 0))
(Note("d'8"), (0, 0, 1))
(Note("e'8"), (0, 0, 2))
(Note("f'8"), (0, 1, 0))
(Note("g'8"), (0, 1, 1))
(Note("a'8"), (0, 1, 2))
(Note("b'8"), (1, 0, 0))
(Note("c''8"), (1, 0, 1))
(Note("d''8"), (1, 0, 2))
```

Return tuple of zero or more nonnegative integers.

componenttools.component_to_score_root

componenttools.**component_to_score_root**(*component*)

New in version 1.1. Change *component* to score root:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> staff = Staff([tuplet])
>>> note = staff.leaves[0]
>>> componenttools.component_to_score_root(note)
Staff{1}
```

Return score root.

componenttools.component_to_tuplet_depth

componenttools.**component_to_tuplet_depth**(*component*)

New in version 1.1. Change *component* to tuplet depth:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> staff = Staff([tuplet])
>>> note = staff.leaves[0]

>>> componenttools.component_to_tuplet_depth(note)
1

>>> componenttools.component_to_tuplet_depth(tuplet)
0

>>> componenttools.component_to_tuplet_depth(staff)
0
```

Return nonnegative integer.

componenttools.copy_and_partition_governed_component_subtree_by_leaf_counts

componenttools.**copy_and_partition_governed_component_subtree_by_leaf_counts**(*container*, *leaf_counts*)

New in version 1.1. Copy *container* and partition copy according to *leaf_counts*:

```
>>> voice = Voice(r"\times 2/3 { c'8 d'8 e'8 } \times 2/3 { f'8 g'8 a'8 }")
>>> beamtools.BeamSpanner(voice[0].leaves)
BeamSpanner(c'8, d'8, e'8)
```

```
>>> beamtools.BeamSpanner(voice[1].leaves)
BeamSpanner(f'8, g'8, a'8)

>>> f(voice)
\new Voice {
    \times 2/3 {
        c'8 [
        d'8
        e'8 ]
    }
    \times 2/3 {
        f'8 [
        g'8
        a'8 ]
    }
}

>>> result = componenttools.copy_and_partition_governed_component_subtree_by_leaf_counts(
... voice, [1, 2, 3])

>>> first, second, third = result

>>> f(first)
\new Voice {
    \times 2/3 {
        c'8 [ ]
    }
}

>>> f(second)
\new Voice {
    \times 2/3 {
        d'8 [
        e'8 ]
    }
}

>>> f(third)
\new Voice {
    \times 2/3 {
        f'8 [
        g'8
        a'8 ]
    }
}
```

Set *leaf_counts* to an iterable of zero or more positive integers.

Return a list of parts equal in length to that of *leaf_counts*. Changed in version 2.0: renamed `clonewp.by_leaf_counts_with_parentage()` to `componenttools.copy_and_partition_governed_component_subtree_by_leaf_counts()`.

componenttools.copy_components_and_covered_spanners

componenttools.**copy_components_and_covered_spanners**(*components*, *n=1*)

New in version 1.1. Copy *components* and covered spanners.

The *components* must be thread-contiguous.

Covered spanners are those spanners that cover *components*.

The steps taken in this function are as follows. Withdraw *components* from crossing spanners. Preserve spanners that *components* cover. Deep copy *components*. Reapply crossing spanners to source *components*. Return copied components with covered spanners.

```
>>> voice = Voice(Measure((2, 8), notetools.make_repeated_notes(2)) * 3)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(voice)
>>> beam = beamtools.BeamSpanner(voice.leaves[:4])
>>> f(voice)
\new Voice {
    {
        \time 2/8
        c'8 [
        d'8
    }
    {
        e'8
        f'8 ]
    }
    {
        g'8
        a'8
    }
}

>>> result = componenttools.copy_components_and_covered_spanners(voice.leaves)
>>> result
(Note("c'8"), Note("d'8"), Note("e'8"), Note("f'8"), Note("g'8"), Note("a'8"))

>>> new_voice = Voice(result)
>>> f(new_voice)
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
    g'8
    a'8
}

>>> voice.leaves[0] is new_voice.leaves[0]
False
```

Copy *components* a total of *n* times.

```
>>> result = componenttools.copy_components_and_covered_spanners(voice.leaves[:2], n=3)
>>> result
(Note("c'8"), Note("d'8"), Note("c'8"), Note("d'8"), Note("c'8"), Note("d'8"))

>>> new_voice = Voice(result)
>>> f(new_voice)
\new Voice {
    c'8
    d'8
    c'8
    d'8
    c'8
    d'8
}
```

Changed in version 2.0: renamed `clone.covered()` to `componenttools.copy_components_and_covered_span`
in version 2.0: renamed `componenttools.clone_components_and_covered_spanners()` to
`componenttools.copy_components_and_covered_spanners()`.

componenttools.copy_components_and_fracture_crossing_spanners

componenttools.**copy_components_and_fracture_crossing_spanners**(*components*, *n=1*)

New in version 1.1. Copy *components* and fracture crossing spanners.

The *components* must be thread-contiguous.

The steps this function takes are as follows. Deep copy *components*. Deep copy spanners that attach to any component in *components*. Fracture spanners that attach to components not in *components*. Return Python list of copied components.

```
>>> voice = Voice(Measure((2, 8), notetools.make_repeated_notes(2)) * 3)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(voice)
>>> beam = beamtools.BeamSpanner(voice.leaves[:4])
>>> f(voice)
\new Voice {
    {
        \time 2/8
        c'8 [
        d'8
    }
    {
        e'8
        f'8 ]
    }
    {
        g'8
        a'8
    }
}

>>> result = componenttools.copy_components_and_fracture_crossing_spanners(
...     voice.leaves[2:4])
>>> result
(Note("e'8"), Note("f'8"))

>>> new_voice = Voice(result)
>>> f(new_voice)
\new Voice {
    e'8 [
    f'8 ]
}

>>> voice.leaves[2] is new_voice.leaves[0]
False
```

Copy *components* a total of *n* times.

```
>>> result = componenttools.copy_components_and_fracture_crossing_spanners(
...     voice.leaves[2:4], n=3)
>>> result
(Note("e'8"), Note("f'8"), Note("e'8"), Note("f'8"), Note("e'8"), Note("f'8"))
```

```
>>> new_voice = Voice(result)
>>> f(new_voice)
\new Voice {
    e'8 [
    f'8 ]
    e'8 [
    f'8 ]
    e'8 [
    f'8 ]
}
```

Changed in version 2.0: renamed `clone.fracture()` to `componenttools.copy_components_and_fracture_cr`
in version 2.0: renamed `componenttools.clone_components_and_fracture_crossing_spanners()`
to `componenttools.copy_components_and_fracture_crossing_spanners()`.

componenttools.copy_components_and_immediate_parent_of_first_component

componenttools.**copy_components_and_immediate_parent_of_first_component**(*components*)

New in version 1.1. Copy *components* and immediate parent of first component.

The *components* must be thread-contiguous.

Return in newly created container equal to type of first element in *copmonents*.

If the parent of the first element in *components* is a tuplet then insure that the tuplet multiplier of the function output equals the tuplet multiplier of the parent of the first element in *components*.

```
>>> voice = Voice(r"\times 2/3 { c'8 d' e' } \times 2/3 { f'8 g' a' }")
>>> voice.append(r"\times 2/3 { b'8 c'' d'' }")
>>> beam = beamtools.BeamSpanner(voice.leaves[:4])

>>> f(voice)
\new Voice {
    \times 2/3 {
        c'8 [
        d'8
        e'8
    }
    \times 2/3 {
        f'8 ]
        g'8
        a'8
    }
    \times 2/3 {
        b'8
        c''8
        d''8
    }
}

>>> leaves = voice.leaves[:2]
>>> componenttools.copy_components_and_immediate_parent_of_first_component(leaves)
Tuplet(2/3, [c'8, d'8])
```

Parent-contiguity is not required. Thread-contiguous *components* suffice.

```
>>> leaves = voice.leaves[:5]
>>> componenttools.copy_components_and_immediate_parent_of_first_component(leaves)
Tuplet(2/3, [c'8, d'8, e'8, f'8, g'8])
```

Note: this function copies only the *immediate parent* of the first element in *components*. This function ignores any further parentage of *components* above the immediate parent of *components*.

Todo

this function should (but does not) copy marks that attach to *components* and to the immediate parent of the first component; extend function to do so.

Changed in version 2.0: renamed `clonewp.with_parent()` to `componenttools.copy_components_and_immediate_parent_of_first_component()`.Changed in version 2.0: renamed `componenttools.clone_components_and_immediate_parent_of_first_componen` to `componenttools.copy_components_and_immediate_parent_of_first_component()`.

componenttools.copy_components_and_remove_spanners

`componenttools.`**`copy_components_and_remove_spanners`**(*components*, *n=1*)

New in version 1.1. Copy *components* and remove all spanners.

The *components* must be thread-contiguous.

The steps taken by this function are as follows. Withdraw all components at any level in *components* from spanners. Deep copy unspanned components in *components*. Reapply spanners to all components at any level in *components*.

```
>>> voice = Voice(Measure((2, 8), notetools.make_repeated_notes(2)) * 3)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(voice)
>>> beam = beamtools.BeamSpanner(voice.leaves[:4])
>>> f(voice)
\new Voice {
    {
        \time 2/8
        c'8 [
        d'8
    }
    {
        e'8
        f'8 ]
    }
    {
        g'8
        a'8
    }
}
```

```
>>> result = componenttools.copy_components_and_remove_spanners(voice.leaves[2:4])
>>> result
(Note("e'8"), Note("f'8"))
```

```
>>> new_voice = Voice(result)
>>> f(new_voice)
\new Voice {
```

```
    e'8
    f'8
}
```

```
>>> voice.leaves[2] is new_voice.leaves[0]
False
```

Copy *components* a total of *n* times.

```
>>> result = componenttools.copy_components_and_remove_spanners(voice.leaves[2:4], n=3)
>>> result
(Note("e'8"), Note("f'8"), Note("e'8"), Note("f'8"), Note("e'8"), Note("f'8"))

>>> new_voice = Voice(result)
>>> f(new_voice)
\new Voice {
    e'8
    f'8
    e'8
    f'8
    e'8
    f'8
}
```

Changed in version 2.0: renamed `componenttools.clone_components_and_remove_all_spanners()` to `componenttools.copy_components_and_remove_spanners()`.Changed in version 2.9: renamed `componenttools.copy_components_and_remove_all_spanners()` to `componenttools.copy_components_and_remove_spanners()`.

componenttools.copy_governed_component_subtree_by_leaf_range

`componenttools.`**`copy_governed_component_subtree_by_leaf_range`**(*component*, *start=0*, *stop=None*)

New in version 1.1. Copy governed *component* subtree by leaf range.

Governed subtree means *component* together with children of *component*.

Leaf range refers to the sequential parentage of *component* from *start* leaf index to *stop* leaf index:

```
>>> voice = Voice(r"\times 2/3 { c'8 d'8 e'8 } \times 2/3 { f'8 g'8 a'8 }")
>>> t = Staff([voice])

>>> f(t)
\new Staff {
    \new Voice {
        \times 2/3 {
            c'8
            d'8
            e'8
        }
        \times 2/3 {
            f'8
            g'8
            a'8
        }
    }
}
```

```
>>> u = componenttools.copy_governed_component_subtree_by_leaf_range(t, 1, 5)
>>> f(u)
\new Staff {
    \new Voice {
        \times 2/3 {
            d'8
            e'8
        }
        \times 2/3 {
            f'8
            g'8
        }
    }
}
```

Copy sequential containers in leaves' parentage up to the first parallel container in leaves' parentage.

Trim and shrink copied containers as necessary.

When *stop* is none copy all leaves from *start* forward. Changed in version 2.0: renamed `clonewp.by_leaf_range_with_parentage()` to `componenttools.copy_governed_component_subtree_by_leaf_range()`.Changed in version 2.0: renamed `componenttools.clone_governed_component_subtree_by_leaf_range()` to `componenttools.copy_governed_component_subtree_by_leaf_range()`.

componenttools.copy_governed_component_subtree_from_offset_to

componenttools.**copy_governed_component_subtree_from_offset_to**(*component*, *start=0*, *stop=None*)

New in version 1.1. Copy governed *component* subtree from *start* prolated duration to *stop* prolated duration.

Governed subtree refers to *component* together with the children of *component*:

```
>>> voice = Voice(r"c'8 d'8 \times 2/3 { e'8 f'8 g'8 }")
```

```
>>> f(voice)
\new Voice {
   c'8
   d'8
   \times 2/3 {
      e'8
      f'8
      g'8
   }
}
```

```
>>> new = componenttools.copy_governed_component_subtree_from_offset_to(
...     voice, (0, 8), (3, 8))
```

```
>>> f(new)
\new Voice {
   c'8
   d'8
   \times 2/3 {
      e'8
      f'16
```

```
    }
}
```

Raise contiguity error if asked to slice a parallel container.

```
>>> staff = Staff(Voice("c'8 d'8") * 2)
>>> staff.is_parallel = True
>>> f(staff)
\new Staff <<
\new Voice {
    c'8
    d'8
}
\new Voice {
    c'8
    d'8
}
>>
```

Raise contiguity error when attempting to copy fleaves from parallel container.

But note that cases with `0 = start` work correctly:

```
>>> new = componenttools.copy_governed_component_subtree_from_offset_to(
...     voice, (0, 8), (1, 8))

>>> f(new)
\new Voice {
    c'8
}
```

Cases with `0 < start` do not work correctly:

```
>>> new = componenttools.copy_governed_component_subtree_from_offset_to(
...     voice, (1, 8), (2, 8))

>>> f(new)
\new Voice {
    c'8
    d'8
}
```

Create ad hoc tuplets as required:

```
>>> voice = Voice([Note("c'4")])
>>> new = componenttools.copy_governed_component_subtree_from_offset_to(
...     voice, 0, (1, 12))

>>> f(new)
\new Voice {
    \times 2/3 {
        c'8
    }
}
```

Function does NOT copy parentage of *component* when *component* is a leaf:

```
>>> voice = Voice([Note("c'4")])
>>> new_leaf = componenttools.copy_governed_component_subtree_from_offset_to(
...     voice[0], 0, (1, 8))
```

```
>>> f(new_leaf)
c'8

>>> new_leaf.parent is None
True
```

Return `(untrimmed_copy, first_dif, second_dif)`.

componenttools.cut_component_at_prolated_duration

componenttools.**cut_component_at_prolated_duration**(*component*, *prolated_duration*)

New in version 2.0. Cut *component* at dotted *prolated_duration*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> componenttools.cut_component_at_prolated_duration(staff, Duration(1, 32))
>>> f(staff)
\new Staff {
    c'16. [
    d'8
    e'8
    f'8 ]
}
```

Cut *component* at tied *prolated_duration*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> componenttools.cut_component_at_prolated_duration(staff, Duration(3, 64))
>>> f(staff)
\new Staff {
    c'16 [ ~
    c'64
    d'8
    e'8
    f'8 ]
}
```

Cut *component* at nonbinary *prolated_duration*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> componenttools.cut_component_at_prolated_duration(staff, Duration(1, 24))
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8 [
    }
    d'8
    e'8
    f'8 ]
}
```

Return none.

componenttools.extend_in_parent_of_component

componenttools.**extend_in_parent_of_component**(*component*, *new_components*, *grow_spanners=True*)

New in version 2.10. Extend *new_components* in parent of *component*.

Example 1. Extend *new_component* in parent of *component*. Grow spanners:

```
>>> voice = Voice("c'8 [ d'8 e'8 ]")

>>> f(voice)
\new Voice {
    c'8 [
    d'8
    e'8 ]
}

>>> new_components = [Note("c'8"), Note("d'8"), Note("e'8")]
>>> componenttools.extend_in_parent_of_component(
...     voice.leaves[-1], new_components, grow_spanners=True)
[Note("e'8"), Note("c'8"), Note("d'8"), Note("e'8")]

>>> f(voice)
\new Voice {
    c'8 [
    d'8
    e'8
    c'8
    d'8
    e'8 ]
}
```

Example 2. Extend *new_component* in parent of *component*. Do not grow spanners:

```
>>> voice = Voice("c'8 [ d'8 e'8 ]")

>>> f(voice)
\new Voice {
    c'8 [
    d'8
    e'8 ]
}

>>> new_components = [Note("c'8"), Note("d'8"), Note("e'8")]
>>> componenttools.extend_in_parent_of_component(
...     voice.leaves[-1], new_components, grow_spanners=False)
[Note("e'8"), Note("c'8"), Note("d'8"), Note("e'8")]

>>> f(voice)
\new Voice {
    c'8 [
    d'8
    e'8 ]
    c'8
    d'8
    e'8
}
```

Return *component* and *new_components* together in newly constructed list.

componenttools.extend_left_in_parent_of_component

componenttools.**extend_left_in_parent_of_component**(*component*, *new_components*, *grow_spanners=True*)

New in version 2.10. Extend *new_components* left in parent of *component*.

Example 1. Extend *new_components* left in parent of *component*. Grow spanners:

```
>>> voice = Voice("c'8 [ d'8 e'8 ]")

>>> f(voice)
\new Voice {
    c'8 [
    d'8
    e'8 ]
}

>>> notes = [Note("c'8"), Note("d'8"), Note("e'8")]
>>> componenttools.extend_left_in_parent_of_component(
...     voice[0], notes, grow_spanners=True)
[Note("c'8"), Note("d'8"), Note("e'8"), Note("c'8")]

>>> f(voice)
\new Voice {
    c'8 [
    d'8
    e'8
    c'8
    d'8
    e'8 ]
}
```

Example 2. Extend *new_components* left in parent of *component*. Do not grow spanners:

```
>>> voice = Voice("c'8 [ d'8 e'8 ]")

>>> notes = [Note("c'8"), Note("d'8"), Note("e'8")]
>>> componenttools.extend_left_in_parent_of_component(
...     voice[0], notes, grow_spanners=False)
[Note("c'8"), Note("d'8"), Note("e'8"), Note("c'8")]

>>> f(voice)
\new Voice {
    c'8
    d'8
    e'8
    c'8 [
    d'8
    e'8 ]
}
```

Return *new_components* and *component* together in newly created list.

componenttools.get_component_in_expr_with_name

componenttools.**get_component_in_expr_with_name**(*expr*, *name*)

New in version 2.10. Get component in *expr* with *name*:

```
>>> voice_1 = Voice("c'4 d'4 e'4 f'4")
>>> voice_1.name = 'Top Voice'
>>> voice_2 = Voice(r'\clef "bass" c4 d4 e4 f4')
>>> voice_2.name = 'Bottom Voice'
>>> staff = Staff([voice_1, voice_2])
>>> f(staff)
\new Staff {
    \context Voice = "Top Voice" {
        c'4
        d'4
        e'4
        f'4
    }
    \context Voice = "Bottom Voice" {
        \clef "bass"
        c4
        d4
        e4
        f4
    }
}

>>> voice = componenttools.get_component_in_expr_with_name(staff, 'Top Voice')
>>> f(voice)
\context Voice = "Top Voice" {
    c'4
    d'4
    e'4
    f'4
}
```

Return one component.

Raise missing component error when no named component is found.

Raise extra component error when more than one component with *name* is found.

componenttools.get_component_start_offset

componenttools.**get_component_start_offset**(*component*)

New in version 1.1. Get *component* start offset:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> componenttools.get_component_start_offset(staff[1])
Offset(1, 8)
```

Return nonnegative fraction.

componenttools.get_component_start_offset_in_seconds

componenttools.**get_component_start_offset_in_seconds**(*component*)

New in version 1.1. Get *component* start offset in seconds:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score = Score([staff])
>>> contexttools.TempoMark(Duration(1, 4), 52)(score)
TempoMark(Duration(1, 4), 52)(Score<<1>>)
>>> f(score)
\new Score <<
    \new Staff {
        \tempo 4=52
        c'8
        d'8
        e'8
        f'8
    }
>>

>>> componenttools.get_component_start_offset_in_seconds(score.leaves[1])
Offset(15, 26)
```

Return nonnegative fraction.

componenttools.get_component_stop_offset

componenttools.**get_component_stop_offset**(*component*)

New in version 1.1. Get *component* stop offset:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> componenttools.get_component_stop_offset(staff[1])
Offset(1, 4)
```

Return positive fraction.

componenttools.get_component_stop_offset_in_seconds

componenttools.**get_component_stop_offset_in_seconds**(*component*)

New in version 1.1. Get *component* stop offset in seconds:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score = Score([staff])
>>> contexttools.TempoMark(Duration(1, 4), 52)(score)
TempoMark(Duration(1, 4), 52)(Score<<1>>)
>>> f(score)
\new Score <<
    \new Staff {
```

```
        \tempo 4=52
        c'8
        d'8
        e'8
        f'8
    }
>>
```

```
>>> componenttools.get_component_stop_offset_in_seconds(score.leaves[1])
Offset(15, 13)
```

Return positive fraction.

componenttools.get_components_in_expr_with_name

componenttools.**get_components_in_expr_with_name**(*expr*, *name*)

New in version 2.9. Get components in *expr* with *name*:

```
>>> staff = Staff(r"\new Voice { c'8 d'8 } \new Voice { e'8 f'8 } \new Voice { g'4 }")
>>> staff[0].name = 'outer voice'
>>> staff[1].name = 'middle voice'
>>> staff[2].name = 'outer voice'
```

```
>>> f(staff)
\new Staff {
    \context Voice = "outer voice" {
        c'8
        d'8
    }
    \context Voice = "middle voice" {
        e'8
        f'8
    }
    \context Voice = "outer voice" {
        g'4
    }
}
```

```
>>> componenttools.get_components_in_expr_with_name(staff, 'outer voice')
[Voice-"outer voice"{2}, Voice-"outer voice"{1}]
```

```
>>> componenttools.get_components_in_expr_with_name(staff, 'middle voice')
[Voice-"middle voice"{2}]
```

Return list of zero or more components found.

componenttools.get_first_component_in_expr_with_name

componenttools.**get_first_component_in_expr_with_name**(*expr*, *name*)

New in version 1.1. Get first component in *expr* with *name*:

```
>>> flute_staff = Staff("c'8 d'8 e'8 f'8")
>>> flute_staff.name = 'Flute'
>>> violin_staff = Staff("c'8 d'8 e'8 f'8")
>>> violin_staff.name = 'Violin'
```

```
>>> staff_group = scoretools.StaffGroup([flute_staff, violin_staff])
>>> score = Score([staff_group])

>>> componenttools.get_first_component_in_expr_with_name(score, 'Violin')
Staff-"Violin"{4}
```

Changed in version 2.0: Function returns first component found. Function previously returned tuple of all components found.Changed in version 2.0: renamed `scoretools.find()` to `componenttools.get_first_component_in_expr_with_name()`.Changed in version 2.0: Removed *klass* and *context* keywords. Function operates only on component name.

componenttools.get_first_component_with_name_in_improper_parentage_of_component

componenttools.**get_first_component_with_name_in_improper_parentage_of_component**(*component*, *name*)

New in version 2.0. Get first component with *name* in improper parentage of *component*:

```
>>> score = Score([Staff("c'4 d'4 e'4 f'4")])
>>> score.name = 'The Score'

>>> f(score)
\context Score = "The Score" <<
    \new Staff {
        c'4
        d'4
        e'4
        f'4
    }
>>

>>> leaf = score.leaves[0]

>>> componenttools.get_first_component_with_name_in_improper_parentage_of_component(
...     leaf, 'The Score')
Score-"The Score"<<1>>

>>> componenttools.get_first_component_with_name_in_improper_parentage_of_component(
...     leaf, 'foo') is None
True
```

Return component or none.

componenttools.get_first_component_with_name_in_proper_parentage_of_component

componenttools.**get_first_component_with_name_in_proper_parentage_of_component**(*component*, *name*)

New in version 2.0. Get first component with *name* in proper parentage of *component*:

```
>>> score = Score([Staff("c'4 d'4 e'4 f'4")])
>>> score.name = 'The Score'

>>> f(score)
\context Score = "The Score" <<
    \new Staff {
        c'4
        d'4
```

```
        e'4
        f'4
    }
>>
```

```
>>> leaf = score.leaves[0]
```

```
>>> componenttools.get_first_component_with_name_in_proper_parentage_of_component(
...     leaf, 'The Score')
Score-"The Score"<<1>>
```

```
>>> componenttools.get_first_component_with_name_in_proper_parentage_of_component(
...     leaf, 'foo') is None
True
```

Return component or none.

componenttools.get_first_instance_of_klass_in_improper_parentage_of_component

componenttools.**get_first_instance_of_klass_in_improper_parentage_of_component**(*component*, *klass*)

New in version 2.0. Get first instance of *klass* in improper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> componenttools.get_first_instance_of_klass_in_improper_parentage_of_component(
...     staff[0], Note)
Note("c'8")
```

Return component or none.

componenttools.get_first_instance_of_klass_in_proper_parentage_of_component

componenttools.**get_first_instance_of_klass_in_proper_parentage_of_component**(*component*, *klass*)

New in version 1.1. Get first instance of *klass* in proper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> componenttools.get_first_instance_of_klass_in_proper_parentage_of_component(
...     staff[0], Staff)
Staff{4}
```

Return component or none. Changed in version 2.0: renamed `componenttools.get_first()` to `componenttools.get_first_instance_of_klass_in_proper_parentage_of_component()`.

componenttools.get_improper_contents_of_component

componenttools.**get_improper_contents_of_component**(*component*)

New in version 2.9. Get improper contents of *component*:

```
>>> staff = Staff("c' d' e' f'")
```

```
>>> f(staff)
\new Staff {
    c'4
    d'4
```

```
    e'4
    f'4
}
```

```
>>> componenttools.get_improper_contents_of_component(staff)
[Staff{4}, Note("c'4"), Note("d'4"), Note("e'4"), Note("f'4")]
```

The functions works for both containers and leaves.

Return a list of *component* together with the proper contents of *component*.

componenttools.get_improper_descendents_of_component

componenttools.**get_improper_descendents_of_component**(*component*)

New in version 2.9. Get improper descendents of *component*:

```
>>> staff = Staff(r"c'4 \times 2/3 { d'8 e'8 f'8 }")
```

```
>>> f(staff)
\new Staff {
    c'4
    \times 2/3 {
        d'8
        e'8
        f'8
    }
}
```

```
>>> for x in componenttools.get_improper_descendents_of_component(staff):
...     x
...
Staff{2}
Note("c'4")
Tuplet(2/3, [d'8, e'8, f'8])
Note("d'8")
Note("e'8")
Note("f'8")
```

Function returns exactly the same components as `iterationtools.iterate_components_in_expr()`.

Return list of *component* together with proper descendents of *component*.

componenttools.get_improper_descendents_of_component_that_cross_offset

componenttools.**get_improper_descendents_of_component_that_cross_offset**(*component*, *prolated_offset*)

New in version 2.0. Get improper contents of *component* that cross *prolated_offset*:

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
```

```
>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
```

```
        d'8
    }
    {
        e'8
        f'8
    }
}
```

Examples refer to the score above.

No components cross prolated offset `0`:

```
>>> componenttools.get_improper_descendents_of_component_that_cross_offset(staff, 0)
[]
```

Staff, measure and leaf cross prolated offset `1/16`:

```
>>> componenttools.get_improper_descendents_of_component_that_cross_offset(
...     staff, Duration(1, 16))
[Staff{2}, Measure(2/8, [c'8, d'8]), Note("c'8")]
```

Staff and measure cross prolated offset `1/8`:

```
>>> componenttools.get_improper_descendents_of_component_that_cross_offset(
...     staff, Duration(1, 8))
[Staff{2}, Measure(2/8, [c'8, d'8])]
```

Staff crosses prolated offset `1/4`:

```
>>> componenttools.get_improper_descendents_of_component_that_cross_offset(
...     staff, Duration(1, 4))
[Staff{2}]
```

No components cross prolated offset `99`:

```
>>> componenttools.get_improper_descendents_of_component_that_cross_offset(
...     staff, 99)
[]
```

Return list.

componenttools.get_improper_descendents_of_component_that_start_with_component

componenttools.**get_improper_descendents_of_component_that_start_with_component**(*component*)

New in version 2.9. Get improper contents of *component* that start with *component*:

```
>>> staff = Staff(r"c' << \new Voice { d' } \new Voice { e' } >> f'")

>>> f(staff)
\new Staff {
    c'4
    <<
        \new Voice {
            d'4
        }
        \new Voice {
            e'4
        }
    >>
```

```
    f'4
}
```

```
>>> componenttools.get_improper_descendents_of_component_that_start_with_component(
...     staff[1])
[<<Voice{1}, Voice{1}>>, Voice{1}, Note("d'4"), Voice{1}, Note("e'4")]
```

Return list of *component* together with improper contents that start with component.

componenttools.get_improper_descendents_of_component_that_stop_with_component

componenttools.**get_improper_descendents_of_component_that_stop_with_component**(*component*)

New in version 2.9. Get improper descendents of *component* that stop with *component*:

```
>>> staff = Staff(r"c' << \new Voice { d' } \new Voice { e' } >> f'")
```

```
>>> f(staff)
\new Staff {
    c'4
    <<
        \new Voice {
            d'4
        }
        \new Voice {
            e'4
        }
    >>
    f'4
}
```

```
>>> componenttools.get_improper_descendents_of_component_that_stop_with_component(staff)
[Staff{3}, Note("f'4")]
```

Return list of *component* together with proper contents that stop with *component*. Changed in version 2.9: renamed `componenttools.get_improper_contents_of_component_that_stop_with_component()` to `componenttools.get_improper_descendents_of_component_that_stop_with_component()`.

componenttools.get_improper_parentage_of_component

componenttools.**get_improper_parentage_of_component**(*component*)

New in version 1.1. Get improper parentage of *component*:

```
>>> tuplet = Tuplet(Fraction(2, 3), "c'8 d'8 e'8")
>>> staff = Staff([tuplet])
>>> note = staff.leaves[0]
```

```
>>> componenttools.get_improper_parentage_of_component(note)
(Note("c'8"), Tuplet(2/3, [c'8, d'8, e'8]), Staff{1})
```

Return tuple of zero or more components.

componenttools.get_improper_parentage_of_component_that_start_with_component

componenttools.**get_improper_parentage_of_component_that_start_with_component**(*component*)

New in version 2.9. Get improper parentage of *component* that start with *component*:

```
>>> staff = Staff(r"c' << \new Voice { d' } \new Voice { e' } >> f'")

>>> f(staff)
\new Staff {
    c'4
    <<
        \new Voice {
            d'4
        }
        \new Voice {
            e'4
        }
    >>
    f'4
}

>>> componenttools.get_improper_parentage_of_component_that_start_with_component(
...     staff.leaves[1])
[Note("d'4"), Voice{1}, <<Voice{1}, Voice{1}>>]
```

Return list of *component* together with proper parentage that start with *component*.

componenttools.get_improper_parentage_of_component_that_stop_with_component

componenttools.**get_improper_parentage_of_component_that_stop_with_component**(*component*)

New in version 2.9. Get improper parentage of *component* that stop with *component*:

```
>>> staff = Staff(r"c' << \new Voice { d' } \new Voice { e' } >> f'")

f(staff)
\new Staff {
    c'4
    <<
        \new Voice {
            d'4
        }
        \new Voice {
            e'4
        }
    >>
    f'4
}

>>> componenttools.get_improper_parentage_of_component_that_stop_with_component(
...     staff.leaves[-1])
[Note("f'4"), Staff{3}]
```

Return list of *component* with proper parentage that stop with *component*.

componenttools.get_leftmost_components_with_prolated_duration_at_most

componenttools.**get_leftmost_components_with_prolated_duration_at_most**(*components*, *prolated_duration*)

New in version 2.0. Get leftmost components in *component* with prolated duration at most *prolated_duration*.

Return tuple of `components[:i]` together with the prolated duration of `components[:i]`:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> componenttools.get_leftmost_components_with_prolated_duration_at_most(
...     voice[:], Duration(1, 4))
([Note("c'8"), Note("d'8")], Duration(1, 4))
```

Maximize `i` such that the prolated duration of `components[:i]` is no greater than *prolated_duration*.

Input *components* must be thread-contiguous.

Todo

implement `componenttools.list_leftmost_components_with_prolated_duration_at_least()`.

Todo

implement `componenttools.list_rightmost_components_with_prolated_duration_at_most()`.

Todo

implement `componenttools.list_rightmost_components_with_prolated_duration_at_least()`.

Changed in version 2.0: renamed `componenttools.get_le_duration_prolated()` to `componenttools.get_leftmost_components_with_prolated_duration_at_most()`.Changed in version 2.9: renamed `componenttools.list_leftmost_components_with_prolated_duration_at_most` to `componenttools.get_leftmost_components_with_prolated_duration_at_most()`.

componenttools.get_likely_multiplier_of_components

`componenttools.`**`get_likely_multiplier_of_components`**(*components*)

New in version 2.0. Get likely multiplier of *components*:

```
>>> staff = Staff("c'8.. d'8.. e'8.. f'8..")
>>> f(staff)
\new Staff {
    c'8..
    d'8..
    e'8..
    f'8..
}
>>> componenttools.get_likely_multiplier_of_components(staff[:])
Duration(7, 4)
```

Return 1 when no multiplier is likely:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}
>>> componenttools.get_likely_multiplier_of_components(staff[:])
Duration(1, 1)
```

Return none when more than one multiplier is likely:

```
>>> staff = Staff(notetools.make_notes([0, 2, 4, 5], [(3, 16), (7, 32)]))
>>> f(staff)
\new Staff {
    c'8.
    d'8..
    e'8.
    f'8..
}
>>> componenttools.get_likely_multiplier_of_components(staff[:]) is None
True
```

Return fraction or none.

componenttools.get_lineage_of_component

componenttools.**get_lineage_of_component**(*component*)

New in version 2.9. Get lineage of *component*:

```
>>> staff = Staff(r"c'4 \times 2/3 { d'8 e'8 f'8 }")

f(staff)
\new Staff {
    c'4
    \times 2/3 {
        d'8
        e'8
        f'8
    }
}

componenttools.get_lineage_of_component(staff[1])
[Staff{2}, Tuplet(2/3, [d'8, e'8, f'8]), Note("d'8"), Note("e'8"), Note("f'8")]
```

Return list of parentage, component and descendents.

componenttools.get_lineage_of_component_that_start_with_component

componenttools.**get_lineage_of_component_that_start_with_component**(*component*)

New in version 2.9. Get lineage of *component* that start with *component*:

```
>>> staff = Staff(r"c' << \new Voice { d'8 e'8 } \new Voice { d''8 e''8 } >> f'4")

>>> f(staff)
\new Staff {
    c'4
    <<
        \new Voice {
            d'8
            e'8
        }
        \new Voice {
            d''8
            e''8
```

```
        }
    >>
    f'4
}
```

```
>>> staff[1][0]
Voice{2}
```

```
>>> componenttools.get_lineage_of_component_that_start_with_component(staff[1][0])
[<<Voice{2}, Voice{2}>>, Voice{2}, Note("d'8")]
```

Return list of all components in the lineage of *component* that start with *component*.

The list always includes *component*.

componenttools.get_lineage_of_component_that_stop_with_component

componenttools.**get_lineage_of_component_that_stop_with_component**(*component*)

New in version 2.9. Get lineage of *component* that stop with *component*:

```
>>> staff = Staff(r"c' << \new Voice { d'8 e'8 } \new Voice { d''8 e''8 } >> f'4")
```

```
>>> f(staff)
\new Staff {
    c'4
    <<
        \new Voice {
            d'8
            e'8
        }
        \new Voice {
            d''8
            e''8
        }
    >>
    f'4
}
```

```
>>> staff[1][0]
Voice{2}
```

```
>>> componenttools.get_lineage_of_component_that_stop_with_component(staff[1][0])
[<<Voice{2}, Voice{2}>>, Voice{2}, Note("e'8")]
```

Return list of all components in the lineage of *component* that stop with *component*.

The list always includes *component*.

componenttools.get_most_distant_sequential_container_in_improper_parentage_of_component

componenttools.**get_most_distant_sequential_container_in_improper_parentage_of_component**(*com*

New in version 2.9. Get first sequential container in the improper parentage of *component* such that the parent of sequential container is either a parellel container or else none:

```
>>> voice_1 = Voice("c'8 d'8")
>>> voice_2 = Voice("e'8 f'8")
```

```
>>> t = Voice([Container([voice_1, voice_2])])
>>> t[0].is_parallel = True
>>> t[0][0].name = 'voice 1'
>>> t[0][1].name = 'voice 2'

>>> f(t)
\new Voice {
    <<
        \context Voice = "voice 1" {
            c'8
            d'8
        }
        \context Voice = "voice 2" {
            e'8
            f'8
        }
    >>
}

>>> note = t.leaves[1]

>>> componenttools.get_most_distant_sequential_container_in_improper_parentage_of_component(
...     note)
Voice-"voice 1"{2}
```

Return none when no such container exists in the improper parentage of *component*.

componenttools.get_nth_component_in_expr

componenttools.**get_nth_component_in_expr**(*expr*, *klasses*, *n=0*)

New in version 1.1. Get component *n* in the *klasses* of *expr*:

```
>>> staff = Staff([])
>>> durations = [Duration(n, 16) for n in range(1, 5)]
>>> notes = notetools.make_notes([0, 2, 4, 5], durations)
>>> rests = resttools.make_rests(durations)
>>> from abjad.tools import sequencetools
>>> leaves = sequencetools.interlace_sequences(notes, rests)
>>> staff.extend(leaves)

>>> f(staff)
\new Staff {
    c'16
    r16
    d'8
    r8
    e'8.
    r8.
    f'4
    r4
}

>>> for n in range(4):
...         componenttools.get_nth_component_in_expr(staff, Note, n)
...
Note("c'16")
Note("d'8")
```

```
Note("e'8.")
Note("f'4")

>>> for n in range(4):
...         componenttools.get_nth_component_in_expr(staff, Rest, n)
...
Rest('r16')
Rest('r8')
Rest('r8.')
Rest('r4')

>>> componenttools.get_nth_component_in_expr(staff, Staff)
Staff{8}
```

Read right-to-left for negative values of *n*:

```
>>> for n in range(3, -1, -1):
...         componenttools.get_nth_component_in_expr(staff, Rest, n)
...
Rest('r4')
Rest('r8.')
Rest('r8')
Rest('r16')
```

Return component or none. Changed in version 2.0: renamed `iterate.get_nth()` to `componenttools.get_nth_component_in_expr()`.

componenttools.get_nth_component_in_time_order_from_component

componenttools.**get_nth_component_in_time_order_from_component**(*component*, *n*)

New in version 2.9. Get nth component from *component* in temporal order:

```
>>> staff = Staff(r"c'4 \times 2/3 { d'8 e'8 f'8 } g'2")

>>> f(staff)
\new Staff {
    c'4
    \times 2/3 {
        d'8
        e'8
        f'8
    }
    g'2
}

>>> staff.leaves[1]
Note("d'8")
```

Return component right of *component* for positive *n*:

```
>>> componenttools.get_nth_component_in_time_order_from_component(
...     staff.leaves[1], 1)
Note("e'8")

>>> componenttools.get_nth_component_in_time_order_from_component(
...     staff.leaves[1], 2)
Note("f'8")
```

```
>>> componenttools.get_nth_component_in_time_order_from_component(
...     staff.leaves[1], 3)
Note("g'2")
```

Return component left of *component* for negative *n*:

```
>>> componenttools.get_nth_component_in_time_order_from_component(
...     staff.leaves[1], -1)
Note("c'4")
```

Return *component* when *n* is `0`:

```
>>> componenttools.get_nth_component_in_time_order_from_component(
...     staff.leaves[1], 0)
Note("d'8")
```

Return none when *n* is out of range:

```
>>> componenttools.get_nth_component_in_time_order_from_component(
...     staff.leaves[1], 99) is None
True
```

Return none when *component* has no parent:

```
>>> componenttools.get_nth_component_in_time_order_from_component(
...     staff, 1) is None
True
```

Return component or none.

componenttools.get_nth_namesake_from_component

componenttools.**get_nth_namesake_from_component**(*component*, *n*)

New in version 2.0. For positive *n*, return namesake to the right of *component*:

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> componenttools.get_nth_namesake_from_component(t[1], 1)
Note("e'8")
```

For negative *n*, return namesake to the left of *component*:

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> componenttools.get_nth_namesake_from_component(t[1], -1)
Note("c'8")
```

Return *component* when *n* is zero:

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> componenttools.get_nth_namesake_from_component(t[1], 0)
Note("d'8")
```

Return component or none.

componenttools.get_nth_sibling_from_component

componenttools.**get_nth_sibling_from_component**(*component*, *n*)

New in version 2.9. Get nth sibling from *component*:

```
>>> staff = Staff("c' d' e' f'")

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
}

>>> staff[1]
Note("d'4")
```

Return sibling to the right of *component* for positive *n*:

```
>>> componenttools.get_nth_sibling_from_component(staff[1], 1)
Note("e'4")
```

Return sibling to the left of *component* for negative *n*:

```
>>> componenttools.get_nth_sibling_from_component(staff[1], -1)
Note("c'4")
```

Return *component* when *n* is `0`:

```
>>> componenttools.get_nth_sibling_from_component(staff[1], 0)
Note("d'4")
```

Return none when *n* is out of range:

```
>>> componenttools.get_nth_sibling_from_component(staff[1], 99) is None
True
```

Return none when *component* has no parent:

```
>>> componenttools.get_nth_sibling_from_component(staff, 1) is None
True
```

Return component or none.

componenttools.get_parent_and_start_stop_indices_of_components

componenttools.**get_parent_and_start_stop_indices_of_components**(*components*)

New in version 1.1. Get parent and start / stop indices of *components*:

```
>>> t = Staff("c'8 d'8 e'8 f'8 g'8 a'8")

>>> f(t)
\new Staff {
    c'8
    d'8
    e'8
    f'8
    g'8
    a'8
}
```

```
>>> leaves = t[-2:]
>>> leaves
[Note("g'8"), Note("a'8")]
>>> componenttools.get_parent_and_start_stop_indices_of_components(leaves)
(Staff{6}, 4, 5)
```

Return parent / start index / stop index triple. Return parent as component or none. Return nonnegative integer start index and nonnegative index stop index. Changed in version 2.0: renamed `componenttools.get_with_indices()` to `componenttools.get_parent_and_start_stop_indices_of_components()`.

componenttools.get_proper_contents_of_component

componenttools.**get_proper_contents_of_component**(*component*)

New in version 2.9. Get proper contents of *component*:

```
>>> staff = Staff("c' d' e' f'")
```

```
>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
}
```

```
>>> componenttools.get_proper_contents_of_component(staff)
[Note("c'4"), Note("d'4"), Note("e'4"), Note("f'4")]
```

The function works on leaves:

```
>>> componenttools.get_proper_contents_of_component(staff[0])
[]
```

Return list of the proper contents of component.

componenttools.get_proper_descendents_of_component

componenttools.**get_proper_descendents_of_component**(*component*)

New in version 2.9. Get proper descendents of *component*:

```
>>> staff = Staff(r"c'4 \times 2/3 { d'8 e'8 f'8 }")
```

```
>>> f(staff)
\new Staff {
    c'4
    \times 2/3 {
        d'8
        e'8
        f'8
    }
}
```

```
>>> componenttools.get_proper_descendents_of_component(staff)
[Note("c'4"), Tuplet(2/3, [d'8, e'8, f'8]), Note("d'8"), Note("e'8"), Note("f'8")]
```

Return list of proper descendents of *component*.

componenttools.get_proper_parentage_of_component

componenttools.**get_proper_parentage_of_component**(*component*)

New in version 1.1. Get proper parentage of *component*:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> staff = Staff([tuplet])
>>> note = staff.leaves[0]
>>> componenttools.get_proper_parentage_of_component(note)
(FixedDurationTuplet(1/4, [c'8, d'8, e'8]), Staff{1})
```

Return tuple of zero or more components.

componenttools.is_immediate_temporal_successor_of_component

componenttools.**is_immediate_temporal_successor_of_component**(*component*, *expr*)

New in version 2.9. True when *expr* is immediate temporal successor of *component*.

Otherwise false.

componenttools.is_orphan_component

componenttools.**is_orphan_component**(*component*)

New in version 1.1. True when *component* has no parent. Otherwise false:

```
>>> note = Note("c'4")
>>> componenttools.is_orphan_component(note)
True
```

Return boolean. Changed in version 2.0: renamed `componenttools.component_is_orphan()` to `componenttools.is_orphan_component()`.

componenttools.is_well_formed_component

componenttools.**is_well_formed_component**(*expr*, *allow_empty_containers=True*)

New in version 1.1. True when *component* is well formed:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)
>>> componenttools.is_well_formed_component(staff)
True
```

Otherwise false:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> staff[1].written_duration = Duration(1, 4)
>>> beamtools.BeamSpanner(staff[:])
BeamSpanner(c'8, d'4, e'8, f'8)
>>> componenttools.is_well_formed_component(staff)
False
```

Beamed quarter notes are not well formed.

Return boolean.

componenttools.list_badly_formed_components_in_expr

componenttools.**list_badly_formed_components_in_expr**(*expr*)

New in version 1.1. List badly formed components in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> staff[1].written_duration = Duration(1, 4)
>>> beamtools.BeamSpanner(staff[:])
BeamSpanner(c'8, d'4, e'8, f'8)
>>> f(staff)
\new Staff {
    c'8 [
    d'4
    e'8
    f'8 ]
}
>>> componenttools.list_badly_formed_components_in_expr(staff)
[Note("d'4")]
```

Beamed quarter notes are not well formed.

Return newly created list of zero or more components.

componenttools.move_component_subtree_to_right_in_immediate_parent_of_component

componenttools.**move_component_subtree_to_right_in_immediate_parent_of_component**(*component*)

New in version 2.0. Move *component* subtree to right in immediate parent of *component*:

```
>>> voice = Voice("c'8 [ d'8 ] e'8 [ f'8 ]")

>>> f(voice)
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> componenttools.move_component_subtree_to_right_in_immediate_parent_of_component(
... voice[1])

>>> f(voice)
\new Voice {
    c'8 [
    e'8 ]
    d'8 [
    f'8 ]
}
```

Return none.

Todo

add `n = 1` keyword to generalize flipped distance.

Todo

make `componenttools.move_component_subtree_to_right_in_immediate_parent_of_component()` work when spanners attach to children of component:

```
>>> voice = Voice(r"\times 2/3 { c'8 [ d'8 e'8 } \times 2/3 { f'8 ] g'8 a'8 }")

>>> componenttools.move_component_subtree_to_right_in_immediate_parent_of_component(
... voice[0])

>>> f(voice)
\new Voice {
    \times 2/3 {
        f'8 ]
        g'8
        a'8
    }
    \times 2/3 {
        c'8 [
        d'8
        e'8
    }
}

>>> componenttools.is_well_formed_component(voice)
False
```

Preserve spanners. Changed in version 2.0: renamed `componenttools.flip()` to `componenttools.move_component_subtree_to_right_in_immediate_parent_of_component()`.

componenttools.move_parentage_and_spanners_from_components_to_components

componenttools.**move_parentage_and_spanners_from_components_to_components**(*donors*, *recipients*)

New in version 1.1. Move parentage and spanners from *donors* to *recipients*.

Give everything from donors to recipients. Almost exactly the same as container setitem logic. This helper works with orphan donors. Container setitem logic can not work with orphan donors. Return donors. Changed in version 2.0: renamed `scoretools.bequeath()` to `componenttools.move_parentage_and_spanners_from_components_to_components()`.

componenttools.number_is_between_start_and_stop_offsets_of_component

componenttools.**number_is_between_start_and_stop_offsets_of_component**(*timepoint*, *component*)

New in version 2.0. True when *timepoint* is within the prolated duration of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> leaf = staff.leaves[0]

>>> componenttools.number_is_between_start_and_stop_offsets_of_component(
...     Duration(1, 16), leaf)
True
```

```
>>> componenttools.number_is_between_start_and_stop_offsets_of_component(
...     Duration(1, 12), leaf)
True
```

Otherwise false:

```
>>> componenttools.number_is_between_start_and_stop_offsets_of_component(
...     Duration(1, 4), leaf)
False
```

Return boolean.

componenttools.number_is_between_start_and_stop_offsets_of_component_in_seconds

componenttools.**number_is_between_start_and_stop_offsets_of_component_in_seconds**(*timepoint*, *component*)

New in version 2.0. True when *timepoint* is within the duration of *component* in seconds:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.TempoMark(Duration(1, 4), 60, target_context=Staff)(staff)
TempoMark(Duration(1, 4), 60)(Staff{4})

>>> leaf = staff.leaves[0]

>>> componenttools.number_is_between_start_and_stop_offsets_of_component_in_seconds(
... 0.1, leaf)
True
```

Otherwise false:

```
>>> componenttools.number_is_between_start_and_stop_offsets_of_component_in_seconds(
... 0.5, leaf)
False
```

Return boolean.

componenttools.partition_components_by_durations_exactly

componenttools.**partition_components_by_durations_exactly**(*components*, *durations*, *cyclic=False*, *in_seconds=False*, *overhang=False*)

New in version 1.1.

componenttools.partition_components_by_durations_ge

componenttools.**partition_components_by_durations_ge**(*components*, *durations*, *cyclic=False*, *in_seconds=False*, *overhang=False*)

New in version 1.1. Partition *components* by *durations*.

Example 1. Partition *components* cyclically by prolated *durations*. Keep overhang:

```
>>> string = "abj: | 2/8 c'8 d'8 || 2/8 e'8 f'8 || 2/8 g'8 a'8 || 2/8 b'8 c''8 |"
>>> staff = Staff(string)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
    }
    {
        b'8
        c''8
    }
}

>>> parts = componenttools.partition_components_by_durations_ge(
...     staff.leaves, [Duration(3, 16), Duration(1, 16)], cyclic=True, overhang=True)

>>> for part in parts:
...     part
...
[Note("c'8"), Note("d'8")]
[Note("e'8")]
[Note("f'8"), Note("g'8")]
[Note("a'8")]
[Note("b'8"), Note("c''8")]
```

Return list of lists.

Function works not just on components but on any durated objects including spanners.

componenttools.partition_components_by_durations_le

componenttools.**partition_components_by_durations_le**(*components*, *durations*, *cyclic=False*, *in_seconds=False*, *overhang=False*)

New in version 1.1.

componenttools.remove_component_subtree_from_score_and_spanners

componenttools.**remove_component_subtree_from_score_and_spanners**(*components*)

New in version 1.1. Example 1. Remove one leaf from score:

```
>>> voice = Voice("c'8 [ { d'8 e'8 } f'8 ]")
>>> spannertools.GlissandoSpanner(voice.leaves)
GlissandoSpanner(c'8, d'8, e'8, f'8)
```

```
>>> f(voice)
\new Voice {
    c'8 [ \glissando
    {
        d'8 \glissando
        e'8 \glissando
    }
    f'8 ]
}

>>> componenttools.remove_component_subtree_from_score_and_spanners(voice.leaves[1:2])
(Note("d'8"),)

>>> f(voice)
\new Voice {
    c'8 [ \glissando
    {
        e'8 \glissando
    }
    f'8 ]
}
```

Example 2. Remove contiguous leaves from score:

```
>>> voice = Voice("c'8 [ { d'8 e'8 } f'8 ]")
>>> spannertools.GlissandoSpanner(voice.leaves)
GlissandoSpanner(c'8, d'8, e'8, f'8)

>>> f(voice)
\new Voice {
    c'8 [ \glissando
    {
        d'8 \glissando
        e'8 \glissando
    }
    f'8 ]
}

>>> componenttools.remove_component_subtree_from_score_and_spanners(voice.leaves[:2])
(Note("c'8"), Note("d'8"))

>>> f(voice)
\new Voice {
    {
        e'8 [ \glissando
    }
    f'8 ]
}
```

Example 3. Remove noncontiguous leaves from score:

```
>>> voice = Voice("c'8 [ { d'8 e'8 } f'8 ]")
>>> spannertools.GlissandoSpanner(voice.leaves)
GlissandoSpanner(c'8, d'8, e'8, f'8)

>>> f(voice)
\new Voice {
    c'8 [ \glissando
    {
```

```
        d'8 \glissando
        e'8 \glissando
    }
    f'8 ]
}

>>> componenttools.remove_component_subtree_from_score_and_spanners(
... [voice.leaves[0], voice.leaves[2]])
[Note("c'8"), Note("e'8")]

>>> f(voice)
\new Voice {
    { d'8 [ \glissando
    }
    f'8 ]
}
```

Example 4. Remove container from score:

```
>>> voice = Voice("c'8 [ { d'8 e'8 } f'8 ]")
>>> spannertools.GlissandoSpanner(voice.leaves)
GlissandoSpanner(c'8, d'8, e'8, f'8)

>>> f(voice)
\new Voice {
    c'8 [ \glissando
    {
        d'8 \glissando
        e'8 \glissando
    }
    f'8 ]
}

>>> componenttools.remove_component_subtree_from_score_and_spanners(voice[1:2])
[{d'8, e'8}]

>>> f(voice)
\new Voice {
    c'8 [ \glissando
    f'8 ]
}
```

Withdraw *components* and children of *components* from spanners.

Return either tuple or list of *components* and children of *components*.

Todo

regularize return value of function.

Changed in version 2.0: renamed `componenttools.detach()` to `componenttools.remove_component_subtree_from_score_and_spanners()`.

componenttools.replace_components_with_children_of_components

`componenttools.`**`replace_components_with_children_of_components`**(*components*)

New in version 1.1. Remove arbitrary *components* from score but retain children of *components* in score:

```
>>> staff = Staff(Container(notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> spannertools.SlurSpanner(staff[:])
SlurSpanner({c'8, d'8}, {e'8, f'8})
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    {
        c'8 [ (
        d'8
    }
    {
        e'8
        f'8 ] )
    }
}

>>> componenttools.replace_components_with_children_of_components(staff[0:1])
[{}]

>>> f(staff)
\new Staff {
    c'8 [ (
    d'8
    {
        e'8
        f'8 ] )
    }
}
```

Return *components*. Changed in version 2.0: renamed `componenttools.slip()` to `componenttools.replace_components_with_children_of_components()`.

componenttools.report_component_format_contributions

componenttools.**report_component_format_contributions**(*component*, *verbose=False*)

New in version 1.1. Report *component* format contributions as string.

Set *verbose* to True or False.

componenttools.split_component_at_offset

componenttools.**split_component_at_offset**(*component*, *offset*, *fracture_spanners=False*, *tie_split_notes=True*, *tie_split_rests=False*)

New in version 1.1. Split *component* at *offset*.

Example 1. Split *component* at *offset*. Don't fracture spanners:

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)

>>> beamtools.BeamSpanner(staff[0])
BeamSpanner(|2/8(2)|)
>>> beamtools.BeamSpanner(staff[1])
```

```
BeamSpanner(|2/8(2)|)
>>> spannertools.SlurSpanner(staff.leaves)
SlurSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8 [ (
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}

>>> halves = componenttools.split_component_at_offset(
... staff.leaves[0], (1, 32), fracture_spanners=False, tie_split_notes=False)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'32 [ (
        c'16.
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}
```

Example 2. Split component at offset at fracture crossing spanners:

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)

>>> beamtools.BeamSpanner(staff[0])
BeamSpanner(|2/8(2)|)
>>> beamtools.BeamSpanner(staff[1])
BeamSpanner(|2/8(2)|)
>>> spannertools.SlurSpanner(staff.leaves)
SlurSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8 [ (
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}
```

```
>>> halves = componenttools.split_component_at_offset(
... staff.leaves[0], (1, 32), fracture_spanners=True, tie_split_notes=False)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'32 ( ) [
        c'16. (
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}
```

Return pair of left and right part-lists.

componenttools.split_components_at_offsets

componenttools.**split_components_at_offsets**(*components*, *offsets*, *fracture_spanners=False*, *cyclic=False*, *tie_split_notes=True*, *tie_split_rests=False*)

New in version 2.0. Example 1. Split components cyclically and do not fracture crossing spanners:

```
>>> staff = Staff("abj: | 2/8 c'8 d'8 || 2/8 e'8 f'8 |")

>>> beamtools.BeamSpanner(staff[0])
BeamSpanner(|2/8(2)|)
>>> beamtools.BeamSpanner(staff[1])
BeamSpanner(|2/8(2)|)
>>> spannertools.SlurSpanner(staff.leaves)
SlurSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8 [ (
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}

>>> componenttools.split_components_at_offsets(
...     staff.leaves, [Duration(3, 32)], cyclic=True)
[[Note("c'16.")], [Note("c'32"), Note("d'16")],
[Note("d'16"), Note("e'32")], [Note("e'16.")], [Note("f'16.")], [Note("f'32")]]

>>> f(staff)
\new Staff {
    {
        \time 2/8
```

```
        c'16. [ ( ~
        c'32
        d'16 ~
        d'16 ]
    }
    {
        e'32 [ ~
        e'16.
        f'16. ~
        f'32 ] )
    }
}
```

Example 2. Split components cyclically and fracture spanners:

```
>>> staff = Staff("abj: | 2/8 c'8 d'8 || 2/8 e'8 f'8 |")

>>> beamtools.BeamSpanner(staff[0])
BeamSpanner(|2/8(2)|)
>>> beamtools.BeamSpanner(staff[1])
BeamSpanner(|2/8(2)|)
>>> spannertools.SlurSpanner(staff.leaves)
SlurSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8 [ (
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}

>>> result = componenttools.split_components_at_offsets(
... staff.leaves, [Duration(3, 32)], cyclic=True, fracture_spanners=True)

>>> result
[[Note("c'16.")], [Note("c'32"), Note("d'16")], [Note("d'16"), Note("e'32")],
[Note("e'16.")], [Note("f'16.")], [Note("f'32")]]

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'16. ( ) [ ~
        c'32 (
        d'16 ) ~
        d'16 ] (
    }
    {
        e'32 ) [ ~
        e'16. (
        f'16. ) ~
        f'32 ] ( )
```

```
    }
}
```

Example 3. Split components once and do not fracture crossing spanners:

```
>>> staff = Staff("abj: | 2/8 c'8 d'8 || 2/8 e'8 f'8 |")

>>> beamtools.BeamSpanner(staff[0])
BeamSpanner(|2/8(2)|)
>>> beamtools.BeamSpanner(staff[1])
BeamSpanner(|2/8(2)|)
>>> spannertools.SlurSpanner(staff.leaves)
SlurSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8 [ (
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}

>>> offsets = [Duration(1, 32), Duration(3, 32), Duration(5, 32)]

>>> shards = componenttools.split_components_at_offsets(
... staff[:1], offsets, cyclic=False, fracture_spanners=False, tie_split_notes=False)

>>> f(staff)
\new Staff {
    {
        \time 1/32
        c'32 [ (
    }
    {
        \time 3/32
        c'16.
    }
    {
        \time 4/32
        d'8 ]
    }
    {
        \time 2/8
        e'8 [
        f'8 ] )
    }
}
```

Example 4. Split components once and fracture crossing spanners:

```
>>> staff = Staff("abj: | 2/8 c'8 d'8 || 2/8 e'8 f'8 |")
```

```
>>> beamtools.BeamSpanner(staff[0])
BeamSpanner(|2/8(2)|)
>>> beamtools.BeamSpanner(staff[1])
BeamSpanner(|2/8(2)|)
>>> spannertools.SlurSpanner(staff.leaves)
SlurSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8 [ (
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}

>>> offsets = [Duration(1, 32), Duration(3, 32), Duration(5, 32)]
>>> shards = componenttools.split_components_at_offsets(
... staff[:1], offsets, cyclic=False, fracture_spanners=True, tie_split_notes=False)

>>> f(staff)
\new Staff {
    {
        \time 1/32
        c'32 [ ] ( )
    }
    {
        \time 3/32
        c'16. [ ] ( )
    }
    {
        \time 4/32
        d'8 [ ] (
    }
    {
        \time 2/8
        e'8 [
        f'8 ] )
    }
}
```

Example 5. Split tupletted components once and fracture crossing spanners:

```
>>> staff = Staff(r"\times 2/3 { c'8 d'8 e'8 } \times 2/3 { f'8 g'8 a'8 }")

>>> beamtools.BeamSpanner(staff[0])
BeamSpanner({c'8, d'8, e'8})
>>> beamtools.BeamSpanner(staff[1])
BeamSpanner({f'8, g'8, a'8})
>>> spannertools.SlurSpanner(staff.leaves)
SlurSpanner(c'8, d'8, e'8, f'8, g'8, a'8)

>>> f(staff)
\new Staff {
```

```
        \times 2/3 {
            c'8 [ (
            d'8
            e'8 ]
        }
        \times 2/3 {
            f'8 [
            g'8
            a'8 ] )
        }
    }
```

```
>>> offsets = [(1, 8)]
>>> shards = componenttools.split_components_at_offsets(
... staff.leaves, offsets, cyclic=False, fracture_spanners=True, tie_split_notes=True)
```

```
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8 [ (
        d'16 ) ~
        d'16 (
        e'8 ]
    }
    \times 2/3 {
        f'8 [
        g'8
        a'8 ] )
    }
}
```

Return list of newly split shards.

Note: Add tests of tupletted notes and rests.

Note: Add examples that show mark and context mark handling.

Note: Add example showing grace and after grace handling.

---

componenttools.sum_duration_of_components_in_seconds

componenttools.**sum_duration_of_components_in_seconds**(*components*)

New in version 1.1. Sum duration of *components* in seconds:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> score = Score([Staff([tuplet])])
>>> contexttools.TempoMark(Duration(1, 4), 48)(score)
TempoMark(Duration(1, 4), 48)(Score<<1>>)
>>> f(score)
\new Score <<
    \new Staff {
        \times 2/3 {
            \tempo 4=48
```

```
            c'8
            d'8
            e'8
        }
    }
>>
```

```
>>> componenttools.sum_duration_of_components_in_seconds(tuplet[:])
Duration(5, 4)
```

Changed in version 2.0: renamed `durationtools.sum_seconds()` to `componenttools.sum_duration_of_components_in_seconds()`.

componenttools.sum_preprolated_duration_of_components

componenttools.**sum_preprolated_duration_of_components**(*components*)

New in version 1.1. Sum preprolated duration of *components*:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> componenttools.sum_preprolated_duration_of_components(tuplet[:])
Duration(3, 8)
```

Return zero on empty iterable:

```
>>> componenttools.sum_preprolated_duration_of_components([])
0
```

Raise contiguity error on nonparent-contiguous *components*:

```
>>> t = Voice(r"\times 2/3 { c'8 d'8 e'8 } \times 2/3 { f'8 g'8 a'8 }")
```

```
>>> f(t)
\new Voice {
    \times 2/3 {
        c'8
        d'8
        e'8
    }
    \times 2/3 {
        f'8
        g'8
        a'8
    }
}
```

```
>>> componenttools.sum_preprolated_duration_of_components(t.leaves)
Duration(3, 4)
```

Changed in version 2.0: renamed `componenttools.get_duration_preprolated()` to `componenttools.sum_preprolated_duration_of_components()`.

componenttools.sum_prolated_duration_of_components

componenttools.**sum_prolated_duration_of_components**(*components*)

New in version 1.1. Sum prolated duration of *components*:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> f(tuplet)
\times 2/3 {
    c'8
    d'8
    e'8
}
>>> componenttools.sum_prolated_duration_of_components(tuplet[:])
Duration(1, 4)
```

Changed in version 2.0: renamed `durationtools.sum_prolated()` to `componenttools.sum_prolated_duration_of_components()`.

componenttools.tabulate_well_formedness_violations_in_expr

componenttools.**tabulate_well_formedness_violations_in_expr**(*expr*)

New in version 1.1. Tabulate well-formedness violations in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> staff[1].written_duration = Duration(1, 4)
>>> beamtools.BeamSpanner(staff[:])
BeamSpanner(c'8, d'4, e'8, f'8)
>>> f(staff)
\new Staff {
    c'8 [
    d'4
    e'8
    f'8 ]
}
```

```
>>> componenttools.tabulate_well_formedness_violations_in_expr(staff)
   1 /    4 beamed quarter note
   0 /    1 discontiguous spanner
   0 /    5 duplicate id
   0 /    1 empty container
   0 /    0 intermarked hairpin
   0 /    0 misdurated measure
   0 /    0 misfilled measure
   0 /    4 mispitched tie
   0 /    4 misrepresented flag
   0 /    5 missing parent
   0 /    0 nested measure
   0 /    0 overlapping beam
   0 /    0 overlapping glissando
   0 /    0 overlapping octavation
   0 /    0 short hairpin
```

Beamed quarter notes are not well formed.

componenttools.yield_components_grouped_by_preprolated_duration

componenttools.**yield_components_grouped_by_preprolated_duration**(*components*)

New in version 2.0. Example 1. Yield topmost components grouped by preprolated duration:

```
>>> staff = Staff(r"\times 2/3 { c'4 c'4 c'8 c'16 c'16 } c'16 c'16 c'8 c'8")
```

```
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'4
        c'4
        c'8
        c'16
        c'16
    }
    c'16
    c'16
    c'8
    c'8
}

>>> for x in componenttools.yield_components_grouped_by_preprolated_duration(staff):
...     x
...
(Tuplet(2/3, [c'4, c'4, c'8, c'16, c'16]),)
(Note("c'16"), Note("c'16"))
(Note("c'8"), Note("c'8"))
```

Example 2. Yield topmost components grouped by preprolated duration.

Note that function treats input as a flat sequence and attempts no navigation of the score tree. But it's possible to group components lower in the score tree by passing the output of a component iterator as input to this function:

```
>>> staff = Staff(r"\times 2/3 { c'4 c'4 c'8 c'16 c'16 } c'16 c'16 c'8 c'8")

>>> leaves = iterationtools.iterate_leaves_in_expr(staff)
>>> for x in componenttools.yield_components_grouped_by_preprolated_duration(leaves):
...     x
(Note("c'4"), Note("c'4"))
(Note("c'8"),)
(Note("c'16"), Note("c'16"), Note("c'16"), Note("c'16"))
(Note("c'8"), Note("c'8"))
```

Return generator.

Note: Might be best to add `in_sequence` or `topmost` to the name of this function.

---

componenttools.yield_components_grouped_by_prolated_duration

componenttools.**yield_components_grouped_by_prolated_duration**(*components*)

New in version 2.0. Example 1. Yield topmost components grouped by prolated duration:

```
>>> staff = Staff(r"\times 2/3 { c'4 c'4 c'8 c'16 c'16 } c'16 c'16 c'8 c'8")

>>> f(staff)
\new Staff {
    \times 2/3 {
        c'4
        c'4
        c'8
        c'16
        c'16
```

```
    }
    c'16
    c'16
    c'8
    c'8
}
```

```
>>> for x in componenttools.yield_components_grouped_by_prolated_duration(staff):
...     x
...
(Tuplet(2/3, [c'4, c'4, c'8, c'16, c'16]),)
(Note("c'16"), Note("c'16"))
(Note("c'8"), Note("c'8"))
```

Example 2. Yield topmost components grouped by prolated duration.

Note that function treats input as a flat sequence and attempts no navigation of the score tree. But it's possible to group components lower in the score tree by passing the output of a component iterator as input to this function:

```
>>> staff = Staff(r"\times 2/3 { c'4 c'4 c'8 c'16 c'16 } c'16 c'16 c'8 c'8")

>>> leaves = iterationtools.iterate_leaves_in_expr(staff)
>>> for x in componenttools.yield_components_grouped_by_prolated_duration(leaves):
...     x
(Note("c'4"), Note("c'4"))
(Note("c'8"),)
(Note("c'16"), Note("c'16"))
(Note("c'16"), Note("c'16"))
(Note("c'8"), Note("c'8"))
```

Return generator.

Note: Might be best to add `in_sequence` or `topmost` to the name of this function.

---

componenttools.yield_groups_of_mixed_klasses_in_sequence

componenttools.**yield_groups_of_mixed_klasses_in_sequence**(*sequence*, *klasses*)

New in version 2.0. Example 1. Yield groups of notes and chords at only the top level of score:

```
>>> staff = Staff(r"\times 2/3 { c'8 d'8 r8 } \times 2/3 { r8 <e' g'>8 <f' a'>8 }")
>>> staff.extend("g'8 a'8 r8 r8 <b' d''>8 <c'' e''>8")

>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8
        d'8
        r8
    }
    \times 2/3 {
        r8
        <e' g'>8
        <f' a'>8
    }
    g'8
    a'8
```

```
    r8
    r8
    <b' d''>8
    <c'' e''>8
}
```

```
>>> for group in componenttools.yield_groups_of_mixed_klasses_in_sequence(
...     staff, (Note, Chord)):
...     group
(Note("g'8"), Note("a'8"))
(Chord("<b' d''>8"), Chord("<c'' e''>8"))
```

Example 2. Yield groups of notes and chords at all levels of score:

```
>>> leaves = iterationtools.iterate_leaves_in_expr(staff)
```

```
>>> for group in componenttools.yield_groups_of_mixed_klasses_in_sequence(
...     leaves, (Note, Chord)):
...     group
(Note("c'8"), Note("d'8"))
(Chord("<e' g'>8"), Chord("<f' a'>8"), Note("g'8"), Note("a'8"))
(Chord("<b' d''>8"), Chord("<c'' e''>8"))
```

Return generator.

componenttools.yield_topmost_components_grouped_by_type

componenttools.**yield_topmost_components_grouped_by_type**(*expr*)

New in version 2.0. Example 1. Yield topmost components in *expr* grouped by type:

```
>>> staff = Staff(r"\times 2/3 { c'8 d'8 r8 } \times 2/3 { r8 <e' g'>8 <f' a'>8 }")
>>> staff.extend("g'8 a'8 r8 r8 <b' d''>8 <c'' e''>8")
```

```
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8
        d'8
        r8
    }
    \times 2/3 {
        r8
        <e' g'>8
        <f' a'>8
    }
    g'8
    a'8
    r8
    r8
    <b' d''>8
    <c'' e''>8
}
```

```
>>> for x in componenttools.yield_topmost_components_grouped_by_type(staff):
...     x
(Tuplet(2/3, [c'8, d'8, r8]), Tuplet(2/3, [r8, <e' g'>8, <f' a'>8]))
(Note("g'8"), Note("a'8"))
```

```
(Rest('r8'), Rest('r8'))
(Chord("<b' d''>8"), Chord("<c'' e''>8"))
```

Example 2. Yield leaves at all score levels in *expr* grouped by type:

```
>>> leaves = iterationtools.iterate_leaves_in_expr(staff)

>>> for x in componenttools.yield_topmost_components_grouped_by_type(leaves):
...     x
(Note("c'8"), Note("d'8"))
(Rest('r8'), Rest('r8'))
(Chord("<e' g'>8"), Chord("<f' a'>8"))
(Note("g'8"), Note("a'8"))
(Rest('r8'), Rest('r8'))
(Chord("<b' d''>8"), Chord("<c'' e''>8"))
```

Return generator.

componenttools.yield_topmost_components_of_klass_grouped_by_type

componenttools.**yield_topmost_components_of_klass_grouped_by_type**(*expr*, *klass*)

New in version 2.0. Example 1. Yield runs of topmost notes in *expr*:

```
>>> staff = Staff(r"\times 2/3 { c'8 d'8 r8 } \times 2/3 { r8 <e' g'>8 <f' a'>8 }")
>>> staff.extend("g'8 a'8 r8 r8 <b' d''>8 <c'' e''>8")

>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8
        d'8
        r8
    }
    \times 2/3 {
        r8
        <e' g'>8
        <f' a'>8
    }
    g'8
    a'8
    r8
    r8
    <b' d''>8
    <c'' e''>8
}

>>> for group in componenttools.yield_topmost_components_of_klass_grouped_by_type(
...     staff, Note):
...     group
(Note("g'8"), Note("a'8"))
```

Example 2. Yield runs of notes at all levels in *expr*:

```
>>> leaves = iterationtools.iterate_leaves_in_expr(staff)

>>> for group in componenttools.yield_topmost_components_of_klass_grouped_by_type(
...     leaves, Note):
```

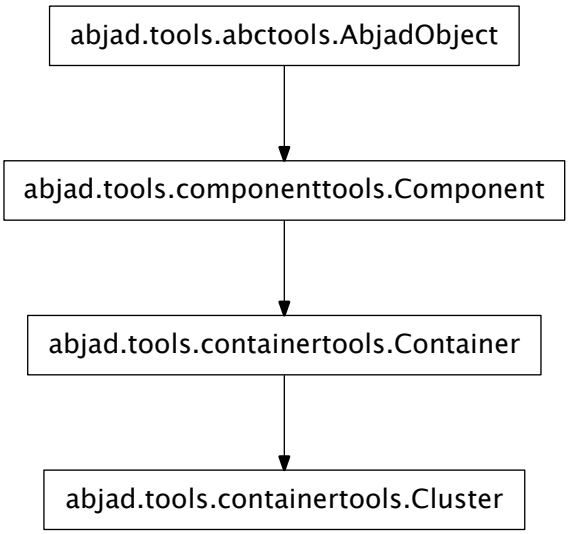
```
...     group
(Note("c'8"), Note("d'8"))
(Note("g'8"), Note("a'8"))
```

Return generator.

containertools

concrete classes

containertools.Cluster



class containertools.**Cluster**(*music=None*, ***kwargs*)

New in version 1.1. Abjad model of a tone cluster container:

```
>>> cluster = containertools.Cluster("c'8 d'8 b'8")

>>> cluster
Cluster(c'8, d'8, b'8)

>>> f(cluster)
\makeClusters {
    c'8
    d'8
    b'8
}
```

Return cluster object.

Read-only Properties

Cluster.**contents_duration**
Inherited from containertools.Container

Cluster.**duration_in_seconds**
Inherited from containertools.Container

Cluster.**leaves**
Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

Cluster.**lilypond_format**

Cluster.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

Cluster.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Cluster.**parent**
Inherited from componenttools.Component

Cluster.**preprolated_duration**
Inherited from containertools.Container

Cluster.**prolated_duration**
Inherited from componenttools.Component

Cluster.**prolation**
Inherited from componenttools.Component

Cluster.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Cluster.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Cluster.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Cluster.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Cluster.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Cluster.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Cluster.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Cluster.**is_parallel**
Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from containertools.Container

Methods

Cluster.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

Cluster.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: expr may now be a LilyPond input string. Inherited from containertools.Container

Cluster.**index**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from containertools.Container

Cluster.**insert**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from containertools.Container

Cluster.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")
```

```
>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

Cluster.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

Cluster.**__add__**(*expr*)

Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

Cluster.**__contains__**(*expr*)

True if expr is in container, otherwise False.

Inherited from containertools.Container

Cluster.**__delitem__**(*i*)

Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

Cluster.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Cluster.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Cluster.__getitem__(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

Cluster.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Cluster.__iadd__(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

Cluster.__imul__(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

Cluster.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Cluster.__len__()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

Cluster.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Cluster.__mul__(*n*)
Inherited from componenttools.Component

Cluster.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Cluster.__radd__(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

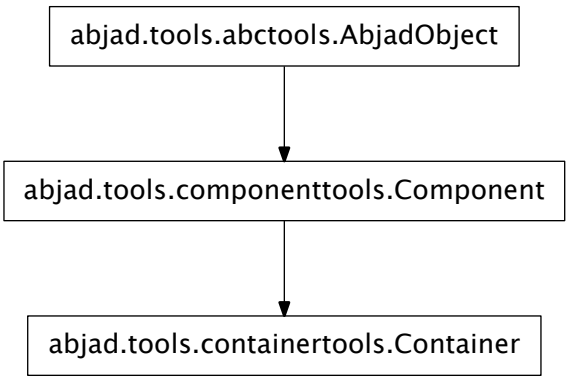
Cluster.__repr__()

Cluster.**__rmul__**(*n*)
Inherited from componenttools.Component

Cluster.**__setitem__**(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

containertools.Container



class containertools.**Container**(*music=None*, ***kwargs*)
Abjad model of a music container:

```
>>> container = Container("c'8 d'8 e'8 f'8")
>>> f(container)
{
    c'8
    d'8
    e'8
    f'8
}
```

Return container object.

Read-only Properties

Container.**contents_duration**
Container.**duration_in_seconds**

Container.**leaves**
Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Container.**lilypond_format**
Inherited from componenttools.Component

Container.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Container.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Container.**parent**
Inherited from componenttools.Component

Container.**preprolated_duration**

Container.**prolated_duration**
Inherited from componenttools.Component

Container.**prolation**
Inherited from componenttools.Component

Container.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Container.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Container.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Container.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Container.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Container.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Container.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Container.**is_parallel**
Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Methods

Container.**append**(*component*)
Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
```

```
        d'8
        e'8 ]
    }

    >>> container.append(Note("f'8"))

    >>> f(container)
    {
        c'8 [
        d'8
        e'8 ]
        f'8
    }
```

Return none.

Container.**extend**(*expr*)

Extend *expr* against container:

```
    >>> container = Container("c'8 d'8 e'8")
    >>> beam = beamtools.BeamSpanner(container.music)

    >>> f(container)
    {
        c'8 [
        d'8
        e'8 ]
    }

    >>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

    >>> f(container)
    {
        c'8 [
        d'8
        e'8 ]
        cs'8
        ds'8
        es'8
    }
```

Return none. New in version 2.3: `expr` may now be a LilyPond input string.

Container.**index**(*component*)

Index *component* in container:

```
    >>> container = Container("c'8 d'8 e'8")

    >>> note = container[-1]
    >>> note
    Note("e'8")

    >>> container.index(note)
    2
```

Return nonnegative integer.

Container.**insert**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

`Container.`**`pop`**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

`Container.`**`remove`**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}
```

```
>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Special Methods

`Container.__add__`(*expr*)
Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

`Container.__contains__`(*expr*)
True if expr is in container, otherwise False.

`Container.__delitem__`(*i*)
Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

`Container.__eq__`(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`Container.__ge__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`Container.__getitem__`(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

`Container.__gt__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`Container.__iadd__`(*expr*)
__iadd__ avoids unnecessary copying of structures.

`Container.__imul__`(*total*)
Multiply contents of container 'total' times. Return multiplied container.

`Container.__le__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

Container.__len__()
Return nonnegative integer number of components in container.

Container.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Container.__mul__(*n*)
Inherited from componenttools.Component

Container.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

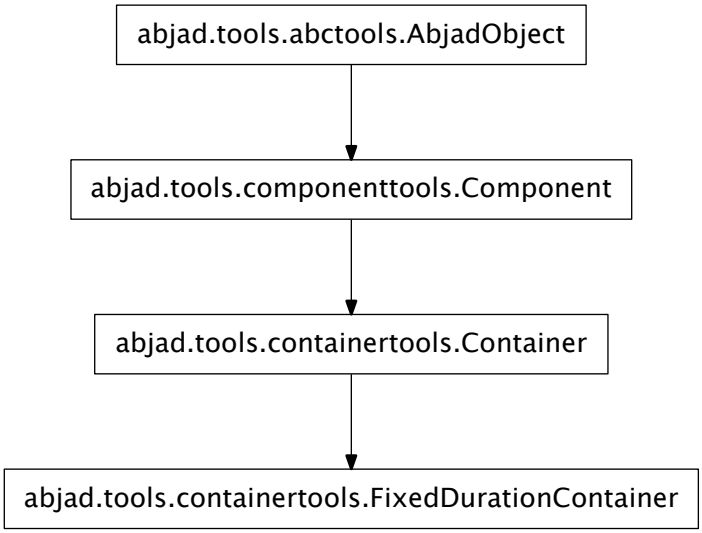
Container.__radd__(*expr*)
Extend container by contents of expr to the right.

Container.__repr__()
String format of container for interpreter display.

Container.__rmul__(*n*)
Inherited from componenttools.Component

Container.__setitem__(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

containertools.FixedDurationContainer



class containertools.**FixedDurationContainer**(*target_duration*, *music=None*, ***kwargs*)

New in version 2.9. Fixed-duration container:

```
>>> container = containertools.FixedDurationContainer((3, 8), "c'8 d'8 e'8")

>>> container
FixedDurationContainer(Duration(3, 8), [Note("c'8"), Note("d'8"), Note("e'8")])

>>> f(container)
{
    c'8
    d'8
    e'8
}
```

Fixed-duration containers extend container behavior with format-time checking against a user-specified target duration.

Return fixed-duration container.

Read-only Properties

FixedDurationContainer.**contents_duration**

Inherited from containertools.Container

FixedDurationContainer.**duration_in_seconds**

Inherited from containertools.Container

FixedDurationContainer.**is_full**

True when preprolated duration equals target duration.

FixedDurationContainer.**is_misfilled**
True when preprolated duration does not equal target duration.

FixedDurationContainer.**is_overfull**
True when preprolated duration is greater than target duration.

FixedDurationContainer.**is_underfull**
True when preprolated duration is less than target duration.

FixedDurationContainer.**leaves**
Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

FixedDurationContainer.**lilypond_format**
Read-only LilyPond format of fixed-duration container.

FixedDurationContainer.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

FixedDurationContainer.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

FixedDurationContainer.**parent**
Inherited from componenttools.Component

FixedDurationContainer.**preprolated_duration**
Inherited from containertools.Container

FixedDurationContainer.**prolated_duration**
Inherited from componenttools.Component

FixedDurationContainer.**prolation**
Inherited from componenttools.Component

FixedDurationContainer.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

FixedDurationContainer.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

FixedDurationContainer.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

FixedDurationContainer.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

FixedDurationContainer.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

FixedDurationContainer.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

FixedDurationContainer.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

FixedDurationContainer.**is_parallel**
Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
```

```
            g4.
        }
    >>
```

Return none.

Inherited from containertools.Container

FixedDurationContainer.**target_duration**

Read / write target duration of fixed-duration container.

Methods

FixedDurationContainer.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

FixedDurationContainer.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
```

```
        ds'8
        es'8
    }
```

Return none. New in version 2.3: `expr` may now be a LilyPond input string. Inherited from `containertools.Container`

`FixedDurationContainer.`**`index`**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from `containertools.Container`

`FixedDurationContainer.`**`insert`**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from `containertools.Container`

`FixedDurationContainer.`**`pop`**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
```

```
        e'8 ]
    }

    >>> container.pop(-1)
    Note("e'8")

    >>> f(container)
    {
        c'8 [
        d'8 ]
    }
```

Return component.

Inherited from containertools.Container

FixedDurationContainer.**remove**(*component*)

Remove *component* from container:

```
    >>> container = Container("c'8 d'8 e'8")
    >>> beam = beamtools.BeamSpanner(container.music)

    >>> f(container)
    {
        c'8 [
        d'8
        e'8 ]
    }

    >>> note = container[-1]
    >>> note
    Note("e'8")

    >>> container.remove(note)

    >>> f(container)
    {
        c'8 [
        d'8 ]
    }
```

Return none.

Inherited from containertools.Container

Special Methods

FixedDurationContainer.**__add__**(*expr*)

Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

FixedDurationContainer.**__contains__**(*expr*)

True if expr is in container, otherwise False.

Inherited from containertools.Container

FixedDurationContainer.**__delitem__**(*i*)

Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

FixedDurationContainer.__eq__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

FixedDurationContainer.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

FixedDurationContainer.__getitem__(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

FixedDurationContainer.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

FixedDurationContainer.__iadd__(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

FixedDurationContainer.__imul__(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

FixedDurationContainer.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

FixedDurationContainer.__len__()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

FixedDurationContainer.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

FixedDurationContainer.__mul__(*n*)
Inherited from componenttools.Component

FixedDurationContainer.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

FixedDurationContainer.**__radd__**(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

FixedDurationContainer.**__repr__**()

FixedDurationContainer.**__rmul__**(*n*)
Inherited from componenttools.Component

FixedDurationContainer.**__setitem__**(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

functions

containertools.all_are_containers

containertools.**all_are_containers**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad containers:

```
>>> containers = 3 * Container("c'8 d'8 e'8")

>>> containertools.all_are_containers(containers)
True
```

True when *expr* is an empty sequence:

```
>>> containertools.all_are_containers([])
True
```

Otherwise false:

```
>>> containertools.all_are_containers('foo')
False
```

Return boolean.

Function wraps componenttools.all_are_components().

containertools.delete_contents_of_container

containertools.**delete_contents_of_container**(*container*)
Delete contents of *container*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

```
>>> containertools.delete_contents_of_container(staff)
[Note("c'8"), Note("d'8"), Note("e'8"), Note("f'8")]

>>> f(staff)
\new Staff {
}
```

Return *container* contents. Changed in version 2.0: renamed `containertools.contents_delete()` to `containertools.delete_contents_of_container()`.

containertools.delete_contents_of_container_starting_at_or_after_offset

containertools.**delete_contents_of_container_starting_at_or_after_offset**(*container*, *prolated_offset*)

New in version 2.0. Delete contents of *container* starting at or after *prolated_offset*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> containertools.delete_contents_of_container_starting_at_or_after_offset(
...     staff, Duration(1, 8))
Staff{1}

>>> f(staff)
\new Staff {
    c'8 [ ]
}
```

Return *container*. Changed in version 2.0: renamed `containertools.contents_delete_starting_not_before_p` to `containertools.delete_contents_of_container_starting_at_or_after_offset()`.

containertools.delete_contents_of_container_starting_before_or_at_offset

containertools.**delete_contents_of_container_starting_before_or_at_offset**(*container*, *prolated_offset*)

New in version 2.0. Delete contents of *container* starting before or at *prolated_offset*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
```

```
    e'8
    f'8 ]
}
```

```
>>> containertools.delete_contents_of_container_starting_before_or_at_offset(
...     staff, Duration(1, 8))
Staff{2}

>>> f(staff)
\new Staff {
    e'8 [
    f'8 ]
}
```

Return *container*. Changed in version 2.0: renamed `containertools.contents_delete_starting_not_after_pr` to `containertools.delete_contents_of_container_starting_before_or_at_offset()`.

containertools.delete_contents_of_container_starting_strictly_after_offset

`containertools.`**`delete_contents_of_container_starting_strictly_after_offset`**(*container*, *prolated_offset*)

New in version 2.0. Delete contents of *container* starting strictly after *prolated_offset*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> containertools.delete_contents_of_container_starting_strictly_after_offset(
...     staff, Duration(1, 8))
Staff{2}

>>> f(staff)
\new Staff {
    c'8 [
    d'8 ]
}
```

Return *container*. Changed in version 2.0: renamed `containertools.contents_delete_starting_after_prolat` to `containertools.delete_contents_of_container_starting_strictly_after_offset()`.

containertools.delete_contents_of_container_starting_strictly_before_offset

`containertools.`**`delete_contents_of_container_starting_strictly_before_offset`**(*container*, *prolated_offset*)

New in version 2.0. Delete contents of *container* contents starting strictly before *prolated_offset*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> containertools.delete_contents_of_container_starting_strictly_before_offset(
...     staff, Duration(1, 8))
Staff{3}

>>> f(staff)
\new Staff {
    d'8 [
    e'8
    f'8 ]
}
```

Return *container*. Changed in version 2.0: renamed `containertools.contents_delete_starting_before_prola` to `containertools.delete_contents_of_container_starting_strictly_before_offset()`.

containertools.eject_contents_of_container

containertools.**eject_contents_of_container**(*container*)

New in version 2.0. Eject contents of *container*:

```
>>> container = Container("c'8 d'8 e'8 f'8")

>>> f(container)
{
    c'8
    d'8
    e'8
    f'8
}

>>> containertools.eject_contents_of_container(container)
[Note("c'8"), Note("d'8"), Note("e'8"), Note("f'8")]

>>> container
{}

>>> f(container)
{
}
```

Return list of *container* contents.

containertools.fuse_like_named_contiguous_containers_in_expr

containertools.**fuse_like_named_contiguous_containers_in_expr**(*expr*)

Fuse like-named contiguous containers in *expr*:

```
>>> staff = Staff(r"\new Voice { c'8 d'8 } \new Voice { e'8 f'8 }")
>>> staff[0].name = 'soprano'
>>> staff[1].name = 'soprano'

>>> f(staff)
\new Staff {
    \context Voice = "soprano" {
        c'8
        d'8
    }
    \context Voice = "soprano" {
        e'8
        f'8
    }
}

>>> containertools.fuse_like_named_contiguous_containers_in_expr(staff)
Staff{1}

>>> f(staff)
\new Staff {
    \context Voice = "soprano" {
        c'8
        d'8
        e'8
        f'8
    }
}
```

Return *expr*. Changed in version 2.0: renamed `fuse.containers_by_reference()` to `containertools.fuse_like_named_contiguous_containers_in_expr()`.

containertools.get_element_starting_at_exactly_offset

containertools.**get_element_starting_at_exactly_offset**(*container*, *prolated_offset*)

New in version 2.0. Get *container* element starting at exactly *prolated_offset*:

```
>>> voice = Voice("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")

>>> containertools.get_element_starting_at_exactly_offset(voice, Duration(6, 8))
Note("b'8")
```

Raise missing component error when no *container* element starts at exactly *prolated_offset*. Changed in version 2.0: renamed `containertools.get_element_starting_at_prolated_offset()` to `containertools.get_element_starting_at_exactly_offset()`.

containertools.get_first_container_in_improper_parentage_of_component

containertools.**get_first_container_in_improper_parentage_of_component**(*component*)

New in version 2.0. Get first container in improper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> containertools.get_first_container_in_improper_parentage_of_component(staff[1])
Staff{4}
```

Return container or none.

containertools.get_first_container_in_proper_parentage_of_component

containertools.**get_first_container_in_proper_parentage_of_component**(*component*)

New in version 2.0. Get first container in proper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> containertools.get_first_container_in_proper_parentage_of_component(staff[1])
Staff{4}
```

Return container or none.

containertools.get_first_element_starting_at_or_after_offset

containertools.**get_first_element_starting_at_or_after_offset**(*container*, *prolated_offset*)

New in version 2.0. Get first *container* element starting at or after *prolated_offset*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> containertools.get_first_element_starting_at_or_after_offset(staff, Duration(1, 8))
Note("d'8")
```

Return component.

Return none when no *container* element starts at or after *prolated_offset*. Changed in version 2.0: renamed `containertools.get_leftmost_element_starting_not_before_prolated_offset()` to `containertools.get_first_element_starting_at_or_after_offset()`.

containertools.get_first_element_starting_before_or_at_offset

containertools.**get_first_element_starting_before_or_at_offset**(*container*, *prolated_offset*)

New in version 2.0. Get first *container* element starting before or at *prolated_offset*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> containertools.get_first_element_starting_before_or_at_offset(staff, Duration(1, 8))
Note("d'8")
```

Return component.

Return none when no *container* element starts before or at *prolated_offset*. Changed in version 2.0: renamed `containertools.get_rightmost_element_starting_not_after_prolated_offset()` to `containertools.get_first_element_starting_before_or_at_offset()`.

containertools.get_first_element_starting_strictly_after_offset

containertools.**get_first_element_starting_strictly_after_offset**(*container*, *prolated_offset*)

New in version 2.0. Get first *container* element starting strictly after *prolated_offset*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> containertools.get_first_element_starting_strictly_after_offset(staff, Duration(1, 8))
Note("e'8")
```

Return component.

Return none when no *container* element starts strictly after *prolated_offset*. Changed in version 2.0: renamed `containertools.get_leftmost_element_starting_after_prolated_offset()` to `containertools.get_first_element_starting_strictly_after_offset()`.

containertools.get_first_element_starting_strictly_before_offset

containertools.**get_first_element_starting_strictly_before_offset**(*container*, *prolated_offset*)

New in version 2.0. Get first *container* element starting strictly before *prolated_offset*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> containertools.get_first_element_starting_strictly_before_offset(staff, Duration(1, 8))
Note("c'8")
```

Return component.

Return none when *container* element starts stirctly before *prolated_offset*. Changed in version 2.0: renamed `containertools.get_rightmost_element_starting_before_prolated_offset()` to `containertools.get_first_element_starting_strictly_before_offset()`.

containertools.insert_component

containertools.**insert_component**(*container*, *i*, *component*, *fracture_spanners=False*)

New in version 2.10. Insert *component* into *container* at index *i*.

Example 1. Insert *component* into *container* at index *i*. Do not fracture crossing spanners:

```
>>> staff = Staff("c'8 [ d'8 e'8 f'8 ]")

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> containertools.insert_component(staff, 1, Note("cs'8"), fracture_spanners=False)
Staff{5}

>>> f(staff)
\new Staff {
    c'8 [
    cs'8
    d'8
    e'8
    f'8 ]
}
```

Example 2. Insert *component* into *container* at index *i*. Fracture crossing spanners.

```
>>> staff = Staff("c'8 [ d'8 e'8 f'8 ]")

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> parts = containertools.insert_component(staff, 1, Rest('r8'), fracture_spanners=True)

>>> f(staff)
\new Staff {
    c'8 [ ]
    r8
    d'8 [
    e'8
    f'8 ]
}
```

Return *container* or list of fractured spanners.

containertools.move_parentage_children_and_spanners_from_components_to_empty_container

containertools.**move_parentage_children_and_spanners_from_components_to_empty_container**(*comp*
con-
taine

Move parentage, children and spanners from donor *components* to recipient empty *container*:

```
>>> voice = Voice("{ c'8 [ d'8 } { e'8 f'8 } { g'8 a'8 ] }")
```

```
>>> f(voice)
\new Voice {
    {
        c'8 [
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8 ]
    }
}

>>> tuplet = Tuplet(Fraction(3, 4), [])
>>> containertools.move_parentage_children_and_spanners_from_components_to_empty_container(
... voice[:2], tuplet)

>>> f(voice)
\new Voice {
    \fraction \times 3/4 {
        c'8 [
        d'8
        e'8
        f'8
    }
    {
        g'8
        a'8 ]
    }
}
```

Return none.

containertools.remove_leafless_containers_in_expr

containertools.**remove_leafless_containers_in_expr**(*expr*)

Remove empty containers in *expr*:

```
>>> staff = Staff("{ c'8 d'8 } { e'8 f'8 } { g'8 a'8 } { b'8 c''8 }")
>>> beamtools.BeamSpanner(staff[:])
BeamSpanner({c'8, d'8}, {e'8, f'8}, {g'8, a'8}, {b'8, c''8})

>>> containertools.delete_contents_of_container(staff[1])
[Note("e'8"), Note("f'8")]
>>> containertools.delete_contents_of_container(staff[-1])
[Note("b'8"), Note("c''8")]

>>> f(staff)
\new Staff {
    {
        c'8 [
        d'8
    }
    {
```

```
        }
        {
            g'8
            a'8 ]
        }
        {
        }
    }
```

```
>>> containertools.remove_leafless_containers_in_expr(staff)
```

```
>>> f(staff)
\new Staff {
    {
        c'8 [
        d'8
    }
    {
        g'8
        a'8 ]
    }
}
```

Return none. Changed in version 2.0: renamed `containertools.remove_empty()` to `containertools.remove_leafless_containers_in_expr()`.

containertools.repeat_contents_of_container

containertools.**repeat_contents_of_container**(*container*, *total=2*)

New in version 1.1. Repeat contents of *container*:

```
>>> staff = Staff("c'8 d'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8)
```

```
>>> f(staff)
\new Staff {
    c'8 [
    d'8 ]
}
```

```
>>> containertools.repeat_contents_of_container(staff, 3)
Staff{6}
```

```
>>> f(staff)
\new Staff {
    c'8 [
    d'8 ]
    c'8 [
    d'8 ]
    c'8 [
    d'8 ]
}
```

Leave *container* unchanged when *total* is `1`.

Empty *container* when *total* is `0`.

Return *container*. Changed in version 2.0: renamed `containertools.contents_multiply()` to `containertools.repeat_contents_of_container()`.

containertools.repeat_last_n_elements_of_container

`containertools.`**`repeat_last_n_elements_of_container`**(*container*, *n=1*, *total=2*)

New in version 1.1. Repeat last *n* elements of *container*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> containertools.repeat_last_n_elements_of_container(staff, n=2, total=3)
Staff{8}

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
    e'8 [
    f'8 ]
    e'8 [
    f'8 ]
}
```

Return *container*. Changed in version 2.0: renamed `containertools.extend_cyclic()` to `containertools.repeat_last_n_elements_of_container()`.

containertools.replace_container_slice_with_rests

`containertools.`**`replace_container_slice_with_rests`**(*container*, *start=None*, *stop=None*, *big_endian=True*)

New in version 2.10. Replace *container* slice from *start* to *stop* with big-endian rests.

Example 1. Replace all container elements:

```
>>> container = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b' c''8")

>>> container = containertools.replace_container_slice_with_rests(container)

>>> f(container)
\new Staff {
    r1
}
```

Example 2. Replace container elements from `1` forward:

```
>>> container = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b' c''8")

>>> container = containertools.replace_container_slice_with_rests(
...     container, start=1)

>>> f(container)
\new Staff {
    c'8
    r2..
}
```

Example 3. Replace container elements from 1 to 2:

```
>>> container = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b' c''8")
```

::

```
    >>> container= containertools.replace_container_slice_with_rests(
    ...         container, start=1, stop=2)
```

```
>>> f(container)
\new Staff {
    c'8
    r8
    e'8
    f'8
    g'8
    a'8
    b'8
    c''8
}
```

Return *container*.

containertools.replace_contents_of_target_container_with_contents_of_source_container

containertools.**replace_contents_of_target_container_with_contents_of_source_container**(*target_container*, *source*)

New in version 2.0. Replace contents of *target_container* with contents of *source_container*:

```
>>> staff = Staff(Tuplet(Fraction(2, 3), "c'8 d'8 e'8") * 3)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(
...     staff)
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, ... [5] ..., c''8, d''8)

>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8 [
        d'8
        e'8
    }
    \times 2/3 {
        f'8
        g'8
        a'8
```

```
        }
        \times 2/3 {
            b'8
            c''8
            d''8 ]
        }
    }
```

```
>>> container = Container("c'8 d'8 e'8")
>>> spannertools.SlurSpanner(container.leaves)
SlurSpanner(c'8, d'8, e'8)
```

```
>>> f(container)
{
    c'8 (
    d'8
    e'8 )
}
```

```
>>> containertools.replace_contents_of_target_container_with_contents_of_source_container(
...     staff[1], container)
Tuplet(2/3, [c'8, d'8, e'8])
```

```
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8 [
        d'8
        e'8
    }
    \times 2/3 {
        c'8 (
        d'8
        e'8 )
    }
    \times 2/3 {
        b'8
        c''8
        d''8 ]
    }
}
```

Leave *source_container* empty:

```
>>> container
{}
```

Return *target_container*.

containertools.report_container_modifications

containertools.**report_container_modifications**(*container*)

Report *container* modifications as string:

```
>>> container = Container("c'8 d'8 e'8 f'8")
>>> container.override.note_head.color = 'red'
>>> container.override.note_head.style = 'harmonic'
```

```
>>> f(container)
{
    \override NoteHead #'color = #red
    \override NoteHead #'style = #'harmonic
    c'8
    d'8
    e'8
    f'8
    \revert NoteHead #'color
    \revert NoteHead #'style
}

>>> string = containertools.report_container_modifications(container)

>>> print string
{
    \override NoteHead #'color = #red
    \override NoteHead #'style = #'harmonic
    %%% 4 components omitted %%%
    \revert NoteHead #'color
    \revert NoteHead #'style
}
```

Return string.

containertools.reverse_contents_of_container

containertools.**reverse_contents_of_container**(*container*)

New in version 1.1. Reverse contents of *container*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves[:2])
BeamSpanner(c'8, d'8)
>>> spannertools.SlurSpanner(staff.leaves[2:])
SlurSpanner(e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8 ]
    e'8 (
    f'8 )
}

>>> containertools.reverse_contents_of_container(staff)
Staff{4}

>>> f(staff)
\new Staff {
    f'8 (
    e'8 )
    d'8 [
    c'8 ]
}
```

Return *container*. Changed in version 2.0: renamed `containertools.contents_reverse()` to `containertools.reverse_contents_of_container()`.

containertools.scale_contents_of_container

containertools.**scale_contents_of_container**(*container*, *multiplier*)

New in version 1.1. Scale contents of *container* by dot *multiplier*:

```
>>> staff = Staff("c'8 d'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8 ]
}

>>> containertools.scale_contents_of_container(staff, Duration(3, 2))
Staff{2}

>>> f(staff)
\new Staff {
    c'8. [
    d'8. ]
}
```

Scale contents of *container* by tie *multiplier*:

```
>>> staff = Staff("c'8 d'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8 ]
}

>>> containertools.scale_contents_of_container(staff, Duration(5, 4))
Staff{4}

>>> f(staff)
\new Staff {
    c'8 [ ~
    c'32
    d'8 ~
    d'32 ]
}
```

Scale contents of *container* by nonbinary *multiplier*:

```
>>> staff = Staff("c'8 d'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8 ]
}
```

```
>>> containertools.scale_contents_of_container(staff, Duration(4, 3))
Staff{2}

>>> f(staff)
\new Staff {
    \times 2/3 {
        c'4 [
    }
    \times 2/3 {
        d'4 ]
    }
}
```

Return *container*. Changed in version 2.0: renamed `containertools.contents_scale()` to `containertools.scale_contents_of_container()`.

containertools.set_container_multiplier

`containertools.`**`set_container_multiplier`**(*container*, *multiplier*)

Set *container multiplier*:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")

>>> f(tuplet)
\times 2/3 {
    c'8
    d'8
    e'8
}

>>> containertools.set_container_multiplier(tuplet, Duration(3, 4))

>>> f(tuplet)
\fraction \times 3/4 {
    c'8
    d'8
    e'8
}
```

Return none. Changed in version 2.0: renamed `containertools.multiplier_set()` to `containertools.set_container_multiplier()`.

containertools.split_container_at_index

`containertools.`**`split_container_at_index`**(*component*, *i*, *fracture_spanners=False*)

New in version 1.1. General component index split algorithm. Works on leaves, tuplets, measures, contexts and unqualified containers. Keyword controls spanner behavior at split time. Use containertools.split_container_at_index_and_fracture_crossing_spanners() to fracture spanners. Use containertools.split_container_at_index_and_do_not_fracture_crossing_spanners() to leave spanners unchanged.

Example 1. Split container and do not fracture crossing spanners:

```
>>> voice = Voice(Measure((3, 8), "c'8 c'8 c'8") * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(voice)
>>> beam = beamtools.BeamSpanner(voice[:])
```

```
>>> f(voice)
\new Voice {
    {
        \time 3/8
        c'8 [
        d'8
        e'8
    }
    {
        f'8
        g'8
        a'8 ]
    }
}

>>> containertools.split_container_at_index(voice[1], 1, fracture_spanners=False)
(Measure(1/8, [f'8]), Measure(2/8, [g'8, a'8]))

>>> f(voice)
\new Voice {
    {
        \time 3/8
        c'8 [
        d'8
        e'8
    }
    {
        \time 1/8
        f'8
    }
    {
        \time 2/8
        g'8
        a'8 ]
    }
}
```

Example 2. Split container and fracture crossing spanners:

```
>>> voice = Voice(tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 c'8 c'8") * 2)
>>> tuplet = voice[1]
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(voice)
>>> beam = beamtools.BeamSpanner(voice[:])

>>> f(voice)
\new Voice {
    \times 2/3 {
        c'8 [
        d'8
        e'8
    }
    \times 2/3 {
        f'8
        g'8
        a'8 ]
    }
}
```

```
>>> left, right = containertools.split_container_at_index(
...         tuplet, 1, fracture_spanners=True)

>>> f(voice)
\new Voice {
    \times 2/3 {
        c'8 [
        d'8
        e'8
    }
    \times 2/3 {
        f'8 ]
    }
    \times 2/3 {
        g'8 [
        a'8 ]
    }
}
```

Leave spanners and leaves untouched.

Resize resizable containers.

Preserve container multiplier.

Preserve meter denominator.

Return split parts.

containertools.split_container_by_counts

containertools.**split_container_by_counts**(*components*, *counts*, *fracture_spanners=False*, *cyclic=False*)

New in version 1.1. Partition Python list of zero or more Abjad components. Partition by zero or more positive integers in counts list. Fracture spanners or not according to keyword. Read counts in list cyclically or not according to keyword. Return list of component lists.

Example 1. Split container cyclically by counts and do not fracture crossing spanners:

```
>>> container = Container("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")
>>> voice = Voice([container])
>>> beam = beamtools.BeamSpanner(voice)
>>> slur = spannertools.SlurSpanner(container)

>>> f(voice)
\new Voice {
    {
        c'8 [ (
        d'8
        e'8
        f'8
        g'8
        a'8
        b'8
        c''8 ] )
    }
}
```

```
>>> containertools.split_container_by_counts(
...     container, [1, 3], cyclic=True, fracture_spanners=False)
[[{c'8}], [{d'8, e'8, f'8}], [{g'8}], [{a'8, b'8, c''8}]]

>>> f(voice)
\new Voice {
    {
        c'8 [ (
    }
    {
        d'8
        e'8
        f'8
    }
    {
        g'8
    }
    {
        a'8
        b'8
        c''8 ] )
    }
}
```

Example 2. Split container cyclically by counts and fracture crossing spanners:

```
>>> container = Container("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")
>>> voice = Voice([container])
>>> beam = beamtools.BeamSpanner(voice)
>>> slur = spannertools.SlurSpanner(container)

>>> f(voice)
\new Voice {
    {
        c'8 [ (
        d'8
        e'8
        f'8
        g'8
        a'8
        b'8
        c''8 ] )
    }
}

>>> containertools.split_container_by_counts(
...     container, [1, 3], cyclic=True, fracture_spanners=True)
[[{c'8}], [{d'8, e'8, f'8}], [{g'8}], [{a'8, b'8, c''8}]]

>>> f(voice)
\new Voice {
    {
        c'8 ( ) [
    }
    {
        d'8 (
        e'8
        f'8 )
```

```
    }
    {
        g'8 ( )
    }
    {
        a'8 (
        b'8
        c''8 ] )
    }
}
```

Example 3. Split container once by counts and do not fracture crossing spanners:

```
>>> container = Container("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")
>>> voice = Voice([container])
>>> beam = beamtools.BeamSpanner(voice)
>>> slur = spannertools.SlurSpanner(container)

>>> f(voice)
\new Voice {
    {
        c'8 [ (
        d'8
        e'8
        f'8
        g'8
        a'8
        b'8
        c''8 ] )
    }
}

>>> containertools.split_container_by_counts(
...     container, [1, 3], cyclic=False, fracture_spanners=False)
[[{c'8}], [{d'8, e'8, f'8}], [{g'8, a'8, b'8, c''8}]]

>>> f(voice)
\new Voice {
    {
        c'8 [ (
    }
    {
        d'8
        e'8
        f'8
    }
    {
        g'8
        a'8
        b'8
        c''8 ] )
    }
}
```

Example 4. Split container once by counts and fracture crossing spanners:

```
>>> container = Container("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")
>>> voice = Voice([container])
>>> beam = beamtools.BeamSpanner(voice)
```

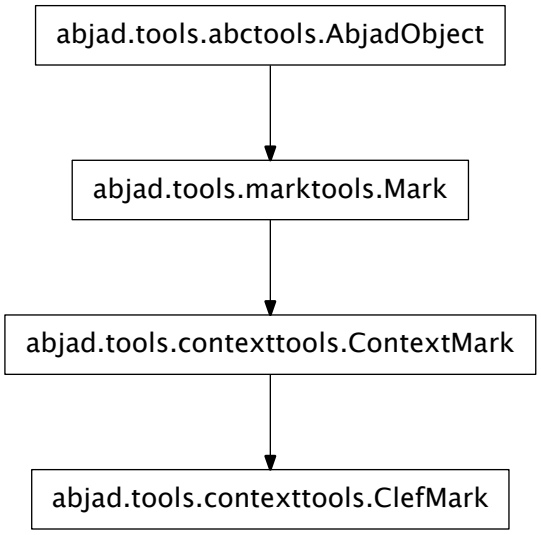
```
>>> slur = spannertools.SlurSpanner(container)

>>> f(voice)
\new Voice {
    {
        c'8 [ (
        d'8
        e'8
        f'8
        g'8
        a'8
        b'8
        c''8 ] )
    }
}

>>> containertools.split_container_by_counts(
...     container, [1, 3], cyclic=False, fracture_spanners=True)
[[{c'8}], [{d'8, e'8, f'8}], [{g'8, a'8, b'8, c''8}]]

>>> f(voice)
\new Voice {
    {
        c'8 ( ) [
    }
    {
        d'8 (
        e'8
        f'8 )
    }
    {
        g'8 (
        a'8
        b'8
        c''8 ] )
    }
}
```

Return list of split parts.

contexttools

concrete classes

contexttools.ClefMark



class contexttools.**ClefMark**(*arg*, *target_context=None*)

New in version 2.0. Abjad model of a clef:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> contexttools.ClefMark('treble')(staff)
ClefMark('treble')(Staff{4})

>>> f(staff)
\new Staff {
    \clef "treble"
    c'8
    d'8
    e'8
    f'8
}
```

Clef marks target the staff context by default.

Read-only Properties

ClefMark.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`ClefMark.`**`lilypond_format`**

Read-only LilyPond format of clef:

```
>>> clef = contexttools.ClefMark('treble')
>>> clef.lilypond_format
'\\clef "treble"'
```

Return string.

`ClefMark.`**`middle_c_position`**

Read-only middle-C position of clef:

```
>>> clef = contexttools.ClefMark('treble')
>>> clef.middle_c_position
-6
```

Return integer number of stafflines.

`ClefMark.`**`start_component`**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`ClefMark.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`ClefMark.`**`target_context`**

Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

Read/write Properties

ClefMark.**clef_name**

Get clef name:

```
>>> clef = contexttools.ClefMark('treble')
>>> clef.clef_name
'treble'
```

Set clef name:

```
>>> clef.clef_name = 'alto'
>>> clef.clef_name
'alto'
```

Return string.

Methods

ClefMark.**attach**(*start_component*)

Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

ClefMark.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Special Methods

ClefMark.**__call__**(**args*)

Inherited from marktools.Mark

ClefMark.**__delattr__**(**args*)

Inherited from marktools.Mark

ClefMark.**__eq__**(*arg*)

ClefMark.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ClefMark.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ClefMark.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ClefMark.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

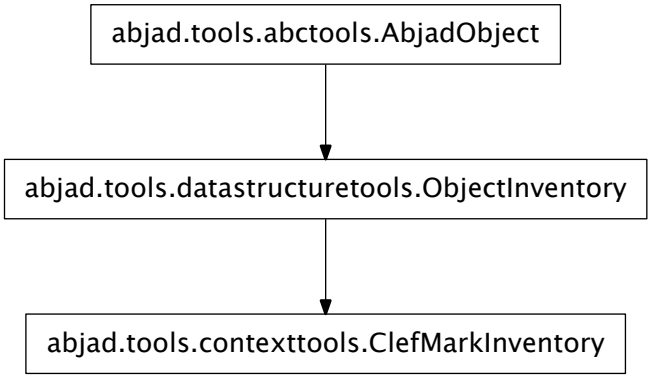
Raise exception.

Inherited from abctools.AbjadObject

ClefMark.**__ne__**(*arg*)
Inherited from marktools.Mark

ClefMark.**__repr__**()
Inherited from marktools.Mark

contexttools.ClefMarkInventory



class contexttools.**ClefMarkInventory**(*tokens=None*, *name=None*)
New in version 2.8. Abjad model of an ordered list of clefs:

```
>>> inventory = contexttools.ClefMarkInventory(['treble', 'bass'])

>>> inventory
ClefMarkInventory([ClefMark('treble'), ClefMark('bass')])

>>> 'treble' in inventory
True

>>> contexttools.ClefMark('treble') in inventory
True

>>> 'alto' in inventory
False
```

Clef mark inventories implement list interface and are mutable.

Read-only Properties

ClefMarkInventory.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

ClefMarkInventory.**name**

Read / write name of inventory.

Inherited from datastructuretools.ObjectInventory

Methods

ClefMarkInventory.**append**(*token*)

Change *token* to item and append.

Inherited from datastructuretools.ObjectInventory

ClefMarkInventory.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.list

ClefMarkInventory.**extend**(*tokens*)

Change *tokens* to items and extend.

Inherited from datastructuretools.ObjectInventory

ClefMarkInventory.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.list

ClefMarkInventory.**insert**()

L.insert(index, object) – insert object before index

Inherited from __builtin__.list

ClefMarkInventory.**pop**([*index*]) → item – remove and return item at index (default last).

Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

ClefMarkInventory.**remove**()

L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

ClefMarkInventory.**reverse**()

L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

ClefMarkInventory.**sort**()

L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

ClefMarkInventory.__**add**__()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

ClefMarkInventory.__**contains**__(*token*)
Inherited from datastructuretools.ObjectInventory

ClefMarkInventory.__**delitem**__()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

ClefMarkInventory.__**delslice**__()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

ClefMarkInventory.__**eq**__()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

ClefMarkInventory.__**ge**__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

ClefMarkInventory.__**getitem**__()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

ClefMarkInventory.__**getslice**__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

ClefMarkInventory.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

ClefMarkInventory.__**iadd**__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

ClefMarkInventory.__**imul**__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

ClefMarkInventory.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.list

ClefMarkInventory.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

ClefMarkInventory.__**len**__() <==> *len(x)*
Inherited from __builtin__.list

ClefMarkInventory.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

ClefMarkInventory.__**mul**__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

ClefMarkInventory.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

ClefMarkInventory.__**repr**__()
Inherited from datastructuretools.ObjectInventory

ClefMarkInventory.__**reversed**__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

ClefMarkInventory.__**rmul**__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

ClefMarkInventory.__**setitem**__()
x.__setitem__(i, y) <==> x[i]=y

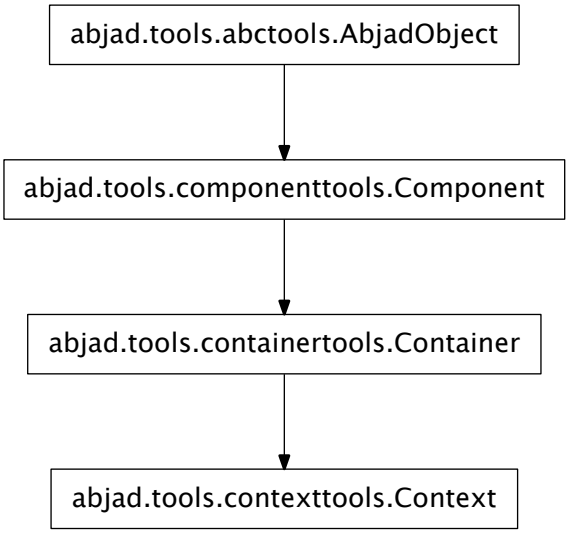
Inherited from __builtin__.list

ClefMarkInventory.__**setslice**__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

contexttools.Context



class contexttools.**Context**(*music=None*, *context_name='Context'*, *name=None*)

New in version 1.0. Abjad model of a horizontal layer of music.

```
>>> context = contexttools.Context(
... name='MeterVoice', context_name='TimeSignatureContext')

>>> context
TimeSignatureContext-"MeterVoice"{}

>>> f(context)
\context TimeSignatureContext = "MeterVoice" {
}
```

Return context object.

Read-only Properties

Context.**contents_duration**

Inherited from containertools.Container

Context.**duration_in_seconds**

Inherited from containertools.Container

Context.**engraver_consists**

New in version 2.0. Unordered set of LilyPond engravers to include in context definition.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_consists.append('Horizontal_bracket_engraver')
>>> f(staff)
\new Staff \with {
```

```
        \consists Horizontal_bracket_engraver
    } {
    }
```

Context.**engraver_removals**
New in version 2.0. Unordered set of LilyPond engravers to remove from context.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_removals.append('Time_signature_engraver')
>>> f(staff)
\new Staff \with {
    \remove Time_signature_engraver
} {
}
```

Context.**is_semantic**

Context.**leaves**
Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

Context.**lilypond_format**

Context.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

Context.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Context.**parent**
Inherited from componenttools.Component

Context.**preprolated_duration**
Inherited from containertools.Container

Context.**prolated_duration**
Inherited from componenttools.Component

Context.**prolation**
Inherited from componenttools.Component

Context.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Context.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Context.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Context.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Context.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Context.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Context.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Context.**context_name**
Read / write name of context as a string.

Context.**is_nonsemantic**
Set indicator of nonsemantic voice:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (5, 16), (5, 16)])
>>> voice = Voice(measures)
>>> voice.name = 'HiddenTimeSignatureVoice'

>>> voice.is_nonsemantic = True

>>> f(voice)
\context Voice = "HiddenTimeSignatureVoice" {
    {
        \time 1/8
        s1 * 1/8
    }
    {
        \time 5/16
        s1 * 5/16
    }
    {
        s1 * 5/16
```

```
    }
}
```

```
>>> voice.is_nonsemantic
True
```

Get indicator of nonsemantic voice:

```
>>> voice = Voice([])
```

```
>>> voice.is_nonsemantic
False
```

Return boolean.

The intent of this read / write attribute is to allow composers to tag invisible voices used to house time signatures indications, bar number directives or other pieces of score-global non-musical information. Such nonsemantic voices can then be omitted from voice interation and other functions.

`Context.`**`is_parallel`**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])
```

```
>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}
```

```
>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True
```

```
>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from `containertools.Container`

Context.**name**
Read-write name of context. Must be string or none.

Methods

Context.**append**(*component*)
Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

Context.**extend**(*expr*)
Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: expr may now be a LilyPond input string. Inherited from containertools.Container

Context.**index**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from containertools.Container

Context.**insert**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from containertools.Container

Context.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")
```

```
>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

Context.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

Context.**__add__**(*expr*)

Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

Context.**__contains__**(*expr*)

True if expr is in container, otherwise False.

Inherited from containertools.Container

Context.**__delitem__**(*i*)

Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

Context.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Context.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Context.__getitem__(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

Context.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Context.__iadd__(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

Context.__imul__(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

Context.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Context.__len__()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

Context.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Context.__mul__(*n*)
Inherited from componenttools.Component

Context.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Context.__radd__(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

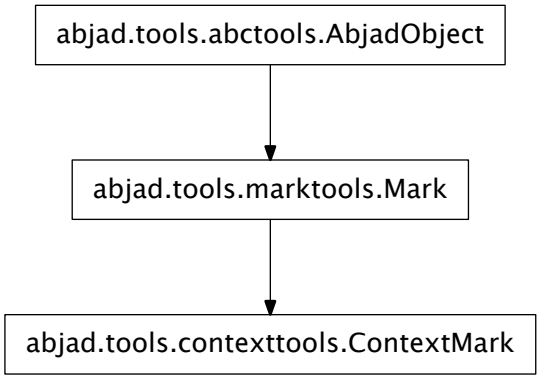
Context.**__repr__**()
Changed in version 2.0. Named contexts now print name at the interpreter.

Context.**__rmul__**(*n*)
Inherited from componenttools.Component

Context.**__setitem__**(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

contexttools.ContextMark



class contexttools.**ContextMark**(*target_context=None*)
New in version 2.0. Abstract class from which concrete context marks inherit:

```
>>> note = Note("c'4")

>>> contexttools.ContextMark()(note)
ContextMark()(c'4)
```

Context marks override __call__ to attach to Abjad components.

Context marks implement __slots__.

Read-only Properties

ContextMark.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

ContextMark.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

ContextMark.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

ContextMark.**target_context**

Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Methods

ContextMark.**attach**(*start_component*)

Make sure no context mark of same type is already attached to score component that starts with start component.

ContextMark.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Special Methods

ContextMark.**__call__**(**args*)

Inherited from marktools.Mark

ContextMark.**__delattr__**(**args*)

Inherited from marktools.Mark

ContextMark.__**eq**__(*arg*)
Inherited from marktools.Mark

ContextMark.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContextMark.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ContextMark.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContextMark.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

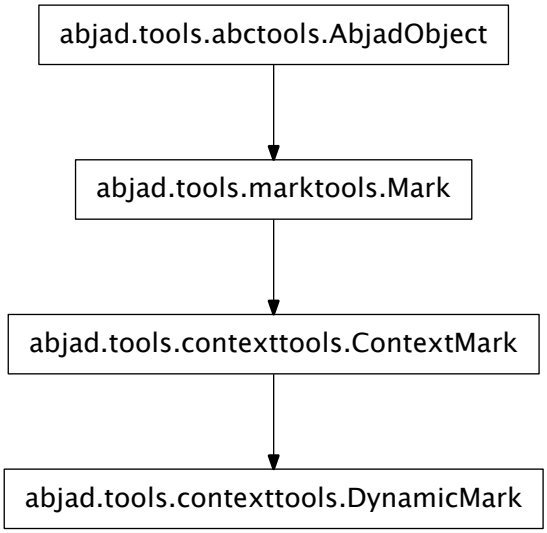
Raise exception.

Inherited from abctools.AbjadObject

ContextMark.__**ne**__(*arg*)
Inherited from marktools.Mark

ContextMark.__**repr**__()
Inherited from marktools.Mark

contexttools.DynamicMark



class contexttools.**DynamicMark**(*dynamic_name*, *target_context=None*)

New in version 2.0. Abjad model of a dynamic mark:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> contexttools.DynamicMark('f')(staff[0])
DynamicMark('f')(c'8)

>>> f(staff)
\new Staff {
    c'8 \f
    d'8
    e'8
    f'8
}
```

Dynamic marks target the staff context by default.

Read-only Properties

DynamicMark.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

DynamicMark.**lilypond_format**

Read-only LilyPond input format of dynamic mark:

```
>>> dynamic_mark = contexttools.DynamicMark('f')
>>> dynamic_mark.lilypond_format
'\f'
```

Return string.

DynamicMark.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

DynamicMark.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

DynamicMark.**target_context**

Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Read/write Properties

DynamicMark.**dynamic_name**

Get dynamic name:

```
>>> dynamic = contexttools.DynamicMark('f')
>>> dynamic.dynamic_name
'f'
```

Set dynamic name:

```
>>> dynamic.dynamic_name = 'p'
>>> dynamic.dynamic_name
'p'
```

Return string.

Methods

DynamicMark.**attach**(*start_component*)

Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

DynamicMark.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Special Methods

DynamicMark.**__call__**(**args*)

DynamicMark.**__delattr__**(**args*)

Inherited from marktools.Mark

DynamicMark.**__eq__**(*arg*)

DynamicMark.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DynamicMark.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DynamicMark.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DynamicMark.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

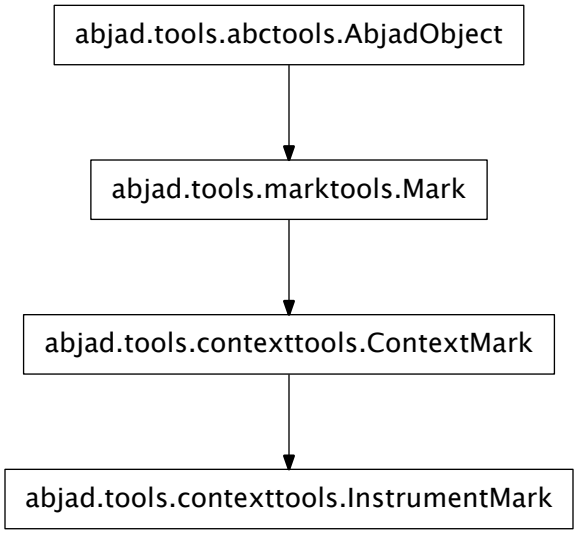
Inherited from abctools.AbjadObject

DynamicMark.**__ne__**(*arg*)

Inherited from marktools.Mark

DynamicMark.**__repr__**()
Inherited from marktools.Mark

contexttools.InstrumentMark



class contexttools.**InstrumentMark**(*instrument_name*, *short_instrument_name*, *instrument_name_markup=None*, *short_instrument_name_markup=None*, *target_context=None*)

New in version 2.0. Abjad model of an instrument change:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> contexttools.InstrumentMark('Flute', 'Fl.')(staff)
InstrumentMark(instrument_name='Flute', short_instrument_name='Fl.')(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Flute }
    \set Staff.shortInstrumentName = \markup { Fl. }
    c'8
    d'8
    e'8
    f'8
}
```

Instrument marks target staff context by default.

Read-only Properties

InstrumentMark.**default_instrument_name**
Read-only default instrument name.

Return string.

InstrumentMark.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

InstrumentMark.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

InstrumentMark.**lilypond_format**

Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

InstrumentMark.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

InstrumentMark.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

InstrumentMark.**target_context**

Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Read/write Properties

InstrumentMark.**instrument_name**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

InstrumentMark.**instrument_name_markup**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

InstrumentMark.**short_instrument_name**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

InstrumentMark.**short_instrument_name_markup**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Methods

InstrumentMark.**attach**(*start_component*)

Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

InstrumentMark.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Special Methods

InstrumentMark.**__call__**(**args*)

Inherited from marktools.Mark

InstrumentMark.**__delattr__**(**args*)

Inherited from marktools.Mark

InstrumentMark.**__eq__**(*arg*)

InstrumentMark.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

InstrumentMark.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

InstrumentMark.**__hash__**()

InstrumentMark.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

InstrumentMark.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

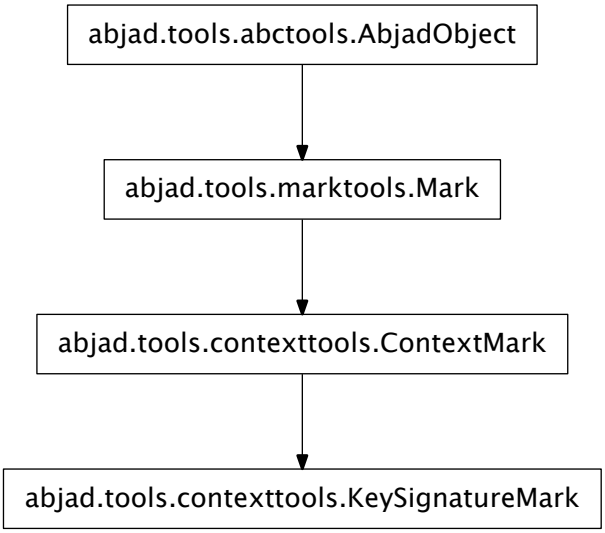
Raise exception.

Inherited from abctools.AbjadObject

InstrumentMark.**__ne__**(*arg*)
Inherited from marktools.Mark

InstrumentMark.**__repr__**()
Inherited from marktools.Mark

contexttools.KeySignatureMark



class contexttools.**KeySignatureMark**(*tonic*, *mode*, *target_context=None*)
New in version 2.0. Abjad model of a key signature setting or key signature change:

```
>>> staff = Staff("e'8 fs'8 gs'8 a'8")

>>> contexttools.KeySignatureMark('e', 'major')(staff)
KeySignatureMark(NamedChromaticPitchClass('e'), Mode('major'))(Staff{4})

>>> f(staff)
\new Staff {
    \key e \major
    e'8
    fs'8
    gs'8
    a'8
}
```

Key signature marks target staff context by default.

Read-only Properties

KeySignatureMark.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`KeySignatureMark.`**`lilypond_format`**

Read-only LilyPond format of key signature mark:

```
>>> key_signature = contexttools.KeySignatureMark('e', 'major')
>>> key_signature.lilypond_format
'\\key e \\major'
```

Return string.

`KeySignatureMark.`**`name`**

Read-only name of key signature:

```
>>> key_signature = contexttools.KeySignatureMark('e', 'major')
>>> key_signature.name
'E major'
```

Return string.

`KeySignatureMark.`**`start_component`**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`KeySignatureMark.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`KeySignatureMark.`**`target_context`**

Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

Read/write Properties

KeySignatureMark.**mode**

Get mode of key signature:

```
>>> key_signature = contexttools.KeySignatureMark('e', 'major')
>>> key_signature.mode
Mode('major')
```

Set mode of key signature:

```
>>> key_signature.mode = 'minor'
>>> key_signature.mode
Mode('minor')
```

Return mode.

KeySignatureMark.**tonic**

Get tonic of key signature:

```
>>> key_signature = contexttools.KeySignatureMark('e', 'major')
>>> key_signature.tonic
NamedChromaticPitchClass('e')
```

Set tonic of key signature:

```
>>> key_signature.tonic = 'd'
>>> key_signature.tonic
NamedChromaticPitchClass('d')
```

Return named chromatic pitch.

Methods

KeySignatureMark.**attach**(*start_component*)

Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

KeySignatureMark.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Special Methods

KeySignatureMark.**__call__**(**args*)

Inherited from marktools.Mark

KeySignatureMark.**__delattr__**(**args*)
Inherited from marktools.Mark

KeySignatureMark.**__eq__**(*arg*)

KeySignatureMark.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

KeySignatureMark.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

KeySignatureMark.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

KeySignatureMark.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

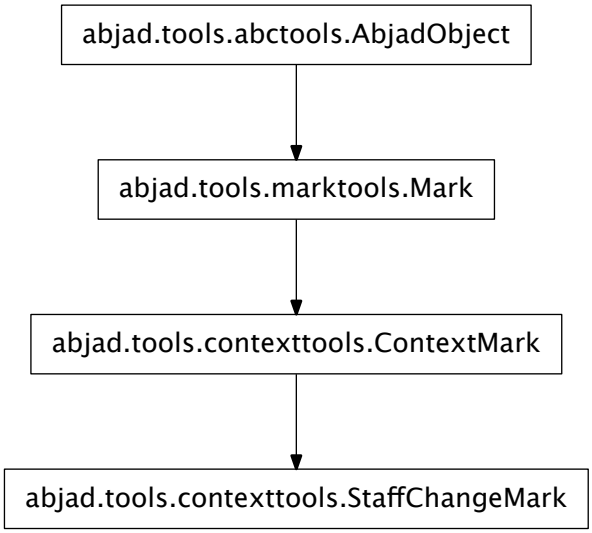
Inherited from abctools.AbjadObject

KeySignatureMark.**__ne__**(*arg*)
Inherited from marktools.Mark

KeySignatureMark.**__repr__**()
Inherited from marktools.Mark

KeySignatureMark.**__str__**()

contexttools.StaffChangeMark



class contexttools.**StaffChangeMark**(*staff=None*, *target_context=None*)

New in version 2.0. Abjad model of a staff change:

```
>>> piano_staff = scoretools.PianoStaff([])
>>> rh_staff = Staff("c'8 d'8 e'8 f'8")
>>> rh_staff.name = 'RHStaff'
>>> lh_staff = Staff("s2")
>>> lh_staff.name = 'LHStaff'
>>> piano_staff.extend([rh_staff, lh_staff])

>>> f(piano_staff)
\new PianoStaff <<
    \context Staff = "RHStaff" {
        c'8
        d'8
        e'8
        f'8
    }
    \context Staff = "LHStaff" {
        s2
    }
>>

>>> contexttools.StaffChangeMark(lh_staff)(rh_staff[2])
StaffChangeMark(Staff-"LHStaff"{1})(e'8)

>>> f(piano_staff)
\new PianoStaff <<
    \context Staff = "RHStaff" {
        c'8
```

```
            d'8
            \change Staff = LHStaff
            e'8
            f'8
        }
        \context Staff = "LHStaff" {
            s2
        }
    >>
```

Staff change marks target staff context by default.

Read-only Properties

StaffChangeMark.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

StaffChangeMark.**lilypond_format**

Read-only LilyPond format of staff change mark:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> staff.name = 'RHStaff'
>>> staff_change = contexttools.StaffChangeMark(staff)
>>> staff_change.lilypond_format
'\\change Staff = RHStaff'
```

Return string.

StaffChangeMark.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

StaffChangeMark.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

StaffChangeMark.**target_context**

Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

Read/write Properties

`StaffChangeMark.`**`staff`**

Get staff of staff change mark:

```
>>> rh_staff = Staff("c'8 d'8 e'8 f'8")
>>> rh_staff.name = 'RHStaff'
>>> staff_change = contexttools.StaffChangeMark(rh_staff)
>>> staff_change.staff
Staff-"RHStaff"{4}
```

Set staff of staff change mark:

```
>>> lh_staff = Staff("s2")
>>> lh_staff.name = 'LHStaff'
>>> staff_change.staff = lh_staff
>>> staff_change.staff
Staff-"LHStaff"{1}
```

Return staff.

Methods

`StaffChangeMark.`**`attach`**`(`*start_component*`)`

Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from `contexttools.ContextMark`

`StaffChangeMark.`**`detach`**`()`

Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from `contexttools.ContextMark`

Special Methods

`StaffChangeMark.`**`__call__`**`(`**args*`)`

Inherited from `marktools.Mark`

StaffChangeMark.__delattr__(*args)
Inherited from marktools.Mark

StaffChangeMark.__eq__(arg)

StaffChangeMark.__ge__(arg)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StaffChangeMark.__gt__(arg)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

StaffChangeMark.__le__(arg)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StaffChangeMark.__lt__(arg)
Abjad objects by default do not implement this method.

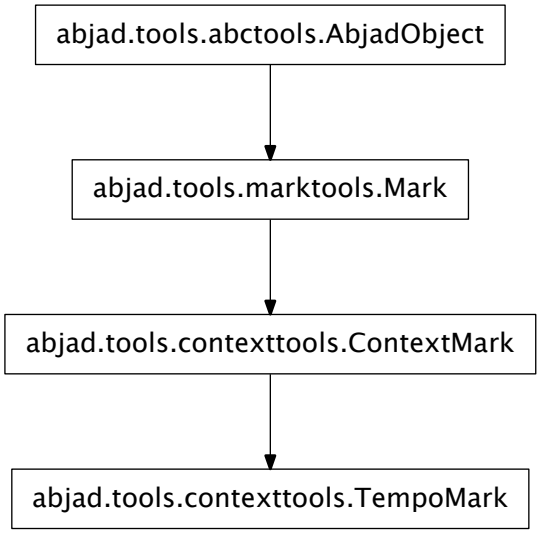
Raise exception.

Inherited from abctools.AbjadObject

StaffChangeMark.__ne__(arg)
Inherited from marktools.Mark

StaffChangeMark.__repr__()
Inherited from marktools.Mark

contexttools.TempoMark



class contexttools.**TempoMark**(**args*, ***kwargs*)

New in version 2.0. Abjad model of a tempo indication:

```
>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)

>>> contexttools.TempoMark(Duration(1, 8), 52)(staff[0])
TempoMark(Duration(1, 8), 52)(c'8)

>>> f(score)
\new Score <<
    \new Staff {
        \tempo 8=52
        c'8
        d'8
        e'8
        f'8
    }
>>
```

Tempo marks target **score** context by default.

Initialization allows many different types of input argument structure.

Read-only Properties

TempoMark.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`TempoMark.`**`is_imprecise`**

True if tempo mark is entirely textual, or if tempo mark's units_per_minute is a range:

```
>>> contexttools.TempoMark(Duration(1, 4), 60).is_imprecise
False
>>> contexttools.TempoMark('Langsam', 4, 60).is_imprecise
False
>>> contexttools.TempoMark('Langsam').is_imprecise
True
>>> contexttools.TempoMark('Langsam', 4, (35, 50)).is_imprecise
True
>>> contexttools.TempoMark(Duration(1, 4), (35, 50)).is_imprecise
True
```

Return boolean.

`TempoMark.`**`lilypond_format`**

Read-only LilyPond format of tempo mark:

```
>>> tempo = contexttools.TempoMark(Duration(1, 8), 52)
>>> tempo.lilypond_format
'\\tempo 8=52'

>>> tempo.textual_indication = 'Gingerly'
>>> tempo.lilypond_format
'\\tempo Gingerly 8=52'

>>> tempo.units_per_minute = (52, 56)
>>> tempo.lilypond_format
'\\tempo Gingerly 8=52~56'
```

Return string.

`TempoMark.`**`quarters_per_minute`**

Read-only quarters per minute of tempo mark:

```
>>> tempo = contexttools.TempoMark(Duration(1, 8), 52)
>>> tempo.quarters_per_minute
Duration(104, 1)
```

Return fraction, or tuple if units_per_minute is a range, or None if tempo mark is imprecise.

`TempoMark.`**`start_component`**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`TempoMark.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`TempoMark.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

Read/write Properties

`TempoMark.`**`duration`**
Get duration of tempo mark:

```
>>> tempo = contexttools.TempoMark(Duration(1, 8), 52)
>>> tempo.duration
Duration(1, 8)
```

Set duration of tempo mark:

```
>>> tempo.duration = Duration(1, 4)
>>> tempo.duration
Duration(1, 4)
```

Return duration, or None if tempo mark is imprecise.

`TempoMark.`**`textual_indication`**
Get textual indication of tempo mark:

```
>>> tempo = contexttools.TempoMark('Langsam', Duration(1, 8), 52)
>>> tempo.textual_indication
'Langsam'
```

Return string or None.

`TempoMark.`**`units_per_minute`**
Get units per minute of tempo mark:

```
>>> tempo = contexttools.TempoMark(Duration(1, 8), 52)
>>> tempo.units_per_minute
52
```

Set units per minute of tempo mark:

```
>>> tempo.units_per_minute = 56
>>> tempo.units_per_minute
56
```

Return number.

Methods

TempoMark.**attach**(*start_component*)

Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

TempoMark.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

TempoMark.**is_tempo_mark_token**(*expr*)

True when *expr* has the form of a tempo mark initializer:

```
>>> tempo_mark = contexttools.TempoMark(Duration(1, 4), 72)
>>> tempo_mark.is_tempo_mark_token((Duration(1, 4), 84))
True
```

Otherwise false:

```
>>> tempo_mark.is_tempo_mark_token(84)
False
```

Return boolean.

Special Methods

TempoMark.**__add__**(*expr*)

TempoMark.**__call__**(**args*)

Inherited from marktools.Mark

TempoMark.**__delattr__**(**args*)

Inherited from marktools.Mark

TempoMark.**__div__**(*expr*)

TempoMark.**__eq__**(*expr*)

TempoMark.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TempoMark.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TempoMark.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TempoMark.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

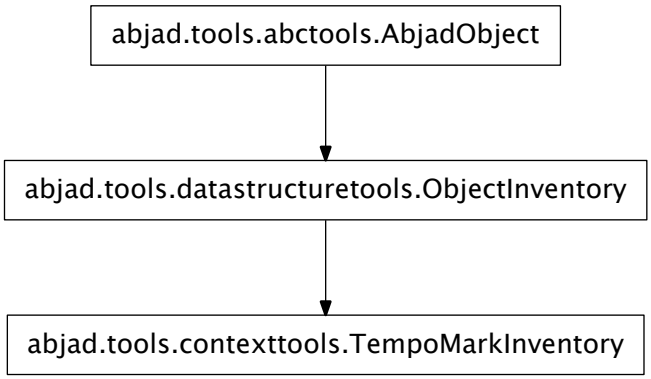
TempoMark.**__mul__**(*multiplier*)

TempoMark.**__ne__**(*arg*)
Inherited from marktools.Mark

TempoMark.**__repr__**()
Inherited from marktools.Mark

TempoMark.**__sub__**(*expr*)

contexttools.TempoMarkInventory



class contexttools.**TempoMarkInventory**(*tokens=None*, *name=None*)
New in version 2.7. Abjad model of an ordered list of tempo marks:

```
>>> inventory = contexttools.TempoMarkInventory([
...     ('Andante', Duration(1, 8), 72),
...     ('Allegro', Duration(1, 8), 84)])

>>> for tempo_mark in inventory:
...     tempo_mark
...
TempoMark('Andante', Duration(1, 8), 72)
TempoMark('Allegro', Duration(1, 8), 84)
```

Tempo mark inventories implement list interface and are mutable.

Read-only Properties

`TempoMarkInventory.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Read/write Properties

`TempoMarkInventory.`**`name`**

Read / write name of inventory.

Inherited from `datastructuretools.ObjectInventory`

Methods

`TempoMarkInventory.`**`append`**`(`*token*`)`

Change *token* to item and append.

Inherited from `datastructuretools.ObjectInventory`

`TempoMarkInventory.`**`count`**`(`*value*`)` → integer – return number of occurrences of value

Inherited from `__builtin__.list`

`TempoMarkInventory.`**`extend`**`(`*tokens*`)`

Change *tokens* to items and extend.

Inherited from `datastructuretools.ObjectInventory`

`TempoMarkInventory.`**`index`**`(`*value*[, *start*[, *stop*]])` → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from `__builtin__.list`

`TempoMarkInventory.`**`insert`**`()`

L.insert(index, object) – insert object before index

Inherited from `__builtin__.list`

`TempoMarkInventory.`**`pop`**`([`*index*`])` → item – remove and return item at index (default last).

Raises IndexError if list is empty or index is out of range.

Inherited from `__builtin__.list`

`TempoMarkInventory.`**`remove`**`()`

L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from `__builtin__.list`

`TempoMarkInventory.`**`reverse`**`()`

L.reverse() – reverse *IN PLACE*

Inherited from `__builtin__.list`

`TempoMarkInventory.`**`sort`**`()`

L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from `__builtin__.list`

Special Methods

`TempoMarkInventory.`**`__add__`**`()`

x.__add__(y) <==> x+y

Inherited from `__builtin__.list`

TempoMarkInventory.__**contains**__(*token*)
Inherited from datastructuretools.ObjectInventory

TempoMarkInventory.__**delitem**__()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

TempoMarkInventory.__**delslice**__()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

TempoMarkInventory.__**eq**__()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

TempoMarkInventory.__**ge**__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

TempoMarkInventory.__**getitem**__()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

TempoMarkInventory.__**getslice**__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

TempoMarkInventory.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

TempoMarkInventory.__**iadd**__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

TempoMarkInventory.__**imul**__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

TempoMarkInventory.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.list

TempoMarkInventory.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

TempoMarkInventory.__**len**__() <==> *len(x)*
Inherited from __builtin__.list

TempoMarkInventory.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

TempoMarkInventory.__**mul**__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

TempoMarkInventory.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

TempoMarkInventory.__**repr**__()
Inherited from datastructuretools.ObjectInventory

TempoMarkInventory.__**reversed**__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

TempoMarkInventory.__**rmul**__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

TempoMarkInventory.__**setitem**__()
x.__setitem__(i, y) <==> x[i]=y

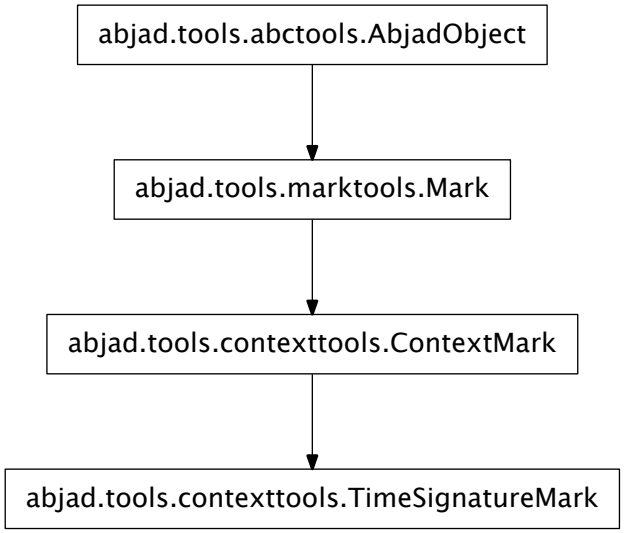
Inherited from __builtin__.list

TempoMarkInventory.__**setslice**__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

contexttools.TimeSignatureMark



class contexttools.**TimeSignatureMark**(**args*, ***kwargs*)

New in version 2.0. Abjad model of a time signature:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> contexttools.TimeSignatureMark((4, 8))(staff[0])
TimeSignatureMark((4, 8))(c'8)

>>> f(staff)
\new Staff {
    \time 4/8
    c'8
    d'8
    e'8
    f'8
}
```

Abjad time signature marks target **staff context** by default.

Initialize time signature marks to **score context** like this:

```
>>> contexttools.TimeSignatureMark((4, 8), target_context = Score)
TimeSignatureMark((4, 8), target_context = Score)
```

Time signatures are immutable.

Read-only Properties

TimeSignatureMark.**duration**

Read-only duration of time signature mark:

```
>>> time_signature = contexttools.TimeSignatureMark((3, 8))
>>> time_signature.duration
Duration(3, 8)
```

Return fraction.

TimeSignatureMark.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

TimeSignatureMark.**is_nonbinary**

Read-only indicator true when time siganture mark is nonbinary:

```
>>> time_signature = contexttools.TimeSignatureMark((3, 8))
>>> time_signature.is_nonbinary
False
```

Return boolean.

TimeSignatureMark.**lilypond_format**

Read-only LilyPond format of time signature mark:

```
>>> time_signature = contexttools.TimeSignatureMark((3, 8))
>>> time_signature.lilypond_format
'\\time 3/8'
```

Return string.

TimeSignatureMark.**multiplier**

Read-only multiplier of time signature mark:

```
>>> time_signature = contexttools.TimeSignatureMark((3, 8))
>>> time_signature.multiplier
Fraction(1, 1)
```

Return fraction.

TimeSignatureMark.**pair**

New in version 2.8. Read-only numerator / denominator pair of time signature:

```
>>> time_signature = contexttools.TimeSignatureMark((3, 8))
>>> time_signature.pair
(3, 8)
```

Return length-2 tuple.

TimeSignatureMark.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`TimeSignatureMark.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`TimeSignatureMark.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

Read/write Properties

`TimeSignatureMark.`**`denominator`**
Get denominator of time signature mark:

```
>>> time_signature = contexttools.TimeSignatureMark((3, 8))
>>> time_signature
TimeSignatureMark((3, 8))
>>> time_signature.denominator
8
```

Set denominator of time signature mark:

```
>>> time_signature.denominator = 16
>>> time_signature.denominator
16
```

Return integer.

`TimeSignatureMark.`**`numerator`**
Get numerator of time signature mark:

```
>>> time_signature = contexttools.TimeSignatureMark((3, 8))
>>> time_signature.numerator
3
```

Set numerator of time signature mark:

```
>>> time_signature.numerator = 4
>>> time_signature.numerator
4
```

Set integer.

`TimeSignatureMark.`**`partial`**
Get partial measure pick-up of time signature mark:

```
>>> time_signature = contexttools.TimeSignatureMark(
...     (3, 8), partial=Duration(1, 8))
```

```
>>> time_signature.partial
Duration(1, 8)
```

Set partial measure pick-up of time signature mark:

```
>>> time_signature.partial = Duration(1, 4)
>>> time_signature.partial
Duration(1, 4)
```

Set fraction or none.

Methods

TimeSignatureMark.**attach**(*start_component*)

TimeSignatureMark.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Special Methods

TimeSignatureMark.**__call__**(**args*)

Inherited from marktools.Mark

TimeSignatureMark.**__delattr__**(**args*)

Inherited from marktools.Mark

TimeSignatureMark.**__eq__**(*arg*)

TimeSignatureMark.**__ge__**(*arg*)

TimeSignatureMark.**__gt__**(*arg*)

TimeSignatureMark.**__le__**(*arg*)

TimeSignatureMark.**__lt__**(*arg*)

TimeSignatureMark.**__ne__**(*arg*)

TimeSignatureMark.**__nonzero__**()

TimeSignatureMark.**__repr__**()

TimeSignatureMark.**__str__**()

functions

contexttools.all_are_contexts

contexttools.**all_are_contexts**(*expr*)

New in version 2.10. True when *expr* is a sequence of Abjad contexts:

```
>>> contexts = 3 * Voice("c'8 d'8 e'8")

>>> contexttools.all_are_contexts(contexts)
True
```

True when *expr* is an empty sequence:

```
>>> contexttools.all_are_contexts([])
True
```

Otherwise false:

```
>>> contexttools.all_are_contexts('foo')
False
```

Return boolean.

Function wraps `componenttools.all_are_components()`.

contexttools.detach_clef_marks_attached_to_component

contexttools.**detach_clef_marks_attached_to_component**(*component*)

New in version 2.3. Detach clef marks attached to *component*:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")
>>> clef_mark = contexttools.ClefMark('treble')
>>> clef_mark.attach(staff)
ClefMark('treble')(Staff{4})

>>> f(staff)
\new Staff {
    \clef "treble"
    c'4
    d'4
    e'4
    f'4
}

>>> contexttools.detach_clef_marks_attached_to_component(staff)
(ClefMark('treble'),)

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
}
```

Return tuple of zero or more clef marks.

contexttools.detach_context_marks_attached_to_component

contexttools.**detach_context_marks_attached_to_component**(*component*, *klasses=None*)

New in version 2.0. Detach context marks attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> clef_mark = contexttools.ClefMark('treble')(staff)
>>> dynamic_mark = contexttools.DynamicMark('p')(staff[0])
>>> f(staff)
\new Staff {
    \clef "treble"
    c'8 \p
    d'8
    e'8
    f'8
}

>>> contexttools.detach_context_marks_attached_to_component(staff[0])
(DynamicMark('p'),)

>>> f(staff)
\new Staff {
    \clef "treble"
    c'8
    d'8
    e'8
    f'8
}
```

Return tuple of zero or context marks.

contexttools.detach_dynamic_marks_attached_to_component

contexttools.**detach_dynamic_marks_attached_to_component**(*component*)

New in version 2.3. Detach dynamic marks attached to *component*:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")
>>> dynamic_mark = contexttools.DynamicMark('p')
>>> dynamic_mark.attach(staff[0])
DynamicMark('p')(c'4)

>>> f(staff)
\new Staff {
    c'4 \p
    d'4
    e'4
    f'4
}

>>> contexttools.detach_dynamic_marks_attached_to_component(staff[0])
(DynamicMark('p'),)

>>> f(staff)
\new Staff {
    c'4
    d'4
```

```
    e'4
    f'4
}
```

Return tuple of zero or more dynamic marks.

contexttools.detach_instrument_marks_attached_to_component

contexttools.**detach_instrument_marks_attached_to_component**(*component*)

New in version 2.1. Detach instrument marks attached to *component*:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")
>>> instrument_mark = contexttools.InstrumentMark('Violin ', 'Vn. ')
>>> instrument_mark.attach(staff)
InstrumentMark(instrument_name='Violin ', short_instrument_name='Vn. ')(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Violin  }
    \set Staff.shortInstrumentName = \markup { Vn.  }
    c'4
    d'4
    e'4
    f'4
}

>>> contexttools.detach_instrument_marks_attached_to_component(staff)
(InstrumentMark(instrument_name='Violin ', short_instrument_name='Vn. '),)

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
}
```

Return tuple of zero or more instrument marks.

contexttools.detach_key_signature_marks_attached_to_component

contexttools.**detach_key_signature_marks_attached_to_component**(*component*)

New in version 2.3. Detach key signature marks attached to *component*:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")
>>> key_signature_mark = contexttools.KeySignatureMark('c', 'major')
>>> key_signature_mark.attach(staff)
KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4})

>>> f(staff)
\new Staff {
    \key c \major
    c'4
    d'4
    e'4
```

```
    f'4
}
```

```
>>> contexttools.detach_key_signature_marks_attached_to_component(staff)
(KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major')),)
```

```
>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
}
```

Return tuple of zero or more key signature marks.

contexttools.detach_staff_change_marks_attached_to_component

contexttools.**detach_staff_change_marks_attached_to_component**(*component*)

New in version 2.3. Detach staff change marks attached to *component*:

```
>>> piano_staff = scoretools.PianoStaff([])
>>> rh_staff = Staff("c'8 d'8 e'8 f'8")
>>> rh_staff.name = 'RHStaff'
>>> lh_staff = Staff("s2")
>>> lh_staff.name = 'LHStaff'
>>> piano_staff.extend([rh_staff, lh_staff])
>>> contexttools.StaffChangeMark(lh_staff)(rh_staff[2])
StaffChangeMark(Staff-"LHStaff"{1})(e'8)
```

```
>>> f(piano_staff)
\new PianoStaff <<
    \context Staff = "RHStaff" {
        c'8
        d'8
        \change Staff = LHStaff
        e'8
        f'8
    }
    \context Staff = "LHStaff" {
        s2
    }
>>
```

```
>>> contexttools.detach_staff_change_marks_attached_to_component(rh_staff[2])
(StaffChangeMark(Staff-"LHStaff"{1}),)
```

Return tuple of zero or more staff change marks.

contexttools.detach_tempo_marks_attached_to_component

contexttools.**detach_tempo_marks_attached_to_component**(*component*)

New in version 2.3. Detach tempo marks attached to *component*:

```
>>> score = Score([])
>>> staff = Staff("c'4 d'4 e'4 f'4")
>>> score.append(staff)

>>> tempo_mark = contexttools.TempoMark(Duration(1, 8), 52)
>>> tempo_mark.attach(staff)
TempoMark(Duration(1, 8), 52)(Staff{4})

>>> f(score)
\new Score <<
    \new Staff {
        \tempo 8=52
        c'4
        d'4
        e'4
        f'4
    }
>>

>>> contexttools.detach_tempo_marks_attached_to_component(staff)
(TempoMark(Duration(1, 8), 52),)

>>> f(score)
\new Score <<
    \new Staff {
        c'4
        d'4
        e'4
        f'4
    }
>>
```

Return tuple of zero or more tempo marks.

contexttools.detach_time_signature_marks_attached_to_component

contexttools.**detach_time_signature_marks_attached_to_component**(*component*)

New in version 2.0. Detach time signature marks attached to *component*:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")
>>> contexttools.TimeSignatureMark((4, 4))(staff[0])
TimeSignatureMark((4, 4))(c'4)

>>> f(staff)
\new Staff {
    \time 4/4
    c'4
    d'4
    e'4
    f'4
}

>>> contexttools.detach_time_signature_marks_attached_to_component(staff[0])
(TimeSignatureMark((4, 4)),)

>>> f(staff)
\new Staff {
```

```
        c'4
        d'4
        e'4
        f'4
    }
```

Return tuple of zero or more time signature marks.

contexttools.get_clef_mark_attached_to_component

contexttools.**get_clef_mark_attached_to_component**(*component*)

New in version 2.3. Get clef mark attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('treble')(staff)
ClefMark('treble')(Staff{4})

>>> f(staff)
\new Staff {
    \clef "treble"
    c'8
    d'8
    e'8
    f'8
}

>>> contexttools.get_clef_mark_attached_to_component(staff)
ClefMark('treble')(Staff{4})
```

Return clef mark.

Raise missing mark error when no clef mark attached to *component*.

contexttools.get_clef_marks_attached_to_component

contexttools.**get_clef_marks_attached_to_component**(*component*)

New in version 2.3. Get clef marks attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('treble')(staff)
ClefMark('treble')(Staff{4})

>>> f(staff)
\new Staff {
    \clef "treble"
    c'8
    d'8
    e'8
    f'8
}

>>> contexttools.get_clef_marks_attached_to_component(staff)
(ClefMark('treble')(Staff{4}),)
```

Return tuple of zero or more clef marks.

contexttools.get_context_mark_attached_to_component

contexttools.**get_context_mark_attached_to_component**(*component*, *klasses=None*)

New in version 2.3. Get context mark attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('treble')(staff)
ClefMark('treble')(Staff{4})

>>> f(staff)
\new Staff {
    \clef "treble"
    c'8
    d'8
    e'8
    f'8
}

>>> contexttools.get_context_mark_attached_to_component(staff)
ClefMark('treble')(Staff{4})
```

Return context mark.

Raise missing mark error when no context mark attaches to *component*.

contexttools.get_context_marks_attached_to_any_improper_parent_of_component

contexttools.**get_context_marks_attached_to_any_improper_parent_of_component**(*component*)

New in version 2.0. Get all context marks attached to any improper parent of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('treble')(staff)
ClefMark('treble')(Staff{4})
>>> contexttools.DynamicMark('f')(staff[0])
DynamicMark('f')(c'8)

>>> f(staff)
\new Staff {
    \clef "treble"
    c'8 \f
    d'8
    e'8
    f'8
}

>>> contexttools.get_context_marks_attached_to_any_improper_parent_of_component(staff[0])
(DynamicMark('f')(c'8), ClefMark('treble')(Staff{4}))
```

Return tuple.

contexttools.get_context_marks_attached_to_component

contexttools.**get_context_marks_attached_to_component**(*component*, *klasses=None*)

New in version 2.0. Get context marks attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('treble')(staff)
ClefMark('treble')(Staff{4})
>>> contexttools.DynamicMark('p')(staff[0])
DynamicMark('p')(c'8)

>>> f(staff)
\new Staff {
    \clef "treble"
    c'8 \p
    d'8
    e'8
    f'8
}

>>> contexttools.get_context_marks_attached_to_component(staff[0])
(DynamicMark('p')(c'8),)
```

Return tuple of zero or more context marks.

contexttools.get_dynamic_mark_attached_to_component

contexttools.**get_dynamic_mark_attached_to_component**(*component*)

New in version 2.3. Get dynamic mark attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.DynamicMark('p')(staff[0])
DynamicMark('p')(c'8)

>>> f(staff)
\new Staff {
    c'8 \p
    d'8
    e'8
    f'8
}

>>> contexttools.get_dynamic_mark_attached_to_component(staff[0])
DynamicMark('p')(c'8)
```

Return dynamic mark.

Raise missing mark error when no dynamic mark attaches to *component*.

Raise extra mark error when more than one dynamic mark attaches to *component*.

contexttools.get_dynamic_marks_attached_to_component

contexttools.**get_dynamic_marks_attached_to_component**(*component*)

New in version 2.0. Get dynamic marks attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.DynamicMark('p')(staff[0])
DynamicMark('p')(c'8)
```

```
>>> f(staff)
\new Staff {
    c'8 \p
    d'8
    e'8
    f'8
}

>>> contexttools.get_dynamic_marks_attached_to_component(staff[0])
(DynamicMark('p')(c'8),)
```

Return tuple of zero or more dynamic marks.

contexttools.get_effective_clef

contexttools.**get_effective_clef**(*component*)

New in version 2.0. Get effective clef of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('treble')(staff)
ClefMark('treble')(Staff{4})

>>> f(staff)
\new Staff {
    \clef "treble"
    c'8
    d'8
    e'8
    f'8
}

>>> for note in staff:
...     print note, contexttools.get_effective_clef(note)
...
c'8 ClefMark('treble')(Staff{4})
d'8 ClefMark('treble')(Staff{4})
e'8 ClefMark('treble')(Staff{4})
f'8 ClefMark('treble')(Staff{4})
```

Return clef mark or none.

contexttools.get_effective_context_mark

contexttools.**get_effective_context_mark**(*component*, *klass*)

New in version 2.0. Get effective context mark of *klass* from *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.TimeSignatureMark((4, 8))(staff)
TimeSignatureMark((4, 8))(Staff{4})

>>> f(staff)
\new Staff {
    \time 4/8
    c'8
    d'8
    e'8
```

```
        f'8
    }
```

```
>>> contexttools.get_effective_context_mark(staff[0], contexttools.TimeSignatureMark)
TimeSignatureMark((4, 8))(Staff{4})
```

Return context mark or none.

contexttools.get_effective_dynamic

contexttools.**get_effective_dynamic**(*component*)

New in version 2.0. Get effective dynamic of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.DynamicMark('f')(staff[0])
DynamicMark('f')(c'8)
```

```
>>> f(staff)
\new Staff {
    c'8 \f
    d'8
    e'8
    f'8
}
```

```
>>> for note in staff:
...     print note, contexttools.get_effective_dynamic(note)
...
c'8 DynamicMark('f')(c'8)
d'8 DynamicMark('f')(c'8)
e'8 DynamicMark('f')(c'8)
f'8 DynamicMark('f')(c'8)
```

Return dynamic mark or none.

contexttools.get_effective_instrument

contexttools.**get_effective_instrument**(*component*)

New in version 2.0. Get effective instrument of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.InstrumentMark('Flute', 'Fl.')(staff)
InstrumentMark(instrument_name='Flute', short_instrument_name='Fl.')(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Flute }
    \set Staff.shortInstrumentName = \markup { Fl. }
    c'8
    d'8
    e'8
    f'8
}
```

```
>>> for note in staff:
...     print note, contexttools.get_effective_instrument(note)
...
c'8 InstrumentMark(instrument_name='Flute', short_instrument_name='Fl.')(Staff{4})
d'8 InstrumentMark(instrument_name='Flute', short_instrument_name='Fl.')(Staff{4})
e'8 InstrumentMark(instrument_name='Flute', short_instrument_name='Fl.')(Staff{4})
f'8 InstrumentMark(instrument_name='Flute', short_instrument_name='Fl.')(Staff{4})
```

Return instrument mark or none.

contexttools.get_effective_key_signature

contexttools.**get_effective_key_signature**(*component*)

New in version 2.0. Get effective key signature of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.KeySignatureMark('c', 'major')(staff)
KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \key c \major
    c'8
    d'8
    e'8
    f'8
}
```

```
>>> for note in staff:
...     note, contexttools.get_effective_key_signature(note)
...
(Note("c'8"), KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4}))
(Note("d'8"), KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4}))
(Note("e'8"), KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4}))
(Note("f'8"), KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4}))
```

Return key signature mark or none.

contexttools.get_effective_staff

contexttools.**get_effective_staff**(*component*)

New in version 2.0. Get effective staff of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> staff.name = 'First Staff'
```

```
>>> f(staff)
\context Staff = "First Staff" {
    c'8
    d'8
    e'8
    f'8
}
```

```
>>> for note in staff:
...     print note, contexttools.get_effective_staff(note)
```

```
...
c'8 Staff-"First Staff"{4}
d'8 Staff-"First Staff"{4}
e'8 Staff-"First Staff"{4}
f'8 Staff-"First Staff"{4}
```

Return staff or none.

contexttools.get_effective_tempo

contexttools.**get_effective_tempo**(*component*)

New in version 2.0. Get effective tempo of *component*:

```
>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)
>>> contexttools.TempoMark(Duration(1, 8), 52)(staff[0])
TempoMark(Duration(1, 8), 52)(c'8)

>>> f(score)
\new Score <<
    \new Staff {
        \tempo 8=52
        c'8
        d'8
        e'8
        f'8
    }
>>

>>> for note in staff:
...     print note, contexttools.get_effective_tempo(note)
...
c'8 TempoMark(Duration(1, 8), 52)(c'8)
d'8 TempoMark(Duration(1, 8), 52)(c'8)
e'8 TempoMark(Duration(1, 8), 52)(c'8)
f'8 TempoMark(Duration(1, 8), 52)(c'8)
```

Return tempo mark or none.

contexttools.get_effective_time_signature

contexttools.**get_effective_time_signature**(*component*)

New in version 2.0. Get effective time signature of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.TimeSignatureMark((4, 8))(staff)
TimeSignatureMark((4, 8))(Staff{4})

>>> f(staff)
\new Staff {
    \time 4/8
    c'8
    d'8
    e'8
    f'8
}
```

```
>>> for note in staff:
...     note, contexttools.get_effective_time_signature(note)
...
(Note("c'8"), TimeSignatureMark((4, 8))(Staff{4}))
(Note("d'8"), TimeSignatureMark((4, 8))(Staff{4}))
(Note("e'8"), TimeSignatureMark((4, 8))(Staff{4}))
(Note("f'8"), TimeSignatureMark((4, 8))(Staff{4}))
```

Return time signature mark or none.

contexttools.get_instrument_mark_attached_to_component

contexttools.**get_instrument_mark_attached_to_component**(*component*)

New in version 2.1. Get instrument mark attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> violin = contexttools.InstrumentMark('Violin ', 'Vn. ')
>>> violin.attach(staff)
InstrumentMark(instrument_name='Violin ', short_instrument_name='Vn. ')(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Violin  }
    \set Staff.shortInstrumentName = \markup { Vn.  }
    c'8
    d'8
    e'8
    f'8
}

>>> contexttools.get_instrument_mark_attached_to_component(staff)
InstrumentMark(instrument_name='Violin ', short_instrument_name='Vn. ')(Staff{4})
```

Return instrument mark.

Raise missing mark error when no instrument mark attaches to *component*.

contexttools.get_instrument_marks_attached_to_component

contexttools.**get_instrument_marks_attached_to_component**(*component*)

New in version 2.3. Get instrument marks attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.InstrumentMark('Flute', 'Fl.')(staff)
InstrumentMark(instrument_name='Flute', short_instrument_name='Fl.')(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Flute }
    \set Staff.shortInstrumentName = \markup { Fl. }
    c'8
    d'8
    e'8
    f'8
}
```

```
>>> contexttools.get_instrument_marks_attached_to_component(staff)
(InstrumentMark(instrument_name='Flute', short_instrument_name='Fl.')(Staff{4}),)
```

Return tuple of zero or more instrument marks.

contexttools.get_key_signature_mark_attached_to_component

contexttools.**get_key_signature_mark_attached_to_component**(*component*)

New in version 2.3. Get key signature mark attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.KeySignatureMark('c', 'major')(staff)
KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4})

>>> f(staff)
\new Staff {
    \key c \major
    c'8
    d'8
    e'8
    f'8
}

>>> contexttools.get_key_signature_mark_attached_to_component(staff)
KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4})
```

Return key signature mark.

Raise missing mark error when no key signature mark attaches to component.

contexttools.get_key_signature_marks_attached_to_component

contexttools.**get_key_signature_marks_attached_to_component**(*component*)

New in version 2.3. Get key signature marks attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.KeySignatureMark('c', 'major')(staff)
KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4})

>>> f(staff)
\new Staff {
    \key c \major
    c'8
    d'8
    e'8
    f'8
}

>>> contexttools.get_key_signature_marks_attached_to_component(staff)
(KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4}),)
```

Return tuple of zero or more key signature marks.

contexttools.get_staff_change_mark_attached_to_component

contexttools.**get_staff_change_mark_attached_to_component**(*component*)

New in version 2.3. Get staff change mark attached to *component*:

```
>>> piano_staff = scoretools.PianoStaff([])
>>> rh_staff = Staff("c'8 d'8 e'8 f'8")
>>> rh_staff.name = 'RHStaff'
>>> lh_staff = Staff("s2")
>>> lh_staff.name = 'LHStaff'
>>> piano_staff.extend([rh_staff, lh_staff])
>>> contexttools.StaffChangeMark(lh_staff)(rh_staff[2])
StaffChangeMark(Staff-"LHStaff"{1})(e'8)

>>> f(piano_staff)
\new PianoStaff <<
    \context Staff = "RHStaff" {
        c'8
        d'8
        \change Staff = LHStaff
        e'8
        f'8
    }
    \context Staff = "LHStaff" {
        s2
    }
>>

>>> contexttools.get_staff_change_mark_attached_to_component(rh_staff[2])
StaffChangeMark(Staff-"LHStaff"{1})(e'8)
```

Return staff change mark.

Raise missing mark error when no staff change mark attaches to *component*.

contexttools.get_staff_change_marks_attached_to_component

contexttools.**get_staff_change_marks_attached_to_component**(*component*)

New in version 2.3. Get staff change marks attached to *component*:

```
>>> piano_staff = scoretools.PianoStaff([])
>>> rh_staff = Staff("c'8 d'8 e'8 f'8")
>>> rh_staff.name = 'RHStaff'
>>> lh_staff = Staff("s2")
>>> lh_staff.name = 'LHStaff'
>>> piano_staff.extend([rh_staff, lh_staff])
>>> contexttools.StaffChangeMark(lh_staff)(rh_staff[2])
StaffChangeMark(Staff-"LHStaff"{1})(e'8)

>>> f(piano_staff)
\new PianoStaff <<
    \context Staff = "RHStaff" {
        c'8
        d'8
        \change Staff = LHStaff
        e'8
        f'8
```

```
        }
        \context Staff = "LHStaff" {
            s2
        }
    >>
```

```
>>> contexttools.get_staff_change_marks_attached_to_component(rh_staff[2])
(StaffChangeMark(Staff-"LHStaff"{1})(e'8),)
```

Return tuple of zero or more staff change marks.

contexttools.get_tempo_mark_attached_to_component

contexttools.**get_tempo_mark_attached_to_component**(*component*)

New in version 2.3. Get tempo mark attached to *component*:

```
>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)
```

```
>>> contexttools.TempoMark(Duration(1, 8), 52)(staff)
TempoMark(Duration(1, 8), 52)(Staff{4})
```

```
>>> f(score)
\new Score <<
    \new Staff {
        \tempo 8=52
        c'8
        d'8
        e'8
        f'8
    }
>>
```

```
>>> contexttools.get_tempo_mark_attached_to_component(staff)
TempoMark(Duration(1, 8), 52)(Staff{4})
```

Return tempo mark.

Raise missing mark error when no tempo mark attaches to *component*.

contexttools.get_tempo_marks_attached_to_component

contexttools.**get_tempo_marks_attached_to_component**(*component*)

New in version 2.3. Get tempo marks attached to *component*:

```
>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)
```

```
>>> contexttools.TempoMark(Duration(1, 8), 52)(staff)
TempoMark(Duration(1, 8), 52)(Staff{4})
```

```
>>> f(score)
\new Score <<
    \new Staff {
```

```
            \tempo 8=52
            c'8
            d'8
            e'8
            f'8
        }
    >>
```

```
>>> contexttools.get_tempo_marks_attached_to_component(staff)
(TempoMark(Duration(1, 8), 52)(Staff{4}),)
```

Return tuple of zero or more tempo marks.

contexttools.get_time_signature_mark_attached_to_component

contexttools.**get_time_signature_mark_attached_to_component**(*component*)

New in version 2.0. Get time signature mark attached to *component*:

```
>>> measure = Measure((4, 8), "c'8 d'8 e'8 f'8")
```

```
>>> f(measure)
{
    \time 4/8
    c'8
    d'8
    e'8
    f'8
}
```

```
>>> contexttools.get_time_signature_mark_attached_to_component(measure)
TimeSignatureMark((4, 8))(|4/8, c'8, d'8, e'8, f'8|)
```

Return time signature mark.

Raise missing mark error when no time signature mark attaches to *component*.

contexttools.get_time_signature_marks_attached_to_component

contexttools.**get_time_signature_marks_attached_to_component**(*component*)

New in version 2.3. Get time signature marks attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.TimeSignatureMark((2, 4))(staff)
TimeSignatureMark((2, 4))(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \time 2/4
    c'8
    d'8
    e'8
    f'8
}
```

```
>>> contexttools.get_time_signature_marks_attached_to_component(staff)
(TimeSignatureMark((2, 4))(Staff{4}),)
```

Return tuple of zero or more time_signature marks.

contexttools.is_component_with_clef_mark_attached

contexttools.**is_component_with_clef_mark_attached**(*expr*)

New in version 2.3. True when *expr* is a component with clef mark attached:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('treble')(staff)
ClefMark('treble')(Staff{4})

>>> f(staff)
\new Staff {
    \clef "treble"
    c'8
    d'8
    e'8
    f'8
}

>>> contexttools.is_component_with_clef_mark_attached(staff)
True
```

False otherwise:

```
>>> contexttools.is_component_with_clef_mark_attached(staff[0])
False
```

Return boolean.

contexttools.is_component_with_context_mark_attached

contexttools.**is_component_with_context_mark_attached**(*expr*, *klasses=None*)

New in version 2.0. True when *expr* is a component with context mark of *klasses* attached:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.TimeSignatureMark((4, 8))(staff[0])
TimeSignatureMark((4, 8))(c'8)
>>> f(staff)
\new Staff {
    \time 4/8
    c'8
    d'8
    e'8
    f'8
}
>>> contexttools.is_component_with_context_mark_attached(staff[0])
True
```

Otherwise false:

```
>>> contexttools.is_component_with_context_mark_attached(staff)
False
```

Return boolean.

contexttools.is_component_with_dynamic_mark_attached

contexttools.**is_component_with_dynamic_mark_attached**(*expr*)

New in version 2.3. True when *expr* is a component and has a dynamic mark attached:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.DynamicMark('p')(staff[0])
DynamicMark('p')(c'8)

>>> f(staff)
\new Staff {
    c'8 \p
    d'8
    e'8
    f'8
}

>>> contexttools.is_component_with_dynamic_mark_attached(staff[0])
True
```

Otherwise false:

```
>>> contexttools.is_component_with_dynamic_mark_attached(staff)
False
```

Return boolean.

contexttools.is_component_with_instrument_mark_attached

contexttools.**is_component_with_instrument_mark_attached**(*expr*)

New in version 2.3. True when *expr* is a component with instrument mark attached:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> violin = contexttools.InstrumentMark('Violin ', 'Vn. ')
>>> violin.attach(staff)
InstrumentMark(instrument_name='Violin ', short_instrument_name='Vn. ')(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Violin  }
    \set Staff.shortInstrumentName = \markup { Vn.  }
    c'8
    d'8
    e'8
    f'8
}

>>> contexttools.is_component_with_instrument_mark_attached(staff)
True
```

Otherwise false:

```
>>> contexttools.is_component_with_instrument_mark_attached(staff[0])
False
```

Return boolean.

contexttools.is_component_with_key_signature_mark_attached

contexttools.**is_component_with_key_signature_mark_attached**(*expr*)

New in version 2.3. True when *expr* is a component with key signature mark attached:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.KeySignatureMark('c', 'major')(staff)
KeySignatureMark(NamedChromaticPitchClass('c'), Mode('major'))(Staff{4})

>>> f(staff)
\new Staff {
    \key c \major
    c'8
    d'8
    e'8
    f'8
}

>>> contexttools.is_component_with_key_signature_mark_attached(staff)
True
```

Otherwise false:

```
>>> contexttools.is_component_with_key_signature_mark_attached(staff[0])
False
```

Return boolean.

contexttools.is_component_with_staff_change_mark_attached

contexttools.**is_component_with_staff_change_mark_attached**(*expr*)

New in version 2.3. True when *expr* is a component with staff change mark attached:

```
>>> piano_staff = scoretools.PianoStaff([])
>>> rh_staff = Staff("c'8 d'8 e'8 f'8")
>>> rh_staff.name = 'RHStaff'
>>> lh_staff = Staff("s2")
>>> lh_staff.name = 'LHStaff'
>>> piano_staff.extend([rh_staff, lh_staff])
>>> contexttools.StaffChangeMark(lh_staff)(rh_staff[2])
StaffChangeMark(Staff-"LHStaff"{1})(e'8)

>>> f(piano_staff)
\new PianoStaff <<
    \context Staff = "RHStaff" {
        c'8
        d'8
        \change Staff = LHStaff
        e'8
        f'8
    }
    \context Staff = "LHStaff" {
        s2
    }
>>
```

```
>>> contexttools.is_component_with_staff_change_mark_attached(rh_staff[2])
True
```

Otherwise false:

```
>>> contexttools.is_component_with_staff_change_mark_attached(rh_staff)
False
```

Return boolean.

contexttools.is_component_with_tempo_mark_attached

contexttools.**is_component_with_tempo_mark_attached**(*expr*)

New in version 2.3. True when *expr* is a component with tempo mark attached:

```
>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)

>>> contexttools.TempoMark(Duration(1, 8), 52)(staff)
TempoMark(Duration(1, 8), 52)(Staff{4})

>>> f(score)
\new Score <<
    \new Staff {
        \tempo 8=52
        c'8
        d'8
        e'8
        f'8
    }
>>

>>> contexttools.is_component_with_tempo_mark_attached(staff)
True
```

Otherwise false:

```
>>> contexttools.is_component_with_tempo_mark_attached(staff[0])
False
```

Return boolean.

contexttools.is_component_with_time_signature_mark_attached

contexttools.**is_component_with_time_signature_mark_attached**(*expr*)

New in version 2.0. True when *expr* is a component with time signature mark attached:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.TimeSignatureMark((4, 8))(staff[0])
TimeSignatureMark((4, 8))(c'8)

>>> f(staff)
\new Staff {
    \time 4/8
    c'8
    d'8
```

```
    e'8
    f'8
}
```

```
>>> contexttools.is_component_with_time_signature_mark_attached(staff[0])
True
```

Otherwise false:

```
>>> contexttools.is_component_with_time_signature_mark_attached(staff)
False
```

Return boolean.

contexttools.list_clef_names

contexttools.**list_clef_names**()

New in version 2.8. List clef names:

```
>>> contexttools.list_clef_names()
['alto', 'baritone', 'bass', 'mezzosoprano', 'percussion', 'soprano', 'treble']
```

Return list of strings.

contexttools.set_accidental_style_on_sequential_contexts_in_expr

contexttools.**set_accidental_style_on_sequential_contexts_in_expr**(*expr*, *accidental_style*)

New in version 2.0. Set *accidental_style* for sequential semantic contexts in *expr*:

```
>>> score = Score(Staff("c'8 d'8") * 2)
>>> contexttools.set_accidental_style_on_sequential_contexts_in_expr(score, 'forget')
```

```
>>> f(score)
\new Score <<
    \new Staff {
        #(set-accidental-style 'forget)
        c'8
        d'8
    }
    \new Staff {
        #(set-accidental-style 'forget)
        c'8
        d'8
    }
>>
```

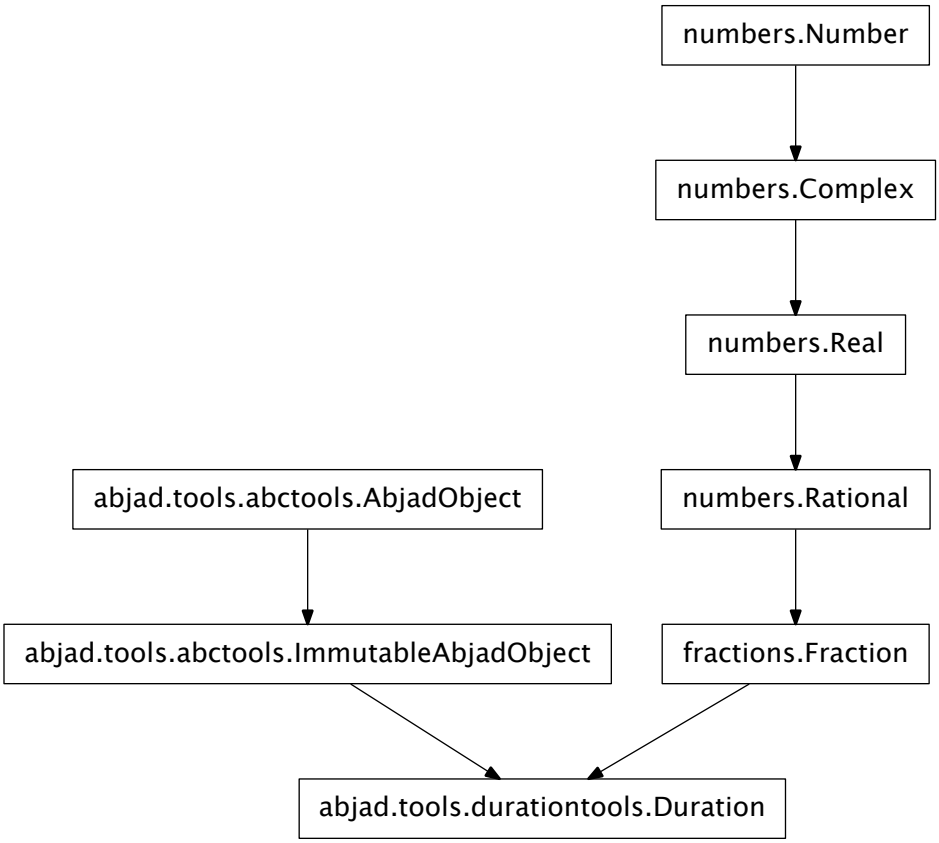
Skip nonsemantic contexts.

Function looks like a hack but isn't. LilyPond uses the dedicated command shown here to set accidental style. This means that it is not possible to set accidental style on a top-level context like score with a single override.

durationtools

concrete classes

durationtools.Duration



class durationtools.**Duration**(**args*, ***kwargs*)

New in version 2.0. Abjad model of musical duration.

Initialize from integer numerator:

```
>>> Duration(3)
Duration(3, 1)
```

Initialize from integer numerator and denominator:

```
>>> Duration(3, 16)
Duration(3, 16)
```

Initialize from integer-equivalent numeric numerator:

```
>>> Duration(3.0)
Duration(3, 1)
```

Initialize from integer-equivalent numeric numerator and denominator:

```
>>> Duration(3.0, 16)
Duration(3, 16)
```

Initialize from integer-equivalent singleton:

```
>>> Duration((3,))
Duration(3, 1)
```

Initialize from integer-equivalent pair:

```
>>> Duration((3, 16))
Duration(3, 16)
```

Initialize from other duration:

```
>>> Duration(Duration(3, 16))
Duration(3, 16)
```

Intialize from fraction:

```
>>> Duration(Fraction(3, 16))
Duration(3, 16)
```

Initialize from solidus string:

```
>>> Duration('3/16')
Duration(3, 16)
```

Changed in version 2.9: initialize from LilyPond duration string:

```
>>> Duration('8.')
Duration(3, 16)
```

Changed in version 2.9: initialize from nonreduced fraction:

```
>>> from abjad.tools import mathtools

>>> Duration(mathtools.NonreducedFraction(3, 16))
Duration(3, 16)
```

Durations inherit from built-in fraction:

```
>>> isinstance(Duration(3, 16), Fraction)
True
```

Durations are numeric:

```
>>> import numbers

>>> isinstance(Duration(3, 16), numbers.Number)
True
```

Durations are immutable.

Read-only Properties

Duration.**denominator**
Inherited from fractions.Fraction

Duration.**imag**
Real numbers have no imaginary component.

Inherited from numbers.Real

Duration.**numerator**
Inherited from fractions.Fraction

Duration.**pair**
New in version 2.9. Read-only pair of duration numerator and denominator:

```
>>> duration = Duration(3, 16)

>>> duration.pair
(3, 16)
```

Return integer pair.

Duration.**real**
Real numbers are their real component.

Inherited from numbers.Real

Duration.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

Duration.**conjugate**()
Conjugate is a no-op for Reals.

Inherited from numbers.Real

classmethod Duration.**from_decimal**(*dec*)
Converts a finite Decimal instance to a rational number, exactly.

Inherited from fractions.Fraction

classmethod Duration.**from_float**(*f*)
Converts a finite float to a rational number, exactly.

Beware that Fraction.from_float(0.3) != Fraction(3, 10).

Inherited from fractions.Fraction

Duration.**limit_denominator**(*max_denominator=1000000*)
Closest Fraction to self with denominator at most max_denominator.

```
>>> Fraction('3.141592653589793').limit_denominator(10)
Fraction(22, 7)
>>> Fraction('3.141592653589793').limit_denominator(100)
Fraction(311, 99)
>>> Fraction(4321, 8765).limit_denominator(10000)
Fraction(4321, 8765)
```

Inherited from fractions.Fraction

Special Methods

Duration.**__abs__**(**args*)

Duration.**__add__**(**args*)

Duration.**__complex__**()
complex(self) == complex(float(self), 0)

Inherited from numbers.Real

Duration.**__div__**(**args*)

Duration.**__divmod__**(**args*)

Duration.**__eq__**(*arg*)

Duration.**__float__**()
float(self) = self.numerator / self.denominator

It's important that this conversion use the integer's "true" division rather than casting one side to float before dividing so that ratios of huge integers convert without overflowing.

Inherited from numbers.Rational

Duration.**__floordiv__**(*a*, *b*)
a // b

Inherited from fractions.Fraction

Duration.**__ge__**(*arg*)

Duration.**__gt__**(*arg*)

Duration.**__hash__**()
hash(self)

Tricky because values that are exactly representable as a float must have the same hash as that float.

Inherited from fractions.Fraction

Duration.**__le__**(*arg*)

Duration.**__lt__**(*arg*)

Duration.**__mod__**(**args*)

Duration.**__mul__**(**args*)

Duration.**__ne__**(*arg*)

Duration.**__neg__**(**args*)

Duration.**__nonzero__**(*a*)
a != 0

Inherited from fractions.Fraction

Duration.**__pos__**(**args*)

Duration.**__pow__**(**args*)

Duration.**__radd__**(**args*)

Duration.**__rdiv__**(**args*)

Duration.**__rdivmod__**(**args*)

Duration.**__repr__**()

Duration.__**rfloordiv**__(*b*, *a*)
a // b

Inherited from fractions.Fraction

Duration.__**rmod**__(**args*)

Duration.__**rmul**__(**args*)

Duration.__**rpow**__(**args*)

Duration.__**rsub**__(**args*)

Duration.__**rtruediv**__(**args*)

Duration.__**str**__()
str(self)

Inherited from fractions.Fraction

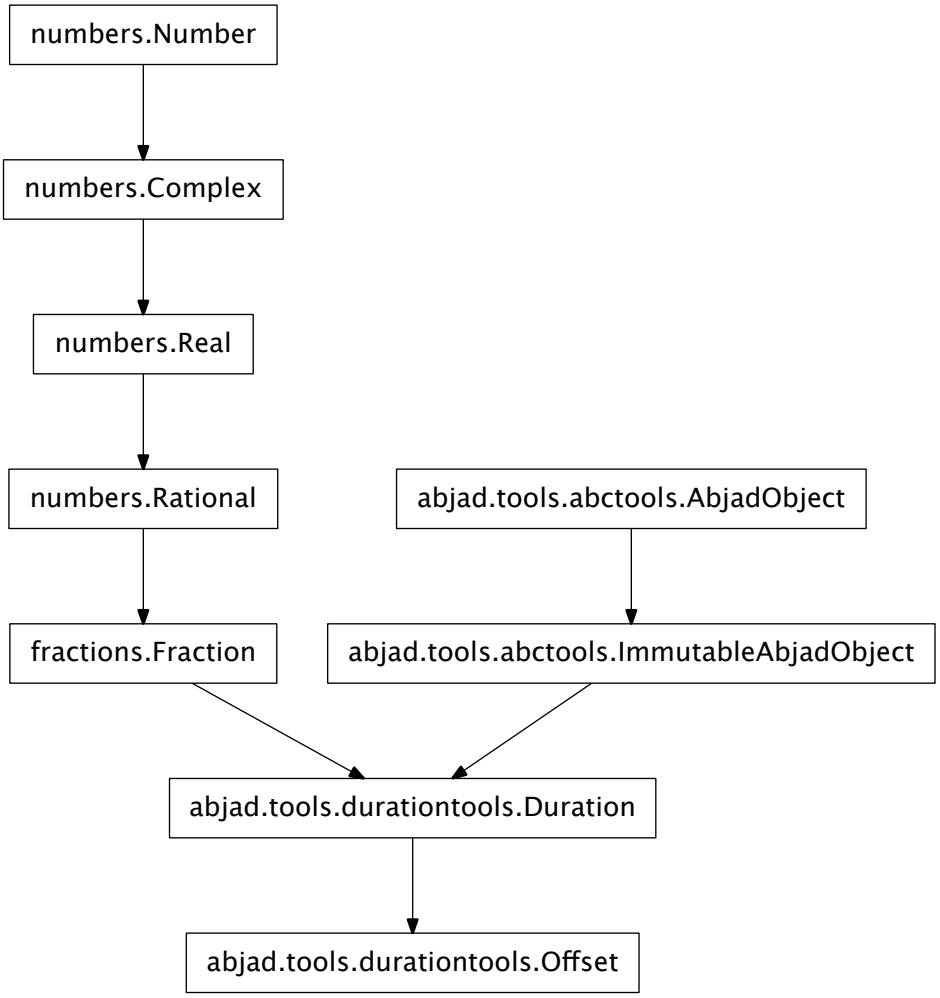
Duration.__**sub**__(**args*)

Duration.__**truediv**__(**args*)

Duration.__**trunc**__(*a*)
trunc(a)

Inherited from fractions.Fraction

durationtools.Offset



class durationtools.**Offset**(**args*, ***kwargs*)

New in version 2.0. Abjad model of offset value of musical time:

```
>>> from abjad.tools import durationtools

>>> durationtools.Offset(121, 16)
Offset(121, 16)
```

Offset inherits from duration (which inherits from built-in `Fraction`).

Read-only Properties

Offset.**denominator**

Inherited from fractions.Fraction

Offset.**imag**
Real numbers have no imaginary component.

Inherited from numbers.Real

Offset.**numerator**
Inherited from fractions.Fraction

Offset.**pair**
New in version 2.9. Read-only pair of duration numerator and denominator:

```
>>> duration = Duration(3, 16)
```

```
>>> duration.pair
(3, 16)
```

Return integer pair.

Inherited from durationtools.Duration

Offset.**real**
Real numbers are their real component.

Inherited from numbers.Real

Offset.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

Offset.**conjugate**()
Conjugate is a no-op for Reals.

Inherited from numbers.Real

classmethod Offset.**from_decimal**(*dec*)
Converts a finite Decimal instance to a rational number, exactly.

Inherited from fractions.Fraction

classmethod Offset.**from_float**(*f*)
Converts a finite float to a rational number, exactly.

Beware that Fraction.from_float(0.3) != Fraction(3, 10).

Inherited from fractions.Fraction

Offset.**limit_denominator**(*max_denominator=1000000*)
Closest Fraction to self with denominator at most max_denominator.

```
>>> Fraction('3.141592653589793').limit_denominator(10)
Fraction(22, 7)
>>> Fraction('3.141592653589793').limit_denominator(100)
Fraction(311, 99)
>>> Fraction(4321, 8765).limit_denominator(10000)
Fraction(4321, 8765)
```

Inherited from fractions.Fraction

Special Methods

Offset.**__abs__**(**args*)
Inherited from durationtools.Duration

Offset.**__add__**(**args*)
Inherited from durationtools.Duration

Offset.**__complex__**()
complex(self) == complex(float(self), 0)

Inherited from numbers.Real

Offset.**__div__**(**args*)
Inherited from durationtools.Duration

Offset.**__divmod__**(**args*)
Inherited from durationtools.Duration

Offset.**__eq__**(*arg*)
Inherited from durationtools.Duration

Offset.**__float__**()
float(self) = self.numerator / self.denominator

It's important that this conversion use the integer's "true" division rather than casting one side to float before dividing so that ratios of huge integers convert without overflowing.

Inherited from numbers.Rational

Offset.**__floordiv__**(*a*, *b*)
a // b

Inherited from fractions.Fraction

Offset.**__ge__**(*arg*)
Inherited from durationtools.Duration

Offset.**__gt__**(*arg*)
Inherited from durationtools.Duration

Offset.**__hash__**()
hash(self)

Tricky because values that are exactly representable as a float must have the same hash as that float.

Inherited from fractions.Fraction

Offset.**__le__**(*arg*)
Inherited from durationtools.Duration

Offset.**__lt__**(*arg*)
Inherited from durationtools.Duration

Offset.**__mod__**(**args*)
Inherited from durationtools.Duration

Offset.**__mul__**(**args*)
Inherited from durationtools.Duration

Offset.**__ne__**(*arg*)
Inherited from durationtools.Duration

Offset.**__neg__**(**args*)
Inherited from durationtools.Duration

Offset.__nonzero__(*a*)
a != 0

Inherited from fractions.Fraction

Offset.__pos__(**args*)
Inherited from durationtools.Duration

Offset.__pow__(**args*)
Inherited from durationtools.Duration

Offset.__radd__(**args*)
Inherited from durationtools.Duration

Offset.__rdiv__(**args*)
Inherited from durationtools.Duration

Offset.__rdivmod__(**args*)
Inherited from durationtools.Duration

Offset.__repr__()
Inherited from durationtools.Duration

Offset.__rfloordiv__(*b*, *a*)
a // b

Inherited from fractions.Fraction

Offset.__rmod__(**args*)
Inherited from durationtools.Duration

Offset.__rmul__(**args*)
Inherited from durationtools.Duration

Offset.__rpow__(**args*)
Inherited from durationtools.Duration

Offset.__rsub__(**args*)
Inherited from durationtools.Duration

Offset.__rtruediv__(**args*)
Inherited from durationtools.Duration

Offset.__str__()
str(self)

Inherited from fractions.Fraction

Offset.__sub__(*expr*)
New in version 2.10. Offset taken from offset returns duration:

```
>>> durationtools.Offset(2) - durationtools.Offset(1, 2)
Duration(3, 2)
```

Duration taken from offset returns another offset:

```
>>> durationtools.Offset(2) - durationtools.Duration(1, 2)
Offset(3, 2)
```

Coerce *expr* to offset when *expr* is neither offset nor duration:

```
>>> durationtools.Offset(2) - Fraction(1, 2)
Duration(3, 2)
```

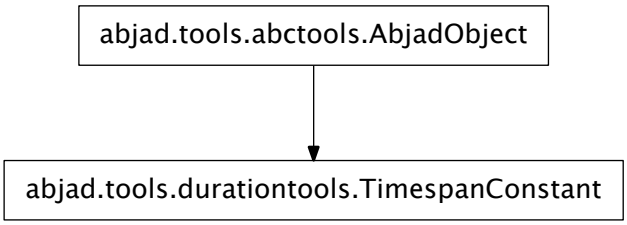
Return duration or offset.

Offset.**__truediv__**(**args*)
Inherited from durationtools.Duration

Offset.**__trunc__**(*a*)
trunc(a)

Inherited from fractions.Fraction

durationtools.TimespanConstant



class durationtools.**TimespanConstant**(*start_offset=None*, *stop_offset=None*)
New in version 1.0. Timespan constant.

Timespan contant `[1/2, 3/2)`:

```
>>> timespan_constant = durationtools.TimespanConstant((1, 2), (3, 2))
```

```
>>> timespan_constant
TimespanConstant(start_offset=Offset(1, 2), stop_offset=Offset(3, 2))
```

```
>>> z(timespan_constant)
durationtools.TimespanConstant(
    start_offset=durationtools.Offset(1, 2),
    stop_offset=durationtools.Offset(3, 2)
    )
```

Timespan constants are object-modeled offset pairs.

Timespan constants are immutable.

Read-only Properties

TimespanConstant.**duration**
Duration of timespan constant.

TimespanConstant.**start_offset**
Start offset of timespan constant specified by user.

Return offset.

TimespanConstant.**stop_offset**
Stop offset of timespan constant specified by user.

Return stop offset.

TimespanConstant.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

TimespanConstant.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TimespanConstant.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimespanConstant.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TimespanConstant.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimespanConstant.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimespanConstant.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TimespanConstant.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

functions

durationtools.all_are_duration_tokens

durationtools.**all_are_duration_tokens**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad duration tokens:

```
>>> from abjad.tools import durationtools

>>> duration_tokens = ['8.', (3, 16), Fraction(3, 16), Duration(3, 16)]

>>> durationtools.all_are_duration_tokens(duration_tokens)
True
```

True when *expr* is an empty sequence:

```
>>> durationtools.all_are_duration_tokens([])
True
```

Otherwise false:

```
>>> durationtools.all_are_durations('foo')
False
```

Return boolean.

durationtools.all_are_durations

durationtools.**all_are_durations**(*expr*)

New in version 2.6. True when *expr* is a sequence of Abjad durations:

```
>>> from abjad.tools import durationtools

>>> durations = [Duration((3, 16)), Duration((4, 16))]

>>> durationtools.all_are_durations(durations)
True
```

True when *expr* is an empty sequence:

```
>>> durationtools.all_are_durations([])
True
```

Otherwise false:

```
>>> durationtools.all_are_durations('foo')
False
```

Return boolean.

durationtools.assignable_rational_to_dot_count

durationtools.**assignable_rational_to_dot_count**(*rational*)

New in version 2.0. Change assignable *rational* to dot count:

```
>>> from abjad.tools import durationtools

>>> for n in range(1, 9):
...     try:
...                 rational = Fraction(n, 16)
...                 dot_count = durationtools.assignable_rational_to_dot_count(rational)
...                 print '%s\t%s' % (rational, dot_count)
...     except AssignabilityError:
...                 pass
```

```
...
1/16    0
1/8     0
3/16    1
1/4     0
3/8     1
7/16    2
1/2     0
```

Raise assignability error when *rational* not assignable.

Return nonnegative integer.

durationtools.assignable_rational_to_lilypond_duration_string

durationtools.**assignable_rational_to_lilypond_duration_string**(*rational*)

New in version 2.0. Change assignable *rational* to LilyPond duration string:

```
>>> from abjad.tools import durationtools

>>> durationtools.assignable_rational_to_lilypond_duration_string(Fraction(3, 16))
'8.'
```

Raise assignability error when *rational* not assignable.

Return string.

durationtools.duration_pair_to_prolation_string

durationtools.**duration_pair_to_prolation_string**(*pair*)

New in version 2.0. Change positive integer duration *pair* to colon-separated prolation string:

```
>>> from abjad.tools import durationtools

>>> durationtools.duration_pair_to_prolation_string((2, 3))
'3:2'
```

Return string.

durationtools.duration_token_to_assignable_duration_pairs

durationtools.**duration_token_to_assignable_duration_pairs**(*duration_token*)

New in version 1.1. Change *duration_token* to big-endian tuple of assignable duration pairs:

```
>>> from abjad.tools import durationtools

>>> duration_tokens = [(n, 16) for n in range(10, 20)]
>>> for duration_token in duration_tokens:
...     pairs = durationtools.duration_token_to_assignable_duration_pairs(
...         duration_token)
...     print duration_token, pairs
...
(10, 16) ((8, 16), (2, 16))
(11, 16) ((8, 16), (3, 16))
(12, 16) ((12, 16),)
(13, 16) ((12, 16), (1, 16))
```

```
(14, 16) ((14, 16),)
(15, 16) ((15, 16),)
(16, 16) ((16, 16),)
(17, 16) ((16, 16), (1, 16))
(18, 16) ((16, 16), (2, 16))
(19, 16) ((16, 16), (3, 16))
```

Return tuple of integer pairs. Changed in version 2.0: renamed `durationtools.token_decompose()` to `durationtools.duration_token_to_assignable_duration_pairs()`.

durationtools.duration_token_to_duration_pair

durationtools.**duration_token_to_duration_pair**(*duration_token*)

New in version 1.1. Change *duration_token* to duration pair:

```
>>> from abjad.tools import durationtools

>>> durationtools.duration_token_to_duration_pair(Fraction(2, 4))
(1, 2)
```

New in version 2.0: Change LilyPond duration string to duration pair:

```
>>> durationtools.duration_token_to_duration_pair('8.')
(3, 16)
```

Return pair. Changed in version 2.0: renamed `durationtools.token_unpack()` to `durationtools.duration_token_to_duration_pair()`.

durationtools.duration_token_to_rational

durationtools.**duration_token_to_rational**(*duration_token*)

New in version 2.0. Change *duration_token* to rational:

```
>>> from abjad.tools import durationtools

>>> durationtools.duration_token_to_rational((4, 16))
Fraction(1, 4)

>>> durationtools.duration_token_to_rational('4.')
Fraction(3, 8)
```

Return fraction.

durationtools.duration_tokens_to_duration_pairs

durationtools.**duration_tokens_to_duration_pairs**(*duration_tokens*)

New in version 2.0. Change *duration_tokens* to duration pairs:

```
>>> from abjad.tools import durationtools

>>> durationtools.duration_tokens_to_duration_pairs([Fraction(2, 4), 3, '8.', (5, 16)])
[(1, 2), (3, 1), (3, 16), (5, 16)]
```

Return new object of *duration_tokens* type.

durationtools.duration_tokens_to_duration_pairs_with_least_common_denominator

durationtools.**duration_tokens_to_duration_pairs_with_least_common_denominator**(*duration_tokens*)

New in version 2.0. Change *duration_tokens* to duration pairs with least common denominator:

```
>>> from abjad.tools import durationtools

>>> durationtools.duration_tokens_to_duration_pairs_with_least_common_denominator(
... [Fraction(2, 4), 3, '8.', (5, 16)])
[(8, 16), (48, 16), (3, 16), (5, 16)]
```

Return new object of *duration_tokens* type.

durationtools.duration_tokens_to_least_common_denominator

durationtools.**duration_tokens_to_least_common_denominator**(*duration_tokens*)

New in version 2.0. Change *duration_tokens* to least common denominator:

```
>>> from abjad.tools import durationtools

>>> durationtools.duration_tokens_to_least_common_denominator(
...     [Fraction(2, 4), 3, '8.', (5, 16)])
16
```

Return positive integer.

durationtools.duration_tokens_to_rationals

durationtools.**duration_tokens_to_rationals**(*duration_tokens*)

New in version 2.0. Change *duration_tokens* to rationals:

```
>>> from abjad.tools import durationtools

>>> durationtools.duration_tokens_to_rationals([Fraction(2, 4), 3, '8.', (5, 16)])
[Fraction(1, 2), Fraction(3, 1), Fraction(3, 16), Fraction(5, 16)]
```

Return new object of *duration_tokens* type.

durationtools.group_duration_tokens_by_implied_prolation

durationtools.**group_duration_tokens_by_implied_prolation**(*durations*)

New in version 1.1. Group *durations* by implied prolation:

```
>>> from abjad.tools import durationtools

>>> duration_tokens = [(1, 4), (1, 8), (1, 3), (1, 6), (1, 4)]

>>> durationtools.group_duration_tokens_by_implied_prolation(duration_tokens)
[[(1, 4), (1, 8)], [(1, 3), (1, 6)], [(1, 4)]]
```

Return list of integer pair lists. Changed in version 2.0: renamed `durationtools.agglomerate_by_prolation()` to `durationtools.group_duration_tokens_by_impli`

durationtools.is_assignable_rational

durationtools.**is_assignable_rational**(*expr*)

New in version 1.1. True when *expr* is assignable rational. Otherwise false:

```
>>> from abjad.tools import durationtools

>>> for numerator in range(0, 16 + 1):
...     duration = Fraction(numerator, 16)
...     print '%s\t%s' % (duration, durationtools.is_assignable_rational(duration))
...
0     False
1/16  True
1/8   True
3/16  True
1/4   True
5/16  False
3/8   True
7/16  True
1/2   True
9/16  False
5/8   False
11/16 False
3/4   True
13/16 False
7/8   True
15/16 True
1     True
```

Return boolean. Changed in version 2.0: renamed `durationtools.is_assignable()` to `durationtools.is_assignable_rational()`.

durationtools.is_binary_rational

durationtools.**is_binary_rational**(*rational*)

New in version 1.1. True when *rational* is of the form `1/2**n`. Otherwise false:

```
>>> from abjad.tools import durationtools

>>> for n in range(1, 17):
...     rational = Fraction(1, n)
...     print '%s\t%s' % (rational, durationtools.is_binary_rational(rational))
...
1       True
1/2     True
1/3     False
1/4     True
1/5     False
1/6     False
1/7     False
1/8     True
1/9     False
1/10    False
1/11    False
1/12    False
1/13    False
1/14    False
```

```
1/15    False
1/16    True
```

Return boolean.

durationtools.is_duration_pair

durationtools.**is_duration_pair**(*arg*)

New in version 1.1. True when *arg* has the form of a pair of integers that initialize a positive rational:

```
>>> from abjad.tools import durationtools

>>> durationtools.is_duration_pair((5, 16))
True
```

Otherwise false:

```
>>> durationtools.is_duration_pair((-5, 16))
False
```

Return boolean. Changed in version 2.0: renamed `durationtools.is_pair()` to `durationtools.is_duration_pair()`.

durationtools.is_duration_token

durationtools.**is_duration_token**(*expr*)

New in version 2.0. True when *expr* has the form of an Abjad duration token:

```
>>> from abjad.tools import durationtools

>>> durationtools.is_duration_token('8.')
True
```

Otherwise false:

```
>>> durationtools.is_duration_token('foo')
False
```

Return boolean.

durationtools.is_lilypond_duration_name

durationtools.**is_lilypond_duration_name**(*expr*)

New in version 2.0. True when *expr* is a LilyPond duartion name:

```
>>> from abjad.tools import durationtools

>>> durationtools.is_lilypond_duration_name('\\breve')
True
```

Otherwise false:

```
>>> durationtools.is_lilypond_duration_name('foo')
False
```

The regex `^(\\breve|\\longa|\\maxima)$` underlies this predicate.

Return boolean.

durationtools.is_lilypond_duration_string

`durationtools.`**`is_lilypond_duration_string`**(*expr*)

New in version 2.0. True when *expr* is a LilyPond duration string:

```
>>> from abjad.tools import durationtools

>>> durationtools.is_lilypond_duration_string('4.. * 1/2')
True
```

Otherwise false:

```
>>> durationtools.is_lilypond_duration_string('foo')
False
```

The regex `^(1|2|4|8|16|32|64|128|\breve|\longa|\maxima)\s*(\.*)\s*(\*\s*(\d+(/\d+)?))?$` underlies this predicate.

Return boolean.

durationtools.is_proper_tuplet_multiplier

`durationtools.`**`is_proper_tuplet_multiplier`**(*multiplier*)

True when `1/2 < multiplier < 2`.

```
>>> for n in range(17):
...     rational = Fraction(n, 8)
...     multiplier = durationtools.is_proper_tuplet_multiplier(rational)
...     print '%s   %s' % (rational, multiplier)
...
0         False
1/8     False
1/4     False
3/8     False
1/2     False
5/8     True
3/4     True
7/8     True
1         True
9/8     True
5/4     True
11/8    True
3/2     True
13/8    True
7/4     True
15/8    True
2         False
```

This function models the idea that `4:3`, `4:5`, `4:6`, `4:7` are valid tuplet multipliers while `4:2` and `4:8` aren't. Changed in version 2.0: renamed `durationtools.is_tuplet_multiplier()` to `durationtools.is_proper_tuplet_multiplier()`.

durationtools.lilypond_duration_string_to_rational

durationtools.**lilypond_duration_string_to_rational**(*duration_string*)

New in version 2.0. Change LilyPond *duration_string* to rational:

```
>>> from abjad.tools import durationtools

>>> durationtools.lilypond_duration_string_to_rational('8.')
Fraction(3, 16)
```

Return fraction.

durationtools.lilypond_duration_string_to_rational_list

durationtools.**lilypond_duration_string_to_rational_list**(*duration_string*)

New in version 2.0. Change LilyPond *duration_string* to rational list:

```
>>> from abjad.tools import durationtools

>>> durationtools.lilypond_duration_string_to_rational_list('8.. 32 8.. 32')
[Fraction(7, 32), Fraction(1, 32), Fraction(7, 32), Fraction(1, 32)]
```

Return list of fractions.

durationtools.multiply_duration_pair

durationtools.**multiply_duration_pair**(*pair*, *multiplier*)

New in version 1.1. Multiply duration *pair* by rational *multiplier*:

```
>>> from abjad.tools import durationtools

>>> durationtools.multiply_duration_pair((4, 8), Fraction(4, 5))
(16, 40)
```

Naive multiplication with no simplification of anything intended for certain types of meter multiplication.

Return integer pair. Changed in version 2.0: renamed `durationtools.pair_multiply_naive()` to `durationtools.multiply_duration_pair()`.

durationtools.multiply_duration_pair_and_reduce_factors

durationtools.**multiply_duration_pair_and_reduce_factors**(*pair*, *multiplier*)

New in version 1.1. Multiply *pair* by rational *multiplier* and reduce factors:

```
>>> from abjad.tools import durationtools

>>> durationtools.multiply_duration_pair_and_reduce_factors((4, 8), Fraction(2, 3))
(4, 12)
```

Intended for certain types of meter multiplication.

Return integer pair. Changed in version 2.0: renamed `durationtools.pair_multiply_reduce_factors()` to `durationtools.multiply_duration_pair_and_reduce_factors()`.

durationtools.multiply_duration_pair_and_try_to_preserve_numerator

durationtools.**multiply_duration_pair_and_try_to_preserve_numerator**(*pair*, *multiplier*)

New in version 1.1. Multiply duration *pair* by rational *multiplier* and try to preserve numerator:

```
>>> durationtools.multiply_duration_pair_and_try_to_preserve_numerator(
...     (9, 16), Fraction(2, 3))
(9, 24)
```

Intended for certain types of meter multiplication.

Return integer pair. Changed in version 2.0: renamed `durationtools.pair_multiply_constant_numerator()` to `durationtools.multiply_duration_pair_and_try_to_preserve_numerator()`.

durationtools.numeric_seconds_to_clock_string

durationtools.**numeric_seconds_to_clock_string**(*seconds*)

New in version 2.0. Change numeric *seconds* to clock string:

```
>>> from abjad.tools import durationtools

>>> durationtools.numeric_seconds_to_clock_string(117)
'1\'57"'
```

Return string.

durationtools.numeric_seconds_to_escaped_clock_string

durationtools.**numeric_seconds_to_escaped_clock_string**(*seconds*)

New in version 2.0. Change numeric *seconds* to escaped clock string:

```
>>> from abjad.tools import durationtools

>>> note = Note("c'4")
>>> clock_string = durationtools.numeric_seconds_to_escaped_clock_string(117)

>>> markuptools.Markup('"%s"' % clock_string, Up)(note)
Markup(('1\'57\\"',), direction=Up)(c'4)

>>> f(note)
c'4 ^ \markup { 1'57\\" }
```

Escape seconds indicator for output as LilyPond markup.

Return string.

durationtools.positive_integer_to_implied_prolation_multiplier

durationtools.**positive_integer_to_implied_prolation_multiplier**(*n*)

New in version 1.1. Change positive integer *n* to implied porlation multiplier:

```
>>> for denominator in range(1, 17):
...     multiplier = durationtools.positive_integer_to_implied_prolation_multiplier(
...         denominator)
```

```
...     print '%s %4s' % (denominator, multiplier)
...
1          1
2          1
3          2/3
4          1
5          4/5
6          2/3
7          4/7
8          1
9          8/9
10         4/5
11         8/11
12         2/3
13         8/13
14         4/7
15         8/15
16         1
```

Return positive fraction less than or equal to `1`. Changed in version 2.0: renamed `durationtools.denominator_to_multiplier()` to `durationtools.positive_integer_to_implied_prolation_multiplier()`.

durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator

durationtools.**rational_to_duration_pair_with_multiple_of_specified_integer_denominator**(*dura*
in-
te-
ger_d

Change *duration* to duration pair with multiple of specified *integer_denominator*:

```
>>> from abjad.tools import durationtools

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 2)
(1, 2)

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 4)
(2, 4)

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 8)
(4, 8)

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 16)
(8, 16)

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 3)
(3, 6)

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 6)
(3, 6)
```

```
>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 12)
(6, 12)

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 24)
(12, 24)

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 5)
(5, 10)

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 10)
(5, 10)

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 20)
(10, 20)

>>> durationtools.rational_to_duration_pair_with_multiple_of_specified_integer_denominator(
...     Fraction(1, 2), 40)
(20, 40)
```

Return integer pair.

durationtools.rational_to_duration_pair_with_specified_integer_denominator

durationtools.**rational_to_duration_pair_with_specified_integer_denominator**(*duration*, *integer_denominator*)

New in version 1.1. Change *duration* to duraiton pair with specified *integer_denominator*:

```
>>> from abjad.tools import durationtools

>>> for n in range(1, 17):
...     rational = Fraction(n, 16)
...     pair = durationtools.rational_to_duration_pair_with_specified_integer_denominator(
...         rational, 16)
...     print '%s\t%s' % (rational, pair)
...
1/16    (1, 16)
1/8     (2, 16)
3/16    (3, 16)
1/4     (4, 16)
5/16    (5, 16)
3/8     (6, 16)
7/16    (7, 16)
1/2     (8, 16)
9/16    (9, 16)
5/8     (10, 16)
11/16   (11, 16)
3/4     (12, 16)
13/16   (13, 16)
7/8     (14, 16)
```

```
15/16   (15, 16)
1         (16, 16)
```

Return integer pair. Changed in version 2.0: renamed `durationtools.in_terms_of()` to `durationtools.rational_to_duration_pair_with_specified_integer_denominator()`.

durationtools.rational_to_equal_or_greater_assignable_rational

durationtools.**rational_to_equal_or_greater_assignable_rational**(*rational*)

New in version 1.1. Change *rational* to equal or greater assignable rational:

```
>>> from abjad.tools import durationtools

>>> for n in range(1, 17):
...     prolated = Fraction(n, 16)
...     written = durationtools.rational_to_equal_or_greater_assignable_rational(prolated)
...     print '%s/16\t%s' % (n, written)
...
1/16    1/16
2/16    1/8
3/16    3/16
4/16    1/4
5/16    3/8
6/16    3/8
7/16    7/16
8/16    1/2
9/16    3/4
10/16   3/4
11/16   3/4
12/16   3/4
13/16   7/8
14/16   7/8
15/16   15/16
16/16   1
```

Return fraction.

Function returns dotted and double dotted durations where possible. Changed in version 2.0: Fixed to produce monotonically increasing output in response to monotonically increasing input.Changed in version 2.0: renamed `durationtools.prolated_to_written_not_less_than()` to `durationtools.rational_to_equal_or_greater_assignable_rational()`.

durationtools.rational_to_equal_or_greater_binary_rational

durationtools.**rational_to_equal_or_greater_binary_rational**(*rational*)

New in version 1.1. Change *rational* to equal to greater binary rational:

```
>>> for n in range(1, 17):
...     rational = Fraction(n, 16)
...     written_duration = durationtools.rational_to_equal_or_greater_binary_rational(
...         rational)
...     print '%s/16 %4s' % (n, written_duration)
...
1/16    1/16
2/16    1/8
3/16    1/4
```

```
4/16    1/4
5/16    1/2
6/16    1/2
7/16    1/2
8/16    1/2
9/16    1
10/16   1
11/16   1
12/16   1
13/16   1
14/16   1
15/16   1
16/16   1
```

```
>>> durationtools.rational_to_equal_or_greater_binary_rational(Fraction(1, 80))
Fraction(1, 64)
```

```
>>> durationtools.rational_to_equal_or_greater_binary_rational(Fraction(17, 16))
Fraction(2, 1)
```

Use to find written duration of tupletted leaves.

Return fraction. Changed in version 2.0: renamed `durationtools.naive_prolated_to_written_not_less_than` to `durationtools.rational_to_equal_or_greater_binary_rational()`.

durationtools.rational_to_equal_or_lesser_assignable_rational

durationtools.**rational_to_equal_or_lesser_assignable_rational**(*rational*)

New in version 1.1. Change *rational* to equal or lesser assignable rational:

```
>>> from abjad.tools import durationtools
```

```
>>> for n in range(1, 17):
...     rational = Fraction(n, 16)
...     written = durationtools.rational_to_equal_or_lesser_assignable_rational(rational)
...     print '%s/16\t%s' % (n, written)
...
1/16    1/16
2/16    1/8
3/16    3/16
4/16    1/4
5/16    1/4
6/16    3/8
7/16    7/16
8/16    1/2
9/16    1/2
10/16   1/2
11/16   1/2
12/16   3/4
13/16   3/4
14/16   7/8
15/16   15/16
16/16   1
```

Return fraction.

Function returns dotted and double dotted durations where possible. Changed in version 2.0: Fixed to produce monotonically increasing output in response to monotonically increasing input.Changed

in version 2.0: renamed `durationtools.prolated_to_written_not_greater_than()` to `durationtools.rational_to_equal_or_lesser_assignable_rational()`.

durationtools.rational_to_equal_or_lesser_binary_rational

`durationtools.`**`rational_to_equal_or_lesser_binary_rational`**(*rational*)

New in version 1.1. Change *rational* to equal or lesser binary rational:

```
>>> for n in range(1, 17):
...     rational = Fraction(n, 16)
...     written_duration = durationtools.rational_to_equal_or_lesser_binary_rational(
...         rational)
...     print '%s/16 %4s' % (n, written_duration)
...
1/16    1/16
2/16    1/8
3/16    1/8
4/16    1/4
5/16    1/4
6/16    1/4
7/16    1/4
8/16    1/2
9/16    1/2
10/16   1/2
11/16   1/2
12/16   1/2
13/16   1/2
14/16   1/2
15/16   1/2
16/16   1
```

```
>>> durationtools.rational_to_equal_or_lesser_binary_rational(Fraction(1, 80))
Fraction(1, 128)
```

Return fraction.

Function intended to find written duration of notes inside tuplet. Changed in version 2.0: renamed `durationtools.naive_prolated_to_written_not_greater_than()` to `durationtools.rational_to_equal_or_lesser_binary_rational()`.

durationtools.rational_to_flag_count

`durationtools.`**`rational_to_flag_count`**(*rational*)

New in version 2.0. Change *rational* to number of flags required to notate:

```
>>> from abjad.tools import durationtools
```

```
>>> durationtools.rational_to_flag_count(Fraction(1, 32))
3
```

Return nonnegative integer.

durationtools.rational_to_fraction_string

`durationtools.`**`rational_to_fraction_string`**(*rational*)

New in version 1.1. Change *rational* to fraction string:

```
>>> from abjad.tools import durationtools

>>> durationtools.rational_to_fraction_string(Fraction(2, 4))
'1/2'
```

Return string.

durationtools.rational_to_prolation_string

durationtools.**rational_to_prolation_string**(*rational*)

New in version 2.0. Change *rational* to prolation string:

```
>>> from abjad.tools import durationtools

>>> generator = durationtools.yield_all_positive_rationals_uniquely()
>>> for n in range(16):
...     rational = generator.next()
...     prolation_string = durationtools.rational_to_prolation_string(rational)
...     print '%s\\t%s' % (rational, prolation_string)
...
1         1:1
2         1:2
1/2     2:1
1/3     3:1
3         1:3
4         1:4
3/2     2:3
2/3     3:2
1/4     4:1
1/5     5:1
5         1:5
6         1:6
5/2     2:5
4/3     3:4
3/4     4:3
2/5     5:2
```

Return string.

durationtools.rational_to_proper_fraction

durationtools.**rational_to_proper_fraction**(*rational*)

New in version 2.0. Change *rational* to proper fraction:

```
>>> from abjad.tools import durationtools

>>> durationtools.rational_to_proper_fraction(Fraction(116, 8))
(14, Fraction(1, 2))
```

Return pair.

durationtools.rewrite_rational_under_new_tempo

durationtools.**rewrite_rational_under_new_tempo**(*prolated_duration_1*, *tempo_mark_1*, *tempo_mark_2*)

New in version 2.0. Given *prolated_duration_1* governed by *tempo_mark_1*, return *prolated_duration_2* governed by *tempo_mark_2* such that *prolated_duration_1* and *prolated_duration_2* consume exactly the same amount of time in seconds.

Consider the two tempo indications below.

```
>>> from abjad.tools import durationtools

>>> tempo_mark_1 = contexttools.TempoMark(Duration(1, 4), 60)
>>> tempo_mark_2 = contexttools.TempoMark(Duration(1, 4), 90)
```

The first tempo indication specifies quarter = 60 MM. The second tempo indication specifies quarter = 90 MM.

The second tempo is 1 1/2 times as fast as the first:

```
>>> tempo_mark_2 / tempo_mark_1
Duration(3, 2)
```

An triplet eighth note at tempo 1 equals a regular eighth note at tempo 2.

```
>>> durationtools.rewrite_rational_under_new_tempo(
...     Duration(1, 12), tempo_mark_1, tempo_mark_2)
Duration(1, 8)
```

Conversely, a regular eighth not at tempo 1 equals a dotted sixteenth at tempo 2.

```
>>> durationtools.rewrite_rational_under_new_tempo(
...     Duration(1, 8), tempo_mark_1, tempo_mark_2)
Duration(3, 16)
```

Return fraction.

durationtools.yield_all_assignable_rationals

durationtools.**yield_all_assignable_rationals**()

New in version 2.0. Yield all assignable rationals in Cantor diagonalized order:

```
>>> from abjad.tools import durationtools

>>> generator = durationtools.yield_all_assignable_rationals()
>>> for n in range(16):
...     generator.next()
...
Fraction(1, 1)
Fraction(2, 1)
Fraction(1, 2)
Fraction(3, 1)
Fraction(4, 1)
Fraction(3, 2)
Fraction(1, 4)
Fraction(6, 1)
Fraction(3, 4)
Fraction(7, 1)
Fraction(8, 1)
Fraction(7, 2)
```

```
Fraction(1, 8)
Fraction(7, 4)
Fraction(3, 8)
Fraction(12, 1)
```

Return fraction generator.

durationtools.yield_all_positive_integer_pairs

durationtools.**yield_all_positive_integer_pairs**()

New in version 2.0. Yield all positive integer pairs in Cantor diagonalized order:

```
>>> from abjad.tools import durationtools

>>> generator = durationtools.yield_all_positive_integer_pairs()
>>> for n in range(16):
...     generator.next()
...
(1, 1)
(2, 1)
(1, 2)
(1, 3)
(2, 2)
(3, 1)
(4, 1)
(3, 2)
(2, 3)
(1, 4)
(1, 5)
(2, 4)
(3, 3)
(4, 2)
(5, 1)
(6, 1)
```

Return pair generator.

durationtools.yield_all_positive_rationals

durationtools.**yield_all_positive_rationals**()

New in version 2.0. Yield all positive rationals in Cantor diagonalized order:

```
>>> from abjad.tools import durationtools

>>> generator = durationtools.yield_all_positive_rationals()
>>> for n in range(16):
...     generator.next()
...
Fraction(1, 1)
Fraction(2, 1)
Fraction(1, 2)
Fraction(1, 3)
Fraction(1, 1)
Fraction(3, 1)
Fraction(4, 1)
Fraction(3, 2)
```

```
Fraction(2, 3)
Fraction(1, 4)
Fraction(1, 5)
Fraction(1, 2)
Fraction(1, 1)
Fraction(2, 1)
Fraction(5, 1)
Fraction(6, 1)
```

Return fraction generator.

durationtools.yield_all_positive_rationals_uniquely

durationtools.**yield_all_positive_rationals_uniquely**()

New in version 2.0. Yield all positive rationals in Cantor diagonalized order uniquely:

```
>>> generator = durationtools.yield_all_positive_rationals_uniquely()
>>> for n in range(16):
...     generator.next()
...
Fraction(1, 1)
Fraction(2, 1)
Fraction(1, 2)
Fraction(1, 3)
Fraction(3, 1)
Fraction(4, 1)
Fraction(3, 2)
Fraction(2, 3)
Fraction(1, 4)
Fraction(1, 5)
Fraction(5, 1)
Fraction(6, 1)
Fraction(5, 2)
Fraction(4, 3)
Fraction(3, 4)
Fraction(2, 5)
```

Return fraction generator.

durationtools.yield_prolation_rewrite_pairs

durationtools.**yield_prolation_rewrite_pairs**(*prolated_duration*, *minimum_written_duration=None*)

New in version 2.0. Yield all prolation rewrite pairs of *prolated_duration* in Cantor diagonalized order.

Ensure written duration never less than *minimum_written_duration*.

The different ways to notate a prolated duration of `1/8`:

```
>>> from abjad.tools import durationtools

>>> pairs = durationtools.yield_prolation_rewrite_pairs(
... Fraction(1, 8))

>>> for pair in pairs: pair
...
(Fraction(1, 1), Fraction(1, 8))
```

```
(Fraction(2, 3), Fraction(3, 16))
(Fraction(4, 3), Fraction(3, 32))
(Fraction(4, 7), Fraction(7, 32))
(Fraction(8, 7), Fraction(7, 64))
(Fraction(8, 15), Fraction(15, 64))
(Fraction(16, 15), Fraction(15, 128))
(Fraction(16, 31), Fraction(31, 128))
```

The different ways to notate a prolated duration of `1/12`:

```
>>> pairs = durationtools.yield_prolation_rewrite_pairs(
... Fraction(1, 12))

>>> for pair in pairs: pair
...
(Fraction(2, 3), Fraction(1, 8))
(Fraction(4, 3), Fraction(1, 16))
(Fraction(8, 9), Fraction(3, 32))
(Fraction(16, 9), Fraction(3, 64))
(Fraction(16, 21), Fraction(7, 64))
(Fraction(32, 21), Fraction(7, 128))
(Fraction(32, 45), Fraction(15, 128))
```

The different ways to notate a prolated duration of `5/48`:

```
>>> pairs = durationtools.yield_prolation_rewrite_pairs(
... Fraction(5, 48))

>>> for pair in pairs: pair
...
(Fraction(5, 6), Fraction(1, 8))
(Fraction(5, 3), Fraction(1, 16))
(Fraction(5, 9), Fraction(3, 16))
(Fraction(10, 9), Fraction(3, 32))
(Fraction(20, 21), Fraction(7, 64))
(Fraction(40, 21), Fraction(7, 128))
(Fraction(8, 9), Fraction(15, 128))
```

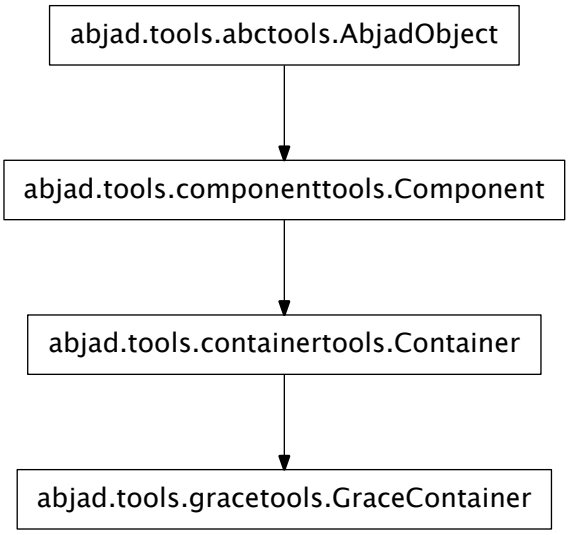
When *minimum_written_duration* is none set to `1/128`.

Return generator of paired fractions.

gracetools

concrete classes

gracetools.GraceContainer



class gracetools.**GraceContainer**(*music=None*, *kind='grace'*, ***kwargs*)

Abjad model of grace music:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(voice[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(voice)
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> grace_notes = [Note("c'16"), Note("d'16")]
>>> gracetools.GraceContainer(grace_notes, kind='grace')(voice[1])
Note("d'8")

>>> f(voice)
\new Voice {
    c'8 [
    \grace {
        c'16
        d'16
```

```
        }
        d'8
        e'8
        f'8 ]
    }
```

```
    >>> after_grace_notes = [Note("e'16"), Note("f'16")]
    >>> gracetools.GraceContainer(after_grace_notes, kind='after')(voice[1])
    Note("d'8")

    >>> f(voice)
    \new Voice {
        c'8 [
        \grace {
            c'16
            d'16
        }
        \afterGrace
        d'8
        {
            e'16
            f'16
        }
        e'8
        f'8 ]
    }
```

Grace objects are containers you can fill with notes, rests and chords.

Grace containers override the special `__call__` method.

Use `GraceContainer()` to attach grace containers to nongrace notes, rests and chords.

Read-only Properties

`GraceContainer.`**`contents_duration`**

Inherited from `containertools.Container`

`GraceContainer.`**`duration_in_seconds`**

Inherited from `containertools.Container`

`GraceContainer.`**`leaves`**

Read-only tuple of leaves in container:

```
    >>> container = Container("c'8 d'8 e'8")

    >>> container.leaves
    (Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from `containertools.Container`

`GraceContainer.`**`lilypond_format`**

`GraceContainer.`**`music`**

Read-only tuple of components in container:

```
    >>> container = Container("c'8 d'8 e'8")
```

```
>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

GraceContainer.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

GraceContainer.**parent**
Inherited from componenttools.Component

GraceContainer.**preprolated_duration**
Inherited from containertools.Container

GraceContainer.**prolated_duration**
Inherited from componenttools.Component

GraceContainer.**prolation**
Inherited from componenttools.Component

GraceContainer.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

GraceContainer.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

GraceContainer.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

GraceContainer.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

GraceContainer.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

GraceContainer.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

GraceContainer.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

GraceContainer.**is_parallel**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from containertools.Container

GraceContainer.**kind**

Get *kind* of grace container:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> gracetools.GraceContainer([Note("cs'16")], kind = 'grace')(staff[1])
Note("d'8")
>>> grace_container = staff[1].grace
>>> grace_container.kind
'grace'
```

Return string.

Set *kind* of grace container:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> gracetools.GraceContainer([Note("cs'16")], kind = 'grace')(staff[1])
Note("d'8")
>>> grace_container = staff[1].grace
>>> grace_container.kind = 'acciaccatura'
```

```
>>> grace_container.kind
'acciaccatura'
```

Set string.

Valid options include `'after'`, `'grace'`, `'acciaccatura'`, `'appoggiatura'`.

Methods

`GraceContainer.`**`append`**`(`*component*`)`

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from `containertools.Container`

`GraceContainer.`**`detach`**`()`

Detach grace container from leaf:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> grace_container = gracetools.GraceContainer([Note("cs'16")], kind = 'grace')
>>> grace_container(staff[1])
Note("d'8")
>>> f(staff)
\new Staff {
    c'8
    \grace {
        cs'16
    }
    d'8
    e'8
    f'8
}

>>> grace_container.detach()
GraceContainer()
>>> f(staff)
\new Staff {
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

Return grace container.

GraceContainer.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: `expr` may now be a LilyPond input string. Inherited from `containertools.Container`

GraceContainer.**index**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from `containertools.Container`

GraceContainer.**insert**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
```

```
    e'8 ]
}
```

```
>>> container.insert(1, Note("cs'8"))
```

```
>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from containertools.Container

GraceContainer.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}
```

```
>>> container.pop(-1)
Note("e'8")
```

```
>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

GraceContainer.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}
```

```
>>> note = container[-1]
>>> note
Note("e'8")
```

```
>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

GraceContainer.**__add__**(*expr*)

Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

GraceContainer.**__call__**(*arg*)

GraceContainer.**__contains__**(*expr*)

True if expr is in container, otherwise False.

Inherited from containertools.Container

GraceContainer.**__delitem__**(*i*)

Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

GraceContainer.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

GraceContainer.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GraceContainer.**__getitem__**(*i*)

Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

GraceContainer.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

GraceContainer.**__iadd__**(*expr*)

__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

GraceContainer.**__imul__**(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

GraceContainer.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GraceContainer.**__len__**()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

GraceContainer.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GraceContainer.**__mul__**(*n*)
Inherited from componenttools.Component

GraceContainer.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

GraceContainer.**__radd__**(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

GraceContainer.**__repr__**()

GraceContainer.**__rmul__**(*n*)
Inherited from componenttools.Component

GraceContainer.**__setitem__**(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

functions

gracetools.all_are_grace_containers

gracetools.**all_are_grace_containers**(*expr*, *kind=None*)
New in version 2.6. True when *expr* is a sequence of Abjad grace containers:

```
>>> graces = [
...     gracetools.GraceContainer("<c' e' g'>4"),
...     gracetools.GraceContainer("<c' f' a'>4")]
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> grace_notes = [Note("c'16"), Note("d'16")]
```

```
>>> grace_container = gracetools.GraceContainer(grace_notes, kind='grace')
>>> grace_container(voice[1])
Note("d'8")

>>> f(voice)
\new Voice {
    c'8
    \grace {
        c'16
        d'16
    }
    d'8
    e'8
    f'8
}

>>> gracetools.all_are_grace_containers([grace_container])
True
```

True when *expr* is an empty sequence:

```
>>> gracetools.all_are_grace_containers([])
True
```

Otherwise false:

```
>>> gracetools.all_are_grace_containers('foo')
False
```

Return boolean.

gracetools.detach_grace_containers_attached_to_leaf

gracetools.**detach_grace_containers_attached_to_leaf**(*leaf*, *kind=None*)

New in version 2.0. Detach grace containers attached to *leaf*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> grace_container = gracetools.GraceContainer([Note("cs'16")], kind='grace')
>>> grace_container(staff[1])
Note("d'8")

>>> f(staff)
\new Staff {
    c'8
    \grace {
        cs'16
    }
    d'8
    e'8
    f'8
}

>>> gracetools.get_grace_containers_attached_to_leaf(staff[1])
(GraceContainer(cs'16),)

>>> gracetools.detach_grace_containers_attached_to_leaf(staff[1])
(GraceContainer(),)
```

```
>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> gracetools.get_grace_containers_attached_to_leaf(staff[1])
()
```

Return tuple.

gracetools.detach_grace_containers_attached_to_leaves_in_expr

gracetools.**detach_grace_containers_attached_to_leaves_in_expr**(*expr*, *kind=None*)

New in version 2.9. Detach grace containers attached to leaves in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> grace_container = gracetools.GraceContainer([Note("cs'16")], kind='grace')
>>> grace_container(staff[1])
Note("d'8")

>>> f(staff)
\new Staff {
    c'8
    \grace {
        cs'16
    }
    d'8
    e'8
    f'8
}

>>> gracetools.detach_grace_containers_attached_to_leaves_in_expr(staff)
(GraceContainer(),)

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}
```

Return tuple of zero or more grace containers.

gracetools.get_grace_containers_attached_to_leaf

gracetools.**get_grace_containers_attached_to_leaf**(*leaf*, *kind=None*)

New in version 2.0. Example 1. Get all grace containers attached to *leaf*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> gracetools.GraceContainer([Note("cs'16")], kind='grace')(staff[1])
Note("d'8")
```

```
>>> gracetools.GraceContainer([Note("ds'16")], kind='after')(staff[1])
Note("d'8")

>>> f(staff)
\new Staff {
    c'8
    \grace {
        cs'16
    }
    \afterGrace
    d'8
    {
        ds'16
    }
    e'8
    f'8
}

>>> gracetools.get_grace_containers_attached_to_leaf(staff[1])
(GraceContainer(cs'16), GraceContainer(ds'16))
```

Example 2. Get only (proper) grace containers attached to *leaf*:

```
>>> gracetools.get_grace_containers_attached_to_leaf(staff[1], kind='grace')
(GraceContainer(cs'16),)
```

Example 3. Get only after grace containers attached to *leaf*:

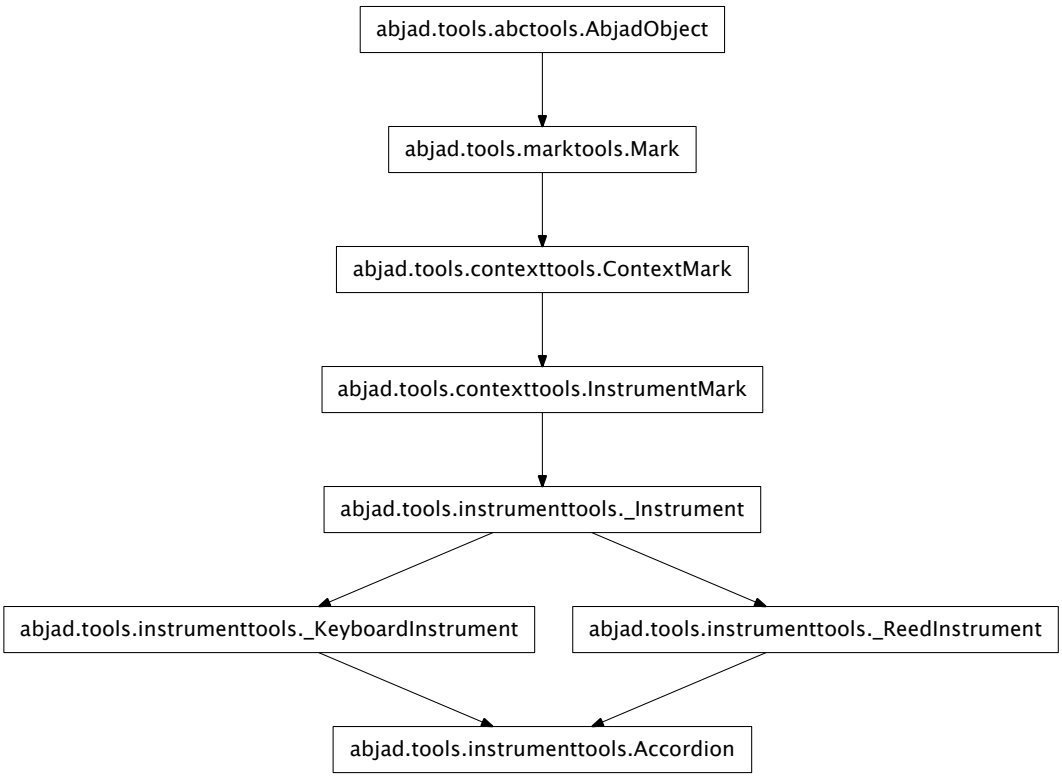
```
>>> gracetools.get_grace_containers_attached_to_leaf(staff[1], kind='after')
(GraceContainer(ds'16),)
```

Return tuple.

instrumenttools

concrete classes

instrumenttools.Accordion



class instrumenttools.**Accordion**(*target_context=None*, ***kwargs*)

Abjad model of the accordion:

```
>>> piano_staff = scoretools.PianoStaff([Staff("c'8 d'8 e'8 f'8"), Staff("c'4 b4")])

>>> instrumenttools.Accordion()(piano_staff)
Accordion()(PianoStaff<<2>>)

>>> f(piano_staff)
\new PianoStaff <<
    \set PianoStaff.instrumentName = \markup { Accordion }
    \set PianoStaff.shortInstrumentName = \markup { Acc. }
    \new Staff {
        c'8
        d'8
        e'8
        f'8
    }
```

```
        \new Staff {
            c'4
            b4
        }
    >>
```

The accordion targets piano staff context by default.

Read-only Properties

Accordion.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Accordion.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Accordion.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Accordion.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Accordion.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Accordion.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Accordion.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Accordion.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

Accordion.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

Accordion.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Accordion.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Accordion.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

Accordion.**all_clefs**
Inherited from instrumenttools._Instrument

Accordion.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

Accordion.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Accordion.**pitch_range**
Inherited from instrumenttools._Instrument

Accordion.**primary_clefs**
Inherited from instrumenttools._Instrument

Accordion.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Accordion.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Accordion.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Accordion.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Accordion.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Accordion.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Accordion.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Accordion.**__call__**(**args*)
Inherited from marktools.Mark

Accordion.**__delattr__**(**args*)
Inherited from marktools.Mark

Accordion.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Accordion.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Accordion.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Accordion.**__hash__**()
Inherited from contexttools.InstrumentMark

Accordion.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Accordion.__lt__(*arg*)
Abjad objects by default do not implement this method.

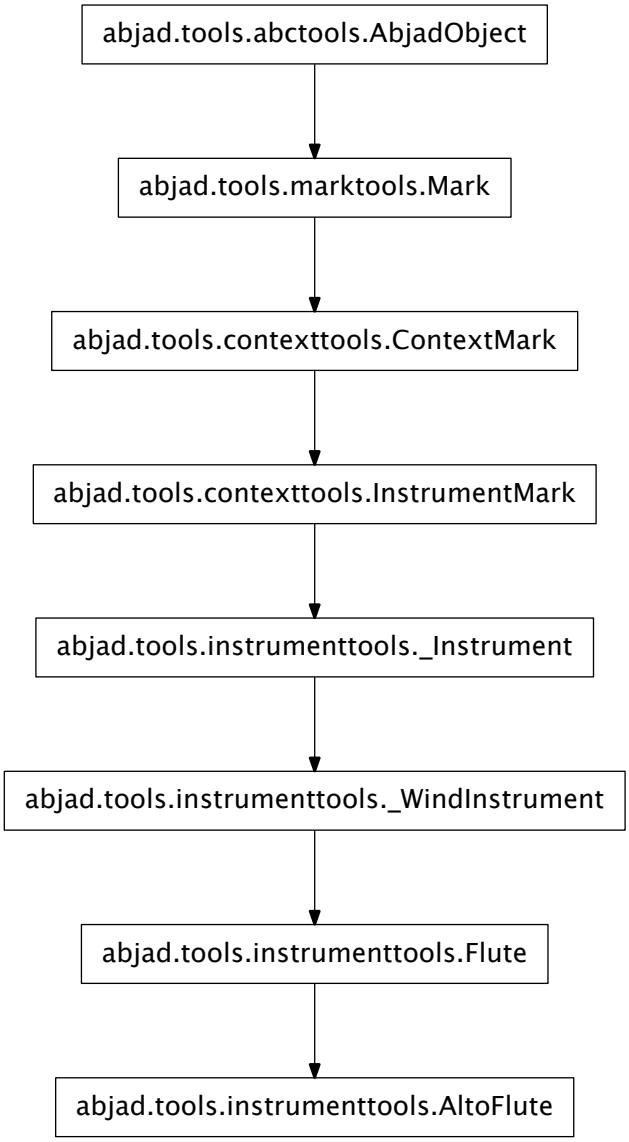
Raise exception.

Inherited from abctools.AbjadObject

Accordion.__ne__(*arg*)
Inherited from marktools.Mark

Accordion.__repr__()
Inherited from marktools.Mark

instrumenttools.AltoFlute



class instrumenttools.**AltoFlute**(***kwargs*)

Abjad model of the alto flute:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.AltoFlute()(staff)
AltoFlute()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Alto flute }
    \set Staff.shortInstrumentName = \markup { Alt. fl. }
    c'8
    d'8
    e'8
    f'8
}
```

The alto flute targets staff context by default.

Read-only Properties

AltoFlute.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

AltoFlute.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

AltoFlute.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

AltoFlute.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

AltoFlute.**is_primary_instrument**
Inherited from instrumenttools._Instrument

AltoFlute.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

AltoFlute.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

AltoFlute.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`AltoFlute.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`AltoFlute.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`AltoFlute.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`AltoFlute.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`AltoFlute.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`AltoFlute.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`AltoFlute.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`AltoFlute.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`AltoFlute.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`AltoFlute.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`AltoFlute.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

AltoFlute.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

AltoFlute.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

AltoFlute.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

AltoFlute.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

AltoFlute.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

AltoFlute.**__call__**(**args*)
Inherited from marktools.Mark

AltoFlute.**__delattr__**(**args*)
Inherited from marktools.Mark

AltoFlute.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

AltoFlute.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AltoFlute.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

AltoFlute.**__hash__**()
Inherited from contexttools.InstrumentMark

AltoFlute.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AltoFlute.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

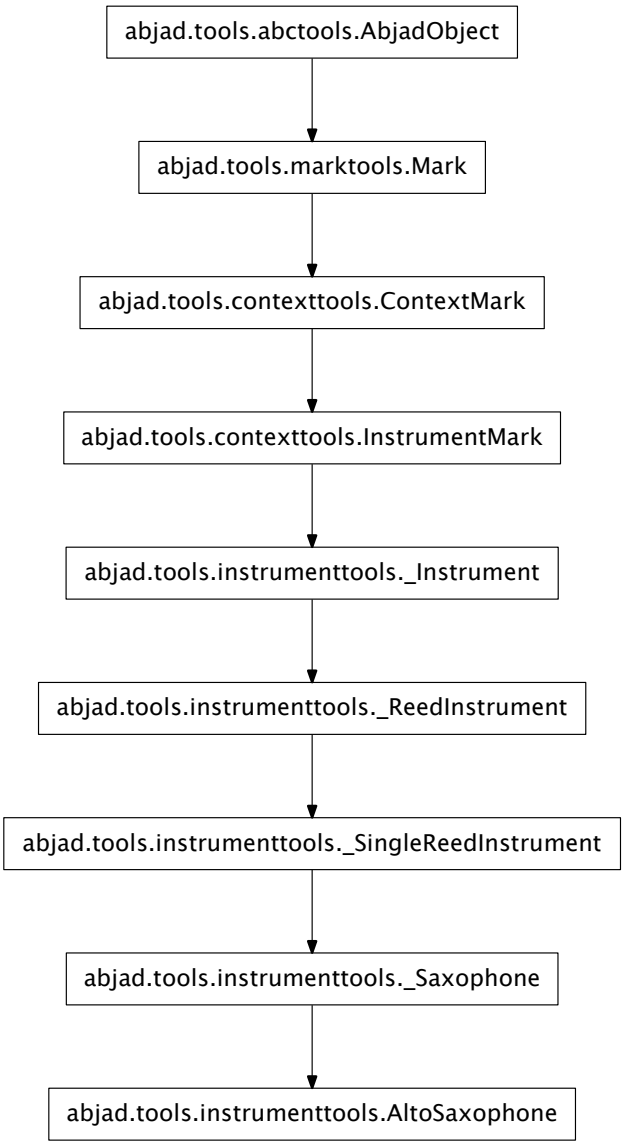
Raise exception.

Inherited from abctools.AbjadObject

AltoFlute.**__ne__**(*arg*)
Inherited from marktools.Mark

AltoFlute.**__repr__**()
Inherited from marktools.Mark

instrumenttools.AltoSaxophone



class instrumenttools.**AltoSaxophone**(***kwargs*)

New in version 2.6. Abjad model of the alto saxophone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.AltoSaxophone()(staff)
AltoSaxophone()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Alto saxophone }
    \set Staff.shortInstrumentName = \markup { Alto sax. }
    c'8
    d'8
    e'8
    f'8
}
```

The alto saxophone is pitched in E-flat.

The alto saxophone targets staff context by default.

Read-only Properties

AltoSaxophone.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

AltoSaxophone.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

AltoSaxophone.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

AltoSaxophone.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

AltoSaxophone.**is_primary_instrument**

Inherited from instrumenttools._Instrument

AltoSaxophone.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

AltoSaxophone.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

AltoSaxophone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

AltoSaxophone.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

AltoSaxophone.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

AltoSaxophone.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

AltoSaxophone.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

AltoSaxophone.**all_clefs**
Inherited from instrumenttools._Instrument

AltoSaxophone.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`AltoSaxophone.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`AltoSaxophone.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`AltoSaxophone.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`AltoSaxophone.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`AltoSaxophone.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

AltoSaxophone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

AltoSaxophone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

AltoSaxophone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

AltoSaxophone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

AltoSaxophone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

AltoSaxophone.**__call__**(**args*)
Inherited from marktools.Mark

AltoSaxophone.**__delattr__**(**args*)
Inherited from marktools.Mark

AltoSaxophone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

AltoSaxophone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AltoSaxophone.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

AltoSaxophone.**__hash__**()
Inherited from contexttools.InstrumentMark

AltoSaxophone.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AltoSaxophone.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

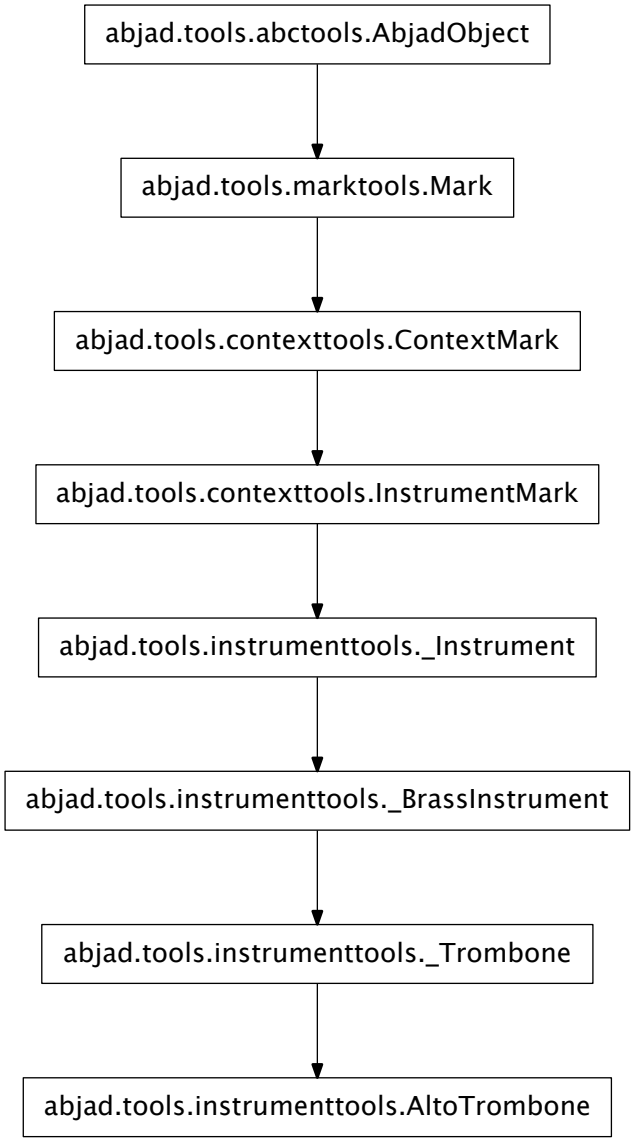
Raise exception.

Inherited from abctools.AbjadObject

AltoSaxophone.**__ne__**(*arg*)
Inherited from marktools.Mark

AltoSaxophone.**__repr__**()
Inherited from marktools.Mark

instrumenttools.AltoTrombone



class instrumenttools.**AltoTrombone**(***kwargs*)

New in version 2.0. Abjad model of the alto trombone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('bass')(staff)
ClefMark('bass')(Staff{4})

>>> instrumenttools.AltoTrombone()(staff)
AltoTrombone()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \clef "bass"
    \set Staff.instrumentName = \markup { Alto trombone }
    \set Staff.shortInstrumentName = \markup { Alt. trb. }
    c'8
    d'8
    e'8
    f'8
}
```

The tenor trombone targets staff context by default.

Read-only Properties

AltoTrombone.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

AltoTrombone.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

AltoTrombone.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

AltoTrombone.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

AltoTrombone.**is_primary_instrument**
Inherited from instrumenttools._Instrument

AltoTrombone.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

AltoTrombone.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

AltoTrombone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`AltoTrombone.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`AltoTrombone.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`AltoTrombone.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`AltoTrombone.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`AltoTrombone.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`AltoTrombone.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`AltoTrombone.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`AltoTrombone.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`AltoTrombone.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`AltoTrombone.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`AltoTrombone.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

AltoTrombone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

AltoTrombone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

AltoTrombone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

AltoTrombone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

AltoTrombone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

AltoTrombone.**__call__**(**args*)
Inherited from marktools.Mark

AltoTrombone.**__delattr__**(**args*)
Inherited from marktools.Mark

AltoTrombone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

AltoTrombone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AltoTrombone.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

AltoTrombone.**__hash__**()
Inherited from contexttools.InstrumentMark

AltoTrombone.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AltoTrombone.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

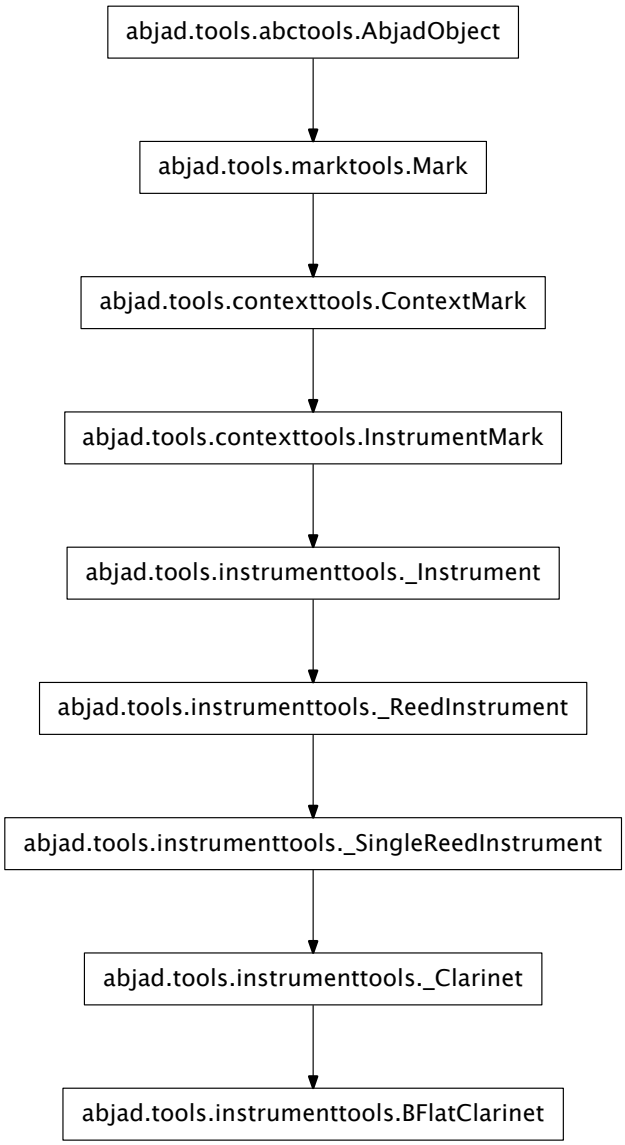
Raise exception.

Inherited from abctools.AbjadObject

AltoTrombone.**__ne__**(*arg*)
Inherited from marktools.Mark

AltoTrombone.**__repr__**()
Inherited from marktools.Mark

instrumenttools.BFlatClarinet



class instrumenttools.**BFlatClarinet**(***kwargs*)

New in version 2.0. Abjad model of the B-flat clarinet:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.BFlatClarinet()(staff)
BFlatClarinet()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Clarinet in B-flat }
    \set Staff.shortInstrumentName = \markup { Cl. in B-flat }
    c'8
    d'8
    e'8
    f'8
}
```

The B-flat clarinet targets staff context by default.

Read-only Properties

BFlatClarinet.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BFlatClarinet.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BFlatClarinet.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BFlatClarinet.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

BFlatClarinet.**is_primary_instrument**
Inherited from instrumenttools._Instrument

BFlatClarinet.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

BFlatClarinet.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

BFlatClarinet.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`BFlatClarinet.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`BFlatClarinet.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`BFlatClarinet.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`BFlatClarinet.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`BFlatClarinet.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`BFlatClarinet.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BFlatClarinet.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`BFlatClarinet.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`BFlatClarinet.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`BFlatClarinet.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BFlatClarinet.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

BFlatClarinet.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

BFlatClarinet.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

BFlatClarinet.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

BFlatClarinet.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

BFlatClarinet.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

BFlatClarinet.**__call__**(**args*)
Inherited from marktools.Mark

BFlatClarinet.**__delattr__**(**args*)
Inherited from marktools.Mark

BFlatClarinet.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

BFlatClarinet.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BFlatClarinet.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BFlatClarinet.**__hash__**()
Inherited from contexttools.InstrumentMark

BFlatClarinet.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BFlatClarinet.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

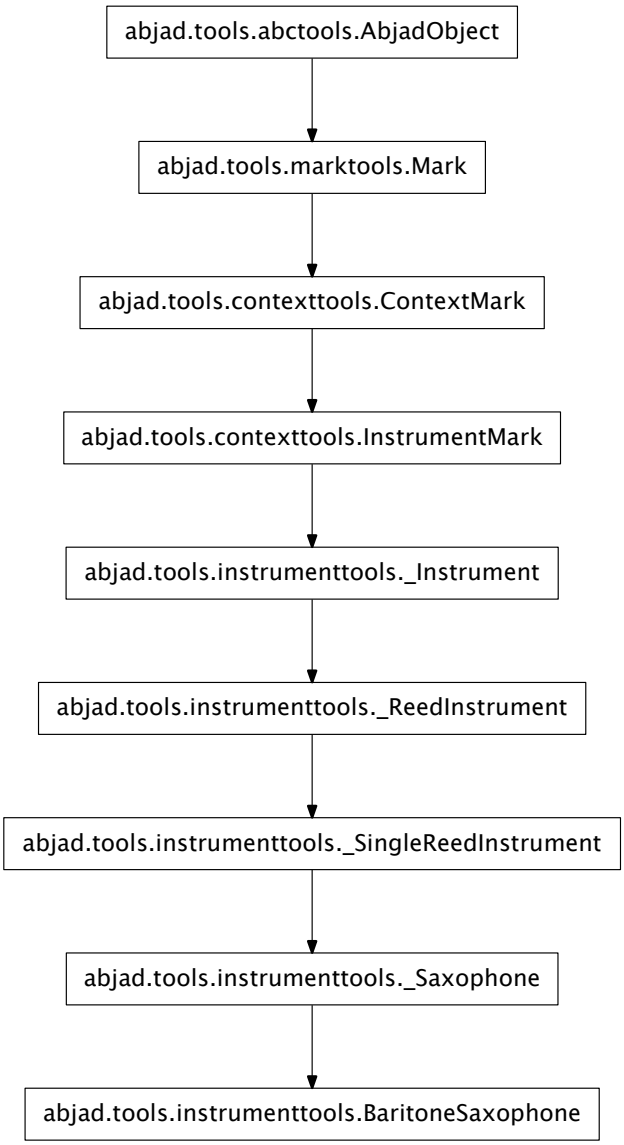
Raise exception.

Inherited from abctools.AbjadObject

BFlatClarinet.**__ne__**(*arg*)
Inherited from marktools.Mark

BFlatClarinet.**__repr__**()
Inherited from marktools.Mark

instrumenttools.BaritoneSaxophone



class instrumenttools.**BaritoneSaxophone**(***kwargs*)

New in version 2.6. Abjad model of the baritone saxophone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.BaritoneSaxophone()(staff)
BaritoneSaxophone()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Baritone saxophone }
    \set Staff.shortInstrumentName = \markup { Bar. sax. }
    c'8
    d'8
    e'8
    f'8
}
```

The baritone saxophone is pitched in E-flat.

The baritone saxophone targets staff context by default.

Read-only Properties

BaritoneSaxophone.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BaritoneSaxophone.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BaritoneSaxophone.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BaritoneSaxophone.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

BaritoneSaxophone.**is_primary_instrument**

Inherited from instrumenttools._Instrument

BaritoneSaxophone.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

BaritoneSaxophone.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

BaritoneSaxophone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

BaritoneSaxophone.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

BaritoneSaxophone.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

BaritoneSaxophone.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BaritoneSaxophone.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

BaritoneSaxophone.**all_clefs**
Inherited from instrumenttools._Instrument

BaritoneSaxophone.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BaritoneSaxophone.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`BaritoneSaxophone.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`BaritoneSaxophone.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`BaritoneSaxophone.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BaritoneSaxophone.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

BaritoneSaxophone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

BaritoneSaxophone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

BaritoneSaxophone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

BaritoneSaxophone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

BaritoneSaxophone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

BaritoneSaxophone.**__call__**(**args*)
Inherited from marktools.Mark

BaritoneSaxophone.**__delattr__**(**args*)
Inherited from marktools.Mark

BaritoneSaxophone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

BaritoneSaxophone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BaritoneSaxophone.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BaritoneSaxophone.__**hash**__()
Inherited from contexttools.InstrumentMark

BaritoneSaxophone.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BaritoneSaxophone.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

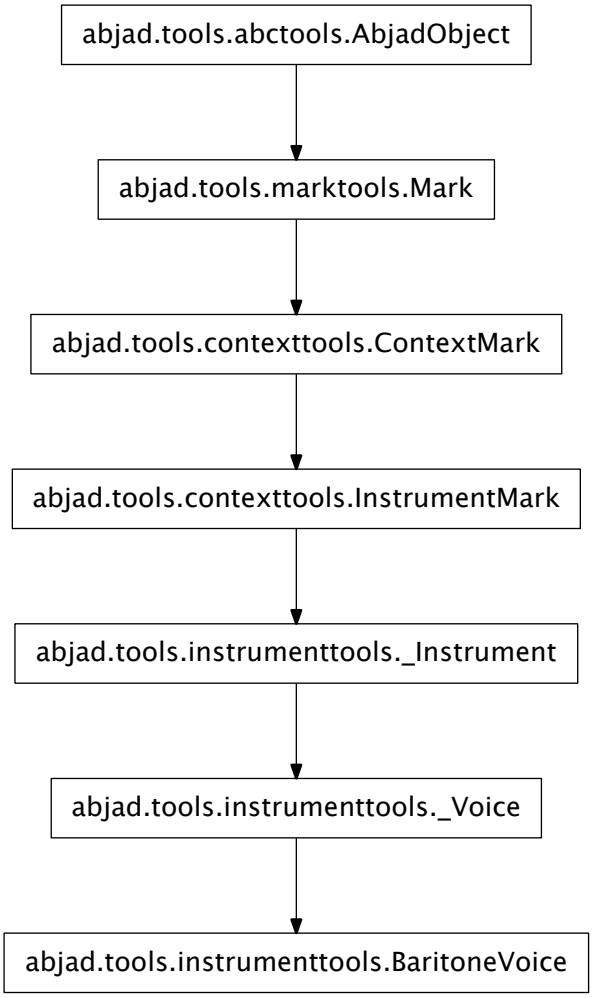
Raise exception.

Inherited from abctools.AbjadObject

BaritoneSaxophone.__**ne**__(*arg*)
Inherited from marktools.Mark

BaritoneSaxophone.__**repr**__()
Inherited from marktools.Mark

instrumenttools.BaritoneVoice



class instrumenttools.**BaritoneVoice**(***kwargs*)

New in version 2.8. Abjad model of the baritone voice:

```
>>> staff = Staff("c8 d8 e8 f8")

>>> instrumenttools.BaritoneVoice()(staff)
BaritoneVoice()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Baritone voice }
    \set Staff.shortInstrumentName = \markup { Baritone }
    c8
    d8
```

```
        e8
        f8
    }
```

The baritone voice targets staff context by default.

Read-only Properties

BaritoneVoice.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BaritoneVoice.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BaritoneVoice.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BaritoneVoice.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

BaritoneVoice.**is_primary_instrument**
Inherited from instrumenttools._Instrument

BaritoneVoice.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

BaritoneVoice.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

BaritoneVoice.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

BaritoneVoice.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

BaritoneVoice.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

BaritoneVoice.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BaritoneVoice.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

BaritoneVoice.**all_clefs**
Inherited from instrumenttools._Instrument

BaritoneVoice.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

BaritoneVoice.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

BaritoneVoice.**pitch_range**
Inherited from instrumenttools._Instrument

BaritoneVoice.**primary_clefs**
Inherited from instrumenttools._Instrument

BaritoneVoice.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

BaritoneVoice.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

BaritoneVoice.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

BaritoneVoice.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

BaritoneVoice.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

BaritoneVoice.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

BaritoneVoice.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

BaritoneVoice.**__call__**(**args*)
Inherited from marktools.Mark

BaritoneVoice.**__delattr__**(**args*)
Inherited from marktools.Mark

BaritoneVoice.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

BaritoneVoice.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BaritoneVoice.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BaritoneVoice.**__hash__**()
Inherited from contexttools.InstrumentMark

BaritoneVoice.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BaritoneVoice.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

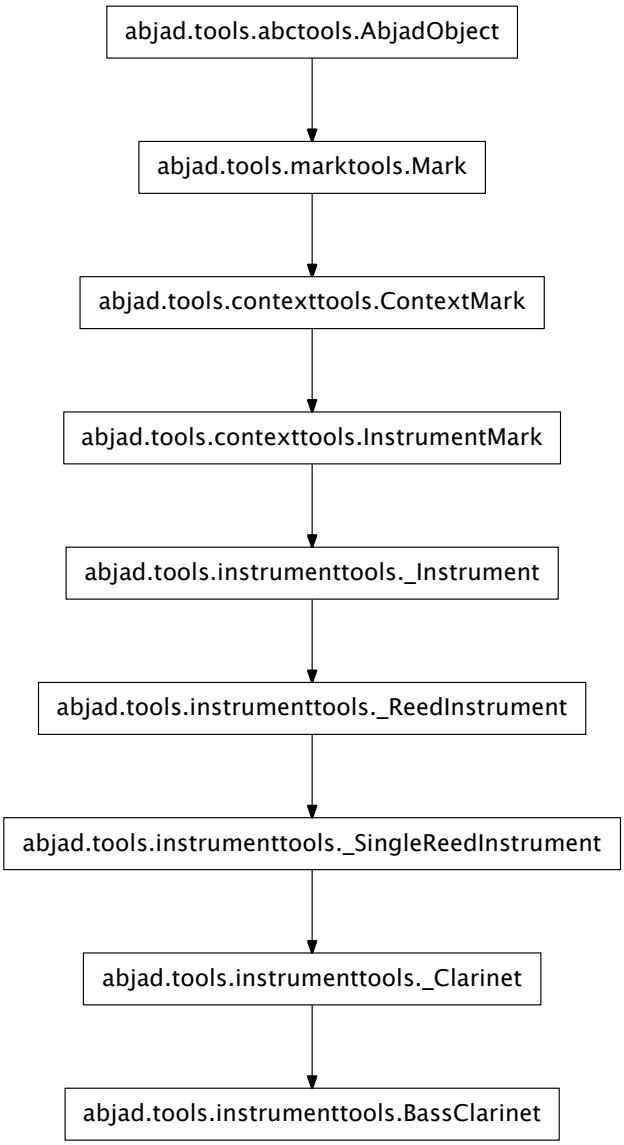
Raise exception.

Inherited from abctools.AbjadObject

BaritoneVoice.**__ne__**(*arg*)
Inherited from marktools.Mark

BaritoneVoice.**__repr__**()
Inherited from marktools.Mark

instrumenttools.BassClarinet



class instrumenttools.**BassClarinet**(***kwargs*)

New in version 2.0. Abjad model of the bass clarinet:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.BassClarinet()(staff)
BassClarinet()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Bass clarinet }
    \set Staff.shortInstrumentName = \markup { Bass cl. }
    c'8
    d'8
    e'8
    f'8
}
```

The bass clarinet targets staff context by default.

Read-only Properties

BassClarinet.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BassClarinet.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BassClarinet.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BassClarinet.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

BassClarinet.**is_primary_instrument**
Inherited from instrumenttools._Instrument

BassClarinet.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

BassClarinet.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

BassClarinet.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`BassClarinet.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`BassClarinet.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`BassClarinet.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`BassClarinet.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`BassClarinet.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`BassClarinet.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BassClarinet.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`BassClarinet.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`BassClarinet.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`BassClarinet.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BassClarinet.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

BassClarinet.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

BassClarinet.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

BassClarinet.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

BassClarinet.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

BassClarinet.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

BassClarinet.**__call__**(**args*)
Inherited from marktools.Mark

BassClarinet.**__delattr__**(**args*)
Inherited from marktools.Mark

BassClarinet.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

BassClarinet.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BassClarinet.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BassClarinet.**__hash__**()
Inherited from contexttools.InstrumentMark

BassClarinet.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BassClarinet.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

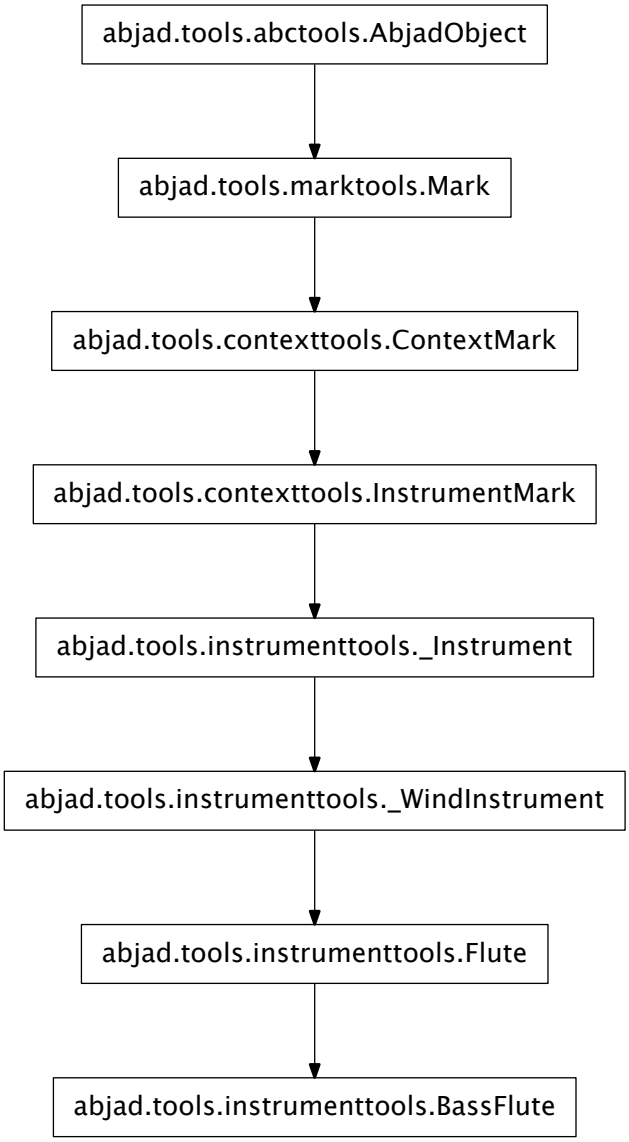
Raise exception.

Inherited from abctools.AbjadObject

BassClarinet.**__ne__**(*arg*)
Inherited from marktools.Mark

BassClarinet.**__repr__**()
Inherited from marktools.Mark

instrumenttools.BassFlute



class instrumenttools.**BassFlute**(***kwargs*)

New in version 2.0. Abjad model of the bass flute:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.BassFlute()(staff)
BassFlute()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Bass flute }
    \set Staff.shortInstrumentName = \markup { Bass fl. }
    c'8
    d'8
    e'8
    f'8
}
```

The bass flute targets staff context by default.

Read-only Properties

BassFlute.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BassFlute.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BassFlute.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BassFlute.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

BassFlute.**is_primary_instrument**
Inherited from instrumenttools._Instrument

BassFlute.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

BassFlute.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

BassFlute.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`BassFlute.`**`start_component`**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`BassFlute.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`BassFlute.`**`target_context`**

Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`BassFlute.`**`traditional_pitch_range`**

Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`BassFlute.`**`all_clefs`**

Inherited from `instrumenttools._Instrument`

`BassFlute.`**`instrument_name`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BassFlute.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`BassFlute.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`BassFlute.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`BassFlute.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BassFlute.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

BassFlute.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

BassFlute.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

BassFlute.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

BassFlute.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

BassFlute.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

BassFlute.**__call__**(**args*)
Inherited from marktools.Mark

BassFlute.**__delattr__**(**args*)
Inherited from marktools.Mark

BassFlute.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

BassFlute.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BassFlute.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BassFlute.**__hash__**()
Inherited from contexttools.InstrumentMark

BassFlute.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BassFlute.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

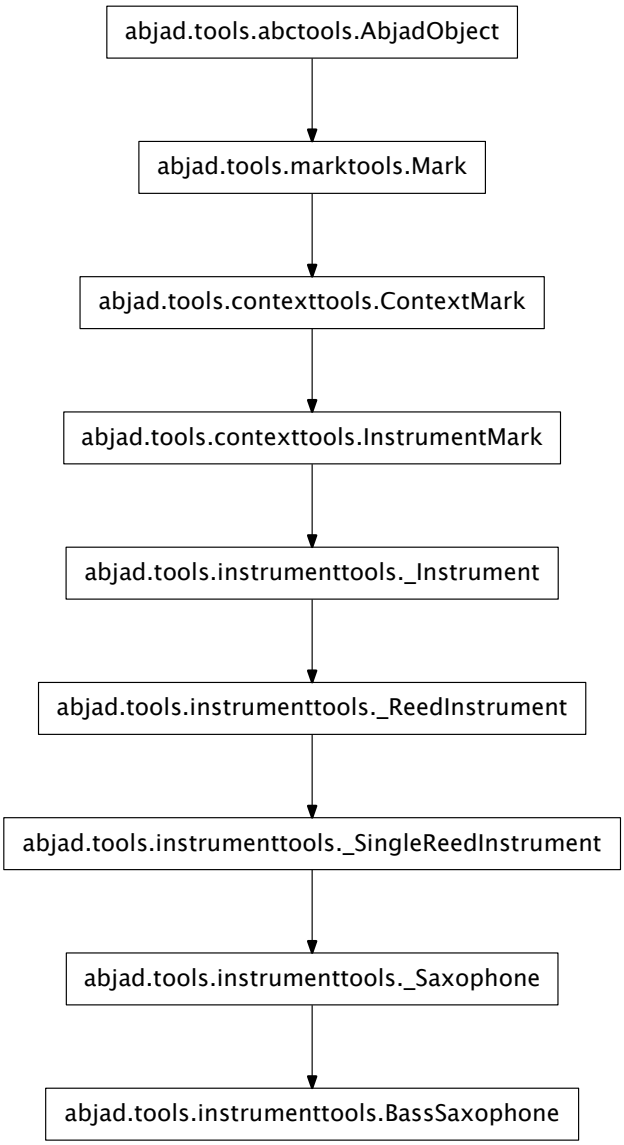
Raise exception.

Inherited from abctools.AbjadObject

BassFlute.**__ne__**(*arg*)
Inherited from marktools.Mark

BassFlute.**__repr__**()
Inherited from marktools.Mark

instrumenttools.BassSaxophone



class instrumenttools.**BassSaxophone**(***kwargs*)

New in version 2.6. Abjad model of the bass saxophone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.BassSaxophone()(staff)
BassSaxophone()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Bass saxophone }
    \set Staff.shortInstrumentName = \markup { Bass sax. }
    c'8
    d'8
    e'8
    f'8
}
```

The bass saxophone is pitched in B-flat.

The bass saxophone targets staff context by default.

Read-only Properties

BassSaxophone.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BassSaxophone.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BassSaxophone.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BassSaxophone.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

BassSaxophone.**is_primary_instrument**

Inherited from instrumenttools._Instrument

BassSaxophone.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

BassSaxophone.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

BassSaxophone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

BassSaxophone.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

BassSaxophone.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

BassSaxophone.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BassSaxophone.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

BassSaxophone.**all_clefs**
Inherited from instrumenttools._Instrument

BassSaxophone.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BassSaxophone.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`BassSaxophone.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`BassSaxophone.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`BassSaxophone.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BassSaxophone.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

BassSaxophone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

BassSaxophone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

BassSaxophone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

BassSaxophone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

BassSaxophone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

BassSaxophone.**__call__**(**args*)
Inherited from marktools.Mark

BassSaxophone.**__delattr__**(**args*)
Inherited from marktools.Mark

BassSaxophone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

BassSaxophone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BassSaxophone.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BassSaxophone.**__hash__**()
Inherited from contexttools.InstrumentMark

BassSaxophone.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BassSaxophone.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

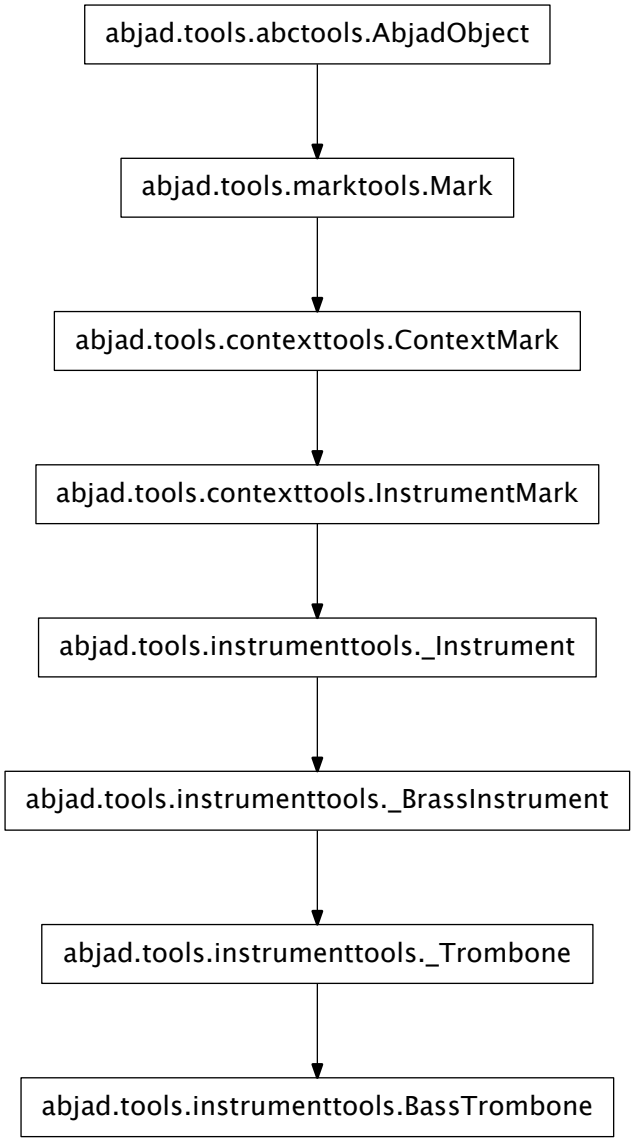
Raise exception.

Inherited from abctools.AbjadObject

BassSaxophone.**__ne__**(*arg*)
Inherited from marktools.Mark

BassSaxophone.**__repr__**()
Inherited from marktools.Mark

instrumenttools.BassTrombone



class instrumenttools.**BassTrombone**(***kwargs*)

New in version 2.0. Abjad model of the tenor trombone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('bass')(staff)
ClefMark('bass')(Staff{4})

>>> instrumenttools.BassTrombone()(staff)
BassTrombone()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \clef "bass"
    \set Staff.instrumentName = \markup { Bass trombone }
    \set Staff.shortInstrumentName = \markup { Bass trb. }
    c'8
    d'8
    e'8
    f'8
}
```

The tenor trombone targets staff context by default.

Read-only Properties

BassTrombone.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BassTrombone.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BassTrombone.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BassTrombone.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

BassTrombone.**is_primary_instrument**
Inherited from instrumenttools._Instrument

BassTrombone.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

BassTrombone.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

BassTrombone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`BassTrombone.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`BassTrombone.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`BassTrombone.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`BassTrombone.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`BassTrombone.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`BassTrombone.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BassTrombone.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`BassTrombone.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`BassTrombone.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`BassTrombone.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`BassTrombone.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

BassTrombone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

BassTrombone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

BassTrombone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

BassTrombone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

BassTrombone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

BassTrombone.**__call__**(**args*)
Inherited from marktools.Mark

BassTrombone.**__delattr__**(**args*)
Inherited from marktools.Mark

BassTrombone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

BassTrombone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BassTrombone.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BassTrombone.__hash__()
Inherited from contexttools.InstrumentMark

BassTrombone.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BassTrombone.__lt__(*arg*)
Abjad objects by default do not implement this method.

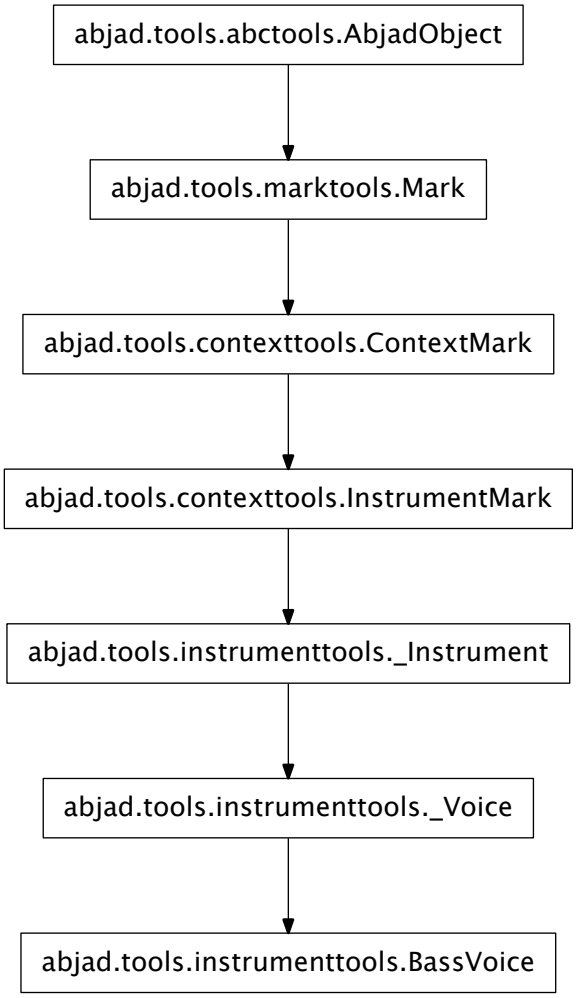
Raise exception.

Inherited from abctools.AbjadObject

BassTrombone.__ne__(*arg*)
Inherited from marktools.Mark

BassTrombone.__repr__()
Inherited from marktools.Mark

instrumenttools.BassVoice



class instrumenttools.**BassVoice**(***kwargs*)

New in version 2.8. Abjad model of the bass voice:

```
>>> staff = Staff("c8 d8 e8 f8")

>>> instrumenttools.BassVoice()(staff)
BassVoice()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Bass voice }
    \set Staff.shortInstrumentName = \markup { Bass }
    c8
    d8
```

```
        e8
        f8
    }
```

The bass voice targets staff context by default.

Read-only Properties

BassVoice.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BassVoice.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

BassVoice.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BassVoice.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

BassVoice.**is_primary_instrument**
Inherited from instrumenttools._Instrument

BassVoice.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

BassVoice.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

BassVoice.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

BassVoice.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

BassVoice.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

BassVoice.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

BassVoice.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

BassVoice.**all_clefs**
Inherited from instrumenttools._Instrument

BassVoice.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

BassVoice.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

BassVoice.**pitch_range**
Inherited from instrumenttools._Instrument

BassVoice.**primary_clefs**
Inherited from instrumenttools._Instrument

BassVoice.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

BassVoice.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

BassVoice.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

BassVoice.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

BassVoice.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

BassVoice.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

BassVoice.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

BassVoice.**__call__**(**args*)
Inherited from marktools.Mark

BassVoice.**__delattr__**(**args*)
Inherited from marktools.Mark

BassVoice.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

BassVoice.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BassVoice.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BassVoice.**__hash__**()
Inherited from contexttools.InstrumentMark

BassVoice.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BassVoice.__lt__(*arg*)
Abjad objects by default do not implement this method.

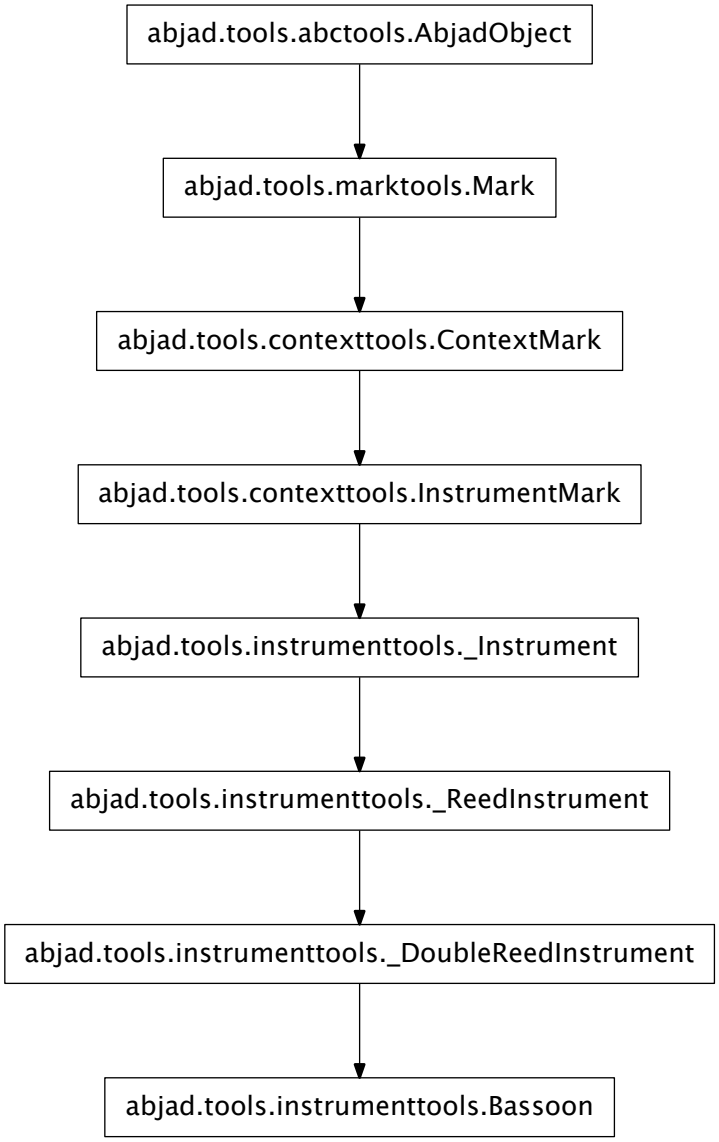
Raise exception.

Inherited from abctools.AbjadObject

BassVoice.__ne__(*arg*)
Inherited from marktools.Mark

BassVoice.__repr__()
Inherited from marktools.Mark

instrumenttools.Bassoon



class instrumenttools.**Bassoon**(***kwargs*)

New in version 2.0. Abjad model of the bassoon:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('bass')(staff)
ClefMark('bass')(Staff{4})

>>> instrumenttools.Bassoon()(staff)
Bassoon()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \clef "bass"
    \set Staff.instrumentName = \markup { Bassoon }
    \set Staff.shortInstrumentName = \markup { Bsn. }
    c'8
    d'8
    e'8
    f'8
}
```

The bassoon targets staff context by default.

Read-only Properties

Bassoon.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Bassoon.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Bassoon.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Bassoon.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Bassoon.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Bassoon.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Bassoon.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Bassoon.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Bassoon.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Bassoon.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Bassoon.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Bassoon.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Bassoon.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Bassoon.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Bassoon.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`Bassoon.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`Bassoon.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`Bassoon.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Bassoon.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

Bassoon.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Bassoon.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Bassoon.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Bassoon.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Bassoon.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Bassoon.**__call__**(**args*)
Inherited from marktools.Mark

Bassoon.**__delattr__**(**args*)
Inherited from marktools.Mark

Bassoon.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Bassoon.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Bassoon.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Bassoon.__hash__()
Inherited from contexttools.InstrumentMark

Bassoon.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Bassoon.__lt__(*arg*)
Abjad objects by default do not implement this method.

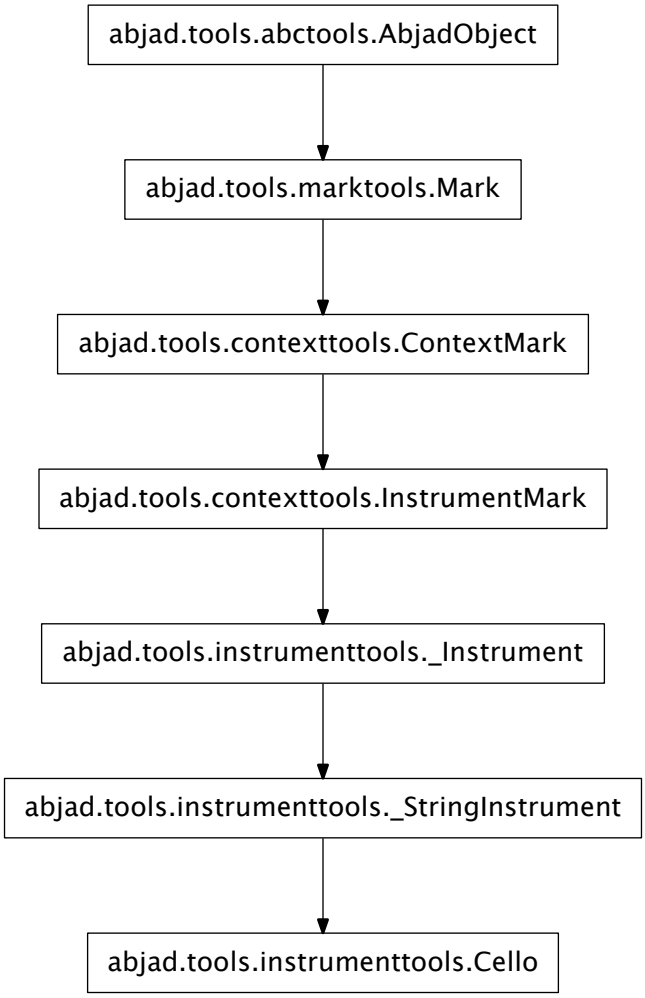
Raise exception.

Inherited from abctools.AbjadObject

Bassoon.__ne__(*arg*)
Inherited from marktools.Mark

Bassoon.__repr__()
Inherited from marktools.Mark

instrumenttools.Cello



class instrumenttools.**Cello**(***kwargs*)

New in version 2.0. Abjad model of the cello:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('bass')(staff)
ClefMark('bass')(Staff{4})

>>> instrumenttools.Cello()(staff)
Cello()(Staff{4})

>>> f(staff)
\new Staff {
    \clef "bass"
    \set Staff.instrumentName = \markup { Cello }
```

```
        \set Staff.shortInstrumentName = \markup { Vc. }
        c'8
        d'8
        e'8
        f'8
    }
```

The cello targets staff context by default.

Read-only Properties

Cello.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Cello.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Cello.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Cello.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Cello.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Cello.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Cello.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Cello.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

Cello.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

Cello.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Cello.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Cello.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

Cello.**all_clefs**
Inherited from instrumenttools._Instrument

Cello.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

Cello.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Cello.**pitch_range**
Inherited from instrumenttools._Instrument

Cello.**primary_clefs**
Inherited from instrumenttools._Instrument

Cello.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Cello.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Cello.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Cello.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Cello.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Cello.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Cello.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Cello.**__call__**(**args*)
Inherited from marktools.Mark

Cello.**__delattr__**(**args*)
Inherited from marktools.Mark

Cello.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Cello.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Cello.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Cello.**__hash__**()
Inherited from contexttools.InstrumentMark

Cello.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Cello.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

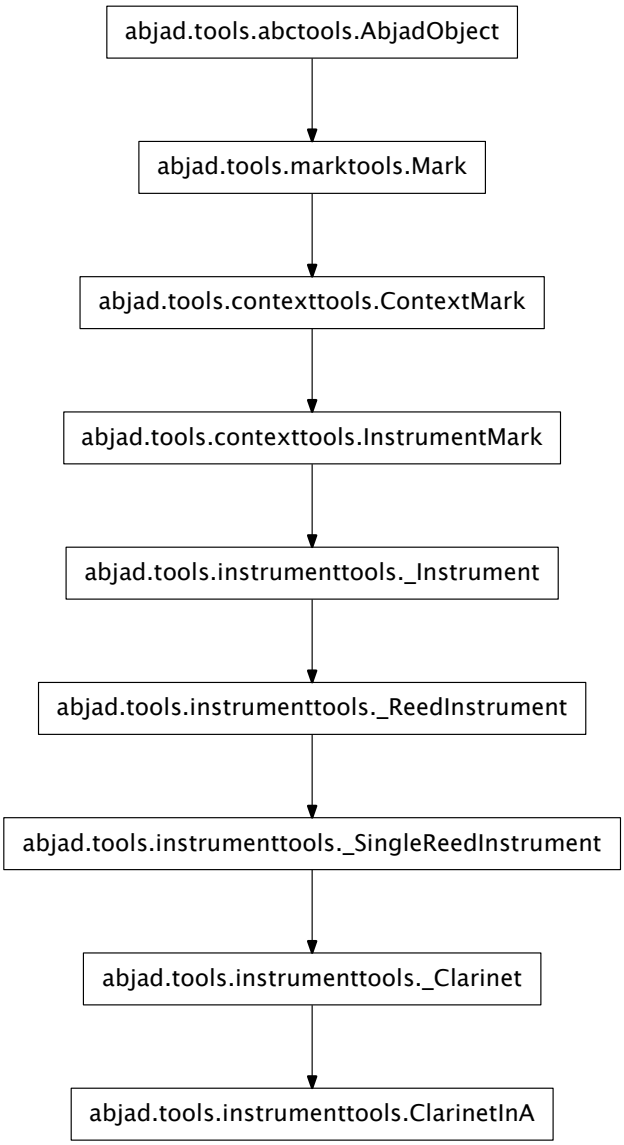
Raise exception.

Inherited from abctools.AbjadObject

Cello.**__ne__**(*arg*)
Inherited from marktools.Mark

Cello.**__repr__**()
Inherited from marktools.Mark

instrumenttools.ClarinetInA



class instrumenttools.**ClarinetInA**(***kwargs*)

New in version 2.6. Abjad model of the clarinet in A:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.ClarinetInA()(staff)
ClarinetInA()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Clarinet in A }
    \set Staff.shortInstrumentName = \markup { Cl. A \natural }
    c'8
    d'8
    e'8
    f'8
}
```

The clarinet in A targets staff context by default.

Read-only Properties

ClarinetInA.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

ClarinetInA.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

ClarinetInA.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

ClarinetInA.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

ClarinetInA.**is_primary_instrument**
Inherited from instrumenttools._Instrument

ClarinetInA.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

ClarinetInA.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

ClarinetInA.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`ClarinetInA.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`ClarinetInA.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`ClarinetInA.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`ClarinetInA.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`ClarinetInA.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`ClarinetInA.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`ClarinetInA.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`ClarinetInA.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`ClarinetInA.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`ClarinetInA.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`ClarinetInA.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

ClarinetInA.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

ClarinetInA.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

ClarinetInA.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

ClarinetInA.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

ClarinetInA.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

ClarinetInA.**__call__**(**args*)
Inherited from marktools.Mark

ClarinetInA.**__delattr__**(**args*)
Inherited from marktools.Mark

ClarinetInA.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

ClarinetInA.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ClarinetInA.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ClarinetInA.**__hash__**()
Inherited from contexttools.InstrumentMark

ClarinetInA.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ClarinetInA.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

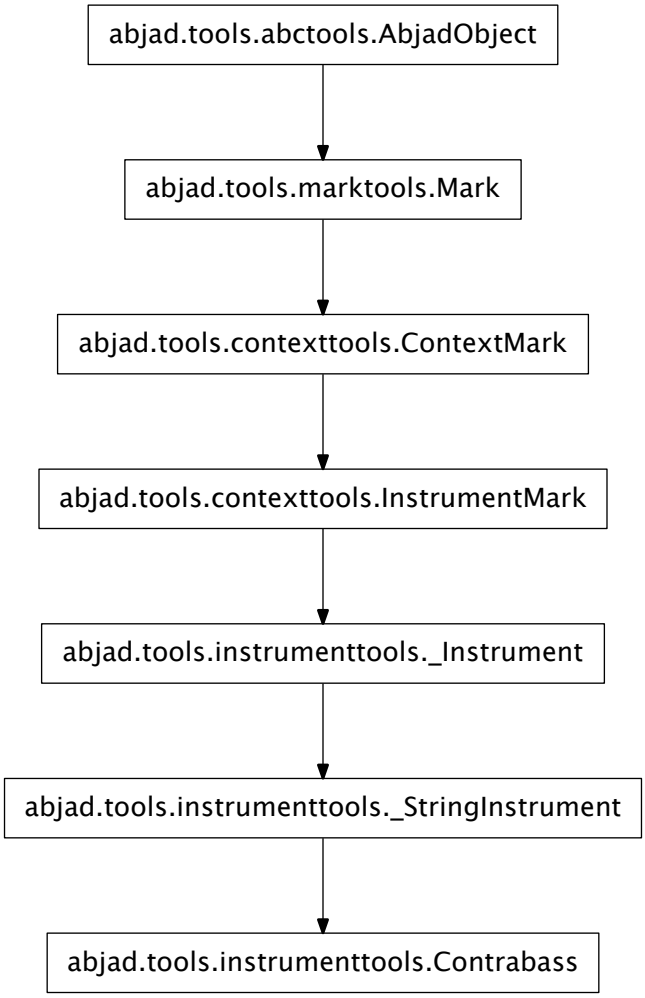
Raise exception.

Inherited from abctools.AbjadObject

ClarinetInA.**__ne__**(*arg*)
Inherited from marktools.Mark

ClarinetInA.**__repr__**()
Inherited from marktools.Mark

instrumenttools.Contrabass



class instrumenttools.**Contrabass**(***kwargs*)

New in version 2.0. Abjad model of the contrabass:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('bass')(staff)
ClefMark('bass')(Staff{4})

>>> instrumenttools.Contrabass()(staff)
Contrabass()(Staff{4})

>>> f(staff)
\new Staff {
    \clef "bass"
    \set Staff.instrumentName = \markup { Contrabass }
```

```
        \set Staff.shortInstrumentName = \markup { Vb. }
        c'8
        d'8
        e'8
        f'8
    }
```

The contrabass targets staff context by default.

Read-only Properties

Contrabass.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Contrabass.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Contrabass.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Contrabass.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Contrabass.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Contrabass.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Contrabass.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Contrabass.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

Contrabass.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

Contrabass.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Contrabass.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Contrabass.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

Contrabass.**all_clefs**
Inherited from instrumenttools._Instrument

Contrabass.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

Contrabass.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Contrabass.**pitch_range**
Inherited from instrumenttools._Instrument

Contrabass.**primary_clefs**
Inherited from instrumenttools._Instrument

Contrabass.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Contrabass.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Contrabass.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Contrabass.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Contrabass.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Contrabass.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Contrabass.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Contrabass.**__call__**(**args*)
Inherited from marktools.Mark

Contrabass.**__delattr__**(**args*)
Inherited from marktools.Mark

Contrabass.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Contrabass.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Contrabass.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Contrabass.**__hash__**()
Inherited from contexttools.InstrumentMark

Contrabass.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Contrabass.__lt__(*arg*)
Abjad objects by default do not implement this method.

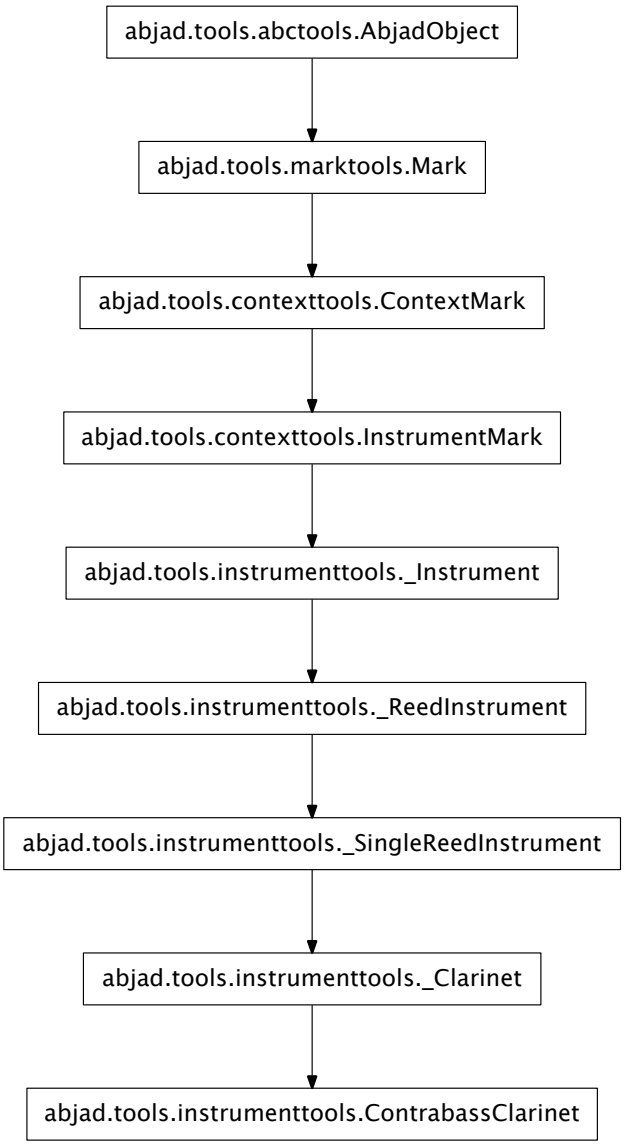
Raise exception.

Inherited from abctools.AbjadObject

Contrabass.__ne__(*arg*)
Inherited from marktools.Mark

Contrabass.__repr__()
Inherited from marktools.Mark

instrumenttools.ContrabassClarinet



class instrumenttools.**ContrabassClarinet**(***kwargs*)

New in version 2.6. Abjad model of the contrassbass clarinet:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.ContrabassClarinet()(staff)
ContrabassClarinet()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Contrabass clarinet }
    \set Staff.shortInstrumentName = \markup { Cbass cl. }
    c'8
    d'8
    e'8
    f'8
}
```

The contrabass clarinet targets staff context by default.

Read-only Properties

ContrabassClarinet.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

ContrabassClarinet.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

ContrabassClarinet.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

ContrabassClarinet.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

ContrabassClarinet.**is_primary_instrument**
Inherited from instrumenttools._Instrument

ContrabassClarinet.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

ContrabassClarinet.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

ContrabassClarinet.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`ContrabassClarinet.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`ContrabassClarinet.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`ContrabassClarinet.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`ContrabassClarinet.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`ContrabassClarinet.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`ContrabassClarinet.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`ContrabassClarinet.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`ContrabassClarinet.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`ContrabassClarinet.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`ContrabassClarinet.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`ContrabassClarinet.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

ContrabassClarinet.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

ContrabassClarinet.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

ContrabassClarinet.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

ContrabassClarinet.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

ContrabassClarinet.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

ContrabassClarinet.**__call__**(**args*)
Inherited from marktools.Mark

ContrabassClarinet.**__delattr__**(**args*)
Inherited from marktools.Mark

ContrabassClarinet.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

ContrabassClarinet.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContrabassClarinet.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ContrabassClarinet.__hash__()
Inherited from contexttools.InstrumentMark

ContrabassClarinet.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContrabassClarinet.__lt__(*arg*)
Abjad objects by default do not implement this method.

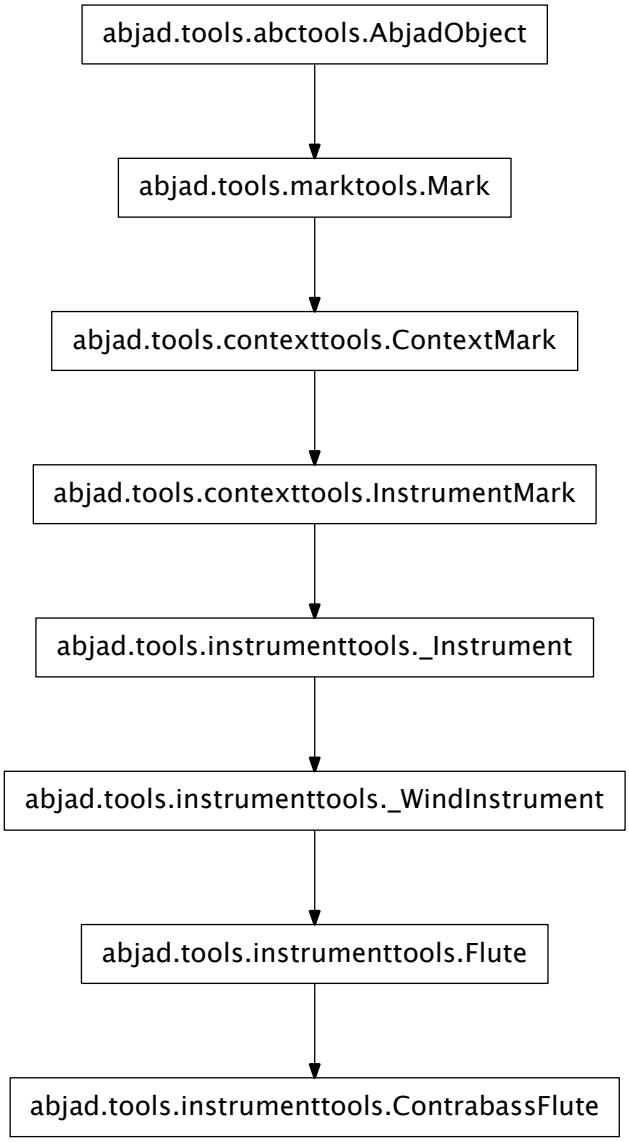
Raise exception.

Inherited from abctools.AbjadObject

ContrabassClarinet.__ne__(*arg*)
Inherited from marktools.Mark

ContrabassClarinet.__repr__()
Inherited from marktools.Mark

instrumenttools.ContrabassFlute



class instrumenttools.**ContrabassFlute**(***kwargs*)

New in version 2.0. Abjad model of the contrabass flute:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.ContrabassFlute()(staff)
ContrabassFlute()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Contrabass flute }
    \set Staff.shortInstrumentName = \markup { Cbass. fl. }
    c'8
    d'8
    e'8
    f'8
}
```

The contrabass flute targets staff context by default.

Read-only Properties

ContrabassFlute.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

ContrabassFlute.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

ContrabassFlute.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

ContrabassFlute.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

ContrabassFlute.**is_primary_instrument**
Inherited from instrumenttools._Instrument

ContrabassFlute.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

ContrabassFlute.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

ContrabassFlute.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`ContrabassFlute.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`ContrabassFlute.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`ContrabassFlute.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`ContrabassFlute.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`ContrabassFlute.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`ContrabassFlute.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`ContrabassFlute.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`ContrabassFlute.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`ContrabassFlute.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`ContrabassFlute.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`ContrabassFlute.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

ContrabassFlute.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

ContrabassFlute.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

ContrabassFlute.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

ContrabassFlute.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

ContrabassFlute.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

ContrabassFlute.**__call__**(**args*)
Inherited from marktools.Mark

ContrabassFlute.**__delattr__**(**args*)
Inherited from marktools.Mark

ContrabassFlute.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

ContrabassFlute.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContrabassFlute.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ContrabassFlute.__hash__()
Inherited from contexttools.InstrumentMark

ContrabassFlute.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContrabassFlute.__lt__(*arg*)
Abjad objects by default do not implement this method.

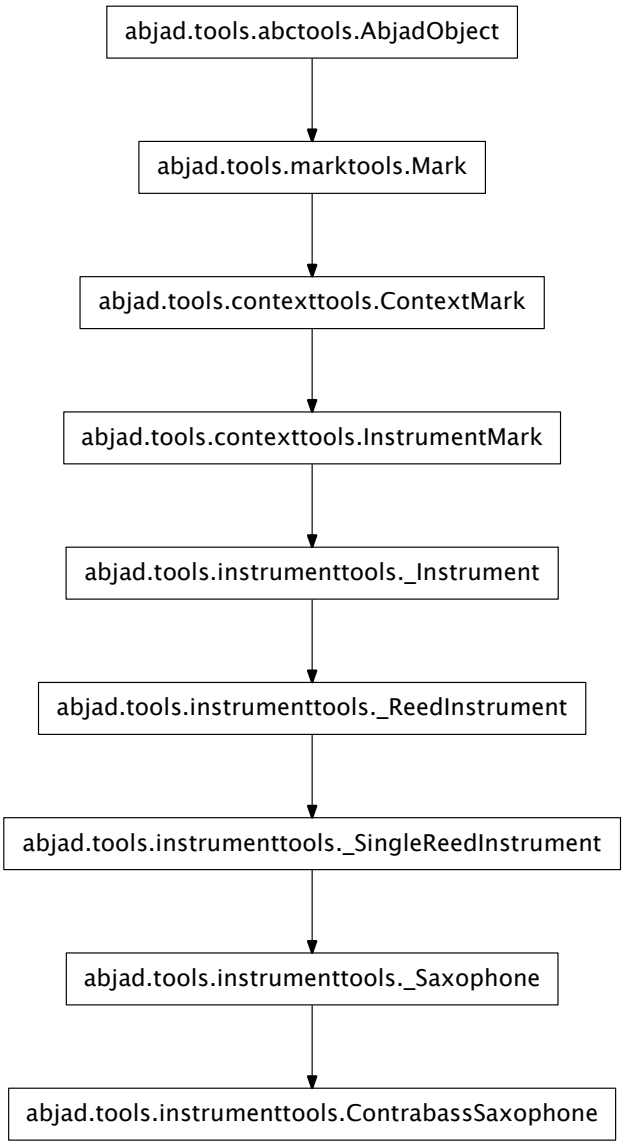
Raise exception.

Inherited from abctools.AbjadObject

ContrabassFlute.__ne__(*arg*)
Inherited from marktools.Mark

ContrabassFlute.__repr__()
Inherited from marktools.Mark

instrumenttools.ContrabassSaxophone



class instrumenttools.**ContrabassSaxophone**(***kwargs*)

New in version 2.6. Abjad model of the bass saxophone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.ContrabassSaxophone()(staff)
ContrabassSaxophone()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Contrabass saxophone }
    \set Staff.shortInstrumentName = \markup { Cbass. sax. }
    c'8
    d'8
    e'8
    f'8
}
```

The contrabass saxophone is pitched in E-flat.

The contrabass saxophone targets staff context by default.

Read-only Properties

ContrabassSaxophone.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

ContrabassSaxophone.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

ContrabassSaxophone.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

ContrabassSaxophone.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

ContrabassSaxophone.**is_primary_instrument**

Inherited from instrumenttools._Instrument

ContrabassSaxophone.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

ContrabassSaxophone.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

ContrabassSaxophone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

ContrabassSaxophone.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

ContrabassSaxophone.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

ContrabassSaxophone.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

ContrabassSaxophone.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

ContrabassSaxophone.**all_clefs**
Inherited from instrumenttools._Instrument

ContrabassSaxophone.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`ContrabassSaxophone.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`ContrabassSaxophone.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`ContrabassSaxophone.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`ContrabassSaxophone.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`ContrabassSaxophone.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

ContrabassSaxophone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

ContrabassSaxophone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

ContrabassSaxophone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

ContrabassSaxophone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

ContrabassSaxophone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

ContrabassSaxophone.**__call__**(**args*)
Inherited from marktools.Mark

ContrabassSaxophone.**__delattr__**(**args*)
Inherited from marktools.Mark

ContrabassSaxophone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

ContrabassSaxophone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContrabassSaxophone.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ContrabassSaxophone.__**hash**__()
Inherited from contexttools.InstrumentMark

ContrabassSaxophone.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContrabassSaxophone.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

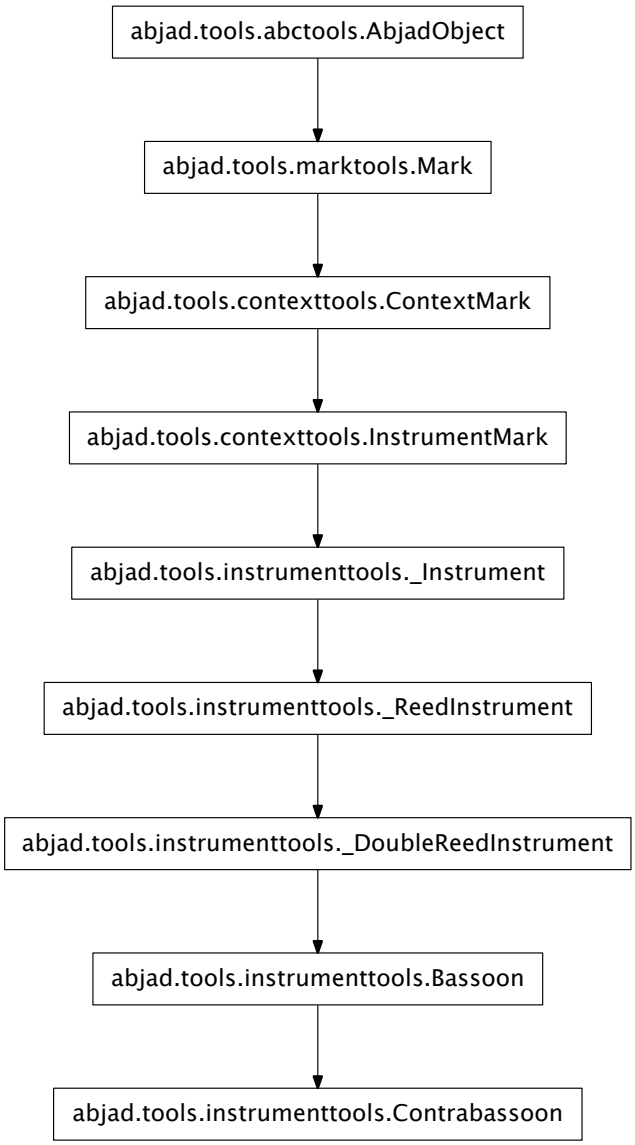
Raise exception.

Inherited from abctools.AbjadObject

ContrabassSaxophone.__**ne**__(*arg*)
Inherited from marktools.Mark

ContrabassSaxophone.__**repr**__()
Inherited from marktools.Mark

instrumenttools.Contrabassoon



class instrumenttools.**Contrabassoon**(***kwargs*)

New in version 2.0. Abjad model of the contrabassoon:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('bass')(staff)
ClefMark('bass')(Staff{4})

>>> instrumenttools.Contrabassoon()(staff)
Contrabassoon()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \clef "bass"
    \set Staff.instrumentName = \markup { Contrabassoon }
    \set Staff.shortInstrumentName = \markup { Contrabsn. }
    c'8
    d'8
    e'8
    f'8
}
```

The contrabassoon targets staff context by default.

Read-only Properties

Contrabassoon.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Contrabassoon.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Contrabassoon.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Contrabassoon.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Contrabassoon.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Contrabassoon.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Contrabassoon.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Contrabassoon.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Contrabassoon.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Contrabassoon.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Contrabassoon.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Contrabassoon.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Contrabassoon.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Contrabassoon.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Contrabassoon.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`Contrabassoon.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`Contrabassoon.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`Contrabassoon.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Contrabassoon.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

Contrabassoon.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Contrabassoon.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Contrabassoon.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Contrabassoon.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Contrabassoon.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Contrabassoon.**__call__**(**args*)
Inherited from marktools.Mark

Contrabassoon.**__delattr__**(**args*)
Inherited from marktools.Mark

Contrabassoon.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Contrabassoon.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Contrabassoon.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Contrabassoon.**__hash__**()
Inherited from contexttools.InstrumentMark

Contrabassoon.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Contrabassoon.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

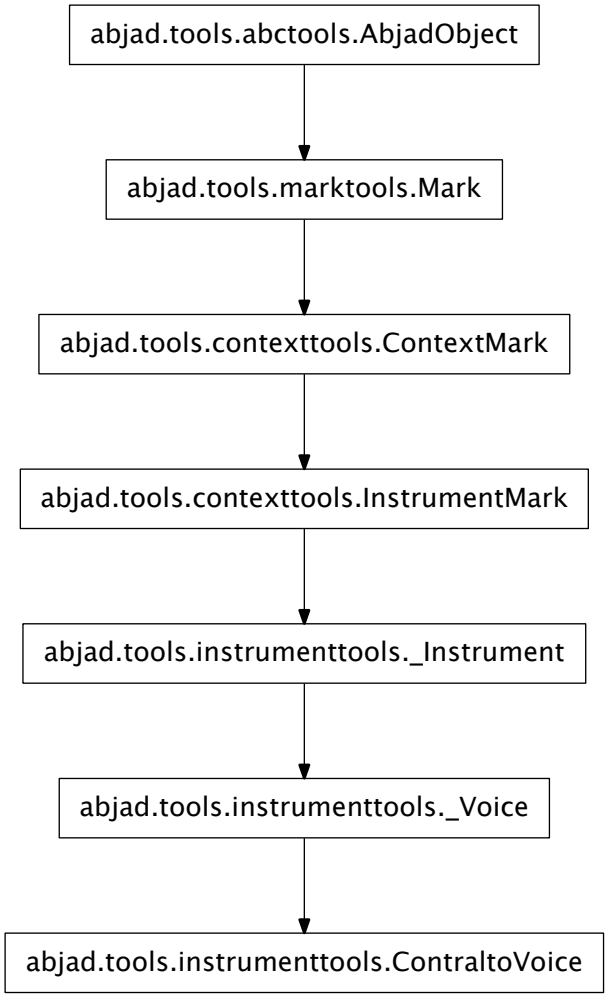
Raise exception.

Inherited from abctools.AbjadObject

Contrabassoon.**__ne__**(*arg*)
Inherited from marktools.Mark

Contrabassoon.**__repr__**()
Inherited from marktools.Mark

instrumenttools.ContraltoVoice



class instrumenttools.**ContraltoVoice**(***kwargs*)

New in version 2.8. Abjad model of the contralto voice:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.ContraltoVoice()(staff)
ContraltoVoice()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Contralto voice }
    \set Staff.shortInstrumentName = \markup { Contralto }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

The contralto voice targets staff context by default.

Read-only Properties

ContraltoVoice.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

ContraltoVoice.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

ContraltoVoice.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

ContraltoVoice.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

ContraltoVoice.**is_primary_instrument**
Inherited from instrumenttools._Instrument

ContraltoVoice.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

ContraltoVoice.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

ContraltoVoice.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

ContraltoVoice.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

ContraltoVoice.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

ContraltoVoice.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

ContraltoVoice.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

ContraltoVoice.**all_clefs**
Inherited from instrumenttools._Instrument

ContraltoVoice.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

ContraltoVoice.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

ContraltoVoice.**pitch_range**
Inherited from instrumenttools._Instrument

ContraltoVoice.**primary_clefs**
Inherited from instrumenttools._Instrument

ContraltoVoice.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

ContraltoVoice.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

ContraltoVoice.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

ContraltoVoice.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

ContraltoVoice.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

ContraltoVoice.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

ContraltoVoice.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

ContraltoVoice.**__call__**(**args*)
Inherited from marktools.Mark

ContraltoVoice.**__delattr__**(**args*)
Inherited from marktools.Mark

ContraltoVoice.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

ContraltoVoice.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContraltoVoice.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ContraltoVoice.**__hash__**()
Inherited from contexttools.InstrumentMark

ContraltoVoice.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ContraltoVoice.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

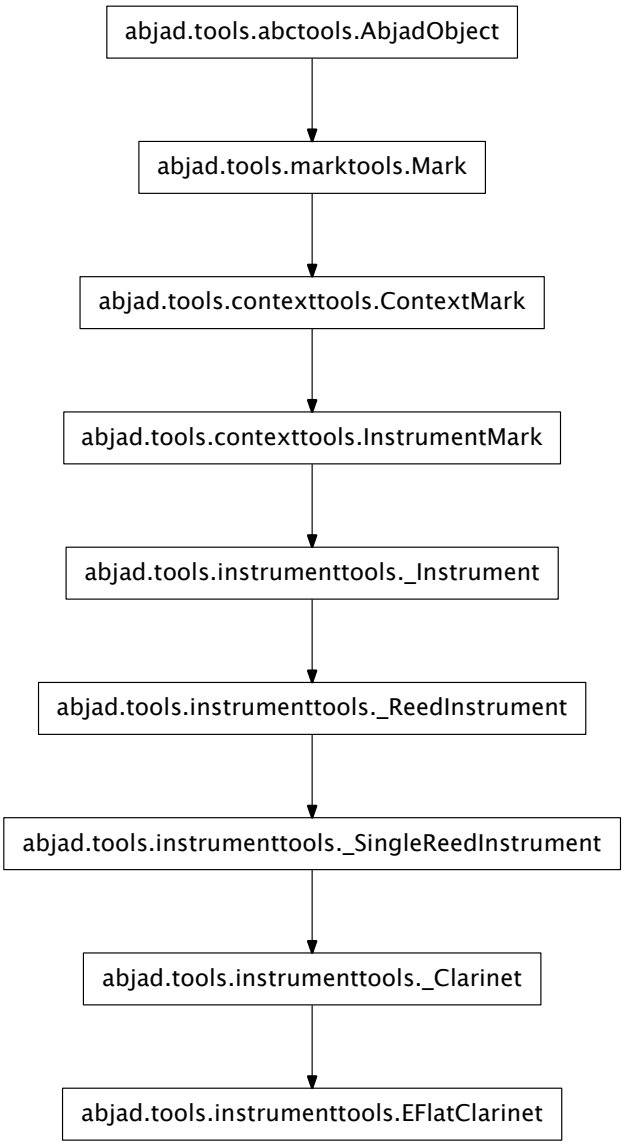
Raise exception.

Inherited from abctools.AbjadObject

ContraltoVoice.**__ne__**(*arg*)
Inherited from marktools.Mark

ContraltoVoice.**__repr__**()
Inherited from marktools.Mark

instrumenttools.EFlatClarinet



class instrumenttools.**EFlatClarinet**(***kwargs*)

New in version 2.0. Abjad model of the E-flat clarinet:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.EFlatClarinet()(staff)
EFlatClarinet()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Clarinet in E-flat }
    \set Staff.shortInstrumentName = \markup { Cl. E-flat }
    c'8
    d'8
    e'8
    f'8
}
```

The E-flat clarinet targets staff context by default.

Read-only Properties

`EFlatClarinet.`**`default_instrument_name`**

Read-only default instrument name.

Return string.

Inherited from `contexttools.InstrumentMark`

`EFlatClarinet.`**`default_short_instrument_name`**

Read-only default short instrument name.

Return string.

Inherited from `contexttools.InstrumentMark`

`EFlatClarinet.`**`effective_context`**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`EFlatClarinet.`**`interval_of_transposition`**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from `instrumenttools._Instrument`

`EFlatClarinet.`**`is_primary_instrument`**

Inherited from `instrumenttools._Instrument`

`EFlatClarinet.`**`is_secondary_instrument`**

Inherited from `instrumenttools._Instrument`

`EFlatClarinet.`**`is_transposing`**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from `instrumenttools._Instrument`

`EFlatClarinet.`**`lilypond_format`**

Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`EFlatClarinet.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`EFlatClarinet.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`EFlatClarinet.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`EFlatClarinet.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`EFlatClarinet.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`EFlatClarinet.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`EFlatClarinet.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`EFlatClarinet.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`EFlatClarinet.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`EFlatClarinet.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`EFlatClarinet.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

EFlatClarinet.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

EFlatClarinet.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

EFlatClarinet.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

EFlatClarinet.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

EFlatClarinet.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

EFlatClarinet.**__call__**(**args*)
Inherited from marktools.Mark

EFlatClarinet.**__delattr__**(**args*)
Inherited from marktools.Mark

EFlatClarinet.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

EFlatClarinet.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

EFlatClarinet.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

EFlatClarinet.**__hash__**()
Inherited from contexttools.InstrumentMark

EFlatClarinet.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

EFlatClarinet.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

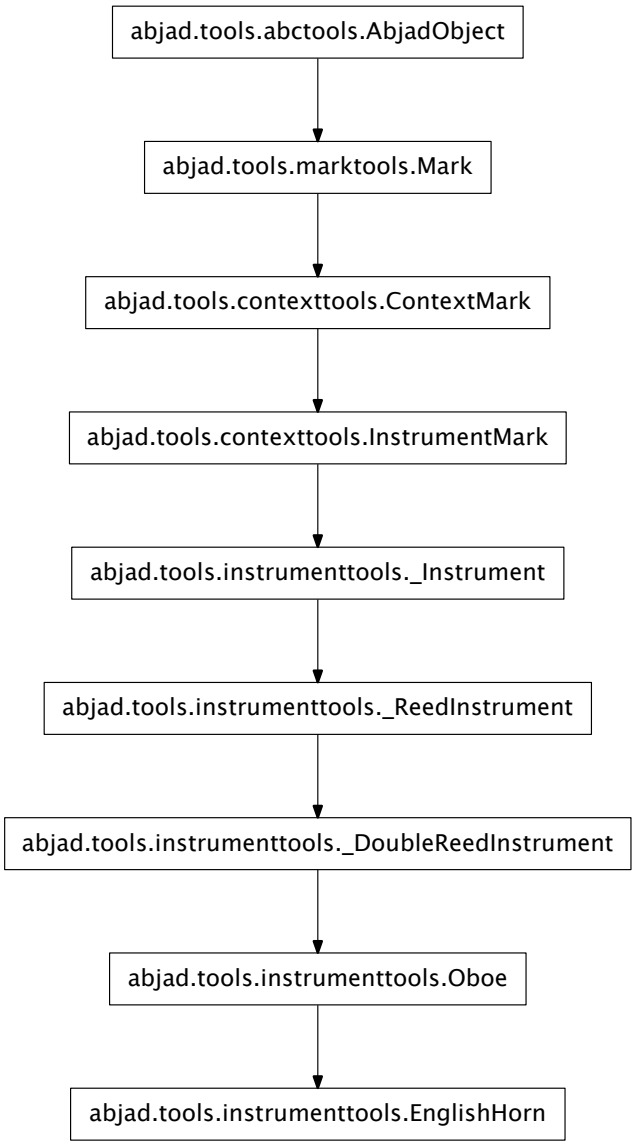
Raise exception.

Inherited from abctools.AbjadObject

EFlatClarinet.**__ne__**(*arg*)
Inherited from marktools.Mark

EFlatClarinet.**__repr__**()
Inherited from marktools.Mark

instrumenttools.EnglishHorn



class instrumenttools.**EnglishHorn**(***kwargs*)

New in version 2.0. Abjad model of the English horn:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.EnglishHorn()(staff)
EnglishHorn()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { English horn }
    \set Staff.shortInstrumentName = \markup { Eng. hn. }
    c'8
    d'8
    e'8
    f'8
}
```

The English horn targets staff context by default.

Read-only Properties

EnglishHorn.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

EnglishHorn.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

EnglishHorn.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

EnglishHorn.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

EnglishHorn.**is_primary_instrument**
Inherited from instrumenttools._Instrument

EnglishHorn.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

EnglishHorn.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

EnglishHorn.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`EnglishHorn.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`EnglishHorn.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`EnglishHorn.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`EnglishHorn.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`EnglishHorn.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`EnglishHorn.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`EnglishHorn.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`EnglishHorn.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`EnglishHorn.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`EnglishHorn.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`EnglishHorn.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

EnglishHorn.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

EnglishHorn.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

EnglishHorn.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

EnglishHorn.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

EnglishHorn.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

EnglishHorn.**__call__**(**args*)
Inherited from marktools.Mark

EnglishHorn.**__delattr__**(**args*)
Inherited from marktools.Mark

EnglishHorn.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

EnglishHorn.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

EnglishHorn.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

EnglishHorn.**__hash__**()
Inherited from contexttools.InstrumentMark

EnglishHorn.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

EnglishHorn.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

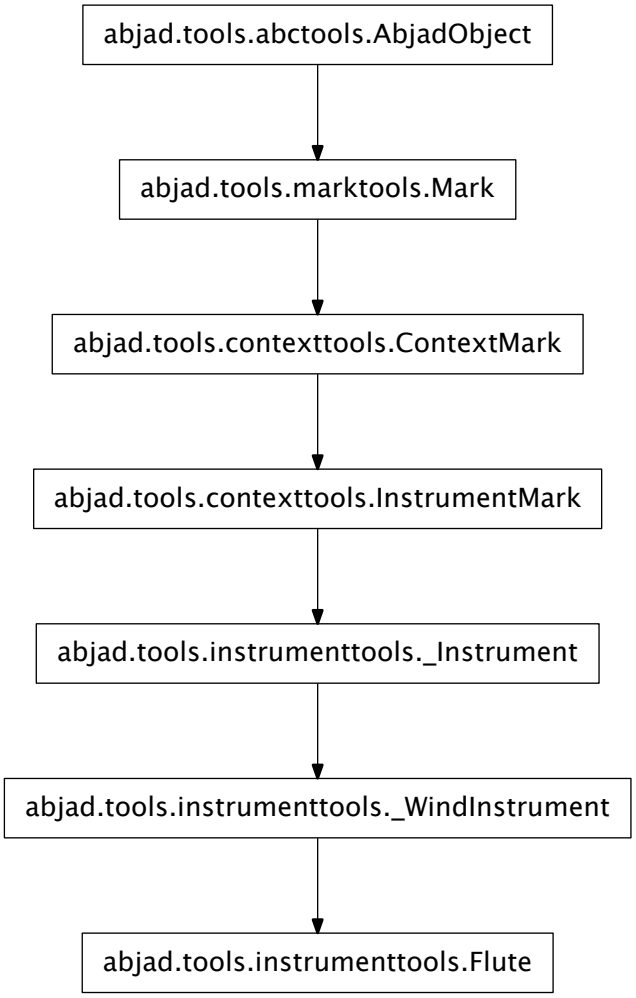
Raise exception.

Inherited from abctools.AbjadObject

EnglishHorn.**__ne__**(*arg*)
Inherited from marktools.Mark

EnglishHorn.**__repr__**()
Inherited from marktools.Mark

instrumenttools.Flute



class instrumenttools.**Flute**(***kwargs*)

New in version 2.0. Abjad model of the flute:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.Flute()(staff)
Flute()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Flute }
    \set Staff.shortInstrumentName = \markup { Fl. }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

The flute targets staff context by default.

Read-only Properties

Flute.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Flute.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Flute.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Flute.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Flute.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Flute.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Flute.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Flute.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Flute.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Flute.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Flute.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Flute.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Flute.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Flute.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

Flute.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Flute.**pitch_range**
Inherited from instrumenttools._Instrument

Flute.**primary_clefs**
Inherited from instrumenttools._Instrument

Flute.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Flute.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Flute.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Flute.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Flute.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Flute.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Flute.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Flute.**__call__**(**args*)
Inherited from marktools.Mark

Flute.**__delattr__**(**args*)
Inherited from marktools.Mark

Flute.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Flute.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Flute.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Flute.**__hash__**()
Inherited from contexttools.InstrumentMark

Flute.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Flute.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

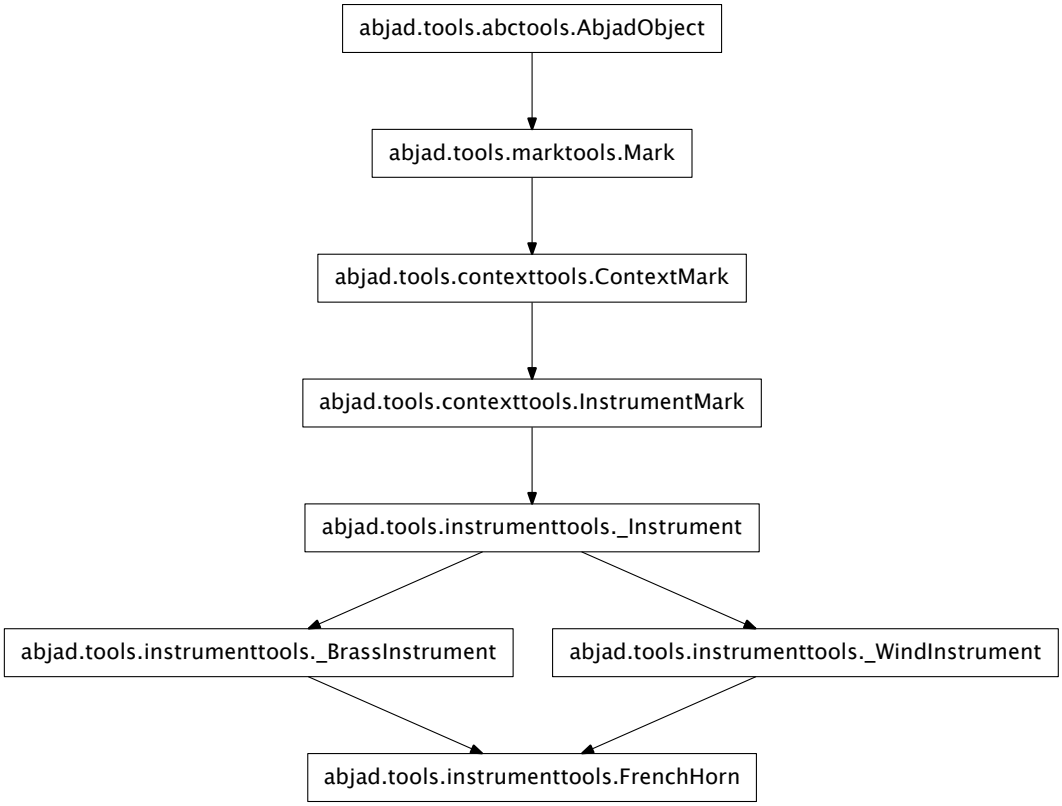
Raise exception.

Inherited from abctools.AbjadObject

Flute.**__ne__**(*arg*)
Inherited from marktools.Mark

Flute.**__repr__**()
Inherited from marktools.Mark

instrumenttools.FrenchHorn



class instrumenttools.**FrenchHorn**(***kwargs*)
New in version 2.0. Abjad model of the French horn:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.FrenchHorn()(staff)
FrenchHorn()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Horn }
    \set Staff.shortInstrumentName = \markup { Hn. }
    c'8
    d'8
    e'8
    f'8
}
```

The French horn targets staff context by default.

Read-only Properties

FrenchHorn.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

FrenchHorn.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

FrenchHorn.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

FrenchHorn.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

FrenchHorn.**is_primary_instrument**

Inherited from instrumenttools._Instrument

FrenchHorn.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

FrenchHorn.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

FrenchHorn.**lilypond_format**

Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

FrenchHorn.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

FrenchHorn.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

FrenchHorn.**target_context**

Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

FrenchHorn.**traditional_pitch_range**

Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

FrenchHorn.**all_clefs**

Inherited from instrumenttools._Instrument

FrenchHorn.**instrument_name**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`FrenchHorn.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`FrenchHorn.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`FrenchHorn.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`FrenchHorn.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`FrenchHorn.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

FrenchHorn.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

FrenchHorn.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

FrenchHorn.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

FrenchHorn.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

FrenchHorn.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

FrenchHorn.**__call__**(**args*)
Inherited from marktools.Mark

FrenchHorn.**__delattr__**(**args*)
Inherited from marktools.Mark

FrenchHorn.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

FrenchHorn.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

FrenchHorn.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

FrenchHorn.__hash__()
Inherited from contexttools.InstrumentMark

FrenchHorn.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

FrenchHorn.__lt__(*arg*)
Abjad objects by default do not implement this method.

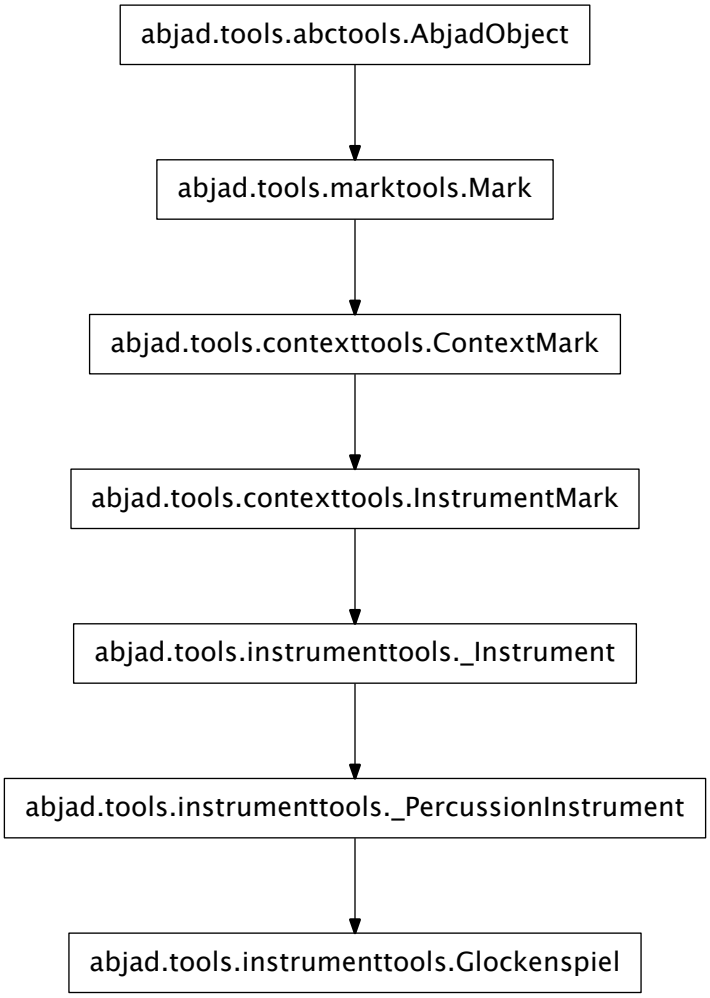
Raise exception.

Inherited from abctools.AbjadObject

FrenchHorn.__ne__(*arg*)
Inherited from marktools.Mark

FrenchHorn.__repr__()
Inherited from marktools.Mark

instrumenttools.Glockenspiel



class instrumenttools.**Glockenspiel**(***kwargs*)

New in version 2.0. Abjad model of the glockenspiel:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.Glockenspiel()(staff)
Glockenspiel()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Glockenspiel }
    \set Staff.shortInstrumentName = \markup { Gkspl. }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

The glockenspiel targets staff context by default.

Read-only Properties

Glockenspiel.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Glockenspiel.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Glockenspiel.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Glockenspiel.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Glockenspiel.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Glockenspiel.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Glockenspiel.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Glockenspiel.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Glockenspiel.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Glockenspiel.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Glockenspiel.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Glockenspiel.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Glockenspiel.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Glockenspiel.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

Glockenspiel.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Glockenspiel.**pitch_range**
Inherited from instrumenttools._Instrument

Glockenspiel.**primary_clefs**
Inherited from instrumenttools._Instrument

Glockenspiel.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Glockenspiel.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Glockenspiel.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Glockenspiel.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Glockenspiel.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Glockenspiel.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Glockenspiel.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Glockenspiel.**__call__**(**args*)
Inherited from marktools.Mark

Glockenspiel.**__delattr__**(**args*)
Inherited from marktools.Mark

Glockenspiel.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Glockenspiel.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Glockenspiel.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Glockenspiel.**__hash__**()
Inherited from contexttools.InstrumentMark

Glockenspiel.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Glockenspiel.__lt__(*arg*)
Abjad objects by default do not implement this method.

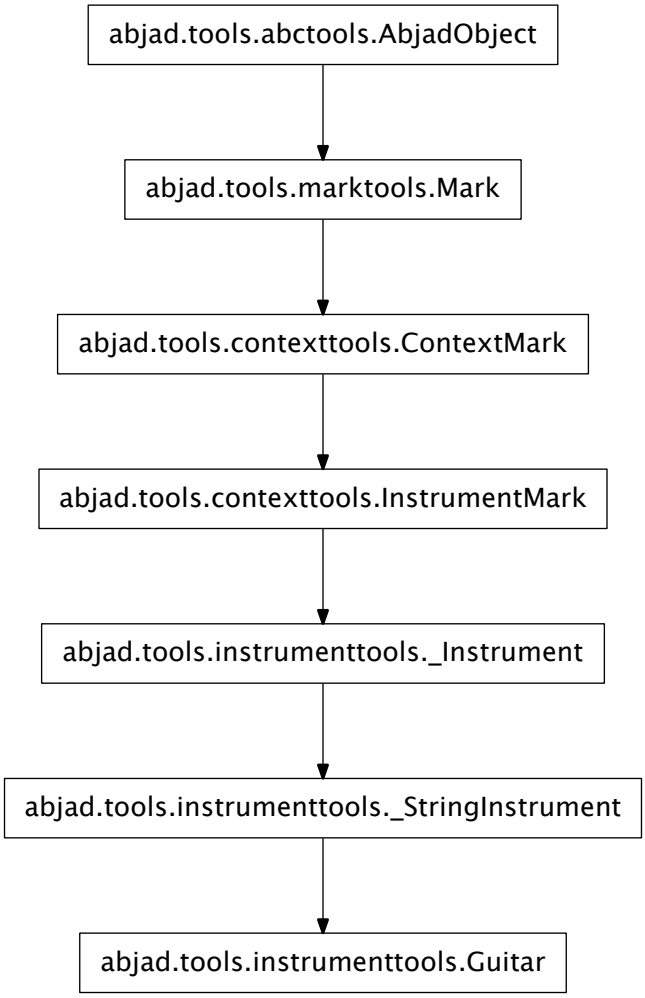
Raise exception.

Inherited from abctools.AbjadObject

Glockenspiel.__ne__(*arg*)
Inherited from marktools.Mark

Glockenspiel.__repr__()
Inherited from marktools.Mark

instrumenttools.Guitar



class instrumenttools.**Guitar**(***kwargs*)

New in version 2.0. Abjad model of the guitar:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.Guitar()(staff)
Guitar()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Guitar }
    \set Staff.shortInstrumentName = \markup { Gt. }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

The guitar targets staff context by default.

Read-only Properties

Guitar.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Guitar.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Guitar.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Guitar.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Guitar.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Guitar.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Guitar.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Guitar.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Guitar.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Guitar.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Guitar.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Guitar.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Guitar.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Guitar.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

Guitar.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Guitar.**pitch_range**
Inherited from instrumenttools._Instrument

Guitar.**primary_clefs**
Inherited from instrumenttools._Instrument

Guitar.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Guitar.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Guitar.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Guitar.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Guitar.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Guitar.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Guitar.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Guitar.**__call__**(**args*)
Inherited from marktools.Mark

Guitar.**__delattr__**(**args*)
Inherited from marktools.Mark

Guitar.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Guitar.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Guitar.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Guitar.**__hash__**()
Inherited from contexttools.InstrumentMark

Guitar.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Guitar.__lt__(*arg*)
Abjad objects by default do not implement this method.

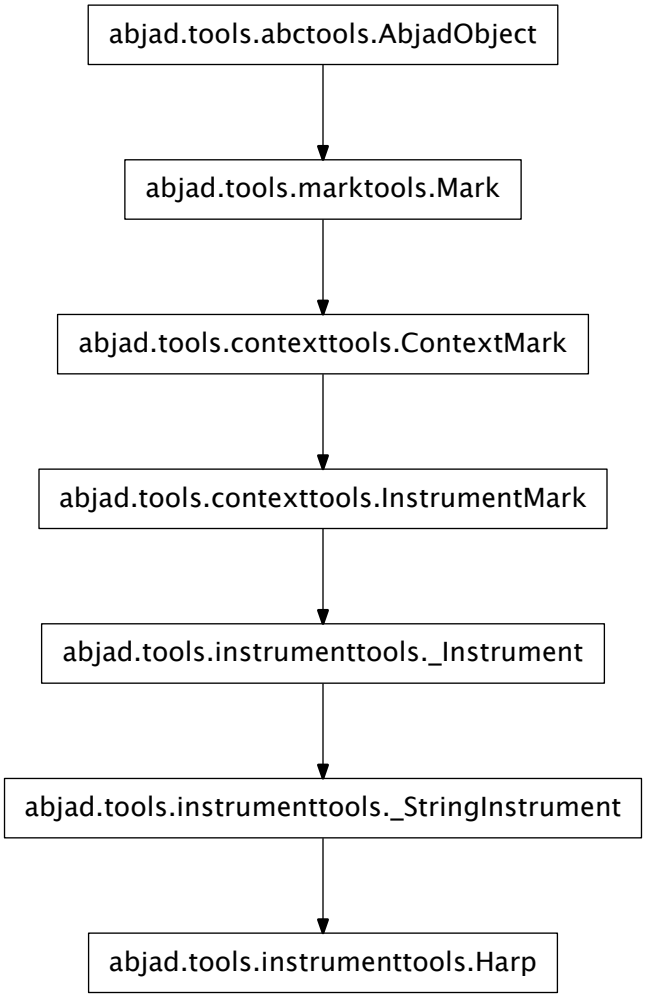
Raise exception.

Inherited from abctools.AbjadObject

Guitar.__ne__(*arg*)
Inherited from marktools.Mark

Guitar.__repr__()
Inherited from marktools.Mark

instrumenttools.Harp



class instrumenttools.**Harp**(*target_context=None*, ***kwargs*)

New in version 2.0. Abjad model of the harp:

```
>>> piano_staff = scoretools.PianoStaff([Staff("c'8 d'8 e'8 f'8"), Staff("c'4 b4")])

>>> instrumenttools.Harp()(piano_staff)
Harp()(PianoStaff<<2>>)

>>> f(piano_staff)
\new PianoStaff <<
    \set PianoStaff.instrumentName = \markup { Harp }
    \set PianoStaff.shortInstrumentName = \markup { Hp. }
    \new Staff {
        c'8
```

```
            d'8
            e'8
            f'8
        }
        \new Staff {
            c'4
            b4
        }
    >>
```

The harp targets piano staff context by default.

Read-only Properties

Harp.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Harp.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Harp.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Harp.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Harp.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Harp.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Harp.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Harp.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Harp.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Harp.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Harp.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Harp.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Harp.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Harp.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Harp.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`Harp.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`Harp.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`Harp.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Harp.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

Harp.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Harp.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Harp.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Harp.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Harp.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Harp.**__call__**(**args*)
Inherited from marktools.Mark

Harp.**__delattr__**(**args*)
Inherited from marktools.Mark

Harp.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Harp.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Harp.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Harp.__hash__()
Inherited from contexttools.InstrumentMark

Harp.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Harp.__lt__(*arg*)
Abjad objects by default do not implement this method.

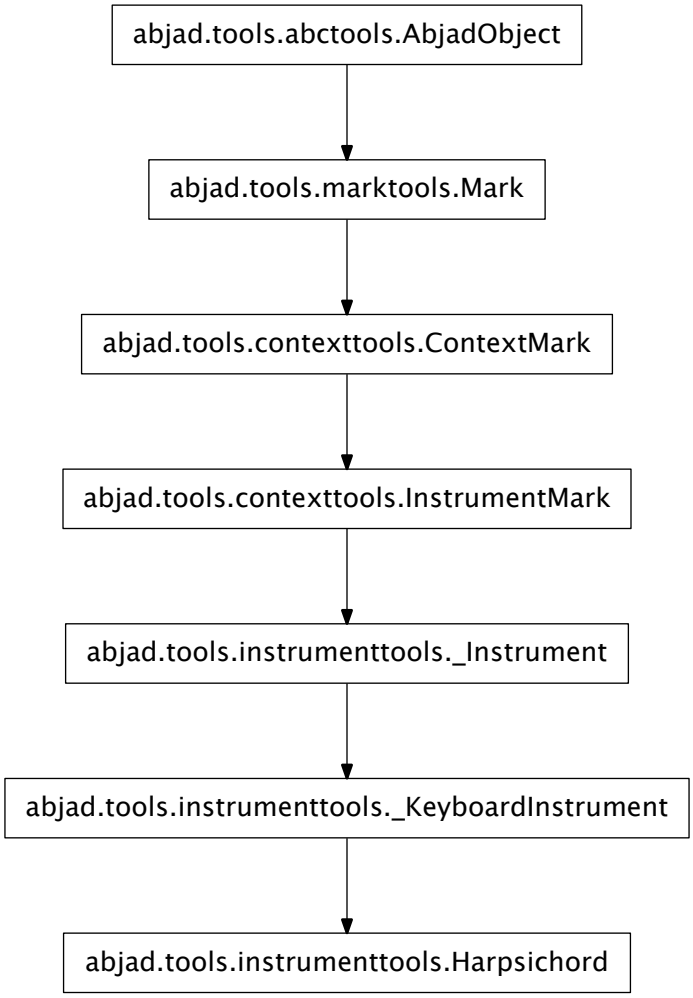
Raise exception.

Inherited from abctools.AbjadObject

Harp.__ne__(*arg*)
Inherited from marktools.Mark

Harp.__repr__()
Inherited from marktools.Mark

instrumenttools.Harpsichord



class instrumenttools.**Harpsichord**(*target_context=None*, ***kwargs*)

New in version 2.5. Abjad model of the harpsichord:

```
>>> piano_staff = scoretools.PianoStaff([Staff("c'8 d'8 e'8 f'8"), Staff("c'4 b4")])

>>> instrumenttools.Harpsichord()(piano_staff)
Harpsichord()(PianoStaff<<2>>)

>>> f(piano_staff)
\new PianoStaff <<
    \set PianoStaff.instrumentName = \markup { Harpsichord }
    \set PianoStaff.shortInstrumentName = \markup { Hpschd. }
    \new Staff {
        c'8
```

```
            d'8
            e'8
            f'8
        }
        \new Staff {
            c'4
            b4
        }
    >>
```

The harpsichord targets piano staff context by default.

Return instrument.

Read-only Properties

Harpsichord.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Harpsichord.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Harpsichord.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Harpsichord.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Harpsichord.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Harpsichord.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Harpsichord.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Harpsichord.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Harpsichord.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Harpsichord.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Harpsichord.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Harpsichord.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Harpsichord.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Harpsichord.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Harpsichord.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`Harpsichord.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`Harpsichord.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`Harpsichord.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Harpsichord.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

Harpsichord.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Harpsichord.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Harpsichord.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Harpsichord.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Harpsichord.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Harpsichord.**__call__**(**args*)
Inherited from marktools.Mark

Harpsichord.**__delattr__**(**args*)
Inherited from marktools.Mark

Harpsichord.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Harpsichord.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Harpsichord.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Harpsichord.__hash__()
Inherited from contexttools.InstrumentMark

Harpsichord.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Harpsichord.__lt__(*arg*)
Abjad objects by default do not implement this method.

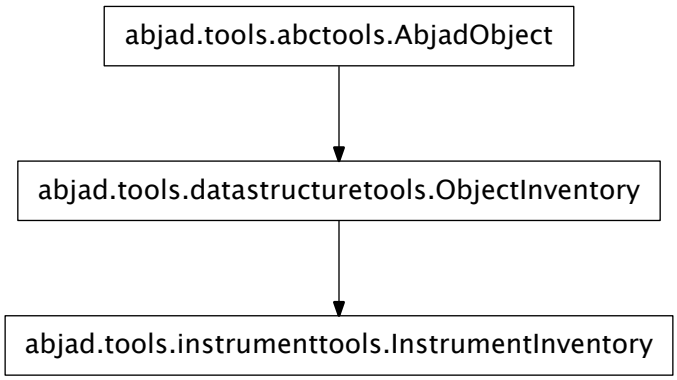
Raise exception.

Inherited from abctools.AbjadObject

Harpsichord.__ne__(*arg*)
Inherited from marktools.Mark

Harpsichord.__repr__()
Inherited from marktools.Mark

instrumenttools.InstrumentInventory



class instrumenttools.**InstrumentInventory**(*tokens=None*, *name=None*)
New in version 2.8. Abjad model of an ordered list of instruments:

```
>>> inventory = instrumenttools.InstrumentInventory(
...     [instrumenttools.Flute(), instrumenttools.Guitar()])

>>> inventory
InstrumentInventory([Flute(), Guitar()])
```

Instrument inventories implement list interface and are mutable.

Read-only Properties

InstrumentInventory.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

InstrumentInventory.**name**
Read / write name of inventory.

Inherited from datastructuretools.ObjectInventory

Methods

InstrumentInventory.**append**(*token*)
Change *token* to item and append.

Inherited from datastructuretools.ObjectInventory

InstrumentInventory.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.list

InstrumentInventory.**extend**(*tokens*)
Change *tokens* to items and extend.

Inherited from datastructuretools.ObjectInventory

InstrumentInventory.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.list

InstrumentInventory.**insert**()
L.insert(index, object) – insert object before index

Inherited from __builtin__.list

InstrumentInventory.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

InstrumentInventory.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

InstrumentInventory.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

InstrumentInventory.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

InstrumentInventory.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

InstrumentInventory.__**contains**__(*token*)
Inherited from datastructuretools.ObjectInventory

InstrumentInventory.__**delitem**__()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

InstrumentInventory.__**delslice**__()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

InstrumentInventory.__**eq**__()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

InstrumentInventory.__**ge**__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

InstrumentInventory.__**getitem**__()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

InstrumentInventory.__**getslice**__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

InstrumentInventory.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

InstrumentInventory.__**iadd**__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

InstrumentInventory.__**imul**__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

InstrumentInventory.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.list

InstrumentInventory.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

InstrumentInventory.__**len**__() <==> *len(x)*
Inherited from __builtin__.list

InstrumentInventory.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

InstrumentInventory.__mul__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

InstrumentInventory.__ne__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

InstrumentInventory.__repr__()
Inherited from datastructuretools.ObjectInventory

InstrumentInventory.__reversed__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

InstrumentInventory.__rmul__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

InstrumentInventory.__setitem__()
x.__setitem__(i, y) <==> x[i]=y

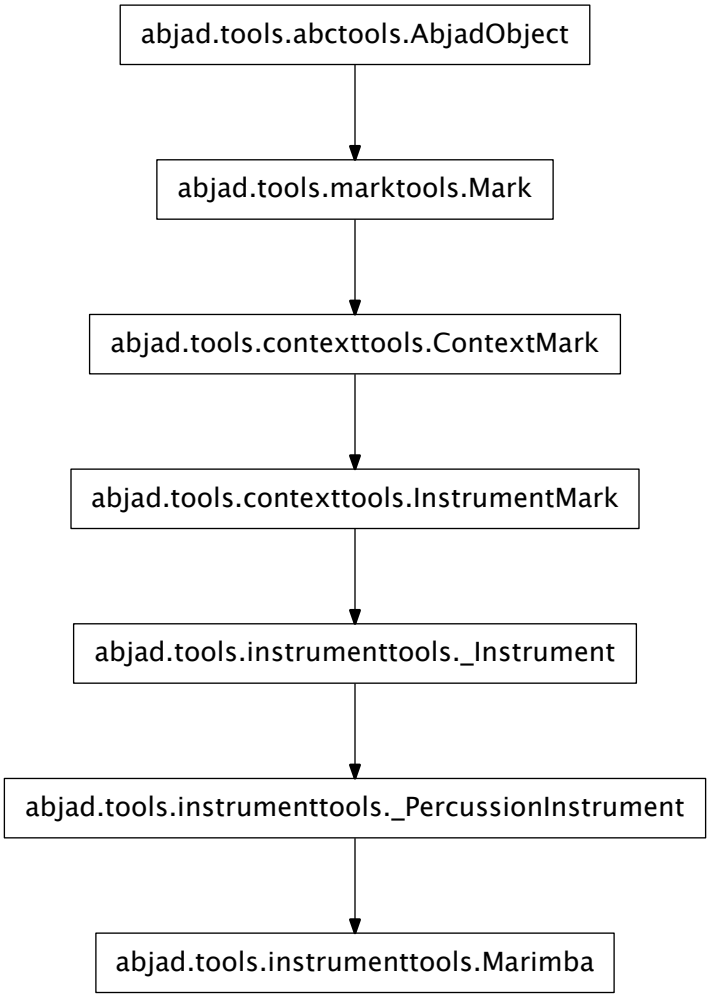
Inherited from __builtin__.list

InstrumentInventory.__setslice__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

instrumenttools.Marimba



class instrumenttools.**Marimba**(***kwargs*)

New in version 2.0. Abjad model of the marimba:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.Marimba()(staff)
Marimba()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Marimba }
    \set Staff.shortInstrumentName = \markup { Mb. }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

The marimba targets staff context by default.

Read-only Properties

Marimba.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Marimba.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Marimba.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Marimba.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Marimba.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Marimba.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Marimba.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Marimba.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

Marimba.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

Marimba.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Marimba.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Marimba.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

Marimba.**all_clefs**
Inherited from instrumenttools._Instrument

Marimba.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

Marimba.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Marimba.**pitch_range**
Inherited from instrumenttools._Instrument

Marimba.**primary_clefs**
Inherited from instrumenttools._Instrument

Marimba.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Marimba.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Marimba.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Marimba.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Marimba.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Marimba.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Marimba.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Marimba.**__call__**(**args*)
Inherited from marktools.Mark

Marimba.**__delattr__**(**args*)
Inherited from marktools.Mark

Marimba.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Marimba.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Marimba.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Marimba.**__hash__**()
Inherited from contexttools.InstrumentMark

Marimba.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Marimba.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

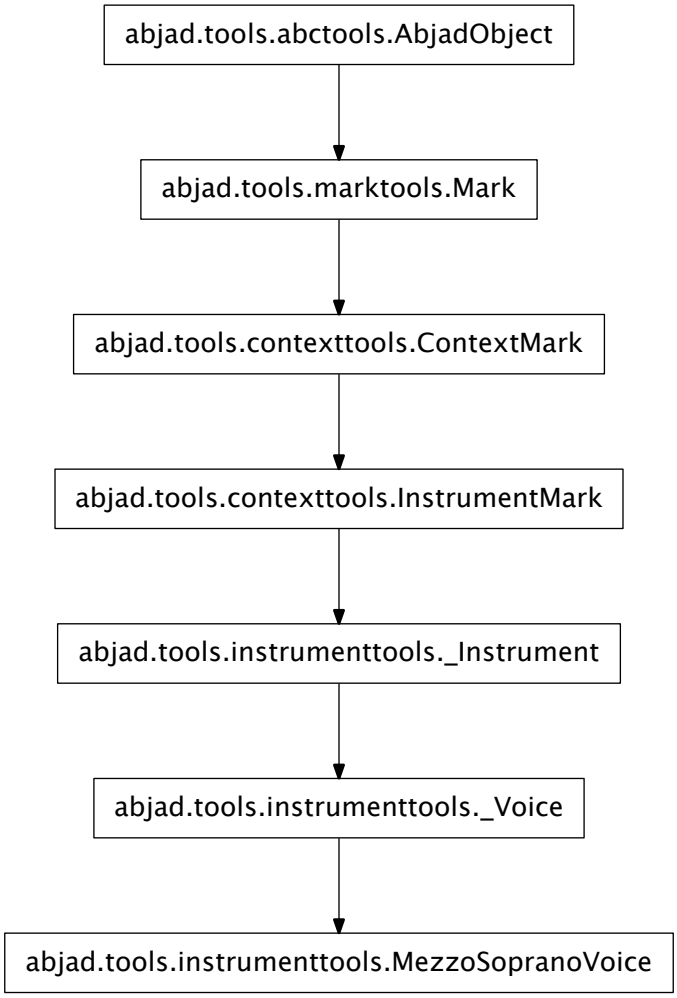
Raise exception.

Inherited from abctools.AbjadObject

Marimba.**__ne__**(*arg*)
Inherited from marktools.Mark

Marimba.**__repr__**()
Inherited from marktools.Mark

instrumenttools.MezzoSopranoVoice



class instrumenttools.**MezzoSopranoVoice**(***kwargs*)

New in version 2.8. Abjad model of the mezzo-soprano voice:

```
>>> staff = Staff("c''8 d''8 e''8 f''8")

>>> instrumenttools.MezzoSopranoVoice()(staff)
MezzoSopranoVoice()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Mezzo-soprano voice }
    \set Staff.shortInstrumentName = \markup { Mezzo-soprano }
    c''8
    d''8
```

```
        e''8
        f''8
    }
```

The mezzo-soprano voice targets staff context by default.

Read-only Properties

MezzoSopranoVoice.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

MezzoSopranoVoice.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

MezzoSopranoVoice.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

MezzoSopranoVoice.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

MezzoSopranoVoice.**is_primary_instrument**
Inherited from instrumenttools._Instrument

MezzoSopranoVoice.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

MezzoSopranoVoice.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

MezzoSopranoVoice.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

MezzoSopranoVoice.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

MezzoSopranoVoice.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

MezzoSopranoVoice.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

MezzoSopranoVoice.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

MezzoSopranoVoice.**all_clefs**
Inherited from instrumenttools._Instrument

MezzoSopranoVoice.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

MezzoSopranoVoice.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

MezzoSopranoVoice.**pitch_range**
Inherited from instrumenttools._Instrument

MezzoSopranoVoice.**primary_clefs**
Inherited from instrumenttools._Instrument

MezzoSopranoVoice.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

MezzoSopranoVoice.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

MezzoSopranoVoice.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

MezzoSopranoVoice.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

MezzoSopranoVoice.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

MezzoSopranoVoice.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

MezzoSopranoVoice.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

MezzoSopranoVoice.**__call__**(**args*)
Inherited from marktools.Mark

MezzoSopranoVoice.**__delattr__**(**args*)
Inherited from marktools.Mark

MezzoSopranoVoice.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

MezzoSopranoVoice.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MezzoSopranoVoice.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MezzoSopranoVoice.**__hash__**()
Inherited from contexttools.InstrumentMark

MezzoSopranoVoice.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MezzoSopranoVoice.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

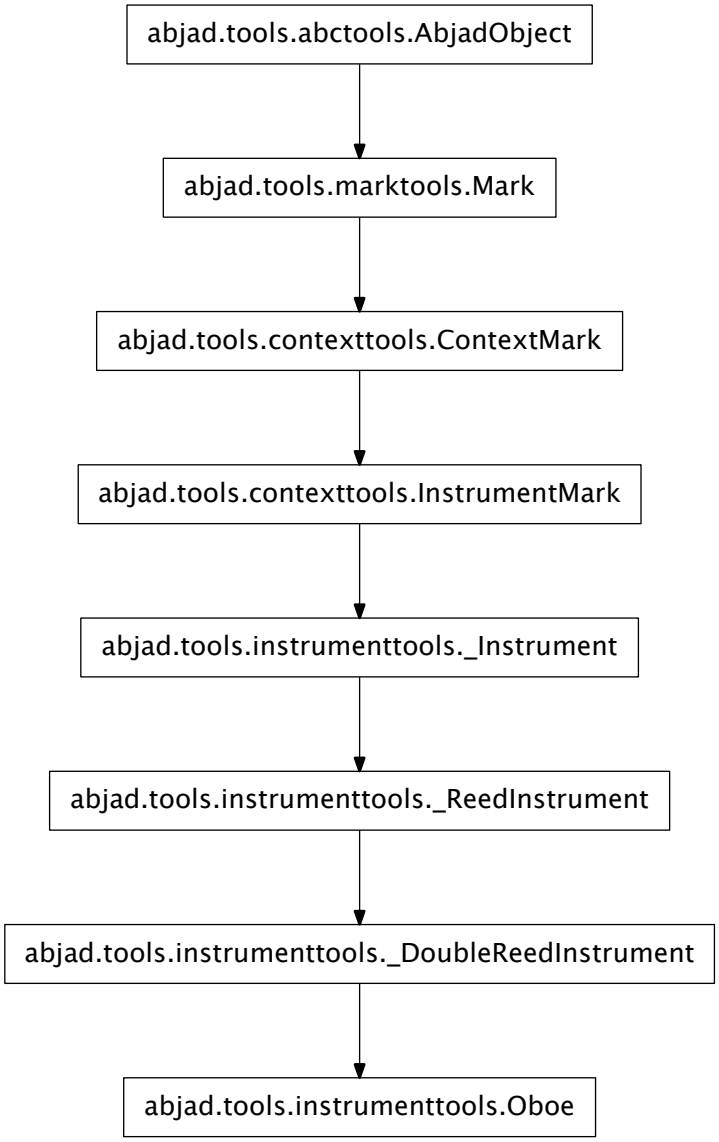
Raise exception.

Inherited from abctools.AbjadObject

MezzoSopranoVoice.__**ne**__(*arg*)
Inherited from marktools.Mark

MezzoSopranoVoice.__**repr**__()
Inherited from marktools.Mark

instrumenttools.Oboe



class instrumenttools.**Oboe**(***kwargs*)

New in version 2.0. Abjad model of the oboe:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.Oboe()(staff)
Oboe()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Oboe }
    \set Staff.shortInstrumentName = \markup { Ob. }
    c'8
    d'8
    e'8
    f'8
}
```

The oboe targets staff context by default.

Read-only Properties

Oboe.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Oboe.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Oboe.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Oboe.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Oboe.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Oboe.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Oboe.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Oboe.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Oboe.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Oboe.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Oboe.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Oboe.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Oboe.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Oboe.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Oboe.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`Oboe.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`Oboe.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`Oboe.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Oboe.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

Oboe.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Oboe.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Oboe.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Oboe.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

Oboe.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Oboe.**__call__**(**args*)
Inherited from marktools.Mark

Oboe.**__delattr__**(**args*)
Inherited from marktools.Mark

Oboe.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Oboe.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Oboe.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Oboe.**__hash__**()
Inherited from contexttools.InstrumentMark

Oboe.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Oboe.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

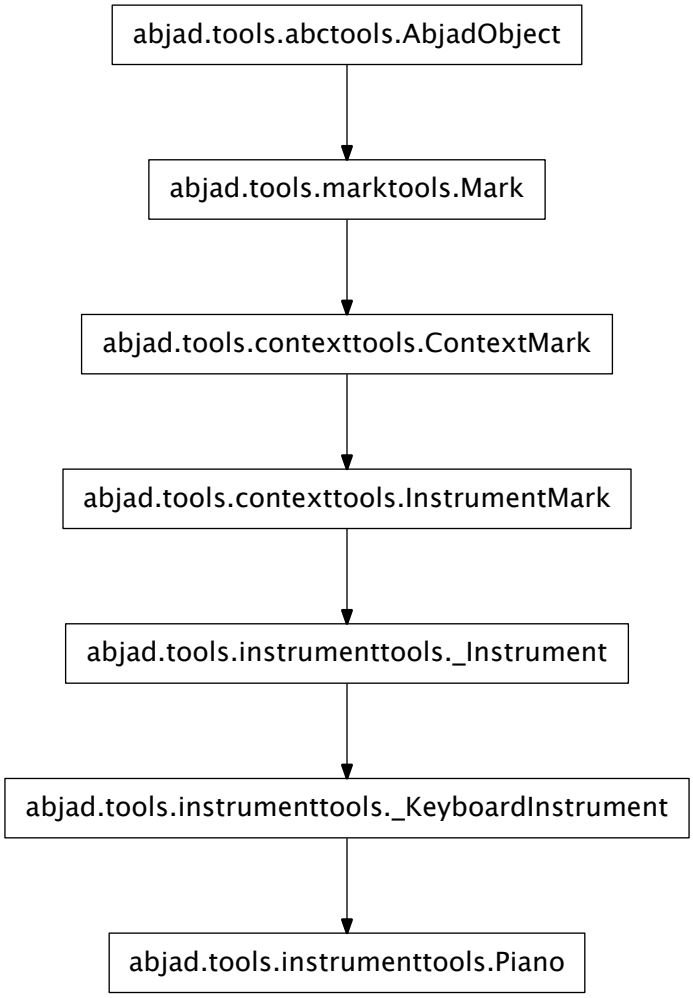
Raise exception.

Inherited from abctools.AbjadObject

Oboe.**__ne__**(*arg*)
Inherited from marktools.Mark

Oboe.**__repr__**()
Inherited from marktools.Mark

instrumenttools.Piano



class instrumenttools.**Piano**(*target_context=None*, ***kwargs*)

New in version 2.0. Abjad model of the piano:

```
>>> piano_staff = scoretools.PianoStaff([Staff("c'8 d'8 e'8 f'8"), Staff("c'4 b4")])

>>> instrumenttools.Piano()(piano_staff)
Piano()(PianoStaff<<2>>)

>>> f(piano_staff)
\new PianoStaff <<
    \set PianoStaff.instrumentName = \markup { Piano }
    \set PianoStaff.shortInstrumentName = \markup { Pf. }
    \new Staff {
        c'8
```

```
            d'8
            e'8
            f'8
        }
        \new Staff {
            c'4
            b4
        }
    >>
```

The piano targets piano staff context by default.

Read-only Properties

Piano.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Piano.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Piano.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Piano.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Piano.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Piano.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Piano.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Piano.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Piano.`**`start_component`**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Piano.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Piano.`**`target_context`**

Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Piano.`**`traditional_pitch_range`**

Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Piano.`**`all_clefs`**

Inherited from `instrumenttools._Instrument`

`Piano.`**`instrument_name`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Piano.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`Piano.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`Piano.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`Piano.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Piano.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

Piano.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Piano.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Piano.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Piano.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

Piano.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Piano.**__call__**(**args*)
Inherited from marktools.Mark

Piano.**__delattr__**(**args*)
Inherited from marktools.Mark

Piano.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Piano.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Piano.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Piano.__hash__()
Inherited from contexttools.InstrumentMark

Piano.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Piano.__lt__(*arg*)
Abjad objects by default do not implement this method.

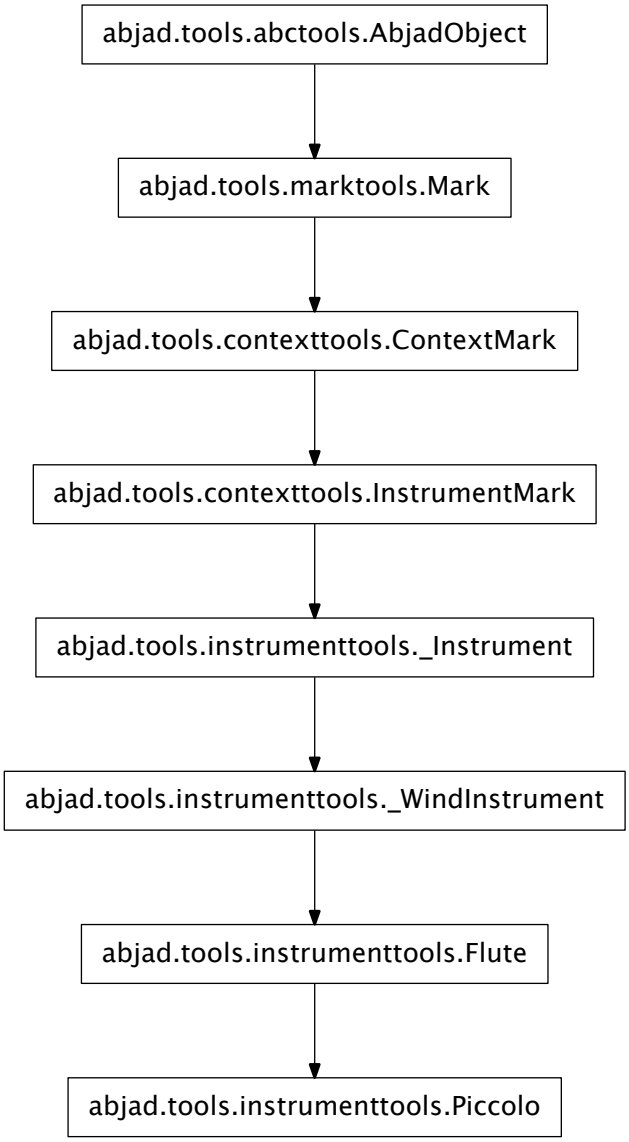
Raise exception.

Inherited from abctools.AbjadObject

Piano.__ne__(*arg*)
Inherited from marktools.Mark

Piano.__repr__()
Inherited from marktools.Mark

instrumenttools.Piccolo



class instrumenttools.**Piccolo**(***kwargs*)

New in version 2.0. Abjad model of the piccolo:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.Piccolo()(staff)
Piccolo()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Piccolo }
    \set Staff.shortInstrumentName = \markup { Picc. }
    c'8
    d'8
    e'8
    f'8
}
```

The piccolo targets staff context by default.

Read-only Properties

Piccolo.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Piccolo.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Piccolo.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Piccolo.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Piccolo.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Piccolo.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Piccolo.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Piccolo.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Piccolo.`**`start_component`**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Piccolo.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Piccolo.`**`target_context`**

Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Piccolo.`**`traditional_pitch_range`**

Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Piccolo.`**`all_clefs`**

Inherited from `instrumenttools._Instrument`

`Piccolo.`**`instrument_name`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Piccolo.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`Piccolo.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`Piccolo.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`Piccolo.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`Piccolo.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

Piccolo.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Piccolo.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Piccolo.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Piccolo.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

Piccolo.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Piccolo.**__call__**(**args*)
Inherited from marktools.Mark

Piccolo.**__delattr__**(**args*)
Inherited from marktools.Mark

Piccolo.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Piccolo.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Piccolo.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Piccolo.__hash__()
Inherited from contexttools.InstrumentMark

Piccolo.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Piccolo.__lt__(*arg*)
Abjad objects by default do not implement this method.

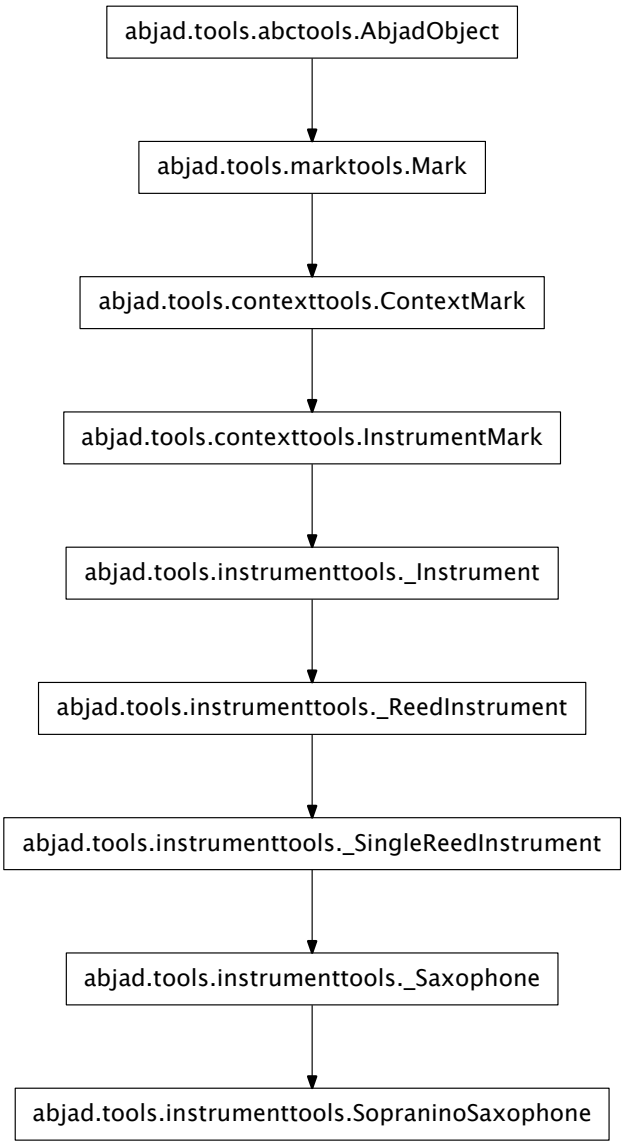
Raise exception.

Inherited from abctools.AbjadObject

Piccolo.__ne__(*arg*)
Inherited from marktools.Mark

Piccolo.__repr__()
Inherited from marktools.Mark

instrumenttools.SopraninoSaxophone



class instrumenttools.**SopraninoSaxophone**(***kwargs*)

New in version 2.6. Abjad model of the sopranino saxophone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.SopraninoSaxophone()(staff)
SopraninoSaxophone()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Sopranino saxophone }
    \set Staff.shortInstrumentName = \markup { Sopranino sax. }
    c'8
    d'8
    e'8
    f'8
}
```

The sopranino saxophone is pitched in E-flat.

The sopranino saxophone targets staff context by default.

Read-only Properties

SopraninoSaxophone.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

SopraninoSaxophone.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

SopraninoSaxophone.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

SopraninoSaxophone.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

SopraninoSaxophone.**is_primary_instrument**

Inherited from instrumenttools._Instrument

SopraninoSaxophone.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

SopraninoSaxophone.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

SopraninoSaxophone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

SopraninoSaxophone.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

SopraninoSaxophone.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

SopraninoSaxophone.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

SopraninoSaxophone.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

SopraninoSaxophone.**all_clefs**
Inherited from instrumenttools._Instrument

SopraninoSaxophone.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`SopraninoSaxophone.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`SopraninoSaxophone.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`SopraninoSaxophone.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`SopraninoSaxophone.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`SopraninoSaxophone.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

SopraninoSaxophone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

SopraninoSaxophone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

SopraninoSaxophone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

SopraninoSaxophone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

SopraninoSaxophone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

SopraninoSaxophone.**__call__**(**args*)
Inherited from marktools.Mark

SopraninoSaxophone.**__delattr__**(**args*)
Inherited from marktools.Mark

SopraninoSaxophone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

SopraninoSaxophone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SopraninoSaxophone.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SopraninoSaxophone.**__hash__**()
Inherited from contexttools.InstrumentMark

SopraninoSaxophone.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SopraninoSaxophone.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

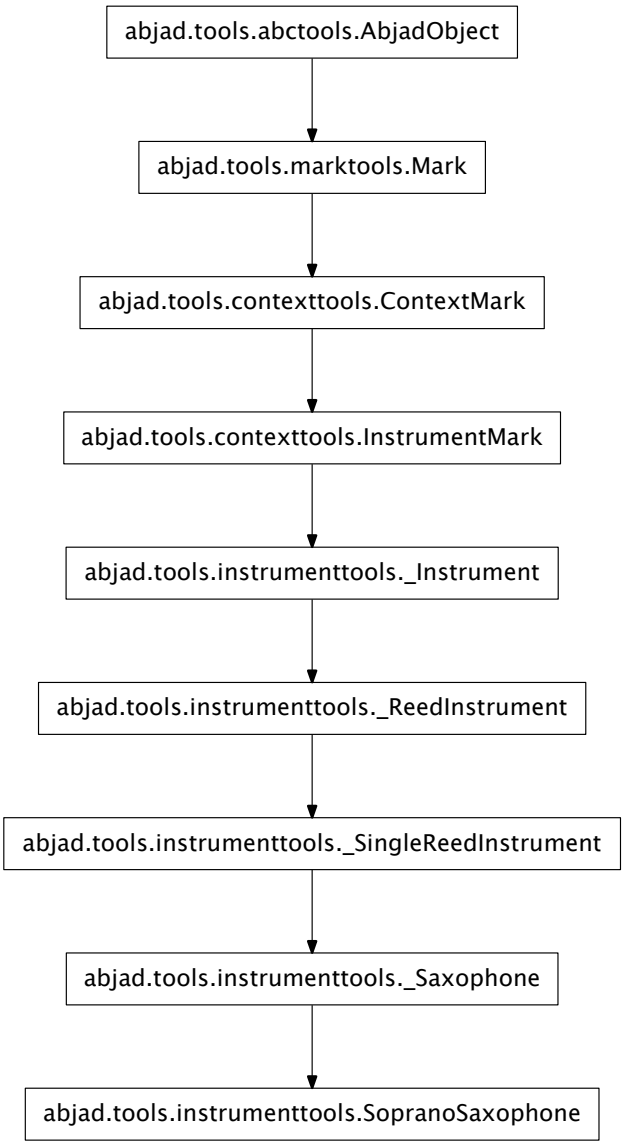
Raise exception.

Inherited from abctools.AbjadObject

SopraninoSaxophone.**__ne__**(*arg*)
Inherited from marktools.Mark

SopraninoSaxophone.**__repr__**()
Inherited from marktools.Mark

instrumenttools.SopranoSaxophone



class instrumenttools.**SopranoSaxophone**(***kwargs*)

New in version 2.6. Abjad model of the soprano saxophone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.SopranoSaxophone()(staff)
SopranoSaxophone()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Soprano saxophone }
    \set Staff.shortInstrumentName = \markup { Sop. sax. }
    c'8
    d'8
    e'8
    f'8
}
```

The soprano saxophone is pitched in B-flat.

The soprano saxophone targets staff context by default.

Read-only Properties

SopranoSaxophone.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

SopranoSaxophone.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

SopranoSaxophone.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

SopranoSaxophone.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

SopranoSaxophone.**is_primary_instrument**

Inherited from instrumenttools._Instrument

SopranoSaxophone.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

SopranoSaxophone.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

SopranoSaxophone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

SopranoSaxophone.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

SopranoSaxophone.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

SopranoSaxophone.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

SopranoSaxophone.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

SopranoSaxophone.**all_clefs**
Inherited from instrumenttools._Instrument

SopranoSaxophone.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`SopranoSaxophone.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`SopranoSaxophone.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`SopranoSaxophone.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`SopranoSaxophone.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`SopranoSaxophone.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

SopranoSaxophone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

SopranoSaxophone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

SopranoSaxophone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

SopranoSaxophone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

SopranoSaxophone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

SopranoSaxophone.**__call__**(**args*)
Inherited from marktools.Mark

SopranoSaxophone.**__delattr__**(**args*)
Inherited from marktools.Mark

SopranoSaxophone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

SopranoSaxophone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SopranoSaxophone.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SopranoSaxophone.**__hash__**()
Inherited from contexttools.InstrumentMark

SopranoSaxophone.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SopranoSaxophone.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

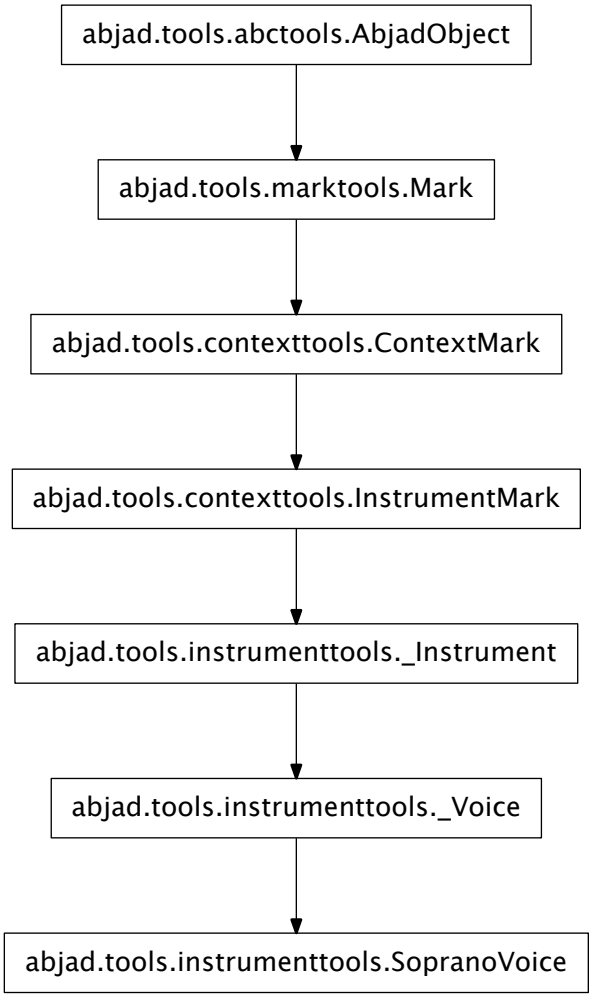
Raise exception.

Inherited from abctools.AbjadObject

SopranoSaxophone.**__ne__**(*arg*)
Inherited from marktools.Mark

SopranoSaxophone.**__repr__**()
Inherited from marktools.Mark

instrumenttools.SopranoVoice



class instrumenttools.**SopranoVoice**(***kwargs*)

New in version 2.8. Abjad model of the soprano voice:

```
>>> staff = Staff("c''8 d''8 e''8 f''8")

>>> instrumenttools.SopranoVoice()(staff)
SopranoVoice()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Soprano voice }
    \set Staff.shortInstrumentName = \markup { Soprano }
    c''8
    d''8
```

```
        e''8
        f''8
    }
```

The soprano voice targets staff context by default.

Read-only Properties

SopranoVoice.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

SopranoVoice.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

SopranoVoice.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

SopranoVoice.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

SopranoVoice.**is_primary_instrument**

Inherited from instrumenttools._Instrument

SopranoVoice.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

SopranoVoice.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

SopranoVoice.**lilypond_format**

Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

SopranoVoice.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

SopranoVoice.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

SopranoVoice.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

SopranoVoice.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

SopranoVoice.**all_clefs**
Inherited from instrumenttools._Instrument

SopranoVoice.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

SopranoVoice.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

SopranoVoice.**pitch_range**
Inherited from instrumenttools._Instrument

SopranoVoice.**primary_clefs**
Inherited from instrumenttools._Instrument

SopranoVoice.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

SopranoVoice.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

SopranoVoice.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

SopranoVoice.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

SopranoVoice.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

SopranoVoice.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

SopranoVoice.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

SopranoVoice.**__call__**(**args*)
Inherited from marktools.Mark

SopranoVoice.**__delattr__**(**args*)
Inherited from marktools.Mark

SopranoVoice.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

SopranoVoice.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SopranoVoice.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SopranoVoice.**__hash__**()
Inherited from contexttools.InstrumentMark

SopranoVoice.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SopranoVoice.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

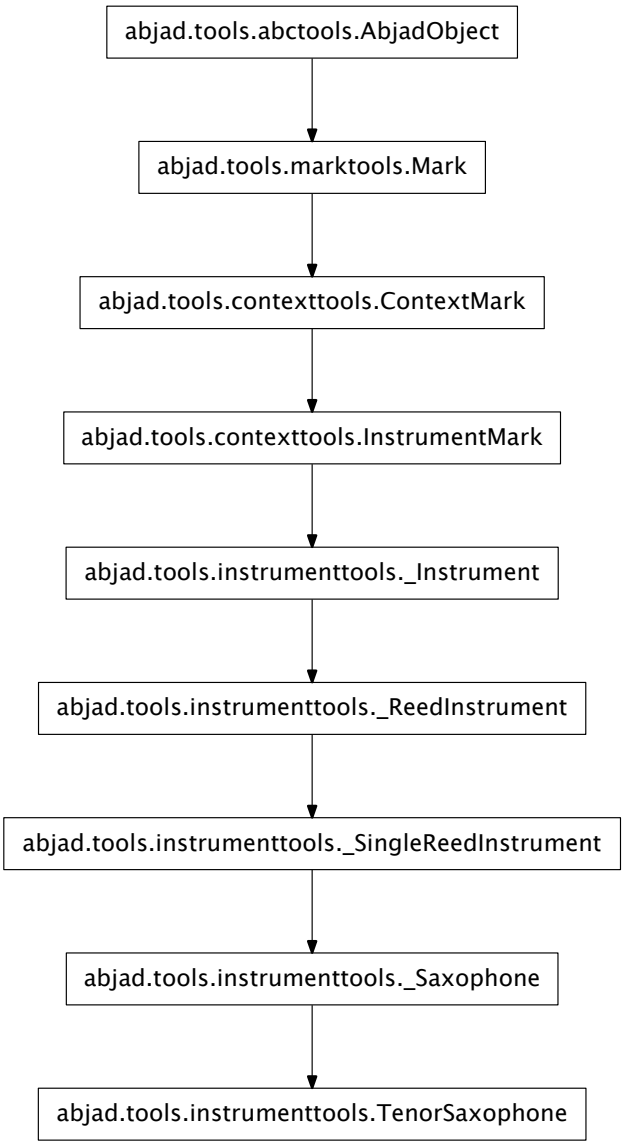
Raise exception.

Inherited from abctools.AbjadObject

SopranoVoice.**__ne__**(*arg*)
Inherited from marktools.Mark

SopranoVoice.**__repr__**()
Inherited from marktools.Mark

instrumenttools.TenorSaxophone



class instrumenttools.**TenorSaxophone**(***kwargs*)

New in version 2.6. Abjad model of the tenor saxophone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.TenorSaxophone()(staff)
TenorSaxophone()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Tenor saxophone }
    \set Staff.shortInstrumentName = \markup { Ten. sax. }
    c'8
    d'8
    e'8
    f'8
}
```

The tenor saxophone is pitched in B-flat.

The tenor saxophone targets staff context by default.

Read-only Properties

TenorSaxophone.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

TenorSaxophone.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

TenorSaxophone.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

TenorSaxophone.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

TenorSaxophone.**is_primary_instrument**

Inherited from instrumenttools._Instrument

TenorSaxophone.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

TenorSaxophone.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

TenorSaxophone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

TenorSaxophone.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

TenorSaxophone.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

TenorSaxophone.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

TenorSaxophone.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

TenorSaxophone.**all_clefs**
Inherited from instrumenttools._Instrument

TenorSaxophone.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`TenorSaxophone.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`TenorSaxophone.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`TenorSaxophone.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`TenorSaxophone.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`TenorSaxophone.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

TenorSaxophone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

TenorSaxophone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

TenorSaxophone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

TenorSaxophone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

TenorSaxophone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

TenorSaxophone.**__call__**(**args*)
Inherited from marktools.Mark

TenorSaxophone.**__delattr__**(**args*)
Inherited from marktools.Mark

TenorSaxophone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

TenorSaxophone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TenorSaxophone.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TenorSaxophone.**__hash__**()
Inherited from contexttools.InstrumentMark

TenorSaxophone.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TenorSaxophone.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

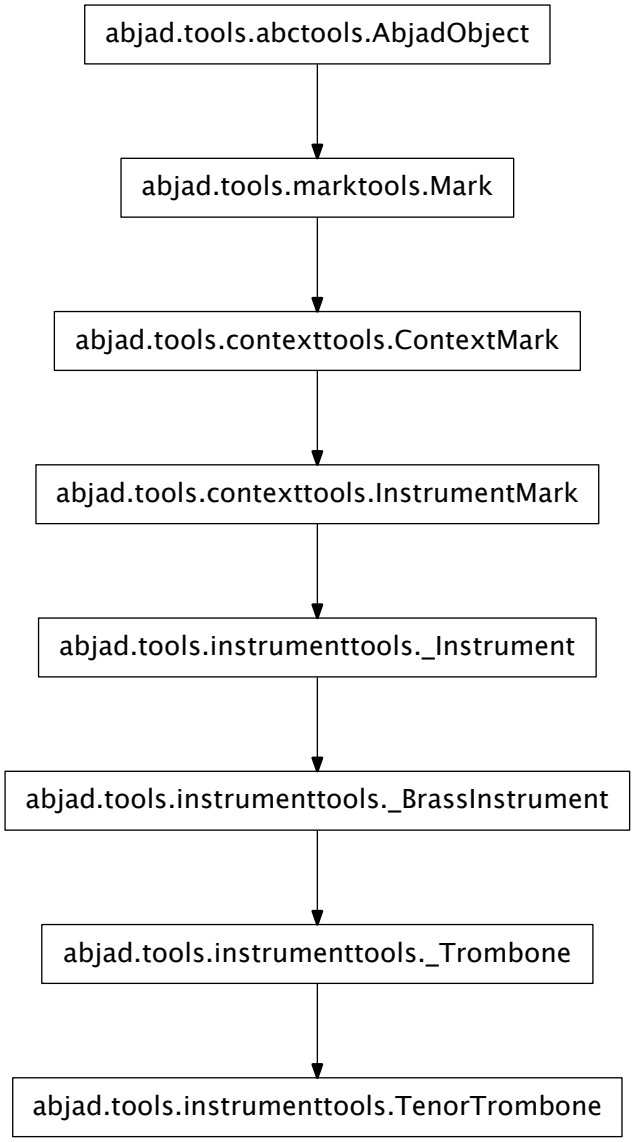
Raise exception.

Inherited from abctools.AbjadObject

TenorSaxophone.**__ne__**(*arg*)
Inherited from marktools.Mark

TenorSaxophone.**__repr__**()
Inherited from marktools.Mark

instrumenttools.TenorTrombone



class instrumenttools.**TenorTrombone**(***kwargs*)

New in version 2.0. Abjad model of the tenor trombone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('bass')(staff)
ClefMark('bass')(Staff{4})

>>> instrumenttools.TenorTrombone()(staff)
TenorTrombone()(Staff{4})
```

```
>>> f(staff)
\new Staff {
    \clef "bass"
    \set Staff.instrumentName = \markup { Tenor trombone }
    \set Staff.shortInstrumentName = \markup { Ten. trb. }
    c'8
    d'8
    e'8
    f'8
}
```

The tenor trombone targets staff context by default.

Read-only Properties

`TenorTrombone.`**`default_instrument_name`**
Read-only default instrument name.

Return string.

Inherited from `contexttools.InstrumentMark`

`TenorTrombone.`**`default_short_instrument_name`**
Read-only default short instrument name.

Return string.

Inherited from `contexttools.InstrumentMark`

`TenorTrombone.`**`effective_context`**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`TenorTrombone.`**`interval_of_transposition`**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from `instrumenttools._Instrument`

`TenorTrombone.`**`is_primary_instrument`**
Inherited from `instrumenttools._Instrument`

`TenorTrombone.`**`is_secondary_instrument`**
Inherited from `instrumenttools._Instrument`

`TenorTrombone.`**`is_transposing`**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from `instrumenttools._Instrument`

`TenorTrombone.`**`lilypond_format`**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`TenorTrombone.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`TenorTrombone.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`TenorTrombone.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`TenorTrombone.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`TenorTrombone.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`TenorTrombone.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`TenorTrombone.`**`instrument_name_markup`**

Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

`TenorTrombone.`**`pitch_range`**

Inherited from `instrumenttools._Instrument`

`TenorTrombone.`**`primary_clefs`**

Inherited from `instrumenttools._Instrument`

`TenorTrombone.`**`short_instrument_name`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from `contexttools.InstrumentMark`

`TenorTrombone.`**`short_instrument_name_markup`**

Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from `contexttools.InstrumentMark`

TenorTrombone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

TenorTrombone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

TenorTrombone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

TenorTrombone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are `'en-us'` and `'en-uk'`.

Inherited from instrumenttools._Instrument

TenorTrombone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

TenorTrombone.**__call__**(**args*)
Inherited from marktools.Mark

TenorTrombone.**__delattr__**(**args*)
Inherited from marktools.Mark

TenorTrombone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

TenorTrombone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TenorTrombone.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TenorTrombone.__hash__()
Inherited from contexttools.InstrumentMark

TenorTrombone.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TenorTrombone.__lt__(*arg*)
Abjad objects by default do not implement this method.

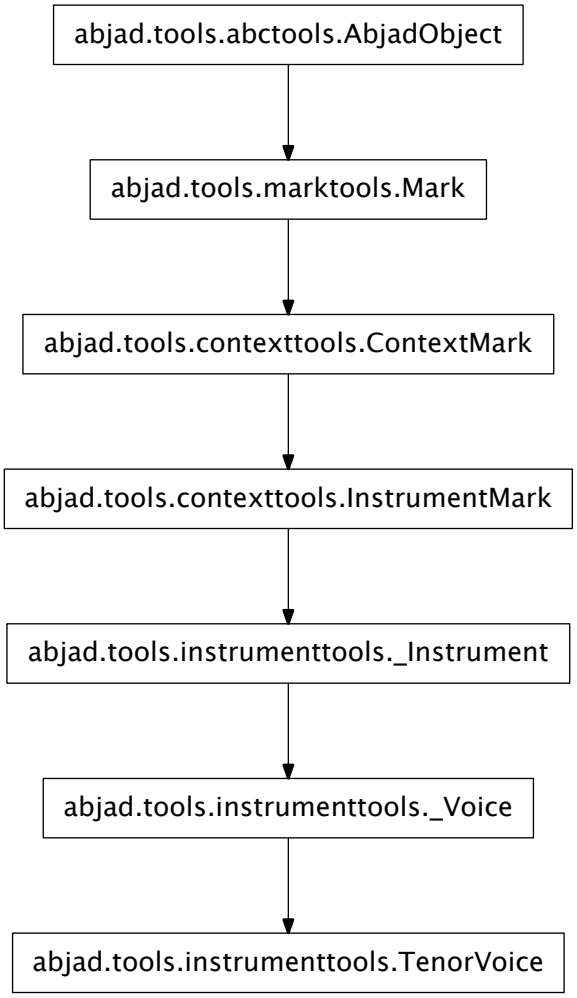
Raise exception.

Inherited from abctools.AbjadObject

TenorTrombone.__ne__(*arg*)
Inherited from marktools.Mark

TenorTrombone.__repr__()
Inherited from marktools.Mark

instrumenttools.TenorVoice



class instrumenttools.**TenorVoice**(***kwargs*)

New in version 2.8. Abjad model of the tenor voice:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.TenorVoice()(staff)
TenorVoice()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Tenor voice }
    \set Staff.shortInstrumentName = \markup { Tenor }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

The tenor voice targets staff context by default.

Read-only Properties

TenorVoice.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

TenorVoice.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

TenorVoice.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

TenorVoice.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

TenorVoice.**is_primary_instrument**

Inherited from instrumenttools._Instrument

TenorVoice.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

TenorVoice.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

TenorVoice.**lilypond_format**

Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

TenorVoice.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

TenorVoice.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

TenorVoice.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

TenorVoice.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

TenorVoice.**all_clefs**
Inherited from instrumenttools._Instrument

TenorVoice.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

TenorVoice.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

TenorVoice.**pitch_range**
Inherited from instrumenttools._Instrument

TenorVoice.**primary_clefs**
Inherited from instrumenttools._Instrument

TenorVoice.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

TenorVoice.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

TenorVoice.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

TenorVoice.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

TenorVoice.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

TenorVoice.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

TenorVoice.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

TenorVoice.**__call__**(**args*)
Inherited from marktools.Mark

TenorVoice.**__delattr__**(**args*)
Inherited from marktools.Mark

TenorVoice.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

TenorVoice.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TenorVoice.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TenorVoice.**__hash__**()
Inherited from contexttools.InstrumentMark

TenorVoice.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TenorVoice.__lt__(*arg*)
Abjad objects by default do not implement this method.

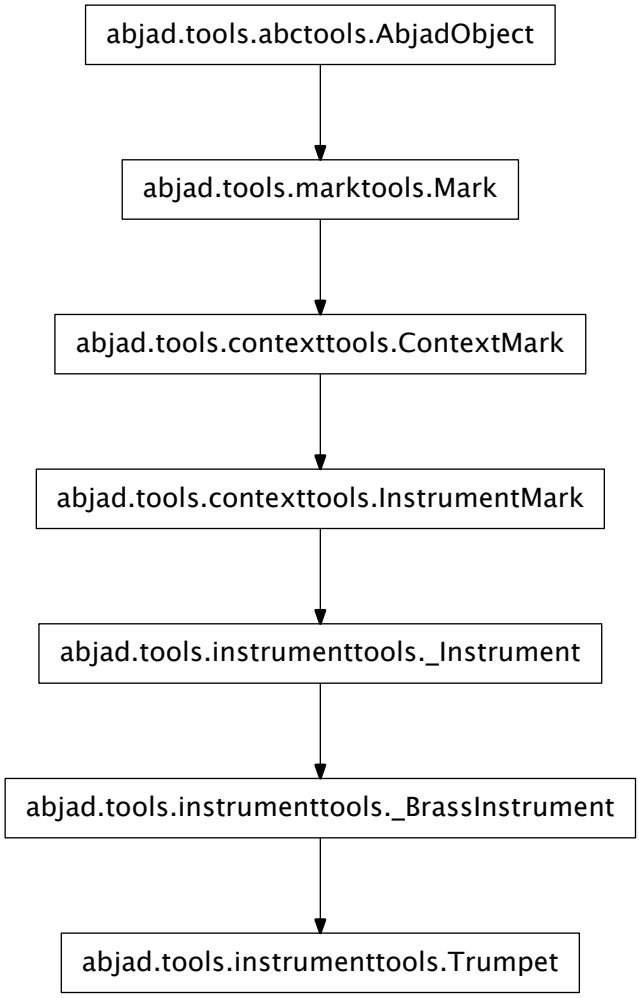
Raise exception.

Inherited from abctools.AbjadObject

TenorVoice.__ne__(*arg*)
Inherited from marktools.Mark

TenorVoice.__repr__()
Inherited from marktools.Mark

instrumenttools.Trumpet



class instrumenttools.**Trumpet**(***kwargs*)

New in version 2.0. Abjad model of the trumpet:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.Trumpet()(staff)
Trumpet()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Trumpet }
    \set Staff.shortInstrumentName = \markup { Tp. }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

The trumpet targets staff context by default.

Read-only Properties

`Trumpet.`**`default_instrument_name`**
Read-only default instrument name.

Return string.

Inherited from `contexttools.InstrumentMark`

`Trumpet.`**`default_short_instrument_name`**
Read-only default short instrument name.

Return string.

Inherited from `contexttools.InstrumentMark`

`Trumpet.`**`effective_context`**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Trumpet.`**`interval_of_transposition`**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from `instrumenttools._Instrument`

`Trumpet.`**`is_primary_instrument`**
Inherited from `instrumenttools._Instrument`

`Trumpet.`**`is_secondary_instrument`**
Inherited from `instrumenttools._Instrument`

`Trumpet.`**`is_transposing`**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from `instrumenttools._Instrument`

`Trumpet.`**`lilypond_format`**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Trumpet.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Trumpet.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Trumpet.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Trumpet.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Trumpet.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Trumpet.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

Trumpet.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Trumpet.**pitch_range**
Inherited from instrumenttools._Instrument

Trumpet.**primary_clefs**
Inherited from instrumenttools._Instrument

Trumpet.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Trumpet.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Trumpet.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Trumpet.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Trumpet.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Trumpet.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Trumpet.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Trumpet.**__call__**(**args*)
Inherited from marktools.Mark

Trumpet.**__delattr__**(**args*)
Inherited from marktools.Mark

Trumpet.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Trumpet.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Trumpet.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Trumpet.**__hash__**()
Inherited from contexttools.InstrumentMark

Trumpet.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Trumpet.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

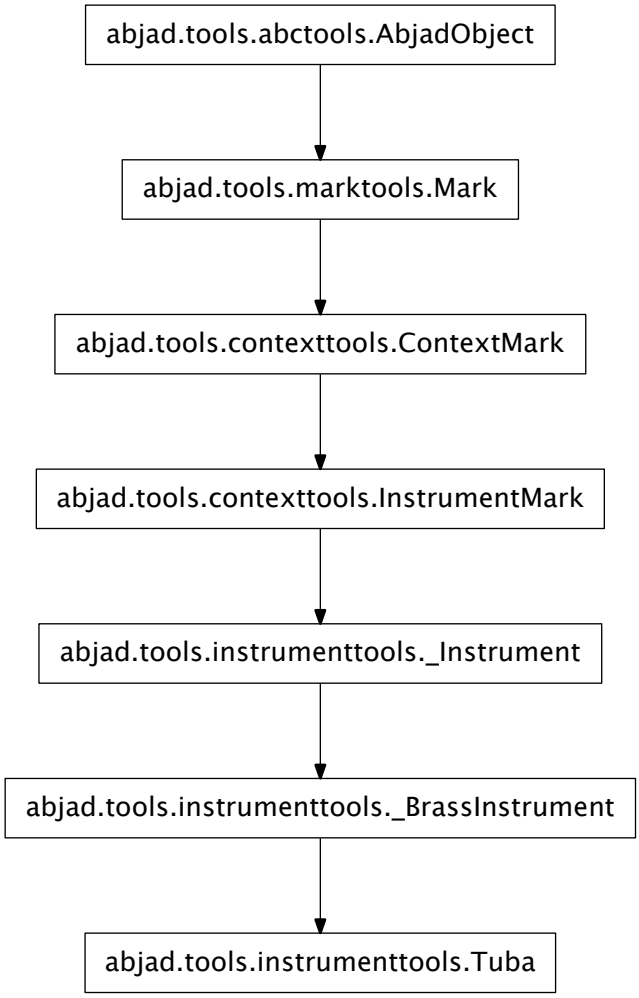
Raise exception.

Inherited from abctools.AbjadObject

Trumpet.**__ne__**(*arg*)
Inherited from marktools.Mark

Trumpet.**__repr__**()
Inherited from marktools.Mark

instrumenttools.Tuba



class instrumenttools.**Tuba**(***kwargs*)

New in version 2.0. Abjad model of the tuba:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('bass')(staff)
ClefMark('bass')(Staff{4})

>>> instrumenttools.Tuba()(staff)
Tuba()(Staff{4})

>>> f(staff)
\new Staff {
    \clef "bass"
    \set Staff.instrumentName = \markup { Tuba }
```

```
        \set Staff.shortInstrumentName = \markup { Tb. }
        c'8
        d'8
        e'8
        f'8
    }
```

The tuba targets staff context by default.

Read-only Properties

Tuba.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Tuba.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Tuba.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Tuba.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Tuba.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Tuba.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Tuba.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Tuba.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Tuba.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Tuba.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Tuba.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Tuba.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Tuba.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Tuba.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

Tuba.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Tuba.**pitch_range**
Inherited from instrumenttools._Instrument

Tuba.**primary_clefs**
Inherited from instrumenttools._Instrument

Tuba.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Tuba.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Tuba.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Tuba.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Tuba.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Tuba.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Tuba.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Tuba.**__call__**(**args*)
Inherited from marktools.Mark

Tuba.**__delattr__**(**args*)
Inherited from marktools.Mark

Tuba.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Tuba.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Tuba.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Tuba.**__hash__**()
Inherited from contexttools.InstrumentMark

Tuba.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Tuba.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

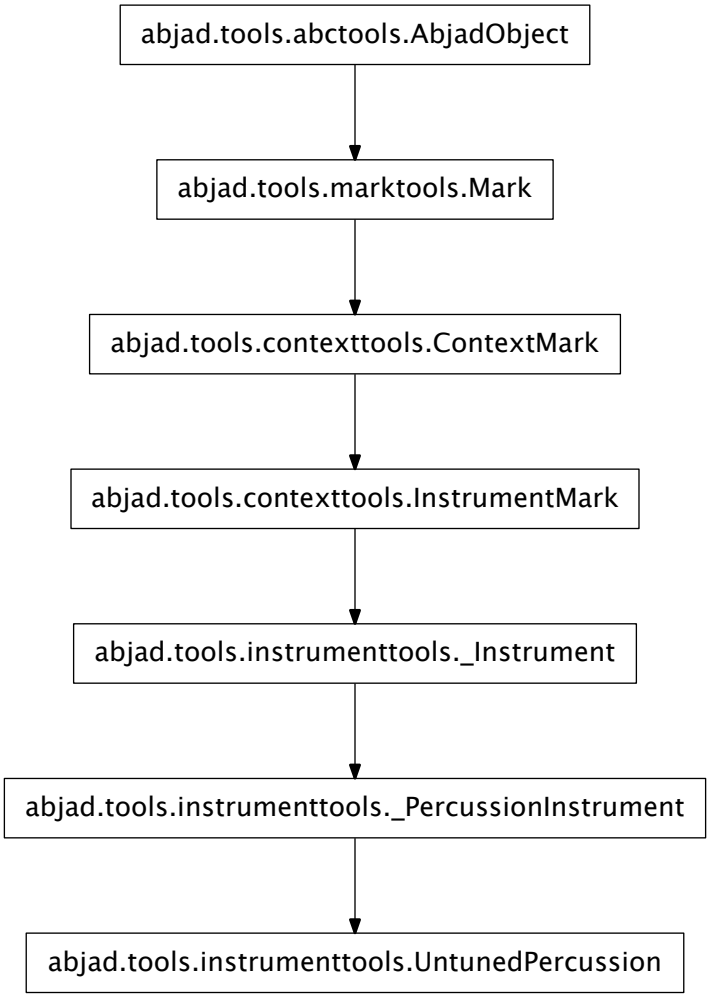
Raise exception.

Inherited from abctools.AbjadObject

Tuba.**__ne__**(*arg*)
Inherited from marktools.Mark

Tuba.**__repr__**()
Inherited from marktools.Mark

instrumenttools.UntunedPercussion



class instrumenttools.**UntunedPercussion**(***kwargs*)

New in version 2.0. Abjad model of untuned percussion:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.UntunedPercussion()(staff)
UntunedPercussion()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Untuned percussion }
    \set Staff.shortInstrumentName = \markup { Perc. }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

Untuned percussion targets the staff context by default.

Read-only Properties

UntunedPercussion.**default_instrument_name**

Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

UntunedPercussion.**default_short_instrument_name**

Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

UntunedPercussion.**effective_context**

Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

UntunedPercussion.**interval_of_transposition**

Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

UntunedPercussion.**is_primary_instrument**

Inherited from instrumenttools._Instrument

UntunedPercussion.**is_secondary_instrument**

Inherited from instrumenttools._Instrument

UntunedPercussion.**is_transposing**

True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

UntunedPercussion.**lilypond_format**

Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

UntunedPercussion.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

UntunedPercussion.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

UntunedPercussion.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

UntunedPercussion.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

UntunedPercussion.**all_clefs**
Inherited from instrumenttools._Instrument

UntunedPercussion.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

UntunedPercussion.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

UntunedPercussion.**pitch_range**
Inherited from instrumenttools._Instrument

UntunedPercussion.**primary_clefs**
Inherited from instrumenttools._Instrument

UntunedPercussion.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

UntunedPercussion.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

UntunedPercussion.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

UntunedPercussion.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

UntunedPercussion.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

UntunedPercussion.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

UntunedPercussion.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

UntunedPercussion.**__call__**(**args*)
Inherited from marktools.Mark

UntunedPercussion.**__delattr__**(**args*)
Inherited from marktools.Mark

UntunedPercussion.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

UntunedPercussion.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

UntunedPercussion.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

UntunedPercussion.**__hash__**()
Inherited from contexttools.InstrumentMark

UntunedPercussion.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

UntunedPercussion.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

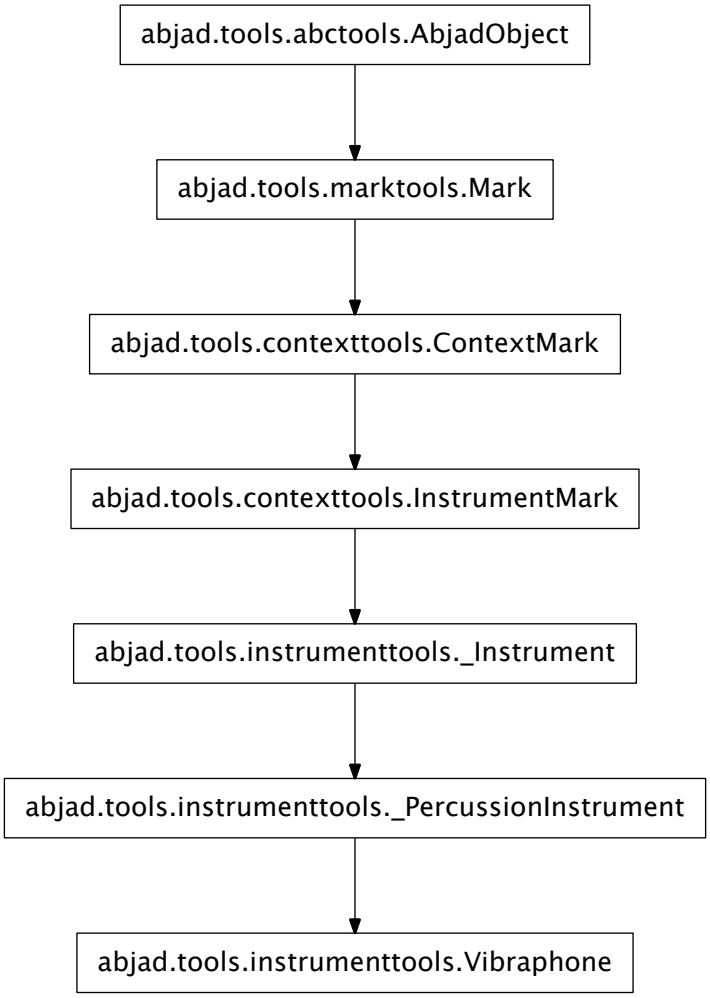
Raise exception.

Inherited from abctools.AbjadObject

UntunedPercussion.__**ne**__(*arg*)
Inherited from marktools.Mark

UntunedPercussion.__**repr**__()
Inherited from marktools.Mark

instrumenttools.Vibraphone



class instrumenttools.**Vibraphone**(***kwargs*)

New in version 2.0. Abjad model of the vibraphone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.Vibraphone()(staff)
Vibraphone()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Vibraphone }
    \set Staff.shortInstrumentName = \markup { Vibr. }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

The vibraphone targets staff context by default.

Read-only Properties

Vibraphone.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Vibraphone.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Vibraphone.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Vibraphone.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Vibraphone.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Vibraphone.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Vibraphone.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Vibraphone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from `contexttools.InstrumentMark`

`Vibraphone.`**`start_component`**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Vibraphone.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`Vibraphone.`**`target_context`**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from `contexttools.ContextMark`

`Vibraphone.`**`traditional_pitch_range`**
Read-only traditional pitch range.

Return pitch range.

Inherited from `instrumenttools._Instrument`

Read/write Properties

`Vibraphone.`**`all_clefs`**
Inherited from `instrumenttools._Instrument`

`Vibraphone.`**`instrument_name`**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from `contexttools.InstrumentMark`

Vibraphone.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Vibraphone.**pitch_range**
Inherited from instrumenttools._Instrument

Vibraphone.**primary_clefs**
Inherited from instrumenttools._Instrument

Vibraphone.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Vibraphone.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Vibraphone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Vibraphone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Vibraphone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Vibraphone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Vibraphone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Vibraphone.**__call__**(**args*)
Inherited from marktools.Mark

Vibraphone.**__delattr__**(**args*)
Inherited from marktools.Mark

Vibraphone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Vibraphone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Vibraphone.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Vibraphone.**__hash__**()
Inherited from contexttools.InstrumentMark

Vibraphone.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Vibraphone.__lt__(*arg*)
Abjad objects by default do not implement this method.

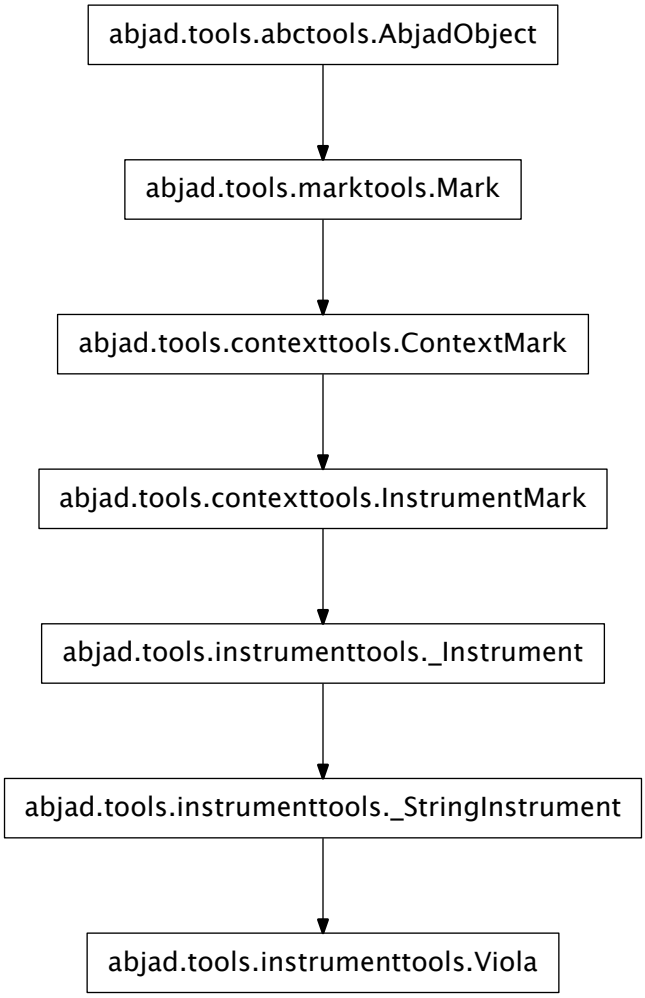
Raise exception.

Inherited from abctools.AbjadObject

Vibraphone.__ne__(*arg*)
Inherited from marktools.Mark

Vibraphone.__repr__()
Inherited from marktools.Mark

instrumenttools.Viola



class instrumenttools.**Viola**(***kwargs*)

New in version 2.0. Abjad model of the viola:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('alto')(staff)
ClefMark('alto')(Staff{4})

>>> instrumenttools.Viola()(staff)
Viola()(Staff{4})

>>> f(staff)
\new Staff {
    \clef "alto"
    \set Staff.instrumentName = \markup { Viola }
```

```
        \set Staff.shortInstrumentName = \markup { Va. }
        c'8
        d'8
        e'8
        f'8
    }
```

The viola targets staff context by default.

Read-only Properties

Viola.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Viola.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Viola.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Viola.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Viola.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Viola.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Viola.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Viola.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

Viola.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

Viola.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Viola.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Viola.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

Viola.**all_clefs**
Inherited from instrumenttools._Instrument

Viola.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

Viola.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Viola.**pitch_range**
Inherited from instrumenttools._Instrument

Viola.**primary_clefs**
Inherited from instrumenttools._Instrument

Viola.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Viola.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Viola.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Viola.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Viola.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Viola.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Viola.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Viola.**__call__**(**args*)
Inherited from marktools.Mark

Viola.**__delattr__**(**args*)
Inherited from marktools.Mark

Viola.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Viola.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Viola.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Viola.**__hash__**()
Inherited from contexttools.InstrumentMark

Viola.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Viola.__lt__(*arg*)
Abjad objects by default do not implement this method.

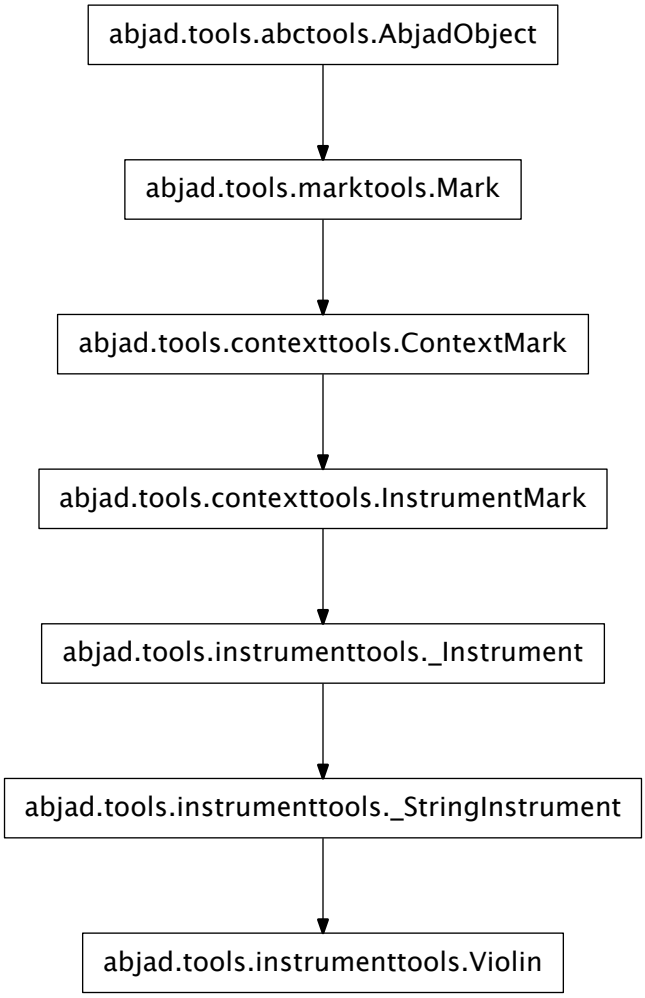
Raise exception.

Inherited from abctools.AbjadObject

Viola.__ne__(*arg*)
Inherited from marktools.Mark

Viola.__repr__()
Inherited from marktools.Mark

instrumenttools.Violin



class instrumenttools.**Violin**(***kwargs*)

New in version 2.0. Abjad model of the violin:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.Violin()(staff)
Violin()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Violin }
    \set Staff.shortInstrumentName = \markup { Vn. }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

The violin targets staff context by default.

Read-only Properties

Violin.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Violin.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Violin.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Violin.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Violin.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Violin.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Violin.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Violin.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

Violin.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

Violin.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Violin.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Violin.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

Violin.**all_clefs**
Inherited from instrumenttools._Instrument

Violin.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

Violin.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Violin.**pitch_range**
Inherited from instrumenttools._Instrument

Violin.**primary_clefs**
Inherited from instrumenttools._Instrument

Violin.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Violin.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Violin.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Violin.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Violin.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Violin.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Violin.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Violin.**__call__**(**args*)
Inherited from marktools.Mark

Violin.**__delattr__**(**args*)
Inherited from marktools.Mark

Violin.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Violin.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Violin.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Violin.**__hash__**()
Inherited from contexttools.InstrumentMark

Violin.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Violin.__lt__(*arg*)
Abjad objects by default do not implement this method.

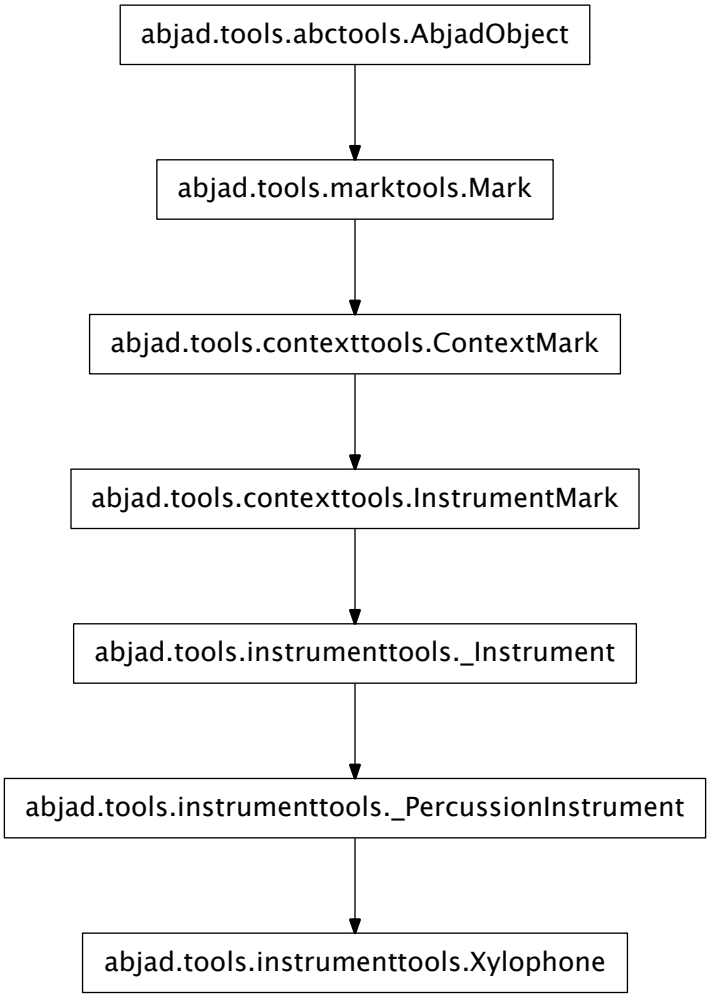
Raise exception.

Inherited from abctools.AbjadObject

Violin.__ne__(*arg*)
Inherited from marktools.Mark

Violin.__repr__()
Inherited from marktools.Mark

instrumenttools.Xylophone



class instrumenttools.**Xylophone**(***kwargs*)

New in version 2.0. Abjad model of the xylphone:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> instrumenttools.Xylophone()(staff)
Xylophone()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Xylophone }
    \set Staff.shortInstrumentName = \markup { Xyl. }
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

The xylophone targets staff context by default.

Read-only Properties

Xylophone.**default_instrument_name**
Read-only default instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Xylophone.**default_short_instrument_name**
Read-only default short instrument name.

Return string.

Inherited from contexttools.InstrumentMark

Xylophone.**effective_context**
Read-only reference to effective context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.effective_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Xylophone.**interval_of_transposition**
Read-only interval of transposition.

Return melodic diatonic interval.

Inherited from instrumenttools._Instrument

Xylophone.**is_primary_instrument**
Inherited from instrumenttools._Instrument

Xylophone.**is_secondary_instrument**
Inherited from instrumenttools._Instrument

Xylophone.**is_transposing**
True when instrument is transposing. False otherwise.

Return boolean.

Inherited from instrumenttools._Instrument

Xylophone.**lilypond_format**
Read-only LilyPond input format of instrument mark:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.lilypond_format
['\set Staff.instrumentName = \markup { Flute }',
    '\set Staff.shortInstrumentName = \markup { Fl. }']
```

Return list.

Inherited from contexttools.InstrumentMark

Xylophone.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

Xylophone.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Xylophone.**target_context**
Read-only reference to target context of context mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.target_context is None
True
```

Return context mark or none.

Inherited from contexttools.ContextMark

Xylophone.**traditional_pitch_range**
Read-only traditional pitch range.

Return pitch range.

Inherited from instrumenttools._Instrument

Read/write Properties

Xylophone.**all_clefs**
Inherited from instrumenttools._Instrument

Xylophone.**instrument_name**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name
'Flute'
```

Set instrument name:

```
>>> instrument.instrument_name = 'Alto Flute'
>>> instrument.instrument_name
'Alto Flute'
```

Return string.

Inherited from contexttools.InstrumentMark

Xylophone.**instrument_name_markup**
Get instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.instrument_name_markup
Markup(('Flute',))
```

Set instrument name:

```
>>> instrument.instrument_name_markup = 'Alto Flute'
>>> instrument.instrument_name_markup
Markup(('Alto Flute',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Xylophone.**pitch_range**
Inherited from instrumenttools._Instrument

Xylophone.**primary_clefs**
Inherited from instrumenttools._Instrument

Xylophone.**short_instrument_name**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name
'Fl.'
```

Set short instrument name:

```
>>> instrument.short_instrument_name = 'Alto Fl.'
>>> instrument.short_instrument_name
'Alto Fl.'
```

Return string.

Inherited from contexttools.InstrumentMark

Xylophone.**short_instrument_name_markup**
Get short instrument name:

```
>>> instrument = contexttools.InstrumentMark('Flute', 'Fl.')
>>> instrument.short_instrument_name_markup
Markup(('Fl.',))
```

Set short instrument name:

```
>>> instrument.short_instrument_name_markup = 'Alto Fl.'
>>> instrument.short_instrument_name_markup
Markup(('Alto Fl.',))
```

Return markup.

Inherited from contexttools.InstrumentMark

Xylophone.**sounding_pitch_of_fingered_middle_c**
Inherited from instrumenttools._Instrument

Methods

Xylophone.**attach**(*start_component*)
Make sure no context mark of same type is already attached to score component that starts with start component.

Inherited from contexttools.ContextMark

Xylophone.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> context_mark = contexttools.ContextMark()(note)

>>> context_mark.start_component
Note("c'4")

>>> context_mark.detach()
ContextMark()

>>> context_mark.start_component is None
True
```

Return context mark.

Inherited from contexttools.ContextMark

Xylophone.**get_default_performer_name**(*locale=None*)
New in version 2.5. Get default player name.

Available values for *locale* are 'en-us' and 'en-uk'.

Inherited from instrumenttools._Instrument

Xylophone.**get_performer_names**()
New in version 2.5. Get performer names.

Inherited from instrumenttools._Instrument

Special Methods

Xylophone.**__call__**(**args*)
Inherited from marktools.Mark

Xylophone.**__delattr__**(**args*)
Inherited from marktools.Mark

Xylophone.**__eq__**(*arg*)
Inherited from contexttools.InstrumentMark

Xylophone.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Xylophone.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Xylophone.**__hash__**()
Inherited from contexttools.InstrumentMark

Xylophone.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Xylophone.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Xylophone.**__ne__**(*arg*)
Inherited from marktools.Mark

Xylophone.**__repr__**()
Inherited from marktools.Mark

functions

instrumenttools.default_instrument_name_to_instrument_class

instrumenttools.**default_instrument_name_to_instrument_class**(*default_instrument_name*)
New in version 2.5. Change *default_instrument_name* to class name:

```
>>> instrumenttools.default_instrument_name_to_instrument_class('clarinet in E-flat')
<class 'abjad.tools.instrumenttools.EFlatClarinet.EFlatClarinet.EFlatClarinet'>
```

Return class.

When *default_instrument_name* matches no instrument class:

```
>>> instrumenttools.default_instrument_name_to_instrument_class('foo') is None
True
```

Return none.

instrumenttools.iterate_notes_and_chords_in_expr_outside_traditional_instrument_ranges

instrumenttools.**iterate_notes_and_chords_in_expr_outside_traditional_instrument_ranges**(*expr*)
New in version 2.0. Iterate notes and chords in *expr* outside traditional instrument ranges:

```
>>> staff = Staff("c'8 r8 <d fs>8 r8")
>>> instrumenttools.Violin()(staff)
Violin()(Staff{4})

>>> list(
... instrumenttools.iterate_notes_and_chords_in_expr_outside_traditional_instrument_ranges(
... staff))
[Chord('<d fs>8')]
```

Return generator.

instrumenttools.list_instrument_names

instrumenttools.**list_instrument_names**()

New in version 2.5. List instrument names:

```
>>> for instrument_name in instrumenttools.list_instrument_names():
...     instrument_name
...
'accordion'
'alto flute'
'alto saxophone'
'alto trombone'
'clarinet in B-flat'
'baritone saxophone'
'baritone voice'
'bass clarinet'
'bass flute'
'bass saxophone'
'bass trombone'
'bass voice'
'bassoon'
'cello'
'clarinet in A'
'contrabass'
'contrabass clarinet'
'contrabass flute'
'contrabass saxophone'
'contrabassoon'
'contralto voice'
'clarinet in E-flat'
'English horn'
'flute'
'horn'
'glockenspiel'
'guitar'
'harp'
'harpsichord'
'marimba'
'mezzo-soprano voice'
'oboe'
'piano'
'piccolo'
'sopranino saxophone'
'soprano saxophone'
'soprano voice'
'tenor saxophone'
'tenor trombone'
'tenor voice'
'trumpet'
'tuba'
'untuned percussion'
'vibraphone'
'viola'
'violin'
'xylophone'
```

Return list.

instrumenttools.list_instruments

instrumenttools.**list_instruments**(*klasses=None*)

New in version 2.5. List instruments in `instrumenttools` module:

```
>>> for instrument in instrumenttools.list_instruments()[:5]:
...     instrument
...
<class 'abjad.tools.instrumenttools.Accordion.Accordion.Accordion'>
<class 'abjad.tools.instrumenttools.AltoFlute.AltoFlute.AltoFlute'>
<class 'abjad.tools.instrumenttools.AltoSaxophone.AltoSaxophone.AltoSaxophone'>
<class 'abjad.tools.instrumenttools.AltoTrombone.AltoTrombone.AltoTrombone'>
<class 'abjad.tools.instrumenttools.BFlatClarinet.BFlatClarinet.BFlatClarinet'>
```

Return list.

instrumenttools.list_primary_instruments

instrumenttools.**list_primary_instruments**()

New in version 2.5. List primary instruments:

```
>>> for primary_instrument in instrumenttools.list_primary_instruments():
...     primary_instrument
...
<class 'abjad.tools.instrumenttools.Accordion.Accordion.Accordion'>
<class 'abjad.tools.instrumenttools.AltoSaxophone.AltoSaxophone.AltoSaxophone'>
<class 'abjad.tools.instrumenttools.BFlatClarinet.BFlatClarinet.BFlatClarinet'>
<class 'abjad.tools.instrumenttools.BaritoneVoice.BaritoneVoice.BaritoneVoice'>
<class 'abjad.tools.instrumenttools.BassVoice.BassVoice.BassVoice'>
<class 'abjad.tools.instrumenttools.Bassoon.Bassoon.Bassoon'>
<class 'abjad.tools.instrumenttools.Cello.Cello.Cello'>
<class 'abjad.tools.instrumenttools.Contrabass.Contrabass.Contrabass'>
<class 'abjad.tools.instrumenttools.ContraltoVoice.ContraltoVoice.ContraltoVoice'>
<class 'abjad.tools.instrumenttools.Flute.Flute.Flute'>
<class 'abjad.tools.instrumenttools.FrenchHorn.FrenchHorn.FrenchHorn'>
<class 'abjad.tools.instrumenttools.Guitar.Guitar.Guitar'>
<class 'abjad.tools.instrumenttools.Harp.Harp.Harp'>
<class 'abjad.tools.instrumenttools.Harpsichord.Harpsichord.Harpsichord'>
<class 'abjad.tools.instrumenttools.MezzoSopranoVoice.MezzoSopranoVoice.MezzoSopranoVoice'>
<class 'abjad.tools.instrumenttools.Oboe.Oboe.Oboe'>
<class 'abjad.tools.instrumenttools.Piano.Piano.Piano'>
<class 'abjad.tools.instrumenttools.SopranoVoice.SopranoVoice.SopranoVoice'>
<class 'abjad.tools.instrumenttools.TenorTrombone.TenorTrombone.TenorTrombone'>
<class 'abjad.tools.instrumenttools.TenorVoice.TenorVoice.TenorVoice'>
<class 'abjad.tools.instrumenttools.Trumpet.Trumpet.Trumpet'>
<class 'abjad.tools.instrumenttools.Tuba.Tuba.Tuba'>
<class 'abjad.tools.instrumenttools.Viola.Viola.Viola'>
<class 'abjad.tools.instrumenttools.Violin.Violin.Violin'>
```

Return list

instrumenttools.list_secondary_instruments

instrumenttools.**list_secondary_instruments**()

New in version 2.5. List secondary instruments:

```
>>> for secondary_instrument in instrumenttools.list_secondary_instruments()[:5]:
...     secondary_instrument
...
<class 'abjad.tools.instrumenttools.AltoFlute.AltoFlute.AltoFlute'>
<class 'abjad.tools.instrumenttools.AltoTrombone.AltoTrombone.AltoTrombone'>
<class 'abjad.tools.instrumenttools.BaritoneSaxophone.BaritoneSaxophone.BaritoneSaxophone'>
<class 'abjad.tools.instrumenttools.BassClarinet.BassClarinet.BassClarinet'>
<class 'abjad.tools.instrumenttools.BassFlute.BassFlute.BassFlute'>
```

Return list

instrumenttools.notes_and_chords_in_expr_are_on_expected_clefs

instrumenttools.**notes_and_chords_in_expr_are_on_expected_clefs**(*expr*, *percussion_clef_is_allowed=True*)

New in version 2.0. True when notes and chords in *expr* are on expected clefs:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('treble')(staff)
ClefMark('treble')(Staff{4})
>>> instrumenttools.Violin()(staff)
Violin()(Staff{4})

>>> instrumenttools.notes_and_chords_in_expr_are_on_expected_clefs(staff)
True
```

False otherwise:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('alto')(staff)
ClefMark('alto')(Staff{4})
>>> instrumenttools.Violin()(staff)
Violin()(Staff{4})

>>> instrumenttools.notes_and_chords_in_expr_are_on_expected_clefs(staff)
False
```

Allow percussion clef when *percussion_clef_is_allowed* is true:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.ClefMark('percussion')(staff)
ClefMark('percussion')(Staff{4})
>>> instrumenttools.Violin()(staff)
Violin()(Staff{4})

>>> f(staff)
\new Staff {
    \clef "percussion"
    \set Staff.instrumentName = \markup { Violin }
    \set Staff.shortInstrumentName = \markup { Vn. }
    c'8
    d'8
    e'8
    f'8
}
```

```
>>> instrumenttools.notes_and_chords_in_expr_are_on_expected_clefs(
...     staff, percussion_clef_is_allowed=True)
True
```

Disallow percussion clef when *percussion_clef_is_allowed* is false:

```
>>> instrumenttools.notes_and_chords_in_expr_are_on_expected_clefs(
...     staff, percussion_clef_is_allowed=False)
False
```

Return boolean.

instrumenttools.notes_and_chords_in_expr_are_within_traditional_instrument_ranges

instrumenttools.**notes_and_chords_in_expr_are_within_traditional_instrument_ranges**(*expr*)

New in version 2.0. True when notes and chords in *expr* are within traditional instrument ranges:

```
>>> staff = Staff("c'8 r8 <d' fs'>8 r8")
>>> instrumenttools.Violin()(staff)
Violin()(Staff{4})

>>> instrumenttools.notes_and_chords_in_expr_are_within_traditional_instrument_ranges(
...     staff)
True
```

False otherwise:

```
>>> staff = Staff("c'8 r8 <d fs>8 r8")
>>> instrumenttools.Violin()(staff)
Violin()(Staff{4})

>>> instrumenttools.notes_and_chords_in_expr_are_within_traditional_instrument_ranges(
...     staff)
False
```

Return boolean.

instrumenttools.transpose_from_fingered_pitch_to_sounding_pitch

instrumenttools.**transpose_from_fingered_pitch_to_sounding_pitch**(*expr*)

New in version 2.0. Transpose notes and chords in *expr* from sounding pitch to fingered pitch:

```
>>> staff = Staff("<c' e' g'>4 d'4 r4 e'4")
>>> instrumenttools.BFlatClarinet()(staff)
BFlatClarinet()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Clarinet in B-flat }
    \set Staff.shortInstrumentName = \markup { Cl. in B-flat }
    <c' e' g'>4
    d'4
    r4
    e'4
}
```

```
>>> for leaf in staff.leaves:
...     leaf.written_pitch_indication_is_at_sounding_pitch = False

>>> instrumenttools.transpose_from_fingered_pitch_to_sounding_pitch(staff)

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Clarinet in B-flat }
    \set Staff.shortInstrumentName = \markup { Cl. in B-flat }
    <bf d' f'>4
    c'4
    r4
    d'4
}
```

Return none.

instrumenttools.transpose_from_sounding_pitch_to_fingered_pitch

instrumenttools.**transpose_from_sounding_pitch_to_fingered_pitch**(*expr*)

New in version 2.0. Transpose notes and chords in *expr* from sounding pitch to fingered pitch:

```
>>> staff = Staff("<c' e' g'>4 d'4 r4 e'4")
>>> instrumenttools.BFlatClarinet()(staff)
BFlatClarinet()(Staff{4})

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Clarinet in B-flat }
    \set Staff.shortInstrumentName = \markup { Cl. in B-flat }
    <c' e' g'>4
    d'4
    r4
    e'4
}

>>> instrumenttools.transpose_from_sounding_pitch_to_fingered_pitch(staff)

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Clarinet in B-flat }
    \set Staff.shortInstrumentName = \markup { Cl. in B-flat }
    <d' fs' a'>4
    e'4
    r4
    fs'4
}
```

Return none.

iotools

functions

iotools.clear_terminal

iotools.**clear_terminal**()
New in version 2.0. Run `clear` if OS is POSIX-compliant (UNIX / Linux / MacOS).

Run `cls` if OS is not POSIX-compliant (Windows):

```
>>> iotools.clear_terminal()
```

Return none.

iotools.f

iotools.**f**(*expr*)
Format *expr* and print to standard out:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}
```

Return none.

iotools.get_last_output_file_name

iotools.**get_last_output_file_name**()
Get last output file name like `6222.ly`.

Return string.

iotools.get_next_output_file_name

iotools.**get_next_output_file_name**()
Get next output file name like `6223.ly`.

Return string.

iotools.log

iotools.**log**()
Open the LilyPond log file in operating system-specific text editor:

```
>>> iotools.log()
```

```
GNU LilyPond 2.12.2
Processing `0440.ly'
Parsing...
Interpreting music...
Preprocessing graphical objects...
Finding the ideal number of pages...
Fitting music on 1 page...
Drawing systems...
Layout output to `0440.ps'...
Converting to `./0440.pdf'...
```

Exit text editor in the usual way.

Return none.

iotools.ly

iotools.**ly**(*target=-1*)

Open the last LilyPond output file in text editor:

```
>>> iotools.ly()
```

```
% Abjad revision 2162
% 2009-05-31 14:29

\version "2.12.2"
\include "english.ly"
\include "/Path/to/abjad/trunk/abjad/cfg/abjad.scm"

{
    c'4
}
```

Open the next-to-last LilyPond output file in text editor:

```
>>> iotools.ly(-2)
```

Exit text editor in the usual way.

Return none.

iotools.p

iotools.**p**(**args*)

New in version 2.7. Parse *args* as LilyPond string:

```
>>> p("{c'4 d'4 e'4 f'4}")
{c'4, d'4, e'4, f'4}
```

```
>>> container = _
>>> f(container)
{
    c'4
    d'4
    e'4
    f'4
}
```

A pitch-name language may also be specified.

```
>>> p("{c'8 des' e' fis'}", 'nederlands')
{c'8, df'8, e'8, fs'8}
```

Return Abjad expression.

iotools.pdf

iotools.**pdf**(*target=-1*)

Open the last PDF generated by Abjad with `iotools.pdf()`.

Open the next-to-last PDF generated by Abjad with `iotools.pdf(-2)`.

Return none.

Abjad writes PDFs to the `~/.abjad/output` directory by default.

You may change this by setting the `abjad_output` variable in the `config.py` file.

iotools.play

iotools.**play**(*expr*)

Play *expr*:

```
>>> note = Note("c'4")
```

```
>>> iotools.play(note)
```

This input creates and opens a one-note MIDI file.

Abjad outputs MIDI files of the format `filename.mid` under Windows.

Abjad outputs MIDI files of the format `filename.midi` under other operating systems.

iotools.profile_expr

iotools.**profile_expr**(*expr*, *sort_by='cum'*, *num_lines=12*, *strip_dirs=True*)

Profile *expr*:

```
>>> iotools.profile_expr('Staff(notetools.make_repeated_notes(8))')
Tue Apr  5 20:32:40 2011    _tmp_abj_profile

         2852 function calls (2829 primitive calls) in 0.006 CPU seconds

   Ordered by: cumulative time
   List reduced from 118 to 12 due to restriction <12>

   ncalls  tottime  percall  cumtime  percall filename:lineno(function)
        1    0.000    0.000    0.006    0.006 <string>:1(<module>)
        1    0.000    0.000    0.003    0.003 make_repeated_notes.py:5(make_repeated
        1    0.001    0.001    0.003    0.003 make_notes.py:12(make_notes)
        1    0.000    0.000    0.003    0.003 Staff.py:21(__init__)
        1    0.000    0.000    0.003    0.003 Context.py:11(__init__)
        1    0.000    0.000    0.003    0.003 Container.py:23(__init__)
        1    0.000    0.000    0.003    0.003 Container.py:271(_initialize_music)
        2    0.000    0.000    0.002    0.001 all_are_thread_contiguous_components.p
```

```
    52    0.001    0.000    0.002    0.000 component_to_thread_signature.py:5(com
     1    0.000    0.000    0.002    0.002 _construct_unprolated_notes.py:4(_cons
     8    0.000    0.000    0.002    0.000 make_tied_note.py:5(make_tied_note)
     8    0.000    0.000    0.002    0.000 make_tied_leaf.py:5(make_tied_leaf)
```

Function wraps the built-in Python `cProfile` module.

Set *expr* to any string of Abjad input.

Set *sort_by* to *'cum'*, *'time'* or *'calls'*.

Set *num_lines* to any positive integer.

Set *strip_dirs* to `True` to strip directory names from output lines.

Note: This function fails on some Linux distros. Some Linux distributions do not include the Python `pstats` module.

Note: This function creates the file `_tmp_abj_profile` in the directory from which it is run.

Note: For information on reading the output of the different Python profilers, see the Python docs.

Changed in version 2.0: renamed `check.profile()` to `iotools.profile_expr()`.

iotools.redo

`iotools.`**`redo`**(*target=-1*, *lily_time=10*)

Rerender the last `.ly` file created in Abjad and then show the resulting PDF:

```
>>> iotools.redo()
```

Rerender the next-to-last `.ly` file created in Abjad and then show the resulting PDF:

```
>>> iotools.redo(-2)
```

Return none.

iotools.save_last_ly_as

`iotools.`**`save_last_ly_as`**(*file_name*)

New in version 2.0. Save last ly file as *file_name*:

```
>>> iotools.save_last_ly_as('/project/output/example-1.ly')
```

Return none.

iotools.save_last_pdf_as

`iotools.`**`save_last_pdf_as`**(*file_name*)

New in version 2.0. Save last PDF as *file_name*:

```
>>> iotools.save_last_pdf_as('/project/output/example-1.pdf')
```

Return none.

iotools.show

iotools.**show**(*expr*, *return_timing=False*, *suppress_pdf=False*, *docs=False*)

Show *expr*:

```
>>> note = Note("c'4")
>>> show(note)
```

Show *expr* and return both Abjad and LilyPond processing time in seconds:

```
>>> staff = Staff(Note("c'4") * 200)
>>> show(note, return_timing=True)
(0, 3)
```

Wrap *expr* in a LilyPond file with settings and overrides suitable for the Abjad reference manual When *docs* is true.

Return none or timing tuple.

Abjad writes LilyPond input files to the `~/.abjad/output` directory by default.

You may change this by setting the `abjad_output` variable in the `config.py` file.

iotools.spawn_subprocess

iotools.**spawn_subprocess**(*command*)

New in version 2.9. Spawn subprocess, run *command*, redirect stderr to stdout and print result:

```
>>> iotools.spawn_subprocess('echo "hello world"')
hello world
```

The function is basically a reimplementation of the deprecated `os.system()` using Python's `subprocess` module.

The function provides a type of shell access from the Abjad interpreter.

Return none.

iotools.write_expr_to_ly

iotools.**write_expr_to_ly**(*expr*, *file_name*, *print_status=False*, *tagline=False*, *docs=False*)

Write *expr* to *file_name*:

```
>>> note = Note("c'4")
>>> iotools.write_expr_to_ly(note, '/home/user/foo.ly')
```

Return none. Changed in version 2.0: renamed `io.write_ly()` to `io.write_expr_to_ly()`.

iotools.write_expr_to_pdf

iotools.**write_expr_to_pdf**(*expr*, *file_name*, *print_status=False*, *tagline=False*)

Write *expr* to pdf *file_name*:

```
>>> note = Note("c'4")
>>> iotools.write_expr_to_pdf(note, 'one_note.pdf')
```

Return none.

iotools.z

iotools.**z**(*expr*)

New in version 2.8. Print the tools package-qualified indented repr of *z*.

iterationtools

functions

iterationtools.iterate_chords_in_expr

iterationtools.**iterate_chords_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate chords forward in *expr*:

```
>>> staff = Staff("<e' g' c''>8 a'8 r8 <d' f' b'>8 r2")

>>> f(staff)
\new Staff {
    <e' g' c''>8
    a'8
    r8
    <d' f' b'>8
    r2
}

>>> for chord in iterationtools.iterate_chords_in_expr(staff):
...     chord
Chord("<e' g' c''>8")
Chord("<d' f' b'>8")
```

Iterate chords backward in *expr*:

::

```
>>> for chord in iterationtools.iterate_chords_in_expr(staff, reverse=True):
...     chord
Chord("<d' f' b'>8")
Chord("<e' g' c''>8")
```

Ignore threads.

Return generator.

iterationtools.iterate_components_and_grace_containers_in_expr

iterationtools.**iterate_components_and_grace_containers_in_expr**(*expr*, *klass*)

Iterate components of *klass* forward in *expr*:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(voice[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> grace_notes = [Note("c'16"), Note("d'16")]
>>> gracetools.GraceContainer(grace_notes, kind='grace')(voice[1])
Note("d'8")

>>> after_grace_notes = [Note("e'16"), Note("f'16")]
>>> gracetools.GraceContainer(after_grace_notes, kind='after')(voice[1])
Note("d'8")

>>> f(voice)
\new Voice {
    c'8 [
    \grace {
        c'16
        d'16
    }
    \afterGrace
    d'8
    {
        e'16
        f'16
    }
    e'8
    f'8 ]
}

>>> x = iterationtools.iterate_components_and_grace_containers_in_expr(voice, Note)
>>> for note in x:
...     note
...
Note("c'8")
Note("c'16")
Note("d'16")
Note("d'8")
Note("e'16")
Note("f'16")
Note("e'8")
Note("f'8")
```

Include grace leaves before main leaves.

Include grace leaves after main leaves. Changed in version 2.0: renamed `iterate.grace()` to `componenttools.iterate_components_and_grace_containers_in_expr()`.

iterationtools.iterate_components_depth_first

iterationtools.**iterate_components_depth_first**(*component*, *capped=True*, *unique=True*, *forbid=None*, *direction='left'*)

New in version 1.1. Iterate components depth-first from *component*.

Todo

Add usage examples.

Changed in version 2.0: renamed `iterate.depth_first()` to `iterationtools.iterate_components_depth_first()`.

iterationtools.iterate_components_in_expr

`iterationtools.`**`iterate_components_in_expr`**(*expr*, *klass=None*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate components forward in *expr*.

iterationtools.iterate_containers_in_expr

`iterationtools.`**`iterate_containers_in_expr`**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate containers forward in *expr*:

```
>>> staff = Staff([Voice("c'8 d'8"), Voice("e'8 f'8 g'8")])
>>> Tuplet(Fraction(2, 3), staff[1][:])
Tuplet(2/3, [e'8, f'8, g'8])
>>> staff.is_parallel = True

>>> f(staff)
\new Staff <<
    \new Voice {
        c'8
        d'8
    }
    \new Voice {
        \times 2/3 {
            e'8
            f'8
            g'8
        }
    }
>>

>>> for x in iterationtools.iterate_containers_in_expr(staff):
...     x
Staff<<2>>
Voice{2}
Voice{1}
Tuplet(2/3, [e'8, f'8, g'8])
```

Iterate containers backward in *expr*:

```
>>> for x in iterationtools.iterate_containers_in_expr(staff, reverse=True):
...     x
Staff<<2>>
Voice{1}
Tuplet(2/3, [e'8, f'8, g'8])
Voice{2}
```

Ignore threads.

Return generator.

iterationtools.iterate_contexts_in_expr

iterationtools.**iterate_contexts_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate contexts forward in *expr*:

```
>>> staff = Staff([Voice("c'8 d'8"), Voice("e'8 f'8 g'8")])
>>> Tuplet(Fraction(2, 3), staff[1][:])
Tuplet(2/3, [e'8, f'8, g'8])
>>> staff.is_parallel = True

>>> f(staff)
\new Staff <<
    \new Voice {
        c'8
        d'8
    }
    \new Voice {
        \times 2/3 {
            e'8
            f'8
            g'8
        }
    }
>>

>>> for x in iterationtools.iterate_contexts_in_expr(staff):
...     x
Staff<<2>>
Voice{2}
Voice{1}
```

Iterate contexts backward in *expr*:

```
>>> for x in iterationtools.iterate_contexts_in_expr(staff, reverse=True):
...     x
Staff<<2>>
Voice{1}
Voice{2}
```

Ignore threads.

Return generator.

iterationtools.iterate_leaf_pairs_in_expr

iterationtools.**iterate_leaf_pairs_in_expr**(*expr*)

New in version 2.0. Iterate leaf pairs forward in *expr*:

```
>>> score = Score([])
>>> notes = [Note("c'8"), Note("d'8"), Note("e'8"), Note("f'8"), Note("g'4")]
>>> score.append(Staff(notes))
>>> notes = [Note(x, (1, 4)) for x in [-12, -15, -17]]
>>> score.append(Staff(notes))
>>> contexttools.ClefMark('bass')(score[1])
ClefMark('bass')(Staff{3})
```

```
>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
        e'8
        f'8
        g'4
    }
    \new Staff {
        \clef "bass"
        c4
        a,4
        g,4
    }
>>
```

```
>>> for pair in iterationtools.iterate_leaf_pairs_in_expr(score):
...         pair
(Note("c'8"), Note('c4'))
(Note("c'8"), Note("d'8"))
(Note('c4'), Note("d'8"))
(Note("d'8"), Note("e'8"))
(Note("d'8"), Note('a,4'))
(Note('c4'), Note("e'8"))
(Note('c4'), Note('a,4'))
(Note("e'8"), Note('a,4'))
(Note("e'8"), Note("f'8"))
(Note('a,4'), Note("f'8"))
(Note("f'8"), Note("g'4"))
(Note("f'8"), Note('g,4'))
(Note('a,4'), Note("g'4"))
(Note('a,4'), Note('g,4'))
(Note("g'4"), Note('g,4'))
```

Iterate leaf pairs left-to-right and top-to-bottom.

Return generator.

iterationtools.iterate_leaves_in_expr

iterationtools.**iterate_leaves_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate leaves forward in *expr*:

```
>>> staff = Staff("abj: | 2/8 c'8 d'8 || 2/8 e'8 f'8 || 2/8 g'8 a'8 |")
>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
```

```
        g'8
        a'8
    }
}
```

```
>>> for leaf in iterationtools.iterate_leaves_in_expr(staff):
...     leaf
...
Note("c'8")
Note("d'8")
Note("e'8")
Note("f'8")
Note("g'8")
Note("a'8")
```

Use the optional *start* and *stop* keyword parameters to control the start and stop indices of iteration.

```
>>> for leaf in iterationtools.iterate_leaves_in_expr(staff, start=3):
...     leaf
...
Note("f'8")
Note("g'8")
Note("a'8")
```

```
>>> for leaf in iterationtools.iterate_leaves_in_expr(staff, start=0, stop=3):
...     leaf
...
Note("c'8")
Note("d'8")
Note("e'8")
```

```
>>> for leaf in iterationtools.iterate_leaves_in_expr(staff, start=2, stop=4):
...     leaf
...
Note("e'8")
Note("f'8")
```

Iterate leaves backward in *expr*:

```
>>> for leaf in iterationtools.iterate_leaves_in_expr(staff, reverse=True):
...     leaf
...
Note("a'8")
Note("g'8")
Note("f'8")
Note("e'8")
Note("d'8")
Note("c'8")
```

```
>>> for leaf in iterationtools.iterate_leaves_in_expr(staff, start=3, reverse=True):
...     leaf
...
Note("e'8")
Note("d'8")
Note("c'8")
```

```
>>> for leaf in iterationtools.iterate_leaves_in_expr(staff, start=0, stop=3, reverse=True):
...     leaf
...
```

```
Note("a'8")
Note("g'8")
Note("f'8")
```

```
>>> for leaf in iterationtools.iterate_leaves_in_expr(staff, start=2, stop=4, reverse=True):
...     leaf
...
Note("f'8")
Note("e'8")
```

Ignore threads.

Return generator.

iterationtools.iterate_measures_in_expr

iterationtools.**iterate_measures_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate measures forward in *expr*:

```
>>> staff = Staff("abj: | 2/8 c'8 d'8 || 2/8 e'8 f'8 || 2/8 g'8 a'8 |")
```

```
>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
    }
}
```

```
>>> for measure in iterationtools.iterate_measures_in_expr(staff):
...     measure
...
Measure(2/8, [c'8, d'8])
Measure(2/8, [e'8, f'8])
Measure(2/8, [g'8, a'8])
```

Use the optional *start* and *stop* keyword parameters to control the start and stop indices of iteration.

```
>>> for measure in iterationtools.iterate_measures_in_expr(staff, start=1):
...     measure
...
Measure(2/8, [e'8, f'8])
Measure(2/8, [g'8, a'8])
```

```
>>> for measure in iterationtools.iterate_measures_in_expr(staff, start=0, stop=2):
...     measure
...
Measure(2/8, [c'8, d'8])
Measure(2/8, [e'8, f'8])
```

Iterate measures backward in *expr*:

```
>>> for measure in iterationtools.iterate_measures_in_expr(staff, reverse=True):
...     measure
...
Measure(2/8, [g'8, a'8])
Measure(2/8, [e'8, f'8])
Measure(2/8, [c'8, d'8])
```

Use the optional *start* and *stop* keyword parameters to control indices of iteration.

```
>>> for measure in iterationtools.iterate_measures_in_expr(staff, start=1, reverse=True):
...     measure
...
Measure(2/8, [e'8, f'8])
Measure(2/8, [c'8, d'8])

>>> for measure in iterationtools.iterate_measures_in_expr(staff, start=0, stop=2, reverse=True)
...     measure
...
Measure(2/8, [g'8, a'8])
Measure(2/8, [e'8, f'8])
```

Ignore threads.

Return generator.

iterationtools.iterate_namesakes_from_component

iterationtools.**iterate_namesakes_from_component**(*component*, *reverse=False*, *start=0*, *stop=None*)

New in version 1.1. Iterate namesakes forward from *component*:

```
>>> container = Container(Staff(notetools.make_repeated_notes(2)) * 2)
>>> container.is_parallel = True
>>> container[0].name = 'staff 1'
>>> container[1].name = 'staff 2'
>>> score = Score([])
>>> score.is_parallel = False
>>> score.extend(container * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(score)

>>> f(score)
\new Score {
    <<
        \context Staff = "staff 1" {
            c'8
            d'8
        }
        \context Staff = "staff 2" {
            e'8
            f'8
        }
    >>
    <<
        \context Staff = "staff 1" {
            g'8
            a'8
```

```
            }
            \context Staff = "staff 2" {
                b'8
                c''8
            }
        >>
    }
```

```
>>> for staff in iterationtools.iterate_namesakes_from_component(score[0][0]):
...     print staff.lilypond_format
...
\context Staff = "staff 1" {
    c'8
    d'8
}
\context Staff = "staff 1" {
    g'8
    a'8
}
```

Iterate namesakes backward from *component*:

::

```
>>> for staff in iterationtools.iterate_namesakes_from_component(score[-1][0], reverse=True):
...     print staff.lilypond_format
...
\context Staff = "staff 1" {
    g'8
    a'8
}
\context Staff = "staff 1" {
    c'8
    d'8
}
```

Return generator.

iterationtools.iterate_notes_and_chords_in_expr

iterationtools.**iterate_notes_and_chords_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate notes and chords forward in *expr*:

```
>>> staff = Staff("<e' g' c''>8 a'8 r8 <d' f' b'>8 r2")
```

```
>>> f(staff)
\new Staff {
    <e' g' c''>8
    a'8
    r8
    <d' f' b'>8
    r2
}
```

```
>>> for leaf in iterationtools.iterate_notes_and_chords_in_expr(staff):
...   leaf
Chord("<e' g' c''>8")
```

```
Note("a'8")
Chord("<d' f' b'>8")
```

Iterate notes and chords backward in *expr*:

```
>>> for leaf in iterationtools.iterate_notes_and_chords_in_expr(staff, reverse=True):
...     leaf
Chord("<d' f' b'>8")
Note("a'8")
Chord("<e' g' c''>8")
```

Ignore threads.

Return generator.

iterationtools.iterate_notes_in_expr

iterationtools.**iterate_notes_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Yield left-to-right notes in *expr*:

```
>>> staff = Staff()
>>> staff.append(Measure((2, 8), "c'8 d'8"))
>>> staff.append(Measure((2, 8), "e'8 f'8"))
>>> staff.append(Measure((2, 8), "g'8 a'8"))

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
    }
}

>>> for note in iterationtools.iterate_notes_in_expr(staff):
...     note
...
Note("c'8")
Note("d'8")
Note("e'8")
Note("f'8")
Note("g'8")
Note("a'8")
```

Use optional *start* and *stop* keyword parameters to control start and stop indices of iteration:

```
>>> for note in iterationtools.iterate_notes_in_expr(staff, start=3):
...     note
...
Note("f'8")
```

```
Note("g'8")
Note("a'8")

>>> for note in iterationtools.iterate_notes_in_expr(staff, start=0, stop=3):
...     note
...
Note("c'8")
Note("d'8")
Note("e'8")

>>> for note in iterationtools.iterate_notes_in_expr(staff, start=2, stop=4):
...     note
...
Note("e'8")
Note("f'8")
```

Yield right-to-left notes in *expr*:

```
>>> staff = Staff()
>>> staff.append(Measure((2, 8), "c'8 d'8"))
>>> staff.append(Measure((2, 8), "e'8 f'8"))
>>> staff.append(Measure((2, 8), "g'8 a'8"))

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
    }
}

>>> for note in iterationtools.iterate_notes_in_expr(staff, reverse=True):
...     note
...
Note("a'8")
Note("g'8")
Note("f'8")
Note("e'8")
Note("d'8")
Note("c'8")
```

Use optional *start* and *stop* keyword parameters to control indices of iteration:

```
>>> for note in iterationtools.iterate_notes_in_expr(staff, reverse=True, start=3):
...     note
...
Note("e'8")
Note("d'8")
Note("c'8")
```

```
>>> for note in iterationtools.iterate_notes_in_expr(staff, reverse=True, start=0, stop=3):
...     note
...
Note("a'8")
Note("g'8")
Note("f'8")

>>> for note in iterationtools.iterate_notes_in_expr(staff, reverse=True, start=2, stop=4):
...     note
...
Note("f'8")
Note("e'8")
```

Ignore threads.

Return generator.

iterationtools.iterate_rests_in_expr

iterationtools.**iterate_rests_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate rests forward in *expr*:

```
>>> staff = Staff("<e' g' c''>8 a'8 r8 <d' f' b'>8 r2")

>>> f(staff)
\new Staff {
    <e' g' c''>8
    a'8
    r8
    <d' f' b'>8
    r2
}

>>> for rest in iterationtools.iterate_rests_in_expr(staff):
...   rest
Rest('r8')
Rest('r2')
```

Iterate rests backward in *expr*:

```
>>> for rest in iterationtools.iterate_rests_in_expr(staff, reverse=True):
...   rest
Rest('r2')
Rest('r8')
```

Ignore threads.

Return generator.

iterationtools.iterate_scores_in_expr

iterationtools.**iterate_scores_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate scores forward in *expr*:

```
>>> score_1 = Score([Staff("c'8 d'8 e'8 f'8")])
>>> score_2 = Score([Staff("c'1"), Staff("g'1")])
>>> scores = [score_1, score_2]
```

```
>>> for score in iterationtools.iterate_scores_in_expr(scores):
...     score
Score<<1>>
Score<<2>>
```

Iterate scores backward in *expr*:

::

```
>>> for score in iterationtools.iterate_scores_in_expr(scores, reverse=True):
...     score
Score<<2>>
Score<<1>>
```

Ignore threads.

Return generator.

iterationtools.iterate_semantic_voices_in_expr

iterationtools.**iterate_semantic_voices_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.0. Iterate semantic voices forward in *expr*:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(
...     [(3, 8), (5, 16), (5, 16)])
>>> meter_voice = Voice(measures)
>>> meter_voice.name = 'TimeSignatuerVoice'
>>> meter_voice.is_nonsemantic = True
>>> music_voice = Voice("c'4. d'4 e'16 f'4 g'16")
>>> music_voice.name = 'MusicVoice'
>>> staff = Staff([meter_voice, music_voice])
>>> staff.is_parallel = True

>>> f(staff)
\new Staff <<
    \context Voice = "TimeSignatuerVoice" {
        {
            \time 3/8
            s1 * 3/8
        }
        {
            \time 5/16
            s1 * 5/16
        }
        {
            s1 * 5/16
        }
    }
    \context Voice = "MusicVoice" {
        c'4.
        d'4
        e'16
        f'4
        g'16
    }
>>
```

```
>>> for voice in iterationtools.iterate_semantic_voices_in_expr(staff):
...     voice
Voice-"MusicVoice"{5}
```

Iterate semantic voices backward in *expr*:

```
>>> for voice in iterationtools.iterate_semantic_voices_in_expr(staff, reverse=True):
...     voice
Voice-"MusicVoice"{5}
```

Return generator.

iterationtools.iterate_skips_in_expr

iterationtools.**iterate_skips_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate skips forward in *expr*:

```
>>> staff = Staff("<e' g' c''>8 a'8 s8 <d' f' b'>8 s2")
```

```
>>> f(staff)
\new Staff {
    <e' g' c''>8
    a'8
    s8
    <d' f' b'>8
    s2
}
```

```
>>> for skip in iterationtools.iterate_skips_in_expr(staff):
...     skip
Skip('s8')
Skip('s2')
```

Iterate skips backwards in *expr*:

```
>>> for skip in iterationtools.iterate_skips_in_expr(staff, reverse=True):
...     skip
Skip('s2')
Skip('s8')
```

Ignore threads.

Return generator.

iterationtools.iterate_staves_in_expr

iterationtools.**iterate_staves_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate staves forward in *expr*:

```
>>> score = Score(4 * Staff([]))
```

```
>>> f(score)
\new Score <<
    \new Staff {
    }
    \new Staff {
    }
```

```
        \new Staff {
        }
        \new Staff {
        }
    >>

    >>> for staff in iterationtools.iterate_staves_in_expr(score):
    ...     staff
    ...
    Staff{}
    Staff{}
    Staff{}
    Staff{}
```

Iterate staves backward in *expr*:

::

```
    >>> for staff in iterationtools.iterate_staves_in_expr(score, reverse=True):
    ...     staff
    ...
    Staff{}
    Staff{}
    Staff{}
    Staff{}
```

Return generator.

iterationtools.iterate_thread_from_component

iterationtools.**iterate_thread_from_component**(*component*, *klass=None*, *reverse=False*)

New in version 2.10. Itearte thread forward from *component* and yield instances of *klass*:

```
    >>> container = Container(Voice(notetools.make_repeated_notes(2)) * 2)
    >>> container.is_parallel = True
    >>> container[0].name = 'voice 1'
    >>> container[1].name = 'voice 2'
    >>> staff = Staff(container * 2)
    >>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)

    >>> f(staff)
    \new Staff {
        <<
            \context Voice = "voice 1" {
                c'8
                d'8
            }
            \context Voice = "voice 2" {
                e'8
                f'8
            }
        >>
        <<
            \context Voice = "voice 1" {
                g'8
                a'8
            }
            \context Voice = "voice 2" {
```

```
            b'8
            c''8
        }
    >>
}
```

Starting from the first leaf in score.

```
>>> for x in iterationtools.iterate_thread_from_component(staff.leaves[0], Note):
...     x
...
Note("c'8")
Note("d'8")
Note("g'8")
Note("a'8")
```

Starting from the second leaf in score.

```
>>> for x in iterationtools.iterate_thread_from_component(staff.leaves[1], Note):
...     x
...
Note("d'8")
Note("g'8")
Note("a'8")
```

Yield all components in thread.

```
>>> for x in iterationtools.iterate_thread_from_component(staff.leaves[0]):
...     x
...
Note("c'8")
Voice-"voice 1"{2}
Note("d'8")
Voice-"voice 1"{2}
Note("g'8")
Note("a'8")
```

Iterate thread backward from *component* and yield instances of *klass*, starting from the last leaf in score.

```
>>> for x in iterationtools.iterate_thread_from_component(staff.leaves[-1], Note, reverse=True):
...     x
Note("c''8")
Note("b'8")
Note("f'8")
Note("e'8")
```

Yield all components in thread:

```
>>> for x in iterationtools.iterate_thread_from_component(staff.leaves[-1], reverse=True):
...     x
Note("c''8")
Voice-"voice 2"{2}
Note("b'8")
Voice-"voice 2"{2}
Note("f'8")
Note("e'8")
```

Return generator.

iterationtools.iterate_thread_in_expr

iterationtools.**iterate_thread_in_expr**(*expr*, *klass*, *containment_signature*, *reverse=False*)

New in version 2.10. Yield left-to-right instances of *klass* in *expr* with *containment_signature*:

```
>>> container = Container(Voice(notetools.make_repeated_notes(2)) * 2)
>>> container.is_parallel = True
>>> container[0].name = 'voice 1'
>>> container[1].name = 'voice 2'
>>> staff = Staff(container * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)

>>> f(staff)
\new Staff {
    <<
        \context Voice = "voice 1" {
            c'8
            d'8
        }
        \context Voice = "voice 2" {
            e'8
            f'8
        }
    >>
    <<
        \context Voice = "voice 1" {
            g'8
            a'8
        }
        \context Voice = "voice 2" {
            b'8
            c''8
        }
    >>
}

>>> signature = componenttools.component_to_containment_signature(staff.leaves[0])
>>> for x in iterationtools.iterate_thread_in_expr(staff, Note, signature):
...     x
...
Note("c'8")
Note("d'8")
Note("g'8")
Note("a'8")
```

Return generator.

iterationtools.iterate_timeline_from_component

iterationtools.**iterate_timeline_from_component**(*expr*, *klass=None*, *reverse=False*)

New in version 2.10. Iterate timeline forward from *component*:

```
>>> score = Score([])
>>> score.append(Staff(notetools.make_repeated_notes(4, Duration(1, 4))))
>>> score.append(Staff(notetools.make_repeated_notes(4)))
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(score)
```

```
>>> f(score)
\new Score <<
    \new Staff {
        c'4
        d'4
        e'4
        f'4
    }
    \new Staff {
        g'8
        a'8
        b'8
        c''8
    }
>>

>>> for leaf in iterationtools.iterate_timeline_from_component(score[1][2]):
...     leaf
...
Note("b'8")
Note("c''8")
Note("e'4")
Note("f'4")
```

Iterate timeline backward from *component*:

```
::

>>> for leaf in iterationtools.iterate_timeline_from_component(score[1][2], reverse=True):
...     leaf
...
Note("b'8")
Note("c'4")
Note("a'8")
Note("g'8")
```

Yield components sorted backward by score offset stop time when *reverse* is True.

Iterate leaves when *klass* is none.

Todo

optimize to avoid behind-the-scenes full-score traversal.

---

iterationtools.iterate_timeline_in_expr

iterationtools.**iterate_timeline_in_expr**(*expr*, *klass=None*, *reverse=False*)

New in version 2.10. Iterate timeline forward in *expr*:

```
>>> score = Score([])
>>> score.append(Staff(notetools.make_repeated_notes(4, Duration(1, 4))))
>>> score.append(Staff(notetools.make_repeated_notes(4)))
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(score)

>>> f(score)
\new Score <<
    \new Staff {
```

```
            c'4
            d'4
            e'4
            f'4
        }
        \new Staff {
            g'8
            a'8
            b'8
            c''8
        }
    >>
```

```
>>> for leaf in iterationtools.iterate_timeline_in_expr(score):
...     leaf
...
Note("c'4")
Note("g'8")
Note("a'8")
Note("d'4")
Note("b'8")
Note("c''8")
Note("e'4")
Note("f'4")
```

Iterate timeline backward in *expr*:

```
::
```

```
>>> for leaf in iterationtools.iterate_timeline_in_expr(score, reverse=True):
...     leaf
...
Note("f'4")
Note("e'4")
Note("d'4")
Note("c''8")
Note("b'8")
Note("c'4")
Note("a'8")
Note("g'8")
```

Iterate leaves when *klass* is none.

Todo

optimize to avoid behind-the-scenes full-score traversal.

---

iterationtools.iterate_tuplets_in_expr

iterationtools.**iterate_tuplets_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.10. Iterate tuplets forward in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")
>>> Tuplet(Fraction(2, 3), staff[:3])
Tuplet(2/3, [c'8, d'8, e'8])
>>> Tuplet(Fraction(2, 3), staff[-3:])
Tuplet(2/3, [a'8, b'8, c''8])
```

```
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8
        d'8
        e'8
    }
    f'8
    g'8
    \times 2/3 {
        a'8
        b'8
        c''8
    }
}
```

```
>>> for tuplet in iterationtools.iterate_tuplets_in_expr(staff):
...     tuplet
...
Tuplet(2/3, [c'8, d'8, e'8])
Tuplet(2/3, [a'8, b'8, c''8])
```

Iterate tuplets backward in *expr*:

```
>>> for tuplet in iterationtools.iterate_tuplets_in_expr(staff, reverse=True):
...     tuplet
...
Tuplet(2/3, [a'8, b'8, c''8])
Tuplet(2/3, [c'8, d'8, e'8])
```

Ignore threads.

Return generator.

iterationtools.iterate_voices_in_expr

iterationtools.**iterate_voices_in_expr**(*expr*, *reverse=False*, *start=0*, *stop=None*)

New in version 2.0. Iterate voices forward in *expr*:

```
>>> voice_1 = Voice("c'8 d'8 e'8 f'8")
>>> voice_2 = Voice("c'4 b4")
>>> staff = Staff([voice_1, voice_2])
>>> staff.is_parallel = True
```

```
>>> f(staff)
\new Staff <<
    \new Voice {
        c'8
        d'8
        e'8
        f'8
    }
    \new Voice {
        c'4
        b4
    }
>>
```

```
>>> for voice in iterationtools.iterate_voices_in_expr(staff):
...     voice
Voice{4}
Voice{2}
```

Iterate voices backward in *expr*:

::

```
>>> for voice in iterationtools.iterate_voices_in_expr(staff, reverse=True):
...     voice
Voice{2}
Voice{4}
```

Return generator.

labeltools

functions

labeltools.color_chord_note_heads_in_expr_by_pitch_class_color_map

labeltools.**color_chord_note_heads_in_expr_by_pitch_class_color_map**(*chord*, *color_map*)

New in version 2.0. Color *chord* note heads by pitch-class *color_map*:

```
>>> chord = Chord([12, 14, 18, 21, 23], (1, 4))

>>> pitches = [[-12, -10, 4], [-2, 8, 11, 17], [19, 27, 30, 33, 37]]
>>> colors = ['red', 'blue', 'green']
>>> color_map = pitchtools.NumberedChromaticPitchClassColorMap(pitches, colors)

>>> labeltools.color_chord_note_heads_in_expr_by_pitch_class_color_map(chord, color_map)
Chord("<c'' d'' fs'' a'' b''>4")

>>> f(chord)
<
    \tweak #'color #red
    c''
    \tweak #'color #red
    d''
    \tweak #'color #green
    fs''
    \tweak #'color #green
    a''
    \tweak #'color #blue
    b''
>4
```

Also works on notes:

```
>>> note = Note("c'4")

>>> labeltools.color_chord_note_heads_in_expr_by_pitch_class_color_map(note, color_map)
Note("c'4")
```

```
>>> f(note)
\once \override NoteHead #'color = #red
c'4
```

When *chord* is neither a chord nor note return *chord* unchanged:

```
>>> staff = Staff([])

>>> labeltools.color_chord_note_heads_in_expr_by_pitch_class_color_map(staff, color_map)
Staff{}
```

Return *chord*. Changed in version 2.0: renamed `chordtools.color_note_heads_by_pc()` to `labeltools.color_chord_note_heads_in_expr_by_pitch_class_color_map()`.

labeltools.color_contents_of_container

`labeltools.`**`color_contents_of_container`**(*container*, *color*)

New in version 2.0. Color contents of *container*:

```
>>> measure = Measure((2, 8), "c'8 d'8")

>>> labeltools.color_contents_of_container(measure, 'red')
Measure(2/8, [c'8, d'8])

>>> f(measure)
{
    \override Accidental #'color = #red
    \override Beam #'color = #red
    \override Dots #'color = #red
    \override NoteHead #'color = #red
    \override Rest #'color = #red
    \override Stem #'color = #red
    \override TupletBracket #'color = #red
    \override TupletNumber #'color = #red
    \time 2/8
    c'8
    d'8
    \revert Accidental #'color
    \revert Beam #'color
    \revert Dots #'color
    \revert NoteHead #'color
    \revert Rest #'color
    \revert Stem #'color
    \revert TupletBracket #'color
    \revert TupletNumber #'color
}
```

Return none. Changed in version 2.0: renamed `containertools.contents_color()` to `labeltools.color_contents_of_container()`.

labeltools.color_leaf

`labeltools.`**`color_leaf`**(*leaf*, *color*)

New in version 2.0. Color note:

```
>>> note = Note("c'4")

>>> labeltools.color_leaf(note, 'red')
Note("c'4")

>>> f(note)
\once \override Accidental #'color = #red
\once \override Dots #'color = #red
\once \override NoteHead #'color = #red
c'4
```

Color rest:

```
>>> rest = Rest('r4')

>>> labeltools.color_leaf(rest, 'red')
Rest('r4')

>>> f(rest)
\once \override Dots #'color = #red
\once \override Rest #'color = #red
r4
```

Color chord:

```
>>> chord = Chord("<c' e' bf'>4")

>>> labeltools.color_leaf(chord, 'red')
Chord("<c' e' bf'>4")

>>> f(chord)
\once \override Accidental #'color = #red
\once \override Dots #'color = #red
\once \override NoteHead #'color = #red
<c' e' bf'>4
```

Return *leaf*.

labeltools.color_leaves_in_expr

labeltools.**color_leaves_in_expr**(*expr*, *color*)

New in version 2.0. Color leaves in *expr*:

```
>>> staff = Staff("cs'8. [ r8. s8. <c' cs' a'>8. ]")

>>> f(staff)
\new Staff {
    cs'8. [
    r8.
    s8.
    <c' cs' a'>8. ]
}

>>> labeltools.color_leaves_in_expr(staff, 'red')

>>> f(staff)
\new Staff {
    \once \override Accidental #'color = #red
```

```
        \once \override Dots #'color = #red
        \once \override NoteHead #'color = #red
        cs'8. [
        \once \override Dots #'color = #red
        \once \override Rest #'color = #red
        r8.
        s8.
        \once \override Accidental #'color = #red
        \once \override Dots #'color = #red
        \once \override NoteHead #'color = #red
        <c' cs' a'>8. ]
    }
```

Return none.

labeltools.color_measure

labeltools.**color_measure**(*measure*, *color='red'*)

New in version 2.0. Color *measure* with *color*:

```
>>> measure = Measure((2, 8), "c'8 d'8")

>>> f(measure)
{
    \time 2/8
    c'8
    d'8
}

>>> labeltools.color_measure(measure, 'red')
Measure(2/8, [c'8, d'8])

>>> f(measure)
{
    \override Beam #'color = #red
    \override Dots #'color = #red
    \override NoteHead #'color = #red
    \override Staff.TimeSignature #'color = #red
    \override Stem #'color = #red
    \time 2/8
    c'8
    d'8
    \revert Beam #'color
    \revert Dots #'color
    \revert NoteHead #'color
    \revert Staff.TimeSignature #'color
    \revert Stem #'color
}
```

Return colored *measure*.

Color names appear in LilyPond Learning Manual appendix B.5.

labeltools.color_nonbinary_measures_in_expr

labeltools.**color_nonbinary_measures_in_expr**(*expr*, *color='red'*)

New in version 2.0. Color nonbinary measures in *expr* with *color*:

```
>>> staff = Staff(Measure((2, 8), "c'8 d'8") * 2)
>>> measuretools.scale_measure_denominator_and_adjust_measure_contents(staff[1], 3)
Measure(3/12, [c'8., d'8.])

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        \time 3/12
        \scaleDurations #'(2 . 3) {
            c'8.
            d'8.
        }
    }
}

>>> labeltools.color_nonbinary_measures_in_expr(staff, 'red')
[Measure(3/12, [c'8., d'8.])]

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        \override Beam #'color = #red
        \override Dots #'color = #red
        \override NoteHead #'color = #red
        \override Staff.TimeSignature #'color = #red
        \override Stem #'color = #red
        \time 3/12
        \scaleDurations #'(2 . 3) {
            c'8.
            d'8.
        }
        \revert Beam #'color
        \revert Dots #'color
        \revert NoteHead #'color
        \revert Staff.TimeSignature #'color
        \revert Stem #'color
    }
}
```

Return list of measures colored.

Color names appear in LilyPond Learning Manual appendix B.5.

labeltools.color_note_head_by_numbered_chromatic_pitch_class_color_map

labeltools.**color_note_head_by_numbered_chromatic_pitch_class_color_map**(*pitch_carrier*)

Color *pitch_carrier* note head:

```
>>> note = Note("c'4")

>>> labeltools.color_note_head_by_numbered_chromatic_pitch_class_color_map(note)
Note("c'4")

>>> f(note)
\once \override NoteHead #'color = #(x11-color 'red)
c'4
```

Numbered chromatic pitch-class color map:

```
0: red
1: MediumBlue
2: orange
3: LightSlateBlue
4: ForestGreen
5: MediumOrchid
6: firebrick
7: DeepPink
8: DarkOrange
9: IndianRed
10: CadetBlue
11: SeaGreen
12: LimeGreen
```

Numbered chromatic pitch-class color map can not be changed.

Raise type error when *pitch_carrier* is not a pitch carrier.

Raise extra pitch error when *pitch_carrier* carries more than 1 note head.

Raise missing pitch error when *pitch_carrier* carries no note head.

Return *pitch_carrier*. Changed in version 2.0: renamed `pitchtools.color_by_pc()` to `labeltools.color_note_head_by_numbered_chromatic_pitch_class_color_map()`.Changed in version 2.0: renamed `notetools.color_note_head_by_numeric_chromatic_pitch_class_color_map()` to `labeltools.color_note_head_by_numbered_chromatic_pitch_class_color_map()`.

labeltools.label_leaves_in_expr_with_inversion_equivalent_chromatic_interval_classes

`labeltools.`**`label_leaves_in_expr_with_inversion_equivalent_chromatic_interval_classes`**(*expr*, *markup_*

New in version 2.0. Label leaves in *expr* with inversion-equivalent chromatic interval classes:

```
>>> notes = notetools.make_notes([0, 25, 11, -4, -14, -13, 9, 10, 6, 5], [Duration(1, 8)])
>>> staff = Staff(notes)
>>> labeltools.label_leaves_in_expr_with_inversion_equivalent_chromatic_interval_classes(
...     staff)

>>> f(staff)
\new Staff {
    c'8 ^ \markup { 1 }
    cs'''8 ^ \markup { 2 }
    b'8 ^ \markup { 2 }
    af8 ^ \markup { 2 }
    bf,8 ^ \markup { 1 }
    b,8 ^ \markup { 2 }
    a'8 ^ \markup { 1 }
    bf'8 ^ \markup { 4 }
```

```
        fs'8 ^ \markup { 1 }
        f'8
    }
```

Return none.

labeltools.label_leaves_in_expr_with_leaf_depth

labeltools.**label_leaves_in_expr_with_leaf_depth**(*expr*, *markup_direction=Down*)

New in version 1.1. Label leaves in *expr* with leaf depth:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8")
>>> tuplettools.FixedDurationTuplet(Duration(2, 8), staff[-3:])
FixedDurationTuplet(1/4, [e'8, f'8, g'8])
>>> labeltools.label_leaves_in_expr_with_leaf_depth(staff)
>>> f(staff)
\new Staff {
    c'8 _ \markup { \small 1 }
    d'8 _ \markup { \small 1 }
    \times 2/3 {
        e'8 _ \markup { \small 2 }
        f'8 _ \markup { \small 2 }
        g'8 _ \markup { \small 2 }
    }
}
```

Changed in version 2.0: renamed `label.leaf_depth()` to `labeltools.label_leaves_in_expr_with_leaf_de`

Return none.

labeltools.label_leaves_in_expr_with_leaf_durations

labeltools.**label_leaves_in_expr_with_leaf_durations**(*expr*, *markup_direction=Down*)

New in version 1.1. Label leaves in *expr* with leaf durations:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(1, 4), "c'8 d'8 e'8")
>>> labeltools.label_leaves_in_expr_with_leaf_durations(tuplet)
>>> f(tuplet)
\times 2/3 {
    c'8 _ \markup { \column { \small 1/8 \small 1/12 } }
    d'8 _ \markup { \column { \small 1/8 \small 1/12 } }
    e'8 _ \markup { \column { \small 1/8 \small 1/12 } }
}
```

Label both written duration and prolated duration.

Return none.

labeltools.label_leaves_in_expr_with_leaf_indices

labeltools.**label_leaves_in_expr_with_leaf_indices**(*expr*, *markup_direction=Down*)

New in version 2.0. Label leaves in *expr* with leaf indices:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> labeltools.label_leaves_in_expr_with_leaf_indices(staff)
>>> f(staff)
```

```
\new Staff {
    c'8 _ \markup { \small 0 }
    d'8 _ \markup { \small 1 }
    e'8 _ \markup { \small 2 }
    f'8 _ \markup { \small 3 }
}
```

Return none.

labeltools.label_leaves_in_expr_with_leaf_numbers

labeltools.**label_leaves_in_expr_with_leaf_numbers**(*expr*, *markup_direction=Down*)

New in version 1.1. Label leaves in *expr* with leaf numbers:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> labeltools.label_leaves_in_expr_with_leaf_numbers(staff)
>>> f(staff)
\new Staff {
    c'8 _ \markup { \small 1 }
    d'8 _ \markup { \small 2 }
    e'8 _ \markup { \small 3 }
    f'8 _ \markup { \small 4 }
}
```

Number leaves starting from `1`. Changed in version 2.0: renamed `label.leaf_numbers()` to `labeltools.label_leaves_in_expr_with_leaf_numbers()`. Return none.

labeltools.label_leaves_in_expr_with_melodic_chromatic_interval_classes

labeltools.**label_leaves_in_expr_with_melodic_chromatic_interval_classes**(*expr*, *markup_direction=Up*)

New in version 2.0. Label leaves in *expr* with melodic chromatic interval classes:

```
>>> notes = notetools.make_notes([0, 25, 11, -4, -14, -13, 9, 10, 6, 5], [Duration(1, 8)])
>>> staff = Staff(notes)
>>> labeltools.label_leaves_in_expr_with_melodic_chromatic_interval_classes(staff)

>>> f(staff)
\new Staff {
    c'8 ^ \markup { +1 }
    cs'''8 ^ \markup { -2 }
    b'8 ^ \markup { -2 }
    af8 ^ \markup { -10 }
    bf,8 ^ \markup { +1 }
    b,8 ^ \markup { +10 }
    a'8 ^ \markup { +1 }
    bf'8 ^ \markup { -4 }
    fs'8 ^ \markup { -1 }
    f'8
}
```

Return none.

labeltools.label_leaves_in_expr_with_melodic_chromatic_intervals

labeltools.**label_leaves_in_expr_with_melodic_chromatic_intervals**(*expr*, *markup_direction=Up*)

New in version 2.0. Label leaves in *expr* with melodic chromatic intervals:

```
>>> notes = notetools.make_notes([0, 25, 11, -4, -14, -13, 9, 10, 6, 5], [Duration(1, 8)])
>>> staff = Staff(notes)
>>> labeltools.label_leaves_in_expr_with_melodic_chromatic_intervals(staff)

>>> f(staff)
\new Staff {
    c'8 ^ \markup { +25 }
    cs'''8 ^ \markup { -14 }
    b'8 ^ \markup { -15 }
    af8 ^ \markup { -10 }
    bf,8 ^ \markup { +1 }
    b,8 ^ \markup { +22 }
    a'8 ^ \markup { +1 }
    bf'8 ^ \markup { -4 }
    fs'8 ^ \markup { -1 }
    f'8
}
```

Return none.

labeltools.label_leaves_in_expr_with_melodic_counterpoint_interval_classes

labeltools.**label_leaves_in_expr_with_melodic_counterpoint_interval_classes**(*expr*, *markup_direction=Up*)

New in version 2.0. Label leaves in *expr* with melodic counterpoint interval classes:

```
>>> notes = notetools.make_notes([0, 25, 11, -4, -14, -13, 9, 10, 6, 5], [Duration(1, 8)])
>>> staff = Staff(notes)
>>> labeltools.label_leaves_in_expr_with_melodic_counterpoint_interval_classes(staff)

>>> f(staff)
\new Staff {
    c'8 ^ \markup { +8 }
    cs'''8 ^ \markup { -2 }
    b'8 ^ \markup { -2 }
    af8 ^ \markup { -7 }
    bf,8 ^ \markup { +1 }
    b,8 ^ \markup { +7 }
    a'8 ^ \markup { +2 }
    bf'8 ^ \markup { -4 }
    fs'8 ^ \markup { +1 }
    f'8
}
```

Return none.

labeltools.label_leaves_in_expr_with_melodic_counterpoint_intervals

labeltools.**label_leaves_in_expr_with_melodic_counterpoint_intervals**(*expr*, *markup_direction=Up*)

New in version 2.0. Label leaves in *expr* with melodic counterpoint intervals:

```
>>> notes = notetools.make_notes([0, 25, 11, -4, -14, -13, 9, 10, 6, 5], [Duration(1, 8)])
>>> staff = Staff(notes)
>>> labeltools.label_leaves_in_expr_with_melodic_counterpoint_intervals(staff)

>>> f(staff)
\new Staff {
    c'8 ^ \markup { +15 }
    cs'''8 ^ \markup { -9 }
    b'8 ^ \markup { -9 }
    af8 ^ \markup { -7 }
    bf,8 ^ \markup { 1 }
    b,8 ^ \markup { +14 }
    a'8 ^ \markup { +2 }
    bf'8 ^ \markup { -4 }
    fs'8 ^ \markup { 1 }
    f'8
}
```

Return none.

labeltools.label_leaves_in_expr_with_melodic_diatonic_interval_classes

labeltools.**label_leaves_in_expr_with_melodic_diatonic_interval_classes**(*expr*, *markup_direction=Up*)

New in version 2.0. Label leaves in *expr* with melodic diatonic interval classes:

```
>>> notes = notetools.make_notes([0, 25, 11, -4, -14, -13, 9, 10, 6, 5], [Duration(1, 8)])
>>> staff = Staff(notes)
>>> labeltools.label_leaves_in_expr_with_melodic_diatonic_interval_classes(staff)

>>> f(staff)
\new Staff {
    c'8 ^ \markup { +aug8 }
    cs'''8 ^ \markup { -M2 }
    b'8 ^ \markup { -aug2 }
    af8 ^ \markup { -m7 }
    bf,8 ^ \markup { aug1 }
    b,8 ^ \markup { +m7 }
    a'8 ^ \markup { +m2 }
    bf'8 ^ \markup { -dim4 }
    fs'8 ^ \markup { aug1 }
    f'8
}
```

Return none.

labeltools.label_leaves_in_expr_with_melodic_diatonic_intervals

labeltools.**label_leaves_in_expr_with_melodic_diatonic_intervals**(*expr*, *markup_direction=Up*)

New in version 2.0. Label leaves in *expr* with melodic diatonic intervals:

```
>>> notes = notetools.make_notes([0, 25, 11, -4, -14, -13, 9, 10, 6, 5], [Duration(1, 8)])
>>> staff = Staff(notes)
>>> labeltools.label_leaves_in_expr_with_melodic_diatonic_intervals(staff)

>>> f(staff)
\new Staff {
    c'8 ^ \markup { +aug15 }
    cs'''8 ^ \markup { -M9 }
    b'8 ^ \markup { -aug9 }
    af8 ^ \markup { -m7 }
    bf,8 ^ \markup { +aug1 }
    b,8 ^ \markup { +m14 }
    a'8 ^ \markup { +m2 }
    bf'8 ^ \markup { -dim4 }
    fs'8 ^ \markup { -aug1 }
    f'8
}
```

Return none.

labeltools.label_leaves_in_expr_with_pitch_class_numbers

labeltools.**label_leaves_in_expr_with_pitch_class_numbers**(*expr*, *number=True*, *color=False*, *markup_direction=Down*)

New in version 1.1. Label leaves in *expr* with pitch-class numbers:

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> labeltools.label_leaves_in_expr_with_pitch_class_numbers(t)
>>> print t.lilypond_format
\new Staff {
    c'8 _ \markup { \small 0 }
    d'8 _ \markup { \small 2 }
    e'8 _ \markup { \small 4 }
    f'8 _ \markup { \small 5 }
}
```

When `color=True` call `color_note_head_by_numbered_chromatic_pitch_class_color_map()`:

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> labeltools.label_leaves_in_expr_with_pitch_class_numbers(t, color=True, number=False)
>>> print t.lilypond_format
\new Staff {
    \once \override NoteHead #'color = #(x11-color 'red)
    c'8
    \once \override NoteHead #'color = #(x11-color 'orange)
    d'8
    \once \override NoteHead #'color = #(x11-color 'ForestGreen)
    e'8
    \once \override NoteHead #'color = #(x11-color 'MediumOrchid)
    f'8
}
```

You can set *number* and *color* at the same time. Changed in version 2.0: renamed `label.leaf_pcs()` to `labeltools.label_leaves_in_expr_with_pitch_class_numbers()`. Return none.

labeltools.label_leaves_in_expr_with_pitch_numbers

labeltools.**label_leaves_in_expr_with_pitch_numbers**(*expr*, *markup_direction=Down*)

New in version 1.1. Label leaves in *expr* with pitch numbers:

```
>>> staff = Staff(leaftools.make_leaves([None, 12, [13, 14, 15], None], [(1, 4)]))
>>> labeltools.label_leaves_in_expr_with_pitch_numbers(staff)
>>> f(staff)
\new Staff {
    r4
    c''4 _ \markup { \small 12 }
    <cs'' d'' ef''>4 _ \markup { \column { \small 15 \small 14 \small 13 } }
    r4
}
```

Return none. Changed in version 2.0: renamed `label.leaf_pitch_numbers()` to `labeltools.label_leaves_in_expr_with_pitch_numbers()`.

labeltools.label_leaves_in_expr_with_prolated_leaf_duration

labeltools.**label_leaves_in_expr_with_prolated_leaf_duration**(*expr*, *markup_direction=Down*)

New in version 1.1. Label leaves in *expr* with prolated leaf duration:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(1, 4), "c'8 d'8 e'8")
>>> labeltools.label_leaves_in_expr_with_prolated_leaf_duration(tuplet)
>>> f(tuplet)
\times 2/3 {
    c'8 _ \markup { \small 1/12 }
    d'8 _ \markup { \small 1/12 }
    e'8 _ \markup { \small 1/12 }
}
```

Return none.

labeltools.label_leaves_in_expr_with_tuplet_depth

labeltools.**label_leaves_in_expr_with_tuplet_depth**(*expr*, *markup_direction=Down*)

New in version 1.1. Label leaves in *expr* with tuplet depth:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8")
>>> tuplettools.FixedDurationTuplet(Duration(2, 8), staff[-3:])
FixedDurationTuplet(1/4, [e'8, f'8, g'8])
>>> labeltools.label_leaves_in_expr_with_tuplet_depth(staff)
>>> f(staff)
\new Staff {
    c'8 _ \markup { \small 0 }
    d'8 _ \markup { \small 0 }
    \times 2/3 {
        e'8 _ \markup { \small 1 }
        f'8 _ \markup { \small 1 }
        g'8 _ \markup { \small 1 }
```

```
    }
}
```

Return none. Changed in version 2.0: renamed `label.leaf_depth_tuplet()` to `labeltools.label_leaves_in_expr_with_tuplet_depth()`.

labeltools.label_leaves_in_expr_with_written_leaf_duration

labeltools.**label_leaves_in_expr_with_written_leaf_duration**(*expr*, *markup_direction=Down*)

New in version 1.1. Label leaves in *expr* with writen leaf duration:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(1, 4), "c'8 d'8 e'8")
>>> labeltools.label_leaves_in_expr_with_leaf_durations(tuplet)
>>> f(tuplet)
\times 2/3 {
    c'8 _ \markup { \column { \small 1/8 \small 1/12 } }
    d'8 _ \markup { \column { \small 1/8 \small 1/12 } }
    e'8 _ \markup { \column { \small 1/8 \small 1/12 } }
}
```

Return none.

labeltools.label_notes_in_expr_with_note_indices

labeltools.**label_notes_in_expr_with_note_indices**(*expr*, *markup_direction=Down*)

New in version 2.0. Label notes in *expr* with note indices:

```
>>> staff = Staff("c'8 d'8 r8 r8 g'8 a'8 r8 c''8")

>>> labeltools.label_notes_in_expr_with_note_indices(staff)

>>> f(staff)
\new Staff {
    c'8 _ \markup { \small 0 }
    d'8 _ \markup { \small 1 }
    r8
    r8
    g'8 _ \markup { \small 2 }
    a'8 _ \markup { \small 3 }
    r8
    c''8 _ \markup { \small 4 }
}
```

Return none.

labeltools.label_tie_chains_in_expr_with_prolated_tie_chain_duration

labeltools.**label_tie_chains_in_expr_with_prolated_tie_chain_duration**(*expr*, *markup_direction=Down*)

Label tie chains in *expr* with prolated tie chain duration:

```
>>> staff = Staff(r"\times 2/3 { c'8 ~ c'8 c'8 ~ } c'8")
>>> labeltools.label_tie_chains_in_expr_with_prolated_tie_chain_duration(staff)
```

```
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8 ~
            _ \markup {
                \small
                    1/6
                }
        c'8
        c'8 ~
            _ \markup {
                \small
                    5/24
                }
    }
    c'8
}
```

Return none.

labeltools.label_tie_chains_in_expr_with_tie_chain_durations

labeltools.**label_tie_chains_in_expr_with_tie_chain_durations**(*expr*, *markup_direction=Down*)

Label tie chains in *expr* with both written tie chain duration and prolated tie chain duration:

```
>>> staff = Staff(r"\times 2/3 { c'8 ~ c'8 c'8 ~ } c'8")
>>> labeltools.label_tie_chains_in_expr_with_tie_chain_durations(staff)
```

```
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8 ~
            _ \markup {
                \column
                    {
                        \small
                            1/4
                        \small
                            1/6
                    }
                }
        c'8
        c'8 ~
            _ \markup {
                \column
                    {
                        \small
                            1/4
                        \small
                            5/24
                    }
                }
    }
    c'8
}
```

Return none.

labeltools.label_tie_chains_in_expr_with_written_tie_chain_duration

labeltools.**label_tie_chains_in_expr_with_written_tie_chain_duration**(*expr*, *markup_direction=Down*)

Label tie chains in *expr* with written tie chain duration.:

```
>>> staff = Staff(r"\times 2/3 { c'8 ~ c'8 c'8 ~ } c'8")
>>> labeltools.label_tie_chains_in_expr_with_written_tie_chain_duration(staff)

>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8 ~
            _ \markup {
                \small
                    1/4
                }
        c'8
        c'8 ~
            _ \markup {
                \small
                    1/4
                }
    }
    c'8
}
```

Return none.

labeltools.label_vertical_moments_in_expr_with_chromatic_interval_classes

labeltools.**label_vertical_moments_in_expr_with_chromatic_interval_classes**(*expr*, *markup_direction=Dow*

New in version 2.0. Label harmonic chromatic interval-classes of every vertical moment in *expr*:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "alto" g4 f4""")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "bass" c,2""")
>>> score.append(staff)

>>> labeltools.label_vertical_moments_in_expr_with_chromatic_interval_classes(
...     score)

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
            _ \markup {
                \small
                    \column
                        {
```

```
                            2
                            7
                        }
                    }
                e'8
                f'8
                    _ \markup {
                        \small
                            \column
                                {
                                    5
                                    5
                                }
                    }
            }
            \new Staff {
                \clef "alto"
                g4
                f4
                    _ \markup {
                        \small
                            \column
                                {
                                    4
                                    5
                                }
                    }
            }
            \new Staff {
                \clef "bass"
                c,2
                    _ \markup {
                        \small
                            \column
                                {
                                    12
                                    7
                                }
                    }
            }
        >>
```

Return none.

labeltools.label_vertical_moments_in_expr_with_chromatic_intervals

labeltools.**label_vertical_moments_in_expr_with_chromatic_intervals**(*expr*, *markup_direction=Down*)

New in version 2.0. Label harmonic chromatic intervals of every vertical moment in *expr*:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "alto" g4 f4""")
>>> score.append(staff)
```

```
>>> staff = Staff(r"""\clef "bass" c,2""")
>>> score.append(staff)

>>> labeltools.label_vertical_moments_in_expr_with_chromatic_intervals(
...     score)

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
            _ \markup {
              \small
                  \column
                      {
                          26
                          19
                      }
                }
        e'8
        f'8
            _ \markup {
              \small
                  \column
                      {
                          29
                          17
                      }
                }
    }
    \new Staff {
        \clef "alto"
        g4
        f4
            _ \markup {
              \small
                  \column
                      {
                          28
                          17
                      }
                }
    }
    \new Staff {
        \clef "bass"
        c,2
            _ \markup {
              \small
                  \column
                      {
                          24
                          19
                      }
                }
    }
>>
```

Return none.

labeltools.label_vertical_moments_in_expr_with_counterpoint_intervals

labeltools.**label_vertical_moments_in_expr_with_counterpoint_intervals**(*expr*, *markup_direction=Down*)

New in version 2.0. Label counterpoint interval of every vertical moment in *expr*:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "alto" g4 f4""")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "bass" c,2""")
>>> score.append(staff)

>>> labeltools.label_vertical_moments_in_expr_with_counterpoint_intervals(score)

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
            _ \markup {
                \small
                    \column
                        {
                            2
                            5
                        }
                }
        e'8
        f'8
            _ \markup {
                \small
                    \column
                        {
                            4
                            4
                        }
                }
    }
    \new Staff {
        \clef "alto"
        g4
        f4
            _ \markup {
                \small
                    \column
                        {
                            3
                            4
                        }
                }
    }
    \new Staff {
        \clef "bass"
        c,2
```

```
                _ \markup {
                    \small
                        \column
                            {
                                8
                                5
                            }
                    }
        }
    >>
```

Return none.

labeltools.label_vertical_moments_in_expr_with_diatonic_intervals

labeltools.**label_vertical_moments_in_expr_with_diatonic_intervals**(*expr*, *markup_direction=Down*)

New in version 2.0. Label diatonic intervals of every vertical moment in *expr*:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "alto" g4 f4""")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "bass" c,2""")
>>> score.append(staff)

>>> labeltools.label_vertical_moments_in_expr_with_diatonic_intervals(score)

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
            _ \markup {
                \small
                    \column
                        {
                            16
                            12
                        }
                }
        e'8
        f'8
            _ \markup {
                \small
                    \column
                        {
                            18
                            11
                        }
                }
    }
    \new Staff {
        \clef "alto"
```

```
            g4
            f4
                _ \markup {
                    \small
                        \column
                            {
                                17
                                11
                            }
                    }
        }
        \new Staff {
            \clef "bass"
            c,2
                _ \markup {
                    \small
                        \column
                            {
                                15
                                12
                            }
                    }
        }
    >>
```

Return none.

labeltools.label_vertical_moments_in_expr_with_interval_class_vectors

labeltools.**label_vertical_moments_in_expr_with_interval_class_vectors**(*expr*, *markup_direction=Down*)

New in version 2.0. Label interval-class vector of every vertical moment in *expr*:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "alto" g4 f4""")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "bass" c,2""")
>>> score.append(staff)

>>> labeltools.label_vertical_moments_in_expr_with_interval_class_vectors(score)

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
            _ \markup {
                \tiny
                    0010020
                }
        e'8
        f'8
            _ \markup {
```

```
                \tiny
                    1000020
                }
        }
        \new Staff {
            \clef "alto"
            g4
            f4
                _ \markup {
                    \tiny
                        0100110
                    }
        }
        \new Staff {
            \clef "bass"
            c,2
                _ \markup {
                    \tiny
                        1000020
                    }
        }
    >>
```

Return none.

labeltools.label_vertical_moments_in_expr_with_numbered_chromatic_pitch_classes

labeltools.**label_vertical_moments_in_expr_with_numbered_chromatic_pitch_classes**(*expr*, *markup_directi*

New in version 2.0. Label pitch-classes of every vertical moment in *expr*:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "alto" g4 f4""")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "bass" c,2""")
>>> score.append(staff)

>>> labeltools.label_vertical_moments_in_expr_with_numbered_chromatic_pitch_classes(
...     score)

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
            _ \markup {
                \small
                    \column
                        {
                            7
                            2
                            0
                        }
```

```
                }
            e'8
            f'8
                _ \markup {
                    \small
                        \column
                            {
                                5
                                0
                            }
                }
        }
        \new Staff {
            \clef "alto"
            g4
            f4
                _ \markup {
                    \small
                        \column
                            {
                                5
                                4
                                0
                            }
                }
        }
        \new Staff {
            \clef "bass"
            c,2
                _ \markup {
                    \small
                        \column
                            {
                                7
                                0
                            }
                }
        }
    >>
```

Return none.

labeltools.label_vertical_moments_in_expr_with_pitch_numbers

labeltools.**label_vertical_moments_in_expr_with_pitch_numbers**(*expr*, *markup_direction=Down*)

New in version 2.0. Label pitch numbers of every vertical moment in *expr*:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "alto" g4 f4""")
>>> score.append(staff)
>>> staff = Staff(r"""\clef "bass" c,2""")
>>> score.append(staff)
```

```
>>> labeltools.label_vertical_moments_in_expr_with_pitch_numbers(score)

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
            _ \markup {
                \small
                    \column
                        {
                            2
                            -5
                            -24
                        }
                }
        e'8
        f'8
            _ \markup {
                \small
                    \column
                        {
                            5
                            -7
                            -24
                        }
                }
    }
    \new Staff {
        \clef "alto"
        g4
        f4
            _ \markup {
                \small
                    \column
                        {
                            4
                            -7
                            -24
                        }
                }
    }
    \new Staff {
        \clef "bass"
        c,2
            _ \markup {
                \small
                    \column
                        {
                            0
                            -5
                            -24
                        }
                }
    }
>>
```

Return none.

labeltools.remove_markup_from_leaves_in_expr

labeltools.**remove_markup_from_leaves_in_expr**(*expr*)

New in version 1.1. Remove markup from leaves in *expr*:

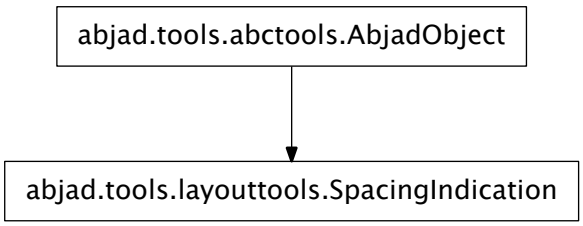
```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> labeltools.label_leaves_in_expr_with_pitch_class_numbers(staff)
>>> f(staff)
\new Staff {
    c'8 _ \markup { \small 0 }
    d'8 _ \markup { \small 2 }
    e'8 _ \markup { \small 4 }
    f'8 _ \markup { \small 5 }
}

>>> labeltools.remove_markup_from_leaves_in_expr(staff)
>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}
```

Return none. Changed in version 2.0: renamed `label.clear_leaves()` to `labeltools.remove_markup_from_leaves_in_expr()`.

layouttools

concrete classes

layouttools.SpacingIndication



class layouttools.**SpacingIndication**(**args*)

Spacing indication token.

LilyPond `Score.proportionalNotationDuration` will equal `proportional_notation_duration` when tempo equals `tempo_indication`:

```
>>> from abjad.tools import layouttools
```

Initialize from tempo mark and proportional notation duration:

```
>>> tempo = contexttools.TempoMark(Duration(1, 8), 44)
>>> indication = layouttools.SpacingIndication(tempo, Duration(1, 68))

>>> indication
SpacingIndication(TempoMark(Duration(1, 8), 44), Duration(1, 68))
```

Initialize from constants:

```
>>> layouttools.SpacingIndication(((1, 8), 44), (1, 68))
SpacingIndication(TempoMark(Duration(1, 8), 44), Duration(1, 68))
```

Initialize from other spacing indication:

```
>>> layouttools.SpacingIndication(indication)
SpacingIndication(TempoMark(Duration(1, 8), 44), Duration(1, 68))
```

Spacing indications are immutable.

Read-only Properties

`SpacingIndication.`**`normalized_spacing_duration`**
Read-only proportional notation duration at 60 MM.

`SpacingIndication.`**`proportional_notation_duration`**
LilyPond proportional notation duration context setting.

`SpacingIndication.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`SpacingIndication.`**`tempo_indication`**
Abjad tempo indication object.

Special Methods

`SpacingIndication.`**`__eq__`**(*expr*)
Spacing indications compare equal when normalized spacing durations compare equal.

`SpacingIndication.`**`__ge__`**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`SpacingIndication.`**`__gt__`**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`SpacingIndication.`**`__le__`**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

SpacingIndication.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SpacingIndication.**__ne__**(*expr*)
Spacing indications compare unequal when normalized spacing durations compare unequal.

SpacingIndication.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

functions

layouttools.make_spacing_vector

layouttools.**make_spacing_vector**(*basic_distance*, *minimum_distance*, *padding*, *stretchability*)
New in version 2.0. Make spacing vector:

```
>>> from abjad.tools import layouttools

>>> vector = layouttools.make_spacing_vector(0, 0, 12, 0)
```

Use to set paper block spacing attributes:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> lilypond_file = lilypondfiletools.make_basic_lilypond_file(staff)
>>> spacing_vector = layouttools.make_spacing_vector(0, 0, 12, 0)
>>> lilypond_file.paper_block.system_system_spacing = spacing_vector

>>> f(lilypond_file)
% Abjad revision 4229
% 2011-04-07 15:19

\version "2.13.44"
\include "english.ly"
\include "/abjad/trunk/abjad/cfg/abjad.scm"

\paper {
    system-system-spacing = #'(
        (basic_distance . 0) (minimum_distance . 0) (padding . 12) (stretchability . 0))
}

\score {
    \new Staff {
        c'8
        d'8
        e'8
        f'8
    }
}
```

Return scheme vector.

layouttools.set_line_breaks_cyclically_by_line_duration_ge

layouttools.**set_line_breaks_cyclically_by_line_duration_ge**(*expr*, *line_duration*, *klass=None*, *adjust_eol=False*, *add_empty_bars=False*)

Iterate *klass* instances in *expr* and accumulate prolated duration. Add line break after every total less than or equal to *line_duration*:

```
>>> from abjad.tools import layouttools

>>> t = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 4)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(t)

>>> f(t)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
    }
    {
        b'8
        c''8
    }
}

>>> layouttools.set_line_breaks_cyclically_by_line_duration_ge(t, Duration(4, 8))
>>> f(t)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
        \break
    }
    {
        g'8
        a'8
    }
    {
        b'8
        c''8
        \break
    }
}
```

When `klass=None` set *klass* to measure.

Set *adjust_eol* to `True` to include a magic Scheme incantation to move end-of-line LilyPond TimeSignature and BarLine grobs to the right. Changed in version 2.0: renamed `layout.line_break_every_prolated()` to `layout.set_line_breaks_cyclically_by_line_duration_ge()`.

layouttools.set_line_breaks_cyclically_by_line_duration_in_seconds_ge

layouttools.**set_line_breaks_cyclically_by_line_duration_in_seconds_ge**(*expr*, *line_duration*, *klass=None*, *adjust_eol=False*, *add_empty_bars=False*)

Iterate *klass* instances in *expr* and accumulate duration in seconds. Add line break after every total less than or equal to *line_duration*:

```
>>> from abjad.tools import layouttools

>>> t = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 4)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(t)
>>> tempo_mark = contexttools.TempoMark(Duration(1, 8), 44, target_context = Staff)(t)

>>> f(t)
\new Staff {
    \tempo 8=44
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
    }
    {
        b'8
        c''8
    }
}

>>> layouttools.set_line_breaks_cyclically_by_line_duration_in_seconds_ge(t, Duration(6))
>>> f(t)
\new Staff {
    \tempo 8=44
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
```

```
            \break
        }
        {
            g'8
            a'8
        }
        {
            b'8
            c''8
        }
    }
```

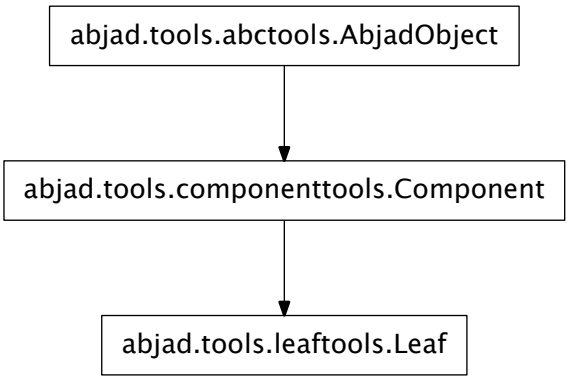
When `klass=None` set *klass* to measure.

Set `adjust_eol = True` to include a magic Scheme incantation to move end-of-line LilyPond TimeSignature and BarLine grobs to the right. Changed in version 2.0: renamed `layout.line_break_every_seconds()` to `layout.set_line_breaks_cyclically_by_line_duration_in_seconds_ge()`.

leaftools

concrete classes

leaftools.Leaf



class `leaftools.`**`Leaf`**(*written_duration*, *duration_multiplier=None*)

Read-only Properties

`Leaf.`**`duration_in_seconds`**

`Leaf.`**`leaf_index`**

`Leaf.`**`lilypond_format`**

Inherited from `componenttools.Component`

`Leaf.`**`multiplied_duration`**

Leaf.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Leaf.**parent**
Inherited from componenttools.Component

Leaf.**preprolated_duration**

Leaf.**prolated_duration**
Inherited from componenttools.Component

Leaf.**prolation**
Inherited from componenttools.Component

Leaf.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Leaf.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Leaf.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Leaf.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Leaf.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Leaf.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Leaf.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties
Leaf.**duration_multiplier**
Leaf.**written_duration**

Leaf.**written_pitch_indication_is_at_sounding_pitch**

Leaf.**written_pitch_indication_is_nonsemantic**

Special Methods

Leaf.__and__(*arg*)

Leaf.__eq__(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Leaf.__ge__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Leaf.__gt__(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Leaf.__le__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Leaf.__lt__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Leaf.__mul__(*n*)

Inherited from componenttools.Component

Leaf.__ne__(*arg*)

True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Leaf.__or__(*arg*)

Leaf.__repr__()

Leaf.__rmul__(*n*)

Inherited from componenttools.Component

Leaf.__str__()

Leaf.__sub__(*arg*)

Leaf.__xor__(*arg*)

functions

leaftools.all_are_leaves

leaftools.**all_are_leaves**(*expr*)

New in version 2.6. True when *expr* is a sequence of Abjad leaves:

```
>>> leaves = [Note("c'4"), Rest('r4'), Note("d'4")]

>>> leaftools.all_are_leaves(leaves)
True
```

True when *expr* is an empty sequence:

```
>>> leaftools.all_are_leaves([])
True
```

Otherwise false:

```
>>> leaftools.all_are_leaves('foo')
False
```

Return boolean.

Function wraps `componenttools.all_are_components()`.

leaftools.change_written_leaf_duration_and_preserve_preprolated_leaf_duration

leaftools.**change_written_leaf_duration_and_preserve_preprolated_leaf_duration**(*leaf*, *written_duration*)

New in version 1.1. Change *leaf* written duration to *written_duration* and preserve preprolated *leaf* duration:

```
>>> note = Note("c'4")

>>> note.written_duration
Duration(1, 4)
>>> note.preprolated_duration
Duration(1, 4)

>>> leaftools.change_written_leaf_duration_and_preserve_preprolated_leaf_duration(
...     note, Duration(3, 16))
Note("c'8. * 4/3")

>>> note.written_duration
Duration(3, 16)
>>> note.preprolated_duration
Duration(1, 4)
```

Add LilyPond multiplier where necessary.

Return *leaf*. Changed in version 2.0: Renamed from `leaftools.duration_rewrite()`. `leaftools.change_written_leaf_duration_and_preserve_preprolated_leaf_duration()`.

leaftools.copy_written_duration_and_multiplier_from_leaf_to_leaf

leaftools.**copy_written_duration_and_multiplier_from_leaf_to_leaf**(*source_leaf*, *target_leaf*)

New in version 2.0. Copy written duration and multiplier from *source_leaf* to *target_leaf*:

```
>>> note = Note("c'4")
>>> note.duration_multiplier = Duration(1, 2)
>>> rest = Rest((1, 64))
>>> leaftools.copy_written_duration_and_multiplier_from_leaf_to_leaf(note, rest)
Rest('r4 * 1/2')
```

Return *target_leaf*.

leaftools.divide_leaf_meiotically

leaftools.**divide_leaf_meiotically**(*leaf*, *n=2*)

New in version 1.1. Divide *leaf* meiotically *n* times:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> leaftools.divide_leaf_meiotically(staff[0], n=4)

>>> f(staff)
\new Staff {
    c'32 [
    c'32
    c'32
    c'32
    d'8
    e'8
    f'8 ]
}
```

Replace *leaf* with *n* new leaves.

Preserve parentage and spanners.

Allow divisions into only `1, 2, 4, 8, 16, ...` and other nonnegative integer powers of `2`.

Produce only leaves and never tuplets or other containers.

Return none.

leaftools.divide_leaves_in_expr_meiotically

leaftools.**divide_leaves_in_expr_meiotically**(*expr*, *n=2*)

New in version 1.1. Divide leaves meiotically in *expr* *n* times:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> leaftools.divide_leaves_in_expr_meiotically(staff[2:], n=4)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'32
    e'32
    e'32
    e'32
    f'32
    f'32
    f'32
    f'32 ]
}
```

Replace every leaf in *expr* with *n* new leaves.

Preserve parentage and spanners.

Allow divisions into only `1, 2, 4, 8, 16, ...` and other nonnegative integer powers of `2`.

Produce only leaves and never tuplets or other containers.

Return none. Changed in version 2.0: renamed `leaftools.meiose()` to `leaftools.divide_leaves_in_expr_meiotically()`.

leaftools.expr_has_leaf_with_dotted_written_duration

leaftools.**expr_has_leaf_with_dotted_written_duration**(*expr*)

New in version 2.0. True when *expr* has at least one leaf with dotted writtern duration:

```
>>> notes = notetools.make_notes([0], [(1, 16), (2, 16), (3, 16)])
>>> leaftools.expr_has_leaf_with_dotted_written_duration(notes)
True
```

False otherwise:

```
>>> notes = notetools.make_notes([0], [(1, 16), (2, 16), (4, 16)])
>>> leaftools.expr_has_leaf_with_dotted_written_duration(notes)
False
```

Return boolean.

leaftools.fuse_leaves

leaftools.**fuse_leaves**(*leaves*)

New in version 1.1. Fuse thread-contiguous *leaves*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> leaftools.fuse_leaves(staff[1:])
[Note("d'4.")]
>>> f(staff)
\new Staff {
    c'8
    d'4.
}
```

Rewrite duration of first leaf in *leaves*.

Detach all leaves in *leaves* other than first leaf from score.

Return list of first leaf in *leaves*. Changed in version 2.0: renamed `fuse.leaves_by_reference()` to `leaftools.fuse_leaves()`.

leaftools.fuse_leaves_in_container_once_by_counts

leaftools.**fuse_leaves_in_container_once_by_counts**(*container*, *counts*, *klass=None*, *big_endian=True*)

Fuse leaves in *container* once by *counts* into instances of *klass*.

leaftools.fuse_leaves_in_tie_chain_by_immediate_parent

leaftools.**fuse_leaves_in_tie_chain_by_immediate_parent**(*tie_chain*)

New in version 1.1. Fuse leaves in *tie_chain* by immediate parent:

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> tietools.TieSpanner(staff.leaves)
TieSpanner(c'8, c'8, c'8, c'8)
>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8 ~
        c'8 ~
    }
    {
        c'8 ~
        c'8
    }
}
```

```
>>> tie_chain = tietools.get_tie_chain(staff.leaves[0])
>>> leaftools.fuse_leaves_in_tie_chain_by_immediate_parent(tie_chain)
[[Note("c'4")], [Note("c'4")]]
```

```
>>> f(staff)
\new Staff {
    {
        \time 2/8
```

```
            c'4 ~
        }
        {
            c'4
        }
    }
```

Return list of fused notes by parent. Changed in version 2.0: renamed `fuse.leaves_in_tie_chain()` to `leaftools.fuse_leaves_in_tie_chain_by_immediate_parent()`.

leaftools.fuse_tied_leaves_in_components_once_by_prolated_durations_without_overhang

leaftools.**fuse_tied_leaves_in_components_once_by_prolated_durations_without_overhang**(*compon*
pro-
lated_du

New in version 1.1. Fuse tied leaves in *components* once by *prolated_durations* without overhang:

```
>>> staff = Staff(notetools.make_repeated_notes(8))
>>> tietools.TieSpanner(staff.leaves)
TieSpanner(c'8, c'8, c'8, c'8, c'8, c'8, c'8, c'8)

>>> f(staff)
\new Staff {
    c'8 ~
    c'8 ~
    c'8 ~
    c'8 ~
    c'8 ~
    c'8 ~
    c'8 ~
    c'8
}

>>> leaftools.fuse_tied_leaves_in_components_once_by_prolated_durations_without_overhang(
... staff, [Duration(3, 8), Duration(3, 8)])

>>> f(staff)
\new Staff {
    c'4. ~
    c'4. ~
    c'8 ~
    c'8
}
```

Return none. Changed in version 2.0: renamed `fuse.tied_leaves_by_prolated_durations()` to `leaftools.fuse_tied_leaves_in_components_once_by_prolated_durations_without_overhang()`.

leaftools.get_composite_offset_difference_series_from_leaves_in_expr

leaftools.**get_composite_offset_difference_series_from_leaves_in_expr**(*expr*)

New in version 2.0. Get composite offset difference series from leaves in *expr*:

```
>>> staff_1 = Staff(r"\times 4/3 { c'8 d'8 e'8 }")
>>> staff_2 = Staff("f'8 g'8 a'8 b'8")
>>> score = Score([staff_1, staff_2])
```

```
>>> f(score)
    \new Score <<
        \new Staff {
            \fraction \times 4/3 {
                c'8
                d'8
                e'8
            }
        }
        \new Staff {
            f'8
            g'8
            a'8
            b'8
        }
    >>
```

```
>>> for x in leaftools.get_composite_offset_difference_series_from_leaves_in_expr(score):
...     x
...
Duration(1, 8)
Duration(1, 24)
Duration(1, 12)
Duration(1, 12)
Duration(1, 24)
Duration(1, 8)
```

Composite offset difference series defined equal to time intervals between unique start and stop offsets of leaves in *expr*.

Return list of durations.

leaftools.get_composite_offset_series_from_leaves_in_expr

leaftools.**get_composite_offset_series_from_leaves_in_expr**(*expr*)

New in version 2.0. Get composite offset series from leaves in *expr*:

```
>>> staff_1 = Staff(r"\times 4/3 { c'8 d'8 e'8 }")
>>> staff_2 = Staff("f'8 g'8 a'8 b'8")
>>> score = Score([staff_1, staff_2])
```

```
>>> f(score)
    \new Score <<
        \new Staff {
            \fraction \times 4/3 {
                c'8
                d'8
                e'8
            }
        }
        \new Staff {
            f'8
            g'8
            a'8
            b'8
        }
    >>
```

```
>>> for offset in leaftools.get_composite_offset_series_from_leaves_in_expr(score):
...     offset
...
Offset(0, 1)
Offset(1, 8)
Offset(1, 6)
Offset(1, 4)
Offset(1, 3)
Offset(3, 8)
Offset(1, 2)
```

Equal to list of unique start and stop offsets of leaves in *expr*.

Return list of fractions.

leaftools.get_leaf_at_index_in_measure_number_in_expr

leaftools.**get_leaf_at_index_in_measure_number_in_expr**(*expr*, *measure_number*, *leaf_index*)

New in version 2.0. Get leaf at *leaf_index* in *measure_number* in *expr*:

```
>>> t = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 3)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(t)
>>> f(t)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
    }
}
```

```
>>> leaftools.get_leaf_at_index_in_measure_number_in_expr(t, 2, 0)
Note("e'8")
```

Return leaf or none.

leaftools.get_leaf_in_expr_with_maximum_prolated_duration

leaftools.**get_leaf_in_expr_with_maximum_prolated_duration**(*expr*)

New in version 2.5. Get leaf in *expr* with maximum prolated duration:

```
>>> staff = Staff("c'4.. d'16 e'4.. f'16")
```

```
>>> leaftools.get_leaf_in_expr_with_maximum_prolated_duration(staff)
Note("c'4..")
```

When two leaves in *expr* are both of equally maximal prolated duration, return the first leaf encountered in forward iteration.

Return none when *expr* contains no leaves:

```
>>> leaftools.get_leaf_in_expr_with_maximum_prolated_duration([]) is None
True
```

Return leaf.

leaftools.get_leaf_in_expr_with_minimum_prolated_duration

leaftools.**get_leaf_in_expr_with_minimum_prolated_duration**(*expr*)

New in version 2.5. Get leaf in *expr* with minimum prolated duration:

```
>>> staff = Staff("c'4.. d'16 e'4.. f'16")
```

```
>>> leaftools.get_leaf_in_expr_with_minimum_prolated_duration(staff)
Note("d'16")
```

When two leaves in *expr* are both of equally minimal prolated duration, return the first leaf encountered in forward iteration.

Return none when *expr* contains no leaves:

```
>>> leaftools.get_leaf_in_expr_with_minimum_prolated_duration([]) is None
True
```

Return leaf.

leaftools.get_nth_leaf_in_expr

leaftools.**get_nth_leaf_in_expr**(*expr*, *n=0*)

New in version 2.0. Get *n* th leaf in *expr*:

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 3)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
    }
}
```

```
>>> for n in range(6):
...     leaftools.get_nth_leaf_in_expr(staff, n)
...
Note("c'8")
Note("d'8")
Note("e'8")
```

```
Note("f'8")
Note("g'8")
Note("a'8")
```

Read backwards for negative values of *n*.

```
>>> leaftools.get_nth_leaf_in_expr(staff, -1)
Note("a'8")
```

Note: Because this function returns as soon as it finds instance *n* of *klasses*, it is more efficient to call `leaftools.get_nth_leaf_in_expr(expr, 0)` than `expr.leaves[0]`. It is likewise more efficient to call `leaftools.get_nth_leaf_in_expr(expr, -1)` than `expr.leaves[-1]`.

Return leaf of none.

leaftools.get_nth_leaf_in_thread_from_leaf

leaftools.**get_nth_leaf_in_thread_from_leaf**(*leaf*, *n=0*)

New in version 2.0. Get *n* th leaf in thread from *leaf*:

```
>>> staff = Staff(2 * Voice("c'8 d'8 e'8 f'8"))
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)

>>> f(staff)
\new Staff {
    \new Voice {
        c'8
        d'8
        e'8
        f'8
    }
    \new Voice {
        g'8
        a'8
        b'8
        c''8
    }
}

>>> for n in range(8):
...     print n, leaftools.get_nth_leaf_in_thread_from_leaf(staff[0][0], n)
...
0 c'8
1 d'8
2 e'8
3 f'8
4 None
5 None
6 None
7 None
```

Return leaf or none.

leaftools.is_bar_line_crossing_leaf

leaftools.**is_bar_line_crossing_leaf**(*leaf*)

New in version 2.0. True when *leaf* crosses bar line:

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> t[2].written_duration *= 2
>>> contexttools.TimeSignatureMark((2, 8), partial = Duration(1, 8))(t[2])
TimeSignatureMark((2, 8), partial=Duration(1, 8))(e'4)
>>> f(t)
\new Staff {
    c'8
    d'8
    \partial 8
    \time 2/8
    e'4
    f'8
}
>>> leaftools.is_bar_line_crossing_leaf(t.leaves[2])
True
```

Otherwise false:

```
>>> leaftools.is_bar_line_crossing_leaf(t.leaves[3])
False
```

Return boolean.

leaftools.list_prolated_durations_of_leaves_in_expr

leaftools.**list_prolated_durations_of_leaves_in_expr**(*expr*)

New in version 2.0. List prolated durations of leaves in *expr*:

```
>>> staff = Staff(r"    imes 2/3 { c'8 d'8 e'8 }        imes 2/3 { c'8 d'8 e'8 }")

>>> for duration in leaftools.list_prolated_durations_of_leaves_in_expr(staff):
...     duration
...
Duration(1, 12)
Duration(1, 12)
Duration(1, 12)
Duration(1, 12)
Duration(1, 12)
Duration(1, 12)
```

Return list of durations.

leaftools.list_written_durations_of_leaves_in_expr

leaftools.**list_written_durations_of_leaves_in_expr**(*expr*)

New in version 2.0. List the written durations of leaves in *expr*:

```
>>> staff = Staff(tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8") * 2)

>>> for duration in leaftools.list_written_durations_of_leaves_in_expr(staff):
...     duration
```

```
...
Duration(1, 8)
Duration(1, 8)
Duration(1, 8)
Duration(1, 8)
Duration(1, 8)
 Duration(1, 8)
```

Return list of durations.

leaftools.make_leaves

leaftools.**make_leaves**(*pitches*, *durations*, *big_endian=True*, *tie_rests=False*)

New in version 1.1. Construct a list of notes, rests or chords.

Set *pitches* is a single pitch, or a list of pitches, or a tuple of pitches.

Integer pitches create notes.

```
>>> leaftools.make_leaves([2, 4, 19], [(1, 4)])
[Note("d'4"), Note("e'4"), Note("g''4")]
```

Tuple pitches create chords.

```
>>> leaftools.make_leaves([(0, 1, 2), (3, 4, 5), (6, 7, 8)], [(1, 4)])
[Chord("<c' cs' d'>4"), Chord("<ef' e' f'>4"), Chord("<fs' g' af'>4")]
```

Set *pitches* to a list of none to create rests.

```
>>> leaftools.make_leaves([None, None, None, None], [(1, 8)])
[Rest('r8'), Rest('r8'), Rest('r8'), Rest('r8')]
```

You can mix and match pitch values.

```
>>> leaftools.make_leaves([12, (1, 2, 3), None, 12], [(1, 4)])
[Note("c''4"), Chord("<cs' d' ef'>4"), Rest('r4'), Note("c''4")]
```

If the length of *pitches* is less than the length of *durations*, the function reads *durations* cyclically.

```
>>> leaftools.make_leaves([13], [(1, 8), (1, 8), (1, 4), (1, 4)])
[Note("cs''8"), Note("cs''8"), Note("cs''4"), Note("cs''4")]
```

Set *durations* to a single duration, a list of duration, or a tuple of durations.

If the length of *durations* is less than the length of *pitches*, the function reads *pitches* cyclically.

```
>>> leaftools.make_leaves([13, 14, 15, 16], [(1, 8)])
[Note("cs''8"), Note("d''8"), Note("ef''8"), Note("e''8")]
```

Duration values not of the form `m / 2 ** n` return leaves nested inside a fixed-multiplier tuplet.

```
>>> leaftools.make_leaves([14], [(1, 12), (1, 12), (1, 12)])
[Tuplet(2/3, [d''8, d''8, d''8])]
```

Set `big_endian=False` to return tied leaf durations from least to greatest:

```
>>> staff = Staff(leaftools.make_leaves([15], [(13, 16)], big_endian=False))
>>> f(staff)
\new Staff {
    ef''16 ~
```

```
    ef''2.
}
```

Set *tie_rests* to true to return tied rests for durations like `5/16` and `9/16`.

```
>>> staff = Staff(leaftools.make_leaves([None], [(5, 16)], tie_rests=True))
>>> f(staff)
\new Staff {
    r4 ~
    r16
}
```

Return list of leaves. Changed in version 2.0: renamed `construct.leaves()` to `leaftools.make_leaves()`.

leaftools.make_leaves_from_note_value_signal

`leaftools.`**`make_leaves_from_note_value_signal`**(*note_value_signal*, *denominator_of_signal*, *tie_rests=False*, *use_skips=False*)

New in version 2.0. Make leaves from *note_value_signal* and *denominator_of_signal*:

```
>>> leaves = leaftools.make_leaves_from_note_value_signal([3, -3, 5, -5], 8)
>>> staff = Staff(leaves)

>>> f(staff)
\new Staff {
    c'4.
    r4.
    c'2 ~
    c'8
    r2
    r8
}
```

Interpret positive elements in *note_value_signal* as notes.

Interpret negative elements in *note_value_signal* as rests.

Set the pitch of all notes to middle C.

When `use_skips=False` use skips instead of rests.

Note: Add skip example.

Return list of notes and / or rests.

leaftools.make_tied_leaf

`leaftools.`**`make_tied_leaf`**(*kind*, *duration*, *big_endian=True*, *pitches=None*, *tied=True*)

Return list of leaves to fill the given duration *duration*.

Leaves returned are tie-spanned when `tied=True`.

duration must be of the form `m / 2**n` for any integer `m`.

***big_endian* must be boolean.** True returns a list of notes of decreasing duration. False returns a list of notes of increasing duration.

pitches a pitch or list of pitch tokens.

tied True to return tied leaves. False otherwise.

leaftools.remove_initial_rests_from_sequence

leaftools.**remove_initial_rests_from_sequence**(*sequence*)

New in version 2.0. Remove initial rests from *sequence*:

```
>>> staff = Staff("r8 r8 c'8 d'8 r4 r4")

>>> f(staff)
\new Staff {
    r8
    r8
    c'8
    d'8
    r4
    r4
}

>>> leaftools.remove_initial_rests_from_sequence(staff)
[Note("c'8"), Note("d'8"), Rest('r4'), Rest('r4')]

>>> f(staff)
\new Staff {
    r8
    r8
    c'8
    d'8
    r4
    r4
}
```

Return list.

leaftools.remove_leaf_and_shrink_durated_parent_containers

leaftools.**remove_leaf_and_shrink_durated_parent_containers**(*leaf*)

New in version 1.1. Remove *leaf* and shrink durated parent containers:

```
>>> measure = Measure((4, 8), [])
>>> measure.append(tuplettools.FixedDurationTuplet((2, 8), "c'8 d'8 e'8"))
>>> measure.append(tuplettools.FixedDurationTuplet((2, 8), "f'8 g'8 a'8"))
>>> beamtools.BeamSpanner(measure.leaves)
BeamSpanner(c'8, d'8, e'8, f'8, g'8, a'8)

>>> f(measure)
{
    \time 4/8
    \times 2/3 {
        c'8 [
        d'8
        e'8
    }
    \times 2/3 {
```

```
            f'8
            g'8
            a'8 ]
        }
    }

    >>> leaftools.remove_leaf_and_shrink_durated_parent_containers(measure.leaves[0])

    >>> f(measure)
    {
        \time 5/12
        \scaleDurations #'(2 . 3) {
            {
                d'8 [
                e'8
            }
            {
                f'8
                g'8
                a'8 ]
            }
        }
    }
```

Return none.

leaftools.remove_outer_rests_from_sequence

leaftools.**remove_outer_rests_from_sequence**(*sequence*)

New in version 2.0. Remove outer rests from *sequence*:

```
    >>> staff = Staff("r8 r8 c'8 d'8 r4 r4")

    >>> f(staff)
    \new Staff {
        r8
        r8
        c'8
        d'8
        r4
        r4
    }

    >>> leaftools.remove_outer_rests_from_sequence(staff)
    [Note("c'8"), Note("d'8")]

    >>> f(staff)
    \new Staff {
        r8
        r8
        c'8
        d'8
        r4
        r4
    }
```

Return list.

leaftools.remove_terminal_rests_from_sequence

leaftools.**remove_terminal_rests_from_sequence**(*sequence*)

New in version 2.0. Remove terminal rests from *sequence*:

```
>>> staff = Staff("r8 r8 c'8 d'8 r4 r4")

>>> f(staff)
\new Staff {
    r8
    r8
    c'8
    d'8
    r4
    r4
}

>>> leaftools.remove_terminal_rests_from_sequence(staff)
[Rest('r8'), Rest('r8'), Note("c'8"), Note("d'8")]

>>> f(staff)
\new Staff {
    r8
    r8
    c'8
    d'8
    r4
    r4
}
```

Return list.

leaftools.repeat_leaf

leaftools.**repeat_leaf**(*leaf*, *total=1*)

New in version 1.1. Repeat *leaf* and extend spanners:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> leaftools.repeat_leaf(staff[0], total=3)

>>> f(staff)
\new Staff {
    c'8 [
    c'8
    c'8
    d'8
    e'8
```

```
    f'8 ]
}
```

Preserve *leaf* written duration.

Preserve parentage and spanners.

Return none. Changed in version 2.0: renamed `leaftools.clone_and_splice_leaf()` to `leaftools.repeat_leaf()`.

leaftools.repeat_leaves_in_expr

`leaftools.`**`repeat_leaves_in_expr`**(*expr*, *total=1*)

New in version 1.1. Repeat leaves in *expr* and extend spanners:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

```
>>> result = leaftools.repeat_leaves_in_expr(staff[2:], total=3)
```

```
>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    e'8
    e'8
    f'8
    f'8
    f'8 ]
}
```

Preserve leaf written durations.

Preserve parentage and spanners.

Return none. Changed in version 2.0: renamed `leaftools.multiply()` to `leaftools.repeat_leaves_in_expr()`.

leaftools.replace_leaves_in_expr_with_named_parallel_voices

`leaftools.`**`replace_leaves_in_expr_with_named_parallel_voices`**(*expr*, *upper_name*, *lower_name*)

Replace leaves in *expr* with two parallel voices containing copies of leaves in *expr*, with the upper voice named *upper_name* and the lower voice named *lower_name*:

```
>>> c = p('{ c c c c }')
>>> f(c)
{
```

```
    c4
    c4
    c4
    c4
}

>>> leaves = leaftools.replace_leaves_in_expr_with_named_parallel_voices(
... c.leaves[1:3], 'upper', 'lower')

>>> f(c)
{
    c4
    <<
        \context Voice = "upper" {
            c4
            c4
        }
        \context Voice = "lower" {
            c4
            c4
        }
    >>
    c4
}
```

If leaves in *expr* have different immediate parents, parallel voices will be created in each parent:

```
>>> c = p(r'{ c8 \times 2/3 { c8 c c } \times 4/5 { c16 c c c c } c8 }')
>>> f(c)
{
    c8
    \times 2/3 {
        c8
        c8
        c8
    }
    \times 4/5 {
        c16
        c16
        c16
        c16
        c16
    }
    c8
}

>>> leaves = leaftools.replace_leaves_in_expr_with_named_parallel_voices(
... c.leaves[2:7], 'upper', 'lower')

>>> f(c)
{
    c8
    \times 2/3 {
        c8
        <<
            \context Voice = "upper" {
                c8
                c8
            }
```

```
                \context Voice = "lower" {
                    c8
                    c8
                }
            >>
        }
        \times 4/5 {
            <<
                \context Voice = "upper" {
                    c16
                    c16
                    c16
                }
                \context Voice = "lower" {
                    c16
                    c16
                    c16
                }
            >>
            c16
            c16
        }
        c8
    }
```

Returns a list leaves in upper voice, and a list of leaves in lower voice.

leaftools.replace_leaves_in_expr_with_parallel_voices

leaftools.**replace_leaves_in_expr_with_parallel_voices**(*expr*)

Replace leaves in *expr* with two parallel voices containing copies of leaves in *expr*:

```
>>> c = p('{ c c c c }')
>>> f(c)
{
    c4
    c4
    c4
    c4
}

>>> leaftools.replace_leaves_in_expr_with_parallel_voices(c.leaves[1:3])
([Note('c4'), Note('c4')], [Note('c4'), Note('c4')])

>>> f(c)
{
    c4
    <<
        \new Voice {
            c4
            c4
        }
        \new Voice {
            c4
            c4
        }
    >>
```

```
    c4
}
```

If leaves in *expr* have different immediate parents, parallel voices will be created in each parent:

```
>>> c = p(r'{ c8 \times 2/3 { c8 c c } \times 4/5 { c16 c c c c } c8 }')
>>> f(c)
{
    c8
    \times 2/3 {
        c8
        c8
        c8
    }
    \times 4/5 {
        c16
        c16
        c16
        c16
        c16
    }
    c8
}

>>> leaves = leaftools.replace_leaves_in_expr_with_parallel_voices(c.leaves[2:7])

>>> f(c)
{
    c8
    \times 2/3 {
        c8
        <<
            \new Voice {
                c8
                c8
            }
            \new Voice {
                c8
                c8
            }
        >>
    }
    \times 4/5 {
        <<
            \new Voice {
                c16
                c16
                c16
            }
            \new Voice {
                c16
                c16
                c16
            }
        >>
        c16
        c16
    }
    c8
```

```
}
```

Returns a list leaves in upper voice, and a list of leaves in lower voice.

leaftools.rest_leaf_at_offset

leaftools.**rest_leaf_at_offset**(*leaf*, *offset*)

New in version 1.1. Split *leaf* at *offset* and rest right half:

```
>>> staff = Staff("c'8 ( d'8 e'8 f'8 )")

>>> f(staff)
\new Staff {
    c'8 (
    d'8
    e'8
    f'8 )
}

>>> leaftools.rest_leaf_at_offset(staff.leaves[1], (1, 32))
([Note("d'32")], [Note("d'16.")])

>>> f(staff)
\new Staff {
    c'8 (
    d'32
    r16.
    e'8
    f'8 )
}
```

Return list of leaves to left of *offset* together with list of leaves to right of *offset*. Changed in version 2.0: renamed `leaftools.shorten()` to `leaftools.rest_leaf_at_offset()`.

leaftools.scale_preprolated_leaf_duration

leaftools.**scale_preprolated_leaf_duration**(*leaf*, *multiplier*)

New in version 1.1. Scale preprolated *leaf* leaf duration by dotted *multiplier*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> leaftools.scale_preprolated_leaf_duration(staff[1], Duration(3, 2))
[Note("d'8.")]
>>> f(staff)
\new Staff {
    c'8 [
    d'8.
    e'8
    f'8 ]
}
```

Scale preprolated *leaf* duration by tied *multiplier*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
```

```
BeamSpanner(c'8, d'8, e'8, f'8)
>>> leaftools.scale_preprolated_leaf_duration(staff[1], Duration(5, 4))
[Note("d'8"), Note("d'32")]
>>> f(staff)
\new Staff {
    c'8 [
    d'8 ~
    d'32
    e'8
    f'8 ]
}
```

Scale preprolated *leaf* duration by nonbinary *multiplier*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> leaftools.scale_preprolated_leaf_duration(staff[1], Duration(2, 3))
[Note("d'8")]
>>> f(staff)
\new Staff {
    c'8 [
    \times 2/3 {
        d'8
    }
    e'8
    f'8 ]
}
```

Scale preprolated *leaf* duration by tied nonbinary *multiplier*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> leaftools.scale_preprolated_leaf_duration(staff[1], Duration(5, 6))
[Note("d'8"), Note("d'32")]
>>> f(staff)
\new Staff {
    c'8 [
    \times 2/3 {
        d'8 ~
        d'32
    }
    e'8
    f'8 ]
}
```

Return *leaf*. Changed in version 2.0: renamed from `leaftools.duration_scale()`. `leaftools.scale_preprolated_leaf_duration()`.

leaftools.set_preprolated_leaf_duration

`leaftools.`**`set_preprolated_leaf_duration`**(*leaf*, *new_preprolated_duration*)

New in version 1.1. Set preprolated *leaf* duration:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> leaftools.set_preprolated_leaf_duration(staff[1], Duration(3, 16))
[Note("d'8.")]
>>> f(staff)
\new Staff {
    c'8 [
    d'8.
    e'8
    f'8 ]
}
```

Set tied preprolated *leaf* duration:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> leaftools.set_preprolated_leaf_duration(staff[1], Duration(5, 32))
[Note("d'8"), Note("d'32")]
>>> f(staff)
\new Staff {
    c'8 [
    d'8 ~
    d'32
    e'8
    f'8 ]
}
```

Set nonbinary preprolated *leaf* duration:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> leaftools.set_preprolated_leaf_duration(staff[1], Duration(1, 12))
[Note("d'8")]
>>> f(staff)
\new Staff {
    c'8 [
    \times 2/3 {
        d'8
    }
    e'8
    f'8 ]
}
```

Set tied nonbinary preprolated *leaf* duration:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'8, d'8, e'8, f'8)
>>> leaftools.set_preprolated_leaf_duration(staff[1], Duration(5, 48))
[Note("d'8"), Note("d'32")]
>>> f(staff)
\new Staff {
    c'8 [
    \times 2/3 {
        d'8 ~
        d'32
    }
    e'8
    f'8 ]
```

```
}
```

Set preprolated *leaf* duration with LilyPond multiplier:

```
>>> note = Note(0, (1, 8))
>>> note.duration_multiplier = Duration(1, 2)
>>> leaftools.set_preprolated_leaf_duration(note, Duration(5, 48))
[Note("c'8 * 5/6")]
>>> f(note)
c'8 * 5/6
```

Return list of *leaf* and leaves newly tied to *leaf*. Changed in version 2.0: renamed `leaftools.change_leaf_preprolated_duration()` to `leaftools.set_preprolated_leaf_duration()`.

leaftools.show_leaves

`leaftools.`**`show_leaves`**(*leaves*, *suppress_pdf=False*)

New in version 2.0. Show *leaves* in temporary piano staff score:

```
>>> leaves = leaftools.make_leaves([None, 1, (-24, -22, 7, 21), None], (1, 4))
>>> score = leaftools.show_leaves(leaves)
\new Score <<
    \new PianoStaff <<
        \context Staff = "treble" {
            \clef "treble"
            r4
            cs'4
            <g' a''>4
            r4
        }
        \context Staff = "bass" {
            \clef "bass"
            r4
            r4
            <c, d,>4
            r4
        }
    >>
>>
```

Useful when working with notes, rests, chords not yet added to score.

Return temporary piano staff score.

leaftools.split_leaf_at_offset

`leaftools.`**`split_leaf_at_offset`**(*leaf*, *offset*, *fracture_spanners=False*, *tie_split_notes=True*, *tie_split_rests=False*)

Split *leaf* at *offset*.

Example 1. Split note at assignable offset. Two notes result. Do not tie notes:

```
>>> staff = Staff(r"abj: | 2/8 c'8 ( d'8 || 2/8 e'8 f'8 ) |")
>>> beamtools.apply_beam_spanners_to_measures_in_expr(staff)
[BeamSpanner(|2/8(2)|), BeamSpanner(|2/8(2)|)]
>>> contexttools.DynamicMark('f')(staff.leaves[0])
```

```
DynamicMark('f')(c'8)
>>> marktools.Articulation('accent')(staff.leaves[0])
Articulation('accent')(c'8)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8 -\accent \f [ (
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}

>>> leaftools.split_leaf_at_offset(staff.leaves[0], (1, 32), tie_split_notes=False)
([Note("c'32")], [Note("c'16.")])

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'32 -\accent \f [ (
        c'16.
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}
```

Example 2. Handle grace and after grace containers correctly.

```
>>> staff = Staff(r"abj: | 2/8 c'8 ( d'8 || 2/8 e'8 f'8 ) |")
>>> beamtools.apply_beam_spanners_to_measures_in_expr(staff)
[BeamSpanner(|2/8(2)|), BeamSpanner(|2/8(2)|)]
>>> gracetools.GraceContainer("cs'16")(staff.leaves[0])
Note("c'8")
>>> gracetools.GraceContainer("ds'16", kind='after')(staff.leaves[0])
Note("c'8")

>>> f(staff)
\new Staff {
    {
        \time 2/8
        \grace {
            cs'16
        }
        \afterGrace
        c'8 [ (
        {
            ds'16
        }
        d'8 ]
    }
    {
```

```
        e'8 [
        f'8 ] )
    }
}
```

```
>>> leaftools.split_leaf_at_offset(staff.leaves[0], (1, 32), tie_split_notes=False)
([Note("c'32")], [Note("c'16.")])
```

```
>>> f(staff)
\new Staff {
    {
        \time 2/8
        \grace {
            cs'16
        }
        c'32 [ (
        \afterGrace
        c'16.
        {
            ds'16
        }
        d'8 ]
    }
    {
        e'8 [
        f'8 ] )
    }
}
```

Return pair.

leaftools.split_leaf_at_offsets

leaftools.**split_leaf_at_offsets**(*leaf*, *offsets*, *cyclic=False*, *fracture_spanners=False*, *tie_split_notes=True*, *tie_split_rests=False*)

New in version 2.10. Split *leaf* at *offsets*.

Example 1. Split note once at *offsets* and tie split notes:

```
>>> staff = Staff("c'1 ( d'1 )")
```

```
>>> f(staff)
\new Staff {
    c'1 (
    d'1 )
}
```

```
>>> leaftools.split_leaf_at_offsets(staff[0], [(3, 8)], tie_split_notes=True)
[[Note("c'4.")], [Note("c'2"), Note("c'8")]]
```

```
>>> f(staff)
\new Staff {
    c'4. ( ~
    c'2 ~
    c'8
    d'1 )
}
```

Example 2. Split note cyclically at *offsets* and tie split notes:

```
>>> staff = Staff("c'1 ( d'1 )")

>>> f(staff)
\new Staff {
    c'1 (
    d'1 )
}

>>> leaftools.split_leaf_at_offsets(staff[0], [(3, 8)], cyclic=True, tie_split_notes=True)
[[Note("c'4.")], [Note("c'4.")], [Note("c'4")]]

>>> f(staff)
\new Staff {
    c'4. ( ~
    c'4. ~
    c'4
    d'1 )
}
```

Example 3. Split note once at *offsets* and do no tie split notes:

```
>>> staff = Staff("c'1 ( d'1 )")

>>> f(staff)
\new Staff {
    c'1 (
    d'1 )
}

>>> leaftools.split_leaf_at_offsets(staff[0], [(3, 8)], tie_split_notes=False)
[[Note("c'4.")], [Note("c'2"), Note("c'8")]]

>>> f(staff)
\new Staff {
    c'4. (
    c'2 ~
    c'8
    d'1 )
}
```

Example 4. Split note cyclically at *offsets* and do not tie split notes:

```
>>> staff = Staff("c'1 ( d'1 )")

>>> f(staff)
\new Staff {
    c'1 (
    d'1 )
}

>>> leaftools.split_leaf_at_offsets(staff[0], [(3, 8)], cyclic=True, tie_split_notes=False)
[[Note("c'4.")], [Note("c'4.")], [Note("c'4")]]

>>> f(staff)
\new Staff {
    c'4. (
    c'4.
```

```
    c'4
    d'1 )
}
```

Example 5. Split tupletted note once at *offsets* and tie split notes:

```
>>> staff = Staff(r"\times 2/3 { c'2 ( d'2 e'2 ) }")

>>> f(staff)
\new Staff {
    \times 2/3 {
        c'2 (
        d'2
        e'2 )
    }
}

>>> leaftools.split_leaf_at_offsets(staff.leaves[1], [(1, 6)], cyclic=False, tie_split_notes=Tru
[[Note("d'4")], [Note("d'4")]]

>>> f(staff)
\new Staff {
    \times 2/3 {
        c'2 (
        d'4 ~
        d'4
        e'2 )
    }
}
```

Note: Add examples showing mark and context mark handling.

Return list of shards.

leaftools.yield_groups_of_mixed_notes_and_chords_in_sequence

leaftools.**yield_groups_of_mixed_notes_and_chords_in_sequence**(*sequence*)

New in version 2.0. Yield groups of mixed notes and chords in *sequence*:

```
>>> staff = Staff("c'8 d'8 r8 r8 <e' g'>8 <f' a'>8 g'8 a'8 r8 r8 <b' d''>8 <c'' e''>8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    r8
    r8
    <e' g'>8
    <f' a'>8
    g'8
    a'8
    r8
    r8
    <b' d''>8
    <c'' e''>8
}
```

```
>>> for group in leaftools.yield_groups_of_mixed_notes_and_chords_in_sequence(staff):
...     group
...
(Note("c'8"), Note("d'8"))
(Chord("<e' g'>8"), Chord("<f' a'>8"), Note("g'8"), Note("a'8"))
(Chord("<b' d''>8"), Chord("<c'' e''>8"))
```

Return generator.

lilypondfiletools

abstract classes

lilypondfiletools.AttributedBlock

class lilypondfiletools.**AttributedBlock**
New in version 2.0. Abjad model of LilyPond input file block with attributes.

Read-only Properties
AttributedBlock.**lilypond_format**

Read/write Properties
AttributedBlock.**is_formatted_when_empty**

Special Methods
AttributedBlock.**__repr__**()

lilypondfiletools.NonattributedBlock

class lilypondfiletools.**NonattributedBlock**
New in version 2.0. Abjad model of LilyPond input file block with no attributes.

Read-only Properties

NonattributedBlock.**lilypond_format**

Read/write Properties

NonattributedBlock.**is_formatted_when_empty**

Methods

NonattributedBlock.**append**()

L.append(object) – append object to end

Inherited from __builtin__.list

NonattributedBlock.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.list

NonattributedBlock.**extend**()

L.extend(iterable) – extend list by appending elements from the iterable

Inherited from __builtin__.list

NonattributedBlock.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.list

NonattributedBlock.**insert**()

L.insert(index, object) – insert object before index

Inherited from __builtin__.list

NonattributedBlock.**pop**([*index*]) → item – remove and return item at index (default last).

Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

NonattributedBlock.**remove**()

L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

NonattributedBlock.**reverse**()

L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

NonattributedBlock.**sort**()

L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

NonattributedBlock.**__add__**()

x.__add__(y) <==> x+y

Inherited from __builtin__.list

NonattributedBlock.**__contains__**()

x.__contains__(y) <==> y in x

Inherited from __builtin__.list

NonattributedBlock.__**delitem**__()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

NonattributedBlock.__**delslice**__()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

NonattributedBlock.__**eq**__()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

NonattributedBlock.__**ge**__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

NonattributedBlock.__**getitem**__()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

NonattributedBlock.__**getslice**__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

NonattributedBlock.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

NonattributedBlock.__**iadd**__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

NonattributedBlock.__**imul**__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

NonattributedBlock.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.list

NonattributedBlock.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

NonattributedBlock.__**len**__() <==> *len(x)*
Inherited from __builtin__.list

NonattributedBlock.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

NonattributedBlock.__**mul**__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

NonattributedBlock.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

NonattributedBlock.__**repr**__()

NonattributedBlock.__**reversed**__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

NonattributedBlock.__**rmul**__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

NonattributedBlock.__**setitem**__()
x.__setitem__(i, y) <==> x[i]=y

Inherited from __builtin__.list

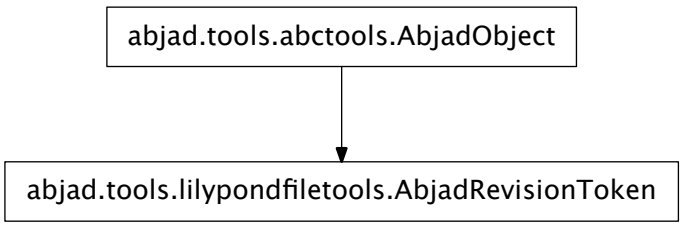
NonattributedBlock.__**setslice**__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

concrete classes

lilypondfiletools.AbjadRevisionToken



class lilypondfiletools.**AbjadRevisionToken**
New in version 2.0. Abjad version token:

```
>>> lilypondfiletools.AbjadRevisionToken()
AbjadRevisionToken(Abjad revision ...)
```

Return Abjad version token.

Read-only Properties

AbjadRevisionToken.**lilypond_format**

Format contribution of Abjad version token:

```
>>> lilypondfiletools.AbjadRevisionToken().lilypond_format
'Abjad revision ...'
```

Return string.

AbjadRevisionToken.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

AbjadRevisionToken.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

AbjadRevisionToken.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadRevisionToken.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

AbjadRevisionToken.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadRevisionToken.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadRevisionToken.**__ne__**(*arg*)

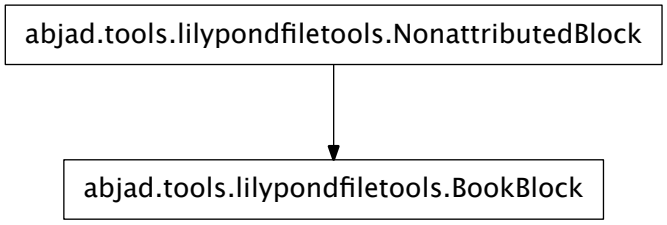
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

AbjadRevisionToken.**__repr__**()

lilypondfiletools.BookBlock



class lilypondfiletools.**BookBlock**

New in version 2.0. Abjad model of LilyPond input file book block:

```
>>> book_block = lilypondfiletools.BookBlock()

>>> book_block
BookBlock()

>>> f(book_block)
\book {}
```

Return book block.

Read-only Properties

BookBlock.**lilypond_format**

Inherited from lilypondfiletools.NonattributedBlock

Read/write Properties

BookBlock.**is_formatted_when_empty**

Inherited from lilypondfiletools.NonattributedBlock

Methods

BookBlock.**append**()

L.append(object) – append object to end

Inherited from __builtin__.list

BookBlock.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.list

BookBlock.**extend**()

L.extend(iterable) – extend list by appending elements from the iterable

Inherited from __builtin__.list

BookBlock.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.list

BookBlock.**insert**()
L.insert(index, object) – insert object before index

Inherited from __builtin__.list

BookBlock.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

BookBlock.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

BookBlock.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

BookBlock.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

BookBlock.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

BookBlock.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.list

BookBlock.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

BookBlock.**__delslice__**()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

BookBlock.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

BookBlock.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

BookBlock.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

BookBlock.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

BookBlock.__gt__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

BookBlock.__iadd__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

BookBlock.__imul__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

BookBlock.__iter__() <==> *iter(x)*
Inherited from __builtin__.list

BookBlock.__le__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

BookBlock.__len__() <==> *len(x)*
Inherited from __builtin__.list

BookBlock.__lt__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

BookBlock.__mul__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

BookBlock.__ne__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

BookBlock.__repr__()
Inherited from lilypondfiletools.NonattributedBlock

BookBlock.__reversed__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

BookBlock.__rmul__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

BookBlock.__setitem__()
x.__setitem__(i, y) <==> x[i]=y

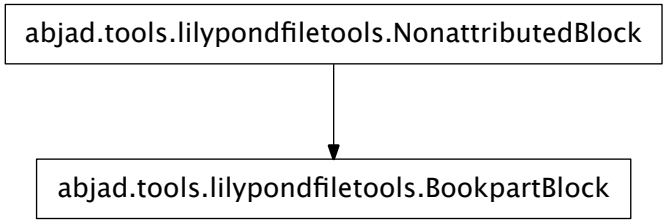
Inherited from __builtin__.list

BookBlock.__setslice__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

lilypondfiletools.BookpartBlock



class lilypondfiletools.**BookpartBlock**

New in version 2.0. Abjad model of LilyPond input file bookpart block:

```
>>> bookpart_block = lilypondfiletools.BookpartBlock()

>>> bookpart_block
BookpartBlock()

>>> f(bookpart_block)
\bookpart {}
```

Return bookpart block.

Read-only Properties

BookpartBlock.**lilypond_format**

Inherited from lilypondfiletools.NonattributedBlock

Read/write Properties

BookpartBlock.**is_formatted_when_empty**

Inherited from lilypondfiletools.NonattributedBlock

Methods

BookpartBlock.**append**()

L.append(object) – append object to end

Inherited from __builtin__.list

BookpartBlock.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.list

BookpartBlock.**extend**()

L.extend(iterable) – extend list by appending elements from the iterable

Inherited from __builtin__.list

BookpartBlock.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.list

BookpartBlock.**insert**()
L.insert(index, object) – insert object before index

Inherited from __builtin__.list

BookpartBlock.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

BookpartBlock.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

BookpartBlock.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

BookpartBlock.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

BookpartBlock.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

BookpartBlock.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.list

BookpartBlock.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

BookpartBlock.**__delslice__**()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

BookpartBlock.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

BookpartBlock.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

BookpartBlock.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

BookpartBlock.__getslice__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

BookpartBlock.__gt__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

BookpartBlock.__iadd__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

BookpartBlock.__imul__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

BookpartBlock.__iter__() <==> *iter(x)*
Inherited from __builtin__.list

BookpartBlock.__le__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

BookpartBlock.__len__() <==> *len(x)*
Inherited from __builtin__.list

BookpartBlock.__lt__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

BookpartBlock.__mul__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

BookpartBlock.__ne__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

BookpartBlock.__repr__()
Inherited from lilypondfiletools.NonattributedBlock

BookpartBlock.__reversed__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

BookpartBlock.__rmul__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

BookpartBlock.__setitem__()
x.__setitem__(i, y) <==> x[i]=y

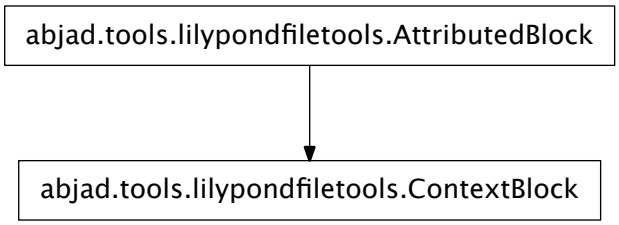
Inherited from __builtin__.list

BookpartBlock.**__setslice__**()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

lilypondfiletools.ContextBlock



class lilypondfiletools.**ContextBlock**(*context_name=None*)
New in version 2.5. Abjad model of LilyPond input file context block:

```
>>> context_block = lilypondfiletools.ContextBlock()

>>> context_block
ContextBlock()

>>> context_block.context_name = 'Score'
>>> context_block.override.bar_number.transparent = True
>>> scheme = schemetools.Scheme('end-of-line-invisible')
>>> context_block.override.time_signature.break_visibility = scheme
>>> context_block.set.proportionalNotationDuration = schemetools.SchemeMoment((1, 45))

>>> f(context_block)
\context {
    \Score
    \override BarNumber #'transparent = ##t
    \override TimeSignature #'break-visibility = #end-of-line-invisible
    proportionalNotationDuration = #(ly:make-moment 1 45)
}
```

Return context block.

Read-only Properties

ContextBlock.**accepts**
ContextBlock.**engraver_consists**

ContextBlock.**engraver_removals**

ContextBlock.**lilypond_format**
Inherited from lilypondfiletools.AttributedBlock

ContextBlock.**override**
Read-only reference to LilyPond grob override component plug-in.

ContextBlock.**set**
Read-only reference LilyPond context setting component plug-in.

Read/write Properties

ContextBlock.**context_name**
Read / write context name.

ContextBlock.**is_formatted_when_empty**
Inherited from lilypondfiletools.AttributedBlock

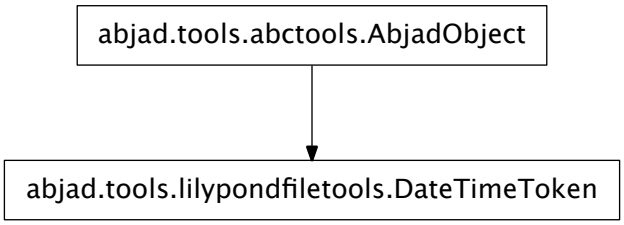
ContextBlock.**name**
Read / write name.

ContextBlock.**type**
Read / write type.

Special Methods

ContextBlock.**__repr__**()
Inherited from lilypondfiletools.AttributedBlock

lilypondfiletools.DateTimeToken



class lilypondfiletools.**DateTimeToken**
New in version 2.0. Date time token:

```
>>> lilypondfiletools.DateTimeToken()
DateTimeToken(...)
```

Return date / time token.

Read-only Properties

DateTimeToken.**lilypond_format**
Format contribution of date time token:

```
>>> lilypondfiletools.DateTimeToken().lilypond_format
'...'
```

Return string.

DateTimeToken.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

DateTimeToken.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DateTimeToken.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DateTimeToken.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DateTimeToken.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DateTimeToken.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

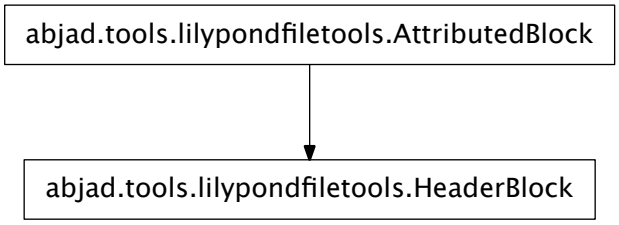
DateTimeToken.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DateTimeToken.**__repr__**()

lilypondfiletools.HeaderBlock



class lilypondfiletools.**HeaderBlock**

New in version 2.0. Abjad model of LilyPond input file header block:

```
>>> header_block = lilypondfiletools.HeaderBlock()

>>> header_block
HeaderBlock()

>>> header_block.composer = markuptools.Markup('Josquin')
>>> header_block.title = markuptools.Markup('Missa sexti tonus')

>>> f(header_block)
\header {
    composer = \markup { Josquin }
    title = \markup { Missa sexti tonus }
}
```

Return header block.

Read-only Properties

HeaderBlock.**lilypond_format**

Inherited from lilypondfiletools.AttributedBlock

Read/write Properties

HeaderBlock.**is_formatted_when_empty**

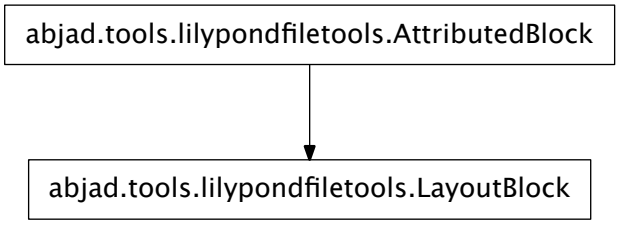
Inherited from lilypondfiletools.AttributedBlock

Special Methods

HeaderBlock.**__repr__**()

Inherited from lilypondfiletools.AttributedBlock

lilypondfiletools.LayoutBlock



class lilypondfiletools.**LayoutBlock**

New in version 2.0. Abjad model of LilyPond input file layout block:

```
>>> layout_block = lilypondfiletools.LayoutBlock()

>>> layout_block
LayoutBlock()

>>> layout_block.indent = 0
>>> layout_block.ragged_right = True

>>> f(layout_block)
\layout {
    indent = #0
    ragged-right = ##t
}
```

Return layout block.

Read-only Properties

LayoutBlock.**context_blocks**

Read-only list of context blocks:

```
>>> layout_block = lilypondfiletools.LayoutBlock()

>>> context_block = lilypondfiletools.ContextBlock('Score')
>>> context_block.override.bar_number.transparent = True

>>> scheme_expr = schemetools.Scheme('end-of-line-invisible')
>>> context_block.override.time_signature.break_visibility = scheme_expr
>>> layout_block.context_blocks.append(context_block)

>>> f(layout_block)
\layout {
    \context {
        \Score
        \override BarNumber #'transparent = ##t
        \override TimeSignature #'break-visibility = #end-of-line-invisible
    }
}
```

Return list.

LayoutBlock.**contexts**
DEPRECATED. USE CONTEXT_BLOCKS INSTEAD.

LayoutBlock.**lilypond_format**
Inherited from lilypondfiletools.AttributedBlock

Read/write Properties

LayoutBlock.**is_formatted_when_empty**
Inherited from lilypondfiletools.AttributedBlock

Special Methods

LayoutBlock.**__repr__**()
Inherited from lilypondfiletools.AttributedBlock

lilypondfiletools.LilyPondFile

class lilypondfiletools.**LilyPondFile**
New in version 2.0. Abjad model of LilyPond input file:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> lilypond_file = lilypondfiletools.make_basic_lilypond_file(staff)
>>> lilypond_file.file_initial_user_comments.append('File construct as an example.')
>>> lilypond_file.file_initial_user_comments.append('Parts shown here for positioning.')
>>> lilypond_file.file_initial_user_includes.append('external-settings-file-1.ly')
>>> lilypond_file.file_initial_user_includes.append('external-settings-file-2.ly')
>>> lilypond_file.default_paper_size = 'letter', 'portrait'
>>> lilypond_file.global_staff_size = 16
>>> lilypond_file.header_block.composer = markuptools.Markup('Josquin')
>>> lilypond_file.header_block.title = markuptools.Markup('Missa sexti tonus')
>>> lilypond_file.layout_block.indent = 0
>>> lilypond_file.layout_block.left_margin = 15
>>> lilypond_file.paper_block.oddFooterMarkup = markuptools.Markup('The odd-page footer')
>>> lilypond_file.paper_block.evenFooterMarkup = markuptools.Markup('The even-page footer')

>>> f(lilypond_file)
% Abjad revision 3719
% 2010-09-24 09:01

% File construct as an example.
% Parts shown here for positioning.

\version "2.13.32"
\include "english.ly"
\include "/Users/trevorbaca/Documents/abjad/trunk/abjad/cfg/abjad.scm"
```

```
\include "external-settings-file-1.ly"
\include "external-settings-file-2.ly"

#(set-default-paper-size "letter" 'portrait)
#(set-global-staff-size 16)

\header {
    composer = \markup { Josquin }
    title = \markup { Missa sexti tonus }
}

\layout {
    indent = #0
    left-margin = #15
}

\paper {
    evenFooterMarkup = \markup { The even-page footer }
    oddFooterMarkup = \markup { The odd-page footer }
}

\new Staff {
    c'8
    d'8
    e'8
    f'8
}
```

Read-only Properties

`LilyPondFile.`**`lilypond_format`**
Format-time contribution of LilyPond file.

Read/write Properties

`LilyPondFile.`**`default_paper_size`**
LilyPond default paper size.

`LilyPondFile.`**`file_initial_system_comments`**
Read-only list of file-initial system comments.

`LilyPondFile.`**`file_initial_system_includes`**
List of file-initial system include commands.

`LilyPondFile.`**`file_initial_user_comments`**
Read-only list of file-initial user comments.

`LilyPondFile.`**`file_initial_user_includes`**
List of file-initial user include commands.

`LilyPondFile.`**`global_staff_size`**
LilyPond global staff size.

Methods

`LilyPondFile.`**`append`**`()`
L.append(object) – append object to end

Inherited from `__builtin__.list`

LilyPondFile.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.list

LilyPondFile.**extend**()
L.extend(iterable) – extend list by appending elements from the iterable

Inherited from __builtin__.list

LilyPondFile.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.list

LilyPondFile.**insert**()
L.insert(index, object) – insert object before index

Inherited from __builtin__.list

LilyPondFile.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

LilyPondFile.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

LilyPondFile.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

LilyPondFile.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

LilyPondFile.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

LilyPondFile.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.list

LilyPondFile.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

LilyPondFile.**__delslice__**()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

LilyPondFile.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

LilyPondFile.__**ge**__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

LilyPondFile.__**getitem**__()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

LilyPondFile.__**getslice**__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

LilyPondFile.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

LilyPondFile.__**iadd**__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

LilyPondFile.__**imul**__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

LilyPondFile.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.list

LilyPondFile.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

LilyPondFile.__**len**__() <==> *len(x)*
Inherited from __builtin__.list

LilyPondFile.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

LilyPondFile.__**mul**__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

LilyPondFile.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

LilyPondFile.__**repr**__()

LilyPondFile.__**reversed**__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

LilyPondFile.__**rmul**__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

LilyPondFile.__**setitem**__()
x.__setitem__(i, y) <==> x[i]=y

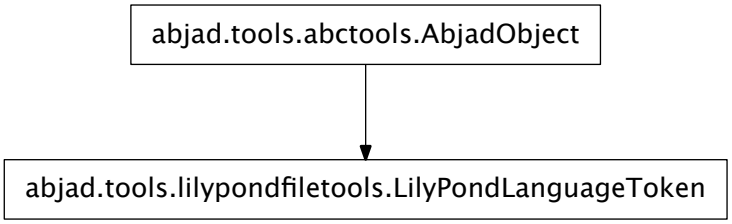
Inherited from __builtin__.list

LilyPondFile.__**setslice**__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

lilypondfiletools.LilyPondLanguageToken



class lilypondfiletools.**LilyPondLanguageToken**
New in version 2.0. LilyPond language token:

```
>>> lilypondfiletools.LilyPondLanguageToken()
LilyPondLanguageToken('english')
```

Return LilyPond language token. Changed in version 2.9: format with LilyPond \language command instead of LilyPond \include command.

Read-only Properties

LilyPondLanguageToken.**lilypond_format**
Format contribution of LilyPond language token:

```
>>> lilypondfiletools.LilyPondLanguageToken().lilypond_format
'\\language "english"'
```

Return string.

LilyPondLanguageToken.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

`LilyPondLanguageToken.__eq__(arg)`
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`LilyPondLanguageToken.__ge__(arg)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`LilyPondLanguageToken.__gt__(arg)`
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`LilyPondLanguageToken.__le__(arg)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`LilyPondLanguageToken.__lt__(arg)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

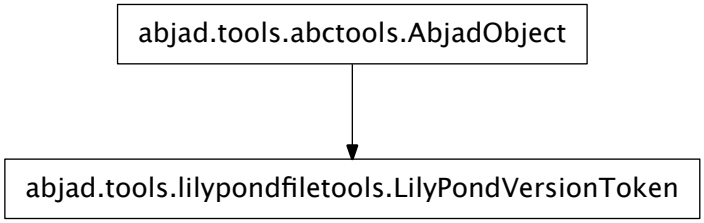
`LilyPondLanguageToken.__ne__(arg)`
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`LilyPondLanguageToken.__repr__()`

lilypondfiletools.LilyPondVersionToken



class lilypondfiletools.**LilyPondVersionToken**

New in version 2.0. LilyPond version token:

```
>>> lilypondfiletools.LilyPondVersionToken()
LilyPondVersionToken(\version "...")
```

Return LilyPond version token.

Read-only Properties

LilyPondVersionToken.**lilypond_format**

Format contribution of LilyPond version token:

```
>>> lilypondfiletools.LilyPondVersionToken().lilypond_format
'\\version "..."'
```

Return string.

LilyPondVersionToken.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

LilyPondVersionToken.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

LilyPondVersionToken.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondVersionToken.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

LilyPondVersionToken.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondVersionToken.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondVersionToken.**__ne__**(*arg*)

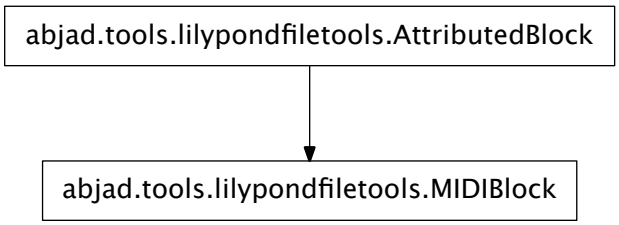
True when id(self) does not equal id(arg).

Return boolean.

Inherited from `abctools.AbjadObject`

`LilyPondVersionToken.__repr__()`

lilypondfiletools.MIDIBlock



class `lilypondfiletools.`**`MIDIBlock`**

New in version 2.0. Abjad model of LilyPond input file MIDI block:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")
>>> score = Score([staff])
>>> lilypond_file = lilypondfiletools.make_basic_lilypond_file(score)

>>> lilypond_file.score_block.append(lilypondfiletools.MIDIBlock())

>>> layout_block = lilypondfiletools.LayoutBlock()
>>> layout_block.is_formatted_when_empty = True
>>> lilypond_file.score_block.append(layout_block)

>>> f(lilypond_file.score_block)
\score {
    \new Score <<
        \new Staff {
            c'4
            d'4
            e'4
            f'4
        }
    >>
    \midi {}
    \layout {}
}
```

MIDI blocks are formatted even when they are empty.

The example here appends MIDI and layout blocks to a score block. Doing this allows LilyPond to create both MIDI and PDF output from a single input file.

Read the LilyPond docs on LilyPond file structure for the details as to why this is the case.

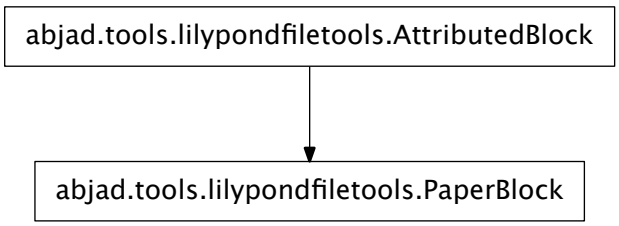
Read-only Properties

MIDIBlock.**lilypond_format**
Inherited from lilypondfiletools.AttributedBlock

Read/write Properties
MIDIBlock.**is_formatted_when_empty**
Inherited from lilypondfiletools.AttributedBlock

Special Methods
MIDIBlock.**__repr__**()
Inherited from lilypondfiletools.AttributedBlock

lilypondfiletools.PaperBlock



class lilypondfiletools.**PaperBlock**
New in version 2.0. Abjad model of LilyPond input file paper block:

```
>>> paper_block = lilypondfiletools.PaperBlock()

>>> paper_block
PaperBlock()

>>> paper_block.print_page_number = True
>>> paper_block.print_first_page_number = False

>>> f(paper_block)
\paper {
    print-first-page-number = ##f
    print-page-number = ##t
}
```

Return paper block.

Read-only Properties
PaperBlock.**lilypond_format**
Inherited from lilypondfiletools.AttributedBlock

Read/write Properties

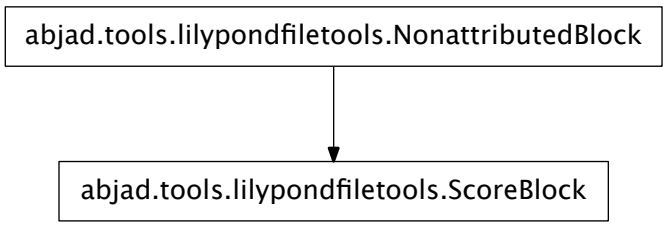
PaperBlock.**is_formatted_when_empty**
Inherited from lilypondfiletools.AttributedBlock

PaperBlock.**minimal_page_breaking**

Special Methods

PaperBlock.**__repr__**()
Inherited from lilypondfiletools.AttributedBlock

lilypondfiletools.ScoreBlock



class lilypondfiletools.**ScoreBlock**
New in version 2.0. Abjad model of LilyPond input file score block:

```
>>> score_block = lilypondfiletools.ScoreBlock()

>>> score_block
ScoreBlock()

>>> score_block.append(Staff([]))
>>> f(score_block)
\score {
    \new Staff {
    }
}
```

ScoreBlocks does not format when empty, as this generates a parser error in LilyPond:

```
>>> score_block = lilypondfiletools.ScoreBlock()
>>> score_block.lilypond_format == ''
True
```

Return score block.

Read-only Properties

ScoreBlock.**lilypond_format**
Inherited from lilypondfiletools.NonattributedBlock

Read/write Properties

ScoreBlock.**is_formatted_when_empty**
Inherited from lilypondfiletools.NonattributedBlock

Methods

ScoreBlock.**append**()
L.append(object) – append object to end

Inherited from __builtin__.list

ScoreBlock.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.list

ScoreBlock.**extend**()
L.extend(iterable) – extend list by appending elements from the iterable

Inherited from __builtin__.list

ScoreBlock.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.list

ScoreBlock.**insert**()
L.insert(index, object) – insert object before index

Inherited from __builtin__.list

ScoreBlock.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

ScoreBlock.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

ScoreBlock.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

ScoreBlock.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

ScoreBlock.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

ScoreBlock.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.list

ScoreBlock.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

ScoreBlock.__**delslice**__()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

ScoreBlock.__**eq**__()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

ScoreBlock.__**ge**__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

ScoreBlock.__**getitem**__()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

ScoreBlock.__**getslice**__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

ScoreBlock.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

ScoreBlock.__**iadd**__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

ScoreBlock.__**imul**__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

ScoreBlock.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.list

ScoreBlock.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

ScoreBlock.__**len**__() <==> *len(x)*
Inherited from __builtin__.list

ScoreBlock.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

ScoreBlock.__**mul**__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

ScoreBlock.__ne__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

ScoreBlock.__repr__()
Inherited from lilypondfiletools.NonattributedBlock

ScoreBlock.__reversed__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

ScoreBlock.__rmul__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

ScoreBlock.__setitem__()
x.__setitem__(i, y) <==> x[i]=y

Inherited from __builtin__.list

ScoreBlock.__setslice__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

functions

lilypondfiletools.make_basic_lilypond_file

lilypondfiletools.**make_basic_lilypond_file**(*music=None*)
New in version 2.0. Make basic LilyPond file with *music*:

```
>>> score = Score([Staff("c'8 d'8 e'8 f'8")])
>>> lilypond_file = lilypondfiletools.make_basic_lilypond_file(score)
>>> lilypond_file.header_block.composer = markuptools.Markup('Josquin')
>>> lilypond_file.layout_block.indent = 0
>>> lilypond_file.paper_block.top_margin = 15
>>> lilypond_file.paper_block.left_margin = 15

>>> f(lilypond_file)
\header {
    composer = \markup { Josquin }
}

\layout {
    indent = #0
}

\paper {
    left-margin = #15
    top-margin = #15
}

\new Score <<
    \new Staff {
```

```
            c'8
            d'8
            e'8
            f'8
        }
    >>
```

Equip LilyPond file with header, layout and paper blocks.

Return LilyPond file.

lilypondfiletools.make_floating_time_signature_lilypond_file

lilypondfiletools.**make_floating_time_signature_lilypond_file**(*music=None*)

New in version 2.10. Make floating time signature LilyPond file from *music*.

Function creates a basic LilyPond file.

Function then applies many layout settings.

View source here for the complete inventory of settings applied.

Returns LilyPond file object.

lilypondfiletools.make_time_signature_context_block

lilypondfiletools.**make_time_signature_context_block**(*font_size=3*, *padding=4*)

New in version 2.9. Make time signature context block:

```
>>> context_block = lilypondfiletools.make_time_signature_context_block()
```

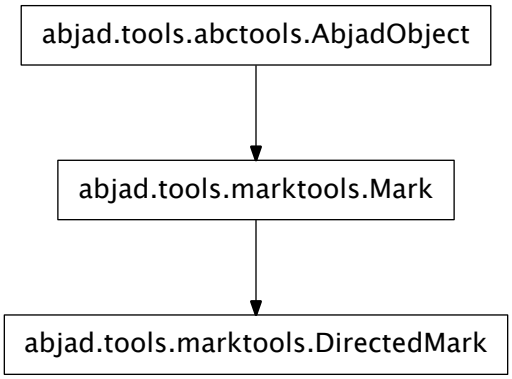
```
>>> f(context_block)
\context {
    \type Engraver_group
    \name TimeSignatureContext
    \consists Axis_group_engraver
    \consists Time_signature_engraver
    \override TimeSignature #'X-extent = #'(0 . 0)
    \override TimeSignature #'X-offset = #ly:self-alignment-interface::x-aligned-on-self
    \override TimeSignature #'Y-extent = #'(0 . 0)
    \override TimeSignature #'break-align-symbol = ##f
    \override TimeSignature #'break-visibility = #end-of-line-invisible
    \override TimeSignature #'font-size = #3
    \override TimeSignature #'self-alignment-X = #center
    \override VerticalAxisGroup #'default-staff-staff-spacing = #'(
        (basic_distance . 0) (minimum_distance . 0) (padding . 4) (stretchability . 0))
}
```

Return context block.

marktools

abstract classes

marktools.DirectedMark



class marktools.**DirectedMark**(**args*, ***kwargs*)

Abstract base class of Marks which possess a vertical, typographic direction, i.e. above or below the staff.

Read-only Properties

DirectedMark.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

DirectedMark.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

DirectedMark.**direction**

Methods

DirectedMark.**attach**(*start_component*)

Attach mark to *start_component*:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()

>>> mark.attach(note)
Mark()(c'4)

>>> mark.start_component
Note("c'4")
```

Return mark.

Inherited from marktools.Mark

DirectedMark.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")

>>> mark.detach()
Mark()

>>> mark.start_component is None
True
```

Return mark.

Inherited from marktools.Mark

Special Methods

DirectedMark.**__call__**(**args*)

Inherited from marktools.Mark

DirectedMark.**__delattr__**(**args*)

Inherited from marktools.Mark

DirectedMark.**__eq__**(*arg*)

Inherited from marktools.Mark

DirectedMark.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DirectedMark.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DirectedMark.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DirectedMark.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

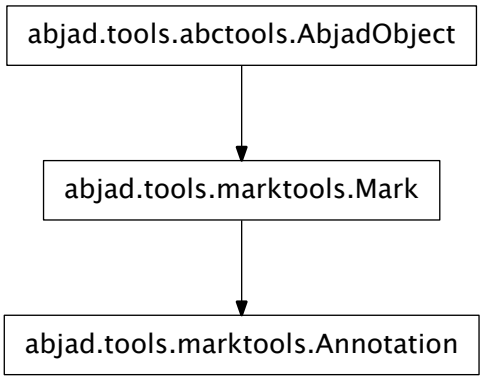
Inherited from abctools.AbjadObject

DirectedMark.__ne__(*arg*)
Inherited from marktools.Mark

DirectedMark.__repr__()
Inherited from marktools.Mark

concrete classes

marktools.Annotation



class marktools.**Annotation**(**args*)
New in version 2.0. User-defined annotation:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> pitch = pitchtools.NamedChromaticPitch('ds')
>>> marktools.Annotation('special pitch', pitch)(staff[0])
Annotation('special pitch', NamedChromaticPitch('ds'))(c'8)
```

```
>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}
```

Annotations contribute no formatting.

Annotations implement `__slots__`.

Read-only Properties

`Annotation.`**`start_component`**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Annotation.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Read/write Properties

`Annotation.`**`name`**

Get name of annotation:

```
>>> pitch = pitchtools.NamedChromaticPitch('ds')
>>> annotation = marktools.Annotation('special_pitch', pitch)
>>> annotation.name
'special_pitch'
```

Set name of annotation:

```
>>> annotation.name = 'revised special pitch'
>>> annotation.name
'revised special pitch'
```

Set string.

`Annotation.`**`value`**

Get value of annotation:

```
>>> annotation.value
NamedChromaticPitch('ds')
```

Set value of annotation:

```
>>> annotation.value = pitchtools.NamedChromaticPitch('e')
>>> annotation.value
NamedChromaticPitch('e')
```

Set arbitrary object.

Methods

Annotation.**attach**(*start_component*)

Attach mark to *start_component*:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()

>>> mark.attach(note)
Mark()(c'4)

>>> mark.start_component
Note("c'4")
```

Return mark.

Inherited from marktools.Mark

Annotation.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")

>>> mark.detach()
Mark()

>>> mark.start_component is None
True
```

Return mark.

Inherited from marktools.Mark

Special Methods

Annotation.**__call__**(**args*)

Inherited from marktools.Mark

Annotation.**__delattr__**(**args*)

Inherited from marktools.Mark

Annotation.**__eq__**(*arg*)

Annotation.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Annotation.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Annotation.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Annotation.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

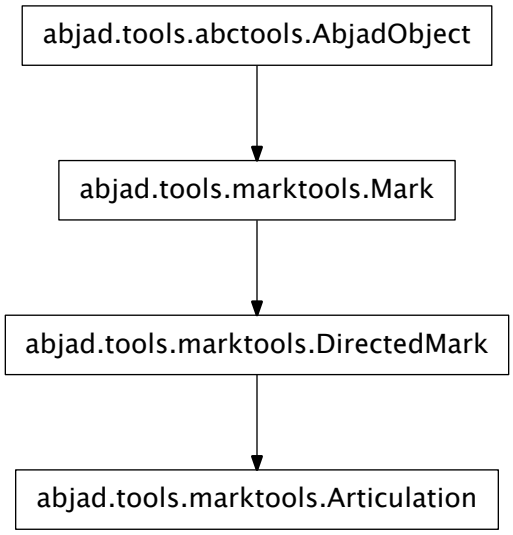
Raise exception.

Inherited from abctools.AbjadObject

Annotation.**__ne__**(*arg*)
Inherited from marktools.Mark

Annotation.**__repr__**()
Inherited from marktools.Mark

marktools.Articulation



class marktools.**Articulation**(**args*)
Abjad model of musical articulation:

```
>>> note = Note("c'4")

>>> marktools.Articulation('staccato')(note)
Articulation('staccato')(c'4)

>>> f(note)
c'4 -\staccato
```

Articulations implement __slots__.

Read-only Properties

Articulation.**lilypond_format**

Read-only LilyPond format string of articulation:

```
>>> articulation = marktools.Articulation('marcato', Up)
>>> articulation.lilypond_format
'^\marcato'
```

Return string.

Articulation.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)
```

```
>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

Articulation.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Articulation.**direction**

Inherited from marktools.DirectedMark

Articulation.**name**

Get name of articulation:

```
>>> articulation = marktools.Articulation('staccato', Up)
>>> articulation.name
'staccato'
```

Set name of articulation:

```
>>> articulation.name = 'marcato'
>>> articulation.name
'marcato'
```

Set string.

Methods

Articulation.**attach**(*start_component*)

Attach mark to *start_component*:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()
```

```
>>> mark.attach(note)
Mark()(c'4)
```

```
>>> mark.start_component
Note("c'4")
```

Return mark.

Inherited from marktools.Mark

Articulation.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")

>>> mark.detach()
Mark()

>>> mark.start_component is None
True
```

Return mark.

Inherited from marktools.Mark

Special Methods

Articulation.**__call__**(**args*)

Inherited from marktools.Mark

Articulation.**__delattr__**(**args*)

Inherited from marktools.Mark

Articulation.**__eq__**(*expr*)

Articulation.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Articulation.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Articulation.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Articulation.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Articulation.**__ne__**(*arg*)

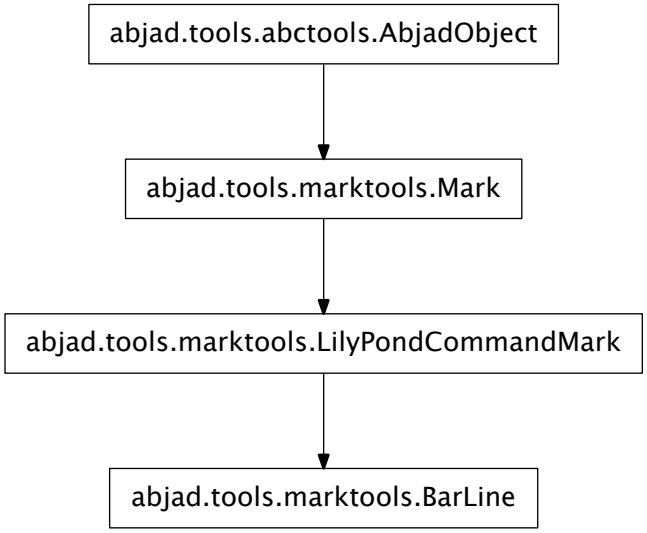
Inherited from marktools.Mark

Articulation.**__repr__**()

Inherited from marktools.Mark

Articulation.__str__()

marktools.BarLine



class marktools.**BarLine**(*bar_line_string='|'*, *format_slot='after'*)

New in version 2.4. Abjad model of bar line:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")

>>> bar_line = marktools.BarLine('|.')(staff[-1])

>>> bar_line
BarLine('|.')(f'4)

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
    \bar "|."
}
```

Return bar line.

Read-only Properties

BarLine.**lilypond_format**

Read-only LilyPond input format of LilyPond command mark:

```
>>> note = Note("c'4")
>>> lilypond_command = marktools.LilyPondCommandMark('slurDotted')(note)
>>> lilypond_command.lilypond_format
'\slurDotted'
```

Return string.

Inherited from `marktools.LilyPondCommandMark`

`BarLine.`**`start_component`**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`BarLine.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Read/write Properties

`BarLine.`**`bar_line_string`**

Get bar line string of bar line:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")
>>> bar_line = marktools.BarLine()(staff[-1])
>>> bar_line.bar_line_string
'|'
```

Set bar line string of bar line:

```
>>> bar_line.bar_line_string = '|.'
>>> bar_line.bar_line_string
'|.'

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
    \bar "|."
}
```

Set string.

`BarLine.`**`command_name`**

Get command name of LilyPond command mark:

```
>>> lilypond_command = marktools.LilyPondCommandMark('slurDotted')
>>> lilypond_command.command_name
'slurDotted'
```

Set command name of LilyPond command mark:

```
>>> lilypond_command.command_name = 'slurDashed'
>>> lilypond_command.command_name
'slurDashed'
```

Set string.

Inherited from `marktools.LilyPondCommandMark`

`BarLine.`**`format_slot`**

New in version 2.3. Get format slot of LilyPond command mark:

```
>>> note = Note("c'4")
>>> lilypond_command = marktools.LilyPondCommandMark('break', 'after')
>>> lilypond_command.format_slot
'after'
```

Set format slot of LiyPond command mark:

```
>>> note = Note("c'4")
>>> lilypond_command = marktools.LilyPondCommandMark('break', 'after')
>>> lilypond_command.format_slot = 'before'
>>> lilypond_command.format_slot
'before'
```

Set to `'before'`, `'after'`, `'opening'`, `'closing'`, `'right'` or none.

Inherited from `marktools.LilyPondCommandMark`

Methods

`BarLine.`**`attach`**`(`*start_component*`)`

Attach mark to *start_component*:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()

>>> mark.attach(note)
Mark()(c'4)

>>> mark.start_component
Note("c'4")
```

Return mark.

Inherited from `marktools.Mark`

`BarLine.`**`detach`**`()`

Detach mark:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")

>>> mark.detach()
Mark()

>>> mark.start_component is None
True
```

Return mark.

Inherited from marktools.Mark

Special Methods

BarLine.__call__(**args*)
Inherited from marktools.Mark

BarLine.__delattr__(**args*)
Inherited from marktools.Mark

BarLine.__eq__(*arg*)
Inherited from marktools.LilyPondCommandMark

BarLine.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BarLine.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BarLine.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BarLine.__lt__(*arg*)
Abjad objects by default do not implement this method.

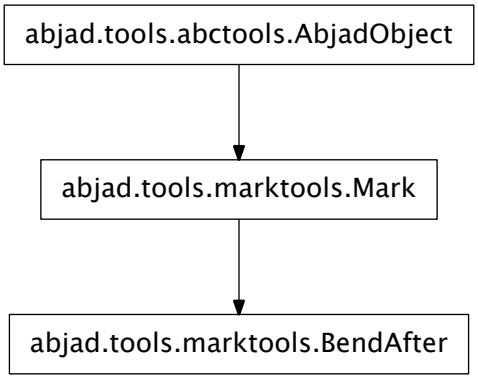
Raise exception.

Inherited from abctools.AbjadObject

BarLine.__ne__(*arg*)
Inherited from marktools.Mark

BarLine.__repr__()
Inherited from marktools.Mark

marktools.BendAfter



class marktools.**BendAfter**(**args*)

Abjad model of a fall or doit:

```
>>> note = Note("c'4")

>>> marktools.BendAfter(-4)(note)
BendAfter(-4.0)(c'4)

>>> f(note)
c'4 - \bendAfter #'-4.0
```

BendAfter implements __slots__.

Read-only Properties

BendAfter.**lilypond_format**

Read-only LilyPond format string:

```
>>> bend = marktools.BendAfter(-4)
>>> bend.lilypond_format
"- \\bendAfter #'-4.0"
```

Return string.

BendAfter.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

BendAfter.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

BendAfter.**bend_amount**
Get bend amount:

```
>>> bend = marktools.BendAfter(8)
>>> bend.bend_amount
8.0
```

Set bend amount:

```
>>> bend.bend_amount = -4
>>> bend.bend_amount
-4.0
```

Set float.

Methods

BendAfter.**attach**(*start_component*)
Attach mark to *start_component*:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()

>>> mark.attach(note)
Mark()(c'4)

>>> mark.start_component
Note("c'4")
```

Return mark.

Inherited from marktools.Mark

BendAfter.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")

>>> mark.detach()
Mark()

>>> mark.start_component is None
True
```

Return mark.

Inherited from marktools.Mark

Special Methods

BendAfter.__call__(**args*)
Inherited from marktools.Mark

BendAfter.__delattr__(**args*)
Inherited from marktools.Mark

BendAfter.__eq__(*expr*)

BendAfter.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BendAfter.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BendAfter.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BendAfter.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

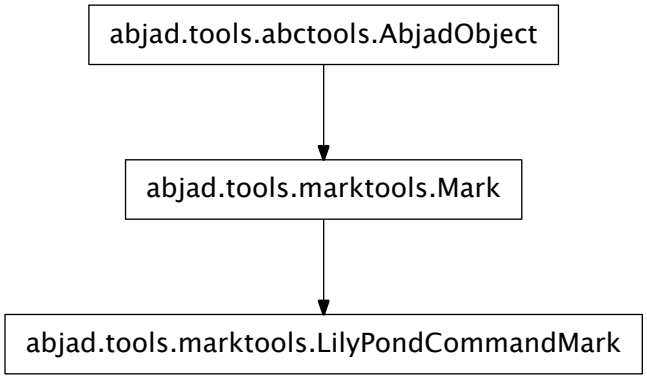
Inherited from abctools.AbjadObject

BendAfter.__ne__(*arg*)
Inherited from marktools.Mark

BendAfter.__repr__()
Inherited from marktools.Mark

BendAfter.__str__()

marktools.LilyPondCommandMark



class marktools.**LilyPondCommandMark**(**args*)

New in version 2.0. LilyPond command mark:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> slur = spannertools.SlurSpanner(staff.leaves)

>>> lilypond_command = marktools.LilyPondCommandMark('slurDotted')(staff[0])

>>> f(staff)
\new Staff {
    \slurDotted
    c'8 (
    d'8
    e'8
    f'8 )
}
```

Initialize LilyPond command marks from command name; or from command name with format slot; or from another LilyPond command mark; or from another LilyPond command mark with format slot.

LilyPond command marks implement __slots__.

Read-only Properties

LilyPondCommandMark.**lilypond_format**

Read-only LilyPond input format of LilyPond command mark:

```
>>> note = Note("c'4")
>>> lilypond_command = marktools.LilyPondCommandMark('slurDotted')(note)
>>> lilypond_command.lilypond_format
'\slurDotted'
```

Return string.

LilyPondCommandMark.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`LilyPondCommandMark.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Read/write Properties

`LilyPondCommandMark.`**`command_name`**

Get command name of LilyPond command mark:

```
>>> lilypond_command = marktools.LilyPondCommandMark('slurDotted')
>>> lilypond_command.command_name
'slurDotted'
```

Set command name of LilyPond command mark:

```
>>> lilypond_command.command_name = 'slurDashed'
>>> lilypond_command.command_name
'slurDashed'
```

Set string.

`LilyPondCommandMark.`**`format_slot`**

New in version 2.3. Get format slot of LilyPond command mark:

```
>>> note = Note("c'4")
>>> lilypond_command = marktools.LilyPondCommandMark('break', 'after')
>>> lilypond_command.format_slot
'after'
```

Set format slot of LiyPond command mark:

```
>>> note = Note("c'4")
>>> lilypond_command = marktools.LilyPondCommandMark('break', 'after')
>>> lilypond_command.format_slot = 'before'
>>> lilypond_command.format_slot
'before'
```

Set to `'before'`, `'after'`, `'opening'`, `'closing'`, `'right'` or none.

Methods

`LilyPondCommandMark.`**`attach`**(*start_component*)

Attach mark to *start_component*:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()

>>> mark.attach(note)
Mark()(c'4)
```

```
>>> mark.start_component
Note("c'4")
```

Return mark.

Inherited from marktools.Mark

LilyPondCommandMark.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")

>>> mark.detach()
Mark()

>>> mark.start_component is None
True
```

Return mark.

Inherited from marktools.Mark

Special Methods

LilyPondCommandMark.**__call__**(**args*)

Inherited from marktools.Mark

LilyPondCommandMark.**__delattr__**(**args*)

Inherited from marktools.Mark

LilyPondCommandMark.**__eq__**(*arg*)

LilyPondCommandMark.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondCommandMark.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

LilyPondCommandMark.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondCommandMark.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

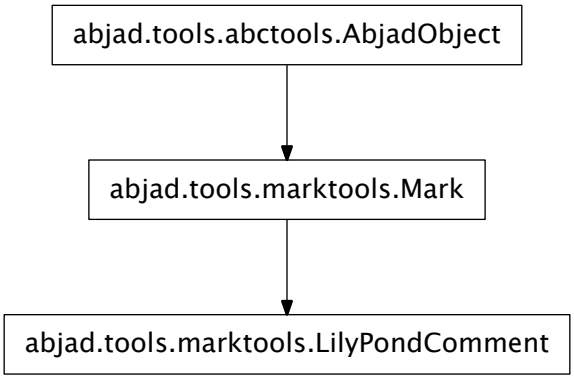
Inherited from abctools.AbjadObject

LilyPondCommandMark.**__ne__**(*arg*)

Inherited from marktools.Mark

LilyPondCommandMark.__repr__()
Inherited from marktools.Mark

marktools.LilyPondComment



class marktools.**LilyPondComment**(**args*)
New in version 2.0.Changed in version 2.3: Changed Comment to LilyPondComment. User-defined comment:

```
>>> note = Note("c'4")

>>> marktools.LilyPondComment('this is a comment')(note)
LilyPondComment('this is a comment')(c'4)

>>> f(note)
% this is a comment
c'4
```

Initialize LilyPond comment from contents string; or contents string and format slot; or from other LilyPond comment; or from other LilyPond comment and format slot.

LilyPond comments implement __slots__.

Read-only Properties

LilyPondComment.**lilypond_format**
Read-only LilyPond input format of comment:

```
>>> comment = marktools.LilyPondComment('this is a comment.')
>>> comment.lilypond_format
'% this is a comment.'
```

Return string.

LilyPondComment.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`LilyPondComment.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Read/write Properties

`LilyPondComment.`**`contents_string`**
Get contents string of comment:

```
>>> comment = marktools.LilyPondComment('comment contents string')
>>> comment.contents_string
'comment contents string'
```

Set contents string of comment:

```
>>> comment.contents_string = 'new comment contents string'
>>> comment.contents_string
'new comment contents string'
```

Set string.

`LilyPondComment.`**`format_slot`**
New in version 2.3. Get format slot of LilyPond comment:

```
>>> note = Note("c'4")
>>> lilypond_comment = marktools.LilyPondComment('comment')
>>> lilypond_comment.format_slot
'before'
```

Set format slot of LiyPond comment:

```
>>> note = Note("c'4")
>>> lilypond_comment = marktools.LilyPondComment('comment')
>>> lilypond_comment.format_slot = 'after'
>>> lilypond_comment.format_slot
'after'
```

Set to `'before'`, `'after'`, `'opening'`, `'closing'`, `'right'` or none.

Methods

`LilyPondComment.`**`attach`**(*start_component*)
Attach mark to *start_component*:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()

>>> mark.attach(note)
Mark()(c'4)
```

```
>>> mark.start_component
Note("c'4")
```

Return mark.

Inherited from marktools.Mark

LilyPondComment.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")

>>> mark.detach()
Mark()

>>> mark.start_component is None
True
```

Return mark.

Inherited from marktools.Mark

Special Methods

LilyPondComment.**__call__**(**args*)

Inherited from marktools.Mark

LilyPondComment.**__delattr__**(**args*)

Inherited from marktools.Mark

LilyPondComment.**__eq__**(*arg*)

LilyPondComment.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondComment.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

LilyPondComment.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondComment.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

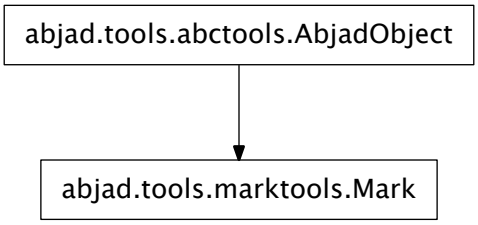
Inherited from abctools.AbjadObject

LilyPondComment.**__ne__**(*arg*)

Inherited from marktools.Mark

LilyPondComment.**__repr__**()
Inherited from marktools.Mark

marktools.Mark



class marktools.**Mark**(**args*)
New in version 2.0. Abstract class from which concrete marks inherit:

```
>>> note = Note("c'4")

>>> marktools.Mark()(note)
Mark()(c'4)
```

Marks override ____call__ to attach to a note, rest or chord.

Marks are immutable.

Read-only Properties

Mark.**start_component**
Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Mark.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

Mark.**attach**(*start_component*)
Attach mark to *start_component*:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()
```

```
>>> mark.attach(note)
Mark()(c'4)

>>> mark.start_component
Note("c'4")
```

Return mark.

Mark.**detach**()

Detach mark:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")

>>> mark.detach()
Mark()

>>> mark.start_component is None
True
```

Return mark.

Special Methods

Mark.**__call__**(**args*)

Mark.**__delattr__**(**args*)

Mark.**__eq__**(*arg*)

Mark.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Mark.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Mark.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Mark.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

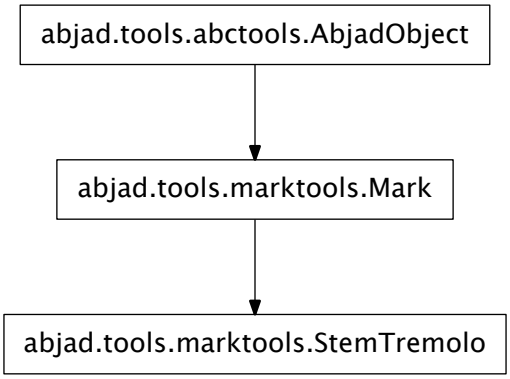
Raise exception.

Inherited from abctools.AbjadObject

Mark.**__ne__**(*arg*)

Mark.**__repr__**()

marktools.StemTremolo



class marktools.**StemTremolo**(**args*)

New in version 2.0. Abjad model of stem tremolo:

```
>>> note = Note("c'4")

>>> marktools.StemTremolo(16)(note)
StemTremolo(16)(c'4)

>>> f(note)
c'4 :16
```

Stem tremolos implement `__slots__`.

Read-only Properties

StemTremolo.**lilypond_format**

Read-only LilyPond format string:

```
>>> stem_tremolo = marktools.StemTremolo(16)
>>> stem_tremolo.lilypond_format
':16'
```

Return string.

StemTremolo.**start_component**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from marktools.Mark

StemTremolo.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

StemTremolo.**tremolo_flags**
Get tremolo flags:

```
>>> stem_tremolo = marktools.StemTremolo(16)
>>> stem_tremolo.tremolo_flags
16
```

Set tremolo flags:

```
>>> stem_tremolo.tremolo_flags = 32
>>> stem_tremolo.tremolo_flags
32
```

Set integer.

Methods

StemTremolo.**attach**(*start_component*)
Attach mark to *start_component*:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()

>>> mark.attach(note)
Mark()(c'4)

>>> mark.start_component
Note("c'4")
```

Return mark.

Inherited from marktools.Mark

StemTremolo.**detach**()
Detach mark:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")

>>> mark.detach()
Mark()

>>> mark.start_component is None
True
```

Return mark.

Inherited from marktools.Mark

Special Methods

StemTremolo.**__call__**(**args*)
Inherited from marktools.Mark

StemTremolo.**__delattr__**(**args*)
Inherited from marktools.Mark

StemTremolo.**__eq__**(*expr*)

StemTremolo.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StemTremolo.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

StemTremolo.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StemTremolo.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StemTremolo.**__ne__**(*arg*)
Inherited from marktools.Mark

StemTremolo.**__repr__**()
Inherited from marktools.Mark

StemTremolo.**__str__**()

functions

marktools.attach_annotations_to_components_in_expr

marktools.**attach_annotations_to_components_in_expr**(*expr*, *annotations*)
New in version 2.3. Attach *annotations* to components in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> annotation = marktools.Annotation('foo', 'bar')
>>> marktools.attach_annotations_to_components_in_expr(staff.leaves, [annotation])

>>> for x in staff:
...     print x, marktools.get_annotations_attached_to_component(x)
...
c'8 (Annotation('foo', 'bar')(c'8),)
d'8 (Annotation('foo', 'bar')(d'8),)
e'8 (Annotation('foo', 'bar')(e'8),)
f'8 (Annotation('foo', 'bar')(f'8),)
```

Return none.

marktools.attach_articulations_to_notes_and_chords_in_expr

marktools.**attach_articulations_to_notes_and_chords_in_expr**(*expr*, *articulations*)

New in version 2.0. Attach *articulations* to notes and chords in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.attach_articulations_to_notes_and_chords_in_expr(staff, list('^.'))

>>> f(staff)
\new Staff {
    c'8 -\marcato -\staccato
    d'8 -\marcato -\staccato
    e'8 -\marcato -\staccato
    f'8 -\marcato -\staccato
}
```

Return none.

marktools.attach_lilypond_command_marks_to_components_in_expr

marktools.**attach_lilypond_command_marks_to_components_in_expr**(*expr*, *lilypond_command_marks*)

New in version 2.3. Attach *lilypond_command_marks* to components in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> lilypond_command_mark = marktools.LilyPondCommandMark('stemUp')
>>> marktools.attach_lilypond_command_marks_to_components_in_expr(
...     staff.leaves, [lilypond_command_mark])

>>> f(staff)
\new Staff {
    \stemUp
    c'8
    \stemUp
    d'8
    \stemUp
    e'8
    \stemUp
    f'8
}
```

Return none.

marktools.attach_lilypond_comments_to_components_in_expr

marktools.**attach_lilypond_comments_to_components_in_expr**(*expr*, *lilypond_comments*)

New in version 2.3. Attach *lilypond_comments* to components in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> lilypond_comment = marktools.LilyPondComment('foo', 'right')
>>> marktools.attach_lilypond_comments_to_components_in_expr(
...     staff.leaves, [lilypond_comment])
```

```
>>> f(staff)
\new Staff {
    c'8 % foo
    d'8 % foo
    e'8 % foo
    f'8 % foo
}
```

Return none.

marktools.attach_stem_tremolos_to_notes_and_chords_in_expr

marktools.**attach_stem_tremolos_to_notes_and_chords_in_expr**(*expr*, *stem_tremolos*)

New in version 2.3. Attach *stem_tremolos* to notes and chords in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> stem_tremolo = marktools.StemTremolo(16)
>>> marktools.attach_stem_tremolos_to_notes_and_chords_in_expr(staff, [stem_tremolo])
```

```
>>> f(staff)
\new Staff {
    c'8 :16
    d'8 :16
    e'8 :16
    f'8 :16
}
```

Return none.

marktools.detach_annotations_attached_to_component

marktools.**detach_annotations_attached_to_component**(*component*)

New in version 2.0. Detach annotations attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> marktools.Annotation('annotation 1')(staff[0])
Annotation('annotation 1')(c'8)
>>> marktools.Annotation('annotation 2')(staff[0])
Annotation('annotation 2')(c'8)
```

```
>>> f(staff)
\new Staff {
    c'8 (
    d'8
    e'8
    f'8 )
}
```

```
>>> marktools.get_annotations_attached_to_component(staff[0])
(Annotation('annotation 1')(c'8), Annotation('annotation 2')(c'8))
```

```
>>> marktools.detach_annotations_attached_to_component(staff[0])
(Annotation('annotation 1'), Annotation('annotation 2'))
```

```
>>> marktools.get_annotations_attached_to_component(staff[0])
()
```

Return tuple or zero or more annotations detached.

marktools.detach_articulations_attached_to_component

marktools.**detach_articulations_attached_to_component**(*component*)

New in version 2.0. Detach articulations attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> marktools.Articulation('^')(staff[0])
Articulation('^')(c'8)
>>> marktools.Articulation('.')(staff[0])
Articulation('.')(c'8)

>>> f(staff)
\new Staff {
    c'8 -\marcato -\staccato (
    d'8
    e'8
    f'8 )
}

>>> marktools.get_articulations_attached_to_component(staff[0])
(Articulation('^')(c'8), Articulation('.')(c'8))

>>> marktools.detach_articulations_attached_to_component(staff[0])
(Articulation('^'), Articulation('.'))

>>> marktools.get_articulations_attached_to_component(staff[0])
()
```

Return tuple or zero or more articulations detached.

marktools.detach_lilypond_command_marks_attached_to_component

marktools.**detach_lilypond_command_marks_attached_to_component**(*component*, *command_name=None*)

New in version 2.0. Detach LilyPond command marks attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> marktools.LilyPondCommandMark('slurDotted')(staff[0])
LilyPondCommandMark('slurDotted')(c'8)
>>> marktools.LilyPondCommandMark('slurUp')(staff[0])
LilyPondCommandMark('slurUp')(c'8)

>>> f(staff)
\new Staff {
    \slurDotted
    \slurUp
    c'8 (
    d'8
    e'8
```

```
    f'8 )
}

>>> marktools.detach_lilypond_command_marks_attached_to_component(staff[0])
(LilyPondCommandMark('slurDotted'), LilyPondCommandMark('slurUp'))

>>> f(staff)
\new Staff {
    c'8 (
    d'8
    e'8
    f'8 )
}
```

Return tuple of zero or more marks detached.

marktools.detach_lilypond_comments_attached_to_component

marktools.**detach_lilypond_comments_attached_to_component**(*component*)

New in version 2.0. Detach LilyPond comments attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> marktools.LilyPondComment('comment 1')(staff[0])
LilyPondComment('comment 1')(c'8)
>>> marktools.LilyPondComment('comment 2')(staff[0])
LilyPondComment('comment 2')(c'8)

>>> f(staff)
\new Staff {
    % comment 1
    % comment 2
    c'8 (
    d'8
    e'8
    f'8 )
}

>>> marktools.detach_lilypond_comments_attached_to_component(staff[0])
(LilyPondComment('comment 1'), LilyPondComment('comment 2'))

>>> f(staff)
\new Staff {
    c'8 (
    d'8
    e'8
    f'8 )
}

>>> marktools.get_lilypond_comments_attached_to_component(staff[0])
()
```

Return tuple or zero or more LilyPond comments.

marktools.detach_marks_attached_to_component

marktools.**detach_marks_attached_to_component**(*component*)

New in version 2.0. Detach marks attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> marktools.Articulation('^')(staff[0])
Articulation('^')(c'8)
>>> marktools.LilyPondComment('comment 1')(staff[0])
LilyPondComment('comment 1')(c'8)
>>> marktools.LilyPondCommandMark('slurUp')(staff[0])
LilyPondCommandMark('slurUp')(c'8)

>>> f(staff)
\new Staff {
    % comment 1
    \slurUp
    c'8 -\marcato (
    d'8
    e'8
    f'8 )
}

>>> for mark in marktools.get_marks_attached_to_component(staff[0]):
...     mark
...
Articulation('^')(c'8)
LilyPondComment('comment 1')(c'8)
LilyPondCommandMark('slurUp')(c'8)

>>> for mark in marktools.detach_marks_attached_to_component(staff[0]):
...     mark
...
Articulation('^')
LilyPondComment('comment 1')
LilyPondCommandMark('slurUp')

>>> marktools.get_marks_attached_to_component(staff[0])
()
```

Return tuple or zero or more marks detached.

marktools.detach_marks_attached_to_components_in_expr

marktools.**detach_marks_attached_to_components_in_expr**(*expr*)

New in version 2.9. Detach marks attached to components in *expr*:

```
>>> staff = Staff("c'4 \staccato d' \marcato e' \staccato f' \marcato")

>>> f(staff)
\new Staff {
    c'4 -\staccato
    d'4 -\marcato
    e'4 -\staccato
    f'4 -\marcato
}
```

```
>>> for mark in marktools.detach_marks_attached_to_components_in_expr(staff):
...     mark
...
Articulation('staccato')
Articulation('marcato')
Articulation('staccato')
Articulation('marcato')

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
}
```

Return tuple of zero or more detached marks.

marktools.detach_noncontext_marks_attached_to_component

marktools.**detach_noncontext_marks_attached_to_component**(*component*)

New in version 2.3. Detach noncontext marks attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.TimeSignatureMark((2, 4))(staff[0])
TimeSignatureMark((2, 4))(c'8)
>>> marktools.Articulation('staccato')(staff[0])
Articulation('staccato')(c'8)

>>> f(staff)
\new Staff {
    \time 2/4
    c'8 -\staccato
    d'8
    e'8
    f'8
}

>>> marktools.detach_noncontext_marks_attached_to_component(staff[0])
(Articulation('staccato'),)

>>> f(staff)
\new Staff {
    \time 2/4
    c'8
    d'8
    e'8
    f'8
}
```

Return tuple of noncontext marks.

marktools.detach_stem_tremolos_attached_to_component

marktools.**detach_stem_tremolos_attached_to_component**(*component*)

New in version 2.0. Detach stem tremolos attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.StemTremolo(16)(staff[0])
StemTremolo(16)(c'8)

>>> f(staff)
\new Staff {
    c'8 :16
    d'8
    e'8
    f'8
}

>>> marktools.get_stem_tremolos_attached_to_component(staff[0])
(StemTremolo(16)(c'8),)

>>> marktools.detach_stem_tremolos_attached_to_component(staff[0])
(StemTremolo(16),)

>>> marktools.get_stem_tremolos_attached_to_component(staff[0])
()
```

Return tuple or zero or more stem tremolos detached.

marktools.get_annotation_attached_to_component

marktools.**get_annotation_attached_to_component**(*component*)

New in version 2.0. Get exactly one annotation attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.Annotation('special information')(staff[0])
Annotation('special information')(c'8)

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> marktools.get_annotation_attached_to_component(staff[0])
Annotation('special information')(c'8)
```

Return one annotation.

Raise missing mark error when no annotation is attached.

Raise extra mark error when more than one annotation is attached.

marktools.get_annotations_attached_to_component

marktools.**get_annotations_attached_to_component**(*component*)

New in version 2.0. Get annotations attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.Annotation('annotation 1')(staff[0])
```

```
Annotation('annotation 1')(c'8)
>>> marktools.Annotation('annotation 2')(staff[0])
Annotation('annotation 2')(c'8)

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> marktools.get_annotations_attached_to_component(staff[0])
(Annotation('annotation 1')(c'8), Annotation('annotation 2')(c'8))
```

Return tuple of zero or more annotations.

marktools.get_articulation_attached_to_component

marktools.**get_articulation_attached_to_component**(*component*)

New in version 2.0. Get exactly one articulation attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.Articulation('staccato')(staff[0])
Articulation('staccato')(c'8)

>>> f(staff)
\new Staff {
    c'8 -\staccato
    d'8
    e'8
    f'8
}

>>> marktools.get_articulation_attached_to_component(staff[0])
Articulation('staccato')(c'8)
```

Return one articulation.

Raise missing mark error when no articulation is attached.

Raise extra mark error when more than one articulation is attached.

marktools.get_articulations_attached_to_component

marktools.**get_articulations_attached_to_component**(*component*)

New in version 2.0. Get articulations attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.Articulation('staccato')(staff[0])
Articulation('staccato')(c'8)
>>> marktools.Articulation('marcato')(staff[0])
Articulation('marcato')(c'8)

>>> f(staff)
\new Staff {
    c'8 -\marcato -\staccato
```

```
        d'8
        e'8
        f'8
    }

    >>> marktools.get_articulations_attached_to_component(staff[0])
    (Articulation('staccato')(c'8), Articulation('marcato')(c'8))
```

Return tuple of zero or more articulations.

marktools.get_lilypond_command_mark_attached_to_component

marktools.**get_lilypond_command_mark_attached_to_component**(*component*)

New in version 2.0. Get exactly one LilyPond command mark attached to *component*:

```
    >>> staff = Staff("c'8 d'8 e'8 f'8")
    >>> marktools.LilyPondCommandMark('stemUp')(staff[0])
    LilyPondCommandMark('stemUp')(c'8)

    >>> f(staff)
    \new Staff {
        \stemUp
        c'8
        d'8
        e'8
        f'8
    }

    >>> marktools.get_lilypond_command_mark_attached_to_component(staff[0])
    LilyPondCommandMark('stemUp')(c'8)
```

Return one LilyPond command mark.

Raise missing mark error when no LilyPond command mark is attached.

Raise extra mark error when more than one LilyPond command mark is attached.

marktools.get_lilypond_command_marks_attached_to_component

marktools.**get_lilypond_command_marks_attached_to_component**(*component*, *command_name=None*)

New in version 2.0. Get LilyPond command marks attached to *component*:

```
    >>> staff = Staff("c'8 d'8 e'8 f'8")
    >>> slur = spannertools.SlurSpanner(staff.leaves)
    >>> marktools.LilyPondCommandMark('slurDotted')(staff[0])
    LilyPondCommandMark('slurDotted')(c'8)
    >>> marktools.LilyPondCommandMark('slurUp')(staff[0])
    LilyPondCommandMark('slurUp')(c'8)

    >>> f(staff)
    \new Staff {
        \slurDotted
        \slurUp
        c'8 (
        d'8
        e'8
```

```
        f'8 )
    }

    >>> marktools.get_lilypond_command_marks_attached_to_component(staff[0])
    (LilyPondCommandMark('slurDotted')(c'8), LilyPondCommandMark('slurUp')(c'8))
```

Return tuple of zero or more marks.

marktools.get_lilypond_comment_attached_to_component

marktools.**get_lilypond_comment_attached_to_component**(*component*)

New in version 2.0. Get exactly one LilyPond comment attached to *component*:

```
    >>> staff = Staff("c'8 d'8 e'8 f'8")
    >>> marktools.LilyPondComment('comment')(staff[0])
    LilyPondComment('comment')(c'8)

    >>> f(staff)
    \new Staff {
        % comment
        c'8
        d'8
        e'8
        f'8
    }

    >>> marktools.get_lilypond_comment_attached_to_component(staff[0])
    LilyPondComment('comment')(c'8)
```

Return one LilyPond comment.

Raise missing mark error when no LilyPond comment is attached.

Raise extra mark error when more than one LilyPond comment is attached.

marktools.get_lilypond_comments_attached_to_component

marktools.**get_lilypond_comments_attached_to_component**(*component*)

New in version 2.0. Get LilyPond comments attached to *component*:

```
    >>> staff = Staff("c'8 d'8 e'8 f'8")
    >>> slur = spannertools.SlurSpanner(staff.leaves)
    >>> marktools.LilyPondComment('comment 1')(staff[0])
    LilyPondComment('comment 1')(c'8)
    >>> marktools.LilyPondComment('comment 2')(staff[0])
    LilyPondComment('comment 2')(c'8)

    >>> f(staff)
    \new Staff {
        % comment 1
        % comment 2
        c'8 (
        d'8
        e'8
        f'8 )
    }
```

```
>>> marktools.get_lilypond_comments_attached_to_component(staff[0])
(LilyPondComment('comment 1')(c'8), LilyPondComment('comment 2')(c'8))
```

Return tuple of zero or more LilyPond comments.

marktools.get_mark_attached_to_component

marktools.**get_mark_attached_to_component**(*component*)

New in version 2.0. Get exactly one mark attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.Mark()(staff[0])
Mark()(c'8)

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> marktools.get_mark_attached_to_component(staff[0])
Mark()(c'8)
```

Return one mark.

Raise missing mark error when no mark is attached.

Raise extra mark error when more than one mark is attached.

marktools.get_marks_attached_to_component

marktools.**get_marks_attached_to_component**(*component*)

New in version 2.0. Get all marks attached to *component*‘:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> comment_mark = marktools.LilyPondComment('beginning of note content')(staff[0])
>>> marktools.LilyPondCommandMark('slurDotted')(staff[0])
LilyPondCommandMark('slurDotted')(c'8)

>>> f(staff)
\new Staff {
    % beginning of note content
    \slurDotted
    c'8 (
    d'8
    e'8
    f'8 )
}

>>> marktools.get_marks_attached_to_component(staff[0])
(LilyPondComment('beginning of note content')(c'8), LilyPondCommandMark('slurDotted')(c'8))
```

Return tuple of zero or more marks. Changed in version 2.0: renamed `marktools.get_all_marks_attached_to_component()` to `marktools.get_marks_attached_to_component()`.

marktools.get_marks_attached_to_components_in_expr

marktools.**get_marks_attached_to_components_in_expr**(*expr*)

New in version 2.9. Get marks attached to components in *expr*:

```
>>> staff = Staff(r"c'4 \pp d' \staccato e' \ff f' \staccato")

\new Staff {
    c'4 \pp
    d'4 -\staccato
    e'4 \ff
    f'4 -\staccato
}

>>> for mark in marktools.get_marks_attached_to_components_in_expr(staff):
...     mark
...
DynamicMark('pp')(c'4)
Articulation('staccato')(d'4)
DynamicMark('ff')(e'4)
Articulation('staccato')(f'4)
```

Return tuple of zero or more marks.

marktools.get_noncontext_mark_attached_to_component

marktools.**get_noncontext_mark_attached_to_component**(*component*)

New in version 2.0. Get exactly one noncontext_mark attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.Articulation('staccato')(staff[0])
Articulation('staccato')(c'8)

>>> f(staff)
\new Staff {
    c'8 -\staccato
    d'8
    e'8
    f'8
}

>>> marktools.get_noncontext_mark_attached_to_component(staff[0])
Articulation('staccato')(c'8)
```

Return one noncontext_mark.

Raise missing mark error when no noncontext_mark is attached.

Raise extra mark error when more than one noncontext_mark is attached.

marktools.get_noncontext_marks_attached_to_component

marktools.**get_noncontext_marks_attached_to_component**(*component*)

New in version 2.0. Get noncontext marks attached to component:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> contexttools.TimeSignatureMark((2, 4))(staff[0])
TimeSignatureMark((2, 4))(c'8)
>>> marktools.Articulation('staccato')(staff[0])
Articulation('staccato')(c'8)

>>> f(staff)
\new Staff {
    \time 2/4
    c'8 -\staccato
    d'8
    e'8
    f'8
}

>>> marktools.get_noncontext_marks_attached_to_component(staff[0])
(Articulation('staccato')(c'8),)
```

Return tuple of zero or more marks.

marktools.get_stem_tremolo_attached_to_component

marktools.**get_stem_tremolo_attached_to_component**(*component*)

New in version 2.0. Get stem tremolo attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.StemTremolo(16)(staff[0])
StemTremolo(16)(c'8)

>>> f(staff)
\new Staff {
    c'8 :16
    d'8
    e'8
    f'8
}

>>> marktools.get_stem_tremolo_attached_to_component(staff[0])
StemTremolo(16)(c'8)
```

Raise missing mark error when no stem tremolo attaches to *component*.

Raise extra mark error when more than one stem tremolo attaches to *component*.

Return stem tremolo.

marktools.get_stem_tremolos_attached_to_component

marktools.**get_stem_tremolos_attached_to_component**(*component*, *tremolo_flags=None*)

New in version 2.3. Get stem tremolos attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.StemTremolo(16)(staff[0])
StemTremolo(16)(c'8)

>>> f(staff)
\new Staff {
    c'8 :16
    d'8
    e'8
    f'8
}

>>> marktools.get_stem_tremolos_attached_to_component(staff[0])
(StemTremolo(16)(c'8),)
```

Return tuple of zero or more stem tremolos.

marktools.get_value_of_annotation_attached_to_component

marktools.**get_value_of_annotation_attached_to_component**(*component*, *name*, *default_value=None*)

New in version 2.0. Get value of annotation with *name* attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> marktools.Annotation('special dictionary', {})(staff[0])
Annotation('special dictionary', {})(c'8)

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> marktools.get_value_of_annotation_attached_to_component(staff[0], 'special dictionary')
{}
```

Return arbitrary value of annotation.

Return *default_value* when no annotation with *name* is attached.

Raise extra mark error when more than one annotation with *name* is attached.

marktools.is_component_with_annotation_attached

marktools.**is_component_with_annotation_attached**(*expr*, *annotation_name=None*, *annotation_value=None*)

New in version 2.3. True when *expr* is component with annotation attached:

```
>>> note = Note("c'4")
>>> marktools.Annotation('foo', 'bar')(note)
Annotation('foo', 'bar')(c'4)

>>> marktools.is_component_with_annotation_attached(note)
True
```

False otherwise:

```
>>> note = Note("c'4")

>>> marktools.is_component_with_annotation_attached(note)
False
```

Return boolean.

marktools.is_component_with_articulation_attached

marktools.**is_component_with_articulation_attached**(*expr*, *articulation_name=None*)

New in version 2.3. True when *expr* is component with articulation attached:

```
>>> note = Note("c'4")
>>> marktools.Articulation('staccato')(note)
Articulation('staccato')(c'4)

>>> marktools.is_component_with_articulation_attached(note)
True
```

False otherwise:

```
>>> note = Note("c'4")

>>> marktools.is_component_with_articulation_attached(note)
False
```

Return boolean.

marktools.is_component_with_lilypond_command_mark_attached

marktools.**is_component_with_lilypond_command_mark_attached**(*expr*, *command_name=None*)

New in version 2.0. True when *expr* is component with LilyPond command mark attached:

```
>>> note = Note("c'4")
>>> marktools.LilyPondCommandMark('stemUp')(note)
LilyPondCommandMark('stemUp')(c'4)

>>> marktools.is_component_with_lilypond_command_mark_attached(note)
True
```

False otherwise:

```
>>> note = Note("c'4")

>>> marktools.is_component_with_lilypond_command_mark_attached(note)
False
```

Return boolean.

marktools.is_component_with_lilypond_comment_attached

marktools.**is_component_with_lilypond_comment_attached**(*expr*, *comment_contents_string=None*)

New in version 2.3. True when *expr* is component with LilyPond comment mark attached:

```
>>> note = Note("c'4")
>>> marktools.LilyPondComment('comment here')(note)
LilyPondComment('comment here')(c'4)

>>> marktools.is_component_with_lilypond_comment_attached(note)
True
```

False otherwise:

```
>>> note = Note("c'4")

>>> marktools.is_component_with_lilypond_comment_attached(note)
False
```

Return boolean.

marktools.is_component_with_mark_attached

marktools.**is_component_with_mark_attached**(*expr*)

New in version 2.3. True when *expr* is component with mark attached:

```
>>> note = Note("c'4")
>>> marktools.Mark()(note)
Mark()(c'4)

>>> marktools.is_component_with_mark_attached(note)
True
```

False otherwise:

```
>>> note = Note("c'4")

>>> marktools.is_component_with_mark_attached(note)
False
```

Return boolean.

marktools.is_component_with_noncontext_mark_attached

marktools.**is_component_with_noncontext_mark_attached**(*expr*)

New in version 2.3. True when *expr* is component with noncontext mark attached:

```
>>> note = Note("c'4")
>>> marktools.Articulation('staccato')(note)
Articulation('staccato')(c'4)

>>> marktools.is_component_with_noncontext_mark_attached(note)
True
```

False otherwise:

```
>>> note = Note("c'4")

>>> marktools.is_component_with_noncontext_mark_attached(note)
False
```

Return boolean.

marktools.is_component_with_stem_tremolo_attached

marktools.**is_component_with_stem_tremolo_attached**(*expr*)

New in version 2.3. True when *expr* is component with LilyPond command mark attached:

```
>>> note = Note("c'4")
>>> marktools.StemTremolo(16)(note)
StemTremolo(16)(c'4)

>>> marktools.is_component_with_stem_tremolo_attached(note)
True
```

False otherwise:

```
>>> note = Note("c'4")

>>> marktools.is_component_with_stem_tremolo_attached(note)
False
```

Return boolean.

marktools.move_marks

marktools.**move_marks**(*donor*, *recipient*)

Move marks from *donor* component to *recipient* component:

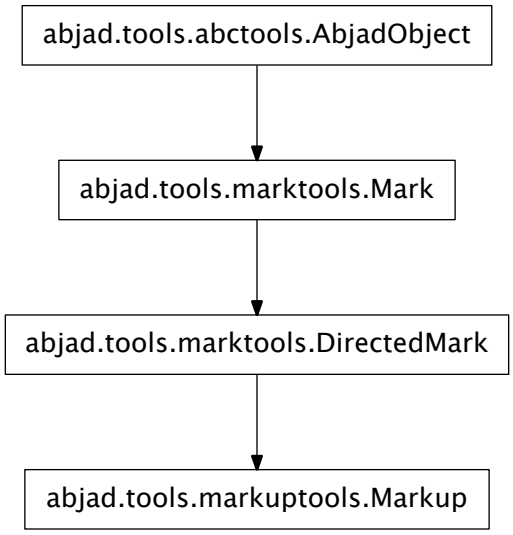
```
>>> staff = Staff(r'\clef "bass" c \staccato d e f')

>>> f(staff)
\new Staff {
    \clef "bass"
    c4 -\staccato
    d4
    e4
    f4
}

>>> marktools.move_marks(staff[0], staff[2])
[Articulation('staccato')(e4), ClefMark('bass')(e4)]

>>> f(staff)
\new Staff {
    c4
    d4
    \clef "bass"
    e4 -\staccato
    f4
}
```

Return list of marks moved.

markuptools

concrete classes

markuptools.Markup



class markuptools.**Markup**(*argument*, *direction=None*, *markup_name=None*)

Abjad model of LilyPond markup.

Initialize from string:

```
>>> markup = markuptools.Markup(r'\bold { "This is markup text." }')

>>> markup
Markup((MarkupCommand('bold', ['This is markup text.']),))

>>> f(markup)
\markup { \bold { "This is markup text." } }
```

Initialize any markup from existing markup:

```
>>> markup_1 = markuptools.Markup('foo', direction=Up)
>>> markup_2 = markuptools.Markup(markup_1, direction=Down)

>>> f(markup_1)
^ \markup { foo }

>>> f(markup_2)
_ \markup { foo }
```

Attach markup to score components like this:

```
>>> note = Note("c'4")

>>> markup = markuptools.Markup(r'\bold { "This is markup text." }')

>>> markup(note)
Markup((MarkupCommand('bold', ['This is markup text.']),))(c'4)

>>> f(note)
c'4 - \markup { \bold { "This is markup text." } }
```

Set *direction* to `Up`, `Down`, `'neutral'`, `'^'`, `'_'`, `'-'` or None.

Markup objects are immutable.

Read-only Properties

`Markup.`**`contents`**

Read-only tuple of contents of markup:

```
>>> markup = markuptools.Markup(r'\bold { "This is markup text." }')
>>> markup.contents
(MarkupCommand('bold', ['This is markup text.']),)
```

Return string

`Markup.`**`indented_lilypond_format`**

Read-only indented LilyPond format of markup:

```
>>> markup = markuptools.Markup(r'\bold { "This is markup text." }')
>>> print markup.indented_lilypond_format
\markup {
    \bold {
        "This is markup text."
        }
    }
```

Return string.

`Markup.`**`lilypond_format`**

Read-only LilyPond format of markup:

```
>>> markup = markuptools.Markup(r'\bold { "This is markup text." }')
>>> markup.lilypond_format
'\\markup { \\bold { "This is markup text." } }'
```

Return string.

`Markup.`**`markup_name`**

Read-only name of markup:

```
>>> markup = markuptools.Markup(
...     r'\bold { allegro ma non troppo }', markup_name='non troppo')

>>> markup.markup_name
'non troppo'
```

Return string or none.

`Markup.`**`start_component`**

Read-only reference to mark start component:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")
```

Return component or none.

Inherited from `marktools.Mark`

`Markup.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Read/write Properties

`Markup.`**`direction`**
Inherited from `marktools.DirectedMark`

Methods

`Markup.`**`attach`**`(`*start_component*`)`
Attach mark to *start_component*:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()

>>> mark.attach(note)
Mark()(c'4)

>>> mark.start_component
Note("c'4")
```

Return mark.

Inherited from `marktools.Mark`

`Markup.`**`detach`**`()`
Detach mark:

```
>>> note = Note("c'4")
>>> mark = marktools.Mark()(note)

>>> mark.start_component
Note("c'4")

>>> mark.detach()
Mark()

>>> mark.start_component is None
True
```

Return mark.

Inherited from `marktools.Mark`

Special Methods

Markup.__call__(**args*)
Inherited from marktools.Mark

Markup.__delattr__(**args*)
Inherited from marktools.Mark

Markup.__eq__(*expr*)

Markup.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Markup.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Markup.__hash__()

Markup.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Markup.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

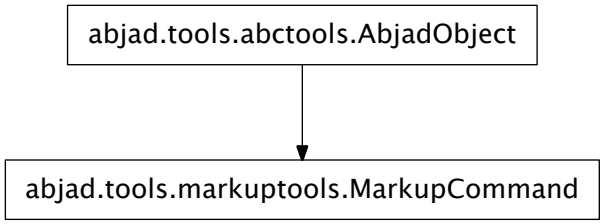
Inherited from abctools.AbjadObject

Markup.__ne__(*expr*)

Markup.__repr__()
Inherited from marktools.Mark

Markup.__str__()

markuptools.MarkupCommand



class markuptools.**MarkupCommand**(*command*, **args*)

Abjad model of a LilyPond markup command:

```
>>> circle = markuptools.MarkupCommand('draw-circle', 2.5, 0.1, False)
>>> square = markuptools.MarkupCommand('rounded-box', 'hello?')
>>> line = markuptools.MarkupCommand('line', [square, 'wow!'])
>>> rotate = markuptools.MarkupCommand('rotate', 60, line)
>>> combine = markuptools.MarkupCommand('combine', rotate, circle)

>>> print combine
\combine \rotate #60 \line { \rounded-box hello? wow! } \draw-circle #2.5 #0.1 ##f
```

Insert markup command in markup to attach to score components:

```
>>> note = Note("c'4")

>>> markup = markuptools.Markup(combine)

>>> markup = markup(note)

>>> f(note)
c'4
    - \markup {
        \combine
            \rotate
                #60
                \line
                    {
                        \rounded-box
                            hello?
                        wow!
                    }
            \draw-circle
                #2.5
                #0.1
                ##f
        }
```

Markup commands are immutable.

Read-only Properties

MarkupCommand.**args**

Read-only tuple of markup command arguments.

MarkupCommand.**command**

Read-only string of markup command command-name.

MarkupCommand.**lilypond_format**

Read-only format of markup command:

```
>>> markup_command = markuptools.MarkupCommand('draw-circle', 2.5, 0.1, False)
>>> markup_command.lilypond_format
'\\draw-circle #2.5 #0.1 ##f'
```

Returns string.

MarkupCommand.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

MarkupCommand.__**eq**__(*other*)

MarkupCommand.__**ge**__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MarkupCommand.__**gt**__(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MarkupCommand.__**le**__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MarkupCommand.__**lt**__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MarkupCommand.__**ne**__(*arg*)

True when id(self) does not equal id(arg).

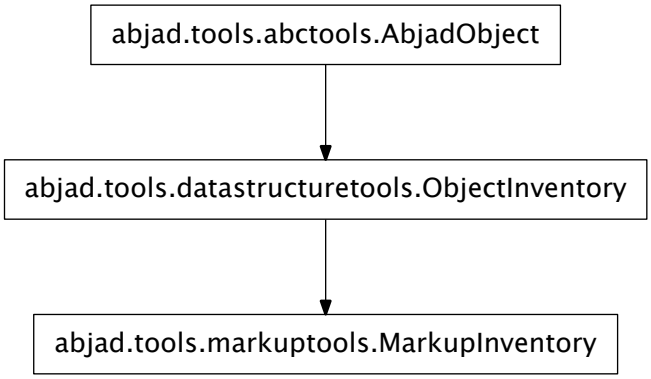
Return boolean.

Inherited from abctools.AbjadObject

MarkupCommand.__**repr**__()

MarkupCommand.__**str**__()

markuptools.MarkupInventory



class markuptools.**MarkupInventory**(*tokens=None*, *name=None*)

New in version 2.8. Abjad model of an ordered list of markup:

```
>>> inventory = markuptools.MarkupInventory(['foo', 'bar'])

>>> inventory
MarkupInventory([Markup(('foo',)), Markup(('bar',))])
```

Markup inventories implement the list interface and are mutable.

Read-only Properties

MarkupInventory.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

MarkupInventory.**name**

Read / write name of inventory.

Inherited from datastructuretools.ObjectInventory

Methods

MarkupInventory.**append**(*token*)

Change *token* to item and append.

Inherited from datastructuretools.ObjectInventory

MarkupInventory.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.list

MarkupInventory.**extend**(*tokens*)

Change *tokens* to items and extend.

Inherited from datastructuretools.ObjectInventory

MarkupInventory.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.list

MarkupInventory.**insert**()
L.insert(index, object) – insert object before index

Inherited from __builtin__.list

MarkupInventory.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

MarkupInventory.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

MarkupInventory.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

MarkupInventory.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

MarkupInventory.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

MarkupInventory.**__contains__**(*token*)
Inherited from datastructuretools.ObjectInventory

MarkupInventory.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

MarkupInventory.**__delslice__**()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

MarkupInventory.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

MarkupInventory.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

MarkupInventory.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

MarkupInventory.__getslice__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

MarkupInventory.__gt__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

MarkupInventory.__iadd__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

MarkupInventory.__imul__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

MarkupInventory.__iter__() <==> *iter(x)*
Inherited from __builtin__.list

MarkupInventory.__le__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

MarkupInventory.__len__() <==> *len(x)*
Inherited from __builtin__.list

MarkupInventory.__lt__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

MarkupInventory.__mul__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

MarkupInventory.__ne__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

MarkupInventory.__repr__()
Inherited from datastructuretools.ObjectInventory

MarkupInventory.__reversed__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

MarkupInventory.__rmul__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

MarkupInventory.__setitem__()
x.__setitem__(i, y) <==> x[i]=y

Inherited from __builtin__.list

MarkupInventory.__setslice__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

functions

markuptools.all_are_markup

markuptools.**all_are_markup**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad markup:

```
>>> markup = markuptools.Markup('some text')

>>> markuptools.all_are_markup([markup])
True
```

True when *expr* is an empty sequence:

```
>>> markuptools.all_are_markup([])
True
```

Otherwise false:

```
>>> markuptools.all_are_markup('foo')
False
```

Return boolean.

markuptools.combine_markup_commands

markuptools.**combine_markup_commands**(**commands*)
Combine MarkupCommand and/or string objects.

LilyPond's 'combine' markup command can only take two arguments, so in order to combine more than two stencils, a cascade of 'combine' commands must be employed. *combine_markup_commands* simplifies this process.

```
>>> from abjad.tools.schemetools import SchemePair

>>> markup_a = markuptools.MarkupCommand('draw-circle', 4, 0.4, False)
>>> markup_b = markuptools.MarkupCommand(
...     'filled-box',
...     schemetools.SchemePair(-4, 4),
...     schemetools.SchemePair(-0.5, 0.5), 1)
>>> markup_c = "some text"

>>> markup = markuptools.combine_markup_commands(markup_a, markup_b, markup_c)
>>> result = markup.lilypond_format

>>> print result
\combine \combine \draw-circle #4 #0.4 ##f
    \filled-box #'(-4 . 4) #'(-0.5 . 0.5) #1 "some text"
```

Returns a markup command instance, or a string if that was the only argument.

markuptools.get_down_markup_attached_to_component

markuptools.**get_down_markup_attached_to_component**(*component*)

New in version 2.0. Get down-markup attached to component:

```
>>> chord = Chord([-11, 2, 5], (1, 4))

>>> markuptools.Markup('UP', Up)(chord)
Markup(('UP',), direction=Up)(<cs d' f'>4)

>>> markuptools.Markup('DOWN', Down)(chord)
Markup(('DOWN',), direction=Down)(<cs d' f'>4)

>>> markuptools.get_down_markup_attached_to_component(chord)
(Markup(('DOWN',), direction=Down)(<cs d' f'>4),)
```

Return tuple of zero or more markup objects.

markuptools.get_markup_attached_to_component

markuptools.**get_markup_attached_to_component**(*component*)

New in version 2.0. Get markup attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> slur = spannertools.SlurSpanner(staff[:])

>>> markuptools.Markup('foo')(staff[0])
Markup(('foo',))(c'8)

>>> markuptools.Markup('bar')(staff[0])
Markup(('bar',))(c'8)

>>> f(staff)
\new Staff {
    c'8 (
        - \markup {
            \column
                {
                    foo
                    bar
                }
            }
    d'8
    e'8
    f'8 )
}

>>> markuptools.get_markup_attached_to_component(staff[0])
(Markup(('foo',))(c'8), Markup(('bar',))(c'8))
```

Return tuple of zero or more markup objects.

markuptools.get_up_markup_attached_to_component

markuptools.**get_up_markup_attached_to_component**(*component*)

New in version 2.0. Get up-markup attached to component:

```
>>> chord = Chord([-11, 2, 5], (1, 4))

>>> markuptools.Markup('UP', Up)(chord)
Markup(('UP',), direction=Up)(<cs d' f'>4)

>>> markuptools.Markup('DOWN', Down)(chord)
Markup(('DOWN',), direction=Down)(<cs d' f'>4)

>>> markuptools.get_up_markup_attached_to_component(chord)
(Markup(('UP',), direction=Up)(<cs d' f'>4),)
```

Return tuple of zero or more markup objects.

markuptools.make_big_centered_page_number_markup

markuptools.**make_big_centered_page_number_markup**(*text=None*)

New in version 1.1. Make big centered page number markup:

```
>>> markup = markuptools.make_big_centered_page_number_markup()

>>> print markup.indented_lilypond_format
\markup {
    \fill-line
        {
            \bold
                \fontsize
                    #3
                    \concat
                        {
                            \on-the-fly
                                print
                                page-number-check-first
                            \fromproperty
                                page
                            :page-number-string
                        }
        }
    }
```

Return markup. Changed in version 2.0: renamed `markuptools.big_centered_page_number()` to `markuptools.make_big_centered_page_number_markup()`.

markuptools.make_blank_line_markup

markuptools.**make_blank_line_markup**()

New in version 2.9. Make blank line markup:

```
>>> markup = markuptools.make_blank_line_markup()

>>> markup
Markup((MarkupCommand('fill-line', [' ']),))

>>> f(markup)
\markup { \fill-line { " " } }
```

Return markup.

markuptools.make_centered_title_markup

markuptools.**make_centered_title_markup**(*title*, *font_name='Times'*, *font_size=18*)

New in version 2.9. Make centered *title* markup:

```
>>> markup = markuptools.make_centered_title_markup('String Quartet')

>>> print markup.indented_lilypond_format
\markup {
    \column
        {
            \center-align
                {
                    \override
                        #'(font - name Times)
                        \fontsize
                            #18
                            {
                                " "
                                " "
                                " "
                                " "
                                " "
                                \line
                                    {
                                        "String Quartet"
                                    }
                                " "
                                " "
                                " "
                            }
                }
        }
    }
```

Return markup.

markuptools.make_vertically_adjusted_composer_markup

markuptools.**make_vertically_adjusted_composer_markup**(*composer*, *font_name='Times'*, *font_size=3*, *space_above=20*, *space_right=0*)

New in version 2.9. Make vertically adjusted *composer* markup:

```
>>> markup = markuptools.make_vertically_adjusted_composer_markup('Josquin Desprez')

>>> print markup.indented_lilypond_format
\markup {
    \override
        #'(font - name Times)
        {
            \hspace
                #0
            \raise
                #-20
                \fontsize
                    #3
```

```
                    "Josquin Desprez"
                \hspace
                    #0
            }
        }
```

Return markup.

markuptools.remove_markup_attached_to_component

markuptools.**remove_markup_attached_to_component**(*component*)

New in version 2.0. Remove markup attached to *component*:

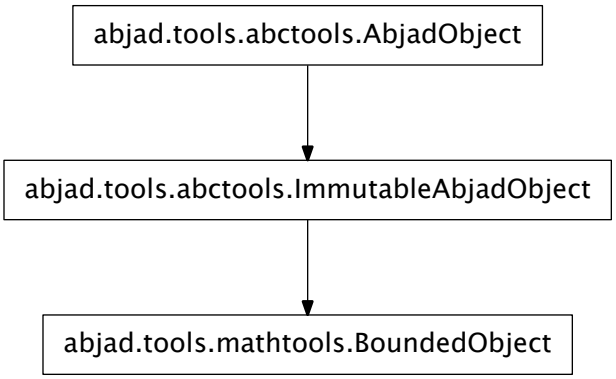
```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> slur = spannertools.SlurSpanner(staff[:])
>>> markuptools.Markup('foo')(staff[0])
Markup(('foo',))(c'8)
>>> markuptools.Markup('bar')(staff[0])
Markup(('bar',))(c'8)

>>> f(staff)
\new Staff {
    c'8 (
        - \markup {
            \column
                {
                    foo
                    bar
                }
            }
    d'8
    e'8
    f'8 )
}

>>> markuptools.remove_markup_attached_to_component(staff[0])
(Markup(('foo',)), Markup(('bar',)))

>>> f(staff)
\new Staff {
    c'8 (
    d'8
    e'8
    f'8 )
}
```

Return tuple of zero or more markup objects.

mathtools

abstract classes

mathtools.BoundedObject



class mathtools.**BoundedObject**(**args*, ***kwargs*)

New in version 2.10. Bounded object mix-in.

Bounded objects are immutable.

Read-only Properties

BoundedObject.**is_closed**

BoundedObject.**is_half_closed**

BoundedObject.**is_half_open**

BoundedObject.**is_open**

BoundedObject.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

BoundedObject.**is_left_closed**

BoundedObject.**is_left_open**

BoundedObject.**is_right_closed**

BoundedObject.**is_right_open**

Special Methods

BoundedObject.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

BoundedObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

BoundedObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

BoundedObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

BoundedObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

BoundedObject.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

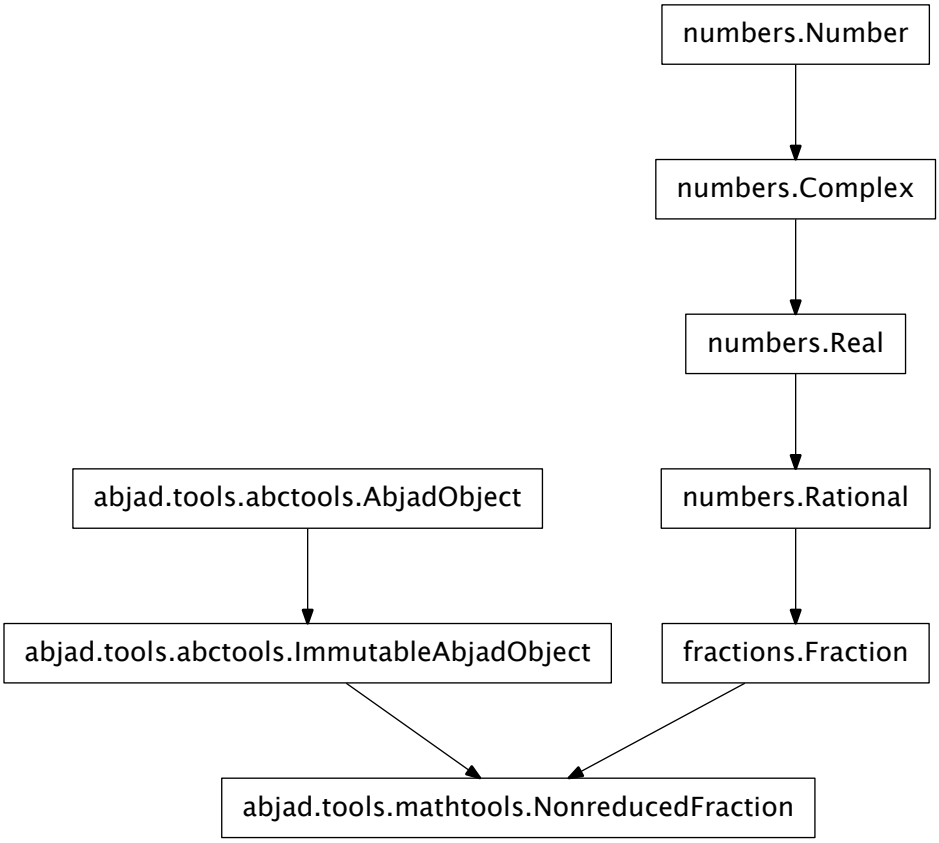
BoundedObject.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

concrete classes

mathtools.NonreducedFraction



class mathtools.**NonreducedFraction**(**args*, ***kwargs*)

New in version 2.9. Initialize with an integer numerator and integer denominator:

```
>>> from abjad.tools import mathtools
```

```
>>> mathtools.NonreducedFraction(3, 6)
NonreducedFraction(3, 6)
```

Initialize with only an integer denominator:

```
>>> mathtools.NonreducedFraction(3)
NonreducedFraction(3, 1)
```

Initialize with an integer pair:

```
>>> mathtools.NonreducedFraction((3, 6))
NonreducedFraction(3, 6)
```

Initialize with an integer singleton:

```
>>> mathtools.NonreducedFraction((3,))
NonreducedFraction(3, 1)
```

Similar to built-in fraction except that numerator and denominator do not reduce.

Nonreduced fractions inherit from built-in fraction:

```
>>> isinstance(mathtools.NonreducedFraction(3, 6), Fraction)
True
```

Nonreduced fractions are numbers:

```
>>> import numbers

>>> isinstance(mathtools.NonreducedFraction(3, 6), numbers.Number)
True
```

Nonreduced fractions are immutable.

Read-only Properties

NonreducedFraction.**denominator**

Read-only denominator of nonreduced fraction:

```
>>> fraction = mathtools.NonreducedFraction(-6, 3)

abajd> fraction.denominator
3
```

Return positive integer.

NonreducedFraction.**imag**

Real numbers have no imaginary component.

Inherited from numbers.Real

NonreducedFraction.**numerator**

Read-only numerator of nonreduced fraction:

```
>>> fraction = mathtools.NonreducedFraction(-6, 3)

abajd> fraction.numerator
3
```

Return integer.

NonreducedFraction.**pair**

Read only pair of nonreduced fraction numerator and denominator:

```
>>> fraction = mathtools.NonreducedFraction(-6, 3)

>>> fraction.pair
(-6, 3)
```

Return integer pair.

NonreducedFraction.**real**

Real numbers are their real component.

Inherited from numbers.Real

NonreducedFraction.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NonreducedFraction.**conjugate**()
Conjugate is a no-op for Reals.

Inherited from numbers.Real

classmethod NonreducedFraction.**from_decimal**(*dec*)
Converts a finite Decimal instance to a rational number, exactly.

Inherited from fractions.Fraction

classmethod NonreducedFraction.**from_float**(*f*)
Converts a finite float to a rational number, exactly.

Beware that Fraction.from_float(0.3) != Fraction(3, 10).

Inherited from fractions.Fraction

NonreducedFraction.**limit_denominator**(*max_denominator=1000000*)
Closest Fraction to self with denominator at most max_denominator.

```
>>> Fraction('3.141592653589793').limit_denominator(10)
Fraction(22, 7)
>>> Fraction('3.141592653589793').limit_denominator(100)
Fraction(311, 99)
>>> Fraction(4321, 8765).limit_denominator(10000)
Fraction(4321, 8765)
```

Inherited from fractions.Fraction

NonreducedFraction.**reduce**()
Reduce nonreduced fraction:

```
>>> fraction = mathtools.NonreducedFraction(-6, 3)

>>> fraction.reduce()
Fraction(-2, 1)
```

Return fraction.

Special Methods

NonreducedFraction.**__abs__**()
Absolute value of nonreduced fraction:

```
>>> abs(mathtools.NonreducedFraction(-3, 3))
NonreducedFraction(3, 3)
```

Return nonreduced fraction.

NonreducedFraction.**__add__**(*expr*)
Add *expr* to *self*:

```
>>> mathtools.NonreducedFraction(3, 3) + 1
NonreducedFraction(6, 3)
```

Return nonreduced fraction.

NonreducedFraction.__**complex**__()
complex(self) == complex(float(self), 0)

Inherited from numbers.Real

NonreducedFraction.__**div**__(*expr*)
Divide nonreduced fraction by expr:

```
>>> mathtools.NonreducedFraction(3, 3) / 1
NonreducedFraction(3, 3)
```

Return nonreduced fraction.

NonreducedFraction.__**divmod**__(*other*)
divmod(self, other): The pair (self // other, self % other).

Sometimes this can be computed faster than the pair of operations.

Inherited from numbers.Real

NonreducedFraction.__**eq**__(*expr*)
True when *expr* equals *self*:

```
>>> mathtools.NonreducedFraction(3, 3) == 1
True
```

Return boolean.

NonreducedFraction.__**float**__()
float(self) = self.numerator / self.denominator

It's important that this conversion use the integer's "true" division rather than casting one side to float before dividing so that ratios of huge integers convert without overflowing.

Inherited from numbers.Rational

NonreducedFraction.__**floordiv**__(*a*, *b*)
a // b

Inherited from fractions.Fraction

NonreducedFraction.__**ge**__(*expr*)
True when nonreduced fraction is greater than or equal to *expr*:

```
>>> mathtools.NonreducedFraction(3, 3) >= 1
True
```

Return boolean.

NonreducedFraction.__**gt**__(*expr*)
True when nonreduced fraction is greater than *expr*:

```
>>> mathtools.NonreducedFraction(3, 3) > 1
False
```

Return boolean.

NonreducedFraction.__**hash**__()
hash(self)

Tricky because values that are exactly representable as a float must have the same hash as that float.

Inherited from fractions.Fraction

NonreducedFraction.__le__(*expr*)
True when nonreduced fraction is less than or equal to *expr*:

```
>>> mathtools.NonreducedFraction(3, 3) <= 1
True
```

Return boolean.

NonreducedFraction.__lt__(*expr*)
True when nonreduced fraction is less than *expr*:

```
>>> mathtools.NonreducedFraction(3, 3) < 1
False
```

Return boolean.

NonreducedFraction.__mod__(*a*, *b*)
a % b

Inherited from fractions.Fraction

NonreducedFraction.__mul__(*expr*)
Multiply nonreduced fraction by expr:

```
>>> mathtools.NonreducedFraction(3, 3) * 3
NonreducedFraction(9, 3)
```

Return nonreduced fraction.

NonreducedFraction.__ne__(*expr*)
True when *expr* does not equal *self*:

```
>>> mathtools.NonreducedFraction(3, 3) != 'foo'
True
```

Return boolean.

NonreducedFraction.__neg__()
Negate nonreduced fraction:

```
>>> -mathtools.NonreducedFraction(3, 3)
NonreducedFraction(-3, 3)
```

Return nonreduced fraction.

NonreducedFraction.__nonzero__(*a*)
a != 0

Inherited from fractions.Fraction

NonreducedFraction.__pos__(*a*)
+a: Coerces a subclass instance to Fraction

Inherited from fractions.Fraction

NonreducedFraction.__pow__(*a*, *b*)
a ** b

If b is not an integer, the result will be a float or complex since roots are generally irrational. If b is an integer, the result will be rational.

Inherited from fractions.Fraction

NonreducedFraction.__radd__(*expr*)
Add nonreduced fraction to *expr*:

```
>>> 1 + mathtools.NonreducedFraction(3, 3)
NonreducedFraction(6, 3)
```

Return nonreduced fraction.

NonreducedFraction.**__rdiv__**(*expr*)
Divide *expr* by nonreduced fraction:

```
>>> 1 / mathtools.NonreducedFraction(3, 3)
NonreducedFraction(3, 3)
```

Return nonreduced fraction.

NonreducedFraction.**__rdivmod__**(*other*)
divmod(other, self): The pair (self // other, self % other).

Sometimes this can be computed faster than the pair of operations.

Inherited from numbers.Real

NonreducedFraction.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

NonreducedFraction.**__rfloordiv__**(*b*, *a*)
a // b

Inherited from fractions.Fraction

NonreducedFraction.**__rmod__**(*b*, *a*)
a % b

Inherited from fractions.Fraction

NonreducedFraction.**__rmul__**(*expr*)
Multiply *expr* by nonreduced fraction:

```
>>> 3 * mathtools.NonreducedFraction(3, 3)
NonreducedFraction(9, 3)
```

Return nonreduced fraction.

NonreducedFraction.**__rpow__**(*b*, *a*)
a ** b

Inherited from fractions.Fraction

NonreducedFraction.**__rsub__**(*expr*)
Subtract nonreduced fraction from *expr*:

```
>>> 1 - mathtools.NonreducedFraction(3, 3)
NonreducedFraction(0, 3)
```

Return nonreduced fraction.

NonreducedFraction.**__rtruediv__**(*b*, *a*)
a / b

Inherited from fractions.Fraction

NonreducedFraction.**__str__**()
String representation of nonreduced fraction:

```
>>> fraction = mathtools.NonreducedFraction(-6, 3)

>>> str(fraction)
'-6/3'
```

Return string.

NonreducedFraction.**__sub__**(*expr*)
Subtract *expr* from self:

```
>>> mathtools.NonreducedFraction(3, 3) - 2
NonreducedFraction(-3, 3)
```

Return nonreduced fraction.

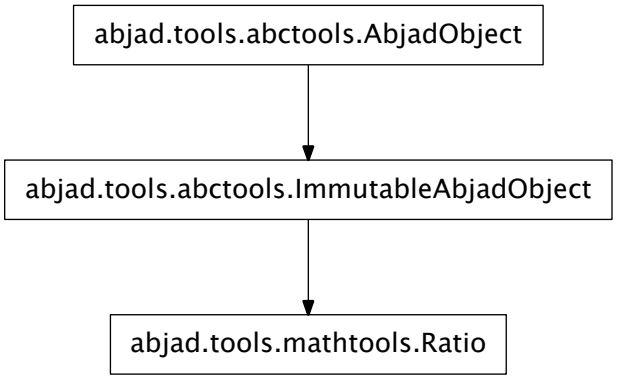
NonreducedFraction.**__truediv__**(*a*, *b*)
a / b

Inherited from fractions.Fraction

NonreducedFraction.**__trunc__**(*a*)
trunc(a)

Inherited from fractions.Fraction

mathtools.Ratio



class mathtools.**Ratio**(**args*, ***kwargs*)
New in version 2.10. Ratio of two or more nonzero integers.

Initialize from two or more nonzero integers:

```
>>> from abjad.tools import mathtools

>>> mathtools.Ratio(1, 2, 1)
Ratio(1, 2, 1)
```

Or initialize from a tuple or list:

```
>>> ratio = mathtools.Ratio((1, 2, 1))
>>> ratio
Ratio(1, 2, 1)
```

Use a tuple to return ratio integers.

```
>>> tuple(ratio)
(1, 2, 1)
```

Ratios are immutable.

Read-only Properties

`Ratio.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`Ratio.`**`count`**(*value*) → integer – return number of occurrences of value

Inherited from `__builtin__.tuple`

`Ratio.`**`index`**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from `__builtin__.tuple`

Special Methods

`Ratio.`**`__add__`**()

x.__add__(y) <==> x+y

Inherited from `__builtin__.tuple`

`Ratio.`**`__contains__`**()

x.__contains__(y) <==> y in x

Inherited from `__builtin__.tuple`

`Ratio.`**`__eq__`**(*other*)

`Ratio.`**`__ge__`**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`Ratio.`**`__getitem__`**()

x.__getitem__(y) <==> x[y]

Inherited from `__builtin__.tuple`

`Ratio.`**`__getslice__`**()

x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from `__builtin__.tuple`

Ratio.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Ratio.__**hash**__() <==> *hash(x)*
Inherited from __builtin__.tuple

Ratio.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.tuple

Ratio.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Ratio.__**len**__() <==> *len(x)*
Inherited from __builtin__.tuple

Ratio.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Ratio.__**mul**__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.tuple

Ratio.__**ne**__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Ratio.__**repr**__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

Ratio.__**rmul**__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.tuple

functions

mathtools.are_relatively_prime

mathtools.**are_relatively_prime**(*expr*)
New in version 2.5. True when *expr* is a sequence comprising zero or more numbers, all of which are relatively prime:

```
>>> from abjad.tools import mathtools

>>> mathtools.are_relatively_prime([13, 14, 15])
True
```

Otherwise false:

```
>>> mathtools.are_relatively_prime([13, 14, 15, 16])
False
```

Note that function returns true when *expr* is an empty sequence:

```
>>> mathtools.are_relatively_prime([])
True
```

Function returns false when *expr* is nonsensical type:

```
>>> mathtools.are_relatively_prime('foo')
False
```

Return boolean.

mathtools.arithmetic_mean

mathtools.**arithmetic_mean**(*sequence*)

New in version 1.1. Arithmetic means of *sequence* as an exact integer:

```
>>> from abjad.tools import mathtools

>>> mathtools.arithmetic_mean([1, 2, 2, 20, 30])
11
```

As a rational:

```
>>> mathtools.arithmetic_mean([1, 2, 20])
Fraction(23, 3)
```

As a float:

```
>>> mathtools.arithmetic_mean([2, 2, 20.0])
8.0
```

Return number. Changed in version 2.0: renamed `sequencetools.arithmetic_mean()` to `mathtools.arithmetic_mean()`.

mathtools.binomial_coefficient

mathtools.**binomial_coefficient**(*n*, *k*)

New in version 2.0. Binomial coefficient of *n* choose *k*:

```
>>> from abjad.tools import mathtools

>>> for k in range(8):
...     print k, '\t', mathtools.binomial_coefficient(8, k)
...
0  1
1  8
2  28
```

```
3  56
4  70
5  56
6  28
7  8
```

Return positive integer.

mathtools.cumulative_products

mathtools.**cumulative_products**(*sequence*)

Cumulative products of *sequence*:

```
>>> from abjad.tools import mathtools
```

```
>>> mathtools.cumulative_products([1, 2, 3, 4, 5, 6, 7, 8])
[1, 2, 6, 24, 120, 720, 5040, 40320]
```

```
>>> mathtools.cumulative_products([1, -2, 3, -4, 5, -6, 7, -8])
[1, -2, -6, 24, 120, -720, -5040, 40320]
```

Raise type error when *sequence* is neither list nor tuple.

Raise value error on empty *sequence*.

Return list. Changed in version 2.0: renamed `sequencetools.cumulative_products()` to `mathtools.cumulative_products()`.

mathtools.cumulative_signed_weights

mathtools.**cumulative_signed_weights**(*sequence*)

Cumulative signed weights of *sequence*:

```
>>> from abjad.tools import mathtools
```

```
>>> l = [1, -2, -3, 4, -5, -6, 7, -8, -9, 10]
>>> mathtools.cumulative_signed_weights(l)
[1, -3, -6, 10, -15, -21, 28, -36, -45, 55]
```

Raise type error when *sequence* is not a list.

For cumulative (unsigned) weights use `mathtools.cumulative_sums([abs(x) for x in l])`.

Return list. Changed in version 2.0: renamed `sequencetools.cumulative_weights_signed()` to `mathtools.cumulative_signed_weights()`.

mathtools.cumulative_sums

mathtools.**cumulative_sums**(*sequence*)

Cumulative sums of *sequence*:

```
>>> from abjad.tools import mathtools
```

```
>>> mathtools.cumulative_sums([1, 2, 3, 4, 5, 6, 7, 8])
[1, 3, 6, 10, 15, 21, 28, 36]
```

Raise type error when *sequence* is neither list nor tuple.

Raise value error on empty *sequence*.

Return list. Changed in version 2.0: renamed `sequencetools.cumulative_sums()` to `mathtools.cumulative_sums()`.

mathtools.cumulative_sums_zero

`mathtools.`**`cumulative_sums_zero`**(*sequence*)

Cumulative sums of *sequence* starting from `0`:

```
>>> from abjad.tools import mathtools

>>> mathtools.cumulative_sums_zero([1, 2, 3, 4, 5, 6, 7, 8])
[0, 1, 3, 6, 10, 15, 21, 28, 36]
```

Return `[0]` on empty *sequence*:

```
>>> mathtools.cumulative_sums_zero([])
[0]
```

Return list. Changed in version 2.0: renamed `mathtools.cumulative_sums_zero()` to `mathtools.cumulative_sums_zero()`.

mathtools.cumulative_sums_zero_pairwise

`mathtools.`**`cumulative_sums_zero_pairwise`**(*sequence*)

List pairwise cumulative sums of *sequence* from `0`:

```
>>> from abjad.tools import mathtools

>>> mathtools.cumulative_sums_zero_pairwise([1, 2, 3, 4, 5, 6])
[(0, 1), (1, 3), (3, 6), (6, 10), (10, 15), (15, 21)]
```

Return list of pairs. Changed in version 2.0: renamed `sequencetools.pairwise_cumulative_sums_zero()` to `mathtools.cumulative_sums_zero_pairwise()`.

mathtools.difference_series

`mathtools.`**`difference_series`**(*sequence*)

Difference series of *sequence*:

```
>>> from abjad.tools import mathtools

>>> mathtools.difference_series([1, 1, 2, 3, 5, 5, 6])
[0, 1, 1, 2, 0, 1]
```

Return list. Changed in version 2.0: renamed `sequencetools.difference_series()` to `mathtools.difference_series()`.

mathtools.divide_number_by_ratio

`mathtools.`**`divide_number_by_ratio`**(*number*, *ratio*)

Divide integer by *ratio*:

```
>>> from abjad.tools import mathtools

>>> mathtools.divide_number_by_ratio(1, [1, 1, 3])
[Fraction(1, 5), Fraction(1, 5), Fraction(3, 5)]
```

Divide fraction by *ratio*:

```
>>> mathtools.divide_number_by_ratio(Fraction(1), [1, 1, 3])
[Fraction(1, 5), Fraction(1, 5), Fraction(3, 5)]
```

Divide float by ratio:

```
>>> mathtools.divide_number_by_ratio(1.0, [1, 1, 3])
[0.20000000000000001, 0.20000000000000001, 0.60000000000000009]
```

Raise type error on nonnumeric *number*.

Raise type error on noninteger in *ratio*.

Return list of fractions or list of floats. Changed in version 2.0: renamed `mathtools.divide_number_by_ratio()` to `mathtools.divide_number_by_ratio()`.

mathtools.divisors

`mathtools.`**`divisors`**`(n)`

Positive divisors of integer *n* in increasing order:

```
>>> from abjad.tools import mathtools

>>> mathtools.divisors(84)
[1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84]

>>> for x in range(10, 20):
...     print x, mathtools.divisors(x)
...
10 [1, 2, 5, 10]
11 [1, 11]
12 [1, 2, 3, 4, 6, 12]
13 [1, 13]
14 [1, 2, 7, 14]
15 [1, 3, 5, 15]
16 [1, 2, 4, 8, 16]
17 [1, 17]
18 [1, 2, 3, 6, 9, 18]
19 [1, 19]
```

Allow nonpositive *n*:

```
>>> mathtools.divisors(-27)
[1, 3, 9, 27]
```

Raise type error on noninteger *n*.

Raise not implemented error on `0`.

Return list of positive integers.

mathtools.factors

mathtools.**factors**(*n*)

Integer factors of positive integer *n* in increasing order:

```
>>> from abjad.tools import mathtools

>>> mathtools.factors(84)
[1, 2, 2, 3, 7]

>>> for n in range(10, 20):
...   print n, mathtools.factors(n)
...
10 [1, 2, 5]
11 [1, 11]
12 [1, 2, 2, 3]
13 [1, 13]
14 [1, 2, 7]
15 [1, 3, 5]
16 [1, 2, 2, 2, 2]
17 [1, 17]
18 [1, 2, 3, 3]
19 [1, 19]
```

Raise type error on noninteger *n*.

Raise value error on nonpositive *n*.

Return list of one or more positive integers.

mathtools.get_shared_numeric_sign

mathtools.**get_shared_numeric_sign**(*sequence*)

Return `1` when all *sequence* elements are positive:

```
>>> from abjad.tools import mathtools

>>> mathtools.get_shared_numeric_sign([1, 2, 3])
1
```

Return `-1` when all *sequence* elements are negative:

```
>>> mathtools.get_shared_numeric_sign([-1, -2, -3])
-1
```

Return `0` on empty *sequence*:

```
>>> mathtools.get_shared_numeric_sign([])
0
```

Otherwise return none:

```
>>> mathtools.get_shared_numeric_sign([1, 2, -3]) is None
True
```

Return `1`, `-1`, `0` or none. Changed in version 2.0: renamed `sequencetools.sign()` to `mathtools.get_shared_numeric_sign()`.

mathtools.greatest_common_divisor

mathtools.**greatest_common_divisor**(**integers*)

New in version 2.0. Greatest common divisor of *integers*:

```
>>> from abjad.tools import mathtools

>>> mathtools.greatest_common_divisor(84, -94, -144)
2
```

Allow nonpositive *integers*.

Raise type error on noninteger *integers*.

Raise not implemented error when `0` in *integers*.

Return positive integer.

mathtools.greatest_multiple_less_equal

mathtools.**greatest_multiple_less_equal**(*m*, *n*)

Greatest integer multiple of *m* less than or equal to *n*:

```
>>> from abjad.tools import mathtools

>>> mathtools.greatest_multiple_less_equal(10, 47)
40

>>> for m in range(1, 10):
...     print m, mathtools.greatest_multiple_less_equal(m, 47)
...
1 47
2 46
3 45
4 44
5 45
6 42
7 42
8 40
9 45

>>> for n in range(10, 100, 10):
...     print mathtools.greatest_multiple_less_equal(7, n), n
...
7 10
14 20
28 30
35 40
49 50
56 60
70 70
77 80
84 90
```

Raise type error on nonnumeric *m*.

Raise type error on nonnumeric *n*.

Return nonnegative integer.

mathtools.greatest_power_of_two_less_equal

mathtools.**greatest_power_of_two_less_equal**(*n*, *i=0*)

Greatest integer power of two less than or equal to positive *n*:

```
>>> from abjad.tools import mathtools

>>> for n in range(10, 20):
...     print '\t%s\t%s' % (n, mathtools.greatest_power_of_two_less_equal(n))
...
    10 8
    11 8
    12 8
    13 8
    14 8
    15 8
    16 16
    17 16
    18 16
    19 16
```

Greatest-but-`i` integer power of `2` less than or equal to positive *n*:

```
>>> for n in range(10, 20):
...     print '\t%s\t%s' % (n, mathtools.greatest_power_of_two_less_equal(n, i=1))
...
    10 4
    11 4
    12 4
    13 4
    14 4
    15 4
    16 8
    17 8
    18 8
    19 8
```

Raise type error on nonnumeric *n*.

Raise value error on nonpositive *n*.

Return positive integer.

mathtools.integer_equivalent_number_to_integer

mathtools.**integer_equivalent_number_to_integer**(*number*)

New in version 2.0. Integer-equivalent *number* to integer:

```
>>> from abjad.tools import mathtools

>>> mathtools.integer_equivalent_number_to_integer(17.0)
17
```

Return noninteger-equivalent number unchanged:

```
>>> mathtools.integer_equivalent_number_to_integer(17.5)
17.5
```

Raise type error on nonnumber input.

Return number.

mathtools.integer_to_base_k_tuple

mathtools.**integer_to_base_k_tuple**(*n*, *k*)

New in version 2.0. Nonnegative integer *n* to base-*k* tuple:

```
>>> from abjad.tools import mathtools

>>> mathtools.integer_to_base_k_tuple(1066, 10)
(1, 0, 6, 6)
```

Return tuple of one or more positive integers.

mathtools.integer_to_binary_string

mathtools.**integer_to_binary_string**(*n*)

Positive integer *n* to binary string:

```
>>> from abjad.tools import mathtools

>>> mathtools.integer_to_binary_string(5)
'101'

>>> for n in range(1, 17):
...     print '\t%s\t%s' % (n, mathtools.integer_to_binary_string(n))
...
    1   1
    2   10
    3   11
    4   100
    5   101
    6   110
    7   111
    8   1000
    9   1001
    10  1010
    11  1011
    12  1100
    13  1101
    14  1110
    15  1111
    16  10000
```

Return string. Changed in version 2.0: renamed `mathtools.binary_string()` to `mathtools.integer_to_binary_string()`.

mathtools.interpolate_cosine

mathtools.**interpolate_cosine**(*y1*, *y2*, *mu*)

Cosine interpolate *y1* and *y2* with *mu* normalized `[0, 1]`:

```
>>> from abjad.tools import mathtools

>>> mathtools.interpolate_cosine(0, 1, 0.5)
0.49999999999999994
```

Return float. Changed in version 2.0: renamed `interpolate.cosine()` to `mathtools.interpolate_cosine()`.

mathtools.interpolate_divide

`mathtools.`**`interpolate_divide`**(*total*, *start_fraction*, *stop_fraction*, *exp='cosine'*)

Divide *total* into segments of sizes computed from interpolating between *start_fraction* and *stop_fraction*:

```
>>> from abjad.tools import mathtools

>>> mathtools.interpolate_divide(10, 1, 1, exp=1)
[1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0]
>>> sum(mathtools.interpolate_divide(10, 1, 1, exp=1))
10.0

>>> mathtools.interpolate_divide(10, 5, 1)
[4.7986734489043181, 2.8792040693425909, 1.3263207210948171,
0.99580176065827419]
>>> sum(mathtools.interpolate_divide(10, 5, 1))
10.0
```

Set `exp='cosine'` for cosine interpolation.

Set *exp* to a numeric value for exponential interpolation with *exp* as the exponent.

Scale resulting segments so that their sum equals exactly *total*.

Return a list of floats. Changed in version 2.0: renamed `interpolate.divide()` to `mathtools.interpolate_divide()`.

mathtools.interpolate_divide_multiple

`mathtools.`**`interpolate_divide_multiple`**(*totals*, *key_values*, *exp='cosine'*)

New in version 2.0. Interpolate *key_values* such that the sum of the resulting interpolated values equals the given *totals*:

```
>>> from abjad.tools import mathtools

>>> mathtools.interpolate_divide_multiple([100, 50], [20, 10, 20])
[19.4487, 18.5201, 16.2270, 13.7156, 11.7488, 10.4879,
9.8515, 9.5130, 10.4213, 13.0736, 16.9918]
```

The operation is the same as `mathtools.interpolate_divide()`. But this function takes multiple *totals* and *key_values* at once.

Precondition: `len(totals) == len(key_values) - 1`.

Set *totals* equal to a list or tuple of the total sum of interpolated values.

Set *key_values* equal a list or tuple of key values to interpolate.

Set *exp* to *consine* for consine interpolation.

Set *exp* to a number for exponential interpolation.

Returns a list of floats. Changed in version 2.0: renamed `interpolate.divide_multiple()` to `mathtools.interpolate_divide_multiple()`.

mathtools.interpolate_exponential

`mathtools.`**`interpolate_exponential`**(*y1*, *y2*, *mu*, *exp=1*)

Exponential interpolate *y1* and *y2* with *mu* normalized `[0, 1]`:

```
>>> from abjad.tools import mathtools

>>> mathtools.interpolate_exponential(0, 1, 0.5, 4)
0.0625
```

Set *exp* equal to the exponent of interpolation.

Return float. Changed in version 2.0: renamed `interpolate.exponential()` to `mathtools.interpolate_exponential()`.

mathtools.interpolate_linear

`mathtools.`**`interpolate_linear`**(*y1*, *y2*, *mu*)

Linear interpolate *y1* and *y2* with *mu* normalized `[0, 1]`:

```
>>> mathtools.interpolate_linear(0, 1, 0.5)
0.5
```

Return float. Changed in version 2.0: renamed `interpolate.linear()` to `mathtools.interpolate_linear()`.

mathtools.interval_string_to_pair_and_indicators

`mathtools.`**`interval_string_to_pair_and_indicators`**(*interval_string*)

New in version 1.0. Change *interval_string* to pair, boolean start indicator and boolean stop indicator:

```
>>> mathtools.interval_string_to_pair_and_indicators('[5, 8)')
((5, 8), False, True)
```

Parse square brackets as closed interval bounds.

Parse parentheses as open interval bounds.

Return triple.

mathtools.is_assignable_integer

`mathtools.`**`is_assignable_integer`**(*expr*)

New in version 2.0. True when *expr* is equivalent to an integer and can be written without recourse to ties:

```
>>> from abjad.tools import mathtools

>>> for n in range(0, 16 + 1):
...     print '%s\t%s' % (n, mathtools.is_assignable_integer(n))
...
0  False
1  True
```

```
2  True
3  True
4  True
5  False
6  True
7  True
8  True
9  False
10 False
11 False
12 True
13 False
14 True
15 True
16 True
```

Otherwise false.

Return boolean. Changed in version 2.0: renamed `mathtools.is_assignable()` to `mathtools.is_assignable_integer()`.

mathtools.is_dotted_integer

`mathtools.`**`is_dotted_integer`**(*expr*)

New in version 2.0. True when *expr* is equivalent to a positive integer and can be written with zero or more dots:

```
>>> from abjad.tools import mathtools
```

```
>>> for expr in range(16):
...     print '%s       %s' % (expr, mathtools.is_dotted_integer(expr))
...
0         False
1         False
2         False
3         True
4         False
5         False
6         True
7         True
8         False
9         False
10        False
11        False
12        True
13        False
14        True
15        True
```

Otherwise false.

Return boolean.

Integer *n* qualifies as dotted when `abs(n)` is of the form `2**j * (2**k - 1)` with integers `0 <= j`, `2 < k`.

mathtools.is_integer_equivalent_expr

mathtools.**is_integer_equivalent_expr**(*expr*)

New in version 2.5. True when *expr* is an integer-equivalent number:

```
>>> from abjad.tools import mathtools

>>> mathtools.is_integer_equivalent_expr(12.0)
True
```

True when *expr* evaluates to an integer:

```
>>> mathtools.is_integer_equivalent_expr('12')
True
```

Otherwise false:

```
>>> mathtools.is_integer_equivalent_expr('foo')
False
```

Return boolean.

mathtools.is_integer_equivalent_number

mathtools.**is_integer_equivalent_number**(*expr*)

New in version 2.0. True when *expr* is a number and *expr* is equivalent to an integer:

```
>>> from abjad.tools import mathtools

>>> mathtools.is_integer_equivalent_number(12.0)
True
```

Otherwise false:

```
>>> mathtools.is_integer_equivalent_number(Duration(1, 2))
False
```

Return boolean.

mathtools.is_negative_integer

mathtools.**is_negative_integer**(*expr*)

New in version 2.0. True when *expr* equals a negative integer:

```
>>> from abjad.tools import mathtools

>>> mathtools.is_negative_integer(-1)
True
```

Otherwise false:

```
>>> mathtools.is_negative_integer(0)
False

>>> mathtools.is_negative_integer(99)
False
```

Return boolean.

mathtools.is_nonnegative_integer

mathtools.**is_nonnegative_integer**(*expr*)

New in version 2.0. True when *expr* equals a nonnegative integer:

```
>>> from abjad.tools import mathtools

>>> mathtools.is_nonnegative_integer(99)
True

>>> mathtools.is_nonnegative_integer(0)
True
```

Otherwise false:

```
>>> mathtools.is_nonnegative_integer(-1)
False
```

Return boolean.

mathtools.is_nonnegative_integer_equivalent_number

mathtools.**is_nonnegative_integer_equivalent_number**(*expr*)

New in version 2.0. True when *expr* is a nonnegative integer-equivalent number. Otherwise false:

```
>>> from abjad.tools import mathtools

>>> mathtools.is_nonnegative_integer_equivalent_number(Duration(4, 2))
True
```

Return boolean.

mathtools.is_nonnegative_integer_power_of_two

mathtools.**is_nonnegative_integer_power_of_two**(*expr*)

True when *expr* is a nonnegative integer power of 2:

```
>>> from abjad.tools import mathtools

>>> for n in range(10):
...     print n, mathtools.is_nonnegative_integer_power_of_two(n)
...
0 True
1 True
2 True
3 False
4 True
5 False
6 False
7 False
8 True
9 False
```

Otherwise false.

Return boolean. Changed in version 2.0: renamed `mathtools.is_power_of_two()` to `mathtools.is_nonnegative_integer_power_of_two()`.

mathtools.is_positive_integer

mathtools.**is_positive_integer**(*expr*)

New in version 2.0. True when *expr* equals a positive integer:

```
>>> from abjad.tools import mathtools

>>> mathtools.is_positive_integer(99)
True
```

Otherwise false:

```
>>> mathtools.is_positive_integer(0)
False

>>> mathtools.is_positive_integer(-1)
False
```

Return boolean.

mathtools.is_positive_integer_equivalent_number

mathtools.**is_positive_integer_equivalent_number**(*expr*)

New in version 2.0. True when *expr* is a positive integer-equivalent number. Otherwise false:

```
>>> from abjad.tools import mathtools

>>> mathtools.is_positive_integer_equivalent_number(Duration(4, 2))
True
```

Return boolean.

mathtools.is_positive_integer_power_of_two

mathtools.**is_positive_integer_power_of_two**(*expr*)

True when *expr* is a positive integer power of 2:

```
>>> from abjad.tools import mathtools

>>> for n in range(10):
...     print n, mathtools.is_positive_integer_power_of_two(n)
...
0 False
1 True
2 True
3 False
4 True
5 False
6 False
7 False
8 True
9 False
```

Otherwise false.

Return boolean.

mathtools.least_common_multiple

mathtools.**least_common_multiple**(**integers*)

Least common multiple of positive *integers*:

```
>>> from abjad.tools import mathtools

>>> mathtools.least_common_multiple(2, 4, 5, 10, 20)
20
```

Return positive integer.

mathtools.least_multiple_greater_equal

mathtools.**least_multiple_greater_equal**(*m*, *n*)

Return the least integer multiple of *m* greater than or equal to *n*.

```
>>> from abjad.tools import mathtools

>>> mathtools.least_multiple_greater_equal(10, 47)
50

>>> for m in range(1, 10):
...     print m, mathtools.least_multiple_greater_equal(m, 47)
...
1 47
2 48
3 48
4 48
5 50
6 48
7 49
8 48
9 54

>>> for n in range(10, 100, 10):
...     print mathtools.least_multiple_greater_equal(7, n), n
...
14 10
21 20
35 30
42 40
56 50
63 60
70 70
84 80
91 90
```

Return integer.

mathtools.least_power_of_two_greater_equal

mathtools.**least_power_of_two_greater_equal**(*n*, *i=0*)

Return least integer power of two greater than or equal to positive *n*:

```
>>> from abjad.tools import mathtools

>>> for n in range(10, 20):
...     print '\t%s\t%s' % (n, mathtools.least_power_of_two_greater_equal(n))
...
    10 16
    11 16
    12 16
    13 16
    14 16
    15 16
    16 16
    17 32
    18 32
    19 32
```

When `i = 1`, return the first integer power of `2` greater than the least integer power of `2` greater than or equal to *n*.

```
>>> for n in range(10, 20):
...     print '\t%s\t%s' % (n, mathtools.least_power_of_two_greater_equal(n, i=1))
...
    10 32
    11 32
    12 32
    13 32
    14 32
    15 32
    16 32
    17 64
    18 64
    19 64
```

When `i = 2`, return the second integer power of `2` greater than the least integer power of `2` greater than or equal to *n*, and, in general, return the `i` th integer power of `2` greater than the least integer power of `2` greater than or equal to *n*.

Raise type error on nonnumeric *n*.

Raise value error on nonpositive *n*.

Return integer.

mathtools.next_integer_partition

mathtools.**next_integer_partition**(*integer_partition*)

New in version 2.0. Next integer partition following *integer_partition* in descending lex order:

```
>>> mathtools.next_integer_partition((8, 3))
(8, 2, 1)

>>> mathtools.next_integer_partition((8, 2, 1))
(8, 1, 1, 1)

>>> mathtools.next_integer_partition((8, 1, 1, 1))
(7, 4)
```

Input *integer_partition* must be sequence of positive integers.

Return integer partition as tuple of positive integers.

mathtools.partition_integer_by_ratio

mathtools.**partition_integer_by_ratio**(*n*, *ratio*)

Partition positive integer-equivalent *n* by *ratio*:

```
>>> from abjad.tools import mathtools

>>> mathtools.partition_integer_by_ratio(10, [1, 2])
[3, 7]
```

Partition positive integer-equivalent *n* by *ratio* with negative parts:

```
>>> mathtools.partition_integer_by_ratio(10, [1, -2])
[3, -7]
```

Partition negative integer-equivalent *n* by *ratio*:

```
>>> mathtools.partition_integer_by_ratio(-10, [1, 2])
[-3, -7]
```

Partition negative integer-equivalent *n* by *ratio* with negative parts:

```
>>> mathtools.partition_integer_by_ratio(-10, [1, -2])
[-3, 7]
```

Return result with weight equal to absolute value of *n*.

Raise type error on noninteger *n*.

Return list of integers.

mathtools.partition_integer_into_canonic_parts

mathtools.**partition_integer_into_canonic_parts**(*n*, *big_endian=True*)

Partition integer *n* into big-endian or small-endian parts.

Return all parts positive on positive *n*:

```
>>> for n in range(1, 11):
...     print n, mathtools.partition_integer_into_canonic_parts(n)
...
1 (1,)
2 (2,)
3 (3,)
4 (4,)
5 (4, 1)
6 (6,)
7 (7,)
8 (8,)
9 (8, 1)
10 (8, 2)
```

Return all parts negative on negative *n*:

```
>>> for n in reversed(range(-20, -10)):
...     print n, mathtools.partition_integer_into_canonic_parts(n)
...
-11 (-8, -3)
-12 (-12,)
-13 (-12, -1)
-14 (-14,)
-15 (-15,)
-16 (-16,)
-17 (-16, -1)
-18 (-16, -2)
-19 (-16, -3)
-20 (-16, -4)
```

Return little-endian tuple:

```
>>> for n in range(11, 21):
...     print n, mathtools.partition_integer_into_canonic_parts(n, big_endian=False)
...
11 (3, 8)
12 (12,)
13 (1, 12)
14 (14,)
15 (15,)
16 (16,)
17 (1, 16)
18 (2, 16)
19 (3, 16)
20 (4, 16)
```

Return big-endian tuple `t = (t_0, ..., t_j)` such that

- `sum(t) == n`
- `t_i` can be written without recourse to ties, and
- `t_(i + 1) < t_i` for every `t_i` in `t`.

Raise type error on noninteger *n*.

Return tuple of one or more integers.

mathtools.partition_integer_into_halves

mathtools.**partition_integer_into_halves**(*n*, *bigger='left'*, *even='allowed'*)

Write positive integer *n* as the pair `t = (left, right)` such that `n == left + right`.

When *n* is odd the greater part of `t` corresponds to the value of *bigger*:

```
>>> from abjad.tools import mathtools

>>> mathtools.partition_integer_into_halves(7, bigger='left')
(4, 3)
>>> mathtools.partition_integer_into_halves(7, bigger='right')
(3, 4)
```

Likewise when *n* is even and `even = 'disallowed'`:

```
>>> mathtools.partition_integer_into_halves(8, bigger='left', even='disallowed')
(5, 3)
>>> mathtools.partition_integer_into_halves(8, bigger='right', even='disallowed')
(3, 5)
```

But when *n* is even and `even = 'allowed'` then `left == right` and *bigger* is ignored:

```
>>> mathtools.partition_integer_into_halves(8)
(4, 4)
>>> mathtools.partition_integer_into_halves(8, bigger='left')
(4, 4)
>>> mathtools.partition_integer_into_halves(8, bigger='right')
(4, 4)
```

When *n* is `0` return `(0, 0)`:

```
>>> mathtools.partition_integer_into_halves(0)
(0, 0)
```

When *n* is `0` and `even = 'disallowed'` raise partition error.

Raise type error on noninteger *n*.

Raise value error on negative *n*.

Return pair of positive integers.

mathtools.partition_integer_into_units

mathtools.**partition_integer_into_units**(*n*)

Partition positive integer into units:

```
>>> from abjad.tools import mathtools

>>> mathtools.partition_integer_into_units(6)
[1, 1, 1, 1, 1, 1]
```

Partition negative integer into units:

```
>>> mathtools.partition_integer_into_units(-5)
[-1, -1, -1, -1, -1]
```

Partition `0` into units:

```
>>> mathtools.partition_integer_into_units(0)
[]
```

Return list of zero or more parts with absolute value equal to `1`.

mathtools.remove_powers_of_two

mathtools.**remove_powers_of_two**(*n*)

Remove powers of `2` from the factors of positive integer *n*:

```
>>> from abjad.tools import mathtools
```

```
>>> for n in range(10, 100, 10):
...     print '\t%s\t%s' % (n, mathtools.remove_powers_of_two(n))
...
    10 5
    20 5
    30 15
    40 5
    50 25
    60 15
    70 35
    80 5
    90 45
```

Raise type error on noninteger *n*.

Raise value error on nonpositive *n*.

Return positive integer.

mathtools.sign

mathtools.**sign**(*n*)

Return `-1` on negative *n*:

```
>>> mathtools.sign(-96.2)
-1
```

Return `0` when *n* is `0`:

```
>>> mathtools.sign(0)
0
```

Return `1` on positive *n*:

```
>>> mathtools.sign(Duration(9, 8))
1
```

Return `-1`, `0` or `1`.

mathtools.weight

mathtools.**weight**(*sequence*)

Sum of the absolute value of the elements in *sequence*:

```
>>> mathtools.weight([-1, -2, 3, 4, 5])
15
```

Return nonnegative integer. Changed in version 2.0: renamed `sequencetools.weight()` to `mathtools.weight()`.

mathtools.yield_all_compositions_of_integer

mathtools.**yield_all_compositions_of_integer**(*n*)

New in version 2.0. Yield all compositions of positive integer *n* in descending lex order:

```
>>> from abjad.tools import mathtools

>>> for integer_composition in mathtools.yield_all_compositions_of_integer(5):
...     integer_composition
...
(5,)
(4, 1)
(3, 2)
(3, 1, 1)
(2, 3)
(2, 2, 1)
(2, 1, 2)
(2, 1, 1, 1)
(1, 4)
(1, 3, 1)
(1, 2, 2)
(1, 2, 1, 1)
(1, 1, 3)
(1, 1, 2, 1)
(1, 1, 1, 2)
(1, 1, 1, 1, 1)
```

Integer compositions are ordered integer partitions.

Return generator of positive integer tuples of length at least 1. Changed in version 2.0: renamed `mathtools.integer_compositions()` to `mathtools.yield_all_compositions_of_integer()`.

mathtools.yield_all_partitions_of_integer

mathtools.**yield_all_partitions_of_integer**(*n*)

New in version 2.0. Yield all partitions of positive integer *n* in descending lex order:

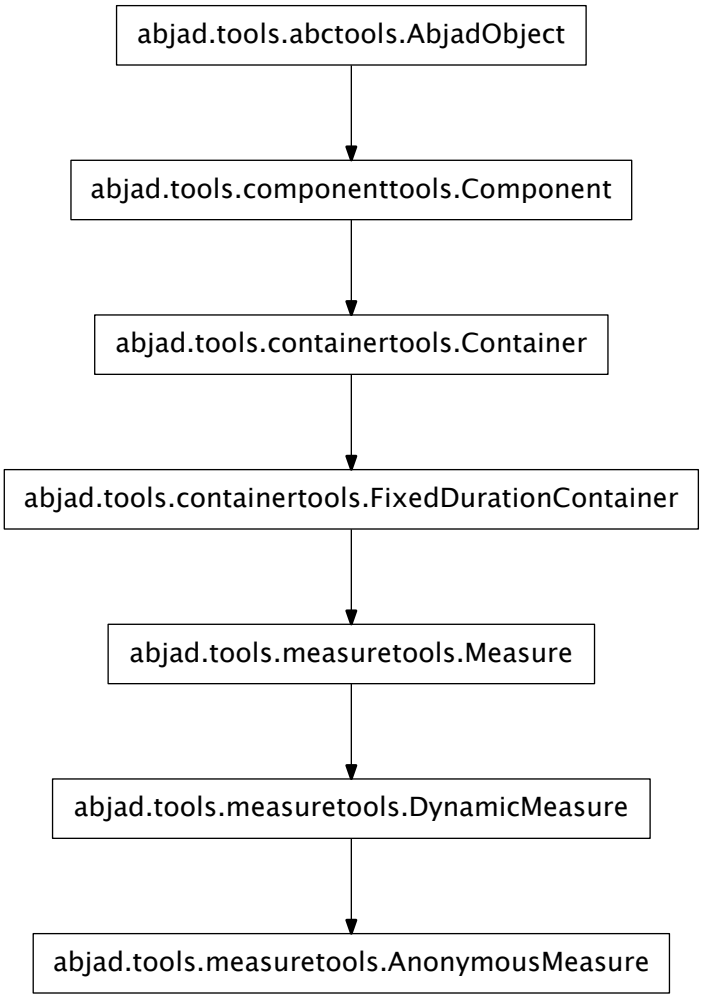
```
>>> from abjad.tools import mathtools

>>> for partition in mathtools.yield_all_partitions_of_integer(7):
...     partition
...
(7,)
(6, 1)
(5, 2)
(5, 1, 1)
(4, 3)
(4, 2, 1)
(4, 1, 1, 1)
(3, 3, 1)
(3, 2, 2)
(3, 2, 1, 1)
(3, 1, 1, 1, 1)
(2, 2, 2, 1)
(2, 2, 1, 1, 1)
(2, 1, 1, 1, 1, 1)
(1, 1, 1, 1, 1, 1, 1)
```

Return generator of positive integer tuples of length at least 1. Changed in version 2.0: renamed `mathtools.integer_partitions()` to `mathtools.yield_all_partitions_of_integer()`.

measuretools

concrete classes

measuretools.AnonymousMeasure



class measuretools.**AnonymousMeasure**(*music=None*, ***kwargs*)

New in version 1.1. Dynamic measure with no time signature:

```
>>> measure = measuretools.AnonymousMeasure("c'8 d'8 e'8 f'8")

>>> f(measure)
{
    \override Staff.TimeSignature #'stencil = ##f
    \time 1/2
```

```
        c'8
        d'8
        e'8
        f'8
        \revert Staff.TimeSignature #'stencil
    }

    >>> notes = [Note("c'8"), Note("d'8")]
    >>> measure.extend(notes)

    >>> f(measure)
    {
        \override Staff.TimeSignature #'stencil = ##f
        \time 3/4
        c'8
        d'8
        e'8
        f'8
        c'8
        d'8
        \revert Staff.TimeSignature #'stencil
    }
```

Return anonymous measure.

Read-only Properties

AnonymousMeasure.**contents_duration**

Inherited from containertools.Container

AnonymousMeasure.**duration_in_seconds**

Inherited from containertools.Container

AnonymousMeasure.**is_binary**

True when measure time signature denominator is an integer power of 2:

```
>>> measure = Measure((5, 8), "c'8 d' e' f' g'")
>>> measure.is_binary
True
```

Otherwise false:

```
>>> measure = Measure((5, 9), "c'8 d' e' f' g'")
>>> measure.is_binary
False
```

Return boolean.

Inherited from measuretools.Measure

AnonymousMeasure.**is_full**

True when prolated duration equals time signature duration:

```
>>> measure = Measure((4, 8), "c'8 d'8 e'8 f'8")

>>> measure.is_full
True
```

Otherwise false.

Return boolean.

Inherited from measuretools.Measure

AnonymousMeasure.**is_misfilled**

New in version 2.9. True when measure is either underfull or overfull:

```
>>> measure = Measure((3, 4), "c' d' e' f'")

>>> measure
Measure(3/4, [c'4, d'4, e'4, f'4])

>>> measure.is_misfilled
True
```

Otherwise false:

```
>>> measure = Measure((3, 4), "c' d' e'")

>>> measure
Measure(3/4, [c'4, d'4, e'4])

>>> measure.is_misfilled
False
```

Return boolean.

Inherited from measuretools.Measure

AnonymousMeasure.**is_nonbinary**

True when measure time signature denominator is not an integer power of 2:

```
>>> measure = Measure((5, 9), "c'8 d' e' f' g'")
>>> measure.is_nonbinary
True
```

Otherwise false:

```
>>> measure = Measure((5, 8), "c'8 d' e' f' g'")
>>> measure.is_nonbinary
False
```

Return boolean.

Inherited from measuretools.Measure

AnonymousMeasure.**is_overfull**

New in version 1.1. True when prolated duration is greater than time signature duration:

```
>>> measure = Measure((3, 4), "c'4 d' e' f'")

>>> measure.is_overfull
True
```

Otherwise false.

Return boolean.

Inherited from measuretools.Measure

AnonymousMeasure.**is_underfull**

New in version 1.1. True when prolated duration is less than time signature duration:

```
>>> measure = Measure((3, 4), "c'4 d'")
```

```
>>> measure.is_underfull
True
```

Otherwise false.

Return boolean.

Inherited from measuretools.Measure

AnonymousMeasure.**leaves**

Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

AnonymousMeasure.**lilypond_format**

Inherited from measuretools.Measure

AnonymousMeasure.**measure_number**

1-indexed measure number:

```
>>> staff = Staff()
>>> staff.append(Measure((3, 4), "c' d' e'"))
>>> staff.append(Measure((2, 4), "f' g'"))

>>> f(staff)
\new Staff {
    {
        \time 3/4
        c'4
        d'4
        e'4
    }
    {
        \time 2/4
        f'4
        g'4
    }
}

>>> staff[0].measure_number
1

>>> staff[1].measure_number
2
```

Return positive integer.

Inherited from measuretools.Measure

AnonymousMeasure.**multiplier**

Multiplier of measure time signature:

```
>>> measure = Measure((5, 12), "c'8 d' e' f' g'")
```

```
>>> measure.multiplier
Fraction(2, 3)
```

Return fraction.

Inherited from `measuretools.Measure`

`AnonymousMeasure.`**`music`**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from `containertools.Container`

`AnonymousMeasure.`**`override`**
Read-only reference to LilyPond grob override component plug-in.

Inherited from `componenttools.Component`

`AnonymousMeasure.`**`parent`**
Inherited from `componenttools.Component`

`AnonymousMeasure.`**`preprolated_duration`**
Inherited from `measuretools.DynamicMeasure`

`AnonymousMeasure.`**`prolated_duration`**
Inherited from `componenttools.Component`

`AnonymousMeasure.`**`prolation`**
Inherited from `componenttools.Component`

`AnonymousMeasure.`**`set`**
Read-only reference LilyPond context setting component plug-in.

Inherited from `componenttools.Component`

`AnonymousMeasure.`**`spanners`**
Read-only reference to unordered set of spanners attached to component.

Inherited from `componenttools.Component`

`AnonymousMeasure.`**`start_offset`**
Read-only start offset of component.

Inherited from `componenttools.Component`

`AnonymousMeasure.`**`start_offset_in_seconds`**
Read-only start offset of comonent in seconds.

Inherited from `componenttools.Component`

`AnonymousMeasure.`**`stop_offset`**
Read-only stop offset of component.

Inherited from `componenttools.Component`

`AnonymousMeasure.`**`stop_offset_in_seconds`**
Read-only stop offset of component in seconds.

Inherited from `componenttools.Component`

AnonymousMeasure.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

AnonymousMeasure.**target_duration**
New in version 2.9. Read-only target duration of measure always equal to duration of effective time signature.

Inherited from measuretools.Measure

Read/write Properties

AnonymousMeasure.**always_format_time_signature**
New in version 2.9. Read / write flag to indicate whether time signature should appear in LilyPond format even when not expected.

Set to true when necessary to print the same signature repeatedly.

Default to false.

Return boolean.

Inherited from measuretools.Measure

AnonymousMeasure.**automatically_adjust_time_signature**
New in version 2.9. Read / write flag to indicate whether time signature should update automatically following contents-changing operations:

```
>>> measure = Measure((3, 4), "c' d' e'")

>>> measure
Measure(3/4, [c'4, d'4, e'4])

>>> measure.automatically_adjust_time_signature = True
>>> measure.append('r')

>>> measure
Measure(4/4, [c'4, d'4, e'4, r4])
```

Default to false.

Return boolean.

Inherited from measuretools.Measure

AnonymousMeasure.**denominator**
Get explicit denominator of dynamic measure:

```
>>> measure = measuretools.DynamicMeasure("c'8 d'8 e'8 f'8")

>>> measure.denominator is None
True
```

Set explicit denominator of dynamic measure:

```
>>> measure.denominator = 8

>>> f(measure)
{
    \time 4/8
    c'8
    d'8
```

```
        e'8
        f'8
    }
```

Set positive integer or none.

Inherited from `measuretools.DynamicMeasure`

`AnonymousMeasure.`**`is_parallel`**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from `containertools.Container`

`AnonymousMeasure.`**`suppress_meter`**

Get meter suppression indicator:

```
>>> measure = measuretools.DynamicMeasure("c'8 d'8 e'8 f'8")

>>> f(measure)
{
    \time 1/2
    c'8
    d'8
    e'8
```

```
    f'8
}
```

```
>>> measure.suppress_meter
False
```

Set meter suppression indicator:

```
>>> measure.suppress_meter = True
```

```
>>> measure.suppress_meter
True
```

```
>>> f(measure)
{
    c'8
    d'8
    e'8
    f'8
}
```

Set boolean.

Inherited from `measuretools.DynamicMeasure`

Methods

`AnonymousMeasure.`**`append`**`(`*component*`)`

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}
```

```
>>> container.append(Note("f'8"))
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from `containertools.Container`

`AnonymousMeasure.`**`extend`**`(`*expr*`)`

Extend dynamic measure:

```
>>> measure = measuretools.DynamicMeasure("c'8 d'8 e'8")
```

```
>>> f(measure)
{
    \time 3/8
    c'8
    d'8
    e'8
}

>>> measure.extend([Note("f'8"), Note("g'8")])

>>> f(measure)
{
    \time 5/8
    c'8
    d'8
    e'8
    f'8
    g'8
}
```

Return none.

Inherited from `measuretools.DynamicMeasure`

`AnonymousMeasure.`**`index`**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from `containertools.Container`

`AnonymousMeasure.`**`insert`**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
```

```
    e'8 ]
}
```

Return none.

Inherited from containertools.Container

AnonymousMeasure.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

AnonymousMeasure.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

AnonymousMeasure.**__add__**(*arg*)
Add two measures together in-score or outside-of-score. Wrapper around measuretools.fuse_measures.

Inherited from measuretools.Measure

AnonymousMeasure.**__contains__**(*expr*)
True if expr is in container, otherwise False.

Inherited from containertools.Container

AnonymousMeasure.**__delitem__**(*i*)
Container item deletion with optional time signature adjustment.

Inherited from measuretools.Measure

AnonymousMeasure.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

AnonymousMeasure.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AnonymousMeasure.**__getitem__**(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

AnonymousMeasure.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

AnonymousMeasure.**__iadd__**(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

AnonymousMeasure.**__imul__**(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

AnonymousMeasure.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AnonymousMeasure.**__len__**()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

AnonymousMeasure.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AnonymousMeasure.__mul__(*n*)
Inherited from componenttools.Component

AnonymousMeasure.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

AnonymousMeasure.__radd__(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

AnonymousMeasure.__repr__()
String form of measure with parentheses for interpreter display.

Inherited from measuretools.Measure

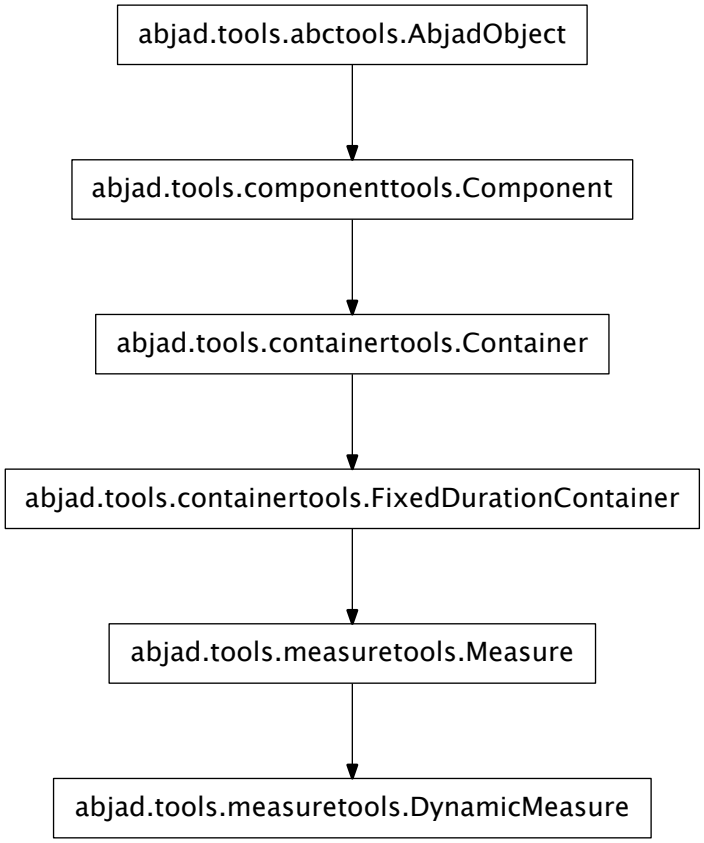
AnonymousMeasure.__rmul__(*n*)
Inherited from componenttools.Component

AnonymousMeasure.__setitem__(*i*, *expr*)
Container setitem logic with optional time signature adjustment. Changed in version 2.9: Measure setitem logic now adjusts time signatue automatically when adjust_time_signature_automatically is true.
Inherited from measuretools.Measure

AnonymousMeasure.__str__()
String form of measure with pipes for single string display.

Inherited from measuretools.Measure

measuretools.DynamicMeasure



class measuretools.**DynamicMeasure**(*music=None*, ***kwargs*)

New in version 1.1. Measure sets meter dynamically to exactly equal contents duration:

```
>>> measure = measuretools.DynamicMeasure("c'8 d'8 e'8")

>>> measure
DynamicMeasure(3/8, [c'8, d'8, e'8])

>>> f(measure)
{
    \time 3/8
    c'8
    d'8
    e'8
}
```

Return dynamic measure.

Read-only Properties

DynamicMeasure.**contents_duration**
Inherited from containertools.Container

DynamicMeasure.**duration_in_seconds**
Inherited from containertools.Container

DynamicMeasure.**is_binary**
True when measure time signature denominator is an integer power of 2:

```
>>> measure = Measure((5, 8), "c'8 d' e' f' g'")
>>> measure.is_binary
True
```

Otherwise false:

```
>>> measure = Measure((5, 9), "c'8 d' e' f' g'")
>>> measure.is_binary
False
```

Return boolean.

Inherited from measuretools.Measure

DynamicMeasure.**is_full**
True when prolated duration equals time signature duration:

```
>>> measure = Measure((4, 8), "c'8 d'8 e'8 f'8")

>>> measure.is_full
True
```

Otherwise false.

Return boolean.

Inherited from measuretools.Measure

DynamicMeasure.**is_misfilled**
New in version 2.9. True when measure is either underfull or overfull:

```
>>> measure = Measure((3, 4), "c' d' e' f'")

>>> measure
Measure(3/4, [c'4, d'4, e'4, f'4])

>>> measure.is_misfilled
True
```

Otherwise false:

```
>>> measure = Measure((3, 4), "c' d' e'")

>>> measure
Measure(3/4, [c'4, d'4, e'4])

>>> measure.is_misfilled
False
```

Return boolean.

Inherited from measuretools.Measure

DynamicMeasure.**is_nonbinary**
True when measure time signature denominator is not an integer power of 2:

```
>>> measure = Measure((5, 9), "c'8 d' e' f' g'")
>>> measure.is_nonbinary
True
```

Otherwise false:

```
>>> measure = Measure((5, 8), "c'8 d' e' f' g'")
>>> measure.is_nonbinary
False
```

Return boolean.

Inherited from `measuretools.Measure`

`DynamicMeasure.`**`is_overfull`**

New in version 1.1. True when prolated duration is greater than time signature duration:

```
>>> measure = Measure((3, 4), "c'4 d' e' f'")

>>> measure.is_overfull
True
```

Otherwise false.

Return boolean.

Inherited from `measuretools.Measure`

`DynamicMeasure.`**`is_underfull`**

New in version 1.1. True when prolated duration is less than time signature duration:

```
>>> measure = Measure((3, 4), "c'4 d'")

>>> measure.is_underfull
True
```

Otherwise false.

Return boolean.

Inherited from `measuretools.Measure`

`DynamicMeasure.`**`leaves`**

Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from `containertools.Container`

`DynamicMeasure.`**`lilypond_format`**

Inherited from `measuretools.Measure`

`DynamicMeasure.`**`measure_number`**

1-indexed measure number:

```
>>> staff = Staff()
>>> staff.append(Measure((3, 4), "c' d' e'"))
>>> staff.append(Measure((2, 4), "f' g'"))
```

```
>>> f(staff)
\new Staff {
    {
        \time 3/4
        c'4
        d'4
        e'4
    }
    {
        \time 2/4
        f'4
        g'4
    }
}

>>> staff[0].measure_number
1

>>> staff[1].measure_number
2
```

Return positive integer.

Inherited from measuretools.Measure

DynamicMeasure.**multiplier**

Multiplier of measure time signature:

```
>>> measure = Measure((5, 12), "c'8 d' e' f' g'")

>>> measure.multiplier
Fraction(2, 3)
```

Return fraction.

Inherited from measuretools.Measure

DynamicMeasure.**music**

Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

DynamicMeasure.**override**

Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

DynamicMeasure.**parent**

Inherited from componenttools.Component

DynamicMeasure.**preprolated_duration**

DynamicMeasure.**prolated_duration**

Inherited from componenttools.Component

DynamicMeasure.**prolation**
Inherited from componenttools.Component

DynamicMeasure.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

DynamicMeasure.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

DynamicMeasure.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

DynamicMeasure.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

DynamicMeasure.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

DynamicMeasure.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

DynamicMeasure.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

DynamicMeasure.**target_duration**
New in version 2.9. Read-only target duration of measure always equal to duration of effective time signature.

Inherited from measuretools.Measure

Read/write Properties

DynamicMeasure.**always_format_time_signature**
New in version 2.9. Read / write flag to indicate whether time signature should appear in LilyPond format even when not expected.

Set to true when necessary to print the same signature repeatedly.

Default to false.

Return boolean.

Inherited from measuretools.Measure

DynamicMeasure.**automatically_adjust_time_signature**
New in version 2.9. Read / write flag to indicate whether time signature should update automatically following contents-changing operations:

```
>>> measure = Measure((3, 4), "c' d' e'")
```

```
>>> measure
Measure(3/4, [c'4, d'4, e'4])

>>> measure.automatically_adjust_time_signature = True
>>> measure.append('r')

>>> measure
Measure(4/4, [c'4, d'4, e'4, r4])
```

Default to false.

Return boolean.

Inherited from `measuretools.Measure`

`DynamicMeasure.`**`denominator`**

Get explicit denominator of dynamic measure:

```
>>> measure = measuretools.DynamicMeasure("c'8 d'8 e'8 f'8")

>>> measure.denominator is None
True
```

Set explicit denominator of dynamic measure:

```
>>> measure.denominator = 8

>>> f(measure)
{
    \time 4/8
    c'8
    d'8
    e'8
    f'8
}
```

Set positive integer or none.

`DynamicMeasure.`**`is_parallel`**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from containertools.Container

DynamicMeasure.**suppress_meter**

Get meter suppression indicator:

```
>>> measure = measuretools.DynamicMeasure("c'8 d'8 e'8 f'8")

>>> f(measure)
{
    \time 1/2
    c'8
    d'8
    e'8
    f'8
}

>>> measure.suppress_meter
False
```

Set meter suppression indicator:

```
>>> measure.suppress_meter = True

>>> measure.suppress_meter
True

>>> f(measure)
{
    c'8
    d'8
    e'8
    f'8
}
```

Set boolean.

Methods

DynamicMeasure.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

DynamicMeasure.**extend**(*expr*)

Extend dynamic measure:

```
>>> measure = measuretools.DynamicMeasure("c'8 d'8 e'8")

>>> f(measure)
{
    \time 3/8
    c'8
    d'8
    e'8
}

>>> measure.extend([Note("f'8"), Note("g'8")])

>>> f(measure)
{
    \time 5/8
    c'8
    d'8
    e'8
    f'8
    g'8
}
```

Return none.

DynamicMeasure.**index**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from containertools.Container

DynamicMeasure.**insert**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from containertools.Container

DynamicMeasure.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

DynamicMeasure.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

DynamicMeasure.**__add__**(*arg*)

Add two measures together in-score or outside-of-score. Wrapper around measuretools.fuse_measures.

Inherited from measuretools.Measure

DynamicMeasure.**__contains__**(*expr*)

True if expr is in container, otherwise False.

Inherited from containertools.Container

DynamicMeasure.**__delitem__**(*i*)

Container item deletion with optional time signature adjustment.

Inherited from measuretools.Measure

DynamicMeasure.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DynamicMeasure.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DynamicMeasure.**__getitem__**(*i*)

Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

DynamicMeasure.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DynamicMeasure.**__iadd__**(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

DynamicMeasure.**__imul__**(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

DynamicMeasure.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DynamicMeasure.**__len__**()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

DynamicMeasure.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DynamicMeasure.**__mul__**(*n*)
Inherited from componenttools.Component

DynamicMeasure.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DynamicMeasure.**__radd__**(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

DynamicMeasure.**__repr__**()
String form of measure with parentheses for interpreter display.

Inherited from measuretools.Measure

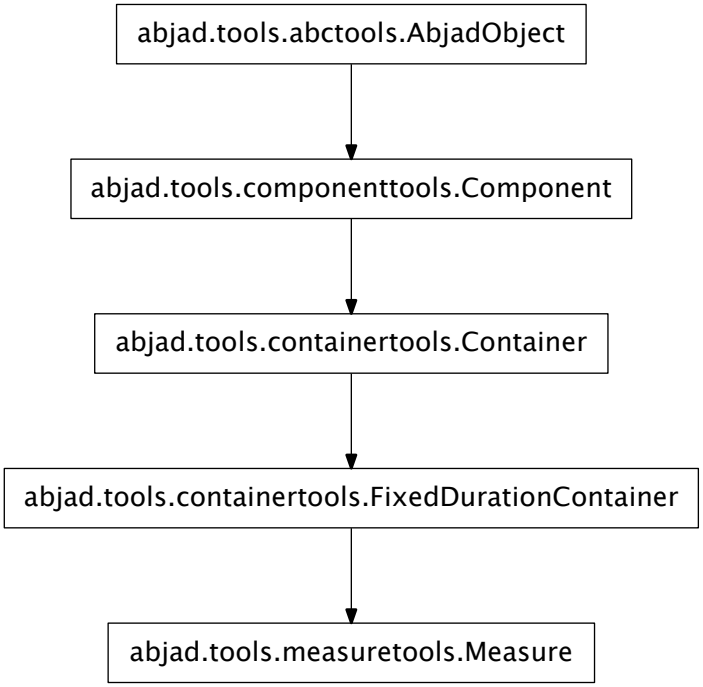
DynamicMeasure.**__rmul__**(*n*)
Inherited from componenttools.Component

DynamicMeasure.**__setitem__**(*i*, *expr*)
Container setitem logic with optional time signature adjustment. Changed in version 2.9: Measure setitem logic now adjusts time signatue automatically when adjust_time_signature_automatically is true.
Inherited from measuretools.Measure

DynamicMeasure.**__str__**()
String form of measure with pipes for single string display.

Inherited from `measuretools.Measure`

measuretools.Measure



class `measuretools.`**`Measure`**(*meter*, *music=None*, ***kwargs*)

New in version 1.1.Changed in version 2.9: measure now inherits from fixed-duration container. Abjad model of a measure:

```
>>> measure = Measure((4, 8), "c'8 d' e' f'")

>>> measure
Measure(4/8, [c'8, d'8, e'8, f'8])

>>> f(measure)
{
    \time 4/8
    c'8
    d'8
    e'8
    f'8
}
```

Return measure object.

Read-only Properties

Measure.**contents_duration**
Inherited from containertools.Container

Measure.**duration_in_seconds**
Inherited from containertools.Container

Measure.**is_binary**
True when measure time signature denominator is an integer power of 2:

```
>>> measure = Measure((5, 8), "c'8 d' e' f' g'")
>>> measure.is_binary
True
```

Otherwise false:

```
>>> measure = Measure((5, 9), "c'8 d' e' f' g'")
>>> measure.is_binary
False
```

Return boolean.

Measure.**is_full**
True when prolated duration equals time signature duration:

```
>>> measure = Measure((4, 8), "c'8 d'8 e'8 f'8")

>>> measure.is_full
True
```

Otherwise false.

Return boolean.

Measure.**is_misfilled**
New in version 2.9. True when measure is either underfull or overfull:

```
>>> measure = Measure((3, 4), "c' d' e' f'")

>>> measure
Measure(3/4, [c'4, d'4, e'4, f'4])

>>> measure.is_misfilled
True
```

Otherwise false:

```
>>> measure = Measure((3, 4), "c' d' e'")

>>> measure
Measure(3/4, [c'4, d'4, e'4])

>>> measure.is_misfilled
False
```

Return boolean.

Measure.**is_nonbinary**
True when measure time signature denominator is not an integer power of 2:

```
>>> measure = Measure((5, 9), "c'8 d' e' f' g'")
>>> measure.is_nonbinary
True
```

Otherwise false:

```
>>> measure = Measure((5, 8), "c'8 d' e' f' g'")
>>> measure.is_nonbinary
False
```

Return boolean.

Measure.**is_overfull**

New in version 1.1. True when prolated duration is greater than time signature duration:

```
>>> measure = Measure((3, 4), "c'4 d' e' f'")

>>> measure.is_overfull
True
```

Otherwise false.

Return boolean.

Measure.**is_underfull**

New in version 1.1. True when prolated duration is less than time signature duration:

```
>>> measure = Measure((3, 4), "c'4 d'")

>>> measure.is_underfull
True
```

Otherwise false.

Return boolean.

Measure.**leaves**

Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

Measure.**lilypond_format**

Measure.**measure_number**

1-indexed measure number:

```
>>> staff = Staff()
>>> staff.append(Measure((3, 4), "c' d' e'"))
>>> staff.append(Measure((2, 4), "f' g'"))

>>> f(staff)
\new Staff {
    {
        \time 3/4
        c'4
        d'4
        e'4
    }
    {
        \time 2/4
        f'4
```

```
            g'4
        }
    }
```

```
>>> staff[0].measure_number
1
```

```
>>> staff[1].measure_number
2
```

Return positive integer.

Measure.**multiplier**

Multiplier of measure time signature:

```
>>> measure = Measure((5, 12), "c'8 d' e' f' g'")
```

```
>>> measure.multiplier
Fraction(2, 3)
```

Return fraction.

Measure.**music**

Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

Measure.**override**

Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Measure.**parent**

Inherited from componenttools.Component

Measure.**preprolated_duration**

Preprolated duration of measure:

```
>>> measure = Measure((5, 12), "c'8 d' e' f' g'")
```

```
>>> measure.preprolated_duration
Duration(5, 12)
```

Equal measure contents duration times time signature multiplier.

Return duration.

Measure.**prolated_duration**

Inherited from componenttools.Component

Measure.**prolation**

Inherited from componenttools.Component

Measure.**set**

Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Measure.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Measure.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Measure.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Measure.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Measure.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Measure.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Measure.**target_duration**
New in version 2.9. Read-only target duration of measure always equal to duration of effective time signature.

Read/write Properties

Measure.**always_format_time_signature**
New in version 2.9. Read / write flag to indicate whether time signature should appear in LilyPond format even when not expected.

Set to true when necessary to print the same signature repeatedly.

Default to false.

Return boolean.

Measure.**automatically_adjust_time_signature**
New in version 2.9. Read / write flag to indicate whether time signature should update automatically following contents-changing operations:

```
>>> measure = Measure((3, 4), "c' d' e'")

>>> measure
Measure(3/4, [c'4, d'4, e'4])

>>> measure.automatically_adjust_time_signature = True
>>> measure.append('r')

>>> measure
Measure(4/4, [c'4, d'4, e'4, r4])
```

Default to false.

Return boolean.

Measure.**is_parallel**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from containertools.Container

Methods

Measure.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}
```

```
>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

Measure.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: expr may now be a LilyPond input string. Inherited from containertools.Container

Measure.**index**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from containertools.Container

Measure.**insert**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from `containertools.Container`

`Measure.`**`pop`**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from `containertools.Container`

`Measure.`**`remove`**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
```

```
        e'8 ]
    }

    >>> note = container[-1]
    >>> note
    Note("e'8")

    >>> container.remove(note)

    >>> f(container)
    {
        c'8 [
        d'8 ]
    }
```

Return none.

Inherited from containertools.Container

Special Methods

Measure.**__add__**(*arg*)
Add two measures together in-score or outside-of-score. Wrapper around measuretools.fuse_measures.

Measure.**__contains__**(*expr*)
True if expr is in container, otherwise False.

Inherited from containertools.Container

Measure.**__delitem__**(*i*)
Container item deletion with optional time signature adjustment.

Measure.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Measure.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Measure.**__getitem__**(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

Measure.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Measure.**__iadd__**(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

Measure.**__imul__**(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

Measure.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Measure.**__len__**()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

Measure.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Measure.**__mul__**(*n*)
Inherited from componenttools.Component

Measure.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Measure.**__radd__**(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

Measure.**__repr__**()
String form of measure with parentheses for interpreter display.

Measure.**__rmul__**(*n*)
Inherited from componenttools.Component

Measure.**__setitem__**(*i*, *expr*)
Container setitem logic with optional time signature adjustment. Changed in version 2.9: Measure setitem logic now adjusts time signatue automatically when adjust_time_signature_automatically is true.

Measure.**__str__**()
String form of measure with pipes for single string display.

functions

measuretools.all_are_measures

measuretools.**all_are_measures**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad measures:

```
>>> measures = 3 * Measure((3, 4), "c'4 d'4 e'4")
```

```
>>> for measure in measures:
...     measure
...
Measure(3/4, [c'4, d'4, e'4])
Measure(3/4, [c'4, d'4, e'4])
Measure(3/4, [c'4, d'4, e'4])

>>> measuretools.all_are_measures(measures)
True
```

True when *expr* is an empty sequence:

```
>>> measuretools.all_are_measures([])
True
```

Otherwise false:

```
>>> measuretools.all_are_measures('foo')
False
```

Return boolean.

Function wraps `componenttools.all_are_components()`.

measuretools.append_spacer_skip_to_underfull_measure

measuretools.**append_spacer_skip_to_underfull_measure**(*rigid_measure*)

New in version 1.1. Append spacer skip to underfull *measure*:

```
>>> measure = Measure((4, 12), "c'8 d'8 e'8 f'8")
>>> contexttools.detach_time_signature_marks_attached_to_component(measure)
(TimeSignatureMark((4, 12)),)
>>> contexttools.TimeSignatureMark((5, 12))(measure)
TimeSignatureMark((5, 12))(|5/12, c'8, d'8, e'8, f'8|)
>>> measure.is_underfull
True

>>> measuretools.append_spacer_skip_to_underfull_measure(measure)
Measure(5/12, [c'8, d'8, e'8, f'8, s1 * 1/8])

>>> f(measure)
{
    \time 5/12
    \scaleDurations #'(2 . 3) {
        c'8
        d'8
        e'8
        f'8
        s1 * 1/8
    }
}
```

Append nothing to nonunderfull *measure*.

Return *measure*.

measuretools.append_spacer_skips_to_underfull_measures_in_expr

measuretools.**append_spacer_skips_to_underfull_measures_in_expr**(*expr*)

New in version 1.1. Append spacer skips to underfull measures in *expr*:

```
>>> staff = Staff(Measure((3, 8), "c'8 d'8 e'8") * 3)
>>> contexttools.detach_time_signature_marks_attached_to_component(staff[1])
(TimeSignatureMark((3, 8)),)
>>> contexttools.TimeSignatureMark((4, 8))(staff[1])
TimeSignatureMark((4, 8))(|4/8, c'8, d'8, e'8|)
>>> contexttools.detach_time_signature_marks_attached_to_component(staff[2])
(TimeSignatureMark((3, 8)),)
>>> contexttools.TimeSignatureMark((5, 8))(staff[2])
TimeSignatureMark((5, 8))(|5/8, c'8, d'8, e'8|)
>>> staff[1].is_underfull
True
>>> staff[2].is_underfull
True

>>> measuretools.append_spacer_skips_to_underfull_measures_in_expr(staff)
[Measure(4/8, [c'8, d'8, e'8, s1 * 1/8]), Measure(5/8, [c'8, d'8, e'8, s1 * 1/4])]

>>> f(staff)
\new Staff {
    {
        \time 3/8
        c'8
        d'8
        e'8
    }
    {
        \time 4/8
        c'8
        d'8
        e'8
        s1 * 1/8
    }
    {
        \time 5/8
        c'8
        d'8
        e'8
        s1 * 1/4
    }
}
```

Return measures treated. Changed in version 2.0: renamed `measuretools.remedy_underfull_measures()` to `measuretools.append_spacer_skips_to_underfull_measures_in_expr()`.

measuretools.apply_full_measure_tuplets_to_contents_of_measures_in_expr

measuretools.**apply_full_measure_tuplets_to_contents_of_measures_in_expr**(*expr*)

New in version 2.0. Apply full-measure tuplets to contents of measures in *expr*:

```
>>> staff = Staff([Measure((2, 8), "c'8 d'8"), Measure((3, 8), "e'8 f'8 g'8")])
```

```
>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        \time 3/8
        e'8
        f'8
        g'8
    }
}

>>> measuretools.apply_full_measure_tuplets_to_contents_of_measures_in_expr(staff)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        {
            c'8
            d'8
        }
    }
    {
        \time 3/8
        {
            e'8
            f'8
            g'8
        }
    }
}
```

Return none.

measuretools.comment_measures_in_container_with_measure_numbers

measuretools.**comment_measures_in_container_with_measure_numbers**(*container*)

New in version 1.1. Comment measures in *container* with measure numbers:

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 3)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)

>>> measuretools.comment_measures_in_container_with_measure_numbers(staff)

>>> f(staff)
\new Staff {
    % start measure 1
    {
        \time 2/8
        c'8
        d'8
    }
    % stop measure 1
```

```
        % start measure 2
        {
            e'8
            f'8
        }
        % stop measure 2
        % start measure 3
        {
            g'8
            a'8
        }
        % stop measure 3
    }
```

Changed in version 2.0: renamed `label.measure_numbers()` to `measuretools.comment_measures_in_container_with_measure_numbers()`.

measuretools.extend_measures_in_expr_and_apply_full_measure_tuplets

measuretools.**extend_measures_in_expr_and_apply_full_measure_tuplets**(*expr*, *supplement*)

New in version 2.0. Extend measures in *expr* with *supplement* and apply full-measure tuplets to contents of measures:

```
>>> staff = Staff([Measure((2, 8), "c'8 d'8"), Measure((3, 8), "e'8 f'8 g'8")])

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        \time 3/8
        e'8
        f'8
        g'8
    }
}

>>> supplement = [Rest((1, 16))]
>>> measuretools.extend_measures_in_expr_and_apply_full_measure_tuplets(
... staff, supplement)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        \times 4/5 {
            c'8
            d'8
            r16
        }
    }
    {
```

```
            \time 3/8
            \fraction \times 6/7 {
                e'8
                f'8
                g'8
                r16
            }
        }
    }
```

Return none.

measuretools.fill_measures_in_expr_with_full_measure_spacer_skips

measuretools.**fill_measures_in_expr_with_full_measure_spacer_skips**(*expr*, *iterctrl=None*)

New in version 1.1. Fill measures in *expr* with full-measure spacer skips.

measuretools.fill_measures_in_expr_with_minimal_number_of_notes

measuretools.**fill_measures_in_expr_with_minimal_number_of_notes**(*expr*, *big_endian=True*, *iterctrl=None*)

New in version 1.1. Fill measures in *expr* with minimal number of big-endian notes.

```
>>> measure = Measure((5, 18), [])

>>> measuretools.fill_measures_in_expr_with_minimal_number_of_notes(
...     measure, big_endian=True)

>>> f(measure)
{
        ime 5/18
    \scaleDurations #'(8 . 9) {
        c'4 ~
        c'16
    }
}
```

Fill measures in *expr* with minimal number of little-endian notes.

```
>>> measure = Measure((5, 18), [])

>>> measuretools.fill_measures_in_expr_with_minimal_number_of_notes(
...     measure, big_endian=False)

>>> f(measure)
{
        ime 5/18
    \scaleDurations #'(8 . 9) {
        c'16 ~
        c'4
    }
}
```

Return none.

measuretools.fill_measures_in_expr_with_repeated_notes

measuretools.**fill_measures_in_expr_with_repeated_notes**(*expr*, *written_duration*, *iterctrl=None*)

New in version 1.1. Fill measures in *expr* with repeated notes.

measuretools.fill_measures_in_expr_with_time_signature_denominator_notes

measuretools.**fill_measures_in_expr_with_time_signature_denominator_notes**(*expr*, *iterctrl=None*)

New in version 1.1. Fill measures in *expr* with meter denominator notes:

```
>>> staff = Staff([Measure((3, 4), []), Measure((3, 16), []), Measure((3, 8), [])])
>>> measuretools.fill_measures_in_expr_with_time_signature_denominator_notes(staff)
```

```
>>> f(staff)
\new Staff {
    {
        \time 3/4
        c'4
        c'4
        c'4
    }
    {
        \time 3/16
        c'16
        c'16
        c'16
    }
    {
        \time 3/8
        c'8
        c'8
        c'8
    }
}
```

Delete existing contents of measures in *expr*.

Return none.

measuretools.fuse_contiguous_measures_in_container_cyclically_by_counts

measuretools.**fuse_contiguous_measures_in_container_cyclically_by_counts**(*container*, *counts*, *mark=False*)

New in version 1.1. Fuse contiguous measures in *container* cyclically by *counts*:

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 5)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
```

```
>>> f(staff)
\new Staff {
    {
```

```
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
    }
    {
        b'8
        c''8
    }
    {
        d''8
        e''8
    }
}
```

```
>>> counts = (2, 1)
>>> measuretools.fuse_contiguous_measures_in_container_cyclically_by_counts(staff, counts)
```

```
>>> f(staff)
\new Staff {
    {
        \time 4/8
        c'8
        d'8
        e'8
        f'8
    }
    {
        \time 2/8
        g'8
        a'8
    }
    {
        \time 4/8
        b'8
        c''8
        d''8
        e''8
    }
}
```

Return none.

Set *mark* to true to mark fused measures for later reference. Changed in version 2.0: renamed `fuse.measures_by_counts_cyclic()` to `measuretools.fuse_contiguous_measures_in_container_cyclically_by_counts()`.

measuretools.fuse_measures

measuretools.**fuse_measures**(*measures*)

New in version 1.1. Fuse *measures*:

```
>>> staff = Staff(measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (2, 16)]))
>>> measuretools.fill_measures_in_expr_with_repeated_notes(staff, Duration(1, 16))
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> beamtools.BeamSpanner(staff.leaves)
BeamSpanner(c'16, d'16, e'16, f'16)

>>> f(staff)
\new Staff {
    {
        \time 1/8
        c'16 [
        d'16
    }
    {
        \time 2/16
        e'16
        f'16 ]
    }
}

>>> measuretools.fuse_measures(staff[:])
Measure(2/8, [c'16, d'16, e'16, f'16])

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'16 [
        d'16
        e'16
        f'16 ]
    }
}
```

Return new measure.

Allow parent-contiguous *measures*.

Allow outside-of-score *measures*.

Do not define measure fusion across intervening container boundaries.

Calculate best new time signature.

Instantiate new measure.

Give *measures* contents to new measure.

Give *measures* dominant spanners to new measure.

Give *measures* parentage to new measure.

Leave *measures* empty, unspanned and outside-of-score. Changed in version 2.0: renamed `fuse.measures_by_reference()` to `measuretools.fuse_measures()`.

measuretools.get_first_measure_in_improper_parentage_of_component

measuretools.**get_first_measure_in_improper_parentage_of_component**(*component*)

New in version 2.0. Get first measure in improper parentage of *component*:

```
>>> measure = Measure((2, 4), "c'8 d'8 e'8 f'8")
>>> staff = Staff([measure])

>>> f(staff)
\new Staff {
    {
        \time 2/4
        c'8
        d'8
        e'8
        f'8
    }
}

>>> measuretools.get_first_measure_in_improper_parentage_of_component(staff.leaves[0])
Measure(2/4, [c'8, d'8, e'8, f'8])
```

Return measure or none.

measuretools.get_first_measure_in_proper_parentage_of_component

measuretools.**get_first_measure_in_proper_parentage_of_component**(*component*)

New in version 2.0. Get first measure in proper parentage of *component*:

```
>>> measure = Measure((2, 4), "c'8 d'8 e'8 f'8")
>>> staff = Staff([measure])

>>> f(staff)
\new Staff {
    {
        \time 2/4
        c'8
        d'8
        e'8
        f'8
    }
}

>>> measuretools.get_first_measure_in_proper_parentage_of_component(staff.leaves[0])
Measure(2/4, [c'8, d'8, e'8, f'8])
```

Return measure or none.

measuretools.get_next_measure_from_component

measuretools.**get_next_measure_from_component**(*component*)

New in version 1.1. Get next measure from *component*.

When *component* is voice, staff or other sequential context, and when *component* contains a measure, return first measure in *component*. This starts the process of forwards measure iteration.

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> measuretools.get_next_measure_from_component(staff)
Measure(2/8, [c'8, d'8])
```

When *component* is voice, staff or other sequential context, and when *component* contains no measure, raise missing measure error.

When *component* is a measure and there is a measure immediately following *component*, return measure immediately following component.

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> measuretools.get_previous_measure_from_component(staff[0]) is None
True
```

When *component* is a measure and there is no measure immediately following *component*, return `None`.

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> measuretools.get_previous_measure_from_component(staff[-1])
Measure(2/8, [c'8, d'8])
```

When *component* is a leaf and there is a measure in the parentage of *component*, return the measure in the parentage of *component*.

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> measuretools.get_previous_measure_from_component(staff.leaves[0])
Measure(2/8, [c'8, d'8])
```

When *component* is a leaf and there is no measure in the parentage of *component*, raise missing measure error. Changed in version 2.0: renamed `iterate.measure_next()` to `measuretools.get_next_measure_from_component()`.

measuretools.get_nth_measure_in_expr

`measuretools.`**`get_nth_measure_in_expr`**(*expr*, *n=0*)

New in version 2.0. Get nth measure in *expr*:

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 3)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
```

```
    }
}
```

Read forward for positive values of *n*.

```
>>> for n in range(3):
...     measuretools.get_nth_measure_in_expr(staff, n)
...
Measure(2/8, [c'8, d'8])
Measure(2/8, [e'8, f'8])
Measure(2/8, [g'8, a'8])
```

Read backward for negative values of *n*.

```
>>> for n in range(3, -1, -1):
...     measuretools.get_nth_measure_in_expr(staff, n)
...
Measure(2/8, [g'8, a'8])
Measure(2/8, [e'8, f'8])
Measure(2/8, [c'8, d'8])
```

Changed in version 2.0: renamed `iterate.get_nth_measure()` to `measuretools.get_nth_measure_in_expr()`.

measuretools.get_one_indexed_measure_number_in_expr

`measuretools.`**`get_one_indexed_measure_number_in_expr`**(*expr*, *measure_number*)

New in version 2.0. Get one-indexed *measure_number* in *expr*:

```
>>> t = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 3)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(t)
```

```
>>> f(t)
\new Staff {
    {
        \time 2/8
        c'8
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8
    }
}
>>> measuretools.get_one_indexed_measure_number_in_expr(t, 3)
Measure(2/8, [g'8, a'8])
```

Note that measures number from `1`.

measuretools.get_previous_measure_from_component

`measuretools.`**`get_previous_measure_from_component`**(*component*)

New in version 1.1. Get previous measure from *component*.

When *component* is voice, staff or other sequential context, and when *component* contains a measure, return last measure in *component*. This starts the process of backwards measure iteration.

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> measuretools.get_previous_measure_from_component(staff)
Measure(2/8, [e'8, f'8])
```

When *component* is voice, staff or other sequential context, and when *component* contains no measure, raise missing measure error.

When *component* is a measure and there is a measure immediately preceeding *component*, return measure immediately preceeding component.

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> measuretools.get_previous_measure_from_component(staff[-1])
Measure(2/8, [c'8, d'8])
```

When *component* is a measure and there is no measure immediately preceeding *component*, return `None`.

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> measuretools.get_previous_measure_from_component(staff[0]) is None
True
```

When *component* is a leaf and there is a measure in the parentage of *component*, return the measure in the parentage of *component*.

```
>>> staff = Staff(Measure((2, 8), notetools.make_repeated_notes(2)) * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)
>>> measuretools.get_previous_measure_from_component(staff.leaves[0])
Measure(2/8, [c'8, d'8])
```

When *component* is a leaf and there is no measure in the parentage of *component*, raise missing measure error. Changed in version 2.0: renamed `iterate.measure_prev()` to `measuretools.get_previous_measure_from_component()`.

measuretools.list_time_signatures_of_measures_in_expr

measuretools.**list_time_signatures_of_measures_in_expr**(*components*)

New in version 2.0. List time signatures of measures in *expr*:

```
>>> staff = Staff('abj: | 2/8 c8 d8 || 3/8 c8 d8 e8 || 4/8 c8 d8 e8 f8 |')
```

```
>>> f(staff)
\new Staff {
    {
        \time 2/8
        c8
        d8
    }
    {
        \time 3/8
        c8
        d8
        e8
    }
```

```
    {
        \time 4/8
        c8
        d8
        e8
        f8
    }
}
```

```
>>> for x in measuretools.list_time_signatures_of_measures_in_expr(staff): x
...
TimeSignatureMark((2, 8))(|2/8, c8, d8|)
TimeSignatureMark((3, 8))(|3/8, c8, d8, e8|)
TimeSignatureMark((4, 8))(|4/8, c8, d8, e8, f8|)
```

Return list of zero or more time signatures. Changed in version 2.0: renamed `measuretools.list_time_signatures_of_mesures_in_expr()` to `measuretools.list_time_signatures_of_measures_in_expr()`.

measuretools.make_measures_with_full_measure_spacer_skips

measuretools.**make_measures_with_full_measure_spacer_skips**(*time_signatures*)

New in version 1.1. Make measures with full-measure spacer skips from *time_signatures*:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (5, 16), (5, 16)])
```

```
>>> staff = Staff(measures)
```

```
>>> f(staff)
\new Staff {
    {
        \time 1/8
        s1 * 1/8
    }
    {
        \time 5/16
        s1 * 5/16
    }
    {
        s1 * 5/16
    }
}
```

Return list of rigid measures. Changed in version 2.0: renamed `measuretools.make()` to `measuretools.make_measures_with_full_measure_spacer_skips()`.

measuretools.measure_to_one_line_input_string

measuretools.**measure_to_one_line_input_string**(*measure*)

New in version 2.6. Change *measure* to one-line input string:

```
>>> measure = Measure((4, 4), "c'4 d'4 e'4 f'4")
```

```
>>> input_string = measuretools.measure_to_one_line_input_string(measure)

>>> print input_string
Measure((4, 4), "c'4 d'4 e'4 f'4")

>>> new_measure = eval(input_string)

>>> new_measure
Measure(4/4, [c'4, d'4, e'4, f'4])

>>> f(new_measure)
{
    \time 4/4
    c'4
    d'4
    e'4
    f'4
}
```

The purpose of this function is to create an evaluable string from simple measures.

Spanners, articulations and overrides not supported.

Return string.

measuretools.move_full_measure_tuplet_prolation_to_measure_time_signature

measuretools.**move_full_measure_tuplet_prolation_to_measure_time_signature**(*expr*)

New in version 1.1. Move prolation of full-measure tuplet to meter of measure.

Measures usually become nonbinary as as result:

```
>>> t = Measure((2, 8), [tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")])
>>> measuretools.move_full_measure_tuplet_prolation_to_measure_time_signature(t)

>>> f(t)
{
    \time 3/12
    \scaleDurations #'(2 . 3) {
        c'8
        d'8
        e'8
    }
}
```

Return none. Changed in version 2.0: renamed `measuretools.subsume()` to `measuretools.move_full_measure_tuplet_prolation_to_measure_time_signature()`.

measuretools.move_measure_prolation_to_full_measure_tuplet

measuretools.**move_measure_prolation_to_full_measure_tuplet**(*expr*)

New in version 2.0. Move measure prolation to full-measure tuplet.

Turn nonbinary measures into binary measures containing a single fixed-duration tuplet.

Note that not all nonbinary measures can be made binary.

Returns None because processes potentially many measures. Changed in version 2.0: renamed `measuretools.project()` to `measuretools.move_measure_prolation_to_full_measure_tuplet()`.

measuretools.multiply_and_scale_contents_of_measures_in_expr

`measuretools.`**`multiply_and_scale_contents_of_measures_in_expr`**(*expr*, *multiplier_pairs*)

New in version 1.1. Multiply and scale contents of measures in *expr* by *multiplier_pairs*.

The *multiplier_pairs* argument must be a list of `(contents_multiplier, denominator_multiplier)` pairs.

Both *contents_multiplier* and *denominator_multiplier* must be positive integers.

Example 1. Multiply measure contents by `3`. Scale time signature denominator by `3`:

```
>>> measure = Measure((3, 16), "c'16 c'16 c'16")

>>> measuretools.multiply_and_scale_contents_of_measures_in_expr(measure, [(3, 3)])
[Measure(9/48, [c'32, c'32, c'32, c'32, c'32, c'32, c'32, c'32, c'32])]
```

Example 2. Multiply measure contents by `3`. Scale time signature denominator by `2`:

```
>>> measure = Measure((3, 16), "c'16 c'16 c'16")

>>> measuretools.multiply_and_scale_contents_of_measures_in_expr(measure, [(3, 2)])
[Measure(9/32, [c'32, c'32, c'32, c'32, c'32, c'32, c'32, c'32, c'32])]
```

Example 3. Multiply measure contents `3`:

```
>>> measure = Measure((3, 16), "c'16 c'16 c'16")

>>> measuretools.multiply_and_scale_contents_of_measures_in_expr(measure, [(3, 1)])
[Measure(9/16, [c'16, c'16, c'16, c'16, c'16, c'16, c'16, c'16, c'16])]
```

Return list of measures changed.

measuretools.multiply_contents_of_measures_in_expr

`measuretools.`**`multiply_contents_of_measures_in_expr`**(*expr*, *n*)

New in version 1.1. Multiply contents `n - 1` times and adjust meter of every measure in *expr*:

```
>>> measure = Measure((3, 8), "c'8 d'8 e'8")
>>> beamtools.BeamSpanner(measure.leaves)
BeamSpanner(c'8, d'8, e'8)

>>> f(measure)
{
    \time 3/8
    c'8 [
    d'8
    e'8 ]
}

>>> measuretools.multiply_contents_of_measures_in_expr(measure, 3)
```

```
>>> f(measure)
{
    \time 9/8
    c'8 [
    d'8
    e'8 ]
    c'8 [
    d'8
    e'8 ]
    c'8 [
    d'8
    e'8 ]
}
```

Changed in version 2.0: renamed `measuretools.spin()` to `measuretools.multiply_contents_of_measures_`

measuretools.pad_measures_in_expr_with_rests

`measuretools.`**`pad_measures_in_expr_with_rests`**(*expr*, *front*, *back*, *splice=False*)

New in version 1.1. Pad measures in *expr* with rests.

Iterate all measures in *expr*. Insert rest with duration equal to *front* at beginning of each measure. Insert rest with duation aqual to *back* at end of each measure.

Set *front* to a positive rational or none. Set *back* to a positive rational or none.

Note that this function is designed to help create regularly spaced charts and tables of musical materials. This function makes most sense when used on anonymous measures or dynamic measures.

```
>>> t = Staff(measuretools.AnonymousMeasure("c'8 d'8") * 2)
>>> front, back = Duration(1, 32), Duration(1, 64)
>>> measuretools.pad_measures_in_expr_with_rests(t, front, back)

>>> f(t)
\new Staff {
    {
        \override Staff.TimeSignature #'stencil = ##f
        \time 19/64
        r32
        c'8
        d'8
        r64
        \revert Staff.TimeSignature #'stencil
    }
    {
        \override Staff.TimeSignature #'stencil = ##f
        r32
        c'8
        d'8
        r64
        \revert Staff.TimeSignature #'stencil
    }
}
```

Works when measures contain stacked voices:

```
>>> measure = measuretools.DynamicMeasure(
...     Voice(notetools.make_repeated_notes(2)) * 2)
```

```
>>> measure.is_parallel = True
>>> t = Staff(measure * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(t)
>>> measuretools.pad_measures_in_expr_with_rests(
...     t, Duration(1, 32), Duration(1, 64))

>>> f(t)
\new Staff {
    <<
        \time 19/64
        \new Voice {
            r32
            c'8
            d'8
            r64
        }
        \new Voice {
            r32
            e'8
            f'8
            r64
        }
    >>
    <<
        \new Voice {
            r32
            g'8
            a'8
            r64
        }
        \new Voice {
            r32
            b'8
            c''8
            r64
        }
    >>
}
```

Set the optional *splice* keyword to `True` to extend edge spanners over newly inserted rests:

```
>>> t = measuretools.DynamicMeasure("c'8 d'8")
>>> beamtools.BeamSpanner(t[:])
BeamSpanner(c'8, d'8)
>>> measuretools.pad_measures_in_expr_with_rests(
...     t, Duration(1, 32), Duration(1, 64), splice = True)

>>> f(t)
{
    \time 19/64
    r32 [
    c'8
    d'8
    r64 ]
}
```

Return none.

Raise value when *front* is neither a positive rational nor none.

Raise value when *back* is neither a positive rational nor none. Changed in version 2.0: renamed `layout.insert_measure_padding_rest()` to `measuretools.pad_measures_in_expr_with_rests()`.

measuretools.pad_measures_in_expr_with_skips

measuretools.**pad_measures_in_expr_with_skips**(*expr*, *front*, *back*, *splice=False*)

New in version 2.0. Pad measures in *expr* with skips.

Iterate all measures in *expr*. Insert skip with duration equal to *front* at beginning of each measure. Insert skip with duation aqual to *back* at end of each measure.

Set *front* to a positive rational or none. Set *back* to a positive rational or none.

Note that this function is designed to help create regularly spaced charts and tables of musical materials. This function makes most sense when used on anonymous measures and dynamic measures.

```
>>> t = Staff(measuretools.AnonymousMeasure("c'8 d'8") * 2)
>>> front, back = Duration(1, 32), Duration(1, 64)
>>> measuretools.pad_measures_in_expr_with_skips(t, front, back)

>>> f(t)
\new Staff {
    {
        \override Staff.TimeSignature #'stencil = ##f
        \time 19/64
        s32
        c'8
        d'8
        s64
        \revert Staff.TimeSignature #'stencil
    }
    {
        \override Staff.TimeSignature #'stencil = ##f
        s32
        c'8
        d'8
        s64
        \revert Staff.TimeSignature #'stencil
    }
}
```

Works when measures contain stacked voices.

```
>>> measure = measuretools.DynamicMeasure(
...     Voice(notetools.make_repeated_notes(2)) * 2)
>>> measure.is_parallel = True
>>> t = Staff(measure * 2)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(t)
>>> measuretools.pad_measures_in_expr_with_skips(
...     t, Duration(1, 32), Duration(1, 64))

>>> f(t)
\new Staff {
    <<
        \time 19/64
        \new Voice {
            s32
```

```
            c'8
            d'8
            s64
        }
        \new Voice {
            s32
            e'8
            f'8
            s64
        }
    >>
    <<
        \new Voice {
            s32
            g'8
            a'8
            s64
        }
        \new Voice {
            s32
            b'8
            c''8
            s64
        }
    >>
}
```

Set the optional *splice* keyword to `True` to extend edge spanners over newly inserted skips:

```
>>> t = measuretools.DynamicMeasure("c'8 d'8")
>>> beamtools.BeamSpanner(t[:])
BeamSpanner(c'8, d'8)
>>> measuretools.pad_measures_in_expr_with_skips(
...     t, Duration(1, 32), Duration(1, 64), splice = True)

>>> f(t)
{
    \time 19/64
    s32 [
    c'8
    d'8
    s64 ]
}
```

Return none.

Raise value error when *front* is neither a positive rational nor none.

Raise value error when *back* is neither a positive rational nor none. Changed in version 2.0: renamed `layout.insert_measure_padding_skip()` to `measuretools.pad_measures_in_expr_with_skips()`.

measuretools.replace_contents_of_measures_in_expr

measuretools.**replace_contents_of_measures_in_expr**(*expr*, *new_contents*)

New in version 1.1. Replace contents of measures in *expr* with *new_contents*:

```
>>> staff = Staff(measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (3, 16)]))

>>> f(staff)
\new Staff {
    {
        \time 1/8
        s1 * 1/8
    }
    {
        \time 3/16
        s1 * 3/16
    }
}

>>> notes = [Note("c'16"), Note("d'16"), Note("e'16"), Note("f'16")]
>>> measuretools.replace_contents_of_measures_in_expr(staff, notes)
[Measure(1/8, [c'16, d'16]), Measure(3/16, [e'16, f'16, s1 * 1/16])]

>>> f(staff)
\new Staff {
    {
        \time 1/8
        c'16
        d'16
    }
    {
        \time 3/16
        e'16
        f'16
        s1 * 1/16
    }
}
```

Preserve duration of all measures.

Skip measures that are too small.

Pad extra space at end of measures with spacer skip.

If not enough measures raise stop iteration.

Return measures iterated. Changed in version 2.0: renamed `measuretools.overwrite_contents()` to `measuretools.replace_contents_of_measures_in_expr()`.

measuretools.report_time_signature_distribution

`measuretools.`**`report_time_signature_distribution`**`(`*expr*`)`

New in version 2.0. Report meter distribution of *expr* as string:

```
>>> measuretools.report_time_signature_distribution(t)
'\t3/80\t2\n\t2/16\t73\n\t7/40\t1\n\t3/16\t20\n\t16/80\t1\n\t17/80\t1\n
\t19/80\t1\n\t4/16\t73\n\t5/16\t62\n\t13/40\t1\n\t27/80\t1\n\t6/16\t12\
n\t7/16\t16\n\t8/16\t13\n\t9/16\t15\n\t10/16\t4\n'
```

Return string.

measuretools.scale_contents_of_measures_in_expr

measuretools.**scale_contents_of_measures_in_expr**(*expr*, *multiplier=1*)

New in version 2.0. Scale contents of measures in *expr* by *multiplier*.

Iterate expr. For every measure in expr first multiply the measure meter by *multiplier* and then scale measure contents to fit the new meter.

Extend `containertools.scale_contents_of_container()`.

Return none.

measuretools.scale_measure_and_adjust_time_signature

measuretools.**scale_measure_and_adjust_time_signature**(*measure*, *multiplier=1*)

New in version 2.0. Scale *measure* by *multiplier* and adjust meter:

```
>>> t = Measure((3, 8), "c'8 d'8 e'8")
>>> measuretools.scale_measure_and_adjust_time_signature(t, Duration(2, 3))
Measure(3/12, [c'8, d'8, e'8])

>>> f(t)
{
\time 3/12
\scaleDurations #'(2 . 3) {
    c'8
    d'8
    e'8
}
}
```

Return *measure*.

measuretools.scale_measure_denominator_and_adjust_measure_contents

measuretools.**scale_measure_denominator_and_adjust_measure_contents**(*measure*, *new_denominator_factor*)

New in version 1.1. Change binary *measure* to nonbinary measure with *new_denominator_factor*:

```
>>> measure = Measure((2, 8), "c'8 d'8")
>>> beamtools.BeamSpanner(measure.leaves)
BeamSpanner(c'8, d'8)

>>> f(measure)
{
    \time 2/8
    c'8 [
    d'8 ]
}

>>> measuretools.scale_measure_denominator_and_adjust_measure_contents(measure, 3)
Measure(3/12, [c'8., d'8.])

>>> f(measure)
{
    \time 3/12
    \scaleDurations #'(2 . 3) {
```

```
        c'8. [
        d'8. ]
    }
}
```

Treat *new_denominator_factor* like clever form of `1`: `3/3` or `5/5` or `7/7`, etc.

Preserve *measure* prolated duration.

Derive new *measure* multiplier.

Scale *measure* contents.

Pick best new meter. Changed in version 2.0: renamed `measuretools.change_binary_measure_to_nonbinary()` to `measuretools.scale_measure_denominator_and_adjust_measure_contents()`.

measuretools.set_always_format_time_signature_of_measures_in_expr

`measuretools.`**`set_always_format_time_signature_of_measures_in_expr`**(*expr*, *value=True*)

New in version 2.9. Set *always_format_time_signature* of measures in *expr* to boolean *value*.

Return none.

measuretools.set_measure_denominator_and_adjust_numerator

`measuretools.`**`set_measure_denominator_and_adjust_numerator`**(*measure*, *denominator*)

New in version 1.1. Set *measure* meter *denominator* and multiply meter numerator accordingly:

```
>>> measure = Measure((3, 8), "c'8 d'8 e'8")
>>> beamtools.BeamSpanner(measure.leaves)
BeamSpanner(c'8, d'8, e'8)

>>> f(measure)
{
    \time 3/8
    c'8 [
    d'8
    e'8 ]
}

>>> measuretools.set_measure_denominator_and_adjust_numerator(measure, 16)
Measure(6/16, [c'8, d'8, e'8])

>>> f(measure)
{
    \time 6/16
    c'8 [
    d'8
    e'8 ]
}
```

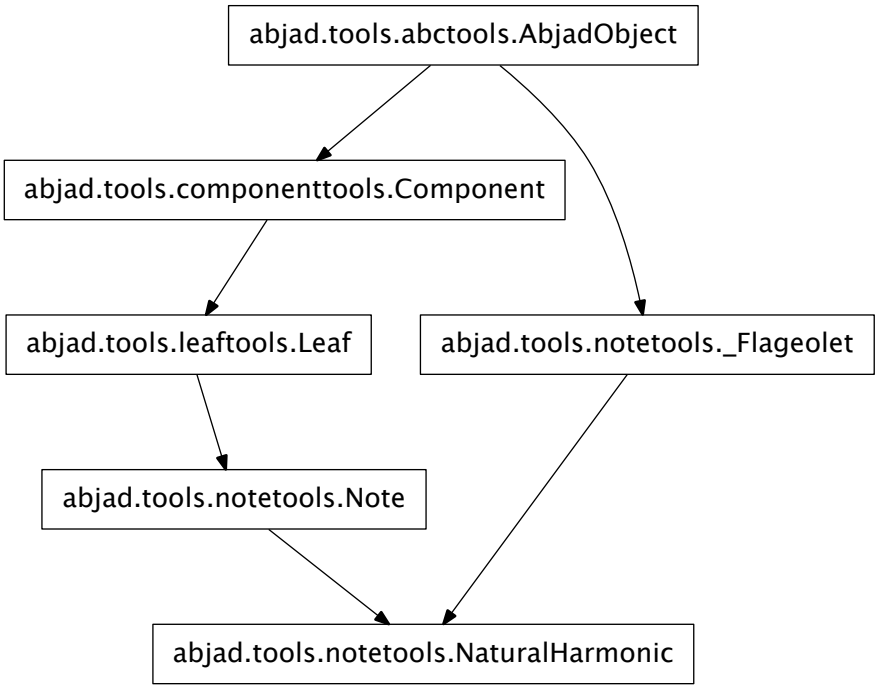
Leave *measure* contents unchanged.

Return *measure*. Changed in version 2.0: renamed `measuretools.set_measure_denominator_and_multiply_num` to `measuretools.set_measure_denominator_and_adjust_numerator()`.

notetools

concrete classes

notetools.NaturalHarmonic



class notetools.**NaturalHarmonic**(**args*)

Abjad model of natural harmonic.

Initialize natural harmonic by hand:

```
>>> notetools.NaturalHarmonic("cs'8.")
NaturalHarmonic(cs', 8.)
```

Initialize natural harmonic from note:

```
>>> note = Note("cs'8.")

>>> notetools.NaturalHarmonic(note)
NaturalHarmonic(cs', 8.)
```

Natural harmonics are immutable.

Read-only Properties

NaturalHarmonic.**duration_in_seconds**

Inherited from leaftools.Leaf

NaturalHarmonic.**fingered_pitch**
Read-only fingered pitch of note:

```
>>> staff = Staff("d''8 e''8 f''8 g''8")
>>> piccolo = instrumenttools.Piccolo()(staff)
>>> instrumenttools.transpose_from_sounding_pitch_to_fingered_pitch(staff)

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Piccolo }
    \set Staff.shortInstrumentName = \markup { Picc. }
    d'8
    e'8
    f'8
    g'8
}

>>> staff[0].fingered_pitch
NamedChromaticPitch("d'")
```

Return named chromatic pitch.

Inherited from notetools.Note

NaturalHarmonic.**leaf_index**
Inherited from leaftools.Leaf

NaturalHarmonic.**lilypond_format**
Inherited from componenttools.Component

NaturalHarmonic.**multiplied_duration**
Inherited from leaftools.Leaf

NaturalHarmonic.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

NaturalHarmonic.**parent**
Inherited from componenttools.Component

NaturalHarmonic.**preprolated_duration**
Inherited from leaftools.Leaf

NaturalHarmonic.**prolated_duration**
Inherited from componenttools.Component

NaturalHarmonic.**prolation**
Inherited from componenttools.Component

NaturalHarmonic.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

NaturalHarmonic.**sounding_pitch**
Read-only sounding pitch of note:

```
>>> staff = Staff("d''8 e''8 f''8 g''8")
>>> piccolo = instrumenttools.Piccolo()(staff)

>>> instrumenttools.transpose_from_sounding_pitch_to_fingered_pitch(staff)
```

```
>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Piccolo }
    \set Staff.shortInstrumentName = \markup { Picc. }
    d'8
    e'8
    f'8
    g'8
}
>>> staff[0].sounding_pitch
NamedChromaticPitch("d''")
```

Return named chromatic pitch.

Inherited from `notetools.Note`

`NaturalHarmonic.`**`spanners`**
Read-only reference to unordered set of spanners attached to component.

Inherited from `componenttools.Component`

`NaturalHarmonic.`**`start_offset`**
Read-only start offset of component.

Inherited from `componenttools.Component`

`NaturalHarmonic.`**`start_offset_in_seconds`**
Read-only start offset of comonent in seconds.

Inherited from `componenttools.Component`

`NaturalHarmonic.`**`stop_offset`**
Read-only stop offset of component.

Inherited from `componenttools.Component`

`NaturalHarmonic.`**`stop_offset_in_seconds`**
Read-only stop offset of component in seconds.

Inherited from `componenttools.Component`

`NaturalHarmonic.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`NaturalHarmonic.`**`suono_reale`**
Actual sound of the harmonic when played.

Inherited from `notetools._Flageolet`

Read/write Properties

`NaturalHarmonic.`**`duration_multiplier`**
Inherited from `leaftools.Leaf`

`NaturalHarmonic.`**`note_head`**
Get note head of note:

```
>>> note = Note(13, (3, 16))
>>> note.note_head
NoteHead("cs''")
```

Set note head of note:

```
>>> note = Note(13, (3, 16))
>>> note.note_head = 14
>>> note
Note("d''8.")
```

Inherited from notetools.Note

NaturalHarmonic.**written_duration**
Inherited from leaftools.Leaf

NaturalHarmonic.**written_pitch**
Get named pitch of note:

```
>>> note = Note(13, (3, 16))
>>> note.written_pitch
NamedChromaticPitch("cs''")
```

Set named pitch of note:

```
>>> note = Note(13, (3, 16))
>>> note.written_pitch = 14
>>> note
Note("d''8.")
```

Inherited from notetools.Note

NaturalHarmonic.**written_pitch_indication_is_at_sounding_pitch**
Inherited from leaftools.Leaf

NaturalHarmonic.**written_pitch_indication_is_nonsemantic**
Inherited from leaftools.Leaf

Special Methods

NaturalHarmonic.**__and__**(*arg*)
Inherited from leaftools.Leaf

NaturalHarmonic.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

NaturalHarmonic.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NaturalHarmonic.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

NaturalHarmonic.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NaturalHarmonic.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NaturalHarmonic.__mul__(*n*)
Inherited from componenttools.Component

NaturalHarmonic.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

NaturalHarmonic.__or__(*arg*)
Inherited from leaftools.Leaf

NaturalHarmonic.__repr__()

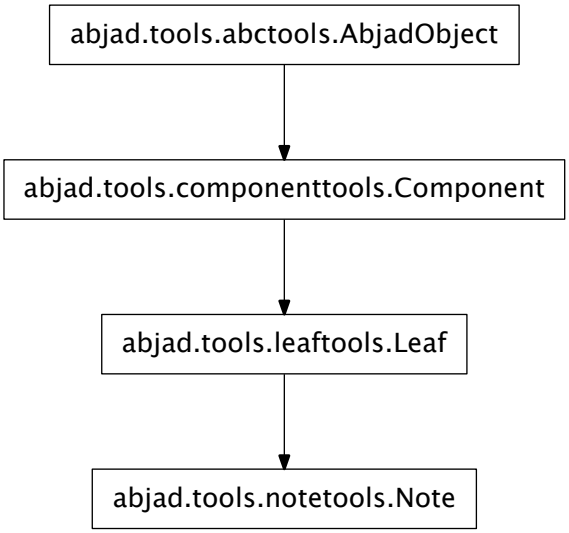
NaturalHarmonic.__rmul__(*n*)
Inherited from componenttools.Component

NaturalHarmonic.__str__()
Inherited from leaftools.Leaf

NaturalHarmonic.__sub__(*arg*)
Inherited from leaftools.Leaf

NaturalHarmonic.__xor__(*arg*)
Inherited from leaftools.Leaf

notetools.Note



class notetools.**Note**(**args*, ***kwargs*)

New in version 1.0. Abjad model of a note:

```
>>> Note("cs''8.")
Note("cs''8.")
```

Notes are immutable.

Read-only Properties

Note.**duration_in_seconds**

Inherited from leaftools.Leaf

Note.**fingered_pitch**

Read-only fingered pitch of note:

```
>>> staff = Staff("d''8 e''8 f''8 g''8")
>>> piccolo = instrumenttools.Piccolo()(staff)
>>> instrumenttools.transpose_from_sounding_pitch_to_fingered_pitch(staff)

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Piccolo }
    \set Staff.shortInstrumentName = \markup { Picc. }
    d'8
    e'8
    f'8
    g'8
}
```

```
>>> staff[0].fingered_pitch
NamedChromaticPitch("d'")
```

Return named chromatic pitch.

Note.**leaf_index**
Inherited from leaftools.Leaf

Note.**lilypond_format**
Inherited from componenttools.Component

Note.**multiplied_duration**
Inherited from leaftools.Leaf

Note.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Note.**parent**
Inherited from componenttools.Component

Note.**preprolated_duration**
Inherited from leaftools.Leaf

Note.**prolated_duration**
Inherited from componenttools.Component

Note.**prolation**
Inherited from componenttools.Component

Note.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Note.**sounding_pitch**
Read-only sounding pitch of note:

```
>>> staff = Staff("d''8 e''8 f''8 g''8")
>>> piccolo = instrumenttools.Piccolo()(staff)

>>> instrumenttools.transpose_from_sounding_pitch_to_fingered_pitch(staff)

>>> f(staff)
\new Staff {
    \set Staff.instrumentName = \markup { Piccolo }
    \set Staff.shortInstrumentName = \markup { Picc. }
    d'8
    e'8
    f'8
    g'8
}
>>> staff[0].sounding_pitch
NamedChromaticPitch("d''")
```

Return named chromatic pitch.

Note.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Note.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Note.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Note.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Note.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Note.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Note.**duration_multiplier**
Inherited from leaftools.Leaf

Note.**note_head**
Get note head of note:

```
>>> note = Note(13, (3, 16))
>>> note.note_head
NoteHead("cs''")
```

Set note head of note:

```
>>> note = Note(13, (3, 16))
>>> note.note_head = 14
>>> note
Note("d''8.")
```

Note.**written_duration**
Inherited from leaftools.Leaf

Note.**written_pitch**
Get named pitch of note:

```
>>> note = Note(13, (3, 16))
>>> note.written_pitch
NamedChromaticPitch("cs''")
```

Set named pitch of note:

```
>>> note = Note(13, (3, 16))
>>> note.written_pitch = 14
>>> note
Note("d''8.")
```

Note.**written_pitch_indication_is_at_sounding_pitch**
Inherited from leaftools.Leaf

Note.**written_pitch_indication_is_nonsemantic**
Inherited from leaftools.Leaf

Special Methods

Note.**__and__**(*arg*)
Inherited from leaftools.Leaf

Note.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Note.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Note.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Note.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Note.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Note.**__mul__**(*n*)
Inherited from componenttools.Component

Note.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Note.**__or__**(*arg*)
Inherited from leaftools.Leaf

Note.**__repr__**()
Inherited from leaftools.Leaf

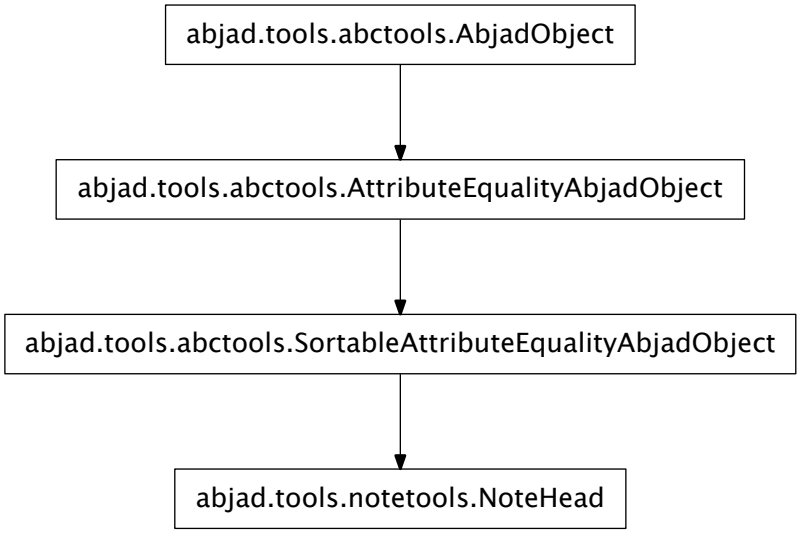
Note.**__rmul__**(*n*)
Inherited from componenttools.Component

Note.**__str__**()
Inherited from leaftools.Leaf

Note.**__sub__**(*arg*)
Inherited from leaftools.Leaf

Note.**__xor__**(*arg*)
Inherited from leaftools.Leaf

notetools.NoteHead



class notetools.**NoteHead**(*written_pitch=None*, *client=None*, *is_cautionary=False*, *is_forced=False*, *tweak_pairs=()*)
Abjad model of a note head:

```
>>> notetools.NoteHead(13)
NoteHead("cs''")
```

Note heads are immutable.

Read-only Properties

NoteHead.**lilypond_format**
Read-only LilyPond input format of note head:

```
>>> note_head = notetools.NoteHead("cs''")
>>> note_head.lilypond_format
"cs''"
```

Return string.

NoteHead.**named_chromatic_pitch**
Read-only named chromatic pitch equal to note head:

```
>>> note_head = notetools.NoteHead("cs''")
>>> note_head.named_chromatic_pitch
NamedChromaticPitch("cs''")
```

Return named chromatic pitch.

NoteHead.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

NoteHead.**tweak**

Read-only LilyPond tweak reservoir:

```
>>> note_head = notetools.NoteHead("cs''")
>>> note_head.tweak
LilyPondTweakReservoir()
```

Return LilyPond tweak reservoir.

Read/write Properties

NoteHead.**is_cautionary**

Get cautionary accidental flag:

```
>>> note_head = notetools.NoteHead("cs''")
>>> note_head.is_cautionary
False
```

Set cautionary accidental flag:

```
>>> note_head = notetools.NoteHead("cs''")
>>> note_head.is_cautionary = True
```

Return boolean.

NoteHead.**is_forced**

NoteHead.**written_pitch**

Get named pitch of note head:

```
>>> note_head = notetools.NoteHead("cs''")
>>> note_head.written_pitch
NamedChromaticPitch("cs''")
```

Set named pitch of note head:

```
>>> note_head = notetools.NoteHead("cs''")
>>> note_head.written_pitch = "d''"
>>> note_head.written_pitch
NamedChromaticPitch("d''")
```

Set pitch token.

Special Methods

NoteHead.**__eq__**(*arg*)

Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NoteHead.**__ge__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NoteHead.**__gt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NoteHead.**__le__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NoteHead.**__lt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NoteHead.**__ne__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NoteHead.**__repr__**()

NoteHead.**__str__**()

functions

notetools.add_artificial_harmonic_to_note

notetools.**add_artificial_harmonic_to_note**(*note*, *melodic_diatonic_interval=None*)
Add artifical harmonic to *note* at *melodic_diatonic_interval*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beamtools.BeamSpanner(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> notetools.add_artificial_harmonic_to_note(staff[0])
Chord("<c' f'>8")
```

```
>>> f(staff)
\new Staff {
    <
        c'
        \tweak #'style #'harmonic
        f'
    >8 [
    d'8
    e'8
    f'8 ]
}
```

When `melodic_diatonic_interval=None` set to a perfect fourth.

Create new artificial harmonic chord from *note*.

Move parentage and spanners from *note* to artificial harmonic chord.

Return artificial harmonic chord. Changed in version 2.0: renamed `harmonictools.add_artificial()` to `notetools.add_artificial_harmonic_to_note()`.

notetools.all_are_notes

`notetools.`**`all_are_notes`**`(`*expr*`)`

New in version 2.6. True when *expr* is a sequence of Abjad notes:

```
>>> notes = [Note("c'4"), Note("d'4"), Note("e'4")]

>>> notetools.all_are_notes(notes)
True
```

True when *expr* is an empty sequence:

```
>>> notetools.all_are_notes([])
True
```

Otherwise false:

```
>>> notetools.all_are_notes('foo')
False
```

Return boolean.

Function wraps `componenttools.all_are_components()`.

notetools.make_accelerating_notes_with_lilypond_multipliers

`notetools.`**`make_accelerating_notes_with_lilypond_multipliers`**`(`*pitches*, *total*, *start*, *stop*, *exp='cosine'*, *written='8'*`)`

Make accelerating notes with LilyPond multipliers:

```
>>> pitches = [1, 2]
>>> total = (1, 2)
>>> start = (1, 4)
>>> stop = (1, 8)
>>> args = [pitches, total, start, stop]
```

```
>>> notes = notetools.make_accelerating_notes_with_lilypond_multipliers(*args)

>>> notes
[Note("cs'8 * 113/64"), Note("d'8 * 169/128"), Note("cs'8 * 117/128")]

>>> Voice(notes).prolated_duration
Duration(1, 2)
```

Set note pitches cyclically from *pitches*.

Return as many interpolation values as necessary to fill the *total* duration requested.

Interpolate durations from *start* to *stop*.

Set note durations to *written* duration times computed interpolated multipliers.

Return list of notes. Changed in version 2.0: renamed `construct.notes_curve()` to `notetools.make_accelerating_notes_with_lilypond_multipliers()`.

notetools.make_notes

notetools.**make_notes**(*pitches*, *durations*, *big_endian=True*)

Make notes according to *pitches* and *durations*.

Cycle through *pitches* when the length of *pitches* is less than the length of *durations*:

```
>>> notetools.make_notes([0], [(1, 16), (1, 8), (1, 8)])
[Note("c'16"), Note("c'8"), Note("c'8")]
```

Cycle through *durations* when the length of *durations* is less than the length of *pitches*:

```
>>> notetools.make_notes([0, 2, 4, 5, 7], [(1, 16), (1, 8), (1, 8)])
[Note("c'16"), Note("d'8"), Note("e'8"), Note("f'16"), Note("g'8")]
```

Create ad hoc tuplets for nonassignable durations:

```
>>> notetools.make_notes([0], [(1, 16), (1, 12), (1, 8)])
[Note("c'16"), Tuplet(2/3, [c'8]), Note("c'8")]
```

Set `big_endian=True` to express tied values in decreasing duration:

```
>>> notetools.make_notes([0], [(13, 16)], big_endian=True)
[Note("c'2."), Note("c'16")]
```

Set `big_endian=False` to express tied values in increasing duration:

```
>>> notetools.make_notes([0], [(13, 16)], big_endian=False)
[Note("c'16"), Note("c'2.")]
```

Set *pitches* to a single pitch or a sequence of pitches.

Set *durations* to a single duration or a list of durations.

Return list of newly constructed notes. Changed in version 2.0: renamed `construct.notes()` to `notetools.make_notes()`.

notetools.make_notes_with_multiplied_durations

notetools.**make_notes_with_multiplied_durations**(*pitch*, *written_duration*, *multiplied_durations*)

New in version 2.0. Make *written_duration* notes with *pitch* and *multiplied_durations*:

```
>>> args = [0, Duration(1, 4), [(1, 2), (1, 3), (1, 4), (1, 5)]]
>>> notetools.make_notes_with_multiplied_durations(*args)
[Note("c'4 * 2"), Note("c'4 * 4/3"), Note("c'4 * 1"), Note("c'4 * 4/5")]
```

Useful for making spatially positioned notes.

Return list of notes.

notetools.make_percussion_note

notetools.**make_percussion_note**(*pitch*, *total_duration*, *max_note_duration=(1, 8)*)

Make percussion note:

```
>>> notetools.make_percussion_note(2, (1, 4), (1, 8))
[Note("d'8"), Rest('r8')]

>>> notetools.make_percussion_note(2, (1, 64), (1, 8))
[Note("d'64")]

>>> notetools.make_percussion_note(2, (5, 64), (1, 8))
[Note("d'16"), Rest('r64')]

>>> notetools.make_percussion_note(2, (5, 4), (1, 8))
[Note("d'8"), Rest('r1'), Rest('r8')]
```

Return list of newly constructed note followed by zero or more newly constructed rests.

Durations of note and rests returned will sum to *total_duration*.

Duration of note returned will be no greater than *max_note_duration*.

Duration of rests returned will sum to note duration taken from *total_duration*.

Useful for percussion music where attack duration is negligible and tied notes undesirable. Changed in version 2.0: renamed `construct.percussion_note()` to `notetools.make_percussion_note()`.

notetools.make_quarter_notes_with_lilypond_multipliers

notetools.**make_quarter_notes_with_lilypond_multipliers**(*pitches*, *multiplied_durations*)

New in version 2.0. Make quarter notes with *pitches* and *multiplied_durations*:

```
>>> args = [[0, 2, 4, 5], [(1, 4), (1, 5), (1, 6), (1, 7)]]
>>> notetools.make_quarter_notes_with_lilypond_multipliers(*args)
[Note("c'4 * 1"), Note("d'4 * 4/5"), Note("e'4 * 2/3"), Note("f'4 * 4/7")]
```

Read *pitches* cyclically where the length of *pitches* is less than the length of *multiplied_durations*:

```
>>> args = [[0], [(1, 4), (1, 5), (1, 6), (1, 7)]]
>>> notetools.make_quarter_notes_with_lilypond_multipliers(*args)
[Note("c'4 * 1"), Note("c'4 * 4/5"), Note("c'4 * 2/3"), Note("c'4 * 4/7")]
```

Read *multiplied_durations* cyclically where the length of *multiplied_durations* is less than the length of *pitches*:

```
>>> args = [[0, 2, 4, 5], [(1, 5)]]
>>> notetools.make_quarter_notes_with_lilypond_multipliers(*args)
[Note("c'4 * 4/5"), Note("d'4 * 4/5"), Note("e'4 * 4/5"), Note("f'4 * 4/5")]
```

Return list of zero or more newly constructed notes. Changed in version 2.0: renamed `construct.quarter_notes_with_multipliers()` to `notetools.make_quarter_notes_with_lilypond_multipliers()`.

notetools.make_repeated_notes

notetools.**make_repeated_notes**(*count*, *duration=Duration(1, 8)*)

Make *count* repeated notes with note head-assignable *duration*:

```
>>> notetools.make_repeated_notes(4)
[Note("c'8"), Note("c'8"), Note("c'8"), Note("c'8")]
```

Make *count* repeated tie chains with tied *duration*:

```
>>> notes = notetools.make_repeated_notes(2, (5, 16))
>>> voice = Voice(notes)

>>> f(voice)
\new Voice {
    c'4 ~
    c'16
    c'4 ~
    c'16
}
```

Make ad hoc tuplet holding *count* repeated notes with nonbinary *duration*:

```
>>> notetools.make_repeated_notes(3, (1, 12))
[Tuplet(2/3, [c'8, c'8, c'8])]
```

Set pitch of all notes created to middle C.

Return list of zero or more newly constructed notes or list of one newly constructed tuplet. Changed in version 2.0: renamed `construct.run()` to `notetools.make_repeated_notes()`.

notetools.make_repeated_notes_from_time_signature

notetools.**make_repeated_notes_from_time_signature**(*time_signature*, *pitch="c"'*)

New in version 2.0. Make repeated notes from *time_signature*:

```
>>> notetools.make_repeated_notes_from_time_signature((5, 32))
[Note("c'32"), Note("c'32"), Note("c'32"), Note("c'32"), Note("c'32")]
```

Make repeated notes with *pitch* from *time_signature*:

```
>>> notetools.make_repeated_notes_from_time_signature((5, 32), pitch="d''")
[Note("d''32"), Note("d''32"), Note("d''32"), Note("d''32"), Note("d''32")]
```

Return list of notes.

notetools.make_repeated_notes_from_time_signatures

notetools.**make_repeated_notes_from_time_signatures**(*time_signatures*, *pitch="c"'*)

Make repated notes from *time_signatures*:

```
notetools.make_repeated_notes_from_time_signatures([(2, 8), (3, 32)])
[[Note("c'8"), Note("c'8")], [Note("c'32"), Note("c'32"), Note("c'32")]]
```

Make repeated notes with *pitch* from *time_signatures*:

```
>>> notetools.make_repeated_notes_from_time_signatures([(2, 8), (3, 32)], pitch="d''")
[[Note("d''8"), Note("d''8")], [Note("d''32"), Note("d''32"), Note("d''32")]]
```

Return two-dimensional list of note lists.

Use `sequencetools.flatten_sequence()` to flatten output if required.

notetools.make_repeated_notes_with_shorter_notes_at_end

notetools.**make_repeated_notes_with_shorter_notes_at_end**(*pitch*, *written_duration*, *total_duration*, *prolation=1*)

Make repeated notes with *pitch* and *written_duration* summing to *total_duration* under *prolation*:

```
>>> args = [0, Duration(1, 16), Duration(1, 4)]
>>> notes = notetools.make_repeated_notes_with_shorter_notes_at_end(*args)
>>> voice = Voice(notes)

>>> f(voice)
\new Voice {
    c'16
    c'16
    c'16
    c'16
}
```

Fill binary remaining duration with binary notes of lesser written duration:

```
>>> args = [0, Duration(1, 16), Duration(9, 32)]
>>> notes = notetools.make_repeated_notes_with_shorter_notes_at_end(*args)
>>> voice = Voice(notes)

>>> f(voice)
\new Voice {
    c'16
    c'16
    c'16
    c'16
    c'32
}
```

Fill nonbinary remaining duration with ad hoc tuplet:

```
>>> args = [0, Duration(1, 16), Duration(4, 10)]
>>> notes = notetools.make_repeated_notes_with_shorter_notes_at_end(*args)
>>> voice = Voice(notes)
```

```
>>> f(voice)
\new Voice {
    c'16
    c'16
    c'16
    c'16
    c'16
    c'16
    \times 4/5 {
        c'32
    }
}
```

Set *prolation* when constructing notes in a nonbinary measure.

Return list of newly constructed components. Changed in version 2.0: renamed `construct.note_train()` to `notetools.make_repeated_notes_with_shorter_notes_at_end()`.

notetools.make_tied_note

`notetools.`**`make_tied_note`**(*pitch*, *duration*, *big_endian=True*)

Returns a list of notes to fill the given duration.

Notes returned are tie-spanned.

notetools.yield_groups_of_notes_in_sequence

`notetools.`**`yield_groups_of_notes_in_sequence`**(*sequence*)

New in version 2.0. Yield groups of notes in *sequence*:

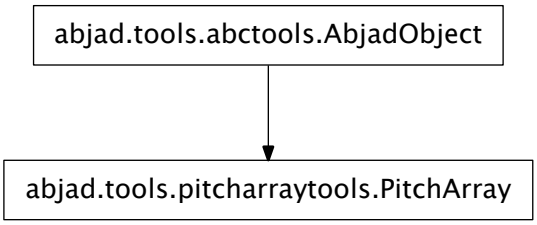
```
>>> staff = Staff("c'8 d'8 r8 r8 <e' g'>8 <f' a'>8 g'8 a'8 r8 r8 <b' d''>8 <c'' e''>8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    r8
    r8
    <e' g'>8
    <f' a'>8
    g'8
    a'8
    r8
    r8
    <b' d''>8
    <c'' e''>8
}

>>> for note in notetools.yield_groups_of_notes_in_sequence(staff):
...     note
...
(Note("c'8"), Note("d'8"))
(Note("g'8"), Note("a'8"))
```

Return generator.

pitcharraytools

concrete classes

pitcharraytools.PitchArray



class pitcharraytools.**PitchArray**(**args*)

New in version 2.0. Two-dimensional array of pitches.

Read-only Properties

PitchArray.**cell_tokens_by_row**

PitchArray.**cell_widths_by_row**

PitchArray.**cells**

PitchArray.**columns**

PitchArray.**depth**

PitchArray.**dimensions**

PitchArray.**has_voice_crossing**

PitchArray.**is_rectangular**

PitchArray.**pitches**

PitchArray.**pitches_by_row**

PitchArray.**rows**

PitchArray.**size**

PitchArray.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

PitchArray.**voice_crossing_count**

PitchArray.**weight**

PitchArray.**width**

Methods

PitchArray.**append_column**(*column*)
PitchArray.**append_row**(*row*)

PitchArray.**apply_pitches_by_row**(*pitch_lists*)

PitchArray.**copy_subarray**(*upper_left_pair*, *lower_right_pair*)

PitchArray.**has_spanning_cell_over_index**(*index*)

PitchArray.**pad_to_depth**(*depth*)

PitchArray.**pad_to_width**(*width*)

PitchArray.**pop_column**(*column_index*)

PitchArray.**pop_row**(*row_index=-1*)

PitchArray.**remove_row**(*row*)

Special Methods

PitchArray.**__add__**(*arg*)
PitchArray.**__contains__**(*arg*)

PitchArray.**__eq__**(*arg*)

PitchArray.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchArray.**__getitem__**(*arg*)

PitchArray.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

PitchArray.**__iadd__**(*arg*)

PitchArray.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchArray.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

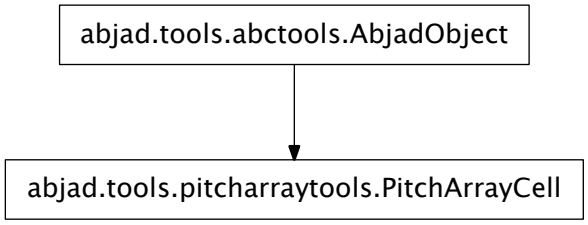
PitchArray.**__ne__**(*arg*)

PitchArray.**__repr__**()

PitchArray.**__setitem__**(*i*, *arg*)

PitchArray.**__str__**()

pitcharraytools.PitchArrayCell



class pitcharraytools.**PitchArrayCell**(*cell_token=None*)

One cell in a pitch array.

```
>>> from abjad.tools import pitcharraytools

>>> array = pitcharraytools.PitchArray([[1, 2, 1], [2, 1, 1]])
>>> print array
[ ] [     ] [ ]
[     ] [ ] [ ]
>>> cell = array[0][1]
>>> cell
PitchArrayCell(x2)

>>> cell.column_indices
(1, 2)

>>> cell.indices
(0, (1, 2))

>>> cell.is_first_in_row
False

>>> cell.is_last_in_row
False

>>> cell.next
PitchArrayCell(x1)

>>> cell.parent_array
PitchArray(PitchArrayRow(x1, x2, x1), PitchArrayRow(x2, x1, x1))

>>> cell.parent_column
PitchArrayColumn(x2, x2)

>>> cell.parent_row
PitchArrayRow(x1, x2, x1)

>>> cell.pitches
[]
```

```
>>> cell.prev
PitchArrayCell(x1)

>>> cell.row_index
0

>>> cell.token
2

>>> cell.width
2
```

Return pitch array cell.

Read-only Properties

`PitchArrayCell.`**`column_indices`**
Read-only tuple of one or more nonnegative integer indices.

`PitchArrayCell.`**`indices`**

`PitchArrayCell.`**`is_first_in_row`**

`PitchArrayCell.`**`is_last_in_row`**

`PitchArrayCell.`**`next`**

`PitchArrayCell.`**`parent_array`**

`PitchArrayCell.`**`parent_column`**

`PitchArrayCell.`**`parent_row`**

`PitchArrayCell.`**`prev`**

`PitchArrayCell.`**`row_index`**

`PitchArrayCell.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`PitchArrayCell.`**`token`**

`PitchArrayCell.`**`weight`**

`PitchArrayCell.`**`width`**

Read/write Properties

`PitchArrayCell.`**`pitches`**

Methods

`PitchArrayCell.`**`matches_cell`**(*arg*)

Special Methods

`PitchArrayCell.`**`__eq__`**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

PitchArrayCell.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchArrayCell.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

PitchArrayCell.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchArrayCell.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchArrayCell.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

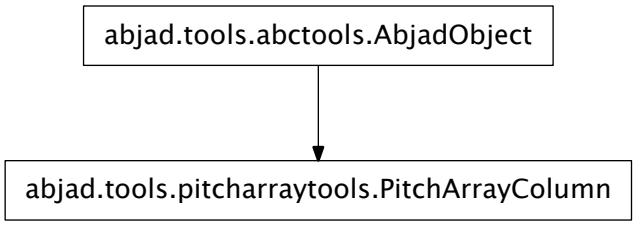
Return boolean.

Inherited from abctools.AbjadObject

PitchArrayCell.**__repr__**()

PitchArrayCell.**__str__**()

pitcharraytools.PitchArrayColumn



class pitcharraytools.**PitchArrayColumn**(*cells*)
New in version 2.0. Column in a pitch array:

```
>>> from abjad.tools import pitcharraytools
```

```
>>> array = pitcharraytools.PitchArray([
...   [1, (2, 1), (-1.5, 2)],
...   [(7, 2), (6, 1), 1]])

>>> print array
[  ] [d'] [bqf    ]
[g'     ] [fs'] [ ]

>>> array.columns[0]
PitchArrayColumn(x1, g' x2)

>>> print array.columns[0]
[  ]
[g'     ]
```

Return pitch array column.

Read-only Properties

PitchArrayColumn.**cell_tokens**
PitchArrayColumn.**cell_widths**

PitchArrayColumn.**cells**

PitchArrayColumn.**column_index**

PitchArrayColumn.**depth**

PitchArrayColumn.**dimensions**

PitchArrayColumn.**has_voice_crossing**

PitchArrayColumn.**is_defective**

PitchArrayColumn.**parent_array**

PitchArrayColumn.**pitches**

PitchArrayColumn.**start_cells**

PitchArrayColumn.**start_pitches**

PitchArrayColumn.**stop_cells**

PitchArrayColumn.**stop_pitches**

PitchArrayColumn.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

PitchArrayColumn.**weight**

PitchArrayColumn.**width**

Methods

PitchArrayColumn.**append**(*cell*)
PitchArrayColumn.**extend**(*cells*)

PitchArrayColumn.**remove_pitches**()

Special Methods

PitchArrayColumn.**__eq__**(*arg*)

PitchArrayColumn.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchArrayColumn.**__getitem__**(*arg*)

PitchArrayColumn.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

PitchArrayColumn.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchArrayColumn.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

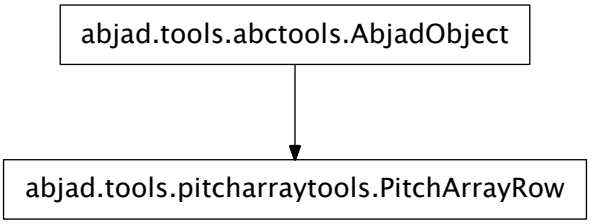
Inherited from abctools.AbjadObject

PitchArrayColumn.**__ne__**(*arg*)

PitchArrayColumn.**__repr__**()

PitchArrayColumn.**__str__**()

pitcharraytools.PitchArrayRow



class pitcharraytools.**PitchArrayRow**(*cells*)

New in version 2.0. One row in pitch array.

```
>>> from abjad.tools import pitcharraytools
```

```
>>> array = pitcharraytools.PitchArray([[1, 2, 1], [2, 1, 1]])
>>> array[0].cells[0].pitches.append(0)
>>> array[0].cells[1].pitches.append(2)
>>> array[1].cells[2].pitches.append(4)
>>> print array
[c'] [d'    ] [  ]
[         ] [ ] [e']

>>> array[0]
PitchArrayRow(c', d' x2, x1)

>>> array[0].cell_widths
(1, 2, 1)

>>> array[0].dimensions
(1, 4)

>>> array[0].pitches
(NamedChromaticPitch("c'"), NamedChromaticPitch("d'"))
```

Return pitch array row.

Read-only Properties

PitchArrayRow.**cell_tokens**

PitchArrayRow.**cell_widths**

PitchArrayRow.**cells**

PitchArrayRow.**depth**

PitchArrayRow.**dimensions**

PitchArrayRow.**is_defective**

PitchArrayRow.**is_in_range**

PitchArrayRow.**parent_array**

PitchArrayRow.**pitches**

PitchArrayRow.**row_index**

PitchArrayRow.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

PitchArrayRow.**weight**

PitchArrayRow.**width**

Read/write Properties

PitchArrayRow.**pitch_range**

Methods

PitchArrayRow.**append**(*cell_token*)

PitchArrayRow.**apply_pitches**(*pitch_tokens*)

PitchArrayRow.**copy_subrow**(*start=None*, *stop=None*)

PitchArrayRow.**empty_pitches**()

PitchArrayRow.**extend**(*cell_tokens*)

PitchArrayRow.**has_spanning_cell_over_index**(*i*)

PitchArrayRow.**index**(*cell*)

PitchArrayRow.**merge**(*cells*)

PitchArrayRow.**pad_to_width**(*width*)

PitchArrayRow.**pop**(*cell_index*)

PitchArrayRow.**remove**(*cell*)

PitchArrayRow.**withdraw**()

Special Methods

PitchArrayRow.**__add__**(*arg*)

PitchArrayRow.**__eq__**(*arg*)

PitchArrayRow.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchArrayRow.**__getitem__**(*arg*)

PitchArrayRow.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

PitchArrayRow.**__iadd__**(*arg*)

PitchArrayRow.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchArrayRow.**__len__**()

PitchArrayRow.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchArrayRow.**__ne__**(*arg*)

PitchArrayRow.**__repr__**()

PitchArrayRow.**__str__**()

functions

pitcharraytools.all_are_pitch_arrays

pitcharraytools.**all_are_pitch_arrays**(*expr*)

New in version 2.6. True when *expr* is a sequence of Abjad pitch arrays:

```
>>> pitch_array = pitcharraytools.PitchArray([[1, 2, 1], [2, 1, 1]])

>>> pitcharraytools.all_are_pitch_arrays([pitch_array])
True
```

True when *expr* is an empty sequence:

```
>>> pitcharraytools.all_are_pitch_arrays([])
True
```

Otherwise false:

```
>>> pitcharraytools.all_are_pitch_arrays('foo')
False
```

Return boolean.

pitcharraytools.concatenate_pitch_arrays

pitcharraytools.**concatenate_pitch_arrays**(*pitch_arrays*)

New in version 2.0. Concatenate *pitch_arrays*:

```
>>> array_1 = pitcharraytools.PitchArray([[1, 2, 1], [2, 1, 1]])
>>> print array_1
[ ] [     ] [ ]
[     ] [ ] [ ]

>>> array_2 = pitcharraytools.PitchArray([[3, 4], [4, 3]])
>>> print array_2
[     ] [           ]
[           ] [     ]

>>> array_3 = pitcharraytools.PitchArray([[1, 1], [1, 1]])
>>> print array_3
[ ] [ ]
[ ] [ ]

>>> merged_array = pitcharraytools.concatenate_pitch_arrays([array_1, array_2, array_3])
>>> print merged_array
[ ] [     ] [ ] [     ] [           ] [ ] [ ]
[     ] [ ] [ ] [           ] [     ] [ ] [ ]
```

Return pitch array.

pitcharraytools.list_nonspanning_subarrays_of_pitch_array

pitcharraytools.**list_nonspanning_subarrays_of_pitch_array**(*pitch_array*)

New in version 2.0. List nonspanning subarrays of *pitch_array*:

```
>>> array = pitcharraytools.PitchArray([
...     [2, 2, 3, 1],
...     [1, 2, 1, 1, 2, 1],
...     [1, 1, 1, 1, 1, 1, 1, 1]])
>>> print array
[     ] [     ] [           ] [ ]
[ ] [     ] [ ] [ ] [     ] [ ]
[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

>>> subarrays = pitcharraytools.list_nonspanning_subarrays_of_pitch_array(array)
>>> len(subarrays)
3

>>> print subarrays[0]
[     ] [     ]
[ ] [     ] [ ]
[ ] [ ] [ ] [ ]

>>> print subarrays[1]
[           ]
[ ] [     ]
[ ] [ ] [ ]

>>> print subarrays[2]
[ ]
[ ]
[ ]
```

Return list.

pitcharraytools.make_empty_pitch_array_from_list_of_pitch_lists

pitcharraytools.**make_empty_pitch_array_from_list_of_pitch_lists**(*leaf_iterables*)

New in version 2.0. Make empty pitch array from *leaf_iterables*:

```
>>> score = Score([])
>>> score.append(Staff("c'8 d'8 e'8 f'8"))
>>> score.append(Staff("c'4 d'4"))
>>> score.append(Staff(tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8") * 2))

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
        e'8
        f'8
    }
    \new Staff {
        c'4
        d'4
    }
    \new Staff {
        \times 2/3 {
            c'8
            d'8
            e'8
```

```
            }
            \times 2/3 {
                c'8
                d'8
                e'8
            }
        }
    >>
```

```
>>> array = pitcharraytools.make_empty_pitch_array_from_list_of_pitch_lists(score)
>>> print array
[     ] [     ] [     ] [     ]
[                 ] [                 ]
[ ] [     ] [ ] [ ] [     ] [ ]
```

Return pitch array.

pitcharraytools.make_pitch_array_score_from_pitch_arrays

pitcharraytools.**make_pitch_array_score_from_pitch_arrays**(*pitch_arrays*)

New in version 2.0. Make pitch-array score from *pitch_arrays*:

```
>>> from abjad.tools import pitcharraytools

>>> array_1 = pitcharraytools.PitchArray([
...     [1, (2, 1), ([-2, -1.5], 2)],
...     [(7, 2), (6, 1), 1]])

>>> array_2 = pitcharraytools.PitchArray([
...     [1, 1, 1],
...     [1, 1, 1]])

>>> score = pitcharraytools.make_pitch_array_score_from_pitch_arrays([array_1, array_2])

>>> f(score)
\new Score <<
    \new StaffGroup <<
        \new Staff {
            {
                \time 4/8
                r8
                d'8
                <bf bqf>4
            }
            {
                \time 3/8
                r8
                r8
                r8
            }
        }
        \new Staff {
            {
                \time 4/8
                g'4
                fs'8
                r8
```

```
            }
            {
                \time 3/8
                r8
                r8
                r8
            }
        }
    >>
>>
```

Create one staff per pitch-array row.

Return score.

pitcharraytools.make_populated_pitch_array_from_list_of_pitch_lists

pitcharraytools.**make_populated_pitch_array_from_list_of_pitch_lists**(*leaf_iterables*)

New in version 2.0. Make populated pitch array from *leaf_iterables*:

```
>>> from abjad.tools import pitcharraytools

>>> score = Score([])
>>> score.append(Staff("c'8 d'8 e'8 f'8"))
>>> score.append(Staff("c'4 d'4"))
>>> score.append(Staff(tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8") * 2))
>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
        e'8
        f'8
    }
    \new Staff {
        c'4
        d'4
    }
    \new Staff {
        \times 2/3 {
            c'8
            d'8
            e'8
        }
        \times 2/3 {
            c'8
            d'8
            e'8
        }
    }
>>

>>> array = pitcharraytools.make_populated_pitch_array_from_list_of_pitch_lists(score)
>>> print array
[c'     ] [d'     ] [e'     ] [f'     ]
[c'                 ] [d'                 ]
[c'] [d'     ] [e'] [c'] [d'     ] [e']
```

Return pitch array.

pitcharraytools.pitch_array_row_to_measure

pitcharraytools.**pitch_array_row_to_measure**(*pitch_array_row*, *cell_duration_denominator=8*)

New in version 2.0. Change *pitch_array_row* to measure with meter *pitch_array_row.width* over *cell_duration_denominator*:

```
>>> from abjad.tools import pitcharraytools
>>> array = pitcharraytools.PitchArray([
...     [1, (2, 1), ([-2, -1.5], 2)],
...     [(7, 2), (6, 1), 1]])

>>> print array
[  ] [d'] [bf bqf    ]
[g'     ] [fs'   ] [ ]

>>> measure = pitcharraytools.pitch_array_row_to_measure(array.rows[0])

>>> f(measure)
{
    \time 4/8
    r8
    d'8
    <bf bqf>4
}
```

Return measure.

pitcharraytools.pitch_array_to_measures

pitcharraytools.**pitch_array_to_measures**(*pitch_array*, *cell_duration_denominator=8*)

New in version 2.0. Change *pitch_array* to measures with meters *row.width* over *cell_duration_denominator* for each row in *pitch_array*:

```
>>> from abjad.tools import pitcharraytools
>>> array = pitcharraytools.PitchArray([
...     [1, (2, 1), ([-2, -1.5], 2)],
...     [(7, 2), (6, 1), 1]])

>>> print array
[  ] [d'] [bf bqf    ]
[g'     ] [fs'   ] [ ]

>>> pitcharraytools.pitch_array_to_measures(array)
[Measure(4/8, [r8, d'8, <bf bqf>4]), Measure(4/8, [g'4, fs'8, r8])]
>>> for measure in _:
...     f(measure)
...
{
    \time 4/8
    r8
    d'8
    <bf bqf>4
}
```

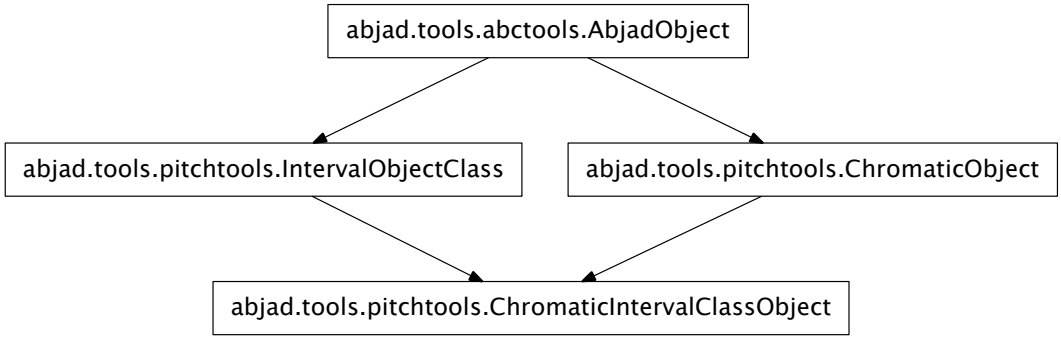
```
{
    \time 4/8
    g'4
    fs'8
    r8
}
```

Return list of measures.

pitchtools

abstract classes

pitchtools.ChromaticIntervalClassObject



class pitchtools.**ChromaticIntervalClassObject**

New in version 2.0. Chromatic interval-class base class.

Read-only Properties

ChromaticIntervalClassObject.**number**

Inherited from pitchtools.IntervalObjectClass

ChromaticIntervalClassObject.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ChromaticIntervalClassObject.**__abs__**()

ChromaticIntervalClassObject.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ChromaticIntervalClassObject.**__float__**()

ChromaticIntervalClassObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ChromaticIntervalClassObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ChromaticIntervalClassObject.**__hash__**()
Inherited from pitchtools.IntervalObjectClass

ChromaticIntervalClassObject.**__int__**()

ChromaticIntervalClassObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ChromaticIntervalClassObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ChromaticIntervalClassObject.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

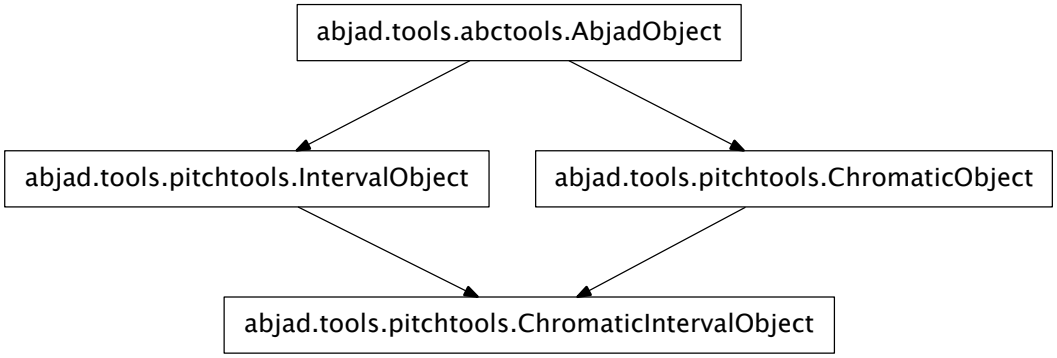
Return boolean.

Inherited from abctools.AbjadObject

ChromaticIntervalClassObject.**__repr__**()
Inherited from pitchtools.IntervalObjectClass

ChromaticIntervalClassObject.**__str__**()
Inherited from pitchtools.IntervalObjectClass

pitchtools.ChromaticIntervalObject



class pitchtools.**ChromaticIntervalObject**(*arg*)

New in version 2.0. Chromatic interval base class.

Read-only Properties

ChromaticIntervalObject.**cents**

Inherited from pitchtools.IntervalObject

ChromaticIntervalObject.**interval_class**

Inherited from pitchtools.IntervalObject

ChromaticIntervalObject.**number**

ChromaticIntervalObject.**semitones**

ChromaticIntervalObject.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ChromaticIntervalObject.**__abs__**()

ChromaticIntervalObject.**__add__**(*arg*)

ChromaticIntervalObject.**__eq__**(*arg*)

ChromaticIntervalObject.**__float__**()

ChromaticIntervalObject.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ChromaticIntervalObject.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ChromaticIntervalObject.**__hash__**()
Inherited from pitchtools.IntervalObject

ChromaticIntervalObject.**__int__**()

ChromaticIntervalObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ChromaticIntervalObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

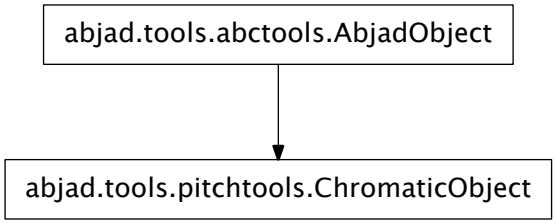
ChromaticIntervalObject.**__ne__**(*arg*)

ChromaticIntervalObject.**__repr__**()

ChromaticIntervalObject.**__str__**()

ChromaticIntervalObject.**__sub__**(*arg*)

pitchtools.ChromaticObject



class pitchtools.**ChromaticObject**
..versionadded:: 2.0

Chromatic object base class.

Read-only Properties

ChromaticObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ChromaticObject.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

ChromaticObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

ChromaticObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

ChromaticObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

ChromaticObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

ChromaticObject.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

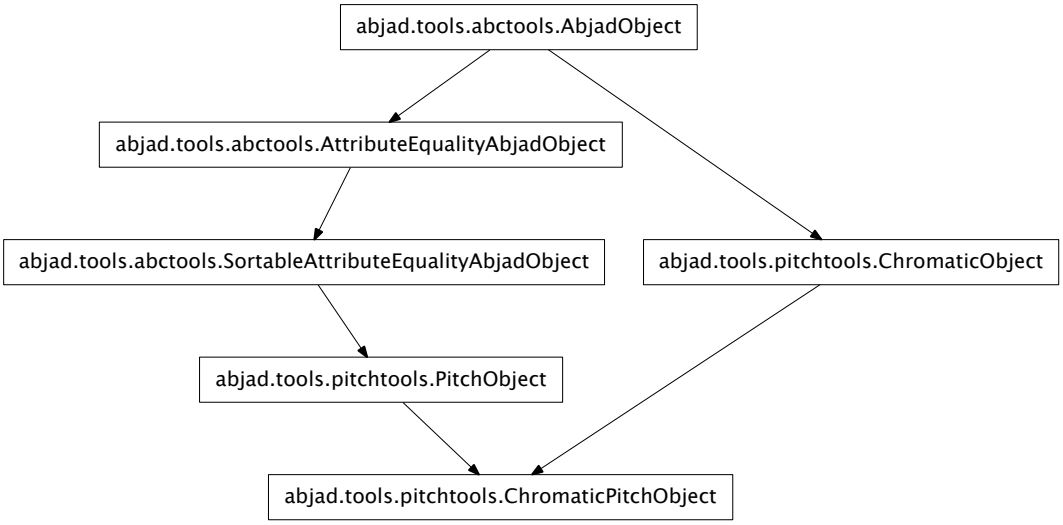
Inherited from `abctools.AbjadObject`

ChromaticObject.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

pitchtools.ChromaticPitchObject



class pitchtools.**ChromaticPitchObject**
New in version 2.0. Chromatic pitch base class.

Read-only Properties

ChromaticPitchObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ChromaticPitchObject.**__abs__**()
Inherited from pitchtools.PitchObject

ChromaticPitchObject.**__eq__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

ChromaticPitchObject.**__float__**()
Inherited from pitchtools.PitchObject

ChromaticPitchObject.**__ge__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

ChromaticPitchObject.**__gt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

ChromaticPitchObject.**__hash__**()
Inherited from pitchtools.PitchObject

ChromaticPitchObject.**__int__**()
Inherited from pitchtools.PitchObject

ChromaticPitchObject.**__le__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

ChromaticPitchObject.**__lt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

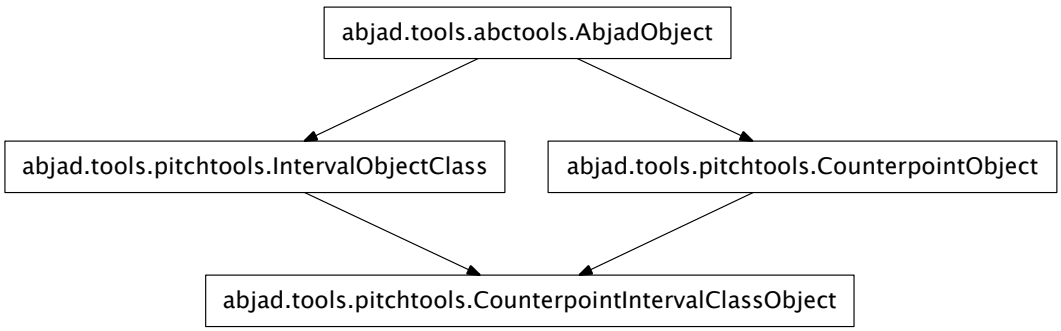
Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

ChromaticPitchObject.**__ne__**(*arg*)
Inherited from pitchtools.PitchObject

ChromaticPitchObject.**__repr__**()
Inherited from pitchtools.PitchObject

pitchtools.CounterpointIntervalClassObject



class pitchtools.**CounterpointIntervalClassObject**
New in version 2.0. Counterpoint interval-class base class.

Read-only Properties

CounterpointIntervalClassObject.**number**
Inherited from pitchtools.IntervalObjectClass

CounterpointIntervalClassObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

CounterpointIntervalClassObject.**__abs__**()
CounterpointIntervalClassObject.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

CounterpointIntervalClassObject.**__float__**()

CounterpointIntervalClassObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CounterpointIntervalClassObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

CounterpointIntervalClassObject.**__hash__**()
Inherited from pitchtools.IntervalObjectClass

CounterpointIntervalClassObject.**__int__**()

CounterpointIntervalClassObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CounterpointIntervalClassObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CounterpointIntervalClassObject.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

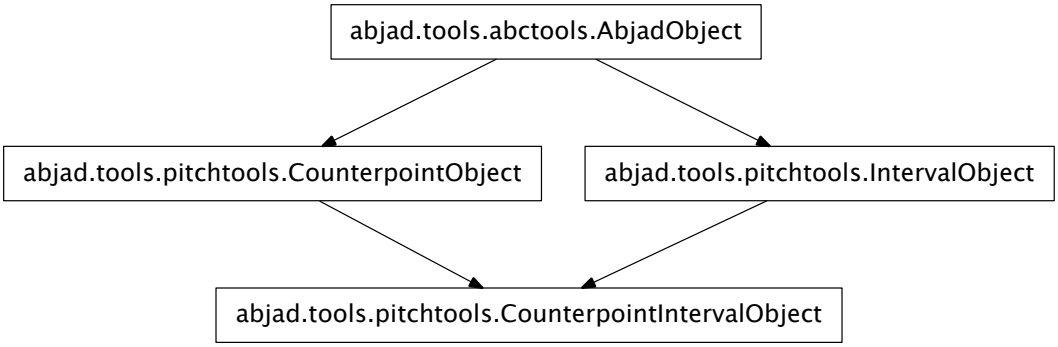
Return boolean.

Inherited from abctools.AbjadObject

CounterpointIntervalClassObject.**__repr__**()
Inherited from pitchtools.IntervalObjectClass

CounterpointIntervalClassObject.**__str__**()
Inherited from pitchtools.IntervalObjectClass

pitchtools.CounterpointIntervalObject



class pitchtools.**CounterpointIntervalObject**
..versionadded:: 2.0

Counterpoint interval base class.

Read-only Properties

CounterpointIntervalObject.**cents**
Inherited from pitchtools.IntervalObject

CounterpointIntervalObject.**interval_class**
Inherited from pitchtools.IntervalObject

CounterpointIntervalObject.**number**

CounterpointIntervalObject.**semitones**

CounterpointIntervalObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

CounterpointIntervalObject.**__abs__**()
CounterpointIntervalObject.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

CounterpointIntervalObject.**__float__**()

CounterpointIntervalObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CounterpointIntervalObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

CounterpointIntervalObject.**__hash__**()
Inherited from pitchtools.IntervalObject

CounterpointIntervalObject.**__int__**()

CounterpointIntervalObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CounterpointIntervalObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CounterpointIntervalObject.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

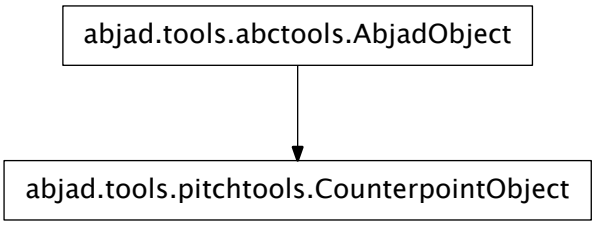
Return boolean.

Inherited from abctools.AbjadObject

CounterpointIntervalObject.**__repr__**()
Inherited from pitchtools.IntervalObject

CounterpointIntervalObject.**__str__**()
Inherited from pitchtools.IntervalObject

pitchtools.CounterpointObject



class pitchtools.**CounterpointObject**
Counterpoint object base class.

Read-only Properties

CounterpointObject.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

CounterpointObject.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

CounterpointObject.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CounterpointObject.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

CounterpointObject.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CounterpointObject.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CounterpointObject.**__ne__**(*arg*)

True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

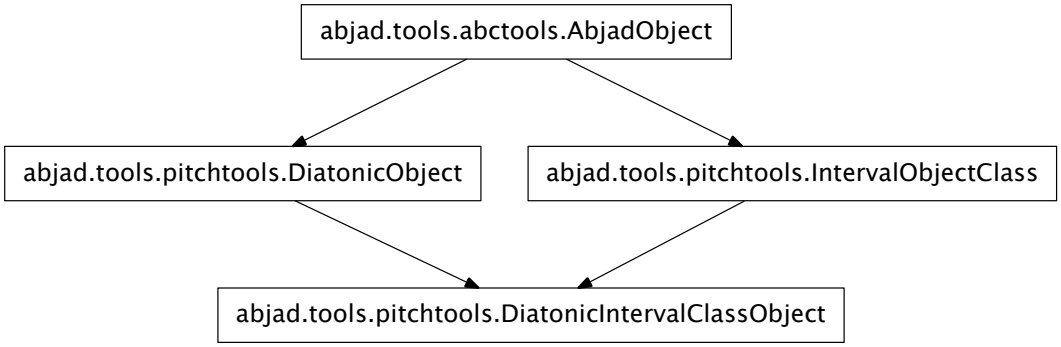
CounterpointObject.**__repr__**()

Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

pitchtools.DiatonicIntervalClassObject



class pitchtools.**DiatonicIntervalClassObject**
New in version 2.0. Diatonic interval-class base class.

Read-only Properties

DiatonicIntervalClassObject.**number**
Inherited from pitchtools.IntervalObjectClass

DiatonicIntervalClassObject.**quality_string**

DiatonicIntervalClassObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

DiatonicIntervalClassObject.**__abs__**()

DiatonicIntervalClassObject.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DiatonicIntervalClassObject.**__float__**()

DiatonicIntervalClassObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicIntervalClassObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DiatonicIntervalClassObject.**__hash__**()
Inherited from pitchtools.IntervalObjectClass

DiatonicIntervalClassObject.**__int__**()

DiatonicIntervalClassObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicIntervalClassObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicIntervalClassObject.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

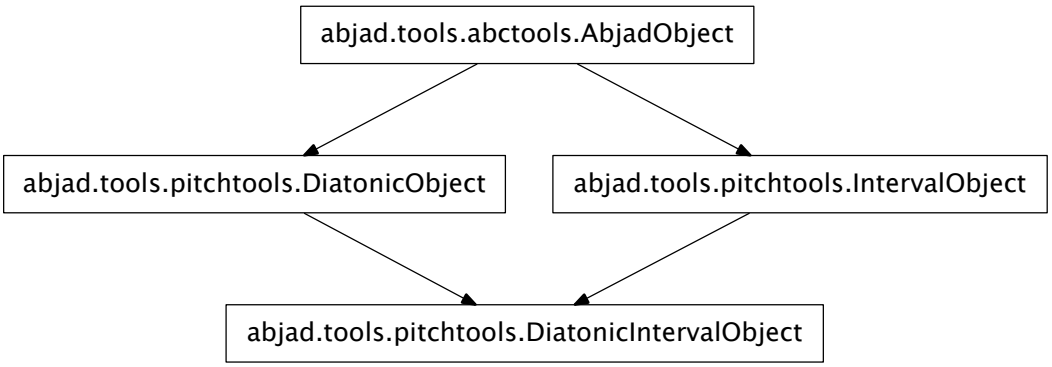
Return boolean.

Inherited from abctools.AbjadObject

DiatonicIntervalClassObject.**__repr__**()

DiatonicIntervalClassObject.**__str__**()

pitchtools.DiatonicIntervalObject



class pitchtools.**DiatonicIntervalObject**(*quality_string*, *number*)
New in version 2.0. Diatonic interval base class.

Read-only Properties

DiatonicIntervalObject.**cents**
Inherited from pitchtools.IntervalObject

DiatonicIntervalObject.**diatonic_interval_class**

DiatonicIntervalObject.**interval_class**

DiatonicIntervalObject.**interval_string**

DiatonicIntervalObject.**number**

DiatonicIntervalObject.**quality_string**

DiatonicIntervalObject.**semitones**

DiatonicIntervalObject.**staff_spaces**

DiatonicIntervalObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

DiatonicIntervalObject.**__abs__**()
DiatonicIntervalObject.**__eq__**(*arg*)

DiatonicIntervalObject.**__float__**()

DiatonicIntervalObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicIntervalObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DiatonicIntervalObject.**__hash__**()
Inherited from pitchtools.IntervalObject

DiatonicIntervalObject.**__int__**()

DiatonicIntervalObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicIntervalObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

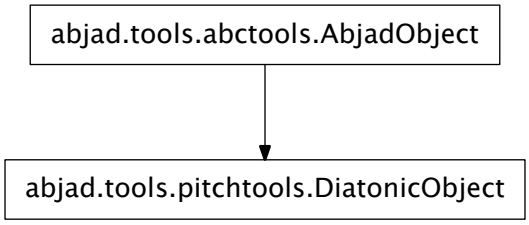
Inherited from abctools.AbjadObject

DiatonicIntervalObject.**__ne__**(*arg*)

DiatonicIntervalObject.**__repr__**()

DiatonicIntervalObject.**__str__**()

pitchtools.DiatonicObject



class pitchtools.**DiatonicObject**
..versionadded:: 2.0

Diatonic object base class.

Read-only Properties

DiatonicObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

DiatonicObject.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DiatonicObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DiatonicObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicObject.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

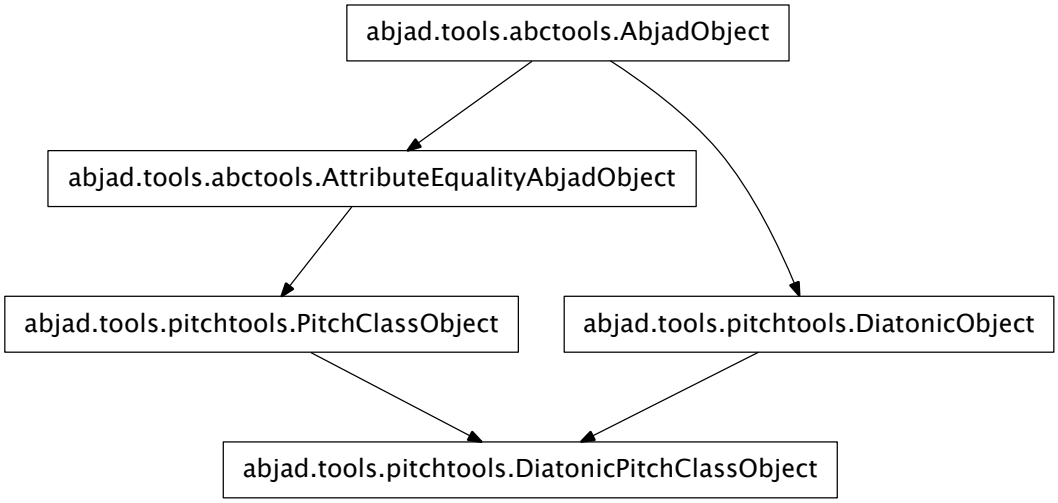
Inherited from abctools.AbjadObject

DiatonicObject.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

pitchtools.DiatonicPitchClassObject



class pitchtools.**DiatonicPitchClassObject**
New in version 2.0. Diatonic pitch-class base class.

Read-only Properties

DiatonicPitchClassObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

DiatonicPitchClassObject.**__abs__**()

DiatonicPitchClassObject.__**eq**__(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

DiatonicPitchClassObject.__**float**__()

DiatonicPitchClassObject.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicPitchClassObject.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DiatonicPitchClassObject.__**hash**__()
Inherited from pitchtools.PitchClassObject

DiatonicPitchClassObject.__**int**__()

DiatonicPitchClassObject.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicPitchClassObject.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiatonicPitchClassObject.__**ne**__(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

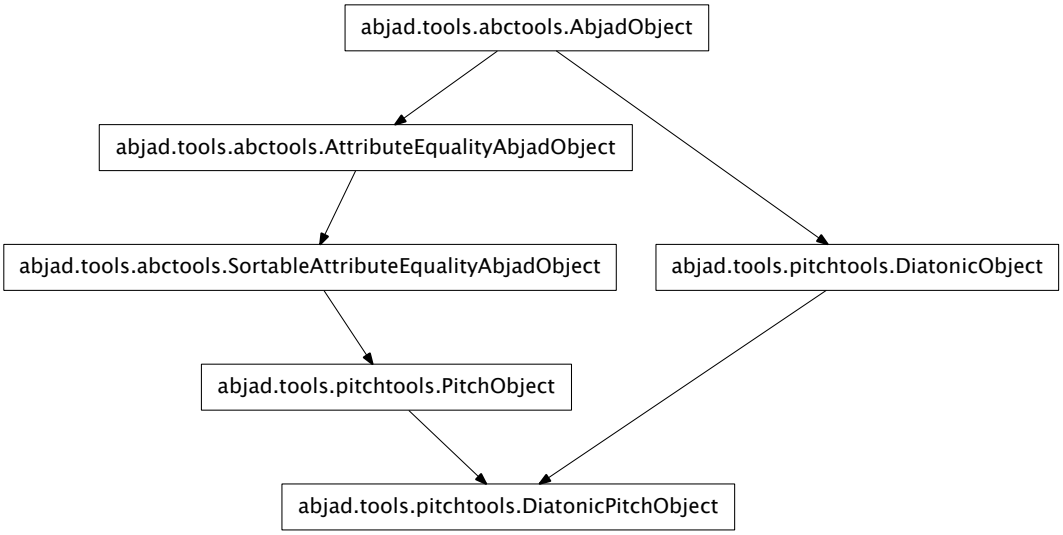
Inherited from abctools.AttributeEqualityAbjadObject

DiatonicPitchClassObject.__**repr**__()
Interpreter representation of object defined equal to class name and format string.

Return string.

Inherited from abctools.AttributeEqualityAbjadObject

pitchtools.DiatonicPitchObject



class pitchtools.**DiatonicPitchObject**

New in version 2.0. Diatonic pitch base class.

Read-only Properties

DiatonicPitchObject.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

DiatonicPitchObject.**__abs__**()

DiatonicPitchObject.**__eq__**(*arg*)

Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

DiatonicPitchObject.**__float__**()

DiatonicPitchObject.**__ge__**(*arg*)

Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

DiatonicPitchObject.**__gt__**(*arg*)

Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

DiatonicPitchObject.**__hash__**()
Inherited from pitchtools.PitchObject

DiatonicPitchObject.**__int__**()

DiatonicPitchObject.**__le__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

DiatonicPitchObject.**__lt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

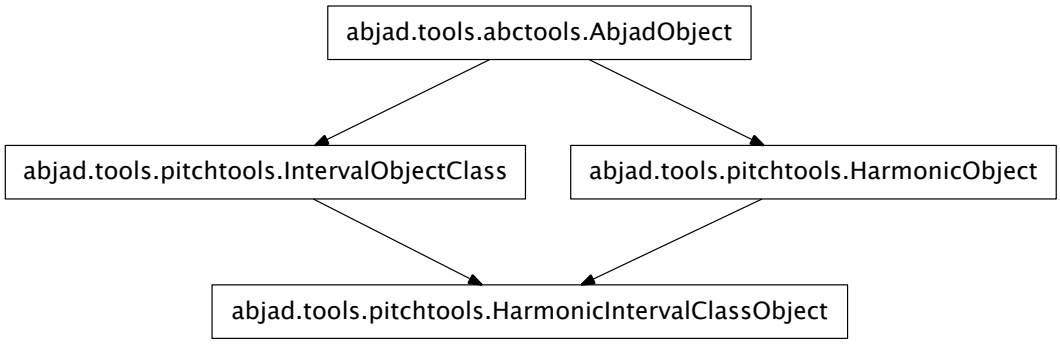
Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

DiatonicPitchObject.**__ne__**(*arg*)
Inherited from pitchtools.PitchObject

DiatonicPitchObject.**__repr__**()
Inherited from pitchtools.PitchObject

pitchtools.HarmonicIntervalClassObject



class pitchtools.**HarmonicIntervalClassObject**
New in version 2.0. Harmonic interval-class base class.

Read-only Properties

HarmonicIntervalClassObject.**number**
Inherited from pitchtools.IntervalObjectClass

HarmonicIntervalClassObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

HarmonicIntervalClassObject.__**abs**__()
Inherited from pitchtools.IntervalObjectClass

HarmonicIntervalClassObject.__**eq**__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

HarmonicIntervalClassObject.__**float**__()
Inherited from pitchtools.IntervalObjectClass

HarmonicIntervalClassObject.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicIntervalClassObject.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

HarmonicIntervalClassObject.__**hash**__()
Inherited from pitchtools.IntervalObjectClass

HarmonicIntervalClassObject.__**int**__()
Inherited from pitchtools.IntervalObjectClass

HarmonicIntervalClassObject.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicIntervalClassObject.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicIntervalClassObject.__**ne**__(*arg*)
True when id(self) does not equal id(arg).

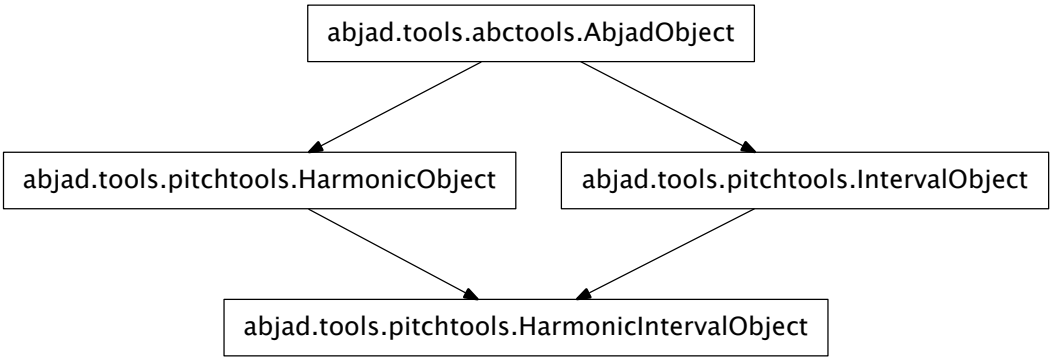
Return boolean.

Inherited from abctools.AbjadObject

HarmonicIntervalClassObject.__**repr**__()
Inherited from pitchtools.IntervalObjectClass

HarmonicIntervalClassObject.__**str**__()
Inherited from pitchtools.IntervalObjectClass

pitchtools.HarmonicIntervalObject



class pitchtools.**HarmonicIntervalObject**
..versionadded:: 2.0

Harmonic interval base class.

Read-only Properties

HarmonicIntervalObject.**cents**
Inherited from pitchtools.IntervalObject

HarmonicIntervalObject.**interval_class**
Inherited from pitchtools.IntervalObject

HarmonicIntervalObject.**number**
Inherited from pitchtools.IntervalObject

HarmonicIntervalObject.**semitones**
Inherited from pitchtools.IntervalObject

HarmonicIntervalObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

HarmonicIntervalObject.**__abs__**()
Inherited from pitchtools.IntervalObject

HarmonicIntervalObject.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

HarmonicIntervalObject.**__float__**()
Inherited from pitchtools.IntervalObject

HarmonicIntervalObject.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicIntervalObject.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

HarmonicIntervalObject.__hash__()
Inherited from pitchtools.IntervalObject

HarmonicIntervalObject.__int__()
Inherited from pitchtools.IntervalObject

HarmonicIntervalObject.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicIntervalObject.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicIntervalObject.__ne__(*arg*)
True when id(self) does not equal id(arg).

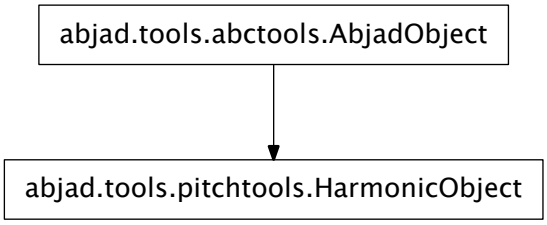
Return boolean.

Inherited from abctools.AbjadObject

HarmonicIntervalObject.__repr__()
Inherited from pitchtools.IntervalObject

HarmonicIntervalObject.__str__()
Inherited from pitchtools.IntervalObject

pitchtools.HarmonicObject



class pitchtools.**HarmonicObject**
..versionadded:: 2.0

Harmonic object base class.

Read-only Properties

HarmonicObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

HarmonicObject.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

HarmonicObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

HarmonicObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`HarmonicObject.__ne__(arg)`
True when `id(self)` does not equal `id(arg)`.

Return boolean.

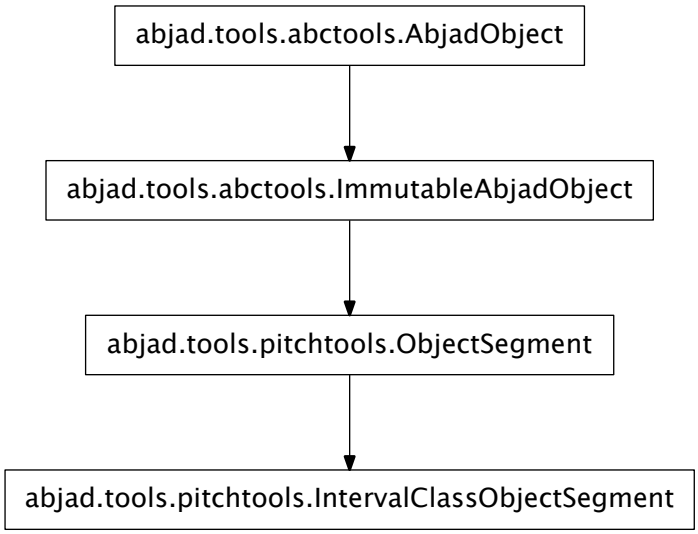
Inherited from `abctools.AbjadObject`

`HarmonicObject.__repr__()`
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

pitchtools.IntervalClassObjectSegment



class `pitchtools.IntervalClassObjectSegment(*args, **kwargs)`
New in version 2.0. Interval-class segment base class.

Read-only Properties

`IntervalClassObjectSegment.interval_class_numbers`
`IntervalClassObjectSegment.interval_classes`

`IntervalClassObjectSegment.storage_format`
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

IntervalClassObjectSegment.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.tuple

IntervalClassObjectSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

Special Methods

IntervalClassObjectSegment.**__add__**(*arg*)
Inherited from pitchtools.ObjectSegment

IntervalClassObjectSegment.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__getslice__**(*start*, *stop*)
Inherited from pitchtools.ObjectSegment

IntervalClassObjectSegment.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

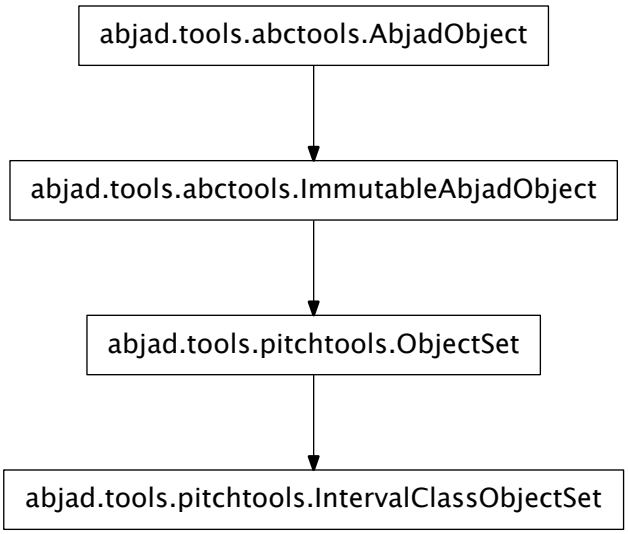
IntervalClassObjectSegment.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.tuple

IntervalClassObjectSegment.**__repr__**()

IntervalClassObjectSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

pitchtools.IntervalClassObjectSet



class pitchtools.**IntervalClassObjectSet**(**args*, ***kwargs*)
New in version 2.0. Interval-class set base class.

Read-only Properties

IntervalClassObjectSet.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

IntervalClassObjectSet.**copy**()
Return a shallow copy of a set.

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**difference**()
Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**intersection**()
Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

IntervalClassObjectSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

IntervalClassObjectSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

IntervalClassObjectSet.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**hash**__() <==> *hash(x)*
Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**len**__() <==> *len(x)*
Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**or**__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**rand**__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**repr**__() <==> *repr(x)*
Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**ror**__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**rsub**__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**rxor**__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

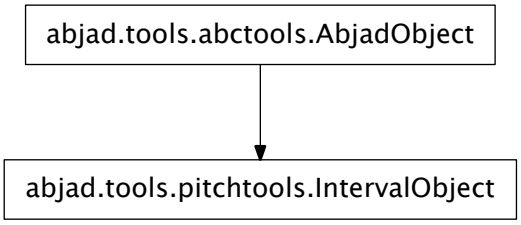
IntervalClassObjectSet.__**sub**__()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

IntervalClassObjectSet.__**xor**__()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.IntervalObject



class pitchtools.**IntervalObject**
New in version 2.0. Interval base class.

Read-only Properties

IntervalObject.**cents**
IntervalObject.**interval_class**

IntervalObject.**number**

IntervalObject.**semitones**

IntervalObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

IntervalObject.**__abs__**()
IntervalObject.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

IntervalObject.**__float__**()

IntervalObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

IntervalObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

IntervalObject.**__hash__**()

IntervalObject.**__int__**()

IntervalObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

IntervalObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

IntervalObject.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

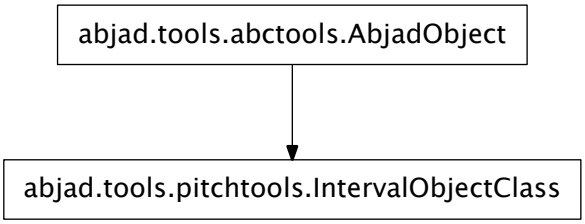
Return boolean.

Inherited from abctools.AbjadObject

IntervalObject.**__repr__**()

IntervalObject.**__str__**()

pitchtools.IntervalObjectClass



class pitchtools.**IntervalObjectClass**
New in version 2.0. Interval-class base class.

Read-only Properties

IntervalObjectClass.**number**

IntervalObjectClass.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

IntervalObjectClass.**__abs__**()

IntervalObjectClass.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

IntervalObjectClass.**__float__**()

IntervalObjectClass.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

IntervalObjectClass.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

IntervalObjectClass.**__hash__**()

IntervalObjectClass.**__int__**()

IntervalObjectClass.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

IntervalObjectClass.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

IntervalObjectClass.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

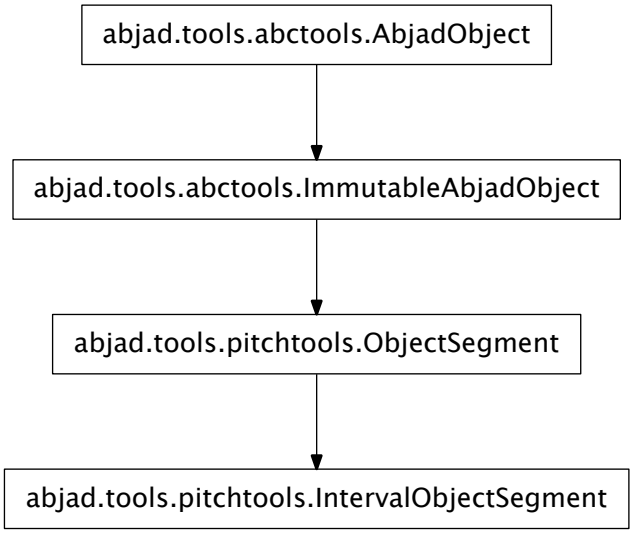
Return boolean.

Inherited from `abctools.AbjadObject`

IntervalObjectClass.**__repr__**()

IntervalObjectClass.**__str__**()

pitchtools.IntervalObjectSegment



class `pitchtools.`**`IntervalObjectSegment`**(**args*, ***kwargs*)

New in version 2.0. Class of abstract ordered collection of interval instances from which concrete classes inherit.

Read-only Properties

`IntervalObjectSegment.`**`interval_classes`**

`IntervalObjectSegment.`**`intervals`**

`IntervalObjectSegment.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`IntervalObjectSegment.`**`count`**(*value*) → integer – return number of occurrences of value

Inherited from `__builtin__.tuple`

`IntervalObjectSegment.`**`index`**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from `__builtin__.tuple`

`IntervalObjectSegment.`**`rotate`**(*n*)

Special Methods

`IntervalObjectSegment.`**`__add__`**(*arg*)

Inherited from `pitchtools.ObjectSegment`

IntervalObjectSegment.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

IntervalObjectSegment.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

IntervalObjectSegment.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

IntervalObjectSegment.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

IntervalObjectSegment.**__getslice__**(*start*, *stop*)
Inherited from pitchtools.ObjectSegment

IntervalObjectSegment.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

IntervalObjectSegment.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

IntervalObjectSegment.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

IntervalObjectSegment.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

IntervalObjectSegment.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

IntervalObjectSegment.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

IntervalObjectSegment.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

IntervalObjectSegment.**__ne__**()
x.__ne__(y) <==> x!=y

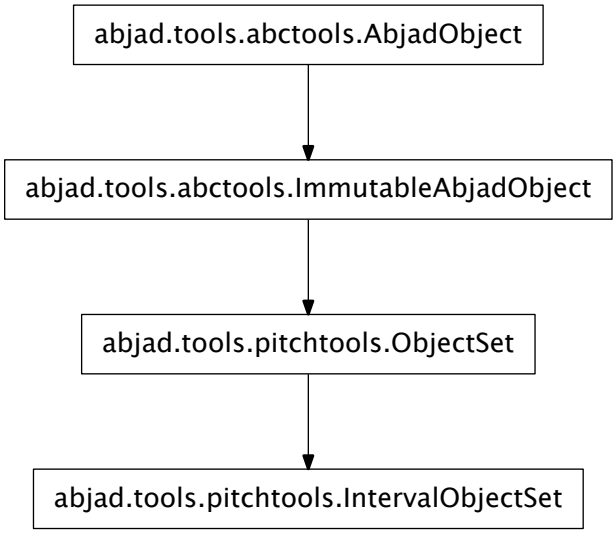
Inherited from __builtin__.tuple

IntervalObjectSegment.**__repr__**()

IntervalObjectSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

IntervalObjectSegment.**__str__**()

pitchtools.IntervalObjectSet



class `pitchtools.`**`IntervalObjectSet`**(**args*, ***kwargs*)

New in version 2.0. Abstract interval set.

Read-only Properties

`IntervalObjectSet.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`IntervalObjectSet.`**`copy`**`()`

Return a shallow copy of a set.

Inherited from `__builtin__.frozenset`

`IntervalObjectSet.`**`difference`**`()`

Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from `__builtin__.frozenset`

`IntervalObjectSet.`**`intersection`**`()`

Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from `__builtin__.frozenset`

IntervalObjectSet.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

IntervalObjectSet.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

IntervalObjectSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

IntervalObjectSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

IntervalObjectSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

IntervalObjectSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

IntervalObjectSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

IntervalObjectSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

IntervalObjectSet.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

IntervalObjectSet.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

IntervalObjectSet.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

IntervalObjectSet.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.frozenset

IntervalObjectSet.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.frozenset

IntervalObjectSet.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

IntervalObjectSet.__**len**__() <==> *len(x)*
Inherited from __builtin__.frozenset

IntervalObjectSet.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

IntervalObjectSet.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

IntervalObjectSet.__**or**__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

IntervalObjectSet.__**rand**__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

IntervalObjectSet.__**repr**__() <==> *repr(x)*
Inherited from __builtin__.frozenset

IntervalObjectSet.__**ror**__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

IntervalObjectSet.__**rsub**__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

IntervalObjectSet.__**rxor**__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

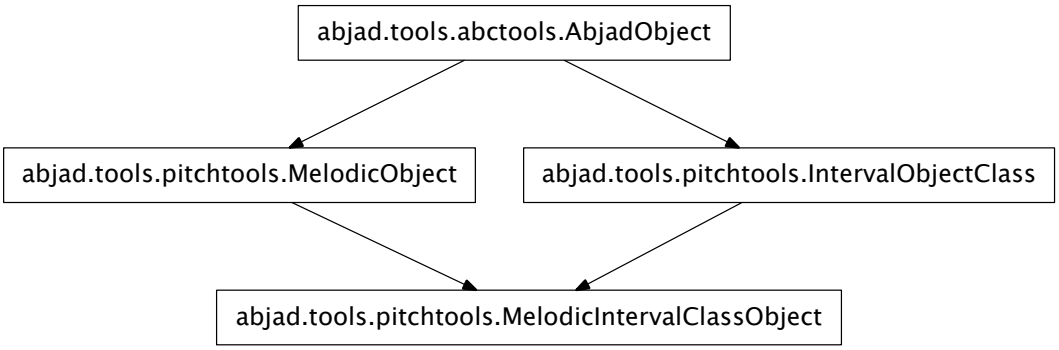
IntervalObjectSet.__**sub**__()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

IntervalObjectSet.__**xor**__()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.MelodicIntervalClassObject



class pitchtools.**MelodicIntervalClassObject**
New in version 2.0. Melodic interval-class base class.

Read-only Properties

MelodicIntervalClassObject.**direction_number**
MelodicIntervalClassObject.**direction_symbol**

MelodicIntervalClassObject.**direction_word**

MelodicIntervalClassObject.**number**
Inherited from pitchtools.IntervalObjectClass

MelodicIntervalClassObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

MelodicIntervalClassObject.**__abs__**()
Inherited from pitchtools.IntervalObjectClass
MelodicIntervalClassObject.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MelodicIntervalClassObject.**__float__**()
Inherited from pitchtools.IntervalObjectClass

MelodicIntervalClassObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicIntervalClassObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MelodicIntervalClassObject.**__hash__**()
Inherited from pitchtools.IntervalObjectClass

MelodicIntervalClassObject.**__int__**()
Inherited from pitchtools.IntervalObjectClass

MelodicIntervalClassObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicIntervalClassObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicIntervalClassObject.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

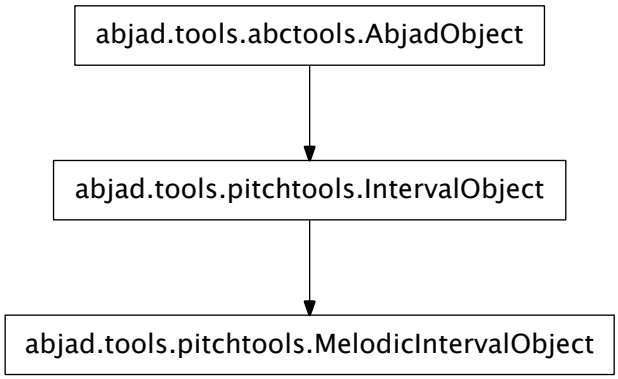
Return boolean.

Inherited from abctools.AbjadObject

MelodicIntervalClassObject.**__repr__**()
Inherited from pitchtools.IntervalObjectClass

MelodicIntervalClassObject.**__str__**()
Inherited from pitchtools.IntervalObjectClass

pitchtools.MelodicIntervalObject



class pitchtools.**MelodicIntervalObject**
New in version 2.0. Melodic interval base class.

Read-only Properties

MelodicIntervalObject.**cents**
Inherited from pitchtools.IntervalObject

MelodicIntervalObject.**direction_number**

MelodicIntervalObject.**direction_string**

MelodicIntervalObject.**interval_class**
Inherited from pitchtools.IntervalObject

MelodicIntervalObject.**number**
Inherited from pitchtools.IntervalObject

MelodicIntervalObject.**semitones**
Inherited from pitchtools.IntervalObject

MelodicIntervalObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

MelodicIntervalObject.**__abs__**()

MelodicIntervalObject.**__eq__**(*arg*)

MelodicIntervalObject.**__float__**()
Inherited from pitchtools.IntervalObject

MelodicIntervalObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicIntervalObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MelodicIntervalObject.**__hash__**()
Inherited from pitchtools.IntervalObject

MelodicIntervalObject.**__int__**()
Inherited from pitchtools.IntervalObject

MelodicIntervalObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicIntervalObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

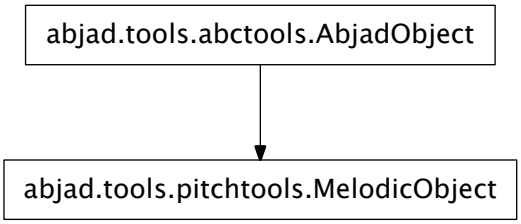
MelodicIntervalObject.**__ne__**(*arg*)

MelodicIntervalObject.**__neg__**()

MelodicIntervalObject.**__repr__**()
Inherited from pitchtools.IntervalObject

MelodicIntervalObject.**__str__**()
Inherited from pitchtools.IntervalObject

pitchtools.MelodicObject



class pitchtools.**MelodicObject**
..versionadded:: 2.0

Melodic object base class.

Read-only Properties

MelodicObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

MelodicObject.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MelodicObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MelodicObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicObject.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

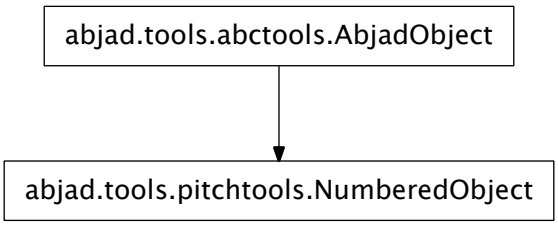
Inherited from abctools.AbjadObject

MelodicObject.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

pitchtools.NumberedObject



class pitchtools.**NumberedObject**
..versionadded: 1.1.2

Numbered object base class.

Read-only Properties

NumberedObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

NumberedObject.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

NumberedObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

NumberedObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedObject.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

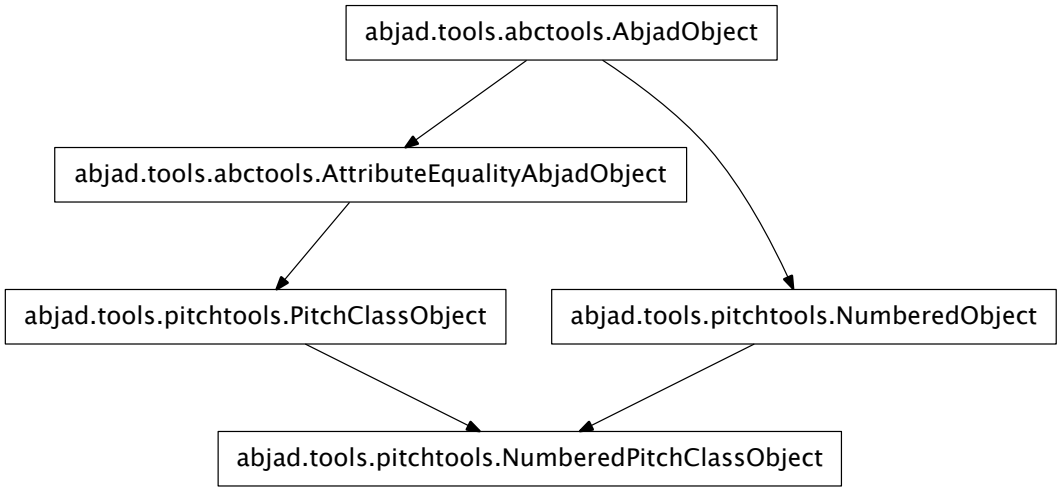
Inherited from abctools.AbjadObject

NumberedObject.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

pitchtools.NumberedPitchClassObject



class pitchtools.**NumberedPitchClassObject**

New in version 2.0. Numbered pitch-class base class.

Read-only Properties

NumberedPitchClassObject.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

NumberedPitchClassObject.**__eq__**(*arg*)

Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NumberedPitchClassObject.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedPitchClassObject.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

NumberedPitchClassObject.**__hash__**()

Inherited from pitchtools.PitchClassObject

NumberedPitchClassObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedPitchClassObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedPitchClassObject.**__ne__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

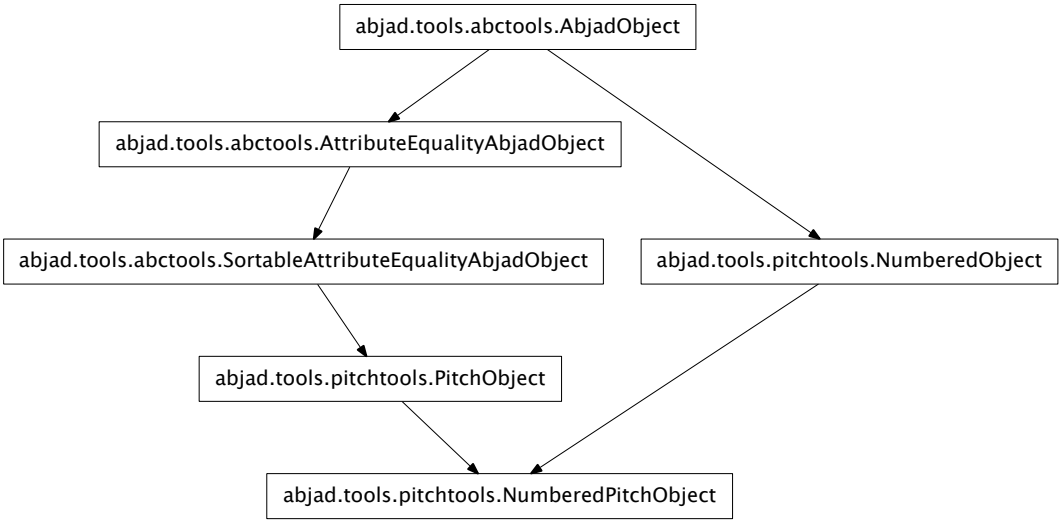
Inherited from abctools.AttributeEqualityAbjadObject

NumberedPitchClassObject.**__repr__**()
Interpreter representation of object defined equal to class name and format string.

Return string.

Inherited from abctools.AttributeEqualityAbjadObject

pitchtools.NumberedPitchObject



class pitchtools.**NumberedPitchObject**
New in version 2.0. Numbered pitch base class from which concrete classes inherit.

Read-only Properties

NumberedPitchObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

NumberedPitchObject.**__abs__**()
Inherited from pitchtools.PitchObject

NumberedPitchObject.**__eq__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NumberedPitchObject.**__float__**()
Inherited from pitchtools.PitchObject

NumberedPitchObject.**__ge__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedPitchObject.**__gt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedPitchObject.**__hash__**()
Inherited from pitchtools.PitchObject

NumberedPitchObject.**__int__**()
Inherited from pitchtools.PitchObject

NumberedPitchObject.**__le__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedPitchObject.**__lt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

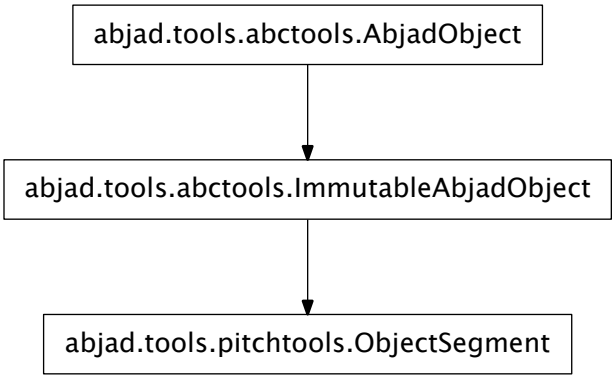
Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedPitchObject.**__ne__**(*arg*)
Inherited from pitchtools.PitchObject

NumberedPitchObject.**__repr__**()
Inherited from pitchtools.PitchObject

pitchtools.ObjectSegment



class pitchtools.**ObjectSegment**(**args*, ***kwargs*)

New in version 2.0. Mix-in base class for ordered collections of pitch objects.

Read-only Properties

ObjectSegment.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

ObjectSegment.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

ObjectSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

Special Methods

ObjectSegment.**__add__**(*arg*)

ObjectSegment.**__contains__**()

x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

ObjectSegment.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

ObjectSegment.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

ObjectSegment.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

ObjectSegment.**__getslice__**(*start*, *stop*)

ObjectSegment.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

ObjectSegment.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

ObjectSegment.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

ObjectSegment.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

ObjectSegment.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

ObjectSegment.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

ObjectSegment.**__mul__**(*n*)

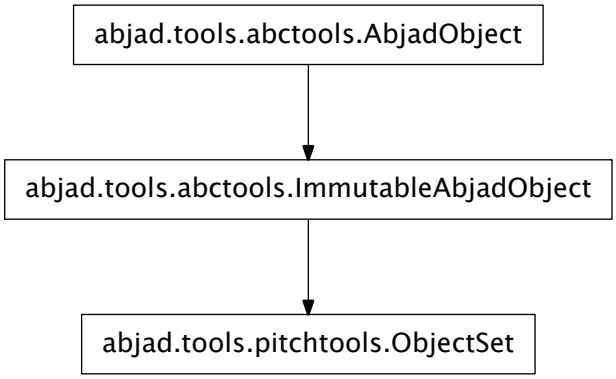
ObjectSegment.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.tuple

ObjectSegment.**__repr__**() <==> *repr(x)*
Inherited from __builtin__.tuple

ObjectSegment.**__rmul__**(*n*)

pitchtools.ObjectSet



class pitchtools.**ObjectSet**(**args*, ***kwargs*)

New in version 2.0. Music-theoretic set base class.

Read-only Properties

ObjectSet.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

ObjectSet.**copy**()

Return a shallow copy of a set.

Inherited from __builtin__.frozenset

ObjectSet.**difference**()

Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

ObjectSet.**intersection**()

Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

ObjectSet.**isdisjoint**()

Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

ObjectSet.**issubset**()

Report whether another set contains this set.

Inherited from __builtin__.frozenset

ObjectSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

ObjectSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

ObjectSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

ObjectSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

ObjectSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

ObjectSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

ObjectSet.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

ObjectSet.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

ObjectSet.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

ObjectSet.**__hash__**(*)* <==> *hash(x)*
Inherited from __builtin__.frozenset

ObjectSet.**__iter__**(*)* <==> *iter(x)*
Inherited from __builtin__.frozenset

ObjectSet.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

ObjectSet.**__len__**(*)* <==> *len(x)*
Inherited from __builtin__.frozenset

ObjectSet.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

ObjectSet.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

ObjectSet.__**or**__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

ObjectSet.__**rand**__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

ObjectSet.__**repr**__() <==> *repr(x)*
Inherited from __builtin__.frozenset

ObjectSet.__**ror**__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

ObjectSet.__**rsub**__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

ObjectSet.__**rxor**__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

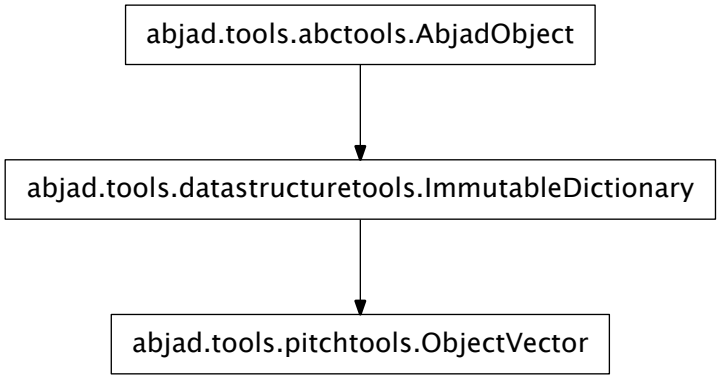
ObjectSet.__**sub**__()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

ObjectSet.__**xor**__()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.ObjectVector



class `pitchtools.`**`ObjectVector`**

New in version 2.0. Music theoretic vector base class.

Read-only Properties

`ObjectVector.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`ObjectVector.`**`clear`**`()` → None. Remove all items from D.
Inherited from `__builtin__.dict`

`ObjectVector.`**`copy`**`()` → a shallow copy of D
Inherited from `__builtin__.dict`

`ObjectVector.`**`get`**`(`$k[, d]$`)` → D[k] if k in D, else d. d defaults to None.
Inherited from `__builtin__.dict`

`ObjectVector.`**`has_key`**`(`k`)` → True if D has a key k, else False
Inherited from `__builtin__.dict`

`ObjectVector.`**`items`**`()` → list of D's (key, value) pairs, as 2-tuples
Inherited from `__builtin__.dict`

`ObjectVector.`**`iteritems`**`()` → an iterator over the (key, value) items of D
Inherited from `__builtin__.dict`

`ObjectVector.`**`iterkeys`**`()` → an iterator over the keys of D
Inherited from `__builtin__.dict`

`ObjectVector.`**`itervalues`**`()` → an iterator over the values of D
Inherited from `__builtin__.dict`

ObjectVector.**keys**() → list of D's keys
Inherited from __builtin__.dict

ObjectVector.**pop**(*k*[, *d*]) → v, remove specified key and return the corresponding value.
If key is not found, d is returned if given, otherwise KeyError is raised

Inherited from __builtin__.dict

ObjectVector.**popitem**() → (k, v), remove and return some (key, value) pair as a
2-tuple; but raise KeyError if D is empty.

Inherited from __builtin__.dict

ObjectVector.**setdefault**(*k*[, *d*]) → D.get(k,d), also set D[k]=d if k not in D
Inherited from __builtin__.dict

ObjectVector.**update**([*E*], ***F*) → None. Update D from dict/iterable E and F.
If E present and has a .keys() method, does: for k in E: D[k] = E[k] If E present and lacks .keys() method, does: for (k, v) in E: D[k] = v In either case, this is followed by: for k in F: D[k] = F[k]

Inherited from __builtin__.dict

ObjectVector.**values**() → list of D's values
Inherited from __builtin__.dict

ObjectVector.**viewitems**() → a set-like object providing a view on D's items
Inherited from __builtin__.dict

ObjectVector.**viewkeys**() → a set-like object providing a view on D's keys
Inherited from __builtin__.dict

ObjectVector.**viewvalues**() → an object providing a view on D's values
Inherited from __builtin__.dict

Special Methods

ObjectVector.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.dict

ObjectVector.**__contains__**(*k*) → True if D has a key k, else False
Inherited from __builtin__.dict

ObjectVector.**__delitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

ObjectVector.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.dict

ObjectVector.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.dict

ObjectVector.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.dict

ObjectVector.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.dict

ObjectVector.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.dict

ObjectVector.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.dict

ObjectVector.**__len__**() <==> *len(x)*
Inherited from __builtin__.dict

ObjectVector.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.dict

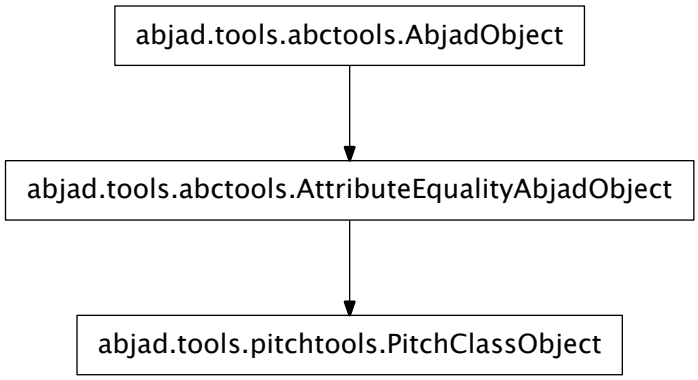
ObjectVector.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.dict

ObjectVector.**__repr__**() <==> *repr(x)*
Inherited from __builtin__.dict

ObjectVector.**__setitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

pitchtools.PitchClassObject



class pitchtools.**PitchClassObject**
New in version 2.0. Pitch-class base class.

Read-only Properties

PitchClassObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

PitchClassObject.**__eq__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

PitchClassObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchClassObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

PitchClassObject.**__hash__**()

PitchClassObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchClassObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PitchClassObject.**__ne__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

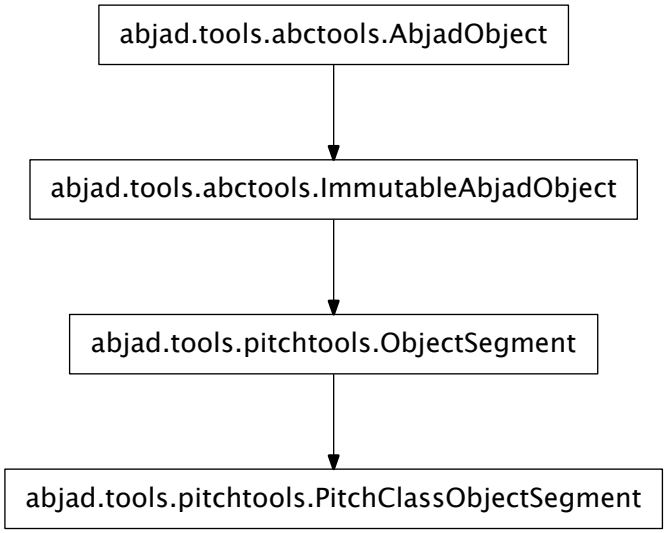
Inherited from abctools.AttributeEqualityAbjadObject

PitchClassObject.**__repr__**()
Interpreter representation of object defined equal to class name and format string.

Return string.

Inherited from abctools.AttributeEqualityAbjadObject

pitchtools.PitchClassObjectSegment



class pitchtools.**PitchClassObjectSegment**(**args*, ***kwargs*)

New in version 2.0. Pitch-class segment base class.

Read-only Properties

PitchClassObjectSegment.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

PitchClassObjectSegment.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

PitchClassObjectSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

Special Methods

PitchClassObjectSegment.**__add__**(*arg*)

Inherited from pitchtools.ObjectSegment

PitchClassObjectSegment.**__contains__**()

x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

PitchClassObjectSegment.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

PitchClassObjectSegment.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

PitchClassObjectSegment.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

PitchClassObjectSegment.**__getslice__**(*start*, *stop*)
Inherited from pitchtools.ObjectSegment

PitchClassObjectSegment.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

PitchClassObjectSegment.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

PitchClassObjectSegment.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

PitchClassObjectSegment.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

PitchClassObjectSegment.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

PitchClassObjectSegment.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

PitchClassObjectSegment.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

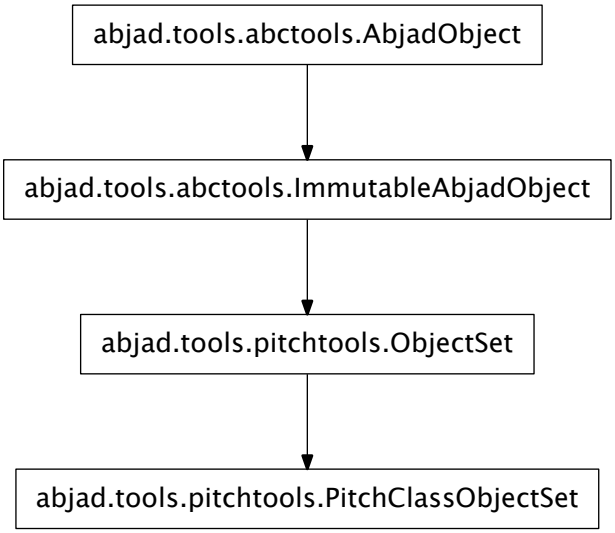
PitchClassObjectSegment.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.tuple

PitchClassObjectSegment.**__repr__**() <==> *repr(x)*
Inherited from __builtin__.tuple

PitchClassObjectSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

pitchtools.PitchClassObjectSet



class pitchtools.**PitchClassObjectSet**(**args*, ***kwargs*)

New in version 2.0. Pitch-class set base class.

Read-only Properties

PitchClassObjectSet.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

PitchClassObjectSet.**copy**()

Return a shallow copy of a set.

Inherited from __builtin__.frozenset

PitchClassObjectSet.**difference**()

Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

PitchClassObjectSet.**intersection**()

Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

PitchClassObjectSet.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

PitchClassObjectSet.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

PitchClassObjectSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

PitchClassObjectSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

PitchClassObjectSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

PitchClassObjectSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

PitchClassObjectSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

PitchClassObjectSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

PitchClassObjectSet.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

PitchClassObjectSet.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

PitchClassObjectSet.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

PitchClassObjectSet.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.frozenset

PitchClassObjectSet.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.frozenset

PitchClassObjectSet.__le__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

PitchClassObjectSet.__len__() <==> *len(x)*
Inherited from __builtin__.frozenset

PitchClassObjectSet.__lt__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

PitchClassObjectSet.__ne__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

PitchClassObjectSet.__or__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

PitchClassObjectSet.__rand__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

PitchClassObjectSet.__repr__() <==> *repr(x)*
Inherited from __builtin__.frozenset

PitchClassObjectSet.__ror__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

PitchClassObjectSet.__rsub__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

PitchClassObjectSet.__rxor__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

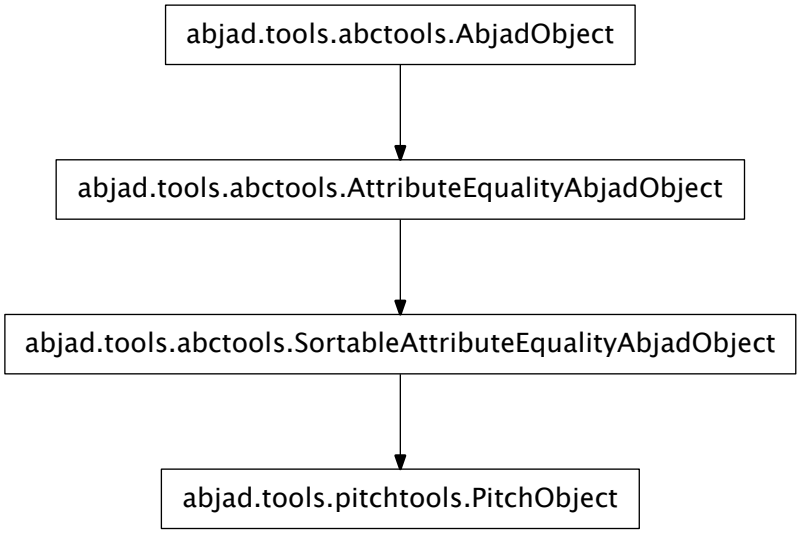
PitchClassObjectSet.__sub__()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

PitchClassObjectSet.__xor__()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.PitchObject



class pitchtools.**PitchObject**
New in version 2.0. Pitch base class.

Read-only Properties

PitchObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

PitchObject.**__abs__**()

PitchObject.**__eq__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

PitchObject.**__float__**()

PitchObject.**__ge__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

PitchObject.**__gt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from `abctools.SortableAttributeEqualityAbjadObject`

`PitchObject.__hash__()`

`PitchObject.__int__()`

`PitchObject.__le__(arg)`
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from `abctools.SortableAttributeEqualityAbjadObject`

`PitchObject.__lt__(arg)`
Initialize new object from *arg* and evaluate comparison attributes.

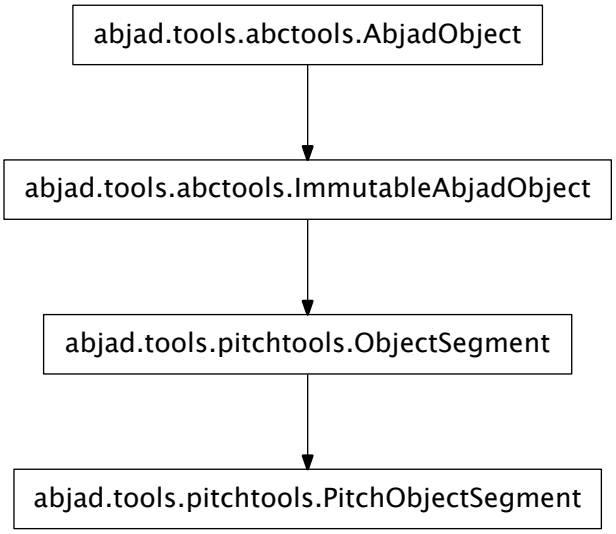
Return boolean.

Inherited from `abctools.SortableAttributeEqualityAbjadObject`

`PitchObject.__ne__(arg)`

`PitchObject.__repr__()`

pitchtools.PitchObjectSegment



class `pitchtools.PitchObjectSegment(*args, **kwargs)`
New in version 2.0. Pitch segment base class.

Read-only Properties

PitchObjectSegment.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

PitchObjectSegment.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.tuple

PitchObjectSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

Special Methods

PitchObjectSegment.**__add__**(*arg*)
Inherited from pitchtools.ObjectSegment

PitchObjectSegment.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

PitchObjectSegment.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

PitchObjectSegment.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

PitchObjectSegment.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

PitchObjectSegment.**__getslice__**(*start*, *stop*)
Inherited from pitchtools.ObjectSegment

PitchObjectSegment.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

PitchObjectSegment.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

PitchObjectSegment.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

PitchObjectSegment.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

PitchObjectSegment.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

PitchObjectSegment.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

PitchObjectSegment.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

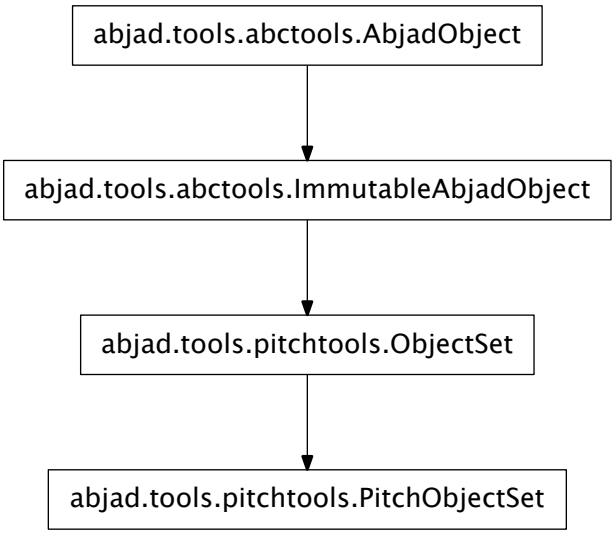
PitchObjectSegment.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.tuple

PitchObjectSegment.**__repr__**() <==> *repr(x)*
Inherited from __builtin__.tuple

PitchObjectSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

pitchtools.PitchObjectSet



class pitchtools.**PitchObjectSet**(**args*, ***kwargs*)
New in version 2.0. Pitch set base class.

Read-only Properties

PitchObjectSet.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

PitchObjectSet.**copy**()
Return a shallow copy of a set.

Inherited from __builtin__.frozenset

PitchObjectSet.**difference**()
Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

PitchObjectSet.**intersection**()
Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

PitchObjectSet.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

PitchObjectSet.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

PitchObjectSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

PitchObjectSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

PitchObjectSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

PitchObjectSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

PitchObjectSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

PitchObjectSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

PitchObjectSet.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

PitchObjectSet.__ge__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

PitchObjectSet.__gt__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

PitchObjectSet.__hash__() <==> *hash(x)*
Inherited from __builtin__.frozenset

PitchObjectSet.__iter__() <==> *iter(x)*
Inherited from __builtin__.frozenset

PitchObjectSet.__le__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

PitchObjectSet.__len__() <==> *len(x)*
Inherited from __builtin__.frozenset

PitchObjectSet.__lt__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

PitchObjectSet.__ne__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

PitchObjectSet.__or__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

PitchObjectSet.__rand__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

PitchObjectSet.__repr__() <==> *repr(x)*
Inherited from __builtin__.frozenset

PitchObjectSet.__ror__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

PitchObjectSet.__rsub__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

PitchObjectSet.__rxor__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

PitchObjectSet.__sub__()
x.__sub__(y) <==> x-y

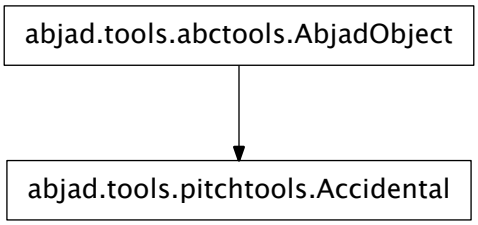
Inherited from __builtin__.frozenset

PitchObjectSet.**__xor__**()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

concrete classes

pitchtools.Accidental



class pitchtools.**Accidental**(*arg=''*)
New in version 2.0. Abjad model of the accidental:

```
>>> pitchtools.Accidental('s')
Accidental('s')
```

Accidentals are immutable.

Read-only Properties

Accidental.**alphabetic_accidental_abbreviation**
Read-only alphabetic string:

```
>>> accidental = pitchtools.Accidental('s')
>>> accidental.alphabetic_accidental_abbreviation
's'
```

Return string.

Accidental.**is_adjusted**
True for all accidentals equal to a nonzero number of semitones. False otherwise:

```
>>> accidental = pitchtools.Accidental('s')
>>> accidental.is_adjusted
True
```

Return boolean.

Accidental.**lilypond_format**
Read-only LilyPond input format of accidental:

```
>>> accidental = pitchtools.Accidental('s')
>>> accidental.lilypond_format
's'
```

Return string.

Accidental.**name**
Read-only name of accidental:

```
>>> accidental = pitchtools.Accidental('s')
>>> accidental.name
'sharp'
```

Return string.

Accidental.**semitones**
Read-only semitones of accidental:

```
>>> accidental = pitchtools.Accidental('s')
>>> accidental.semitones
1
```

Return number.

Accidental.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Accidental.**symbolic_accidental_string**
Read-only symbolic string of accidental:

```
>>> accidental = pitchtools.Accidental('s')
>>> accidental.symbolic_accidental_string
'#'
```

Return string.

Special Methods

Accidental.**__add__**(*arg*)
Accidental.**__eq__**(*arg*)

Accidental.**__ge__**(*arg*)

Accidental.**__gt__**(*arg*)

Accidental.**__le__**(*arg*)

Accidental.**__lt__**(*arg*)

Accidental.**__ne__**(*arg*)

Accidental.**__neg__**()

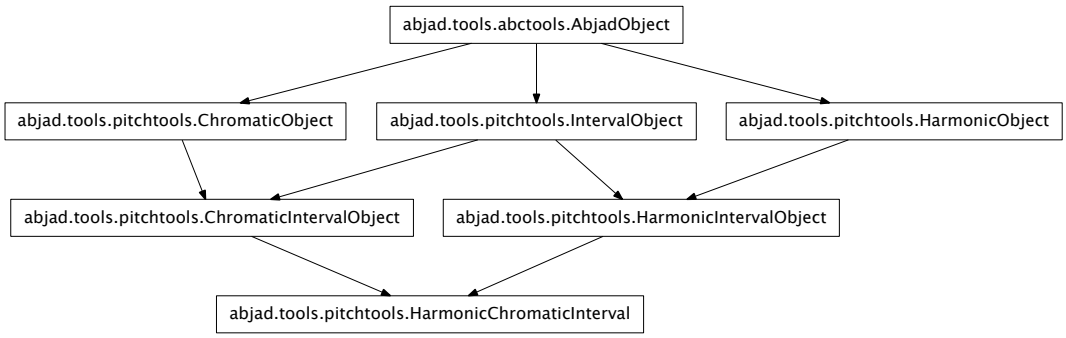
Accidental.**__nonzero__**()

Accidental.**__repr__**()

Accidental.**__str__**()

Accidental.**__sub__**(*arg*)

pitchtools.HarmonicChromaticInterval



class pitchtools.**HarmonicChromaticInterval**(*arg*)

New in version 2.0. Abjad model of harmonic chromatic interval:

```
>>> pitchtools.HarmonicChromaticInterval(-14)
HarmonicChromaticInterval(14)
```

Harmonic chromatic intervals are immutable.

Read-only Properties

HarmonicChromaticInterval.**cents**

Inherited from pitchtools.IntervalObject

HarmonicChromaticInterval.**harmonic_chromatic_interval_class**

Read-only harmonic chromatic interval-class:

```
>>> harmonic_chromatic_interval = pitchtools.HarmonicChromaticInterval(14)
>>> harmonic_chromatic_interval.harmonic_chromatic_interval_class
HarmonicChromaticIntervalClass(2)
```

Return harmonic chromatic interval-class.

HarmonicChromaticInterval.**interval_class**

Inherited from pitchtools.IntervalObject

HarmonicChromaticInterval.**number**

Inherited from pitchtools.ChromaticIntervalObject

HarmonicChromaticInterval.**semitones**

Inherited from pitchtools.ChromaticIntervalObject

HarmonicChromaticInterval.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

HarmonicChromaticInterval.**__abs__**()
Inherited from pitchtools.ChromaticIntervalObject

HarmonicChromaticInterval.**__add__**(*arg*)
Inherited from pitchtools.ChromaticIntervalObject

HarmonicChromaticInterval.**__eq__**(*arg*)
Inherited from pitchtools.ChromaticIntervalObject

HarmonicChromaticInterval.**__float__**()
Inherited from pitchtools.ChromaticIntervalObject

HarmonicChromaticInterval.**__ge__**(*arg*)

HarmonicChromaticInterval.**__gt__**(*arg*)

HarmonicChromaticInterval.**__hash__**()
Inherited from pitchtools.IntervalObject

HarmonicChromaticInterval.**__int__**()
Inherited from pitchtools.ChromaticIntervalObject

HarmonicChromaticInterval.**__le__**(*arg*)

HarmonicChromaticInterval.**__lt__**(*arg*)

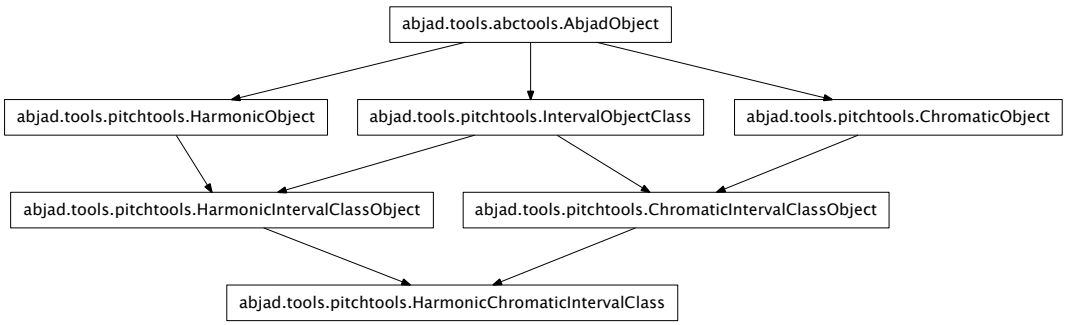
HarmonicChromaticInterval.**__ne__**(*arg*)
Inherited from pitchtools.ChromaticIntervalObject

HarmonicChromaticInterval.**__repr__**()
Inherited from pitchtools.ChromaticIntervalObject

HarmonicChromaticInterval.**__str__**()
Inherited from pitchtools.ChromaticIntervalObject

HarmonicChromaticInterval.**__sub__**(*arg*)
Inherited from pitchtools.ChromaticIntervalObject

pitchtools.HarmonicChromaticIntervalClass



class pitchtools.**HarmonicChromaticIntervalClass**(*token*)
New in version 2.0. Abjad model of harmonic chromatic interval-class:

```
>>> pitchtools.HarmonicChromaticIntervalClass(-14)
HarmonicChromaticIntervalClass(2)
```

Harmonic chromatic interval-classes are immutable.

Read-only Properties

HarmonicChromaticIntervalClass.**number**
Inherited from pitchtools.IntervalObjectClass

HarmonicChromaticIntervalClass.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

HarmonicChromaticIntervalClass.**__abs__**()
Inherited from pitchtools.ChromaticIntervalClassObject

HarmonicChromaticIntervalClass.**__eq__**(*arg*)

HarmonicChromaticIntervalClass.**__float__**()
Inherited from pitchtools.ChromaticIntervalClassObject

HarmonicChromaticIntervalClass.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicChromaticIntervalClass.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

HarmonicChromaticIntervalClass.**__hash__**()
Inherited from pitchtools.IntervalObjectClass

HarmonicChromaticIntervalClass.**__int__**()
Inherited from pitchtools.ChromaticIntervalClassObject

HarmonicChromaticIntervalClass.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicChromaticIntervalClass.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

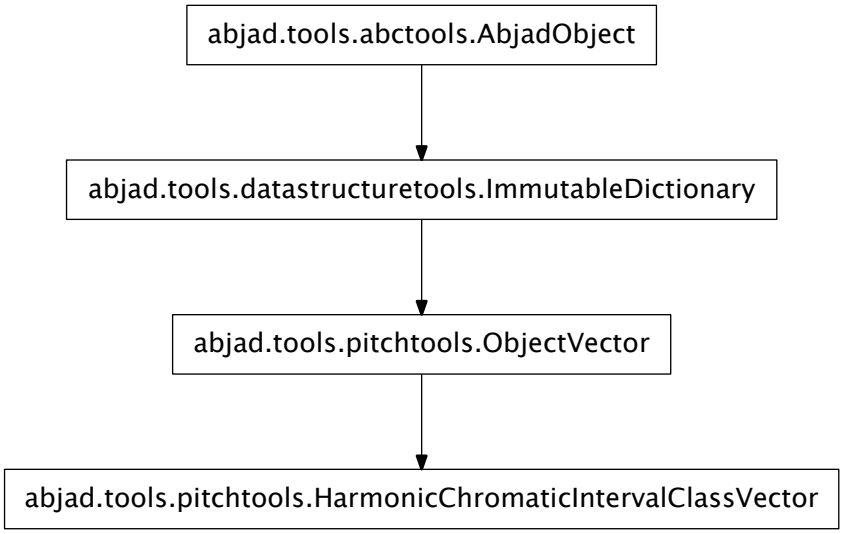
Inherited from abctools.AbjadObject

HarmonicChromaticIntervalClass.**__ne__**(*arg*)

HarmonicChromaticIntervalClass.**__repr__**()
Inherited from pitchtools.IntervalObjectClass

HarmonicChromaticIntervalClass.**__str__**()
Inherited from pitchtools.IntervalObjectClass

pitchtools.HarmonicChromaticIntervalClassVector



class pitchtools.**HarmonicChromaticIntervalClassVector**(*expr*)
New in version 2.0. Abjad model of harmonic chromatic interval-class vector:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8")
>>> hcicv = pitchtools.HarmonicChromaticIntervalClassVector(staff)
>>> print hcicv
0 1 3 2 1 2 0 1 0 0 0 0
```

Harmonic chromatic interval-class vector is quartertone-aware:

```
>>> staff.append(Note(1.5, (1, 4)))
>>> hcicv = pitchtools.HarmonicChromaticIntervalClassVector(staff)
>>> print hcicv
0 1 3 2 1 2 0 1 0 0 0 0
1 1 1 1 0 1 0 0 0 0 0 0
```

Harmonic chromatic interval-class vectors are immutable.

Read-only Properties

HarmonicChromaticIntervalClassVector.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

HarmonicChromaticIntervalClassVector.**clear**() → None. Remove all items from D.

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**copy**() → a shallow copy of D

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**get**(*k*[, *d*]) → D[k] if k in D, else d. d defaults to None.

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**has_key**(*k*) → True if D has a key k, else False

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**has_none_of**(*chromatic_interval_numbers*)

True when harmonic chromatic interval-class vector contains none of *chromatic_interval_numbers*. Otherwise false:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8")

>>> hcicv = pitchtools.HarmonicChromaticIntervalClassVector(staff)
>>> hcicv.has_none_of([9, 10, 11])
True
```

Return boolean.

HarmonicChromaticIntervalClassVector.**items**() → list of D's (key, value) pairs, as 2-tuples

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**iteritems**() → an iterator over the (key, value) items of D

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**iterkeys**() → an iterator over the keys of D

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**itervalues**() → an iterator over the values of D

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**keys**() → list of D's keys

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**pop**(*k*[, *d*]) → v, remove specified key and return the corresponding value.

If key is not found, d is returned if given, otherwise KeyError is raised

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**popitem**() → (k, v), remove and return some (key, value) pair as a

2-tuple; but raise KeyError if D is empty.

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**setdefault**(*k*[, *d*]) → D.get(k,d), also set D[k]=d if k not in D

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**update**([*E*], ***F*) → None. Update D from dict/iterable E and F.

If E present and has a .keys() method, does: for k in E: D[k] = E[k] If E present and lacks .keys() method, does: for (k, v) in E: D[k] = v In either case, this is followed by: for k in F: D[k] = F[k]

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**values**() → list of D's values
Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**viewitems**() → a set-like object providing a view on D's items
Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**viewkeys**() → a set-like object providing a view on D's keys
Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**viewvalues**() → an object providing a view on D's values
Inherited from __builtin__.dict

Special Methods

HarmonicChromaticIntervalClassVector.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__contains__**(*k*) → True if D has a key k, else False
Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__delitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

HarmonicChromaticIntervalClassVector.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__len__**() <==> *len(x)*
Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__ne__**()
x.__ne__(y) <==> x!=y

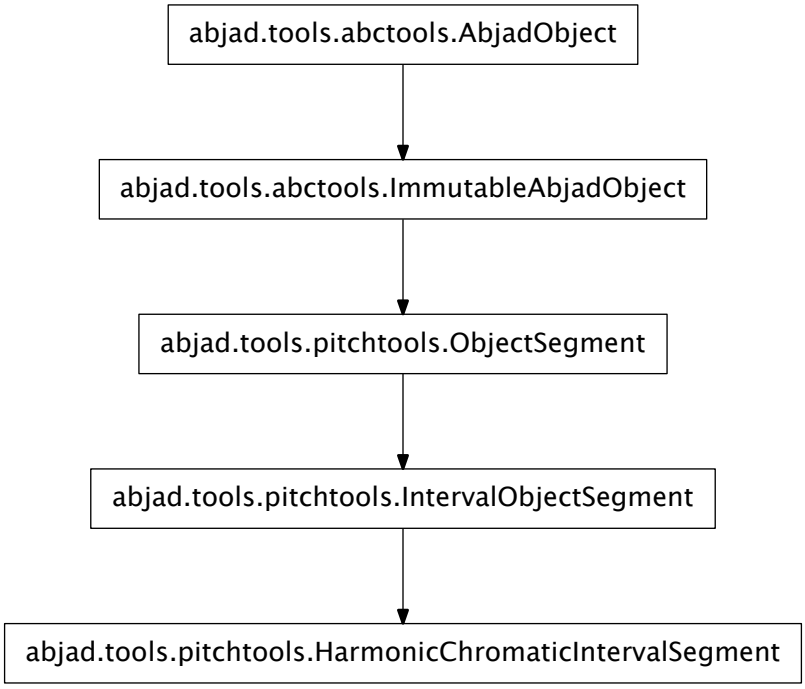
Inherited from __builtin__.dict

HarmonicChromaticIntervalClassVector.**__repr__**()

HarmonicChromaticIntervalClassVector.**__setitem__**(**args*)

HarmonicChromaticIntervalClassVector.**__str__**()

pitchtools.HarmonicChromaticIntervalSegment



class pitchtools.**HarmonicChromaticIntervalSegment**(**args*, ***kwargs*)

New in version 2.0. Abjad model of harmonic chromatic interval segment:

```
>>> pitchtools.HarmonicChromaticIntervalSegment([10, -12, -13, -13.5])
HarmonicChromaticIntervalSegment(10, 12, 13, 13.5)
```

Harmonic chromatic interval segments are immutable.

Read-only Properties

HarmonicChromaticIntervalSegment.**interval_classes**

Inherited from pitchtools.IntervalObjectSegment

HarmonicChromaticIntervalSegment.**intervals**

Inherited from pitchtools.IntervalObjectSegment

HarmonicChromaticIntervalSegment.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

HarmonicChromaticIntervalSegment.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**rotate**(*n*)

Inherited from pitchtools.IntervalObjectSegment

Special Methods

HarmonicChromaticIntervalSegment.**__add__**(*arg*)

Inherited from pitchtools.ObjectSegment

HarmonicChromaticIntervalSegment.**__contains__**()

x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__getitem__**()

x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__getslice__**(*start*, *stop*)

Inherited from pitchtools.ObjectSegment

HarmonicChromaticIntervalSegment.**__gt__**()

x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__hash__**() <==> *hash(x)*

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__iter__**() <==> *iter(x)*

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__le__**()

x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__len__**() <==> *len(x)*

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

HarmonicChromaticIntervalSegment.**__ne__**()
x.__ne__(y) <==> x!=y

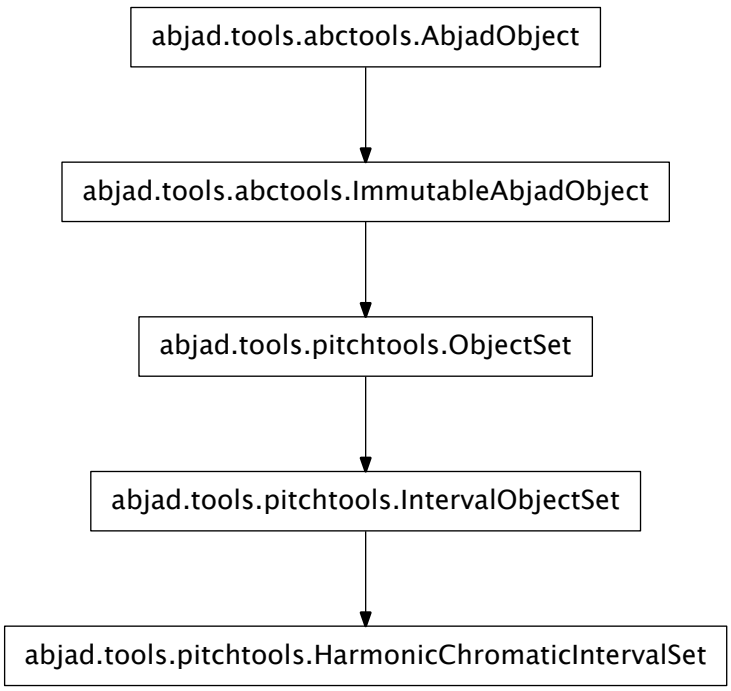
Inherited from __builtin__.tuple

HarmonicChromaticIntervalSegment.**__repr__**()
Inherited from pitchtools.IntervalObjectSegment

HarmonicChromaticIntervalSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

HarmonicChromaticIntervalSegment.**__str__**()
Inherited from pitchtools.IntervalObjectSegment

pitchtools.HarmonicChromaticIntervalSet



class pitchtools.**HarmonicChromaticIntervalSet**(**args*, ***kwargs*)
New in version 2.0. Abjad model of harmonic chromatic interval set:

```
>>> pitchtools.HarmonicChromaticIntervalSet([10, -12, -13, -13, -13.5])
HarmonicChromaticIntervalSet(10, 12, 13, 13.5)
```

Harmonic chromatic interval sets are immutable.

Read-only Properties

HarmonicChromaticIntervalSet.**harmonic_chromatic_interval_numbers**

HarmonicChromaticIntervalSet.**harmonic_chromatic_intervals**

HarmonicChromaticIntervalSet.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

HarmonicChromaticIntervalSet.**copy**()

Return a shallow copy of a set.

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**difference**()

Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**intersection**()

Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**isdisjoint**()

Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**issubset**()

Report whether another set contains this set.

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**issuperset**()

Report whether this set contains another set.

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**symmetric_difference**()

Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**union**()

Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

HarmonicChromaticIntervalSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__len__**() <==> *len(x)*
Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__or__**()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__rand__**()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__repr__**()

HarmonicChromaticIntervalSet.**__ror__**()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__rsub__**()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__rxor__**()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__str__**()

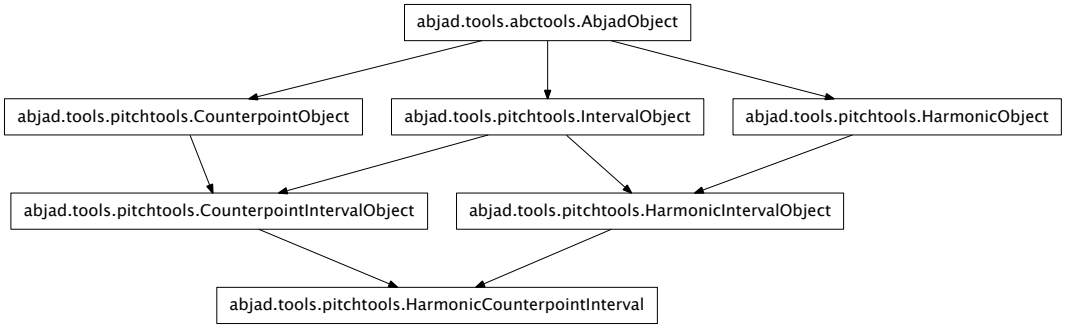
HarmonicChromaticIntervalSet.**__sub__**()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

HarmonicChromaticIntervalSet.**__xor__**()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.HarmonicCounterpointInterval



class pitchtools.**HarmonicCounterpointInterval**(*token*)
New in version 2.0. Abjad model of harmonic counterpoint interval:

```
>>> pitchtools.HarmonicCounterpointInterval(-9)
HarmonicCounterpointInterval(9)
```

Harmonic counterpoint intervals are immutable.

Read-only Properties

HarmonicCounterpointInterval.**cents**
Inherited from pitchtools.IntervalObject

HarmonicCounterpointInterval.**harmonic_counterpoint_interval_class**

HarmonicCounterpointInterval.**interval_class**
Inherited from pitchtools.IntervalObject

HarmonicCounterpointInterval.**number**
Inherited from pitchtools.CounterpointIntervalObject

HarmonicCounterpointInterval.**semitones**
Inherited from pitchtools.CounterpointIntervalObject

HarmonicCounterpointInterval.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

HarmonicCounterpointInterval.**__abs__**()
Inherited from pitchtools.CounterpointIntervalObject

HarmonicCounterpointInterval.**__eq__**(*arg*)

HarmonicCounterpointInterval.**__float__**()
Inherited from pitchtools.CounterpointIntervalObject

HarmonicCounterpointInterval.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicCounterpointInterval.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

HarmonicCounterpointInterval.**__hash__**()
Inherited from pitchtools.IntervalObject

HarmonicCounterpointInterval.**__int__**()
Inherited from pitchtools.CounterpointIntervalObject

HarmonicCounterpointInterval.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicCounterpointInterval.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

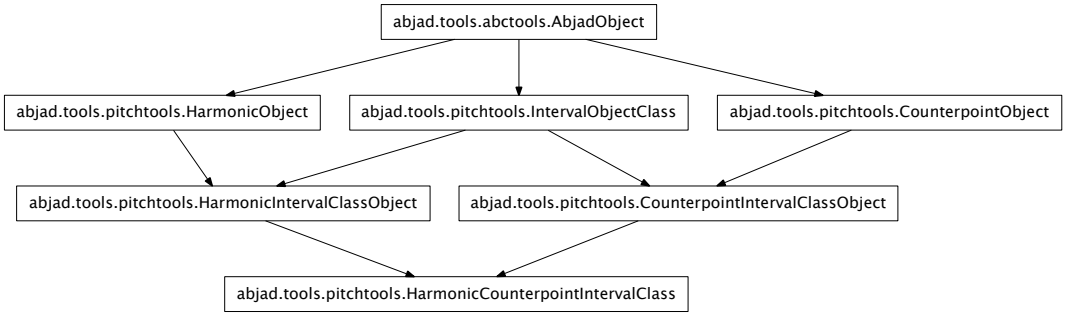
Inherited from abctools.AbjadObject

HarmonicCounterpointInterval.**__ne__**(*arg*)

HarmonicCounterpointInterval.**__repr__**()
Inherited from pitchtools.IntervalObject

HarmonicCounterpointInterval.**__str__**()
Inherited from pitchtools.IntervalObject

pitchtools.HarmonicCounterpointIntervalClass



class pitchtools.**HarmonicCounterpointIntervalClass**(*token*)

New in version 2.0. Abjad model of harmonic counterpoint interval-class:

```
>>> pitchtools.HarmonicCounterpointIntervalClass(-9)
HarmonicCounterpointIntervalClass(2)
```

Harmonic counterpoint interval-classes are immutable.

Read-only Properties

HarmonicCounterpointIntervalClass.**number**

Inherited from pitchtools.IntervalObjectClass

HarmonicCounterpointIntervalClass.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

HarmonicCounterpointIntervalClass.**__abs__**()

Inherited from pitchtools.CounterpointIntervalClassObject

HarmonicCounterpointIntervalClass.**__eq__**(*arg*)

HarmonicCounterpointIntervalClass.**__float__**()

Inherited from pitchtools.CounterpointIntervalClassObject

HarmonicCounterpointIntervalClass.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicCounterpointIntervalClass.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

HarmonicCounterpointIntervalClass.**__hash__**()
Inherited from pitchtools.IntervalObjectClass

HarmonicCounterpointIntervalClass.**__int__**()
Inherited from pitchtools.CounterpointIntervalClassObject

HarmonicCounterpointIntervalClass.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicCounterpointIntervalClass.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

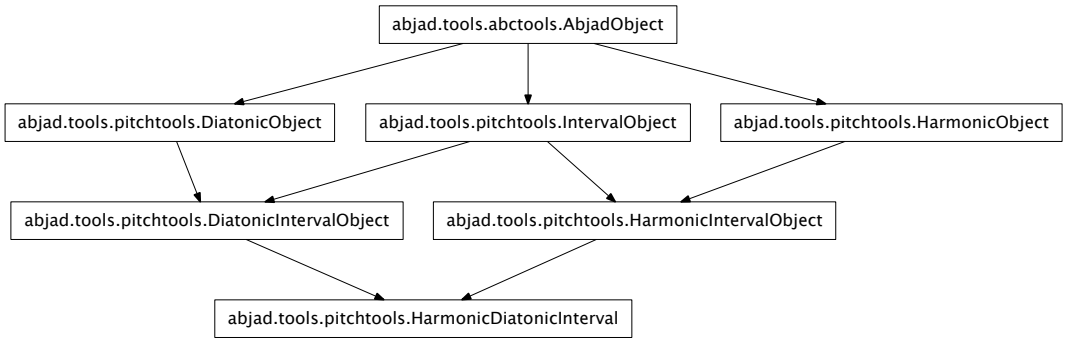
Inherited from abctools.AbjadObject

HarmonicCounterpointIntervalClass.**__ne__**(*arg*)

HarmonicCounterpointIntervalClass.**__repr__**()
Inherited from pitchtools.IntervalObjectClass

HarmonicCounterpointIntervalClass.**__str__**()
Inherited from pitchtools.IntervalObjectClass

pitchtools.HarmonicDiatonicInterval



class pitchtools.**HarmonicDiatonicInterval**(**args*)
New in version 2.0. Abjad model harmonic diatonic interval:

```
>>> pitchtools.HarmonicDiatonicInterval('M9')
HarmonicDiatonicInterval('M9')
```

Harmonic diatonic intervals are immutable.

Read-only Properties

HarmonicDiatonicInterval.**cents**
Inherited from pitchtools.IntervalObject

HarmonicDiatonicInterval.**diatonic_interval_class**
Inherited from pitchtools.DiatonicIntervalObject

HarmonicDiatonicInterval.**harmonic_counterpoint_interval**

HarmonicDiatonicInterval.**harmonic_diatonic_interval_class**

HarmonicDiatonicInterval.**interval_class**
Inherited from pitchtools.DiatonicIntervalObject

HarmonicDiatonicInterval.**interval_string**
Inherited from pitchtools.DiatonicIntervalObject

HarmonicDiatonicInterval.**melodic_diatonic_interval_ascending**

HarmonicDiatonicInterval.**melodic_diatonic_interval_descending**

HarmonicDiatonicInterval.**number**
Inherited from pitchtools.DiatonicIntervalObject

HarmonicDiatonicInterval.**quality_string**
Inherited from pitchtools.DiatonicIntervalObject

HarmonicDiatonicInterval.**semitones**

HarmonicDiatonicInterval.**staff_spaces**

HarmonicDiatonicInterval.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

HarmonicDiatonicInterval.**__abs__**()
Inherited from pitchtools.DiatonicIntervalObject

HarmonicDiatonicInterval.**__eq__**(*arg*)
Inherited from pitchtools.DiatonicIntervalObject

HarmonicDiatonicInterval.**__float__**()
Inherited from pitchtools.DiatonicIntervalObject

HarmonicDiatonicInterval.**__ge__**(*arg*)

HarmonicDiatonicInterval.**__gt__**(*arg*)

HarmonicDiatonicInterval.**__hash__**()
Inherited from pitchtools.IntervalObject

HarmonicDiatonicInterval.**__int__**()
Inherited from pitchtools.DiatonicIntervalObject

HarmonicDiatonicInterval.**__le__**(*arg*)

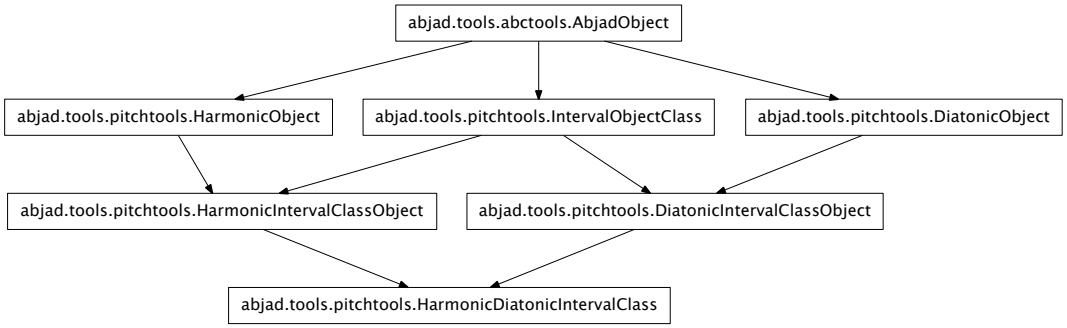
HarmonicDiatonicInterval.**__lt__**(*arg*)

HarmonicDiatonicInterval.**__ne__**(*arg*)
Inherited from pitchtools.DiatonicIntervalObject

HarmonicDiatonicInterval.**__repr__**()

HarmonicDiatonicInterval.**__str__**()

pitchtools.HarmonicDiatonicIntervalClass



class pitchtools.**HarmonicDiatonicIntervalClass**(**args*)

New in version 2.0. Abjad model harmonic diatonic interval-class:

```
>>> pitchtools.HarmonicDiatonicIntervalClass('-M9')
HarmonicDiatonicIntervalClass('M2')
```

Harmonic diatonic interval-classes are immutable.

Read-only Properties

HarmonicDiatonicIntervalClass.**number**

Inherited from pitchtools.IntervalObjectClass

HarmonicDiatonicIntervalClass.**quality_string**

Inherited from pitchtools.DiatonicIntervalClassObject

HarmonicDiatonicIntervalClass.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

HarmonicDiatonicIntervalClass.**invert**()

Read-only inversion of harmonic diatonic interval-class:

```
>>> hdic = pitchtools.HarmonicDiatonicIntervalClass('major', -9)
>>> hdic.invert()
HarmonicDiatonicIntervalClass('m7')
```

Return harmonic diatonic interval-class.

Special Methods

HarmonicDiatonicIntervalClass.**__abs__**()

Inherited from pitchtools.DiatonicIntervalClassObject

HarmonicDiatonicIntervalClass.**__eq__**(*arg*)

HarmonicDiatonicIntervalClass.__float__()
Inherited from pitchtools.DiatonicIntervalClassObject

HarmonicDiatonicIntervalClass.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicDiatonicIntervalClass.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

HarmonicDiatonicIntervalClass.__hash__()
Inherited from pitchtools.IntervalObjectClass

HarmonicDiatonicIntervalClass.__int__()
Inherited from pitchtools.DiatonicIntervalClassObject

HarmonicDiatonicIntervalClass.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HarmonicDiatonicIntervalClass.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

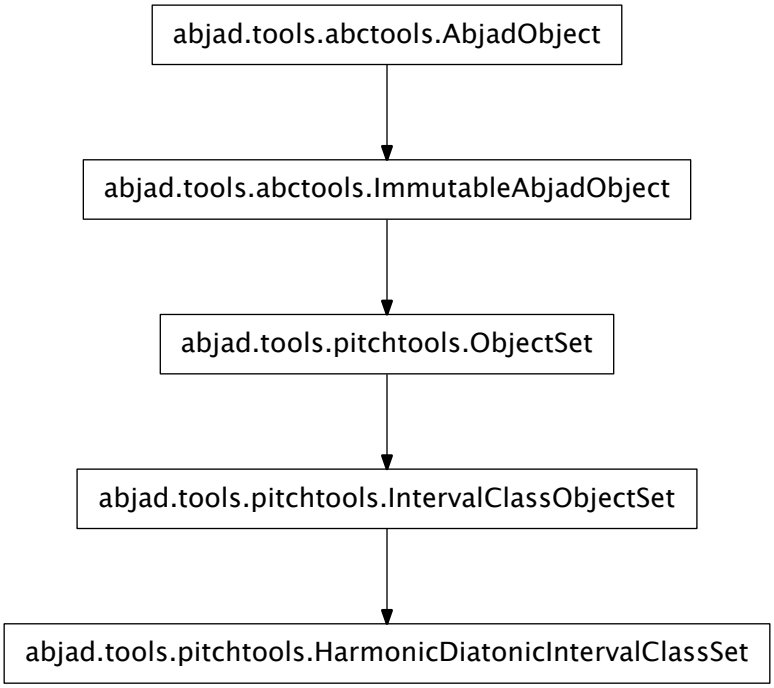
Inherited from abctools.AbjadObject

HarmonicDiatonicIntervalClass.__ne__(*arg*)

HarmonicDiatonicIntervalClass.__repr__()
Inherited from pitchtools.DiatonicIntervalClassObject

HarmonicDiatonicIntervalClass.__str__()

pitchtools.HarmonicDiatonicIntervalClassSet



class pitchtools.**HarmonicDiatonicIntervalClassSet**(**args*, ***kwargs*)

New in version 2.0. Abjad model of harmonic diatonic interval-class set:

```
>>> pitchtools.HarmonicDiatonicIntervalClassSet('m2 M2 m3 M3')
HarmonicDiatonicIntervalClassSet('m2 M2 m3 M3')
```

Harmonic diatonic interval-class sets are immutable.

Read-only Properties

HarmonicDiatonicIntervalClassSet.**harmonic_diatonic_interval_classes**

HarmonicDiatonicIntervalClassSet.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

HarmonicDiatonicIntervalClassSet.**copy**()

Return a shallow copy of a set.

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**difference**()

Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**intersection**()
Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

HarmonicDiatonicIntervalClassSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**hash**__() <==> *hash(x)*
Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**len**__() <==> *len(x)*
Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**or**__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**rand**__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**repr**__()

HarmonicDiatonicIntervalClassSet.__**ror**__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**rsub**__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**rxor**__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**str**__()

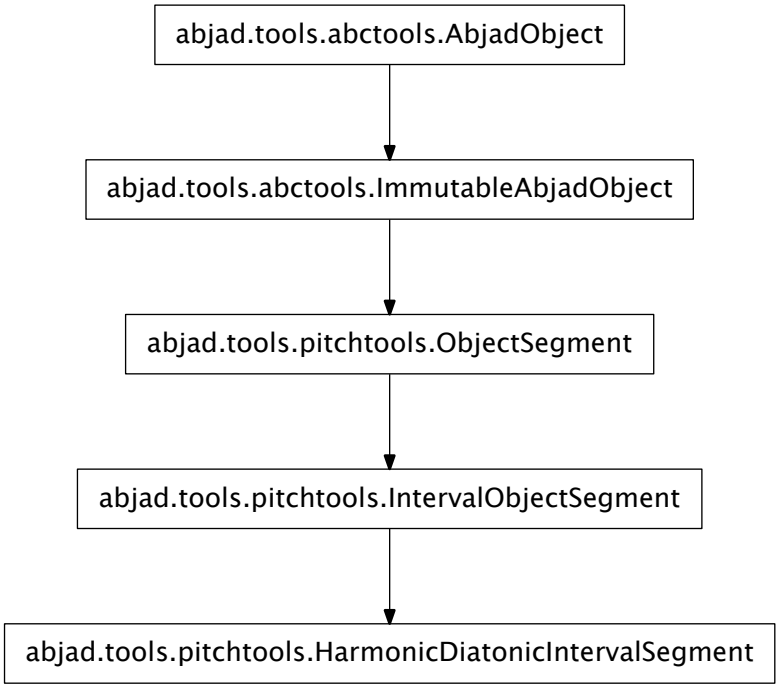
HarmonicDiatonicIntervalClassSet.__**sub**__()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalClassSet.__**xor**__()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.HarmonicDiatonicIntervalSegment



class pitchtools.**HarmonicDiatonicIntervalSegment**(**args*, ***kwargs*)

New in version 2.0. Abjad model of harmonic diatonic interval segment:

```
>>> pitchtools.HarmonicDiatonicIntervalSegment('m2 M9 m3 M3')
HarmonicDiatonicIntervalSegment('m2 M9 m3 M3')
```

Harmonic diatonic interval segments are immutable.

Read-only Properties

HarmonicDiatonicIntervalSegment.**harmonic_chromatic_interval_segment**

HarmonicDiatonicIntervalSegment.**interval_classes**

Inherited from pitchtools.IntervalObjectSegment

HarmonicDiatonicIntervalSegment.**intervals**

Inherited from pitchtools.IntervalObjectSegment

HarmonicDiatonicIntervalSegment.**melodic_chromatic_interval_segment**

HarmonicDiatonicIntervalSegment.**melodic_diatonic_interval_segment**

HarmonicDiatonicIntervalSegment.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

HarmonicDiatonicIntervalSegment.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**rotate**(*n*)

Inherited from pitchtools.IntervalObjectSegment

Special Methods

HarmonicDiatonicIntervalSegment.**__add__**(*arg*)

Inherited from pitchtools.ObjectSegment

HarmonicDiatonicIntervalSegment.**__contains__**()

x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__getitem__**()

x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__getslice__**(*start*, *stop*)

Inherited from pitchtools.ObjectSegment

HarmonicDiatonicIntervalSegment.**__gt__**()

x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__hash__**() <==> *hash(x)*

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__iter__**() <==> *iter(x)*

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__le__**()

x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__len__**() <==> *len(x)*

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__lt__**()

x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

HarmonicDiatonicIntervalSegment.**__ne__**()
x.__ne__(y) <==> x!=y

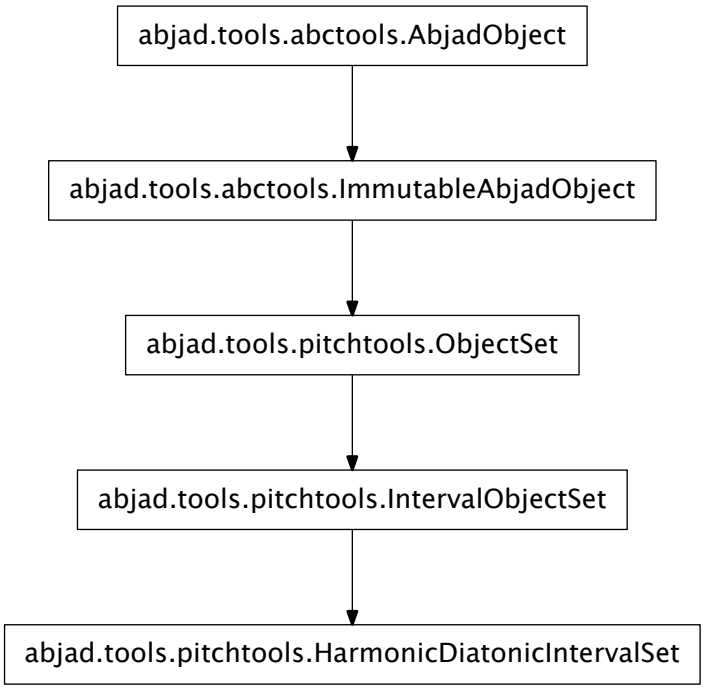
Inherited from __builtin__.tuple

HarmonicDiatonicIntervalSegment.**__repr__**()

HarmonicDiatonicIntervalSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

HarmonicDiatonicIntervalSegment.**__str__**()
Inherited from pitchtools.IntervalObjectSegment

pitchtools.HarmonicDiatonicIntervalSet



class pitchtools.**HarmonicDiatonicIntervalSet**(**args*, ***kwargs*)
New in version 2.0. Abjad model of harmonic diatonic interval set:

```
>>> pitchtools.HarmonicDiatonicIntervalSet('m2 m2 M2 M9')
HarmonicDiatonicIntervalSet('m2 M2 M9')
```

Harmonic diatonic interval sets are immutable.

Read-only Properties

HarmonicDiatonicIntervalSet.**harmonic_chromatic_interval_set**
HarmonicDiatonicIntervalSet.**harmonic_diatonic_interval_numbers**

HarmonicDiatonicIntervalSet.**harmonic_diatonic_intervals**

HarmonicDiatonicIntervalSet.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

HarmonicDiatonicIntervalSet.**copy**()
Return a shallow copy of a set.

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**difference**()
Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**intersection**()
Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

HarmonicDiatonicIntervalSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__len__**() <==> *len(x)*
Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__or__**()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__rand__**()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__repr__**()

HarmonicDiatonicIntervalSet.**__ror__**()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__rsub__**()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__rxor__**()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__str__**()

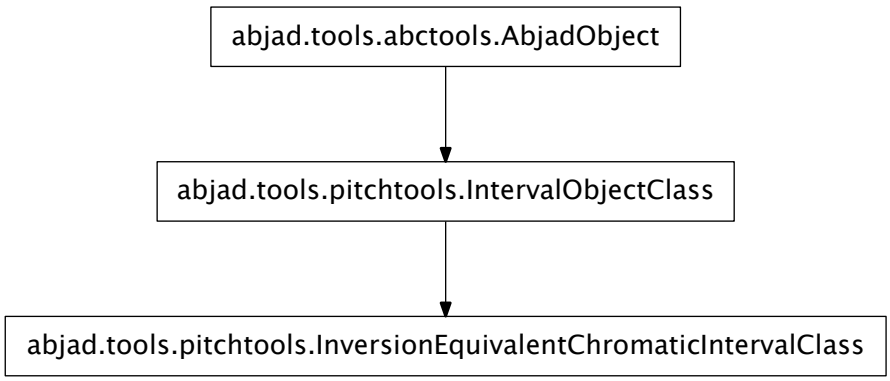
HarmonicDiatonicIntervalSet.**__sub__**()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

HarmonicDiatonicIntervalSet.**__xor__**()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.InversionEquivalentChromaticIntervalClass



class pitchtools.**InversionEquivalentChromaticIntervalClass**(*interval_class_token*)
New in version 2.0. Abjad model of inversion-equivalent chromatic interval-class:

```
>>> pitchtools.InversionEquivalentChromaticIntervalClass(1)
InversionEquivalentChromaticIntervalClass(1)
```

Inversion-equivalent chromatic interval-classes are immutable.

Read-only Properties
InversionEquivalentChromaticIntervalClass.**inversion_equivalent_chromatic_interval_number**

InversionEquivalentChromaticIntervalClass.**number**
Inherited from pitchtools.IntervalObjectClass

InversionEquivalentChromaticIntervalClass.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

InversionEquivalentChromaticIntervalClass.**__abs__**()
InversionEquivalentChromaticIntervalClass.**__eq__**(*arg*)

InversionEquivalentChromaticIntervalClass.**__float__**()
Inherited from pitchtools.IntervalObjectClass

InversionEquivalentChromaticIntervalClass.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

InversionEquivalentChromaticIntervalClass.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

InversionEquivalentChromaticIntervalClass.**__hash__**()

InversionEquivalentChromaticIntervalClass.**__int__**()
Inherited from pitchtools.IntervalObjectClass

InversionEquivalentChromaticIntervalClass.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

InversionEquivalentChromaticIntervalClass.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

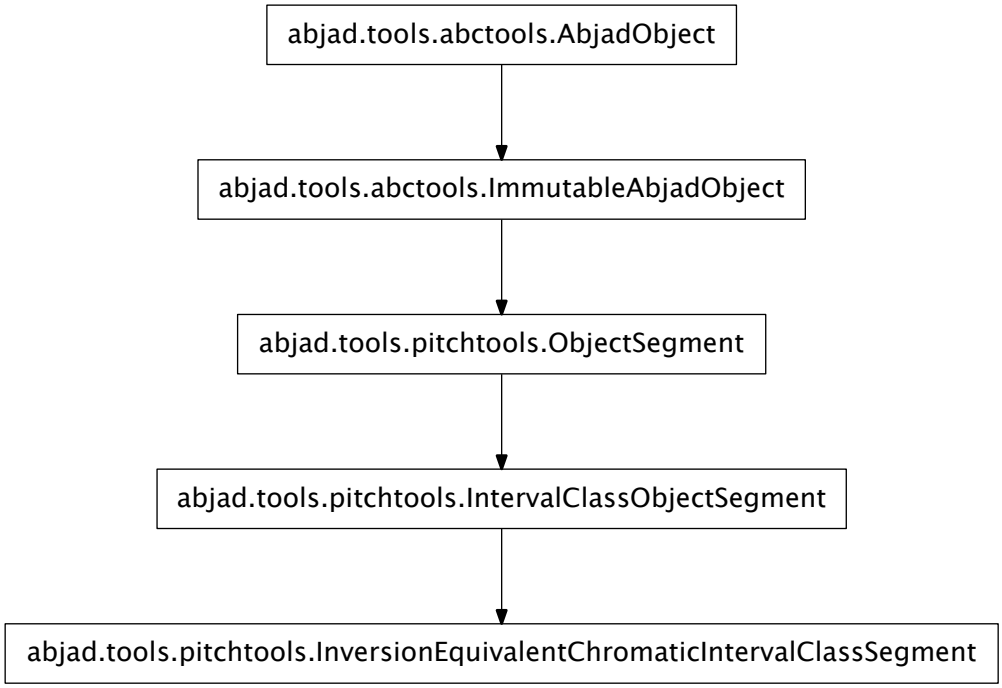
InversionEquivalentChromaticIntervalClass.**__ne__**(*arg*)

InversionEquivalentChromaticIntervalClass.**__neg__**()

InversionEquivalentChromaticIntervalClass.**__repr__**()

InversionEquivalentChromaticIntervalClass.**__str__**()

pitchtools.InversionEquivalentChromaticIntervalClassSegment



class pitchtools.**InversionEquivalentChromaticIntervalClassSegment**(**args*, ***kwargs*)

New in version 2.0. Abjad model of inversion-equivalent chromatic interval-class segment:

```
>>> pitchtools.InversionEquivalentChromaticIntervalClassSegment([2, 1, 0, 5.5, 6])
InversionEquivalentChromaticIntervalClassSegment(2, 1, 0, 5.5, 6)
```

Inversion-equivalent chromatic interval-class segments are immutable.

Read-only Properties

InversionEquivalentChromaticIntervalClassSegment.**interval_class_numbers**

Inherited from pitchtools.IntervalClassObjectSegment

InversionEquivalentChromaticIntervalClassSegment.**interval_classes**

Inherited from pitchtools.IntervalClassObjectSegment

InversionEquivalentChromaticIntervalClassSegment.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

InversionEquivalentChromaticIntervalClassSegment.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

Special Methods

InversionEquivalentChromaticIntervalClassSegment.**__add__**(*arg*)

Inherited from pitchtools.ObjectSegment

InversionEquivalentChromaticIntervalClassSegment.**__contains__**()

x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__getitem__**()

x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__getslice__**(*start*, *stop*)

Inherited from pitchtools.ObjectSegment

InversionEquivalentChromaticIntervalClassSegment.**__gt__**()

x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__hash__**() <==> *hash(x)*

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__iter__**() <==> *iter(x)*

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__le__**()

x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__len__**() <==> *len(x)*

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__lt__**()

x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__mul__**(*n*)

Inherited from pitchtools.ObjectSegment

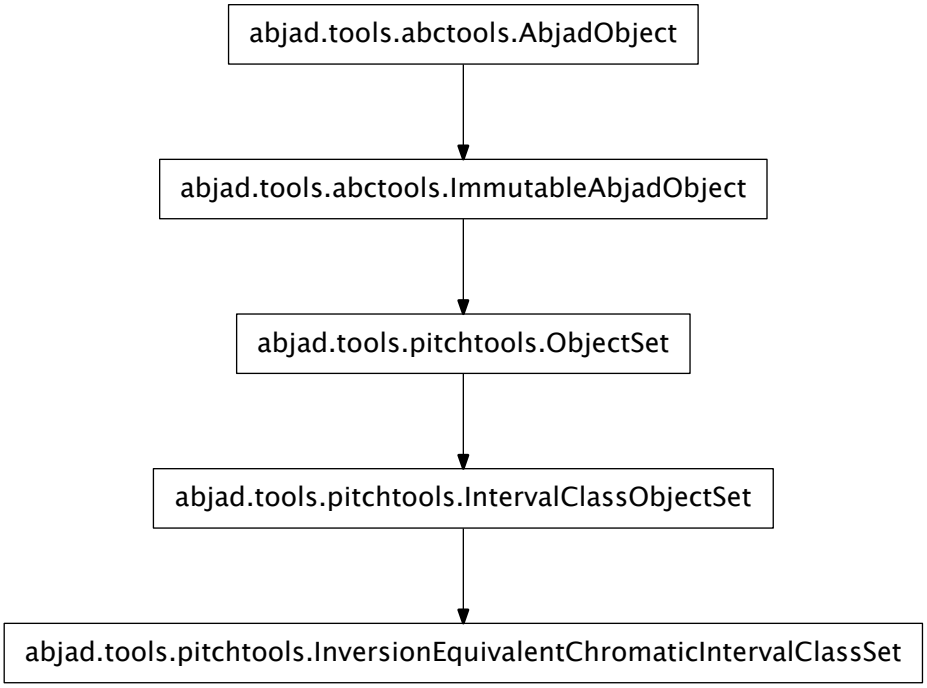
InversionEquivalentChromaticIntervalClassSegment.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.tuple

InversionEquivalentChromaticIntervalClassSegment.**__repr__**()

InversionEquivalentChromaticIntervalClassSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

pitchtools.InversionEquivalentChromaticIntervalClassSet



class pitchtools.**InversionEquivalentChromaticIntervalClassSet**(**args*, ***kwargs*)
New in version 2.0. Abjad model of inversion-equivalent chromatic interval-class set:

```
>>> pitchtools.InversionEquivalentChromaticIntervalClassSet([1, 1, 6, 2, 2])
InversionEquivalentChromaticIntervalClassSet(1, 2, 6)
```

Inversion-equivalent chromatic interval-class sets are immutable.

Read-only Properties

InversionEquivalentChromaticIntervalClassSet.**inversion_equivalent_chromatic_interval_class_**
InversionEquivalentChromaticIntervalClassSet.**inversion_equivalent_chromatic_interval_classe**

InversionEquivalentChromaticIntervalClassSet.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

InversionEquivalentChromaticIntervalClassSet.**copy**()
Return a shallow copy of a set.

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.**difference**()
Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.**intersection**()
Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

InversionEquivalentChromaticIntervalClassSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**eq**__()
x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**ge**__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**hash**__() <==> *hash(x)*
Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**len**__() <==> *len(x)*
Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**or**__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**rand**__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**repr**__()

InversionEquivalentChromaticIntervalClassSet.__**ror**__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**rsub**__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.__**rxor**__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

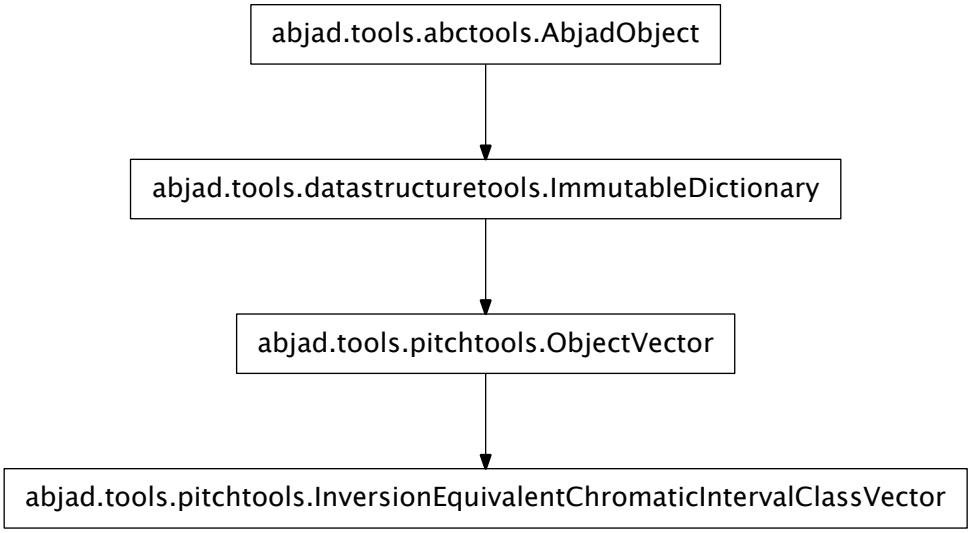
InversionEquivalentChromaticIntervalClassSet.**__sub__**()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

InversionEquivalentChromaticIntervalClassSet.**__xor__**()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.InversionEquivalentChromaticIntervalClassVector



class pitchtools.**InversionEquivalentChromaticIntervalClassVector**(**args*, ***kwargs*)

New in version 2.0. Abjad model of inversion-equivalent chromatic interval-class vector:

```
>>> pitchtools.InversionEquivalentChromaticIntervalClassVector([1, 1, 6, 2, 2, 2])
InversionEquivalentChromaticIntervalClassVector(0 | 2 3 0 0 0 1)
```

Initialize by inversion-equivalent chromatic interval-class counts:

```
>>> pitchtools.InversionEquivalentChromaticIntervalClassVector(counts=[2, 3, 0, 0, 0, 1])
InversionEquivalentChromaticIntervalClassVector(0 | 2 3 0 0 0 1)
```

Inversion-equivalent chromatic interval-class vectors are immutable.

Read-only Properties

InversionEquivalentChromaticIntervalClassVector.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

InversionEquivalentChromaticIntervalClassVector.**clear**() → None. Remove all items from D.

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**copy**() → a shallow copy of D

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**get**(*k*[, *d*]) → D[k] if k in D, else d. d defaults to None.

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**has_key**(*k*) → True if D has a key k, else False

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**items**() → list of D's (key, value) pairs, as 2-tuples

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**iteritems**() → an iterator over the (key, value) items of D

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**iterkeys**() → an iterator over the keys of D

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**itervalues**() → an iterator over the values of D

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**keys**() → list of D's keys

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**pop**(*k*[, *d*]) → v, remove specified key and return the corresponding value.

If key is not found, d is returned if given, otherwise KeyError is raised

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**popitem**() → (k, v), remove and return some (key, value) pair as a

2-tuple; but raise KeyError if D is empty.

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**setdefault**(*k*[, *d*]) → D.get(k,d), also set D[k]=d if k not in D

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**update**([*E*], ***F*) → None. Update D from dict/iterable E and F.

If E present and has a .keys() method, does: for k in E: D[k] = E[k] If E present and lacks .keys() method, does: for (k, v) in E: D[k] = v In either case, this is followed by: for k in F: D[k] = F[k]

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**values**() → list of D's values

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**viewitems**() → a set-like object providing a view on D's items

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**viewkeys**() → a set-like object providing a view on D's keys

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**viewvalues**() → an object providing a view on D's values

Inherited from __builtin__.dict

Special Methods

InversionEquivalentChromaticIntervalClassVector.**__cmp__**(*y*) <==> *cmp(x, y)*

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__contains__**(*k*) → True if D has a key k, else False

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__delitem__**(**args*)

Inherited from datastructuretools.ImmutableDictionary

InversionEquivalentChromaticIntervalClassVector.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__getitem__**()

x.__getitem__(y) <==> x[y]

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__gt__**()

x.__gt__(y) <==> x>y

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__iter__**() <==> *iter(x)*

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__le__**()

x.__le__(y) <==> x<=y

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__len__**() <==> *len(x)*

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__lt__**()

x.__lt__(y) <==> x<y

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__ne__**()

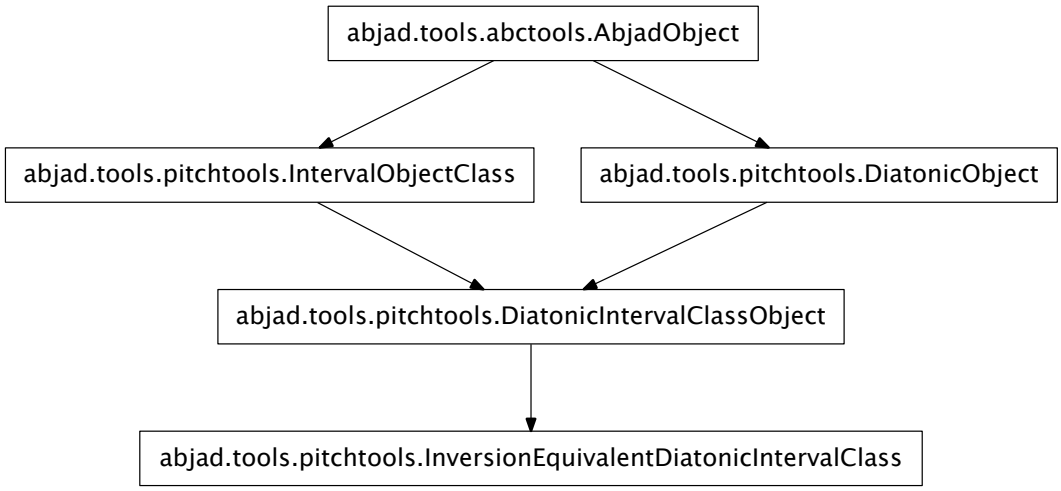
x.__ne__(y) <==> x!=y

Inherited from __builtin__.dict

InversionEquivalentChromaticIntervalClassVector.**__repr__**()

InversionEquivalentChromaticIntervalClassVector.**__setitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

pitchtools.InversionEquivalentDiatonicIntervalClass



class pitchtools.**InversionEquivalentDiatonicIntervalClass**(**args*)
New in version 2.0. Abjad model of inversion-equivalent diatonic interval-class:

```
>>> pitchtools.InversionEquivalentDiatonicIntervalClass('-m14')
InversionEquivalentDiatonicIntervalClass('M2')
```

Inversion-equivalent diatonic interval-classes are immutable.

Read-only Properties

InversionEquivalentDiatonicIntervalClass.**number**
Inherited from pitchtools.IntervalObjectClass

InversionEquivalentDiatonicIntervalClass.**quality_string**
Inherited from pitchtools.DiatonicIntervalClassObject

InversionEquivalentDiatonicIntervalClass.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

InversionEquivalentDiatonicIntervalClass.**__abs__**()
Inherited from pitchtools.DiatonicIntervalClassObject

InversionEquivalentDiatonicIntervalClass.**__eq__**(*arg*)

InversionEquivalentDiatonicIntervalClass.__float__()
Inherited from pitchtools.DiatonicIntervalClassObject

InversionEquivalentDiatonicIntervalClass.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

InversionEquivalentDiatonicIntervalClass.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

InversionEquivalentDiatonicIntervalClass.__hash__()
Inherited from pitchtools.IntervalObjectClass

InversionEquivalentDiatonicIntervalClass.__int__()
Inherited from pitchtools.DiatonicIntervalClassObject

InversionEquivalentDiatonicIntervalClass.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

InversionEquivalentDiatonicIntervalClass.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

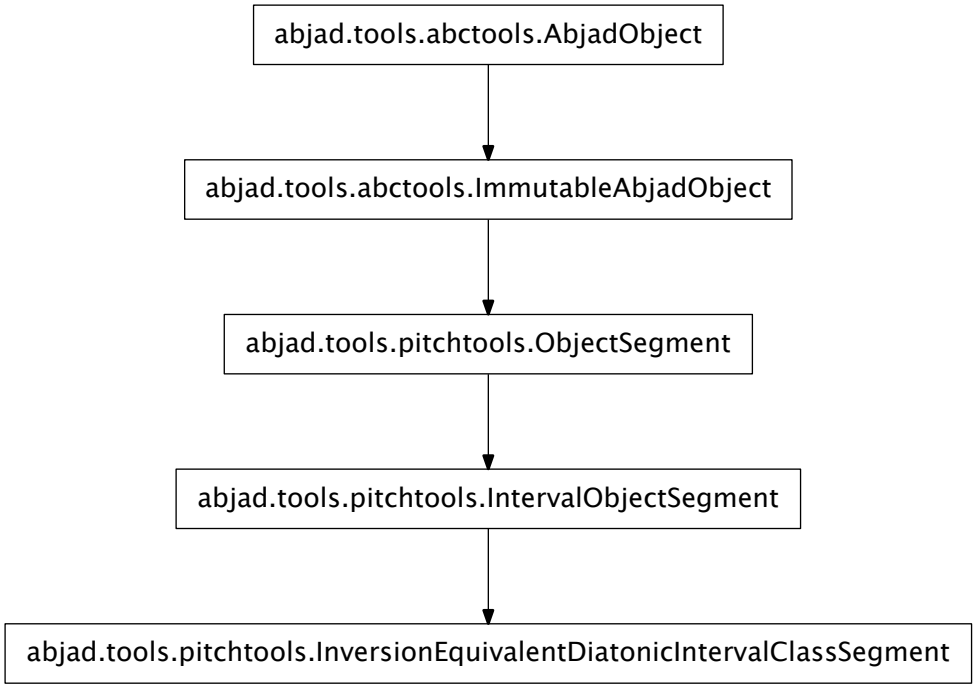
Inherited from abctools.AbjadObject

InversionEquivalentDiatonicIntervalClass.__ne__(*arg*)

InversionEquivalentDiatonicIntervalClass.__repr__()
Inherited from pitchtools.DiatonicIntervalClassObject

InversionEquivalentDiatonicIntervalClass.__str__()
Inherited from pitchtools.DiatonicIntervalClassObject

pitchtools.InversionEquivalentDiatonicIntervalClassSegment



class pitchtools.**InversionEquivalentDiatonicIntervalClassSegment**(**args*, ***kwargs*)

New in version 2.0. Abjad model of inversion-equivalent diatonic interval-class segment:

```
>>> pitchtools.InversionEquivalentDiatonicIntervalClassSegment(
... [('major', 2), ('major', 9), ('minor', -2), ('minor', -9)])
InversionEquivalentDiatonicIntervalClassSegment(M2, M2, m2, m2)
```

Inversion-equivalent diatonic interval-class segments are immutable.

Read-only Properties

InversionEquivalentDiatonicIntervalClassSegment.**interval_classes**

Inherited from pitchtools.IntervalObjectSegment

InversionEquivalentDiatonicIntervalClassSegment.**intervals**

Inherited from pitchtools.IntervalObjectSegment

InversionEquivalentDiatonicIntervalClassSegment.**is_tertian**

True when all diatonic interval-classes in segment are tertian. Otherwise false:

```
>>> dics = pitchtools.InversionEquivalentDiatonicIntervalClassSegment(
... [('major', 3), ('minor', 6), ('major', 6)])
>>> dics.is_tertian
True
```

Return boolean.

InversionEquivalentDiatonicIntervalClassSegment.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

InversionEquivalentDiatonicIntervalClassSegment.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**rotate**(*n*)
Inherited from pitchtools.IntervalObjectSegment

Special Methods

InversionEquivalentDiatonicIntervalClassSegment.**__add__**(*arg*)
Inherited from pitchtools.ObjectSegment

InversionEquivalentDiatonicIntervalClassSegment.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__getslice__**(*start*, *stop*)
Inherited from pitchtools.ObjectSegment

InversionEquivalentDiatonicIntervalClassSegment.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

InversionEquivalentDiatonicIntervalClassSegment.**__ne__**()
x.__ne__(y) <==> x!=y

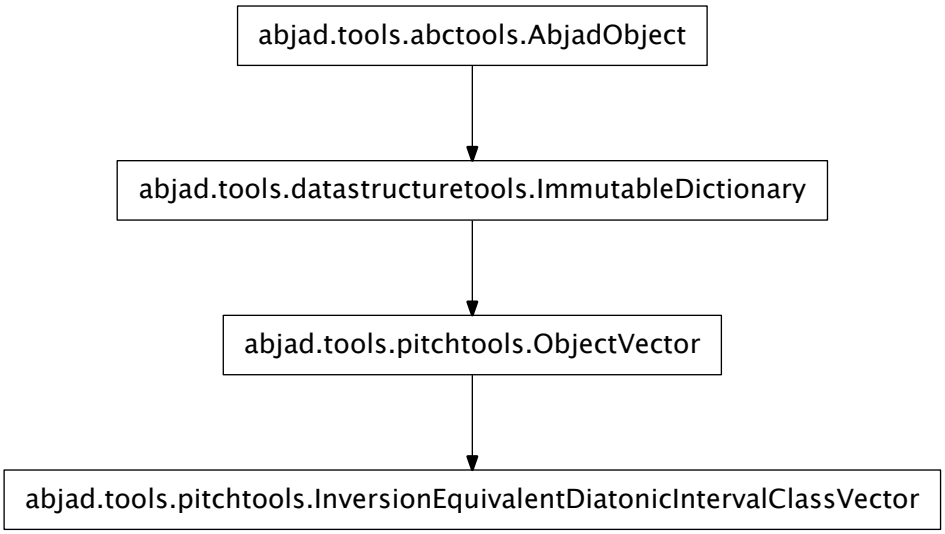
Inherited from __builtin__.tuple

InversionEquivalentDiatonicIntervalClassSegment.**__repr__**()
Inherited from pitchtools.IntervalObjectSegment

InversionEquivalentDiatonicIntervalClassSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

InversionEquivalentDiatonicIntervalClassSegment.**__str__**()
Inherited from pitchtools.IntervalObjectSegment

pitchtools.InversionEquivalentDiatonicIntervalClassVector



class pitchtools.**InversionEquivalentDiatonicIntervalClassVector**(*expr*)
New in version 2.0. Abjad model of inversion-equivalent diatonic interval-class vector:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8")
>>> vector = pitchtools.InversionEquivalentDiatonicIntervalClassVector(staff)
```

```
>>> print vector
{P1: 0, aug1: 0, m2: 1, M2: 3, aug2: 0, dim3: 0, m3: 2, M3: 1, dim4: 0, P4: 3, aug4: 0}
```

Inversion-equivalent diatonic interval-class vector are not quatertone-aware.

Inversion-equivalent diatonic interval-class vectors are immutable.

Read-only Properties

`InversionEquivalentDiatonicIntervalClassVector.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`InversionEquivalentDiatonicIntervalClassVector.`**`clear`**`()` → None. Remove all items from D.

Inherited from `__builtin__.dict`

`InversionEquivalentDiatonicIntervalClassVector.`**`copy`**`()` → a shallow copy of D

Inherited from `__builtin__.dict`

`InversionEquivalentDiatonicIntervalClassVector.`**`get`**`(`*k*`[,` *d*`])` → D[k] if k in D, else d. d defaults to None.

Inherited from `__builtin__.dict`

`InversionEquivalentDiatonicIntervalClassVector.`**`has_key`**`(`*k*`)` → True if D has a key k, else False

Inherited from `__builtin__.dict`

`InversionEquivalentDiatonicIntervalClassVector.`**`items`**`()` → list of D's (key, value) pairs, as 2-tuples

Inherited from `__builtin__.dict`

`InversionEquivalentDiatonicIntervalClassVector.`**`iteritems`**`()` → an iterator over the (key, value) items of D

Inherited from `__builtin__.dict`

`InversionEquivalentDiatonicIntervalClassVector.`**`iterkeys`**`()` → an iterator over the keys of D

Inherited from `__builtin__.dict`

`InversionEquivalentDiatonicIntervalClassVector.`**`itervalues`**`()` → an iterator over the values of D

Inherited from `__builtin__.dict`

`InversionEquivalentDiatonicIntervalClassVector.`**`keys`**`()` → list of D's keys

Inherited from `__builtin__.dict`

`InversionEquivalentDiatonicIntervalClassVector.`**`pop`**`(`*k*`[,` *d*`])` → v, remove specified key and return the corresponding value.

If key is not found, d is returned if given, otherwise KeyError is raised

Inherited from `__builtin__.dict`

`InversionEquivalentDiatonicIntervalClassVector.`**`popitem`**`()` → (k, v), remove and return some (key, value) pair as a

2-tuple; but raise KeyError if D is empty.

Inherited from `__builtin__.dict`

InversionEquivalentDiatonicIntervalClassVector.**setdefault**(*k*[, *d*]) → D.get(k,d), also set D[k]=d if k not in D

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**update**([*E*], **F) → None. Update D from dict/iterable E and F.

If E present and has a .keys() method, does: for k in E: D[k] = E[k] If E present and lacks .keys() method, does: for (k, v) in E: D[k] = v In either case, this is followed by: for k in F: D[k] = F[k]

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**values**() → list of D's values

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**viewitems**() → a set-like object providing a view on D's items

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**viewkeys**() → a set-like object providing a view on D's keys

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**viewvalues**() → an object providing a view on D's values

Inherited from __builtin__.dict

Special Methods

InversionEquivalentDiatonicIntervalClassVector.**__cmp__**(*y*) <==> *cmp(x, y)*

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**__contains__**(*k*) → True if D has a key k, else False

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**__delitem__**(**args*)

Inherited from datastructuretools.ImmutableDictionary

InversionEquivalentDiatonicIntervalClassVector.**__eq__**(*arg*)

InversionEquivalentDiatonicIntervalClassVector.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**__getitem__**()

x.__getitem__(y) <==> x[y]

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**__gt__**()

x.__gt__(y) <==> x>y

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**__iter__**() <==> *iter(x)*

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**__le__**()

x.__le__(y) <==> x<=y

Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**__len__**() <==> *len(x)*
Inherited from __builtin__.dict

InversionEquivalentDiatonicIntervalClassVector.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.dict

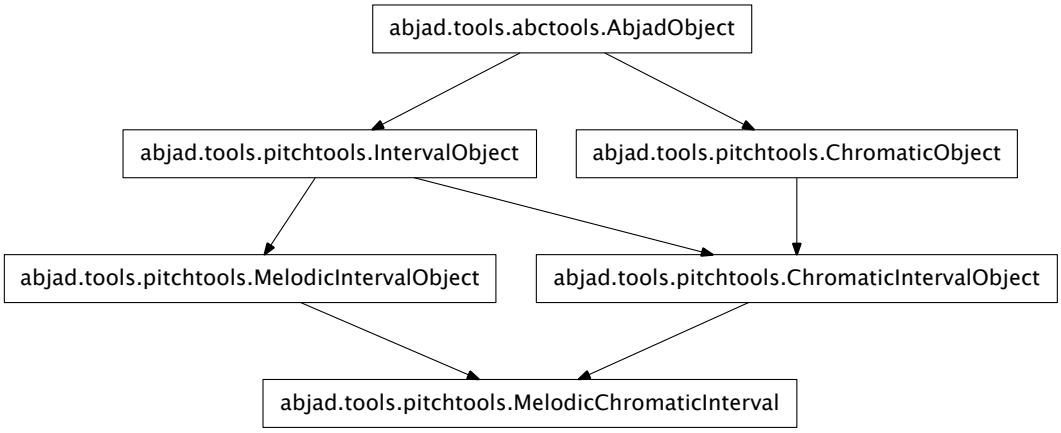
InversionEquivalentDiatonicIntervalClassVector.**__ne__**(*arg*)

InversionEquivalentDiatonicIntervalClassVector.**__repr__**()

InversionEquivalentDiatonicIntervalClassVector.**__setitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

InversionEquivalentDiatonicIntervalClassVector.**__str__**()

pitchtools.MelodicChromaticInterval



class pitchtools.**MelodicChromaticInterval**(*arg*)
New in version 2.0. Abjad model of melodic chromatic interval:

```
>>> pitchtools.MelodicChromaticInterval(-14)
MelodicChromaticInterval(-14)
```

Melodic chromatic intervals are immutable.

Read-only Properties

MelodicChromaticInterval.**cents**
Inherited from pitchtools.IntervalObject

MelodicChromaticInterval.**chromatic_interval_number**
Read-only chromatic interval number:

```
>>> pitchtools.MelodicChromaticInterval(-14).chromatic_interval_number
-14
```

Return integer or float.

MelodicChromaticInterval.**direction_number**
Read-only numeric sign:

```
>>> pitchtools.MelodicChromaticInterval(-14).direction_number
-1
```

Return integer.

MelodicChromaticInterval.**direction_string**
Inherited from pitchtools.MelodicIntervalObject

MelodicChromaticInterval.**harmonic_chromatic_interval**
Read-only harmonic chromatic interval:

```
>>> pitchtools.MelodicChromaticInterval(-14).harmonic_chromatic_interval
HarmonicChromaticInterval(14)
```

Return harmonic chromatic interval.

MelodicChromaticInterval.**interval_class**
Inherited from pitchtools.IntervalObject

MelodicChromaticInterval.**melodic_chromatic_interval_class**
Read-only melodic chromatic interval-class:

```
>>> pitchtools.MelodicChromaticInterval(-14).melodic_chromatic_interval_class
MelodicChromaticIntervalClass(-2)
```

Return melodic chromatic interval-class.

MelodicChromaticInterval.**number**
Inherited from pitchtools.ChromaticIntervalObject

MelodicChromaticInterval.**semitones**
Inherited from pitchtools.ChromaticIntervalObject

MelodicChromaticInterval.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

MelodicChromaticInterval.**__abs__**()
MelodicChromaticInterval.**__add__**(*arg*)
Inherited from pitchtools.ChromaticIntervalObject

MelodicChromaticInterval.**__eq__**(*arg*)
Inherited from pitchtools.ChromaticIntervalObject

MelodicChromaticInterval.**__float__**()
Inherited from pitchtools.ChromaticIntervalObject

MelodicChromaticInterval.**__ge__**(*arg*)

MelodicChromaticInterval.**__gt__**(*arg*)

MelodicChromaticInterval.**__hash__**()

MelodicChromaticInterval.**__int__**()
Inherited from pitchtools.ChromaticIntervalObject

MelodicChromaticInterval.**__le__**(*arg*)

MelodicChromaticInterval.**__lt__**(*arg*)

MelodicChromaticInterval.**__ne__**(*arg*)
Inherited from pitchtools.ChromaticIntervalObject

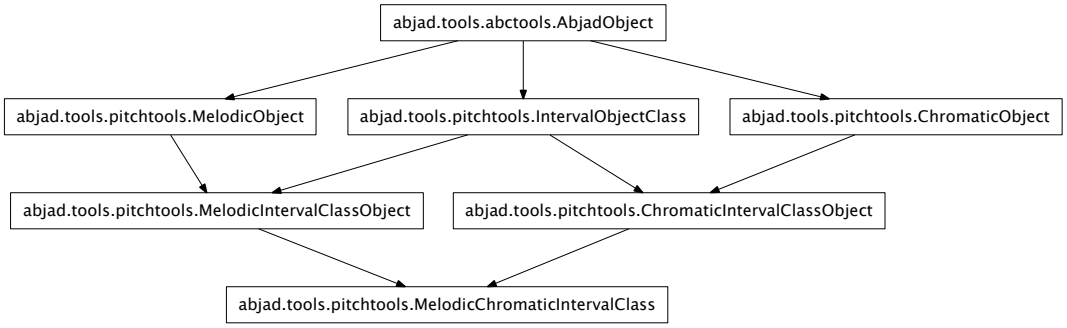
MelodicChromaticInterval.**__neg__**()

MelodicChromaticInterval.**__repr__**()

MelodicChromaticInterval.**__str__**()

MelodicChromaticInterval.**__sub__**(*arg*)
Inherited from pitchtools.ChromaticIntervalObject

pitchtools.MelodicChromaticIntervalClass



class pitchtools.**MelodicChromaticIntervalClass**(*token*)
New in version 2.0. Abjad model of melodic chromatic interval-class:

```
>>> pitchtools.MelodicChromaticIntervalClass(-14)
MelodicChromaticIntervalClass(-2)
```

Melodic chromatic interval-classes are immutable.

Read-only Properties

MelodicChromaticIntervalClass.**direction_number**
Inherited from pitchtools.MelodicIntervalClassObject

MelodicChromaticIntervalClass.**direction_symbol**
Inherited from pitchtools.MelodicIntervalClassObject

MelodicChromaticIntervalClass.**direction_word**
Inherited from pitchtools.MelodicIntervalClassObject

MelodicChromaticIntervalClass.**number**
Inherited from pitchtools.IntervalObjectClass

MelodicChromaticIntervalClass.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

MelodicChromaticIntervalClass.**__abs__**()
Inherited from pitchtools.ChromaticIntervalClassObject

MelodicChromaticIntervalClass.**__eq__**(*arg*)

MelodicChromaticIntervalClass.**__float__**()
Inherited from pitchtools.ChromaticIntervalClassObject

MelodicChromaticIntervalClass.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicChromaticIntervalClass.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MelodicChromaticIntervalClass.**__hash__**()
Inherited from pitchtools.IntervalObjectClass

MelodicChromaticIntervalClass.**__int__**()
Inherited from pitchtools.ChromaticIntervalClassObject

MelodicChromaticIntervalClass.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicChromaticIntervalClass.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

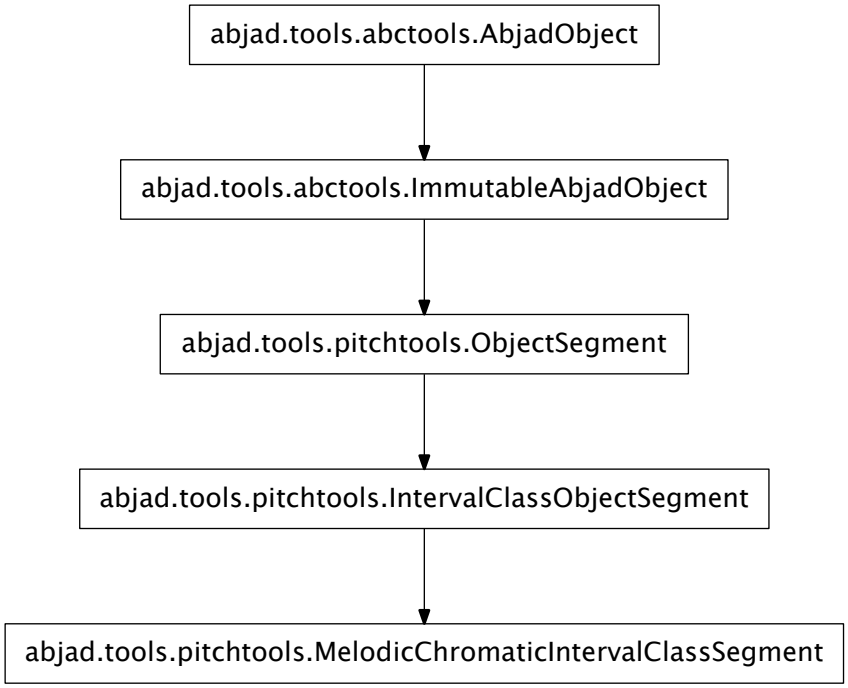
Inherited from abctools.AbjadObject

MelodicChromaticIntervalClass.**__ne__**(*arg*)

MelodicChromaticIntervalClass.**__repr__**()
Inherited from pitchtools.IntervalObjectClass

MelodicChromaticIntervalClass.**__str__**()
Inherited from pitchtools.IntervalObjectClass

pitchtools.MelodicChromaticIntervalClassSegment



class `pitchtools.`**`MelodicChromaticIntervalClassSegment`**(**args*, ***kwargs*)

New in version 2.0. Abjad model of melodic chromatic interval-class segment:

```
>>> pitchtools.MelodicChromaticIntervalClassSegment([-2, -14, 3, 5.5, 6.5])
MelodicChromaticIntervalClassSegment(-2, -2, +3, +5.5, +6.5)
```

Melodic chromatic interval-class segments are immutable.

Read-only Properties

`MelodicChromaticIntervalClassSegment.`**`interval_class_numbers`**

Inherited from `pitchtools.IntervalClassObjectSegment`

`MelodicChromaticIntervalClassSegment.`**`interval_classes`**

Inherited from `pitchtools.IntervalClassObjectSegment`

`MelodicChromaticIntervalClassSegment.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

MelodicChromaticIntervalClassSegment.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

Special Methods

MelodicChromaticIntervalClassSegment.**__add__**(*arg*)

Inherited from pitchtools.ObjectSegment

MelodicChromaticIntervalClassSegment.**__contains__**()

x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__getitem__**()

x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__getslice__**(*start*, *stop*)

Inherited from pitchtools.ObjectSegment

MelodicChromaticIntervalClassSegment.**__gt__**()

x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__hash__**() <==> *hash(x)*

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__iter__**() <==> *iter(x)*

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__le__**()

x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__len__**() <==> *len(x)*

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__lt__**()

x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__mul__**(*n*)

Inherited from pitchtools.ObjectSegment

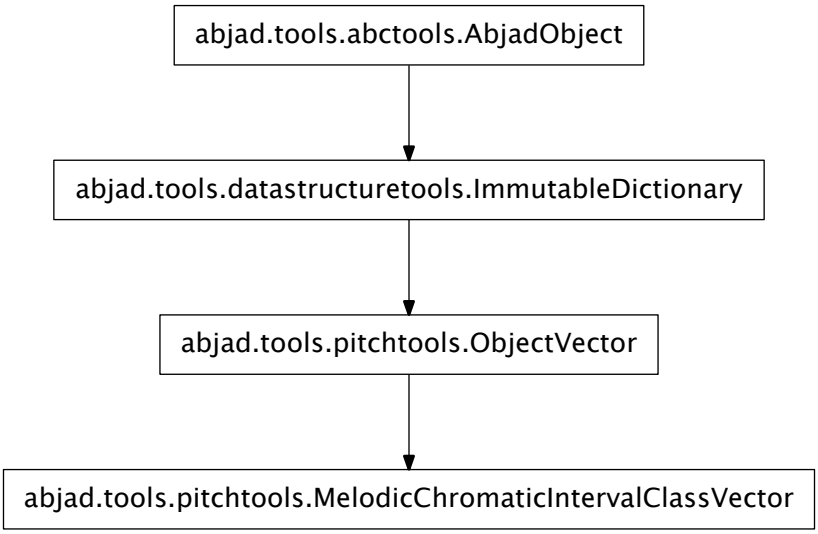
MelodicChromaticIntervalClassSegment.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.tuple

MelodicChromaticIntervalClassSegment.**__repr__**()
Inherited from pitchtools.IntervalClassObjectSegment

MelodicChromaticIntervalClassSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

pitchtools.MelodicChromaticIntervalClassVector



class pitchtools.**MelodicChromaticIntervalClassVector**(*mcic_tokens*)
New in version 2.0. Abjad model of melodic chromatic interval-class vector:

```
>>> print pitchtools.MelodicChromaticIntervalClassVector([-2, -14, 3, 5.5, 6.5])
    .   |   .   .   1   .   .   .   |   .   .   .   .   .   .
        |   .   2   .   .   .   .   |   .   .   .   .   .   .
        |   .   .   .   .   .   1   |   1   .   .   .   .   .
        |   .   .   .   .   .   .   |   .   .   .   .   .   .
```

Melodic chromatic interval-class vectors are immutable.

Read-only Properties

MelodicChromaticIntervalClassVector.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

MelodicChromaticIntervalClassVector.**clear**() → None. Remove all items from D.
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**copy**() → a shallow copy of D
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**get**(*k*[, *d*]) → D[k] if k in D, else d. d defaults to None.
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**has_key**(*k*) → True if D has a key k, else False
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**items**() → list of D's (key, value) pairs, as 2-tuples
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**iteritems**() → an iterator over the (key, value) items of D
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**iterkeys**() → an iterator over the keys of D
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**itervalues**() → an iterator over the values of D
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**keys**() → list of D's keys
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**pop**(*k*[, *d*]) → v, remove specified key and return the corresponding value.
If key is not found, d is returned if given, otherwise KeyError is raised

Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**popitem**() → (k, v), remove and return some (key, value) pair as a
2-tuple; but raise KeyError if D is empty.

Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**setdefault**(*k*[, *d*]) → D.get(k,d), also set D[k]=d if k not in D
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**update**([*E*], ***F*) → None. Update D from dict/iterable E and F.
If E present and has a .keys() method, does: for k in E: D[k] = E[k] If E present and lacks .keys() method, does: for (k, v) in E: D[k] = v In either case, this is followed by: for k in F: D[k] = F[k]

Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**values**() → list of D's values
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**viewitems**() → a set-like object providing a view on D's items
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**viewkeys**() → a set-like object providing a view on D's keys
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**viewvalues**() → an object providing a view on D's values
Inherited from __builtin__.dict

Special Methods

MelodicChromaticIntervalClassVector.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**__contains__**(*k*) → True if D has a key k, else False
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**__delitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

MelodicChromaticIntervalClassVector.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**__len__**()

MelodicChromaticIntervalClassVector.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**__ne__**()
x.__ne__(y) <==> x!=y

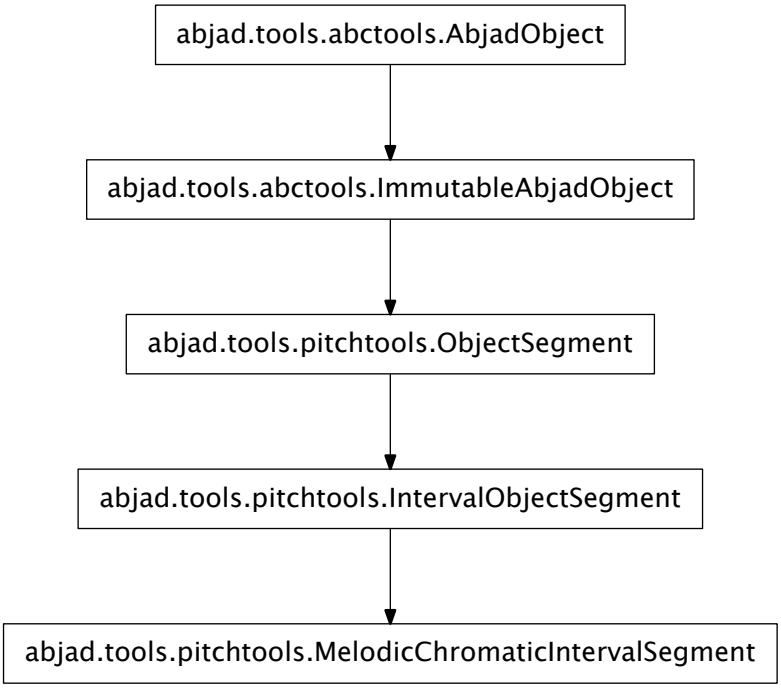
Inherited from __builtin__.dict

MelodicChromaticIntervalClassVector.**__repr__**()

MelodicChromaticIntervalClassVector.**__setitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

MelodicChromaticIntervalClassVector.**__str__**()

pitchtools.MelodicChromaticIntervalSegment



class pitchtools.**MelodicChromaticIntervalSegment**(**args*, ***kwargs*)

New in version 2.0. Abjad model of melodic chromatic interval segment:

```
>>> pitchtools.MelodicChromaticIntervalSegment([11, 13, 13.5, -2, 2.5])
MelodicChromaticIntervalSegment(+11, +13, +13.5, -2, +2.5)
```

Melodic chromatic interval segments are immutable.

Read-only Properties

MelodicChromaticIntervalSegment.**harmonic_chromatic_interval_segment**

MelodicChromaticIntervalSegment.**interval_classes**

Inherited from pitchtools.IntervalObjectSegment

MelodicChromaticIntervalSegment.**intervals**

Inherited from pitchtools.IntervalObjectSegment

MelodicChromaticIntervalSegment.**melodic_chromatic_interval_class_segment**

MelodicChromaticIntervalSegment.**melodic_chromatic_interval_class_vector**

MelodicChromaticIntervalSegment.**melodic_chromatic_interval_numbers**

MelodicChromaticIntervalSegment.**slope**

The slope of a melodic interval segment is the sum of its intervals divided by its length:

```
>>> pitchtools.MelodicChromaticIntervalSegment([1, 2]).slope
Fraction(3, 2)
```

Return fraction.

MelodicChromaticIntervalSegment.**spread**

The maximum harmonic interval spanned by any combination of the intervals within a harmonic chromatic interval segment:

```
>>> pitchtools.MelodicChromaticIntervalSegment([1, 2, -3, 1, -2, 1]).spread
HarmonicChromaticInterval(4)
>>> pitchtools.MelodicChromaticIntervalSegment([1, 1, 1, 2, -3, -2]).spread
HarmonicChromaticInterval(5)
```

Return harmonic chromatic interval.

MelodicChromaticIntervalSegment.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

MelodicChromaticIntervalSegment.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.**rotate**(*n*)

Inherited from pitchtools.IntervalObjectSegment

Special Methods

MelodicChromaticIntervalSegment.**__add__**(*arg*)

Inherited from pitchtools.ObjectSegment

MelodicChromaticIntervalSegment.**__contains__**()

x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.**__getitem__**()

x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.**__getslice__**(*start*, *stop*)

Inherited from pitchtools.ObjectSegment

MelodicChromaticIntervalSegment.__gt__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.__hash__() <==> *hash(x)*
Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.__iter__() <==> *iter(x)*
Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.__le__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.__len__() <==> *len(x)*
Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.__lt__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.__mul__(*n*)
Inherited from pitchtools.ObjectSegment

MelodicChromaticIntervalSegment.__ne__()
x.__ne__(y) <==> x!=y

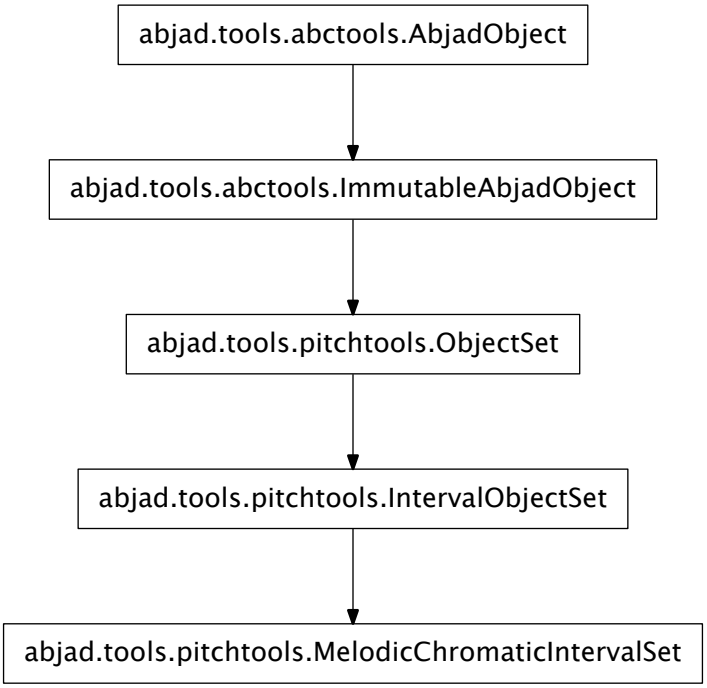
Inherited from __builtin__.tuple

MelodicChromaticIntervalSegment.__repr__()
Inherited from pitchtools.IntervalObjectSegment

MelodicChromaticIntervalSegment.__rmul__(*n*)
Inherited from pitchtools.ObjectSegment

MelodicChromaticIntervalSegment.__str__()
Inherited from pitchtools.IntervalObjectSegment

pitchtools.MelodicChromaticIntervalSet



class pitchtools.**MelodicChromaticIntervalSet**(**args*, ***kwargs*)

New in version 2.0. Abjad model of melodic chromatic interval set:

```
>>> pitchtools.MelodicChromaticIntervalSet([11, 11, 13.5, 13.5])
MelodicChromaticIntervalSet(+11, +13.5)
```

Melodic chromatic interval sets are immutable.

Read-only Properties

MelodicChromaticIntervalSet.**harmonic_chromatic_interval_set**

MelodicChromaticIntervalSet.**melodic_chromatic_interval_numbers**

MelodicChromaticIntervalSet.**melodic_chromatic_intervals**

MelodicChromaticIntervalSet.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

MelodicChromaticIntervalSet.**copy**()

Return a shallow copy of a set.

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**difference**()

Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**intersection**()

Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**isdisjoint**()

Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**issubset**()

Report whether another set contains this set.

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**issuperset**()

Report whether this set contains another set.

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**symmetric_difference**()

Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**union**()

Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

MelodicChromaticIntervalSet.**__and__**()

x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**__cmp__**(*y)* <==> *cmp(x, y*)

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**__contains__**()

x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__gt__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__hash__() <==> *hash(x)*
Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__iter__() <==> *iter(x)*
Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__le__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__len__() <==> *len(x)*
Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__lt__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__ne__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__or__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__rand__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__repr__()

MelodicChromaticIntervalSet.__ror__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__rsub__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__rxor__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.__str__()

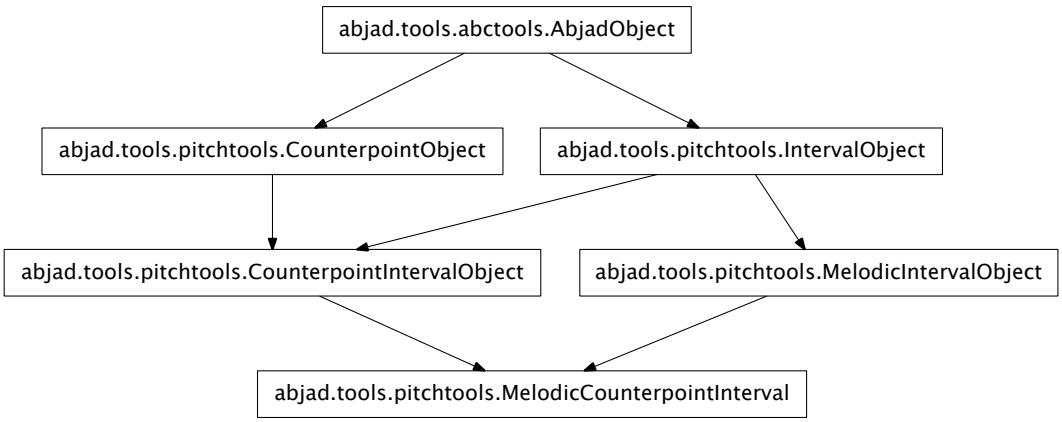
MelodicChromaticIntervalSet.__sub__()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

MelodicChromaticIntervalSet.**__xor__**()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.MelodicCounterpointInterval



class pitchtools.**MelodicCounterpointInterval**(*number*)
New in version 2.0. Abjad model of melodic counterpoint interval:

```
>>> pitchtools.MelodicCounterpointInterval(-9)
MelodicCounterpointInterval(-9)
```

Melodic counterpoint intervals are immutable.

Read-only Properties

MelodicCounterpointInterval.**cents**
Inherited from pitchtools.IntervalObject

MelodicCounterpointInterval.**direction_number**

MelodicCounterpointInterval.**direction_string**
Inherited from pitchtools.MelodicIntervalObject

MelodicCounterpointInterval.**interval_class**
Inherited from pitchtools.IntervalObject

MelodicCounterpointInterval.**melodic_counterpoint_interval_class**

MelodicCounterpointInterval.**number**
Inherited from pitchtools.CounterpointIntervalObject

MelodicCounterpointInterval.**semitones**
Inherited from pitchtools.CounterpointIntervalObject

MelodicCounterpointInterval.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

MelodicCounterpointInterval.__**abs**__()
Inherited from pitchtools.CounterpointIntervalObject

MelodicCounterpointInterval.__**eq**__(*arg*)
Inherited from pitchtools.MelodicIntervalObject

MelodicCounterpointInterval.__**float**__()
Inherited from pitchtools.CounterpointIntervalObject

MelodicCounterpointInterval.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicCounterpointInterval.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MelodicCounterpointInterval.__**hash**__()
Inherited from pitchtools.IntervalObject

MelodicCounterpointInterval.__**int**__()
Inherited from pitchtools.CounterpointIntervalObject

MelodicCounterpointInterval.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicCounterpointInterval.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

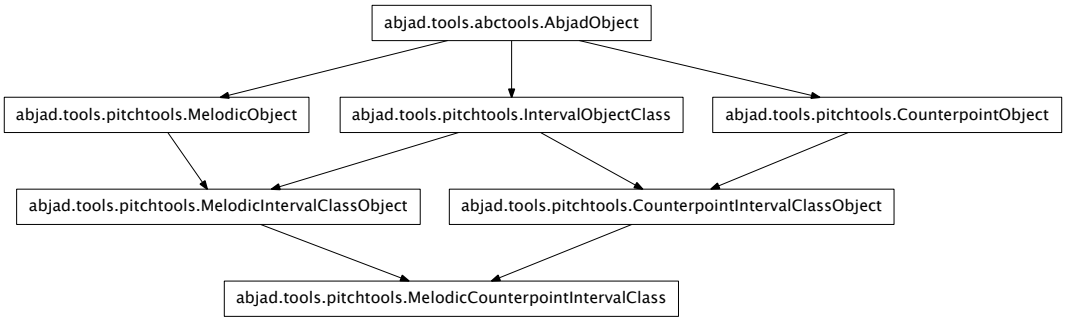
MelodicCounterpointInterval.__**ne**__(*arg*)
Inherited from pitchtools.MelodicIntervalObject

MelodicCounterpointInterval.__**neg**__()
Inherited from pitchtools.MelodicIntervalObject

MelodicCounterpointInterval.__**repr**__()
Inherited from pitchtools.IntervalObject

MelodicCounterpointInterval.__**str**__()

pitchtools.MelodicCounterpointIntervalClass



class pitchtools.**MelodicCounterpointIntervalClass**(*token*)

New in version 2.0. Abjad model of melodic counterpoint interval-class:

```
>>> pitchtools.MelodicCounterpointIntervalClass(-9)
MelodicCounterpointIntervalClass(-2)
```

Melodic counterpoint interval-classes are immutable.

Read-only Properties

MelodicCounterpointIntervalClass.**direction_number**

Inherited from pitchtools.MelodicIntervalClassObject

MelodicCounterpointIntervalClass.**direction_symbol**

Inherited from pitchtools.MelodicIntervalClassObject

MelodicCounterpointIntervalClass.**direction_word**

Inherited from pitchtools.MelodicIntervalClassObject

MelodicCounterpointIntervalClass.**number**

Inherited from pitchtools.IntervalObjectClass

MelodicCounterpointIntervalClass.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

MelodicCounterpointIntervalClass.**__abs__**()

Inherited from pitchtools.CounterpointIntervalClassObject

MelodicCounterpointIntervalClass.**__eq__**(*arg*)

MelodicCounterpointIntervalClass.**__float__**()

Inherited from pitchtools.CounterpointIntervalClassObject

MelodicCounterpointIntervalClass.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicCounterpointIntervalClass.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MelodicCounterpointIntervalClass.__hash__()
Inherited from pitchtools.IntervalObjectClass

MelodicCounterpointIntervalClass.__int__()
Inherited from pitchtools.CounterpointIntervalClassObject

MelodicCounterpointIntervalClass.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicCounterpointIntervalClass.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

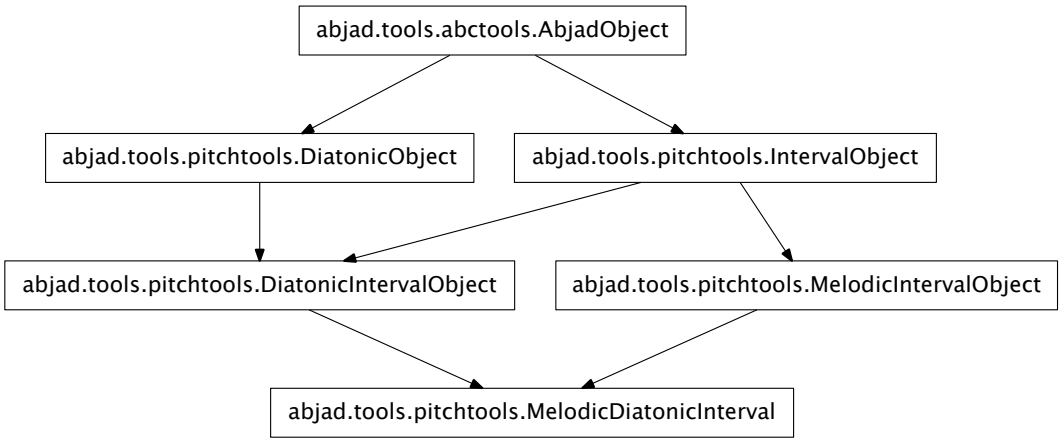
Inherited from abctools.AbjadObject

MelodicCounterpointIntervalClass.__ne__(*arg*)

MelodicCounterpointIntervalClass.__repr__()
Inherited from pitchtools.IntervalObjectClass

MelodicCounterpointIntervalClass.__str__()
Inherited from pitchtools.IntervalObjectClass

pitchtools.MelodicDiatonicInterval



class pitchtools.**MelodicDiatonicInterval**(**args*)

New in version 2.0. Abjad model of melodic diatonic interval:

```
>>> pitchtools.MelodicDiatonicInterval('+M9')
MelodicDiatonicInterval('+M9')
```

Melodic diatonic intervals are immutable.

Read-only Properties

MelodicDiatonicInterval.**cents**

Inherited from pitchtools.IntervalObject

MelodicDiatonicInterval.**diatonic_interval_class**

Inherited from pitchtools.DiatonicIntervalObject

MelodicDiatonicInterval.**direction_number**

MelodicDiatonicInterval.**direction_string**

MelodicDiatonicInterval.**harmonic_chromatic_interval**

MelodicDiatonicInterval.**harmonic_counterpoint_interval**

MelodicDiatonicInterval.**harmonic_diatonic_interval**

MelodicDiatonicInterval.**interval_class**

Inherited from pitchtools.DiatonicIntervalObject

MelodicDiatonicInterval.**interval_string**

Inherited from pitchtools.DiatonicIntervalObject

MelodicDiatonicInterval.**inversion_equivalent_chromatic_interval_class**

MelodicDiatonicInterval.**melodic_chromatic_interval**

MelodicDiatonicInterval.**melodic_counterpoint_interval**

MelodicDiatonicInterval.**melodic_diatonic_interval_class**

MelodicDiatonicInterval.**number**
Inherited from pitchtools.DiatonicIntervalObject

MelodicDiatonicInterval.**quality_string**
Inherited from pitchtools.DiatonicIntervalObject

MelodicDiatonicInterval.**semitones**

MelodicDiatonicInterval.**staff_spaces**

MelodicDiatonicInterval.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

MelodicDiatonicInterval.**__abs__**()
MelodicDiatonicInterval.**__add__**(*arg*)

MelodicDiatonicInterval.**__eq__**(*arg*)
Inherited from pitchtools.DiatonicIntervalObject

MelodicDiatonicInterval.**__float__**()
Inherited from pitchtools.DiatonicIntervalObject

MelodicDiatonicInterval.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicDiatonicInterval.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MelodicDiatonicInterval.**__hash__**()
Inherited from pitchtools.IntervalObject

MelodicDiatonicInterval.**__int__**()
Inherited from pitchtools.DiatonicIntervalObject

MelodicDiatonicInterval.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicDiatonicInterval.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicDiatonicInterval.**__mul__**(*arg*)

MelodicDiatonicInterval.**__ne__**(*arg*)
Inherited from pitchtools.DiatonicIntervalObject

MelodicDiatonicInterval.**__neg__**()

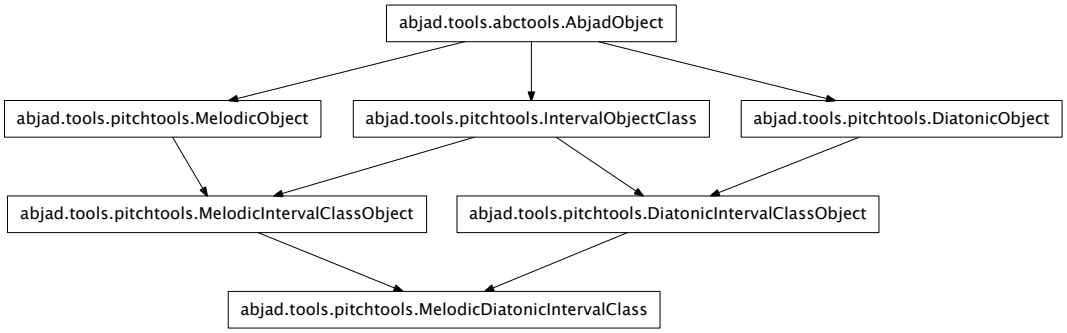
MelodicDiatonicInterval.**__repr__**()

MelodicDiatonicInterval.**__rmul__**(*arg*)

MelodicDiatonicInterval.**__str__**()

MelodicDiatonicInterval.**__sub__**(*arg*)

pitchtools.MelodicDiatonicIntervalClass



class pitchtools.**MelodicDiatonicIntervalClass**(**args*)

New in version 2.0. Abjad model of melodic diatonic interval-class:

```
>>> pitchtools.MelodicDiatonicIntervalClass('-M9')
MelodicDiatonicIntervalClass('-M2')
```

Melodic diatonic interval-classes are immutable.

Read-only Properties

MelodicDiatonicIntervalClass.**direction_number**

MelodicDiatonicIntervalClass.**direction_symbol**

MelodicDiatonicIntervalClass.**direction_word**

MelodicDiatonicIntervalClass.**number**

Inherited from pitchtools.IntervalObjectClass

MelodicDiatonicIntervalClass.**quality_string**

Inherited from pitchtools.DiatonicIntervalClassObject

MelodicDiatonicIntervalClass.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

MelodicDiatonicIntervalClass.**__abs__**()
Inherited from pitchtools.DiatonicIntervalClassObject

MelodicDiatonicIntervalClass.**__eq__**(*arg*)

MelodicDiatonicIntervalClass.**__float__**()
Inherited from pitchtools.DiatonicIntervalClassObject

MelodicDiatonicIntervalClass.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicDiatonicIntervalClass.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MelodicDiatonicIntervalClass.**__hash__**()

MelodicDiatonicIntervalClass.**__int__**()
Inherited from pitchtools.DiatonicIntervalClassObject

MelodicDiatonicIntervalClass.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MelodicDiatonicIntervalClass.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

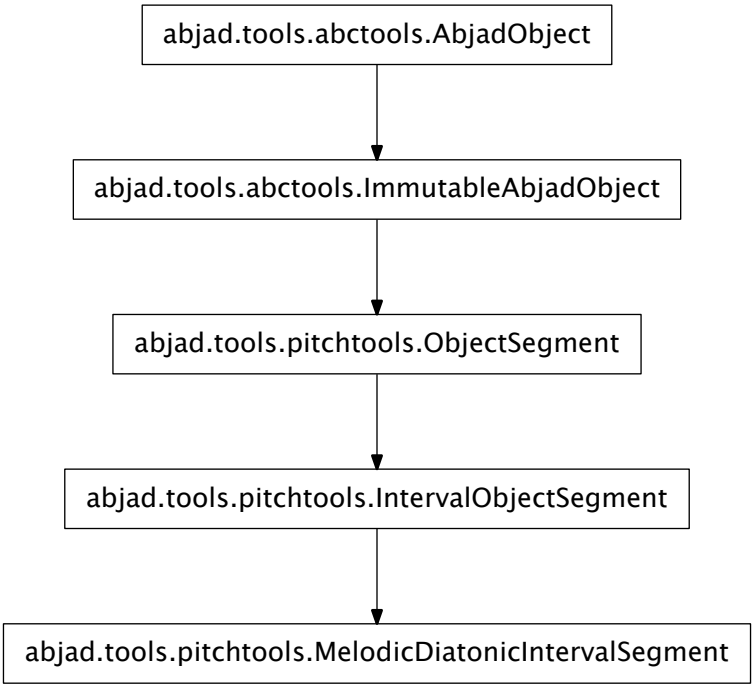
Inherited from abctools.AbjadObject

MelodicDiatonicIntervalClass.**__ne__**(*arg*)

MelodicDiatonicIntervalClass.**__repr__**()
Inherited from pitchtools.DiatonicIntervalClassObject

MelodicDiatonicIntervalClass.**__str__**()

pitchtools.MelodicDiatonicIntervalSegment



class pitchtools.**MelodicDiatonicIntervalSegment**(**args*, ***kwargs*)

New in version 2.0. Abjad model of melodic diatonic interval segment:

```
>>> pitchtools.MelodicDiatonicIntervalSegment('M2 M9 -m3 -P4')
MelodicDiatonicIntervalSegment('+M2 +M9 -m3 -P4')
```

Melodic diatonic interval segments are immutable.

Read-only Properties

MelodicDiatonicIntervalSegment.**harmonic_chromatic_interval_segment**

MelodicDiatonicIntervalSegment.**harmonic_diatonic_interval_segment**

MelodicDiatonicIntervalSegment.**interval_classes**

Inherited from pitchtools.IntervalObjectSegment

MelodicDiatonicIntervalSegment.**intervals**

Inherited from pitchtools.IntervalObjectSegment

MelodicDiatonicIntervalSegment.**melodic_chromatic_interval_segment**

MelodicDiatonicIntervalSegment.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

MelodicDiatonicIntervalSegment.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**rotate**(*n*)

Inherited from pitchtools.IntervalObjectSegment

Special Methods

MelodicDiatonicIntervalSegment.**__add__**(*arg*)

Inherited from pitchtools.ObjectSegment

MelodicDiatonicIntervalSegment.**__contains__**()

x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__getitem__**()

x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__getslice__**(*start*, *stop*)

Inherited from pitchtools.ObjectSegment

MelodicDiatonicIntervalSegment.**__gt__**()

x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__hash__**() <==> *hash(x)*

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__iter__**() <==> *iter(x)*

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__le__**()

x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__len__**() <==> *len(x)*

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__lt__**()

x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

MelodicDiatonicIntervalSegment.**__ne__**()
x.__ne__(y) <==> x!=y

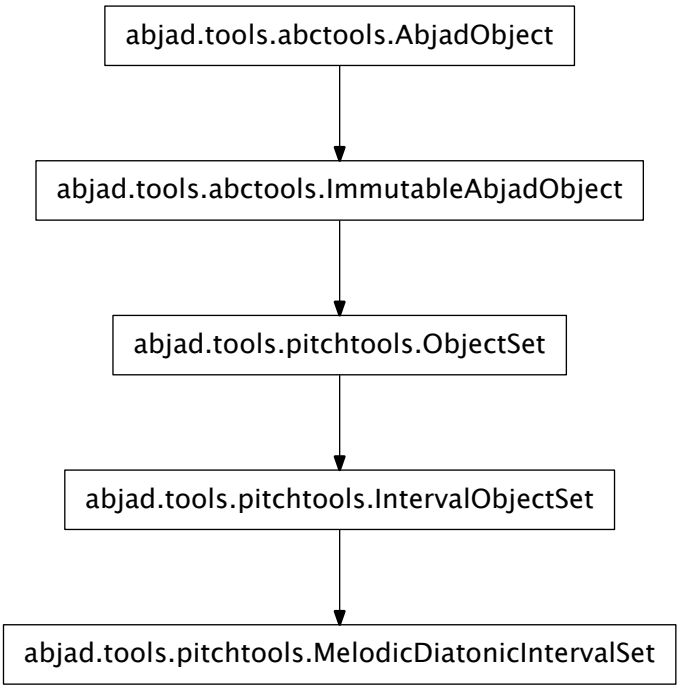
Inherited from __builtin__.tuple

MelodicDiatonicIntervalSegment.**__repr__**()

MelodicDiatonicIntervalSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

MelodicDiatonicIntervalSegment.**__str__**()
Inherited from pitchtools.IntervalObjectSegment

pitchtools.MelodicDiatonicIntervalSet



class pitchtools.**MelodicDiatonicIntervalSet**(**args*, ***kwargs*)
New in version 2.0. Abjad model of melodic diatonic interval set:

```
>>> pitchtools.MelodicDiatonicIntervalSet('M2 M2 -m3 -P4')
MelodicDiatonicIntervalSet('-P4 -m3 +M2')
```

Melodic diatonic interval sets are immutable.

Read-only Properties

MelodicDiatonicIntervalSet.**harmonic_chromatic_interval_set**
MelodicDiatonicIntervalSet.**harmonic_diatonic_interval_set**

MelodicDiatonicIntervalSet.**melodic_chromatic_interval_set**

MelodicDiatonicIntervalSet.**melodic_diatonic_interval_numbers**

MelodicDiatonicIntervalSet.**melodic_diatonic_intervals**

MelodicDiatonicIntervalSet.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

MelodicDiatonicIntervalSet.**copy**()
Return a shallow copy of a set.

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**difference**()
Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**intersection**()
Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

MelodicDiatonicIntervalSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__len__**() <==> *len(x)*
Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__or__**()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__rand__**()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.**__repr__**()

MelodicDiatonicIntervalSet.__ror__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.__rsub__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.__rxor__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.__str__()

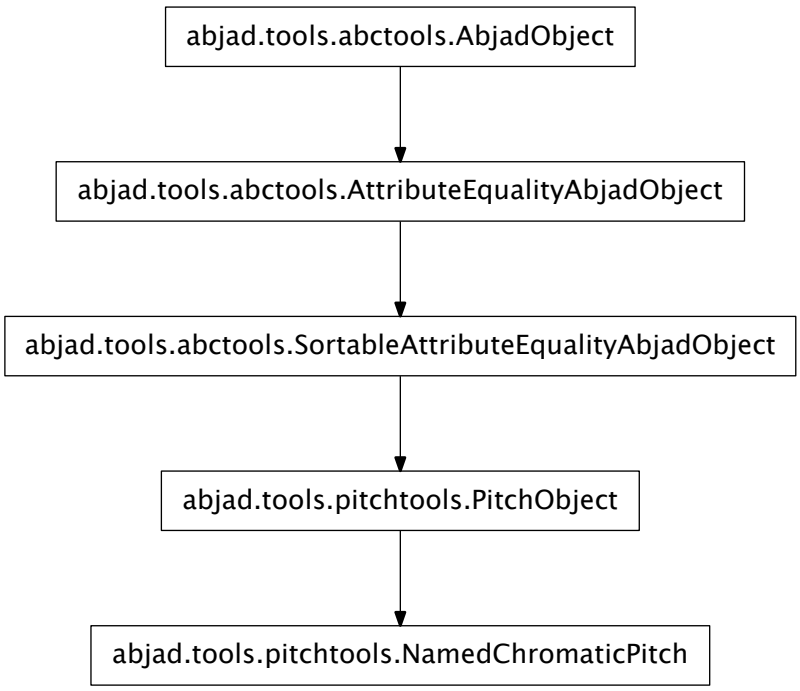
MelodicDiatonicIntervalSet.__sub__()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

MelodicDiatonicIntervalSet.__xor__()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.NamedChromaticPitch



class pitchtools.**NamedChromaticPitch**(**args*, ***kwargs*)

New in version 1.1. Abjad model of named chromatic pitch:

```
>>> pitchtools.NamedChromaticPitch("cs''")
NamedChromaticPitch("cs''")
```

Named chromatic pitches are immutable.

Read-only Properties

NamedChromaticPitch.**accidental_spelling**

Read-only accidental spelling:

```
>>> pitchtools.NamedChromaticPitch("c").accidental_spelling
'mixed'
```

Return string.

NamedChromaticPitch.**chromatic_pitch_class_name**

Read-only chromatic pitch-class name:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.chromatic_pitch_class_name
'cs'
```

Return string.

NamedChromaticPitch.**chromatic_pitch_class_number**

Read-only chromatic pitch-class number:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.chromatic_pitch_class_number
1
```

Return integer or float.

NamedChromaticPitch.**chromatic_pitch_name**

Read-only chromatic pitch name:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.chromatic_pitch_name
"cs''"
```

Return string.

NamedChromaticPitch.**chromatic_pitch_number**

Read-only chromatic pitch-class number:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.chromatic_pitch_number
13
```

Return integer or float.

NamedChromaticPitch.**deviation_in_cents**

Read-only deviation of named chromatic pitch in cents:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.deviation_in_cents is None
True
```

Return integer or none.

NamedChromaticPitch.**diatonic_pitch_class_name**
Read-only diatonic pitch-class name:

```
>>> named_diatonic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_diatonic_pitch.diatonic_pitch_class_name
'c'
```

Return string.

NamedChromaticPitch.**diatonic_pitch_class_number**
Read-only diatonic pitch-class number:

```
>>> named_diatonic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_diatonic_pitch.diatonic_pitch_class_number
0
```

Return integer.

NamedChromaticPitch.**diatonic_pitch_name**
Read-only diatonic pitch name:

```
>>> named_diatonic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_diatonic_pitch.diatonic_pitch_name
"c''"
```

Return string.

NamedChromaticPitch.**diatonic_pitch_number**
Read-only diatonic pitch number:

```
>>> named_diatonic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_diatonic_pitch.diatonic_pitch_number
7
```

Return integer.

NamedChromaticPitch.**lilypond_format**
Read-only LilyPond input format of named chromatic pitch:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.lilypond_format
"cs''"
```

Return string.

NamedChromaticPitch.**named_chromatic_pitch_class**
Read-only named pitch-class:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.named_chromatic_pitch_class
NamedChromaticPitchClass('cs')
```

Return named chromatic pitch-class.

NamedChromaticPitch.**named_diatonic_pitch**
Read-only named diatonic pitch:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.named_diatonic_pitch
NamedDiatonicPitch("c''")
```

Return named diatonic pitch.

NamedChromaticPitch.**named_diatonic_pitch_class**
Read-only named diatonic pitch-class:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.named_diatonic_pitch_class
NamedDiatonicPitchClass('c')
```

Return named diatonic pitch-class.

NamedChromaticPitch.**numbered_chromatic_pitch**
Read-only numbered chromatic pitch from named chromatic pitch:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.numbered_chromatic_pitch_class
NumberedChromaticPitchClass(1)
```

Return numbered chromatic pitch-class.

NamedChromaticPitch.**numbered_chromatic_pitch_class**
Read-only numbered pitch-class:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.numbered_chromatic_pitch_class
NumberedChromaticPitchClass(1)
```

Return numbered chromatic pitch-class.

NamedChromaticPitch.**numbered_diatonic_pitch**
Read-only numbered diatonic pitch:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.numbered_diatonic_pitch
NumberedDiatonicPitch(7)
```

Return numbered diatonic pitch.

NamedChromaticPitch.**numbered_diatonic_pitch_class**
Read-only numbered diatonic pitch:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.numbered_diatonic_pitch_class
NumberedDiatonicPitchClass(0)
```

Return numbered diatonic pitch-class.

NamedChromaticPitch.**octave_number**
Read-only integer octave number:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.octave_number
5
```

Return integer.

NamedChromaticPitch.**pitch_class_octave_label**
Read-only pitch-class / octave label:

```
>>> named_chromatic_pitch = pitchtools.NamedChromaticPitch("cs''")
>>> named_chromatic_pitch.pitch_class_octave_label
'C#5'
```

Return string.

NamedChromaticPitch.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

NamedChromaticPitch.**__abs__**()
NamedChromaticPitch.**__add__**(*melodic_interval*)
New in version 2.0.

NamedChromaticPitch.**__eq__**(*arg*)

NamedChromaticPitch.**__float__**()

NamedChromaticPitch.**__ge__**(*arg*)

NamedChromaticPitch.**__gt__**(*arg*)

NamedChromaticPitch.**__hash__**()

NamedChromaticPitch.**__int__**()

NamedChromaticPitch.**__le__**(*arg*)

NamedChromaticPitch.**__lt__**(*arg*)

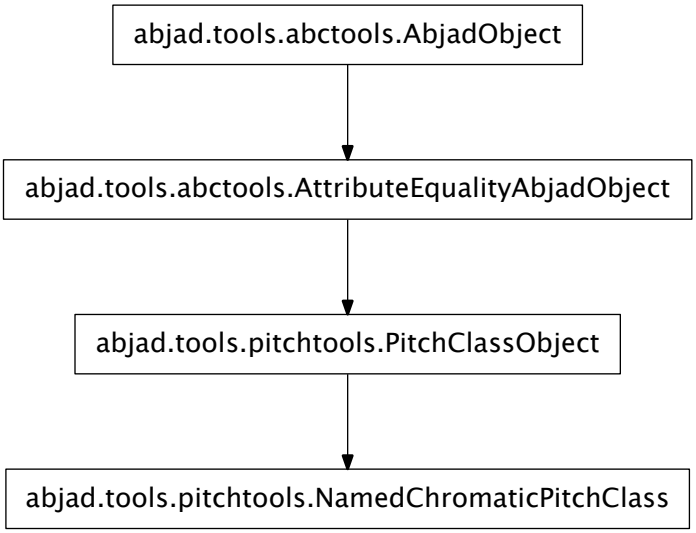
NamedChromaticPitch.**__ne__**(*arg*)

NamedChromaticPitch.**__repr__**()

NamedChromaticPitch.**__str__**()

NamedChromaticPitch.**__sub__**(*arg*)

pitchtools.NamedChromaticPitchClass



class pitchtools.**NamedChromaticPitchClass**(*arg*)

New in version 2.0. Abjad model of named chromatic pitch-class:

```
>>> ncpc = pitchtools.NamedChromaticPitchClass('cs')

>>> ncpc
NamedChromaticPitchClass('cs')
```

Named chromatic pitch-classes are immutable.

Read-only Properties

NamedChromaticPitchClass.**numbered_chromatic_pitch_class**

Read-only numbered chromatic pitch-class:

```
>>> ncpc.numbered_chromatic_pitch_class
NumberedChromaticPitchClass(1)
```

Return numbered chromatic pitch-class.

NamedChromaticPitchClass.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NamedChromaticPitchClass.**apply_accidental**(*accidental*)

Apply *accidental*:

```
>>> ncpc.apply_accidental('qs')
NamedChromaticPitchClass('ctqs')
```

Return named chromatic pitch-class.

NamedChromaticPitchClass.**transpose**(*melodic_diatonic_interval*)

Transpose named chromatic pitch-class by *melodic_diatonic_interval*:

```
>>> ncpc.transpose(pitchtools.MelodicDiatonicInterval('major', 2))
NamedChromaticPitchClass('ds')
```

Return named chromatic pitch-class.

Special Methods

NamedChromaticPitchClass.**__abs__**()

NamedChromaticPitchClass.**__add__**(*melodic_diatonic_interval*)

NamedChromaticPitchClass.**__eq__**(*arg*)

Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NamedChromaticPitchClass.**__float__**()

NamedChromaticPitchClass.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NamedChromaticPitchClass.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

NamedChromaticPitchClass.**__hash__**()

Inherited from pitchtools.PitchClassObject

NamedChromaticPitchClass.**__int__**()

NamedChromaticPitchClass.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NamedChromaticPitchClass.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NamedChromaticPitchClass.**__ne__**(*arg*)

Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

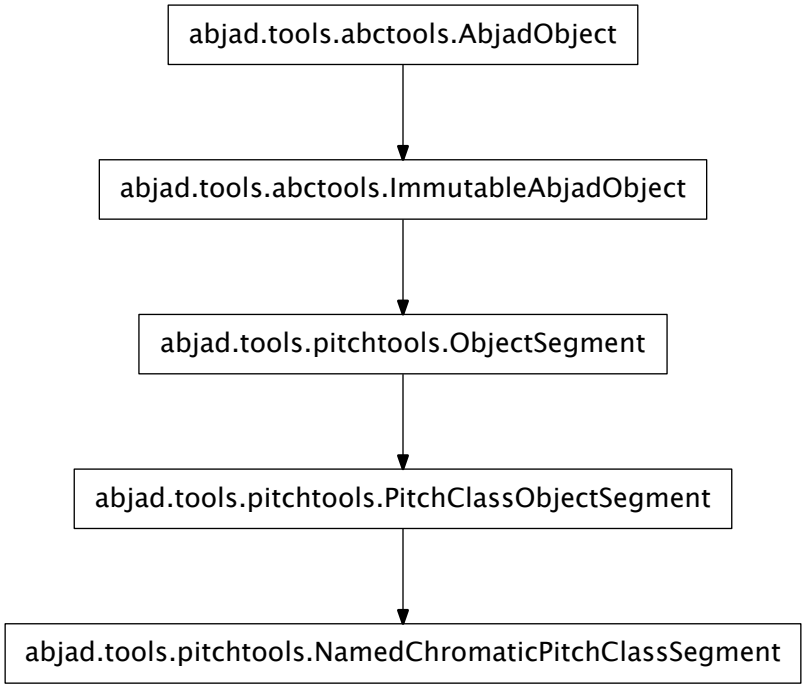
Inherited from abctools.AttributeEqualityAbjadObject

NamedChromaticPitchClass.**__repr__**()

NamedChromaticPitchClass.**__str__**()

NamedChromaticPitchClass.**__sub__**(*arg*)

pitchtools.NamedChromaticPitchClassSegment



class pitchtools.**NamedChromaticPitchClassSegment**(**args*, ***kwargs*)

New in version 2.0. Abjad model of named chromatic pitch-class segment:

```
>>> pitchtools.NamedChromaticPitchClassSegment(['gs', 'a', 'as', 'c', 'cs'])
NamedChromaticPitchClassSegment(['gs', 'a', 'as', 'c', 'cs'])
```

Named chromatic pitch-class segments are immutable.

Read-only Properties

NamedChromaticPitchClassSegment.**inversion_equivalent_diatonic_interval_class_segment**

NamedChromaticPitchClassSegment.**named_chromatic_pitch_class_set**

NamedChromaticPitchClassSegment.**named_chromatic_pitch_classes**

NamedChromaticPitchClassSegment.**numbered_chromatic_pitch_class_segment**

NamedChromaticPitchClassSegment.**numbered_chromatic_pitch_class_set**

NamedChromaticPitchClassSegment.**numbered_chromatic_pitch_classes**

NamedChromaticPitchClassSegment.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NamedChromaticPitchClassSegment.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.**is_equivalent_under_transposition**(*arg*)

NamedChromaticPitchClassSegment.**retrograde**()

NamedChromaticPitchClassSegment.**rotate**(*n*)

NamedChromaticPitchClassSegment.**transpose**(*melodic_diatonic_interval*)

Special Methods

NamedChromaticPitchClassSegment.**__add__**(*arg*)
Inherited from pitchtools.ObjectSegment

NamedChromaticPitchClassSegment.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.**__getslice__**(*start*, *stop*)
Inherited from pitchtools.ObjectSegment

NamedChromaticPitchClassSegment.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.__**len**__() <==> *len(x)*
Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.__**mul**__(*n*)
Inherited from pitchtools.ObjectSegment

NamedChromaticPitchClassSegment.__**ne**__()
x.__ne__(y) <==> x!=y

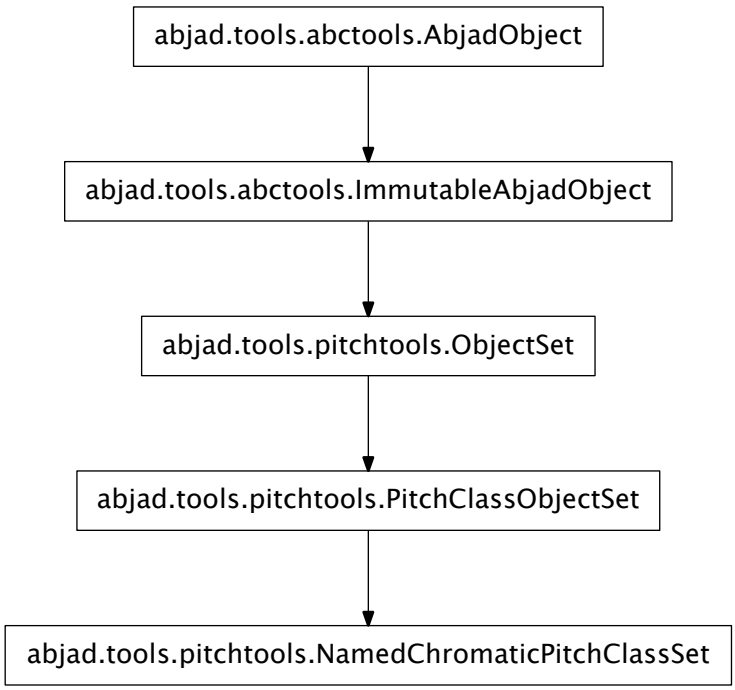
Inherited from __builtin__.tuple

NamedChromaticPitchClassSegment.__**repr**__()

NamedChromaticPitchClassSegment.__**rmul**__(*n*)
Inherited from pitchtools.ObjectSegment

NamedChromaticPitchClassSegment.__**str**__()

pitchtools.NamedChromaticPitchClassSet



class pitchtools.**NamedChromaticPitchClassSet**(**args*, ***kwargs*)

New in version 2.0. Abjad model of a named chromatic pitch-class set:

```
>>> named_chromatic_pitch_class_set = pitchtools.NamedChromaticPitchClassSet(
...     ['gs', 'g', 'as', 'c', 'cs'])

>>> named_chromatic_pitch_class_set
NamedChromaticPitchClassSet(['as', 'c', 'cs', 'g', 'gs'])

>>> print named_chromatic_pitch_class_set
{as, c, cs, g, gs}
```

Named chromatic pitch-class sets are immutable.

Read-only Properties

NamedChromaticPitchClassSet.**inversion_equivalent_diatonic_interval_class_vector**

NamedChromaticPitchClassSet.**named_chromatic_pitch_classes**

Read-only named chromatic pitch-classes:

```
>>> named_chromatic_pitch_class_set = pitchtools.NamedChromaticPitchClassSet(
...     ['gs', 'g', 'as', 'c', 'cs'])
>>> for x in named_chromatic_pitch_class_set.named_chromatic_pitch_classes: x
...
NamedChromaticPitchClass('as')
NamedChromaticPitchClass('c')
NamedChromaticPitchClass('cs')
NamedChromaticPitchClass('g')
NamedChromaticPitchClass('gs')
```

Return tuple.

NamedChromaticPitchClassSet.**numbered_chromatic_pitch_class_set**

NamedChromaticPitchClassSet.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NamedChromaticPitchClassSet.**copy**()

Return a shallow copy of a set.

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**difference**()

Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**intersection**()

Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**order_by**(*npc_seg*)

NamedChromaticPitchClassSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**transpose**(*melodic_diatonic_interval*)
Transpose all npcs in self by melodic diatonic interval.

NamedChromaticPitchClassSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

NamedChromaticPitchClassSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**__eq__**(*arg*)

NamedChromaticPitchClassSet.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.**__hash__**()

NamedChromaticPitchClassSet.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.__le__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.__len__() <==> *len(x)*
Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.__lt__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.__ne__(*arg*)

NamedChromaticPitchClassSet.__or__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.__rand__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.__repr__()

NamedChromaticPitchClassSet.__ror__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.__rsub__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.__rxor__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.__str__()

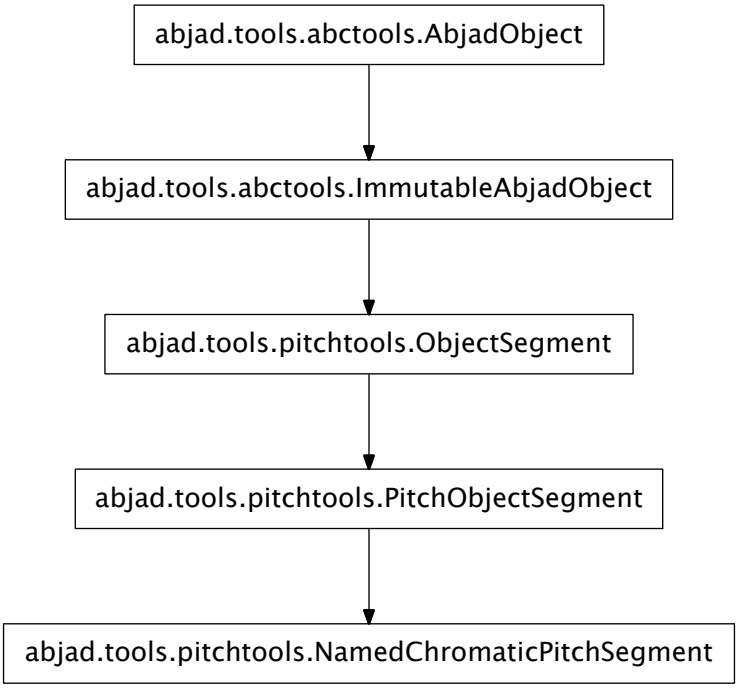
NamedChromaticPitchClassSet.__sub__()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

NamedChromaticPitchClassSet.__xor__()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.NamedChromaticPitchSegment



class pitchtools.**NamedChromaticPitchSegment**(**args*, ***kwargs*)

New in version 2.0. Abjad model of a named chromatic pitch segment:

```
>>> pitchtools.NamedChromaticPitchSegment(['bf', 'bqf', "fs'", "g'", 'bqf', "g'"])
NamedChromaticPitchSegment("bf bqf fs' g' bqf g'")
```

Named chromtic pitch segments are immutable.

Read-only Properties

NamedChromaticPitchSegment.**chromatic_pitch_numbers**

NamedChromaticPitchSegment.**harmonic_chromatic_interval_class_segment**

NamedChromaticPitchSegment.**harmonic_chromatic_interval_segment**

NamedChromaticPitchSegment.**harmonic_diatonic_interval_class_segment**

NamedChromaticPitchSegment.**harmonic_diatonic_interval_segment**

NamedChromaticPitchSegment.**inflection_point_count**

NamedChromaticPitchSegment.**inversion_equivalent_chromatic_interval_class_segment**

NamedChromaticPitchSegment.**inversion_equivalent_chromatic_interval_class_set**

NamedChromaticPitchSegment.**inversion_equivalent_chromatic_interval_class_vector**

NamedChromaticPitchSegment.**local_maxima**

NamedChromaticPitchSegment.**local_minima**

NamedChromaticPitchSegment.**melodic_chromatic_interval_class_segment**

NamedChromaticPitchSegment.**melodic_chromatic_interval_segment**

NamedChromaticPitchSegment.**melodic_diatonic_interval_class_segment**

NamedChromaticPitchSegment.**melodic_diatonic_interval_segment**

NamedChromaticPitchSegment.**named_chromatic_pitch_class_vector**

NamedChromaticPitchSegment.**named_chromatic_pitch_set**

NamedChromaticPitchSegment.**named_chromatic_pitch_vector**

NamedChromaticPitchSegment.**named_chromatic_pitches**

NamedChromaticPitchSegment.**numbered_chromatic_pitch_class_segment**

NamedChromaticPitchSegment.**numbered_chromatic_pitch_class_set**

NamedChromaticPitchSegment.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NamedChromaticPitchSegment.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**transpose**(*melodic_interval*)
Transpose pitches in pitch segment by melodic interval and emit new pitch segment.

Special Methods

NamedChromaticPitchSegment.**__add__**(*arg*)
Inherited from pitchtools.ObjectSegment

NamedChromaticPitchSegment.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__getslice__**(*start*, *stop*)
Inherited from pitchtools.ObjectSegment

NamedChromaticPitchSegment.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

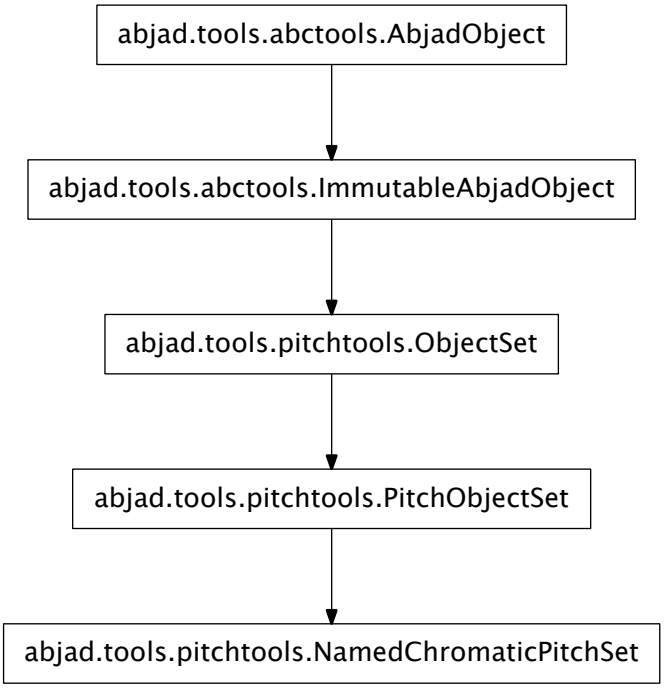
NamedChromaticPitchSegment.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.tuple

NamedChromaticPitchSegment.**__repr__**()

NamedChromaticPitchSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

pitchtools.NamedChromaticPitchSet



class pitchtools.**NamedChromaticPitchSet**(**args*, ***kwargs*)

New in version 2.0. Abjad model of a named chromatic pitch set:

```
>>> pitchtools.NamedChromaticPitchSet(['bf', 'bqf', "fs'", "g'", 'bqf', "g'"])
NamedChromaticPitchSet(['bf', 'bqf', "fs'", "g'"])
```

Named chromatic pitch sets are immutable.

Read-only Properties

NamedChromaticPitchSet.**chromatic_pitch_numbers**

NamedChromaticPitchSet.**duplicate_pitch_classes**

NamedChromaticPitchSet.**is_pitch_class_unique**

NamedChromaticPitchSet.**named_chromatic_pitches**

NamedChromaticPitchSet.**numbered_chromatic_pitch_class_set**

NamedChromaticPitchSet.**numbered_chromatic_pitch_classes**

NamedChromaticPitchSet.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NamedChromaticPitchSet.**copy**()
Return a shallow copy of a set.

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**difference**()
Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**intersection**()
Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**transpose**(*n*)
Transpose all pcs in self by n.

NamedChromaticPitchSet.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

NamedChromaticPitchSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**__eq__**(*arg*)

NamedChromaticPitchSet.__**ge**__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**hash**__() <==> *hash(x)*
Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**len**__() <==> *len(x)*
Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**ne**__(*arg*)

NamedChromaticPitchSet.__**or**__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**rand**__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**repr**__()

NamedChromaticPitchSet.__**ror**__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**rsub**__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**rxor**__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.__**str**__()

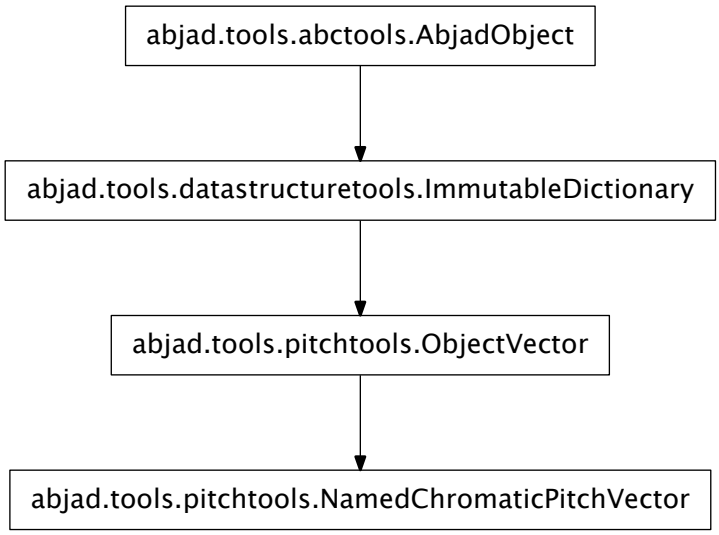
NamedChromaticPitchSet.__**sub**__()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

NamedChromaticPitchSet.**__xor__**()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.NamedChromaticPitchVector



class pitchtools.**NamedChromaticPitchVector**(*pitch_tokens*)
New in version 2.0. Abjad model of named chromatic pitch vector:

```
>>> named_chromatic_pitch_vector = pitchtools.NamedChromaticPitchVector(
...     ["c''", "c''", "cs''", "cs''", "cs''"])

>>> named_chromatic_pitch_vector
NamedChromaticPitchVector(c'': 2, cs'': 3)

>>> print named_chromatic_pitch_vector
NamedChromaticPitchVector(c'': 2, cs'': 3)
```

Named chromatic pitch vectors are immutable.

Read-only Properties

NamedChromaticPitchVector.**chromatic_pitch_numbers**
NamedChromaticPitchVector.**named_chromatic_pitches**

NamedChromaticPitchVector.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NamedChromaticPitchVector.**clear**() → None. Remove all items from D.
Inherited from __builtin__.dict

NamedChromaticPitchVector.**copy**() → a shallow copy of D
Inherited from __builtin__.dict

NamedChromaticPitchVector.**get**(*k*[, *d*]) → D[k] if k in D, else d. d defaults to None.
Inherited from __builtin__.dict

NamedChromaticPitchVector.**has_key**(*k*) → True if D has a key k, else False
Inherited from __builtin__.dict

NamedChromaticPitchVector.**items**() → list of D's (key, value) pairs, as 2-tuples
Inherited from __builtin__.dict

NamedChromaticPitchVector.**iteritems**() → an iterator over the (key, value) items of D
Inherited from __builtin__.dict

NamedChromaticPitchVector.**iterkeys**() → an iterator over the keys of D
Inherited from __builtin__.dict

NamedChromaticPitchVector.**itervalues**() → an iterator over the values of D
Inherited from __builtin__.dict

NamedChromaticPitchVector.**keys**() → list of D's keys
Inherited from __builtin__.dict

NamedChromaticPitchVector.**pop**(*k*[, *d*]) → v, remove specified key and return the corresponding value.
If key is not found, d is returned if given, otherwise KeyError is raised

Inherited from __builtin__.dict

NamedChromaticPitchVector.**popitem**() → (k, v), remove and return some (key, value) pair as a 2-tuple; but raise KeyError if D is empty.

Inherited from __builtin__.dict

NamedChromaticPitchVector.**setdefault**(*k*[, *d*]) → D.get(k,d), also set D[k]=d if k not in D
Inherited from __builtin__.dict

NamedChromaticPitchVector.**update**([*E*], ***F*) → None. Update D from dict/iterable E and F.
If E present and has a .keys() method, does: for k in E: D[k] = E[k] If E present and lacks .keys() method, does: for (k, v) in E: D[k] = v In either case, this is followed by: for k in F: D[k] = F[k]

Inherited from __builtin__.dict

NamedChromaticPitchVector.**values**() → list of D's values
Inherited from __builtin__.dict

NamedChromaticPitchVector.**viewitems**() → a set-like object providing a view on D's items
Inherited from __builtin__.dict

NamedChromaticPitchVector.**viewkeys**() → a set-like object providing a view on D's keys
Inherited from __builtin__.dict

NamedChromaticPitchVector.**viewvalues**() → an object providing a view on D's values
Inherited from __builtin__.dict

Special Methods

NamedChromaticPitchVector.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.dict

NamedChromaticPitchVector.**__contains__**(*k*) → True if D has a key k, else False
Inherited from __builtin__.dict

NamedChromaticPitchVector.**__delitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

NamedChromaticPitchVector.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.dict

NamedChromaticPitchVector.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.dict

NamedChromaticPitchVector.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.dict

NamedChromaticPitchVector.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.dict

NamedChromaticPitchVector.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.dict

NamedChromaticPitchVector.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.dict

NamedChromaticPitchVector.**__len__**() <==> *len(x)*
Inherited from __builtin__.dict

NamedChromaticPitchVector.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.dict

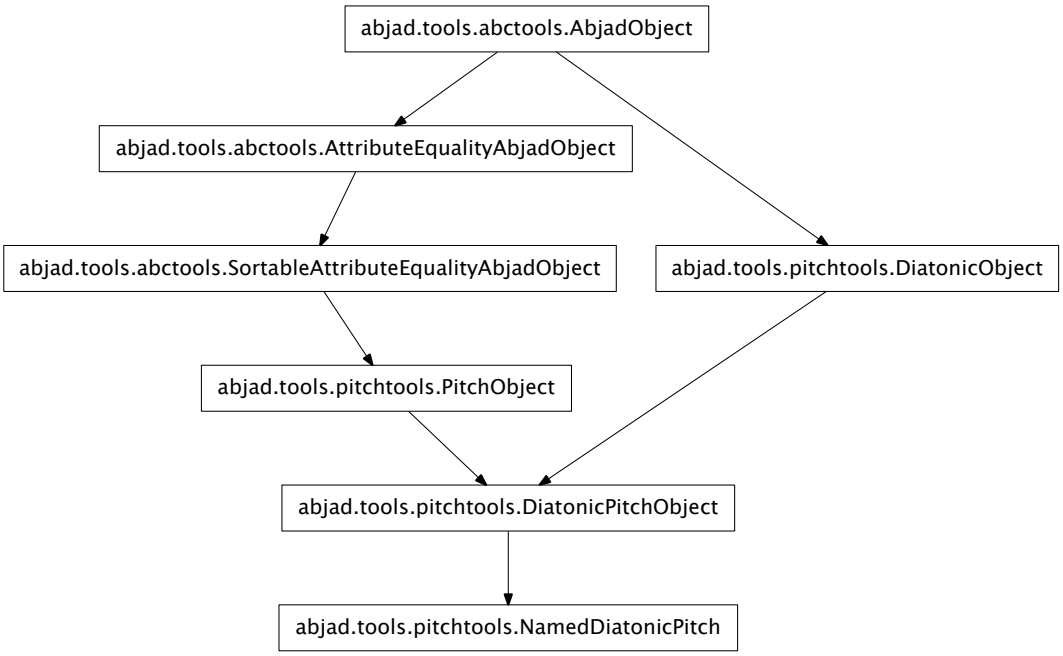
NamedChromaticPitchVector.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.dict

NamedChromaticPitchVector.**__repr__**()

NamedChromaticPitchVector.**__setitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

pitchtools.NamedDiatonicPitch



class pitchtools.**NamedDiatonicPitch**(*arg*)

New in version 2.0. Abjad model of a named diatonic pitch:

```
>>> named_diatonic_pitch = pitchtools.NamedDiatonicPitch("c''")

>>> named_diatonic_pitch
NamedDiatonicPitch("c''")

>>> print named_diatonic_pitch
c''
```

Named diatonic pitches are immutable.

Read-only Properties

NamedDiatonicPitch.**chromatic_pitch_class_name**

Read-only chromatic pitch-class name:

```
>>> pitchtools.NamedDiatonicPitch("c''").chromatic_pitch_class_name
'c'
```

Return string.

NamedDiatonicPitch.**chromatic_pitch_class_number**

Read-only chromatic pitch-class number:

```
>>> pitchtools.NamedDiatonicPitch("c''").chromatic_pitch_class_number
0
```

Return integer.

NamedDiatonicPitch.**chromatic_pitch_name**
Read-only chromatic pitch name:

```
>>> pitchtools.NamedDiatonicPitch("c''").chromatic_pitch_name
"c''"
```

Return string.

NamedDiatonicPitch.**chromatic_pitch_number**
Read-only chromatic pitch number:

```
>>> pitchtools.NamedDiatonicPitch("c''").chromatic_pitch_number
12
```

Return integer.

NamedDiatonicPitch.**diatonic_pitch_class_name**
Read-only diatonic pitch-class name:

```
>>> pitchtools.NamedDiatonicPitch("c''").diatonic_pitch_class_name
'c'
```

Return string.

NamedDiatonicPitch.**diatonic_pitch_class_number**
Read-only diatonic pitch-class number:

```
>>> pitchtools.NamedDiatonicPitch("c''").diatonic_pitch_class_number
0
```

Return integer.

NamedDiatonicPitch.**diatonic_pitch_name**
Read-only diatonic pitch name:

```
>>> pitchtools.NamedDiatonicPitch("c''").diatonic_pitch_name
"c''"
```

Return string.

NamedDiatonicPitch.**diatonic_pitch_number**
Read-only diatonic pitch number:

```
>>> pitchtools.NamedDiatonicPitch("c''").diatonic_pitch_number
7
```

Return integer.

NamedDiatonicPitch.**lilypond_format**
Read-only LilyPond input format of named diatonic pitch:

```
>>> pitchtools.NamedDiatonicPitch("c''").lilypond_format
"c''"
```

Return string.

NamedDiatonicPitch.**named_chromatic_pitch**
Read-only named chromatic pitch:

```
>>> pitchtools.NamedDiatonicPitch("c''").named_chromatic_pitch
NamedChromaticPitch("c''")
```

Return named chromatic pitch.

NamedDiatonicPitch.**named_chromatic_pitch_class**
Read-only named chromatic pitch-class:

```
>>> pitchtools.NamedDiatonicPitch("c''").named_chromatic_pitch_class
NamedChromaticPitchClass('c')
```

Return named chromatic pitch-class.

NamedDiatonicPitch.**named_diatonic_pitch_class**
Read-only named diatonic pitch-class:

```
>>> pitchtools.NamedDiatonicPitch("c''").named_diatonic_pitch_class
NamedDiatonicPitchClass('c')
```

Return named diatonic pitch-class.

NamedDiatonicPitch.**numbered_chromatic_pitch**
Read-only numbered chromatic pitch:

```
>>> pitchtools.NamedDiatonicPitch("c''").numbered_chromatic_pitch
NumberedChromaticPitch(12)
```

Return numbered chromatic pitch.

NamedDiatonicPitch.**numbered_chromatic_pitch_class**
Read-only numbered chromatic pitch-class:

```
>>> pitchtools.NamedDiatonicPitch("c''").numbered_chromatic_pitch_class
NumberedChromaticPitchClass(0)
```

Return numbered chromatic pitch-class.

NamedDiatonicPitch.**numbered_diatonic_pitch**
Read-only numbered diatonic pitch:

```
>>> pitchtools.NamedDiatonicPitch("c''").numbered_diatonic_pitch
NumberedDiatonicPitch(7)
```

Return numbered diatonic pitch.

NamedDiatonicPitch.**numbered_diatonic_pitch_class**
Read-only numbered diatonic pitch-class:

```
>>> pitchtools.NamedDiatonicPitch("c''").numbered_diatonic_pitch_class
NumberedDiatonicPitchClass(0)
```

Return numbered diatonic pitch-class.

NamedDiatonicPitch.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

NamedDiatonicPitch.**__abs__**()
NamedDiatonicPitch.**__eq__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NamedDiatonicPitch.__**float**__()

NamedDiatonicPitch.__**ge**__(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NamedDiatonicPitch.__**gt**__(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NamedDiatonicPitch.__**hash**__()
Inherited from pitchtools.PitchObject

NamedDiatonicPitch.__**int**__()

NamedDiatonicPitch.__**le**__(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NamedDiatonicPitch.__**lt**__(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

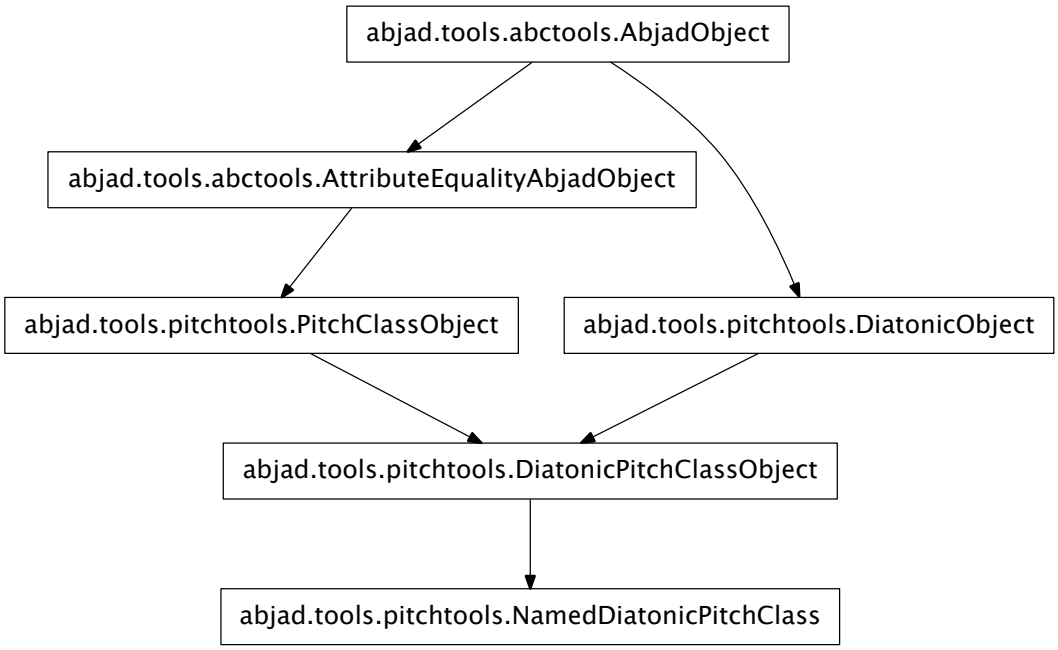
Inherited from abctools.SortableAttributeEqualityAbjadObject

NamedDiatonicPitch.__**ne**__(*arg*)
Inherited from pitchtools.PitchObject

NamedDiatonicPitch.__**repr**__()

NamedDiatonicPitch.__**str**__()

pitchtools.NamedDiatonicPitchClass



class `pitchtools.`**`NamedDiatonicPitchClass`**(*arg*)

New in version 2.0. Abjad model of a named diatonic pitch-class:

```
>>> pitchtools.NamedDiatonicPitchClass('c')
NamedDiatonicPitchClass('c')
```

Named diatonic pitch-classes are immutable.

Read-only Properties

`NamedDiatonicPitchClass.`**`numbered_diatonic_pitch_class`**

Read-only numbered diatonic pitch-class from named diatonic pitch-class:

```
>>> named_diatonic_pitch_class = pitchtools.NamedDiatonicPitchClass('c')
>>> named_diatonic_pitch_class.numbered_diatonic_pitch_class
NumberedDiatonicPitchClass(0)
```

Return numbered diatonic pitch-class.

`NamedDiatonicPitchClass.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Special Methods

`NamedDiatonicPitchClass.`**`__abs__`**`()`

NamedDiatonicPitchClass.__**eq**__(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NamedDiatonicPitchClass.__**float**__()

NamedDiatonicPitchClass.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NamedDiatonicPitchClass.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

NamedDiatonicPitchClass.__**hash**__()
Inherited from pitchtools.PitchClassObject

NamedDiatonicPitchClass.__**int**__()

NamedDiatonicPitchClass.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NamedDiatonicPitchClass.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NamedDiatonicPitchClass.__**ne**__(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

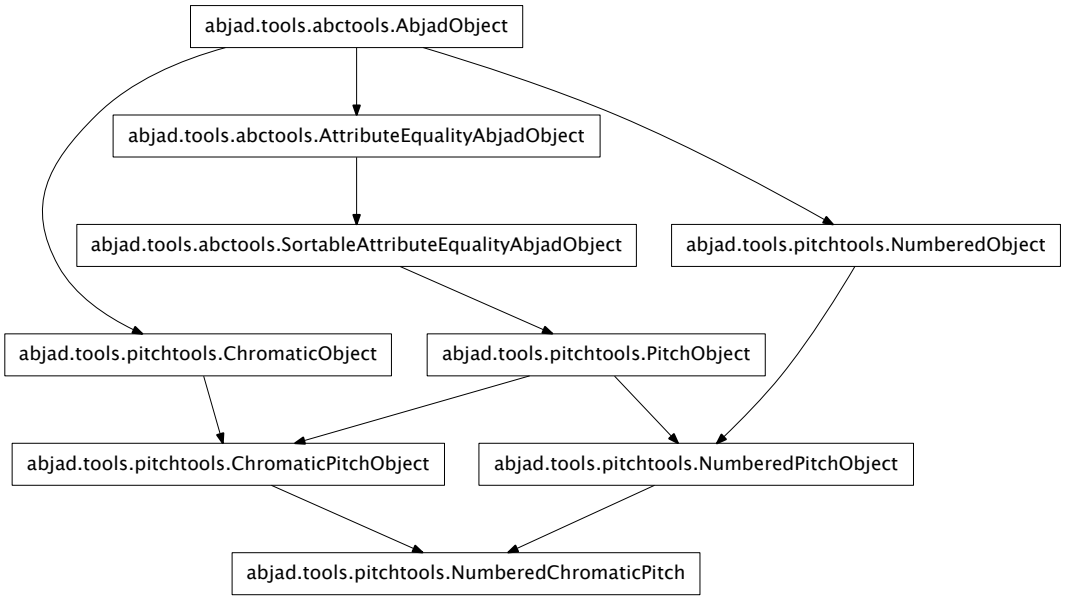
Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NamedDiatonicPitchClass.__**repr**__()

NamedDiatonicPitchClass.__**str**__()

pitchtools.NumberedChromaticPitch



class pitchtools.**NumberedChromaticPitch**(*arg*)

New in version 2.0. Abjad model of a numbered chromatic pitch:

```
>>> pitchtools.NumberedChromaticPitch(13)
NumberedChromaticPitch(13)
```

Numbered chromatic pitches are immutable.

Read-only Properties

NumberedChromaticPitch.**chromatic_pitch_number**

Read-only chromatic pitch-class number:

```
>>> pitchtools.NumberedChromaticPitch(13).chromatic_pitch_number
13
```

Return integer or float.

NumberedChromaticPitch.**diatonic_pitch_class_number**

Read-only diatonic pitch-class number:

```
>>> pitchtools.NumberedChromaticPitch(13).diatonic_pitch_class_number
0
```

Return integer.

NumberedChromaticPitch.**diatonic_pitch_number**

Read-only diatonic pitch-class number:

```
>>> pitchtools.NumberedChromaticPitch(13).diatonic_pitch_number
7
```

Return integer.

NumberedChromaticPitch.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NumberedChromaticPitch.**apply_accidental**(*accidental=None*)
Apply *accidental*:

```
>>> pitchtools.NumberedChromaticPitch(13).apply_accidental('flat')
NumberedChromaticPitch(12)
```

Return numbered chromatic pitch.

NumberedChromaticPitch.**transpose**(*n=0*)
Tranpose by *n* semitones:

```
>>> pitchtools.NumberedChromaticPitch(13).transpose(1)
NumberedChromaticPitch(14)
```

Return numbered chromatic pitch.

Special Methods

NumberedChromaticPitch.**__abs__**()
NumberedChromaticPitch.**__add__**(*arg*)

NumberedChromaticPitch.**__eq__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NumberedChromaticPitch.**__float__**()

NumberedChromaticPitch.**__ge__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedChromaticPitch.**__gt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedChromaticPitch.**__hash__**()

NumberedChromaticPitch.**__int__**()

NumberedChromaticPitch.**__le__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedChromaticPitch.**__lt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedChromaticPitch.**__ne__**(*arg*)
Inherited from pitchtools.PitchObject

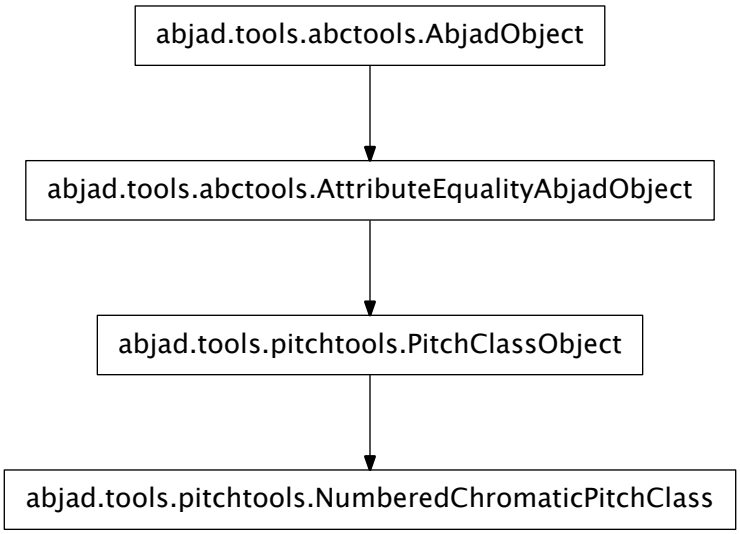
NumberedChromaticPitch.**__neg__**()

NumberedChromaticPitch.**__repr__**()

NumberedChromaticPitch.**__str__**()

NumberedChromaticPitch.**__sub__**(*arg*)

pitchtools.NumberedChromaticPitchClass



class pitchtools.**NumberedChromaticPitchClass**(*arg*)
New in version 2.0. Abjad model of a numbered chromatic pitch-class:

```
>>> pitchtools.NumberedChromaticPitchClass(13)
NumberedChromaticPitchClass(1)
```

Numbered chromatic pitch-classes are immutable.

Read-only Properties

NumberedChromaticPitchClass.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NumberedChromaticPitchClass.**apply_accidental**(*accidental=None*)
Emit new numbered chromatic pitch-class as sum of self and accidental.

NumberedChromaticPitchClass.**invert**()
Invert pitch-class.

NumberedChromaticPitchClass.**multiply**(*n*)
Multiply pitch-class by n.

NumberedChromaticPitchClass.**transpose**(*n*)
Transpose pitch-class by n.

Special Methods

NumberedChromaticPitchClass.**__abs__**()

NumberedChromaticPitchClass.**__add__**(*arg*)
Addition defined against melodic chromatic intervals only.

NumberedChromaticPitchClass.**__eq__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NumberedChromaticPitchClass.**__float__**()

NumberedChromaticPitchClass.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedChromaticPitchClass.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

NumberedChromaticPitchClass.**__hash__**()
Inherited from pitchtools.PitchClassObject

NumberedChromaticPitchClass.**__int__**()

NumberedChromaticPitchClass.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedChromaticPitchClass.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedChromaticPitchClass.**__ne__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

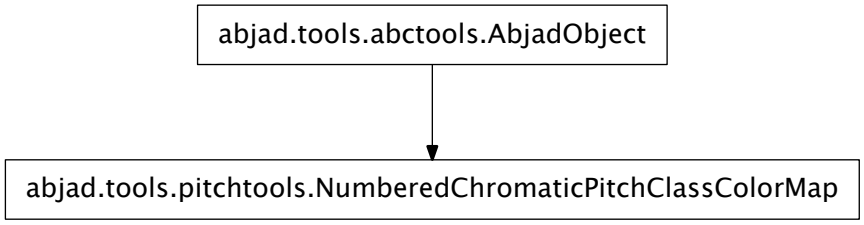
NumberedChromaticPitchClass.**__neg__**()

NumberedChromaticPitchClass.**__repr__**()

NumberedChromaticPitchClass.**__str__**()

NumberedChromaticPitchClass.**__sub__**(*arg*)
Subtraction defined against both melodic chromatic intervals and against other pitch-classes.

pitchtools.NumberedChromaticPitchClassColorMap



class pitchtools.**NumberedChromaticPitchClassColorMap**(*pitch_iterables*, *colors*)
New in version 2.0. Abjad model of a numbered chromatic pitch-class color map:

```
>>> chromatic_pitch_class_numbers = [[-8, 2, 10, 21], [0, 11, 32, 41], [15, 25, 42, 43]]
>>> colors = ['red', 'green', 'blue']
>>> mapping = pitchtools.NumberedChromaticPitchClassColorMap(
... chromatic_pitch_class_numbers, colors)
```

Numbered chromatic pitch-class color maps are immutable.

Read-only Properties

NumberedChromaticPitchClassColorMap.**colors**
NumberedChromaticPitchClassColorMap.**pairs**

NumberedChromaticPitchClassColorMap.**pitch_iterables**

NumberedChromaticPitchClassColorMap.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

NumberedChromaticPitchClassColorMap.**twelve_tone_complete**

NumberedChromaticPitchClassColorMap.**twenty_four_tone_complete**

Methods

NumberedChromaticPitchClassColorMap.**get**(*key*, *alternative=None*)

Special Methods

NumberedChromaticPitchClassColorMap.**__eq__**(*arg*)

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

NumberedChromaticPitchClassColorMap.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

NumberedChromaticPitchClassColorMap.**__getitem__**(*pc*)

NumberedChromaticPitchClassColorMap.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

NumberedChromaticPitchClassColorMap.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

NumberedChromaticPitchClassColorMap.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

NumberedChromaticPitchClassColorMap.**__ne__**(*arg*)

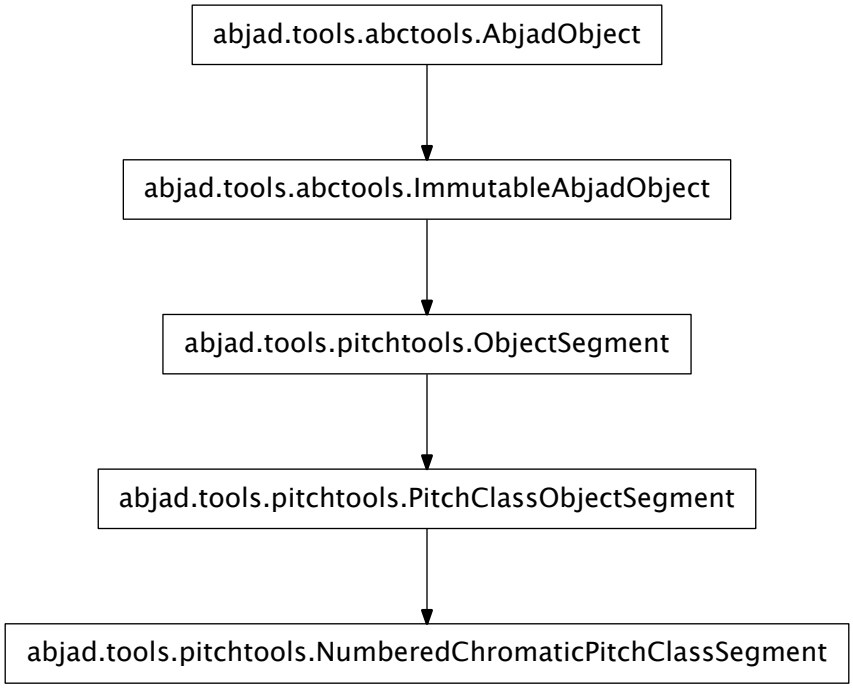
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

NumberedChromaticPitchClassColorMap.**__repr__**()

pitchtools.NumberedChromaticPitchClassSegment



class pitchtools.**NumberedChromaticPitchClassSegment**(**args*, ***kwargs*)

New in version 2.0. Abjad model of a numbered chromatic pitch-class segment:

```
>>> pitchtools.NumberedChromaticPitchClassSegment([-2, -1.5, 6, 7, -1.5, 7])
NumberedChromaticPitchClassSegment([10, 10.5, 6, 7, 10.5, 7])
```

Numbered chromatic pitch-class segments are immutable.

Read-only Properties

NumberedChromaticPitchClassSegment.**inversion_equivalent_chromatic_interval_class_segment**

Read-only inversion-equivalent chromatic interval-class segment:

```
>>> segment = pitchtools.NumberedChromaticPitchClassSegment([10, 10.5, 6, 7, 10.5, 7])
```

```
>>> segment.inversion_equivalent_chromatic_interval_class_segment
InversionEquivalentChromaticIntervalClassSegment(0.5, 4.5, 1, 3.5, 3.5)
```

Return inversion-equivalent chromatic interval-class segment.

NumberedChromaticPitchClassSegment.**numbered_chromatic_pitch_class_set**

Read-only numbered chromatic pitch-class set from numbered chromatic pitch-class segment:

```
>>> segment.numbered_chromatic_pitch_class_set
NumberedChromaticPitchClassSet([6, 7, 10, 10.5])
```

Return numbered chromatic pitch-class set.

NumberedChromaticPitchClassSegment.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NumberedChromaticPitchClassSegment.**alpha**()
Morris alpha transform of numbered chromatic pitch-class segment:

```
>>> segment.alpha()
NumberedChromaticPitchClassSegment([11, 11.5, 7, 6, 11.5, 6])
```

Return numbered chromatic pitch-class segment.

NumberedChromaticPitchClassSegment.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**invert**()
Invert numbered chromatic pitch-class segment:

```
>>> segment.invert()
NumberedChromaticPitchClassSegment([2, 1.5, 6, 5, 1.5, 5])
```

Return numbered chromatic pitch-class segment.

NumberedChromaticPitchClassSegment.**multiply**(*n*)
Multiply numbered chromatic pitch-class segment by *n*:

```
>>> segment.multiply(5)
NumberedChromaticPitchClassSegment([2, 4.5, 6, 11, 4.5, 11])
```

Return numbered chromatic pitch-class segment.

NumberedChromaticPitchClassSegment.**retrograde**()
Retrograde of numbered chromatic pitch-class segment:

```
>>> segment.retrograde()
NumberedChromaticPitchClassSegment([7, 10.5, 7, 6, 10.5, 10])
```

Return numbered chromatic pitch-class segment.

NumberedChromaticPitchClassSegment.**rotate**(*n*)
Rotate numbered chromatic pitch-class segment:

```
>>> segment.rotate(1)
NumberedChromaticPitchClassSegment([7, 10, 10.5, 6, 7, 10.5])
```

Return numbered chromatic pitch-class segment.

NumberedChromaticPitchClassSegment.**transpose**(*n*)
Transpose numbered chromatic pitch-class segment:

```
>>> segment.transpose(10)
NumberedChromaticPitchClassSegment([8, 8.5, 4, 5, 8.5, 5])
```

Return numbered chromatic pitch-class segment.

Special Methods

NumberedChromaticPitchClassSegment.**__add__**(*arg*)
Inherited from pitchtools.ObjectSegment

NumberedChromaticPitchClassSegment.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__getslice__**(*start*, *stop*)
Inherited from pitchtools.ObjectSegment

NumberedChromaticPitchClassSegment.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

NumberedChromaticPitchClassSegment.**__ne__**()
x.__ne__(y) <==> x!=y

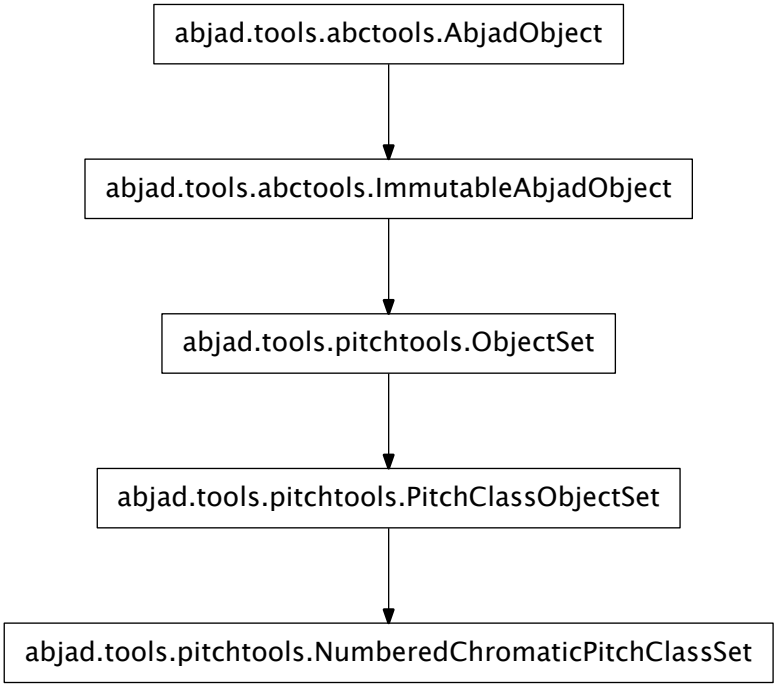
Inherited from __builtin__.tuple

NumberedChromaticPitchClassSegment.**__repr__**()

NumberedChromaticPitchClassSegment.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

NumberedChromaticPitchClassSegment.__str__()

pitchtools.NumberedChromaticPitchClassSet



class pitchtools.**NumberedChromaticPitchClassSet**(**args*, ***kwargs*)

New in version 2.0. Abjad model of a numbered chromatic pitch-class set:

```
>>> ncpcs = pitchtools.NumberedChromaticPitchClassSet([-2, -1.5, 6, 7, -1.5, 7])

>>> ncpcs
NumberedChromaticPitchClassSet([6, 7, 10, 10.5])

>>> print ncpcs
{6, 7, 10, 10.5}
```

Numbered chromatic pitch-class sets are immutable.

Read-only Properties

NumberedChromaticPitchClassSet.**inversion_equivalent_chromatic_interval_class_set**

Read-only inversion-equivalent chromatic interval-class set:

```
>>> ncpcs.inversion_equivalent_chromatic_interval_class_set
InversionEquivalentChromaticIntervalClassSet(0.5, 1, 3, 3.5, 4, 4.5)
```

Return inversion-equivalent chromatic interval-class set.

NumberedChromaticPitchClassSet.**inversion_equivalent_chromatic_interval_class_vector**
Read-only inversion-equivalent chromatic interval-class vector:

```
>>> ncpcs.inversion_equivalent_chromatic_interval_class_vector
InversionEquivalentChromaticIntervalClassVector(0 | 1 0 1 1 0 0 1 0 0 1 1 0)
```

Return inversion-equivalent chromatic interval-class vector.

NumberedChromaticPitchClassSet.**numbered_chromatic_pitch_classes**
Read-only numbered chromatic pitch-classes:

```
>>> result = ncpcs.numbered_chromatic_pitch_classes
```

```
>>> for x in result: x
...
NumberedChromaticPitchClass(6)
NumberedChromaticPitchClass(7)
NumberedChromaticPitchClass(10)
NumberedChromaticPitchClass(10.5)
```

Return tuple.

NumberedChromaticPitchClassSet.**prime_form**
To be implemented.

NumberedChromaticPitchClassSet.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NumberedChromaticPitchClassSet.**copy**()
Return a shallow copy of a set.

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**difference**()
Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**intersection**()
Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**invert**()
Invert numbered chromatic pitch-class set:

```
>>> ncpcs.invert()
NumberedChromaticPitchClassSet([1.5, 2, 5, 6])
```

Return numbered chromatic pitch-class set.

NumberedChromaticPitchClassSet.**is_transposed_subset**(*pcset*)
True when self is transposed subset of *pcset*. False otherwise:

```
>>> pcset_1 = pitchtools.NumberedChromaticPitchClassSet(
... [-2, -1.5, 6, 7, -1.5, 7])
>>> pcset_2 = pitchtools.NumberedChromaticPitchClassSet(
... [-2, -1.5, 6, 7, -1.5, 7, 7.5, 8])

>>> pcset_1.is_transposed_subset(pcset_2)
True
```

Return boolean.

NumberedChromaticPitchClassSet.**is_transposed_superset**(*pcset*)

True when self is transposed superset of *pcset*. False otherwise:

```
>>> pcset_1 = pitchtools.NumberedChromaticPitchClassSet(
... [-2, -1.5, 6, 7, -1.5, 7])
>>> pcset_2 = pitchtools.NumberedChromaticPitchClassSet(
... [-2, -1.5, 6, 7, -1.5, 7, 7.5, 8])

>>> pcset_2.is_transposed_superset(pcset_1)
True
```

Return boolean.

NumberedChromaticPitchClassSet.**isdisjoint**()

Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**issubset**()

Report whether another set contains this set.

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**issuperset**()

Report whether this set contains another set.

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**multiply**(*n*)

Multiply numbered chromatic pitch-class set by *n*:

```
>>> ncpcs.multiply(5)
NumberedChromaticPitchClassSet([2, 4.5, 6, 11])
```

Return numbered chromatic pitch-class set.

NumberedChromaticPitchClassSet.**symmetric_difference**()

Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**transpose**(*n*)

Transpose numbered chromatic pitch-class set by *n*:

```
>>> ncpcs.transpose(5)
NumberedChromaticPitchClassSet([0, 3, 3.5, 11])
```

Return numbered chromatic pitch-class set.

NumberedChromaticPitchClassSet.**union**()

Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

NumberedChromaticPitchClassSet.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__eq__**(*arg*)

NumberedChromaticPitchClassSet.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__hash__**()

NumberedChromaticPitchClassSet.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__len__**() <==> *len(x)*
Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__ne__**(*arg*)

NumberedChromaticPitchClassSet.**__or__**()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__rand__**()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__repr__**()

NumberedChromaticPitchClassSet.**__ror__**()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__rsub__**()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__rxor__**()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__str__**()

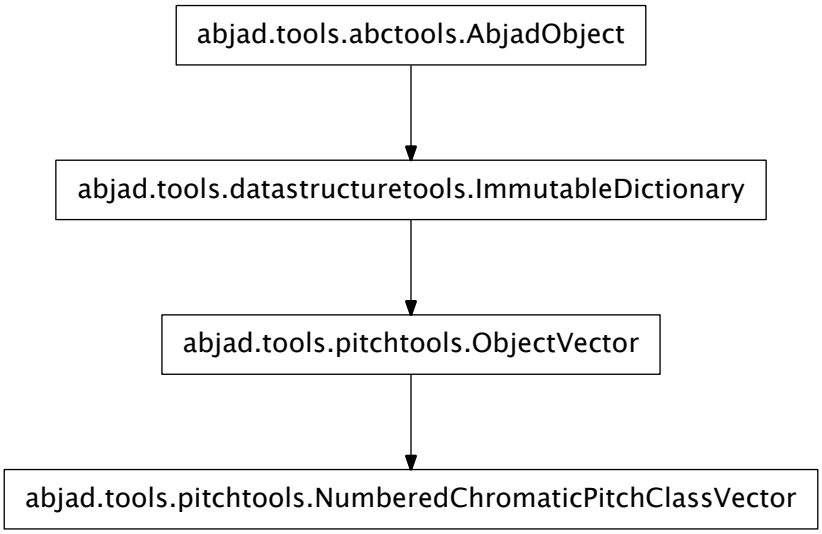
NumberedChromaticPitchClassSet.**__sub__**()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

NumberedChromaticPitchClassSet.**__xor__**()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

pitchtools.NumberedChromaticPitchClassVector



class pitchtools.**NumberedChromaticPitchClassVector**(*pitch_class_tokens*)
New in version 2.0. Abjad model of numbered chromatic pitch-class vector:

```
>>> ncpcv = pitchtools.NumberedChromaticPitchClassVector(
...     [13, 13, 14.5, 14.5, 14.5, 6, 6, 6])

>>> print ncpcv
0 2 0 0 0 0 | 3 0 0 0 0 0
0 0 3 0 0 0 | 0 0 0 0 0 0
```

Numbered chromatic pitch-class vectors are immutable.

Read-only Properties

NumberedChromaticPitchClassVector.**chromatic_pitch_class_numbers**

Read-only chromatic pitch-class numbers from numbered chromatic pitch-class vector:

```
>>> ncpcv.chromatic_pitch_class_numbers
[1, 2.5, 6]
```

Return list.

NumberedChromaticPitchClassVector.**numbered_chromatic_pitch_classes**

Read-only numbered chromatic pitch-classes from numbered chromatic pitch-class vector:

```
>>> result = ncpcv.numbered_chromatic_pitch_classes

>>> for x in result: x
...
NumberedChromaticPitchClass(2.5)
NumberedChromaticPitchClass(1)
NumberedChromaticPitchClass(6)
```

Return list.

NumberedChromaticPitchClassVector.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NumberedChromaticPitchClassVector.**clear**() → None. Remove all items from D.

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**copy**() → a shallow copy of D

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**get**($k[, d]$) → D[k] if k in D, else d. d defaults to None.

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**has_key**(k) → True if D has a key k, else False

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**items**() → list of D's (key, value) pairs, as 2-tuples

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**iteritems**() → an iterator over the (key, value) items of D

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**iterkeys**() → an iterator over the keys of D

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**itervalues**() → an iterator over the values of D

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**keys**() → list of D's keys

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**pop**($k[, d]$) → v, remove specified key and return the corresponding value.

If key is not found, d is returned if given, otherwise KeyError is raised

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**popitem**() → (k, v), remove and return some (key, value) pair as a
2-tuple; but raise KeyError if D is empty.

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**setdefault**(*k*[, *d*]) → D.get(k,d), also set D[k]=d if k not in D

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**update**([*E*], ***F*) → None. Update D from dict/iterable E and F.
If E present and has a .keys() method, does: for k in E: D[k] = E[k] If E present and lacks .keys() method, does: for (k, v) in E: D[k] = v In either case, this is followed by: for k in F: D[k] = F[k]

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**values**() → list of D's values

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**viewitems**() → a set-like object providing a view on D's items

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**viewkeys**() → a set-like object providing a view on D's keys

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**viewvalues**() → an object providing a view on D's values

Inherited from __builtin__.dict

Special Methods

NumberedChromaticPitchClassVector.**__cmp__**(*y*) <==> *cmp(x, y)*

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__contains__**(*k*) → True if D has a key k, else False

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__delitem__**(**args*)

Inherited from datastructuretools.ImmutableDictionary

NumberedChromaticPitchClassVector.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__getitem__**()

x.__getitem__(y) <==> x[y]

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__gt__**()

x.__gt__(y) <==> x>y

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__len__**() <==> *len(x)*
Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__ne__**()
x.__ne__(y) <==> x!=y

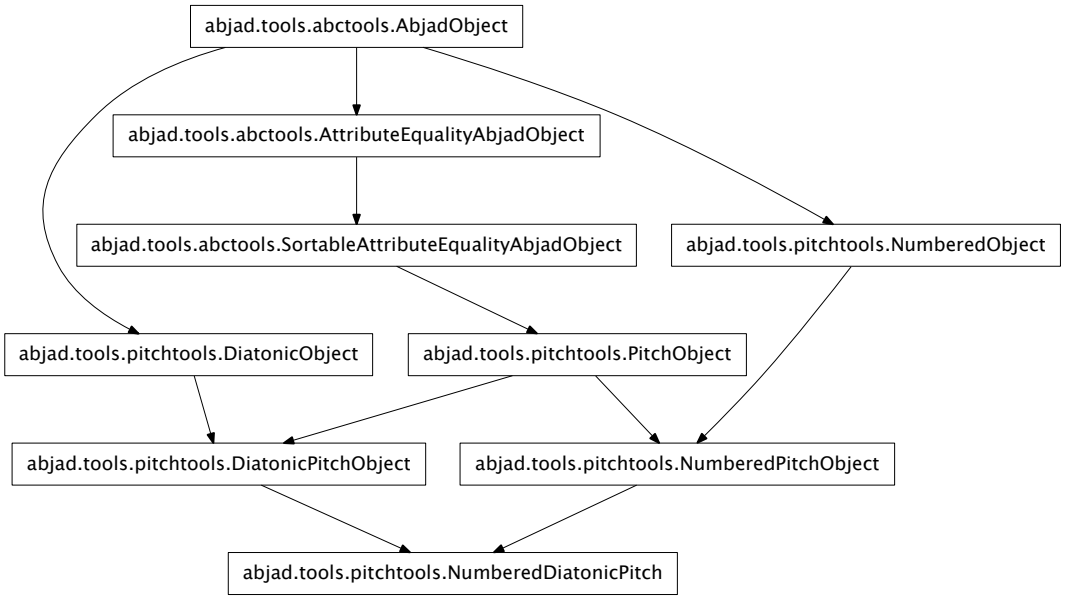
Inherited from __builtin__.dict

NumberedChromaticPitchClassVector.**__repr__**()

NumberedChromaticPitchClassVector.**__setitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

NumberedChromaticPitchClassVector.**__str__**()

pitchtools.NumberedDiatonicPitch



class pitchtools.**NumberedDiatonicPitch**(*arg*)
New in version 2.0. Abjad model of a numbered diatonic pitch:

```
>>> pitchtools.NumberedDiatonicPitch(7)
NumberedDiatonicPitch(7)
```

Numbered diatonic pitches are immutable.

Read-only Properties

NumberedDiatonicPitch.**chromatic_pitch_number**

Read-only chromatic pitch number:

```
>>> pitchtools.NumberedDiatonicPitch(7).chromatic_pitch_number
12
```

Return integer.

NumberedDiatonicPitch.**diatonic_pitch_number**

Read-only diatonic pitch number:

```
>>> pitchtools.NumberedDiatonicPitch(7).diatonic_pitch_number
7
```

Return integer.

NumberedDiatonicPitch.**named_diatonic_pitch**

Read-only named diatonic pitch:

```
>>> pitchtools.NumberedDiatonicPitch(7).named_diatonic_pitch
NamedDiatonicPitch("c''")
```

Return named diatonic pitch.

NumberedDiatonicPitch.**named_diatonic_pitch_class**

Read-only named diatonic pitch-class:

```
>>> pitchtools.NumberedDiatonicPitch(7).named_diatonic_pitch_class
NamedDiatonicPitchClass('c')
```

Return named diatonic pitch-class.

NumberedDiatonicPitch.**numbered_diatonic_pitch_class**

Read-only numbered diatonic pitch-class:

```
>>> pitchtools.NumberedDiatonicPitch(7).numbered_diatonic_pitch_class
NumberedDiatonicPitchClass(0)
```

Return numbered diatonic pitch-class.

NumberedDiatonicPitch.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

NumberedDiatonicPitch.**__abs__**()

NumberedDiatonicPitch.**__eq__**(*arg*)

Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NumberedDiatonicPitch.**__float__**()
Inherited from pitchtools.DiatonicPitchObject

NumberedDiatonicPitch.**__ge__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedDiatonicPitch.**__gt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedDiatonicPitch.**__hash__**()
Inherited from pitchtools.PitchObject

NumberedDiatonicPitch.**__int__**()
Inherited from pitchtools.DiatonicPitchObject

NumberedDiatonicPitch.**__le__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedDiatonicPitch.**__lt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

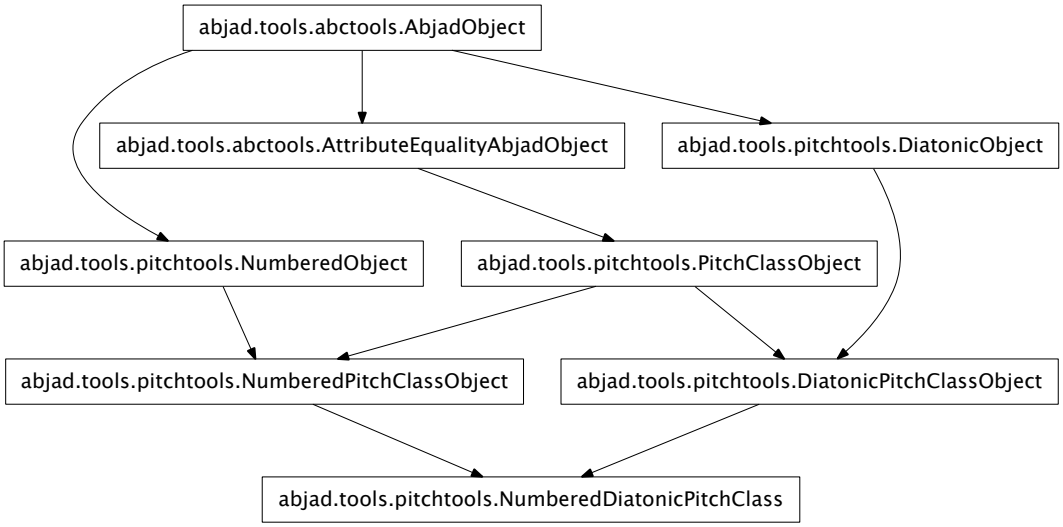
Inherited from abctools.SortableAttributeEqualityAbjadObject

NumberedDiatonicPitch.**__ne__**(*arg*)
Inherited from pitchtools.PitchObject

NumberedDiatonicPitch.**__repr__**()

NumberedDiatonicPitch.**__str__**()

pitchtools.NumberedDiatonicPitchClass



class pitchtools.**NumberedDiatonicPitchClass**(*arg*)

New in version 2.0. Abjad model of a numbered diatonic pitch-class:

```
>>> pitchtools.NumberedDiatonicPitchClass(0)
NumberedDiatonicPitchClass(0)
```

Numbered diatonic pitch-classes are immutable.

Read-only Properties

NumberedDiatonicPitchClass.**named_diatonic_pitch_class**

Read-only named diatonic pitch-class from numbered diatonic pitch-class:

```
>>> numbered_diatonic_pitch_class = pitchtools.NumberedDiatonicPitchClass(0)
>>> numbered_diatonic_pitch_class.named_diatonic_pitch_class
NamedDiatonicPitchClass('c')
```

Return named diatonic pitch-class.

NumberedDiatonicPitchClass.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

NumberedDiatonicPitchClass.**__abs__**()

Inherited from pitchtools.DiatonicPitchClassObject

NumberedDiatonicPitchClass.**__eq__**(*arg*)

Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NumberedDiatonicPitchClass.__float__()
Inherited from pitchtools.DiatonicPitchClassObject

NumberedDiatonicPitchClass.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedDiatonicPitchClass.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

NumberedDiatonicPitchClass.__hash__()
Inherited from pitchtools.PitchClassObject

NumberedDiatonicPitchClass.__int__()
Inherited from pitchtools.DiatonicPitchClassObject

NumberedDiatonicPitchClass.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedDiatonicPitchClass.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NumberedDiatonicPitchClass.__ne__(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

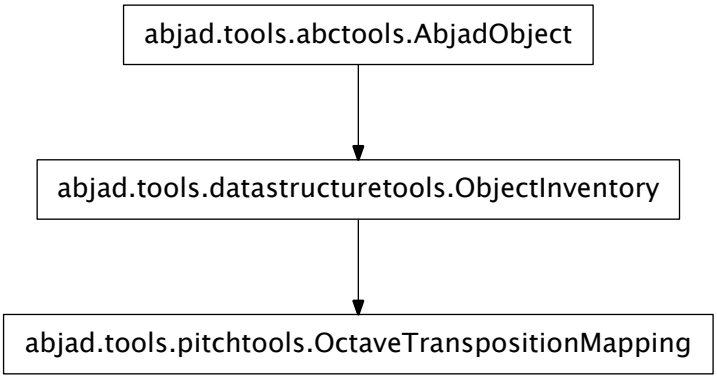
Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

NumberedDiatonicPitchClass.__repr__()

NumberedDiatonicPitchClass.__str__()

pitchtools.OctaveTranspositionMapping



class pitchtools.**OctaveTranspositionMapping**(*tokens=None*, *name=None*)

New in version 2.8. Octave transposition mapping:

```
>>> pitchtools.OctaveTranspositionMapping([('[A0, C4)', 15), ('[C4, C8)', 27)])
OctaveTranspositionMapping([('[A0, C4)', 15), ('[C4, C8)', 27)])
```

Octave transposition mappings model pitchtools.transpose_chromatic_pitch_number_by_octave_transpo input.

Octave transposition mappings implement the list interface and are mutable.

Read-only Properties

OctaveTranspositionMapping.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

OctaveTranspositionMapping.**name**

Read / write name of inventory.

Inherited from datastructuretools.ObjectInventory

Methods

OctaveTranspositionMapping.**append**(*token*)

Change *token* to item and append.

Inherited from datastructuretools.ObjectInventory

OctaveTranspositionMapping.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.list

OctaveTranspositionMapping.**extend**(*tokens*)
Change *tokens* to items and extend.

Inherited from datastructuretools.ObjectInventory

OctaveTranspositionMapping.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.list

OctaveTranspositionMapping.**insert**()
L.insert(index, object) – insert object before index

Inherited from __builtin__.list

OctaveTranspositionMapping.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

OctaveTranspositionMapping.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

OctaveTranspositionMapping.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

OctaveTranspositionMapping.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

OctaveTranspositionMapping.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

OctaveTranspositionMapping.**__contains__**(*token*)
Inherited from datastructuretools.ObjectInventory

OctaveTranspositionMapping.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

OctaveTranspositionMapping.**__delslice__**()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

OctaveTranspositionMapping.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

OctaveTranspositionMapping.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

OctaveTranspositionMapping.__**getitem**__()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

OctaveTranspositionMapping.__**getslice**__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

OctaveTranspositionMapping.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

OctaveTranspositionMapping.__**iadd**__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

OctaveTranspositionMapping.__**imul**__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

OctaveTranspositionMapping.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.list

OctaveTranspositionMapping.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

OctaveTranspositionMapping.__**len**__() <==> *len(x)*
Inherited from __builtin__.list

OctaveTranspositionMapping.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

OctaveTranspositionMapping.__**mul**__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

OctaveTranspositionMapping.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

OctaveTranspositionMapping.__**repr**__()

OctaveTranspositionMapping.__**reversed**__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

OctaveTranspositionMapping.__**rmul**__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

OctaveTranspositionMapping.**__setitem__**()
x.__setitem__(i, y) <==> x[i]=y

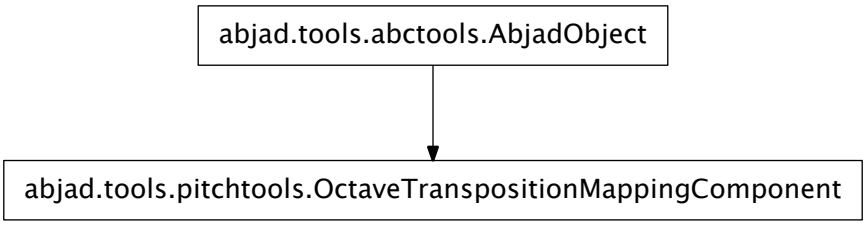
Inherited from __builtin__.list

OctaveTranspositionMapping.**__setslice__**()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

pitchtools.OctaveTranspositionMappingComponent



class pitchtools.**OctaveTranspositionMappingComponent**(**args*)
New in version 2.8. Octave transposition mapping component:

```
>>> pitchtools.OctaveTranspositionMappingComponent('[A0, C8]', 15)
OctaveTranspositionMappingComponent('[A0, C8]', 15)
```

Initialize from input parameters separately, from a pair, from a string or from another mapping component.

Model pitchtools.transpose_chromatic_pitch_number_by_octave_transposition_mapping input part. (See the docs for that function.)

Octave transposition mapping components are mutable.

Read-only Properties

OctaveTranspositionMappingComponent.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

OctaveTranspositionMappingComponent.**source_pitch_range**
Read / write source pitch range:

```
>>> mapping_component = pitchtools.OctaveTranspositionMappingComponent(
...     '[A0, C8]', 15)
>>> mapping_component.source_pitch_range
PitchRange('[A0, C8]')
```

Return pitch range or none.

OctaveTranspositionMappingComponent.**target_octave_start_pitch**

Read / write target octave start pitch:

```
>>> mapping_component = pitchtools.OctaveTranspositionMappingComponent(
...     '[A0, C8]', 15)
>>> mapping_component.target_octave_start_pitch
NumberedChromaticPitch(15)
```

Return numbered chromatic pitch or none.

Special Methods

OctaveTranspositionMappingComponent.**__eq__**(*other*)

OctaveTranspositionMappingComponent.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OctaveTranspositionMappingComponent.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

OctaveTranspositionMappingComponent.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OctaveTranspositionMappingComponent.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

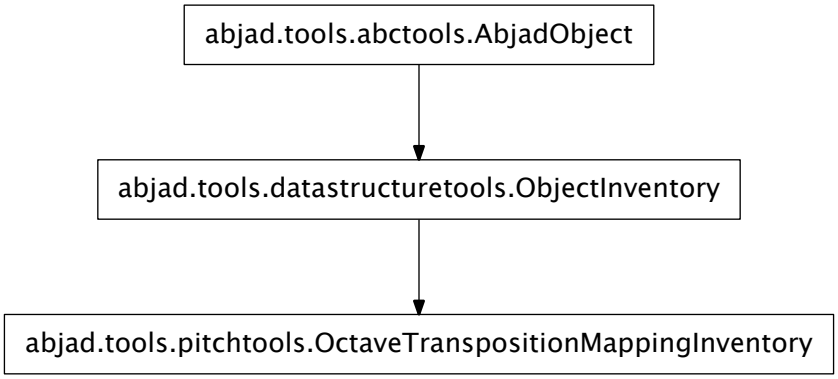
Raise exception.

Inherited from abctools.AbjadObject

OctaveTranspositionMappingComponent.**__ne__**(*other*)

OctaveTranspositionMappingComponent.**__repr__**()

pitchtools.OctaveTranspositionMappingInventory



class pitchtools.**OctaveTranspositionMappingInventory**(*tokens=None*, *name=None*)

New in version 2.8. Model of an ordered list of octave transposition mappings:

```
>>> mapping_1 = pitchtools.OctaveTranspositionMapping([('[A0, C4)', 15), ('[C4, C8)', 27)])
>>> mapping_2 = pitchtools.OctaveTranspositionMapping([('[A0, C8]', -18)])
>>> inventory = pitchtools.OctaveTranspositionMappingInventory([mapping_1, mapping_2])

>>> z(inventory)
pitchtools.OctaveTranspositionMappingInventory([
    pitchtools.OctaveTranspositionMapping([
        pitchtools.OctaveTranspositionMappingComponent(
            pitchtools.PitchRange(
                '[A0, C4)'
                ),
            pitchtools.NumberedChromaticPitch(
                15
                )
            ),
        pitchtools.OctaveTranspositionMappingComponent(
            pitchtools.PitchRange(
                '[C4, C8)'
                ),
            pitchtools.NumberedChromaticPitch(
                27
                )
            )
        ]),
    pitchtools.OctaveTranspositionMapping([
        pitchtools.OctaveTranspositionMappingComponent(
            pitchtools.PitchRange(
                '[A0, C8]'
                ),
            pitchtools.NumberedChromaticPitch(
                -18
                )
```

```
            )
        ])
    ])
```

Octave transposition mapping inventories implement list interface and are mutable.

Read-only Properties

`OctaveTranspositionMappingInventory.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Read/write Properties

`OctaveTranspositionMappingInventory.`**`name`**

Read / write name of inventory.

Inherited from `datastructuretools.ObjectInventory`

Methods

`OctaveTranspositionMappingInventory.`**`append`**`(`*token*`)`

Change *token* to item and append.

Inherited from `datastructuretools.ObjectInventory`

`OctaveTranspositionMappingInventory.`**`count`**`(`*value*`)` → integer – return number of occurrences of value

Inherited from `__builtin__.list`

`OctaveTranspositionMappingInventory.`**`extend`**`(`*tokens*`)`

Change *tokens* to items and extend.

Inherited from `datastructuretools.ObjectInventory`

`OctaveTranspositionMappingInventory.`**`index`**`(`*value*[, *start*[, *stop*]]`)` → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from `__builtin__.list`

`OctaveTranspositionMappingInventory.`**`insert`**`()`

L.insert(index, object) – insert object before index

Inherited from `__builtin__.list`

`OctaveTranspositionMappingInventory.`**`pop`**`(`[*index*]`)` → item – remove and return item at index (default last).

Raises IndexError if list is empty or index is out of range.

Inherited from `__builtin__.list`

`OctaveTranspositionMappingInventory.`**`remove`**`()`

L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from `__builtin__.list`

`OctaveTranspositionMappingInventory.`**`reverse`**`()`

L.reverse() – reverse *IN PLACE*

Inherited from `__builtin__.list`

OctaveTranspositionMappingInventory.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

OctaveTranspositionMappingInventory.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.**__contains__**(*token*)
Inherited from datastructuretools.ObjectInventory

OctaveTranspositionMappingInventory.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.**__delslice__**()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.**__iadd__**()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.**__imul__**()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.list

OctaveTranspositionMappingInventory.__le__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.__len__() <==> *len(x)*
Inherited from __builtin__.list

OctaveTranspositionMappingInventory.__lt__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.__mul__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.__ne__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.__repr__()
Inherited from datastructuretools.ObjectInventory

OctaveTranspositionMappingInventory.__reversed__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.__rmul__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

OctaveTranspositionMappingInventory.__setitem__()
x.__setitem__(i, y) <==> x[i]=y

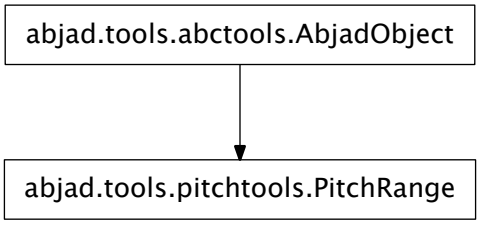
Inherited from __builtin__.list

OctaveTranspositionMappingInventory.__setslice__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

pitchtools.PitchRange



class pitchtools.**PitchRange**(**args*, ***kwargs*)

New in version 2.0. Abjad model of pitch range:

```
>>> pitchtools.PitchRange(-12, 36)
PitchRange('[C3, C7]')
```

Initalize from pitch numbers, pitch names, pitch instances, one-line reprs or other pitch range objects.

Pitch ranges test for equality and inequality against other pitch ranges.

Pitch ranges test less than, greater than, less-equal and greater-equal against pitches.

Pitch ranges do not sort relative to other pitch ranges.

Pitch ranges are immutable.

Read-only Properties

PitchRange.**one_line_named_chromatic_pitch_repr**

Read-only one-line named chromatic pitch repr of pitch of range:

```
>>> pitch_range = pitchtools.PitchRange(-12, 36)
>>> pitch_range.one_line_named_chromatic_pitch_repr
'[C3, C7]'
```

Return string.

PitchRange.**one_line_numbered_chromatic_pitch_repr**

Read-only one-line numbered chromatic pitch repr of pitch of range:

```
>>> pitch_range = pitchtools.PitchRange(-12, 36)
>>> pitch_range.one_line_numbered_chromatic_pitch_repr
'[-12, 36]'
```

Return string.

PitchRange.**pitch_range_name**

New in version 2.7. Read-only name of pitch range:

```
>>> pitch_range = pitchtools.PitchRange(-12, 36, pitch_range_name='four-octave range')
>>> pitch_range.pitch_range_name
'four-octave range'
```

Return string or none.

PitchRange.**pitch_range_name_markup**

New in version 2.7. Read-only markup of pitch range name:

```
>>> from abjad.tools.markuptools import Markup

>>> pitch_range = pitchtools.PitchRange(-12, 36,
...     pitch_range_name_markup=Markup('four-octave range'))
>>> pitch_range.pitch_range_name_markup
Markup(('four-octave range',))
```

Default to *pitch_range_name* when *pitch_range_name_markup* not set explicitly.

Return markup or none.

PitchRange.**start_pitch**

Read-only start pitch of range:

```
>>> pitch_range = pitchtools.PitchRange(-12, 36)
>>> pitch_range.start_pitch
NamedChromaticPitch('c')
```

Return pitch.

PitchRange.**start_pitch_is_included_in_range**

Read-only boolean true when start pitch is included in range. Otherwise false:

```
>>> pitch_range = pitchtools.PitchRange(-12, 36)
>>> pitch_range.start_pitch_is_included_in_range
True
```

Return boolean.

PitchRange.**stop_pitch**

Read-only stop pitch of range:

```
>>> pitch_range = pitchtools.PitchRange(-12, 36)
>>> pitch_range.stop_pitch
NamedChromaticPitch("c''''")
```

Return pitch.

PitchRange.**stop_pitch_is_included_in_range**

Read-only boolean true when stop pitch is included in range. Otherwise false:

```
>>> pitch_range = pitchtools.PitchRange(-12, 36)
>>> pitch_range.stop_pitch_is_included_in_range
True
```

Return boolean.

PitchRange.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

PitchRange.**__contains__**(*arg*)

PitchRange.**__eq__**(*arg*)

PitchRange.**__ge__**(*arg*)

PitchRange.**__gt__**(*arg*)

PitchRange.**__le__**(*arg*)

PitchRange.**__lt__**(*arg*)

PitchRange.**__ne__**(*arg*)

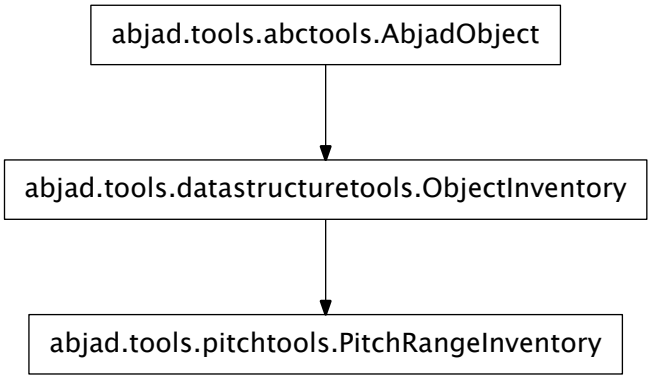
PitchRange.**__repr__**()

Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

pitchtools.PitchRangeInventory



class pitchtools.**PitchRangeInventory**(*tokens=None*, *name=None*)

New in version 2.7. Abjad model of an ordered list of pitch ranges:

```
>>> pitchtools.PitchRangeInventory(['[C3, C6]', '[C4, C6]'])
PitchRangeInventory([PitchRange('[C3, C6]'), PitchRange('[C4, C6]')])
```

Pitch range inventories implement list interface and are mutable.

Read-only Properties

PitchRangeInventory.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

PitchRangeInventory.**name**

Read / write name of inventory.

Inherited from datastructuretools.ObjectInventory

Methods

PitchRangeInventory.**append**(*token*)
Change *token* to item and append.

Inherited from datastructuretools.ObjectInventory

PitchRangeInventory.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.list

PitchRangeInventory.**extend**(*tokens*)
Change *tokens* to items and extend.

Inherited from datastructuretools.ObjectInventory

PitchRangeInventory.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.list

PitchRangeInventory.**insert**()
L.insert(index, object) – insert object before index

Inherited from __builtin__.list

PitchRangeInventory.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

PitchRangeInventory.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

PitchRangeInventory.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

PitchRangeInventory.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

PitchRangeInventory.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

PitchRangeInventory.**__contains__**(*token*)
Inherited from datastructuretools.ObjectInventory

PitchRangeInventory.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

PitchRangeInventory.**__delslice__**()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

PitchRangeInventory.__**eq**__()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

PitchRangeInventory.__**ge**__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

PitchRangeInventory.__**getitem**__()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

PitchRangeInventory.__**getslice**__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

PitchRangeInventory.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

PitchRangeInventory.__**iadd**__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

PitchRangeInventory.__**imul**__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

PitchRangeInventory.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.list

PitchRangeInventory.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

PitchRangeInventory.__**len**__() <==> *len(x)*
Inherited from __builtin__.list

PitchRangeInventory.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

PitchRangeInventory.__**mul**__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

PitchRangeInventory.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

PitchRangeInventory.__**repr**__()
Inherited from datastructuretools.ObjectInventory

PitchRangeInventory.__**reversed**__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

PitchRangeInventory.__**rmul**__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

PitchRangeInventory.__**setitem**__()
x.__setitem__(i, y) <==> x[i]=y

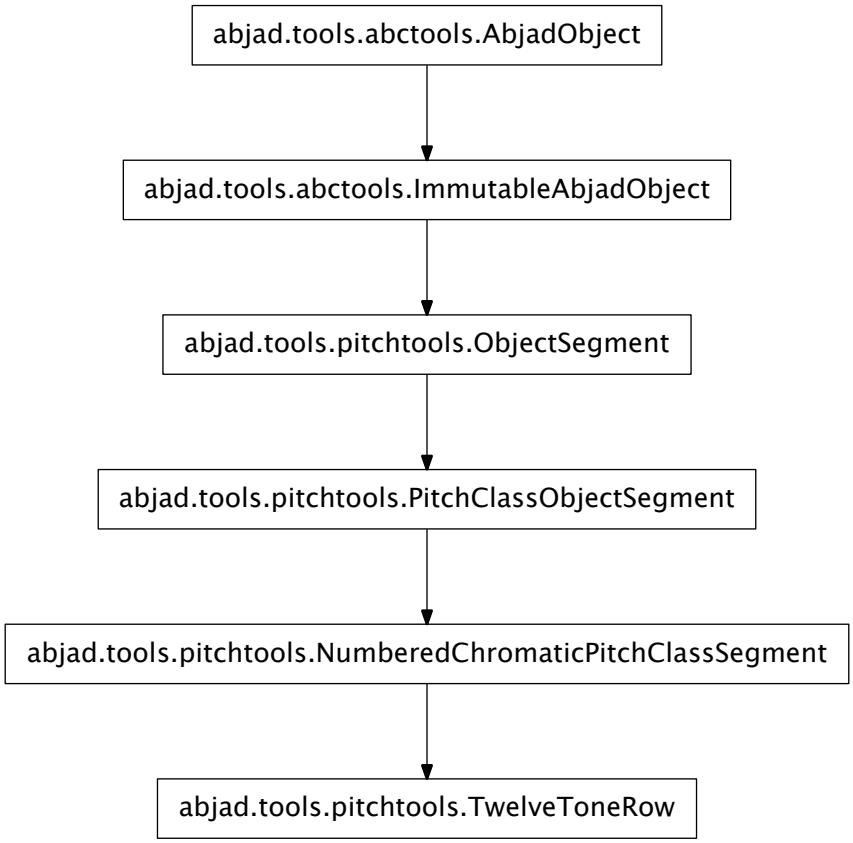
Inherited from __builtin__.list

PitchRangeInventory.__**setslice**__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

pitchtools.TwelveToneRow



class pitchtools.**TwelveToneRow**(**args*, ***kwargs*)

New in version 2.0. Abjad model of twelve-tone row:

```
>>> pitchtools.TwelveToneRow([0, 1, 11, 9, 3, 6, 7, 5, 4, 10, 2, 8])
TwelveToneRow([0, 1, 11, 9, 3, 6, 7, 5, 4, 10, 2, 8])
```

Twelve-tone rows validate pitch-classes at initialization.

Twelve-tone rows inherit canonical operators from numbered chromatic pitch-class segment.

Twelve-tone rows return numbered chromatic pitch-class segments on calls to getslice.

Twelve-tone rows are immutable.

Read-only Properties

TwelveToneRow.**inversion_equivalent_chromatic_interval_class_segment**

Read-only inversion-equivalent chromatic interval-class segment:

```
>>> segment = pitchtools.NumberedChromaticPitchClassSegment([10, 10.5, 6, 7, 10.5, 7])
```

```
>>> segment.inversion_equivalent_chromatic_interval_class_segment
InversionEquivalentChromaticIntervalClassSegment(0.5, 4.5, 1, 3.5, 3.5)
```

Return inversion-equivalent chromatic interval-class segment.

Inherited from pitchtools.NumberedChromaticPitchClassSegment

TwelveToneRow.**numbered_chromatic_pitch_class_set**

Read-only numbered chromatic pitch-class set from numbered chromatic pitch-class segment:

```
>>> segment.numbered_chromatic_pitch_class_set
NumberedChromaticPitchClassSet([6, 7, 10, 10.5])
```

Return numbered chromatic pitch-class set.

Inherited from pitchtools.NumberedChromaticPitchClassSegment

TwelveToneRow.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

TwelveToneRow.**alpha**()

Morris alpha transform of numbered chromatic pitch-class segment:

```
>>> segment.alpha()
NumberedChromaticPitchClassSegment([11, 11.5, 7, 6, 11.5, 6])
```

Return numbered chromatic pitch-class segment.

Inherited from pitchtools.NumberedChromaticPitchClassSegment

TwelveToneRow.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

TwelveToneRow.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

TwelveToneRow.**invert**()
Invert numbered chromatic pitch-class segment:

```
>>> segment.invert()
NumberedChromaticPitchClassSegment([2, 1.5, 6, 5, 1.5, 5])
```

Return numbered chromatic pitch-class segment.

Inherited from pitchtools.NumberedChromaticPitchClassSegment

TwelveToneRow.**multiply**(*n*)
Multiply numbered chromatic pitch-class segment by *n*:

```
>>> segment.multiply(5)
NumberedChromaticPitchClassSegment([2, 4.5, 6, 11, 4.5, 11])
```

Return numbered chromatic pitch-class segment.

Inherited from pitchtools.NumberedChromaticPitchClassSegment

TwelveToneRow.**retrograde**()
Retrograde of numbered chromatic pitch-class segment:

```
>>> segment.retrograde()
NumberedChromaticPitchClassSegment([7, 10.5, 7, 6, 10.5, 10])
```

Return numbered chromatic pitch-class segment.

Inherited from pitchtools.NumberedChromaticPitchClassSegment

TwelveToneRow.**rotate**(*n*)
Rotate numbered chromatic pitch-class segment:

```
>>> segment.rotate(1)
NumberedChromaticPitchClassSegment([7, 10, 10.5, 6, 7, 10.5])
```

Return numbered chromatic pitch-class segment.

Inherited from pitchtools.NumberedChromaticPitchClassSegment

TwelveToneRow.**transpose**(*n*)
Transpose numbered chromatic pitch-class segment:

```
>>> segment.transpose(10)
NumberedChromaticPitchClassSegment([8, 8.5, 4, 5, 8.5, 5])
```

Return numbered chromatic pitch-class segment.

Inherited from pitchtools.NumberedChromaticPitchClassSegment

Special Methods

TwelveToneRow.**__add__**(*arg*)
Inherited from pitchtools.ObjectSegment

TwelveToneRow.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

TwelveToneRow.**__eq__**(*arg*)

TwelveToneRow.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

TwelveToneRow.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

TwelveToneRow.**__getslice__**(*start*, *stop*)

TwelveToneRow.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

TwelveToneRow.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

TwelveToneRow.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

TwelveToneRow.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

TwelveToneRow.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

TwelveToneRow.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

TwelveToneRow.**__mul__**(*n*)

TwelveToneRow.**__ne__**(*arg*)

TwelveToneRow.**__repr__**()
Inherited from pitchtools.NumberedChromaticPitchClassSegment

TwelveToneRow.**__rmul__**(*n*)

TwelveToneRow.**__str__**()
Inherited from pitchtools.NumberedChromaticPitchClassSegment

functions

pitchtools.all_are_chromatic_pitch_class_name_octave_number_pairs

pitchtools.**all_are_chromatic_pitch_class_name_octave_number_pairs**(*expr*)
New in version 1.1. True when all elements of *expr* are pitch tokens. Otherwise false:

```
>>> pitchtools.all_are_chromatic_pitch_class_name_octave_number_pairs(
... [('c', 4), ('d', 4), pitchtools.NamedChromaticPitch('e', 4)])
True
```

Return boolean.

pitchtools.all_are_named_chromatic_pitch_tokens

pitchtools.**all_are_named_chromatic_pitch_tokens**(*expr*)

New in version 2.6. True when *expr* is a sequence of named chromatic pitch tokens:

```
>>> named_chromatic_pitch_tokens = [('c', 4), pitchtools.NamedChromaticPitch("a'")]

>>> pitchtools.all_are_named_chromatic_pitch_tokens(named_chromatic_pitch_tokens)
True
```

True when *expr* is an empty sequence:

```
>>> pitchtools.all_are_named_chromatic_pitch_tokens([])
True
```

Otherwise false:

```
>>> pitchtools.all_are_named_chromatic_pitch_tokens('foo')
False
```

Return boolean.

pitchtools.alphabetic_accidental_abbreviation_to_symbolic_accidental_string

pitchtools.**alphabetic_accidental_abbreviation_to_symbolic_accidental_string**(*alphabetic_accidenta*

New in version 2.5. Change *alphabetic_accidental_abbreviation* to symbolic accidental string:

```
>>> pitchtools.alphabetic_accidental_abbreviation_to_symbolic_accidental_string('tqs')
'#+'
```

None when *alphabetic_accidental_abbreviation* is not a valid alphabetic accidental abbreviation.

Return string or none.

pitchtools.apply_accidental_to_named_chromatic_pitch

pitchtools.**apply_accidental_to_named_chromatic_pitch**(*named_chromatic_pitch*, *accidental=None*)

New in version 2.0. Apply *accidental* to *named_chromatic_pitch*:

```
>>> pitch = pitchtools.NamedChromaticPitch("cs''")
>>> pitchtools.apply_accidental_to_named_chromatic_pitch(pitch, 'f')
NamedChromaticPitch("c''")
```

Return new named pitch.

pitchtools.calculate_harmonic_chromatic_interval

pitchtools.**calculate_harmonic_chromatic_interval**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate harmonic chromatic interval from *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_harmonic_chromatic_interval(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
HarmonicChromaticInterval(14)
```

Return harmonic chromatic interval.

pitchtools.calculate_harmonic_chromatic_interval_class

pitchtools.**calculate_harmonic_chromatic_interval_class**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate harmonic chromatic interval-class from *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_harmonic_chromatic_interval_class(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
HarmonicChromaticIntervalClass(2)
```

Return harmonic chromatic interval-class.

pitchtools.calculate_harmonic_counterpoint_interval

pitchtools.**calculate_harmonic_counterpoint_interval**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate harmonic counterpoint interval *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_harmonic_counterpoint_interval(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
HarmonicCounterpointInterval(9)
```

Return harmonic counterpoint interval-class.

pitchtools.calculate_harmonic_counterpoint_interval_class

pitchtools.**calculate_harmonic_counterpoint_interval_class**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate harmonic counterpoint interval-class from *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_harmonic_counterpoint_interval_class(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
HarmonicCounterpointIntervalClass(2)
```

Return harmonic counterpoint interval-class.

pitchtools.calculate_harmonic_diatonic_interval

pitchtools.**calculate_harmonic_diatonic_interval**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate harmonic diatonic interval from *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_harmonic_diatonic_interval(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
HarmonicDiatonicInterval('M9')
```

Return harmonic diatonic interval.

pitchtools.calculate_harmonic_diatonic_interval_class

pitchtools.**calculate_harmonic_diatonic_interval_class**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate harmonic diatonic interval-class from *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_harmonic_diatonic_interval_class(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
HarmonicDiatonicIntervalClass('M2')
```

Return harmonic diatonic interval-class.

pitchtools.calculate_melodic_chromatic_interval

pitchtools.**calculate_melodic_chromatic_interval**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate melodic chromatic interval from *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_melodic_chromatic_interval(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
MelodicChromaticInterval(+14)
```

Return melodic chromatic interval.

pitchtools.calculate_melodic_chromatic_interval_class

pitchtools.**calculate_melodic_chromatic_interval_class**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate melodic chromatic interval-class from *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_melodic_chromatic_interval_class(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
MelodicChromaticIntervalClass(+2)
```

Return melodic chromatic interval-class.

pitchtools.calculate_melodic_counterpoint_interval

pitchtools.**calculate_melodic_counterpoint_interval**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate melodic counterpoint interval *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_melodic_counterpoint_interval(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
MelodicCounterpointInterval(+9)
```

Return melodic counterpoint interval.

pitchtools.calculate_melodic_counterpoint_interval_class

pitchtools.**calculate_melodic_counterpoint_interval_class**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate melodic counterpoint interval-class from *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_melodic_counterpoint_interval_class(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
MelodicCounterpointIntervalClass(+2)
```

Return melodic counterpoint interval-class.

pitchtools.calculate_melodic_diatonic_interval

pitchtools.**calculate_melodic_diatonic_interval**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate melodic diatonic interval from *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_melodic_diatonic_interval(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
MelodicDiatonicInterval('+M9')
```

Return melodic diatonic interval.

pitchtools.calculate_melodic_diatonic_interval_class

pitchtools.**calculate_melodic_diatonic_interval_class**(*pitch_carrier_1*, *pitch_carrier_2*)

New in version 2.0. Calculate melodic diatonic interval-class from *pitch_carrier_1* to *pitch_carrier_2*:

```
>>> pitchtools.calculate_melodic_diatonic_interval_class(
... pitchtools.NamedChromaticPitch(-2), pitchtools.NamedChromaticPitch(12))
MelodicDiatonicIntervalClass('+M2')
```

Return melodic diatonic interval-class.

pitchtools.chromatic_pitch_class_name_to_chromatic_pitch_class_number

pitchtools.**chromatic_pitch_class_name_to_chromatic_pitch_class_number**(*chromatic_pitch_class_name*)

New in version 2.0. Change *chromatic_pitch_class_name* to chromatic pitch-class number:

```
>>> pitchtools.chromatic_pitch_class_name_to_chromatic_pitch_class_number('cs')
1
```

Return chromatic pitch-class number.

pitchtools.chromatic_pitch_class_name_to_diatonic_pitch_class_name

pitchtools.**chromatic_pitch_class_name_to_diatonic_pitch_class_name**(*chromatic_pitch_class_name*)

New in version 2.0. Change *chromatic_pitch_class_name* to diatonic pitch-class name:

```
>>> pitchtools.chromatic_pitch_class_name_to_diatonic_pitch_class_name('cs')
'c'
```

Return string.

pitchtools.chromatic_pitch_class_number_to_chromatic_pitch_class_name

pitchtools.**chromatic_pitch_class_number_to_chromatic_pitch_class_name**(*chromatic_pitch_class_numbe*

New in version 1.1. Change *chromatic_pitch_class_number* to chromatic pitch-class name:

```
>>> tmp = pitchtools.chromatic_pitch_class_number_to_chromatic_pitch_class_name
>>> for n in range(0, 13):
...     pc = n / 2.0
...     pitch_name = tmp(pc)
...     print '%s   %s' % (pc, pitch_name)
...
```

```
0.0   c
0.5   cqs
1.0   cs
1.5   dqf
2.0   d
2.5   dqs
3.0   ef
3.5   eqf
4.0   e
4.5   eqs
5.0   f
5.5   fqs
6.0   fs
```

Return string. Changed in version 2.0: renamed `pitchtools.pc_to_pitch_name()` to `pitchtools.chromatic_pitch_class_number_to_chromatic_pitch_class_name()`.

pitchtools.chromatic_pitch_class_number_to_chromatic_pitch_class_name_with_flats

pitchtools.**chromatic_pitch_class_number_to_chromatic_pitch_class_name_with_flats**(*chromatic_pit*

New in version 1.1. Change chromatic pitch-class number to chromatic pitch-class name with flats:

```
>>> tmp = pitchtools.chromatic_pitch_class_number_to_chromatic_pitch_class_name_with_flats

>>> for n in range(13):
...     pc = n / 2.0
...     name = tmp(pc)
...     print '%s   %s' % (pc, name)
...
0.0   c
0.5   dtqf
1.0   df
1.5   dqf
2.0   d
2.5   etqf
3.0   ef
3.5   eqf
4.0   e
4.5   fqf
5.0   f
5.5   gtqf
6.0   gf
```

Return string. Changed in version 2.0: renamed `pitchtools.pc_to_pitch_name_flats()` to `pitchtools.chromatic_pitch_class_number_to_chromatic_pitch_class_name_with_flats()`.

pitchtools.chromatic_pitch_class_number_to_chromatic_pitch_class_name_with_sharps

pitchtools.**chromatic_pitch_class_number_to_chromatic_pitch_class_name_with_sharps**(*chromatic_p*

New in version 1.1. Change *chromatic_pitch_class_number* to chromatic pitch-class name with sharps:

```
>>> tmp = pitchtools.chromatic_pitch_class_number_to_chromatic_pitch_class_name_with_sharps
>>> for n in range(13):
...     pc = n / 2.0
...     name = tmp(pc)
...     print '%s   %s' % (pc, name)
```

```
...
0.0   c
0.5   cqs
1.0   cs
1.5   ctqs
2.0   d
2.5   dqs
3.0   ds
3.5   dtqs
4.0   e
4.5   eqs
5.0   f
5.5   fqs
6.0   fs
```

Return string. Changed in version 2.0: renamed `pitchtools.pc_to_pitch_name_sharps()` to `pitchtools.chromatic_pitch_class_number_to_chromatic_pitch_class_name_with_sharps()`.

pitchtools.chromatic_pitch_class_number_to_diatonic_pitch_class_number

pitchtools.**chromatic_pitch_class_number_to_diatonic_pitch_class_number**(*chromatic_pitch_class_numb*

New in version 2.0. Change *chromatic_pitch_class_number* to diatonic pitch-class number:

```
>>> pitchtools.chromatic_pitch_class_number_to_diatonic_pitch_class_number(1)
0
```

Return integer.

pitchtools.chromatic_pitch_name_to_chromatic_pitch_class_name

pitchtools.**chromatic_pitch_name_to_chromatic_pitch_class_name**(*chromatic_pitch_name*)

New in version 2.0. Change *chromatic_pitch_name* to chromatic pitch-class name:

```
>>> pitchtools.chromatic_pitch_name_to_chromatic_pitch_class_name("cs''")
'cs'
```

Return string.

pitchtools.chromatic_pitch_name_to_chromatic_pitch_class_number

pitchtools.**chromatic_pitch_name_to_chromatic_pitch_class_number**(*chromatic_pitch_name*)

New in version 2.0. Change *chromatic_class_name* to chromatic pitch-class-number:

```
>>> pitchtools.chromatic_pitch_name_to_chromatic_pitch_class_number("cs''")
1
```

Return integer or float.

pitchtools.chromatic_pitch_name_to_chromatic_pitch_number

pitchtools.**chromatic_pitch_name_to_chromatic_pitch_number**(*chromatic_pitch_name*)

New in version 2.0. Change *chromatic_pitch_name* to chromatic pitch number:

```
>>> pitchtools.chromatic_pitch_name_to_chromatic_pitch_number("cs''")
13
```

Return integer or float.

pitchtools.chromatic_pitch_name_to_diatonic_pitch_class_name

pitchtools.**chromatic_pitch_name_to_diatonic_pitch_class_name**(*chromatic_pitch_name*)

New in version 2.0. Change *chromatic_pitch_name* to diatonic pitch name:

```
>>> pitchtools.chromatic_pitch_name_to_diatonic_pitch_class_name("cs''")
'c'
```

Return string.

pitchtools.chromatic_pitch_name_to_diatonic_pitch_class_number

pitchtools.**chromatic_pitch_name_to_diatonic_pitch_class_number**(*chromatic_pitch_name*)

New in version 2.0. Change *chromatic_pitch_name* to diatonic pitch-class number:

```
>>> pitchtools.chromatic_pitch_name_to_diatonic_pitch_class_number("cs''")
0
```

Return integer.

pitchtools.chromatic_pitch_name_to_diatonic_pitch_name

pitchtools.**chromatic_pitch_name_to_diatonic_pitch_name**(*chromatic_pitch_name*)

New in version 2.0. Change *chromatic_pitch_name* to diatonic pitch name:

```
>>> pitchtools.chromatic_pitch_name_to_diatonic_pitch_name("cs''")
"c''"
```

Return string.

pitchtools.chromatic_pitch_name_to_diatonic_pitch_number

pitchtools.**chromatic_pitch_name_to_diatonic_pitch_number**(*chromatic_pitch_name*)

New in version 2.0. Change *chromatic_pitch_name* to diatonic pitch number:

```
>>> pitchtools.chromatic_pitch_name_to_diatonic_pitch_number("cs''")
7
```

Return integer.

pitchtools.chromatic_pitch_name_to_octave_number

pitchtools.**chromatic_pitch_name_to_octave_number**(*chromatic_pitch_name*)

New in version 2.0. Change *chromatic_pitch_name* to octave number:

```
>>> pitchtools.chromatic_pitch_name_to_octave_number('cs')
3
```

Return integer.

pitchtools.chromatic_pitch_names_string_to_named_chromatic_pitch_list

pitchtools.**chromatic_pitch_names_string_to_named_chromatic_pitch_list**(*chromatic_pitch_names_string*)

New in version 2.0. Change *chromatic_pitch_names_string* to named chromatic pitch list:

```
>>> string = "cs, cs cs' cs''"
>>> result = pitchtools.chromatic_pitch_names_string_to_named_chromatic_pitch_list(string)

>>> for named_chromatic_pitch in result:
...     named_chromatic_pitch
...
NamedChromaticPitch('cs,')
NamedChromaticPitch('cs')
NamedChromaticPitch("cs'")
NamedChromaticPitch("cs''")
```

Return list of named chromatic pitches.

pitchtools.chromatic_pitch_number_and_accidental_semitones_to_octave_number

pitchtools.**chromatic_pitch_number_and_accidental_semitones_to_octave_number**(*chromatic_pitch_number*, *accidental_semitones*)

New in version 1.1. Change *chromatic_pitch_number* and *accidental_semitones* to octave number:

```
>>> pitchtools.chromatic_pitch_number_and_accidental_semitones_to_octave_number(12, -2)
5
```

Return integer. Changed in version 2.0: renamed `pitchtools.pitch_number_and_accidental_semitones_to_oc` to `pitchtools.chromatic_pitch_number_and_accidental_semitones_to_octave_number()`.

pitchtools.chromatic_pitch_number_to_chromatic_pitch_class_number

pitchtools.**chromatic_pitch_number_to_chromatic_pitch_class_number**(*chromatic_pitch_number*)

New in version 2.0. Change *chromatic_pitch_number* to chromatic pitch-class number:

```
>>> pitchtools.chromatic_pitch_number_to_chromatic_pitch_class_number(13)
1
```

Return integer or float.

pitchtools.chromatic_pitch_number_to_chromatic_pitch_name

pitchtools.**chromatic_pitch_number_to_chromatic_pitch_name**(*chromatic_pitch_number*, *accidental_spelling='mixed'*)

New in version 2.0. Change *chromatic_pitch_number* to chromatic pitch name:

```
>>> pitchtools.chromatic_pitch_number_to_chromatic_pitch_name(13)
"cs''"
```

Return string.

pitchtools.chromatic_pitch_number_to_chromatic_pitch_triple

pitchtools.**chromatic_pitch_number_to_chromatic_pitch_triple**(*chromatic_pitch_number*, *accidental_spelling='mixed'*)

Change *chromatic_pitch_number* to diatonic pitch-class name / alphabetic accidental abbreviation / octave number triple:

```
>>> pitchtools.chromatic_pitch_number_to_chromatic_pitch_triple(
... 13, accidental_spelling='sharps')
('c', Accidental('s'), 5)
```

Return tuple. Changed in version 2.0: renamed `pitchtools.number_to_letter_accidental_octave()` to `pitchtools.chromatic_pitch_number_to_chromatic_pitch_triple()`.

pitchtools.chromatic_pitch_number_to_diatonic_pitch_class_number

pitchtools.**chromatic_pitch_number_to_diatonic_pitch_class_number**(*chromatic_pitch_number*)

New in version 2.0. Change *chromatic_pitch_number* to diatonic pitch-class number:

```
>>> pitchtools.chromatic_pitch_number_to_diatonic_pitch_class_number(13)
0
```

Return integer.

pitchtools.chromatic_pitch_number_to_diatonic_pitch_number

pitchtools.**chromatic_pitch_number_to_diatonic_pitch_number**(*chromatic_pitch_number*)

New in version 2.0. Change *chromatic_pitch_number* to diatonic pitch number:

```
>>> pitchtools.chromatic_pitch_number_to_diatonic_pitch_number(13)
7
```

Return integer.

pitchtools.chromatic_pitch_number_to_octave_number

pitchtools.**chromatic_pitch_number_to_octave_number**(*chromatic_pitch_number*)

New in version 1.1. Change *chromatic_pitch_number* to octave number:

```
>>> pitchtools.chromatic_pitch_number_to_octave_number(13)
5
```

Return integer. Changed in version 2.0: renamed `pitchtools.pitch_number_to_octave()` to `pitchtools.chromatic_pitch_number_to_octave_number()`.

pitchtools.clef_and_staff_position_number_to_named_chromatic_pitch

pitchtools.**clef_and_staff_position_number_to_named_chromatic_pitch**(*clef*, *staff_position_number*)

New in version 2.0. Change *clef* and *staff_position_number* to named chromatic pitch:

```
>>> clef = contexttools.ClefMark('treble')
>>> for n in range(-6, 6):
...     pitch = pitchtools.clef_and_staff_position_number_to_named_chromatic_pitch(clef, n)
...     print '%s\t%s\t%s' % (clef.clef_name, n, pitch)
treble    -6 c'
treble    -5 d'
treble    -4 e'
treble    -3 f'
treble    -2 g'
treble    -1 a'
treble    0  b'
treble    1  c''
treble    2  d''
treble    3  e''
treble    4  f''
treble    5  g''
```

Return named chromatic pitch.

pitchtools.contains_subsegment

pitchtools.**contains_subsegment**(*chromatic_pitch_class_numbers*, *chromatic_pitch_numbers*)

New in version 1.1. True when *chromatic_pitch_numbers* contain *chromatic_pitch_class_numbers* as subsegment:

```
>>> pcs = [2, 7, 10]
>>> pitches = [6, 9, 12, 13, 14, 19, 22, 27, 28, 29, 32, 35]
>>> pitchtools.contains_subsegment(pcs, pitches)
True
```

Return boolean.

pitchtools.diatonic_pitch_class_name_to_chromatic_pitch_class_number

pitchtools.**diatonic_pitch_class_name_to_chromatic_pitch_class_number**(*diatonic_pitch_class_name*)

New in version 1.1. Change *diatonic_pitch_class_name* to chromatic pitch-class number:

```
>>> pitchtools.diatonic_pitch_class_name_to_chromatic_pitch_class_number('f')
5
```

Return integer.

pitchtools.diatonic_pitch_class_name_to_diatonic_pitch_class_number

pitchtools.**diatonic_pitch_class_name_to_diatonic_pitch_class_number**(*diatonic_pitch_class_name*)

New in version 2.0. Change *diatonic_pitch_class_name* to diatonic pitch-class number:

```
>>> pitchtools.diatonic_pitch_class_name_to_diatonic_pitch_class_number('c')
0
```

Return integer.

pitchtools.diatonic_pitch_class_number_to_chromatic_pitch_class_number

pitchtools.**diatonic_pitch_class_number_to_chromatic_pitch_class_number**(*diatonic_pitch_class_number*)

New in version 2.0. Change *diatonic_pitch_class_number* to chromatic pitch-class number:

```
>>> pitchtools.diatonic_pitch_class_number_to_chromatic_pitch_class_number(6)
11
```

Return nonnegative integer.

pitchtools.diatonic_pitch_class_number_to_diatonic_pitch_class_name

pitchtools.**diatonic_pitch_class_number_to_diatonic_pitch_class_name**(*diatonic_pitch_class_number*)

New in version 2.0. Change *diatonic_pitch_class_number* to diatonic pitch-class name:

```
>>> pitchtools.diatonic_pitch_class_number_to_diatonic_pitch_class_name(0)
'c'
```

Return string.

pitchtools.diatonic_pitch_name_to_chromatic_pitch_class_name

pitchtools.**diatonic_pitch_name_to_chromatic_pitch_class_name**(*diatonic_pitch_name*)

New in version 2.0. Change *diatonic_pitch_name* to chromatic pitch-class name:

```
>>> pitchtools.diatonic_pitch_name_to_chromatic_pitch_class_name("c''")
'c'
```

Return string.

pitchtools.diatonic_pitch_name_to_chromatic_pitch_class_number

pitchtools.**diatonic_pitch_name_to_chromatic_pitch_class_number**(*diatonic_pitch_name*)

New in version 2.0. Change *diatonic_pitch_name* to chromatic pitch-class number:

```
>>> pitchtools.diatonic_pitch_name_to_chromatic_pitch_class_number("c''")
0
```

Return integer.

pitchtools.diatonic_pitch_name_to_chromatic_pitch_name

pitchtools.**diatonic_pitch_name_to_chromatic_pitch_name**(*diatonic_pitch_name*)

New in version 2.0. Change *diatonic_pitch_name* to chromatic pitch name:

```
>>> pitchtools.diatonic_pitch_name_to_chromatic_pitch_name("c''")
"c''"
```

Return string.

pitchtools.diatonic_pitch_name_to_chromatic_pitch_number

pitchtools.**diatonic_pitch_name_to_chromatic_pitch_number**(*diatonic_pitch_name*)

New in version 2.0. Change *diatonic_pitch_name* to chromatic pitch number:

```
>>> pitchtools.diatonic_pitch_name_to_chromatic_pitch_number("c''")
12
```

Return integer.

pitchtools.diatonic_pitch_name_to_diatonic_pitch_class_name

pitchtools.**diatonic_pitch_name_to_diatonic_pitch_class_name**(*diatonic_pitch_name*)

New in version 2.0. Change *diatonic_pitch_name* to diatonic pitch-class name:

```
>>> pitchtools.diatonic_pitch_name_to_diatonic_pitch_class_name("c''")
'c'
```

Return string.

pitchtools.diatonic_pitch_name_to_diatonic_pitch_class_number

pitchtools.**diatonic_pitch_name_to_diatonic_pitch_class_number**(*diatonic_pitch_name*)

New in version 2.0. Change *diatonic_pitch_name* to diatonic pitch-class number:

```
>>> pitchtools.diatonic_pitch_name_to_diatonic_pitch_class_number("c''")
0
```

Return integer.

pitchtools.diatonic_pitch_name_to_diatonic_pitch_number

pitchtools.**diatonic_pitch_name_to_diatonic_pitch_number**(*diatonic_pitch_name*)

New in version 2.0. Change *diatonic_pitch_name* to diatonic pitch number:

```
>>> pitchtools.diatonic_pitch_name_to_diatonic_pitch_number("c''")
7
```

Return integer.

pitchtools.diatonic_pitch_number_to_chromatic_pitch_number

pitchtools.**diatonic_pitch_number_to_chromatic_pitch_number**(*diatonic_pitch_number*)

New in version 2.0. Change *diatonic_pitch_number* to chromatic pitch number:

```
>>> pitchtools.diatonic_pitch_number_to_chromatic_pitch_number(7)
12
```

Return integer.

pitchtools.diatonic_pitch_number_to_diatonic_pitch_class_name

pitchtools.**diatonic_pitch_number_to_diatonic_pitch_class_name**(*diatonic_pitch_number*)

New in version 2.0. Change *diatonic_pitch_number* to diatonic pitch-class name:

```
>>> pitchtools.diatonic_pitch_number_to_diatonic_pitch_class_name(7)
'c'
```

Return string.

pitchtools.diatonic_pitch_number_to_diatonic_pitch_class_number

pitchtools.**diatonic_pitch_number_to_diatonic_pitch_class_number**(*diatonic_pitch_number*)

New in version 2.0. Change *diatonic_pitch_number* to diatonic pitch-class number:

```
>>> pitchtools.diatonic_pitch_number_to_diatonic_pitch_class_number(7)
0
```

Return nonnegative integer.

pitchtools.diatonic_pitch_number_to_diatonic_pitch_name

pitchtools.**diatonic_pitch_number_to_diatonic_pitch_name**(*diatonic_pitch_number*)

New in version 2.0. Change *diatonic_pitch_number* to diatonic pitch name:

```
>>> pitchtools.diatonic_pitch_number_to_diatonic_pitch_name(7)
"c''"
```

Return string.

pitchtools.expr_has_duplicate_named_chromatic_pitch

pitchtools.**expr_has_duplicate_named_chromatic_pitch**(*expr*)

New in version 2.0. True when *expr* has duplicate named chromatic pitch. Otherwise false:

```
>>> chord = Chord([13, 13, 14], (1, 4))
>>> pitchtools.expr_has_duplicate_named_chromatic_pitch(chord)
True
```

Return boolean.

pitchtools.expr_has_duplicate_numbered_chromatic_pitch_class

pitchtools.**expr_has_duplicate_numbered_chromatic_pitch_class**(*expr*)

New in version 2.0. True when *expr* has duplicate numbered chromatic pitch-class. Otherwise false:

```
>>> chord = Chord([1, 13, 14], (1, 4))
>>> pitchtools.expr_has_duplicate_numbered_chromatic_pitch_class(chord)
True
```

Return boolean. Changed in version 2.0: renamed `pitchtools.expr_has_duplicate_numeric_chromatic_pitch` to `pitchtools.expr_has_duplicate_numbered_chromatic_pitch_class()`.

pitchtools.expr_to_melodic_chromatic_interval_segment

pitchtools.**expr_to_melodic_chromatic_interval_segment**(*expr*)

New in version 2.0. Change *expr* to melodic chromatic interval segment:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")
>>> pitchtools.expr_to_melodic_chromatic_interval_segment(staff)
MelodicChromaticIntervalSegment(+2, +2, +1, +2, +2, +2, +1)
```

Return melodic chromatic interval segment.

pitchtools.get_named_chromatic_pitch_from_pitch_carrier

pitchtools.**get_named_chromatic_pitch_from_pitch_carrier**(*pitch_carrier*)

New in version 1.1. Get named chromatic pitch from *pitch_carrier*:

```
>>> pitch = pitchtools.NamedChromaticPitch('df', 5)
>>> pitch
NamedChromaticPitch("df''")
>>> pitchtools.get_named_chromatic_pitch_from_pitch_carrier(pitch)
NamedChromaticPitch("df''")

>>> note = Note(('df', 5), (1, 4))
>>> note
Note("df''4")
>>> pitchtools.get_named_chromatic_pitch_from_pitch_carrier(note)
NamedChromaticPitch("df''")

>>> note = Note(('df', 5), (1, 4))
>>> note.note_head
NoteHead("df''")
>>> pitchtools.get_named_chromatic_pitch_from_pitch_carrier(note.note_head)
NamedChromaticPitch("df''")

>>> chord = Chord([('df', 5)], (1, 4))
>>> chord
Chord("<df''>4")
>>> pitchtools.get_named_chromatic_pitch_from_pitch_carrier(chord)
NamedChromaticPitch("df''")

>>> pitchtools.get_named_chromatic_pitch_from_pitch_carrier(13)
NamedChromaticPitch("cs''")
```

Raise missing pitch error when *pitch_carrier* carries no pitch.

Raise extra pitch error when *pitch_carrier* carries more than one pitch.

Return named chromatic pitch. Changed in version 2.0: renamed `pitchtools.get_pitch()` to `pitchtools.get_named_chromatic_pitch_from_pitch_carrier()`.

pitchtools.get_numbered_chromatic_pitch_class_from_pitch_carrier

pitchtools.**get_numbered_chromatic_pitch_class_from_pitch_carrier**(*pitch_carrier*)

New in version 2.0. Get numbered chromatic pitch-class from *pitch_carrier*:

```
>>> note = Note("cs'4")
>>> pitchtools.get_numbered_chromatic_pitch_class_from_pitch_carrier(note)
NumberedChromaticPitchClass(1)
```

Raise missing pitch error on empty chords.

Raise extra pitch error on many-note chords.

Return numbered chromatic pitch-class. Changed in version 2.0: renamed `pitchtools.get_numeric_chromatic_pitch_class_from_pitch_carrier()` to `pitchtools.get_numbered_chromatic_pitch_class_from_pitch_carrier()`.

pitchtools.harmonic_chromatic_interval_class_number_dictionary

pitchtools.**harmonic_chromatic_interval_class_number_dictionary**(*pitches*)

New in version 1.1. Change named chromatic pitches to harmonic chromatic interval-class number dictionary:

```
>>> chord = Chord([0, 2, 11], (1, 4))
>>> vector = pitchtools.harmonic_chromatic_interval_class_number_dictionary(
... chord.written_pitches)
>>> vector
{0: 0, 1: 0, 2: 1, 3: 0, 4: 0, 5: 0, 6: 0, 7: 0, 8: 0, 9: 1, 10: 0, 11: 1}
```

Return dictionary. Changed in version 2.0: renamed `pitchtools.get_interval_vector()` to `pitchtools.harmonic_chromatic_interval_class_number_dictionary()`.

pitchtools.insert_and_transpose_nested_subruns_in_chromatic_pitch_class_number_list

pitchtools.**insert_and_transpose_nested_subruns_in_chromatic_pitch_class_number_list**(*notes*, *subrun_indic*

New in version 1.1. Insert and transpose nested subruns in *chromatic_pitch_class_number_list* according to *subrun_indicators*:

```
>>> notes = [Note(p, (1, 4)) for p in [0, 2, 7, 9, 5, 11, 4]]
>>> subrun_indicators = [(0, [2, 4]), (4, [3, 1])]
>>> pitchtools.insert_and_transpose_nested_subruns_in_chromatic_pitch_class_number_list(
... notes, subrun_indicators)
```

```
>>> t = []
>>> for x in notes:
...     try:
...         t.append(x.written_pitch.chromatic_pitch_number)
...     except AttributeError:
...         t.append([y.written_pitch.chromatic_pitch_number for y in x])
```

```
>>> t
[0, [5, 7], 2, [4, 0, 6, 11], 7, 9, 5, [10, 6, 8], 11, [7], 4]
```

Set *subrun_indicators* to a list of zero or more `(index, length_list)` pairs.

For each `(index, length_list)` pair in *subrun_indicators* the function will read *index* mod `len(notes)` and insert a subrun of length `length_list[0]` immediately after `notes[index]`, a subrun of length `length_list[1]` immediately after `notes[index+1]`, and, in general, a subrun of `length_list[i]` immediately after `notes[index+i]`, for `i < length(length_list)`.

New subruns are wrapped with lists. These wrapper lists are designed to allow inspection of the structural changes to *notes* immediately after the function returns. For this reason most calls to this function will be followed by `notes = sequencetools.flatten_sequence(notes)`:

```
>>> for note in notes: note
...
Note("c'4")
[Note("f'4"), Note("g'4")]
Note("d'4")
[Note("e'4"), Note("c'4"), Note("fs'4"), Note("b'4")]
Note("g'4")
Note("a'4")
Note("f'4")
[Note("bf'4"), Note("fs'4"), Note("af'4")]
Note("b'4")
[Note("g'4")]
Note("e'4")
```

This function is designed to work on a built-in Python list of notes. This function is **not** designed to work on Abjad voices, staves or other containers because the function currently implements no spanner-handling. That is, this function is designed to be used during precomposition when other, similar abstract pitch transforms may be common.

Return list of integers and / or floats. Changed in version 2.0: renamed `pitchtools.insert_transposed_pc_subruns()` to `pitchtools.insert_and_transpose_nested_subru`

pitchtools.instantiate_pitch_and_interval_test_collection

pitchtools.**instantiate_pitch_and_interval_test_collection**()

New in version 2.0. Instantiate pitch and interval test collection:

```
>>> for x in pitchtools.instantiate_pitch_and_interval_test_collection(): x
...
HarmonicChromaticInterval(1)
HarmonicChromaticIntervalClass(1)
HarmonicCounterpointInterval(1)
HarmonicCounterpointIntervalClass(1)
HarmonicDiatonicInterval('M2')
HarmonicDiatonicIntervalClass('M2')
InversionEquivalentChromaticIntervalClass(1)
InversionEquivalentDiatonicIntervalClass('M2')
MelodicChromaticInterval(+1)
MelodicChromaticIntervalClass(+1)
MelodicCounterpointInterval(1)
MelodicCounterpointIntervalClass(+1)
MelodicDiatonicInterval('+M2')
MelodicDiatonicIntervalClass('+M2')
NamedChromaticPitch('c')
NamedChromaticPitchClass('c')
NamedDiatonicPitch('c')
NamedDiatonicPitchClass('c')
NumberedChromaticPitch(1)
NumberedChromaticPitchClass(1)
NumberedDiatonicPitch(1)
NumberedDiatonicPitchClass(1)
```

Use to test pitch and interval interface consistency.

Return list.

pitchtools.inventory_aggregate_subsets

pitchtools.**inventory_aggregate_subsets**()

New in version 2.0. Inventory aggregate subsets:

```
>>> U_star = pitchtools.inventory_aggregate_subsets()
>>> len(U_star)
4096
>>> for pcset in U_star[:20]:
...   pcset
NumberedChromaticPitchClassSet([])
NumberedChromaticPitchClassSet([0])
NumberedChromaticPitchClassSet([1])
NumberedChromaticPitchClassSet([0, 1])
NumberedChromaticPitchClassSet([2])
NumberedChromaticPitchClassSet([0, 2])
NumberedChromaticPitchClassSet([1, 2])
NumberedChromaticPitchClassSet([0, 1, 2])
NumberedChromaticPitchClassSet([3])
NumberedChromaticPitchClassSet([0, 3])
NumberedChromaticPitchClassSet([1, 3])
NumberedChromaticPitchClassSet([0, 1, 3])
NumberedChromaticPitchClassSet([2, 3])
NumberedChromaticPitchClassSet([0, 2, 3])
NumberedChromaticPitchClassSet([1, 2, 3])
NumberedChromaticPitchClassSet([0, 1, 2, 3])
NumberedChromaticPitchClassSet([4])
NumberedChromaticPitchClassSet([0, 4])
NumberedChromaticPitchClassSet([1, 4])
NumberedChromaticPitchClassSet([0, 1, 4])
```

There are 4096 subsets of the aggregate.

This is `U*` in [Morris 1987].

Return list of numbered chromatic pitch-class sets.

pitchtools.inventory_inversion_equivalent_diatonic_interval_classes

pitchtools.**inventory_inversion_equivalent_diatonic_interval_classes**()

New in version 2.0. Inventory inversion-equivalent diatonic interval-classes:

```
>>> for dic in pitchtools.inventory_inversion_equivalent_diatonic_interval_classes():
...     dic
...
InversionEquivalentDiatonicIntervalClass('P1')
InversionEquivalentDiatonicIntervalClass('aug1')
InversionEquivalentDiatonicIntervalClass('m2')
InversionEquivalentDiatonicIntervalClass('M2')
InversionEquivalentDiatonicIntervalClass('aug2')
InversionEquivalentDiatonicIntervalClass('dim3')
InversionEquivalentDiatonicIntervalClass('m3')
InversionEquivalentDiatonicIntervalClass('M3')
InversionEquivalentDiatonicIntervalClass('dim4')
```

```
InversionEquivalentDiatonicIntervalClass('P4')
InversionEquivalentDiatonicIntervalClass('aug4')
```

There are 11 inversion-equivalent diatonic interval-classes.

It is an open question as to whether octaves should be included.

Return list of inversion-equivalent diatonic interval-classes.

pitchtools.inversion_equivalent_chromatic_interval_class_number_dictionary

pitchtools.**inversion_equivalent_chromatic_interval_class_number_dictionary**(*pitches*)

New in version 1.1. Change named chromatic *pitches* to inversion-equivalent chromatic interval-class number dictionary:

```
>>> chord = Chord("<c' d' b''>4")
>>> vector = pitchtools.inversion_equivalent_chromatic_interval_class_number_dictionary(
... chord.written_pitches)
>>> for i in range(7):
...     print '\t%s\t%s' % (i, vector[i])
...
    0   0
    1   1
    2   1
    3   1
    4   0
    5   0
    6   0
```

Changed in version 2.0: works with quartertones. Return dictionary.

pitchtools.is_alphabetic_accidental_abbreviation

pitchtools.**is_alphabetic_accidental_abbreviation**(*expr*)

New in version 2.0. True when *expr* is an alphabetic accidental abbrevation. Otherwise false:

```
>>> pitchtools.is_alphabetic_accidental_abbreviation('tqs')
True
```

The regex `^([s]{1,2}|[f]{1,2}|t?q?[fs])!?$` underlies this predicate.

Return boolean.

pitchtools.is_chromatic_pitch_class_name

pitchtools.**is_chromatic_pitch_class_name**(*expr*)

New in version 2.0. True when *expr* is a chromatic pitch-class name. Otherwise false:

```
>>> pitchtools.is_chromatic_pitch_class_name('fs')
True
```

The regex `^([a-g,A-G])(([s]{1,2}|[f]{1,2}|t?q?[fs]|)!?)$` underlies this predicate.

Return boolean.

pitchtools.is_chromatic_pitch_class_name_octave_number_pair

pitchtools.**is_chromatic_pitch_class_name_octave_number_pair**(*expr*)

New in version 1.1. True when *arg* has the form of a chromatic pitch-class / octave number pair. Otherwise false:

```
>>> pitchtools.is_chromatic_pitch_class_name_octave_number_pair(('cs', 5))
True
```

Return boolean. Changed in version 2.0: renamed `pitchtools.is_pair()` to `pitchtools.is_chromatic_pitch_class_name_octave_number_pair()`.

pitchtools.is_chromatic_pitch_class_number

pitchtools.**is_chromatic_pitch_class_number**(*expr*)

New in version 2.0. True *expr* is a chromatic pitch-class number. Otherwise false:

```
>>> pitchtools.is_chromatic_pitch_class_number(1)
True
```

The chromatic pitch-class numbers are equal to the set `[0, 0.5, ..., 11, 11.5]`.

Return boolean.

pitchtools.is_chromatic_pitch_name

pitchtools.**is_chromatic_pitch_name**(*expr*)

New in version 2.0. True *expr* is a chromatic pitch name. Otherwise false:

```
>>> pitchtools.is_chromatic_pitch_name('c,')
True
```

The regex `^([a-g,A-G])(([s]{1,2}|[f]{1,2}|t?q?[f,s]|)!?)(,+|'+|)$` underlies this predicate.

Return boolean.

pitchtools.is_chromatic_pitch_number

pitchtools.**is_chromatic_pitch_number**(*expr*)

New in version 2.0. True *expr* is a chromatic pitch number. Otherwise false:

```
>>> pitchtools.is_chromatic_pitch_number(13)
True
```

The chromatic pitch numbers are equal to the set of all integers in union with the set of all integers plus of minus `0.5`.

Return boolean.

pitchtools.is_diatonic_pitch_class_name

pitchtools.**is_diatonic_pitch_class_name**(*expr*)

New in version 2.0. True when *expr* is a diatonic pitch-class name. Otherwise false:

```
>>> pitchtools.is_diatonic_pitch_class_name('c')
True
```

The regex `^[a-g,A-G]$` underlies this predicate.

Return boolean.

pitchtools.is_diatonic_pitch_class_number

pitchtools.**is_diatonic_pitch_class_number**(*expr*)

New in version 2.0. True when *expr* is a diatonic pitch-class number. Otherwise false:

```
>>> pitchtools.is_diatonic_pitch_class_number(0)
True
```

The diatonic pitch-class numbers are equal to the set `[0, 1, 2, 3, 4, 5, 6]`.

Return boolean.

pitchtools.is_diatonic_pitch_name

pitchtools.**is_diatonic_pitch_name**(*expr*)

New in version 2.0. True when *expr* is a diatonic pitch name. Otherwise false:

```
>>> pitchtools.is_diatonic_pitch_name("c''")
True
```

The regex `(^[a-g,A-G])(,+|'+|)$` underlies this predicate.

Return boolean.

pitchtools.is_diatonic_pitch_number

pitchtools.**is_diatonic_pitch_number**(*expr*)

New in version 2.0. True when *expr* is a diatonic pitch number. Otherwise false:

```
>>> pitchtools.is_diatonic_pitch_number(7)
True
```

The diatonic pitch numbers are equal to the set of integers.

Return boolean.

pitchtools.is_diatonic_quality_abbreviation

pitchtools.**is_diatonic_quality_abbreviation**(*expr*)

New in version 2.0. True when *expr* is a diatonic quality abbreviation. Otherwise false:

```
>>> pitchtools.is_diatonic_quality_abbreviation('aug')
True
```

The regex `^M|m|P|aug|dim$` underlies this predicate.

Return boolean.

pitchtools.is_harmonic_diatonic_interval_abbreviation

pitchtools.**is_harmonic_diatonic_interval_abbreviation**(*expr*)

New in version 2.0. True when *expr* is a harmonic diatonic interval abbreviation. Otherwise false:

```
>>> pitchtools.is_harmonic_diatonic_interval_abbreviation('M9')
True
```

The regex `^(M|m|P|aug|dim)(\d+)$` underlies this predicate.

Return boolean.

pitchtools.is_melodic_diatonic_interval_abbreviation

pitchtools.**is_melodic_diatonic_interval_abbreviation**(*expr*)

New in version 2.0. True when *expr* is a melodic diatonic interval abbreviation. Otherwise false:

```
>>> pitchtools.is_melodic_diatonic_interval_abbreviation('+M9')
True
```

The regex `^([+,-]?)(M|m|P|aug|dim)(\d+)$` underlies this predicate.

Return boolean.

pitchtools.is_named_chromatic_pitch_token

pitchtools.**is_named_chromatic_pitch_token**(*pitch_token*)

New in version 1.1. True when *pitch_token* has the form of an Abjad pitch token. Otherwise false:

```
>>> pitchtools.is_named_chromatic_pitch_token(('c', 4))
True
```

Return boolean. Changed in version 2.0: renamed `pitchtools.is_pitch_token()` to `pitchtools.is_named_chromatic_pitch_token()`.

pitchtools.is_octave_tick_string

pitchtools.**is_octave_tick_string**(*expr*)

New in version 2.0. True when *expr* is an octave tick string. Otherwise false:

```
>>> pitchtools.is_octave_tick_string(',,,')
True
```

The regex `^,+|'+|$` underlies this predicate.

Return boolean.

pitchtools.is_pitch_carrier

pitchtools.**is_pitch_carrier**(*expr*)

New in version 1.1. True when *expr* is an Abjad pitch, note, note-head of chord instance. Otherwise false:

```
>>> note = Note("c'4")
>>> pitchtools.is_pitch_carrier(note)
True
```

Return boolean. Changed in version 2.0: renamed `pitchtools.is_carrier()` to `pitchtools.is_pitch_carrier()`.

pitchtools.is_pitch_class_octave_number_string

`pitchtools.`**`is_pitch_class_octave_number_string`**(*expr*)

New in version 2.5. True when *expr* is a pitch-class / octave number string. Otherwise false:

```
>>> pitchtools.is_pitch_class_octave_number_string('C#2')
True
```

Quartertone accidentals are supported.

The regex `^([A-G])([#]{1,2}|[b]{1,2}|[#]?[+]|[b]?[~]|)([-]?[0-9]+)$` underlies this predicate.

Return boolean.

pitchtools.is_symbolic_accidental_string

`pitchtools.`**`is_symbolic_accidental_string`**(*expr*)

New in version 2.5. True when *expr* is a symbolic accidental string. Otherwise false:

```
>>> pitchtools.is_symbolic_accidental_string('#+')
True
```

True on empty string.

The regex `^([#]{1,2}|[b]{1,2}|[#]?[+]|[b]?[~]|)$` underlies this predicate.

Return boolean.

pitchtools.is_symbolic_pitch_range_string

`pitchtools.`**`is_symbolic_pitch_range_string`**(*expr*)

New in version 2.5. True when *expr* is a symbolic pitch range string. Otherwise false:

```
>>> pitchtools.is_symbolic_pitch_range_string('[A0, C8]')
True
```

The regex that underlies this predicate matches against two comma-separated pitch indicators enclosed in some combination of square brackets and round parentheses.

Return boolean.

pitchtools.iterate_named_chromatic_pitch_pairs_in_expr

`pitchtools.`**`iterate_named_chromatic_pitch_pairs_in_expr`**(*expr*)

New in version 2.0. Iterate left-to-right, top-to-bottom named chromatic pitch pairs in *expr*:

```
>>> score = Score([])
>>> notes = [Note("c'8"), Note("d'8"), Note("e'8"), Note("f'8"), Note("g'4")]
>>> score.append(Staff(notes))
>>> notes = [Note(x, (1, 4)) for x in [-12, -15, -17]]
>>> score.append(Staff(notes))
```

```
>>> contexttools.ClefMark('bass')(score[1])
ClefMark('bass')(Staff{3})

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
        e'8
        f'8
        g'4
    }
    \new Staff {
        \clef "bass"
        c4
        a,4
        g,4
    }
>>

>>> for pair in pitchtools.iterate_named_chromatic_pitch_pairs_in_expr(score):
...     pair
...
(NamedChromaticPitch("c'"), NamedChromaticPitch('c'))
(NamedChromaticPitch("c'"), NamedChromaticPitch("d'"))
(NamedChromaticPitch('c'), NamedChromaticPitch("d'"))
(NamedChromaticPitch("d'"), NamedChromaticPitch("e'"))
(NamedChromaticPitch("d'"), NamedChromaticPitch('a,'))
(NamedChromaticPitch('c'), NamedChromaticPitch("e'"))
(NamedChromaticPitch('c'), NamedChromaticPitch('a,'))
(NamedChromaticPitch("e'"), NamedChromaticPitch('a,'))
(NamedChromaticPitch("e'"), NamedChromaticPitch("f'"))
(NamedChromaticPitch('a,'), NamedChromaticPitch("f'"))
(NamedChromaticPitch("f'"), NamedChromaticPitch("g'"))
(NamedChromaticPitch("f'"), NamedChromaticPitch('g,'))
(NamedChromaticPitch('a,'), NamedChromaticPitch("g'"))
(NamedChromaticPitch('a,'), NamedChromaticPitch('g,'))
(NamedChromaticPitch("g'"), NamedChromaticPitch('g,'))
```

Chords are handled correctly.

```
>>> chord_1 = Chord([0, 2, 4], (1, 4))
>>> chord_2 = Chord([17, 19], (1, 4))
>>> staff = Staff([chord_1, chord_2])

>>> f(staff)
\new Staff {
    <c' d' e'>4
    <f'' g''>4
}

>>> for pair in pitchtools.iterate_named_chromatic_pitch_pairs_in_expr(staff):
...     print pair
(NamedChromaticPitch("c'"), NamedChromaticPitch("d'"))
(NamedChromaticPitch("c'"), NamedChromaticPitch("e'"))
(NamedChromaticPitch("d'"), NamedChromaticPitch("e'"))
(NamedChromaticPitch("c'"), NamedChromaticPitch("f''"))
(NamedChromaticPitch("c'"), NamedChromaticPitch("g''"))
(NamedChromaticPitch("d'"), NamedChromaticPitch("f''"))
```

```
(NamedChromaticPitch("d''"), NamedChromaticPitch("g''"))
(NamedChromaticPitch("e''"), NamedChromaticPitch("f''"))
(NamedChromaticPitch("e''"), NamedChromaticPitch("g''"))
(NamedChromaticPitch("f''"), NamedChromaticPitch("g''"))
```

Return generator.

pitchtools.list_chromatic_pitch_numbers_in_expr

pitchtools.**list_chromatic_pitch_numbers_in_expr**(*expr*)

New in version 2.0. List chromatic pitch numbers in *expr*:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> pitchtools.list_chromatic_pitch_numbers_in_expr(tuplet)
(0, 2, 4)
```

Return tuple of zero or more numbers.

pitchtools.list_harmonic_chromatic_intervals_in_expr

pitchtools.**list_harmonic_chromatic_intervals_in_expr**(*expr*)

New in version 2.0. List harmonic chromatic intervals in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> for interval in sorted(pitchtools.list_harmonic_chromatic_intervals_in_expr(staff)):
...     interval
...
HarmonicChromaticInterval(1)
HarmonicChromaticInterval(2)
HarmonicChromaticInterval(2)
HarmonicChromaticInterval(3)
HarmonicChromaticInterval(4)
HarmonicChromaticInterval(5)
```

Return unordered set.

pitchtools.list_harmonic_diatonic_intervals_in_expr

pitchtools.**list_harmonic_diatonic_intervals_in_expr**(*expr*)

New in version 2.0. List harmonic diatonic intervals in *expr*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> for interval in sorted(pitchtools.list_harmonic_diatonic_intervals_in_expr(staff)):
...     interval
...
HarmonicDiatonicInterval('m2')
HarmonicDiatonicInterval('M2')
HarmonicDiatonicInterval('M2')
HarmonicDiatonicInterval('m3')
HarmonicDiatonicInterval('M3')
HarmonicDiatonicInterval('P4')
```

Return unordered set.

pitchtools.list_inversion_equivalent_chromatic_interval_classes_pairwise

pitchtools.**list_inversion_equivalent_chromatic_interval_classes_pairwise**(*pitch_carriers*, *wrap=False*)

New in version 2.0. List inversion-equivalent chromatic interval-classes pairwise between *pitch_carriers*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
    g'8
    a'8
    b'8
    c''8
}

>>> result = pitchtools.list_inversion_equivalent_chromatic_interval_classes_pairwise(
... staff, wrap=False)

>>> for x in result: x
...
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(1)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(1)

>>> result = pitchtools.list_inversion_equivalent_chromatic_interval_classes_pairwise(
... staff, wrap=True)

>>> for x in result: x
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(1)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(1)
InversionEquivalentChromaticIntervalClass(0)

>>> notes = staff.leaves
>>> notes = list(reversed(notes))

>>> result = pitchtools.list_inversion_equivalent_chromatic_interval_classes_pairwise(
... notes, wrap=False)

>>> for x in result: x
...
InversionEquivalentChromaticIntervalClass(1)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
```

```
InversionEquivalentChromaticIntervalClass(1)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
```

```
>>> result = pitchtools.list_inversion_equivalent_chromatic_interval_classes_pairwise(
... notes, wrap=True)
```

```
>>> for x in result: x
...
InversionEquivalentChromaticIntervalClass(1)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(1)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(2)
InversionEquivalentChromaticIntervalClass(0)
```

When `wrap=False` do not return `pitch_carriers[-1] - pitch_carriers[0]` as last in series.

When `wrap=True` do return `pitch_carriers[-1] - pitch_carriers[0]` as last in series.

Return list.

pitchtools.list_melodic_chromatic_interval_numbers_pairwise

pitchtools.**list_melodic_chromatic_interval_numbers_pairwise**(*pitch_carriers*, *wrap=False*)

New in version 1.1. List melodic chromatic interval numbers pairwise between *pitch_carriers*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")
```

```
>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
    g'8
    a'8
    b'8
    c''8
}
```

```
>>> pitchtools.list_melodic_chromatic_interval_numbers_pairwise(
... staff)
[2, 2, 1, 2, 2, 2, 1]
```

```
>>> pitchtools.list_melodic_chromatic_interval_numbers_pairwise(
... staff, wrap=True)
[2, 2, 1, 2, 2, 2, 1, -12]
```

```
>>> notes = [
...     Note("c'8"), Note("d'8"), Note("e'8"), Note("f'8"),
...     Note("g'8"), Note("a'8"), Note("b'8"), Note("c''8")]
```

```
>>> notes.reverse()

>>> pitchtools.list_melodic_chromatic_interval_numbers_pairwise(
... notes)
[-1, -2, -2, -2, -1, -2, -2]

>>> pitchtools.list_melodic_chromatic_interval_numbers_pairwise(
... notes, wrap=True)
[-1, -2, -2, -2, -1, -2, -2, 12]
```

When `wrap = False` do not return `pitch_carriers[-1] - pitch_carriers[0]` as last in series.

When `wrap = True` do return `pitch_carriers[-1] - pitch_carriers[0]` as last in series.

Return list. Changed in version 2.0: renamed `pitchtools.get_signed_interval_series()` to `pitchtools.list_melodic_chromatic_interval_numbers_pairwise()`.

pitchtools.list_named_chromatic_pitches_in_expr

pitchtools.**list_named_chromatic_pitches_in_expr**(*expr*)

New in version 2.0. List named chromatic pitches in *expr*:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")
>>> beam_spanner = beamtools.BeamSpanner(staff[:])

>>> for x in pitchtools.list_named_chromatic_pitches_in_expr(beam_spanner):
...     x
...
NamedChromaticPitch("c'")
NamedChromaticPitch("d'")
NamedChromaticPitch("e'")
NamedChromaticPitch("f'")
```

Return tuple.

pitchtools.list_numbered_chromatic_pitch_classes_in_expr

pitchtools.**list_numbered_chromatic_pitch_classes_in_expr**(*expr*)

New in version 2.0. List numbered chromatic pitch-classes in *expr*:

```
>>> chord = Chord("<cs'' d'' ef''>4")

>>> for x in pitchtools.list_numbered_chromatic_pitch_classes_in_expr(chord):
...     x
...
NumberedChromaticPitchClass(1)
NumberedChromaticPitchClass(2)
NumberedChromaticPitchClass(3)
```

Works with notes, chords, defective chords.

Return tuple or zero or more numbered chromatic pitch-classes. Changed in version 2.0: renamed `pitchtools.list_numeric_chromatic_pitch_classes_in_expr()` to `pitchtools.list_numbered_chromatic_pitch_classes_in_expr()`.

pitchtools.list_octave_transpositions_of_pitch_carrier_within_pitch_range

pitchtools.**list_octave_transpositions_of_pitch_carrier_within_pitch_range**(*pitch_carrier*, *pitch_range*)

New in version 1.1. List octave transpositions of *pitch_carrier* in *pitch_range*:

```
>>> chord = Chord("<c' d' e'>4")
>>> pitch_range = pitchtools.PitchRange(0, 48)

>>> result = pitchtools.list_octave_transpositions_of_pitch_carrier_within_pitch_range(
...     chord, pitch_range)

>>> for chord in result:
...     chord
...
Chord("<c' d' e'>4")
Chord("<c'' d'' e''>4")
Chord("<c''' d''' e'''>4")
Chord("<c'''' d'''' e''''>4")
```

Return list of newly created *pitch_carrier* objects.

pitchtools.list_ordered_named_chromatic_pitch_pairs_from_expr_1_to_expr_2

pitchtools.**list_ordered_named_chromatic_pitch_pairs_from_expr_1_to_expr_2**(*expr_1*, *expr_2*)

New in version 2.0. List ordered named chromatic pitch pairs from *expr_1* to *expr_2*:

```
>>> chord_1 = Chord([0, 1, 2], (1, 4))
>>> chord_2 = Chord([3, 4], (1, 4))

>>> for pair in pitchtools.list_ordered_named_chromatic_pitch_pairs_from_expr_1_to_expr_2(
...     chord_1, chord_2):
...     pair
(NamedChromaticPitch("c'"), NamedChromaticPitch("ef'"))
(NamedChromaticPitch("c'"), NamedChromaticPitch("e'"))
(NamedChromaticPitch("cs'"), NamedChromaticPitch("ef'"))
(NamedChromaticPitch("cs'"), NamedChromaticPitch("e'"))
(NamedChromaticPitch("d'"), NamedChromaticPitch("ef'"))
(NamedChromaticPitch("d'"), NamedChromaticPitch("e'"))
```

Return generator.

pitchtools.list_unordered_named_chromatic_pitch_pairs_in_expr

pitchtools.**list_unordered_named_chromatic_pitch_pairs_in_expr**(*expr*)

New in version 2.0. List unordered named chromatic pitch pairs in *expr*:

```
>>> chord = Chord("<c' cs' d' ef'>4")

>>> for pair in pitchtools.list_unordered_named_chromatic_pitch_pairs_in_expr(chord):
...     pair
...
(NamedChromaticPitch("c'"), NamedChromaticPitch("cs'"))
(NamedChromaticPitch("c'"), NamedChromaticPitch("d'"))
(NamedChromaticPitch("c'"), NamedChromaticPitch("ef'"))
```

```
(NamedChromaticPitch("cs'"), NamedChromaticPitch("d'"))
(NamedChromaticPitch("cs'"), NamedChromaticPitch("ef'"))
(NamedChromaticPitch("d'"), NamedChromaticPitch("ef'"))
```

Return generator.

pitchtools.make_n_middle_c_centered_pitches

pitchtools.**make_n_middle_c_centered_pitches**(*n*)

New in version 2.0. Make *n* middle-c centered pitches, where 0 < *n*:

```
>>> for p in pitchtools.make_n_middle_c_centered_pitches(5): p
NamedChromaticPitch('f')
NamedChromaticPitch('a')
NamedChromaticPitch("c'")
NamedChromaticPitch("e'")
NamedChromaticPitch("g'")

>>> for p in pitchtools.make_n_middle_c_centered_pitches(4): p
NamedChromaticPitch('g')
NamedChromaticPitch('b')
NamedChromaticPitch("d'")
NamedChromaticPitch("f'")
```

Return list of zero or more named chromatic pitches.

pitchtools.named_chromatic_pitch_and_clef_to_staff_position_number

pitchtools.**named_chromatic_pitch_and_clef_to_staff_position_number**(*pitch*, *clef*)

New in version 2.0. Change named chromatic *pitch* and *clef* to staff position number:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c''8")
>>> clef = contexttools.ClefMark('treble')
>>> for note in staff:
...     written_pitch = note.written_pitch
...     number = pitchtools.named_chromatic_pitch_and_clef_to_staff_position_number(
...         written_pitch, clef)
...     print '%s\t%s' % (written_pitch, number)
c'      -6
d'      -5
e'      -4
f'      -3
g'      -2
a'      -1
b'      0
c''     1
```

Return integer.

pitchtools.named_chromatic_pitch_tokens_to_named_chromatic_pitches

pitchtools.**named_chromatic_pitch_tokens_to_named_chromatic_pitches**(*pitch_tokens*)

New in version 2.0. Change named chromatic *pitch_tokens* to named chromatic pitches:

```
>>> pitchtools.named_chromatic_pitch_tokens_to_named_chromatic_pitches([0, 2, ('ef', 4)])
[NamedChromaticPitch("c'"), NamedChromaticPitch("d'"), NamedChromaticPitch("ef'")]
```

Return list of zero or more named chromatic pitches.

pitchtools.octave_number_to_octave_tick_string

pitchtools.**octave_number_to_octave_tick_string**(*octave_number*)

New in version 2.0. Change *octave_number* to octave tick string:

```
>>> for octave_number in range(-1, 9):
...     tick_string = pitchtools.octave_number_to_octave_tick_string(octave_number)
...     print "%s\t%s" % (octave_number, tick_string)
...
-1 ,,,,
0  ,,,
1  ,,
2  ,
3
4  '
5  ''
6  '''
7  ''''
8  '''''
```

Raise type error on noninteger input.

Return string.

pitchtools.octave_tick_string_to_octave_number

pitchtools.**octave_tick_string_to_octave_number**(*tick_string*)

New in version 2.0. Change *tick_string* to octave number:

```
>>> pitchtools.octave_tick_string_to_octave_number("'")
4
```

Raise type error on nonstring input.

Raise value error on input not of tick string format.

Return integer.

pitchtools.pentatonic_pitch_number_to_chromatic_pitch_number

pitchtools.**pentatonic_pitch_number_to_chromatic_pitch_number**(*pentatonic_scale_degree*, *transpose=1*, *phase=0*)

New in version 1.1. Changed *pentatonic_scale_degree* number to chromatic pitch number:

```
>>> for pentatonic_scale_degree in range(9):
...     result = pitchtools.pentatonic_pitch_number_to_chromatic_pitch_number(
...         pentatonic_scale_degree)
...     print '%s %4s' % (pentatonic_scale_degree, result)
...
0  1
```

```
1  3
2  6
3  8
4  10
5  13
6  15
7  18
8  20
```

Pentatonic scale degrees may be negative:

```
>>> for pentatonic_scale_degree in range(-1, -9, -1):
...     result = pitchtools.pentatonic_pitch_number_to_chromatic_pitch_number(
...         pentatonic_scale_degree)
...     print '%s %4s' % (pentatonic_scale_degree, result)
...
-1 -2
-2 -4
-3 -6
-4 -9
-5 -11
-6 -14
-7 -16
-8 -18
```

Return integer. Changed in version 2.0: renamed `pitchtools.pentatonic_to_chromatic()` to `pitchtools.pentatonic_pitch_number_to_chromatic_pitch_number()`.

pitchtools.permute_named_chromatic_pitch_carrier_list_by_twelve_tone_row

pitchtools.**permute_named_chromatic_pitch_carrier_list_by_twelve_tone_row**(*pitches*, *row*)

New in version 2.0. Permute named chromatic pitch carrier list by twelve-tone *row*:

```
>>> notes = notetools.make_notes([17, -10, -2, 11], [Duration(1, 4)])
>>> row = pitchtools.TwelveToneRow([10, 0, 2, 6, 8, 7, 5, 3, 1, 9, 4, 11])
>>> pitchtools.permute_named_chromatic_pitch_carrier_list_by_twelve_tone_row(notes, row)
[Note('bf4'), Note('d4'), Note("f''4"), Note("b'4")]
```

Function works by reference only. No objects are copied.

Return list.

pitchtools.pitch_class_octave_number_string_to_chromatic_pitch_name

pitchtools.**pitch_class_octave_number_string_to_chromatic_pitch_name**(*pitch_class_octave_number_strin*

New in version 2.5. Change *pitch_class_octave_number_string* to chromatic pitch name:

```
>>> pitchtools.pitch_class_octave_number_string_to_chromatic_pitch_name('C#+2')
'ctqs,'
```

Return string.

pitchtools.register_chromatic_pitch_class_numbers_by_chromatic_pitch_number_aggregate

pitchtools.**register_chromatic_pitch_class_numbers_by_chromatic_pitch_number_aggregate**(*pitch_class_numbers*, *aggregate*)

New in version 1.1. Register chromatic *pitch_class_numbers* by chromatic pitch-number *aggregate*:

```
>>> pitchtools.register_chromatic_pitch_class_numbers_by_chromatic_pitch_number_aggregate(
...     [10, 0, 2, 6, 8, 7, 5, 3, 1, 9, 4, 11],
...     [10, 19, 20, 23, 24, 26, 27, 29, 30, 33, 37, 40])
[10, 24, 26, 30, 20, 19, 29, 27, 37, 33, 40, 23]
```

Return list of zero or more chromatic pitch numbers.

pitchtools.respell_named_chromatic_pitches_in_expr_with_flats

pitchtools.**respell_named_chromatic_pitches_in_expr_with_flats**(*expr*)

New in version 1.1. Respell named chromatic pitches in *expr* with flats:

```
>>> staff = Staff(notetools.make_repeated_notes(6))
>>> pitchtools.set_ascending_named_chromatic_pitches_on_tie_chains_in_expr(staff)

>>> f(staff)
\new Staff {
    c'8
    cs'8
    d'8
    ef'8
    e'8
    f'8
}

>>> pitchtools.respell_named_chromatic_pitches_in_expr_with_flats(staff)

>>> f(staff)
\new Staff {
    c'8
    df'8
    d'8
    ef'8
    e'8
    f'8
}
```

Return none. Changed in version 2.0: renamed `pitchtools.make_flat()` to `pitchtools.respell_named_chromatic_pitches_in_expr_with_flats()`.

pitchtools.respell_named_chromatic_pitches_in_expr_with_sharps

pitchtools.**respell_named_chromatic_pitches_in_expr_with_sharps**(*expr*)

New in version 1.1. Respell named chromatic pitches in *expr* with sharps:

```
>>> staff = Staff(notetools.make_repeated_notes(6))
>>> pitchtools.set_ascending_named_chromatic_pitches_on_tie_chains_in_expr(staff)
```

```
>>> f(staff)
\new Staff {
    c'8
    cs'8
    d'8
    ef'8
    e'8
    f'8
}

>>> pitchtools.respell_named_chromatic_pitches_in_expr_with_sharps(staff)

>>> f(staff)
\new Staff {
    c'8
    cs'8
    d'8
    ds'8
    e'8
    f'8
}
```

Return none. Changed in version 2.0: renamed `pitchtools.make_sharp()` to `pitchtools.respell_named_chromatic_pitches_in_expr_with_sharps()`.

pitchtools.set_ascending_named_chromatic_pitches_on_tie_chains_in_expr

pitchtools.**set_ascending_named_chromatic_pitches_on_tie_chains_in_expr**(*expr*)

New in version 1.1. Set ascending named chromatic pitches on nontied pitched components in *expr*:

```
>>> voice = Voice(notetools.make_notes(0, [(5, 32)] * 4))
>>> pitchtools.set_ascending_named_chromatic_pitches_on_tie_chains_in_expr(voice)

>>> f(voice)
\new Voice {
    c'8 ~
    c'32
    cs'8 ~
    cs'32
    d'8 ~
    d'32
    ef'8 ~
    ef'32
}
```

Used primarily in generating test file examples.

Return none. Changed in version 2.0: renamed `pitchtools.chromaticize()` to `pitchtools.set_ascending_named_chromatic_pitches_on_tie_chains_in_expr()`.

pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr

pitchtools.**set_ascending_named_diatonic_pitches_on_tie_chains_in_expr**(*expr*, *key_signature=None*)

New in version 1.1. Set ascending named diatonic pitches on nontied pitched components in *expr*:

```
>>> staff = Staff(notetools.make_notes(0, [(5, 32)] * 4))
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(staff)

>>> f(staff)
\new Staff {
    c'8 ~
    c'32
    d'8 ~
    d'32
    e'8 ~
    e'32
    f'8 ~
    f'32
}
```

Used primarily in generating test file examples. New in version 2.0: Optional *key_signature* keyword argument. Return none. Changed in version 2.0: renamed `pitchtools.diatonicize()` to `pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr()`.

pitchtools.set_default_accidental_spelling

`pitchtools.`**`set_default_accidental_spelling`**(*spelling='mixed'*)

New in version 1.1. Set default accidental spelling to sharps:

```
>>> from abjad.tools import configurationtools

>>> pitchtools.set_default_accidental_spelling('sharps')

>>> [Note(13, (1, 4)), Note(15, (1, 4))]
[Note("cs''4"), Note("ds''4")]
```

Set default accidental spelling to flats:

```
>>> pitchtools.set_default_accidental_spelling('flats')

>>> [Note(13, (1, 4)), Note(15, (1, 4))]
[Note("df''4"), Note("ef''4")]
```

Set default accidental spelling to mixed:

```
>>> pitchtools.set_default_accidental_spelling()

>>> [Note(13, (1, 4)), Note(15, (1, 4))]
[Note("cs''4"), Note("ef''4")]
```

Mixed is system default.

Mixed test case must appear last here for doc tests to check correctly.

Return none. Changed in version 2.0: renamed `pitchtools.change_default_accidental_spelling()` to `pitchtools.set_default_accidental_spelling()`.Changed in version 2.9: renamed `configurationtools.set_default_accidental_spelling()` to `pitchtools.set_default_accidental_spelling()`.

pitchtools.set_written_pitch_of_pitched_components_in_expr

pitchtools.**set_written_pitch_of_pitched_components_in_expr**(*expr*, *written_pitch=0*)

New in version 2.9. Set written pitch of pitched components in *expr* to *written_pitch*:

```
>>> staff = Staff("c' d' e' f'")

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
}

>>> pitchtools.set_written_pitch_of_pitched_components_in_expr(staff)

>>> f(staff)
\new Staff {
    c'4
    c'4
    c'4
    c'4
}
```

Use as a way of neutralizing pitch information in an arbitrary piece of score.

Return none.

pitchtools.sort_named_chromatic_pitch_carriers_in_expr

pitchtools.**sort_named_chromatic_pitch_carriers_in_expr**(*pitch_carriers*)

New in version 2.0. List named chromatic pitch carriers in *expr* sorted by numbered chromatic pitch-class:

```
>>> chord = Chord([9, 11, 12, 14, 16], (1, 4))
>>> notes = chordtools.arpeggiate_chord(chord)

>>> pitchtools.sort_named_chromatic_pitch_carriers_in_expr(notes)
[Note("c''4"), Note("d''4"), Note("e''4"), Note("a'4"), Note("b'4")]
```

The elements in *pitch_carriers* are not changed in any way.

Return list.

pitchtools.spell_chromatic_interval_number

pitchtools.**spell_chromatic_interval_number**(*diatonic_interval_number*, *chromatic_interval_number*)

New in version 2.0. Spell *chromatic_interval_number* according to *diatonic_interval_number*:

```
>>> pitchtools.spell_chromatic_interval_number(2, 1)
MelodicDiatonicInterval('+m2')
```

Return melodic diatonic interval.

pitchtools.spell_chromatic_pitch_number

pitchtools.**spell_chromatic_pitch_number**(*chromatic_pitch_number*, *diatonic_pitch_class_name*)

New in version 1.1. Spell *chromatic_pitch_number* according to *diatonic_pitch_class_name*:

```
>>> pitchtools.spell_chromatic_pitch_number(14, 'c')
(Accidental('ss'), 5)
```

Return accidental / octave-number pair. Changed in version 2.0: renamed `pitchtools.number_letter_to_accidental_octave()` to `pitchtools.spell_chromatic_pitch_number()`.

pitchtools.split_chromatic_pitch_class_name

pitchtools.**split_chromatic_pitch_class_name**(*chromatic_pitch_class_name*)

New in version 1.1. Change *chromatic_pitch_class_name* to diatonic pitch-class name / alphabetic accidental abbreviation pair:

```
>>> pitchtools.split_chromatic_pitch_class_name('cs')
('c', 's')
```

Return pair of strings. Changed in version 2.0: renamed `pitchtools.name_to_letter_accidental()` to `pitchtools.split_chromatic_pitch_class_name()`.

pitchtools.suggest_clef_for_named_chromatic_pitches

pitchtools.**suggest_clef_for_named_chromatic_pitches**(*pitches*)

New in version 1.1. Suggest clef for named chromatic *pitches*:

```
>>> staff = Staff(notetools.make_notes(range(-12, -6), [(1, 4)]))
>>> pitchtools.suggest_clef_for_named_chromatic_pitches(staff)
ClefMark('bass')
```

Suggest clef based on minimal number of ledger lines.

Return clef mark. Changed in version 2.0: renamed `pitchtools.suggest_clef()` to `pitchtools.suggest_clef_for_named_chromatic_pitches()`.

pitchtools.symbolic_accidental_string_to_alphabetic_accidental_abbreviation

pitchtools.**symbolic_accidental_string_to_alphabetic_accidental_abbreviation**(*symbolic_accidental_*

New in version 2.5. Change *symbolic_accidental_string* to alphabetic accidental abbreviation:

```
>>> pitchtools.symbolic_accidental_string_to_alphabetic_accidental_abbreviation('#+')
'tqs'
```

None when *symbolic_accidental_string* is not a valid symbolic accidental string.

Return string or none.

pitchtools.transpose_chromatic_pitch_by_melodic_chromatic_interval_segment

pitchtools.**transpose_chromatic_pitch_by_melodic_chromatic_interval_segment**(*pitch*, *segment*)

New in version 2.0. Transpose chromatic *pitch* by melodic chromatic interval *segment*:

```
>>> ncp = pitchtools.NumberedChromaticPitch(0)
>>> mcis = pitchtools.MelodicChromaticIntervalSegment([0, -1, 2])
>>> pitchtools.transpose_chromatic_pitch_by_melodic_chromatic_interval_segment(ncp, mcis)
[NumberedChromaticPitch(0), NumberedChromaticPitch(-1), NumberedChromaticPitch(1)]
```

Transpose by each interval in *segment* such that each tranposition transposes the resulting pitch of the previous transposition.

Return list of numbered chromatic pitches.

pitchtools.transpose_chromatic_pitch_class_number_to_chromatic_pitch_number_neighbor

pitchtools.**transpose_chromatic_pitch_class_number_to_chromatic_pitch_number_neighbor**(*chromat chro- matic_p*

New in version 1.1. Transpose *chromatic_pitch_class_number* by octaves to nearest neighbor of *chromatic_pitch_number*:

```
>>> pitchtools.transpose_chromatic_pitch_class_number_to_chromatic_pitch_number_neighbor(
...     12, 4)
16
```

Resulting chromatic pitch number must be within one tritone of *chromatic_pitch_number*.

Return chromatic pitch number.

pitchtools.transpose_chromatic_pitch_number_by_octave_transposition_mapping

pitchtools.**transpose_chromatic_pitch_number_by_octave_transposition_mapping**(*chromatic_pitch_num map- ping*)

New in version 1.1. Transpose *chromatic_pitch_number* by the some number of octaves up or down. Derive correct number of octaves from *mapping* where *mapping* is a list of `(range_spec, octave)` pairs and `range_spec` is, in turn, a `(start, stop)` pair suitable to pass to the built-in Python `range()` function:

```
>>> mapping = [((-39, -13), 0), ((-12, 23), 12), ((24, 48), 24)]
```

The mapping given here comprises three `(range_spec, octave)` pairs. The first such pair is `((-39, -13), 0)` and can be read as follows: "any pitches between `-39` and `-13` should be transposed into the octave rooted at pitch `0`." The octave rooted at pitch `0` equals the twelve pitches `range(0, 0 + 12)` or `[0, 1, ..., 10, 11]`.

The second `(range_spec, octave)` pair is `((-12, 23), 12)` and can be read as "any pitches between `-12` and `23` should be transposed into the octave rooted at pitch `12`," with the octave rooted at pitch `12` equal to the twelve pitches `range(12, 12 + 12)` or `[12, 13, ..., 22, 23]`.

The third and last `(range_spec, octave)` pair is `((24, 48), 24)` and can be read as "any pitches between `24` and `48` should be transposed to the octave rooted at `24`," with the octave rooted at `24` equal to the twelve pitches `range(24, 24, + 12)` or `[24, 25, ..., 34, 35]`.

The mapping given here divides the compass of the piano, from `-39` to `48`, into three disjunct subranges and then explains how to transpose pitches found in any of those three disjunct subranges. This means that, for example, all the f-sharps within the range of the piano now undergo a known transposition under *mapping* as defined here:

```
>>> pitchtools.transpose_chromatic_pitch_number_by_octave_transposition_mapping(
...     -30, mapping)
6
```

We verify that pitch `-30` should map to pitch `6` by noticing that pitch `-30` falls in the first of the three subranges defined by *mapping* from `-39` to `-13` and then noting that *mapping* sends pitches with that subrange to the octave rooted at pitch `0`. The octave transposition of `-30` that falls within the octave rooted at `0` is `6`:

```
>>> pitchtools.transpose_chromatic_pitch_number_by_octave_transposition_mapping(
...     -18, mapping)
6
```

Likewise, *mapping* sends pitch `-18` to pitch `6` because pitch `-18` falls in the same subrange from `-39` to `-13` as did pitch `-39` and so undergoes the same transposition to the octave rooted at `0`.

In this way we can map all f-sharps from `-39` to `48` according to *mapping*:

```
>>> pitch_numbers = [-30, -18, -6, 6, 18, 30, 42]
>>> for n in pitch_numbers:
...   n, pitchtools.transpose_chromatic_pitch_number_by_octave_transposition_mapping(
...         n, mapping)
...
(-30, 6)
(-18, 6)
(-6, 18)
(6, 18)
(18, 18)
(30, 30)
(42, 30)
```

And so on.

Return chromatic pitch number. Changed in version 2.0: renamed `pitchtools.send_pitch_number_to_octave()` to `pitchtools.transpose_chromatic_pitch_number_b`

pitchtools.transpose_named_chromatic_pitch_by_melodic_chromatic_interval_and_respell

`pitchtools.`**`transpose_named_chromatic_pitch_by_melodic_chromatic_interval_and_respell`**(*pitch*, *staff_sp*
melodic

New in version 1.1. Transpose named chromatic pitch by *melodic_chromatic_interval* and respell *staff_spaces* above or below:

```
>>> pitch = pitchtools.NamedChromaticPitch(0)

>>> pitchtools.transpose_named_chromatic_pitch_by_melodic_chromatic_interval_and_respell(
...     pitch, 1, 0.5)
NamedChromaticPitch("dtqf'")
```

Return new named chromatic pitch. Changed in version 2.0: renamed `pitchtools.staff_space_transpose()` to `pitchtools.transpose_named_chromatic_pitch_by_melo`

pitchtools.transpose_pitch_carrier_by_melodic_interval

pitchtools.**transpose_pitch_carrier_by_melodic_interval**(*pitch_carrier*, *melodic_interval*)

New in version 2.0. Transpose *pitch_carrier* by diatonic *melodic_interval*:

```
>>> chord = Chord("<c' e' g'>4")

>>> pitchtools.transpose_pitch_carrier_by_melodic_interval(chord, '+m2')
Chord("<df' f' af'>4")
```

Transpose *pitch_carrier* by chromatic *melodic_interval*:

```
>>> chord = Chord("<c' e' g'>4")

>>> pitchtools.transpose_pitch_carrier_by_melodic_interval(chord, 1)
Chord("<cs' f' af'>4")
```

Return non-pitch-carrying input unchaged:

```
>>> rest = Rest('r4')

>>> pitchtools.transpose_pitch_carrier_by_melodic_interval(rest, 1)
Rest('r4')
```

Return *pitch_carrier*.

pitchtools.transpose_pitch_expr_into_pitch_range

pitchtools.**transpose_pitch_expr_into_pitch_range**(*pitch_expr*, *pitch_range*)

New in version 2.0. Transpose *pitch_expr* into *pitch_range*:

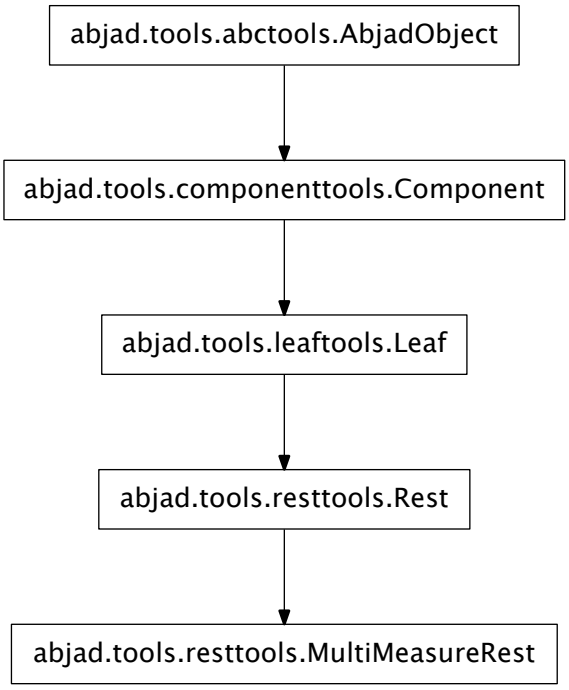
```
>>> pitchtools.transpose_pitch_expr_into_pitch_range(
...     [-2, -1, 13, 14], pitchtools.PitchRange(0, 12))
[10, 11, 1, 2]
```

Return new *pitch_expr* object.

resttools

concrete classes

resttools.MultiMeasureRest



class resttools.**MultiMeasureRest**(**args*, ***kwargs*)

New in version 2.0. Abjad model of a multi-measure rest:

```
>>> resttools.MultiMeasureRest((1, 4))
MultiMeasureRest('R4')
```

Multi-measure rests are immutable.

Read-only Properties

MultiMeasureRest.**duration_in_seconds**

Inherited from leaftools.Leaf

MultiMeasureRest.**leaf_index**

Inherited from leaftools.Leaf

MultiMeasureRest.**lilypond_format**

Inherited from componenttools.Component

MultiMeasureRest.**multiplied_duration**

Inherited from leaftools.Leaf

MultiMeasureRest.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

MultiMeasureRest.**parent**
Inherited from componenttools.Component

MultiMeasureRest.**preprolated_duration**
Inherited from leaftools.Leaf

MultiMeasureRest.**prolated_duration**
Inherited from componenttools.Component

MultiMeasureRest.**prolation**
Inherited from componenttools.Component

MultiMeasureRest.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

MultiMeasureRest.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

MultiMeasureRest.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

MultiMeasureRest.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

MultiMeasureRest.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

MultiMeasureRest.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

MultiMeasureRest.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

MultiMeasureRest.**duration_multiplier**
Inherited from leaftools.Leaf

MultiMeasureRest.**written_duration**
Inherited from leaftools.Leaf

MultiMeasureRest.**written_pitch_indication_is_at_sounding_pitch**
Inherited from leaftools.Leaf

MultiMeasureRest.**written_pitch_indication_is_nonsemantic**
Inherited from leaftools.Leaf

Special Methods

MultiMeasureRest.**__and__**(*arg*)
Inherited from leaftools.Leaf

MultiMeasureRest.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MultiMeasureRest.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MultiMeasureRest.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MultiMeasureRest.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MultiMeasureRest.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MultiMeasureRest.**__mul__**(*n*)
Inherited from componenttools.Component

MultiMeasureRest.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MultiMeasureRest.**__or__**(*arg*)
Inherited from leaftools.Leaf

MultiMeasureRest.**__repr__**()
Inherited from leaftools.Leaf

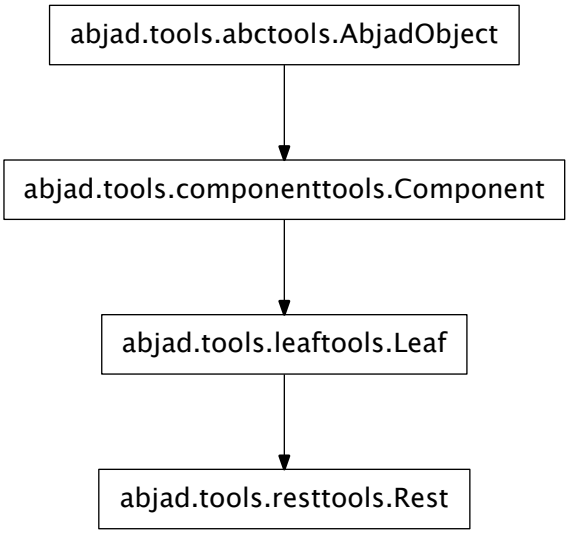
MultiMeasureRest.**__rmul__**(*n*)
Inherited from componenttools.Component

MultiMeasureRest.**__str__**()
Inherited from leaftools.Leaf

MultiMeasureRest.**__sub__**(*arg*)
Inherited from leaftools.Leaf

MultiMeasureRest.**__xor__**(*arg*)
Inherited from leaftools.Leaf

resttools.Rest



class resttools.**Rest**(**args*, ***kwargs*)
Abjad model of a rest:

```
>>> Rest((3, 16))
Rest('r8.')
```

Read-only Properties

Rest.**duration_in_seconds**
Inherited from leaftools.Leaf

Rest.**leaf_index**
Inherited from leaftools.Leaf

Rest.**lilypond_format**
Inherited from componenttools.Component

Rest.**multiplied_duration**
Inherited from leaftools.Leaf

Rest.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Rest.**parent**
Inherited from componenttools.Component

Rest.**preprolated_duration**
Inherited from leaftools.Leaf

Rest.**prolated_duration**
Inherited from componenttools.Component

Rest.**prolation**
Inherited from componenttools.Component

Rest.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Rest.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Rest.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Rest.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Rest.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Rest.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Rest.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Rest.**duration_multiplier**
Inherited from leaftools.Leaf

Rest.**written_duration**
Inherited from leaftools.Leaf

Rest.**written_pitch_indication_is_at_sounding_pitch**
Inherited from leaftools.Leaf

Rest.**written_pitch_indication_is_nonsemantic**
Inherited from leaftools.Leaf

Special Methods

Rest.**__and__**(*arg*)
Inherited from leaftools.Leaf

Rest.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

Rest.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

Rest.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

Rest.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

Rest.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

Rest.**__mul__**(*n*)
Inherited from `componenttools.Component`

Rest.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

Rest.**__or__**(*arg*)
Inherited from `leaftools.Leaf`

Rest.**__repr__**()
Inherited from `leaftools.Leaf`

Rest.**__rmul__**(*n*)
Inherited from `componenttools.Component`

Rest.**__str__**()
Inherited from `leaftools.Leaf`

Rest.**__sub__**(*arg*)
Inherited from `leaftools.Leaf`

Rest.**__xor__**(*arg*)
Inherited from `leaftools.Leaf`

functions

resttools.all_are_rests

resttools.**all_are_rests**(*expr*)

New in version 2.6. True when *expr* is a sequence of Abjad rests:

```
>>> rests = [Rest('r4'), Rest('r4'), Rest('r4')]

>>> resttools.all_are_rests(rests)
True
```

True when *expr* is an empty sequence:

```
>>> resttools.all_are_rests([])
True
```

Otherwise false:

```
>>> resttools.all_are_rests('foo')
False
```

Return boolean.

Function wraps `componenttools.all_are_components()`.

resttools.is_lilypond_rest_string

resttools.**is_lilypond_rest_string**(*expr*)

New in version 2.0. True when *expr* is a LilyPond rest string:

```
>>> resttools.is_lilypond_rest_string('r4.. * 1/2')
True
```

Otherwise false:

```
>>> resttools.is_lilypond_rest_string('text')
False
```

The regex `^(r|R)\s*(1|2|4|8|16|32|64|128|\breve|\longa|\maxima)\s*(\.*)\s*(\*\s*(\d+(/\d+`
underlies this predicate.

Return boolean.

resttools.make_multi_measure_rests

resttools.**make_multi_measure_rests**(*duration_tokens*)

New in version 2.0. Make multi-measure rests from *duration_tokens*:

```
>>> resttools.make_multi_measure_rests([(4, 4), (7, 4)])
[MultiMeasureRest('R1'), MultiMeasureRest('R1..')]
```

Return list.

resttools.make_repeated_rests_from_time_signature

resttools.**make_repeated_rests_from_time_signature**(*time_signature*)

New in version 2.0. Make repeated rests from *time_signature*:

```
>>> resttools.make_repeated_rests_from_time_signature((5, 32))
[Rest('r32'), Rest('r32'), Rest('r32'), Rest('r32'), Rest('r32')]
```

Return list of newly constructed rests.

resttools.make_repeated_rests_from_time_signatures

resttools.**make_repeated_rests_from_time_signatures**(*time_signatures*)

Make repated rests from *time_signatures*:

```
resttools.make_repeated_rests_from_time_signatures([(2, 8), (3, 32)])
[[Rest('r8'), Rest('r8')], [Rest('r32'), Rest('r32'), Rest('r32')]]
```

Return two-dimensional list of newly constructed rest lists.

Use `sequencetools.flatten_sequence()` to flatten output if required.

resttools.make_rests

resttools.**make_rests**(*duration_tokens*, *big_endian=True*, *tied=False*)

New in version 1.1. Make rests.

Make big-endian rests:

```
>>> resttools.make_rests([(5, 16), (9, 16)], big_endian=True)
[Rest('r4'), Rest('r16'), Rest('r2'), Rest('r16')]
```

Make little-endian rests:

```
>>> resttools.make_rests([(5, 16), (9, 16)], big_endian=False)
[Rest('r16'), Rest('r4'), Rest('r16'), Rest('r2')]
```

Make tied rests:

```
>>> voice = Voice(resttools.make_rests([(5, 16), (9, 16)], tied=True))
```

```
>>> f(voice)
\new Voice {
    r4 ~
    r16
    r2 ~
    r16
}
```

Return list of rests. Changed in version 2.0: renamed `construct.rests()` to `resttools.make_rests()`.

resttools.make_tied_rest

resttools.**make_tied_rest**(*duration*, *big_endian=True*, *tied=False*)

Returns a list of rests to fill given duration.

Rests returned are tie-spanned when `tied=True`.

resttools.replace_leaves_in_expr_with_rests

resttools.**replace_leaves_in_expr_with_rests**(*expr*)

New in version 1.1. Replace leaves in *expr* with rests:

```
>>> staff = Staff(Measure((2, 8), "c'8 d'8") * 2)
>>> resttools.replace_leaves_in_expr_with_rests(staff[0])

>>> f(staff)
\new Staff {
    {
        \time 2/8
        r8
        r8
    }
    {
        c'8
        d'8
    }
}
```

Return none.

resttools.set_vertical_positioning_pitch_on_rest

resttools.**set_vertical_positioning_pitch_on_rest**(*rest*, *pitch*)

New in version 2.0. Set vertical positioning *pitch* on *rest*:

```
>>> rest = Rest((1, 4))

>>> resttools.set_vertical_positioning_pitch_on_rest(rest, "d''")
Rest('r4')

>>> f(rest)
d''4 \rest
```

Raise type error when *rest* is not a rest.

Return *rest*.

resttools.yield_groups_of_rests_in_sequence

resttools.**yield_groups_of_rests_in_sequence**(*sequence*)

New in version 2.0. Yield groups of rests in *sequence*:

```
>>> staff = Staff("c'8 d'8 r8 r8 <e' g'>8 <f' a'>8 g'8 a'8 r8 r8 <b' d''>8 <c'' e''>8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    r8
    r8
```

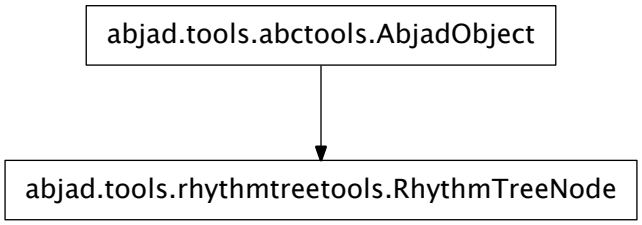
```
        <e' g'>8
        <f' a'>8
        g'8
        a'8
        r8
        r8
        <b' d''>8
        <c'' e''>8
    }

    >>> for rest in resttools.yield_groups_of_rests_in_sequence(staff):
    ...     rest
    ...
    (Rest('r8'), Rest('r8'))
    (Rest('r8'), Rest('r8'))
```

Return generator.

rhythmtreetools

abstract classes

rhythmtreetools.RhythmTreeNode



class rhythmtreetools.**RhythmTreeNode**(*duration*)

Abstract base class of nodes in a rhythm tree structure.

Read-only Properties

RhythmTreeNode.**depth**

The depth of a node in a rhythm-tree structure:

```
    >>> rtm = '(4 ((2 (1 1)) (2 (1 1))))'
    >>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]

    >>> tree.depth
    0

    >>> tree[0].depth
    1
```

```
>>> tree[0][0].depth
2
```

Return int.

RhythmTreeNode.**depthwise_inventory**

A dictionary of all nodes in a rhythm-tree, organized by their depth relative the root node:

```
>>> rtm = '(4 ((2 (1 1)) (2 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]
>>> inventory = tree.depthwise_inventory
>>> for depth in sorted(inventory):
...     print 'DEPTH: {}'.format(depth)
...     for node in inventory[depth]:
...         print node.duration, node.offset
...
DEPTH: 0
4 0
DEPTH: 1
2 0
2 2
DEPTH: 2
1 0
1 1
1 2
1 3
```

Return dictionary.

RhythmTreeNode.**improper_parentage**

The improper parentage of a node in a rhythm-tree, being the sequence of node beginning with itself and ending with the root node of the tree:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)

>>> a.improper_parentage == (a,)
True

>>> b.improper_parentage == (b, a)
True

>>> c.improper_parentage == (c, b, a)
True
```

Return tuple of *RhythmTreeNode* instances.

RhythmTreeNode.**offset**

The starting offset of a node in a rhythm-tree relative the root:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]

>>> tree.offset
Offset(0, 1)
```

```
>>> tree[1].offset
Offset(1, 2)

>>> tree[0][1].offset
Offset(1, 4)
```

Return Offset instance.

RhythmTreeNode.**parent**

The node's parent node:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)

>>> a.parent is None
True

>>> b.parent is a
True

>>> c.parent is b
True
```

Return *RhythmTreeNode* instance.

RhythmTreeNode.**parentage_ratios**

A sequence describing the relative durations of the nodes in a node's improper parentage.

The first item in the sequence is the duration of the root node, and subsequent items are pairs of the duration of the next node in the parentage chain and the total duration of that node and its siblings:

```
>>> a = rhythmtreetools.RhythmTreeContainer(1)
>>> b = rhythmtreetools.RhythmTreeContainer(2)
>>> c = rhythmtreetools.RhythmTreeLeaf(3)
>>> d = rhythmtreetools.RhythmTreeLeaf(4)
>>> e = rhythmtreetools.RhythmTreeLeaf(5)

>>> a.extend([b, c])
>>> b.extend([d, e])

>>> a.parentage_ratios
(1,)

>>> b.parentage_ratios
(1, (2, 5))

>>> c.parentage_ratios
(1, (3, 5))

>>> d.parentage_ratios
(1, (2, 5), (4, 9))

>>> e.parentage_ratios
(1, (2, 5), (5, 9))
```

Return tuple.

RhythmTreeNode.**pretty_rtm_format**

The node's pretty-printed RTM format:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]
>>> print tree.pretty_rtm_format
(1 (
    (1 (
        1
        1))
    (1 (
        1
        1))))
```

Return string.

RhythmTreeNode.**prolated_duration**

The prolated duration of the node:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]

>>> tree.prolated_duration
Duration(1, 1)

>>> tree[1].prolated_duration
Duration(1, 2)

>>> tree[1][1].prolated_duration
Duration(1, 4)
```

Return *Duration* instance.

RhythmTreeNode.**proper_parentage**

The proper parentage of a node in a rhythm-tree, being the sequence of node beginning with the node's immediate parent and ending with the root node of the tree:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)

>>> a.proper_parentage == ()
True

>>> b.proper_parentage == (a,)
True

>>> c.proper_parentage == (b, a)
True
```

Return tuple of *RhythmTreeNode* instances.

RhythmTreeNode.**root_node**

The root node of the rhythm-tree: that node in the tree which has no parent:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()
```

```
>>> a.append(b)
>>> b.append(c)

>>> a.root_node is a
True
>>> b.root_node is a
True
>>> c.root_node is a
True
```

Return *RhythmTreeNode* instance.

RhythmTreeNode.**rtm_format**

The node's RTM format:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]
>>> tree.rtm_format
'(1 ((1 (1 1)) (1 (1 1))))'
```

Return string.

RhythmTreeNode.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

RhythmTreeNode.**duration**

The node's duration in pulses:

```
>>> node = rhythmtreetools.RhythmTreeLeaf(1)
>>> node.duration
1

>>> node.duration = 2
>>> node.duration
2
```

Return int.

Special Methods

RhythmTreeNode.**__call__**(*pulse_duration*)

RhythmTreeNode.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

RhythmTreeNode.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeNode.**__getstate__**()

RhythmTreeNode.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

RhythmTreeNode.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeNode.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeNode.**__ne__**(*other*)

RhythmTreeNode.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

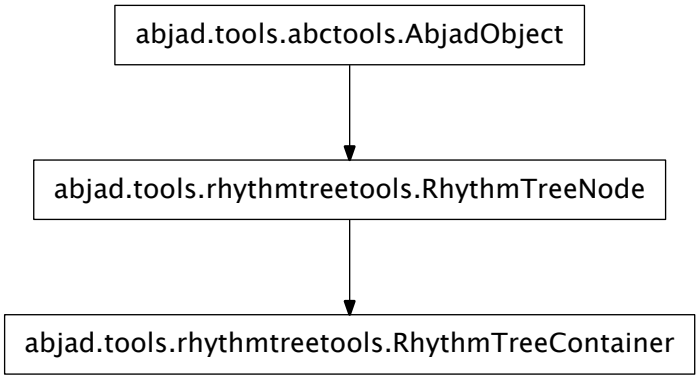
Return string.

Inherited from abctools.AbjadObject

RhythmTreeNode.**__setstate__**(*state*)

concrete classes

rhythmtreetools.RhythmTreeContainer



class rhythmtreetools.**RhythmTreeContainer**(*duration=1*, *children=None*)
A container node in a rhythm tree structure:

```
>>> container = rhythmtreetools.RhythmTreeContainer(duration=1, children=[])
>>> container
RhythmTreeContainer(
    duration=1
    )
```

Similar to Abjad containers, *RhythmTreeContainer* supports a list interface, and can be appended, extended, indexed and so forth by other *RhythmTreeNode* subclasses:

```
>>> leaf_a = rhythmtreetools.RhythmTreeLeaf(1)
>>> leaf_b = rhythmtreetools.RhythmTreeLeaf(2)
>>> container.extend([leaf_a, leaf_b])
>>> container
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=1,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=2,
            is_pitched=True,
            ),
    ),
    duration=1
    )

>>> another_container = rhythmtreetools.RhythmTreeContainer(2)
>>> another_container.append(rhythmtreetools.RhythmTreeLeaf(3))
>>> another_container.append(container[1])
>>> container.append(another_container)
>>> container
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=1,
            is_pitched=True,
            ),
        RhythmTreeContainer(
            children=(
                RhythmTreeLeaf(
                    duration=3,
                    is_pitched=True,
                    ),
                RhythmTreeLeaf(
                    duration=2,
                    is_pitched=True,
                    ),
            ),
            duration=2
            ),
    ),
    duration=1
    )
```

Call *RhythmTreeContainer* with a duration to generate a tuplet structure:

```
>>> container((1, 4))
[FixedDurationTuplet(1/4, [c'8, {@ 5:4 c'8., c'8 @}])]
```

```
>>> f(_[0])
\times 2/3 {
    c'8
    \times 4/5 {
        c'8.
        c'8
    }
}
```

Returns *RhythmTreeContainer* instance.

Read-only Properties

RhythmTreeContainer.**children**

The children of a *RhythmTreeContainer* instance:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()
>>> d = rhythmtreetools.RhythmTreeLeaf()
>>> e = rhythmtreetools.RhythmTreeContainer()

>>> a.extend([b, c])
>>> b.extend([d, e])

>>> a.children == (b, c)
True

>>> b.children == (d, e)
True

>>> e.children == ()
True
```

Return tuple of *RhythmTreeNode* instances.

RhythmTreeContainer.**contents_duration**

The total duration of the children of a *RhythmTreeContainer* instance:

```
>>> rtm = '(1 (1 (2 (1 1 1)) 2))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]

>>> tree.contents_duration
5

>>> tree[1].contents_duration
3
```

Return int.

RhythmTreeContainer.**depth**

The depth of a node in a rhythm-tree structure:

```
>>> rtm = '(4 ((2 (1 1)) (2 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]

>>> tree.depth
0
```

```
>>> tree[0].depth
1

>>> tree[0][0].depth
2
```

Return int.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeContainer.`**`depthwise_inventory`**

A dictionary of all nodes in a rhythm-tree, organized by their depth relative the root node:

```
>>> rtm = '(4 ((2 (1 1)) (2 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]
>>> inventory = tree.depthwise_inventory
>>> for depth in sorted(inventory):
...     print 'DEPTH: {}'.format(depth)
...     for node in inventory[depth]:
...         print node.duration, node.offset
...
DEPTH: 0
4 0
DEPTH: 1
2 0
2 2
DEPTH: 2
1 0
1 1
1 2
1 3
```

Return dictionary.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeContainer.`**`improper_parentage`**

The improper parentage of a node in a rhythm-tree, being the sequence of node beginning with itself and ending with the root node of the tree:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)

>>> a.improper_parentage == (a,)
True

>>> b.improper_parentage == (b, a)
True

>>> c.improper_parentage == (c, b, a)
True
```

Return tuple of *RhythmTreeNode* instances.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeContainer.`**`offset`**

The starting offset of a node in a rhythm-tree relative the root:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]

>>> tree.offset
Offset(0, 1)

>>> tree[1].offset
Offset(1, 2)

>>> tree[0][1].offset
Offset(1, 4)
```

Return Offset instance.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeContainer.`**`parent`**

The node's parent node:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)

>>> a.parent is None
True

>>> b.parent is a
True

>>> c.parent is b
True
```

Return *RhythmTreeNode* instance.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeContainer.`**`parentage_ratios`**

A sequence describing the relative durations of the nodes in a node's improper parentage.

The first item in the sequence is the duration of the root node, and subsequent items are pairs of the duration of the next node in the parentage chain and the total duration of that node and its siblings:

```
>>> a = rhythmtreetools.RhythmTreeContainer(1)
>>> b = rhythmtreetools.RhythmTreeContainer(2)
>>> c = rhythmtreetools.RhythmTreeLeaf(3)
>>> d = rhythmtreetools.RhythmTreeLeaf(4)
>>> e = rhythmtreetools.RhythmTreeLeaf(5)

>>> a.extend([b, c])
>>> b.extend([d, e])

>>> a.parentage_ratios
(1,)

>>> b.parentage_ratios
(1, (2, 5))
```

```
>>> c.parentage_ratios
(1, (3, 5))

>>> d.parentage_ratios
(1, (2, 5), (4, 9))

>>> e.parentage_ratios
(1, (2, 5), (5, 9))
```

Return tuple.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeContainer.`**`pretty_rtm_format`**

The node's pretty-printed RTM format:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]
>>> print tree.pretty_rtm_format
(1 (
    (1 (
        1
        1))
    (1 (
        1
        1))))
```

Return string.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeContainer.`**`prolated_duration`**

The prolated duration of the node:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]

>>> tree.prolated_duration
Duration(1, 1)

>>> tree[1].prolated_duration
Duration(1, 2)

>>> tree[1][1].prolated_duration
Duration(1, 4)
```

Return *Duration* instance.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeContainer.`**`proper_parentage`**

The proper parentage of a node in a rhythm-tree, being the sequence of node beginning with the node's immediate parent and ending with the root node of the tree:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)
```

```
>>> a.proper_parentage == ()
True

>>> b.proper_parentage == (a,)
True

>>> c.proper_parentage == (b, a)
True
```

Return tuple of *RhythmTreeNode* instances.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeContainer.`**`root_node`**

The root node of the rhythm-tree: that node in the tree which has no parent:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)

>>> a.root_node is a
True
>>> b.root_node is a
True
>>> c.root_node is a
True
```

Return *RhythmTreeNode* instance.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeContainer.`**`rtm_format`**

The node's RTM format:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]
>>> tree.rtm_format
'(1 ((1 (1 1)) (1 (1 1))))'
```

Return string.

`RhythmTreeContainer.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Read/write Properties

`RhythmTreeContainer.`**`duration`**

The node's duration in pulses:

```
>>> node = rhythmtreetools.RhythmTreeLeaf(1)
>>> node.duration
1
```

```
>>> node.duration = 2
>>> node.duration
2
```

Return int.

Inherited from `rhythmtreetools.RhythmTreeNode`

Methods

`RhythmTreeContainer.`**`append`**`(`*`node`*`)`

Append *node* to container:

```
>>> a = rhythmtreetools.RhythmTreeContainer(1)
>>> b = rhythmtreetools.RhythmTreeLeaf(2)
>>> c = rhythmtreetools.RhythmTreeLeaf(3)

>>> a
RhythmTreeContainer(
    duration=1
    )

>>> a.append(b)
>>> a
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=2,
            is_pitched=True,
            ),
    ),
    duration=1
    )

>>> a.append(c)
>>> a
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=2,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=3,
            is_pitched=True,
            ),
    ),
    duration=1
    )
```

It is also possible to append with valid RTM strings, so long as they parse to a single tree:

```
>>> a.append('(7 (1 1 1))')
>>> a
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=2,
            is_pitched=True,
```

```
            ),
        RhythmTreeLeaf(
            duration=3,
            is_pitched=True,
            ),
        RhythmTreeContainer(
            children=(
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
            ),
            duration=7
            ),
    ),
    duration=1
    )
```

Return *None*.

RhythmTreeContainer.**extend**(*expr*)

Extend *expr* against container:

```
>>> a = rhythmtreetools.RhythmTreeContainer(1)
>>> b = rhythmtreetools.RhythmTreeLeaf(2)
>>> c = rhythmtreetools.RhythmTreeLeaf(3)

>>> a
RhythmTreeContainer(
    duration=1
    )

>>> a.extend([b, c])
>>> a
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=2,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=3,
            is_pitched=True,
            ),
    ),
    duration=1
    )
```

It is also possible to extend with valid RTM strings:

```
>>> a.extend('(4 (1 1)) (5 (1 1))')
>>> a
```

```
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=2,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=3,
            is_pitched=True,
            ),
        RhythmTreeContainer(
            children=(
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
            ),
            duration=4
            ),
        RhythmTreeContainer(
            children=(
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
            ),
            duration=5
            ),
    ),
    duration=1
    )
```

Return *None*.

RhythmTreeContainer.**index**(*node*)

Index *node* in container:

```
>>> a = rhythmtreetools.RhythmTreeContainer(1)
>>> b = rhythmtreetools.RhythmTreeLeaf(2)
>>> c = rhythmtreetools.RhythmTreeLeaf(3)

>>> a.extend([b, c])

>>> a.index(b)
0

>>> a.index(c)
1
```

Return nonnegative integer.

RhythmTreeContainer.**insert**(*i*, *node*)

Insert *node* in container at index *i*:

```
>>> a = rhythmtreetools.RhythmTreeContainer(1)
>>> b = rhythmtreetools.RhythmTreeLeaf(2)
>>> c = rhythmtreetools.RhythmTreeLeaf(3)
>>> d = rhythmtreetools.RhythmTreeLeaf(100)

>>> a.extend([b, c])

>>> a
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=2,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=3,
            is_pitched=True,
            ),
    ),
    duration=1
    )

>>> a.insert(1, d)

>>> a
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=2,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=100,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=3,
            is_pitched=True,
            ),
    ),
    duration=1
    )
```

Return *None*.

RhythmTreeContainer.**pop**(*i=-1*)

Pop node at index *i* from container:

```
>>> a = rhythmtreetools.RhythmTreeContainer(1)
>>> b = rhythmtreetools.RhythmTreeLeaf(2)
>>> c = rhythmtreetools.RhythmTreeLeaf(3)

>>> a.extend([b, c])

>>> a
RhythmTreeContainer(
    children=(
```

```
            RhythmTreeLeaf(
                duration=2,
                is_pitched=True,
                ),
            RhythmTreeLeaf(
                duration=3,
                is_pitched=True,
                ),
        ),
        duration=1
        )

    >>> node = a.pop()

    >>> node == c
    True

    >>> a
    RhythmTreeContainer(
        children=(
            RhythmTreeLeaf(
                duration=2,
                is_pitched=True,
                ),
        ),
        duration=1
        )
```

Return node.

RhythmTreeContainer.**remove**(*node*)

Remove *node* from container:

```
    >>> a = rhythmtreetools.RhythmTreeContainer(1)
    >>> b = rhythmtreetools.RhythmTreeLeaf(2)
    >>> c = rhythmtreetools.RhythmTreeLeaf(3)

    >>> a.extend([b, c])

    >>> a
    RhythmTreeContainer(
        children=(
            RhythmTreeLeaf(
                duration=2,
                is_pitched=True,
                ),
            RhythmTreeLeaf(
                duration=3,
                is_pitched=True,
                ),
        ),
        duration=1
        )

    >>> a.remove(b)

    >>> a
    RhythmTreeContainer(
        children=(
```

```
            RhythmTreeLeaf(
                duration=3,
                is_pitched=True,
                ),
        ),
        duration=1
        )
```

Return *None*.

Special Methods

RhythmTreeContainer.**__add__**(*expr*)

Concatenate containers self and expr. The operation c = a + b returns a new RhythmTreeContainer c with the content of both a and b, and a duration equal to the sum of the durations of a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand:

```
>>> a = rhythmtreetools.RhythmTreeParser()('(1 (1 1 1))')[0]
>>> b = rhythmtreetools.RhythmTreeParser()('(2 (3 4))')[0]

>>> c = a + b

>>> c.duration
3

>>> c
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=1,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=1,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=1,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=3,
            is_pitched=True,
            ),
        RhythmTreeLeaf(
            duration=4,
            is_pitched=True,
            ),
    ),
    duration=3
    )
```

RhythmTreeContainer.**__call__**(*pulse_duration*)

Generate Abjad score components:

```
>>> rtm = '(1 (1 (2 (1 1 1)) 2))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]
```

```
>>> tree((1, 4))
[FixedDurationTuplet(1/4, [c'16, {@ 3:2 c'16, c'16, c'16 @}, c'8])]
```

Return sequence of components.

RhythmTreeContainer.**__contains__**(*expr*)

True if expr is in container, otherwise False:

```
>>> container = rhythmtreetools.RhythmTreeContainer()
>>> a = rhythmtreetools.RhythmTreeLeaf()
>>> b = rhythmtreetools.RhythmTreeLeaf()
>>> container.append(a)

>>> a in container
True

>>> b in container
False
```

Return boolean.

RhythmTreeContainer.**__delitem__**(*i*)

Find node at index or slice *i* in container and detach from parentage:

```
>>> container = rhythmtreetools.RhythmTreeContainer()
>>> leaf = rhythmtreetools.RhythmTreeLeaf()

>>> container.append(leaf)
>>> container.children == (leaf,)
True
>>> leaf.parent is container
True

>>> del(container[0])

>>> container.children == ()
True
>>> leaf.parent is None
True
```

Return *None*.

RhythmTreeContainer.**__eq__**(*other*)

True if type, duration and children are equivalent, otherwise False.

Return boolean.

RhythmTreeContainer.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeContainer.**__getitem__**(*i*)

Return node at index *i* in container:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeLeaf()
>>> c = rhythmtreetools.RhythmTreeContainer()
>>> d = rhythmtreetools.RhythmTreeLeaf()
```

```
>>> e = rhythmtreetools.RhythmTreeLeaf()
>>> f = rhythmtreetools.RhythmTreeLeaf()

>>> a.extend([b, c, f])
>>> c.extend([d, e])

>>> a[0] is b
True
>>> a[1] is c
True
>>> a[2] is f
True
```

Return *RhythmTreeNode* instance.

RhythmTreeContainer.**__getstate__**()
Inherited from rhythmtreetools.RhythmTreeNode

RhythmTreeContainer.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

RhythmTreeContainer.**__iter__**()

RhythmTreeContainer.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeContainer.**__len__**()
Return nonnegative integer number of nodes in container.

RhythmTreeContainer.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeContainer.**__ne__**(*other*)
Inherited from rhythmtreetools.RhythmTreeNode

RhythmTreeContainer.**__repr__**()

RhythmTreeContainer.**__setitem__**(*i*, *expr*)
Set *expr* in self at nonnegative integer index *i*, or set *expr* in self at slice i. Replace contents of *self[i]* with *expr*. Attach parentage to contents of *expr*, and detach parentage of any replaced nodes.

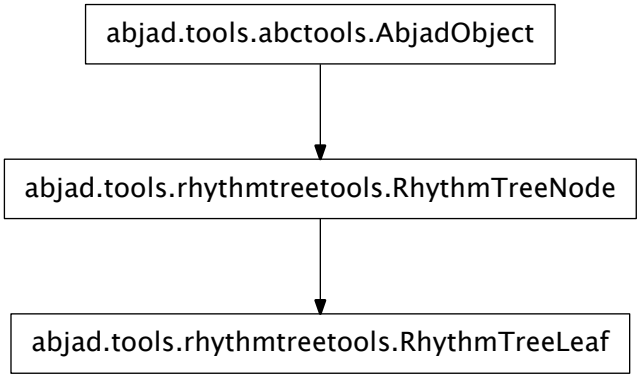
```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeLeaf()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.parent is a
True
>>> a.children == (b,)
True
```

```
>>> a[0] = c

>>> c.parent is a
True
>>> b.parent is None
True
>>> a.children == (c,)
True
```

Return *None*.

RhythmTreeContainer.**__setstate__**(*state*)
Inherited from rhythmtreetools.RhythmTreeNode

rhythmtreetools.RhythmTreeLeaf



class rhythmtreetools.**RhythmTreeLeaf**(*duration=1*, *is_pitched=True*)
A leaf node in a rhythm tree:

```
>>> leaf = rhythmtreetools.RhythmTreeLeaf(duration=5, is_pitched=True)
>>> leaf
RhythmTreeLeaf(
    duration=5,
    is_pitched=True,
    )
```

Call with a pulse duration to generate Abjad leaf objects:

```
>>> result = leaf((1, 8))
>>> result
[Note("c'2"), Note("c'8")]
```

Generates rests when called, if *is_pitched* is False:

```
>>> rhythmtreetools.RhythmTreeLeaf(duration=7, is_pitched=False)((1, 16))
[Rest('r4..')]
```

Return *RhythmTreeLeaf*.

Read-only Properties

RhythmTreeLeaf.**depth**

The depth of a node in a rhythm-tree structure:

```
>>> rtm = '(4 ((2 (1 1)) (2 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]

>>> tree.depth
0

>>> tree[0].depth
1

>>> tree[0][0].depth
2
```

Return int.

Inherited from rhythmtreetools.RhythmTreeNode

RhythmTreeLeaf.**depthwise_inventory**

A dictionary of all nodes in a rhythm-tree, organized by their depth relative the root node:

```
>>> rtm = '(4 ((2 (1 1)) (2 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]
>>> inventory = tree.depthwise_inventory
>>> for depth in sorted(inventory):
...     print 'DEPTH: {}'.format(depth)
...     for node in inventory[depth]:
...         print node.duration, node.offset
...
DEPTH: 0
4 0
DEPTH: 1
2 0
2 2
DEPTH: 2
1 0
1 1
1 2
1 3
```

Return dictionary.

Inherited from rhythmtreetools.RhythmTreeNode

RhythmTreeLeaf.**improper_parentage**

The improper parentage of a node in a rhythm-tree, being the sequence of node beginning with itself and ending with the root node of the tree:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)

>>> a.improper_parentage == (a,)
True
```

```
>>> b.improper_parentage == (b, a)
True

>>> c.improper_parentage == (c, b, a)
True
```

Return tuple of *RhythmTreeNode* instances.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeLeaf.`**`offset`**

The starting offset of a node in a rhythm-tree relative the root:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]

>>> tree.offset
Offset(0, 1)

>>> tree[1].offset
Offset(1, 2)

>>> tree[0][1].offset
Offset(1, 4)
```

Return Offset instance.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeLeaf.`**`parent`**

The node's parent node:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)

>>> a.parent is None
True

>>> b.parent is a
True

>>> c.parent is b
True
```

Return *RhythmTreeNode* instance.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeLeaf.`**`parentage_ratios`**

A sequence describing the relative durations of the nodes in a node's improper parentage.

The first item in the sequence is the duration of the root node, and subsequent items are pairs of the duration of the next node in the parentage chain and the total duration of that node and its siblings:

```
>>> a = rhythmtreetools.RhythmTreeContainer(1)
>>> b = rhythmtreetools.RhythmTreeContainer(2)
>>> c = rhythmtreetools.RhythmTreeLeaf(3)
```

```
>>> d = rhythmtreetools.RhythmTreeLeaf(4)
>>> e = rhythmtreetools.RhythmTreeLeaf(5)

>>> a.extend([b, c])
>>> b.extend([d, e])

>>> a.parentage_ratios
(1,)

>>> b.parentage_ratios
(1, (2, 5))

>>> c.parentage_ratios
(1, (3, 5))

>>> d.parentage_ratios
(1, (2, 5), (4, 9))

>>> e.parentage_ratios
(1, (2, 5), (5, 9))
```

Return tuple.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeLeaf.`**`pretty_rtm_format`**

The node's pretty-printed RTM format:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]
>>> print tree.pretty_rtm_format
(1 (
    (1 (
        1
        1))
    (1 (
        1
        1))))
```

Return string.

Inherited from `rhythmtreetools.RhythmTreeNode`

`RhythmTreeLeaf.`**`prolated_duration`**

The prolated duration of the node:

```
>>> rtm = '(1 ((1 (1 1)) (1 (1 1))))'
>>> tree = rhythmtreetools.RhythmTreeParser()(rtm)[0]

>>> tree.prolated_duration
Duration(1, 1)

>>> tree[1].prolated_duration
Duration(1, 2)

>>> tree[1][1].prolated_duration
Duration(1, 4)
```

Return *Duration* instance.

Inherited from `rhythmtreetools.RhythmTreeNode`

RhythmTreeLeaf.**proper_parentage**

The proper parentage of a node in a rhythm-tree, being the sequence of node beginning with the node's immediate parent and ending with the root node of the tree:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)

>>> a.proper_parentage == ()
True

>>> b.proper_parentage == (a,)
True

>>> c.proper_parentage == (b, a)
True
```

Return tuple of *RhythmTreeNode* instances.

Inherited from rhythmtreetools.RhythmTreeNode

RhythmTreeLeaf.**root_node**

The root node of the rhythm-tree: that node in the tree which has no parent:

```
>>> a = rhythmtreetools.RhythmTreeContainer()
>>> b = rhythmtreetools.RhythmTreeContainer()
>>> c = rhythmtreetools.RhythmTreeLeaf()

>>> a.append(b)
>>> b.append(c)

>>> a.root_node is a
True
>>> b.root_node is a
True
>>> c.root_node is a
True
```

Return *RhythmTreeNode* instance.

Inherited from rhythmtreetools.RhythmTreeNode

RhythmTreeLeaf.**rtm_format**

The node's RTM format:

```
>>> rhythmtreetools.RhythmTreeLeaf(1, is_pitched=True).rtm_format
'1'
>>> rhythmtreetools.RhythmTreeLeaf(5, is_pitched=False).rtm_format
'-5'
```

Return string.

RhythmTreeLeaf.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

RhythmTreeLeaf.**duration**

The node's duration in pulses:

```
>>> node = rhythmtreetools.RhythmTreeLeaf(1)
>>> node.duration
1

>>> node.duration = 2
>>> node.duration
2
```

Return int.

Inherited from rhythmtreetools.RhythmTreeNode

RhythmTreeLeaf.**is_pitched**

True if leaf is pitched:

```
>>> leaf = rhythmtreetools.RhythmTreeLeaf()
>>> leaf.is_pitched
True

>>> leaf.is_pitched = False
>>> leaf.is_pitched
False
```

Return boolean.

Special Methods

RhythmTreeLeaf.**__call__**(*pulse_duration*)

Generate Abjad score components:

```
>>> leaf = rhythmtreetools.RhythmTreeLeaf(5)
>>> leaf((1, 4))
[Note("c'1"), Note("c'4")]
```

Return sequence of components.

RhythmTreeLeaf.**__eq__**(*other*)

RhythmTreeLeaf.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeLeaf.**__getstate__**()

Inherited from rhythmtreetools.RhythmTreeNode

RhythmTreeLeaf.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

RhythmTreeLeaf.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeLeaf.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

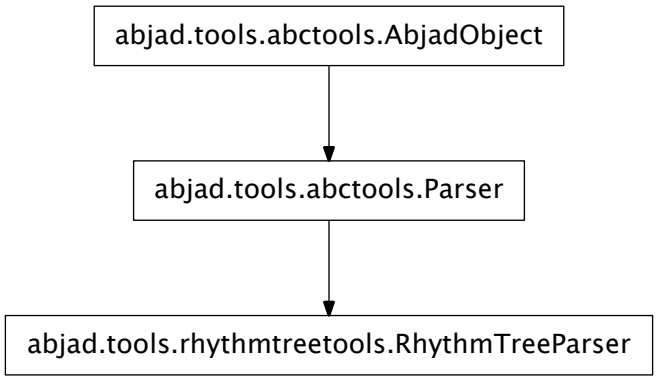
Inherited from abctools.AbjadObject

RhythmTreeLeaf.**__ne__**(*other*)
Inherited from rhythmtreetools.RhythmTreeNode

RhythmTreeLeaf.**__repr__**()

RhythmTreeLeaf.**__setstate__**(*state*)
Inherited from rhythmtreetools.RhythmTreeNode

rhythmtreetools.RhythmTreeParser



class rhythmtreetools.**RhythmTreeParser**(*debug=False*)
Parses RTM-style rhythm syntax:

```
>>> parser = rhythmtreetools.RhythmTreeParser()

>>> rtm = '(1 (1 (2 (1 -1 1)) -2))'
>>> result = parser(rtm)[0]
>>> result
RhythmTreeContainer(
    children=(
        RhythmTreeLeaf(
            duration=1,
            is_pitched=True,
            ),
        RhythmTreeContainer(
            children=(
                RhythmTreeLeaf(
                    duration=1,
                    is_pitched=True,
                    ),
                RhythmTreeLeaf(
```

```
                        duration=1,
                        is_pitched=False,
                        ),
                    RhythmTreeLeaf(
                        duration=1,
                        is_pitched=True,
                        ),
                ),
                duration=2
                ),
            RhythmTreeLeaf(
                duration=2,
                is_pitched=False,
                ),
        ),
        duration=1
        )

    >>> result.rtm_format
    '(1 (1 (2 (1 -1 1)) -2))'
```

Returns *RhythmTreeParser* instance.

Read-only Properties

RhythmTreeParser.**debug**
True if the parser runs in debugging mode.

Inherited from abctools.Parser

RhythmTreeParser.**lexer**
The parser's PLY Lexer instance.

Inherited from abctools.Parser

RhythmTreeParser.**lexer_rules_object**

RhythmTreeParser.**logger**
The parser's Logger instance.

Inherited from abctools.Parser

RhythmTreeParser.**logger_path**
The output path for the parser's logfile.

Inherited from abctools.Parser

RhythmTreeParser.**output_path**
The output path for files associated with the parser.

Inherited from abctools.Parser

RhythmTreeParser.**parser**
The parser's PLY LRParser instance.

Inherited from abctools.Parser

RhythmTreeParser.**parser_rules_object**

RhythmTreeParser.**pickle_path**
The output path for the parser's pickled parsing tables.

Inherited from abctools.Parser

RhythmTreeParser.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

RhythmTreeParser.**p_container__LPAREN__INTEGER__node_list_closed__RPAREN**(*p*)
container : LPAREN INTEGER node_list_closed RPAREN

RhythmTreeParser.**p_error**(*p*)

RhythmTreeParser.**p_leaf__INTEGER**(*p*)
leaf : INTEGER

RhythmTreeParser.**p_node__container**(*p*)
node : container

RhythmTreeParser.**p_node__leaf**(*p*)
node : leaf

RhythmTreeParser.**p_node_list__node_list__node_list_item**(*p*)
node_list : node_list node_list_item

RhythmTreeParser.**p_node_list__node_list_item**(*p*)
node_list : node_list_item

RhythmTreeParser.**p_node_list_closed__LPAREN__node_list__RPAREN**(*p*)
node_list_closed : LPAREN node_list RPAREN

RhythmTreeParser.**p_node_list_item__node**(*p*)
node_list_item : node

RhythmTreeParser.**p_toplevel__EMPTY**(*p*)
toplevel :

RhythmTreeParser.**p_toplevel__toplevel__container**(*p*)
toplevel : toplevel container

RhythmTreeParser.**t_INTEGER**(*t*)
(-?[1-9]d*)

RhythmTreeParser.**t_error**(*t*)

RhythmTreeParser.**t_newline**(*t*)
n+

RhythmTreeParser.**tokenize**(*input_string*)
Tokenize *input string* and print results.

Inherited from abctools.Parser

Special Methods

RhythmTreeParser.**__call__**(*input_string*)
Parse *input_string* and return result.

Inherited from abctools.Parser

RhythmTreeParser.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

RhythmTreeParser.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeParser.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

RhythmTreeParser.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeParser.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmTreeParser.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

RhythmTreeParser.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

functions

rhythmtreetools.parse_rtm_syntax

rhythmtreetools.**parse_rtm_syntax**(*rtm*)
Parse RTM syntax:

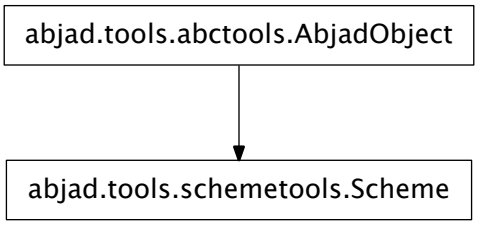
```
>>> from abjad.tools.rhythmtreetools import parse_rtm_syntax

>>> rtm = '(1 (1 (1 (1 1)) 1))'
>>> result = parse_rtm_syntax(rtm)
>>> result
FixedDurationTuplet(1/4, [c'8, c'16, c'16, c'8])
```

Return *FixedDurationTuplet* or *Container* instance.

schemetools

concrete classes

schemetools.Scheme



class schemetools.**Scheme**(**args*, ***kwargs*)

Abjad model of Scheme code:

```
>>> from abjad.tools import schemetools
>>> s = schemetools.Scheme(True)
>>> s.lilypond_format
'##t'
```

schemetools.Scheme can represent nested structures:

```
>>> s = schemetools.Scheme(('left', (1, 2, False)), ('right', (1, 2, 3.3)))
>>> s.lilypond_format
'#((left (1 2 #f)) (right (1 2 3.3)))'
```

schemetools.Scheme wraps variable-length arguments into a tuple:

```
>>> s = schemetools.Scheme(1, 2, 3)
>>> q = schemetools.Scheme((1, 2, 3))
>>> s.lilypond_format == q.lilypond_format
True
```

schemetools.Scheme also takes an optional *quoting* keyword, by which Scheme's various quote, unquote, unquote-splicing characters can be prepended to the formatted result:

```
>>> s = schemetools.Scheme((1, 2, 3), quoting="'#")
>>> s.lilypond_format
"#'#(1 2 3)"
```

schemetools.Scheme can also force quotes around strings which contain no whitespace:

```
>>> s = schemetools.Scheme('nospaces', force_quotes=True)
>>> f(s)
#"nospaces"
```

The above is useful in certain override situations, as LilyPond's Scheme interpreter will treat unquoted strings as symbols rather than strings.

Scheme is immutable.

Read-only Properties

Scheme.**force_quotes**

Scheme.**lilypond_format**

Hash-mark-prepended format of Scheme:

```
>>> from abjad.tools.schemetools import Scheme
>>> Scheme(True).lilypond_format
'##t'
```

Returns string.

Scheme.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

Scheme.**__eq__**(*other*)

Scheme.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Scheme.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Scheme.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Scheme.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Scheme.**__ne__**(*arg*)

True when id(self) does not equal id(arg).

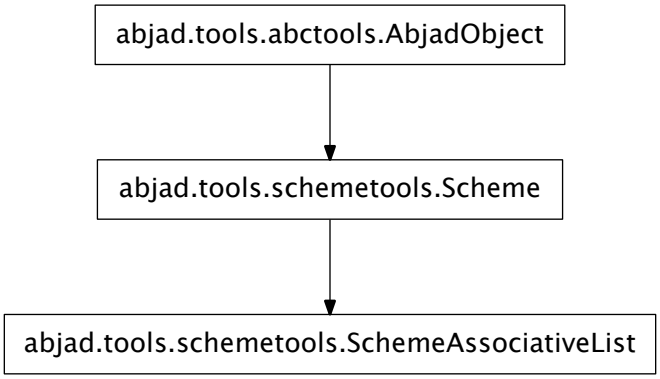
Return boolean.

Inherited from abctools.AbjadObject

Scheme.**__repr__**()

Scheme.**__str__**()

schemetools.SchemeAssociativeList



class schemetools.**SchemeAssociativeList**(**args*, ***kwargs*)

New in version 2.0. Abjad model of Scheme associative list:

```
>>> from abjad.tools.schemetools import SchemeAssociativeList
>>> SchemeAssociativeList(('space', 2), ('padding', 0.5))
SchemeAssociativeList((SchemePair(('space', 2)), SchemePair(('padding', 0.5))))
```

Scheme associative lists are immutable.

Read-only Properties

SchemeAssociativeList.**force_quotes**

Inherited from schemetools.Scheme

SchemeAssociativeList.**lilypond_format**

Hash-mark-prepended format of Scheme:

```
>>> from abjad.tools.schemetools import Scheme
>>> Scheme(True).lilypond_format
'##t'
```

Returns string.

Inherited from schemetools.Scheme

SchemeAssociativeList.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

SchemeAssociativeList.**__eq__**(*other*)

Inherited from schemetools.Scheme

SchemeAssociativeList.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeAssociativeList.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SchemeAssociativeList.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeAssociativeList.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeAssociativeList.__ne__(*arg*)
True when id(self) does not equal id(arg).

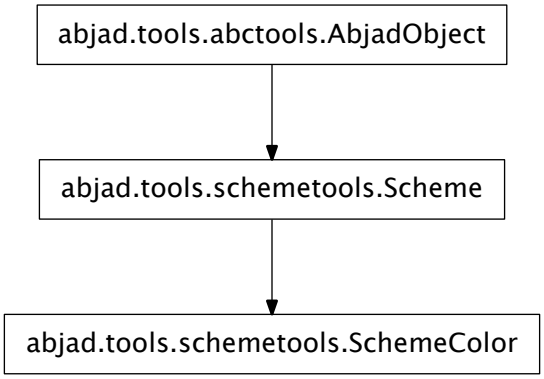
Return boolean.

Inherited from abctools.AbjadObject

SchemeAssociativeList.__repr__()
Inherited from schemetools.Scheme

SchemeAssociativeList.__str__()
Inherited from schemetools.Scheme

schemetools.SchemeColor



class schemetools.**SchemeColor**(**args*, ***kwargs*)

Abjad model of Scheme color:

```
>>> schemetools.SchemeColor('ForestGreen')
SchemeColor('ForestGreen')
```

Scheme colors are immutable.

Read-only Properties

SchemeColor.**force_quotes**

Inherited from schemetools.Scheme

SchemeColor.**lilypond_format**

Hash-mark-prepended format of Scheme:

```
>>> from abjad.tools.schemetools import Scheme
>>> Scheme(True).lilypond_format
'##t'
```

Returns string.

Inherited from schemetools.Scheme

SchemeColor.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

SchemeColor.**__eq__**(*other*)

Inherited from schemetools.Scheme

SchemeColor.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeColor.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SchemeColor.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeColor.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeColor.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

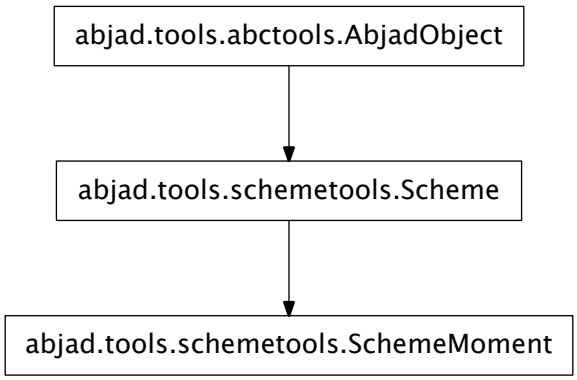
Return boolean.

Inherited from `abctools.AbjadObject`

SchemeColor.**__repr__**()
Inherited from `schemetools.Scheme`

SchemeColor.**__str__**()
Inherited from `schemetools.Scheme`

schemetools.SchemeMoment



class schemetools.**SchemeMoment**(**args*, ***kwargs*)
Abjad model of LilyPond moment:

```
>>> schemetools.SchemeMoment(1, 68)
SchemeMoment((1, 68))
```

Initialize scheme moments with a single fraction, two integers or another scheme moment.

Scheme moments are immutable.

Read-only Properties

SchemeMoment.**duration**
Duration of scheme moment:

```
>>> scheme_moment = schemetools.SchemeMoment(1, 68)
>>> scheme_moment.duration
Duration(1, 68)
```

Return duration.

SchemeMoment.**force_quotes**
Inherited from `schemetools.Scheme`

SchemeMoment.**lilypond_format**
Hash-mark-prepended format of Scheme:

```
>>> from abjad.tools.schemetools import Scheme
>>> Scheme(True).lilypond_format
'##t'
```

Returns string.

Inherited from schemetools.Scheme

SchemeMoment.**storage_format**
Storage format of Abjad object.

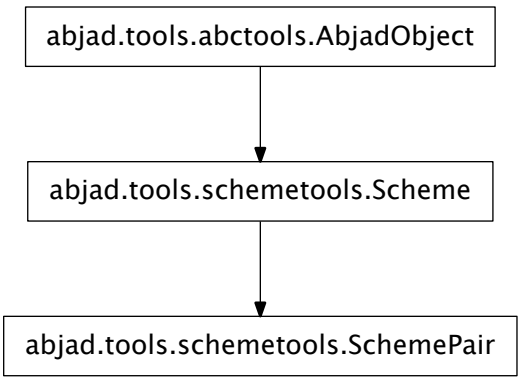
Return string.

Inherited from abctools.AbjadObject

Special Methods

SchemeMoment.**__eq__**(*arg*)
SchemeMoment.**__ge__**(*arg*)
SchemeMoment.**__gt__**(*arg*)
SchemeMoment.**__le__**(*arg*)
SchemeMoment.**__lt__**(*arg*)
SchemeMoment.**__ne__**(*arg*)
SchemeMoment.**__repr__**()
SchemeMoment.**__str__**()
Inherited from schemetools.Scheme

schemetools.SchemePair



class schemetools.**SchemePair**(**args*, ***kwargs*)
Abjad model of Scheme pair:

```
>>> schemetools.SchemePair('spacing', 4)
SchemePair(('spacing', 4))
```

Initialize Scheme pairs with a tuple, two separate values or another Scheme pair.

Scheme pairs are immutable.

Read-only Properties

`SchemePair.`**`force_quotes`**

Inherited from `schemetools.Scheme`

`SchemePair.`**`lilypond_format`**

`SchemePair.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Special Methods

`SchemePair.`**`__eq__`**(*other*)

Inherited from `schemetools.Scheme`

`SchemePair.`**`__ge__`**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`SchemePair.`**`__gt__`**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`SchemePair.`**`__le__`**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`SchemePair.`**`__lt__`**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`SchemePair.`**`__ne__`**(*arg*)

True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

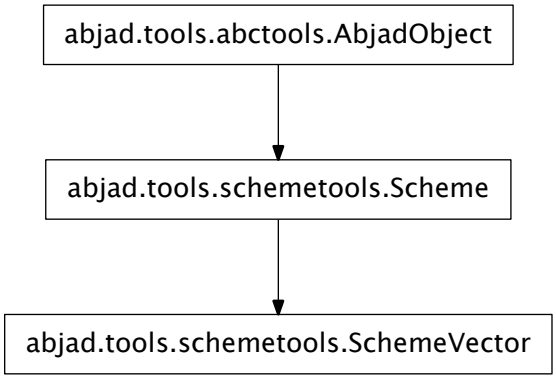
`SchemePair.`**`__repr__`**()

Inherited from `schemetools.Scheme`

`SchemePair.`**`__str__`**()

Inherited from `schemetools.Scheme`

schemetools.SchemeVector



class schemetools.**SchemeVector**(**args*)

New in version 2.0. Abjad model of Scheme vector:

```
>>> schemetools.SchemeVector(True, True, False)
SchemeVector((True, True, False))
```

Scheme vectors and Scheme vector constants differ in only their LilyPond input format.

Scheme vectors are immutable.

Read-only Properties

SchemeVector.**force_quotes**

Inherited from schemetools.Scheme

SchemeVector.**lilypond_format**

Hash-mark-prepended format of Scheme:

```
>>> from abjad.tools.schemetools import Scheme
>>> Scheme(True).lilypond_format
'##t'
```

Returns string.

Inherited from schemetools.Scheme

SchemeVector.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

SchemeVector.**__eq__**(*other*)

Inherited from schemetools.Scheme

SchemeVector.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeVector.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SchemeVector.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeVector.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeVector.__ne__(*arg*)
True when id(self) does not equal id(arg).

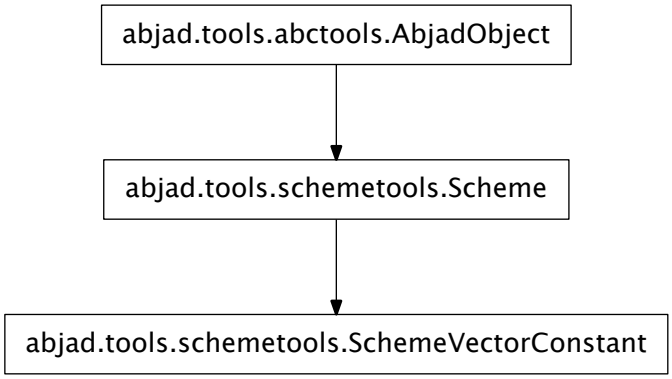
Return boolean.

Inherited from abctools.AbjadObject

SchemeVector.__repr__()
Inherited from schemetools.Scheme

SchemeVector.__str__()
Inherited from schemetools.Scheme

schemetools.SchemeVectorConstant



class schemetools.**SchemeVectorConstant**(**args*)

New in version 2.0. Abjad model of Scheme vector constant:

```
>>> schemetools.SchemeVectorConstant(True, True, False)
SchemeVectorConstant((True, True, False))
```

Scheme vectors and Scheme vector constants differ in only their LilyPond input format.

Scheme vector constants are immutable.

Read-only Properties

SchemeVectorConstant.**force_quotes**

Inherited from schemetools.Scheme

SchemeVectorConstant.**lilypond_format**

Hash-mark-prepended format of Scheme:

```
>>> from abjad.tools.schemetools import Scheme
>>> Scheme(True).lilypond_format
'##t'
```

Returns string.

Inherited from schemetools.Scheme

SchemeVectorConstant.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

SchemeVectorConstant.**__eq__**(*other*)

Inherited from schemetools.Scheme

SchemeVectorConstant.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeVectorConstant.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SchemeVectorConstant.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeVectorConstant.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeVectorConstant.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

SchemeVectorConstant.**__repr__**()
Inherited from schemetools.Scheme

SchemeVectorConstant.**__str__**()
Inherited from schemetools.Scheme

functions

schemetools.format_scheme_value

schemetools.**format_scheme_value**(*value*, *force_quotes=False*)
Format *value* as Scheme would:

```
>>> schemetools.format_scheme_value(1)
'1'

>>> schemetools.format_scheme_value('foo')
'foo'

>>> schemetools.format_scheme_value('bar baz')
'"bar baz"'

>>> schemetools.format_scheme_value([1.5, True, False])
'(1.5 #t #f)'
```

Strings without whitespace can be forcibly quoted via the *force_quotes* keyword:

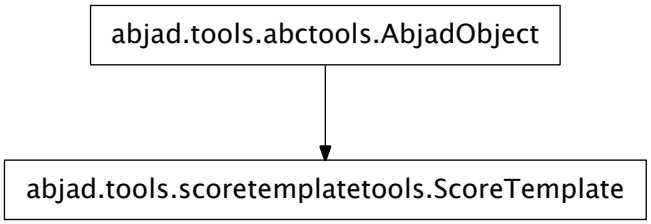
```
>>> schemetools.format_scheme_value('foo', force_quotes=True)
'"foo"'
```

Return string.

scoretemplatetools

abstract classes

scoretemplatetools.ScoreTemplate



class scoretemplatetools.**ScoreTemplate**
New in version 2.8. Abstract score template.

Read-only Properties

ScoreTemplate.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ScoreTemplate.**__call__**()

ScoreTemplate.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ScoreTemplate.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ScoreTemplate.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ScoreTemplate.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ScoreTemplate.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ScoreTemplate.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

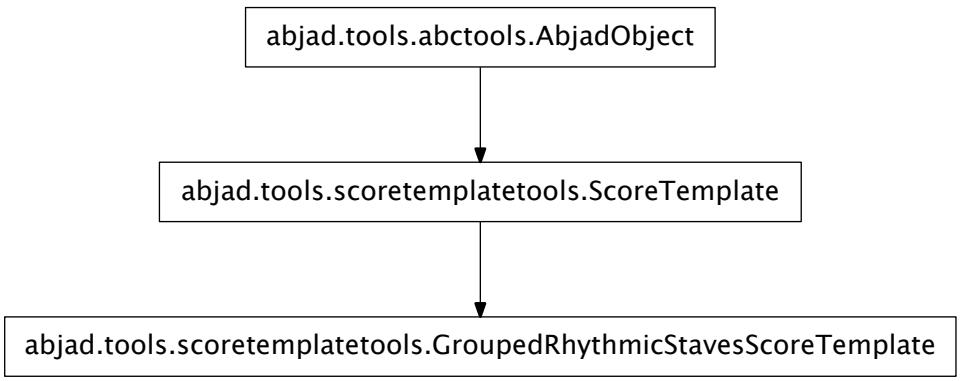
ScoreTemplate.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

concrete classes

scoretemplatetools.GroupedRhythmicStavesScoreTemplate



class scoretemplatetools.**GroupedRhythmicStavesScoreTemplate**(*staff_count=2*)
New in version 2.9. Grouped rhythmic staves score template:

```
>>> template = scoretemplatetools.GroupedRhythmicStavesScoreTemplate(staff_count=4)
>>> score = template()
```

```
>>> score
Score-"Grouped Rhythmic Staves Score"<<1>>

>>> f(score)
\context Score = "Grouped Rhythmic Staves Score" <<
    \context StaffGroup = "Grouped Rhythmic Staves Staff Group" <<
        \context RhythmicStaff = "Staff 1" {
            \context Voice = "Voice 1" {
            }
        }
        \context RhythmicStaff = "Staff 2" {
            \context Voice = "Voice 2" {
            }
        }
        \context RhythmicStaff = "Staff 3" {
            \context Voice = "Voice 3" {
            }
        }
        \context RhythmicStaff = "Staff 4" {
            \context Voice = "Voice 4" {
            }
        }
    >>
>>
```

Return score template object.

Read-only Properties

GroupedRhythmicStavesScoreTemplate.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

GroupedRhythmicStavesScoreTemplate.**__call__**()

GroupedRhythmicStavesScoreTemplate.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

GroupedRhythmicStavesScoreTemplate.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GroupedRhythmicStavesScoreTemplate.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

GroupedRhythmicStavesScoreTemplate.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GroupedRhythmicStavesScoreTemplate.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GroupedRhythmicStavesScoreTemplate.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

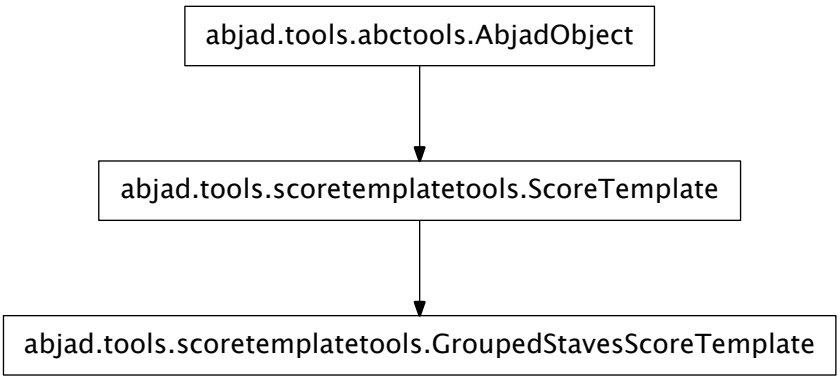
Inherited from abctools.AbjadObject

GroupedRhythmicStavesScoreTemplate.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

scoretemplatetools.GroupedStavesScoreTemplate



class scoretemplatetools.**GroupedStavesScoreTemplate**(*staff_count=2*)
New in version 2.10. Grouped staves score template:

```
>>> template = scoretemplatetools.GroupedStavesScoreTemplate(staff_count=4)
>>> score = template()

>>> score
Score-"Grouped Staves Score"<<1>>

>>> f(score)
\context Score = "Grouped Staves Score" <<
    \context StaffGroup = "Grouped Staves Staff Group" <<
        \context Staff = "Staff 1" {
```

```
                \context Voice = "Voice 1" {
                }
            }
            \context Staff = "Staff 2" {
                \context Voice = "Voice 2" {
                }
            }
            \context Staff = "Staff 3" {
                \context Voice = "Voice 3" {
                }
            }
            \context Staff = "Staff 4" {
                \context Voice = "Voice 4" {
                }
            }
        >>
    >>
```

Return score template object.

Read-only Properties

GroupedStavesScoreTemplate.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

GroupedStavesScoreTemplate.**__call__**()

GroupedStavesScoreTemplate.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

GroupedStavesScoreTemplate.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GroupedStavesScoreTemplate.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

GroupedStavesScoreTemplate.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GroupedStavesScoreTemplate.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GroupedStavesScoreTemplate.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

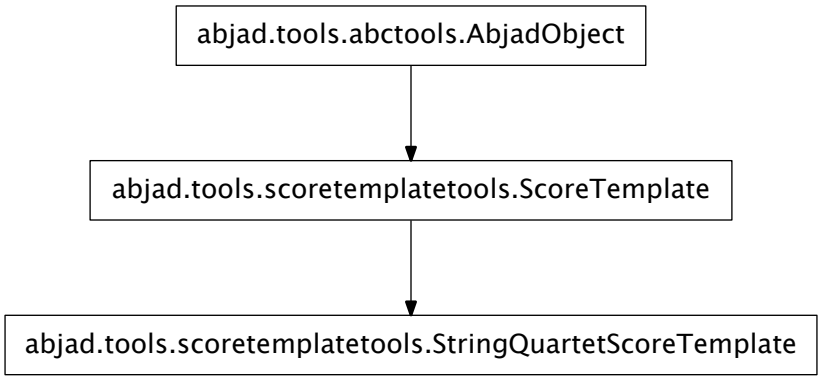
Inherited from abctools.AbjadObject

GroupedStavesScoreTemplate.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

scoretemplatetools.StringQuartetScoreTemplate



class scoretemplatetools.**StringQuartetScoreTemplate**
New in version 2.8. String quartet score template:

```
>>> template = scoretemplatetools.StringQuartetScoreTemplate()
>>> score = template()

>>> score
Score-"String Quartet Score"<<1>>

>>> f(score)
\context Score = "String Quartet Score" <<
    \context StaffGroup = "String Quartet Staff Group" <<
        \context Staff = "First Violin Staff" {
            \clef "treble"
            \set Staff.instrumentName = \markup { Violin }
            \set Staff.shortInstrumentName = \markup { Vn. }
            \context Voice = "First Violin Voice" {
            }
        }
```

```
            \context Staff = "Second Violin Staff" {
                \clef "treble"
                \set Staff.instrumentName = \markup { Violin }
                \set Staff.shortInstrumentName = \markup { Vn. }
                \context Voice = "Second Violin Voice" {
                }
            }
            \context Staff = "Viola Staff" {
                \clef "alto"
                \set Staff.instrumentName = \markup { Viola }
                \set Staff.shortInstrumentName = \markup { Va. }
                \context Voice = "Viola Voice" {
                }
            }
            \context Staff = "Cello Staff" {
                \clef "bass"
                \set Staff.instrumentName = \markup { Cello }
                \set Staff.shortInstrumentName = \markup { Vc. }
                \context Voice = "Cello Voice" {
                }
            }
        >>
    >>
```

Return score template.

Read-only Properties

`StringQuartetScoreTemplate.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Special Methods

`StringQuartetScoreTemplate.`**`__call__`**`()`

`StringQuartetScoreTemplate.`**`__eq__`**`(`*arg*`)`

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`StringQuartetScoreTemplate.`**`__ge__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`StringQuartetScoreTemplate.`**`__gt__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`StringQuartetScoreTemplate.`**`__le__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StringQuartetScoreTemplate.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StringQuartetScoreTemplate.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

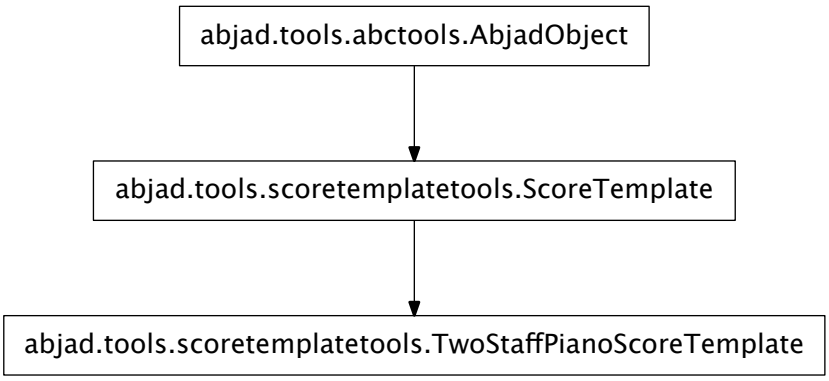
Inherited from abctools.AbjadObject

StringQuartetScoreTemplate.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

scoretemplatetools.TwoStaffPianoScoreTemplate



class scoretemplatetools.**TwoStaffPianoScoreTemplate**
New in version 2.8. Two-staff piano score template:

```
>>> template = scoretemplatetools.TwoStaffPianoScoreTemplate()
>>> score = template()

>>> score
Score-"Two-Staff Piano Score"<<1>>

>>> f(score)
\context Score = "Two-Staff Piano Score" <<
    \context PianoStaff = "Piano Staff" <<
        \set PianoStaff.instrumentName = \markup { Piano }
```

```
            \set PianoStaff.shortInstrumentName = \markup { Pf. }
            \context Staff = "RH Staff" {
                \clef "treble"
                \context Voice = "RH Voice" {
                }
            }
            \context Staff = "LH Staff" {
                \clef "bass"
                \context Voice = "LH Voice" {
                }
            }
        >>
    >>
```

Return score template.

Read-only Properties

`TwoStaffPianoScoreTemplate.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Special Methods

`TwoStaffPianoScoreTemplate.`**`__call__`**`()`

`TwoStaffPianoScoreTemplate.`**`__eq__`**`(`*arg*`)`

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`TwoStaffPianoScoreTemplate.`**`__ge__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TwoStaffPianoScoreTemplate.`**`__gt__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`TwoStaffPianoScoreTemplate.`**`__le__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TwoStaffPianoScoreTemplate.`**`__lt__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TwoStaffPianoScoreTemplate.__ne__(arg)`
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`TwoStaffPianoScoreTemplate.__repr__()`
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

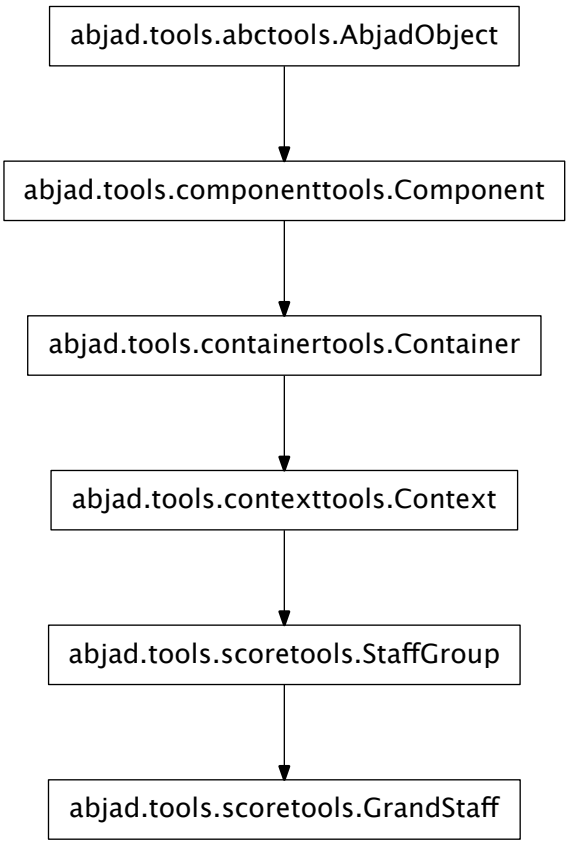
Return string.

Inherited from `abctools.AbjadObject`

scoretools

concrete classes

scoretools.GrandStaff



class scoretools.**GrandStaff**(*music*, *context_name='GrandStaff'*, *name=None*)

Abjad model of grand staff:

```
>>> staff_1 = Staff("c'4 d'4 e'4 f'4 g'1")
>>> staff_2 = Staff("g2 f2 e1")

>>> grand_staff = scoretools.GrandStaff([staff_1, staff_2])

>>> f(grand_staff)
\new GrandStaff <<
    \new Staff {
        c'4
        d'4
        e'4
        f'4
        g'1
    }
    \new Staff {
        g2
        f2
        e1
    }
>>
```

Return grand staff.

Read-only Properties

GrandStaff.**contents_duration**

Inherited from containertools.Container

GrandStaff.**duration_in_seconds**

Inherited from containertools.Container

GrandStaff.**engraver_consists**

New in version 2.0. Unordered set of LilyPond engravers to include in context definition.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_consists.append('Horizontal_bracket_engraver')
>>> f(staff)
\new Staff \with {
    \consists Horizontal_bracket_engraver
} {
}
```

Inherited from contexttools.Context

GrandStaff.**engraver_removals**

New in version 2.0. Unordered set of LilyPond engravers to remove from context.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_removals.append('Time_signature_engraver')
>>> f(staff)
\new Staff \with {
    \remove Time_signature_engraver
} {
}
```

Inherited from contexttools.Context

GrandStaff.**is_semantic**
Inherited from contexttools.Context

GrandStaff.**leaves**
Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

GrandStaff.**lilypond_format**
Inherited from contexttools.Context

GrandStaff.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

GrandStaff.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

GrandStaff.**parent**
Inherited from componenttools.Component

GrandStaff.**preprolated_duration**
Inherited from containertools.Container

GrandStaff.**prolated_duration**
Inherited from componenttools.Component

GrandStaff.**prolation**
Inherited from componenttools.Component

GrandStaff.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

GrandStaff.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

GrandStaff.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

GrandStaff.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

GrandStaff.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

GrandStaff.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

GrandStaff.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

GrandStaff.**context_name**
Read / write name of context as a string.

Inherited from contexttools.Context

GrandStaff.**is_nonsemantic**
Set indicator of nonsemantic voice:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (5, 16), (5, 16)])
>>> voice = Voice(measures)
>>> voice.name = 'HiddenTimeSignatureVoice'

>>> voice.is_nonsemantic = True

>>> f(voice)
\context Voice = "HiddenTimeSignatureVoice" {
    {
        \time 1/8
        s1 * 1/8
    }
    {
        \time 5/16
        s1 * 5/16
    }
    {
        s1 * 5/16
    }
}

>>> voice.is_nonsemantic
True
```

Get indicator of nonsemantic voice:

```
>>> voice = Voice([])
```

```
>>> voice.is_nonsemantic
False
```

Return boolean.

The intent of this read / write attribute is to allow composers to tag invisible voices used to house time signatures indications, bar number directives or other pieces of score-global non-musical information. Such nonsemantic voices can then be omitted from voice interation and other functions.

Inherited from `contexttools.Context`

`GrandStaff.`**`is_parallel`**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from `containertools.Container`

`GrandStaff.`**`name`**

Read-write name of context. Must be string or none.

Inherited from `contexttools.Context`

Methods

GrandStaff.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

GrandStaff.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: expr may now be a LilyPond input string. Inherited from containertools.Container

GrandStaff.**index**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from containertools.Container

GrandStaff.**insert**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from containertools.Container

GrandStaff.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

GrandStaff.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

GrandStaff.**__add__**(*expr*)

Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

GrandStaff.**__contains__**(*expr*)

True if expr is in container, otherwise False.

Inherited from containertools.Container

GrandStaff.**__delitem__**(*i*)

Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

GrandStaff.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

GrandStaff.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GrandStaff.__getitem__(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

GrandStaff.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

GrandStaff.__iadd__(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

GrandStaff.__imul__(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

GrandStaff.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GrandStaff.__len__()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

GrandStaff.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GrandStaff.__mul__(*n*)
Inherited from componenttools.Component

GrandStaff.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

GrandStaff.__radd__(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

GrandStaff.__repr__()
Changed in version 2.0. Named contexts now print name at the interpreter.

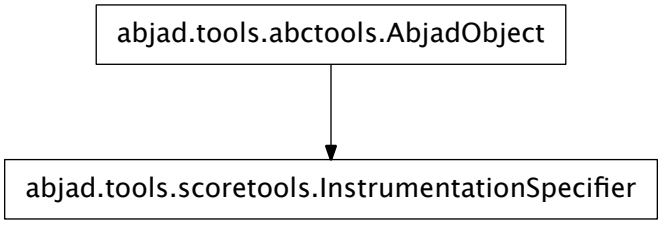
Inherited from contexttools.Context

GrandStaff.__rmul__(*n*)
Inherited from componenttools.Component

GrandStaff.**__setitem__**(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

scoretools.InstrumentationSpecifier



class scoretools.**InstrumentationSpecifier**(*performers=None*)
New in version 2.5. Abjad model of score instrumentation:

```
>>> flute = scoretools.Performer('Flute')
>>> flute.instruments.append(instrumenttools.Flute())
>>> flute.instruments.append(instrumenttools.AltoFlute())

>>> guitar = scoretools.Performer('Guitar')
>>> guitar.instruments.append(instrumenttools.Guitar())

>>> instrumentation_specifier = scoretools.InstrumentationSpecifier([flute, guitar])

>>> z(instrumentation_specifier)
scoretools.InstrumentationSpecifier(
    performers=scoretools.PerformerInventory([
        scoretools.Performer(
            name='Flute',
            instruments=instrumenttools.InstrumentInventory([
                instrumenttools.Flute(),
                instrumenttools.AltoFlute()
                ])
            ),
        scoretools.Performer(
            name='Guitar',
            instruments=instrumenttools.InstrumentInventory([
                instrumenttools.Guitar()
                ])
            )
        ])
    )
```

Return instrumentation specifier.

Read-only Properties

InstrumentationSpecifier.**instrument_count**

Read-only number of instruments in score:

```
>>> instrumentation_specifier.instrument_count
3
```

Return nonnegative integer.

InstrumentationSpecifier.**instruments**

Read-only list of instruments derived from performers:

```
>>> instrumentation_specifier.instruments
[Flute(), AltoFlute(), Guitar()]
```

Return list.

InstrumentationSpecifier.**performer_count**

Read-only number of performers in score:

```
>>> instrumentation_specifier.performer_count
2
```

Return nonnegative integer.

InstrumentationSpecifier.**performer_name_string**

Read-only string of performer names:

```
>>> instrumentation_specifier.performer_name_string
'Flute, Guitar'
```

Return string.

InstrumentationSpecifier.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

InstrumentationSpecifier.**performers**

Read / write list of performers in score:

```
>>> z(instrumentation_specifier.performers)
scoretools.PerformerInventory([
    scoretools.Performer(
        name='Flute',
        instruments=instrumenttools.InstrumentInventory([
            instrumenttools.Flute(),
            instrumenttools.AltoFlute()
            ])
        ),
    scoretools.Performer(
        name='Guitar',
        instruments=instrumenttools.InstrumentInventory([
            instrumenttools.Guitar()
            ])
        )
    ])
```

Return performer inventory.

Special Methods

`InstrumentationSpecifier.__eq__`(*other*)

`InstrumentationSpecifier.__ge__`(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`InstrumentationSpecifier.__gt__`(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`InstrumentationSpecifier.__le__`(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`InstrumentationSpecifier.__lt__`(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`InstrumentationSpecifier.__ne__`(*other*)

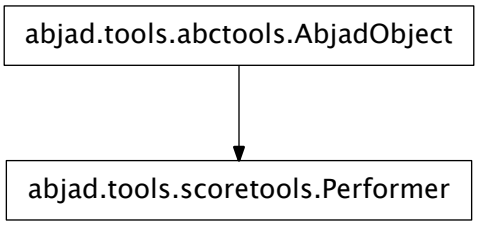
`InstrumentationSpecifier.__repr__`()

Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

scoretools.Performer



class `scoretools.Performer`(*name=None*, *instruments=None*)

New in version 2.5. Abjad model of performer:

```
>>> scoretools.Performer(name='flutist')
Performer(name='flutist', instruments=InstrumentInventory([]))
```

The purpose of the class is to model things like flute I doubling piccolo and alto flute.

At present the class is a list of instruments.

Read-only Properties

Performer.**instrument_count**

Read-only number of instruments to be played by performer:

```
>>> performer = scoretools.Performer('flutist')

>>> performer.instruments.append(instrumenttools.Flute())
>>> performer.instruments.append(instrumenttools.Piccolo())

>>> performer.instrument_count
2
```

Return nonnegative integer

Performer.**is_doubling**

Is performer to play more than one instrument?

```
>>> performer = scoretools.Performer('flutist')

>>> performer.instruments.append(instrumenttools.Flute())
>>> performer.instruments.append(instrumenttools.Piccolo())

>>> performer.is_doubling
True
```

Return boolean.

Performer.**likely_instruments_based_on_performer_name**

New in version 2.5. Likely instruments based on performer name:

```
>>> flutist = scoretools.Performer(name='flutist')
>>> for likely_instrument in flutist.likely_instruments_based_on_performer_name:
...     likely_instrument
...
<class 'abjad.tools.instrumenttools.AltoFlute.AltoFlute.AltoFlute'>
<class 'abjad.tools.instrumenttools.BassFlute.BassFlute.BassFlute'>
<class 'abjad.tools.instrumenttools.ContrabassFlute.ContrabassFlute.ContrabassFlute'>
<class 'abjad.tools.instrumenttools.Flute.Flute.Flute'>
<class 'abjad.tools.instrumenttools.Piccolo.Piccolo.Piccolo'>
```

Return list.

Performer.**most_likely_instrument_based_on_performer_name**

New in version 2.5. Most likely instrument based on performer name:

```
>>> flutist = scoretools.Performer(name='flutist')
>>> flutist.most_likely_instrument_based_on_performer_name
<class 'abjad.tools.instrumenttools.Flute.Flute.Flute'>
```

Return instrument class.

Performer.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Performer.**instruments**

List of instruments to be played by performer:

```
>>> performer = scoretools.Performer('flutist')

>>> performer.instruments.append(instrumenttools.Flute())
>>> performer.instruments.append(instrumenttools.Piccolo())

>>> performer.instruments
InstrumentInventory([Flute(), Piccolo()])
```

Return list.

Performer.**name**

Score name of performer:

```
>>> performer = scoretools.Performer('flutist')

>>> performer.name
'flutist'
```

Return string.

Methods

Performer.**make_performer_name_instrument_dictionary**(*locale=None*)

New in version 2.5. Make performer name / instrument dictionary.

Return dictionary.

Special Methods

Performer.**__eq__**(*other*)

Performer.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Performer.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Performer.**__hash__**()

Performer.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Performer.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

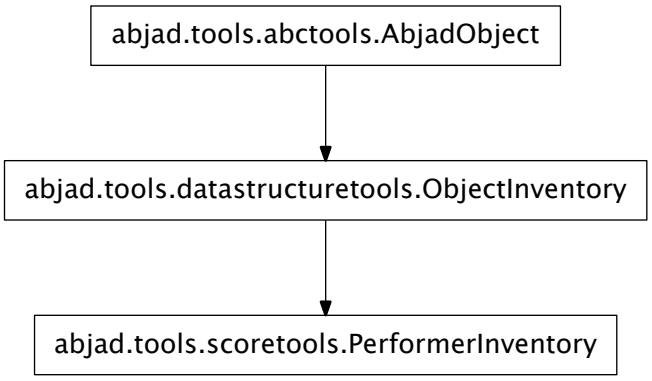
Performer.**__ne__**(*other*)

Performer.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

scoretools.PerformerInventory



class scoretools.**PerformerInventory**(*tokens=None*, *name=None*)
New in version 2.8. Abjad model of an ordered list of performers.

Performer inventories implement the list interface and are mutable.

Read-only Properties

PerformerInventory.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

PerformerInventory.**name**
Read / write name of inventory.

Inherited from datastructuretools.ObjectInventory

Methods

PerformerInventory.**append**(*token*)
Change *token* to item and append.

Inherited from datastructuretools.ObjectInventory
PerformerInventory.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.list

PerformerInventory.**extend**(*tokens*)
Change *tokens* to items and extend.

Inherited from datastructuretools.ObjectInventory

PerformerInventory.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.list

PerformerInventory.**insert**()
L.insert(index, object) – insert object before index

Inherited from __builtin__.list

PerformerInventory.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

PerformerInventory.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

PerformerInventory.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

PerformerInventory.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

PerformerInventory.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

PerformerInventory.**__contains__**(*token*)
Inherited from datastructuretools.ObjectInventory

PerformerInventory.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

PerformerInventory.**__delslice__**()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

PerformerInventory.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

PerformerInventory.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

PerformerInventory.__**getitem**__()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

PerformerInventory.__**getslice**__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

PerformerInventory.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

PerformerInventory.__**iadd**__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

PerformerInventory.__**imul**__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

PerformerInventory.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.list

PerformerInventory.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

PerformerInventory.__**len**__() <==> *len(x)*
Inherited from __builtin__.list

PerformerInventory.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

PerformerInventory.__**mul**__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

PerformerInventory.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

PerformerInventory.__**repr**__()
Inherited from datastructuretools.ObjectInventory

PerformerInventory.__**reversed**__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

PerformerInventory.__**rmul**__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

PerformerInventory.__setitem__()
x.__setitem__(i, y) <==> x[i]=y

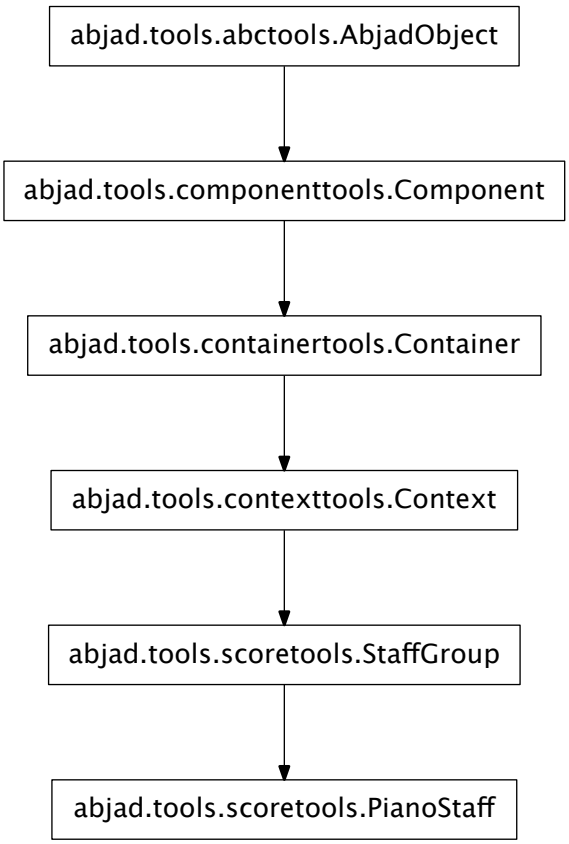
Inherited from __builtin__.list

PerformerInventory.__setslice__()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

scoretools.PianoStaff



class scoretools.**PianoStaff**(*music=None*, *context_name='PianoStaff'*, *name=None*)
Abjad model of piano staff:

```
>>> staff_1 = Staff("c'4 d'4 e'4 f'4 g'1")
>>> staff_2 = Staff("g2 f2 e1")

>>> piano_staff = scoretools.PianoStaff([staff_1, staff_2])
```

```
>>> f(piano_staff)
\new PianoStaff <<
    \new Staff {
        c'4
        d'4
        e'4
        f'4
        g'1
    }
    \new Staff {
        g2
        f2
        e1
    }
>>
```

Return piano staff.

Read-only Properties

PianoStaff.**contents_duration**

Inherited from containertools.Container

PianoStaff.**duration_in_seconds**

Inherited from containertools.Container

PianoStaff.**engraver_consists**

New in version 2.0. Unordered set of LilyPond engravers to include in context definition.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_consists.append('Horizontal_bracket_engraver')
>>> f(staff)
\new Staff \with {
    \consists Horizontal_bracket_engraver
} {
}
```

Inherited from contexttools.Context

PianoStaff.**engraver_removals**

New in version 2.0. Unordered set of LilyPond engravers to remove from context.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_removals.append('Time_signature_engraver')
>>> f(staff)
\new Staff \with {
    \remove Time_signature_engraver
} {
}
```

Inherited from contexttools.Context

PianoStaff.**is_semantic**

Inherited from contexttools.Context

PianoStaff.**leaves**

Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

PianoStaff.**lilypond_format**
Inherited from contexttools.Context

PianoStaff.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

PianoStaff.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

PianoStaff.**parent**
Inherited from componenttools.Component

PianoStaff.**preprolated_duration**
Inherited from containertools.Container

PianoStaff.**prolated_duration**
Inherited from componenttools.Component

PianoStaff.**prolation**
Inherited from componenttools.Component

PianoStaff.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

PianoStaff.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

PianoStaff.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

PianoStaff.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

PianoStaff.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

PianoStaff.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

PianoStaff.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

PianoStaff.**context_name**
Read / write name of context as a string.

Inherited from contexttools.Context

PianoStaff.**is_nonsemantic**
Set indicator of nonsemantic voice:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (5, 16), (5, 16)])
>>> voice = Voice(measures)
>>> voice.name = 'HiddenTimeSignatureVoice'

>>> voice.is_nonsemantic = True

>>> f(voice)
\context Voice = "HiddenTimeSignatureVoice" {
    {
        \time 1/8
        s1 * 1/8
    }
    {
        \time 5/16
        s1 * 5/16
    }
    {
        s1 * 5/16
    }
}

>>> voice.is_nonsemantic
True
```

Get indicator of nonsemantic voice:

```
>>> voice = Voice([])

>>> voice.is_nonsemantic
False
```

Return boolean.

The intent of this read / write attribute is to allow composers to tag invisible voices used to house time signatures indications, bar number directives or other pieces of score-global non-musical information. Such nonsemantic voices can then be omitted from voice interation and other functions.

Inherited from contexttools.Context

PianoStaff.**is_parallel**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from containertools.Container

PianoStaff.**name**

Read-write name of context. Must be string or none.

Inherited from contexttools.Context

Methods

PianoStaff.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}
```

```
>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

PianoStaff.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: expr may now be a LilyPond input string. Inherited from containertools.Container

PianoStaff.**index**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from containertools.Container

PianoStaff.**insert**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from `containertools.Container`

`PianoStaff.`**`pop`**`(`*i=-1*`)`

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from `containertools.Container`

`PianoStaff.`**`remove`**`(`*component*`)`

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
```

```
        e'8 ]
    }

    >>> note = container[-1]
    >>> note
    Note("e'8")

    >>> container.remove(note)

    >>> f(container)
    {
        c'8 [
        d'8 ]
    }
```

Return none.

Inherited from containertools.Container

Special Methods

PianoStaff.**__add__**(*expr*)

Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

PianoStaff.**__contains__**(*expr*)

True if expr is in container, otherwise False.

Inherited from containertools.Container

PianoStaff.**__delitem__**(*i*)

Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

PianoStaff.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

PianoStaff.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PianoStaff.**__getitem__**(*i*)

Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

PianoStaff.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

PianoStaff.__iadd__(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

PianoStaff.__imul__(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

PianoStaff.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PianoStaff.__len__()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

PianoStaff.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PianoStaff.__mul__(*n*)
Inherited from componenttools.Component

PianoStaff.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

PianoStaff.__radd__(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

PianoStaff.__repr__()
Changed in version 2.0. Named contexts now print name at the interpreter.

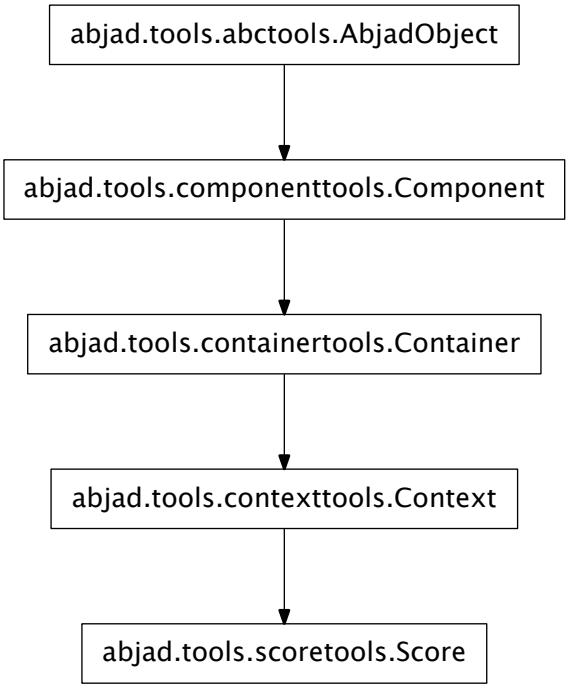
Inherited from contexttools.Context

PianoStaff.__rmul__(*n*)
Inherited from componenttools.Component

PianoStaff.__setitem__(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

scoretools.Score



class scoretools.**Score**(*music=None*, *context_name='Score'*, *name=None*)

Abjad model of a score:

```
>>> staff_1 = Staff("c'8 d'8 e'8 f'8")
>>> staff_2 = Staff("c'8 d'8 e'8 f'8")
>>> score = Score([staff_1, staff_2])
>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
        e'8
        f'8
    }
    \new Staff {
        c'8
        d'8
        e'8
        f'8
    }
>>
```

Return score object.

Read-only Properties

Score.**contents_duration**

Inherited from containertools.Container

Score.**duration_in_seconds**

Inherited from containertools.Container

Score.**engraver_consists**

New in version 2.0. Unordered set of LilyPond engravers to include in context definition.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_consists.append('Horizontal_bracket_engraver')
>>> f(staff)
\new Staff \with {
    \consists Horizontal_bracket_engraver
} {
}
```

Inherited from contexttools.Context

Score.**engraver_removals**

New in version 2.0. Unordered set of LilyPond engravers to remove from context.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_removals.append('Time_signature_engraver')
>>> f(staff)
\new Staff \with {
    \remove Time_signature_engraver
} {
}
```

Inherited from contexttools.Context

Score.**is_semantic**

Inherited from contexttools.Context

Score.**leaves**

Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

Score.**lilypond_format**

Inherited from contexttools.Context

Score.**music**

Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

Score.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Score.**parent**
Inherited from componenttools.Component

Score.**preprolated_duration**
Inherited from containertools.Container

Score.**prolated_duration**
Inherited from componenttools.Component

Score.**prolation**
Inherited from componenttools.Component

Score.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Score.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Score.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Score.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Score.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Score.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Score.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Score.**context_name**
Read / write name of context as a string.

Inherited from contexttools.Context

Score.**is_nonsemantic**
Set indicator of nonsemantic voice:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (5, 16), (5, 16)])
>>> voice = Voice(measures)
>>> voice.name = 'HiddenTimeSignatureVoice'

>>> voice.is_nonsemantic = True

>>> f(voice)
\context Voice = "HiddenTimeSignatureVoice" {
    {
        \time 1/8
        s1 * 1/8
    }
    {
        \time 5/16
        s1 * 5/16
    }
    {
        s1 * 5/16
    }
}

>>> voice.is_nonsemantic
True
```

Get indicator of nonsemantic voice:

```
>>> voice = Voice([])

>>> voice.is_nonsemantic
False
```

Return boolean.

The intent of this read / write attribute is to allow composers to tag invisible voices used to house time signatures indications, bar number directives or other pieces of score-global non-musical information. Such nonsemantic voices can then be omitted from voice interation and other functions.

Inherited from `contexttools.Context`

`Score.`**`is_parallel`**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from containertools.Container

Score.**name**

Read-write name of context. Must be string or none.

Inherited from contexttools.Context

Methods

Score.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

Score.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: `expr` may now be a LilyPond input string. Inherited from `containertools.Container`

`Score.`**`index`**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from `containertools.Container`

`Score.`**`insert`**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from containertools.Container

Score.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

Score.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

Score.__**add**__(*expr*)
Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

Score.__**contains**__(*expr*)
True if expr is in container, otherwise False.

Inherited from containertools.Container

Score.__**delitem**__(*i*)
Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

Score.__**eq**__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Score.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Score.__**getitem**__(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

Score.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Score.__**iadd**__(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

Score.__**imul**__(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

Score.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Score.__**len**__()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

Score.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Score.__mul__(*n*)
Inherited from componenttools.Component

Score.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Score.__radd__(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

Score.__repr__()
Changed in version 2.0. Named contexts now print name at the interpreter.

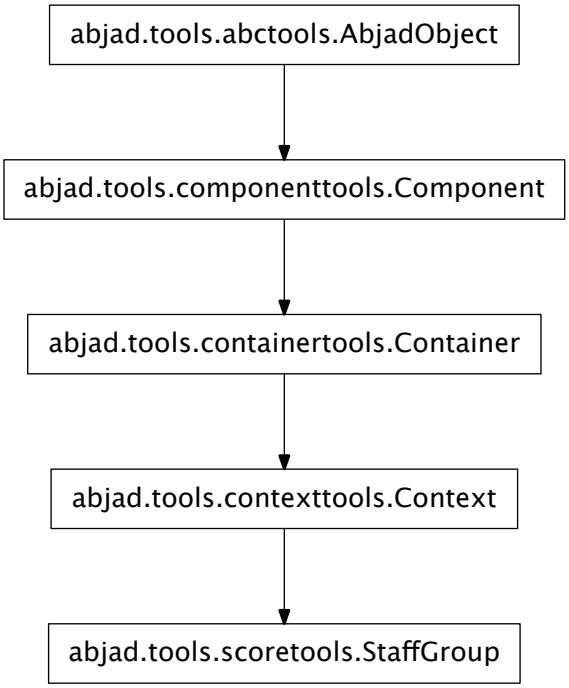
Inherited from contexttools.Context

Score.__rmul__(*n*)
Inherited from componenttools.Component

Score.__setitem__(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

scoretools.StaffGroup



class scoretools.**StaffGroup**(*music=None*, *context_name='StaffGroup'*, *name=None*)

Abjad model of staff group:

```
>>> staff_1 = Staff("c'4 d'4 e'4 f'4 g'1")
>>> staff_2 = Staff("g2 f2 e1")

>>> staff_group = scoretools.StaffGroup([staff_1, staff_2])

>>> f(staff_group)
\new StaffGroup <<
    \new Staff {
        c'4
        d'4
        e'4
        f'4
        g'1
    }
    \new Staff {
        g2
        f2
        e1
    }
>>
```

Return staff group.

Read-only Properties

StaffGroup.**contents_duration**
Inherited from containertools.Container

StaffGroup.**duration_in_seconds**
Inherited from containertools.Container

StaffGroup.**engraver_consists**
New in version 2.0. Unordered set of LilyPond engravers to include in context definition.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_consists.append('Horizontal_bracket_engraver')
>>> f(staff)
\new Staff \with {
    \consists Horizontal_bracket_engraver
} {
}
```

Inherited from contexttools.Context

StaffGroup.**engraver_removals**
New in version 2.0. Unordered set of LilyPond engravers to remove from context.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_removals.append('Time_signature_engraver')
>>> f(staff)
\new Staff \with {
    \remove Time_signature_engraver
} {
}
```

Inherited from contexttools.Context

StaffGroup.**is_semantic**
Inherited from contexttools.Context

StaffGroup.**leaves**
Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

StaffGroup.**lilypond_format**
Inherited from contexttools.Context

StaffGroup.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

StaffGroup.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

StaffGroup.**parent**
Inherited from componenttools.Component

StaffGroup.**preprolated_duration**
Inherited from containertools.Container

StaffGroup.**prolated_duration**
Inherited from componenttools.Component

StaffGroup.**prolation**
Inherited from componenttools.Component

StaffGroup.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

StaffGroup.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

StaffGroup.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

StaffGroup.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

StaffGroup.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

StaffGroup.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

StaffGroup.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

StaffGroup.**context_name**
Read / write name of context as a string.

Inherited from contexttools.Context

StaffGroup.**is_nonsemantic**
Set indicator of nonsemantic voice:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (5, 16), (5, 16)])
>>> voice = Voice(measures)
>>> voice.name = 'HiddenTimeSignatureVoice'

>>> voice.is_nonsemantic = True

>>> f(voice)
\context Voice = "HiddenTimeSignatureVoice" {
    {
        \time 1/8
        s1 * 1/8
    }
    {
        \time 5/16
        s1 * 5/16
    }
    {
        s1 * 5/16
    }
}

>>> voice.is_nonsemantic
True
```

Get indicator of nonsemantic voice:

```
>>> voice = Voice([])

>>> voice.is_nonsemantic
False
```

Return boolean.

The intent of this read / write attribute is to allow composers to tag invisible voices used to house time signatures indications, bar number directives or other pieces of score-global non-musical information. Such nonsemantic voices can then be omitted from voice interation and other functions.

Inherited from `contexttools.Context`

`StaffGroup.`**`is_parallel`**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from containertools.Container

StaffGroup.**name**

Read-write name of context. Must be string or none.

Inherited from contexttools.Context

Methods

StaffGroup.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

StaffGroup.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: `expr` may now be a LilyPond input string. Inherited from `containertools.Container`

`StaffGroup.`**`index`**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from `containertools.Container`

`StaffGroup.`**`insert`**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from containertools.Container

StaffGroup.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

StaffGroup.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

StaffGroup.__**add**__(*expr*)
Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

StaffGroup.__**contains**__(*expr*)
True if expr is in container, otherwise False.

Inherited from containertools.Container

StaffGroup.__**delitem**__(*i*)
Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

StaffGroup.__**eq**__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

StaffGroup.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StaffGroup.__**getitem**__(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

StaffGroup.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

StaffGroup.__**iadd**__(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

StaffGroup.__**imul**__(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

StaffGroup.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StaffGroup.__**len**__()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

StaffGroup.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StaffGroup.**__mul__**(*n*)
Inherited from componenttools.Component

StaffGroup.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

StaffGroup.**__radd__**(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

StaffGroup.**__repr__**()
Changed in version 2.0. Named contexts now print name at the interpreter.

Inherited from contexttools.Context

StaffGroup.**__rmul__**(*n*)
Inherited from componenttools.Component

StaffGroup.**__setitem__**(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

functions

scoretools.add_double_bar_to_end_of_score

scoretools.**add_double_bar_to_end_of_score**(*score*)
New in version 2.0. Add double bar to end of *score*:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")

>>> scoretools.add_double_bar_to_end_of_score(staff)
BarLine('|.')(f'4)

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
    \bar "|."
}
```

Return double bar.

scoretools.add_markup_to_end_of_score

scoretools.**add_markup_to_end_of_score**(*score*, *markup*, *extra_offset=None*)

New in version 2.0. Add *markup* to end of *score*:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")
>>> markup = r'\italic \right-column { "Bremen - Boston - LA." "Jul 2010 - May 2011." }'
>>> markup = markuptools.Markup(markup, Down)
>>> markup = scoretools.add_markup_to_end_of_score(staff, markup, (4, -2))

>>> z(markup)
markuptools.Markup(
    (MarkupCommand('italic', MarkupCommand('right-column',
        ['Bremen - Boston - LA.', 'Jul 2010 - May 2011.'])),),
    direction=Down
    )

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    \once \override TextScript #'extra-offset = #'(4 . -2)
    f'4 _ \markup {
        \italic
            \right-column
                {
                    "Bremen - Boston - LA."
                    "Jul 2010 - May 2011."
                }
        }
}
```

Return *markup*.

scoretools.all_are_scores

scoretools.**all_are_scores**(*expr*)

New in version 2.6. True when *expr* is a sequence of Abjad scores:

```
>>> score = Score([Staff([Note("c'4")])])

>>> score
Score<<1>>

>>> scoretools.all_are_scores([score])
True
```

True when *expr* is an empty sequence:

```
>>> scoretools.all_are_scores([])
True
```

Otherwise false:

```
>>> scoretools.all_are_scores('foo')
False
```

Return boolean.

Function wraps `componenttools.all_are_components()`.

scoretools.get_first_score_in_improper_parentage_of_component

`scoretools.`**`get_first_score_in_improper_parentage_of_component`**(*component*)

New in version 2.0. Get first score in improper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score = Score([staff])

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
        e'8
        f'8
    }
>>

>>> scoretools.get_first_score_in_improper_parentage_of_component(score.leaves[0])
Score<<1>>
```

Return score or none.

scoretools.get_first_score_in_proper_parentage_of_component

`scoretools.`**`get_first_score_in_proper_parentage_of_component`**(*component*)

New in version 2.0. Get first score in proper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> score = Score([staff])

>>> f(score)
\new Score <<
    \new Staff {
        c'8
        d'8
        e'8
        f'8
    }
>>

>>> scoretools.get_first_score_in_proper_parentage_of_component(score.leaves[0])
Score<<1>>
```

Return score or none.

scoretools.list_performer_names

`scoretools.`**`list_performer_names`**(*locale='en-us'*)

New in version 2.5. List performer names:

```
>>> for performer_name in scoretools.list_performer_names():
...     performer_name
...
'accordionist'
'baritone'
'bass'
'bassist'
'bassoonist'
'cellist'
'clarinetist'
'contralto'
'flutist'
'guitarist'
'harpist'
'harpsichordist'
'hornist'
'mezzo-soprano'
'oboist'
'percussionist'
'pianist'
'saxophonist'
'soprano'
'tenor'
'trombonist'
'trumpeter'
'tubist'
'vibraphonist'
'violinist'
'violist'
'xylophonist'
```

Available values for *locale* are `'en-us'` and `'en-uk'`.

scoretools.list_primary_performer_names

scoretools.**list_primary_performer_names**()

New in version 2.5. List performer names:

```
>>> for pair in scoretools.list_primary_performer_names():
...     pair
...
('accordionist', 'acc.')
('baritone', 'baritone')
('bass', 'bass')
('bassist', 'vb.')
('bassoonist', 'bsn.')
('cellist', 'vc.')
('clarinetist', 'cl. in B-flat')
('contralto', 'contralto')
('flutist', 'fl.')
('guitarist', 'gt.')
('harpist', 'hp.')
('harpsichordist', 'hpschd.')
('hornist', 'hn.')
('mezzo-soprano', 'mezzo-soprano')
('oboist', 'ob.')
('pianist', 'pf.')
```

```
('saxophonist', 'alto sax.')
('soprano', 'soprano')
('tenor', 'tenor')
('trombonist', 'ten. trb.')
('trumpeter', 'tp.')
('tubist', 'tb.')
('violinist', 'vn.')
('violist', 'va.')
```

Return list.

scoretools.make_empty_piano_score

scoretools.**make_empty_piano_score**()

New in version 1.1. Make empty piano score:

```
>>> score, treble, bass = scoretools.make_empty_piano_score()
```

```
>>> f(score)
\new Score <<
    \new PianoStaff <<
        \context Staff = "treble" {
            \clef "treble"
        }
        \context Staff = "bass" {
            \clef "bass"
        }
    >>
>>
```

Return score, treble staff, bass staff. Changed in version 2.0: renamed `scoretools.make_piano_staff()` to `scoretools.make_empty_piano_score()`.

scoretools.make_piano_score_from_leaves

scoretools.**make_piano_score_from_leaves**(*leaves*, *lowest_treble_pitch=None*)

New in version 2.0. Make piano score from *leaves*:

```
>>> notes = [Note(x, (1, 4)) for x in [-12, 37, -10, 2, 4, 17]]
>>> score, treble_staff, bass_staff = scoretools.make_piano_score_from_leaves(notes)
```

```
>>> f(score)
\new Score <<
    \new PianoStaff <<
        \context Staff = "treble" {
            \clef "treble"
            r4
            cs''''4
            r4
            d'4
            e'4
            f''4
        }
        \context Staff = "bass" {
            \clef "bass"
            c4
```

```
                r4
                d4
                r4
                r4
                r4
            }
        >>
    >>
```

When `lowest_treble_pitch=None` set to B3.

Return score, treble staff, bass staff.

scoretools.make_piano_sketch_score_from_leaves

scoretools.**make_piano_sketch_score_from_leaves**(*leaves*, *lowest_treble_pitch=None*)

New in version 2.0. Make piano sketch score from *leaves*:

```
>>> notes = notetools.make_notes([-12, -10, -8, -7, -5, 0, 2, 4, 5, 7], [(1, 4)])
>>> score, treble_staff, bass_staff = scoretools.make_piano_sketch_score_from_leaves(notes)

>>> f(score)
\new Score \with {
    \override BarLine #'stencil = ##f
    \override BarNumber #'transparent = ##t
    \override SpanBar #'stencil = ##f
    \override TimeSignature #'stencil = ##f
} <<
    \new PianoStaff <<
        \context Staff = "treble" {
            \clef "treble"
            #(set-accidental-style 'forget)
            r4
            r4
            r4
            r4
            r4
            c'4
            d'4
            e'4
            f'4
            g'4
        }
        \context Staff = "bass" {
            \clef "bass"
            #(set-accidental-style 'forget)
            c4
            d4
            e4
            f4
            g4
            r4
            r4
            r4
            r4
            r4
        }
```

```
    >>
>>
```

When `lowest_treble_pitch=None` set to B3.

Make time signatures and bar numbers transparent.

Do not print bar lines or span bars.

Set all staff accidental styles to forget.

Return score, treble staff, bass staff.

sequencetools

concrete classes

sequencetools.CyclicList

abjad.tools.sequencetools.CyclicList

class `sequencetools.`**`CyclicList`**

New in version 2.0. Abjad model of cyclic list:

```
>>> from abjad.tools import sequencetools

>>> cyclic_list = sequencetools.CyclicList('abcd')

>>> cyclic_list
CyclicList([a, b, c, d])

>>> for x in range(8):
...     print x, cyclic_list[x]
...
0 a
1 b
2 c
3 d
4 a
5 b
6 c
7 d
```

Cyclic lists overload the item-getting method of built-in lists.

Cyclic lists return a value for any integer index.

Cyclic lists otherwise behave exactly like built-in lists.

Methods

CyclicList.**append**()
L.append(object) – append object to end

Inherited from __builtin__.list

CyclicList.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.list

CyclicList.**extend**()
L.extend(iterable) – extend list by appending elements from the iterable

Inherited from __builtin__.list

CyclicList.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.list

CyclicList.**insert**()
L.insert(index, object) – insert object before index

Inherited from __builtin__.list

CyclicList.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

CyclicList.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

CyclicList.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

CyclicList.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

CyclicList.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

CyclicList.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.list

CyclicList.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

CyclicList.**__delslice__**()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

CyclicList.__**eq**__()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

CyclicList.__**ge**__()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

CyclicList.__**getitem**__(*expr*)

CyclicList.__**getslice**__(*start_index*, *stop_index*)

CyclicList.__**gt**__()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

CyclicList.__**iadd**__()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

CyclicList.__**imul**__()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

CyclicList.__**iter**__() <==> *iter(x)*
Inherited from __builtin__.list

CyclicList.__**le**__()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

CyclicList.__**len**__() <==> *len(x)*
Inherited from __builtin__.list

CyclicList.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

CyclicList.__**mul**__()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

CyclicList.__**ne**__()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

CyclicList.__**repr**__()

CyclicList.__**reversed**__()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

CyclicList.__**rmul**__()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

CyclicList.**__setitem__**()
x.__setitem__(i, y) <==> x[i]=y

Inherited from __builtin__.list

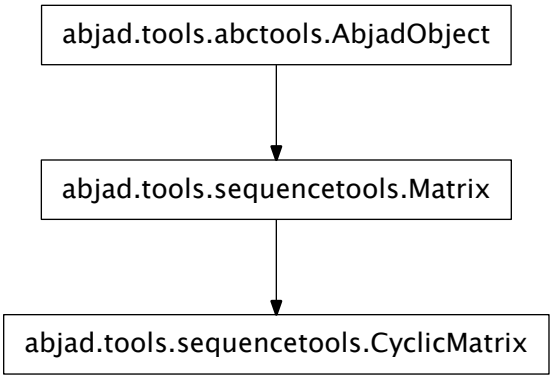
CyclicList.**__setslice__**()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

CyclicList.**__str__**()

sequencetools.CyclicMatrix



class sequencetools.**CyclicMatrix**(**args*, ***kwargs*)
New in version 2.0. Abjad model of cyclic matrix.

Initialize from rows:

```
>>> from abjad.tools import sequencetools

>>> cyclic_matrix = sequencetools.CyclicMatrix(
...     [[0, 1, 2, 3], [10, 11, 12, 13], [20, 21, 22, 23]])

>>> cyclic_matrix
CyclicMatrix(3x4)

>>> cyclic_matrix[2]
CyclicTuple([20, 21, 22, 23])

>>> cyclic_matrix[2][2]
22

>>> cyclic_matrix[99]
CyclicTuple([0, 1, 2, 3])
```

```
>>> cyclic_matrix[99][99]
3
```

Initialize from columns:

```
>>> cyclic_matrix = sequencetools.CyclicMatrix(
...     columns=[[0, 10, 20], [1, 11, 21], [2, 12, 22], [3, 13, 23]])

>>> cyclic_matrix
CyclicMatrix(3x4)

>>> cyclic_matrix[2]
CyclicTuple([20, 21, 22, 23])

>>> cyclic_matrix[2][2]
22

>>> cyclic_matrix[99]
CyclicTuple([0, 1, 2, 3])

>>> cyclic_matrix[99][99]
3
```

CyclicMatrix implements only item retrieval in this revision.

Concatenation and division remain to be implemented.

Standard transforms of linear algebra remain to be implemented.

Read-only Properties

`CyclicMatrix.`**`columns`**

Read-only columns:

```
>>> cyclic_matrix = sequencetools.CyclicMatrix(
...     [[0, 1, 2, 3], [10, 11, 12, 13], [20, 21, 22, 23]])

>>> cyclic_matrix.columns
CyclicTuple([[0, 10, 20], [1, 11, 21], [2, 12, 22], [3, 13, 23]])
```

Return cyclic tuple.

`CyclicMatrix.`**`rows`**

Read-only rows:

```
>>> cyclic_matrix = sequencetools.CyclicMatrix(
...     [[0, 1, 2, 3], [10, 11, 12, 13], [20, 21, 22, 23]])

>>> cyclic_matrix.rows
CyclicTuple([[0, 1, 2, 3], [10, 11, 12, 13], [20, 21, 22, 23]])
```

Return cyclic tuple.

`CyclicMatrix.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Special Methods

CyclicMatrix.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

CyclicMatrix.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

CyclicMatrix.**__getitem__**(*expr*)

CyclicMatrix.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

CyclicMatrix.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

CyclicMatrix.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

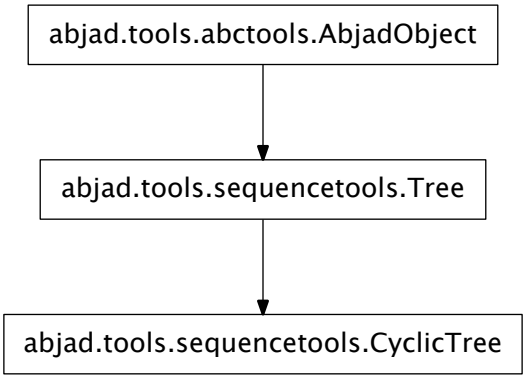
CyclicMatrix.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

CyclicMatrix.**__repr__**()

sequencetools.CyclicTree



class sequencetools.**CyclicTree**(*expr*)

New in version 2.5. Like `Tree` but with cyclic s Abjad data structure to work with a sequence whose elements have been grouped into arbitrarily many levels of **cyclic** containment.

Exactly like the `Tree` class but with the additional affordance that all integer indices of any size work at every level of structure; like `CyclicTuple`, `CyclicList` and `CyclicMatrix`, no index errors raises in working with objects of this class.

```
>>> from abjad.tools import sequencetools
```

Here is a cyclic tree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> cyclic_tree = sequencetools.CyclicTree(sequence)

>>> cyclic_tree
CyclicTree([[0, 1], [2, 3], [4, 5], [6, 7]])
```

Here's an internal node:

```
>>> cyclic_tree[2]
CyclicTree([4, 5])
```

Here's the same node indexed with a different way:

```
>>> cyclic_tree[2]
CyclicTree([4, 5])
```

With a negative index:

```
>>> cyclic_tree[-2]
CyclicTree([4, 5])
```

And another negative index:

```
>>> cyclic_tree[-6]
CyclicTree([4, 5])
```

Here's a leaf node:

```
>>> cyclic_tree[2][0]
CyclicTree(4)
```

And here's the same node indexed a different way:

```
>>> cyclic_tree[2][20]
CyclicTree(4)
```

All other interface attributes function as in `Tree`.

Read-only Properties

`CyclicTree.`**`children`**

New in version 2.4. Children of node:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].children
(Tree(2), Tree(3))
```

Return tuple of zero or more nodes.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`depth`**

New in version 2.4. Depth of subtree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].depth
2
```

Return nonnegative integer.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`improper_parentage`**

New in version 2.4. Improper parentage of node:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].improper_parentage
(Tree([2, 3]), Tree([[0, 1], [2, 3], [4, 5], [6, 7]]))
```

Return tuple of one or more nodes.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`index_in_parent`**

New in version 2.4. Index of node in parent:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].index_in_parent
1
```

Return nonnegative integer.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`level`**

New in version 2.4. Level of node:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].level
1
```

Return nonnegative integer.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`negative_level`**

New in version 2.4. Negative level of node:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].negative_level
-2
```

Return negative integer.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`position`**

New in version 2.4. Position of node relative to root:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].position
(1,)
```

Return tuple of zero or more nonnegative integers.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`proper_parentage`**

New in version 2.4. Proper parentage of node:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].proper_parentage
(Tree([[0, 1], [2, 3], [4, 5], [6, 7]]),)
```

Return tuple of zero or more nodes.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`root`**

New in version 2.4. Root of tree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)
```

```
>>> tree[1].proper_parentage
(Tree([[0, 1], [2, 3], [4, 5], [6, 7]]),)
```

Return node.

Inherited from sequencetools.Tree

CyclicTree.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

CyclicTree.**width**
New in version 2.4. Number of leaves in subtree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)
```

```
>>> tree[1].width
2
```

Return nonnegative integer.

Inherited from sequencetools.Tree

Methods

CyclicTree.**get_next_n_complete_nodes_at_level**(*n*, *level*)
New in version 2.5. Get next *n* complete nodes at *level* from node.

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)
```

With nonnegative *level*:

Get next 4 nodes at level 2:

```
>>> tree[0][0].get_next_n_complete_nodes_at_level(4, 2)
[Tree(1), Tree(2), Tree(3), Tree(4)]
```

Get next 3 nodes at level 1:

```
>>> tree[0][0].get_next_n_complete_nodes_at_level(3, 1)
[Tree([1]), Tree([2, 3]), Tree([4, 5]), Tree([6, 7])]
```

With negative *level*:

Get next 4 nodes at level -1:

```
>>> tree[0][0].get_next_n_complete_nodes_at_level(4, -1)
[Tree(1), Tree(2), Tree(3), Tree(4)]
```

Get next 3 nodes at level -2:

```
>>> tree[0][0].get_next_n_complete_nodes_at_level(3, -2)
[Tree([1]), Tree([2, 3]), Tree([4, 5]), Tree([6, 7])]
```

Trim first node if necessary.

Return list of nodes.

Inherited from sequencetools.Tree

CyclicTree.**get_next_n_nodes_at_level**(*n*, *level*)

New in version 2.4. Get next *n* nodes at *level* from node.

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)
```

With nonnegative *level*:

Get next 4 nodes at level 2:

```
>>> tree[0][0].get_next_n_nodes_at_level(4, 2)
[Tree(1), Tree(2), Tree(3), Tree(4)]
```

Get next 3 nodes at level 1:

```
>>> tree[0][0].get_next_n_nodes_at_level(3, 1)
[Tree([1]), Tree([2, 3]), Tree([4, 5])]
```

Get next node at level 0:

```
>>> tree[0][0].get_next_n_nodes_at_level(1, 0)
[Tree([[1], [2, 3], [4, 5], [6, 7]])]
```

With negative *level*:

Get next 4 nodes at level -1:

```
>>> tree[0][0].get_next_n_nodes_at_level(4, -1)
[Tree(1), Tree(2), Tree(3), Tree(4)]
```

Get next 3 nodes at level -2:

```
>>> tree[0][0].get_next_n_nodes_at_level(3, -2)
[Tree([1]), Tree([2, 3]), Tree([4, 5])]
```

Trim first node if necessary.

Return list of nodes.

Inherited from sequencetools.Tree

CyclicTree.**get_node_at_position**(*position*)

New in version 2.4. Get node at *position*:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree.get_node_at_position((2, 1))
Tree(5)
```

Return node.

Inherited from sequencetools.Tree

CyclicTree.**get_position_of_descendant**(*descendant*)

New in version 2.4. Get position of *descendent* relative to node rather than relative to root:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[3].get_position_of_descendant(tree[3][0])
(0,)
```

Return tuple of zero or more nonnegative integers.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`is_at_level`**(*level*)

New in version 2.4. True when node is at *level* in tree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1][1].is_at_level(-1)
True
```

False otherwise:

```
>>> tree[1][1].is_at_level(0)
False
```

Return boolean.

Predicate works for positive, negative and zero-valued *level*.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`iterate_at_level`**(*level*)

New in version 2.4. Iterate depth at *level*:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> for x in tree.iterate_at_level(0): x
...
Tree([[0, 1], [2, 3], [4, 5], [6, 7]])

>>> for x in tree.iterate_at_level(1): x
...
Tree([0, 1])
Tree([2, 3])
Tree([4, 5])
Tree([6, 7])

>>> for x in tree.iterate_at_level(2): x
...
Tree(0)
Tree(1)
Tree(2)
Tree(3)
Tree(4)
Tree(5)
Tree(6)
Tree(7)

>>> for x in tree.iterate_at_level(-1): x
...
Tree(0)
Tree(1)
Tree(2)
Tree(3)
Tree(4)
Tree(5)
```

```
Tree(6)
Tree(7)

>>> for x in tree.iterate_at_level(-2): x
...
Tree([0, 1])
Tree([2, 3])
Tree([4, 5])
Tree([6, 7])

>>> for x in tree.iterate_at_level(-3): x
...
Tree([[0, 1], [2, 3], [4, 5], [6, 7]])
```

Return node generator.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`iterate_depth_first`**`()`

New in version 2.4. Iterate tree depth-first:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> for node in tree.iterate_depth_first(): node
...
Tree([[0, 1], [2, 3], [4, 5], [6, 7]])
Tree([0, 1])
Tree(0)
Tree(1)
Tree([2, 3])
Tree(2)
Tree(3)
Tree([4, 5])
Tree(4)
Tree(5)
Tree([6, 7])
Tree(6)
Tree(7)
```

Return node generator.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`iterate_payload`**`()`

New in version 2.4. Iterate tree payload:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> for element in tree.iterate_payload():
...     element
...
0
1
2
3
4
5
```

```
6
7
```

Return payload generator.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`remove`**`(`*node*`)`

New in version 2.4. Remove *node* from tree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree.remove(tree[1])

>>> tree
Tree([[0, 1], [4, 5], [6, 7]])
```

Return none.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`remove_to_root`**`()`

New in version 2.4. Remove node and all nodes left of node to root:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]

>>> tree = sequencetools.Tree(sequence)
>>> tree[0][0].remove_to_root()
>>> tree
Tree([[1], [2, 3], [4, 5], [6, 7]])

>>> tree = sequencetools.Tree(sequence)
>>> tree[0][1].remove_to_root()
>>> tree
Tree([[2, 3], [4, 5], [6, 7]])

>>> tree = sequencetools.Tree(sequence)
>>> tree[1].remove_to_root()
>>> tree
Tree([[4, 5], [6, 7]])
```

Modify in-place to root.

Return none.

Inherited from `sequencetools.Tree`

`CyclicTree.`**`to_nested_lists`**`()`

New in version 2.5. Change tree to nested lists:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree
Tree([[0, 1], [2, 3], [4, 5], [6, 7]])

>>> tree.to_nested_lists()
[[0, 1], [2, 3], [4, 5], [6, 7]]
```

Return list of lists.

Inherited from `sequencetools.Tree`

Special Methods

CyclicTree.**__contains__**(*expr*)
Inherited from sequencetools.Tree

CyclicTree.**__eq__**(*other*)
Inherited from sequencetools.Tree

CyclicTree.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CyclicTree.**__getitem__**(*expr*)
Inherited from sequencetools.Tree

CyclicTree.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

CyclicTree.**__iter__**()

CyclicTree.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CyclicTree.**__len__**()
Inherited from sequencetools.Tree

CyclicTree.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

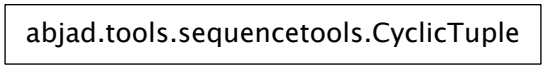
Inherited from abctools.AbjadObject

CyclicTree.**__ne__**(*other*)
Inherited from sequencetools.Tree

CyclicTree.**__repr__**()
Inherited from sequencetools.Tree

CyclicTree.**__str__**()
Inherited from sequencetools.Tree

sequencetools.CyclicTuple



class sequencetools.**CyclicTuple**

New in version 2.0. Abjad model of cyclic tuple:

```
>>> from abjad.tools import sequencetools

>>> cyclic_tuple = sequencetools.CyclicTuple('abcd')

>>> cyclic_tuple
CyclicTuple([a, b, c, d])

>>> for x in range(8):
...     print x, cyclic_tuple[x]
...
0 a
1 b
2 c
3 d
4 a
5 b
6 c
7 d
```

Cyclic tuples overload the item-getting method of built-in tuples.

Cyclic tuples return a value for any integer index.

Cyclic tuples otherwise behave exactly like built-in tuples.

Methods

CyclicTuple.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.tuple

CyclicTuple.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

Special Methods

CyclicTuple.**__add__**()

x.__add__(y) <==> x+y

Inherited from __builtin__.tuple

CyclicTuple.**__contains__**()

x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

CyclicTuple.**__eq__**()

x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

CyclicTuple.**__ge__**()

x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

CyclicTuple.**__getitem__**(*expr*)

CyclicTuple.**__getslice__**(*start_index*, *stop_index*)

CyclicTuple.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

CyclicTuple.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

CyclicTuple.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

CyclicTuple.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

CyclicTuple.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

CyclicTuple.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

CyclicTuple.**__mul__**()
x.__mul__(n) <==> x*n

Inherited from __builtin__.tuple

CyclicTuple.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.tuple

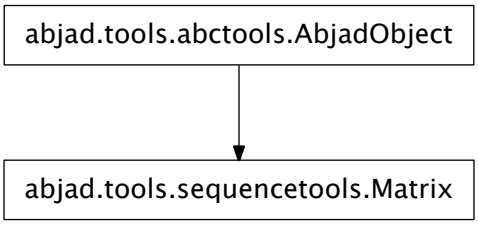
CyclicTuple.**__repr__**()

CyclicTuple.**__rmul__**()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.tuple

CyclicTuple.**__str__**()

sequencetools.Matrix



class sequencetools.**Matrix**(**args*, ***kwargs*)
New in version 2.0. Abjad model of matrix.

Initialize from rows:

```
>>> matrix = sequencetools.Matrix([[0, 1, 2, 3], [10, 11, 12, 13], [20, 21, 22, 23]])

>>> matrix
Matrix(3x4)

>>> matrix[:]
((0, 1, 2, 3), (10, 11, 12, 13), (20, 21, 22, 23))

>>> matrix[2]
(20, 21, 22, 23)

>>> matrix[2][0]
20
```

Initialize from columns:

```
>>> matrix = sequencetools.Matrix(
...     columns=[[0, 10, 20], [1, 11, 21], [2, 12, 22], [3, 13, 23]])

>>> matrix
Matrix(3x4)

>>> matrix[:]
((0, 1, 2, 3), (10, 11, 12, 13), (20, 21, 22, 23))

>>> matrix[2]
(20, 21, 22, 23)

>>> matrix[2][0]
20
```

Matrix implements only item retrieval in this revision.

Concatenation and division remain to be implemented.

Standard transforms of linear algebra remain to be implemented.

Read-only Properties

`Matrix.columns`

Read-only columns:

```
>>> matrix = sequencetools.Matrix([[0, 1, 2, 3], [10, 11, 12, 13], [20, 21, 22, 23]])

>>> matrix.columns
((0, 10, 20), (1, 11, 21), (2, 12, 22), (3, 13, 23))
```

Return tuple.

`Matrix.rows`

Read-only rows:

```
>>> matrix = sequencetools.Matrix([[0, 1, 2, 3], [10, 11, 12, 13], [20, 21, 22, 23]])

>>> matrix.rows
((0, 1, 2, 3), (10, 11, 12, 13), (20, 21, 22, 23))
```

Return tuple.

Matrix.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

Matrix.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Matrix.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Matrix.**__getitem__**(*expr*)

Matrix.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Matrix.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Matrix.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

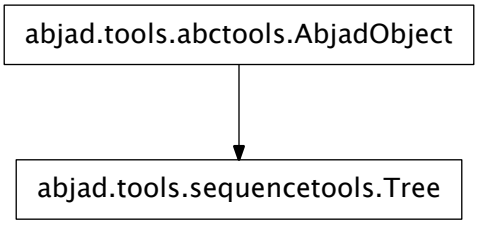
Matrix.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Matrix.**__repr__**()

sequencetools.Tree



class sequencetools.**Tree**(*expr*)

New in version 2.4. Abjad data structure to work with a sequence whose elements have been grouped into arbitrarily many levels of containment.

Example: a list of pitches that have been grouped into cells that have, in turn, been grouped into groups of cells that have, in turn, been grouped into groups of groups of cells.

```
>>> from abjad.tools import sequencetools
```

Here is a tree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree
Tree([[0, 1], [2, 3], [4, 5], [6, 7]])

>>> tree.parent is None
True

>>> tree.children
(Tree([0, 1]), Tree([2, 3]), Tree([4, 5]), Tree([6, 7]))

>>> tree.depth
3
```

Here's an internal node:

```
>>> tree[2]
Tree([4, 5])

>>> tree[2].parent
Tree([[0, 1], [2, 3], [4, 5], [6, 7]])

>>> tree[2].children
(Tree(4), Tree(5))

>>> tree[2].depth
2
```

```
>>> tree[2].level
1
```

Here's a leaf node:

```
>>> tree[2][0]
Tree(4)

>>> tree[2][0].parent
Tree([4, 5])

>>> tree[2][0].children
()

>>> tree[2][0].depth
1

>>> tree[2][0].level
2

>>> tree[2][0].position
(2, 0)

>>> tree[2][0].payload
4
```

Only leaf nodes carry payload. Internal nodes carry no payload.

Negative levels are available to work with trees bottom-up instead of top-down.

Trees do not yet implement append or extend methods.

Read-only Properties

`Tree.`**`children`**

New in version 2.4. Children of node:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].children
(Tree(2), Tree(3))
```

Return tuple of zero or more nodes.

`Tree.`**`depth`**

New in version 2.4. Depth of subtree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].depth
2
```

Return nonnegative integer.

`Tree.`**`improper_parentage`**

New in version 2.4. Improper parentage of node:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)
```

```
>>> tree[1].improper_parentage
(Tree([2, 3]), Tree([[0, 1], [2, 3], [4, 5], [6, 7]]))
```

Return tuple of one or more nodes.

Tree.**index_in_parent**

New in version 2.4. Index of node in parent:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].index_in_parent
1
```

Return nonnegative integer.

Tree.**level**

New in version 2.4. Level of node:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].level
1
```

Return nonnegative integer.

Tree.**negative_level**

New in version 2.4. Negative level of node:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].negative_level
-2
```

Return negative integer.

Tree.**position**

New in version 2.4. Position of node relative to root:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].position
(1,)
```

Return tuple of zero or more nonnegative integers.

Tree.**proper_parentage**

New in version 2.4. Proper parentage of node:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].proper_parentage
(Tree([[0, 1], [2, 3], [4, 5], [6, 7]]),)
```

Return tuple of zero or more nodes.

Tree.**root**

New in version 2.4. Root of tree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].proper_parentage
(Tree([[0, 1], [2, 3], [4, 5], [6, 7]]),)
```

Return node.

Tree.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Tree.**width**

New in version 2.4. Number of leaves in subtree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1].width
2
```

Return nonnegative integer.

Methods

Tree.**get_next_n_complete_nodes_at_level**(*n*, *level*)

New in version 2.5. Get next *n* complete nodes at *level* from node.

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)
```

With nonnegative *level*:

Get next 4 nodes at level 2:

```
>>> tree[0][0].get_next_n_complete_nodes_at_level(4, 2)
[Tree(1), Tree(2), Tree(3), Tree(4)]
```

Get next 3 nodes at level 1:

```
>>> tree[0][0].get_next_n_complete_nodes_at_level(3, 1)
[Tree([1]), Tree([2, 3]), Tree([4, 5]), Tree([6, 7])]
```

With negative *level*:

Get next 4 nodes at level -1:

```
>>> tree[0][0].get_next_n_complete_nodes_at_level(4, -1)
[Tree(1), Tree(2), Tree(3), Tree(4)]
```

Get next 3 nodes at level -2:

```
>>> tree[0][0].get_next_n_complete_nodes_at_level(3, -2)
[Tree([1]), Tree([2, 3]), Tree([4, 5]), Tree([6, 7])]
```

Trim first node if necessary.

Return list of nodes.

Tree.**get_next_n_nodes_at_level**(*n*, *level*)

New in version 2.4. Get next *n* nodes at *level* from node.

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)
```

With nonnegative *level*:

Get next 4 nodes at level 2:

```
>>> tree[0][0].get_next_n_nodes_at_level(4, 2)
[Tree(1), Tree(2), Tree(3), Tree(4)]
```

Get next 3 nodes at level 1:

```
>>> tree[0][0].get_next_n_nodes_at_level(3, 1)
[Tree([1]), Tree([2, 3]), Tree([4, 5])]
```

Get next node at level 0:

```
>>> tree[0][0].get_next_n_nodes_at_level(1, 0)
[Tree([[1], [2, 3], [4, 5], [6, 7]])]
```

With negative *level*:

Get next 4 nodes at level -1:

```
>>> tree[0][0].get_next_n_nodes_at_level(4, -1)
[Tree(1), Tree(2), Tree(3), Tree(4)]
```

Get next 3 nodes at level -2:

```
>>> tree[0][0].get_next_n_nodes_at_level(3, -2)
[Tree([1]), Tree([2, 3]), Tree([4, 5])]
```

Trim first node if necessary.

Return list of nodes.

Tree.**get_node_at_position**(*position*)

New in version 2.4. Get node at *position*:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree.get_node_at_position((2, 1))
Tree(5)
```

Return node.

Tree.**get_position_of_descendant**(*descendant*)

New in version 2.4. Get position of *descendent* relative to node rather than relative to root:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[3].get_position_of_descendant(tree[3][0])
(0,)
```

Return tuple of zero or more nonnegative integers.

Tree.**is_at_level**(*level*)

New in version 2.4. True when node is at *level* in tree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree[1][1].is_at_level(-1)
True
```

False otherwise:

```
>>> tree[1][1].is_at_level(0)
False
```

Return boolean.

Predicate works for positive, negative and zero-valued *level*.

Tree.**iterate_at_level**(*level*)

New in version 2.4. Iterate depth at *level*:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> for x in tree.iterate_at_level(0): x
...
Tree([[0, 1], [2, 3], [4, 5], [6, 7]])

>>> for x in tree.iterate_at_level(1): x
...
Tree([0, 1])
Tree([2, 3])
Tree([4, 5])
Tree([6, 7])

>>> for x in tree.iterate_at_level(2): x
...
Tree(0)
Tree(1)
Tree(2)
Tree(3)
Tree(4)
Tree(5)
Tree(6)
Tree(7)

>>> for x in tree.iterate_at_level(-1): x
...
Tree(0)
Tree(1)
Tree(2)
Tree(3)
Tree(4)
Tree(5)
Tree(6)
Tree(7)

>>> for x in tree.iterate_at_level(-2): x
...
Tree([0, 1])
Tree([2, 3])
Tree([4, 5])
Tree([6, 7])
```

```
>>> for x in tree.iterate_at_level(-3): x
...
Tree([[0, 1], [2, 3], [4, 5], [6, 7]])
```

Return node generator.

Tree.**iterate_depth_first**()

New in version 2.4. Iterate tree depth-first:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> for node in tree.iterate_depth_first(): node
...
Tree([[0, 1], [2, 3], [4, 5], [6, 7]])
Tree([0, 1])
Tree(0)
Tree(1)
Tree([2, 3])
Tree(2)
Tree(3)
Tree([4, 5])
Tree(4)
Tree(5)
Tree([6, 7])
Tree(6)
Tree(7)
```

Return node generator.

Tree.**iterate_payload**()

New in version 2.4. Iterate tree payload:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> for element in tree.iterate_payload():
...     element
...
0
1
2
3
4
5
6
7
```

Return payload generator.

Tree.**remove**(*node*)

New in version 2.4. Remove *node* from tree:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree.remove(tree[1])

>>> tree
Tree([[0, 1], [4, 5], [6, 7]])
```

Return none.

Tree.**remove_to_root**()
New in version 2.4. Remove node and all nodes left of node to root:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]

>>> tree = sequencetools.Tree(sequence)
>>> tree[0][0].remove_to_root()
>>> tree
Tree([[1], [2, 3], [4, 5], [6, 7]])

>>> tree = sequencetools.Tree(sequence)
>>> tree[0][1].remove_to_root()
>>> tree
Tree([[2, 3], [4, 5], [6, 7]])

>>> tree = sequencetools.Tree(sequence)
>>> tree[1].remove_to_root()
>>> tree
Tree([[4, 5], [6, 7]])
```

Modify in-place to root.

Return none.

Tree.**to_nested_lists**()
New in version 2.5. Change tree to nested lists:

```
>>> sequence = [[0, 1], [2, 3], [4, 5], [6, 7]]
>>> tree = sequencetools.Tree(sequence)

>>> tree
Tree([[0, 1], [2, 3], [4, 5], [6, 7]])

>>> tree.to_nested_lists()
[[0, 1], [2, 3], [4, 5], [6, 7]]
```

Return list of lists.

Special Methods

Tree.**__contains__**(*expr*)
Tree.**__eq__**(*other*)

Tree.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Tree.**__getitem__**(*expr*)

Tree.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Tree.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Tree.__len__()

Tree.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Tree.__ne__(*other*)

Tree.__repr__()

Tree.__str__()

functions

sequencetools.all_are_assignable_integers

sequencetools.**all_are_assignable_integers**(*expr*)
New in version 2.0. True when *expr* is a sequence and all elements in *expr* are notehead-assignable integers:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.all_are_assignable_integers([1, 2, 3, 4, 6, 7, 8, 12, 14, 15, 16])
True
```

True when *expr* is an empty sequence:

```
>>> sequencetools.all_are_assignable_integers([])
True
```

False otherwise:

```
>>> sequencetools.all_are_assignable_integers('foo')
False
```

Return boolean.

sequencetools.all_are_equal

sequencetools.**all_are_equal**(*expr*)
New in version 2.0. True when *expr* is a sequence and all elements in *expr* are equal:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.all_are_equal([99, 99, 99, 99, 99, 99])
True
```

True when *expr* is an empty sequence:

```
>>> sequencetools.all_are_equal([])
True
```

False otherwise:

```
>>> sequencetools.all_are_equal(17)
False
```

Return boolean.

sequencetools.all_are_integer_equivalent_exprs

sequencetools.**all_are_integer_equivalent_exprs**(*expr*)

New in version 2.0. True when *expr* is a sequence and all elements in *expr* are integer-equivalent expressions:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.all_are_integer_equivalent_exprs([1, '2', 3.0, Fraction(4, 1)])
True
```

Otherwise false:

```
>>> sequencetools.all_are_integer_equivalent_exprs([1, '2', 3.5, 4])
False
```

Return boolean.

sequencetools.all_are_integer_equivalent_numbers

sequencetools.**all_are_integer_equivalent_numbers**(*expr*)

New in version 2.0. True when *expr* is a sequence and all elements in *expr* are integer-equivalent numbers:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.all_are_integer_equivalent_numbers([1, 2, 3.0, Fraction(4, 1)])
True
```

Otherwise false:

```
>>> sequencetools.all_are_integer_equivalent_numbers([1, 2, 3.5, 4])
False
```

Return boolean.

sequencetools.all_are_nonnegative_integer_equivalent_numbers

sequencetools.**all_are_nonnegative_integer_equivalent_numbers**(*expr*)

New in version 2.0. True *expr* is a sequence and when all elements in *expr* are nonnegative integer-equivalent numbers. Otherwise false:

```
>>> from abjad.tools import sequencetools
```

```
>>> expr = [0, 0.0, Fraction(0), 2, 2.0, Fraction(2)]
>>> sequencetools.all_are_nonnegative_integer_equivalent_numbers(expr)
True
```

Return boolean.

sequencetools.all_are_nonnegative_integer_powers_of_two

sequencetools.**all_are_nonnegative_integer_powers_of_two**(*expr*)

New in version 2.0. True when *expr* is a sequence and all elements in *expr* are nonnegative integer powers of two:

```
>>> sequencetools.all_are_nonnegative_integer_powers_of_two([0, 1, 1, 1, 2, 4, 32, 32])
True
```

True when *expr* is an empty sequence:

```
>>> sequencetools.all_are_nonnegative_integer_powers_of_two([])
True
```

False otherwise:

```
>>> sequencetools.all_are_nonnegative_integer_powers_of_two(17)
False
```

Return boolean.

sequencetools.all_are_nonnegative_integers

sequencetools.**all_are_nonnegative_integers**(*expr*)

New in version 2.0. True when *expr* is a sequence and all elements in *expr* are nonnegative integers:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.all_are_nonnegative_integers([0, 1, 2, 99])
True
```

Otherwise false:

```
>>> sequencetools.all_are_nonnegative_integers([0, 1, 2, -99])
False
```

Return boolean.

sequencetools.all_are_numbers

sequencetools.**all_are_numbers**(*expr*)

New in version 1.1. True when *expr* is a sequence and all elements in *expr* are numbers:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.all_are_numbers([1, 2, 3.0, Fraction(13, 8)])
True
```

True when *expr* is an empty sequence:

```
>>> sequencetools.all_are_numbers([])
True
```

False otherwise:

```
>>> sequencetools.all_are_numbers(17)
False
```

Return boolean. Changed in version 2.0: renamed `sequencetools.is_numeric()` to `sequencetools.all_are_numbers()`.

sequencetools.all_are_pairs

`sequencetools.`**`all_are_pairs`**(*expr*)

True when *expr* is a sequence whose members are all sequences of length 2:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.all_are_pairs([(1, 2), (3, 4), (5, 6), (7, 8)])
True
```

True when *expr* is an empty sequence:

```
>>> sequencetools.all_are_pairs([])
True
```

False otherwise:

```
>>> sequencetools.all_are_pairs('foo')
False
```

Return boolean.

sequencetools.all_are_pairs_of_types

`sequencetools.`**`all_are_pairs_of_types`**(*expr*, *first_type*, *second_type*)

True when *expr* is a sequence whose members are all sequences of length 2, and where the first member of each pair is an instance of *first_type* and where the second member of each pair is an instance of *second_type*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.all_are_pairs_of_types([(1., 'a'), (2.1, 'b'), (3.45, 'c')], float, str)
True
```

True when *expr* is an empty sequence:

```
>>> sequencetools.all_are_pairs_of_types([], float, str)
True
```

False otherwise:

```
>>> sequencetools.all_are_pairs_of_types('foo', float, str)
False
```

Return boolean.

sequencetools.all_are_positive_integer_equivalent_numbers

`sequencetools.`**`all_are_positive_integer_equivalent_numbers`**(*expr*)

New in version 2.0. True when *expr* is a sequence and all elements in *expr* are positive integer-equivalent numbers. Otherwise false:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.all_are_positive_integer_equivalent_numbers([Fraction(4, 2), 2.0, 2])
True
```

Return boolean.

sequencetools.all_are_positive_integers

sequencetools.**all_are_positive_integers**(*expr*)

New in version 2.0. True when *expr* is a sequence and all elements in *expr* are positive integers:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.all_are_positive_integers([1, 2, 3, 99])
True
```

Otherwise false:

```
>>> sequencetools.all_are_positive_integers(17)
False
```

Return boolean.

sequencetools.all_are_unequal

sequencetools.**all_are_unequal**(*expr*)

New in version 1.1. True when *expr* is a sequence all elements in *expr* are unequal:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.all_are_unequal([1, 2, 3, 4, 9])
True
```

True when *expr* is an empty sequence:

```
>>> sequencetools.all_are_unequal([])
True
```

False otherwise:

```
>>> sequencetools.all_are_unequal(17)
False
```

Return boolean. Changed in version 2.0: renamed `sequencetools.is_unique()` to `sequencetools.all_are_unequal()`.

sequencetools.count_length_two_runs_in_sequence

sequencetools.**count_length_two_runs_in_sequence**(*sequence*)

New in version 1.1. Count length-2 runs in *sequence*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.count_length_two_runs_in_sequence([0, 0, 1, 1, 1, 2, 3, 4, 5])
3
```

Return nonnegative integer. Changed in version 2.0: renamed `sequencetools.count_repetitions()` to `sequencetools.count_length_two_runs_in_sequence()`.

sequencetools.divide_sequence_elements_by_greatest_common_divisor

sequencetools.**divide_sequence_elements_by_greatest_common_divisor**(*sequence*)

New in version 2.0. Divide *sequence* elements by greatest common divisor:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.divide_sequence_elements_by_greatest_common_divisor([2, 2, -8, -16])
[1, 1, -4, -8]
```

Allow negative *sequence* elements.

Raise type error on noninteger *sequence* elements.

Raise not implemented error when `0` in *sequence*.

Return new *sequence* object.

sequencetools.flatten_sequence

sequencetools.**flatten_sequence**(*sequence*, *klasses=None*, *depth=-1*)

New in version 1.1. Flatten *sequence*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.flatten_sequence([1, [2, 3, [4]], 5, [6, 7, [8]]])
[1, 2, 3, 4, 5, 6, 7, 8]
```

Flatten *sequence* to depth `1`:

```
>>> sequencetools.flatten_sequence([1, [2, 3, [4]], 5, [6, 7, [8]]], depth=1)
[1, 2, 3, [4], 5, 6, 7, [8]]
```

Flatten *sequence* to depth `2`:

```
>>> sequencetools.flatten_sequence([1, [2, 3, [4]], 5, [6, 7, [8]]], depth=2)
[1, 2, 3, 4, 5, 6, 7, 8]
```

Leave *sequence* unchanged.

Return newly constructed *sequence* object. Changed in version 2.0: renamed `listtools.flatten()` to `sequencetools.flatten_sequence()`.

sequencetools.flatten_sequence_at_indices

sequencetools.**flatten_sequence_at_indices**(*sequence*, *indices*, *klasses=None*, *depth=-1*)

New in version 2.0. Flatten *sequence* at *indices*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.flatten_sequence_at_indices([0, 1, [2, 3, 4], [5, 6, 7]], [3])
[0, 1, [2, 3, 4], 5, 6, 7]
```

Flatten *sequence* at negative *indices*:

```
>>> sequencetools.flatten_sequence_at_indices([0, 1, [2, 3, 4], [5, 6, 7]], [-1])
[0, 1, [2, 3, 4], 5, 6, 7]
```

Leave *sequence* unchanged.

Return newly constructed *sequence* object.

sequencetools.get_indices_of_sequence_elements_equal_to_true

sequencetools.**get_indices_of_sequence_elements_equal_to_true**(*sequence*)

New in version 1.1. Get indices of *sequence* elements equal to true:

```
>>> from abjad.tools import sequencetools
```

::

```
    >>> sequence = [0, 0, 0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 1]
```

```
>>> sequencetools.get_indices_of_sequence_elements_equal_to_true(sequence)
(3, 4, 5, 9, 10, 11, 12)
```

Return newly constructed tuple of zero or more nonnegative integers. Changed in version 2.0: renamed `listtools.true_indices()` to `sequencetools.get_indices_of_sequence_elements_equal_to_true()`.

sequencetools.get_sequence_degree_of_rotational_symmetry

sequencetools.**get_sequence_degree_of_rotational_symmetry**(*sequence*)

New in version 2.0. Change *sequence* to degree of rotational symmetry:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.get_sequence_degree_of_rotational_symmetry([1, 2, 3, 4, 5, 6])
1
```

```
>>> sequencetools.get_sequence_degree_of_rotational_symmetry([1, 2, 3, 1, 2, 3])
2
```

```
>>> sequencetools.get_sequence_degree_of_rotational_symmetry([1, 2, 1, 2, 1, 2])
3
```

```
>>> sequencetools.get_sequence_degree_of_rotational_symmetry([1, 1, 1, 1, 1, 1])
6
```

Return positive integer.

sequencetools.get_sequence_element_at_cyclic_index

sequencetools.**get_sequence_element_at_cyclic_index**(*sequence*, *index*)

New in version 2.0. Get *sequence* element at nonnegative cyclic *index*:

```
>>> from abjad.tools import sequencetools
```

```
>>> for index in range(10):
...     print '%s\t%s' % (index, sequencetools.get_sequence_element_at_cyclic_index(
...     'string', index))
...
```

```
0   s
1   t
2   r
3   i
4   n
5   g
6   s
7   t
8   r
9   i
```

Get *sequence* element at negative cyclic *index*:

```
>>> for index in range(1, 11):
...     print '%s\t%s' % (-index, sequencetools.get_sequence_element_at_cyclic_index(
...     'string', -index))
...
-1    g
-2    n
-3    i
-4    r
-5    t
-6    s
-7    g
-8    n
-9    i
-10   r
```

Return reference to *sequence* element.

sequencetools.get_sequence_elements_at_indices

sequencetools.**get_sequence_elements_at_indices**(*sequence*, *indices*)

New in version 2.0. Get *sequence* elements at *indices*:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.get_sequence_elements_at_indices('string of text', (2, 3, 10, 12))
('r', 'i', 't', 'x')
```

Return newly constructed tuple of references to *sequence* elements.

sequencetools.get_sequence_elements_frequency_distribution

sequencetools.**get_sequence_elements_frequency_distribution**(*sequence*)

New in version 2.0. Get *sequence* elements frequency distribution:

```
>>> sequence = [1, 3, 3, 3, 2, 1, 1, 2, 3, 3, 1, 2]
```

```
>>> sequencetools.get_sequence_elements_frequency_distribution(sequence)
[(1, 4), (2, 3), (3, 5)]
```

Return list of element / count pairs.

sequencetools.get_sequence_period_of_rotation

sequencetools.**get_sequence_period_of_rotation**(*sequence*, *n*)

New in version 2.0. Change *sequence* to period of rotation:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.get_sequence_period_of_rotation([1, 2, 3, 1, 2, 3], 1)
3

>>> sequencetools.get_sequence_period_of_rotation([1, 2, 3, 1, 2, 3], 2)
3

>>> sequencetools.get_sequence_period_of_rotation([1, 2, 3, 1, 2, 3], 3)
1
```

Return positive integer.

sequencetools.increase_sequence_elements_at_indices_by_addenda

sequencetools.**increase_sequence_elements_at_indices_by_addenda**(*sequence*, *addenda*, *indices*)

New in version 1.1. Increase *sequence* by *addenda* at *indices*:

```
>>> sequence = [1, 1, 2, 3, 5, 5, 1, 2, 5, 5, 6]

>>> sequencetools.increase_sequence_elements_at_indices_by_addenda(
...     sequence, [0.5, 0.5], [0, 4, 8])
[1.5, 1.5, 2, 3, 5.5, 5.5, 1, 2, 5.5, 5.5, 6]
```

Return list. Changed in version 2.0: renamed `sequencetools.increase_at_indices()` to `sequencetools.increase_sequence_elements_at_indices_by_addenda()`.

sequencetools.increase_sequence_elements_cyclically_by_addenda

sequencetools.**increase_sequence_elements_cyclically_by_addenda**(*sequence*, *addenda*, *shield=True*)

New in version 1.1.. Increase *sequence* cyclically by *addenda*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.increase_sequence_elements_cyclically_by_addenda(
...     range(10), [10, -10], shield=False)
[10, -9, 12, -7, 14, -5, 16, -3, 18, -1]
```

Increase *sequence* cyclically by addenda and map nonpositive values to `1`:

```
>>> sequencetools.increase_sequence_elements_cyclically_by_addenda(
...         range(10), [10, -10], shield=True)
[10, 1, 12, 1, 14, 1, 16, 1, 18, 1]
```

Return list. Changed in version 2.0: renamed `sequencetools.increase_cyclic()` to `sequencetools.increase_sequence_elements_cyclically_by_addenda()`.

sequencetools.interlace_sequences

sequencetools.**interlace_sequences**(**sequences*)

New in version 1.1. Interlace *sequences*:

```
>>> from abjad.tools import sequencetools
```

```
>>> k = range(100, 103)
>>> l = range(200, 201)
>>> m = range(300, 303)
>>> n = range(400, 408)
>>> sequencetools.interlace_sequences(k, l, m, n)
[100, 200, 300, 400, 101, 301, 401, 102, 302, 402, 403, 404, 405, 406, 407]
```

Return list. Changed in version 2.0: renamed `sequencetools.interlace()` to `sequencetools.interlace_sequences()`.

sequencetools.is_fraction_equivalent_pair

sequencetools.**is_fraction_equivalent_pair**(*expr*)

New in version 2.9. True when *expr* is an integer-equivalent pair of numbers excluding `0` as the second term:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.is_fraction_equivalent_pair((2, 3))
True
```

Otherwise false:

```
>>> sequencetools.is_fraction_equivalent_pair((2, 0))
False
```

Return boolean.

sequencetools.is_integer_equivalent_n_tuple

sequencetools.**is_integer_equivalent_n_tuple**(*expr*, *n*)

New in version 2.9. True when *expr* is a tuple of *n* integer-equivalent expressions:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.is_integer_equivalent_n_tuple((2.0, '3', Fraction(4, 1)), 3)
True
```

Otherwise false:

```
>>> sequencetools.is_integer_equivalent_n_tuple((2.5, '3', Fraction(4, 1)), 3)
False
```

Return boolean.

sequencetools.is_integer_equivalent_pair

sequencetools.**is_integer_equivalent_pair**(*expr*)

New in version 2.9. True when *expr* is a pair of integer-equivalent expressions:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.is_integer_equivalent_pair((2.0, '3'))
True
```

Otherwise false:

```
>>> sequencetools.is_integer_equivalent_pair((2.5, '3'))
False
```

Return boolean.

sequencetools.is_integer_equivalent_singleton

sequencetools.**is_integer_equivalent_singleton**(*expr*)

New in version 2.9. True when *expr* is a singleton of integer-equivalent expressions:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.is_integer_equivalent_singleton((2.0,))
True
```

Otherwise false:

```
>>> sequencetools.is_integer_equivalent_singleton((2.5,))
False
```

Return boolean.

sequencetools.is_integer_n_tuple

sequencetools.**is_integer_n_tuple**(*expr*, *n*)

New in version 2.9. True when *expr* is an integer tuple of length *n*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.is_integer_n_tuple((19, 20, 21), 3)
True
```

Otherwise false:

```
>>> sequencetools.is_integer_n_tuple((19, 20, 'text'), 3)
False
```

Return boolean.

sequencetools.is_integer_pair

sequencetools.**is_integer_pair**(*expr*)

New in version 2.9. True when *expr* is an integer tuple of length 2:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.is_integer_pair((19, 20))
True
```

Otherwise false:

```
>>> sequencetools.is_integer_pair(('some', 'text'))
False
```

Return boolean.

sequencetools.is_integer_singleton

sequencetools.**is_integer_singleton**(*expr*)

New in version 2.9. True when *expr* is an integer tuple of of length `1`:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.is_integer_singleton((19,))
True
```

Otherwise false:

```
>>> sequencetools.is_integer_singleton(('text',))
False
```

Return boolean.

sequencetools.is_monotonically_decreasing_sequence

sequencetools.**is_monotonically_decreasing_sequence**(*expr*)

New in version 2.0. True when *expr* is a sequence and the elements in *expr* decrease monotonically:

```
>>> from abjad.tools import sequencetools

>>> expr = [9, 8, 7, 6, 5, 4, 3, 2, 1, 0]
>>> sequencetools.is_monotonically_decreasing_sequence(expr)
True

>>> expr = [3, 3, 3, 3, 3, 3, 3, 2, 1, 0]
>>> sequencetools.is_monotonically_decreasing_sequence(expr)
True

>>> expr = [3, 3, 3, 3, 3, 3, 3, 3, 3, 3]
>>> sequencetools.is_monotonically_decreasing_sequence(expr)
True
```

False when *expr* is a sequence and the elements in *expr* do not decrease monotonically:

```
>>> expr = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
>>> sequencetools.is_monotonically_decreasing_sequence(expr)
False

>>> expr = [0, 1, 2, 3, 3, 3, 3, 3, 3, 3]
>>> sequencetools.is_monotonically_decreasing_sequence(expr)
False
```

True when *expr* is a sequence and *expr* is empty:

```
>>> expr = []
>>> sequencetools.is_monotonically_decreasing_sequence(expr)
True
```

False when *expr* is not a sequence:

```
>>> sequencetools.is_monotonically_decreasing_sequence(17)
False
```

Return boolean.

sequencetools.is_monotonically_increasing_sequence

sequencetools.**is_monotonically_increasing_sequence**(*expr*)

New in version 2.0. True when *expr* is a sequence and the elements in *expr* increase monotonically:

```
>>> from abjad.tools import sequencetools

>>> expr = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
>>> sequencetools.is_monotonically_increasing_sequence(expr)
True

>>> expr = [0, 1, 2, 3, 3, 3, 3, 3, 3, 3]
>>> sequencetools.is_monotonically_increasing_sequence(expr)
True

>>> expr = [3, 3, 3, 3, 3, 3, 3, 3, 3, 3]
>>> sequencetools.is_monotonically_increasing_sequence(expr)
True
```

False when *expr* is a sequence and the elements in *expr* do not increase monotonically:

```
>>> expr = [9, 8, 7, 6, 5, 4, 3, 2, 1, 0]
>>> sequencetools.is_monotonically_increasing_sequence(expr)
False

>>> expr = [3, 3, 3, 3, 3, 3, 3, 2, 1, 0]
>>> sequencetools.is_monotonically_increasing_sequence(expr)
False
```

True when *expr* is a sequence and *expr* is empty:

```
>>> expr = []
>>> sequencetools.is_monotonically_increasing_sequence(expr)
True
```

False when *expr* is not a sequence:

```
>>> sequencetools.is_monotonically_increasing_sequence(17)
False
```

Return boolean.

sequencetools.is_n_tuple

sequencetools.**is_n_tuple**(*expr*, *n*)

True when *expr* is a tuple of length *n*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.is_n_tuple((19, 20, 21), 3)
True
```

Otherwise false:

```
>>> sequencetools.is_n_tuple((19, 20, 21), 4)
False
```

Return boolean.

sequencetools.is_null_tuple

sequencetools.**is_null_tuple**(*expr*)

New in version 2.9. True when *expr* is a tuple of length 0:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.is_null_tuple(())
True
```

Otherwise false:

```
>>> sequencetools.is_null_tuple((19, 20, 21))
False
```

Return boolean.

sequencetools.is_pair

sequencetools.**is_pair**(*expr*)

New in version 2.9. True when *expr* is a tuple of length 2:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.is_pair((19, 20))
True
```

Otherwise false:

```
>>> sequencetools.is_pair((19, 20, 21))
False
```

Return boolean.

sequencetools.is_permutation

sequencetools.**is_permutation**(*expr*, *length=None*)

New in version 2.0. True when *expr* is a permutation:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.is_permutation([4, 5, 0, 3, 2, 1])
True
```

Otherwise false:

```
>>> sequencetools.is_permutation([1, 1, 5, 3, 2, 1])
False
```

True when *expr* is a permutation of first *length* nonnegative integers:

```
>>> sequencetools.is_permutation([4, 5, 0, 3, 2, 1], length=6)
True
```

Otherwise false:

```
>>> sequencetools.is_permutation([4, 0, 3, 2, 1], length=6)
False
```

Return boolean.

sequencetools.is_repetition_free_sequence

sequencetools.**is_repetition_free_sequence**(*expr*)

New in version 2.0. True when *expr* is a sequence and *expr* is repetition free:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.is_repetition_free_sequence([0, 1, 2, 6, 7, 8])
True
```

False when *expr* is a sequence and *expr* is not repetition free:

```
>>> sequencetools.is_repetition_free_sequence([0, 1, 2, 2, 7, 8])
False
```

True when *expr* is an empty sequence:

```
>>> sequencetools.is_repetition_free_sequence([])
True
```

False *expr* is not a sequence:

```
>>> sequencetools.is_repetition_free_sequence(17)
False
```

Return boolean.

sequencetools.is_restricted_growth_function

sequencetools.**is_restricted_growth_function**(*expr*)

New in version 2.0. True when *expr* is a sequence and *expr* meets the criteria for a restricted growth function:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.is_restricted_growth_function([1, 1, 1, 1])
True
```

```
>>> sequencetools.is_restricted_growth_function([1, 1, 1, 2])
True
```

```
>>> sequencetools.is_restricted_growth_function([1, 1, 2, 1])
True
```

```
>>> sequencetools.is_restricted_growth_function([1, 1, 2, 2])
True
```

Otherwise false:

```
>>> sequencetools.is_restricted_growth_function([1, 1, 1, 3])
False

>>> sequencetools.is_restricted_growth_function(17)
False
```

A restricted growth function is a sequence `l` such that `l[0] == 1` and such that `l[i] <= max(l[:i]) + 1` for `1 <= i <= len(l)`.

Return boolean.

sequencetools.is_singleton

sequencetools.**is_singleton**(*expr*)

New in version 2.9. True when *expr* is a tuple of length `1`:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.is_singleton((19,))
True
```

Otherwise false:

```
abajd> sequencetools.is_singleton((19, 20, 21))
False
```

Return boolean.

sequencetools.is_strictly_decreasing_sequence

sequencetools.**is_strictly_decreasing_sequence**(*expr*)

New in version 2.0. True when *expr* is a sequence and the elements in *expr* decrease strictly:

```
>>> from abjad.tools import sequencetools

>>> expr = [9, 8, 7, 6, 5, 4, 3, 2, 1, 0]
>>> sequencetools.is_strictly_decreasing_sequence(expr)
True
```

False when *expr* is a sequence and the elements in *expr* do not decrease strictly:

```
>>> expr = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
>>> sequencetools.is_strictly_decreasing_sequence(expr)
False

>>> expr = [0, 1, 2, 3, 3, 3, 3, 3, 3, 3]
>>> sequencetools.is_strictly_decreasing_sequence(expr)
False

>>> expr = [3, 3, 3, 3, 3, 3, 3, 3, 3, 3]
>>> sequencetools.is_strictly_decreasing_sequence(expr)
False

>>> expr = [3, 3, 3, 3, 3, 3, 3, 2, 1, 0]
>>> sequencetools.is_strictly_decreasing_sequence(expr)
False
```

True when *expr* is an empty sequence:

```
>>> sequencetools.is_strictly_decreasing_sequence([])
True
```

False *expr* is not a sequence:

```
>>> sequencetools.is_strictly_decreasing_sequence(17)
False
```

Return boolean.

sequencetools.is_strictly_increasing_sequence

sequencetools.**is_strictly_increasing_sequence**(*expr*)

New in version 2.0. True when *expr* is a sequence and the elements in *expr* increase strictly:

```
>>> from abjad.tools import sequencetools

>>> expr = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
>>> sequencetools.is_strictly_increasing_sequence(expr)
True
```

False when *expr* is a sequence and the elements in *expr* do not increase strictly:

```
>>> expr = [9, 8, 7, 6, 5, 4, 3, 2, 1, 0]
>>> sequencetools.is_strictly_increasing_sequence(expr)
False

>>> expr = [3, 3, 3, 3, 3, 3, 3, 2, 1, 0]
>>> sequencetools.is_strictly_increasing_sequence(expr)
False

>>> expr = [3, 3, 3, 3, 3, 3, 3, 3, 3, 3]
>>> sequencetools.is_strictly_increasing_sequence(expr)
False

>>> expr = [0, 1, 2, 3, 3, 3, 3, 3, 3, 3]
>>> sequencetools.is_strictly_increasing_sequence(expr)
False
```

True when *expr* is an empty sequence:

```
>>> sequencetools.is_strictly_increasing_sequence([])
True
```

False when *expr* is not a sequence:

```
>>> sequencetools.is_strictly_increasing_sequence(17)
False
```

Return boolean.

sequencetools.iterate_sequence_cyclically

sequencetools.**iterate_sequence_cyclically**(*sequence*, *step=1*, *start=0*, *length='inf'*)

New in version 1.1. Iterate *sequence* cyclically according to *step*, *start* and *length*:

```
>>> from abjad.tools import sequencetools

>>> sequence = [1, 2, 3, 4, 5, 6, 7]

>>> list(sequencetools.iterate_sequence_cyclically(sequence, length=20))
[1, 2, 3, 4, 5, 6, 7, 1, 2, 3, 4, 5, 6, 7, 1, 2, 3, 4, 5, 6]

>>> list(sequencetools.iterate_sequence_cyclically(sequence, 2, length=20))
[1, 3, 5, 7, 2, 4, 6, 1, 3, 5, 7, 2, 4, 6, 1, 3, 5, 7, 2, 4]

>>> list(sequencetools.iterate_sequence_cyclically(sequence, 2, 3, length=20))
[4, 6, 1, 3, 5, 7, 2, 4, 6, 1, 3, 5, 7, 2, 4, 6, 1, 3, 5, 7]

>>> list(sequencetools.iterate_sequence_cyclically(sequence, -2, 5, length=20))
[6, 4, 2, 7, 5, 3, 1, 6, 4, 2, 7, 5, 3, 1, 6, 4, 2, 7, 5, 3]
```

Changed in version 2.0: allows generator input.

```
>>> list(sequencetools.iterate_sequence_cyclically(xrange(1, 8), -2, 5, length=20))
[6, 4, 2, 7, 5, 3, 1, 6, 4, 2, 7, 5, 3, 1, 6, 4, 2, 7, 5, 3]
```

Set *step* to jump size and direction across sequence.

Set *start* to the index of *sequence* where the function begins iterating.

Set *length* to number of elements to return. Set to `'inf'` to return infinitely.

Return generator. Changed in version 2.0: renamed `sequencetools.phasor()` to `sequencetools.iterate_sequence_cyclically()`.

sequencetools.iterate_sequence_cyclically_from_start_to_stop

`sequencetools.`**`iterate_sequence_cyclically_from_start_to_stop`**(*sequence*, *start*, *stop*)

New in version 1.1. Iterate *sequence* cyclically from *start* to *stop*:

```
>>> from abjad.tools import sequencetools

>>> list(sequencetools.iterate_sequence_cyclically_from_start_to_stop(range(20), 18, 10))
[18, 19, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```

Return generator of references to *sequence* elements. Changed in version 2.0: renamed `sequencetools.get_cyclic()` to `sequencetools.iterate_sequence_cyclically_from_start_to_st`

sequencetools.iterate_sequence_forward_and_backward_nonoverlapping

`sequencetools.`**`iterate_sequence_forward_and_backward_nonoverlapping`**(*sequence*)

New in version 2.0. Iterate *sequence* first forward and then backward, with first and last elements repeated:

```
>>> list(sequencetools.iterate_sequence_forward_and_backward_nonoverlapping(
...     [1, 2, 3, 4, 5]))
[1, 2, 3, 4, 5, 5, 4, 3, 2, 1]
```

Return generator.

sequencetools.iterate_sequence_forward_and_backward_overlapping

sequencetools.**iterate_sequence_forward_and_backward_overlapping**(*sequence*)

New in version 2.0. Iterate *sequence* first forward and then backward, with first and last elements appearing only once:

```
>>> from abjad.tools import sequencetools

>>> list(sequencetools.iterate_sequence_forward_and_backward_overlapping([1, 2, 3, 4, 5]))
[1, 2, 3, 4, 5, 4, 3, 2]
```

Return generator.

sequencetools.iterate_sequence_nwise_cyclic

sequencetools.**iterate_sequence_nwise_cyclic**(*sequence*, *n*)

New in version 2.0. Iterate elements in *sequence* cyclically *n* at a time:

```
>>> from abjad.tools import sequencetools

>>> g = sequencetools.iterate_sequence_nwise_cyclic(range(6), 3)
>>> for n in range(10):
...   print g.next()
(0, 1, 2)
(1, 2, 3)
(2, 3, 4)
(3, 4, 5)
(4, 5, 0)
(5, 0, 1)
(0, 1, 2)
(1, 2, 3)
(2, 3, 4)
(3, 4, 5)
```

Return generator.

sequencetools.iterate_sequence_nwise_strict

sequencetools.**iterate_sequence_nwise_strict**(*sequence*, *n*)

New in version 2.0. Iterate elements in *sequence* *n* at a time:

```
>>> for x in sequencetools.iterate_sequence_nwise_strict(range(10), 4):
...     x
...
(0, 1, 2, 3)
(1, 2, 3, 4)
(2, 3, 4, 5)
(3, 4, 5, 6)
(4, 5, 6, 7)
(5, 6, 7, 8)
(6, 7, 8, 9)
```

Return generator.

sequencetools.iterate_sequence_nwise_wrapped

sequencetools.**iterate_sequence_nwise_wrapped**(*sequence*, *n*)

New in version 2.0. Iterate elements in *sequence n* at a time wrapped to beginning:

```
>>> from abjad.tools import sequencetools

>>> list(sequencetools.iterate_sequence_nwise_wrapped(range(6), 3))
[(0, 1, 2), (1, 2, 3), (2, 3, 4), (3, 4, 5), (4, 5, 0), (5, 0, 1)]
```

Return generator.

sequencetools.iterate_sequence_pairwise_cyclic

sequencetools.**iterate_sequence_pairwise_cyclic**(*sequence*)

New in version 1.1. Iterate *sequence* pairwise cyclic:

```
>>> from abjad.tools import sequencetools

>>> generator = sequencetools.iterate_sequence_pairwise_cyclic(range(6))

>>> generator.next()
(0, 1)
>>> generator.next()
(1, 2)
>>> generator.next()
(2, 3)
>>> generator.next()
(3, 4)
>>> generator.next()
(4, 5)
>>> generator.next()
(5, 0)
>>> generator.next()
(0, 1)
>>> generator.next()
(1, 2)
```

Return pair generator.

sequencetools.iterate_sequence_pairwise_strict

sequencetools.**iterate_sequence_pairwise_strict**(*sequence*)

New in version 1.1. Iterate *sequence* pairwise strict:

```
>>> from abjad.tools import sequencetools

>>> list(sequencetools.iterate_sequence_pairwise_strict(range(6)))
[(0, 1), (1, 2), (2, 3), (3, 4), (4, 5)]
```

Return pair generator.

sequencetools.iterate_sequence_pairwise_wrapped

sequencetools.**iterate_sequence_pairwise_wrapped**(*sequence*)

New in version 1.1. Iterate *sequence* pairwise wrapped:

```
>>> from abjad.tools import sequencetools

>>> list(sequencetools.iterate_sequence_pairwise_wrapped(range(6)))
[(0, 1), (1, 2), (2, 3), (3, 4), (4, 5), (5, 0)]
```

Return pair generator.

sequencetools.join_subsequences

sequencetools.**join_subsequences**(*sequence*)

New in version 2.4. Join subsequences in *sequence*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.join_subsequences([(1, 2, 3), (), (4, 5), (), (6,)])
(1, 2, 3, 4, 5, 6)
```

Return newly constructed object of subsequence type.

sequencetools.join_subsequences_by_sign_of_subsequence_elements

sequencetools.**join_subsequences_by_sign_of_subsequence_elements**(*sequence*)

New in version 1.1. Join subsequences in *sequence* by sign:

```
>>> from abjad.tools import sequencetools

>>> sequence = [[1, 2], [3, 4], [-5, -6, -7], [-8, -9, -10], [11, 12]]
>>> sequencetools.join_subsequences_by_sign_of_subsequence_elements(sequence)
[[1, 2, 3, 4], [-5, -6, -7, -8, -9, -10], [11, 12]]

>>> sequence = [[1, 2], [], [], [3, 4, 5], [6, 7]]
>>> sequencetools.join_subsequences_by_sign_of_subsequence_elements(sequence)
[[1, 2], [], [3, 4, 5, 6, 7]]
```

Return newly constructed list. Changed in version 2.0: renamed `sequencetools.join_sublists_by_sign()` to `sequencetools.join_subsequences_by_sign_of_subs`

sequencetools.map_sequence_elements_to_canonic_tuples

sequencetools.**map_sequence_elements_to_canonic_tuples**(*sequence*, *big_endian=True*)

New in version 1.1. Partition *sequence* elements into canonic big-endian parts:

```
>>> sequencetools.map_sequence_elements_to_canonic_tuples(
...     range(10))
[(0,), (1,), (2,), (3,), (4,), (4, 1), (6,), (7,), (8,), (8, 1)]
```

Partition *sequence* elements into canonic little-endian parts:

```
>>> sequencetools.map_sequence_elements_to_canonic_tuples(
...     range(10), big_endian=False)
[(0,), (1,), (2,), (3,), (4,), (1, 4), (6,), (7,), (8,), (1, 8)]
```

Raise type error when *sequence* is not a list.

Raise value error on noninteger elements in *sequence*.

Return list of tuples. Changed in version 2.0: renamed `sequencetools.partition_elements_into_canonic_parts` to `sequencetools.map_sequence_elements_to_canonic_tuples()`.

sequencetools.map_sequence_elements_to_numbered_sublists

`sequencetools.`**`map_sequence_elements_to_numbered_sublists`**(*sequence*)

New in version 1.1. Map *sequence* elements to numbered sublists:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.map_sequence_elements_to_numbered_sublists([1, 2, -3, -4, 5])
[[1], [2, 3], [-4, -5, -6], [-7, -8, -9, -10], [11, 12, 13, 14, 15]]
```

```
>>> sequencetools.map_sequence_elements_to_numbered_sublists([1, 0, -3, -4, 5])
[[1], [], [-2, -3, -4], [-5, -6, -7, -8], [9, 10, 11, 12, 13]]
```

Note that numbering starts at `1`.

Return newly constructed list of lists. Changed in version 2.0: renamed `sequencetools.lengths_to_counts()` to `sequencetools.map_sequence_elements_to_numbered_sub`

sequencetools.merge_duration_sequences

`sequencetools.`**`merge_duration_sequences`**(**sequences*)

Merge duration *sequences*:

```
>>> sequencetools.merge_duration_sequences([10, 10, 10], [7])
[7, 3, 10, 10]
```

Merge more duration sequences:

```
>>> sequencetools.merge_duration_sequences([10, 10, 10], [10, 10])
[10, 10, 10]
```

The idea is that each sequence element represents a duration.

Return list.

sequencetools.negate_absolute_value_of_sequence_elements_at_indices

`sequencetools.`**`negate_absolute_value_of_sequence_elements_at_indices`**(*sequence*, *indices*)

New in version 1.1. Negate the absolute value of *sequence* elements at *indices*:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequence = [1, 2, 3, 4, 5, -6, -7, -8, -9, -10]
```

```
>>> sequencetools.negate_sequence_elements_at_indices(sequence, [0, 1, 2])
[-1, -2, -3, 4, 5, -6, -7, -8, -9, -10]
```

Return newly constructed list. Changed in version 2.0: renamed `sequencetools.negate_elements_at_indices_absolutely()` to `sequencetools.negate_absolute_value_of_sequence_elements_at_indices()`.

sequencetools.negate_absolute_value_of_sequence_elements_cyclically

sequencetools.**negate_absolute_value_of_sequence_elements_cyclically**(*sequence*, *indices*, *period*)

New in version 2.0. Negate the absolute value of *sequence* elements at *indices* cyclically according to *period*:

```
>>> sequence = [1, 2, 3, 4, 5, -6, -7, -8, -9, -10]

>>> sequencetools.negate_absolute_value_of_sequence_elements_cyclically(
...     sequence, [0, 1, 2], 5)
[-1, -2, -3, 4, 5, -6, -7, -8, -9, -10]
```

Return newly constructed list.

sequencetools.negate_sequence_elements_at_indices

sequencetools.**negate_sequence_elements_at_indices**(*sequence*, *indices*)

New in version 1.1. Negate *sequence* elements at *indices*:

```
>>> from abjad.tools import sequencetools

>>> sequence = [1, 2, 3, 4, 5, -6, -7, -8, -9, -10]

>>> sequencetools.negate_sequence_elements_at_indices(sequence, [0, 1, 2])
[-1, -2, -3, 4, 5, -6, -7, -8, -9, -10]
```

Return newly constructed list. Changed in version 2.0: renamed `sequencetools.negate_elements_at_indices()` to `sequencetools.negate_sequence_elements_at_`

sequencetools.negate_sequence_elements_cyclically

sequencetools.**negate_sequence_elements_cyclically**(*sequence*, *indices*, *period*)

New in version 2.0. Negate *sequence* elements at *indices* cyclically according to *period*:

```
>>> from abjad.tools import sequencetools

>>> sequence = [1, 2, 3, 4, 5, -6, -7, -8, -9, -10]

>>> sequencetools.negate_sequence_elements_cyclically(sequence, [0, 1, 2], 5)
[-1, -2, -3, 4, 5, 6, 7, 8, -9, -10]
```

Return newly constructed list.

sequencetools.overwrite_sequence_elements_at_indices

sequencetools.**overwrite_sequence_elements_at_indices**(*sequence*, *pairs*)

New in version 1.1. Overwrite *sequence* elements at indices according to *pairs*:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.overwrite_sequence_elements_at_indices(range(10), [(0, 3), (5, 3)])
[0, 0, 0, 3, 4, 5, 5, 5, 8, 9]
```

Set *pairs* to a list of `(anchor_index, length)` pairs.

Return new list. Changed in version 2.0: renamed `sequencetools.overwrite_slices_at()` to `sequencetools.overwrite_sequence_elements_at_indices()`.

sequencetools.pair_duration_sequence_elements_with_input_pair_values

sequencetools.**pair_duration_sequence_elements_with_input_pair_values**(*duration_sequence*, *input_pairs*)

New in version 2.10. Pair *duration_sequence* elements with the values of *input_pairs*:

```
>>> duration_sequence = [10, 10, 10, 10]
>>> input_pairs = [('red', 1), ('orange', 18), ('yellow', 200)]
```

```
>>> sequencetools.pair_duration_sequence_elements_with_input_pair_values(
... duration_sequence, input_pairs)
[(10, 'red'), (10, 'orange'), (10, 'yellow'), (10, 'yellow')]
```

Return a list of `(element, value)` output pairs.

The *input_pairs* argument must be a list of `(value, duration)` pairs.

The basic idea behind the function is model which input pair value is in effect at the start of each element in *duration_sequence*.

sequencetools.partition_sequence_by_backgrounded_weights

sequencetools.**partition_sequence_by_backgrounded_weights**(*sequence*, *weights*)

New in version 2.9. Partition *sequence* by backgrounded *weights*:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.partition_sequence_by_backgrounded_weights(
...     [-5, -15, -10], [20, 10])
[[-5, -15], [-10]]
```

Further examples:

```
>>> sequencetools.partition_sequence_by_backgrounded_weights(
...     [-5, -15, -10], [5, 5, 5, 5, 5, 5])
[[-5], [-15], [], [], [-10], []]
```

```
>>> sequencetools.partition_sequence_by_backgrounded_weights(
...     [-5, -15, -10], [1, 29])
[[-5], [-15, -10]]
```

```
>>> sequencetools.partition_sequence_by_backgrounded_weights(
...     [-5, -15, -10], [2, 28])
[[-5], [-15, -10]]

>>> sequencetools.partition_sequence_by_backgrounded_weights(
...     [-5, -15, -10], [1, 1, 1, 1, 1, 25])
[[-5], [], [], [], [], [-15, -10]]
```

The term *backgrounded* is a short-hand concocted specifically for this function; rely on the formal definition to understand the function actually does.

Input constraint: the weight of *sequence* must equal the weight of *weights* exactly.

The signs of the elements in *sequence* are ignored.

Formal definition: partition *sequence* into *parts* such that (1.) the length of *parts* equals the length of *weights*; (2.) the elements in *sequence* appear in order in *parts*; and (3.) some final condition that is difficult to formalize.

Notionally what's going on here is that the elements of *weights* are acting as a list of successive time intervals into which the elements of *sequence* are being fit in accordance with the start offset of each *sequence* element.

The function models the grouping together of successive timespans according to which of an underlying sequence of time intervals it is in which each time span begins.

Note that, for any input to this function, the flattened output of this function always equals *sequence* exactly.

Note too that while *partition* is being used here in the sense of the other partitioning functions in the API, the distinguishing feature is this funciton is its ability to produce empty lists as output.

Return list of *sequence* objects.

sequencetools.partition_sequence_by_counts

sequencetools.**partition_sequence_by_counts**(*sequence*, *counts*, *cyclic=False*, *overhang=False*, *copy_elements=False*)

New in version 1.1. Example 1a. Partition sequence once by counts without overhang:

```
>>> sequencetools.partition_sequence_by_counts(
...     range(10), [3], cyclic=False, overhang=False)
[[0, 1, 2]]
```

Example 1b. Partition sequence once by counts without overhang:

```
>>> sequencetools.partition_sequence_by_counts(
...     range(16), [4, 3], cyclic=False, overhang=False)
[[0, 1, 2, 3], [4, 5, 6]]
```

Example 2a. Partition sequence cyclically by counts without overhang:

```
>>> sequencetools.partition_sequence_by_counts(
...     range(10), [3], cyclic=True, overhang=False)
[[0, 1, 2], [3, 4, 5], [6, 7, 8]]
```

Example 2b. Partition sequence cyclically by counts without overhang:

```
>>> sequencetools.partition_sequence_by_counts(
...     range(16), [4, 3], cyclic=True, overhang=False)
[[0, 1, 2, 3], [4, 5, 6], [7, 8, 9, 10], [11, 12, 13]]
```

Example 3a. Partition sequence once by counts with overhang:

```
>>> sequencetools.partition_sequence_by_counts(
...     range(10), [3], cyclic=False, overhang=True)
[[0, 1, 2], [3, 4, 5, 6, 7, 8, 9]]
```

Example 3b. Partition sequence once by counts with overhang:

```
>>> sequencetools.partition_sequence_by_counts(
...     range(16), [4, 3], cyclic=False, overhang=True)
[[0, 1, 2, 3], [4, 5, 6], [7, 8, 9, 10, 11, 12, 13, 14, 15]]
```

Example 4a. Partition sequence cyclically by counts with overhang:

```
>>> sequencetools.partition_sequence_by_counts(
...     range(10), [3], cyclic=True, overhang=True)
[[0, 1, 2], [3, 4, 5], [6, 7, 8], [9]]
```

Example 4b. Partition sequence cyclically by counts with overhang:

```
>>> sequencetools.partition_sequence_by_counts(
...     range(16), [4, 3], cyclic=True, overhang=True)
[[0, 1, 2, 3], [4, 5, 6], [7, 8, 9, 10], [11, 12, 13], [14, 15]]
```

Return list of sequence objects.

sequencetools.partition_sequence_by_ratio_of_lengths

sequencetools.**partition_sequence_by_ratio_of_lengths**(*sequence*, *lengths*)

New in version 2.0. Partition *sequence* by ratio of *lengths*:

```
>>> sequence = tuple(range(10))
```

```
>>> sequencetools.partition_sequence_by_ratio_of_lengths(sequence, [1, 1, 2])
[(0, 1, 2), (3, 4), (5, 6, 7, 8, 9)]
```

Use rounding magic to avoid fractional part lengths.

Return list of *sequence* objects.

sequencetools.partition_sequence_by_ratio_of_weights

sequencetools.**partition_sequence_by_ratio_of_weights**(*sequence*, *weights*)

New in version 2.0. Partition *sequence* by ratio of *weights*:

```
>>> sequencetools.partition_sequence_by_ratio_of_weights([1] * 10, [1, 1, 1])
[[1, 1, 1], [1, 1, 1, 1], [1, 1, 1]]
```

```
>>> sequencetools.partition_sequence_by_ratio_of_weights([1] * 10, [1, 1, 1, 1])
[[1, 1, 1], [1, 1], [1, 1, 1], [1, 1]]
```

```
>>> sequencetools.partition_sequence_by_ratio_of_weights([1] * 10, [2, 2, 3])
[[1, 1, 1], [1, 1, 1], [1, 1, 1, 1]]
```

```
>>> sequencetools.partition_sequence_by_ratio_of_weights([1] * 10, [3, 2, 2])
[[1, 1, 1, 1], [1, 1, 1], [1, 1, 1]]
```

```
>>> sequencetools.partition_sequence_by_ratio_of_weights(
...     [1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2], [1, 1])
[[1, 1, 1, 1, 1, 1, 2, 2], [2, 2, 2, 2]]
```

```
>>> sequencetools.partition_sequence_by_ratio_of_weights(
...     [1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2], [1, 1, 1])
[[1, 1, 1, 1, 1, 1], [2, 2, 2], [2, 2, 2]]
```

Weights of parts of returned list equal *weights_ratio* proportions with some rounding magic.

Return list of lists.

sequencetools.partition_sequence_by_restricted_growth_function

sequencetools.**partition_sequence_by_restricted_growth_function**(*sequence*, *restricted_growth_function*)

New in version 2.0. Partition *sequence* by *restricted_growth_function*:

```
>>> l = range(10)
>>> rgf = [1, 1, 2, 2, 1, 2, 3, 3, 2, 4]

>>> sequencetools.partition_sequence_by_restricted_growth_function(l, rgf)
[[0, 1, 4], [2, 3, 5, 8], [6, 7], [9]]
```

Raise value error when *sequence* length does not equal *restricted_growth_function* length.

Return list of lists.

sequencetools.partition_sequence_by_sign_of_elements

sequencetools.**partition_sequence_by_sign_of_elements**(*sequence, sign=[-1, 0, 1]*)

New in version 1.1. Partition *sequence* elements by sign:

```
>>> sequence = [0, 0, -1, -1, 2, 3, -5, 1, 2, 5, -5, -6]

>>> list(sequencetools.partition_sequence_by_sign_of_elements(sequence))
[[0, 0], [-1, -1], [2, 3], [-5], [1, 2, 5], [-5, -6]]

>>> list(sequencetools.partition_sequence_by_sign_of_elements(sequence, sign=[-1]))
[0, 0, [-1, -1], 2, 3, [-5], 1, 2, 5, [-5, -6]]

>>> list(sequencetools.partition_sequence_by_sign_of_elements(sequence, sign=[0]))
[[0, 0], -1, -1, 2, 3, -5, 1, 2, 5, -5, -6]

>>> list(sequencetools.partition_sequence_by_sign_of_elements(sequence, sign=[1]))
[0, 0, -1, -1, [2, 3], -5, [1, 2, 5], -5, -6]

>>> list(sequencetools.partition_sequence_by_sign_of_elements(sequence, sign=[-1, 0]))
[[0, 0], [-1, -1], 2, 3, [-5], 1, 2, 5, [-5, -6]]

>>> list(sequencetools.partition_sequence_by_sign_of_elements(sequence, sign=[-1, 1]))
[0, 0, [-1, -1], [2, 3], [-5], [1, 2, 5], [-5, -6]]

>>> list(sequencetools.partition_sequence_by_sign_of_elements(sequence, sign=[0, 1]))
[[0, 0], -1, -1, [2, 3], -5, [1, 2, 5], -5, -6]

>>> list(sequencetools.partition_sequence_by_sign_of_elements(sequence, sign=[-1, 0, 1]))
[[0, 0], [-1, -1], [2, 3], [-5], [1, 2, 5], [-5, -6]]
```

When `-1` in `sign`, group negative elements.

When `0` in `sign`, group `0` elements.

When `1` in `sign`, group positive elements.

Return list of tuples of *sequence* element references. Changed in version 2.0: renamed `listtools.group_by_sign()` to `sequencetools.partition_sequence_by_sign_of_elements()`.

sequencetools.partition_sequence_by_value_of_elements

`sequencetools.`**`partition_sequence_by_value_of_elements`**(*sequence*)

New in version 1.1. Group *sequence* elements by value of elements:

```
>>> sequence = [0, 0, -1, -1, 2, 3, -5, 1, 1, 5, -5]
```

```
>>> sequencetools.partition_sequence_by_value_of_elements(sequence)
[(0, 0), (-1, -1), (2,), (3,), (-5,), (1, 1), (5,), (-5,)]
```

Return list of tuples of *sequence* element references. Changed in version 2.0: renamed `sequencetools.group_by_equality()` to `sequencetools.partition_sequence_by_value_of_elements()`.

sequencetools.partition_sequence_by_weights_at_least

`sequencetools.`**`partition_sequence_by_weights_at_least`**(*sequence*, *weights*, *cyclic=False*, *overhang=False*)

New in version 1.1. Partition *sequence* by *weights* at least.

```
>>> sequence = [3, 3, 3, 3, 4, 4, 4, 4, 5, 5]
```

Example 1. Partition sequence once by weights at least without overhang:

```
>>> sequencetools.partition_sequence_by_weights_at_least(
...     sequence, [10, 4], cyclic=False, overhang=False)
[[3, 3, 3, 3], [4]]
```

Example 2. Partition sequence once by weights at least with overhang:

```
>>> sequencetools.partition_sequence_by_weights_at_least(
...     sequence, [10, 4], cyclic=False, overhang=True)
[[3, 3, 3, 3], [4], [4, 4, 4, 5, 5]]
```

Example 3. Partition sequence cyclically by weights at least without overhang:

```
>>> sequencetools.partition_sequence_by_weights_at_least(
...     sequence, [10, 4], cyclic=True, overhang=False)
[[3, 3, 3, 3], [4], [4, 4, 4], [5]]
```

Example 4. Partition sequence cyclically by weights at least with overhang:

```
>>> sequencetools.partition_sequence_by_weights_at_least(
...     sequence, [10, 4], cyclic=True, overhang=True)
[[3, 3, 3, 3], [4], [4, 4, 4], [5], [5]]
```

Return list of sequence objects.

sequencetools.partition_sequence_by_weights_at_most

sequencetools.**partition_sequence_by_weights_at_most**(*sequence*, *weights*, *cyclic=False*, *overhang=False*)

New in version 1.1. Partition *sequence* by *weights* at most.

```
>>> sequence = [3, 3, 3, 3, 4, 4, 4, 4, 5, 5]
```

Example 1. Partition sequence once by weights at most without overhang:

```
>>> sequencetools.partition_sequence_by_weights_at_most(
...     sequence, [10, 4], cyclic=False, overhang=False)
[[3, 3, 3], [3]]
```

Example 2. Partition sequence once by weights at most with overhang:

```
>>> sequencetools.partition_sequence_by_weights_at_most(
...     sequence, [10, 4], cyclic=False, overhang=True)
[[3, 3, 3], [3], [4, 4, 4, 4, 5, 5]]
```

Example 3. Partition sequence cyclically by weights at most without overhang:

```
>>> sequencetools.partition_sequence_by_weights_at_most(
...     sequence, [10, 5], cyclic=True, overhang=False)
[[3, 3, 3], [3], [4, 4], [4], [4, 5], [5]]
```

Example 4. Partition sequence cyclically by weights at most with overhang:

```
>>> sequencetools.partition_sequence_by_weights_at_most(
...     sequence, [10, 5], cyclic=True, overhang=True)
[[3, 3, 3], [3], [4, 4], [4], [4, 5], [5]]
```

Return list of sequence objects.

sequencetools.partition_sequence_by_weights_exactly

sequencetools.**partition_sequence_by_weights_exactly**(*sequence*, *weights*, *cyclic=False*, *overhang=False*)

New in version 1.1. Partition *sequence* by *weights* exactly.

```
>>> sequence = [3, 3, 3, 3, 4, 4, 4, 4, 5]
```

Example 1. Partition sequence once by weights exactly without overhang:

```
>>> sequencetools.partition_sequence_by_weights_exactly(
...     sequence, [3, 9], cyclic=False, overhang=False)
[[3], [3, 3, 3]]
```

Example 2. Partition sequence once by weights exactly with overhang:

```
>>> sequencetools.partition_sequence_by_weights_exactly(
...     sequence, [3, 9], cyclic=False, overhang=True)
[[3], [3, 3, 3], [4, 4, 4, 4, 5]]
```

Example 3. Partition sequence cyclically by weights exactly without overhang:

```
>>> sequencetools.partition_sequence_by_weights_exactly(
...     sequence, [12], cyclic=True, overhang=False)
[[3, 3, 3, 3], [4, 4, 4]]
```

Example 4. Partition sequence cyclically by weights exactly with overhang:

```
>>> sequencetools.partition_sequence_by_weights_exactly(
...     sequence, [12], cyclic=True, overhang=True)
[[3, 3, 3, 3], [4, 4, 4], [4, 5]]
```

Return list sequence objects.

sequencetools.partition_sequence_extended_to_counts

sequencetools.**partition_sequence_extended_to_counts**(*sequence*, *counts*, *overhang=True*)

New in version 2.0. Partition sequence extended to counts.

Example 1. Partition sequence extended to counts with overhang:

```
>>> sequencetools.partition_sequence_extended_to_counts(
...     [1, 2, 3, 4], [6, 6, 6], overhang=True)
[[1, 2, 3, 4, 1, 2], [3, 4, 1, 2, 3, 4], [1, 2, 3, 4, 1, 2], [3, 4]]
```

Example 2. Partition sequence extended to coutns without overhang:

```
>>> sequencetools.partition_sequence_extended_to_counts(
...     [1, 2, 3, 4], [6, 6, 6], overhang=False)
[[1, 2, 3, 4, 1, 2], [3, 4, 1, 2, 3, 4], [1, 2, 3, 4, 1, 2]]
```

Return sequence of sequence objects.

sequencetools.permute_sequence

sequencetools.**permute_sequence**(*sequence*, *permutation*)

New in version 2.0. Permute *sequence* by *permutation*:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.permute_sequence([10, 11, 12, 13, 14, 15], [5, 4, 0, 1, 2, 3])
[15, 14, 10, 11, 12, 13]
```

Return newly constructed *sequence* object.

sequencetools.remove_sequence_elements_at_indices

sequencetools.**remove_sequence_elements_at_indices**(*sequence*, *indices*)

New in version 2.0. Remove *sequence* elements at *indices*:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.remove_sequence_elements_at_indices(range(20), [1, 16, 17, 18])
[0, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19]
```

Ignore negative indices.

Return list.

sequencetools.remove_sequence_elements_at_indices_cyclically

sequencetools.**remove_sequence_elements_at_indices_cyclically**(*sequence*, *indices*, *period*, *offset=0*)

New in version 2.0. Remove *sequence* elements at *indices* mod *period* plus *offset*:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.remove_sequence_elements_at_indices_cyclically(range(20), [0, 1], 5, 3)
[0, 1, 2, 5, 6, 7, 10, 11, 12, 15, 16, 17]
```

Ignore negative indices.

Return list.

sequencetools.remove_subsequence_of_weight_at_index

sequencetools.**remove_subsequence_of_weight_at_index**(*sequence*, *weight*, *index*)

New in version 1.1. Remove subsequence of *weight* at *index*:

```
>>> sequence = (1, 1, 2, 3, 5, 5, 1, 2, 5, 5, 6)
```

```
>>> sequencetools.remove_subsequence_of_weight_at_index(sequence, 13, 4)
(1, 1, 2, 3, 5, 5, 6)
```

Return newly constructed *sequence* object. Changed in version 2.0: renamed `listtools.remove_weighted_subrun_at()` to `sequencetools.remove_subsequence_of_weight_at_i`

sequencetools.repeat_runs_in_sequence_to_count

sequencetools.**repeat_runs_in_sequence_to_count**(*sequence*, *indicators*)

New in version 1.1. Repeat subruns in *sequence* according to *indicators*. The *indicators* input parameter must be a list of zero or more `(start, length, count)` triples. For every `(start, length, count)` indicator in *indicators*, the function copies `sequence[start:start+length]` and inserts `count` new copies of `sequence[start:start+length]` immediately after `sequence[start:start+length]` in *sequence*.

The function reads the value of `count` in every `(start, length, count)` triple not as the total number of occurrences of `sequence[start:start+length]` to appear in *sequence* after execution, but rather as the number of new occurrences of `sequence[start:start+length]` to appear in *sequence* after execution.

The function wraps newly created subruns in tuples. That is, this function returns output with one more level of nesting than given in input.

To insert `10` count of `sequence[:2]` at `sequence[2:2]`:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.repeat_runs_in_sequence_to_count(range(20), [(0, 2, 10)])
[0, 1, (0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1),
2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]
```

To insert `5` count of `sequence[10:12]` at `sequence[12:12]` and then insert `5` count of `sequence[:2]` at `sequence[2:2]`:

```
>>> sequence = range(20)

>>> sequencetools.repeat_runs_in_sequence_to_count(sequence, [(0, 2, 5), (10, 2, 5)])
[0, 1, (0, 1, 0, 1, 0, 1, 0, 1, 0, 1), 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,
(10, 11, 10, 11, 10, 11, 10, 11, 10, 11), 12, 13, 14, 15, 16, 17, 18, 19]
```

Note: This function wraps around the end of *sequence* whenever `len(sequence) < start + length`.

To insert 2 count of `[18, 19, 0, 1]` at `sequence[2:2]`:

```
>>> sequencetools.repeat_runs_in_sequence_to_count(sequence, [(18, 4, 2)])
[0, 1, (18, 19, 0, 1, 18, 19, 0, 1), 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13,
14, 15, 16, 17, 18, 19]
```

To insert 2 count of `[18, 19, 0, 1, 2, 3, 4]` at `sequence[4:4]`:

```
>>> sequencetools.repeat_runs_in_sequence_to_count(sequence, [(18, 8, 2)])
[0, 1, 2, 3, 4, 5, (18, 19, 0, 1, 2, 3, 4, 5, 18, 19, 0, 1, 2, 3, 4, 5), 6, 7, 8, 9,
10, 11, 12, 13, 14, 15, 16, 17, 18, 19]
```

Todo

Implement an optional *wrap* keyword to specify whether this function should wrap around the ened of *sequence* whenever `len(sequence) < start + length` or not.

Todo

Reimplement this function to return a generator.

Generalizations of this function would include functions to repeat subruns in *sequence* to not only a certain count, as implemented here, but to a certain length, weight or sum. That is, `sequencetools.repeat_subruns_to_length()`, `sequencetools.repeat_subruns_to_weight()` and `sequencetools.repeat_subruns_to_sum()`. Changed in version 2.0: renamed `sequencetools.repeat_subruns_to_count()` to `sequencetools.repeat_runs_in_sequence_to_count()`.

sequencetools.repeat_sequence_elements_at_indices

`sequencetools.`**`repeat_sequence_elements_at_indices`**(*sequence*, *indices*, *total*)

New in version 2.0. Repeat *sequence* elements at *indices* to *total* length:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.repeat_sequence_elements_at_indices(range(10), [6, 7, 8], 3)
[0, 1, 2, 3, 4, 5, [6, 6, 6], [7, 7, 7], [8, 8, 8], 9]
```

Return list.

sequencetools.repeat_sequence_elements_at_indices_cyclically

`sequencetools.`**`repeat_sequence_elements_at_indices_cyclically`**(*sequence*, *cycle_token*, *total*)

New in version 2.0. Repeat *sequence* elements at indices specified by *cycle_token* to *total* length:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.repeat_sequence_elements_at_indices_cyclically(range(10), (5, [1, 2]), 3)
[0, [1, 1, 1], [2, 2, 2], 3, 4, 5, [6, 6, 6], [7, 7, 7], 8, 9]
```

The *cycle_token* may be a sieve:

```
>>> from abjad.tools import sievetools

>>> sieve = sievetools.cycle_tokens_to_sieve((5, [1, 2]))
>>> sequencetools.repeat_sequence_elements_at_indices_cyclically(range(10), sieve, 3)
[0, [1, 1, 1], [2, 2, 2], 3, 4, 5, [6, 6, 6], [7, 7, 7], 8, 9]
```

Return list.

sequencetools.repeat_sequence_elements_n_times_each

sequencetools.**repeat_sequence_elements_n_times_each**(*sequence*, *n*)

New in version 1.1. Repeat *sequence* elements *n* times each:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.repeat_sequence_elements_n_times_each((1, -1, 2, -3, 5, -5, 6), 2)
(1, 1, -1, -1, 2, 2, -3, -3, 5, 5, -5, -5, 6, 6)
```

Return newly constructed *sequence* object with copied *sequence* elements. Changed in version 2.0: renamed `listtools.repeat_elements_to_count()` to `sequencetools.repeat_sequence_elements_n_times_each()`.

sequencetools.repeat_sequence_n_times

sequencetools.**repeat_sequence_n_times**(*sequence*, *n*)

New in version 2.0. Repeat *sequence n* times:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.repeat_sequence_n_times((1, 2, 3, 4, 5), 3)
(1, 2, 3, 4, 5, 1, 2, 3, 4, 5, 1, 2, 3, 4, 5)
```

Repeat *sequence* `0` times:

```
>>> sequencetools.repeat_sequence_n_times((1, 2, 3, 4, 5), 0)
()
```

Return newly constructed *sequence* object of copied *sequence* elements.

sequencetools.repeat_sequence_to_length

sequencetools.**repeat_sequence_to_length**(*sequence*, *length*, *start=0*)

New in version 1.1. Repeat *sequence* to nonnegative integer *length*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.repeat_sequence_to_length(range(5), 11)
[0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0]
```

Repeat *sequence* to nonnegative integer *length* from *start*:

```
>>> sequencetools.repeat_sequence_to_length(range(5), 11, start=2)
[2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2]
```

Return newly constructed *sequence* object. Changed in version 2.0: renamed `listtools.repeat_list_to_length()` to `sequencetools.repeat_sequence_to_length()`.

sequencetools.repeat_sequence_to_weight_at_least

sequencetools.**repeat_sequence_to_weight_at_least**(*sequence*, *weight*)

New in version 1.1. Repeat *sequence* to *weight* at least:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.repeat_sequence_to_weight_at_least((5, -5, -5), 23)
(5, -5, -5, 5, -5)
```

Return newly constructed *sequence* object.

sequencetools.repeat_sequence_to_weight_at_most

sequencetools.**repeat_sequence_to_weight_at_most**(*sequence*, *weight*)

New in version 1.1. Repeat *sequence* to *weight* at most:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.repeat_sequence_to_weight_at_most((5, -5, -5), 23)
(5, -5, -5, 5)
```

Return newly constructed *sequence* object.

sequencetools.repeat_sequence_to_weight_exactly

sequencetools.**repeat_sequence_to_weight_exactly**(*sequence*, *weight*)

New in version 1.1. Repeat *sequence* to *weight* exactly:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.repeat_sequence_to_weight_exactly((5, -5, -5), 23)
(5, -5, -5, 5, -3)
```

Return newly constructed *sequence* object.

sequencetools.replace_sequence_elements_cyclically_with_new_material

sequencetools.**replace_sequence_elements_cyclically_with_new_material**(*sequence*, *indices*, *new_material*)

New in version 1.1. Replace *sequence* elements cyclically at *indices* with *new_material*:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequencetools.replace_sequence_elements_cyclically_with_new_material(
... range(20), ([0], 2), (['A', 'B'], 3))
['A', 1, 'B', 3, 4, 5, 'A', 7, 'B', 9, 10, 11, 'A', 13, 'B', 15, 16, 17, 'A', 19]

>>> sequencetools.replace_sequence_elements_cyclically_with_new_material(
... range(20), ([0], 2), (['*'], 1))
['*', 1, '*', 3, '*', 5, '*', 7, '*', 9, '*', 11, '*', 13, '*', 15, '*', 17, '*', 19]

>>> sequencetools.replace_sequence_elements_cyclically_with_new_material(
... range(20), ([0], 2), (['A', 'B', 'C', 'D'], None))
['A', 1, 'B', 3, 'C', 5, 'D', 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]

>>> sequencetools.replace_sequence_elements_cyclically_with_new_material(
... range(20), ([0, 1, 8, 13], None), (['A', 'B', 'C', 'D'], None))
['A', 'B', 2, 3, 4, 5, 6, 7, 'C', 9, 10, 11, 12, 'D', 14, 15, 16, 17, 18, 19]
```

Raise type error when *sequence* not a list.

Return newly constructed list. Changed in version 2.0: renamed `sequencetools.replace_elements_cyclic()` to `sequencetools.replace_sequence_elements_cyclic`

sequencetools.retain_sequence_elements_at_indices

`sequencetools.`**`retain_sequence_elements_at_indices`**(*sequence*, *indices*)

New in version 2.0. Retain *sequence* elements at *indices*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.retain_sequence_elements_at_indices(range(20), [1, 16, 17, 18])
[1, 16, 17, 18]
```

Return sequence elements in the order they appear in *sequence*.

Ignore negative indices.

Return list.

sequencetools.retain_sequence_elements_at_indices_cyclically

`sequencetools.`**`retain_sequence_elements_at_indices_cyclically`**(*sequence*, *indices*, *period*, *offset=0*)

New in version 2.0. Retain *sequence* elements at *indices* mod *period* plus *offset*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.retain_sequence_elements_at_indices_cyclically(range(20), [0, 1], 5, 3)
[3, 4, 8, 9, 13, 14, 18, 19]
```

Ignore negative values in *indices*.

Return list.

sequencetools.reverse_sequence

`sequencetools.`**`reverse_sequence`**(*sequence*)

New in version 2.0. Reverse *sequence*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.reverse_sequence((1, 2, 3, 4, 5))
(5, 4, 3, 2, 1)
```

Return new *sequence* object.

sequencetools.reverse_sequence_elements

sequencetools.**reverse_sequence_elements**(*sequence*)

New in version 2.0. Reverse *sequence* elements:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.reverse_sequence_elements([1, (2, 3, 4), 5, (6, 7)])
[1, (4, 3, 2), 5, (7, 6)]
```

Return new *sequence* object.

sequencetools.rotate_sequence

sequencetools.**rotate_sequence**(*sequence*, *n*)

New in version 1.1. Rotate *sequence* to the right:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.rotate_sequence(range(10), 4)
[6, 7, 8, 9, 0, 1, 2, 3, 4, 5]
```

Rotate *sequence* to the left:

```
>>> sequencetools.rotate_sequence(range(10), -3)
[3, 4, 5, 6, 7, 8, 9, 0, 1, 2]
```

Rotate *sequence* neither to the right nor the left:

```
>>> sequencetools.rotate_sequence(range(10), 0)
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```

Return newly created *sequence* object. Changed in version 2.0: renamed `sequencetools.rotate()` to `sequencetools.rotate_sequence()`.

sequencetools.splice_new_elements_between_sequence_elements

sequencetools.**splice_new_elements_between_sequence_elements**(*sequence*, *new_elements*, *overhang=(0, 0)*)

New in version 1.1. Splice copies of *new_elements* between each of the elements of *sequence*:

```
>>> from abjad.tools import sequencetools

>>> sequence = [0, 1, 2, 3, 4]
>>> new_elements = ['A', 'B']
```

```
>>> sequencetools.splice_new_elements_between_sequence_elements(sequence, new_elements)
[0, 'A', 'B', 1, 'A', 'B', 2, 'A', 'B', 3, 'A', 'B', 4]
```

Splice copies of *new_elements* between each of the elements of *sequence* and after the last element of *sequence*:

```
>>> sequencetools.splice_new_elements_between_sequence_elements(
...     sequence, new_elements, overhang=(0, 1))
[0, 'A', 'B', 1, 'A', 'B', 2, 'A', 'B', 3, 'A', 'B', 4, 'A', 'B']
```

Splice copies of *new_elements* before the first element of *sequence* and between each of the other elements of *sequence*:

```
>>> sequencetools.splice_new_elements_between_sequence_elements(
...     sequence, new_elements, overhang=(1, 0))
['A', 'B', 0, 'A', 'B', 1, 'A', 'B', 2, 'A', 'B', 3, 'A', 'B', 4]
```

Splice copies of *new_elements* before the first element of *sequence*, after the last element of *sequence* and between each of the other elements of *sequence*:

```
>>> sequencetools.splice_new_elements_between_sequence_elements(
...     sequence, new_elements, overhang=(1, 1))
['A', 'B', 0, 'A', 'B', 1, 'A', 'B', 2, 'A', 'B', 3, 'A', 'B', 4, 'A', 'B']
```

Return newly constructed list. Changed in version 2.0: renamed `sequencetools.insert_slice_cyclic()` to `sequencetools.splice_new_elements_between_sequence`

sequencetools.split_sequence_by_weights

`sequencetools.`**`split_sequence_by_weights`**(*sequence*, *weights*, *cyclic=False*, *overhang=False*)

New in version 2.0. Split sequence by weights.

Example 1. Split sequence cyclically by weights with overhang:

```
>>> sequencetools.split_sequence_by_weights(
...     (10, -10, 10, -10), [3, 15, 3], cyclic=True, overhang=True)
[(3,), (7, -8), (-2, 1), (3,), (6, -9), (-1,)]
```

Example 2. Split sequence cyclically by weights without overhang:

```
>>> sequencetools.split_sequence_by_weights(
...         (10, -10, 10, -10), [3, 15, 3], cyclic=True, overhang=False)
[(3,), (7, -8), (-2, 1), (3,), (6, -9)]
```

Example 3. Split sequence once by weights with overhang:

```
>>> sequencetools.split_sequence_by_weights(
...     (10, -10, 10, -10), [3, 15, 3], cyclic=False, overhang=True)
[(3,), (7, -8), (-2, 1), (9, -10)]
```

Example 4. Split sequence once by weights without overhang:

```
>>> sequencetools.split_sequence_by_weights(
...     (10, -10, 10, -10), [3, 15, 3], cyclic=False, overhang=False)
[(3,), (7, -8), (-2, 1)]
```

Return list of sequence types.

sequencetools.split_sequence_extended_to_weights

sequencetools.**split_sequence_extended_to_weights**(*sequence*, *weights*, *overhang=True*)

New in version 2.0. Split sequence extended to weights.

Example 1. Split sequence extended to weights with overhang:

```
>>> sequencetools.split_sequence_extended_to_weights(
...     [1, 2, 3, 4, 5], [7, 7, 7], overhang=True)
[[1, 2, 3, 1], [3, 4], [1, 1, 2, 3], [4, 5]]
```

Example 2. Split sequence extended to weights without overhang:

```
>>> sequencetools.split_sequence_extended_to_weights(
...     [1, 2, 3, 4, 5], [7, 7, 7], overhang=False)
[[1, 2, 3, 1], [3, 4], [1, 1, 2, 3]]
```

Return sequence of sequence objects.

sequencetools.sum_consecutive_sequence_elements_by_sign

sequencetools.**sum_consecutive_sequence_elements_by_sign**(*sequence, sign=[-1, 0, 1]*)

New in version 1.1. Sum consecutive *sequence* elements by *sign*:

```
>>> from abjad.tools import sequencetools
```

```
>>> sequence = [0, 0, -1, -1, 2, 3, -5, 1, 2, 5, -5, -6]
```

```
>>> sequencetools.sum_consecutive_sequence_elements_by_sign(sequence)
[0, -2, 5, -5, 8, -11]
```

```
>>> sequencetools.sum_consecutive_sequence_elements_by_sign(sequence, sign=[-1])
[0, 0, -2, 2, 3, -5, 1, 2, 5, -11]
```

```
>>> sequencetools.sum_consecutive_sequence_elements_by_sign(sequence, sign=[0])
[0, -1, -1, 2, 3, -5, 1, 2, 5, -5, -6]
```

```
>>> sequencetools.sum_consecutive_sequence_elements_by_sign(sequence, sign=[1])
[0, 0, -1, -1, 5, -5, 8, -5, -6]
```

```
>>> sequencetools.sum_consecutive_sequence_elements_by_sign(sequence, sign=[-1, 0])
[0, -2, 2, 3, -5, 1, 2, 5, -11]
```

```
>>> sequencetools.sum_consecutive_sequence_elements_by_sign(sequence, sign=[-1, 1])
[0, 0, -2, 5, -5, 8, -11]
```

```
>>> sequencetools.sum_consecutive_sequence_elements_by_sign(sequence, sign=[0, 1])
[0, -1, -1, 5, -5, 8, -5, -6]
```

```
>>> sequencetools.sum_consecutive_sequence_elements_by_sign(sequence, sign=[-1, 0, 1])
[0, -2, 5, -5, 8, -11]
```

When `-1` in *sign*, sum consecutive negative elements.

When `0` in *sign*, sum consecutive `0` elements.

When `1` in *sign*, sum consecutive positive elements.

Return list. Changed in version 2.0: renamed `sequencetools.sum_by_sign()` to `sequencetools.sum_consecutive_sequence_elements_by_sign()`.

sequencetools.sum_sequence_elements_at_indices

`sequencetools.`**`sum_sequence_elements_at_indices`**(*sequence*, *pairs*, *period=None*, *overhang=True*)

New in version 1.1. Sum *sequence* elements at indices according to *pairs*:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.sum_sequence_elements_at_indices(range(10), [(0, 3)])
[3, 3, 4, 5, 6, 7, 8, 9]
```

Sum *sequence* elements cyclically at indices according to *pairs* and *period*:

```
>>> sequencetools.sum_sequence_elements_at_indices(range(10), [(0, 3)], period=4)
[3, 3, 15, 7, 17]
```

Sum *sequence* elements cyclically at indices according to *pairs* and *period* and do not return incomplete final sum:

```
>>> sequencetools.sum_sequence_elements_at_indices(
...     range(10), [(0, 3)], period=4, overhang=False)
[3, 3, 15, 7]
```

Replace `sequence[i:i+count]` with `sum(sequence[i:i+count])` for each `(i, count)` in *pairs*.

Indices in *pairs* must be less than *period* when *period* is not none.

Return new list. Changed in version 2.0: renamed `sequencetools.sum_slices_at()` to `sequencetools.sum_sequence_elements_at_indices()`.

sequencetools.truncate_runs_in_sequence

`sequencetools.`**`truncate_runs_in_sequence`**(*sequence*)

New in version 1.1. Truncate subruns of like elements in *sequence* to length `1`:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.truncate_runs_in_sequence([1, 1, 2, 3, 3, 3, 9, 4, 4, 4])
[1, 2, 3, 9, 4]
```

Return empty list when *sequence* is empty:

```
>>> sequencetools.truncate_runs_in_sequence([])
[]
```

Raise type error when *sequence* is not a list.

Return new list. Changed in version 2.0: renamed `sequencetools.truncate_subruns()` to `sequencetools.truncate_runs_in_sequence()`.

sequencetools.truncate_sequence_to_sum

`sequencetools.`**`truncate_sequence_to_sum`**(*sequence*, *target_sum*)

New in version 1.1. Truncate *sequence* to *target_sum*:

```
>>> sequence = [-1, 2, -3, 4, -5, 6, -7, 8, -9, 10]

>>> for n in range(10):
...     print n, sequencetools.truncate_sequence_to_sum(sequence, n)
...
0 []
1 [-1, 2]
2 [-1, 2, -3, 4]
3 [-1, 2, -3, 4, -5, 6]
4 [-1, 2, -3, 4, -5, 6, -7, 8]
5 [-1, 2, -3, 4, -5, 6, -7, 8, -9, 10]
6 [-1, 2, -3, 4, -5, 6, -7, 8, -9, 10]
7 [-1, 2, -3, 4, -5, 6, -7, 8, -9, 10]
8 [-1, 2, -3, 4, -5, 6, -7, 8, -9, 10]
9 [-1, 2, -3, 4, -5, 6, -7, 8, -9, 10]
```

Return empty list when *target_sum* is `0`:

```
>>> sequencetools.truncate_sequence_to_sum([1, 2, 3, 4, 5], 0)
[]
```

Raise type error when *sequence* is not a list.

Raise value error on negative *target_sum*.

Return new list. Changed in version 2.0: renamed `sequencetools.truncate_to_sum()` to `sequencetools.truncate_sequence_to_sum()`.

sequencetools.truncate_sequence_to_weight

sequencetools.**truncate_sequence_to_weight**(*sequence*, *weight*)

New in version 1.1. Truncate *sequence* to *weight*:

```
>>> from abjad.tools import sequencetools

>>> l = [-1, 2, -3, 4, -5, 6, -7, 8, -9, 10]
>>> for x in range(10):
...     print x, sequencetools.truncate_sequence_to_weight(l, x)
...
0 []
1 [-1]
2 [-1, 1]
3 [-1, 2]
4 [-1, 2, -1]
5 [-1, 2, -2]
6 [-1, 2, -3]
7 [-1, 2, -3, 1]
8 [-1, 2, -3, 2]
9 [-1, 2, -3, 3]
```

Return empty list when *weight* is `0`:

```
>>> sequencetools.truncate_sequence_to_weight([1, 2, 3, 4, 5], 0)
[]
```

Raise type error when *sequence* is not a list.

Raise value error on negative *weight*.

Return new list. Changed in version 2.0: renamed `sequencetools.truncate_to_weight()` to `sequencetools.truncate_sequence_to_weight()`.

sequencetools.yield_all_combinations_of_sequence_elements

`sequencetools.`**`yield_all_combinations_of_sequence_elements`**(*sequence*, *min_length=None*, *max_length=None*)

New in version 2.0. Yield all combinations of *sequence* in binary string order:

```
>>> list(sequencetools.yield_all_combinations_of_sequence_elements(
...     [1, 2, 3, 4]))
[[], [1], [2], [1, 2], [3], [1, 3], [2, 3], [1, 2, 3], [4], [1, 4],
[2, 4], [1, 2, 4], [3, 4], [1, 3, 4], [2, 3, 4], [1, 2, 3, 4]]
```

Yield all combinations of *sequence* greater than or equal to *min_length* in binary string order:

```
>>> list(sequencetools.yield_all_combinations_of_sequence_elements(
...     [1, 2, 3, 4], min_length=3))
[[1, 2, 3], [1, 2, 4], [1, 3, 4], [2, 3, 4], [1, 2, 3, 4]]
```

Yield all combinations of *sequence* less than or equal to *max_length* in binary string order:

```
>>> list(sequencetools.yield_all_combinations_of_sequence_elements(
...     [1, 2, 3, 4], max_length=2))
[[], [1], [2], [1, 2], [3], [1, 3], [2, 3], [4], [1, 4], [2, 4], [3, 4]]
```

Yield all combiantions of *sequence* greater than or equal to *min_length* and less than or equal to *max_length* in lex order:

```
>>> list(sequencetools.yield_all_combinations_of_sequence_elements(
...     [1, 2, 3, 4], min_length=2, max_length=2))
[[1, 2], [1, 3], [2, 3], [1, 4], [2, 4], [3, 4]]
```

Return generator of newly created *sequence* objects. Changed in version 2.0: renamed `sequencetools.sublists()` to `sequencetools.yield_all_combinations_of_sequence_elements()`.

sequencetools.yield_all_k_ary_sequences_of_length

`sequencetools.`**`yield_all_k_ary_sequences_of_length`**(*k*, *length*)

New in version 2.0. Generate all *k*-ary sequences of *length*:

```
>>> from abjad.tools import sequencetools
```

```
>>> for sequence in sequencetools.yield_all_k_ary_sequences_of_length(2, 3):
...     sequence
...
(0, 0, 0)
(0, 0, 1)
(0, 1, 0)
(0, 1, 1)
(1, 0, 0)
(1, 0, 1)
(1, 1, 0)
(1, 1, 1)
```

Return generator of tuples.

sequencetools.yield_all_pairs_between_sequences

sequencetools.**yield_all_pairs_between_sequences**(*l*, *m*)

New in version 2.0. Yield all pairs between sequences *l* and *m*:

```
>>> from abjad.tools import sequencetools

>>> for pair in sequencetools.yield_all_pairs_between_sequences([1, 2, 3], [4, 5]):
...     pair
...
(1, 4)
(1, 5)
(2, 4)
(2, 5)
(3, 4)
(3, 5)
```

Return pair generator.

sequencetools.yield_all_partitions_of_sequence

sequencetools.**yield_all_partitions_of_sequence**(*sequence*)

New in version 2.0. Yield all partitions of *sequence*:

```
>>> from abjad.tools import sequencetools

>>> for partition in sequencetools.yield_all_partitions_of_sequence([0, 1, 2, 3]):
...     partition
...
[[0, 1, 2, 3]]
[[0, 1, 2], [3]]
[[0, 1], [2, 3]]
[[0, 1], [2], [3]]
[[0], [1, 2, 3]]
[[0], [1, 2], [3]]
[[0], [1], [2, 3]]
[[0], [1], [2], [3]]
```

Return generator of newly created lists.

sequencetools.yield_all_permutations_of_sequence

sequencetools.**yield_all_permutations_of_sequence**(*sequence*)

New in version 1.1. Yield all permutations of *sequence* in lex order:

```
>>> from abjad.tools import sequencetools

>>> list(sequencetools.yield_all_permutations_of_sequence((1, 2, 3)))
[(1, 2, 3), (1, 3, 2), (2, 1, 3), (2, 3, 1), (3, 1, 2), (3, 2, 1)]
```

Return generator of *sequence* objects. Changed in version 2.0: renamed `listtools.permutations()` to `sequencetools.yield_all_permutations_of_sequence()`.

sequencetools.yield_all_permutations_of_sequence_in_orbit

sequencetools.**yield_all_permutations_of_sequence_in_orbit**(*sequence*, *permutation*)

New in version 2.0. Yield all permutations of *sequence* in orbit of *permutation* in lex order:

```
>>> list(sequencetools.yield_all_permutations_of_sequence_in_orbit(
...     (1, 2, 3, 4), [1, 2, 3, 0]))
[(1, 2, 3, 4), (2, 3, 4, 1), (3, 4, 1, 2), (4, 1, 2, 3)]
```

Return generator of *sequence* objects.

sequencetools.yield_all_restricted_growth_functions_of_length

sequencetools.**yield_all_restricted_growth_functions_of_length**(*length*)

New in version 2.0. Generate all restricted growth functions of *length* in lex order:

```
>>> from abjad.tools import sequencetools

>>> for rgf in sequencetools.yield_all_restricted_growth_functions_of_length(4):
...     rgf
...
(1, 1, 1, 1)
(1, 1, 1, 2)
(1, 1, 2, 1)
(1, 1, 2, 2)
(1, 1, 2, 3)
(1, 2, 1, 1)
(1, 2, 1, 2)
(1, 2, 1, 3)
(1, 2, 2, 1)
(1, 2, 2, 2)
(1, 2, 2, 3)
(1, 2, 3, 1)
(1, 2, 3, 2)
(1, 2, 3, 3)
(1, 2, 3, 4)
```

Return generator of tuples.

sequencetools.yield_all_rotations_of_sequence

sequencetools.**yield_all_rotations_of_sequence**(*sequence*, *n=1*)

New in version 2.0. Yield all *n*-rotations of *sequence* up to identity:

```
>>> from abjad.tools import sequencetools

>>> list(sequencetools.yield_all_rotations_of_sequence([1, 2, 3, 4], -1))
[[1, 2, 3, 4], [2, 3, 4, 1], [3, 4, 1, 2], [4, 1, 2, 3]]
```

Return generator of *sequence* objects.

sequencetools.yield_all_set_partitions_of_sequence

sequencetools.**yield_all_set_partitions_of_sequence**(*sequence*)

New in version 2.0. Yield all set partitions of *sequence* in restricted growth function order:

```
>>> for set_partition in sequencetools.yield_all_set_partitions_of_sequence(
...     [21, 22, 23, 24]):
...     set_partition
...
[[21, 22, 23, 24]]
[[21, 22, 23], [24]]
[[21, 22, 24], [23]]
[[21, 22], [23, 24]]
[[21, 22], [23], [24]]
[[21, 23, 24], [22]]
[[21, 23], [22, 24]]
[[21, 23], [22], [24]]
[[21, 24], [22, 23]]
[[21], [22, 23, 24]]
[[21], [22, 23], [24]]
[[21, 24], [22], [23]]
[[21], [22, 24], [23]]
[[21], [22], [23, 24]]
[[21], [22], [23], [24]]
```

Return generator of list of lists.

sequencetools.yield_all_subsequences_of_sequence

sequencetools.**yield_all_subsequences_of_sequence**(*sequence*, *min_length=0*, *max_length=None*)

New in version 2.0. Yield all subsequences of *sequence* in lex order:

```
>>> from abjad.tools import sequencetools

>>> list(sequencetools.yield_all_subsequences_of_sequence([0, 1, 2]))
[[], [0], [0, 1], [0, 1, 2], [1], [1, 2], [2]]
```

Yield all subsequences of *sequence* greater than or equal to *min_length* in lex order:

```
>>> list(sequencetools.yield_all_subsequences_of_sequence(
...     [0, 1, 2, 3, 4], min_length=3))
[[0, 1, 2], [0, 1, 2, 3], [0, 1, 2, 3, 4], [1, 2, 3], [1, 2, 3, 4], [2, 3, 4]]
```

Yield all subsequences of *sequence* less than or equal to *max_length* in lex order:

```
>>> for subsequence in sequencetools.yield_all_subsequences_of_sequence(
...     [0, 1, 2, 3, 4], max_length=3):
...     subsequence
[]
[0]
[0, 1]
[0, 1, 2]
[1]
[1, 2]
[1, 2, 3]
[2]
[2, 3]
[2, 3, 4]
[3]
[3, 4]
[4]
```

Yield all subsequences of *sequence* greater than or equal to *min_length* and less than or equal to *max_length* in lex order:

```
>>> list(sequencetools.yield_all_subsequences_of_sequence(
...     [0, 1, 2, 3, 4], min_length=3, max_length=3))
[[0, 1, 2], [1, 2, 3], [2, 3, 4]]
```

Return generator of newly created *sequence* slices.

sequencetools.yield_all_unordered_pairs_of_sequence

sequencetools.**yield_all_unordered_pairs_of_sequence**(*sequence*)

New in version 2.0. Yield all unordered pairs of *sequence*:

```
>>> from abjad.tools import sequencetools

>>> list(sequencetools.yield_all_unordered_pairs_of_sequence([1, 2, 3, 4]))
[(1, 2), (1, 3), (1, 4), (2, 3), (2, 4), (3, 4)]
```

Yield all unordered pairs of length-1 *sequence*:

```
>>> list(sequencetools.yield_all_unordered_pairs_of_sequence([1]))
[]
```

Yield all unordered pairs of empty *sequence*:

```
>>> list(sequencetools.yield_all_unordered_pairs_of_sequence([]))
[]
```

Yield all unordered pairs of *sequence* with duplicate elements:

```
>>> list(sequencetools.yield_all_unordered_pairs_of_sequence([1, 1, 1]))
[(1, 1), (1, 1), (1, 1)]
```

Pairs are tuples instead of sets to accommodate duplicate *sequence* elements.

Return generator.

sequencetools.yield_outer_product_of_sequences

sequencetools.**yield_outer_product_of_sequences**(*sequences*)

New in version 1.1. Yield outer product of *sequences*:

```
>>> list(sequencetools.yield_outer_product_of_sequences(
...     [[1, 2, 3], ['a', 'b']]))
[[1, 'a'], [1, 'b'], [2, 'a'], [2, 'b'], [3, 'a'], [3, 'b']]

>>> list(sequencetools.yield_outer_product_of_sequences(
...     [[1, 2, 3], ['a', 'b'], ['X', 'Y']]))
[[1, 'a', 'X'], [1, 'a', 'Y'], [1, 'b', 'X'], [1, 'b', 'Y'],
[2, 'a', 'X'], [2, 'a', 'Y'], [2, 'b', 'X'], [2, 'b', 'Y'],
[3, 'a', 'X'], [3, 'a', 'Y'], [3, 'b', 'X'], [3, 'b', 'Y']]

>>> list(sequencetools.yield_outer_product_of_sequences(
...     [[1, 2, 3], [4, 5], [6, 7, 8]]))
[[1, 4, 6], [1, 4, 7], [1, 4, 8], [1, 5, 6], [1, 5, 7], [1, 5, 8],
[2, 4, 6], [2, 4, 7], [2, 4, 8], [2, 5, 6], [2, 5, 7], [2, 5, 8],
[3, 4, 6], [3, 4, 7], [3, 4, 8], [3, 5, 6], [3, 5, 7], [3, 5, 8]]
```

Return generator. Changed in version 2.0: renamed `sequencetools.outer_product()` to `sequencetools.yield_outer_product_of_sequences()`.

sequencetools.zip_sequences_cyclically

`sequencetools.`**`zip_sequences_cyclically`**`(*sequences)`

New in version 1.1. Zip *sequences* cyclically:

```
>>> from abjad.tools import sequencetools

>>> sequencetools.zip_sequences_cyclically([1, 2, 3], ['a', 'b'])
[(1, 'a'), (2, 'b'), (3, 'a')]
```

New in version 1.1: Arbitrary number of input sequences now allowed.

```
>>> sequencetools.zip_sequences_cyclically([10, 11, 12], [20, 21], [30, 31, 32, 33])
[(10, 20, 30), (11, 21, 31), (12, 20, 32), (10, 21, 33)]
```

Cycle over the elements of the sequences of shorter length.

Return list of length equal to sequence of greatest length in *sequences*. Changed in version 2.0: renamed `sequencetools.zip_cyclic()` to `sequencetools.zip_sequences_cyclically()`.

sequencetools.zip_sequences_without_truncation

`sequencetools.`**`zip_sequences_without_truncation`**`(*sequences)`

New in version 1.1. Zip *sequences* nontruncating:

```
>>> sequencetools.zip_sequences_without_truncation(
...     [1, 2, 3, 4], [11, 12, 13], [21, 22, 23])
[(1, 11, 21), (2, 12, 22), (3, 13, 23), (4,)]
```

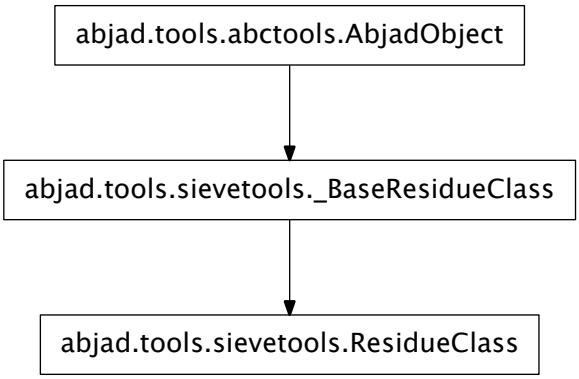
Lengths of the tuples returned may differ but will always be greater than or equal to `1`.

Return list of tuples. Changed in version 2.0: renamed `sequencetools.zip_nontruncating()` to `sequencetools.zip_sequences_without_truncation()`.

sievetools

concrete classes

sievetools.ResidueClass



class sievetools.**ResidueClass**(**args*)

Residue class (or congruence class). Residue classes form the basis of Xenakis sieves. They can be used to construct any complex periodic integer (or boolean) sequence as a combination of simple periodic sequences.

Example from the opening of Xenakis's *Psappha* for solo percussion:

```
>>> from abjad.tools.sievetools import ResidueClass as RC

>>> s1 = (RC(8, 0) | RC(8, 1) | RC(8, 7)) & (RC(5, 1) | RC(5, 3))
>>> s2 = (RC(8, 0) | RC(8, 1) | RC(8, 2)) & RC(5, 0)
>>> s3 = RC(8, 3)
>>> s4 = RC(8, 4)
>>> s5 = (RC(8, 5) | RC(8, 6)) & (RC(5, 2) | RC(5, 3) | RC(5, 4))
>>> s6 = (RC(8, 1) & RC(5, 2))
>>> s7 = (RC(8, 6) & RC(5, 1))

>>> y = s1 | s2 | s3 | s4 | s5 | s6 | s7

>>> y.get_congruent_bases(40)
    [0, 1, 3, 4, 6, 8, 10, 11, 12, 13, 14, 16, 17, 19, 20, 22, 23, 25, 27,
    28, 29, 31, 33, 35, 36, 37, 38, 40]

>>> y.get_boolean_train(40)
    [1, 1, 0, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0,
    1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 0]
```

Return residue class.

Read-only Properties

ResidueClass.**modulo**
Period of residue class.

ResidueClass.**residue**
Residue of residue class.

ResidueClass.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

ResidueClass.**get_boolean_train**(**min_max*)
Returns a boolean train with 0s mapped to the integers that are not congruent bases of the residue class and 1s mapped to those that are. The method takes one or two integer arguments. If only one is given, it is taken as the max range and the min is assumed to be 0.

Example:

```
>>> from abjad.tools.sievetools import ResidueClass as RC

>>> r = RC(3, 0)
>>> r.get_boolean_train(6)
[1, 0, 0, 1, 0, 0]
>>> r.get_congruent_bases(-6, 6)
[-6, -3, 0, 3, 6]
```

Return list.

ResidueClass.**get_congruent_bases**(**min_max*)
Returns all the congruent bases of this residue class within the given range. The method takes one or two integer arguments. If only one it given, it is taken as the max range and the min is assumed to be 0.

Example:

```
>>> from abjad.tools.sievetools import ResidueClass as RC

>>> r = RC(3, 0)
>>> r.get_congruent_bases(6)
[0, 3, 6]
>>> r.get_congruent_bases(-6, 6)
[-6, -3, 0, 3, 6]
```

Return list.

Special Methods

ResidueClass.**__and__**(*arg*)
Inherited from sievetools._BaseResidueClass

ResidueClass.**__eq__**(*exp*)

ResidueClass.**__ge__**(*expr*)

ResidueClass.**__gt__**(*expr*)

ResidueClass.**__le__**(*expr*)

ResidueClass.**__lt__**(*expr*)

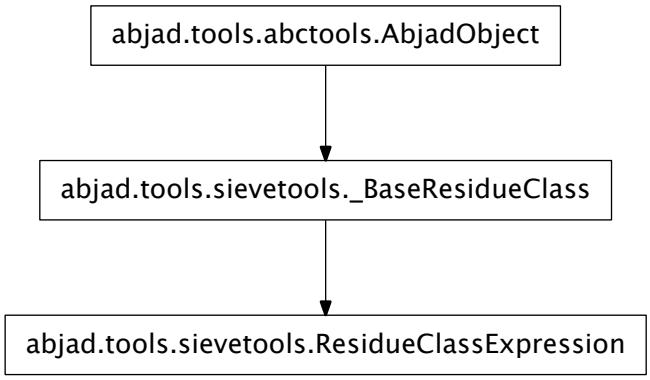
ResidueClass.**__ne__**(*expr*)

ResidueClass.**__or__**(*arg*)
Inherited from sievetools._BaseResidueClass

ResidueClass.**__repr__**()

ResidueClass.**__xor__**(*arg*)
Inherited from sievetools._BaseResidueClass

sievetools.ResidueClassExpression



class sievetools.**ResidueClassExpression**(*rcs*, *operator='or'*)

Read-only Properties

ResidueClassExpression.**operator**
Operator of residue class expression.

ResidueClassExpression.**period**

ResidueClassExpression.**rcs**
Residue classes of expression.

ResidueClassExpression.**representative_boolean_train**

ResidueClassExpression.**representative_congruent_bases**

ResidueClassExpression.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

ResidueClassExpression.**get_boolean_train**(**min_max*)
Returns a boolean train with 0s mapped to the integers that are not congruent bases of the RC expression and 1s mapped to those that are. The method takes one or two integer arguments. If only one is given, it is taken as the max range and min is assumed to be 0.

Example:

```
>>> from abjad.tools.sievetools import ResidueClass as RC

>>> e = RC(3, 0) | RC(2, 0)
>>> e.get_boolean_train(6)
[1, 0, 1, 1, 1, 0]
>>> e.get_congruent_bases(-6, 6)
[-6, -4, -3, -2, 0, 2, 3, 4, 6]
```

Return list.

ResidueClassExpression.**get_congruent_bases**(**min_max*)

Returns all the congruent bases of this RC expression within the given range. The method takes one or two integer arguments. If only one it given, it is taken as the max range and min is assumed to be 0.

Example:

```
>>> from abjad.tools.sievetools import ResidueClass as RC

>>> e = RC(3, 0) | RC(2, 0)
>>> e.get_congruent_bases(6)
[0, 2, 3, 4, 6]
>>> e.get_congruent_bases(-6, 6)
[-6, -4, -3, -2, 0, 2, 3, 4, 6]
```

Return list.

ResidueClassExpression.**is_congruent_base**(*integer*)

Special Methods

ResidueClassExpression.**__and__**(*arg*)

Inherited from sievetools._BaseResidueClass

ResidueClassExpression.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ResidueClassExpression.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ResidueClassExpression.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ResidueClassExpression.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ResidueClassExpression.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ResidueClassExpression.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ResidueClassExpression.**__or__**(*arg*)
Inherited from sievetools._BaseResidueClass

ResidueClassExpression.**__repr__**()

ResidueClassExpression.**__xor__**(*arg*)
Inherited from sievetools._BaseResidueClass

functions

sievetools.all_are_residue_class_expressions

sievetools.**all_are_residue_class_expressions**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad residue class expressions:

```
>>> from abjad.tools import sievetools

>>> sieve = sievetools.ResidueClass(3, 0) | sievetools.ResidueClass(2, 0)

>>> sieve
{ResidueClass(2, 0) | ResidueClass(3, 0)}

>>> sievetools.all_are_residue_class_expressions([sieve])
True
```

True when *expr* is an empty sequence:

```
>>> sievetools.all_are_residue_class_expressions([])
True
```

Otherwise false:

```
>>> sievetools.all_are_residue_class_expressions('foo')
False
```

Return boolean.

sievetools.cycle_tokens_to_sieve

sievetools.**cycle_tokens_to_sieve**(**cycle_tokens*)
New in version 2.0. Make Xenakis sieve from arbitrarily many *cycle_tokens*:

```
>>> from abjad.tools import sievetools

>>> cycle_token_1 = (6, [0, 4, 5])
>>> cycle_token_2 = (10, [0, 1, 2], 6)
>>> sievetools.cycle_tokens_to_sieve(cycle_token_1, cycle_token_2)
```

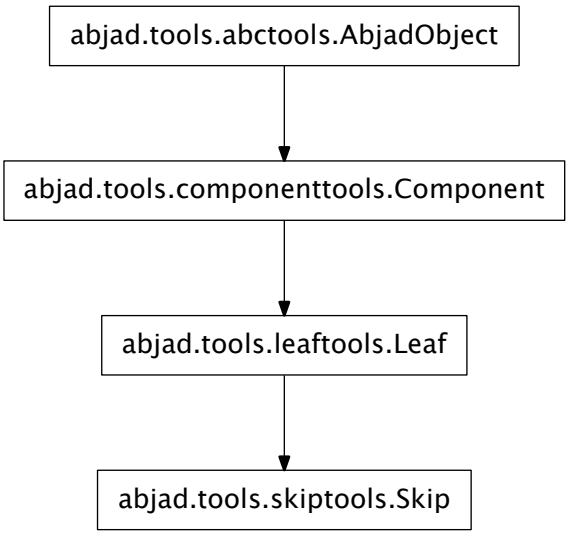
```
{ResidueClass(6, 0) | ResidueClass(6, 4) | ResidueClass(6, 5) |
 ResidueClass(10, 6) | ResidueClass(10, 7) | ResidueClass(10, 8)}
```

Cycle token comprises mandatory *modulo*, mandatory *residues* and optional *offset*.

skiptools

concrete classes

skiptools.Skip



class skiptools.**Skip**(**args*, ***kwargs*)

Abjad model of a LilyPond skip:

```
>>> skiptools.Skip((3, 16))
Skip('s8.')
```

Return skip.

Read-only Properties

Skip.**duration_in_seconds**

Inherited from leaftools.Leaf

Skip.**leaf_index**

Inherited from leaftools.Leaf

Skip.**lilypond_format**

Inherited from componenttools.Component

Skip.**multiplied_duration**

Inherited from leaftools.Leaf

Skip.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Skip.**parent**
Inherited from componenttools.Component

Skip.**preprolated_duration**
Inherited from leaftools.Leaf

Skip.**prolated_duration**
Inherited from componenttools.Component

Skip.**prolation**
Inherited from componenttools.Component

Skip.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Skip.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Skip.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Skip.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Skip.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Skip.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Skip.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Skip.**duration_multiplier**
Inherited from leaftools.Leaf

Skip.**written_duration**
Inherited from leaftools.Leaf

Skip.**written_pitch_indication_is_at_sounding_pitch**
Inherited from leaftools.Leaf

Skip.**written_pitch_indication_is_nonsemantic**
Inherited from leaftools.Leaf

Special Methods

Skip.**__and__**(*arg*)
Inherited from leaftools.Leaf

Skip.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Skip.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Skip.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Skip.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Skip.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Skip.**__mul__**(*n*)
Inherited from componenttools.Component

Skip.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Skip.**__or__**(*arg*)
Inherited from leaftools.Leaf

Skip.**__repr__**()
Inherited from leaftools.Leaf

Skip.**__rmul__**(*n*)
Inherited from componenttools.Component

Skip.**__str__**()
Inherited from leaftools.Leaf

Skip.**__sub__**(*arg*)
Inherited from leaftools.Leaf

Skip.**__xor__**(*arg*)
Inherited from leaftools.Leaf

functions

skiptools.all_are_skips

skiptools.**all_are_skips**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad skips:

```
>>> from abjad.tools import skiptools

>>> skips = 3 * skiptools.Skip('s4')

>>> skips
[Skip('s4'), Skip('s4'), Skip('s4')]

>>> skiptools.all_are_skips(skips)
True
```

True when *expr* is an empty sequence:

```
>>> skiptools.all_are_skips([])
True
```

Otherwise false:

```
>>> skiptools.all_are_skips('foo')
False
```

Return boolean.

Function wraps componenttools.all_are_components().

skiptools.make_repeated_skips_from_time_signature

skiptools.**make_repeated_skips_from_time_signature**(*time_signature*)
New in version 2.0. Make repeated skips from *time_signature*:

```
>>> skiptools.make_repeated_skips_from_time_signature((5, 32))
[Skip('s32'), Skip('s32'), Skip('s32'), Skip('s32'), Skip('s32')]
```

Return list of skips.

skiptools.make_repeated_skips_from_time_signatures

skiptools.**make_repeated_skips_from_time_signatures**(*time_signatures*)
Make repated skips from *time_signatures*:

```
skiptools.make_repeated_skips_from_time_signatures([(2, 8), (3, 32)])
[[Skip('s8'), Skip('s8')], [Skip('s32'), Skip('s32'), Skip('s32')]]
```

Return list of skip lists.

skiptools.make_skips_with_multiplied_durations

skiptools.**make_skips_with_multiplied_durations**(*written_duration*, *multiplied_durations*)

New in version 2.0. Make *written_duration* skips with *multiplied_durations*:

```
>>> skiptools.make_skips_with_multiplied_durations(
...     Duration(1, 4), [(1, 2), (1, 3), (1, 4), (1, 5)])
[Skip('s4 * 2'), Skip('s4 * 4/3'), Skip('s4 * 1'), Skip('s4 * 4/5')]
```

Useful for making invisible layout voices.

Return list of skips. Changed in version 2.0: renamed `construct.skips_with_multipliers()` to `skiptools.make_skips_with_multiplied_durations()`.

skiptools.replace_leaves_in_expr_with_skips

skiptools.**replace_leaves_in_expr_with_skips**(*expr*)

New in version 1.1. Replace leaves in *expr* with skips:

```
>>> staff = Staff(Measure((2, 8), "c'8 d'8") * 2)
>>> skiptools.replace_leaves_in_expr_with_skips(staff[0])
```

```
>>> f(staff)
\new Staff {
    {
        \time 2/8
        s8
        s8
    }
    {
        c'8
        d'8
    }
}
```

Return none. Changed in version 2.0: renamed `leaftools.replace_leaves_with_skips_in()` to `skiptools.replace_leaves_in_expr_with_skips()`.

skiptools.yield_groups_of_skips_in_sequence

skiptools.**yield_groups_of_skips_in_sequence**(*sequence*)

New in version 2.0. Yield groups of skips in *sequence*:

```
>>> staff = Staff("c'8 d'8 s8 s8 <e' g'>8 <f' a'>8 g'8 a'8 s8 s8 <b' d''>8 <c'' e''>8")
```

```
>>> f(staff)
\new Staff {
    c'8
    d'8
    s8
    s8
    <e' g'>8
    <f' a'>8
    g'8
    a'8
    s8
```

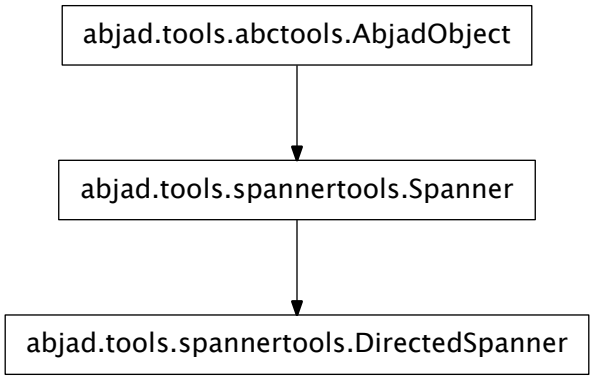
```
    s8
    <b' d''>8
    <c'' e''>8
}

>>> for skip in skiptools.yield_groups_of_skips_in_sequence(staff):
...     skip
...
(Skip('s8'), Skip('s8'))
(Skip('s8'), Skip('s8'))
```

Return generator.

spannertools

abstract classes

spannertools.DirectedSpanner



class spannertools.**DirectedSpanner**(*components*=[ ], *direction*=*None*)

Read-only Properties

DirectedSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

DirectedSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

DirectedSpanner.**leaves**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

DirectedSpanner.**override**
LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

DirectedSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

DirectedSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

DirectedSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

DirectedSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

DirectedSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

DirectedSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

DirectedSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties
DirectedSpanner.**direction**

Methods

DirectedSpanner.**append**(*component*)

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

DirectedSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

DirectedSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

DirectedSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

DirectedSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

DirectedSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are Left, Right and None.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from spannertools.Spanner

DirectedSpanner.**fuse**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
```

```
    f'8 ]
}
```

```
>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]
```

```
>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`DirectedSpanner.`**`index`**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)
```

```
>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`DirectedSpanner.`**`pop`**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.pop()
Note("f'8")
```

```
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from `spannertools.Spanner`

`DirectedSpanner.`**`pop_left`**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.pop_left()
Note("c'8")
```

```
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

DirectedSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

DirectedSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

DirectedSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DirectedSpanner.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DirectedSpanner.**__getitem__**(*expr*)

Inherited from spannertools.Spanner

DirectedSpanner.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DirectedSpanner.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DirectedSpanner.**__len__**()
Inherited from spannertools.Spanner

DirectedSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

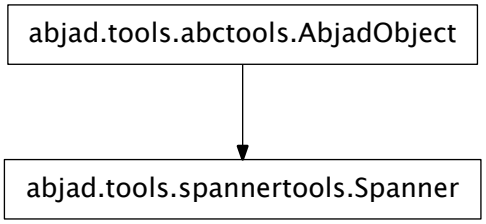
DirectedSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DirectedSpanner.**__repr__**()
Inherited from spannertools.Spanner

spannertools.Spanner



class spannertools.**Spanner**(*components=None*)
New in version 1.1. Any type of notation object that stretches horizontally and encompasses some number of notes, rest, chords, tuplets, measures, voices or other Abjad components.

Beams, slurs, hairpins, trills, glissandi and piano pedal brackets all stretch horizontally on the page to encompass multiple notes and all implement as Abjad spanners. That is, these spanner all have an obvious graphic reality with definite start-, stop- and midpoints.

Abjad also implements a number of spanners of a different type, such as tempo and instrument spanners, which mark a group of notes, rests, chords or measues as carrying a certain tempo or being played by a certain instrument.

The spanner class described here abstracts the functionality that all such spanners, both graphic and nongraphics, share. This shared functionality includes methods to add, remove, inspect and test components governed by the spanner, as well as basic formatting properties. The other spanner classes, such as beam and glissando, all inherit from this class and receive the functionality implemented here.

Read-only Properties

Spanner.**components**
Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list.

Spanner.**duration_in_seconds**
Sum of duration of all leaves in spanner, in seconds.

Spanner.**leaves**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Spanner.**override**
LilyPond grob override component plug-in.

Spanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Spanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Spanner.**set**
LilyPond context setting component plug-in.

Spanner.**start_offset**
Read-only start offset of spanner.

Spanner.**stop_offset**
Read-only stop offset of spanner.

Spanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Spanner.**written_duration**
Sum of written duration of all components in spanner.

Methods

Spanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)
```

```
>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Spanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Spanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Spanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Spanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Spanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Spanner.**fuse**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Spanner.**index**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Spanner.**pop**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Spanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Special Methods

Spanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Spanner.**__contains__**(*expr*)

Spanner.**__eq__**(*arg*)

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

Spanner.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

Spanner.**__getitem__**(*expr*)

Spanner.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

Spanner.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

Spanner.**__len__**()

Spanner.**__lt__**(*other*)

Trivial comparison to allow doctests to work.

Spanner.**__ne__**(*arg*)

True when `id(self)` does not equal `id(arg)`.

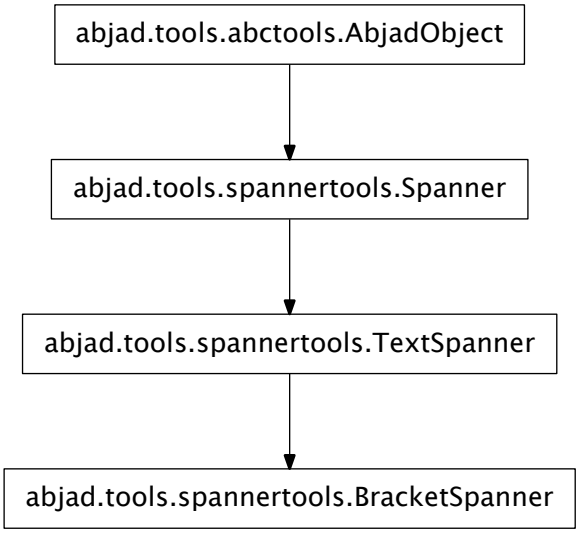
Return boolean.

Inherited from `abctools.AbjadObject`

Spanner.**__repr__**()

concrete classes

spannertools.BracketSpanner



class spannertools.**BracketSpanner**(*components=None*)

Abjad bracket spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spannertools.BracketSpanner(staff[:])
BracketSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    \override TextSpanner #'bound-details #'left #'text = \markup {
        \draw-line #'(0 . -1) }
    \override TextSpanner #'bound-details #'left-broken #'text = ##f
    \override TextSpanner #'bound-details #'right #'text = \markup {
        \draw-line #'(0 . -1) }
    \override TextSpanner #'bound-details #'right-broken #'text = ##f
    \override TextSpanner #'color = #red
    \override TextSpanner #'dash-fraction = #1
    \override TextSpanner #'staff-padding = #2
    \override TextSpanner #'thickness = #1.5
    c'8 \startTextSpan
    d'8
    e'8
    f'8 \stopTextSpan
    \revert TextSpanner #'bound-details #'left #'text
    \revert TextSpanner #'bound-details #'left-broken #'text
    \revert TextSpanner #'bound-details #'right #'text
    \revert TextSpanner #'bound-details #'right-broken #'text
```

```
        \revert TextSpanner #'color
        \revert TextSpanner #'dash-fraction
        \revert TextSpanner #'staff-padding
        \revert TextSpanner #'thickness
    }
```

Render 1.5-unit thick solid red spanner.

Draw nibs at beginning and end of spanner.

Do not draw nibs at line breaks.

Return bracket spanner.

Read-only Properties

`BracketSpanner.`**`components`**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from `spannertools.Spanner`

`BracketSpanner.`**`duration_in_seconds`**

Sum of duration of all leaves in spanner, in seconds.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`leaves`**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`override`**

LilyPond grob override component plug-in.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`preprolated_duration`**

Sum of preprolated duration of all components in spanner.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`prolated_duration`**

Sum of prolated duration of all components in spanner.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`set`**

LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

BracketSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

BracketSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

BracketSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

BracketSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Methods

BracketSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

BracketSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

BracketSpanner.**clear**()
Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
```

```
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`extend`**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
```

```
        d'8 [
        e'8
        f'8 ]
    }
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`fuse`**`(`*`spanner`*`)`

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`index`**`(`*`component`*`)`

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`pop`**`()`

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`pop_left`**`()`

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from `spannertools.Spanner`

Special Methods

`BracketSpanner.`**`__call__`**`(`*expr*`)`

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from `spannertools.Spanner`

`BracketSpanner.`**`__contains__`**`(`*expr*`)`

Inherited from `spannertools.Spanner`

BracketSpanner.__eq__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

BracketSpanner.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BracketSpanner.__getitem__(*expr*)
Inherited from spannertools.Spanner

BracketSpanner.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BracketSpanner.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BracketSpanner.__len__()
Inherited from spannertools.Spanner

BracketSpanner.__lt__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

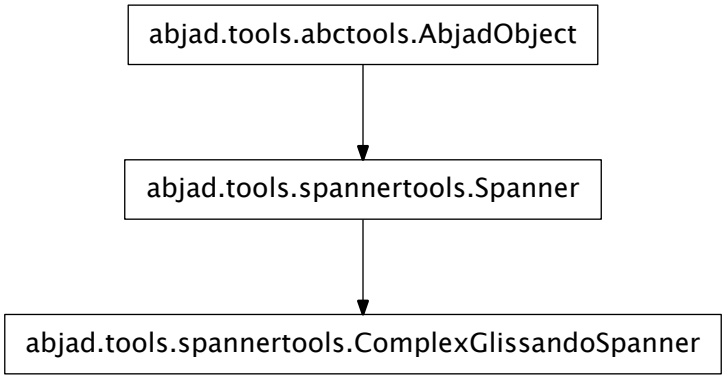
BracketSpanner.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

BracketSpanner.__repr__()
Inherited from spannertools.Spanner

spannertools.ComplexGlissandoSpanner



class spannertools.**ComplexGlissandoSpanner**(*components=None*)

New in version 2.9. Abjad rest-skipping glissando spanner:

```
>>> staff = Staff("c'16 r r g' r8 c'8")

>>> spannertools.ComplexGlissandoSpanner(staff[:])
ComplexGlissandoSpanner(c'16, r16, r16, g'16, r8, c'8)

>>> f(staff)
\new Staff {
    c'16 \glissando
    \once \override NoteColumn #'glissando-skip = ##t
    \once \override Rest #'transparent = ##t
    r16
    \once \override NoteColumn #'glissando-skip = ##t
    \once \override Rest #'transparent = ##t
    r16
    g'16 \glissando
    \once \override NoteColumn #'glissando-skip = ##t
    \once \override Rest #'transparent = ##t
    r8
    c'8
}
```

Should be used with beamtools.BeamSpanner for best effect, along with an override of Stem #'stemlet-length, in order to generate stemlets over each invisible rest.

Format nonlast leaves in spanner with LilyPond glissando command.

Set all Rest instances to transparent.

Set all NoteColumns filled with silences to be skipped by glissandi.

Return *ComplexGlissandoSpanner* instance.

Read-only Properties

ComplexGlissandoSpanner.**components**
Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**duration_in_seconds**
Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**leaves**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**override**
LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

ComplexGlissandoSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Methods

ComplexGlissandoSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**clear**()
Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**extend**(*components*)
Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
```

```
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are Left, Right and None.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**fuse**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`ComplexGlissandoSpanner.`**`index`**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`ComplexGlissandoSpanner.`**`pop`**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from `spannertools.Spanner`

ComplexGlissandoSpanner.**pop_left**()
Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

ComplexGlissandoSpanner.**__call__**(*expr*)
New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**__contains__**(*expr*)
Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ComplexGlissandoSpanner.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ComplexGlissandoSpanner.**__getitem__**(*expr*)
Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ComplexGlissandoSpanner.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ComplexGlissandoSpanner.**__len__**()
Inherited from spannertools.Spanner

ComplexGlissandoSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

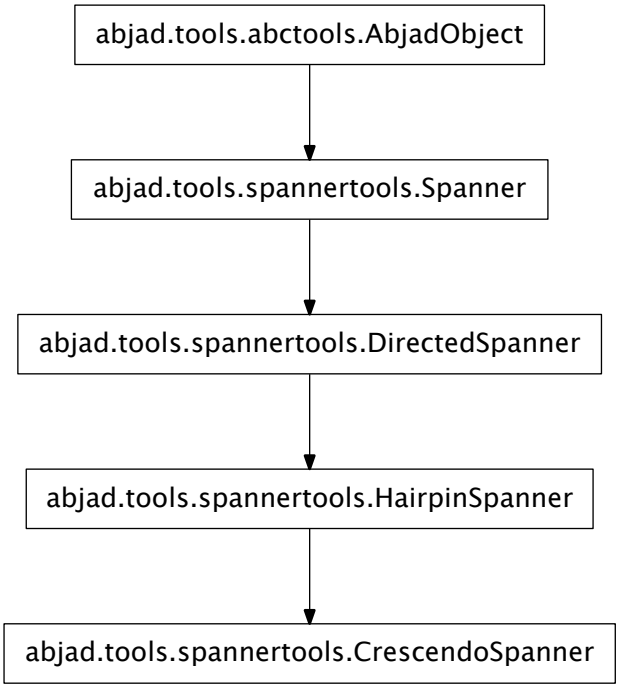
ComplexGlissandoSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ComplexGlissandoSpanner.**__repr__**()
Inherited from spannertools.Spanner

spannertools.CrescendoSpanner



class spannertools.**CrescendoSpanner**(*components=None*, *include_rests=True*, *direction=None*)

Abjad crescendo spanner that includes rests:

```
>>> staff = Staff("r4 c'8 d'8 e'8 f'8 r4")

>>> f(staff)
\new Staff {
    r4
    c'8
    d'8
    e'8
    f'8
    r4
}

>>> spannertools.CrescendoSpanner(staff[:], include_rests=True)
CrescendoSpanner(r4, c'8, d'8, e'8, f'8, r4)

>>> f(staff)
\new Staff {
    r4 \<
    c'8
    d'8
    e'8
    f'8
```

```
    r4 \!
}
```

Abjad crescendo spanner that does not include rests:

```
>>> staff = Staff("r4 c'8 d'8 e'8 f'8 r4")

>>> f(staff)
\new Staff {
    r4
    c'8
    d'8
    e'8
    f'8
    r4
}

>>> spannertools.CrescendoSpanner(staff[:], include_rests=False)
CrescendoSpanner(r4, c'8, d'8, e'8, f'8, r4)

>>> f(staff)
\new Staff {
    r4
    c'8 \<
    d'8
    e'8
    f'8 \!
    r4
}
```

Return crescendo spanner.

Read-only Properties

`CrescendoSpanner.`**`components`**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from `spannertools.Spanner`

`CrescendoSpanner.`**`duration_in_seconds`**

Sum of duration of all leaves in spanner, in seconds.

Inherited from `spannertools.Spanner`

`CrescendoSpanner.`**`leaves`**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

CrescendoSpanner.**override**
LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

CrescendoSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

CrescendoSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

CrescendoSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

CrescendoSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

CrescendoSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

CrescendoSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

CrescendoSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

CrescendoSpanner.**direction**
Inherited from spannertools.DirectedSpanner

CrescendoSpanner.**include_rests**
Get boolean hairpin rests setting:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f', include_rests = True)
>>> hairpin.include_rests
True
```

Set boolean hairpin rests setting:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f', include_rests = True)
>>> hairpin.include_rests = False
>>> hairpin.include_rests
False
```

Set boolean.

Inherited from spannertools.HairpinSpanner

CrescendoSpanner.**shape_string**

Get hairpin shape string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.shape_string
'<'
```

Set hairpin shape string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.shape_string = '>'
>>> hairpin.shape_string
'>'
```

Set string.

Inherited from spannertools.HairpinSpanner

CrescendoSpanner.**start_dynamic_string**

Get hairpin start dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.start_dynamic_string
'p'
```

Set hairpin start dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.start_dynamic_string = 'mf'
>>> hairpin.start_dynamic_string
'mf'
```

Set string.

Inherited from spannertools.HairpinSpanner

CrescendoSpanner.**stop_dynamic_string**

Get hairpin stop dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.stop_dynamic_string
'f'
```

Set hairpin stop dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.stop_dynamic_string = 'mf'
>>> hairpin.stop_dynamic_string
'mf'
```

Set string.

Inherited from spannertools.HairpinSpanner

Methods

CrescendoSpanner.**append**(*component*)

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

CrescendoSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

CrescendoSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

CrescendoSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`CrescendoSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`CrescendoSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`CrescendoSpanner.`**`fuse`**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
```

```
        f'8 ]
    }

    >>> left_beam.fuse(right_beam)
    [(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

    >>> print voice.lilypond_format
    \new Voice {
        c'8 [
        d'8
        e'8
        f'8 ]
    }
```

Return list.

Inherited from `spannertools.Spanner`

`CrescendoSpanner.`**`index`**(*component*)

Return nonnegative integer index of *component* in spanner:

```
    >>> voice = Voice("c'8 d'8 e'8 f'8")
    >>> spanner = beamtools.BeamSpanner(voice[2:])
    >>> spanner
    BeamSpanner(e'8, f'8)

    >>> spanner.index(voice[-2])
    0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`CrescendoSpanner.`**`pop`**()

Remove and return rightmost component in spanner:

```
    >>> voice = Voice("c'8 d'8 e'8 f'8")
    >>> spanner = beamtools.BeamSpanner(voice[:])
    >>> spanner
    BeamSpanner(c'8, d'8, e'8, f'8)

    >>> spanner.pop()
    Note("f'8")

    >>> spanner
    BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from `spannertools.Spanner`

`CrescendoSpanner.`**`pop_left`**()

Remove and return leftmost component in spanner:

```
    >>> voice = Voice("c'8 d'8 e'8 f'8")
    >>> spanner = beamtools.BeamSpanner(voice[:])
    >>> spanner
    BeamSpanner(c'8, d'8, e'8, f'8)

    >>> spanner.pop_left()
    Note("c'8")
```

```
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

CrescendoSpanner.__call__(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

CrescendoSpanner.__contains__(*expr*)

Inherited from spannertools.Spanner

CrescendoSpanner.__eq__(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

CrescendoSpanner.__ge__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CrescendoSpanner.__getitem__(*expr*)

Inherited from spannertools.Spanner

CrescendoSpanner.__gt__(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

CrescendoSpanner.__le__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CrescendoSpanner.__len__()
Inherited from spannertools.Spanner

CrescendoSpanner.__lt__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

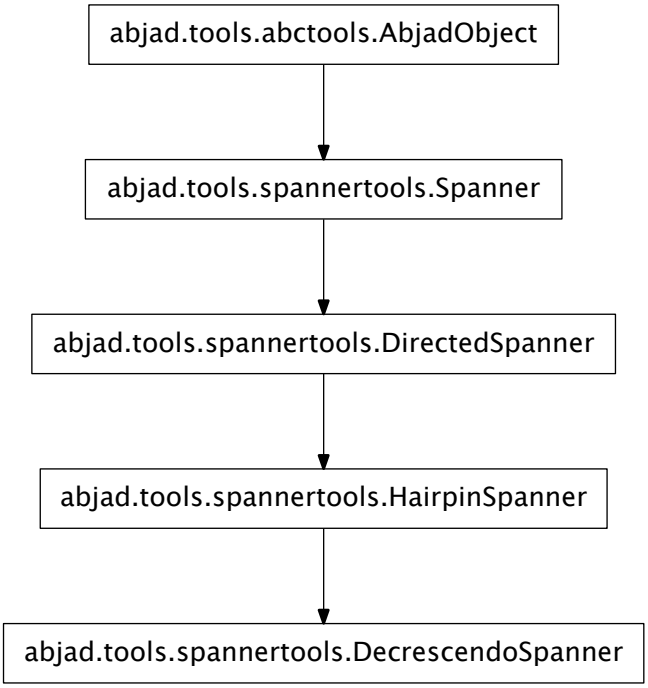
CrescendoSpanner.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

CrescendoSpanner.__repr__()
Inherited from spannertools.Spanner

spannertools.DecrescendoSpanner



class spannertools.**DecrescendoSpanner**(*components=None*, *include_rests=True*, *direction=None*)
Abjad decrescendo spanner that includes rests:

```
>>> staff = Staff("r4 c'8 d'8 e'8 f'8 r4")

>>> f(staff)
\new Staff {
```

```
    r4
    c'8
    d'8
    e'8
    f'8
    r4
}
```

```
>>> spannertools.DecrescendoSpanner(staff[:], include_rests=True)
DecrescendoSpanner(r4, c'8, d'8, e'8, f'8, r4)
```

```
>>> f(staff)
\new Staff {
    r4 \>
    c'8
    d'8
    e'8
    f'8
    r4 \!
}
```

Abjad decrescendo spanner that does not include rests:

```
>>> staff = Staff("r4 c'8 d'8 e'8 f'8 r4")
```

```
>>> f(staff)
\new Staff {
    r4
    c'8
    d'8
    e'8
    f'8
    r4
}
```

```
>>> spannertools.DecrescendoSpanner(staff[:], include_rests=False)
DecrescendoSpanner(r4, c'8, d'8, e'8, f'8, r4)
```

```
>>> f(staff)
\new Staff {
    r4
    c'8 \>
    d'8
    e'8
    f'8 \!
    r4
}
```

Return decrescendo spanner.

Read-only Properties

DecrescendoSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

DecrescendoSpanner.**duration_in_seconds**
Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

DecrescendoSpanner.**leaves**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

DecrescendoSpanner.**override**
LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

DecrescendoSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

DecrescendoSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

DecrescendoSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

DecrescendoSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

DecrescendoSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

DecrescendoSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

DecrescendoSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

DecrescendoSpanner.**direction**

Inherited from spannertools.DirectedSpanner

DecrescendoSpanner.**include_rests**

Get boolean hairpin rests setting:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f', include_rests = True)
>>> hairpin.include_rests
True
```

Set boolean hairpin rests setting:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f', include_rests = True)
>>> hairpin.include_rests = False
>>> hairpin.include_rests
False
```

Set boolean.

Inherited from spannertools.HairpinSpanner

DecrescendoSpanner.**shape_string**

Get hairpin shape string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.shape_string
'<'
```

Set hairpin shape string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.shape_string = '>'
>>> hairpin.shape_string
'>'
```

Set string.

Inherited from spannertools.HairpinSpanner

DecrescendoSpanner.**start_dynamic_string**

Get hairpin start dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.start_dynamic_string
'p'
```

Set hairpin start dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.start_dynamic_string = 'mf'
>>> hairpin.start_dynamic_string
'mf'
```

Set string.

Inherited from spannertools.HairpinSpanner

DecrescendoSpanner.**stop_dynamic_string**

Get hairpin stop dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.stop_dynamic_string
'f'
```

Set hairpin stop dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.stop_dynamic_string = 'mf'
>>> hairpin.stop_dynamic_string
'mf'
```

Set string.

Inherited from spannertools.HairpinSpanner

Methods

DecrescendoSpanner.**append**(*component*)

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

DecrescendoSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

DecrescendoSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from `spannertools.Spanner`

`DecrescendoSpanner.`**`extend`**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`DecrescendoSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`DecrescendoSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`DecrescendoSpanner.`**`fuse`**`(`*spanner*`)`

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`DecrescendoSpanner.`**`index`**`(`*component*`)`

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`DecrescendoSpanner.`**`pop`**`()`

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

DecrescendoSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

DecrescendoSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

DecrescendoSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

DecrescendoSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DecrescendoSpanner.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DecrescendoSpanner.__getitem__(*expr*)
Inherited from spannertools.Spanner

DecrescendoSpanner.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DecrescendoSpanner.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DecrescendoSpanner.__len__()
Inherited from spannertools.Spanner

DecrescendoSpanner.__lt__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

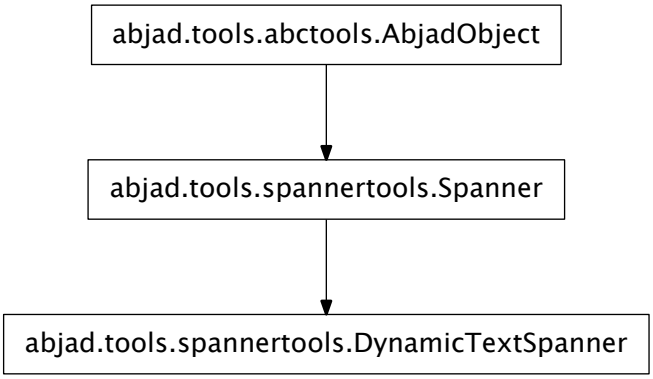
DecrescendoSpanner.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DecrescendoSpanner.__repr__()
Inherited from spannertools.Spanner

spannertools.DynamicTextSpanner



class spannertools.**DynamicTextSpanner**(*components=None*, *mark=''*)

Abjad dynamic text spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spannertools.DynamicTextSpanner(staff[:], 'f')
DynamicTextSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 \f
    d'8
    e'8
    f'8
}
```

Format dynamic *mark* at first leaf in spanner.

Return dynamic text spanner.

Read-only Properties

DynamicTextSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

DynamicTextSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

DynamicTextSpanner.**leaves**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

DynamicTextSpanner.**override**
LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

DynamicTextSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

DynamicTextSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

DynamicTextSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

DynamicTextSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

DynamicTextSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

DynamicTextSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

DynamicTextSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

DynamicTextSpanner.**mark**
Get dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> dynamic_text_spanner = spannertools.DynamicTextSpanner(staff[:], 'f')
>>> dynamic_text_spanner.mark
'f'
```

Set dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> dynamic_text_spanner = spannertools.DynamicTextSpanner(staff[:], 'f')
>>> dynamic_text_spanner.mark = 'p'
>>> dynamic_text_spanner.mark
'p'
```

Set string.

Methods

DynamicTextSpanner.**append**(*component*)

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

DynamicTextSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

DynamicTextSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

DynamicTextSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

DynamicTextSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

DynamicTextSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are Left, Right and None.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from spannertools.Spanner

DynamicTextSpanner.**fuse**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from spannertools.Spanner

DynamicTextSpanner.**index**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from spannertools.Spanner

DynamicTextSpanner.**pop**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")
```

```
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

DynamicTextSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

DynamicTextSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

DynamicTextSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

DynamicTextSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DynamicTextSpanner.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DynamicTextSpanner.__**getitem**__(*expr*)
Inherited from spannertools.Spanner

DynamicTextSpanner.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DynamicTextSpanner.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DynamicTextSpanner.__**len**__()
Inherited from spannertools.Spanner

DynamicTextSpanner.__**lt**__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

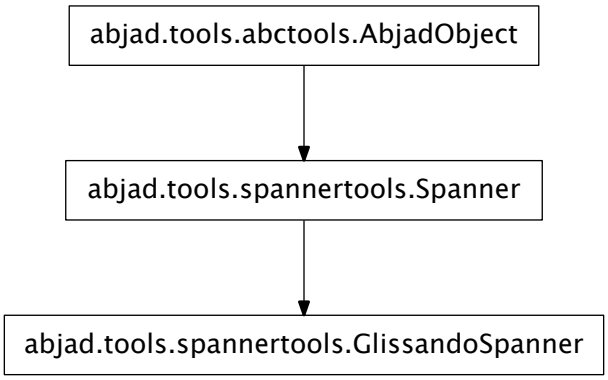
DynamicTextSpanner.__**ne**__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DynamicTextSpanner.__**repr**__()
Inherited from spannertools.Spanner

spannertools.GlissandoSpanner



class spannertools.**GlissandoSpanner**(*components=None*)

Abjad glissando spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spannertools.GlissandoSpanner(staff[:])
GlissandoSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 \glissando
    d'8 \glissando
    e'8 \glissando
    f'8
}
```

Format nonlast leaves in spanner with LilyPond glissando command.

Return glissando spanner.

Read-only Properties

GlissandoSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

GlissandoSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

GlissandoSpanner.**leaves**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

GlissandoSpanner.**override**

LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

GlissandoSpanner.**preprolated_duration**

Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

GlissandoSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

GlissandoSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

GlissandoSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

GlissandoSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

GlissandoSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

GlissandoSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Methods

GlissandoSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

GlissandoSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

GlissandoSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

GlissandoSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

GlissandoSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

GlissandoSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are Left, Right and None.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))
```

```
>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`GlissandoSpanner.`**`fuse`**`(`*`spanner`*`)`

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`GlissandoSpanner.`**`index`**`(`*`component`*`)`

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

GlissandoSpanner.**pop**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

GlissandoSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

GlissandoSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

GlissandoSpanner.__**contains**__(*expr*)
Inherited from spannertools.Spanner

GlissandoSpanner.__**eq**__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

GlissandoSpanner.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GlissandoSpanner.__**getitem**__(*expr*)
Inherited from spannertools.Spanner

GlissandoSpanner.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

GlissandoSpanner.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GlissandoSpanner.__**len**__()
Inherited from spannertools.Spanner

GlissandoSpanner.__**lt**__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

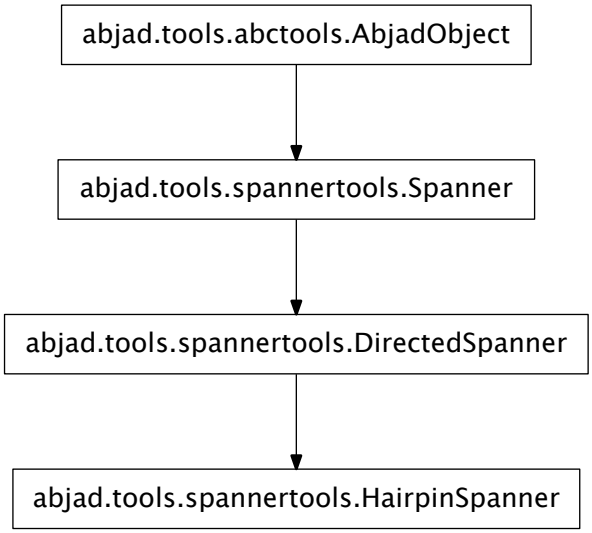
GlissandoSpanner.__**ne**__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

GlissandoSpanner.__**repr**__()
Inherited from spannertools.Spanner

spannertools.HairpinSpanner



class spannertools.**HairpinSpanner**(*components=None*, *descriptor='<'*, *include_rests=True*, *direction=None*)

Abjad hairpin spanner that includes rests:

```
>>> staff = Staff("r4 c'8 d'8 e'8 f'8 r4")

>>> f(staff)
\new Staff {
    r4
    c'8
    d'8
    e'8
    f'8
    r4
}

>>> spannertools.HairpinSpanner(staff[:], 'p < f', include_rests = True)
HairpinSpanner(r4, c'8, d'8, e'8, f'8, r4)

>>> f(staff)
\new Staff {
    r4 \< \p
    c'8
    d'8
    e'8
    f'8
    r4 \f
}
```

Abjad hairpin spanner that does not include rests:

```
>>> staff = Staff("r4 c'8 d'8 e'8 f'8 r4")

>>> f(staff)
\new Staff {
    r4
    c'8
    d'8
    e'8
    f'8
    r4
}

>>> spannertools.HairpinSpanner(staff[:], 'p < f', include_rests = False)
HairpinSpanner(r4, c'8, d'8, e'8, f'8, r4)

>>> f(staff)
\new Staff {
    r4
    c'8 \< \p
    d'8
    e'8
    f'8 \f
    r4
}
```

Return hairpin spanner.

Read-only Properties

`HairpinSpanner.`**`components`**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from `spannertools.Spanner`

`HairpinSpanner.`**`duration_in_seconds`**

Sum of duration of all leaves in spanner, in seconds.

Inherited from `spannertools.Spanner`

`HairpinSpanner.`**`leaves`**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from `spannertools.Spanner`

HairpinSpanner.**override**
LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

HairpinSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

HairpinSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

HairpinSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

HairpinSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

HairpinSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

HairpinSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

HairpinSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

HairpinSpanner.**direction**
Inherited from spannertools.DirectedSpanner

HairpinSpanner.**include_rests**
Get boolean hairpin rests setting:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f', include_rests = True)
>>> hairpin.include_rests
True
```

Set boolean hairpin rests setting:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f', include_rests = True)
>>> hairpin.include_rests = False
>>> hairpin.include_rests
False
```

Set boolean.

HairpinSpanner.**shape_string**

Get hairpin shape string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.shape_string
'<'
```

Set hairpin shape string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.shape_string = '>'
>>> hairpin.shape_string
'>'
```

Set string.

HairpinSpanner.**start_dynamic_string**

Get hairpin start dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.start_dynamic_string
'p'
```

Set hairpin start dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.start_dynamic_string = 'mf'
>>> hairpin.start_dynamic_string
'mf'
```

Set string.

HairpinSpanner.**stop_dynamic_string**

Get hairpin stop dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.stop_dynamic_string
'f'
```

Set hairpin stop dynamic string:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> hairpin = spannertools.HairpinSpanner(staff[:], 'p < f')
>>> hairpin.stop_dynamic_string = 'mf'
>>> hairpin.stop_dynamic_string
'mf'
```

Set string.

Methods

HairpinSpanner.**append**(*component*)

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
```

```
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

HairpinSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

HairpinSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

HairpinSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

HairpinSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`HairpinSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`HairpinSpanner.`**`fuse`**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]
```

```
>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from spannertools.Spanner

HairpinSpanner.**index**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from spannertools.Spanner

HairpinSpanner.**pop**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

HairpinSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

HairpinSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

HairpinSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

HairpinSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

HairpinSpanner.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HairpinSpanner.**__getitem__**(*expr*)

Inherited from spannertools.Spanner

HairpinSpanner.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

HairpinSpanner.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HairpinSpanner.**__len__**()

Inherited from spannertools.Spanner

HairpinSpanner.**__lt__**(*other*)

Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

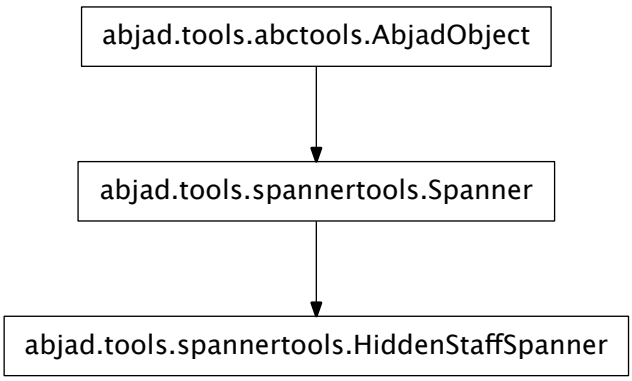
HairpinSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

HairpinSpanner.**__repr__**()
Inherited from spannertools.Spanner

spannertools.HiddenStaffSpanner



class spannertools.**HiddenStaffSpanner**(*components=None*)
Abjad hidden staff spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spannertools.HiddenStaffSpanner(staff[:2])
HiddenStaffSpanner(c'8, d'8)

>>> f(staff)
\new Staff {
    \stopStaff
    c'8
    d'8
    \startStaff
    e'8
    f'8
}
```

Hide staff behind leaves in spanner.

Return hidden staff spanner.

Read-only Properties

HiddenStaffSpanner.**components**
Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`duration_in_seconds`**
Sum of duration of all leaves in spanner, in seconds.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`leaves`**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`override`**
LilyPond grob override component plug-in.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`preprolated_duration`**
Sum of preprolated duration of all components in spanner.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`prolated_duration`**
Sum of prolated duration of all components in spanner.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`set`**
LilyPond context setting component plug-in.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`start_offset`**
Read-only start offset of spanner.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`stop_offset`**
Read-only stop offset of spanner.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

HiddenStaffSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Methods

HiddenStaffSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

HiddenStaffSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

HiddenStaffSpanner.**clear**()
Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

HiddenStaffSpanner.**extend**(*components*)
Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)
```

```
>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`fuse`**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])
```

```
>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`index`**`(`*component*`)`

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`pop`**`()`

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.`**`pop_left`**`()`

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
```

```
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from `spannertools.Spanner`

Special Methods

`HiddenStaffSpanner.__call__(expr)`

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.__contains__(expr)`

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.__eq__(arg)`

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`HiddenStaffSpanner.__ge__(arg)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`HiddenStaffSpanner.__getitem__(expr)`

Inherited from `spannertools.Spanner`

`HiddenStaffSpanner.__gt__(arg)`

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

HiddenStaffSpanner.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HiddenStaffSpanner.**__len__**()
Inherited from spannertools.Spanner

HiddenStaffSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

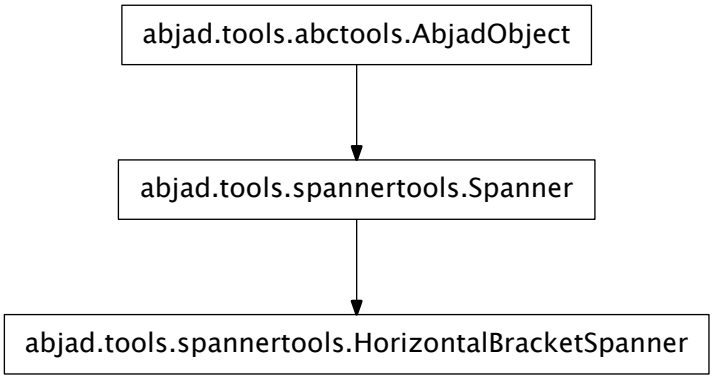
HiddenStaffSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

HiddenStaffSpanner.**__repr__**()
Inherited from spannertools.Spanner

spannertools.HorizontalBracketSpanner



class spannertools.**HorizontalBracketSpanner**(*components=None*)
New in version 2.4. Abjad horizontal bracket spanner:

```
>>> voice = Voice("c'4 d'4 e'4 f'4")
>>> voice.engraver_consists.append('Horizontal_bracket_engraver')

>>> horizontal_bracket_spanner = spannertools.HorizontalBracketSpanner(voice[:])

>>> horizontal_bracket_spanner
HorizontalBracketSpanner(c'4, d'4, e'4, f'4)
```

```
>>> f(voice)
\new Voice \with {
    \consists Horizontal_bracket_engraver
} {
    c'4 \startGroup
    d'4
    e'4
    f'4 \stopGroup
}
```

Return horizontal bracket spanner.

Read-only Properties

HorizontalBracketSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

HorizontalBracketSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**leaves**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**override**

LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**preprolated_duration**

Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**prolated_duration**

Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**set**

LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

HorizontalBracketSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Methods

HorizontalBracketSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**clear**()
Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from `spannertools.Spanner`

`HorizontalBracketSpanner.`**`extend`**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`HorizontalBracketSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`HorizontalBracketSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`HorizontalBracketSpanner.`**`fuse`**`(`*`spanner`*`)`
Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`HorizontalBracketSpanner.`**`index`**`(`*`component`*`)`
Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`HorizontalBracketSpanner.`**`pop`**`()`
Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

HorizontalBracketSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

HorizontalBracketSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

HorizontalBracketSpanner.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HorizontalBracketSpanner.__getitem__(*expr*)
Inherited from spannertools.Spanner

HorizontalBracketSpanner.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

HorizontalBracketSpanner.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HorizontalBracketSpanner.__len__()
Inherited from spannertools.Spanner

HorizontalBracketSpanner.__lt__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

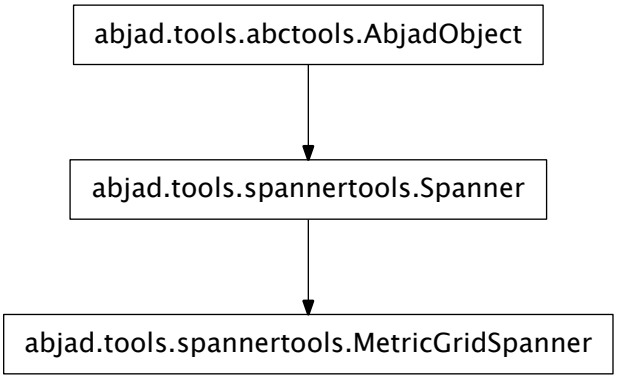
HorizontalBracketSpanner.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

HorizontalBracketSpanner.__repr__()
Inherited from spannertools.Spanner

spannertools.MetricGridSpanner



class spannertools.**MetricGridSpanner**(*components=None*, *meters=None*)

Abjad metric grid spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c'8")

>>> spannertools.MetricGridSpanner(staff.leaves, meters=[(1, 8), (1, 4)])
MetricGridSpanner(c'8, d'8, e'8, f'8, g'8, a'8, b'8, c'8)

>>> f(staff)
\new Staff {
    \time 1/8
    c'8
    \time 1/4
    d'8
    e'8
    \time 1/8
    f'8
    \time 1/4
    g'8
    a'8
    \time 1/8
    b'8
    \time 1/4
    c'8
}
```

Format leaves in spanner cyclically with *meters*.

Return metric grid spanner.

Read-only Properties

MetricGridSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`duration_in_seconds`**
Sum of duration of all leaves in spanner, in seconds.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`leaves`**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`override`**
LilyPond grob override component plug-in.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`preprolated_duration`**
Sum of preprolated duration of all components in spanner.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`prolated_duration`**
Sum of prolated duration of all components in spanner.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`set`**
LilyPond context setting component plug-in.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`start_offset`**
Read-only start offset of spanner.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`stop_offset`**
Read-only stop offset of spanner.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

MetricGridSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

MetricGridSpanner.**meters**
Get metric grid meters:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c'8")
>>> metric_grid_spanner = spannertools.MetricGridSpanner(
...     staff.leaves, meters=[(1, 8), (1, 4)])
```

Set metric grid meters:

```
>>> staff = Staff("c'8 d'8 e'8 f'8 g'8 a'8 b'8 c'8")
>>> metric_grid_spanner = spannertools.MetricGridSpanner(
...     staff.leaves, meters=[(1, 8), (1, 4)])
>>> metric_grid_spanner.meters = [Duration(1, 4)]
```

Set iterable.

Methods

MetricGridSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

MetricGridSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

MetricGridSpanner.**clear**()
Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`extend`**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))
```

```
>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`fuse`**`(`*spanner*`)`

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.`**`index`**`(`*component*`)`

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

MetricGridSpanner.**pop**()
Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

MetricGridSpanner.**pop_left**()
Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

MetricGridSpanner.**split_on_bar**()
Temporarily unavailable.

MetricGridSpanner.**splitting_condition**(*leaf*)
User-definable boolean function to determine whether leaf should be split:

```
>>> voice = Voice("c'4 r4 c'4")

>>> f(voice)
\new Voice {
    c'4
    r4
    c'4
}

>>> def cond(leaf):
...   if not isinstance(leaf, Rest): return True
...   else: return False
>>> metric_grid_spanner = spannertools.MetricGridSpanner(
...     voice.leaves, [Duration(1, 8)])
>>> metric_grid_spanner.splitting_condition = cond

>>> metric_grid_spanner.split_on_bar()
```

```
>>> f(voice)
\new Voice {
    \time 1/8
    c'8 ~
    c'8
    r4
    c'8 ~
    c'8
}
```

Function defaults to return true.

Special Methods

`MetricGridSpanner.__call__(expr)`

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from `spannertools.Spanner`

`MetricGridSpanner.__contains__(expr)`

Inherited from `spannertools.Spanner`

`MetricGridSpanner.__eq__(arg)`

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`MetricGridSpanner.__ge__(arg)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`MetricGridSpanner.__getitem__(expr)`

Inherited from `spannertools.Spanner`

`MetricGridSpanner.__gt__(arg)`

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

MetricGridSpanner.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MetricGridSpanner.**__len__**()
Inherited from spannertools.Spanner

MetricGridSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

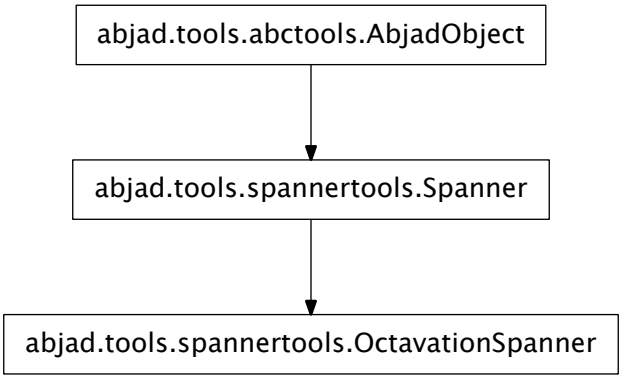
MetricGridSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MetricGridSpanner.**__repr__**()
Inherited from spannertools.Spanner

spannertools.OctavationSpanner



class spannertools.**OctavationSpanner**(*components=None*, *start=0*, *stop=0*)
Abjad octavation spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spanner = spannertools.OctavationSpanner(staff[:], start=1)

>>> f(staff)
\new Staff {
    \ottava #1
    c'8
    d'8
```

```
        e'8
        f'8
        \ottava #0
    }
```

Return octavation spanner.

Read-only Properties

OctavationSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

OctavationSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

OctavationSpanner.**leaves**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

OctavationSpanner.**override**

LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

OctavationSpanner.**preprolated_duration**

Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

OctavationSpanner.**prolated_duration**

Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

OctavationSpanner.**set**

LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

OctavationSpanner.**start_offset**

Read-only start offset of spanner.

Inherited from spannertools.Spanner

OctavationSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

OctavationSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

OctavationSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

OctavationSpanner.**start**
Get octavation start:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> octavation = spannertools.OctavationSpanner(staff[:], start=1)
>>> octavation.start
1
```

Set octavation start:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> octavation = spannertools.OctavationSpanner(staff[:], start=1)
>>> octavation.start
1
```

Set integer.

OctavationSpanner.**stop**
Get octavation stop:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> octavation = spannertools.OctavationSpanner(staff[:], start=2, stop=1)
>>> octavation.stop
1
```

Set octavation stop:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> octavation = spannertools.OctavationSpanner(staff[:], start=2, stop=1)
>>> octavation.stop = 0
>>> octavation.stop
0
```

Set integer.

Methods

OctavationSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)
```

```
>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

OctavationSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

OctavationSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

OctavationSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

OctavationSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)
```

```
>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`OctavationSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`OctavationSpanner.`**`fuse`**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
```

```
        d'8
        e'8
        f'8 ]
    }
```

Return list.

Inherited from spannertools.Spanner

OctavationSpanner.**index**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from spannertools.Spanner

OctavationSpanner.**pop**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

OctavationSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

OctavationSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

OctavationSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

OctavationSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

OctavationSpanner.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OctavationSpanner.**__getitem__**(*expr*)

Inherited from spannertools.Spanner

OctavationSpanner.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

OctavationSpanner.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OctavationSpanner.**__len__**()

Inherited from spannertools.Spanner

OctavationSpanner.**__lt__**(*other*)

Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

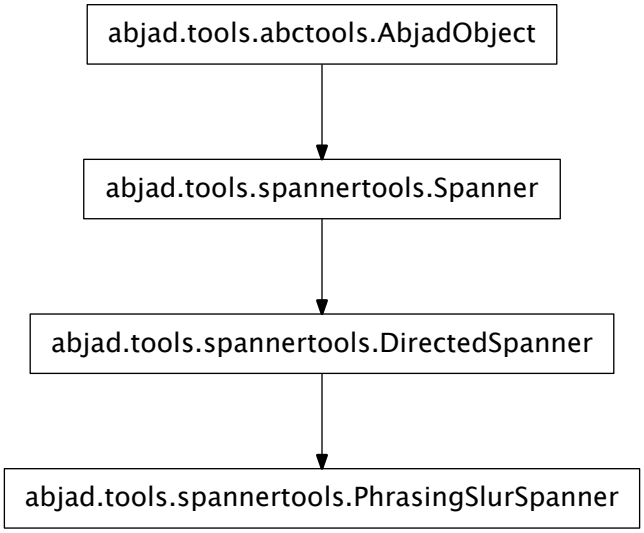
OctavationSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

OctavationSpanner.**__repr__**()
Inherited from spannertools.Spanner

spannertools.PhrasingSlurSpanner



class spannertools.**PhrasingSlurSpanner**(*components=None*, *direction=None*)
Abjad phrasing slur spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spannertools.PhrasingSlurSpanner(staff[:])
PhrasingSlurSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 \(
    d'8
    e'8
    f'8 \)
}
```

Return phrasing slur spanner.

Read-only Properties

PhrasingSlurSpanner.**components**
Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

PhrasingSlurSpanner.**duration_in_seconds**
Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**leaves**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**override**
LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

PhrasingSlurSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

PhrasingSlurSpanner.**direction**
Inherited from spannertools.DirectedSpanner

Methods

PhrasingSlurSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**clear**()
Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are Left, Right and None.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**fuse**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**index**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**pop**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

PhrasingSlurSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

PhrasingSlurSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

PhrasingSlurSpanner.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PhrasingSlurSpanner.**__getitem__**(*expr*)
Inherited from spannertools.Spanner

PhrasingSlurSpanner.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

PhrasingSlurSpanner.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PhrasingSlurSpanner.**__len__**()
Inherited from spannertools.Spanner

PhrasingSlurSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

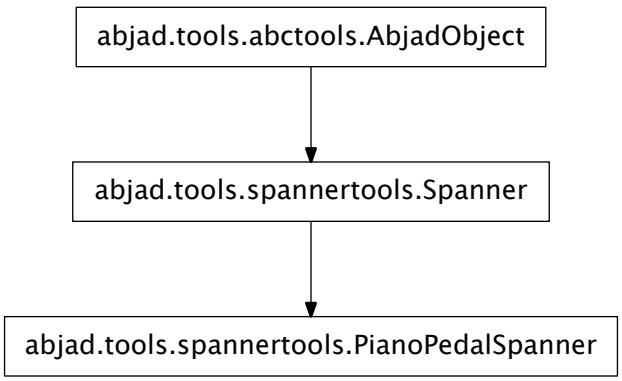
PhrasingSlurSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

PhrasingSlurSpanner.**__repr__**()
Inherited from spannertools.Spanner

spannertools.PianoPedalSpanner



class spannertools.**PianoPedalSpanner**(*components=None*)
Abjad piano pedal spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spannertools.PianoPedalSpanner(staff[:])
PianoPedalSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    \set Staff.pedalSustainStyle = #'mixed
    c'8 \sustainOn
    d'8
    e'8
    f'8 \sustainOff
}
```

Return piano pedal spanner.

Read-only Properties

`PianoPedalSpanner.`**`components`**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from `spannertools.Spanner`

`PianoPedalSpanner.`**`duration_in_seconds`**

Sum of duration of all leaves in spanner, in seconds.

Inherited from `spannertools.Spanner`

`PianoPedalSpanner.`**`leaves`**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from `spannertools.Spanner`

`PianoPedalSpanner.`**`override`**

LilyPond grob override component plug-in.

Inherited from `spannertools.Spanner`

`PianoPedalSpanner.`**`preprolated_duration`**

Sum of preprolated duration of all components in spanner.

Inherited from `spannertools.Spanner`

`PianoPedalSpanner.`**`prolated_duration`**

Sum of prolated duration of all components in spanner.

Inherited from `spannertools.Spanner`

PianoPedalSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

PianoPedalSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

PianoPedalSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

PianoPedalSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

PianoPedalSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

PianoPedalSpanner.**kind**
Get piano pedal spanner kind:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> spanner = spannertools.PianoPedalSpanner(staff[:])
>>> spanner.kind
'sustain'
```

Set piano pedal spanner kind:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> spanner = spannertools.PianoPedalSpanner(staff[:])
>>> spanner.kind = 'sostenuto'
>>> spanner.kind
'sostenuto'
```

Acceptable values 'sustain','sostenuto','corda'.

PianoPedalSpanner.**style**
Get piano pedal spanner style:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> spanner = spannertools.PianoPedalSpanner(staff[:])
>>> spanner.style
'mixed'
```

Set piano pedal spanner style:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> spanner = spannertools.PianoPedalSpanner(staff[:])
>>> spanner.style = 'bracket'
>>> spanner.style
'bracket'
```

Acceptable values 'mixed','bracket','text'.

Methods

PianoPedalSpanner.**append**(*component*)

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

PianoPedalSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

PianoPedalSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

PianoPedalSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

PianoPedalSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

PianoPedalSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are Left, Right and None.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from spannertools.Spanner

PianoPedalSpanner.**fuse**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
```

```
    f'8 ]
}
```

```
>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]
```

```
>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`PianoPedalSpanner.`**`index`**`(`*component*`)`

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)
```

```
>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`PianoPedalSpanner.`**`pop`**`()`

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.pop()
Note("f'8")
```

```
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from `spannertools.Spanner`

`PianoPedalSpanner.`**`pop_left`**`()`

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.pop_left()
Note("c'8")
```

```
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

PianoPedalSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

PianoPedalSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

PianoPedalSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

PianoPedalSpanner.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PianoPedalSpanner.**__getitem__**(*expr*)

Inherited from spannertools.Spanner

PianoPedalSpanner.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

PianoPedalSpanner.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

PianoPedalSpanner.**__len__**()
Inherited from spannertools.Spanner

PianoPedalSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

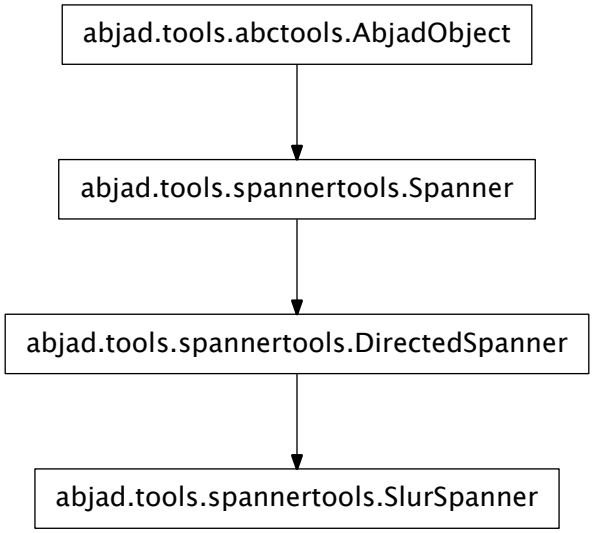
PianoPedalSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

PianoPedalSpanner.**__repr__**()
Inherited from spannertools.Spanner

spannertools.SlurSpanner



class spannertools.**SlurSpanner**(*components=None*, *direction=None*)
Abjad slur spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spannertools.SlurSpanner(staff[:])
SlurSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 (
    d'8
    e'8
```

```
        f'8 )
    }
```

Return slur spanner.

Read-only Properties

`SlurSpanner.`**`components`**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from `spannertools.Spanner`

`SlurSpanner.`**`duration_in_seconds`**

Sum of duration of all leaves in spanner, in seconds.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`leaves`**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`override`**

LilyPond grob override component plug-in.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`preprolated_duration`**

Sum of preprolated duration of all components in spanner.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`prolated_duration`**

Sum of prolated duration of all components in spanner.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`set`**

LilyPond context setting component plug-in.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`start_offset`**

Read-only start offset of spanner.

Inherited from `spannertools.Spanner`

SlurSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

SlurSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

SlurSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

SlurSpanner.**direction**
Inherited from spannertools.DirectedSpanner

Methods

SlurSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

SlurSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

SlurSpanner.**clear**()
Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`extend`**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`fuse`**(*spanner*)
Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`index`**(*component*)
Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`SlurSpanner.`**`pop`**()
Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

SlurSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

SlurSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

SlurSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

SlurSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

SlurSpanner.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SlurSpanner.__getitem__(*expr*)
Inherited from spannertools.Spanner

SlurSpanner.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SlurSpanner.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SlurSpanner.__len__()
Inherited from spannertools.Spanner

SlurSpanner.__lt__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

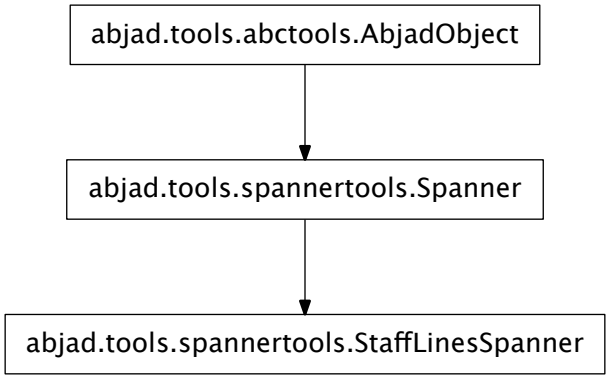
SlurSpanner.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

SlurSpanner.__repr__()
Inherited from spannertools.Spanner

spannertools.StaffLinesSpanner



class spannertools.**StaffLinesSpanner**(*components=None*, *lines=5*)

Abjad staff lines spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spannertools.StaffLinesSpanner(staff[:2], 1)
StaffLinesSpanner(c'8, d'8)

>>> f(staff)
\new Staff {
    \stopStaff
    \override Staff.StaffSymbol #'line-count = #1
    \startStaff
    c'8
    d'8
    \stopStaff
    \revert Staff.StaffSymbol #'line-count
    \startStaff
    e'8
    f'8
}
```

Staff lines spanner handles changing either the line-count or the line-positions property of the StaffSymbol grob, as well as automatically stopping and restarting the staff so that the change may take place.

Return staff lines spanner.

Read-only Properties

StaffLinesSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

StaffLinesSpanner.**duration_in_seconds**
Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

StaffLinesSpanner.**leaves**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

StaffLinesSpanner.**override**
LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

StaffLinesSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

StaffLinesSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

StaffLinesSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

StaffLinesSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

StaffLinesSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

StaffLinesSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

StaffLinesSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

`StaffLinesSpanner.`**`lines`**

Get staff lines spanner line count:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> spanner = spannertools.StaffLinesSpanner(staff[:2], 1)
>>> spanner.lines
1
```

Set staff lines spanner line count:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> spanner = spannertools.StaffLinesSpanner(staff[:2], 1)
>>> spanner.lines = 2
>>> spanner.lines
2
```

Set integer.

Methods

`StaffLinesSpanner.`**`append`**`(`*component*`)`

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from `spannertools.Spanner`

`StaffLinesSpanner.`**`append_left`**`(`*component*`)`

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`StaffLinesSpanner.`**`clear`**`()`

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

StaffLinesSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

StaffLinesSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

StaffLinesSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are Left, Right and None.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`StaffLinesSpanner.`**`fuse`**`(`*`spanner`*`)`
Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`StaffLinesSpanner.`**`index`**`(`*`component`*`)`
Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`StaffLinesSpanner.`**`pop`**`()`
Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

StaffLinesSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

StaffLinesSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

StaffLinesSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

StaffLinesSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

StaffLinesSpanner.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StaffLinesSpanner.__getitem__(*expr*)
Inherited from spannertools.Spanner

StaffLinesSpanner.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

StaffLinesSpanner.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

StaffLinesSpanner.__len__()
Inherited from spannertools.Spanner

StaffLinesSpanner.__lt__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

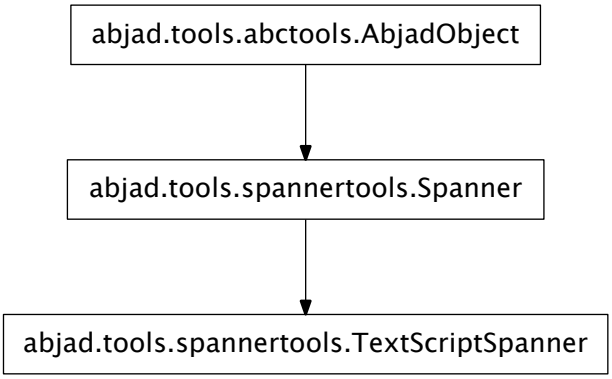
StaffLinesSpanner.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

StaffLinesSpanner.__repr__()
Inherited from spannertools.Spanner

spannertools.TextScriptSpanner



class spannertools.**TextScriptSpanner**(*components=None*)

New in version 2.0. Abjad text script spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spanner = spannertools.TextScriptSpanner(staff[:])
>>> spanner.override.text_script.color = 'red'
>>> markuptools.Markup(r'\italic { espressivo }', Up)(staff[1])
Markup((MarkupCommand('italic', ['espressivo']),), direction=Up)(d'8)

>>> f(staff)
\new Staff {
    \override TextScript #'color = #red
    c'8
    d'8 ^ \markup { \italic { espressivo } }
    e'8
    f'8
    \revert TextScript #'color
}
```

Override LilyPond TextScript grob.

Return text script spanner.

Read-only Properties

TextScriptSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

TextScriptSpanner.**duration_in_seconds**
Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

TextScriptSpanner.**leaves**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

TextScriptSpanner.**override**
LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

TextScriptSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

TextScriptSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

TextScriptSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

TextScriptSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

TextScriptSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

TextScriptSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

TextScriptSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Methods

TextScriptSpanner.**append**(*component*)

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

TextScriptSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

TextScriptSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

TextScriptSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

TextScriptSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

TextScriptSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are Left, Right and None.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from spannertools.Spanner

TextScriptSpanner.**fuse**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
```

```
        f'8 ]
    }

    >>> left_beam.fuse(right_beam)
    [(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

    >>> print voice.lilypond_format
    \new Voice {
        c'8 [
        d'8
        e'8
        f'8 ]
    }
```

Return list.

Inherited from `spannertools.Spanner`

`TextScriptSpanner.`**`index`**(*component*)

Return nonnegative integer index of *component* in spanner:

```
    >>> voice = Voice("c'8 d'8 e'8 f'8")
    >>> spanner = beamtools.BeamSpanner(voice[2:])
    >>> spanner
    BeamSpanner(e'8, f'8)

    >>> spanner.index(voice[-2])
    0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

`TextScriptSpanner.`**`pop`**()

Remove and return rightmost component in spanner:

```
    >>> voice = Voice("c'8 d'8 e'8 f'8")
    >>> spanner = beamtools.BeamSpanner(voice[:])
    >>> spanner
    BeamSpanner(c'8, d'8, e'8, f'8)

    >>> spanner.pop()
    Note("f'8")

    >>> spanner
    BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from `spannertools.Spanner`

`TextScriptSpanner.`**`pop_left`**()

Remove and return leftmost component in spanner:

```
    >>> voice = Voice("c'8 d'8 e'8 f'8")
    >>> spanner = beamtools.BeamSpanner(voice[:])
    >>> spanner
    BeamSpanner(c'8, d'8, e'8, f'8)

    >>> spanner.pop_left()
    Note("c'8")
```

```
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

TextScriptSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

TextScriptSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

TextScriptSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TextScriptSpanner.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TextScriptSpanner.**__getitem__**(*expr*)

Inherited from spannertools.Spanner

TextScriptSpanner.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TextScriptSpanner.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TextScriptSpanner.**__len__**()
Inherited from spannertools.Spanner

TextScriptSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

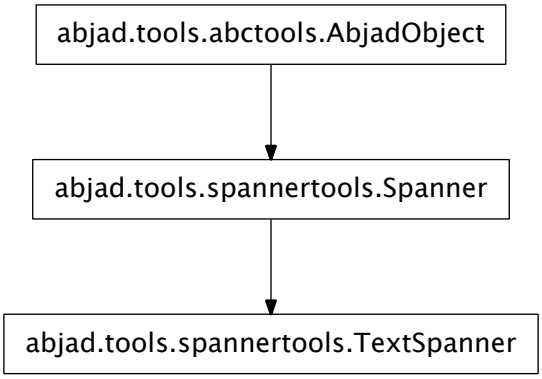
TextScriptSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TextScriptSpanner.**__repr__**()
Inherited from spannertools.Spanner

spannertools.TextSpanner



class spannertools.**TextSpanner**(*components=None*)
New in version 2.0. Abjad text spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> text_spanner = spannertools.TextSpanner(staff[:])

>>> markup = markuptools.Markup(markuptools.MarkupCommand(
...     'bold', markuptools.MarkupCommand('italic', 'foo')))
>>> text_spanner.override.text_spanner.bound_details__left__text = markup
>>> markup = markuptools.Markup(
...     markuptools.MarkupCommand('draw-line', schemetools.SchemePair(0, -1)))
>>> text_spanner.override.text_spanner.bound_details__right__text = markup
>>> text_spanner.override.text_spanner.dash_fraction = 1

>>> f(staff)
\new Staff {
    \override TextSpanner #'bound-details #'left #'text = \markup {
        \bold \italic foo }
```

```
        \override TextSpanner #'bound-details #'right #'text = \markup {
            \draw-line #'(0 . -1) }
        \override TextSpanner #'dash-fraction = #1
        c'8 \startTextSpan
        d'8
        e'8
        f'8 \stopTextSpan
        \revert TextSpanner #'bound-details #'left #'text
        \revert TextSpanner #'bound-details #'right #'text
        \revert TextSpanner #'dash-fraction
    }
```

Override LilyPond TextSpanner grob.

Return text spanner.

Read-only Properties

TextSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

TextSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

TextSpanner.**leaves**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

TextSpanner.**override**

LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

TextSpanner.**preprolated_duration**

Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

TextSpanner.**prolated_duration**

Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

TextSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

TextSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

TextSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

TextSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

TextSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Methods

TextSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

TextSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

TextSpanner.**clear**()
Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from `spannertools.Spanner`

`TextSpanner.`**`extend`**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`TextSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`TextSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))
```

```
>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from `spannertools.Spanner`

`TextSpanner.`**`fuse`**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from `spannertools.Spanner`

`TextSpanner.`**`index`**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from `spannertools.Spanner`

TextSpanner.**pop**()
Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

TextSpanner.**pop_left**()
Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

TextSpanner.**__call__**(*expr*)
New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

TextSpanner.__**contains**__(*expr*)
Inherited from spannertools.Spanner

TextSpanner.__**eq**__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TextSpanner.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TextSpanner.__**getitem**__(*expr*)
Inherited from spannertools.Spanner

TextSpanner.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TextSpanner.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TextSpanner.__**len**__()
Inherited from spannertools.Spanner

TextSpanner.__**lt**__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

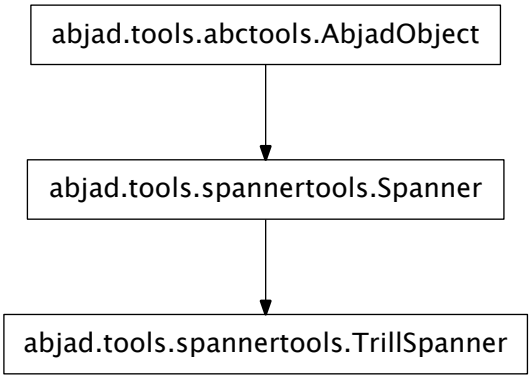
TextSpanner.__**ne**__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TextSpanner.__**repr**__()
Inherited from spannertools.Spanner

spannertools.TrillSpanner



class spannertools.**TrillSpanner**(*components=None*)

Abjad trill spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> spannertools.TrillSpanner(staff[:])
TrillSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 \startTrillSpan
    d'8
    e'8
    f'8 \stopTrillSpan
}
```

Override LilyPond TrillSpanner grob.

Return trill spanner.

Read-only Properties

TrillSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

TrillSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

TrillSpanner.**leaves**
Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

TrillSpanner.**override**
LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

TrillSpanner.**preprolated_duration**
Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

TrillSpanner.**prolated_duration**
Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

TrillSpanner.**set**
LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

TrillSpanner.**start_offset**
Read-only start offset of spanner.

Inherited from spannertools.Spanner

TrillSpanner.**stop_offset**
Read-only stop offset of spanner.

Inherited from spannertools.Spanner

TrillSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

TrillSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

TrillSpanner.**pitch**
Optional read / write pitch for pitched trills.

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> trill = spannertools.TrillSpanner(t[:2])
>>> trill.pitch = pitchtools.NamedChromaticPitch('cs', 4)
```

```
>>> f(t)
\new Staff {
    \pitchedTrill c'8 \startTrillSpan cs'
    d'8 \stopTrillSpan
    e'8
    f'8
}
```

Set pitch.

TrillSpanner.**written_pitch**

Methods

TrillSpanner.**append**(*component*)

Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

TrillSpanner.**append_left**(*component*)

Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

TrillSpanner.**clear**()

Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from spannertools.Spanner

TrillSpanner.**extend**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

TrillSpanner.**extend_left**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

TrillSpanner.**fracture**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are Left, Right and None.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from spannertools.Spanner

TrillSpanner.**fuse**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from spannertools.Spanner

TrillSpanner.**index**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from spannertools.Spanner

TrillSpanner.**pop**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")

>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

TrillSpanner.**pop_left**()
Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

TrillSpanner.**__call__**(*expr*)
New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

TrillSpanner.**__contains__**(*expr*)
Inherited from spannertools.Spanner

TrillSpanner.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TrillSpanner.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TrillSpanner.**__getitem__**(*expr*)
Inherited from spannertools.Spanner

TrillSpanner.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TrillSpanner.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TrillSpanner.**__len__**()
Inherited from spannertools.Spanner

TrillSpanner.**__lt__**(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

TrillSpanner.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TrillSpanner.**__repr__**()
Inherited from spannertools.Spanner

functions

spannertools.all_are_spanners

spannertools.**all_are_spanners**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad spanners:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])

>>> spannertools.all_are_spanners([spanner])
True
```

True when *expr* is an empty sequence:

```
>>> spannertools.all_are_spanners([])
True
```

Otherwise false:

```
>>> spannertools.all_are_spanners('foo')
False
```

Return boolean.

spannertools.apply_octavation_spanner_to_pitched_components

spannertools.**apply_octavation_spanner_to_pitched_components**(*expr*, *ottava_numbered_diatonic_pitch=None*, *quindecisima_numbered_diatonic_pitch=None*)

New in version 1.1. Apply octavation spanner to pitched components in *expr*:

```
>>> t = Measure((4, 8), notetools.make_notes([24, 26, 27, 29], [(1, 8)]))
>>> spannertools.apply_octavation_spanner_to_pitched_components(
...     t, ottava_numbered_diatonic_pitch=14)
OctavationSpanner(|4/8(4)|)

>>> f(t)
{
    \time 4/8
    \ottava #1
    c'''8
    d'''8
    ef'''8
    f'''8
    \ottava #0
}
```

Apply octavation spanner according to the diatonic pitch number of the maximum pitch in *expr*.

Return octavation spanner.

spannertools.destroy_spanners_attached_to_component

spannertools.**destroy_spanners_attached_to_component**(*component*, *klass=None*)

New in version 1.1. Destroy spanners of *klass* attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> trill = spannertools.TrillSpanner(staff)

>>> f(staff)
\new Staff {
    c'8 [ ( \startTrillSpan
    d'8
    e'8
    f'8 ] ) \stopTrillSpan
}

>>> spanners = spannertools.destroy_spanners_attached_to_component(staff[0])

>>> f(staff)
\new Staff {
    c'8 \startTrillSpan
    d'8
    e'8
    f'8 \stopTrillSpan
}
```

Destroy all spanners when *klass* is none.

Return tuple of zero or more empty spanners.

Order of spanners in return value can not be predicted.

spannertools.destroy_spanners_attached_to_components_in_expr

spannertools.**destroy_spanners_attached_to_components_in_expr**(*expr*, *klass=None*)

New in version 2.9. Destroy spanners of *klass* attached to components in *expr*:

```
>>> staff = Staff("c'4 [ ( d' e' f' ) ]")

>>> f(staff)
\new Staff {
    c'4 [ (
    d'4
    e'4
    f'4 ] )
}

>>> spanners = spannertools.destroy_spanners_attached_to_components_in_expr(staff)

>>> f(staff)
\new Staff {
    c'4
    d'4
    e'4
    f'4
}
```

Return tuple of zero or more empty spanners.

Order of spanners in return value can not be predicted.

spannertools.find_index_of_spanner_component_at_score_offset

spannertools.**find_index_of_spanner_component_at_score_offset**(*spanner*, *score_offset*)

Return index of component in 'spanner' that begins at exactly 'score_offset':

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> spannertools.find_index_of_spanner_component_at_score_offset(beam, Duration(3, 8))
3
```

Raise spanner population error when no component in *spanner* begins at exactly *score_offset*. Changed in version 2.0: renamed `spannertools.find_index_at_score_offset()` to `spannertools.find_index_of_spanner_component_at_score_offset()`.

spannertools.find_spanner_component_starting_at_exactly_score_offset

spannertools.**find_spanner_component_starting_at_exactly_score_offset**(*spanner*, *score_offset*)

Find *spanner* component starting at exactly *score_offset*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> spannertools.find_spanner_component_starting_at_exactly_score_offset(
...     beam, Duration(3, 8))
Note("f'8")
```

When no *spanner* component starts at exactly *score_offset* return none.

Return *spanner* component or none. Changed in version 2.0: renamed `spannertools.find_component_at_score_offset()` to `spannertools.find_spanner_component_starting_at_exactly_score_offset()`.

spannertools.fracture_spanners_attached_to_component

spannertools.**fracture_spanners_attached_to_component**(*component*, *direction=None*, *klass=None*)

New in version 1.1. Fracture all spanners attached to *component* according to *direction*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> trill = spannertools.TrillSpanner(staff)
>>> f(staff)
\new Staff {
    c'8 [ ( \startTrillSpan
    d'8
    e'8
    f'8 ] ) \stopTrillSpan
}

>>> parts = spannertools.fracture_spanners_attached_to_component(staff[1], Right)

>>> f(staff)
\new Staff {
    c'8 [ ( \startTrillSpan
    d'8 ] )
    e'8 [ (
    f'8 ] ) \stopTrillSpan
}
```

Set *direction* to `Left`, `Right` or `None`.

spannertools.fracture_spanners_that_cross_components

spannertools.**fracture_spanners_that_cross_components**(*components*)

Fracture to the left of the leftmost component. Fracture to the right of the rightmost component. Do not fracture spanners of any components at higher levels of score. Do not fracture spanners of any components at lower levels of score. Return components.

Components must be thread-contiguous. Some spanners may copy during fracture. This helper is public-safe.

Example:

```
>>> t = Staff(Container(notetools.make_repeated_notes(2)) * 3)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(t)
>>> crescendo = spannertools.CrescendoSpanner(t)
>>> beam = beamtools.BeamSpanner(t[:])
>>> trill = spannertools.TrillSpanner(t.leaves)

>>> f(t)
\new Staff {
    {
        c'8 [ \< \startTrillSpan
        d'8
    }
    {
        e'8
        f'8
    }
    {
        g'8
        a'8 ] \! \stopTrillSpan
    }   }

>>> spannertools.fracture_spanners_that_cross_components(t[1:2])
[{e'8, f'8}]

>>> f(t)
\new Staff {
    {
        c'8 [ \< \startTrillSpan
        d'8 ]
    }
    {
        e'8 [
        f'8 ]
    }
    {
        g'8 [
        a'8 ] \! \stopTrillSpan
    }
}
```

Changed in version 2.0: renamed `spannertools.fracture_crossing()` to `spannertools.fracture_spanners_that_cross_components()`.

spannertools.get_nth_leaf_in_spanner

spannertools.**get_nth_leaf_in_spanner**(*spanner*, *idx*)

Get nth leaf in spanner, no matter how complicated the nesting situation. Changed in version 2.0: renamed

spannertools.get_nth_leaf() to spannertools.get_nth_leaf_in_spanner().

spannertools.get_spanners_attached_to_any_improper_child_of_component

spannertools.**get_spanners_attached_to_any_improper_child_of_component**(*component*, *klass=None*)

New in version 2.0. Get all spanners attached to any improper children of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)
>>> first_slur = spannertools.SlurSpanner(staff.leaves[:2])
>>> second_slur = spannertools.SlurSpanner(staff.leaves[2:])
>>> trill = spannertools.TrillSpanner(staff)

>>> f(staff)
\new Staff {
    c'8 [ ( \startTrillSpan
    d'8 )
    e'8 (
    f'8 ] ) \stopTrillSpan
}

>>> len(spannertools.get_spanners_attached_to_any_improper_child_of_component(staff))
4
```

Get all spanners of *klass* attached to any proper children of *component*:

```
>>> spanner_klass = spannertools.SlurSpanner
>>> result = spannertools.get_spanners_attached_to_any_proper_child_of_component(
... staff, spanner_klass)

>>> list(sorted(result))
[SlurSpanner(c'8, d'8), SlurSpanner(e'8, f'8)]
```

Get all spanners of any *klass* attached to any proper children of *component*:

```
>>> spanner_klasses = (spannertools.SlurSpanner, beamtools.BeamSpanner)
>>> result = spannertools.get_spanners_attached_to_any_proper_child_of_component(
... staff, spanner_klasses)

>>> list(sorted(result))
[BeamSpanner(c'8, d'8, e'8, f'8), SlurSpanner(c'8, d'8), SlurSpanner(e'8, f'8)]
```

Return unordered set of zero or more spanners.

spannertools.get_spanners_attached_to_any_improper_parent_of_component

spannertools.**get_spanners_attached_to_any_improper_parent_of_component**(*component*, *klass=None*)

New in version 1.1. Get all spanners attached to improper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> trill = spannertools.TrillSpanner(staff)
>>> f(staff)
\new Staff {
```

```
    c'8 [ ( \startTrillSpan
    d'8
    e'8
    f'8 ] ) \stopTrillSpan
}
```

```
>>> result = list(sorted(
... spannertools.get_spanners_attached_to_any_improper_parent_of_component(staff[0])))
```

```
>>> for spanner in result:
...     spanner
...
BeamSpanner(c'8, d'8, e'8, f'8)
SlurSpanner(c'8, d'8, e'8, f'8)
TrillSpanner({c'8, d'8, e'8, f'8})
```

Return unordered set of zero or more spanners. Changed in version 2.0: renamed `spannertools.get_all_spanners_attached_to_improper_parentage_of_component()` to `spannertools.get_spanners_attached_to_any_improper_parent_of_component()`.

spannertools.get_spanners_attached_to_any_proper_child_of_component

spannertools.**get_spanners_attached_to_any_proper_child_of_component**(*component*, *klass=None*)

New in version 2.0. Get all spanners attached to any proper children of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)
>>> first_slur = spannertools.SlurSpanner(staff.leaves[:2])
>>> second_slur = spannertools.SlurSpanner(staff.leaves[2:])
>>> trill = spannertools.TrillSpanner(staff)
```

```
>>> f(staff)
\new Staff {
    c'8 [ ( \startTrillSpan
    d'8 )
    e'8 (
    f'8 ] ) \stopTrillSpan
}
```

```
>>> len(spannertools.get_spanners_attached_to_any_proper_child_of_component(staff))
3
```

Get all spanners of *klass* attached to any proper children of *component*:

```
>>> spanner_klass = spannertools.SlurSpanner
>>> result = spannertools.get_spanners_attached_to_any_proper_child_of_component(
... staff, spanner_klass)
```

```
>>> list(sorted(result))
[SlurSpanner(c'8, d'8), SlurSpanner(e'8, f'8)]
```

Get all spanners of any *klass* attached to any proper children of *component*:

```
>>> spanner_klasses = (spannertools.SlurSpanner, beamtools.BeamSpanner)
>>> result = spannertools.get_spanners_attached_to_any_proper_child_of_component(
... staff, spanner_klasses)
```

```
>>> list(sorted(result))
[BeamSpanner(c'8, d'8, e'8, f'8), SlurSpanner(c'8, d'8), SlurSpanner(e'8, f'8)]
```

Return unordered set of zero or more spanners. Changed in version 2.0: renamed `spannertools.get_all_spanners_attached_to_any_proper_children_of_component()` to `spannertools.get_spanners_attached_to_any_proper_child_of_component()`.

spannertools.get_spanners_attached_to_any_proper_parent_of_component

spannertools.**get_spanners_attached_to_any_proper_parent_of_component**(*component*, *klass=None*)

New in version 2.0. Get all spanners attached to any proper parent of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> trill = spannertools.TrillSpanner(staff)
>>> f(staff)
\new Staff {
    c'8 [ ( \startTrillSpan
    d'8
    e'8
    f'8 ] ) \stopTrillSpan
}
```

```
>>> spannertools.get_spanners_attached_to_any_proper_parent_of_component(staff[0])
set([TrillSpanner({c'8, d'8, e'8, f'8})])
```

Return unordered set of zero or more spanners. Changed in version 2.0: renamed `spannertools.get_all_spanners_attached_to_any_proper_parent_of_component()` to `spannertools.get_spanners_attached_to_any_proper_parent_of_component()`.

spannertools.get_spanners_attached_to_component

spannertools.**get_spanners_attached_to_component**(*component*, *klass=None*)

New in version 2.0. Get all spanners attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)
>>> first_slur = spannertools.SlurSpanner(staff.leaves[:2])
>>> second_slur = spannertools.SlurSpanner(staff.leaves[2:])
>>> crescendo = spannertools.CrescendoSpanner(staff.leaves)

>>> f(staff)
\new Staff {
    c'8 [ \< (
    d'8 )
    e'8 (
    f'8 ] \! )
}

>>> result = spannertools.get_spanners_attached_to_component(staff.leaves[0])
>>> for x in sorted(result):
...     x
...
BeamSpanner(c'8, d'8, e'8, f'8)
```

```
CrescendoSpanner(c'8, d'8, e'8, f'8)
SlurSpanner(c'8, d'8)
```

Get spanners of *klass* attached to *component*:

```
>>> klass = beamtools.BeamSpanner
>>> result = spannertools.get_spanners_attached_to_component(staff.leaves[0], klass)
>>> for x in sorted(result):
...     x
...
BeamSpanner(c'8, d'8, e'8, f'8)
```

Get spanners of any *klass* attached to *component*:

```
>>> klasses = (beamtools.BeamSpanner, spannertools.SlurSpanner)
>>> result = spannertools.get_spanners_attached_to_component(staff.leaves[0], klasses)
>>> for x in sorted(result):
...     x
...
BeamSpanner(c'8, d'8, e'8, f'8)
SlurSpanner(c'8, d'8)
```

Return unordered set of zero or more spanners. Changed in version 2.0: renamed `spannertools.get_all_spanners_attached_to_component()` to `spannertools.get_spanners_attached_to_component()`.

spannertools.get_spanners_contained_by_components

`spannertools.`**`get_spanners_contained_by_components`**(*components*)

Return unordered set of spanners contained within any component in list of thread-contiguous components. Getter for t.spanners.contained across thread-contiguous components. Changed in version 2.0: renamed `spannertools.get_contained()` to `spannertools.get_spanners_contained_by_components()`.

spannertools.get_spanners_covered_by_components

`spannertools.`**`get_spanners_covered_by_components`**(*components*)

New in version 1.1. Get spanners covered by *components*.

Return unordered set of spanners completely contained within the time bounds of thread-contiguous components.

A spanner *p* is covered by timespan *t* when and only when `t.start_ofset <= p.start_offset and p.stop_offset <= t.stop_offset`.
Changed in version 2.0: renamed `spannertools.get_covered()` to `spannertools.get_spanners_covered_by_components()`.

spannertools.get_spanners_on_components_or_component_children

`spannertools.`**`get_spanners_on_components_or_component_children`**(*components*)

Return unordered set of all spanners attaching to any component in *components* or attaching to any of the children of any of the components in *components*. Changed in version 2.0: renamed `spannertools.get_attached()` to `spannertools.get_spanners_on_components_or_component_children()`.

spannertools.get_spanners_that_cross_components

spannertools.**get_spanners_that_cross_components**(*components*)

Assert thread-contiguous components. Collect spanners that attach to any component in 'components'. Return unordered set of crossing spanners. A spanner P crosses a list of thread-contiguous components C when P and C share at least one component and when it is the case that NOT ALL of the components in P are also in C. In other words, there is some intersection – but not total intersection – between the components of P and C.

Compare 'crossing' spanners with 'covered' spanners. Compare 'crossing' spanners with 'dominant' spanners. Compare 'crossing' spanners with 'contained' spanners. Compare 'crossing' spanners with 'attached' spanners. Changed in version 2.0: renamed `spannertools.get_crossing()` to `spannertools.get_spanners_that_cross_components()`.

spannertools.get_spanners_that_dominate_component_pair

spannertools.**get_spanners_that_dominate_component_pair**(*left*, *right*)

Return Python list of (spanner, index) pairs. 'left' must be either an Abjad component or None. 'right' must be either an Abjad component or None.

If both 'left' and 'right' are components, then 'left' and 'right' must be thread-contiguous.

This is a special version of spannertools.get_spanners_that_dominate_components(). This version is useful for finding spanners that dominant a zero-length 'crack' between components, as in t[2:2]. Changed in version 2.0: renamed `spannertools.get_dominant_between()` to `spannertools.get_spanners_that_dominate_component_pair()`.

spannertools.get_spanners_that_dominate_components

spannertools.**get_spanners_that_dominate_components**(*components*)

Return Python list of (spanner, index) pairs. Each (spanner, index) pair gives a spanner which dominates all components in 'components' together with the start-index at which spanner first encounters 'components'.

Use this helper to 'lift' any and all spanners temporarily from 'components', perform some action to the underlying score tree, and then reattach all spanners to new score components.

This operation always leaves all expressions in tact. Changed in version 2.0: renamed `spannertools.get_dominant()` to `spannertools.get_spanners_that_dominate_components()`.

spannertools.get_spanners_that_dominate_container_components_from_to

spannertools.**get_spanners_that_dominate_container_components_from_to**(*container*, *start*, *stop*)

Return Python list of (spanner, index) pairs. Each spanner dominates the components specified by slice with start index 'start' and stop index 'stop'. Generalization of dominant spanner-finding functions for slices. This exists for slices like t[2:2] that are empty lists. Changed in version 2.0: renamed `spannertools.get_dominant_slice()` to `spannertools.get_spanners_that_dominate_container_components_from_to()`.

spannertools.get_the_only_spanner_attached_to_any_improper_parent_of_component

spannertools.**get_the_only_spanner_attached_to_any_improper_parent_of_component**(*component*, *klass=None*)

New in version 1.1. Get the only spanner attached to any improper parent *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> trill = spannertools.TrillSpanner(staff)
>>> f(staff)
\new Staff {
    c'8 [ ( \startTrillSpan
    d'8
    e'8
    f'8 ] ) \stopTrillSpan
}

>>> print spannertools.get_the_only_spanner_attached_to_component(staff)
TrillSpanner({c'8, d'8, e'8, f'8})
```

Raise missing spanner error when no spanner attached to *component*.

Raise extra spanner error when more than one spanner attached to *component*.

Return a single spanner.

Note: function will usually be called with *klass* specifier set.

---

spannertools.get_the_only_spanner_attached_to_component

spannertools.**get_the_only_spanner_attached_to_component**(*component*, *klass=None*)

New in version 1.1. Get the only spanner attached to *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)
>>> slur = spannertools.SlurSpanner(staff.leaves)
>>> trill = spannertools.TrillSpanner(staff)
>>> f(staff)
\new Staff {
    c'8 [ ( \startTrillSpan
    d'8
    e'8
    f'8 ] ) \stopTrillSpan
}

>>> print spannertools.get_the_only_spanner_attached_to_component(staff)
TrillSpanner({c'8, d'8, e'8, f'8})
```

Raise missing spanner error when no spanner attached to *component*.

Raise extra spanner error when more than one spanner attached to *component*.

Return a single spanner.

Note: function will usually be called with *klass* specifier set.

---

spannertools.is_component_with_spanner_attached

spannertools.**is_component_with_spanner_attached**(*expr*, *klass=None*)

New in version 2.0. True when *expr* is a component with spanner attached:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(staff.leaves)
>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}

>>> spannertools.is_component_with_spanner_attached(staff[0])
True
```

Otherwise false:

```
>>> spannertools.is_component_with_spanner_attached(staff)
False
```

When *klass* is not none then true when *expr* is a component with a spanner of *klass* attached.

Return true or false.

spannertools.iterate_components_in_spanner

spannertools.**iterate_components_in_spanner**(*spanner*, *klass=None*, *reverse=False*)

New in version 2.10. Yield components in *spanner* one at a time from left to right:

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> p = beamtools.BeamSpanner(t[2:])

>>> notes = spannertools.iterate_components_in_spanner(p, klass=Note)

>>> for note in notes:
...   note
Note("e'8")
Note("f'8")
```

Yield components in *spanner* one at a time from right to left:

::

```
>>> notes = spannertools.iterate_components_in_spanner(p, klass=Note, reverse=True)

>>> for note in notes:
...   note
Note("f'8")
Note("e'8")
```

Return generator.

spannertools.make_covered_spanner_schema

spannertools.**make_covered_spanner_schema**(*components*)

New in version 2.0. Make schema of spanners covered by *components*:

```
>>> voice = Voice(Measure((2, 8), notetools.make_repeated_notes(2)) * 4)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(voice)
>>> beam = beamtools.BeamSpanner(voice.leaves[:4])
>>> slur = spannertools.SlurSpanner(voice[-2:])

>>> f(voice)
\new Voice {
    {
        \time 2/8
        c'8 [
        d'8
    }
    {
        e'8
        f'8 ]
    }
    {
        g'8 (
        a'8
    }
    {
        b'8
        c''8 )
    }
}

>>> spannertools.make_covered_spanner_schema([voice])
{BeamSpanner(c'8, d'8, e'8, f'8): [2, 3, 5, 6], SlurSpanner(|2/8(2)|, |2/8(2)|): [7, 10]}
```

Return dictionary.

spannertools.make_dynamic_spanner_below_with_nib_at_right

spannertools.**make_dynamic_spanner_below_with_nib_at_right**(*dynamic_text*, *components=None*)

New in version 2.0. Span *components* with text spanner. Position spanner below staff and configure with *dynamic_text*, solid line and upward-pointing nib at right.

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> spannertools.make_dynamic_spanner_below_with_nib_at_right('mp', t[:])
TextSpanner(c'8, d'8, e'8, f'8)
>>> f(t)
\new Staff {
    \override TextSpanner #'bound-details #'left #'text = \markup { \dynamic { mp } }
    \override TextSpanner #'bound-details #'right #'text = \markup { \draw-line #'(0 . 1) }
    \override TextSpanner #'bound-details #'right-broken #'text = ##f
    \override TextSpanner #'dash-fraction = #1
    \override TextSpanner #'direction = #down
    c'8 \startTextSpan
    d'8
    e'8
    f'8 \stopTextSpan
```

```
    \revert TextSpanner #'bound-details #'left #'text
    \revert TextSpanner #'bound-details #'right #'text
    \revert TextSpanner #'bound-details #'right-broken #'text
    \revert TextSpanner #'dash-fraction
    \revert TextSpanner #'direction
}
```

Changed in version 2.0: renamed `spanners.dynamic_spanner_below_with_nib_at_right()` to `spannertools.make_dynamic_spanner_below_with_nib_at_right()`.

spannertools.make_solid_text_spanner_above_with_nib_at_right

spannertools.**make_solid_text_spanner_above_with_nib_at_right**(*left_text*, *components=None*)

New in version 2.0. Span *components* with text spanner. Position spanner above staff and configure with *left_text*, solid line and downward-pointing nib at right.

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> spannertools.make_solid_text_spanner_above_with_nib_at_right('foo', t[:])
TextSpanner(c'8, d'8, e'8, f'8)

>>> f(t)
\new Staff {
    \override TextSpanner #'bound-details #'left #'text = \markup { foo }
    \override TextSpanner #'bound-details #'right #'text = \markup {
        \draw-line #'(0 . -1) }
    \override TextSpanner #'bound-details #'right-broken #'text = ##f
    \override TextSpanner #'dash-fraction = #1
    \override TextSpanner #'direction = #up
    c'8 \startTextSpan
    d'8
    e'8
    f'8 \stopTextSpan
    \revert TextSpanner #'bound-details #'left #'text
    \revert TextSpanner #'bound-details #'right #'text
    \revert TextSpanner #'bound-details #'right-broken #'text
    \revert TextSpanner #'dash-fraction
    \revert TextSpanner #'direction
}
```

Changed in version 2.0: renamed `spanners.solid_text_spanner_above_with_nib_at_right()` to `spannertools.make_solid_text_spanner_above_with_nib_at_right()`.

spannertools.make_solid_text_spanner_below_with_nib_at_right

spannertools.**make_solid_text_spanner_below_with_nib_at_right**(*left_text*, *components=None*)

New in version 2.0. Span *components* with text spanner. Position spanner below staff and configure with *left_text*, solid line and upward-pointing nib at right.

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> spannertools.make_solid_text_spanner_below_with_nib_at_right('foo', t[:])
TextSpanner(c'8, d'8, e'8, f'8)
>>> f(t)
\new Staff {
    \override TextSpanner #'bound-details #'left #'text = \markup { foo }
```

```
    \override TextSpanner #'bound-details #'right #'text = \markup { \draw-line #'(0 . 1) }
    \override TextSpanner #'bound-details #'right-broken #'text = ##f
    \override TextSpanner #'dash-fraction = #1
    \override TextSpanner #'direction = #down
    c'8 \startTextSpan
    d'8
    e'8
    f'8 \stopTextSpan
    \revert TextSpanner #'bound-details #'left #'text
    \revert TextSpanner #'bound-details #'right #'text
    \revert TextSpanner #'bound-details #'right-broken #'text
    \revert TextSpanner #'dash-fraction
    \revert TextSpanner #'direction
}
```

Changed in version 2.0: renamed `spanners.solid_text_spanner_below_with_nib_at_right()` to `spannertools.make_solid_text_spanner_below_with_nib_at_right()`.

spannertools.make_spanner_schema

`spannertools.`**`make_spanner_schema`**(*components*)

New in version 2.0. Make schema of spanners contained by *components*:

```
>>> voice = Voice(Measure((2, 8), notetools.make_repeated_notes(2)) * 4)
>>> pitchtools.set_ascending_named_diatonic_pitches_on_tie_chains_in_expr(voice)
>>> beam = beamtools.BeamSpanner(voice.leaves[:4])
>>> slur = spannertools.SlurSpanner(voice[-2:])

>>> f(voice)
\new Voice {
    {
        \time 2/8
        c'8 [
        d'8
    }
    {
        e'8
        f'8 ]
    }
    {
        g'8 (
        a'8
    }
    {
        b'8
        c''8 )
    }
}

>>> spannertools.make_spanner_schema(voice.leaves[2:4])
{BeamSpanner(c'8, d'8, e'8, f'8): [0, 1]}
```

Return dictionary.

spannertools.move_spanners_from_component_to_children_of_component

spannertools.**move_spanners_from_component_to_children_of_component**(*donor*)

Give spanners attaching directly to donor to recipients. Usual use is to give attached spanners from parent to children, which is a composer-safe operation. Changed in version 2.0: renamed `spannertools.give_attached_to_children()` to `spannertools.move_spanners_from_component_to_children_of_component()`.

spannertools.report_format_contributions_of_improper_spanners

spannertools.**report_format_contributions_of_improper_spanners**(*component*, *klass=None*)

New in version 1.1. Report as string format contributions of all spanners attached to improper parentage of *component*:

```
>>> staff = Staff("c'8 [ ( d'8 e'8 f'8 ] )")
>>> trill = spannertools.TrillSpanner(staff)

>>> f(staff)
\new Staff {
    c'8 [ ( \startTrillSpan
    d'8
    e'8
    f'8 ] ) \stopTrillSpan
}

>>> print spannertools.report_spanner_format_contributions(staff[0])
BeamSpanner
    _format_right_of_leaf
        [
SlurSpanner
    _format_right_of_leaf
        (
```

Return string.

spannertools.report_spanner_format_contributions

spannertools.**report_spanner_format_contributions**(*component*, *klass=None*)

New in version 1.1. Report as string format contributions of all spanners attached to *component*:

```
>>> staff = Staff("c'8 [ ( d'8 e'8 f'8 ] )")
>>> trill = spannertools.TrillSpanner(staff)

>>> f(staff)
\new Staff {
    c'8 [ ( \startTrillSpan
    d'8
    e'8
    f'8 ] ) \stopTrillSpan
}

>>> print spannertools.report_spanner_format_contributions(staff[0])
BeamSpanner
    _format_right_of_leaf
```

```
        [
SlurSpanner
    _format_right_of_leaf
        (
```

Return string.

spannertools.withdraw_components_from_spanners_covered_by_components

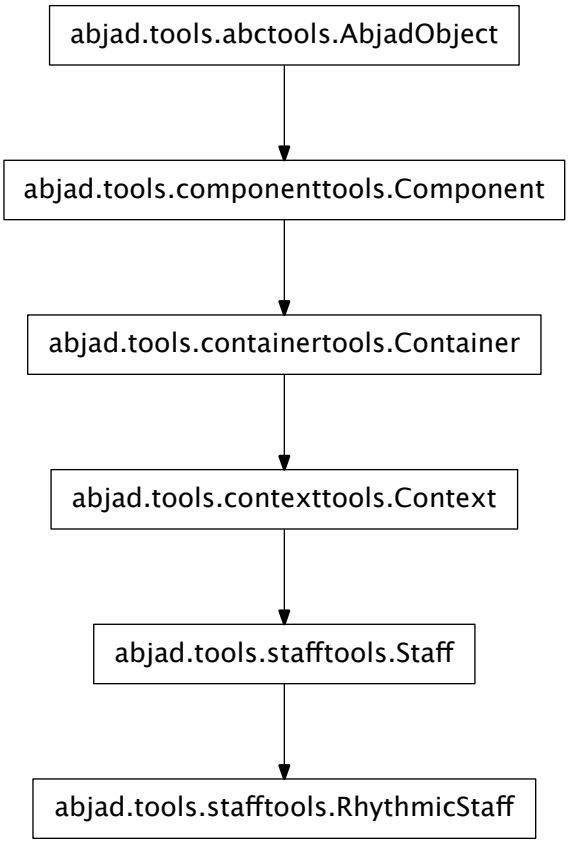
spannertools.**withdraw_components_from_spanners_covered_by_components**(*components*)

Find every spanner covered by 'components'. Withdraw all components in 'components' from covered spanners. Return 'components'. The operation always leaves all score trees in tact. Changed in version 2.0: renamed `spannertools.withdraw_from_covered()` to `spannertools.withdraw_components_from_spanners_covered_by_components()`.

stafftools

concrete classes

stafftools.RhythmicStaff



class stafftools.**RhythmicStaff**(*music=None*, *context_name='RhythmicStaff'*, *name=None*)

Abjad model of a rhythmic staff.

Read-only Properties

RhythmicStaff.**contents_duration**

Inherited from containertools.Container

RhythmicStaff.**duration_in_seconds**

Inherited from containertools.Container

RhythmicStaff.**engraver_consists**

New in version 2.0. Unordered set of LilyPond engravers to include in context definition.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_consists.append('Horizontal_bracket_engraver')
>>> f(staff)
\new Staff \with {
    \consists Horizontal_bracket_engraver
} {
}
```

Inherited from contexttools.Context

RhythmicStaff.**engraver_removals**
New in version 2.0. Unordered set of LilyPond engravers to remove from context.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_removals.append('Time_signature_engraver')
>>> f(staff)
\new Staff \with {
    \remove Time_signature_engraver
} {
}
```

Inherited from contexttools.Context

RhythmicStaff.**is_semantic**
Inherited from contexttools.Context

RhythmicStaff.**leaves**
Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

RhythmicStaff.**lilypond_format**
Inherited from contexttools.Context

RhythmicStaff.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

RhythmicStaff.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

RhythmicStaff.**parent**
Inherited from componenttools.Component

RhythmicStaff.**preprolated_duration**
Inherited from containertools.Container

RhythmicStaff.**prolated_duration**
Inherited from componenttools.Component

RhythmicStaff.**prolation**
Inherited from componenttools.Component

RhythmicStaff.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

RhythmicStaff.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

RhythmicStaff.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

RhythmicStaff.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

RhythmicStaff.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

RhythmicStaff.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

RhythmicStaff.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

RhythmicStaff.**context_name**
Read / write name of context as a string.

Inherited from contexttools.Context

RhythmicStaff.**is_nonsemantic**
Set indicator of nonsemantic voice:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (5, 16), (5, 16)])
>>> voice = Voice(measures)
>>> voice.name = 'HiddenTimeSignatureVoice'

>>> voice.is_nonsemantic = True
```

```
>>> f(voice)
\context Voice = "HiddenTimeSignatureVoice" {
    {
        \time 1/8
        s1 * 1/8
    }
    {
        \time 5/16
        s1 * 5/16
    }
    {
        s1 * 5/16
    }
}

>>> voice.is_nonsemantic
True
```

Get indicator of nonsemantic voice:

```
>>> voice = Voice([])

>>> voice.is_nonsemantic
False
```

Return boolean.

The intent of this read / write attribute is to allow composers to tag invisible voices used to house time signatures indications, bar number directives or other pieces of score-global non-musical information. Such nonsemantic voices can then be omitted from voice interation and other functions.

Inherited from `contexttools.Context`

`RhythmicStaff.`**`is_parallel`**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True
```

```
>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from containertools.Container

RhythmicStaff.**name**

Read-write name of context. Must be string or none.

Inherited from contexttools.Context

Methods

RhythmicStaff.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

RhythmicStaff.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
```

```
        e'8 ]
    }

    >>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

    >>> f(container)
    {
        c'8 [
        d'8
        e'8 ]
        cs'8
        ds'8
        es'8
    }
```

Return none. New in version 2.3: `expr` may now be a LilyPond input string. Inherited from `containertools.Container`

`RhythmicStaff.`**`index`**(*component*)

Index *component* in container:

```
    >>> container = Container("c'8 d'8 e'8")

    >>> note = container[-1]
    >>> note
    Note("e'8")

    >>> container.index(note)
    2
```

Return nonnegative integer.

Inherited from `containertools.Container`

`RhythmicStaff.`**`insert`**(*i*, *component*)

Insert *component* in container at index *i*:

```
    >>> container = Container("c'8 d'8 e'8")
    >>> beam = beamtools.BeamSpanner(container.music)

    >>> f(container)
    {
        c'8 [
        d'8
        e'8 ]
    }

    >>> container.insert(1, Note("cs'8"))

    >>> f(container)
    {
        c'8 [
        cs'8
        d'8
        e'8 ]
    }
```

Return none.

Inherited from `containertools.Container`

RhythmicStaff.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

RhythmicStaff.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

RhythmicStaff.**__add__**(*expr*)

Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both

a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

RhythmicStaff.**__contains__**(*expr*)
True if expr is in container, otherwise False.

Inherited from containertools.Container

RhythmicStaff.**__delitem__**(*i*)
Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

RhythmicStaff.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

RhythmicStaff.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmicStaff.**__getitem__**(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

RhythmicStaff.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

RhythmicStaff.**__iadd__**(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

RhythmicStaff.**__imul__**(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

RhythmicStaff.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmicStaff.**__len__**()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

RhythmicStaff.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RhythmicStaff.__mul__(*n*)
Inherited from componenttools.Component

RhythmicStaff.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

RhythmicStaff.__radd__(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

RhythmicStaff.__repr__()
Changed in version 2.0. Named contexts now print name at the interpreter.

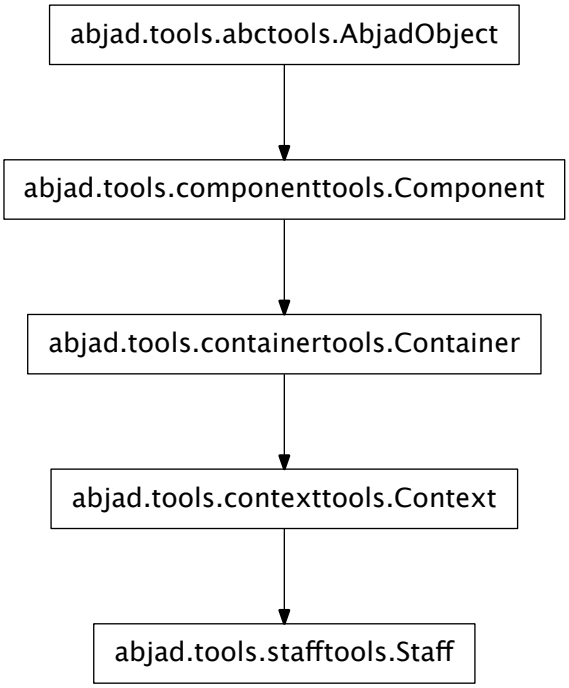
Inherited from contexttools.Context

RhythmicStaff.__rmul__(*n*)
Inherited from componenttools.Component

RhythmicStaff.__setitem__(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

stafftools.Staff



class stafftools.**Staff**(*music=None*, *context_name='Staff'*, *name=None*)

Abjad model of a staff:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}
```

Return staff object.

Read-only Properties

Staff.**contents_duration**

Inherited from containertools.Container

Staff.**duration_in_seconds**

Inherited from containertools.Container

Staff.**engraver_consists**

New in version 2.0. Unordered set of LilyPond engravers to include in context definition.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_consists.append('Horizontal_bracket_engraver')
>>> f(staff)
\new Staff \with {
    \consists Horizontal_bracket_engraver
} {
}
```

Inherited from contexttools.Context

Staff.**engraver_removals**

New in version 2.0. Unordered set of LilyPond engravers to remove from context.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_removals.append('Time_signature_engraver')
>>> f(staff)
\new Staff \with {
    \remove Time_signature_engraver
} {
}
```

Inherited from contexttools.Context

Staff.**is_semantic**

Inherited from contexttools.Context

Staff.**leaves**

Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

Staff.**lilypond_format**

Inherited from contexttools.Context

Staff.**music**

Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

Staff.**override**

Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Staff.**parent**

Inherited from componenttools.Component

Staff.**preprolated_duration**
Inherited from containertools.Container

Staff.**prolated_duration**
Inherited from componenttools.Component

Staff.**prolation**
Inherited from componenttools.Component

Staff.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Staff.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Staff.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Staff.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Staff.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Staff.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Staff.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Staff.**context_name**
Read / write name of context as a string.

Inherited from contexttools.Context

Staff.**is_nonsemantic**
Set indicator of nonsemantic voice:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (5, 16), (5, 16)])
>>> voice = Voice(measures)
>>> voice.name = 'HiddenTimeSignatureVoice'

>>> voice.is_nonsemantic = True
```

```
>>> f(voice)
\context Voice = "HiddenTimeSignatureVoice" {
    {
        \time 1/8
        s1 * 1/8
    }
    {
        \time 5/16
        s1 * 5/16
    }
    {
        s1 * 5/16
    }
}

>>> voice.is_nonsemantic
True
```

Get indicator of nonsemantic voice:

```
>>> voice = Voice([])

>>> voice.is_nonsemantic
False
```

Return boolean.

The intent of this read / write attribute is to allow composers to tag invisible voices used to house time signatures indications, bar number directives or other pieces of score-global non-musical information. Such nonsemantic voices can then be omitted from voice interation and other functions.

Inherited from `contexttools.Context`

`Staff.`**`is_parallel`**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True
```

```
>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from containertools.Container

Staff.**name**
Read-write name of context. Must be string or none.

Inherited from contexttools.Context

Methods

Staff.**append**(*component*)
Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

Staff.**extend**(*expr*)
Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
```

```
    e'8 ]
}
```

```
>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: `expr` may now be a LilyPond input string. Inherited from `containertools.Container`

`Staff.`**`index`**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> note = container[-1]
>>> note
Note("e'8")
```

```
>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from `containertools.Container`

`Staff.`**`insert`**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}
```

```
>>> container.insert(1, Note("cs'8"))
```

```
>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from `containertools.Container`

Staff.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

Staff.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

Staff.**__add__**(*expr*)

Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both

a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

Staff.__contains__(*expr*)
True if expr is in container, otherwise False.

Inherited from containertools.Container

Staff.__delitem__(*i*)
Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

Staff.__eq__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Staff.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Staff.__getitem__(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

Staff.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Staff.__iadd__(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

Staff.__imul__(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

Staff.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Staff.__len__()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

Staff.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Staff.__mul__(*n*)
Inherited from componenttools.Component

Staff.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Staff.__radd__(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

Staff.__repr__()
Changed in version 2.0. Named contexts now print name at the interpreter.

Inherited from contexttools.Context

Staff.__rmul__(*n*)
Inherited from componenttools.Component

Staff.__setitem__(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

functions

stafftools.all_are_staves

stafftools.**all_are_staves**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad staves:

```
>>> staff = Staff("c'4 d'4 e'4 f'4")

>>> stafftools.all_are_staves([staff])
True
```

True when *expr* is an empty sequence:

```
>>> stafftools.all_are_staves([])
True
```

Otherwise false:

```
>>> stafftools.all_are_staves('foo')
False
```

Return boolean.

Function wraps componenttools.all_are_components().

stafftools.get_first_staff_in_improper_parentage_of_component

stafftools.**get_first_staff_in_improper_parentage_of_component**(*component*)

New in version 2.0. Get first staff in improper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> stafftools.get_first_staff_in_improper_parentage_of_component(staff[1])
Staff{4}
```

Return staff or none.

stafftools.get_first_staff_in_proper_parentage_of_component

stafftools.**get_first_staff_in_proper_parentage_of_component**(*component*)

New in version 2.0. Get first staff in proper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> f(staff)
\new Staff {
    c'8
    d'8
    e'8
    f'8
}

>>> stafftools.get_first_staff_in_proper_parentage_of_component(staff[1])
Staff{4}
```

Return staff or none.

stafftools.make_rhythmic_sketch_staff

stafftools.**make_rhythmic_sketch_staff**(*music*)

Make rhythmic staff with transparent meter and transparent bar lines.

stringtools

functions

stringtools.arg_to_bidirectional_direction_string

stringtools.**arg_to_bidirectional_direction_string**(*arg*)

Convert *arg* to bidirectional direction string:

```
>>> from abjad.tools import stringtools

>>> stringtools.arg_to_bidirectional_direction_string('^')
'up'

>>> stringtools.arg_to_bidirectional_direction_string('_')
'down'

>>> stringtools.arg_to_bidirectional_direction_string(1)
'up'

>>> stringtools.arg_to_bidirectional_direction_string(-1)
'down'
```

If *arg* is 'up' or 'down', *arg* will be returned.

Return string or none.

stringtools.arg_to_bidirectional_lilypond_symbol

stringtools.**arg_to_bidirectional_lilypond_symbol**(*arg*)

Convert *arg* to bidirectional LilyPond symbol:

```
>>> from abjad.tools import stringtools

>>> stringtools.arg_to_tridirectional_lilypond_symbol(Up)
'^'

>>> stringtools.arg_to_tridirectional_lilypond_symbol(Down)
'_'

>>> stringtools.arg_to_tridirectional_lilypond_symbol(1)
'^'

>>> stringtools.arg_to_tridirectional_lilypond_symbol(-1)
'_'
```

If *arg* is '^' or '_', *arg* will be returned.

Return str or None.

stringtools.arg_to_tridirectional_direction_string

stringtools.**arg_to_tridirectional_direction_string**(*arg*)

Convert *arg* to tridirectional direction string:

```
>>> from abjad.tools import stringtools

>>> stringtools.arg_to_tridirectional_direction_string('^')
'up'

>>> stringtools.arg_to_tridirectional_direction_string('-')
'center'

>>> stringtools.arg_to_tridirectional_direction_string('_')
'down'
```

```
>>> stringtools.arg_to_tridirectional_direction_string(1)
'up'

>>> stringtools.arg_to_tridirectional_direction_string(0)
'center'

>>> stringtools.arg_to_tridirectional_direction_string(-1)
'down'

>>> stringtools.arg_to_tridirectional_direction_string('default')
'center'
```

If *arg* is None, None will be returned.

Return str or None.

stringtools.arg_to_tridirectional_lilypond_symbol

stringtools.**arg_to_tridirectional_lilypond_symbol**(*arg*)

Convert *arg* to tridirectional LilyPond symbol:

```
>>> from abjad.tools import stringtools

>>> stringtools.arg_to_tridirectional_lilypond_symbol(Up)
'^'

>>> stringtools.arg_to_tridirectional_lilypond_symbol('neutral')
'-'

>>> stringtools.arg_to_tridirectional_lilypond_symbol('default')
'-'

>>> stringtools.arg_to_tridirectional_lilypond_symbol(Down)
'_'

>>> stringtools.arg_to_tridirectional_lilypond_symbol(1)
'^'

>>> stringtools.arg_to_tridirectional_lilypond_symbol(0)
'-'

>>> stringtools.arg_to_tridirectional_lilypond_symbol(-1)
'_'
```

If *arg* is None, None will be returned.

If *arg* is '^', '-', or '_', *arg* will be returned.

Return string or None.

stringtools.arg_to_tridirectional_ordinal_constant

stringtools.**arg_to_tridirectional_ordinal_constant**(*arg*)

Convert *arg* to tridirectional ordinal constant:

```
>>> from abjad.tools import stringtools
```

```
>>> stringtools.arg_to_tridirectional_ordinal_constant('^')
Up

>>> stringtools.arg_to_tridirectional_ordinal_constant('_')
Down

>>> stringtools.arg_to_tridirectional_ordinal_constant(1)
Up

>>> stringtools.arg_to_tridirectional_ordinal_constant(-1)
Down
```

If *arg* is Up, Center or Down, *arg* will be returned.

Return OrdinalConstant or None.

stringtools.capitalize_string_start

stringtools.**capitalize_string_start**(*string*)

New in version 2.5. Capitalize *string*:

```
>>> string = 'violin I'

>>> stringtools.capitalize_string_start(string)
'Violin I'
```

Function differs from built-in `string.capitalize()`.

This function affects only `string[0]` and leaves noninitial characters as-is.

Built-in `string.capitalize()` forces noninitial characters to lowercase.

```
>>> string.capitalize()
'Violin i'
```

Return newly constructed string. Changed in version 2.9: renamed `iotools.capitalize_string_start()` to `stringtools.capitalize_string_start()`.

stringtools.format_input_lines_as_doc_string

stringtools.**format_input_lines_as_doc_string**(*input_lines*)

New in version 2.0. Format *input_lines* as doc string.

Format expressions intelligently.

Treat blank lines intelligently.

Capture hash-suffixed line output.

Use when writing docstrings.

Example skipped because docstring goes crazy on example input.

stringtools.format_input_lines_as_regression_test

stringtools.**format_input_lines_as_regression_test**(*input_lines*, *tab_width=3*)

New in version 2.0. Format *input_lines* as regression test:

```
>>> input_lines = '''
... staff = Staff("c'8 d'8 e'8 f'8")
... beamtools.BeamSpanner(staff.leaves)
... f(staff)
...
... tuplettools.FixedDurationTuplet(Duration(2, 8), staff[:3])
... f(staff)
... '''

>>> stringtools.format_input_lines_as_regression_test(input_lines)

    staff = Staff("c'8 d'8 e'8 f'8")
    beamtools.BeamSpanner(staff.leaves)

    r'''
    \new Staff {
        c'8 [
        d'8
        e'8
        f'8 ]
    }
    '''

    tuplettools.FixedDurationTuplet(Duration(2, 8), staff[:3])

    r'''
    \new Staff {
        \times 2/3 {
            c'8 [
            d'8
            e'8
        }
        f'8 ]
    }

    assert componenttools.is_well_formed_component(staff)
    assert staff.lilypond_format == "\\new Staff {
        \n\t\\times 2/3 {\n\t\tc'8 [\n\t\td'8\n\t\te'8\n\t}\n\tf'8 ]\n}"
    '''
```

Format expressions intelligently.

Treat blank lines intelligently.

Remove line-final hash characters.

Used when writing tests.

stringtools.is_lowercamelcase_string

stringtools.**is_lowercamelcase_string**(*expr*)

New in version 2.5. True when *expr* is a string and is lowercamelcase:

```
>>> stringtools.is_lowercamelcase_string('fooBar')
True
```

False otherwise:

```
>>> stringtools.is_lowercamelcase_string('FooBar')
False
```

Return boolean. Changed in version 2.9: renamed `iotools.is_lowercamelcase_string()` to `stringtools.is_lowercamelcase_string()`.

stringtools.is_space_delimited_lowercase_string

stringtools.**is_space_delimited_lowercase_string**(*expr*)

New in version 2.5. True when *expr* is a string and is space-delimited lowercase:

```
>>> stringtools.is_space_delimited_lowercase_string('foo bar')
True
```

False otherwise:

```
>>> stringtools.is_space_delimited_lowercase_string('foo_bar')
False
```

Return boolean. Changed in version 2.9: renamed `iotools.is_space_delimited_lowercase_string()` to `stringtools.is_space_delimited_lowercase_string()`.

stringtools.is_underscore_delimited_lowercase_file_name

stringtools.**is_underscore_delimited_lowercase_file_name**(*expr*)

New in version 2.7. True when *expr* is a string and is underscore-delimited lowercase file name with extension:

```
>>> stringtools.is_underscore_delimited_lowercase_file_name('foo_bar')
True
```

False otherwise:

```
>>> stringtools.is_underscore_delimited_lowercase_file_name('foo.bar.blah')
False
```

Return boolean. Changed in version 2.9: renamed `iotools.is_underscore_delimited_lowercase_file_name()` to `stringtools.is_underscore_delimited_lowercase_file_name()`.

stringtools.is_underscore_delimited_lowercase_file_name_with_extension

stringtools.**is_underscore_delimited_lowercase_file_name_with_extension**(*expr*)

New in version 2.7. True when *expr* is a string and is underscore-delimited lowercase file name with extension:

```
>>> stringtools.is_underscore_delimited_lowercase_file_name_with_extension('foo_bar.blah')
True
```

False otherwise:

```
>>> stringtools.is_underscore_delimited_lowercase_file_name_with_extension('foo.bar.blah')
False
```

Return boolean. Changed in version 2.9: renamed `iotools.is_underscore_delimited_lowercase_file_name_w` to `stringtools.is_underscore_delimited_lowercase_file_name_with_extension()`.

stringtools.is_underscore_delimited_lowercase_package_name

stringtools.**is_underscore_delimited_lowercase_package_name**(*expr*)

New in version 2.5. True when *expr* is a string and is underscore-delimited lowercase package name:

```
>>> stringtools.is_underscore_delimited_lowercase_package_name('foo.bar.blah_package')
True
```

False otherwise:

```
>>> stringtools.is_underscore_delimited_lowercase_package_name('foo.bar.BlahPackage')
False
```

Return boolean. Changed in version 2.9: renamed `iotools.is_underscore_delimited_lowercase_package_nam` to `stringtools.is_underscore_delimited_lowercase_package_name()`.

stringtools.is_underscore_delimited_lowercase_string

stringtools.**is_underscore_delimited_lowercase_string**(*expr*)

New in version 2.5. True when *expr* is a string and is underscore delimited lowercase:

```
>>> stringtools.is_underscore_delimited_lowercase_string('foo_bar')
True
```

False otherwise:

```
>>> stringtools.is_underscore_delimited_lowercase_string('foo bar')
False
```

Return boolean. Changed in version 2.9: renamed `iotools.is_underscore_delimited_lowercase_string()` to `stringtools.is_underscore_delimited_lowercase_string()`.

stringtools.is_uppercamelcase_string

stringtools.**is_uppercamelcase_string**(*expr*)

New in version 2.5. True when *expr* is a string and is uppercamelcase:

```
>>> stringtools.is_uppercamelcase_string('FooBar')
True
```

False otherwise:

```
>>> stringtools.is_uppercamelcase_string('fooBar')
False
```

Return boolean. Changed in version 2.9: renamed `iotools.is_uppercamelcase_string()` to `stringtools.is_uppercamelcase_string()`.

stringtools.space_delimited_lowercase_to_uppercamelcase

stringtools.**space_delimited_lowercase_to_uppercamelcase**(*string*)

New in version 2.6. Change space-delimited lowercase *string* to uppercamelcase:

```
>>> string = 'bass figure alignment positioning'
>>> stringtools.space_delimited_lowercase_to_uppercamelcase(string)
'BassFigureAlignmentPositioning'
```

Return string. Changed in version 2.9: renamed `iotools.space_delimited_lowercase_to_uppercamelcase()` to `stringtools.space_delimited_lowercase_to_uppercamelcase()`.

stringtools.string_to_strict_directory_name

`stringtools.`**`string_to_strict_directory_name`**(*string*)

New in version 2.6. Change *string* to strict directory name:

```
>>> stringtools.string_to_strict_directory_name('Déja vu')
'deja_vu'
```

Strip accents from accented characters. Change all punctuation (including spaces) to underscore. Set to lowercase.

Return string. Changed in version 2.9: renamed `iotools.string_to_strict_directory_name()` to `stringtools.string_to_strict_directory_name()`.

stringtools.strip_diacritics_from_binary_string

`stringtools.`**`strip_diacritics_from_binary_string`**(*binary_string*)

New in version 2.5. Strip diacritics from *binary_string*:

```
>>> binary_string = 'Dvo\xc5\x99\xc3\xa1k'

>>> print binary_string
Dvořák

>>> stringtools.strip_diacritics_from_binary_string(binary_string)
'Dvorak'
```

Return ASCII string. Changed in version 2.9: renamed `iotools.strip_diacritics_from_binary_string()` to `stringtools.strip_diacritics_from_binary_string()`.

stringtools.underscore_delimited_lowercase_to_lowercamelcase

`stringtools.`**`underscore_delimited_lowercase_to_lowercamelcase`**(*string*)

New in version 2.0. Change underscore-delimited lowercase *string* to lowercamelcase:

```
>>> string = 'bass_figure_alignment_positioning'
>>> stringtools.underscore_delimited_lowercase_to_lowercamelcase(string)
'bassFigureAlignmentPositioning'
```

Changed in version 2.0: renamed `stringtools.underscore_delimited_lowercase_to_lowercamelcase()` to `stringtools.underscore_delimited_lowercase_to_lowercamelcase()`.Changed in version 2.9: renamed `iotools.underscore_delimited_lowercase_to_lowercamelcase()` to `stringtools.underscore_delimited_lowercase_to_lowercamelcase()`.

stringtools.underscore_delimited_lowercase_to_uppercamelcase

`stringtools.`**`underscore_delimited_lowercase_to_uppercamelcase`**(*string*)

New in version 2.0. Change underscore-delimited lowercase *string* to uppercamelcase:

```
>>> string = 'bass_figure_alignment_positioning'
>>> stringtools.underscore_delimited_lowercase_to_uppercamelcase(string)
'BassFigureAlignmentPositioning'
```

Changed in version 2.0: renamed `stringtools.underscore_delimited_lowercase_to_uppercamelcase()` to `stringtools.underscore_delimited_lowercase_to_uppercamelcase()`.Changed in version 2.9: renamed `iotools.underscore_delimited_lowercase_to_uppercamelcase()` to `stringtools.underscore_delimited_lowercase_to_uppercamelcase()`.

stringtools.uppercamelcase_to_space_delimited_lowercase

`stringtools.`**`uppercamelcase_to_space_delimited_lowercase`**(*string*)

New in version 2.6. Change uppercamelcase *string* to space-delimited lowercase:

```
>>> string = 'KeySignatureMark'

>>> stringtools.uppercamelcase_to_space_delimited_lowercase(string)
'key signature mark'
```

Return string. Changed in version 2.9: renamed `iotools.uppercamelcase_to_space_delimited_lowercase()` to `stringtools.uppercamelcase_to_space_delimited_lowercase()`.

stringtools.uppercamelcase_to_underscore_delimited_lowercase

`stringtools.`**`uppercamelcase_to_underscore_delimited_lowercase`**(*string*)

New in version 2.6. Change uppercamelcase *string* to underscore-delimited lowercase:

```
>>> string = 'KeySignatureMark'

>>> stringtools.uppercamelcase_to_underscore_delimited_lowercase(string)
'key_signature_mark'
```

Return string. Changed in version 2.9: renamed `iotools.uppercamelcase_to_underscore_delimited_lowercas` to `stringtools.uppercamelcase_to_underscore_delimited_lowercase()`.

tempotools

functions

tempotools.integer_tempo_to_multiplier_tempo_pairs

`tempotools.`**`integer_tempo_to_multiplier_tempo_pairs`**(*integer_tempo*, *maximum_numerator=None*, *maximum_denominator=None*)

New in version 2.0. Return all multiplier, tempo pairs possible from *integer_tempo*.

Tempi must be no less than `integer_tempo / 2` and not greater than `2 * integer_tempo`:

```
>>> from abjad.tools import tempotools

>>> pairs = tempotools.integer_tempo_to_multiplier_tempo_pairs(58, 8, 8)
>>> for pair in pairs:
...     pair
...
```

```
(Fraction(1, 2), Fraction(29, 1))
(Fraction(1, 1), Fraction(58, 1))
(Fraction(3, 2), Fraction(87, 1))
(Fraction(2, 1), Fraction(116, 1))
```

Return list.

tempotools.integer_tempo_to_multiplier_tempo_pairs_report

tempotools.**integer_tempo_to_multiplier_tempo_pairs_report**(*integer_tempo*, *maximum_numerator=None*, *maximum_denominator=None*)

New in version 2.0. Print all multiplier, tempo pairs possible from *integer_tempo*.

Allow no tempi less than `integer_tempo / 2` nor greater than `2 * integer_tempo`:

```
>>> from abjad.tools import tempotools
```

```
>>> tempotools.integer_tempo_to_multiplier_tempo_pairs_report(58, 8, 8)
2:1     29
1:1     58
2:3     87
1:2     116
```

With more lenient numerator and denominator.

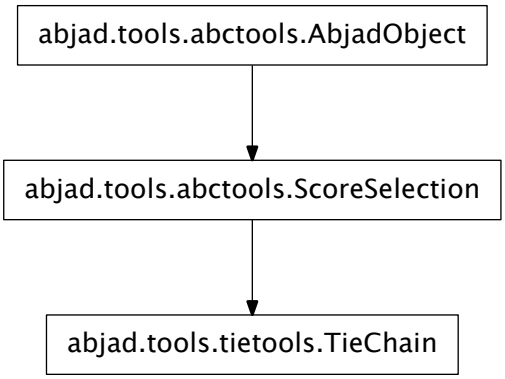
```
>>> tempotools.integer_tempo_to_multiplier_tempo_pairs_report(58, 30, 30)
2:1     29
29:15   30
29:16   32
29:17   34
29:18   36
29:19   38
29:20   40
29:21   42
29:22   44
29:23   46
29:24   48
29:25   50
29:26   52
29:27   54
29:28   56
1:1     58
29:30   60
2:3     87
1:2     116
```

Return none.

tietools

concrete classes

tietools.TieChain



class tietools.**TieChain** (*music*)

New in version 2.9. All the notes in a tie chain:

```
>>> staff = Staff("c' d' e' ~ e'")

>>> tietools.get_tie_chain(staff[2])
TieChain((Note("e'4"), Note("e'4")))
```

Tie chains are immutable score selections.

Read-only Properties

TieChain.**all_leaves_are_in_same_parent**

True when all leaves in tie chain are in same parent.

Return boolean.

TieChain.**duration_in_seconds**

Read-only duration in seconds of components in tie chain.

Return duration.

TieChain.**head**

Read-only reference to element 0 in tie chain.

TieChain.**is_pitched**

True when tie chain head is a note or chord.

Return boolean.

TieChain.**is_trivial**

True when length of tie chain is less than or equal to 1.

Return boolean.

TieChain.**leaves**
Read-only tuple of leaves in tie spanner.

TieChain.**leaves_grouped_by_immediate_parents**
Read-only list of leaves in tie chain grouped by immediate parents of leaves.

Return list of lists.

TieChain.**music**
Read-only tuple of components in selection.

Inherited from abctools.ScoreSelection

TieChain.**preprolated_duration**
Sum of preprolated durations of all components in tie chain.

TieChain.**prolated_duration**
Sum of prolated durations of all components in tie chain.

TieChain.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

TieChain.**written_duration**
Sum of written duration of all components in tie chain.

Special Methods

TieChain.**__contains__**(*expr*)
Inherited from abctools.ScoreSelection

TieChain.**__eq__**(*expr*)
Inherited from abctools.ScoreSelection

TieChain.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TieChain.**__getitem__**(*expr*)
Inherited from abctools.ScoreSelection

TieChain.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TieChain.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TieChain.**__len__**()
Inherited from abctools.ScoreSelection

TieChain.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

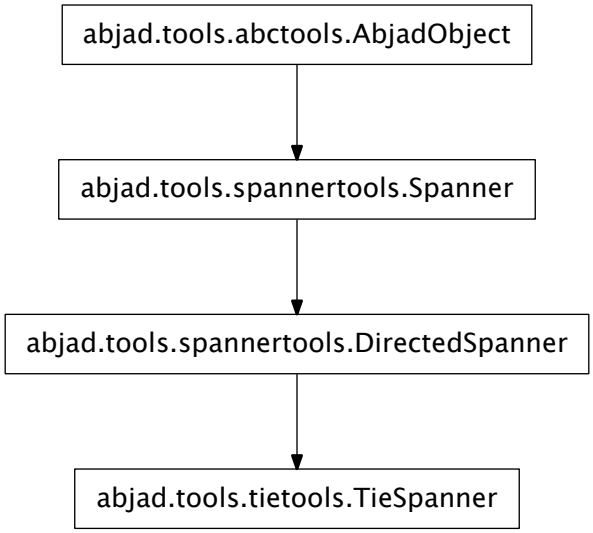
TieChain.__ne__(*expr*)
Inherited from abctools.ScoreSelection

TieChain.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

tietools.TieSpanner



class tietools.**TieSpanner**(*music=None*, *direction=None*)
Abjad tie spanner:

```
>>> staff = Staff(notetools.make_repeated_notes(4))
>>> tietools.TieSpanner(staff[:])
TieSpanner(c'8, c'8, c'8, c'8)

>>> f(staff)
\new Staff {
    c'8 ~
    c'8 ~
    c'8 ~
    c'8
}
```

Return tie spanner.

Read-only Properties

TieSpanner.**components**

Return read-only tuple of components in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.components
(Note("c'8"), Note("d'8"))
```

Changed in version 1.1: Now returns an (immutable) tuple instead of a (mutable) list. Inherited from spannertools.Spanner

TieSpanner.**duration_in_seconds**

Sum of duration of all leaves in spanner, in seconds.

Inherited from spannertools.Spanner

TieSpanner.**leaves**

Return read-only tuple of leaves in spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner.leaves
(Note("c'8"), Note("d'8"))
```

Note: When dealing with large, complex scores accessing this attribute can take some time. Best to make a local copy with leaves = spanner.leaves first. Or use spanner- specific iteration tools.

Inherited from spannertools.Spanner

TieSpanner.**override**

LilyPond grob override component plug-in.

Inherited from spannertools.Spanner

TieSpanner.**preprolated_duration**

Sum of preprolated duration of all components in spanner.

Inherited from spannertools.Spanner

TieSpanner.**prolated_duration**

Sum of prolated duration of all components in spanner.

Inherited from spannertools.Spanner

TieSpanner.**set**

LilyPond context setting component plug-in.

Inherited from spannertools.Spanner

TieSpanner.**start_offset**

Read-only start offset of spanner.

Inherited from spannertools.Spanner

TieSpanner.**stop_offset**

Read-only stop offset of spanner.

Inherited from spannertools.Spanner

TieSpanner.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

TieSpanner.**written_duration**
Sum of written duration of all components in spanner.

Inherited from spannertools.Spanner

Read/write Properties

TieSpanner.**direction**
Inherited from spannertools.DirectedSpanner

Methods

TieSpanner.**append**(*component*)
Add *component* to right of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.append(voice[2])
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return none.

Inherited from spannertools.Spanner

TieSpanner.**append_left**(*component*)
Add *component* to left of spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.append_left(voice[1])
>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return none.

Inherited from spannertools.Spanner

TieSpanner.**clear**()
Remove all components from spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.clear()
>>> spanner
BeamSpanner()
```

Return none.

Inherited from `spannertools.Spanner`

`TieSpanner.`**`extend`**(*components*)

Add iterable *components* to right of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8)

>>> spanner.extend(voice[2:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`TieSpanner.`**`extend_left`**(*components*)

Add iterable *components* to left of spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.extend_left(voice[:2])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)
```

Return none.

Inherited from `spannertools.Spanner`

`TieSpanner.`**`fracture`**(*i*, *direction=None*)

Fracture spanner at *direction* of component at index *i*.

Valid values for *direction* are `Left`, `Right` and `None`.

Return original, left and right spanners.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> beam = beamtools.BeamSpanner(voice[:])
>>> beam
BeamSpanner(c'8, d'8, e'8, f'8)

>>> beam.fracture(1, direction=Left)
(BeamSpanner(c'8, d'8, e'8, f'8), BeamSpanner(c'8), BeamSpanner(d'8, e'8, f'8))

>>> print voice.lilypond_format
\new Voice {
    c'8 [ ]
    d'8 [
    e'8
    f'8 ]
}
```

Set *direction=None* to fracture on both left and right sides.

Return tuple.

Inherited from spannertools.Spanner

TieSpanner.**fuse**(*spanner*)

Fuse contiguous spanners.

Return new spanner.

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> left_beam = beamtools.BeamSpanner(voice[:2])
>>> right_beam = beamtools.BeamSpanner(voice[2:])

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8 ]
    e'8 [
    f'8 ]
}

>>> left_beam.fuse(right_beam)
[(BeamSpanner(c'8, d'8), BeamSpanner(e'8, f'8), BeamSpanner(c'8, d'8, e'8, f'8))]

>>> print voice.lilypond_format
\new Voice {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

Return list.

Inherited from spannertools.Spanner

TieSpanner.**index**(*component*)

Return nonnegative integer index of *component* in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[2:])
>>> spanner
BeamSpanner(e'8, f'8)

>>> spanner.index(voice[-2])
0
```

Return nonnegative integer.

Inherited from spannertools.Spanner

TieSpanner.**pop**()

Remove and return rightmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop()
Note("f'8")
```

```
>>> spanner
BeamSpanner(c'8, d'8, e'8)
```

Return component.

Inherited from spannertools.Spanner

TieSpanner.**pop_left**()

Remove and return leftmost component in spanner:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> spanner = beamtools.BeamSpanner(voice[:])
>>> spanner
BeamSpanner(c'8, d'8, e'8, f'8)

>>> spanner.pop_left()
Note("c'8")

>>> spanner
BeamSpanner(d'8, e'8, f'8)
```

Return component.

Inherited from spannertools.Spanner

Special Methods

TieSpanner.**__call__**(*expr*)

New in version 2.9. Call spanner on *expr* as a shortcut to extend spanner:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")

>>> beam = beamtools.BeamSpanner()
>>> beam(staff[:])
BeamSpanner(c'8, d'8, e'8, f'8)

>>> f(staff)
\new Staff {
    c'8 [
    d'8
    e'8
    f'8 ]
}
```

The method is provided as an experimental way of unifying spanner and mark attachment syntax.

Return spanner.

Inherited from spannertools.Spanner

TieSpanner.**__contains__**(*expr*)

Inherited from spannertools.Spanner

TieSpanner.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TieSpanner.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TieSpanner.__getitem__(*expr*)
Inherited from spannertools.Spanner

TieSpanner.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TieSpanner.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TieSpanner.__len__()
Inherited from spannertools.Spanner

TieSpanner.__lt__(*other*)
Trivial comparison to allow doctests to work.

Inherited from spannertools.Spanner

TieSpanner.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TieSpanner.__repr__()
Inherited from spannertools.Spanner

functions

tietools.add_or_remove_tie_chain_notes_to_achieve_scaled_written_duration

tietools.**add_or_remove_tie_chain_notes_to_achieve_scaled_written_duration**(*tie_chain*, *multiplier*)

Add or remove *tie_chain* notes to achieve scaled written duration:

```
>>> staff = Staff("c'8 [ ]")

>>> f(staff)
\new Staff {
    c'8 [ ]
}

>>> tie_chain = tietools.get_tie_chain(staff[0])
>>> tietools.add_or_remove_tie_chain_notes_to_achieve_scaled_written_duration(
...     tie_chain, Fraction(5, 4))
TieChain((Note("c'8"), Note("c'32")))
```

```
>>> f(staff)
\new Staff {
    c'8 [ ~
    c'32 ]
}
```

Return *tie_chain*. Changed in version 2.0: renamed `tietools.duration_scale()` to `tietools.add_or_remove_tie_chain_notes_to_achieve_scaled_written_duration()`.

tietools.add_or_remove_tie_chain_notes_to_achieve_written_duration

tietools.**add_or_remove_tie_chain_notes_to_achieve_written_duration**(*tie_chain*, *new_written_duration*)

Add or remove *tie_chain* notes to achieve *written_duration*:

```
>>> staff = Staff("c'8 [ ]")

>>> f(staff)
\new Staff {
    c'8 [ ]
}

>>> tie_chain = tietools.get_tie_chain(staff[0])
>>> tietools.add_or_remove_tie_chain_notes_to_achieve_written_duration(
...     tie_chain, Duration(5, 32))
TieChain((Note("c'8"), Note("c'32")))

>>> f(staff)
\new Staff {
    c'8 [ ~
    c'32 ]
}
```

Return *tie_chain*. Changed in version 2.0: renamed `tietools.duration_change()` to `tietools.add_or_remove_tie_chain_notes_to_achieve_written_duration()`.

tietools.apply_tie_spanner_to_leaf_pair

tietools.**apply_tie_spanner_to_leaf_pair**(*left*, *right*)

Apply tie spanner to *left* leaf and *right* leaf:

```
>>> staff = Staff("c'8 ~ c' c' c'")

>>> f(staff)
\new Staff {
    c'8 ~
    c'8
    c'8
    c'8
}

>>> tietools.apply_tie_spanner_to_leaf_pair(staff[1], staff[2])

>>> f(staff)
\new Staff {
    c'8 ~
```

```
    c'8 ~
    c'8
    c'8
}
```

Handle existing tie spanners intelligently.

Return none. Changed in version 2.0: renamed `tietools.span_leaf_pair()` to `tietools.apply_tie_spanner_to_leaf_pair()`.

tietools.are_components_in_same_tie_spanner

`tietools.`**`are_components_in_same_tie_spanner`**(*components*)

True when *components* are in same tie spanner:

```
>>> voice = Voice("c'8 ~ c' d' ~ d'")

>>> f(voice)
\new Voice {
    c'8 ~
    c'8
    d'8 ~
    d'8
}

>>> tietools.are_components_in_same_tie_spanner(voice[:2])
True
```

Otherwise false:

```
>>> tietools.are_components_in_same_tie_spanner(voice[1:3])
False
```

Return boolean. Changed in version 2.0: renamed `tietools.are_in_same_spanner()` to `tietools.are_components_in_same_tie_spanner()`.

tietools.get_nontrivial_tie_chains_masked_by_components

`tietools.`**`get_nontrivial_tie_chains_masked_by_components`**(*components*)

Get nontrivial tie chains masked by *components*:

```
>>> staff = Staff("c'8 ~ c'4 d'8 ~ d'4 e'4.")

>>> f(staff)
\new Staff {
    c'8 ~
    c'4
    d'8 ~
    d'4
    e'4.
}
```

Return only nontrivial tie chains:

```
>>> tietools.get_nontrivial_tie_chains_masked_by_components(staff.leaves)
[TieChain((Note("c'8"), Note("c'4"))), TieChain((Note("d'8"), Note("d'4")))]
```

Return 'masked' tie chains when only some notes of a tie chain are passed in:

```
>>> tietools.get_nontrivial_tie_chains_masked_by_components(staff.leaves[1:2])
[TieChain((Note("c'4"),))]
```

Return list of zero or more (possibly masked) tie chains. Changed in version 2.9: renamed `tietools.get_tie_chains_in_expr()` to `tietools.get_nontrivial_tie_chains_masked_by_components()`.

tietools.get_tie_chain

`tietools.`**`get_tie_chain`**(*component*)

New in version 2.0. Get tie chain from *component*:

```
>>> staff = Staff("c'8 ~ c' d'4")

>>> f(staff)
\new Staff {
    c'8 ~
    c'8
    d'4
}

>>> tietools.get_tie_chain(staff[0])
TieChain((Note("c'8"), Note("c'8")))
```

Return tie chain.

tietools.get_tie_spanner_attached_to_component

`tietools.`**`get_tie_spanner_attached_to_component`**(*component*)

New in version 2.10. Get the only tie spanner attached to *component*:

```
>>> staff = Staff("c'8 ~ c'8 d'4")

>>> f(staff)
\new Staff {
    c'8 ~
    c'8
    d'4
}

>>> tietools.get_tie_spanner_attached_to_component(staff[0])
TieSpanner(c'8, c'8)
```

Return tie spanner.

Raise missing spanner error when no tie spanner attached to *component*.

Raise extra spanner error when more than one tie spanner attached to *component*.

tietools.is_component_with_tie_spanner_attached

`tietools.`**`is_component_with_tie_spanner_attached`**(*expr*)

New in version 2.0. True when *expr* is component with tie spanner attached:

```
>>> staff = Staff("c'8 ~ c' ~ c' ~ c'")

>>> f(staff)
\new Staff {
    c'8 ~
    c'8 ~
    c'8 ~
    c'8
}

>>> tietools.is_component_with_tie_spanner_attached(staff[1])
True
```

Otherwise false:

```
>>> tietools.is_component_with_tie_spanner_attached(staff)
False
```

Return boolean.

tietools.iterate_nontrivial_tie_chains_in_expr

tietools.**iterate_nontrivial_tie_chains_in_expr**(*expr*, *reverse=False*)

Iterate nontrivial tie chains forward in *expr*:

```
>>> staff = Staff(r"c'4 ~ \times 2/3 { c'16 d'8 } e'8 f'4 ~ f'16")

>>> f(staff)
\new Staff {
    c'4 ~
    \times 2/3 {
        c'16
        d'8
    }
    e'8
    f'4 ~
    f'16
}

>>> for x in tietools.iterate_nontrivial_tie_chains_in_expr(staff):
...     x
...
TieChain((Note("c'4"), Note("c'16")))
TieChain((Note("f'4"), Note("f'16")))
```

Iterate nontrivial tie chains backward in *expr*:

```
::

>>> for x in tietools.iterate_nontrivial_tie_chains_in_expr(staff, reverse=True):
...     x
...
TieChain((Note("f'4"), Note("f'16")))
TieChain((Note("c'4"), Note("c'16")))
```

Return generator.

tietools.iterate_pitched_tie_chains_in_expr

tietools.**iterate_pitched_tie_chains_in_expr**(*expr*, *reverse=False*)

New in version 2.10. Iterate pitched tie chains forward in *expr*:

```
>>> staff = Staff(r"c'4 ~ \times 2/3 { c'16 d'8 } e'8 r8 f'8 ~ f'16 r8.")

>>> f(staff)
\new Staff {
    c'4 ~
    \times 2/3 {
        c'16
        d'8
    }
    e'8
    r8
    f'8 ~
    f'16
    r8.
}

>>> for x in tietools.iterate_pitched_tie_chains_in_expr(staff):
...     x
...
TieChain((Note("c'4"), Note("c'16")))
TieChain((Note("d'8"),))
TieChain((Note("e'8"),))
TieChain((Note("f'8"), Note("f'16")))
```

Iterate pitched tie chains backward in *expr*:

```
::

>>> for x in tietools.iterate_pitched_tie_chains_in_expr(staff, reverse=True):
...     x
...
TieChain((Note("f'8"), Note("f'16")))
TieChain((Note("e'8"),))
TieChain((Note("d'8"),))
TieChain((Note("c'4"), Note("c'16")))
```

Tie chains are pitched if they comprise notes or chords.

Tie chains are not pitched if they comprise rests or skips.

Return generator.

tietools.iterate_tie_chains_in_expr

tietools.**iterate_tie_chains_in_expr**(*expr*, *reverse=False*)

Iterate tie chains forward in *expr*:

```
>>> staff = Staff(r"c'4 ~ \times 2/3 { c'16 d'8 } e'8 f'4 ~ f'16")

>>> f(staff)
\new Staff {
    c'4 ~
    \times 2/3 {
```

```
        c'16
        d'8
    }
    e'8
    f'4 ~
    f'16
}
```

```
>>> for x in tietools.iterate_tie_chains_in_expr(staff):
...     x
...
TieChain((Note("c'4"), Note("c'16")))
TieChain((Note("d'8"),))
TieChain((Note("e'8"),))
TieChain((Note("f'4"), Note("f'16")))
```

Iterate tie chains backward in *expr*:

```
::
```

```
>>> for x in tietools.iterate_tie_chains_in_expr(staff, reverse=True):
...     x
...
TieChain((Note("f'4"), Note("f'16")))
TieChain((Note("e'8"),))
TieChain((Note("d'8"),))
TieChain((Note("c'4"), Note("c'16")))
```

Return generator.

tietools.iterate_topmost_tie_chains_and_components_in_expr

tietools.**iterate_topmost_tie_chains_and_components_in_expr**(*expr*)

Iterate topemost tie chains and components forward in *expr*:

```
>>> string = r"c'8 ~ c'32 d'8 ~ d'32 \times 2/3 { e'8 f'8 g'8 } a'8 ~ a'32 b'8 ~ b'32"
>>> staff = Staff(string)
```

```
>>> f(staff)
\new Staff {
    c'8 ~
    c'32
    d'8 ~
    d'32
    \times 2/3 {
        e'8
        f'8
        g'8
    }
    a'8 ~
    a'32
    b'8 ~
    b'32
}
```

```
>>> for x in tietools.iterate_topmost_tie_chains_and_components_in_expr(staff):
...     x
```

```
...
TieChain((Note("c'8"), Note("c'32")))
TieChain((Note("d'8"), Note("d'32")))
Tuplet(2/3, [e'8, f'8, g'8])
TieChain((Note("a'8"), Note("a'32")))
TieChain((Note("b'8"), Note("b'32")))
```

Raise tie chain error on overlapping tie chains.

Return generator. Changed in version 2.0: renamed `iterate.chained_contents()` to `tietools.iterate_topmost_tie_chains_and_components_in_expr()`.

tietools.remove_nonfirst_leaves_in_tie_chain

tietools.**remove_nonfirst_leaves_in_tie_chain**(*tie_chain*)

Remove nonfirst leaves in *tie_chain*:

```
>>> staff = Staff("c'4 ~ c'16")

>>> f(staff)
\new Staff {
    c'4 ~
    c'16
}

>>> tietools.remove_nonfirst_leaves_in_tie_chain(tietools.get_tie_chain(staff[0]))
TieChain((Note("c'4"),))

>>> f(staff)
\new Staff {
    c'4
}
```

Return *tie_chain*. Changed in version 2.0: renamed `tietools.truncate()` to `tietools.remove_all_leaves_in_tie_chain_except_first()`.Changed in version 2.9: renamed `tietools.remove_all_leaves_in_tie_chain_except_first()` to `tietools.remove_nonfirst_leaves_in_tie_chain()`.

tietools.remove_tie_spanners_from_components_in_expr

tietools.**remove_tie_spanners_from_components_in_expr**(*expr*)

Remove tie spanners components in *expr*:

```
>>> staff = Staff("c'4 ~ c'16 d'4 ~ d'16")

>>> f(staff)
\new Staff {
    c'4 ~
    c'16
    d'4 ~
    d'16
}

>>> tietools.remove_tie_spanners_from_components_in_expr(staff[:])
[Note("c'4"), Note("c'16"), Note("d'4"), Note("d'16")]
```

```
>>> f(staff)
\new Staff {
    c'4
    c'16
    d'4
    d'16
}
```

Return *expr*. Changed in version 2.0: renamed `componenttools.untie_shallow()` to `tietools.remove_tie_spanners_from_components_in_expr()`.

tietools.tie_chain_to_tuplet_with_proportions

tietools.**tie_chain_to_tuplet_with_proportions**(*chain*, *divisions*, *diminution=True*, *dotted=True*)

New in version 2.0. Generalized tie-chain division function.

Example 1a. Change *tie_chain* to augmented tuplet with proportions `[1]`. Avoid dots:

```
>>> staff = Staff("c'8 [ ~ c'16 c'16 ]")

>>> f(staff)
\new Staff {
    c'8 [ ~
    c'16
    c'16 ]
}

>>> tie_chain = tietools.get_tie_chain(staff[0])
>>> tietools.tie_chain_to_tuplet_with_proportions(
...     tie_chain, [1], diminution=False, dotted=False)
FixedDurationTuplet(3/16, [c'8])

>>> f(staff)
\new Staff {
    \fraction \times 3/2 {
        c'8 [
    }
    c'16 ]
}
```

Exampl 1b. Change *tie_chain* to augment tuplet with proportions `[1, 2]`. Avoid dots:

```
>>> staff = Staff("c'8 [ ~ c'16 c'16 ]")

>>> f(staff)
\new Staff {
    c'8 [ ~
    c'16
    c'16 ]
}

>>> tie_chain = tietools.get_tie_chain(staff[0])
>>> tietools.tie_chain_to_tuplet_with_proportions(
...     tie_chain, [1, 2], diminution=False, dotted=False)
FixedDurationTuplet(3/16, [c'16, c'8])
```

```
>>> f(staff)
\new Staff {
    {
        c'16 [
        c'8
    }
    c'16 ]
}
```

Examle 1c. Change *tie_chain* to augmented tuplet with proportions `[1, 2, 2]`. Avoid dots:

```
>>> staff = Staff("c'8 [ ~ c'16 c'16 ]")

>>> f(staff)
\new Staff {
    c'8 [ ~
    c'16
    c'16 ]
}

>>> tie_chain = tietools.get_tie_chain(staff[0])
>>> tietools.tie_chain_to_tuplet_with_proportions(
...     tie_chain, [1, 2, 2], diminution=False, dotted=False)
FixedDurationTuplet(3/16, [c'32, c'16, c'16])

>>> f(staff)
\new Staff {
    \fraction \times 6/5 {
        c'32 [
        c'16
        c'16
    }
    c'16 ]
}
```

Todo

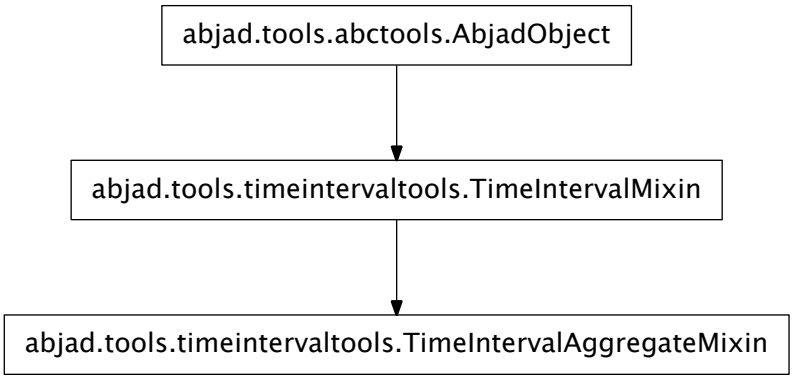
move to tuplettools.

---

timeintervaltools

abstract classes

timeintervaltools.TimeIntervalAggregateMixin



class timeintervaltools.**TimeIntervalAggregateMixin**(**args*, ***kwargs*)

Read-only Properties

TimeIntervalAggregateMixin.**bounds**

Start and stop of self returned as TimeInterval instance:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> bounds = interval.bounds
>>> bounds
TimeInterval(Offset(2, 1), Offset(10, 1), {})
>>> bounds == interval
True
>>> bounds is interval
False
```

Returns *TimeInterval* instance.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**center**

Center offset of start and stop offsets:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.center
Offset(6, 1)
```

Returns *Offset* instance.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**duration**
Duration of the time interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.duration
Duration(8, 1)
```

Returns *Duration* instance.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**earliest_start**

TimeIntervalAggregateMixin.**earliest_stop**

TimeIntervalAggregateMixin.**intervals**

TimeIntervalAggregateMixin.**latest_start**

TimeIntervalAggregateMixin.**latest_stop**

TimeIntervalAggregateMixin.**offset_counts**

TimeIntervalAggregateMixin.**offsets**

TimeIntervalAggregateMixin.**signature**
Tuple of start bound and stop bound.

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.signature
(Offset(2, 1), Offset(10, 1))
```

Returns 2-tuple of *Offset* instances.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**start**
Starting offset of interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.start
Offset(2, 1)
```

Returns *Offset* instance.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**stop**
Stopping offset of interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.stop
Offset(10, 1)
```

Returns *Offset* instance.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

TimeIntervalAggregateMixin.**find_intervals_intersecting_or_tangent_to_interval**()

TimeIntervalAggregateMixin.**find_intervals_intersecting_or_tangent_to_offset**()

TimeIntervalAggregateMixin.**find_intervals_starting_after_offset**()

TimeIntervalAggregateMixin.**find_intervals_starting_and_stopping_within_interval**()

TimeIntervalAggregateMixin.**find_intervals_starting_at_offset**()

TimeIntervalAggregateMixin.**find_intervals_starting_before_offset**()

TimeIntervalAggregateMixin.**find_intervals_starting_or_stopping_at_offset**()

TimeIntervalAggregateMixin.**find_intervals_starting_within_interval**()

TimeIntervalAggregateMixin.**find_intervals_stopping_after_offset**()

TimeIntervalAggregateMixin.**find_intervals_stopping_at_offset**()

TimeIntervalAggregateMixin.**find_intervals_stopping_before_offset**()

TimeIntervalAggregateMixin.**find_intervals_stopping_within_interval**()

TimeIntervalAggregateMixin.**get_overlap_with_interval**(*interval*)
Return amount of overlap with *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**is_contained_by_interval**(*interval*)
True if interval is contained by *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**is_container_of_interval**(*interval*)
True if interval contains *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**is_overlapped_by_interval**(*interval*)
True if interval is overlapped by *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**is_tangent_to_interval**(*interval*)
True if interval is tangent to *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**quantize_to_rational**(*rational*)
Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**scale_by_rational**(*rational*)
Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**scale_to_rational**(*rational*)
Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**shift_by_rational**(*rational*)
Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**shift_to_rational**(*rational*)
Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**split_at_rationals**(**rationals*)
Inherited from timeintervaltools.TimeIntervalMixin

Special Methods

TimeIntervalAggregateMixin.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TimeIntervalAggregateMixin.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimeIntervalAggregateMixin.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TimeIntervalAggregateMixin.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimeIntervalAggregateMixin.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimeIntervalAggregateMixin.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

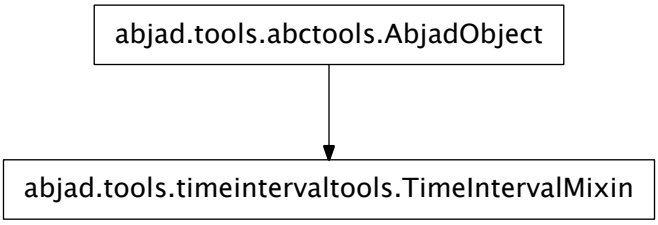
TimeIntervalAggregateMixin.**__nonzero__**()
Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalAggregateMixin.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

timeintervaltools.TimeIntervalMixin



class timeintervaltools.**TimeIntervalMixin**(**args*, ***kwargs*)

Read-only Properties

TimeIntervalMixin.**bounds**

Start and stop of self returned as TimeInterval instance:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> bounds = interval.bounds
>>> bounds
TimeInterval(Offset(2, 1), Offset(10, 1), {})
>>> bounds == interval
True
>>> bounds is interval
False
```

Returns *TimeInterval* instance.

TimeIntervalMixin.**center**

Center offset of start and stop offsets:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.center
Offset(6, 1)
```

Returns *Offset* instance.

TimeIntervalMixin.**duration**

Duration of the time interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.duration
Duration(8, 1)
```

Returns *Duration* instance.

TimeIntervalMixin.**signature**

Tuple of start bound and stop bound.

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.signature
(Offset(2, 1), Offset(10, 1))
```

Returns 2-tuple of *Offset* instances.

TimeIntervalMixin.**start**

Starting offset of interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.start
Offset(2, 1)
```

Returns *Offset* instance.

TimeIntervalMixin.**stop**

Stopping offset of interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.stop
Offset(10, 1)
```

Returns *Offset* instance.

TimeIntervalMixin.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

TimeIntervalMixin.**get_overlap_with_interval**(*interval*)

Return amount of overlap with *interval*.

TimeIntervalMixin.**is_contained_by_interval**(*interval*)

True if interval is contained by *interval*.

TimeIntervalMixin.**is_container_of_interval**(*interval*)

True if interval contains *interval*.

TimeIntervalMixin.**is_overlapped_by_interval**(*interval*)

True if interval is overlapped by *interval*.

TimeIntervalMixin.**is_tangent_to_interval**(*interval*)

True if interval is tangent to *interval*.

TimeIntervalMixin.**quantize_to_rational**(*rational*)

TimeIntervalMixin.**scale_by_rational**(*rational*)

TimeIntervalMixin.**scale_to_rational**(*rational*)

TimeIntervalMixin.**shift_by_rational**(*rational*)

TimeIntervalMixin.**shift_to_rational**(*rational*)

TimeIntervalMixin.**split_at_rationals**(**rationals*)

Special Methods

`TimeIntervalMixin.__eq__(arg)`
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`TimeIntervalMixin.__ge__(arg)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TimeIntervalMixin.__gt__(arg)`
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`TimeIntervalMixin.__le__(arg)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TimeIntervalMixin.__lt__(arg)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TimeIntervalMixin.__ne__(arg)`
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`TimeIntervalMixin.__nonzero__()`

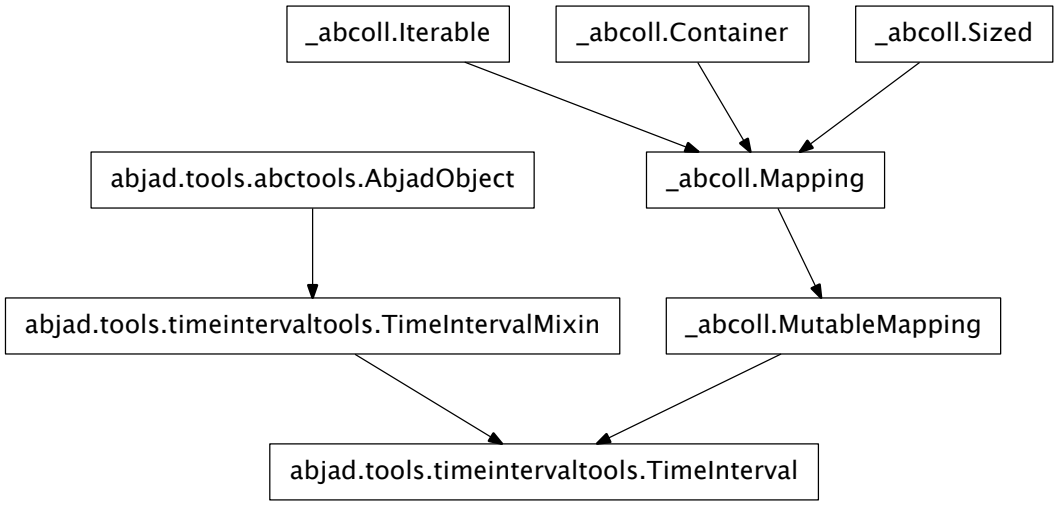
`TimeIntervalMixin.__repr__()`
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

concrete classes

timeintervaltools.TimeInterval



class timeintervaltools.**TimeInterval**(**args*)
A start / stop pair, carrying some metadata.

Read-only Properties

TimeInterval.**bounds**
Start and stop of self returned as TimeInterval instance:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> bounds = interval.bounds
>>> bounds
TimeInterval(Offset(2, 1), Offset(10, 1), {})
>>> bounds == interval
True
>>> bounds is interval
False
```

Returns *TimeInterval* instance.

Inherited from timeintervaltools.TimeIntervalMixin

TimeInterval.**center**
Center point of start and stop bounds.

TimeInterval.**duration**
stop bound minus start bound.

TimeInterval.**signature**
Tuple of start bound and stop bound.

TimeInterval.**start**
start bound.

TimeInterval.**stop**
stop bound.

TimeInterval.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

TimeInterval.**clear**()
Inherited from _abcoll.MutableMapping

TimeInterval.**get**(*key*, *default=None*)
Inherited from _abcoll.Mapping

TimeInterval.**get_overlap_with_interval**(*interval*)
Return amount of overlap with *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeInterval.**is_contained_by_interval**(*interval*)
True if interval is contained by *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeInterval.**is_container_of_interval**(*interval*)
True if interval contains *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeInterval.**is_overlapped_by_interval**(*interval*)
True if interval is overlapped by *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeInterval.**is_tangent_to_interval**(*interval*)
True if interval is tangent to *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeInterval.**items**()
Inherited from _abcoll.Mapping

TimeInterval.**iteritems**()
Inherited from _abcoll.Mapping

TimeInterval.**iterkeys**()
Inherited from _abcoll.Mapping

TimeInterval.**itervalues**()
Inherited from _abcoll.Mapping

TimeInterval.**keys**()
Inherited from _abcoll.Mapping

TimeInterval.**pop**(*key*, *default=<object object at 0x1002b0040>*)
Inherited from _abcoll.MutableMapping

TimeInterval.**popitem**()
Inherited from _abcoll.MutableMapping

TimeInterval.**quantize_to_rational**(*rational*)

TimeInterval.**scale_by_rational**(*rational*)

TimeInterval.**scale_to_rational**(*rational*)

TimeInterval.**setdefault**(*key*, *default=None*)
Inherited from _abcoll.MutableMapping

TimeInterval.**shift_by_rational**(*rational*)

TimeInterval.**shift_to_rational**(*rational*)

TimeInterval.**split_at_rationals**(**rationals*)

TimeInterval.**update**(**args*, ***kwds*)
Inherited from _abcoll.MutableMapping

TimeInterval.**values**()
Inherited from _abcoll.Mapping

Special Methods

TimeInterval.**__contains__**(*key*)
Inherited from _abcoll.Mapping

TimeInterval.**__delitem__**(*item*)

TimeInterval.**__eq__**(*other*)

TimeInterval.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimeInterval.**__getitem__**(*item*)

TimeInterval.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TimeInterval.**__hash__**()

TimeInterval.**__iter__**()

TimeInterval.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimeInterval.**__len__**()

TimeInterval.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

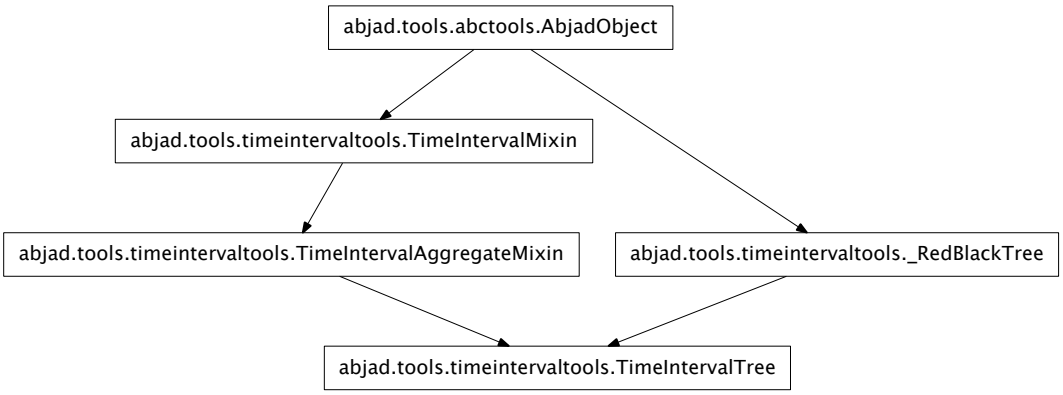
TimeInterval.**__ne__**(*other*)

TimeInterval.**__nonzero__**()
Inherited from timeintervaltools.TimeIntervalMixin

TimeInterval.**__repr__**()

TimeInterval.**__setitem__**(*item*, *value*)

timeintervaltools.TimeIntervalTree



class timeintervaltools.**TimeIntervalTree**(*intervals=None*)
An augmented red-black tree for storing and searching for intervals of time (rather than pitch).

This allows for the arbitrary placement of blocks of material along a time-line. While this functionality could be achieved with Python's built-in collections, this class reduces the complexity of the search process, such as locating overlapping intervals.

TimeIntervalTrees can be instantiated without contents, or from a mixed collection of other TimeIntervalTrees and / or TimeIntervals. The input will be parsed recursively:

```
>>> from abjad.tools.timeintervaltools import TimeIntervalTree
>>> from abjad.tools.timeintervaltools import TimeInterval

>>> interval_one = TimeInterval(0, 10)
>>> interval_two = TimeInterval(1, 8)
>>> interval_three = TimeInterval(3, 13)
>>> tree = TimeIntervalTree([interval_one, interval_two, interval_three])

>>> tree
TimeIntervalTree([
    TimeInterval(Offset(0, 1), Offset(10, 1), {}),
    TimeInterval(Offset(1, 1), Offset(8, 1), {}),
    TimeInterval(Offset(3, 1), Offset(13, 1), {})
])
```

Return *TimeIntervalTree* instance.

Read-only Properties

TimeIntervalTree.**bounds**

Start and stop of self returned as TimeInterval instance:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> bounds = interval.bounds
>>> bounds
TimeInterval(Offset(2, 1), Offset(10, 1), {})
>>> bounds == interval
True
>>> bounds is interval
False
```

Returns *TimeInterval* instance.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTree.**center**

Center offset of start and stop offsets:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.center
Offset(6, 1)
```

Returns *Offset* instance.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTree.**duration**

Absolute difference of the stop and start values of the tree:

```
>>> from abjad.tools.timeintervaltools import *
>>> ti1 = TimeInterval(1, 2)
>>> ti2 = TimeInterval(3, (7, 2))
>>> tree = TimeIntervalTree([ti1, ti2])
>>> tree.duration
Duration(5, 2)
```

Empty trees have a duration of 0.

Return Duration instance.

TimeIntervalTree.**earliest_start**

The minimum start value of all intervals in the tree:

```
>>> from abjad.tools.timeintervaltools import *
>>> ti1 = TimeInterval(1, 2)
>>> ti2 = TimeInterval(3, (7, 2))
>>> tree = TimeIntervalTree([ti1, ti2])
>>> tree.earliest_start
Offset(1, 1)
```

Return Offset instance, or None if tree is empty.

TimeIntervalTree.**earliest_stop**

The minimum stop value of all intervals in the tree:

```
>>> from abjad.tools.timeintervaltools import *
>>> ti1 = TimeInterval(1, 2)
>>> ti2 = TimeInterval(3, (7, 2))
>>> tree = TimeIntervalTree([ti1, ti2])
```

```
>>> tree.earliest_stop
Offset(2, 1)
```

Return `Offset` instance, or None if tree is empty.

`TimeIntervalTree.`**`intervals`**

`TimeIntervalTree.`**`latest_start`**

The maximum start value of all intervals in the tree:

```
>>> from abjad.tools.timeintervaltools import *
>>> ti1 = TimeInterval(1, 2)
>>> ti2 = TimeInterval(3, (7, 2))
>>> tree = TimeIntervalTree([ti1, ti2])
>>> tree.latest_start
Offset(3, 1)
```

Return `Offset` instance, or None if tree is empty.

`TimeIntervalTree.`**`latest_stop`**

The maximum stop value of all intervals in the tree:

```
>>> from abjad.tools.timeintervaltools import *
>>> ti1 = TimeInterval(1, 2)
>>> ti2 = TimeInterval(3, (7, 2))
>>> tree = TimeIntervalTree([ti1, ti2])
>>> tree.latest_stop
Offset(7, 2)
```

Return `Offset` instance, or None if tree is empty.

`TimeIntervalTree.`**`offset_counts`**

Inherited from `timeintervaltools.TimeIntervalAggregateMixin`

`TimeIntervalTree.`**`offsets`**

Inherited from `timeintervaltools.TimeIntervalAggregateMixin`

`TimeIntervalTree.`**`signature`**

Tuple of start bound and stop bound.

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.signature
(Offset(2, 1), Offset(10, 1))
```

Returns 2-tuple of *Offset* instances.

Inherited from `timeintervaltools.TimeIntervalMixin`

`TimeIntervalTree.`**`start`**

Starting offset of interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.start
Offset(2, 1)
```

Returns *Offset* instance.

Inherited from `timeintervaltools.TimeIntervalMixin`

`TimeIntervalTree.`**`stop`**

Stopping offset of interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.stop
Offset(10, 1)
```

Returns *Offset* instance.

Inherited from `timeintervaltools.TimeIntervalMixin`

`TimeIntervalTree.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`TimeIntervalTree.`**`find_intervals_intersecting_or_tangent_to_interval`**`(*args)`
Find all intervals in tree intersecting or tangent to the interval defined in *args*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> interval = TimeInterval(0, 1)
>>> found = tree.find_intervals_intersecting_or_tangent_to_interval(interval)
>>> sorted([x['name'] for x in found])
['a', 'b', 'c']

>>> interval = TimeInterval(3, 4)
>>> found = tree.find_intervals_intersecting_or_tangent_to_interval(interval)
>>> sorted([x['name'] for x in found])
['c', 'd']
```

Return *TimeIntervalTree* instance.

`TimeIntervalTree.`**`find_intervals_intersecting_or_tangent_to_offset`**`(offset)`
Find all intervals in tree intersecting or tangent to *offset*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> offset = 1
>>> found = tree.find_intervals_intersecting_or_tangent_to_offset(offset)
>>> sorted([x['name'] for x in found])
['a', 'b', 'c']

>>> offset = 3
>>> found = tree.find_intervals_intersecting_or_tangent_to_offset(offset)
>>> sorted([x['name'] for x in found])
['c', 'd']
```

Return *TimeIntervalTree* instance.

`TimeIntervalTree.`**`find_intervals_starting_after_offset`**`(offset)`
Find all intervals in tree starting after *offset*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> offset = 0
>>> found = tree.find_intervals_starting_after_offset(offset)
>>> sorted([x['name'] for x in found])
['b', 'd']

>>> offset = 1
>>> found = tree.find_intervals_starting_after_offset(offset)
>>> sorted([x['name'] for x in found])
['d']
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**find_intervals_starting_and_stopping_within_interval**(**args*)

Find all intervals in tree starting and stopping within the interval defined by *args*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> interval = TimeInterval(1, 3)
>>> found = tree.find_intervals_starting_and_stopping_within_interval(interval)
>>> sorted([x['name'] for x in found])
['b', 'd']

>>> interval = TimeInterval(-1, 2)
>>> found = tree.find_intervals_starting_and_stopping_within_interval(interval)
>>> sorted([x['name'] for x in found])
['a', 'b']
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**find_intervals_starting_at_offset**(*offset*)

Find all intervals in tree starting at *offset*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> offset = 0
>>> found = tree.find_intervals_starting_at_offset(offset)
>>> sorted([x['name'] for x in found])
['a', 'c']

>>> offset = 1
>>> found = tree.find_intervals_starting_at_offset(offset)
>>> sorted([x['name'] for x in found])
['b']
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**find_intervals_starting_before_offset**(*offset*)

Find all intervals in tree starting before *offset*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> offset = 1
>>> found = tree.find_intervals_starting_before_offset(offset)
>>> sorted([x['name'] for x in found])
['a', 'c']

>>> offset = 2
>>> found = tree.find_intervals_starting_before_offset(offset)
>>> sorted([x['name'] for x in found])
['a', 'b', 'c']
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**find_intervals_starting_or_stopping_at_offset**(*offset*)

Find all intervals in tree starting or stopping at *offset*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> offset = 2
>>> found = tree.find_intervals_starting_or_stopping_at_offset(offset)
>>> sorted([x['name'] for x in found])
['b', 'd']

>>> offset = 1
>>> found = tree.find_intervals_starting_or_stopping_at_offset(offset)
>>> sorted([x['name'] for x in found])
['a', 'b']
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**find_intervals_starting_within_interval**(**args*)

Find all intervals in tree starting within the interval defined by *args*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> interval = TimeInterval((-1, 2), (1, 2))
>>> found = tree.find_intervals_starting_within_interval(interval)
>>> sorted([x['name'] for x in found])
['a', 'c']

>>> interval = TimeInterval((1, 2), (5, 2))
>>> found = tree.find_intervals_starting_within_interval(interval)
>>> sorted([x['name'] for x in found])
['b', 'd']
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**find_intervals_stopping_after_offset**(*offset*)

Find all intervals in tree stopping after *offset*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> offset = 1
>>> found = tree.find_intervals_stopping_after_offset(offset)
>>> sorted([x['name'] for x in found])
['b', 'c', 'd']

>>> offset = 2
>>> found = tree.find_intervals_stopping_after_offset(offset)
>>> sorted([x['name'] for x in found])
['c', 'd']
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**find_intervals_stopping_at_offset**(*offset*)

Find all intervals in tree stopping at *offset*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> offset = 3
>>> found = tree.find_intervals_stopping_at_offset(offset)
>>> sorted([x['name'] for x in found])
['c', 'd']

>>> offset = 1
>>> found = tree.find_intervals_stopping_at_offset(offset)
>>> sorted([x['name'] for x in found])
['a']
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**find_intervals_stopping_before_offset**(*offset*)

Find all intervals in tree stopping before *offset*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> offset = 3
>>> found = tree.find_intervals_stopping_before_offset(offset)
>>> sorted([x['name'] for x in found])
['a', 'b']

>>> offset = (7, 2)
>>> found = tree.find_intervals_stopping_before_offset(offset)
```

```
>>> sorted([x['name'] for x in found])
['a', 'b', 'c', 'd']
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**find_intervals_stopping_within_interval**(**args*)
Find all intervals in tree stopping within the interval defined by *args*:

```
>>> a = TimeInterval(0, 1, {'name': 'a'})
>>> b = TimeInterval(1, 2, {'name': 'b'})
>>> c = TimeInterval(0, 3, {'name': 'c'})
>>> d = TimeInterval(2, 3, {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])

>>> interval = TimeInterval((3, 2), (5, 2))
>>> found = tree.find_intervals_stopping_within_interval(interval)
>>> sorted([x['name'] for x in found])
['b']

>>> interval = TimeInterval((5, 2), (7, 2))
>>> found = tree.find_intervals_stopping_within_interval(interval)
>>> sorted([x['name'] for x in found])
['c', 'd']
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**get_overlap_with_interval**(*interval*)
Return amount of overlap with *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTree.**is_contained_by_interval**(*interval*)
True if interval is contained by *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTree.**is_container_of_interval**(*interval*)
True if interval contains *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTree.**is_overlapped_by_interval**(*interval*)
True if interval is overlapped by *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTree.**is_tangent_to_interval**(*interval*)
True if interval is tangent to *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTree.**quantize_to_rational**(*rational*)
Quantize all intervals in tree to a multiple (1 or more) of *rational*:

```
>>> a = TimeInterval((1, 16), (1, 8), {'name': 'a'})
>>> b = TimeInterval((2, 7), (13, 7), {'name': 'b'})
>>> c = TimeInterval((3, 5), (8, 5), {'name': 'c'})
>>> d = TimeInterval((2, 3), (5, 3), {'name': 'd'})
>>> tree = TimeIntervalTree([a, b, c, d])
>>> tree
TimeIntervalTree([
    TimeInterval(Offset(1, 16), Offset(1, 8), {'name': 'a'}),
```

```
        TimeInterval(Offset(2, 7), Offset(13, 7), {'name': 'b'}),
        TimeInterval(Offset(3, 5), Offset(8, 5), {'name': 'c'}),
        TimeInterval(Offset(2, 3), Offset(5, 3), {'name': 'd'})
    ])

    >>> rational = (1, 4)
    >>> tree.quantize_to_rational(rational)
    TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 4), {'name': 'a'}),
        TimeInterval(Offset(1, 4), Offset(7, 4), {'name': 'b'}),
        TimeInterval(Offset(1, 2), Offset(3, 2), {'name': 'c'}),
        TimeInterval(Offset(3, 4), Offset(7, 4), {'name': 'd'})
    ])

    >>> rational = (1, 3)
    >>> tree.quantize_to_rational(rational)
    TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 3), {'name': 'a'}),
        TimeInterval(Offset(1, 3), Offset(2, 1), {'name': 'b'}),
        TimeInterval(Offset(2, 3), Offset(5, 3), {'name': 'c'}),
        TimeInterval(Offset(2, 3), Offset(5, 3), {'name': 'd'})
    ])
```

Return *TimeIntervalTree* instance.

TimeIntervalTree.**scale_by_rational**(*rational*)

Scale aggregate duration of tree by *rational*:

```
    >>> from abjad.tools.timeintervaltools import TimeInterval
    >>> from abjad.tools.timeintervaltools import TimeIntervalTree

    >>> one = TimeInterval(0, 1, {'name': 'one'})
    >>> two = TimeInterval((1, 2), (5, 2), {'name': 'two'})
    >>> three = TimeInterval(2, 4, {'name': 'three'})
    >>> tree = TimeIntervalTree([one, two, three])
    >>> tree
    TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'})
    ])

    >>> result = tree.scale_by_rational((2, 3))
    >>> result
    TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(2, 3), {'name': 'one'}),
        TimeInterval(Offset(1, 3), Offset(5, 3), {'name': 'two'}),
        TimeInterval(Offset(4, 3), Offset(8, 3), {'name': 'three'})
    ])
```

Scaling works regardless of the starting offset of the *TimeIntervalTree*:

```
    >>> zero = TimeInterval(-4, 0, {'name': 'zero'})
    >>> tree = TimeIntervalTree([zero, one, two, three])
    >>> tree
    TimeIntervalTree([
        TimeInterval(Offset(-4, 1), Offset(0, 1), {'name': 'zero'}),
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
```

```
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'})
    ])

    >>> result = tree.scale_by_rational(2)
    >>> result
    TimeIntervalTree([
        TimeInterval(Offset(-4, 1), Offset(4, 1), {'name': 'zero'}),
        TimeInterval(Offset(4, 1), Offset(6, 1), {'name': 'one'}),
        TimeInterval(Offset(5, 1), Offset(9, 1), {'name': 'two'}),
        TimeInterval(Offset(8, 1), Offset(12, 1), {'name': 'three'})
    ])

    >>> result.start == tree.start
    True
    >>> result.duration == tree.duration * 2
    True
```

Return *TimeIntervalTree* instance.

`TimeIntervalTree.`**`scale_to_rational`**`(`*rational*`)`

Scale aggregate duration of tree to *rational*:

```
    >>> from abjad.tools.timeintervaltools import TimeInterval
    >>> from abjad.tools.timeintervaltools import TimeIntervalTree

    >>> one = TimeInterval(0, 1, {'name': 'one'})
    >>> two = TimeInterval((1, 2), (5, 2), {'name': 'two'})
    >>> three = TimeInterval(2, 4, {'name': 'three'})
    >>> tree = TimeIntervalTree([one, two, three])
    >>> tree
    TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'})
    ])

    >>> result = tree.scale_to_rational(1)
    >>> result
    TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 4), {'name': 'one'}),
        TimeInterval(Offset(1, 8), Offset(5, 8), {'name': 'two'}),
        TimeInterval(Offset(1, 2), Offset(1, 1), {'name': 'three'})
    ])

    >>> result.scale_to_rational(10)
    TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(5, 2), {'name': 'one'}),
        TimeInterval(Offset(5, 4), Offset(25, 4), {'name': 'two'}),
        TimeInterval(Offset(5, 1), Offset(10, 1), {'name': 'three'})
    ])
```

Scaling works regardless of the starting offset of the *TimeIntervalTree*:

```
    >>> zero = TimeInterval(-4, 0, {'name': 'zero'})
    >>> tree = TimeIntervalTree([zero, one, two, three])
    >>> tree
    TimeIntervalTree([
        TimeInterval(Offset(-4, 1), Offset(0, 1), {'name': 'zero'}),
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
```

```
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'})
    ])

    >>> tree.scale_to_rational(4)
    TimeIntervalTree([
        TimeInterval(Offset(-4, 1), Offset(-2, 1), {'name': 'zero'}),
        TimeInterval(Offset(-2, 1), Offset(-3, 2), {'name': 'one'}),
        TimeInterval(Offset(-7, 4), Offset(-3, 4), {'name': 'two'}),
        TimeInterval(Offset(-1, 1), Offset(0, 1), {'name': 'three'})
    ])
```

Return *TimeIntervalTree* instance.

`TimeIntervalTree.`**`shift_by_rational`**`(`*rational*`)`

Shift aggregate offset of tree by *rational*:

```
    >>> from abjad.tools.timeintervaltools import TimeInterval
    >>> from abjad.tools.timeintervaltools import TimeIntervalTree

    >>> one = TimeInterval(0, 1, {'name': 'one'})
    >>> two = TimeInterval((1, 2), (5, 2), {'name': 'two'})
    >>> three = TimeInterval(2, 4, {'name': 'three'})
    >>> tree = TimeIntervalTree([one, two, three])
    >>> tree
    TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'})
    ])

    >>> result = tree.shift_by_rational(-2.5)
    >>> result
    TimeIntervalTree([
        TimeInterval(Offset(-5, 2), Offset(-3, 2), {'name': 'one'}),
        TimeInterval(Offset(-2, 1), Offset(0, 1), {'name': 'two'}),
        TimeInterval(Offset(-1, 2), Offset(3, 2), {'name': 'three'})
    ])
    >>> result.shift_by_rational(6)
    TimeIntervalTree([
        TimeInterval(Offset(7, 2), Offset(9, 2), {'name': 'one'}),
        TimeInterval(Offset(4, 1), Offset(6, 1), {'name': 'two'}),
        TimeInterval(Offset(11, 2), Offset(15, 2), {'name': 'three'})
    ])
```

Return *TimeIntervalTree* instance.

`TimeIntervalTree.`**`shift_to_rational`**`(`*rational*`)`

Shift aggregate offset of tree to *rational*:

```
    >>> from abjad.tools.timeintervaltools import TimeInterval
    >>> from abjad.tools.timeintervaltools import TimeIntervalTree

    >>> one = TimeInterval(0, 1, {'name': 'one'})
    >>> two = TimeInterval((1, 2), (5, 2), {'name': 'two'})
    >>> three = TimeInterval(2, 4, {'name': 'three'})
    >>> tree = TimeIntervalTree([one, two, three])
    >>> tree
    TimeIntervalTree([
```

```
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'})
    ])

    >>> result = tree.shift_to_rational(100)
    >>> result
    TimeIntervalTree([
        TimeInterval(Offset(100, 1), Offset(101, 1), {'name': 'one'}),
        TimeInterval(Offset(201, 2), Offset(205, 2), {'name': 'two'}),
        TimeInterval(Offset(102, 1), Offset(104, 1), {'name': 'three'})
    ])
```

Return *TimeIntervalTree* instance.

`TimeIntervalTree.`**`split_at_rationals`**`(*rationals)`

Split tree at each rational in *rationals*:

```
    >>> from abjad.tools.timeintervaltools import TimeInterval
    >>> from abjad.tools.timeintervaltools import TimeIntervalTree

    >>> one = TimeInterval(0, 1, {'name': 'one'})
    >>> two = TimeInterval((1, 2), (5, 2), {'name': 'two'})
    >>> three = TimeInterval(2, 4, {'name': 'three'})
    >>> tree = TimeIntervalTree([one, two, three])
    >>> tree
    TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'})
    ])

    >>> result = tree.split_at_rationals(1, 2, 3)
    >>> len(result)
    4

    >>> result[0]
    TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
        TimeInterval(Offset(1, 2), Offset(1, 1), {'name': 'two'})
    ])

    >>> result[1]
    TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'two'})
    ])

    >>> result[2]
    TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(5, 2), {'name': 'two'}),
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'three'})
    ])

    >>> result[3]
    TimeIntervalTree([
        TimeInterval(Offset(3, 1), Offset(4, 1), {'name': 'three'})
    ])
```

Return tuple of *TimeIntervalTree* instances.

Special Methods

TimeIntervalTree.__contains__(*item*)

TimeIntervalTree.__eq__(*other*)

TimeIntervalTree.__ge__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimeIntervalTree.__getitem__(*item*)

TimeIntervalTree.__getslice__(*start*, *end*)

TimeIntervalTree.__gt__(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TimeIntervalTree.__iter__()

TimeIntervalTree.__le__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimeIntervalTree.__len__()

TimeIntervalTree.__lt__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimeIntervalTree.__ne__(*other*)

TimeIntervalTree.__nonzero__()

TimeIntervalTree evaluates to True if it contains any intervals:

```
>>> from abjad.tools.timeintervaltools import *
>>> true_tree = TimeIntervalTree([TimeInterval(0, 1)])
>>> false_tree = TimeIntervalTree([])

>>> bool(true_tree)
True
>>> bool(false_tree)
False
```

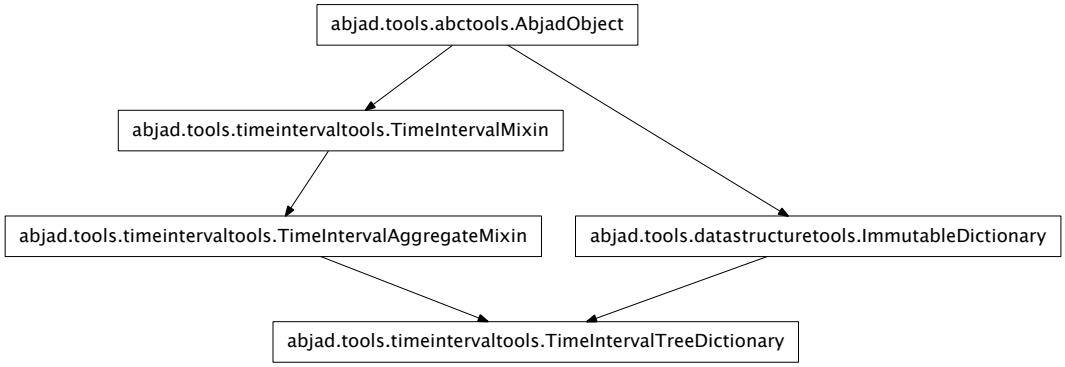
Return boolean.

TimeIntervalTree.__repr__()

TimeIntervalTree.__str__()

Inherited from timeintervaltools._RedBlackTree

timeintervaltools.TimeIntervalTreeDictionary



class timeintervaltools.**TimeIntervalTreeDictionary**(**args*)

A dictionary of *TimeIntervalTrees*:

```
>>> from abjad.tools.timeintervaltools import TimeIntervalTreeDictionary

>>> from abjad.tools.timeintervaltools import TimeIntervalTree
>>> from abjad.tools.timeintervaltools import TimeInterval

>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
>>> treedict
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})
```

TimeIntervalTreeDictionary can be instantiated from one or more other *TimeIntervalTreeDictionary* instances, whose trees will be fused if they share keys. It can also be instantiated from a regular dictionary whose values are *TimeIntervalTree* instances, or from a list of pairs where the second value of each pair is a *TimeIntervalTree* instance.

TimeIntervalTreeDictionary supports the same set of methods and properties as *TimeIntervalTree* and *TimeInterval*, including searching for intervals, quantizing, scaling, shifting and splitting.

TimeIntervalTreeDictionary is immutable.

Return *TimeIntervalTreeDictionary* instance.

Read-only Properties

`TimeIntervalTreeDictionary.`**`bounds`**

Start and stop of self returned as TimeInterval instance:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> bounds = interval.bounds
>>> bounds
TimeInterval(Offset(2, 1), Offset(10, 1), {})
>>> bounds == interval
True
>>> bounds is interval
False
```

Returns *TimeInterval* instance.

Inherited from `timeintervaltools.TimeIntervalMixin`

`TimeIntervalTreeDictionary.`**`center`**

Center offset of start and stop offsets:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.center
Offset(6, 1)
```

Returns *Offset* instance.

Inherited from `timeintervaltools.TimeIntervalMixin`

`TimeIntervalTreeDictionary.`**`composite_tree`**

The *TimeIntervalTree* composed of all the intervals in all trees in self:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})

>>> treedict.composite_tree
TimeIntervalTree([
    TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'})
])
```

Return *TimeIntervalTree* instance.

`TimeIntervalTreeDictionary.`**`duration`**

Duration of the time interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.duration
Duration(8, 1)
```

Returns *Duration* instance.

Inherited from `timeintervaltools.TimeIntervalMixin`

TimeIntervalTreeDictionary.**earliest_start**
The earliest start offset of all intervals in all trees in self:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})

>>> treedict.earliest_start
Offset(0, 1)
```

Return *Offset* instance.

TimeIntervalTreeDictionary.**earliest_stop**
The earliest stop offset of all intervals in all trees in self:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})

>>> treedict.earliest_stop
Offset(1, 1)
```

Return *Offset* instance.

TimeIntervalTreeDictionary.**intervals**

TimeIntervalTreeDictionary.**latest_start**
The latest start offset of all intervals in all trees in self:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})

>>> treedict.latest_start
Offset(2, 1)
```

Return *Offset* instance.

TimeIntervalTreeDictionary.**latest_stop**
The latest stop offset of all intervals in all trees in self:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})

>>> treedict.latest_stop
Offset(3, 1)
```

Return *Offset* instance.

TimeIntervalTreeDictionary.**offset_counts**
Inherited from timeintervaltools.TimeIntervalAggregateMixin

TimeIntervalTreeDictionary.**offsets**
Inherited from timeintervaltools.TimeIntervalAggregateMixin

TimeIntervalTreeDictionary.**signature**
Tuple of start bound and stop bound.

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.signature
(Offset(2, 1), Offset(10, 1))
```

Returns 2-tuple of *Offset* instances.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTreeDictionary.**start**
Starting offset of interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.start
Offset(2, 1)
```

Returns *Offset* instance.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTreeDictionary.**stop**
Stopping offset of interval:

```
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> interval = TimeInterval(2, 10)
>>> interval.stop
Offset(10, 1)
```

Returns *Offset* instance.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTreeDictionary.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

TimeIntervalTreeDictionary.**clear**() → None. Remove all items from D.
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**copy**() → a shallow copy of D
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**find_intervals_intersecting_or_tangent_to_interval**(**args*)
Find all intervals in dictionary intersecting or tangent to the interval defined in *args*:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
>>> treedict
TimeIntervalTreeDictionary({
```

```
        'a': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
        ]),
        'b': TimeIntervalTree([
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })

    >>> interval = TimeInterval(0, 1)
    >>> treedict.find_intervals_intersecting_or_tangent_to_interval(interval)
    TimeIntervalTreeDictionary({
        'a': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
        ]),
        'b': TimeIntervalTree([
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
    })

    >>> interval = TimeInterval(3, 4)
    >>> treedict.find_intervals_intersecting_or_tangent_to_interval(interval)
    TimeIntervalTreeDictionary({
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })
```

Return *TimeIntervalTreeDictionary* instance.

`TimeIntervalTreeDictionary.`**`find_intervals_intersecting_or_tangent_to_offset`**`(`*offset*`)`

Find all intervals in dictionary intersecting or tangent to *offset*:

```
    >>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
    >>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
    >>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
    >>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
    >>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
    >>> treedict
    TimeIntervalTreeDictionary({
        'a': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
        ]),
        'b': TimeIntervalTree([
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
```

```
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })

    >>> offset = 1
    >>> treedict.find_intervals_intersecting_or_tangent_to_offset(offset)
    TimeIntervalTreeDictionary({
        'a': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
        ]),
        'b': TimeIntervalTree([
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
    })

    >>> offset = 3
    >>> treedict.find_intervals_intersecting_or_tangent_to_offset(offset)
    TimeIntervalTreeDictionary({
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })
```

Return *TimeIntervalTreeDictionary* instance.

`TimeIntervalTreeDictionary.`**`find_intervals_starting_after_offset`**`(`*offset*`)`

Find all intervals in dictionary starting after *offset*:

```
    >>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
    >>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
    >>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
    >>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
    >>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
    >>> treedict
    TimeIntervalTreeDictionary({
        'a': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
        ]),
        'b': TimeIntervalTree([
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })

    >>> offset = 0
    >>> treedict.find_intervals_starting_after_offset(offset)
```

```
TimeIntervalTreeDictionary({
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})

>>> offset = 1
>>> treedict.find_intervals_starting_after_offset(offset)
TimeIntervalTreeDictionary({
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})
```

Return *TimeIntervalTreeDictionary* instance.

TimeIntervalTreeDictionary.**find_intervals_starting_and_stopping_within_interval**(**args*)

Find all intervals in dictionary starting and stopping within the interval defined by *args*:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
>>> treedict
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})

>>> interval = TimeInterval(1, 3)
>>> treedict.find_intervals_starting_and_stopping_within_interval(interval)
TimeIntervalTreeDictionary({
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})

>>> interval = TimeInterval(-1, 2)
>>> treedict.find_intervals_starting_and_stopping_within_interval(interval)
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
```

```
        ]),
        'b': TimeIntervalTree([
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
    })
```

Return *TimeIntervalTreeDictionary* instance.

`TimeIntervalTreeDictionary.`**`find_intervals_starting_at_offset`**`(`*offset*`)`

Find all intervals in dictionary starting at *offset*:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
>>> treedict
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})

>>> offset = 0
>>> treedict.find_intervals_starting_at_offset(offset)
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
})

>>> offset = 1
>>> treedict.find_intervals_starting_at_offset(offset)
TimeIntervalTreeDictionary({
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
})
```

Return *TimeIntervalTreeDictionary* instance.

`TimeIntervalTreeDictionary.`**`find_intervals_starting_before_offset`**`(`*offset*`)`

Find all intervals in dictionary starting before *offset*:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
```

```
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
>>> treedict
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})

>>> offset = 1
>>> treedict.find_intervals_starting_before_offset(offset)
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
})

>>> offset = 2
>>> treedict.find_intervals_starting_before_offset(offset)
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
})
```

Return *TimeIntervalTreeDictionary* instance.

TimeIntervalTreeDictionary.**find_intervals_starting_or_stopping_at_offset**(*offset*)

Find all intervals in dictionary starting or stopping at *offset*:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
>>> treedict
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
```

```
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })

    >>> offset = 2
    >>> treedict.find_intervals_starting_or_stopping_at_offset(offset)
    TimeIntervalTreeDictionary({
        'b': TimeIntervalTree([
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })

    >>> offset = 1
    >>> treedict.find_intervals_starting_or_stopping_at_offset(offset)
    TimeIntervalTreeDictionary({
        'a': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
        ]),
        'b': TimeIntervalTree([
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
    })
```

Return *TimeIntervalTreeDictionary* instance.

TimeIntervalTreeDictionary.**find_intervals_starting_within_interval**(**args*)

Find all intervals in dictionary starting within the interval defined by *args*:

```
    >>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
    >>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
    >>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
    >>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
    >>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
    >>> treedict
    TimeIntervalTreeDictionary({
        'a': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
        ]),
        'b': TimeIntervalTree([
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })
```

```
>>> interval = TimeInterval((-1, 2), (1, 2))
>>> treedict.find_intervals_starting_within_interval(interval)
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
})

>>> interval = TimeInterval((1, 2), (5, 2))
>>> treedict.find_intervals_starting_within_interval(interval)
TimeIntervalTreeDictionary({
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})
```

Return *TimeIntervalTreeDictionary* instance.

TimeIntervalTreeDictionary.**find_intervals_stopping_after_offset**(*offset*)

Find all intervals in dictionary stopping after *offset*:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
>>> treedict
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})

>>> offset = 1
>>> treedict.find_intervals_stopping_after_offset(offset)
TimeIntervalTreeDictionary({
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
```

```
        ]),
    })

    >>> offset = 2
    >>> treedict.find_intervals_stopping_after_offset(offset)
    TimeIntervalTreeDictionary({
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })
```

Return *TimeIntervalTreeDictionary* instance.

`TimeIntervalTreeDictionary.`**`find_intervals_stopping_at_offset`**`(`*offset*`)`

Find all intervals in dictionary stopping at *offset*:

```
    >>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
    >>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
    >>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
    >>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
    >>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
    >>> treedict
    TimeIntervalTreeDictionary({
        'a': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
        ]),
        'b': TimeIntervalTree([
            TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
        ]),
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })

    >>> offset = 3
    >>> treedict.find_intervals_stopping_at_offset(offset)
    TimeIntervalTreeDictionary({
        'c': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
        ]),
        'd': TimeIntervalTree([
            TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
        ]),
    })

    >>> offset = 1
    >>> treedict.find_intervals_stopping_at_offset(offset)
    TimeIntervalTreeDictionary({
        'a': TimeIntervalTree([
            TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
        ]),
    })
```

Return *TimeIntervalTreeDictionary* instance.

TimeIntervalTreeDictionary.**find_intervals_stopping_before_offset**(*offset*)

Find all intervals in dictionary stopping before *offset*:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
>>> treedict
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})

>>> offset = 3
>>> treedict.find_intervals_stopping_before_offset(offset)
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
})

>>> offset = (7, 2)
>>> treedict.find_intervals_stopping_before_offset(offset)
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})
```

Return *TimeIntervalTreeDictionary* instance.

TimeIntervalTreeDictionary.**find_intervals_stopping_within_interval**(**args*)

Find all intervals in dictionary stopping within the interval defined by *args*:

```
>>> a = TimeIntervalTree([TimeInterval(0, 1, {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval(1, 2, {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval(0, 3, {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval(2, 3, {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
>>> treedict
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})

>>> interval = TimeInterval((3, 2), (5, 2))
>>> treedict.find_intervals_stopping_within_interval(interval)
TimeIntervalTreeDictionary({
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'b'}),
    ]),
})

>>> interval = TimeInterval((5, 2), (7, 2))
>>> treedict.find_intervals_stopping_within_interval(interval)
TimeIntervalTreeDictionary({
    'c': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(3, 1), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'd'}),
    ]),
})
```

Return *TimeIntervalTreeDictionary* instance.

`TimeIntervalTreeDictionary.`**`get`**`(`*k*`[, `*d*`])` → D[k] if k in D, else d. d defaults to None.
Inherited from `__builtin__.dict`

`TimeIntervalTreeDictionary.`**`get_overlap_with_interval`**`(`*interval*`)`
Return amount of overlap with *interval*.

Inherited from `timeintervaltools.TimeIntervalMixin`

`TimeIntervalTreeDictionary.`**`has_key`**`(`*k*`)` → True if D has a key k, else False
Inherited from `__builtin__.dict`

`TimeIntervalTreeDictionary.`**`is_contained_by_interval`**`(`*interval*`)`
True if interval is contained by *interval*.

Inherited from `timeintervaltools.TimeIntervalMixin`

`TimeIntervalTreeDictionary.`**`is_container_of_interval`**`(`*interval*`)`
True if interval contains *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTreeDictionary.**is_overlapped_by_interval**(*interval*)
True if interval is overlapped by *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTreeDictionary.**is_tangent_to_interval**(*interval*)
True if interval is tangent to *interval*.

Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTreeDictionary.**items**() → list of D's (key, value) pairs, as 2-tuples
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**iteritems**() → an iterator over the (key, value) items of D
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**iterkeys**() → an iterator over the keys of D
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**itervalues**() → an iterator over the values of D
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**keys**() → list of D's keys
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**pop**(*k*[, *d*]) → v, remove specified key and return the corresponding value.
If key is not found, d is returned if given, otherwise KeyError is raised

Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**popitem**() → (k, v), remove and return some (key, value) pair as a 2-tuple; but raise KeyError if D is empty.

Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**quantize_to_rational**(*rational*)
Quantize all intervals in dictionary to a multiple (1 or more) of *rational*:

```
>>> a = TimeIntervalTree([TimeInterval((1, 16), (1, 8), {'name': 'a'})])
>>> b = TimeIntervalTree([TimeInterval((2, 7), (13, 7), {'name': 'b'})])
>>> c = TimeIntervalTree([TimeInterval((3, 5), (8, 5), {'name': 'c'})])
>>> d = TimeIntervalTree([TimeInterval((2, 3), (5, 3), {'name': 'd'})])
>>> treedict = TimeIntervalTreeDictionary({'a': a, 'b': b, 'c': c, 'd': d})
>>> treedict
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(1, 16), Offset(1, 8), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(2, 7), Offset(13, 7), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(3, 5), Offset(8, 5), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 3), Offset(5, 3), {'name': 'd'}),
    ]),
})
```

```
>>> rational = (1, 4)
>>> treedict.quantize_to_rational(rational)
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 4), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 4), Offset(7, 4), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(1, 2), Offset(3, 2), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(3, 4), Offset(7, 4), {'name': 'd'}),
    ]),
})

>>> rational = (1, 3)
>>> treedict.quantize_to_rational(rational)
TimeIntervalTreeDictionary({
    'a': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 3), {'name': 'a'}),
    ]),
    'b': TimeIntervalTree([
        TimeInterval(Offset(1, 3), Offset(2, 1), {'name': 'b'}),
    ]),
    'c': TimeIntervalTree([
        TimeInterval(Offset(2, 3), Offset(5, 3), {'name': 'c'}),
    ]),
    'd': TimeIntervalTree([
        TimeInterval(Offset(2, 3), Offset(5, 3), {'name': 'd'}),
    ]),
})
```

Return *TimeIntervalTreeDictionary* instance.

`TimeIntervalTreeDictionary.`**`scale_by_rational`**`(`*rational*`)`

Scale aggregate duration of dictionary by *rational*:

```
>>> one = TimeIntervalTree([TimeInterval(0, 1, {'name': 'one'})])
>>> two = TimeIntervalTree([TimeInterval((1, 2), (5, 2), {'name': 'two'})])
>>> three = TimeIntervalTree([TimeInterval(2, 4, {'name': 'three'})])
>>> treedict = TimeIntervalTreeDictionary(
...     {'one': one, 'two': two, 'three': three})
>>> treedict
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
    ]),
})

>>> result = treedict.scale_by_rational((2, 3))
>>> result
```

```
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(2, 3), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(4, 3), Offset(8, 3), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(1, 3), Offset(5, 3), {'name': 'two'}),
    ]),
})
```

Scaling works regardless of the starting offset of the *TimeIntervalTreeDictionary*:

```
>>> zero = TimeIntervalTree([TimeInterval(-4, 0, {'name': 'zero'})])
>>> treedict = TimeIntervalTreeDictionary(
...     {'zero': zero, 'one': one, 'two': two, 'three': three})
>>> treedict
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
    ]),
    'zero': TimeIntervalTree([
        TimeInterval(Offset(-4, 1), Offset(0, 1), {'name': 'zero'}),
    ]),
})

>>> result = treedict.scale_by_rational(2)
>>> result
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(4, 1), Offset(6, 1), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(8, 1), Offset(12, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(5, 1), Offset(9, 1), {'name': 'two'}),
    ]),
    'zero': TimeIntervalTree([
        TimeInterval(Offset(-4, 1), Offset(4, 1), {'name': 'zero'}),
    ]),
})

>>> result.start == treedict.start
True
>>> result.duration == treedict.duration * 2
True
```

Return *TimeIntervalTreeDictionary* instance.

`TimeIntervalTreeDictionary.`**`scale_to_rational`**`(`*rational*`)`

Scale aggregate duration of dictionary to *rational*:

```
>>> one = TimeIntervalTree([TimeInterval(0, 1, {'name': 'one'})])
>>> two = TimeIntervalTree([TimeInterval((1, 2), (5, 2), {'name': 'two'})])
>>> three = TimeIntervalTree([TimeInterval(2, 4, {'name': 'three'})])
>>> treedict = TimeIntervalTreeDictionary({'one': one, 'two': two, 'three': three})
>>> treedict
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
    ]),
})

>>> result = treedict.scale_to_rational(1)
>>> result
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 4), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(1, 2), Offset(1, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(1, 8), Offset(5, 8), {'name': 'two'}),
    ]),
})

>>> result.scale_to_rational(10)
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(5, 2), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(5, 1), Offset(10, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(5, 4), Offset(25, 4), {'name': 'two'}),
    ]),
})
```

Scaling works regardless of the starting offset of the *TimeIntervalTreeDictionary*:

```
>>> zero = TimeIntervalTree([TimeInterval(-4, 0, {'name': 'zero'})])
>>> treedict = TimeIntervalTreeDictionary(
...     {'zero': zero, 'one': one, 'two': two, 'three': three})

>>> treedict.scale_to_rational(4)
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(-2, 1), Offset(-3, 2), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(-1, 1), Offset(0, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
```

```
            TimeInterval(Offset(-7, 4), Offset(-3, 4), {'name': 'two'}),
        ]),
        'zero': TimeIntervalTree([
            TimeInterval(Offset(-4, 1), Offset(-2, 1), {'name': 'zero'}),
        ]),
    })
```

Return *TimeIntervalTreeDictionary* instance.

`TimeIntervalTreeDictionary.`**`setdefault`**`(`*k*[, *d*]`)` → D.get(k,d), also set D[k]=d if k not in D

Inherited from `__builtin__.dict`

`TimeIntervalTreeDictionary.`**`shift_by_rational`**`(`*rational*`)`

Shift aggregate offset of dictionary by *rational*:

```
>>> one = TimeIntervalTree([TimeInterval(0, 1, {'name': 'one'})])
>>> two = TimeIntervalTree([TimeInterval((1, 2), (5, 2), {'name': 'two'})])
>>> three = TimeIntervalTree([TimeInterval(2, 4, {'name': 'three'})])
>>> treedict = TimeIntervalTreeDictionary({'one': one, 'two': two, 'three': three})
>>> treedict
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
    ]),
})

>>> result = treedict.shift_by_rational(-2.5)
>>> result
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(-5, 2), Offset(-3, 2), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(-1, 2), Offset(3, 2), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(-2, 1), Offset(0, 1), {'name': 'two'}),
    ]),
})

>>> result.shift_by_rational(6)
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(7, 2), Offset(9, 2), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(11, 2), Offset(15, 2), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(4, 1), Offset(6, 1), {'name': 'two'}),
    ]),
})
```

Return *TimeIntervalTreeDictionary* instance.

TimeIntervalTreeDictionary.**shift_to_rational**(*rational*)

Shift aggregate offset of dictionary to *rational*:

```
>>> one = TimeIntervalTree([TimeInterval(0, 1, {'name': 'one'})])
>>> two = TimeIntervalTree([TimeInterval((1, 2), (5, 2), {'name': 'two'})])
>>> three = TimeIntervalTree([TimeInterval(2, 4, {'name': 'three'})])
>>> treedict = TimeIntervalTreeDictionary({'one': one, 'two': two, 'three': three})
>>> treedict
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
    ]),
})

>>> result = treedict.shift_to_rational(100)
>>> result
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(100, 1), Offset(101, 1), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(102, 1), Offset(104, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(201, 2), Offset(205, 2), {'name': 'two'}),
    ]),
})
```

Return *TimeIntervalTreeDictionary* instance.

TimeIntervalTreeDictionary.**split_at_rationals**(**rationals*)

Split dictionary at each rational in *rationals*:

```
>>> one = TimeIntervalTree([TimeInterval(0, 1, {'name': 'one'})])
>>> two = TimeIntervalTree([TimeInterval((1, 2), (5, 2), {'name': 'two'})])
>>> three = TimeIntervalTree([TimeInterval(2, 4, {'name': 'three'})])
>>> treedict = TimeIntervalTreeDictionary({'one': one, 'two': two, 'three': three})
>>> treedict
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
    ]),
    'three': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(4, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(1, 2), Offset(5, 2), {'name': 'two'}),
    ]),
})
```

```
>>> result = treedict.split_at_rationals(1, 2, 3)
>>> len(result)
4

>>> result[0]
TimeIntervalTreeDictionary({
    'one': TimeIntervalTree([
        TimeInterval(Offset(0, 1), Offset(1, 1), {'name': 'one'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(1, 2), Offset(1, 1), {'name': 'two'}),
    ]),
})

>>> result[1]
TimeIntervalTreeDictionary({
    'two': TimeIntervalTree([
        TimeInterval(Offset(1, 1), Offset(2, 1), {'name': 'two'}),
    ]),
})

>>> result[2]
TimeIntervalTreeDictionary({
    'three': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(3, 1), {'name': 'three'}),
    ]),
    'two': TimeIntervalTree([
        TimeInterval(Offset(2, 1), Offset(5, 2), {'name': 'two'}),
    ]),
})

>>> result[3]
TimeIntervalTreeDictionary({
    'three': TimeIntervalTree([
        TimeInterval(Offset(3, 1), Offset(4, 1), {'name': 'three'}),
    ]),
})
```

Return tuple of *TimeIntervalTreeDictionary* instances.

`TimeIntervalTreeDictionary.`**`update`**`(`$[E]$`, **F)` → None. Update D from dict/iterable E and F.
If E present and has a .keys() method, does: for k in E: D[k] = E[k] If E present and lacks .keys() method, does: for (k, v) in E: D[k] = v In either case, this is followed by: for k in F: D[k] = F[k]

Inherited from `__builtin__.dict`

`TimeIntervalTreeDictionary.`**`values`**`()` → list of D's values
Inherited from `__builtin__.dict`

`TimeIntervalTreeDictionary.`**`viewitems`**`()` → a set-like object providing a view on D's items
Inherited from `__builtin__.dict`

`TimeIntervalTreeDictionary.`**`viewkeys`**`()` → a set-like object providing a view on D's keys
Inherited from `__builtin__.dict`

`TimeIntervalTreeDictionary.`**`viewvalues`**`()` → an object providing a view on D's values
Inherited from `__builtin__.dict`

Special Methods

TimeIntervalTreeDictionary.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__contains__**(*k*) → True if D has a key k, else False
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__delitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

TimeIntervalTreeDictionary.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__len__**() <==> *len(x)*
Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.dict

TimeIntervalTreeDictionary.**__nonzero__**()
Inherited from timeintervaltools.TimeIntervalMixin

TimeIntervalTreeDictionary.**__repr__**()

TimeIntervalTreeDictionary.**__setitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

functions

timeintervaltools.all_are_intervals_or_trees_or_empty

timeintervaltools.**all_are_intervals_or_trees_or_empty**(*input*)
Recursively test if all elements of *input* are TimeIntervals or TimeIntervalTrees. An empty result also return as

True.

timeintervaltools.all_intervals_are_contiguous

timeintervaltools.**all_intervals_are_contiguous**(*intervals*)
True when all intervals in *intervals* are contiguous and non-overlapping.

timeintervaltools.all_intervals_are_nonoverlapping

timeintervaltools.**all_intervals_are_nonoverlapping**(*intervals*)
True when all intervals in *intervals* in tree are non-overlapping.

timeintervaltools.calculate_density_of_attacks_in_interval

timeintervaltools.**calculate_density_of_attacks_in_interval**(*intervals*, *interval*)
Calculate the number of attacks in *interval* over the duration of *interval*.

Return Fraction.

timeintervaltools.calculate_density_of_releases_in_interval

timeintervaltools.**calculate_density_of_releases_in_interval**(*intervals*, *interval*)
Calculate the number of releases in *interval* divided by the duration of *interval*.

Return Fraction.

timeintervaltools.calculate_depth_centroid_of_intervals

timeintervaltools.**calculate_depth_centroid_of_intervals**(*intervals*)
Calculate the weighted mean offset of *intervals*, such that the centroids of each interval in the depth tree of *intervals* make up the values of the mean, and the depth of each interval in the depth tree of *intervals* make up the weights.

Return Offset.

timeintervaltools.calculate_depth_centroid_of_intervals_in_interval

timeintervaltools.**calculate_depth_centroid_of_intervals_in_interval**(*intervals*, *interval*)
Return the weighted mean of the depth tree of *intervals* in *interval*, such that the centroids of each interval of the depth tree are the values, and the weights are the depths at each interval of the depth tree.

timeintervaltools.calculate_depth_density_of_intervals

timeintervaltools.**calculate_depth_density_of_intervals**(*intervals*)
Return a Fraction, of the duration of each interval in the depth tree of *intervals*, multiplied by the depth at that interval, divided by the overall duration of *intervals*.

The depth density of a single interval is 1

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(0, 1)
>>> b = TimeInterval(0, 1)
>>> c = TimeInterval(Fraction(1, 2), 1)
>>> timeintervaltools.calculate_depth_density_of_intervals(a)
Duration(1, 1)
>>> timeintervaltools.calculate_depth_density_of_intervals([a, b])
Duration(2, 1)
>>> timeintervaltools.calculate_depth_density_of_intervals([a, c])
Duration(3, 2)
>>> timeintervaltools.calculate_depth_density_of_intervals([a, b, c])
Duration(5, 2)
```

Return fraction.

timeintervaltools.calculate_depth_density_of_intervals_in_interval

timeintervaltools.**calculate_depth_density_of_intervals_in_interval**(*intervals*, *interval*)

Return a Fraction, of the duration of each interval in the depth tree of *intervals* within *interval*, multiplied by the depth at that interval, divided by the overall duration of *intervals*.

timeintervaltools.calculate_mean_attack_of_intervals

timeintervaltools.**calculate_mean_attack_of_intervals**(*intervals*)

Return Fraction of the average attack offset of *intervals*

timeintervaltools.calculate_mean_release_of_intervals

timeintervaltools.**calculate_mean_release_of_intervals**(*intervals*)

Return a Fraction of the average release offset of *intervals*.

timeintervaltools.calculate_min_mean_and_max_depth_of_intervals

timeintervaltools.**calculate_min_mean_and_max_depth_of_intervals**(*intervals*)

Return a 3-tuple of the minimum, mean and maximum depth of *intervals*. If *intervals* is empty, return None. "Mean" in this case is a weighted mean, where the durations of the intervals in depth tree of *intervals* are the weights

timeintervaltools.calculate_min_mean_and_max_durations_of_intervals

timeintervaltools.**calculate_min_mean_and_max_durations_of_intervals**(*intervals*)

Return a 3-tuple of the minimum, mean and maximum duration of all intervals in *intervals*. If *intervals* is empty, return None.

timeintervaltools.calculate_sustain_centroid_of_intervals

timeintervaltools.**calculate_sustain_centroid_of_intervals**(*intervals*)

Return a weighted mean, such that the centroid of each interval in *intervals* are the values, and the weights are their durations.

timeintervaltools.clip_interval_durations_to_range

timeintervaltools.**clip_interval_durations_to_range**(*intervals*, *minimum=None*, *maximum=None*)

timeintervaltools.compute_depth_of_intervals

timeintervaltools.**compute_depth_of_intervals**(*intervals*)

Compute a tree whose intervals represent the depth (level of overlap) in each boundary pair of *intervals*:

```
>>> from abjad.tools.timeintervaltools import *
>>> a = TimeInterval(0, 3)
>>> b = TimeInterval(6, 12)
>>> c = TimeInterval(9, 15)
>>> tree = TimeIntervalTree([a, b, c])
>>> compute_depth_of_intervals(tree)
TimeIntervalTree([
    TimeInterval(Offset(0, 1), Offset(3, 1), {'depth': 1}),
    TimeInterval(Offset(3, 1), Offset(6, 1), {'depth': 0}),
    TimeInterval(Offset(6, 1), Offset(9, 1), {'depth': 1}),
    TimeInterval(Offset(9, 1), Offset(12, 1), {'depth': 2}),
    TimeInterval(Offset(12, 1), Offset(15, 1), {'depth': 1})
])
```

Return interval tree.

timeintervaltools.compute_depth_of_intervals_in_interval

timeintervaltools.**compute_depth_of_intervals_in_interval**(*intervals*, *interval*)

Compute a tree whose intervals represent the depth (level of overlap) in each boundary pair of *intervals*, cropped within *interval*:

```
>>> from abjad.tools.timeintervaltools import *
>>> a = TimeInterval(0, 3)
>>> b = TimeInterval(6, 12)
>>> c = TimeInterval(9, 15)
>>> tree = TimeIntervalTree([a, b, c])
>>> d = TimeInterval(-1, 16)
>>> compute_depth_of_intervals_in_interval(tree, d)
TimeIntervalTree([
    TimeInterval(Offset(-1, 1), Offset(0, 1), {'depth': 0}),
    TimeInterval(Offset(0, 1), Offset(3, 1), {'depth': 1}),
    TimeInterval(Offset(3, 1), Offset(6, 1), {'depth': 0}),
    TimeInterval(Offset(6, 1), Offset(9, 1), {'depth': 1}),
    TimeInterval(Offset(9, 1), Offset(12, 1), {'depth': 2}),
    TimeInterval(Offset(12, 1), Offset(15, 1), {'depth': 1}),
    TimeInterval(Offset(15, 1), Offset(16, 1), {'depth': 0})
])
```

Return interval tree.

timeintervaltools.compute_logical_and_of_intervals

timeintervaltools.**compute_logical_and_of_intervals**(*intervals*)
Compute the logical AND of a collection of intervals.

Return TimeIntervalTree.

timeintervaltools.compute_logical_and_of_intervals_in_interval

timeintervaltools.**compute_logical_and_of_intervals_in_interval**(*intervals*, *interval*)
Compute the logical AND of a collection of intervals, cropped within *interval*.

Return TimeIntervalTree.

timeintervaltools.compute_logical_not_of_intervals

timeintervaltools.**compute_logical_not_of_intervals**(*intervals*)
Compute the logical NOT of some collection of intervals.

Return TimeIntervalTree.

timeintervaltools.compute_logical_not_of_intervals_in_interval

timeintervaltools.**compute_logical_not_of_intervals_in_interval**(*intervals*, *interval*)
Compute the logical NOT of some collection of intervals, cropped within *interval*.

Return TimeIntervalTree.

timeintervaltools.compute_logical_or_of_intervals

timeintervaltools.**compute_logical_or_of_intervals**(*intervals*)
Compute the logical OR of a collection of intervals.

Return TimeIntervalTree.

timeintervaltools.compute_logical_or_of_intervals_in_interval

timeintervaltools.**compute_logical_or_of_intervals_in_interval**(*intervals*, *interval*)
Compute the logical OR of a collection of intervals, cropped within *interval*.

Return TimeIntervalTree.

timeintervaltools.compute_logical_xor_of_intervals

timeintervaltools.**compute_logical_xor_of_intervals**(*intervals*)

Compute the logical XOR of a collections of intervals.

Return TimeIntervalTree.

timeintervaltools.compute_logical_xor_of_intervals_in_interval

timeintervaltools.**compute_logical_xor_of_intervals_in_interval**(*intervals*, *interval*)

Compute the logical XOR of a collections of intervals, cropped within *interval*.

Return TimeIntervalTree.

timeintervaltools.concatenate_trees

timeintervaltools.**concatenate_trees**(*trees*, *padding=0*)

Merge all trees in *trees*, offsetting each subsequent tree to start after the previous.

Return TimeIntervalTree.

timeintervaltools.explode_intervals_compactly

timeintervaltools.**explode_intervals_compactly**(*intervals*)

Explode the intervals in *intervals* into n non-overlapping trees, where n is the maximum depth of *intervals*.

The algorithm will attempt to insert the exploded intervals into the lowest-indexed resultant tree with free space.

Return an array of *TimeIntervalTree* instances.

timeintervaltools.explode_intervals_into_n_trees_heuristically

timeintervaltools.**explode_intervals_into_n_trees_heuristically**(*intervals*, *n*)

Explode *intervals* into *n* trees, avoiding overlap when possible, and distributing intervals so as to equalize density across the trees.

Return list of TimeIntervalTree instances.

timeintervaltools.explode_intervals_uncompactly

timeintervaltools.**explode_intervals_uncompactly**(*intervals*)

Explode the intervals in *intervals* into n non-overlapping trees, where n is the maximum depth of *intervals*.

The algorithm will attempt to insert the exploded intervals cyclically, making its insertion attempt at the next resultant tree in the array, rather than always beginning its search from index 0.

Return list of *TimeIntervalTree* instances.

timeintervaltools.fuse_overlapping_intervals

timeintervaltools.**fuse_overlapping_intervals**(*intervals*)

Fuse the overlapping intervals in *intervals* and return an *TimeIntervalTree* of the result

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(0, 10)
>>> b = TimeInterval(5, 15)
>>> c = TimeInterval(15, 25)
>>> tree = TimeIntervalTree([a, b, c])
>>> timeintervaltools.fuse_overlapping_intervals(tree)
TimeIntervalTree([
    TimeInterval(Offset(0, 1), Offset(15, 1), {}),
    TimeInterval(Offset(15, 1), Offset(25, 1), {})
])
```

Return TimeIntervalTree.

timeintervaltools.fuse_tangent_or_overlapping_intervals

timeintervaltools.**fuse_tangent_or_overlapping_intervals**(*intervals*)

Fuse all tangent or overlapping intervals and return an *TimeIntervalTree* of the result

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(0, 10)
>>> b = TimeInterval(5, 15)
>>> c = TimeInterval(15, 25)
>>> tree = TimeIntervalTree([a, b, c])
>>> timeintervaltools.fuse_tangent_or_overlapping_intervals(tree)
TimeIntervalTree([
    TimeInterval(Offset(0, 1), Offset(25, 1), {})
])
```

Return TimeIntervalTree.

timeintervaltools.get_all_unique_bounds_in_intervals

timeintervaltools.**get_all_unique_bounds_in_intervals**(*intervals*)

Find all unique starting and ending boundaries in *intervals*.

Return list of Offsets.

timeintervaltools.group_overlapping_intervals_and_yield_groups

timeintervaltools.**group_overlapping_intervals_and_yield_groups**(*intervals*)

Group overlapping intervals in *intervals*.

Yield TimeIntervalTrees.

timeintervaltools.group_tangent_or_overlapping_intervals_and_yield_groups

timeintervaltools.**group_tangent_or_overlapping_intervals_and_yield_groups**(*intervals*)

Group tangent or overlapping intervals in *intervals*.

Yield TimeIntervalTrees.

timeintervaltools.make_monophonic_percussion_score_from_nonoverlapping_intervals

timeintervaltools.**make_monophonic_percussion_score_from_nonoverlapping_intervals**(*intervals*, *colorkey=None*)

Create a monophonic percussion score from nonoverlapping interval collection *intervals*.

Return Score.

timeintervaltools.make_polyphonic_percussion_score_from_nonoverlapping_trees

timeintervaltools.**make_polyphonic_percussion_score_from_nonoverlapping_trees**(*trees*, *colorkey=None*)

Make a polyphonic percussion score from a collections of non-overlapping trees.

Return LilyPondFile.

timeintervaltools.make_voice_from_nonoverlapping_intervals

timeintervaltools.**make_voice_from_nonoverlapping_intervals**(*intervals*, *colorkey=None*, *pitch=None*)

timeintervaltools.mask_intervals_with_intervals

timeintervaltools.**mask_intervals_with_intervals**(*masked_intervals*, *mask_intervals*)

Clip or remove all intervals in *masked_intervals* outside of the bounds defined in *mask_intervals*, while maintaining *masked_intervals*‘ payload contents

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(0, 10, {'a': 1})
>>> b = TimeInterval(5, 15, {'b': 2})
>>> tree = TimeIntervalTree([a, b])
>>> mask = TimeInterval(4, 11)
>>> timeintervaltools.mask_intervals_with_intervals(tree, mask)
TimeIntervalTree([
    TimeInterval(Offset(4, 1), Offset(10, 1), {'a': 1}),
    TimeInterval(Offset(5, 1), Offset(11, 1), {'b': 2})
])
```

Return TimeIntervalTree.

timeintervaltools.resolve_overlaps_between_nonoverlapping_trees

timeintervaltools.**resolve_overlaps_between_nonoverlapping_trees**(*trees*, *minimum_duration=None*)

Create a nonoverlapping TimeIntervalTree from *trees*. Intervals in higher-indexed trees in *trees* only appear in part or whole where they do not overlap intervals from starter-indexed trees

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeIntervalTree(TimeInterval(0, 4, {'a': 1}))
>>> b = TimeIntervalTree(TimeInterval(1, 5, {'b': 2}))
>>> c = TimeIntervalTree(TimeInterval(2, 6, {'c': 3}))
>>> d = TimeIntervalTree(TimeInterval(1, 3, {'d': 4}))
>>> timeintervaltools.resolve_overlaps_between_nonoverlapping_trees([a, b, c, d])
TimeIntervalTree([
    TimeInterval(Offset(0, 1), Offset(4, 1), {'a': 1}),
    TimeInterval(Offset(4, 1), Offset(5, 1), {'b': 2}),
    TimeInterval(Offset(5, 1), Offset(6, 1), {'c': 3})
])
```

Return TimeIntervalTree.

timeintervaltools.round_interval_bounds_to_nearest_multiple_of_rational

timeintervaltools.**round_interval_bounds_to_nearest_multiple_of_rational**(*intervals*, *duration*)

Round all start and stop offsets of *intervals* to the nearest multiple of *duration*.

If both start and stop of an interval collapse on the same offset, that interval's stop will be adjusted to the next larger multiple of *duration*.

Return TimeIntervalTree.

timeintervaltools.scale_aggregate_duration_by_rational

timeintervaltools.**scale_aggregate_duration_by_rational**(*intervals*, *rational*)

Scale the aggregate duration of all intervals in *intervals* by *rational*, maintaining the original start offset

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(-1, 3)
>>> b = TimeInterval(6, 12)
>>> c = TimeInterval(9, 16)
>>> tree = TimeIntervalTree([a, b, c])
>>> timeintervaltools.scale_aggregate_duration_by_rational(tree, Fraction(1, 3))
TimeIntervalTree([
    TimeInterval(Offset(-1, 1), Offset(1, 3), {}),
    TimeInterval(Offset(4, 3), Offset(10, 3), {}),
    TimeInterval(Offset(7, 3), Offset(14, 3), {})
])
```

Return TimeIntervalTree.

timeintervaltools.scale_aggregate_duration_to_rational

timeintervaltools.**scale_aggregate_duration_to_rational**(*intervals*, *rational*)

Scale the aggregate duration of all intervals in *intervals* to *rational*, maintaining the original start offset

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(-1, 3)
>>> b = TimeInterval(6, 12)
>>> c = TimeInterval(9, 16)
>>> tree = TimeIntervalTree([a, b, c])
>>> timeintervaltools.scale_aggregate_duration_to_rational(tree, Fraction(16, 7))
TimeIntervalTree([
    TimeInterval(Offset(-1, 1), Offset(-55, 119), {}),
    TimeInterval(Offset(-1, 17), Offset(89, 119), {}),
    TimeInterval(Offset(41, 119), Offset(9, 7), {})
])
```

Return TimeIntervalTree.

timeintervaltools.scale_interval_durations_by_rational

timeintervaltools.**scale_interval_durations_by_rational**(*intervals*, *rational*)

Scale the duration of each interval in *intervals* by *rational*, maintaining their start offsets

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(-1, 3)
>>> b = TimeInterval(6, 12)
>>> c = TimeInterval(9, 16)
>>> tree = TimeIntervalTree([a, b, c])
>>> timeintervaltools.scale_interval_durations_by_rational(tree, Fraction(6, 5))
TimeIntervalTree([
    TimeInterval(Offset(-1, 1), Offset(19, 5), {}),
    TimeInterval(Offset(6, 1), Offset(66, 5), {}),
    TimeInterval(Offset(9, 1), Offset(87, 5), {})
])
```

Return TimeIntervalTree.

timeintervaltools.scale_interval_durations_to_rational

timeintervaltools.**scale_interval_durations_to_rational**(*intervals*, *rational*)

Scale the duration of each interval in *intervals* to *rational*, maintaining their start offsets

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree
```

```
>>> a = TimeInterval(-1, 3)
>>> b = TimeInterval(6, 12)
>>> c = TimeInterval(9, 16)
>>> tree = TimeIntervalTree([a, b, c])
>>> timeintervaltools.scale_interval_durations_to_rational(tree, Fraction(1, 7))
TimeIntervalTree([
    TimeInterval(Offset(-1, 1), Offset(-6, 7), {}),
    TimeInterval(Offset(6, 1), Offset(43, 7), {}),
    TimeInterval(Offset(9, 1), Offset(64, 7), {})
])
```

Return TimeIntervalTree.

timeintervaltools.scale_interval_offsets_by_rational

timeintervaltools.**scale_interval_offsets_by_rational**(*intervals*, *rational*)

Scale the starting offset of each interval in *intervals* by *rational*, maintaining the startest offset in *intervals*

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(-1, 3)
>>> b = TimeInterval(6, 12)
>>> c = TimeInterval(9, 16)
>>> tree = TimeIntervalTree([a, b, c])
>>> timeintervaltools.scale_interval_offsets_by_rational(tree, Fraction(4, 5))
TimeIntervalTree([
    TimeInterval(Offset(-1, 1), Offset(3, 1), {}),
    TimeInterval(Offset(23, 5), Offset(53, 5), {}),
    TimeInterval(Offset(7, 1), Offset(14, 1), {})
])
```

Return interval tree.

timeintervaltools.shift_aggregate_offset_by_rational

timeintervaltools.**shift_aggregate_offset_by_rational**(*intervals*, *rational*)

Shift the aggregate offset of *intervals* by *rational*

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(-1, 3)
>>> b = TimeInterval(6, 12)
>>> c = TimeInterval(9, 16)
>>> tree = TimeIntervalTree([a, b, c])
>>> timeintervaltools.shift_aggregate_offset_by_rational(tree, Fraction(1, 3))
TimeIntervalTree([
    TimeInterval(Offset(-2, 3), Offset(10, 3), {}),
    TimeInterval(Offset(19, 3), Offset(37, 3), {}),
    TimeInterval(Offset(28, 3), Offset(49, 3), {})
])
```

Return TimeIntervalTree.

timeintervaltools.shift_aggregate_offset_to_rational

timeintervaltools.**shift_aggregate_offset_to_rational**(*intervals*, *rational*)

Shift the aggregate offset of *intervals* to *rational*

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(-1, 3)
>>> b = TimeInterval(6, 12)
>>> c = TimeInterval(9, 16)
>>> tree = TimeIntervalTree([a, b, c])
>>> timeintervaltools.shift_aggregate_offset_to_rational(tree, Fraction(10, 7))
TimeIntervalTree([
    TimeInterval(Offset(10, 7), Offset(38, 7), {}),
    TimeInterval(Offset(59, 7), Offset(101, 7), {}),
    TimeInterval(Offset(80, 7), Offset(129, 7), {})
])
```

Return TimeIntervalTree.

timeintervaltools.split_intervals_at_rationals

timeintervaltools.**split_intervals_at_rationals**(*intervals*, *offsets*)

Split *intervals* at each offset in *offsets*

```
>>> from abjad.tools import timeintervaltools
>>> from abjad.tools.timeintervaltools import TimeInterval
>>> from abjad.tools.timeintervaltools import TimeIntervalTree

>>> a = TimeInterval(-1, 3)
>>> b = TimeInterval(6, 12)
>>> c = TimeInterval(9, 16)
>>> tree = TimeIntervalTree([a, b, c])
>>> timeintervaltools.split_intervals_at_rationals(tree, [1, Fraction(19, 2)])
TimeIntervalTree([
    TimeInterval(Offset(-1, 1), Offset(1, 1), {}),
    TimeInterval(Offset(1, 1), Offset(3, 1), {}),
    TimeInterval(Offset(6, 1), Offset(19, 2), {}),
    TimeInterval(Offset(9, 1), Offset(19, 2), {}),
    TimeInterval(Offset(19, 2), Offset(12, 1), {}),
    TimeInterval(Offset(19, 2), Offset(16, 1), {})
])
```

Return TimeIntervalTree.

timesignaturetools

functions

timesignaturetools.duration_and_possible_denominators_to_time_signature

timesignaturetools.**duration_and_possible_denominators_to_time_signature**(*duration*, *denominators=None*, *factor=None*)

Make new meter equal to *duration*:

```
>>> from abjad.tools import timesignaturetools

>>> timesignaturetools.duration_and_possible_denominators_to_time_signature(Duration(3, 2))
TimeSignatureMark((3, 2))
```

Make new meter equal to *duration* with denominator equal to the first possible element in *denominators*:

```
>>> timesignaturetools.duration_and_possible_denominators_to_time_signature(
... Duration(3, 2), denominators=[5, 6, 7, 8])
TimeSignatureMark((9, 6))
```

Make new meter equal to *duration* with denominator divisible by *factor*:

```
>>> timesignaturetools.duration_and_possible_denominators_to_time_signature(
... Duration(3, 2), factor=5)
TimeSignatureMark((15, 10))
```

Return new meter. Changed in version 2.0: renamed `timesignaturetools.make_best()` to `timesignaturetools.duration_and_possible_denominators_to_time_signature()`.

timesignaturetools.get_nonbinary_factor_from_time_signature_denominator

timesignaturetools.**get_nonbinary_factor_from_time_signature_denominator**(*time_signature*)

Get nonbinary factor from nonbinary *time_signature* denominator:

```
>>> from abjad.tools import timesignaturetools

>>> timesignaturetools.get_nonbinary_factor_from_time_signature_denominator(
... contexttools.TimeSignatureMark((3, 12)))
3

>>> timesignaturetools.get_nonbinary_factor_from_time_signature_denominator(
... contexttools.TimeSignatureMark((3, 13)))
13

>>> timesignaturetools.get_nonbinary_factor_from_time_signature_denominator(
... contexttools.TimeSignatureMark((3, 14)))
7
```

```
>>> timesignaturetools.get_nonbinary_factor_from_time_signature_denominator(
... contexttools.TimeSignatureMark((3, 15)))
15
```

Get `1` from binary *time_signature* denominator:

```
>>> timesignaturetools.get_nonbinary_factor_from_time_signature_denominator(
... contexttools.TimeSignatureMark((3, 16)))
1
```

Return nonnegative integer.

timesignaturetools.is_time_signature_with_equivalent_binary_representation

timesignaturetools.**is_time_signature_with_equivalent_binary_representation**(*expr*)

True when *expr* is a meter with binary-valued duration:

```
>>> from abjad.tools import timesignaturetools

>>> timesignaturetools.is_time_signature_with_equivalent_binary_representation(
... contexttools.TimeSignatureMark((3, 12)))
True
```

Otherwise false:

```
>>> timesignaturetools.is_time_signature_with_equivalent_binary_representation(
... contexttools.TimeSignatureMark((4, 12)))
False

>>> timesignaturetools.is_time_signature_with_equivalent_binary_representation('text')
False
```

Return boolean.

timesignaturetools.time_signature_to_binary_time_signature

timesignaturetools.**time_signature_to_binary_time_signature**(*nonbinary_meter*, *contents_multiplier=Fraction(1, 1)*)

Change nonbinary *meter* to binary meter:

```
>>> from abjad.tools import timesignaturetools

>>> timesignaturetools.time_signature_to_binary_time_signature(
...         contexttools.TimeSignatureMark((3, 12)))
TimeSignatureMark((2, 8))
```

Preserve binary *meter*:

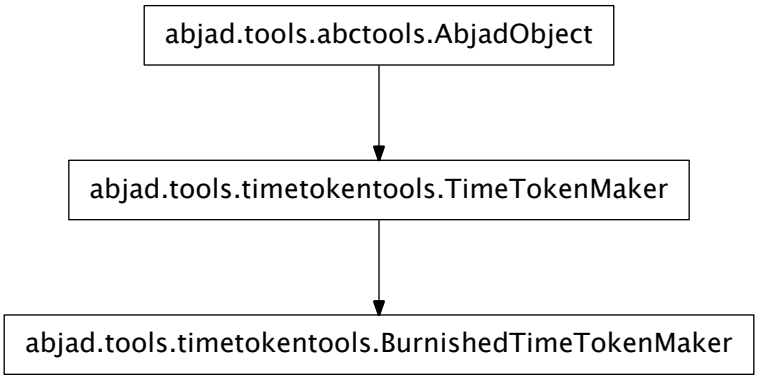
```
>>> timesignaturetools.time_signature_to_binary_time_signature(
...     contexttools.TimeSignatureMark((2, 8)))
TimeSignatureMark((2, 8))
```

Return newly constructed meter. Changed in version 2.0: renamed `timesignaturetools.make_binary()` to `timesignaturetools.time_signature_to_binary_time_sig`

timetokentools

abstract classes

timetokentools.BurnishedTimeTokenMaker



class timetokentools.**BurnishedTimeTokenMaker**(*pattern*, *denominator*, *prolation_addenda=None*, *lefts=None*, *middles=None*, *rights=None*, *left_lengths=None*, *right_lengths=None*, *secondary_divisions=None*, *pattern_helper=None*, *prolation_addenda_helper=None*, *lefts_helper=None*, *middles_helper=None*, *rights_helper=None*, *left_lengths_helper=None*, *right_lengths_helper=None*, *secondary_divisions_helper=None*)

New in version 2.8. Abstract base class for time token makers that burnish some or all of the time tokens they produce.

'Burnishing' means to forcibly cast the first or last (or both first and last) elements of a time token to be either a note or rest.

'Token-burnishing' time token makers burnish every time token they produce.

'Output-burnishing' time token makers burnish only the first and last time tokens they produce and leave interior time tokens unchanged.

Read-only Properties

BurnishedTimeTokenMaker.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

BurnishedTimeTokenMaker.**reverse**()

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from timetokentools.TimeTokenMaker

Special Methods

BurnishedTimeTokenMaker.**__call__**(*duration_tokens*, *seeds=None*)

BurnishedTimeTokenMaker.**__eq__**(*other*)

BurnishedTimeTokenMaker.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BurnishedTimeTokenMaker.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BurnishedTimeTokenMaker.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BurnishedTimeTokenMaker.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BurnishedTimeTokenMaker.**__ne__**(*arg*)

True when id(self) does not equal id(arg).

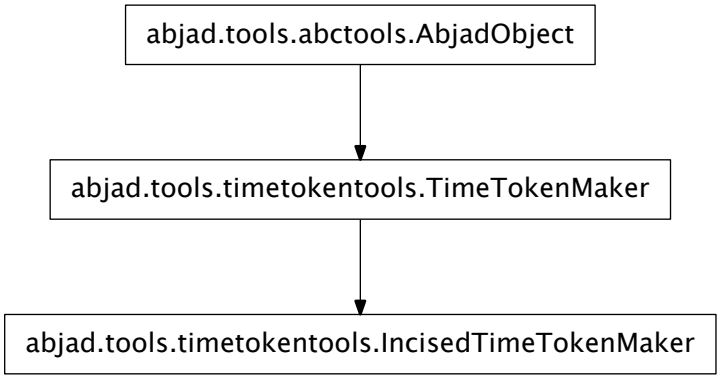
Return boolean.

Inherited from abctools.AbjadObject

BurnishedTimeTokenMaker.**__repr__**()

Inherited from timetokentools.TimeTokenMaker

timetokentools.IncisedTimeTokenMaker



class timetokentools.**IncisedTimeTokenMaker**(*prefix_signal*, *prefix_lengths*, *suffix_signal*, *suffix_lengths*, *denominator*, *prolation_addenda=None*, *secondary_divisions=None*, *prefix_signal_helper=None*, *prefix_lengths_helper=None*, *suffix_signal_helper=None*, *suffix_lengths_helper=None*, *prolation_addenda_helper=None*, *secondary_divisions_helper=None*)

Abstract base class for time token makers that incise some or all of the time tokens they produce.

Time token makers can incise the edge of every time token.

Or time token makers can incise only the start of the first time token and the end of the last time token.

Read-only Properties

IncisedTimeTokenMaker.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

IncisedTimeTokenMaker.**reverse**()

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
```

```
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from timetokentools.TimeTokenMaker

Special Methods

IncisedTimeTokenMaker.**__call__**(*duration_tokens*, *seeds=None*)

IncisedTimeTokenMaker.**__eq__**(*other*)

IncisedTimeTokenMaker.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

IncisedTimeTokenMaker.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

IncisedTimeTokenMaker.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

IncisedTimeTokenMaker.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

IncisedTimeTokenMaker.**__ne__**(*arg*)

True when id(self) does not equal id(arg).

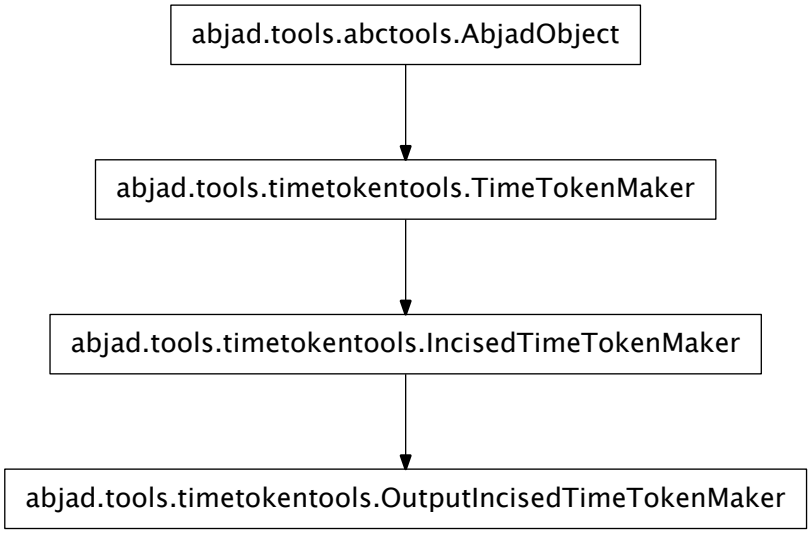
Return boolean.

Inherited from abctools.AbjadObject

IncisedTimeTokenMaker.**__repr__**()

Inherited from timetokentools.TimeTokenMaker

timetokentools.OutputIncisedTimeTokenMaker



class timetokentools.**OutputIncisedTimeTokenMaker**(*prefix_signal*, *prefix_lengths*, *suffix_signal*, *suffix_lengths*, *denominator*, *prolation_addenda=None*, *secondary_divisions=None*, *prefix_signal_helper=None*, *prefix_lengths_helper=None*, *suffix_signal_helper=None*, *suffix_lengths_helper=None*, *prolation_addenda_helper=None*, *secondary_divisions_helper=None*)

New in version 2.8. Abstract base class for time token makers that incise only the first and last time tokens they produce.

Read-only Properties

OutputIncisedTimeTokenMaker.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

OutputIncisedTimeTokenMaker.**reverse**()

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`OutputIncisedTimeTokenMaker.__call__`(*duration_tokens*, *seeds=None*)
Inherited from `timetokentools.IncisedTimeTokenMaker`

`OutputIncisedTimeTokenMaker.__eq__`(*other*)
Inherited from `timetokentools.IncisedTimeTokenMaker`

`OutputIncisedTimeTokenMaker.__ge__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`OutputIncisedTimeTokenMaker.__gt__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`OutputIncisedTimeTokenMaker.__le__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`OutputIncisedTimeTokenMaker.__lt__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

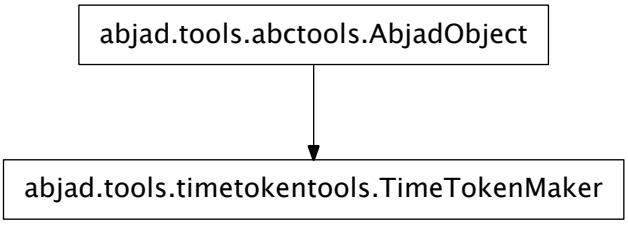
`OutputIncisedTimeTokenMaker.__ne__`(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`OutputIncisedTimeTokenMaker.__repr__`()
Inherited from `timetokentools.TimeTokenMaker`

timetokentools.TimeTokenMaker



class timetokentools.**TimeTokenMaker**
New in version 2.8. Time token maker abstract base class.

Read-only Properties

TimeTokenMaker.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

TimeTokenMaker.**reverse**()
New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Special Methods

TimeTokenMaker.**__call__**(*duration_tokens*, *seeds=None*)
TimeTokenMaker.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TimeTokenMaker.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimeTokenMaker.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TimeTokenMaker.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TimeTokenMaker.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

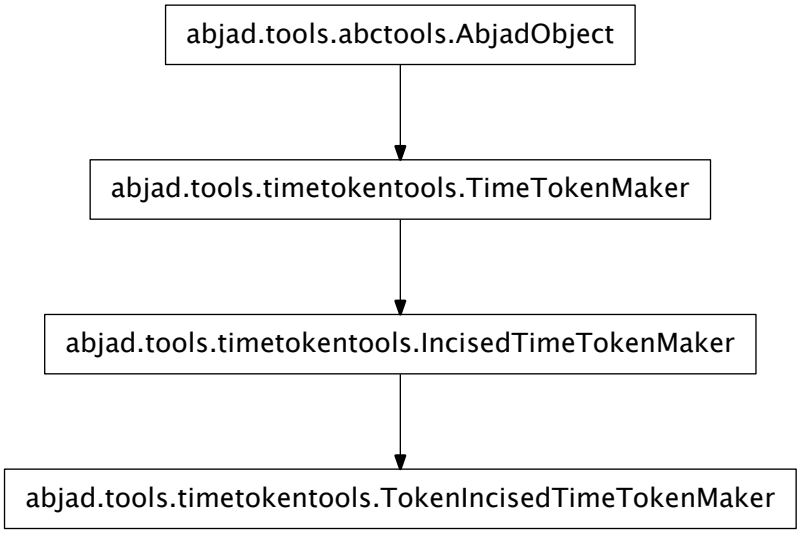
TimeTokenMaker.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TimeTokenMaker.__repr__()

timetokentools.TokenIncisedTimeTokenMaker



class timetokentools.**TokenIncisedTimeTokenMaker**(*prefix_signal*, *prefix_lengths*, *suffix_signal*, *suffix_lengths*, *denominator*, *prolation_addenda=None*, *secondary_divisions=None*, *prefix_signal_helper=None*, *prefix_lengths_helper=None*, *suffix_signal_helper=None*, *suffix_lengths_helper=None*, *prolation_addenda_helper=None*, *secondary_divisions_helper=None*)

New in version 2.8. Abstract base class for time token makers that incise every time token they produce.

Read-only Properties

TokenIncisedTimeTokenMaker.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

TokenIncisedTimeTokenMaker.**reverse**()

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`TokenIncisedTimeTokenMaker.__call__`(*duration_tokens*, *seeds=None*)
Inherited from `timetokentools.IncisedTimeTokenMaker`

`TokenIncisedTimeTokenMaker.__eq__`(*other*)
Inherited from `timetokentools.IncisedTimeTokenMaker`

`TokenIncisedTimeTokenMaker.__ge__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TokenIncisedTimeTokenMaker.__gt__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`TokenIncisedTimeTokenMaker.__le__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TokenIncisedTimeTokenMaker.__lt__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TokenIncisedTimeTokenMaker.__ne__`(*arg*)
True when `id(self)` does not equal `id(arg)`.

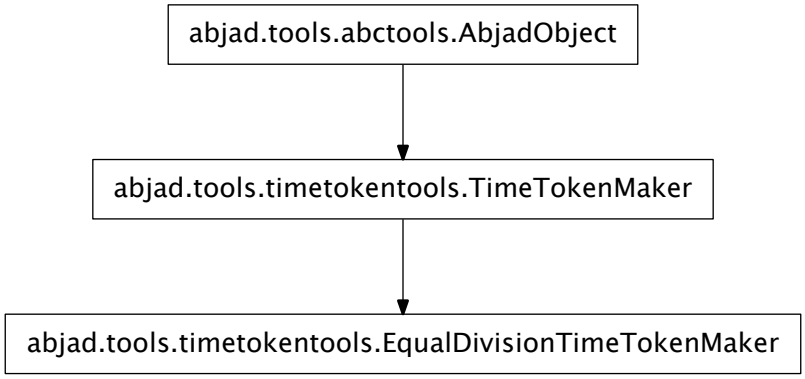
Return boolean.

Inherited from `abctools.AbjadObject`

`TokenIncisedTimeTokenMaker.__repr__`()
Inherited from `timetokentools.TimeTokenMaker`

concrete classes

timetokentools.EqualDivisionTimeTokenMaker



class timetokentools.**EqualDivisionTimeTokenMaker**(*leaf_count*, *is_diminution=True*)

New in version 2.10. Equal division time-token maker:

```
>>> maker = timetokentools.EqualDivisionTimeTokenMaker(4)

>>> duration_tokens = [(1, 4), (1, 8), (1, 6), (1, 12)]
>>> tuplet_lists = maker(duration_tokens)
>>> tuplets = sequencetools.flatten_sequence(tuplet_lists)

>>> staff = Staff(tuplets)

>>> f(staff)
\new Staff {
    {
        c'16
        c'16
        c'16
        c'16
    }
    {
        c'32
        c'32
        c'32
        c'32
    }
    \times 2/3 {
        c'16
        c'16
        c'16
        c'16
    }
    \times 2/3 {
        c'32
```

```
            c'32
            c'32
            c'32
        }
    }
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

`EqualDivisionTimeTokenMaker.`**`is_diminution`**
Return boolean.

`EqualDivisionTimeTokenMaker.`**`leaf_count`**
Leaf count.

Note: add example.

Return positive integer.

`EqualDivisionTimeTokenMaker.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`EqualDivisionTimeTokenMaker.`**`reverse`**`()`
New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`EqualDivisionTimeTokenMaker.`**`__call__`**`(`*duration_tokens*, *seeds=None*`)`
`EqualDivisionTimeTokenMaker.`**`__eq__`**`(`*arg*`)`
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

EqualDivisionTimeTokenMaker.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

EqualDivisionTimeTokenMaker.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

EqualDivisionTimeTokenMaker.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

EqualDivisionTimeTokenMaker.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

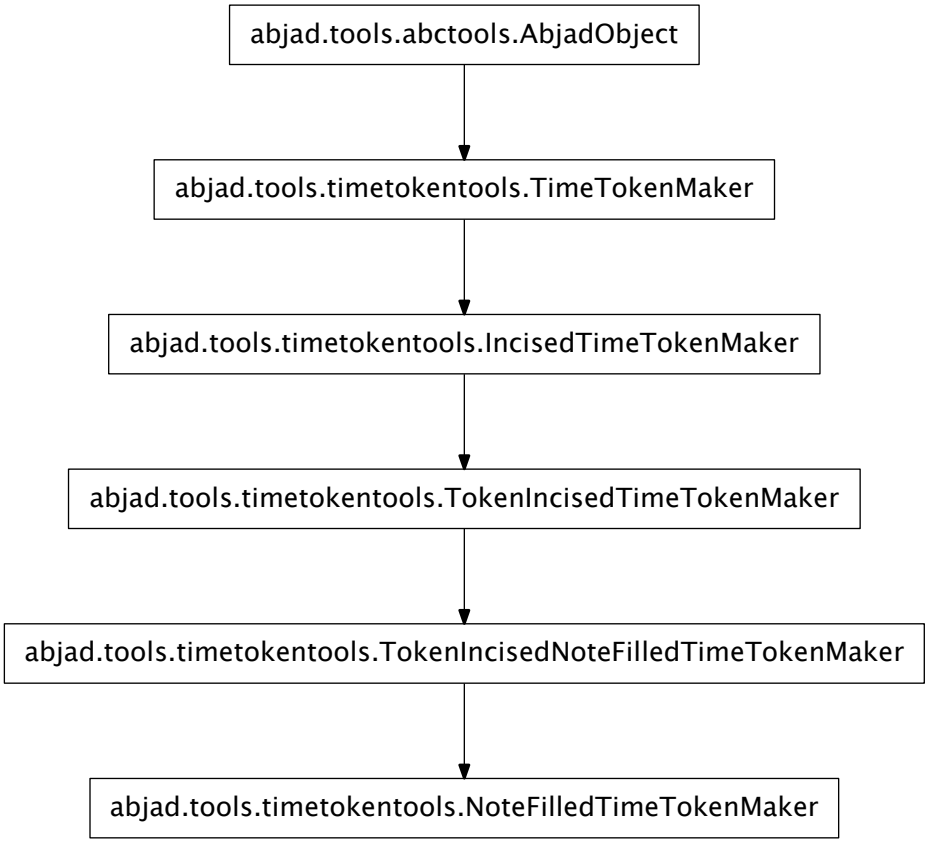
EqualDivisionTimeTokenMaker.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

EqualDivisionTimeTokenMaker.__repr__()
Inherited from timetokentools.TimeTokenMaker

timetokentools.NoteFilledTimeTokenMaker



class timetokentools.**NoteFilledTimeTokenMaker**

New in version 2.8. Note-filled time-token maker:

```
>>> from abjad.tools import sequencetools
>>> from abjad.tools import timetokentools

>>> maker = timetokentools.NoteFilledTimeTokenMaker()

>>> duration_tokens = [(5, 16), (3, 8)]
>>> leaf_lists = maker(duration_tokens)
>>> leaves = sequencetools.flatten_sequence(leaf_lists)

>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(duration_tokens)
>>> staff = Staff(measures)
>>> measures = measuretools.replace_contents_of_measures_in_expr(staff, leaves)

>>> f(staff)
\new Staff {
    {
```

```
            \time 5/16
            c'4
            c'16
        }
        {
            \time 3/8
            c'4.
        }
    }
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

NoteFilledTimeTokenMaker.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

NoteFilledTimeTokenMaker.**reverse**()

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from timetokentools.TimeTokenMaker

Special Methods

NoteFilledTimeTokenMaker.**__call__**(*duration_tokens*, *seeds=None*)

Inherited from timetokentools.IncisedTimeTokenMaker

NoteFilledTimeTokenMaker.**__eq__**(*other*)

Inherited from timetokentools.IncisedTimeTokenMaker

NoteFilledTimeTokenMaker.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NoteFilledTimeTokenMaker.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

NoteFilledTimeTokenMaker.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NoteFilledTimeTokenMaker.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

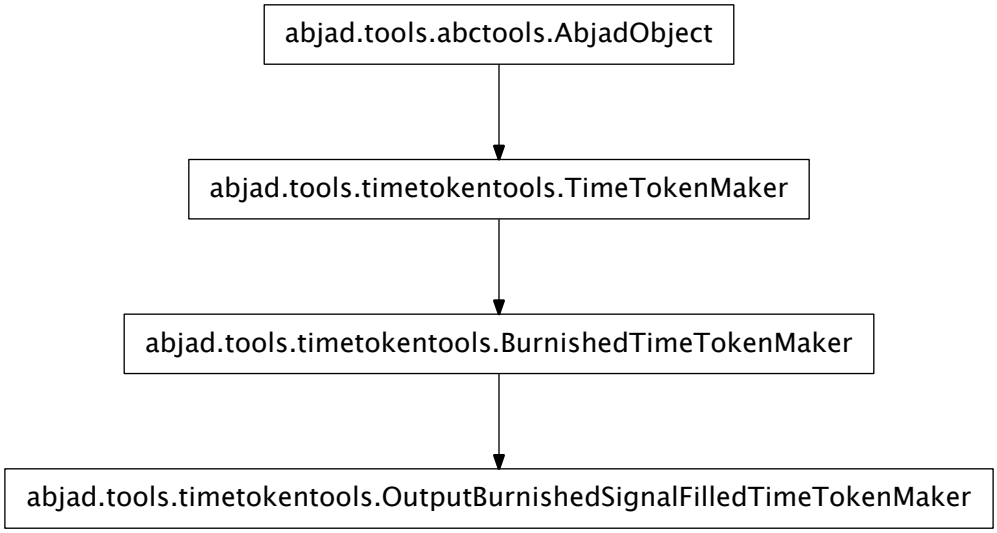
NoteFilledTimeTokenMaker.__**ne**__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

NoteFilledTimeTokenMaker.__**repr**__()

timetokentools.OutputBurnishedSignalFilledTimeTokenMaker



class timetokentools.**OutputBurnishedSignalFilledTimeTokenMaker**(*pattern*, *denominator*, *prolation_addenda=None*, *lefts=None*, *middles=None*, *rights=None*, *left_lengths=None*, *right_lengths=None*, *secondary_divisions=None*, *pattern_helper=None*, *prolation_addenda_helper=None*, *lefts_helper=None*, *middles_helper=None*, *rights_helper=None*, *left_lengths_helper=None*, *right_lengths_helper=None*, *secondary_divisions_helper=None*)

New in version 2.8. Output-burnished signal-filled time-token maker.

Configure the time-token maker at initialization:

```
>>> from abjad.tools import sequencetools
>>> from abjad.tools import timetokentools

>>> pattern, denominator, prolation_addenda = [1, 2, 3], 16, [0, 2]
>>> lefts, middles, rights = [-1], [0], [-1]
>>> left_lengths, right_lengths = [1], [1]
>>> secondary_divisions = [9]
>>> maker = timetokentools.OutputBurnishedSignalFilledTimeTokenMaker(
... pattern, denominator, prolation_addenda, lefts, middles, rights,
... left_lengths, right_lengths, secondary_divisions)
```

Then call the time-token maker on arbitrary duration tokens:

```
>>> duration_tokens = [(3, 8), (4, 8)]
>>> music = maker(duration_tokens)
```

The resulting Abjad objects can be included in any score:

```
>>> music = sequencetools.flatten_sequence(music)
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(duration_tokens)
>>> staff = Staff(measures)
>>> measures = measuretools.replace_contents_of_measures_in_expr(staff, music)

>>> f(staff)
\new Staff {
    {
        \time 3/8
        {
            r16
            c'8
            c'8.
        }
```

```
        }
        {
            \time 4/8
            \fraction \times 3/5 {
                c'16
                c'8
                c'8
            }
            {
                c'16
                c'16
                c'8
                r16
            }
        }
    }
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

`OutputBurnishedSignalFilledTimeTokenMaker.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`OutputBurnishedSignalFilledTimeTokenMaker.`**`reverse`**`()`

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`OutputBurnishedSignalFilledTimeTokenMaker.`**`__call__`**`(`*duration_tokens*, *seeds=None*`)`

Inherited from `timetokentools.BurnishedTimeTokenMaker`

`OutputBurnishedSignalFilledTimeTokenMaker.`**`__eq__`**`(`*other*`)`

Inherited from `timetokentools.BurnishedTimeTokenMaker`

OutputBurnishedSignalFilledTimeTokenMaker.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OutputBurnishedSignalFilledTimeTokenMaker.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

OutputBurnishedSignalFilledTimeTokenMaker.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OutputBurnishedSignalFilledTimeTokenMaker.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

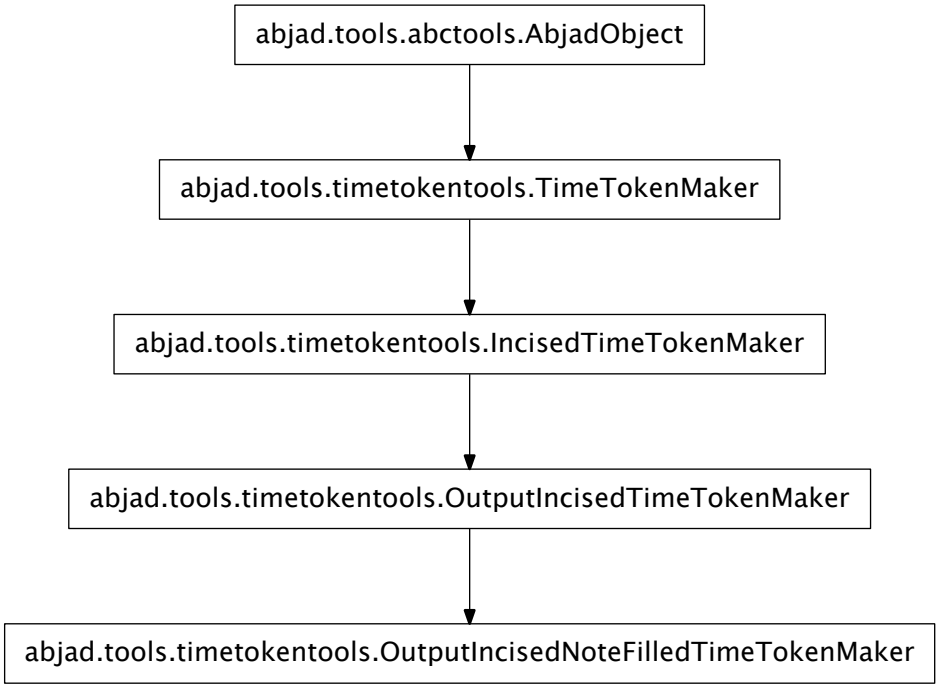
OutputBurnishedSignalFilledTimeTokenMaker.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

OutputBurnishedSignalFilledTimeTokenMaker.__repr__()
Inherited from timetokentools.TimeTokenMaker

timetokentools.OutputIncisedNoteFilledTimeTokenMaker



class timetokentools.**OutputIncisedNoteFilledTimeTokenMaker**(*prefix_signal*, *prefix_lengths*, *suffix_signal*, *suffix_lengths*, *denominator*, *prolation_addenda=None*, *secondary_divisions=None*, *prefix_signal_helper=None*, *prefix_lengths_helper=None*, *suffix_signal_helper=None*, *suffix_lengths_helper=None*, *prolation_addenda_helper=None*, *secondary_divisions_helper=None*)

New in version 2.8. Output-incised note-filled time-token maker.

Configure the time-token maker on initialization:

```
>>> from abjad.tools import sequencetools
>>> from abjad.tools import timetokentools
```

```
>>> prefix_signal, prefix_lengths = [-8], [2]
>>> suffix_signal, suffix_lengths = [-3], [4]
>>> denominator = 32
>>> maker = timetokentools.OutputIncisedNoteFilledTimeTokenMaker(
... prefix_signal, prefix_lengths, suffix_signal, suffix_lengths, denominator)
```

Then call the time-token maker on arbitrary duration tokens:

```
>>> duration_tokens = [(5, 8), (5, 8), (5, 8)]
>>> leaf_lists = maker(duration_tokens)
>>> leaves = sequencetools.flatten_sequence(leaf_lists)
```

The resulting Abjad objects can be included in any score and the time-token maker can be reused:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(duration_tokens)
>>> staff = Staff(measures)
>>> measures = measuretools.replace_contents_of_measures_in_expr(staff, leaves)

>>> f(staff)
\new Staff {
    {
        \time 5/8
        r4
        r4
        c'8
    }
    {
        c'2
        c'8
    }
    {
        c'4
        r16.
        r16.
        r16.
        r16.
    }
}
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

`OutputIncisedNoteFilledTimeTokenMaker.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`OutputIncisedNoteFilledTimeTokenMaker.`**`reverse`**`()`

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`OutputIncisedNoteFilledTimeTokenMaker.__call__`(*duration_tokens*, *seeds=None*)
Inherited from `timetokentools.IncisedTimeTokenMaker`

`OutputIncisedNoteFilledTimeTokenMaker.__eq__`(*other*)
Inherited from `timetokentools.IncisedTimeTokenMaker`

`OutputIncisedNoteFilledTimeTokenMaker.__ge__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`OutputIncisedNoteFilledTimeTokenMaker.__gt__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`OutputIncisedNoteFilledTimeTokenMaker.__le__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`OutputIncisedNoteFilledTimeTokenMaker.__lt__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

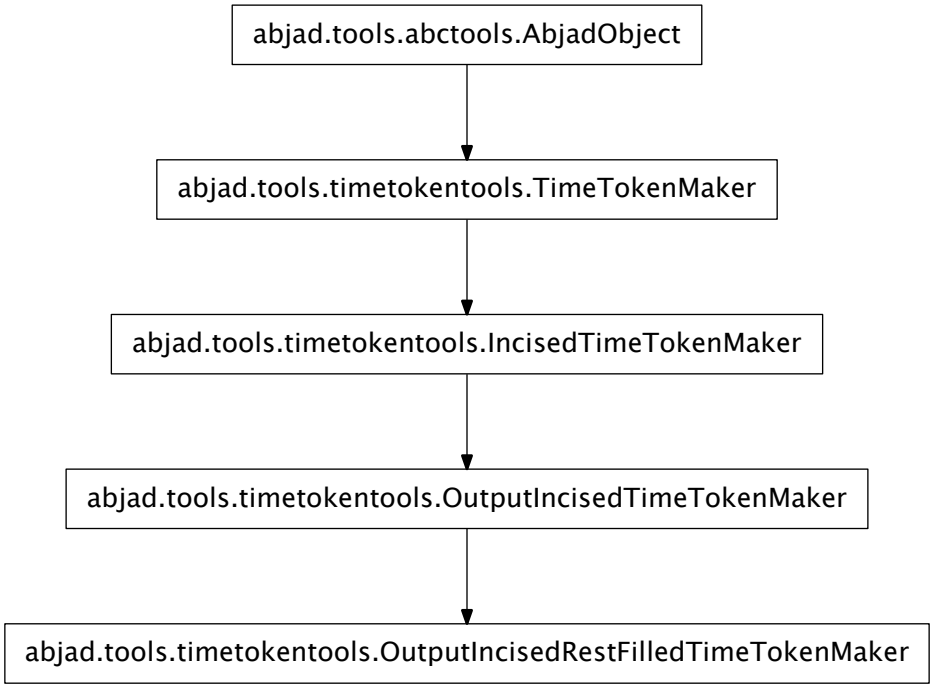
`OutputIncisedNoteFilledTimeTokenMaker.__ne__`(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`OutputIncisedNoteFilledTimeTokenMaker.__repr__`()
Inherited from `timetokentools.TimeTokenMaker`

timetokentools.OutputIncisedRestFilledTimeTokenMaker



class timetokentools.**OutputIncisedRestFilledTimeTokenMaker**(*prefix_signal*, *prefix_lengths*, *suffix_signal*, *suffix_lengths*, *denominator*, *prolation_addenda=None*, *secondary_divisions=None*, *prefix_signal_helper=None*, *prefix_lengths_helper=None*, *suffix_signal_helper=None*, *suffix_lengths_helper=None*, *prolation_addenda_helper=None*, *secondary_divisions_helper=None*)

New in version 2.8. Output-incised rest-filled time-token maker.

Configure the time-token maker on initialization:

```
>>> from abjad.tools import sequencetools
>>> from abjad.tools import timetokentools
```

```
>>> prefix_signal, prefix_lengths = [8], [2]
>>> suffix_signal, suffix_lengths = [3], [4]
>>> denominator = 32
>>> maker = timetokentools.OutputIncisedRestFilledTimeTokenMaker(
... prefix_signal, prefix_lengths, suffix_signal, suffix_lengths, denominator)
```

Then call the time-token maker on arbitrary duration tokens:

```
>>> duration_tokens = [(5, 8), (5, 8), (5, 8)]
>>> leaf_lists = maker(duration_tokens)
>>> leaves = sequencetools.flatten_sequence(leaf_lists)
```

The resulting Abjad objects can be included in any score and the time-token maker can be reused:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(duration_tokens)
>>> staff = Staff(measures)
>>> measures = measuretools.replace_contents_of_measures_in_expr(staff, leaves)

>>> f(staff)
\new Staff {
    {
        \time 5/8
        c'4
        c'4
        r8
    }
    {
        r2
        r8
    }
    {
        r4
        c'16.
        c'16.
        c'16.
        c'16.
    }
}
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

`OutputIncisedRestFilledTimeTokenMaker.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`OutputIncisedRestFilledTimeTokenMaker.`**`reverse`**`()`

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`OutputIncisedRestFilledTimeTokenMaker.__call__`(*duration_tokens*, *seeds=None*)
Inherited from `timetokentools.IncisedTimeTokenMaker`

`OutputIncisedRestFilledTimeTokenMaker.__eq__`(*other*)
Inherited from `timetokentools.IncisedTimeTokenMaker`

`OutputIncisedRestFilledTimeTokenMaker.__ge__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`OutputIncisedRestFilledTimeTokenMaker.__gt__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`OutputIncisedRestFilledTimeTokenMaker.__le__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`OutputIncisedRestFilledTimeTokenMaker.__lt__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

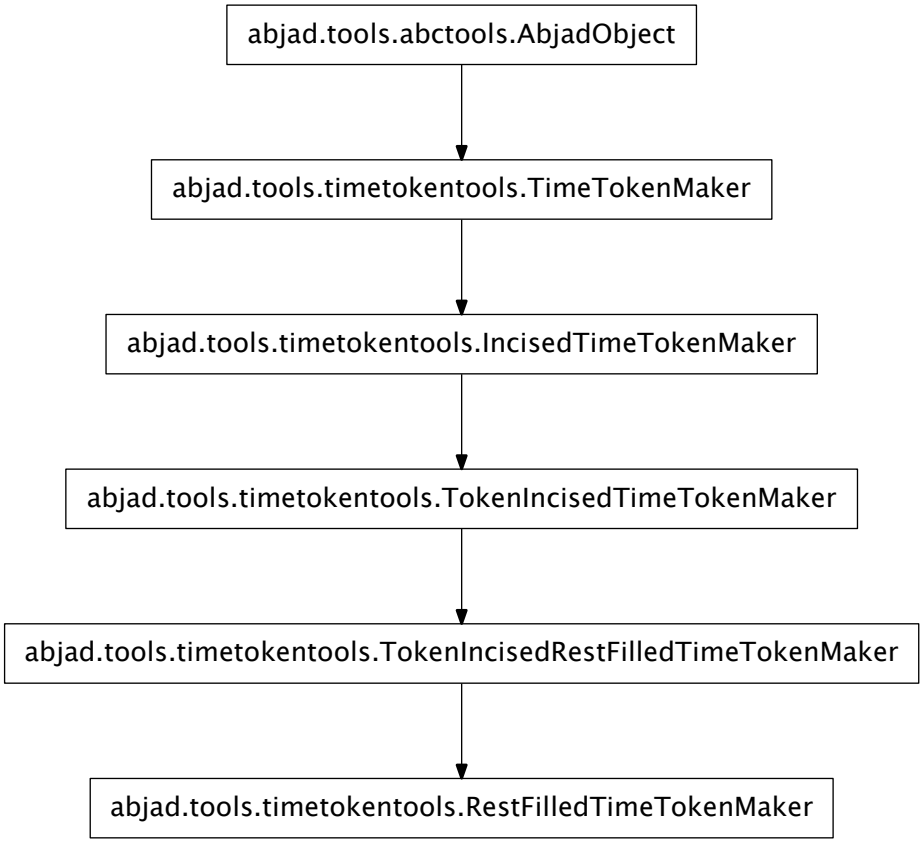
`OutputIncisedRestFilledTimeTokenMaker.__ne__`(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`OutputIncisedRestFilledTimeTokenMaker.__repr__`()
Inherited from `timetokentools.TimeTokenMaker`

timetokentools.RestFilledTimeTokenMaker



class timetokentools.**RestFilledTimeTokenMaker**

New in version 2.8. Rest-filled time-token maker:

```
>>> from abjad.tools import sequencetools
>>> from abjad.tools import timetokentools

>>> maker = timetokentools.RestFilledTimeTokenMaker()

>>> duration_tokens = [(5, 16), (3, 8)]
>>> leaf_lists = maker(duration_tokens)
>>> leaves = sequencetools.flatten_sequence(leaf_lists)

>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(duration_tokens)
>>> staff = Staff(measures)
>>> measures = measuretools.replace_contents_of_measures_in_expr(staff, leaves)

>>> f(staff)
\new Staff {
    {
```

```
            \time 5/16
            r4
            r16
        }
        {
            \time 3/8
            r4.
        }
    }
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

`RestFilledTimeTokenMaker.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`RestFilledTimeTokenMaker.`**`reverse`**`()`

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`RestFilledTimeTokenMaker.`**`__call__`**`(`*duration_tokens*, *seeds=None*`)`

Inherited from `timetokentools.IncisedTimeTokenMaker`

`RestFilledTimeTokenMaker.`**`__eq__`**`(`*other*`)`

Inherited from `timetokentools.IncisedTimeTokenMaker`

`RestFilledTimeTokenMaker.`**`__ge__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

RestFilledTimeTokenMaker.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

RestFilledTimeTokenMaker.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RestFilledTimeTokenMaker.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

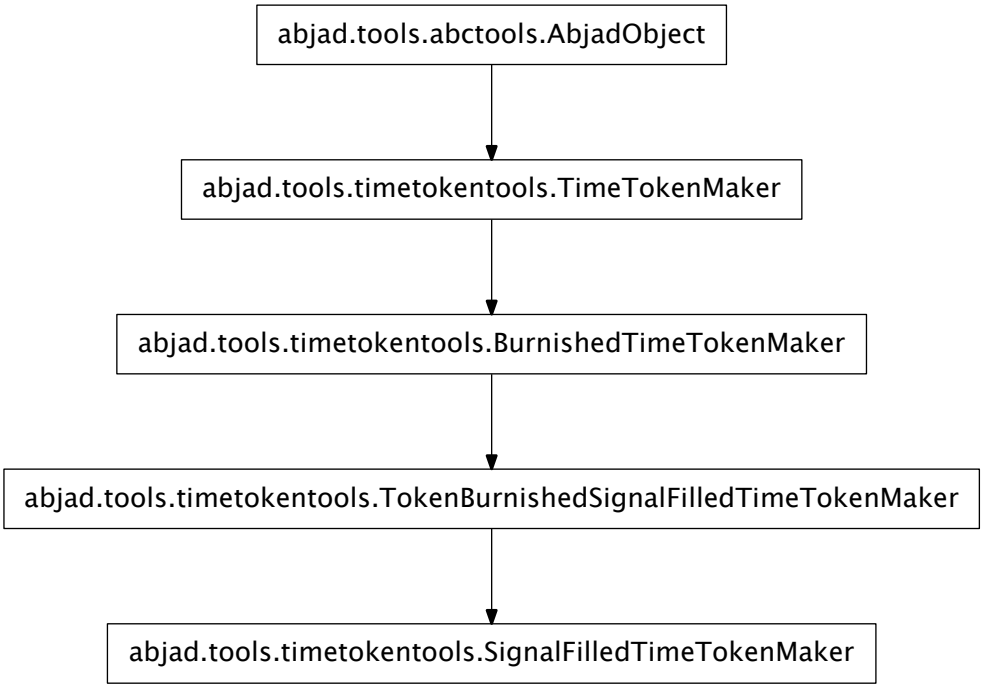
RestFilledTimeTokenMaker.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

RestFilledTimeTokenMaker.**__repr__**()
Inherited from timetokentools.TimeTokenMaker

timetokentools.SignalFilledTimeTokenMaker



class timetokentools.**SignalFilledTimeTokenMaker**(*pattern*, *denominator*, *prolation_addenda=None*, *secondary_divisions=None*, *pattern_helper=None*, *prolation_addenda_helper=None*, *secondary_divisions_helper=None*)

New in version 2.8. Signal-affixed time-token maker.

Configure the time-token maker at initialization:

```
>>> from abjad.tools import sequencetools
>>> from abjad.tools import timetokentools

>>> pattern, denominator, prolation_addenda = [-1, 4, -2, 3], 16, [3, 4]
>>> maker = timetokentools.SignalFilledTimeTokenMaker(
...     pattern, denominator, prolation_addenda)
```

Then call the time-token maker on arbitrary duration tokens:

```
>>> duration_tokens = [(2, 8), (5, 8)]
>>> music = maker(duration_tokens)
```

The resulting Abjad objects can be included in any score and the time-token make can be called indefinitely on other arbitrary sequences of duration tokens:

```
>>> music = sequencetools.flatten_sequence(music)
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(duration_tokens)
>>> staff = Staff(measures)
>>> measures = measuretools.replace_contents_of_measures_in_expr(staff, music)

>>> f(staff)
\new Staff {
    {
        \time 2/8
        \times 4/7 {
            r16
            c'4
            r8
        }
    }
    {
        \time 5/8
        \fraction \times 5/7 {
            c'8.
            r16
            c'4
            r8
            c'8.
            r16
        }
    }
}
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

`SignalFilledTimeTokenMaker.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`SignalFilledTimeTokenMaker.`**`reverse`**`()`

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from timetokentools.TimeTokenMaker

Special Methods

SignalFilledTimeTokenMaker.__call__(*duration_tokens*, *seeds=None*)
Inherited from timetokentools.BurnishedTimeTokenMaker

SignalFilledTimeTokenMaker.__eq__(*other*)
Inherited from timetokentools.BurnishedTimeTokenMaker

SignalFilledTimeTokenMaker.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SignalFilledTimeTokenMaker.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SignalFilledTimeTokenMaker.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SignalFilledTimeTokenMaker.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

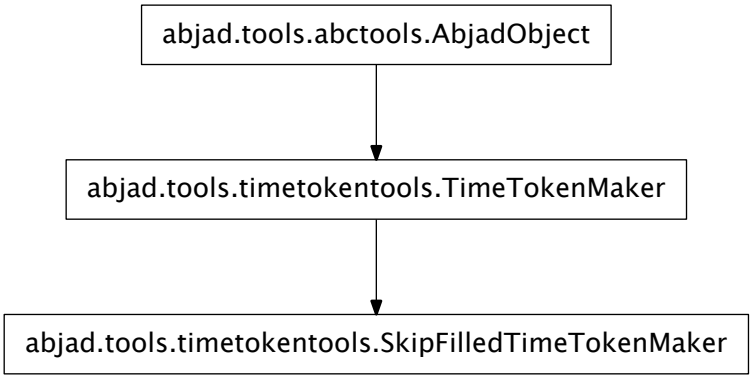
SignalFilledTimeTokenMaker.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

SignalFilledTimeTokenMaker.__repr__()
Inherited from timetokentools.TimeTokenMaker

timetokentools.SkipFilledTimeTokenMaker



class timetokentools.**SkipFilledTimeTokenMaker**

New in version 2.10. Skip-filled time-token maker:

```
>>> maker = timetokentools.SkipFilledTimeTokenMaker()

>>> duration_tokens = [(1, 5), (1, 4), (1, 6), (7, 9)]
>>> leaf_lists = maker(duration_tokens)
>>> leaves = sequencetools.flatten_sequence(leaf_lists)

>>> staff = Staff(leaves)

>>> f(staff)
\new Staff {
    s1 * 1/5
    s1 * 1/4
    s1 * 1/6
    s1 * 7/9
}
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

SkipFilledTimeTokenMaker.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

SkipFilledTimeTokenMaker.**reverse**()

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`SkipFilledTimeTokenMaker.__call__`(*duration_tokens*, *seeds=None*)

`SkipFilledTimeTokenMaker.__eq__`(*arg*)

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`SkipFilledTimeTokenMaker.__ge__`(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`SkipFilledTimeTokenMaker.__gt__`(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`SkipFilledTimeTokenMaker.__le__`(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`SkipFilledTimeTokenMaker.__lt__`(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`SkipFilledTimeTokenMaker.__ne__`(*arg*)

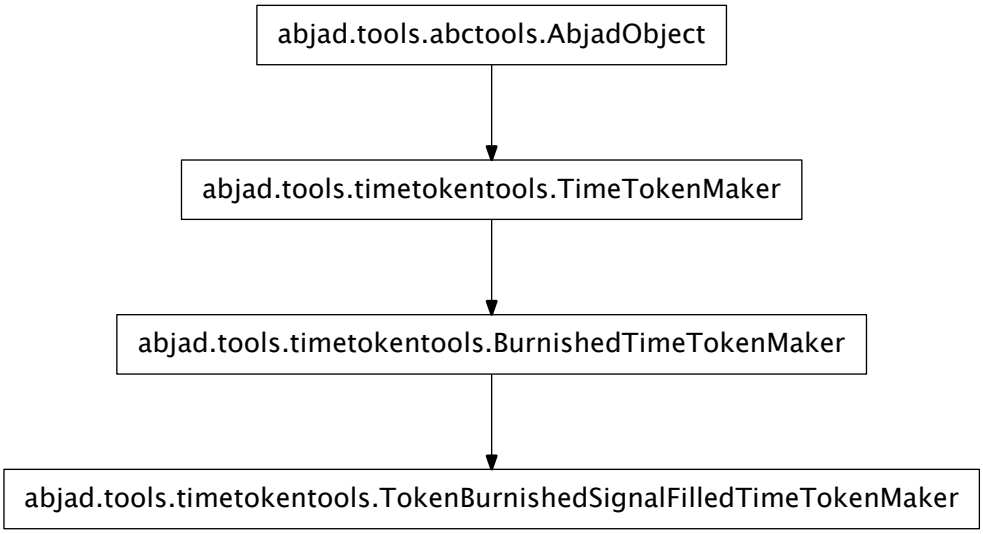
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

SkipFilledTimeTokenMaker.**__repr__**()
Inherited from timetokentools.TimeTokenMaker

timetokentools.TokenBurnishedSignalFilledTimeTokenMaker



class timetokentools.**TokenBurnishedSignalFilledTimeTokenMaker**(*pattern*, *denominator*, *prolation_addenda=None*, *lefts=None*, *middles=None*, *rights=None*, *left_lengths=None*, *right_lengths=None*, *secondary_divisions=None*, *pattern_helper=None*, *prolation_addenda_helper=None*, *lefts_helper=None*, *middles_helper=None*, *rights_helper=None*, *left_lengths_helper=None*, *right_lengths_helper=None*, *secondary_divisions_helper=None*)

New in version 2.8. Token-burnished signal-filled time-token maker.

Configure the time-token maker at instantiation:

```
>>> from abjad.tools import sequencetools
>>> from abjad.tools import timetokentools

>>> pattern, denominator, prolation_addenda = [1, 1, 2, 4], 32, [0, 3]
>>> lefts, middles, rights = [-1], [0], [-1]
>>> left_lengths, right_lengths = [1], [1]
>>> secondary_divisions = [14]
>>> maker = timetokentools.TokenBurnishedSignalFilledTimeTokenMaker(
... pattern, denominator, prolation_addenda, lefts, middles, rights,
... left_lengths, right_lengths, secondary_divisions)
```

Then call the time-token maker on any sequence of duration tokens:

```
>>> duration_tokens = [(5, 16), (6, 16)]
>>> music = maker(duration_tokens)
```

The resulting Abjad objects can then be included in any score and the time-token maker can be called again and again on different duration tokens:

```
>>> music = sequencetools.flatten_sequence(music)
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(duration_tokens)
>>> staff = Staff(measures)
>>> measures = measuretools.replace_contents_of_measures_in_expr(staff, music)

>>> f(staff)
\new Staff {
    {
        \time 5/16
        {
            r32
            c'32
            c'16
            c'8
            c'32
            r32
        }
    }
    {
        \time 6/16
        \times 4/7 {
            r16
            c'8
            r32
        }
        {
            r32
            c'16
            c'8
            r32
        }
    }
}
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

TokenBurnishedSignalFilledTimeTokenMaker.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

TokenBurnishedSignalFilledTimeTokenMaker.**reverse**()
New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from timetokentools.TimeTokenMaker

Special Methods

TokenBurnishedSignalFilledTimeTokenMaker.**__call__**(*duration_tokens*, *seeds=None*)
Inherited from timetokentools.BurnishedTimeTokenMaker

TokenBurnishedSignalFilledTimeTokenMaker.**__eq__**(*other*)
Inherited from timetokentools.BurnishedTimeTokenMaker

TokenBurnishedSignalFilledTimeTokenMaker.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TokenBurnishedSignalFilledTimeTokenMaker.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TokenBurnishedSignalFilledTimeTokenMaker.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TokenBurnishedSignalFilledTimeTokenMaker.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

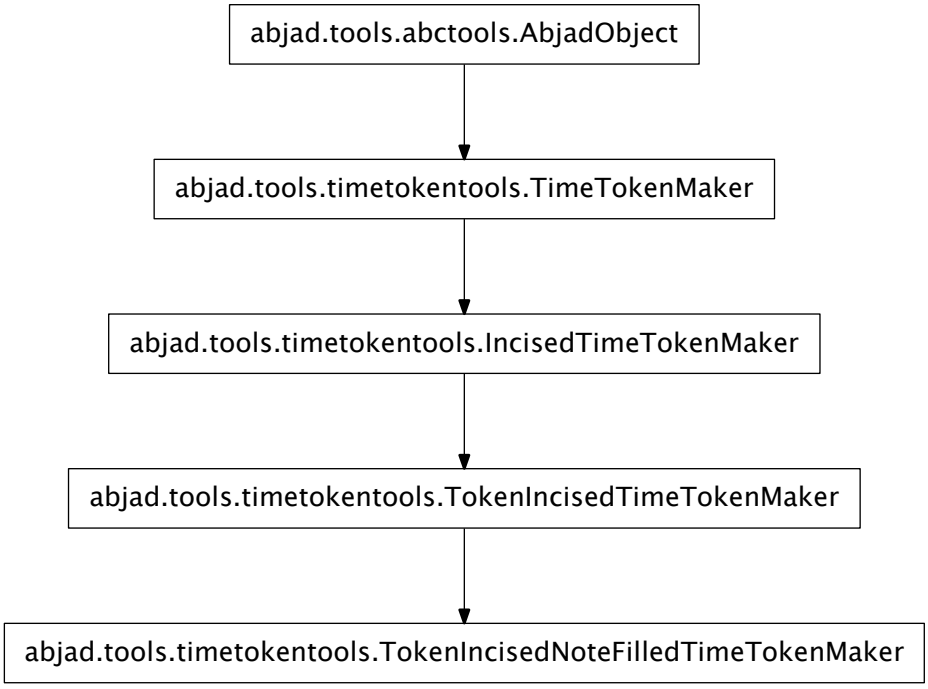
TokenBurnishedSignalFilledTimeTokenMaker.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

TokenBurnishedSignalFilledTimeTokenMaker.**__repr__**()
Inherited from `timetokentools.TimeTokenMaker`

timetokentools.TokenIncisedNoteFilledTimeTokenMaker



class timetokentools.**TokenIncisedNoteFilledTimeTokenMaker**(*prefix_signal*, *prefix_lengths*, *suffix_signal*, *suffix_lengths*, *denominator*, *prolation_addenda=None*, *secondary_divisions=None*, *prefix_signal_helper=None*, *prefix_lengths_helper=None*, *suffix_signal_helper=None*, *suffix_lengths_helper=None*, *prolation_addenda_helper=None*, *secondary_divisions_helper=None*)

New in version 2.8. Token-incised note-filled time-token maker:

```
>>> from abjad.tools import sequencetools
>>> from abjad.tools import timetokentools

>>> prefix_signal, prefix_lengths = [-8], [0, 1]
>>> suffix_signal, suffix_lengths = [-1], [1]
>>> denominator = 32
>>> maker = timetokentools.TokenIncisedNoteFilledTimeTokenMaker(
... prefix_signal, prefix_lengths, suffix_signal, suffix_lengths, denominator)

>>> duration_tokens = [(5, 8), (5, 8), (5, 8), (5, 8)]
>>> leaf_lists = maker(duration_tokens)
>>> leaves = sequencetools.flatten_sequence(leaf_lists)

>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(duration_tokens)
>>> staff = Staff(measures)
>>> measures = measuretools.replace_contents_of_measures_in_expr(staff, leaves)

>>> f(staff)
\new Staff {
    {
        \time 5/8
        c'2
        c'16.
        r32
    }
    {
        r4
        c'4
        c'16.
        r32
    }
    {
        c'2
        c'16.
        r32
    }
    {
```

```
            r4
            c'4
            c'16.
            r32
        }
    }
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

`TokenIncisedNoteFilledTimeTokenMaker.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`TokenIncisedNoteFilledTimeTokenMaker.`**`reverse`**`()`

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`TokenIncisedNoteFilledTimeTokenMaker.`**`__call__`**`(`*duration_tokens*, *seeds=None*`)`

Inherited from `timetokentools.IncisedTimeTokenMaker`

`TokenIncisedNoteFilledTimeTokenMaker.`**`__eq__`**`(`*other*`)`

Inherited from `timetokentools.IncisedTimeTokenMaker`

`TokenIncisedNoteFilledTimeTokenMaker.`**`__ge__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TokenIncisedNoteFilledTimeTokenMaker.`**`__gt__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TokenIncisedNoteFilledTimeTokenMaker.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TokenIncisedNoteFilledTimeTokenMaker.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

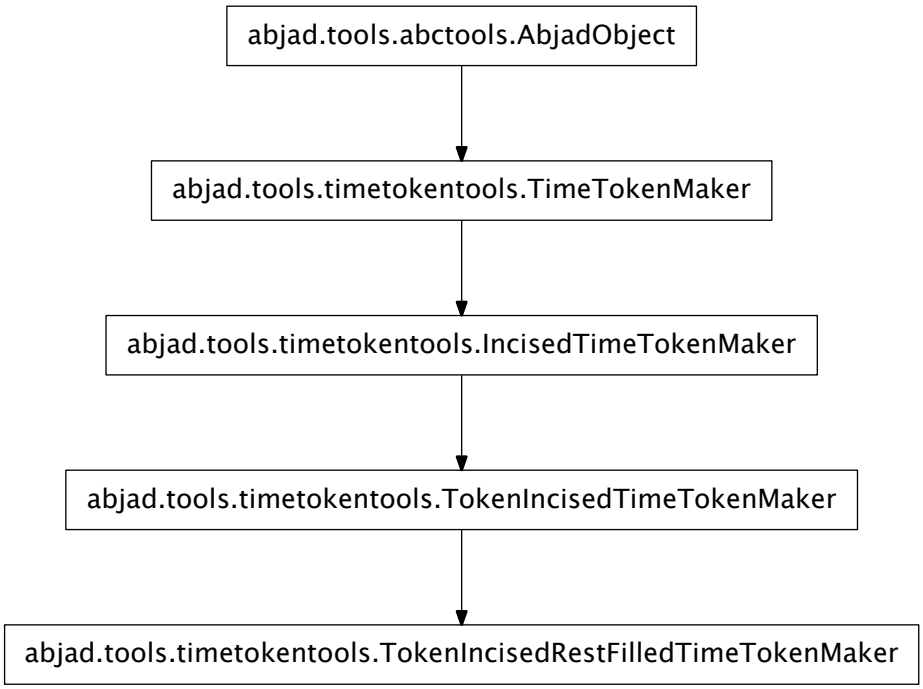
TokenIncisedNoteFilledTimeTokenMaker.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TokenIncisedNoteFilledTimeTokenMaker.__repr__()
Inherited from timetokentools.TimeTokenMaker

timetokentools.TokenIncisedRestFilledTimeTokenMaker



class timetokentools.**TokenIncisedRestFilledTimeTokenMaker**(*prefix_signal*, *prefix_lengths*, *suffix_signal*, *suffix_lengths*, *denominator*, *prolation_addenda=None*, *secondary_divisions=None*, *prefix_signal_helper=None*, *prefix_lengths_helper=None*, *suffix_signal_helper=None*, *suffix_lengths_helper=None*, *prolation_addenda_helper=None*, *secondary_divisions_helper=None*)

New in version 2.8. Token-incised rest-filled time-token maker:

```
>>> from abjad.tools import sequencetools
>>> from abjad.tools import timetokentools

>>> prefix_signal, prefix_lengths = [8], [1, 2, 3, 4]
>>> suffix_signal, suffix_lengths = [1], [1]
>>> denominator = 32
>>> maker = timetokentools.TokenIncisedRestFilledTimeTokenMaker(
... prefix_signal, prefix_lengths, suffix_signal, suffix_lengths, denominator)

>>> duration_tokens = [(5, 8), (5, 8), (5, 8), (5, 8)]
>>> leaf_lists = maker(duration_tokens)
>>> leaves = sequencetools.flatten_sequence(leaf_lists)

>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(duration_tokens)
>>> staff = Staff(measures)
>>> measures = measuretools.replace_contents_of_measures_in_expr(staff, leaves)

>>> f(staff)
\new Staff {
    {
        \time 5/8
        c'4
        r4
        r16.
        c'32
    }
    {
        c'4
        c'4
        r16.
        c'32
    }
    {
        c'4
        c'4
        c'8
    }
```

```
        {
            c'4
            c'4
            c'8
        }
    }
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

`TokenIncisedRestFilledTimeTokenMaker.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`TokenIncisedRestFilledTimeTokenMaker.`**`reverse`**`()`

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`TokenIncisedRestFilledTimeTokenMaker.`**`__call__`**`(`*duration_tokens*, *seeds=None*`)`

Inherited from `timetokentools.IncisedTimeTokenMaker`

`TokenIncisedRestFilledTimeTokenMaker.`**`__eq__`**`(`*other*`)`

Inherited from `timetokentools.IncisedTimeTokenMaker`

`TokenIncisedRestFilledTimeTokenMaker.`**`__ge__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`TokenIncisedRestFilledTimeTokenMaker.`**`__gt__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TokenIncisedRestFilledTimeTokenMaker.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TokenIncisedRestFilledTimeTokenMaker.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

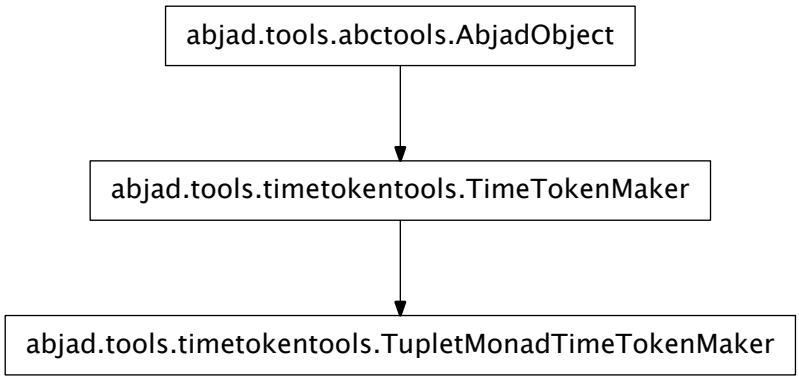
TokenIncisedRestFilledTimeTokenMaker.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

TokenIncisedRestFilledTimeTokenMaker.__repr__()
Inherited from timetokentools.TimeTokenMaker

timetokentools.TupletMonadTimeTokenMaker



class timetokentools.**TupletMonadTimeTokenMaker**
New in version 2.10. Tuplet monad time-token maker:

```
>>> maker = timetokentools.TupletMonadTimeTokenMaker()

>>> duration_tokens = [(1, 5), (1, 4), (1, 6), (7, 9)]
>>> tuplet_lists = maker(duration_tokens)
>>> tuplets = sequencetools.flatten_sequence(tuplet_lists)

>>> staff = Staff(tuplets)
```

```
>>> f(staff)
\new Staff {
    \times 4/5 {
        c'4
    }
    {
        c'4
    }
    \times 2/3 {
        c'4
    }
    \times 8/9 {
        c'2..
    }
}
```

Usage follows the two-step instantiate-then-call pattern shown here.

Return time-token maker.

Read-only Properties

`TupletMonadTimeTokenMaker.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`TupletMonadTimeTokenMaker.`**`reverse`**`()`

New in version 2.10. Reverse time token maker.

Note: method is provisional.

Defined equal to the in-place reversal of the following:

```
self.pattern
self.prolation_addenda
self.lefts
self.middles
self.rights
self.left_lengths
self.right_lengths
self.secondary_divisions
```

Operate in place and return none.

Inherited from `timetokentools.TimeTokenMaker`

Special Methods

`TupletMonadTimeTokenMaker.`**`__call__`**`(`*duration_tokens*, *seeds=None*`)`

`TupletMonadTimeTokenMaker.`**`__eq__`**`(`*arg*`)`

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

TupletMonadTimeTokenMaker.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TupletMonadTimeTokenMaker.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TupletMonadTimeTokenMaker.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TupletMonadTimeTokenMaker.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TupletMonadTimeTokenMaker.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

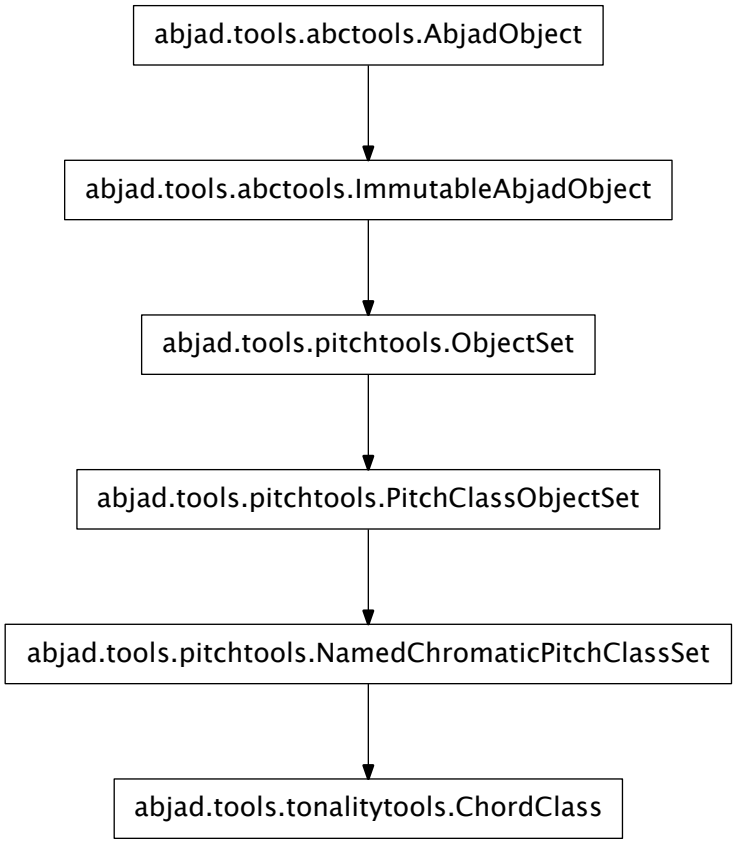
Inherited from abctools.AbjadObject

TupletMonadTimeTokenMaker.__repr__()
Inherited from timetokentools.TimeTokenMaker

tonalitytools

concrete classes

tonalitytools.ChordClass



class tonalitytools.**ChordClass**(**args*, ***kwargs*)

New in version 2.0. Abjad model of tonal chords like G 7, G 6/5, G half-diminished 6/5, etc.

Note that notions like G 7 represent an entire *class of* chords because there are many different spacings and registrations of a G 7 chord.

Read-only Properties

ChordClass.**bass**
ChordClass.**cardinality**

ChordClass.**extent**

ChordClass.**figured_bass**

ChordClass.**inversion**

ChordClass.**inversion_equivalent_diatonic_interval_class_vector**
Inherited from pitchtools.NamedChromaticPitchClassSet

ChordClass.**markup**

ChordClass.**named_chromatic_pitch_classes**
Read-only named chromatic pitch-classes:

```
>>> named_chromatic_pitch_class_set = pitchtools.NamedChromaticPitchClassSet(
...     ['gs', 'g', 'as', 'c', 'cs'])
>>> for x in named_chromatic_pitch_class_set.named_chromatic_pitch_classes: x
...
NamedChromaticPitchClass('as')
NamedChromaticPitchClass('c')
NamedChromaticPitchClass('cs')
NamedChromaticPitchClass('g')
NamedChromaticPitchClass('gs')
```

Return tuple.

Inherited from pitchtools.NamedChromaticPitchClassSet

ChordClass.**numbered_chromatic_pitch_class_set**
Inherited from pitchtools.NamedChromaticPitchClassSet

ChordClass.**quality_indicator**

ChordClass.**quality_pair**

ChordClass.**root**

ChordClass.**root_string**

ChordClass.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

ChordClass.**copy**()
Return a shallow copy of a set.

Inherited from __builtin__.frozenset

ChordClass.**difference**()
Return the difference of two or more sets as a new set.

(i.e. all elements that are in this set but not the others.)

Inherited from __builtin__.frozenset

ChordClass.**intersection**()
Return the intersection of two or more sets as a new set.

(i.e. elements that are common to all of the sets.)

Inherited from __builtin__.frozenset

ChordClass.**isdisjoint**()
Return True if two sets have a null intersection.

Inherited from __builtin__.frozenset

ChordClass.**issubset**()
Report whether another set contains this set.

Inherited from __builtin__.frozenset

ChordClass.**issuperset**()
Report whether this set contains another set.

Inherited from __builtin__.frozenset

ChordClass.**order_by**(*npc_seg*)
Inherited from pitchtools.NamedChromaticPitchClassSet

ChordClass.**symmetric_difference**()
Return the symmetric difference of two sets as a new set.

(i.e. all elements that are in exactly one of the sets.)

Inherited from __builtin__.frozenset

ChordClass.**transpose**()

ChordClass.**union**()
Return the union of sets as a new set.

(i.e. all elements that are in either set.)

Inherited from __builtin__.frozenset

Special Methods

ChordClass.**__and__**()
x.__and__(y) <==> x&y

Inherited from __builtin__.frozenset

ChordClass.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.frozenset

ChordClass.**__contains__**()
x.__contains__(y) <==> y in x.

Inherited from __builtin__.frozenset

ChordClass.**__eq__**(*arg*)

ChordClass.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.frozenset

ChordClass.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.frozenset

ChordClass.**__hash__**()
Inherited from pitchtools.NamedChromaticPitchClassSet

ChordClass.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.frozenset

ChordClass.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.frozenset

ChordClass.__**len**__() <==> *len(x)*
Inherited from __builtin__.frozenset

ChordClass.__**lt**__()
x.__lt__(y) <==> x<y

Inherited from __builtin__.frozenset

ChordClass.__**ne**__(*arg*)

ChordClass.__**or**__()
x.__or__(y) <==> x|y

Inherited from __builtin__.frozenset

ChordClass.__**rand**__()
x.__rand__(y) <==> y&x

Inherited from __builtin__.frozenset

ChordClass.__**repr**__()

ChordClass.__**ror**__()
x.__ror__(y) <==> y|x

Inherited from __builtin__.frozenset

ChordClass.__**rsub**__()
x.__rsub__(y) <==> y-x

Inherited from __builtin__.frozenset

ChordClass.__**rxor**__()
x.__rxor__(y) <==> y^x

Inherited from __builtin__.frozenset

ChordClass.__**str**__()
Inherited from pitchtools.NamedChromaticPitchClassSet

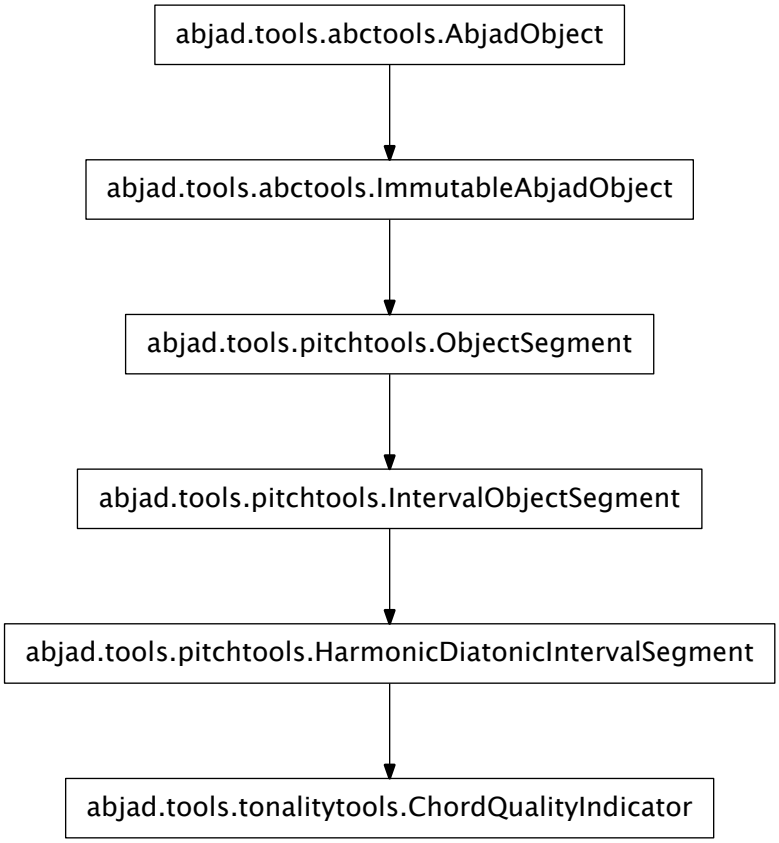
ChordClass.__**sub**__()
x.__sub__(y) <==> x-y

Inherited from __builtin__.frozenset

ChordClass.__**xor**__()
x.__xor__(y) <==> x^y

Inherited from __builtin__.frozenset

tonalitytools.ChordQualityIndicator



class tonalitytools.**ChordQualityIndicator**(**args*, ***kwargs*)
New in version 2.0. Chord quality indicator.

Read-only Properties

ChordQualityIndicator.**cardinality**

ChordQualityIndicator.**extent**

ChordQualityIndicator.**extent_name**

ChordQualityIndicator.**harmonic_chromatic_interval_segment**
Inherited from pitchtools.HarmonicDiatonicIntervalSegment

ChordQualityIndicator.**interval_classes**
Inherited from pitchtools.IntervalObjectSegment

ChordQualityIndicator.**intervals**
Inherited from pitchtools.IntervalObjectSegment

ChordQualityIndicator.**inversion**

ChordQualityIndicator.**melodic_chromatic_interval_segment**
Inherited from pitchtools.HarmonicDiatonicIntervalSegment

ChordQualityIndicator.**melodic_diatonic_interval_segment**
Inherited from pitchtools.HarmonicDiatonicIntervalSegment

ChordQualityIndicator.**position**

ChordQualityIndicator.**quality_string**

ChordQualityIndicator.**rotation**

ChordQualityIndicator.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

ChordQualityIndicator.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.tuple

ChordQualityIndicator.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

ChordQualityIndicator.**rotate**(*n*)
Inherited from pitchtools.IntervalObjectSegment

Special Methods

ChordQualityIndicator.**__add__**(*arg*)
Inherited from pitchtools.ObjectSegment

ChordQualityIndicator.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

ChordQualityIndicator.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

ChordQualityIndicator.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

ChordQualityIndicator.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

ChordQualityIndicator.**__getslice__**(*start*, *stop*)
Inherited from pitchtools.ObjectSegment

ChordQualityIndicator.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

ChordQualityIndicator.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

ChordQualityIndicator.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

ChordQualityIndicator.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

ChordQualityIndicator.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

ChordQualityIndicator.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

ChordQualityIndicator.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

ChordQualityIndicator.**__ne__**()
x.__ne__(y) <==> x!=y

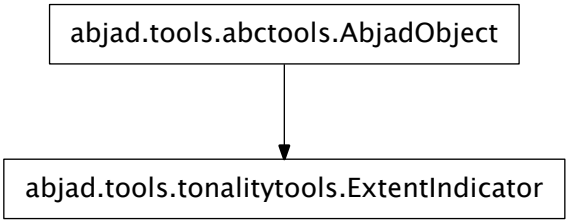
Inherited from __builtin__.tuple

ChordQualityIndicator.**__repr__**()

ChordQualityIndicator.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

ChordQualityIndicator.**__str__**()
Inherited from pitchtools.IntervalObjectSegment

tonalitytools.ExtentIndicator



class tonalitytools.**ExtentIndicator**(*arg*)
New in version 2.0. Indicator of chord extent, such as triad, seventh chord, ninth chord, etc.

Value object that can not be changed after instantiation.

Read-only Properties
ExtentIndicator.**name**
ExtentIndicator.**number**

ExtentIndicator.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ExtentIndicator.**__eq__**(*arg*)
ExtentIndicator.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ExtentIndicator.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ExtentIndicator.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ExtentIndicator.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

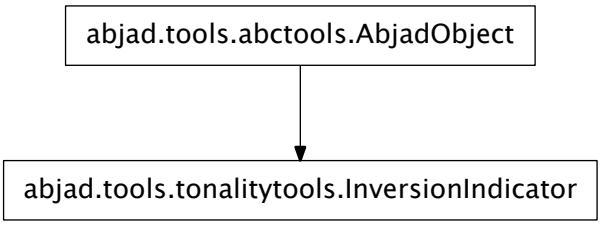
Raise exception.

Inherited from abctools.AbjadObject

ExtentIndicator.**__ne__**(*arg*)

ExtentIndicator.**__repr__**()

tonalitytools.InversionIndicator



class tonalitytools.**InversionIndicator**(*arg=0*)
New in version 2.0. Indicator of the inversion of tertian chords: 5, 63, 64 and also 7, 65, 43, 42, etc. Also root position, first, second, third inversions, etc.

Value object that can not be changed once initialized.

Read-only Properties

`InversionIndicator.`**`name`**

`InversionIndicator.`**`number`**

`InversionIndicator.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

`InversionIndicator.`**`title`**

Methods

`InversionIndicator.`**`extent_to_figured_bass_string`**`(`*extent*`)`

Special Methods

`InversionIndicator.`**`__eq__`**`(`*arg*`)`

`InversionIndicator.`**`__ge__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`InversionIndicator.`**`__gt__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`InversionIndicator.`**`__le__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`InversionIndicator.`**`__lt__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

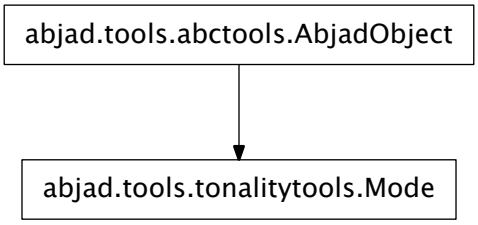
Raise exception.

Inherited from `abctools.AbjadObject`

`InversionIndicator.`**`__ne__`**`(`*arg*`)`

`InversionIndicator.`**`__repr__`**`()`

tonalitytools.Mode



class tonalitytools.**Mode**(*arg*)

New in version 2.0. Diatonic mode. Can be extended for nondiatonic mode.

Modes with different ascending and descending forms not yet implemented.

Read-only Properties

Mode.**melodic_diatonic_interval_segment**

Mode.**mode_name**

Mode.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

Mode.**__eq__**(*arg*)

Mode.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Mode.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Mode.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Mode.**__len__**()

Mode.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

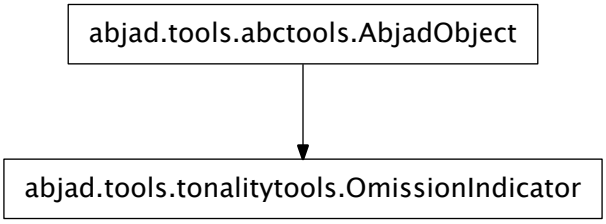
Inherited from abctools.AbjadObject

Mode.__ne__(*arg*)

Mode.__repr__()

Mode.__str__()

tonalitytools.OmissionIndicator



class tonalitytools.**OmissionIndicator**

New in version 2.0. Indicator of missing chord tones.

Value object that can not be chnaged after instantiation.

Read-only Properties

OmissionIndicator.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

OmissionIndicator.__eq__(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

OmissionIndicator.__ge__(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OmissionIndicator.__gt__(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

OmissionIndicator.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OmissionIndicator.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OmissionIndicator.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

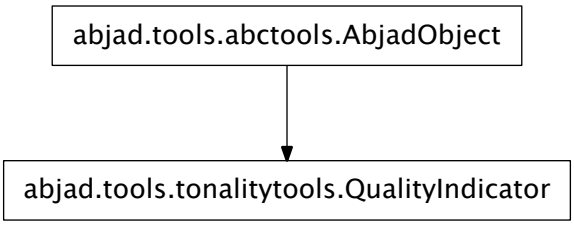
Inherited from abctools.AbjadObject

OmissionIndicator.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

tonalitytools.QualityIndicator



class tonalitytools.**QualityIndicator**(*quality_string*)
New in version 2.0. Indicator of chord quality, such as major, minor, dominant, diminished, etc.

Value object that can not be changed after instantiation.

Read-only Properties

QualityIndicator.**is_uppercase**

QualityIndicator.**quality_string**

QualityIndicator.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

QualityIndicator.**__eq__**(*arg*)

QualityIndicator.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

QualityIndicator.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

QualityIndicator.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

QualityIndicator.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

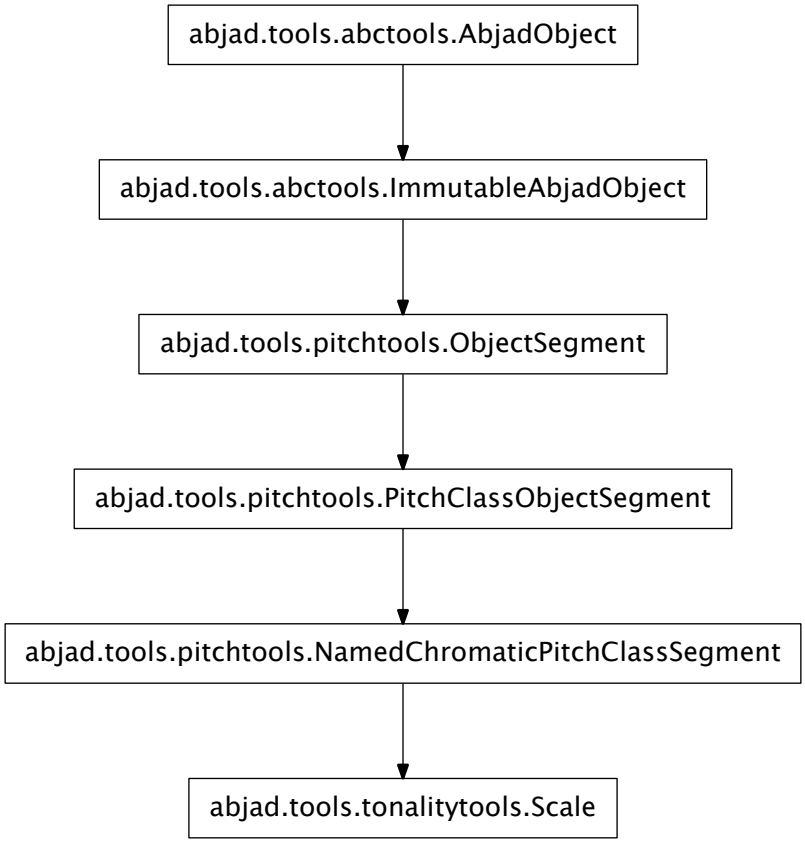
Raise exception.

Inherited from abctools.AbjadObject

QualityIndicator.**__ne__**(*arg*)

QualityIndicator.**__repr__**()

tonalitytools.Scale



class tonalitytools.**Scale**(**args*, ***kwargs*)
New in version 2.0. Abjad model of diatonic scale.

Read-only Properties

Scale.**diatonic_interval_class_segment**

Scale.**dominant**

Scale.**inversion_equivalent_diatonic_interval_class_segment**
Inherited from pitchtools.NamedChromaticPitchClassSegment

Scale.**key_signature**

Scale.**leading_tone**

Scale.**mediant**

Scale.**named_chromatic_pitch_class_set**
Inherited from pitchtools.NamedChromaticPitchClassSegment

Scale.**named_chromatic_pitch_classes**
Inherited from pitchtools.NamedChromaticPitchClassSegment

Scale.**numbered_chromatic_pitch_class_segment**
Inherited from pitchtools.NamedChromaticPitchClassSegment

Scale.**numbered_chromatic_pitch_class_set**
Inherited from pitchtools.NamedChromaticPitchClassSegment

Scale.**numbered_chromatic_pitch_classes**
Inherited from pitchtools.NamedChromaticPitchClassSegment

Scale.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Scale.**subdominant**

Scale.**submediant**

Scale.**superdominant**

Scale.**tonic**

Methods

Scale.**count**(*value*) → integer – return number of occurrences of value
Inherited from __builtin__.tuple

Scale.**create_named_chromatic_pitch_set_in_pitch_range**(*pitch_range*)

Scale.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.
Raises ValueError if the value is not present.

Inherited from __builtin__.tuple

Scale.**is_equivalent_under_transposition**(*arg*)
Inherited from pitchtools.NamedChromaticPitchClassSegment

Scale.**named_chromatic_pitch_class_to_scale_degree**(**args*)

Scale.**retrograde**()
Inherited from pitchtools.NamedChromaticPitchClassSegment

Scale.**rotate**(*n*)
Inherited from pitchtools.NamedChromaticPitchClassSegment

Scale.**scale_degree_to_named_chromatic_pitch_class**(**args*)

Scale.**transpose**(*melodic_diatonic_interval*)
Inherited from pitchtools.NamedChromaticPitchClassSegment

Special Methods

Scale.**__add__**(*arg*)
Inherited from pitchtools.ObjectSegment

Scale.**__contains__**()
x.__contains__(y) <==> y in x

Inherited from __builtin__.tuple

Scale.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.tuple

Scale.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.tuple

Scale.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.tuple

Scale.**__getslice__**(*start*, *stop*)
Inherited from pitchtools.ObjectSegment

Scale.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.tuple

Scale.**__hash__**() <==> *hash(x)*
Inherited from __builtin__.tuple

Scale.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.tuple

Scale.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.tuple

Scale.**__len__**() <==> *len(x)*
Inherited from __builtin__.tuple

Scale.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.tuple

Scale.**__mul__**(*n*)
Inherited from pitchtools.ObjectSegment

Scale.**__ne__**()
x.__ne__(y) <==> x!=y

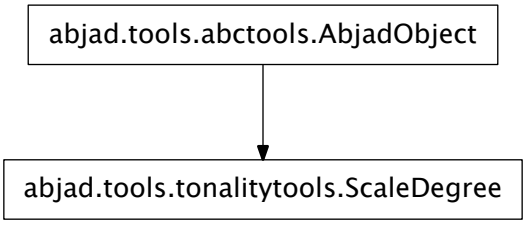
Inherited from __builtin__.tuple

Scale.**__repr__**()

Scale.**__rmul__**(*n*)
Inherited from pitchtools.ObjectSegment

Scale.**__str__**()
Inherited from pitchtools.NamedChromaticPitchClassSegment

tonalitytools.ScaleDegree



class tonalitytools.**ScaleDegree**(**args*)

New in version 2.0. Abjad model of diatonic scale degrees 1, 2, 3, 4, 5, 6, 7 and also chromatic alterations including flat-2, flat-3, flat-6, etc.

Read-only Properties

ScaleDegree.**accidental**

Read-only accidental applied to scale degree.

ScaleDegree.**name**

Read-only name of scale degree.

ScaleDegree.**number**

Read-only number of diatonic scale degree from 1 to 7, inclusive.

ScaleDegree.**roman_numeral_string**

ScaleDegree.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

ScaleDegree.**symbolic_string**

ScaleDegree.**title_string**

Methods

ScaleDegree.**apply_accidental**(*accidental*)

Apply accidental to self and emit new instance.

Special Methods

ScaleDegree.**__eq__**(*arg*)

ScaleDegree.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ScaleDegree.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ScaleDegree.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ScaleDegree.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

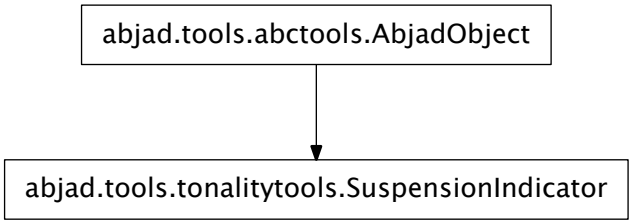
Inherited from abctools.AbjadObject

ScaleDegree.**__ne__**(*arg*)

ScaleDegree.**__repr__**()

ScaleDegree.**__str__**()

tonalitytools.SuspensionIndicator



class tonalitytools.**SuspensionIndicator**(**args*)
New in version 2.0. Indicator of 9-8, 7-6, 4-3, 2-1 and other types of suspension typical of, for example, the Bach chorales.

Value object that can not be changed after instantiation.

Read-only Properties

SuspensionIndicator.**chord_name**
SuspensionIndicator.**figured_bass_pair**

SuspensionIndicator.**figured_bass_string**

SuspensionIndicator.**is_empty**

SuspensionIndicator.**start**

SuspensionIndicator.**stop**

SuspensionIndicator.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

SuspensionIndicator.**title_string**

Special Methods

SuspensionIndicator.**__eq__**(*arg*)
SuspensionIndicator.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SuspensionIndicator.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SuspensionIndicator.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SuspensionIndicator.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

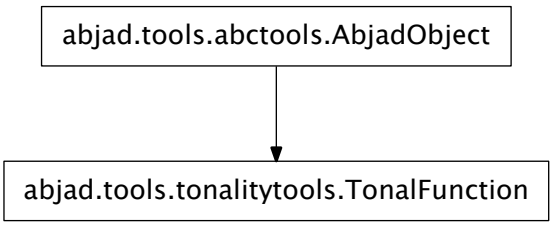
Inherited from abctools.AbjadObject

SuspensionIndicator.**__ne__**(*arg*)

SuspensionIndicator.**__repr__**()

SuspensionIndicator.**__str__**()

tonalitytools.TonalFunction



class tonalitytools.**TonalFunction**(**args*)

New in version 2.0. Abjad model of functions in tonal harmony: I, I6, I64, V, V7, V43, V42, bII, bII6, etc., also i, i6, i64, v, v7, etc.

Value object that can not be changed after instantiation.

Read-only Properties

TonalFunction.**bass_scale_degree**

TonalFunction.**extent**

TonalFunction.**figured_bass_string**

TonalFunction.**inversion**

TonalFunction.**markup**

TonalFunction.**quality**

TonalFunction.**root_scale_degree**

TonalFunction.**scale_degree**

TonalFunction.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

TonalFunction.**suspension**

TonalFunction.**symbolic_string**

Special Methods

TonalFunction.**__eq__**(*arg*)

TonalFunction.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TonalFunction.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

TonalFunction.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TonalFunction.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

TonalFunction.**__ne__**(*arg*)

TonalFunction.**__repr__**()

functions

tonalitytools.analyze_chord

tonalitytools.**analyze_chord**(*expr*)

New in version 2.0. Analyze *expr* and return chord class.

```
>>> from abjad.tools import tonalitytools

>>> chord = Chord([7, 10, 12, 16], (1, 4))
>>> tonalitytools.analyze_chord(chord)
CDominantSeventhInSecondInversion
```

Return none when no tonal chord is understood.

```
>>> chord = Chord(['c', 'cs', 'd'], (1, 4))
>>> tonalitytools.analyze_chord(chord) is None
True
```

Raise tonal harmony error when chord can not analyze.

tonalitytools.analyze_incomplete_chord

tonalitytools.**analyze_incomplete_chord**(*expr*)

New in version 2.0. Analyze *expr* and return chord class based on incomplete pitches.

```
>>> from abjad.tools import tonalitytools

>>> tonalitytools.analyze_incomplete_chord(Chord([7, 11], (1, 4)))
GMajorTriadInRootPosition

>>> tonalitytools.analyze_incomplete_chord(Chord(['fs', 'g', 'b'], (1, 4)))
GMajorSeventhInSecondInversion
```

Return chord class.

tonalitytools.analyze_incomplete_tonal_function

tonalitytools.**analyze_incomplete_tonal_function**(*expr*, *key_signature*)

New in version 2.0. Analyze tonal function of *expr* according to *key_signature*:

```
>>> from abjad.tools import tonalitytools

>>> chord = Chord("<c' e'>4")
>>> key_signature = contexttools.KeySignatureMark('g', 'major')
>>> tonalitytools.analyze_incomplete_tonal_function(chord, key_signature)
IVMajorTriadInRootPosition
```

Return tonal function.

tonalitytools.analyze_tonal_function

tonalitytools.**analyze_tonal_function**(*expr*, *key_signature*)

New in version 2.0. Analyze *expr* and return tonal function according to *key_signature*.

```
>>> from abjad.tools import tonalitytools
```

```
>>> chord = Chord(['ef', 'g', 'bf'], (1, 4))
>>> key_signature = contexttools.KeySignatureMark('c', 'major')
>>> tonalitytools.analyze_tonal_function(chord, key_signature)
FlatIIIMajorTriadInRootPosition
```

Return none when no tonal function is understood.

```
>>> chord = Chord(['c', 'cs', 'd'], (1, 4))
>>> key_signature = contexttools.KeySignatureMark('c', 'major')
>>> tonalitytools.analyze_tonal_function(chord, key_signature) is None
True
```

Return tonal function or none.

tonalitytools.are_scalar_notes

tonalitytools.**are_scalar_notes**(**expr*)

New in version 2.0. True when notes in *expr* are scalar.

```
>>> from abjad.tools import tonalitytools
```

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> tonalitytools.are_scalar_notes(t[:])
True
```

Otherwise false.

```
>>> tonalitytools.are_scalar_notes(Note("c'4"), Note("c'4"))
False
```

Changed in version 2.0: renamed `tonalitytools.are_scalar()` to `tonalitytools.are_scalar_notes()`.

tonalitytools.are_stepwise_ascending_notes

tonalitytools.**are_stepwise_ascending_notes**(**expr*)

New in version 2.0. True when notes in *expr* are stepwise ascneding.

```
>>> from abjad.tools import tonalitytools
```

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> tonalitytools.are_stepwise_ascending_notes(t[:])
True
```

Otherwise false.

```
>>> tonalitytools.are_stepwise_ascending_notes(Note("c'4"), Note("c'4"))
False
```

Changed in version 2.0: renamed `tonalitytools.are_stepwise_ascending()` to `tonalitytools.are_stepwise_ascending_notes()`.

tonalitytools.are_stepwise_descending_notes

tonalitytools.**are_stepwise_descending_notes**(**expr*)

New in version 2.0. True when notes in *expr* are stepwise descending:

```
>>> from abjad.tools import tonalitytools

>>> notes = [Note("c'8"), Note("d'8"), Note("e'8"), Note("f'8")]
>>> t = Staff(list(reversed(notes)))
>>> tonalitytools.are_stepwise_descending_notes(t[:])
True
```

Otherwise false:

```
>>> tonalitytools.are_stepwise_descending_notes(Note("c'4"), Note("c'4"))
False
```

Changed in version 2.0: renamed `tonalitytools.are_stepwise_descending()` to `tonalitytools.are_stepwise_descending_notes()`.

tonalitytools.are_stepwise_notes

tonalitytools.**are_stepwise_notes**(**expr*)

New in version 2.0. True when notes in *expr* are stepwise.

```
>>> from abjad.tools import tonalitytools

>>> t = Staff("c'8 d'8 e'8 f'8")
>>> tonalitytools.are_stepwise_notes(t[:])
True
```

Otherwise false.

```
>>> tonalitytools.are_stepwise_notes(Note("c'4"), Note("c'4"))
False
```

Changed in version 2.0: renamed `tonalitytools.are_stepwise()` to `tonalitytools.are_stepwise_notes()`.

tonalitytools.chord_class_cardinality_to_extent

tonalitytools.**chord_class_cardinality_to_extent**(*cardinality*)

..versionadded:: 2.0

Change integer chord class *cardinality* to integer chord class extent:

```
>>> from abjad.tools import tonalitytools

>>> tonalitytools.chord_class_cardinality_to_extent(4)
7
```

The function above indicates that a tertian chord with 4 unique pitches qualifies as a seventh chord.

tonalitytools.chord_class_extent_to_cardinality

tonalitytools.**chord_class_extent_to_cardinality**(*extent*)
..versionadded:: 2.0

Change integer chord class *extent* to integer chord class cardinality:

```
>>> from abjad.tools import tonalitytools

>>> tonalitytools.chord_class_extent_to_cardinality(7)
4
```

The call above shows that a seventh chord comprises 4 unique pitch-classes.

tonalitytools.chord_class_extent_to_extent_name

tonalitytools.**chord_class_extent_to_extent_name**(*extent*)
New in version 2.0. Change integer chord class *extent* to extent name.

```
>>> from abjad.tools import tonalitytools

>>> tonalitytools.chord_class_extent_to_extent_name(7)
'seventh'
```

The call above shows that a tertian chord subtending 7 staff spaces qualifies as a seventh chord.

tonalitytools.diatonic_interval_class_segment_to_chord_quality_string

tonalitytools.**diatonic_interval_class_segment_to_chord_quality_string**(*dic_seg*)
New in version 2.0. Change diatonic interval-class segment *dic_seg* to chord quality string:

```
>>> from abjad.tools import tonalitytools

>>> dic_seg = pitchtools.InversionEquivalentDiatonicIntervalClassSegment([
...   pitchtools.InversionEquivalentDiatonicIntervalClass('major', 3),
...   pitchtools.InversionEquivalentDiatonicIntervalClass('minor', 3),])
>>> tonalitytools.diatonic_interval_class_segment_to_chord_quality_string(dic_seg)
'major'
```

Todo

Implement `diatonic_interval_class_set_to_chord_quality_string()`.

---

tonalitytools.is_neighbor_note

tonalitytools.**is_neighbor_note**(*note*)
New in version 2.0. True when *note* is preceeded by a stepwise interval in one direction and followed by a stepwise interval in the other direction. Otherwise false.

```
>>> from abjad.tools import tonalitytools
```

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> for note in t:
...     print '%s\t%s' % (note, tonalitytools.is_neighbor_note(note))
...
c'8     False
d'8     False
e'8     False
f'8     False
```

Return boolean.

tonalitytools.is_passing_tone

tonalitytools.**is_passing_tone**(*note*)

New in version 2.0. True when *note* is both preceeded and followed by scalewise sibling notes. Otherwise false.

```
>>> from abjad.tools import tonalitytools
```

```
>>> t = Staff("c'8 d'8 e'8 f'8")
>>> for note in t:
...     print '%s\t%s' % (note, tonalitytools.is_passing_tone(note))
...
c'8     False
d'8     True
e'8     True
f'8     False
```

Return boolean.

tonalitytools.is_unlikely_melodic_diatonic_interval_in_chorale

tonalitytools.**is_unlikely_melodic_diatonic_interval_in_chorale**(*mdi*)

New in version 2.0. True when *mdi* is unlikely melodic diatonic interval in JSB chorale.

```
>>> from abjad.tools import tonalitytools
```

```
>>> mdi = pitchtools.MelodicDiatonicInterval('major', 7)
>>> tonalitytools.is_unlikely_melodic_diatonic_interval_in_chorale(mdi)
True
```

Otherwise False.

```
>>> mdi = pitchtools.MelodicDiatonicInterval('major', 2)
>>> tonalitytools.is_unlikely_melodic_diatonic_interval_in_chorale(mdi)
False
```

Return boolean.

tonalitytools.make_all_notes_in_ascending_and_descending_diatonic_scale

tonalitytools.**make_all_notes_in_ascending_and_descending_diatonic_scale**(*key_signature=None*)

New in version 2.0. Construct one up-down period of scale according to *key_signature*:

```
>>> from abjad.tools import tonalitytools
```

```
>>> score = tonalitytools.make_all_notes_in_ascending_and_descending_diatonic_scale(
... contexttools.KeySignatureMark('E', 'major'))

>>> f(score)
\new Score \with {
    tempoWholesPerMinute = #(ly:make-moment 30 1)
} <<
    \new Staff {
        \key e \major
        e'8
        fs'8
        gs'8
        a'8
        b'8
        cs''8
        ds''8
        e''8
        ds''8
        cs''8
        b'8
        a'8
        gs'8
        fs'8
        e'4
    }
>>
```

Changed in version 2.0: renamed `construct.scale_period()` to `tonalitytools.make_all_notes_in_ascending_and_descending_diatonic_scale()`.

tonalitytools.make_first_n_notes_in_ascending_diatonic_scale

tonalitytools.**make_first_n_notes_in_ascending_diatonic_scale**(*count*, *written_duration=Duration(1, 8)*, *key_signature=None*)

Construct *count* notes with *written_duration* according to *key_signature*:

```
>>> from abjad.tools import tonalitytools

>>> tonalitytools.make_first_n_notes_in_ascending_diatonic_scale(4)
[Note("c'8"), Note("d'8"), Note("e'8"), Note("f'8")]
```

Allow nonassignable *written_duration*:

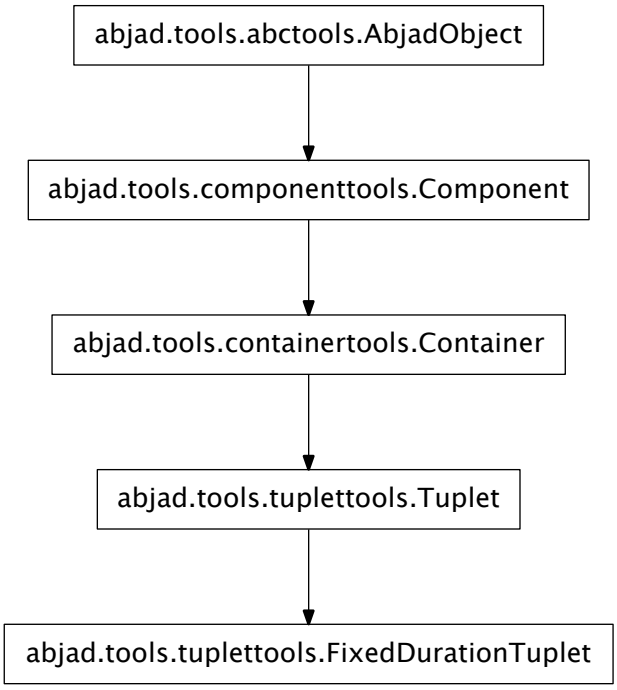
```
>>> staff = Staff(tonalitytools.make_first_n_notes_in_ascending_diatonic_scale(2, (5, 16)))
>>> f(staff)
\new Staff {
    c'4 ~
    c'16
    d'4 ~
    d'16
}
```

New in version 2.0: Optional *key_signature* keyword parameter.Changed in version 2.0: renamed `leaftools.make_first_n_notes_in_ascending_diatonic_scale()` to `tonalitytools.make_first_n_notes_in_ascending_diatonic_scale()`.

tuplettools

concrete classes

tuplettools.FixedDurationTuplet



class tuplettools.**FixedDurationTuplet**(*duration*, *music=None*, ***kwargs*)

Abjad tuplet of fixed duration and variable multiplier:

```
>>> tuplettools.FixedDurationTuplet(Fraction(2, 8), "c'8 d'8 e'8")
FixedDurationTuplet(1/4, [c'8, d'8, e'8])
```

Return fixed-duration tuplet.

Read-only Properties

FixedDurationTuplet.**contents_duration**

Inherited from containertools.Container

FixedDurationTuplet.**duration_in_seconds**

Inherited from containertools.Container

FixedDurationTuplet.**is_augmentation**

True when multiplier is greater than 1. Otherwise false:

```
>>> t = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> t.is_augmentation
False
```

Return boolean.

Inherited from `tuplettools.Tuplet`

`FixedDurationTuplet.`**`is_binary`**

Read-only boolean true when multiplier numerator is power of two. Otherwise false:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")
>>> tuplet.is_binary
True
```

Return boolean.

Inherited from `tuplettools.Tuplet`

`FixedDurationTuplet.`**`is_diminution`**

True when multiplier is less than 1. Otherwise false:

```
>>> t = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> t.is_diminution
True
```

Return boolean.

Inherited from `tuplettools.Tuplet`

`FixedDurationTuplet.`**`is_nonbinary`**

Read-only boolean true when multiplier numerator is not power of two. Otherwise false:

```
>>> tuplet = Tuplet((3, 5), "c'8 d'8 e'8 f'8 g'8")
>>> tuplet.is_nonbinary
True
```

Return boolean.

Inherited from `tuplettools.Tuplet`

`FixedDurationTuplet.`**`is_trivial`**

True when tuplet multiplier is one. Otherwise false:

```
>>> tuplet = Tuplet((1, 1), "c'8 d'8 e'8")
>>> tuplet.is_trivial
True
```

Return boolean.

Inherited from `tuplettools.Tuplet`

`FixedDurationTuplet.`**`leaves`**

Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from `containertools.Container`

FixedDurationTuplet.**lilypond_format**
Inherited from tuplettools.Tuplet

FixedDurationTuplet.**multiplied_duration**
Read-only multiplied duration of tuplet:

```
>>> tuplet = tuplettools.FixedDurationTuplet((1, 4), "c'8 d'8 e'8")
>>> tuplet.multiplied_duration
Duration(1, 4)
```

Return duration.

FixedDurationTuplet.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

FixedDurationTuplet.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

FixedDurationTuplet.**parent**
Inherited from componenttools.Component

FixedDurationTuplet.**preprolated_duration**
Duration prior to prolation:

```
>>> t = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> t.preprolated_duration
Duration(1, 4)
```

Return duration.

Inherited from tuplettools.Tuplet

FixedDurationTuplet.**prolated_duration**
Inherited from componenttools.Component

FixedDurationTuplet.**prolation**
Inherited from componenttools.Component

FixedDurationTuplet.**ratio_string**
Read-only tuplet multiplier formatted with colon as ratio:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")
>>> tuplet.ratio_string
'3:2'
```

Return string.

Inherited from tuplettools.Tuplet

FixedDurationTuplet.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

FixedDurationTuplet.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

FixedDurationTuplet.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

FixedDurationTuplet.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

FixedDurationTuplet.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

FixedDurationTuplet.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

FixedDurationTuplet.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

FixedDurationTuplet.**force_fraction**
Read / write boolean to force n:m fraction in LilyPond format:

```
>>> tuplet = Tuplet(Fraction(2, 3), "c'8 d'8 e'8")

>>> tuplet.force_fraction is None
True

>>> f(tuplet)
\times 2/3 {
    c'8
    d'8
    e'8
}

>>> tuplet.force_fraction = True

>>> f(tuplet)
\fraction \times 2/3 {
    c'8
    d'8
    e'8
}
```

Return boolean or none.

Inherited from tuplettools.Tuplet

FixedDurationTuplet.**is_invisible**
Read / write boolean to render as LilyPond \scaledDurations construct instead of tuplet:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")

>>> f(tuplet)
\times 2/3 {
    c'8
    d'8
    e'8
}

>>> tuplet.is_invisible = True

\scaleDurations #'(2 . 3) {
    c'8
    d'8
    e'8
}
```

This has the effect of rendering no no tuplet bracket and no tuplet number while preserving the rhythmic value of the tuplet and the contents of the tuplet.

Return boolean or none.

Inherited from `tuplettools.Tuplet`

`FixedDurationTuplet.`**`is_parallel`**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
```

```
        }
    >>
```

Return none.

Inherited from containertools.Container

FixedDurationTuplet.**multiplier**

Read-only multiplier of tuplet:

```
>>> tuplet = tuplettools.FixedDurationTuplet((1, 4), "c'8 d'8 e'8")
>>> tuplet.multiplier
Fraction(2, 3)
```

Return fraction.

FixedDurationTuplet.**preferred_denominator**

New in version 2.0. Integer denominator in terms of which tuplet fraction should format:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")
>>> tuplet.preferred_denominator = 4

>>> f(tuplet)
\times 4/6 {
    c'8
    d'8
    e'8
}
```

Return positive integer or none.

Inherited from tuplettools.Tuplet

FixedDurationTuplet.**target_duration**

Read / write target duration of fixed-duration tuplet:

```
>>> tuplet = tuplettools.FixedDurationTuplet((1, 4), "c'8 d'8 e'8")
>>> tuplet.target_duration
Duration(1, 4)

>>> f(tuplet)
\times 2/3 {
    c'8
    d'8
    e'8
}

>>> tuplet.target_duration = Duration(5, 8)
>>> f(tuplet)
\fraction \times 5/3 {
    c'8
    d'8
    e'8
}
```

Return duration.

Methods

FixedDurationTuplet.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

FixedDurationTuplet.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: expr may now be a LilyPond input string. Inherited from containertools.Container

FixedDurationTuplet.**index**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")
```

```
>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from containertools.Container

FixedDurationTuplet.**insert**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from containertools.Container

FixedDurationTuplet.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

FixedDurationTuplet.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

FixedDurationTuplet.**trim**(*start*, *stop='unused'*)

Trim fixed-duration tuplet elements from *start* to *stop*:

```
>>> tuplet = tuplettools.FixedDurationTuplet(Fraction(2, 8), "c'8 d'8 e'8")
>>> tuplet
FixedDurationTuplet(1/4, [c'8, d'8, e'8])

>>> tuplet.trim(2)
>>> tuplet
FixedDurationTuplet(1/6, [c'8, d'8])
```

Preserve fixed-duration tuplet multiplier.

Adjust fixed-duration tuplet duration.

Return none.

Special Methods

FixedDurationTuplet.**__add__**(*arg*)

Add two tuplets of same type and with same multiplier.

Inherited from tuplettools.Tuplet

FixedDurationTuplet.**__contains__**(*expr*)

True if expr is in container, otherwise False.

Inherited from containertools.Container

FixedDurationTuplet.**__delitem__**(*i*)

Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

FixedDurationTuplet.__**eq**__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

FixedDurationTuplet.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

FixedDurationTuplet.__**getitem**__(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

FixedDurationTuplet.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

FixedDurationTuplet.__**iadd**__(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

FixedDurationTuplet.__**imul**__(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

FixedDurationTuplet.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

FixedDurationTuplet.__**len**__()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

FixedDurationTuplet.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

FixedDurationTuplet.__**mul**__(*n*)
Inherited from componenttools.Component

FixedDurationTuplet.__**ne**__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

FixedDurationTuplet.**__radd__**(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

FixedDurationTuplet.**__repr__**()

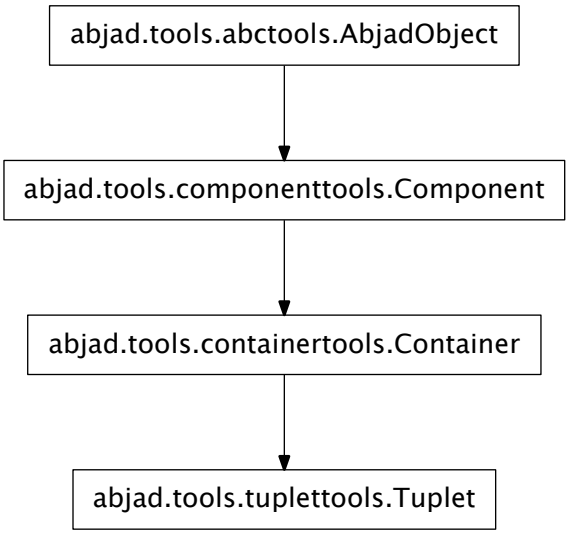
FixedDurationTuplet.**__rmul__**(*n*)
Inherited from componenttools.Component

FixedDurationTuplet.**__setitem__**(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

FixedDurationTuplet.**__str__**()

tuplettools.Tuplet



class tuplettools.**Tuplet**(*multiplier*, *music=None*, ***kwargs*)
Abjad model of a tuplet:

```
>>> tuplet = Tuplet(Fraction(2, 3), "c'8 d'8 e'8")
>>> f(tuplet)
\times 2/3 {
    c'8
    d'8
    e'8
}
```

Return tuplet object.

Read-only Properties

Tuplet.**contents_duration**

Inherited from containertools.Container

Tuplet.**duration_in_seconds**

Inherited from containertools.Container

Tuplet.**is_augmentation**

True when multiplier is greater than 1. Otherwise false:

```
>>> t = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> t.is_augmentation
False
```

Return boolean.

Tuplet.**is_binary**

Read-only boolean true when multiplier numerator is power of two. Otherwise false:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")
>>> tuplet.is_binary
True
```

Return boolean.

Tuplet.**is_diminution**

True when multiplier is less than 1. Otherwise false:

```
>>> t = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> t.is_diminution
True
```

Return boolean.

Tuplet.**is_nonbinary**

Read-only boolean true when multiplier numerator is not power of two. Otherwise false:

```
>>> tuplet = Tuplet((3, 5), "c'8 d'8 e'8 f'8 g'8")
>>> tuplet.is_nonbinary
True
```

Return boolean.

Tuplet.**is_trivial**

True when tuplet multiplier is one. Otherwise false:

```
>>> tuplet = Tuplet((1, 1), "c'8 d'8 e'8")
>>> tuplet.is_trivial
True
```

Return boolean.

Tuplet.**leaves**

Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

Tuplet.**lilypond_format**

Tuplet.**multiplied_duration**
Read-only multiplied duration of tuplet:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")
>>> tuplet.multiplied_duration
Duration(1, 4)
```

Return duration.

Tuplet.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

Tuplet.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Tuplet.**parent**
Inherited from componenttools.Component

Tuplet.**preprolated_duration**
Duration prior to prolation:

```
>>> t = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> t.preprolated_duration
Duration(1, 4)
```

Return duration.

Tuplet.**prolated_duration**
Inherited from componenttools.Component

Tuplet.**prolation**
Inherited from componenttools.Component

Tuplet.**ratio_string**
Read-only tuplet multiplier formatted with colon as ratio:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")
>>> tuplet.ratio_string
'3:2'
```

Return string.

Tuplet.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Tuplet.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Tuplet.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Tuplet.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Tuplet.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Tuplet.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Tuplet.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Tuplet.**force_fraction**
Read / write boolean to force n:m fraction in LilyPond format:

```
>>> tuplet = Tuplet(Fraction(2, 3), "c'8 d'8 e'8")

>>> tuplet.force_fraction is None
True

>>> f(tuplet)
\times 2/3 {
    c'8
    d'8
    e'8
}

>>> tuplet.force_fraction = True

>>> f(tuplet)
\fraction \times 2/3 {
    c'8
    d'8
    e'8
}
```

Return boolean or none.

Tuplet.**is_invisible**
Read / write boolean to render as LilyPond \scaledDurations construct instead of tuplet:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")

>>> f(tuplet)
\times 2/3 {
    c'8
```

```
        d'8
        e'8
    }
```

```
    >>> tuplet.is_invisible = True
```

```
    \scaleDurations #'(2 . 3) {
        c'8
        d'8
        e'8
    }
```

This has the effect of rendering no no tuplet bracket and no tuplet number while preserving the rhythmic value of the tuplet and the contents of the tuplet.

Return boolean or none.

Tuplet.**is_parallel**

Get parallel container:

```
    >>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])
```

```
    >>> f(container)
    {
        \new Voice {
            c'8
            d'8
            e'8
        }
        \new Voice {
            g4.
        }
    }
```

```
    >>> container.is_parallel
    False
```

Return boolean.

Set parallel container:

```
    >>> container.is_parallel = True
```

```
    >>> f(container)
    <<
        \new Voice {
            c'8
            d'8
            e'8
        }
        \new Voice {
            g4.
        }
    >>
```

Return none.

Inherited from containertools.Container

Tuplet.**multiplier**

Read / write tuplet multiplier:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")
>>> tuplet.multiplier
Fraction(2, 3)
```

Return fraction.

`Tuplet.`**`preferred_denominator`**

New in version 2.0. Integer denominator in terms of which tuplet fraction should format:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")
>>> tuplet.preferred_denominator = 4

>>> f(tuplet)
\times 4/6 {
    c'8
    d'8
    e'8
}
```

Return positive integer or none.

Methods

`Tuplet.`**`append`**`(`*component*`)`

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from `containertools.Container`

`Tuplet.`**`extend`**`(`*expr*`)`

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
```

```
    e'8 ]
}

>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: `expr` may now be a LilyPond input string. Inherited from `containertools.Container`

`Tuplet.`**`index`**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from `containertools.Container`

`Tuplet.`**`insert`**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.insert(1, Note("cs'8"))

>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from `containertools.Container`

Tuplet.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

Tuplet.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

Tuplet.**__add__**(*arg*)

Add two tuplets of same type and with same multiplier.

Tuplet.**__contains__**(*expr*)
True if expr is in container, otherwise False.

Inherited from containertools.Container

Tuplet.**__delitem__**(*i*)
Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

Tuplet.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Tuplet.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Tuplet.**__getitem__**(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

Tuplet.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Tuplet.**__iadd__**(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

Tuplet.**__imul__**(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

Tuplet.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Tuplet.**__len__**()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

Tuplet.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Tuplet.**__mul__**(*n*)
Inherited from componenttools.Component

Tuplet.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Tuplet.**__radd__**(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

Tuplet.**__repr__**()

Tuplet.**__rmul__**(*n*)
Inherited from componenttools.Component

Tuplet.**__setitem__**(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

Tuplet.**__str__**()

functions

tuplettools.all_are_tuplets

tuplettools.**all_are_tuplets**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad tuplets:

```
>>> tuplet = Tuplet((2, 3), "c'8 d'8 e'8")

>>> tuplettools.all_are_tuplets([tuplet])
True
```

True when *expr* is an empty sequence:

```
>>> tuplettools.all_are_tuplets([])
True
```

Otherwise false:

```
>>> tuplettools.all_are_tuplets('foo')
False
```

Return boolean.

Function wraps componenttools.all_are_components().

tuplettools.change_augmented_tuplets_in_expr_to_diminished

tuplettools.**change_augmented_tuplets_in_expr_to_diminished**(*tuplet*)
New in version 2.0. Multiply the written duration of the leaves in *tuplet* by the least power of 2 necessary to diminshed *tuplet*.

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 4), "c'8 d'8 e'8")
>>> tuplet
FixedDurationTuplet(1/2, [c'8, d'8, e'8])
>>> tuplettools.change_augmented_tuplets_in_expr_to_diminished(tuplet)
FixedDurationTuplet(1/2, [c'4, d'4, e'4])
```

Todo

make work with nested tuplets.

Changed in version 2.0: renamed `tuplettools.augmentation_to_diminution()` to `tuplettools.change_augmented_tuplets_in_expr_to_diminished()`.

tuplettools.change_diminished_tuplets_in_expr_to_augmented

`tuplettools.`**`change_diminished_tuplets_in_expr_to_augmented`**(*tuplet*)

New in version 2.0. Divide the written duration of the leaves in *tuplet* by the least power of 2 necessary to augment *tuplet*.

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> tuplet
FixedDurationTuplet(1/4, [c'8, d'8, e'8])
>>> tuplettools.change_diminished_tuplets_in_expr_to_augmented(tuplet)
FixedDurationTuplet(1/4, [c'16, d'16, e'16])
```

Todo

make work with nested tuplets.

Changed in version 2.0: renamed `tuplettools.diminution_to_augmentation()` to `tuplettools.change_diminished_tuplets_in_expr_to_augmented()`.

tuplettools.change_fixed_duration_tuplets_in_expr_to_tuplets

`tuplettools.`**`change_fixed_duration_tuplets_in_expr_to_tuplets`**(*expr*)

New in version 2.9. Change fixed-duration tuplets in *expr* to tuplets:

```
>>> staff = Staff(2 * tuplettools.FixedDurationTuplet((2, 8), "c'8 d'8 e'8"))

>>> staff[:]
[FixedDurationTuplet(1/4, [c'8, d'8, e'8]), FixedDurationTuplet(1/4, [c'8, d'8, e'8])]

>>> tuplettools.change_fixed_duration_tuplets_in_expr_to_tuplets(staff)
[Tuplet(2/3, [c'8, d'8, e'8]), Tuplet(2/3, [c'8, d'8, e'8])]

>>> staff[:]
[Tuplet(2/3, [c'8, d'8, e'8]), Tuplet(2/3, [c'8, d'8, e'8])]
```

Return tuplets.

tuplettools.change_tuplets_in_expr_to_fixed_duration_tuplets

tuplettools.**change_tuplets_in_expr_to_fixed_duration_tuplets**(*expr*)

New in version 2.9. Change tuplets in *expr* to fixed-duration tuplets:

```
>>> staff = Staff(r"\times 2/3 { c'8 d'8 e'8 } \times 2/3 { c'8 d'8 e'8 }")

>>> staff[:]
[Tuplet(2/3, [c'8, d'8, e'8]), Tuplet(2/3, [c'8, d'8, e'8])]

>>> tuplettools.change_tuplets_in_expr_to_fixed_duration_tuplets(staff)
[FixedDurationTuplet(1/4, [c'8, d'8, e'8]), FixedDurationTuplet(1/4, [c'8, d'8, e'8])]

>>> staff[:]
[FixedDurationTuplet(1/4, [c'8, d'8, e'8]), FixedDurationTuplet(1/4, [c'8, d'8, e'8])]
```

Return tuplets.

tuplettools.fix_contents_of_tuplets_in_expr

tuplettools.**fix_contents_of_tuplets_in_expr**(*tuplet*)

Scale *tuplet* contents by power of two if tuplet multiplier less than 1/2 or greater than 2. Return tuplet.

```
>>> tuplet = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'4 d'4 e'4")
>>> tuplet
FixedDurationTuplet(1/4, [c'4, d'4, e'4])
>>> tuplettools.fix_contents_of_tuplets_in_expr(tuplet)
FixedDurationTuplet(1/4, [c'8, d'8, e'8])
```

Changed in version 2.0: renamed `tuplettools.contents_fix()` to `tuplettools.fix_contents_of_tuplets_in_expr()`.

tuplettools.fuse_tuplets

tuplettools.**fuse_tuplets**(*tuplets*)

Fuse parent-contiguous *tuplets*:

```
>>> t1 = tuplettools.FixedDurationTuplet(Duration(2, 8), "c'8 d'8 e'8")
>>> beamtools.BeamSpanner(t1[:])
BeamSpanner(c'8, d'8, e'8)
>>> t2 = tuplettools.FixedDurationTuplet(Duration(2, 16), "c'16 d'16 e'16")
>>> spannertools.SlurSpanner(t2[:])
SlurSpanner(c'16, d'16, e'16)
>>> staff = Staff([t1, t2])
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8 [
        d'8
        e'8 ]
    }
    \times 2/3 {
        c'16 (
        d'16
        e'16 )
```

```
        }
    }
```

```
>>> tuplettools.fuse_tuplets(staff[:])
FixedDurationTuplet(3/8, [c'8, d'8, e'8, c'16, d'16, e'16])
```

```
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8 [
        d'8
        e'8 ]
        c'16 (
        d'16
        e'16 )
    }
}
```

Return new tuplet.

Fuse zero or more parent-contiguous *tuplets*.

Allow in-score *tuplets*.

Allow outside-of-score *tuplets*.

All *tuplets* must carry the same multiplier.

All *tuplets* must be of the same type. Changed in version 2.0: renamed `fuse.tuplets_by_reference()` to `tuplettools.fuse_tuplets()`.

tuplettools.get_first_tuplet_in_improper_parentage_of_component

tuplettools.**get_first_tuplet_in_improper_parentage_of_component**(*component*)

New in version 2.0. Get first tuplet in improper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> Tuplet(Fraction(2, 3), staff[:3])
Tuplet(2/3, [c'8, d'8, e'8])
```

```
>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8
        d'8
        e'8
    }
    f'8
}
```

```
>>> tuplettools.get_first_tuplet_in_improper_parentage_of_component(staff.leaves[1])
Tuplet(2/3, [c'8, d'8, e'8])
```

Return tuplet or none.

tuplettools.get_first_tuplet_in_proper_parentage_of_component

tuplettools.**get_first_tuplet_in_proper_parentage_of_component**(*component*)

New in version 2.0. Get first tuplet in proper parentage of *component*:

```
>>> staff = Staff("c'8 d'8 e'8 f'8")
>>> Tuplet(Fraction(2, 3), staff[:3])
Tuplet(2/3, [c'8, d'8, e'8])

>>> f(staff)
\new Staff {
    \times 2/3 {
        c'8
        d'8
        e'8
    }
    f'8
}

>>> tuplettools.get_first_tuplet_in_proper_parentage_of_component(staff.leaves[1])
Tuplet(2/3, [c'8, d'8, e'8])
```

Return tuplet or none.

tuplettools.leaf_to_tuplet_with_n_notes_of_equal_written_duration

tuplettools.**leaf_to_tuplet_with_n_notes_of_equal_written_duration**(*leaf*, *n*, *diminution=True*)

Change *leaf* to tuplet *n* notes of equal written duration.

Example 1. Change leaf to augmented tuplet:

```
>>> for n in range(1, 11):
...     note = Note(0, (3, 16))
...     tuplet = tuplettools.leaf_to_tuplet_with_n_notes_of_equal_written_duration(
...         note, n, diminution=False)
...     print tuplet
...
{@ 1:1 c'8. @}
{@ 1:1 c'16., c'16. @}
{@ 1:1 c'16, c'16, c'16 @}
{@ 1:1 c'32., c'32., c'32., c'32. @}
{@ 5:8 c'64., c'64., c'64., c'64., c'64. @}
{@ 1:1 c'32, c'32, c'32, c'32, c'32, c'32 @}
{@ 7:8 c'64., c'64., c'64., c'64., c'64., c'64., c'64. @}
{@ 1:1 c'64., c'64., c'64., c'64., c'64., c'64., c'64., c'64. @}
{@ 3:4 c'64, c'64, c'64, c'64, c'64, c'64, c'64, c'64, c'64 @}
{@ 5:8 c'128., c'128., c'128., c'128., c'128., c'128., c'128., c'128., c'128., c'128. @}
```

Example 2. Change to leaf diminished tuplet:

```
>>> for n in range(1, 11):
...     note = Note(0, (3, 16))
...     tuplet = tuplettools.leaf_to_tuplet_with_n_notes_of_equal_written_duration(
...         note, n, diminution=True)
...     print tuplet
...
```

```
{@ 1:1 c'8. @}
{@ 1:1 c'16., c'16. @}
{@ 1:1 c'16, c'16, c'16 @}
{@ 1:1 c'32., c'32., c'32., c'32. @}
{@ 5:4 c'32., c'32., c'32., c'32., c'32. @}
{@ 1:1 c'32, c'32, c'32, c'32, c'32, c'32 @}
{@ 7:4 c'32., c'32., c'32., c'32., c'32., c'32., c'32. @}
{@ 1:1 c'64., c'64., c'64., c'64., c'64., c'64., c'64., c'64. @}
{@ 3:2 c'32, c'32, c'32, c'32, c'32, c'32, c'32, c'32, c'32 @}
{@ 5:4 c'64., c'64., c'64., c'64., c'64., c'64., c'64., c'64., c'64., c'64. @}
```

Return fixed-duration tuplet.

tuplettools.leaf_to_tuplet_with_proportions

tuplettools.**leaf_to_tuplet_with_proportions**(*leaf*, *proportions*, *diminution=True*)

Change *leaf* to tuplet with *proportions*.

Example 1. Change *leaf* to augmented tuplet with *proportions*:

```
>>> note = Note(0, (3, 16))

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1], diminution=False)
{@ 1:1 c'8. @}

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1, 2], diminution=False)
{@ 1:1 c'16, c'8 @}

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1, 2, 2], diminution=False)
{@ 5:8 c'64., c'32., c'32. @}

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1, 2, 2, 3], diminution=False)
{@ 2:3 c'64, c'32, c'32, c'32. @}

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1, 2, 2, 3, 3], diminution=False)
{@ 11:12 c'64, c'32, c'32, c'32., c'32. @}

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1, 2, 2, 3, 3, 4], diminution=False)
{@ 5:8 c'128, c'64, c'64, c'64., c'64., c'32 @}
```

Example 2. Change *leaf* to diminished tuplet:

```
>>> note = Note(0, (3, 16))

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1], diminution=True)
{@ 1:1 c'8. @}

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1, 2], diminution=True)
{@ 1:1 c'16, c'8 @}
```

```
>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1, 2, 2], diminution=True)
{@ 5:4 c'32., c'16., c'16. @}

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1, 2, 2, 3], diminution=True)
{@ 4:3 c'32, c'16, c'16, c'16. @}

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1, 2, 2, 3, 3], diminution=True)
{@ 11:6 c'32, c'16, c'16, c'16., c'16. @}

>>> print tuplettools.leaf_to_tuplet_with_proportions(
...     note, [1, 2, 2, 3, 3, 4], diminution=True)
{@ 5:4 c'64, c'32, c'32, c'32., c'32., c'16 @}
```

Return fixed-duration tuplet.

tuplettools.make_tuplet_from_duration_and_proportions

tuplettools.**make_tuplet_from_duration_and_proportions**(*duration*, *proportions*, *avoid_dots=True*, *big_endian=True*, *is_diminution=True*)

New in version 2.10. Make tuplet from *duration* and *proportions*.

Example set 1. Make augmented tuplet from *duration* and *proportions* and avoid dots.

Return tupletted leaves strictly without dots when all *proportions* equal `1`:

```
>>> print tuplettools.make_tuplet_from_duration_and_proportions(
... Fraction(3, 16), [1, 1, 1, -1, -1], avoid_dots=True, is_diminution=False)
{@ 5:6 c'32, c'32, c'32, r32, r32 @}
```

Allow tupletted leaves to return with dots when some *proportions* do not equal `1`:

```
>>> print tuplettools.make_tuplet_from_duration_and_proportions(
... Fraction(3, 16), [1, -2, -2, 3, 3], avoid_dots=True, is_diminution=False)
{@ 11:12 c'64, r32, r32, c'32., c'32. @}
```

Interpret nonassignable *proportions* according to *big_endian*:

```
>>> print tuplettools.make_tuplet_from_duration_and_proportions(
... Fraction(3, 16), [5, -1, 5], avoid_dots=True, big_endian=False, is_diminution=False)
{@ 11:12 c'64, c'16, r64, c'64, c'16 @}
```

Example set 2. Make augmented tuplet from *duration* and *proportions* and encourage dots:

```
>>> tuplettools.make_tuplet_from_duration_and_proportions(
... Fraction(3, 16), [1, 1, 1, -1, -1], avoid_dots=False, is_diminution=False)
FixedDurationTuplet(3/16, [c'64., c'64., c'64., r64., r64.])
```

Interpret nonassignable *proportions* according to *big_endian*:

```
>>> tuplettools.make_tuplet_from_duration_and_proportions(
... Fraction(3, 16), [5, -1, 5], avoid_dots=False, big_endian=False, is_diminution=False)
FixedDurationTuplet(3/16, [c'32..., r128., c'32...])
```

Example set 3. Make diminished tuplet from *duration* and nonzero integer *proportions*.

Return tupletted leaves strictly without dots when all *proportions* equal `1`:

```
>>> print tuplettools.make_tuplet_from_duration_and_proportions(
... Fraction(3, 16), [1, 1, 1, -1, -1], avoid_dots=True, is_diminution=True)
{@ 5:3 c'16, c'16, c'16, r16, r16 @}
```

Allow tupletted leaves to return with dots when some *proportions* do not equal `1`:

```
>>> print tuplettools.make_tuplet_from_duration_and_proportions(
... Fraction(3, 16), [1, -2, -2, 3, 3], avoid_dots=True, is_diminution=True)
{@ 11:6 c'32, r16, r16, c'16., c'16. @}
```

Interpret nonassignable *proportions* according to *big_endian*:

```
>>> print tuplettools.make_tuplet_from_duration_and_proportions(
... Fraction(3, 16), [5, -1, 5], avoid_dots=True, big_endian=False, is_diminution=True)
{@ 11:6 c'32, c'8, r32, c'32, c'8 @}
```

Example set 4. Make diminished tuplet from *duration* and *proportions* and encourage dots:

```
>>> tuplettools.make_tuplet_from_duration_and_proportions(
... Fraction(3, 16), [1, 1, 1, -1, -1], avoid_dots=False, is_diminution=True)
FixedDurationTuplet(3/16, [c'32., c'32., c'32., r32., r32.])
```

Interpret nonassignable *proportions* according to *direction*:

```
>>> tuplettools.make_tuplet_from_duration_and_proportions(
... Fraction(3, 16), [5, -1, 5], avoid_dots=False, big_endian=False, is_diminution=True)
FixedDurationTuplet(3/16, [c'16..., r64., c'16...])
```

Reduce *proportions* relative to each other.

Interpret negative *proportions* as rests.

Return fixed-duration tuplet.

tuplettools.make_tuplet_from_proportions_and_pair

tuplettools.**make_tuplet_from_proportions_and_pair**(*l*, *(n, d)*)

Divide *(n, d)* according to *l*.

Where no prolation is necessary, return container.

```
>>> tuplettools.make_tuplet_from_proportions_and_pair([1], (7, 16))
{c'4..}
```

Where prolation is necessary, return fixed-duration tuplet.

```
>>> tuplettools.make_tuplet_from_proportions_and_pair([1, 2], (7, 16))
FixedDurationTuplet(7/16, [c'8, c'4])
```

```
>>> tuplettools.make_tuplet_from_proportions_and_pair([1, 2, 4], (7, 16))
FixedDurationTuplet(7/16, [c'16, c'8, c'4])
```

```
>>> tuplettools.make_tuplet_from_proportions_and_pair([1, 2, 4, 1], (7, 16))
FixedDurationTuplet(7/16, [c'16, c'8, c'4, c'16])
```

```
>>> tuplettools.make_tuplet_from_proportions_and_pair([1, 2, 4, 1, 2], (7, 16))
FixedDurationTuplet(7/16, [c'16, c'8, c'4, c'16, c'8])

>>> tuplettools.make_tuplet_from_proportions_and_pair([1, 2, 4, 1, 2, 4], (7, 16))
FixedDurationTuplet(7/16, [c'16, c'8, c'4, c'16, c'8, c'4])
```

Note: function accepts a pair rather than a rational.

Note: function interprets *d* as tuplet denominator.

Changed in version 2.0: renamed `divide.pair()` to `tuplettools.make_tuplet_from_proportions_and_pair`

tuplettools.move_prolation_of_tuplet_to_contents_of_tuplet_and_remove_tuplet

tuplettools.**move_prolation_of_tuplet_to_contents_of_tuplet_and_remove_tuplet**(*tuplet*)

Scale `tuplet` contents and then bequeath in-score position of `tuplet` to contents.

Return orphaned `tuplet` emptied of all contents.

```
>>> t = Staff(tuplettools.FixedDurationTuplet(Duration(3, 8), "c'8 d'8") * 2)
>>> beamtools.BeamSpanner(t.leaves)
BeamSpanner(c'8, d'8, c'8, d'8)

>>> f(t)
\new Staff {
    \fraction \times 3/2 {
        c'8 [
        d'8
    }
    \fraction \times 3/2 {
        c'8
        d'8 ]
    }
}

>>> tuplettools.move_prolation_of_tuplet_to_contents_of_tuplet_and_remove_tuplet(t[0])
FixedDurationTuplet(3/8, [])

>>> f(t)
\new Staff {
    c'8. [
    d'8.
    \fraction \times 3/2 {
        c'8
        d'8 ]
    }
}
```

Changed in version 2.0: renamed `tuplettools.subsume()` to `tuplettools.move_prolation_of_tuplet_to_contents_of_tuplet_and_remove_tuplet()`.

tuplettools.remove_trivial_tuplets_in_expr

tuplettools.**remove_trivial_tuplets_in_expr**(*expr*)

Remove trivial tuplets in *expr*:

```
>>> t = tuplettools.FixedDurationTuplet(Duration(1, 4), "c'8 d'8 e'8")
>>> u = tuplettools.FixedDurationTuplet(Duration(1, 4), "c'8 d'8")
>>> s = Staff([t, u])
>>> len(s)
2

>>> s[0]
FixedDurationTuplet(1/4, [c'8, d'8, e'8])
>>> s[1]
FixedDurationTuplet(1/4, [c'8, d'8])

>>> tuplettools.remove_trivial_tuplets_in_expr(s)
>>> len(s)
3
>>> s[0]
FixedDurationTuplet(1/4, [c'8, d'8, e'8])
>>> s[1]
Note("c'8")
>>> s[2]
Note("d'8")

>>> f(s)
\new Staff {
    \times 2/3 {
        c'8
        d'8
        e'8
    }
    c'8
    d'8
}
```

Replace trivial tuplets with plain leaves.

Return none. Changed in version 2.0: renamed `tuplettools.slip_trivial()` to `tuplettools.remove_trivial_tuplets_in_expr()`.

tuplettools.scale_contents_of_tuplets_in_expr_by_multiplier

tuplettools.**scale_contents_of_tuplets_in_expr_by_multiplier**(*tuplet*, *multiplier*)

Scale fixed-duration tuplet by multiplier. Preserve tuplet multiplier. Return tuplet.

tuplettools.set_denominator_of_tuplets_in_expr_to_at_least

tuplettools.**set_denominator_of_tuplets_in_expr_to_at_least**(*expr*, *n*)

New in version 2.0. Set denominator of tuplets in *expr* to at least *n*:

```
>>> tuplet = Tuplet(Fraction(3, 5), "c'4 d'8 e'8 f'4 g'2")
```

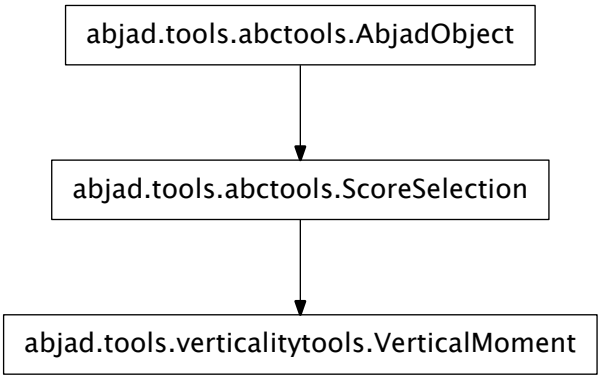
```
>>> f(tuplet)
\fraction \times 3/5 {
    c'4
    d'8
    e'8
    f'4
    g'2
}

>>> tuplettools.set_denominator_of_tuplets_in_expr_to_at_least(tuplet, 8)

>>> f(tuplet)
\fraction \times 6/10 {
    c'4
    d'8
    e'8
    f'4
    g'2
}
```

Return none.

verticalitytools

concrete classes

verticalitytools.VerticalMoment



class verticalitytools.**VerticalMoment** (*prolated_offset*, *governors*, *components*)

Everything happening at a single moment in musical time:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> piano_staff = scoretools.PianoStaff([])
```

```
>>> piano_staff.append(Staff("c'4 e'4 d'4 f'4"))
>>> piano_staff.append(Staff(r"""\clef "bass" g2 f2"""))
>>> score.append(piano_staff)

f(score)
\new Score <<
    \new PianoStaff <<
        \new Staff {
            c'4
            e'4
            d'4
            f'4
        }
        \new Staff {
            \clef "bass"
            g2
            f2
        }
    >>
>>

>>> for x in verticalitytools.iterate_vertical_moments_in_expr(score):
...     x
...
VerticalMoment(0, <<2>>)
VerticalMoment(1/4, <<2>>)
VerticalMoment(1/2, <<2>>)
VerticalMoment(3/4, <<2>>)
```

Create vertical moments with the getters and iterators implemented in the `verticalitytools` module.

Vertical moments are immutable.

Read-only Properties

`VerticalMoment.`**`attack_count`**
Positive integer number of pitch carriers starting at vertical moment.

`VerticalMoment.`**`components`**
Read-only tuple of zero or more components happening at vertical moment.

It is always the case that `self.components = self.overlap_components + self.start_components`.

`VerticalMoment.`**`governors`**
Read-only tuple of one or more containers in which vertical moment is evaluated.

`VerticalMoment.`**`leaves`**
Read-only tuple of zero or more leaves at vertical moment.

`VerticalMoment.`**`measures`**
Read-only tuplet of zero or more measures at vertical moment.

`VerticalMoment.`**`music`**
Read-only tuple of components in selection.

Inherited from `abctools.ScoreSelection`

`VerticalMoment.`**`next_vertical_moment`**
Read-only reference to next vertical moment forward in time.

VerticalMoment.**notes**
Read-only tuple of zero or more notes at vertical moment.

VerticalMoment.**overlap_components**
Read-only tuple of components in vertical moment starting before vertical moment, ordered by score index.

VerticalMoment.**overlap_leaves**
Read-only tuple of leaves in vertical moment starting before vertical moment, ordered by score index.

VerticalMoment.**overlap_measures**
Read-only tuple of measures in vertical moment starting before vertical moment, ordered by score index.

VerticalMoment.**overlap_notes**
Read-only tuple of notes in vertical moment starting before vertical moment, ordered by score index.

VerticalMoment.**prev_vertical_moment**
Read-only reference to prev vertical moment backward in time.

VerticalMoment.**prolated_offset**
Read-only rational-valued score offset at which vertical moment is evaluated.

VerticalMoment.**start_components**
Read-only tuple of components in vertical moment starting with at vertical moment, ordered by score index.

VerticalMoment.**start_leaves**
Read-only tuple of leaves in vertical moment starting with vertical moment, ordered by score index.

VerticalMoment.**start_notes**
Read-only tuple of notes in vertical moment starting with vertical moment, ordered by score index.

VerticalMoment.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

VerticalMoment.**__contains__**(*expr*)
Inherited from abctools.ScoreSelection

VerticalMoment.**__eq__**(*expr*)

VerticalMoment.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

VerticalMoment.**__getitem__**(*expr*)
Inherited from abctools.ScoreSelection

VerticalMoment.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

VerticalMoment.**__hash__**()

VerticalMoment.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

VerticalMoment.__len__()

VerticalMoment.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

VerticalMoment.__ne__(*expr*)

VerticalMoment.__repr__()

functions

verticalitytools.get_vertical_moment_at_offset_in_expr

verticalitytools.**get_vertical_moment_at_offset_in_expr**(*expr*, *prolated_offset*)
New in version 2.0. Get vertical moment at *prolated_offset* in *expr*:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> staff = Staff(r"\times 4/3 { d''8 c''8 b'8 }")
>>> score.append(staff)

>>> piano_staff = scoretools.PianoStaff([])
>>> piano_staff.append(Staff("a'4 g'4"))
>>> piano_staff.append(Staff(r"""\clef "bass" f'8 e'8 d'8 c'8"""))
>>> score.append(piano_staff)

>>> f(score)
\new Score <<
    \new Staff {
        \fraction \times 4/3 {
            d''8
            c''8
            b'8
        }
    }
    \new PianoStaff <<
        \new Staff {
            a'4
            g'4
        }
        \new Staff {
            \clef "bass"
            f'8
            e'8
            d'8
            c'8
        }
    >>
>>
```

```
>>> args = (piano_staff, durationtools.Offset(1, 8))

>>> verticalitytools.get_vertical_moment_at_offset_in_expr(*args)
VerticalMoment(1/8, <<2>>)

>>> vertical_moment = _
>>> vertical_moment.leaves
(Note("a'4"), Note("e'8"))
```

Return vertical moment.

verticalitytools.get_vertical_moment_starting_with_component

verticalitytools.**get_vertical_moment_starting_with_component**(*component*, *governor=None*)

New in version 2.0. Get vertical moment starting with *component*:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> staff = Staff(r"\times 4/3 { d''8 c''8 b'8 }")
>>> score.append(staff)

>>> piano_staff = scoretools.PianoStaff([])
>>> piano_staff.append(Staff("a'4 g'4"))
>>> piano_staff.append(Staff(r"""\clef "bass" f'8 e'8 d'8 c'8"""))
>>> score.append(piano_staff)

>>> f(score)
\new Score <<
    \new Staff {
        \fraction \times 4/3 {
            d''8
            c''8
            b'8
        }
    }
    \new PianoStaff <<
        \new Staff {
            a'4
            g'4
        }
        \new Staff {
            \clef "bass"
            f'8
            e'8
            d'8
            c'8
        }
    >>
>>

>>> leaf = piano_staff[1][1]

>>> verticalitytools.get_vertical_moment_starting_with_component(leaf)
VerticalMoment(1/8, <<3>>)
```

Get vertical moment starting with *component* in *governor* when *governor* is not none:

```
>>> verticalitytools.get_vertical_moment_starting_with_component(leaf,
... governor=piano_staff)
VerticalMoment(1/8, <<2>>)
```

Return vertical moment.

verticalitytools.iterate_vertical_moments_in_expr

verticalitytools.**iterate_vertical_moments_in_expr**(*expr*, *reverse=False*)

New in version 2.10. Iterate vertical moments forward in *expr*:

```
>>> from abjad.tools import verticalitytools

>>> score = Score([])
>>> staff = Staff(r"\times 4/3 { d''8 c''8 b'8 }")
>>> score.append(staff)

>>> piano_staff = scoretools.PianoStaff([])
>>> piano_staff.append(Staff("a'4 g'4"))
>>> piano_staff.append(Staff(r"""\clef "bass" f'8 e'8 d'8 c'8"""))
>>> score.append(piano_staff)

>>> f(score)
\new Score <<
    \new Staff {
        \fraction \times 4/3 {
            d''8
            c''8
            b'8
        }
    }
    \new PianoStaff <<
        \new Staff {
            a'4
            g'4
        }
        \new Staff {
            \clef "bass"
            f'8
            e'8
            d'8
            c'8
        }
    >>
>>

>>> for x in verticalitytools.iterate_vertical_moments_in_expr(score):
...     x.leaves
...
(Note("d''8"), Note("a'4"), Note("f'8"))
(Note("d''8"), Note("a'4"), Note("e'8"))
(Note("c''8"), Note("a'4"), Note("e'8"))
(Note("c''8"), Note("g'4"), Note("d'8"))
(Note("b'8"), Note("g'4"), Note("d'8"))
(Note("b'8"), Note("g'4"), Note("c'8"))
```

```
>>> for x in verticalitytools.iterate_vertical_moments_in_expr(piano_staff):
...     x.leaves
...
(Note("a'4"), Note("f'8"))
(Note("a'4"), Note("e'8"))
(Note("g'4"), Note("d'8"))
(Note("g'4"), Note("c'8"))
```

Iterate vertical moments backward in *expr*:

::

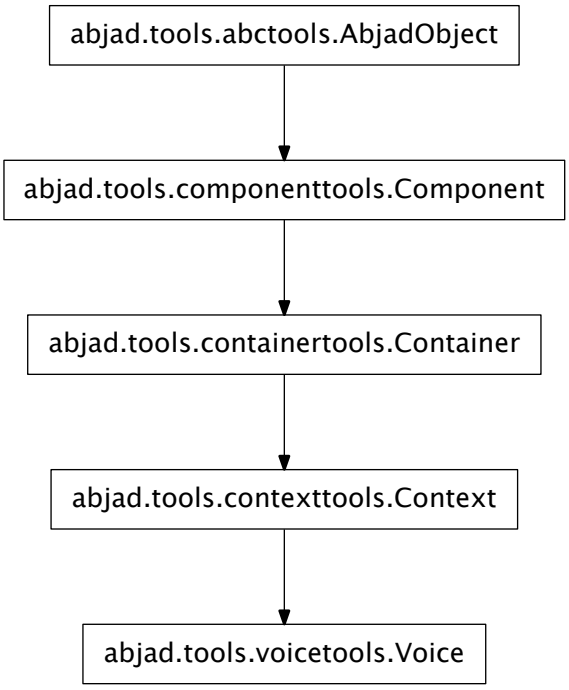
```
>>> for x in verticalitytools.iterate_vertical_moments_in_expr(score, reverse=True):
...     x.leaves
...
(Note("b'8"), Note("g'4"), Note("c'8"))
(Note("b'8"), Note("g'4"), Note("d'8"))
(Note("c''8"), Note("g'4"), Note("d'8"))
(Note("c''8"), Note("a'4"), Note("e'8"))
(Note("d''8"), Note("a'4"), Note("e'8"))
(Note("d''8"), Note("a'4"), Note("f'8"))

>>> for x in verticalitytools.iterate_vertical_moments_in_expr(piano_staff, reverse=True):
...     x.leaves
...
(Note("g'4"), Note("c'8"))
(Note("g'4"), Note("d'8"))
(Note("a'4"), Note("e'8"))
(Note("a'4"), Note("f'8"))
```

Return generator.

voicetools

concrete classes

voicetools.Voice



class voicetools.**Voice**(*music=None*, *context_name='Voice'*, *name=None*)

Abjad model of a voice:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> f(voice)
\new Voice {
    c'8
    d'8
    e'8
    f'8
}
```

Return voice object.

Read-only Properties

Voice.**contents_duration**

Inherited from containertools.Container

Voice.**duration_in_seconds**

Inherited from containertools.Container

Voice.**engraver_consists**
New in version 2.0. Unordered set of LilyPond engravers to include in context definition.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_consists.append('Horizontal_bracket_engraver')
>>> f(staff)
\new Staff \with {
    \consists Horizontal_bracket_engraver
} {
}
```

Inherited from contexttools.Context

Voice.**engraver_removals**
New in version 2.0. Unordered set of LilyPond engravers to remove from context.

Manage with add, update, other standard set commands.

```
>>> staff = Staff([])
>>> staff.engraver_removals.append('Time_signature_engraver')
>>> f(staff)
\new Staff \with {
    \remove Time_signature_engraver
} {
}
```

Inherited from contexttools.Context

Voice.**is_semantic**
Inherited from contexttools.Context

Voice.**leaves**
Read-only tuple of leaves in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.leaves
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple of zero or more leaves.

Inherited from containertools.Container

Voice.**lilypond_format**
Inherited from contexttools.Context

Voice.**music**
Read-only tuple of components in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> container.music
(Note("c'8"), Note("d'8"), Note("e'8"))
```

Return tuple or zero or more components.

Inherited from containertools.Container

Voice.**override**
Read-only reference to LilyPond grob override component plug-in.

Inherited from componenttools.Component

Voice.**parent**
Inherited from componenttools.Component

Voice.**preprolated_duration**
Inherited from containertools.Container

Voice.**prolated_duration**
Inherited from componenttools.Component

Voice.**prolation**
Inherited from componenttools.Component

Voice.**set**
Read-only reference LilyPond context setting component plug-in.

Inherited from componenttools.Component

Voice.**spanners**
Read-only reference to unordered set of spanners attached to component.

Inherited from componenttools.Component

Voice.**start_offset**
Read-only start offset of component.

Inherited from componenttools.Component

Voice.**start_offset_in_seconds**
Read-only start offset of comonent in seconds.

Inherited from componenttools.Component

Voice.**stop_offset**
Read-only stop offset of component.

Inherited from componenttools.Component

Voice.**stop_offset_in_seconds**
Read-only stop offset of component in seconds.

Inherited from componenttools.Component

Voice.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

Voice.**context_name**
Read / write name of context as a string.

Inherited from contexttools.Context

Voice.**is_nonsemantic**
Set indicator of nonsemantic voice:

```
>>> measures = measuretools.make_measures_with_full_measure_spacer_skips(
...     [(1, 8), (5, 16), (5, 16)])
>>> voice = Voice(measures)
>>> voice.name = 'HiddenTimeSignatureVoice'
```

```
>>> voice.is_nonsemantic = True

>>> f(voice)
\context Voice = "HiddenTimeSignatureVoice" {
    {
        \time 1/8
        s1 * 1/8
    }
    {
        \time 5/16
        s1 * 5/16
    }
    {
        s1 * 5/16
    }
}

>>> voice.is_nonsemantic
True
```

Get indicator of nonsemantic voice:

```
>>> voice = Voice([])

>>> voice.is_nonsemantic
False
```

Return boolean.

The intent of this read / write attribute is to allow composers to tag invisible voices used to house time signatures indications, bar number directives or other pieces of score-global non-musical information. Such nonsemantic voices can then be omitted from voice interation and other functions.

Inherited from `contexttools.Context`

`Voice.`**`is_parallel`**

Get parallel container:

```
>>> container = Container([Voice("c'8 d'8 e'8"), Voice('g4.')])

>>> f(container)
{
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
}

>>> container.is_parallel
False
```

Return boolean.

Set parallel container:

```
>>> container.is_parallel = True

>>> f(container)
<<
    \new Voice {
        c'8
        d'8
        e'8
    }
    \new Voice {
        g4.
    }
>>
```

Return none.

Inherited from containertools.Container

Voice.**name**

Read-write name of context. Must be string or none.

Inherited from contexttools.Context

Methods

Voice.**append**(*component*)

Append *component* to container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.append(Note("f'8"))

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    f'8
}
```

Return none.

Inherited from containertools.Container

Voice.**extend**(*expr*)

Extend *expr* against container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
```

```
    d'8
    e'8 ]
}
```

```
>>> container.extend([Note("cs'8"), Note("ds'8"), Note("es'8")])
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
    cs'8
    ds'8
    es'8
}
```

Return none. New in version 2.3: `expr` may now be a LilyPond input string. Inherited from `containertools.Container`

`Voice.`**`index`**(*component*)

Index *component* in container:

```
>>> container = Container("c'8 d'8 e'8")
```

```
>>> note = container[-1]
>>> note
Note("e'8")
```

```
>>> container.index(note)
2
```

Return nonnegative integer.

Inherited from `containertools.Container`

`Voice.`**`insert`**(*i*, *component*)

Insert *component* in container at index *i*:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)
```

```
>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}
```

```
>>> container.insert(1, Note("cs'8"))
```

```
>>> f(container)
{
    c'8 [
    cs'8
    d'8
    e'8 ]
}
```

Return none.

Inherited from `containertools.Container`

Voice.**pop**(*i=-1*)

Pop component at index *i* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> container.pop(-1)
Note("e'8")

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return component.

Inherited from containertools.Container

Voice.**remove**(*component*)

Remove *component* from container:

```
>>> container = Container("c'8 d'8 e'8")
>>> beam = beamtools.BeamSpanner(container.music)

>>> f(container)
{
    c'8 [
    d'8
    e'8 ]
}

>>> note = container[-1]
>>> note
Note("e'8")

>>> container.remove(note)

>>> f(container)
{
    c'8 [
    d'8 ]
}
```

Return none.

Inherited from containertools.Container

Special Methods

Voice.**__add__**(*expr*)

Concatenate containers self and expr. The operation c = a + b returns a new Container c with the content of both

a and b. The operation is non-commutative: the content of the first operand will be placed before the content of the second operand.

Inherited from containertools.Container

Voice.__contains__(*expr*)
True if expr is in container, otherwise False.

Inherited from containertools.Container

Voice.__delitem__(*i*)
Find component(s) at index or slice 'i' in container. Detach component(s) from parentage. Withdraw component(s) from crossing spanners. Preserve spanners that component(s) cover(s).

Inherited from containertools.Container

Voice.__eq__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Voice.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Voice.__getitem__(*i*)
Return component at index i in container. Shallow traversal of container for numeric indices only.

Inherited from containertools.Container

Voice.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Voice.__iadd__(*expr*)
__iadd__ avoids unnecessary copying of structures.

Inherited from containertools.Container

Voice.__imul__(*total*)
Multiply contents of container 'total' times. Return multiplied container.

Inherited from containertools.Container

Voice.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Voice.__len__()
Return nonnegative integer number of components in container.

Inherited from containertools.Container

Voice.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Voice.__mul__(*n*)
Inherited from componenttools.Component

Voice.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Voice.__radd__(*expr*)
Extend container by contents of expr to the right.

Inherited from containertools.Container

Voice.__repr__()
Changed in version 2.0. Named contexts now print name at the interpreter.

Inherited from contexttools.Context

Voice.__rmul__(*n*)
Inherited from componenttools.Component

Voice.__setitem__(*i*, *expr*)
Set 'expr' in self at nonnegative integer index i. Or, set 'expr' in self at slice i. Find spanners that dominate self[i] and children of self[i]. Replace contents at self[i] with 'expr'. Reattach spanners to new contents. This operation leaves all score trees always in tact.

Inherited from containertools.Container

functions

voicetools.all_are_voices

voicetools.**all_are_voices**(*expr*)
New in version 2.6. True when *expr* is a sequence of Abjad voices:

```
>>> voice = Voice("c'4 d'4 e'4 f'4")

>>> voicetools.all_are_voices([voice])
True
```

True when *expr* is an empty sequence:

```
>>> voicetools.all_are_voices([])
True
```

Otherwise false:

```
>>> voicetools.all_are_voices('foo')
False
```

Return boolean.

Function wraps componenttools.all_are_components().

voicetools.get_first_voice_in_improper_parentage_of_component

voicetools.**get_first_voice_in_improper_parentage_of_component**(*component*)

New in version 2.0. Get first voice in improper parentage of *component*:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> staff = Staff([voice])

>>> f(staff)
\new Staff {
    \new Voice {
        c'8
        d'8
        e'8
        f'8
    }
}

>>> voicetools.get_first_voice_in_improper_parentage_of_component(staff.leaves[0])
Voice{4}
```

Return voice or none.

voicetools.get_first_voice_in_proper_parentage_of_component

voicetools.**get_first_voice_in_proper_parentage_of_component**(*component*)

New in version 2.0. Get first voice in proper parentage of *component*:

```
>>> voice = Voice("c'8 d'8 e'8 f'8")
>>> staff = Staff([voice])

>>> f(staff)
\new Staff {
    \new Voice {
        c'8
        d'8
        e'8
        f'8
    }
}

>>> voicetools.get_first_voice_in_proper_parentage_of_component(staff.leaves[0])
Voice{4}
```

Return voice or none.

8.1.2 Internal packages

abctools

abstract classes

abctools.AbjadObject

class abctools.**AbjadObject**(**args*, ***kwargs*)

New in version 2.0. Abstract base class from which all custom classes should inherit.

Abajd objects raise exceptions on __gt__, __ge__, __lt__, __le__.

Abjad objects compare equal only with equal object IDs.

Authors of custom classes should override these behaviors as required.

Read-only Properties

AbjadObject.**storage_format**

Storage format of Abjad object.

Return string.

Special Methods

AbjadObject.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

AbjadObject.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

AbjadObject.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

AbjadObject.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

AbjadObject.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

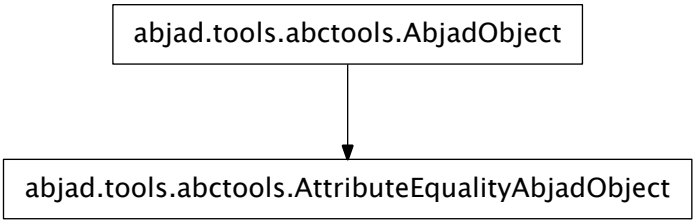
AbjadObject.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

AbjadObject.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

abctools.AttributeEqualityAbjadObject



class abctools.**AttributeEqualityAbjadObject**(**args*, ***kwargs*)
New in version 2.0. Abstract base class to confer nonsorting attribute-equality to any custom class.

Nonsorting objects raise exceptions on `__gt__`, `__ge__`, `__lt__`, `__le__`.

Attribute-equality objects compare equal only with equal comparison attributes.

Read-only Properties

AttributeEqualityAbjadObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

AttributeEqualityAbjadObject.**__eq__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

AttributeEqualityAbjadObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AttributeEqualityAbjadObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

AttributeEqualityAbjadObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AttributeEqualityAbjadObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

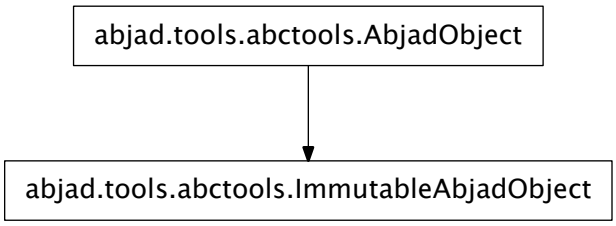
AttributeEqualityAbjadObject.**__ne__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

AttributeEqualityAbjadObject.**__repr__**()
Interpreter representation of object defined equal to class name and format string.

Return string.

abctools.ImmutableAbjadObject



class abctools.**ImmutableAbjadObject**(**args*, ***kwargs*)
New in version 2.8. Abstract base class from which all custom classes which also subclass immutable builtin classes, such as tuple and frozenset, should inherit.

Read-only Properties

ImmutableAbjadObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ImmutableAbjadObject.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

ImmutableAbjadObject.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

ImmutableAbjadObject.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

ImmutableAbjadObject.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

ImmutableAbjadObject.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

ImmutableAbjadObject.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

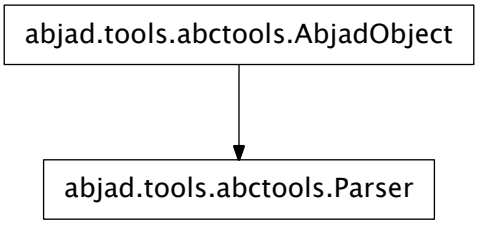
Inherited from `abctools.AbjadObject`

ImmutableAbjadObject.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

abctools.Parser



class abctools.**Parser**(*debug=False*)

Abstract base class for Abjad parsers.

Rules objects for lexing and parsing must be defined by overriding the abstract properties *lexer_rules_object* and *parser_rules_object*.

For most parsers these properties should simply return *self*.

Read-only Properties

Parser.**debug**

True if the parser runs in debugging mode.

Parser.**lexer**

The parser's PLY Lexer instance.

Parser.**lexer_rules_object**

The object containing the parser's lexical rule definitions.

Parser.**logger**

The parser's Logger instance.

Parser.**logger_path**

The output path for the parser's logfile.

Parser.**output_path**

The output path for files associated with the parser.

Parser.**parser**

The parser's PLY LRParser instance.

Parser.**parser_rules_object**

The object containing the parser's syntactical rule definitions.

Parser.**pickle_path**

The output path for the parser's pickled parsing tables.

Parser.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

`Parser.tokenize(input_string)`
Tokenize *input string* and print results.

Special Methods

`Parser.__call__(input_string)`
Parse *input_string* and return result.

`Parser.__eq__(arg)`
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`Parser.__ge__(arg)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`Parser.__gt__(arg)`
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`Parser.__le__(arg)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`Parser.__lt__(arg)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`Parser.__ne__(arg)`
True when `id(self)` does not equal `id(arg)`.

Return boolean.

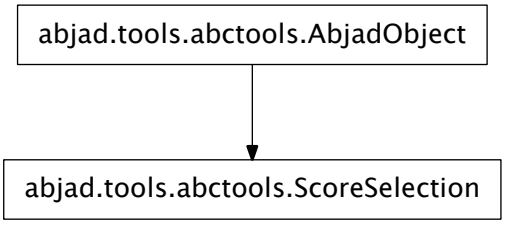
Inherited from `abctools.AbjadObject`

`Parser.__repr__()`
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

abctools.ScoreSelection



class abctools.**ScoreSelection**(*music*)

New in version 2.9. Abstract base class from which selection classes inherit.

Score selections are immutable and never change after instantiation.

Read-only Properties

ScoreSelection.**music**

Read-only tuple of components in selection.

ScoreSelection.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ScoreSelection.**__contains__**(*expr*)

ScoreSelection.**__eq__**(*expr*)

ScoreSelection.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ScoreSelection.**__getitem__**(*expr*)

ScoreSelection.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ScoreSelection.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ScoreSelection.**__len__**()

ScoreSelection.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

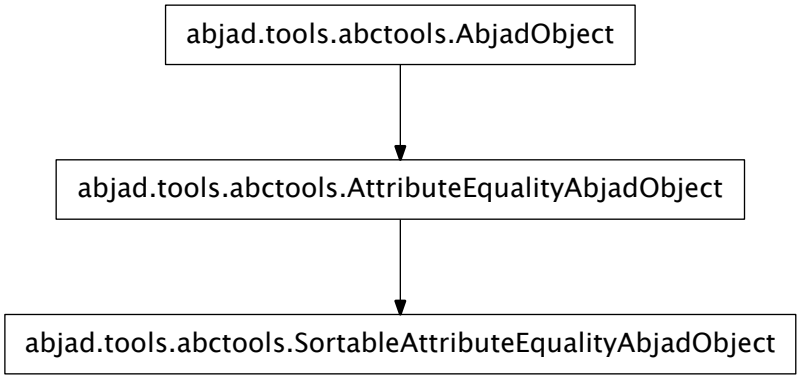
ScoreSelection.**__ne__**(*expr*)

ScoreSelection.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

abctools.SortableAttributeEqualityAbjadObject



class abctools.**SortableAttributeEqualityAbjadObject**(**args*, ***kwargs*)
New in version 2.0. Abstact base class to confer sortable attribute-equality to any custom class.

Sortable attribute-equality comparators implement __eq__, __ne__, __gt__, __ge__, __lt__, __le__ against a single comparison attribute.

Read-only Properties

SortableAttributeEqualityAbjadObject.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

SortableAttributeEqualityAbjadObject.**__eq__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

SortableAttributeEqualityAbjadObject.**__ge__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

SortableAttributeEqualityAbjadObject.**__gt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

SortableAttributeEqualityAbjadObject.**__le__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

SortableAttributeEqualityAbjadObject.**__lt__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

SortableAttributeEqualityAbjadObject.**__ne__**(*arg*)
Initialize new object from *arg* and evaluate comparison attributes.

Return boolean.

Inherited from abctools.AttributeEqualityAbjadObject

SortableAttributeEqualityAbjadObject.**__repr__**()
Interpreter representation of object defined equal to class name and format string.

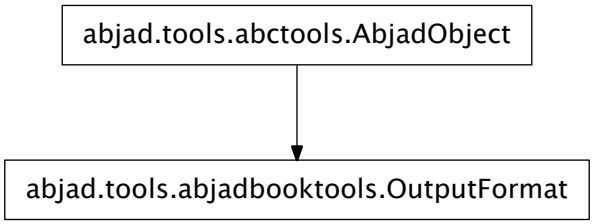
Return string.

Inherited from abctools.AttributeEqualityAbjadObject

abjadbooktools

abstract classes

abjadbooktools.OutputFormat



class abjadbooktools.**OutputFormat**(*code_block_opening*, *code_block_closing*, *code_indent*, *image_block*, *image_format*)

Read-only Properties

OutputFormat.**code_block_closing**

OutputFormat.**code_block_opening**

OutputFormat.**code_indent**

OutputFormat.**image_block**

OutputFormat.**image_format**

OutputFormat.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

OutputFormat.**__call__**(*code_block*)

OutputFormat.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

OutputFormat.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OutputFormat.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

OutputFormat.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OutputFormat.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OutputFormat.**__ne__**(*arg*)

True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

OutputFormat.**__repr__**()

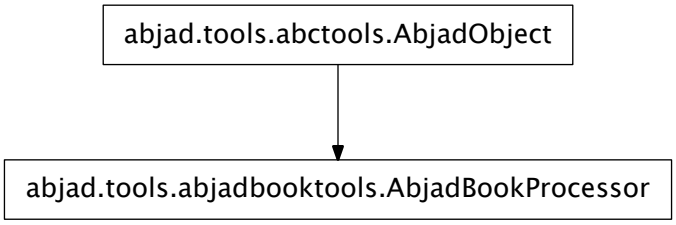
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

concrete classes

abjadbooktools.AbjadBookProcessor



class abjadbooktools.**AbjadBookProcessor**(*directory*, *lines*, *output_format*, *skip_rendering=False*, *image_prefix='image'*)

Read-only Properties

AbjadBookProcessor.**directory**

AbjadBookProcessor.**image_prefix**

AbjadBookProcessor.**lines**

AbjadBookProcessor.**output_format**

AbjadBookProcessor.**skip_rendering**

AbjadBookProcessor.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

AbjadBookProcessor.**__call__**(*verbose=True*)

AbjadBookProcessor.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

AbjadBookProcessor.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadBookProcessor.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

AbjadBookProcessor.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadBookProcessor.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadBookProcessor.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

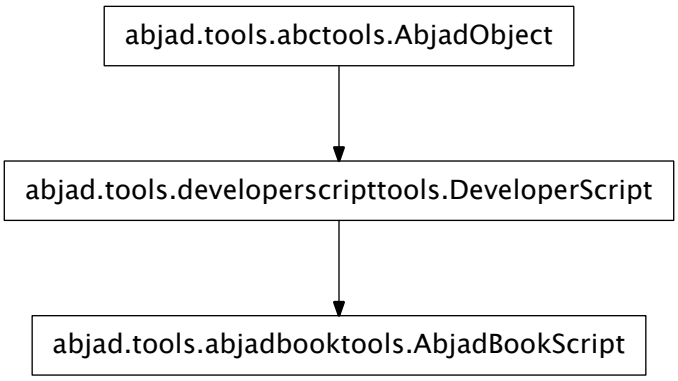
Inherited from abctools.AbjadObject

AbjadBookProcessor.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

abjadbooktools.AbjadBookScript



class abjadbooktools.**AbjadBookScript**

Read-only Properties

AbjadBookScript.**alias**

AbjadBookScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

AbjadBookScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

AbjadBookScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

AbjadBookScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

AbjadBookScript.**long_description**

AbjadBookScript.**output_formats**

AbjadBookScript.**program_name**

The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

AbjadBookScript.**scripting_group**

The script's scripting subcommand group.

Inherited from developerscripttools.DeveloperScript

AbjadBookScript.**short_description**

AbjadBookScript.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

AbjadBookScript.**version**

Methods

AbjadBookScript.**process_args**(*args*)

AbjadBookScript.**setup_argument_parser**(*parser*)

Special Methods

AbjadBookScript.**__call__**(*args=None*)

Inherited from developerscripttools.DeveloperScript

AbjadBookScript.**__eq__**(*arg*)

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from abctools.AbjadObject

AbjadBookScript.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadBookScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

AbjadBookScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadBookScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadBookScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

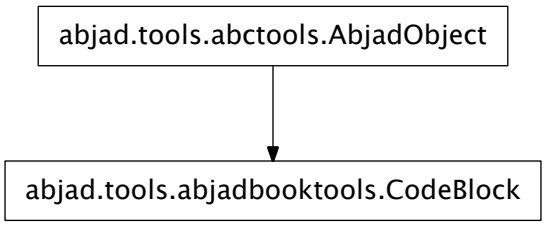
Inherited from abctools.AbjadObject

AbjadBookScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

abjadbooktools.CodeBlock



class abjadbooktools.**CodeBlock**(*lines*, *starting_line_number*, *ending_line_number*, *hide=False*, *strip_prompt=False*)

Read-only Properties
CodeBlock.**ending_line_number**
CodeBlock.**hide**

CodeBlock.**lines**

CodeBlock.**processed_results**

CodeBlock.**starting_line_number**

CodeBlock.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

CodeBlock.**strip_prompt**

Methods
CodeBlock.**read**(*pipe*)

Special Methods
CodeBlock.**__call__**(*pipe*, *image_count=0*, *directory=None*, *image_prefix='image'*)
CodeBlock.**__eq__**(*other*)

CodeBlock.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CodeBlock.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

CodeBlock.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CodeBlock.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CodeBlock.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

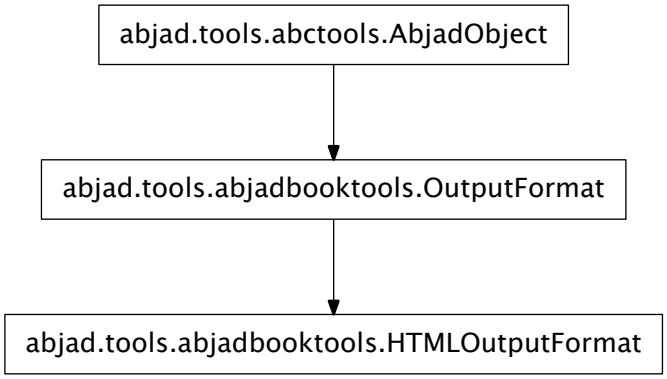
Inherited from abctools.AbjadObject

CodeBlock.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

abjadbooktools.HTMLOutputFormat



class abjadbooktools.**HTMLOutputFormat**

Read-only Properties

HTMLOutputFormat.**code_block_closing**
Inherited from abjadbooktools.OutputFormat

HTMLOutputFormat.**code_block_opening**
Inherited from abjadbooktools.OutputFormat

HTMLOutputFormat.**code_indent**
Inherited from abjadbooktools.OutputFormat

HTMLOutputFormat.**image_block**
Inherited from abjadbooktools.OutputFormat

HTMLOutputFormat.**image_format**
Inherited from abjadbooktools.OutputFormat

HTMLOutputFormat.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

HTMLOutputFormat.**__call__**(*code_block*)
Inherited from abjadbooktools.OutputFormat

HTMLOutputFormat.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

HTMLOutputFormat.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HTMLOutputFormat.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

HTMLOutputFormat.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HTMLOutputFormat.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

HTMLOutputFormat.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

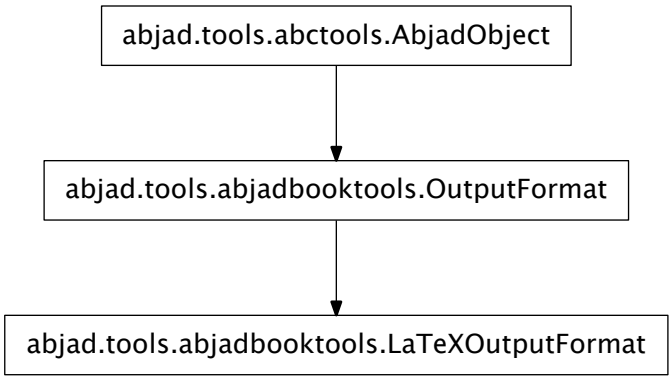
Inherited from abctools.AbjadObject

HTMLOutputFormat.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

abjadbooktools.LaTeXOutputFormat



class abjadbooktools.**LaTeXOutputFormat**

Read-only Properties

LaTeXOutputFormat.**code_block_closing**
Inherited from abjadbooktools.OutputFormat

LaTeXOutputFormat.**code_block_opening**
Inherited from abjadbooktools.OutputFormat

LaTeXOutputFormat.**code_indent**
Inherited from abjadbooktools.OutputFormat

LaTeXOutputFormat.**image_block**
Inherited from abjadbooktools.OutputFormat

LaTeXOutputFormat.**image_format**
Inherited from abjadbooktools.OutputFormat

LaTeXOutputFormat.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

LaTeXOutputFormat.**__call__**(*code_block*)
Inherited from abjadbooktools.OutputFormat

LaTeXOutputFormat.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

LaTeXOutputFormat.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LaTeXOutputFormat.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

LaTeXOutputFormat.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LaTeXOutputFormat.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LaTeXOutputFormat.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

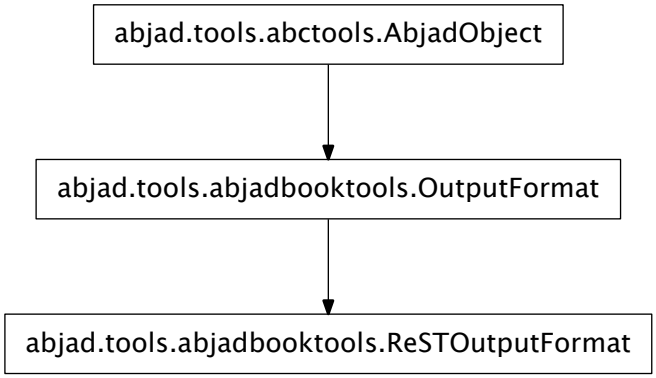
Inherited from abctools.AbjadObject

LaTeXOutputFormat.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

abjadbooktools.ReSTOutputFormat



class abjadbooktools.**ReSTOutputFormat**

Read-only Properties

ReSTOutputFormat.**code_block_closing**
Inherited from abjadbooktools.OutputFormat

ReSTOutputFormat.**code_block_opening**
Inherited from abjadbooktools.OutputFormat

ReSTOutputFormat.**code_indent**
Inherited from abjadbooktools.OutputFormat

ReSTOutputFormat.**image_block**
Inherited from abjadbooktools.OutputFormat

ReSTOutputFormat.**image_format**
Inherited from abjadbooktools.OutputFormat

ReSTOutputFormat.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ReSTOutputFormat.__call__(*code_block*)
Inherited from abjadbooktools.OutputFormat

ReSTOutputFormat.__eq__(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ReSTOutputFormat.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReSTOutputFormat.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ReSTOutputFormat.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReSTOutputFormat.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReSTOutputFormat.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ReSTOutputFormat.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

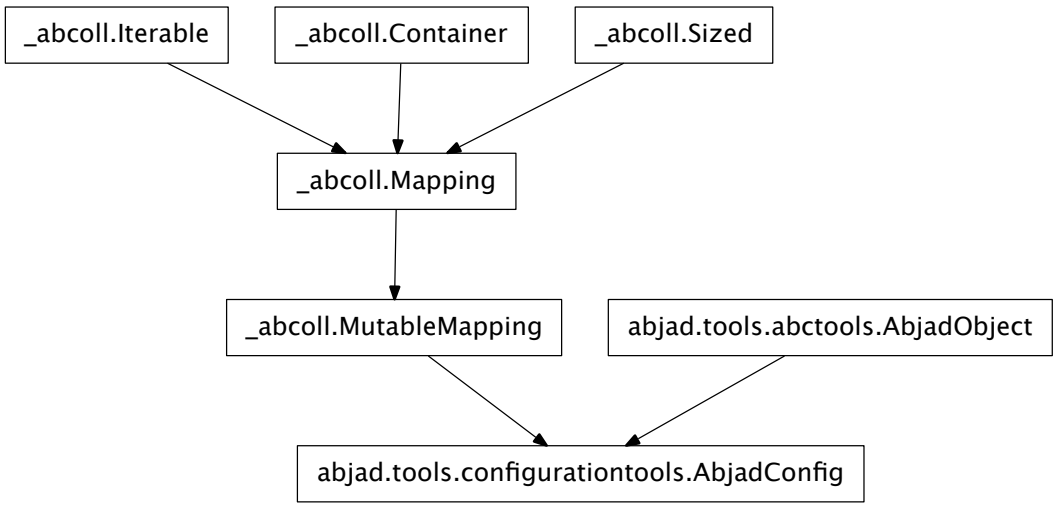
Return string.

Inherited from abctools.AbjadObject

configurationtools

concrete classes

configurationtools.AbjadConfig



class configurationtools.**AbjadConfig**

Abjad configuration object:

```
>>> from abjad.tools.configurationtools import AbjadConfig
>>> ABJCONFIG = AbjadConfig()
>>> ABJCONFIG['accidental_spelling']
'mixed'
```

On instantiation, *AbjadConfig* creates the *$HOME/.abjad/* directory if it does not already exist.

It then attempts to read an *abjad.cfg* file in that directory, parsing it as a *ConfigObj* configuration. A default configuration is generated if no file is found.

The *ConfigObj* instance is validated, and key:value pairs which fail validation are replaced by default values.

The configuration is then written back to disk.

Finally, the Abjad output directory is created if it does not already exist, by referencing the 'abjad_output' key in the configuration.

AbjadConfig supports the mutable mapping interface, and can be subscripted as a dictionary.

Returns *AbjadConfig* instance.

Read-only Properties

AbjadConfig.**ABJAD_CONFIG_DIRECTORY_PATH**

AbjadConfig.**ABJAD_CONFIG_FILE_PATH**

AbjadConfig.**ABJAD_EXPERIMENTAL_PATH**

AbjadConfig.**ABJAD_OUTPUT_PATH**

AbjadConfig.**ABJAD_PATH**

AbjadConfig.**ABJAD_ROOT_PATH**

AbjadConfig.**HOME_PATH**

AbjadConfig.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

AbjadConfig.**clear**()
Inherited from _abcoll.MutableMapping

AbjadConfig.**get**(*key*, *default=None*)
Inherited from _abcoll.Mapping

AbjadConfig.**get_config_spec**()

AbjadConfig.**get_initial_comment**()

AbjadConfig.**get_option_comments**()

AbjadConfig.**get_option_definitions**()

AbjadConfig.**get_option_specs**()

AbjadConfig.**items**()
Inherited from _abcoll.Mapping

AbjadConfig.**iteritems**()
Inherited from _abcoll.Mapping

AbjadConfig.**iterkeys**()
Inherited from _abcoll.Mapping

AbjadConfig.**itervalues**()
Inherited from _abcoll.Mapping

AbjadConfig.**keys**()
Inherited from _abcoll.Mapping

AbjadConfig.**pop**(*key*, *default=<object object at 0x1002b0040>*)
Inherited from _abcoll.MutableMapping

AbjadConfig.**popitem**()
Inherited from _abcoll.MutableMapping

AbjadConfig.**setdefault**(*key*, *default=None*)
Inherited from _abcoll.MutableMapping

AbjadConfig.**update**(**args*, ***kwds*)
Inherited from _abcoll.MutableMapping

AbjadConfig.**values**()
Inherited from _abcoll.Mapping

Special Methods

AbjadConfig.**__contains__**(*key*)
Inherited from _abcoll.Mapping

AbjadConfig.**__delitem__**(*i*)

AbjadConfig.**__eq__**(*other*)
Inherited from _abcoll.Mapping

AbjadConfig.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadConfig.**__getitem__**(*i*)

AbjadConfig.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

AbjadConfig.**__iter__**()

AbjadConfig.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadConfig.**__len__**()

AbjadConfig.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjadConfig.**__ne__**(*other*)
Inherited from _abcoll.Mapping

AbjadConfig.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

AbjadConfig.**__setitem__**(*i*, *arg*)

functions

configurationtools.get_abjad_revision_string

configurationtools.**get_abjad_revision_string**()
New in version 2.0. Get Abjad revision string:

```
>>> configurationtools.get_abjad_revision_string()
'5280'
```

Return string.

configurationtools.get_abjad_startup_string

configurationtools.**get_abjad_startup_string**()

configurationtools.get_abjad_version_string

configurationtools.**get_abjad_version_string**()
New in version 2.0. Get Abjad version string:

```
>>> from abjad.tools import configurationtools

>>> configurationtools.get_abjad_version_string()
'2.10'
```

Return string.

configurationtools.get_lilypond_version_string

configurationtools.**get_lilypond_version_string**()
New in version 2.0. Get LilyPond version string:

```
>>> configurationtools.get_lilypond_version_string()
'2.13.61'
```

Return string.

configurationtools.get_python_version_string

configurationtools.**get_python_version_string**()
New in version 2.0. Get Python version string:

```
>>> from abjad.tools import configurationtools

>>> configurationtools.get_python_version_string()
'2.6.1'
```

Return string.

configurationtools.get_tab_width

configurationtools.**get_tab_width**()
New in version 2.9. Get system tab width:

```
>>> from abjad.tools import configurationtools

>>> configurationtools.get_tab_width()
4
```

The value is used by various functions that generate or test code in the system.

Return nonnegative integer. Changed in version 2.10: renamed `configurationtools.get_system_tab_width()` to `configurationtools.get_tab_width()`.

configurationtools.get_text_editor

configurationtools.**get_text_editor**()
New in version 2.2. Get OS-appropriate text editor.

configurationtools.list_abjad_environment_variables

configurationtools.**list_abjad_environment_variables**()
New in version 1.1. List Abjad environment variables.

Return tuple of zero or more environment variable / setting pairs.

Abjad environment variables are defined in abjad/tools/configurationtools/AbjadConfig/AbjadConfig.py. Changed in version 2.0: renamed configurationtools.list_settings() to configurationtools.list_abjad_environment_variables().

configurationtools.list_package_dependency_versions

configurationtools.**list_package_dependency_versions**()
List package dependency versions:

```
>>> from abjad.tools import configurationtools

>>> configurationtools.list_package_dependency_versions()
{'sphinx': '1.1.2', 'py.test': '2.1.2'}
```

Return dictionary.

configurationtools.read_abjad_user_config_file

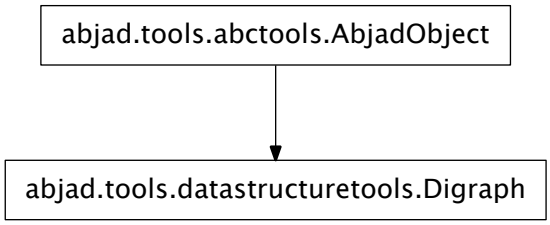
configurationtools.**read_abjad_user_config_file**(*attribute_name*)
Read the content of the config file $HOME/.abjad/config.py.

Returns a dictionary of var : value entries. Changed in version 2.10: renamed configurationtools.read_user_abjad_config_file() to ABJCFG().

datastructuretools

concrete classes

datastructuretools.Digraph



class datastructuretools.**Digraph**(*edges=None*)

A digraph, built out of edges - pairs of hashable objects:

```
>>> from abjad.tools.datastructuretools import Digraph

>>> edges = [('a', 'b'), ('a', 'c'), ('a', 'f'), ('c', 'd'), ('d', 'e'), ('e', 'c')]
>>> digraph = Digraph(edges)
>>> digraph
Digraph(edges=[('a', 'c'), ('a', 'b'), ('a', 'f'), ('c', 'd'), ('d', 'e'), ('e', 'c')])

>>> digraph.root_nodes
('a',)
>>> digraph.terminal_nodes
('b', 'f')
>>> digraph.cyclic_nodes
('c', 'd', 'e')
>>> digraph.is_cyclic
True
```

Return *Digraph* instance.

Read-only Properties

Digraph.**child_graph**

A dictionary representation of the digraph where the keys are child nodes, and where each value is the set of that child's parents.

Digraph.**cyclic_nodes**

A tuple of those nodes which partake in a cycle.

Digraph.**edges**

A tuple of all edges in the graph.

Digraph.**is_cyclic**

Return True if the digraph contains any cycles.

Digraph.**nodes**

A tuple of all nodes in the graph.

Digraph.**parent_graph**
A dictionary representation of the digraph where the keys are parent nodes, and where each value is the set of that parent's children.

Digraph.**root_nodes**
A tuple of those nodes which have no parents.

Digraph.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Digraph.**terminal_nodes**
A tuple of those nodes which have no children.

Methods

Digraph.**partition**()
Partition the digraph into a list of digraphs according to connectivity:

```
>>> from abjad.tools.datastructuretools import Digraph

>>> edges = [('a', 'b'), ('a', 'c'), ('b', 'c'), ('b', 'd'), ('d', 'e')]
>>> edges.extend([('f', 'h'), ('g', 'h')])
>>> edges.append(('i', 'j'))
>>> digraph = Digraph(edges)
>>> for graph in digraph.partition(): graph
...
Digraph(edges=[('a', 'c'), ('a', 'b'), ('b', 'c'), ('b', 'd'), ('d', 'e')])
Digraph(edges=[('f', 'h'), ('g', 'h')])
Digraph(edges=[('i', 'j')])
```

Return list of *Digraph* instances.

Digraph.**reverse**()
Reverse all edges in the graph:

```
>>> from abjad.tools.datastructuretools import Digraph

>>> edges = [('a', 'b'), ('b', 'c'), ('b', 'd')]
>>> digraph = Digraph(edges)
>>> digraph
Digraph(edges=[('a', 'b'), ('b', 'c'), ('b', 'd')])

>>> digraph.reverse()
Digraph(edges=[('b', 'a'), ('c', 'b'), ('d', 'b')])
```

Return *Digraph* instance.

Special Methods

Digraph.**__eq__**(*other*)
Digraph.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Digraph.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Digraph.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Digraph.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

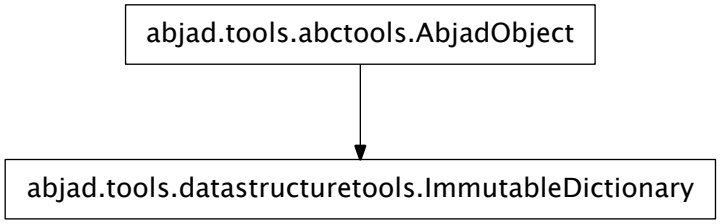
Digraph.__ne__(*other*)

Digraph.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

datastructuretools.ImmutableDictionary



class datastructuretools.**ImmutableDictionary**
New in version 2.0. Immutable dictionary:

```
>>> from abjad.tools import datastructuretools

>>> dictionary = datastructuretools.ImmutableDictionary({'color': 'red', 'number': 9})

>>> dictionary
{'color': 'red', 'number': 9}

>>> dictionary['color']
'red'
```

```
>>> dictionary.size = 'large'
AttributeError: ImmutableDictionary objects are immutable.

>>> dictionary['size'] = 'large'
AttributeError: ImmutableDictionary objects are immutable.
```

Return immutable dictionary.

Read-only Properties

`ImmutableDictionary.storage_format`
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`ImmutableDictionary.clear()` → None. Remove all items from D.
Inherited from `__builtin__.dict`

`ImmutableDictionary.copy()` → a shallow copy of D
Inherited from `__builtin__.dict`

`ImmutableDictionary.get(`$k[, d]$`)` → D[k] if k in D, else d. d defaults to None.
Inherited from `__builtin__.dict`

`ImmutableDictionary.has_key(`k`)` → True if D has a key k, else False
Inherited from `__builtin__.dict`

`ImmutableDictionary.items()` → list of D's (key, value) pairs, as 2-tuples
Inherited from `__builtin__.dict`

`ImmutableDictionary.iteritems()` → an iterator over the (key, value) items of D
Inherited from `__builtin__.dict`

`ImmutableDictionary.iterkeys()` → an iterator over the keys of D
Inherited from `__builtin__.dict`

`ImmutableDictionary.itervalues()` → an iterator over the values of D
Inherited from `__builtin__.dict`

`ImmutableDictionary.keys()` → list of D's keys
Inherited from `__builtin__.dict`

`ImmutableDictionary.pop(`$k[, d]$`)` → v, remove specified key and return the corresponding value.
If key is not found, d is returned if given, otherwise KeyError is raised

Inherited from `__builtin__.dict`

`ImmutableDictionary.popitem()` → (k, v), remove and return some (key, value) pair as a
2-tuple; but raise KeyError if D is empty.

Inherited from `__builtin__.dict`

`ImmutableDictionary.setdefault(`$k[, d]$`)` → D.get(k,d), also set D[k]=d if k not in D
Inherited from `__builtin__.dict`

`ImmutableDictionary.update(`$[E]$, $**F$`)` → None. Update D from dict/iterable E and F.
If E present and has a .keys() method, does: for k in E: D[k] = E[k] If E present and lacks .keys() method, does: for (k, v) in E: D[k] = v In either case, this is followed by: for k in F: D[k] = F[k]

Inherited from `__builtin__.dict`

ImmutableDictionary.**values**() → list of D's values
Inherited from __builtin__.dict

ImmutableDictionary.**viewitems**() → a set-like object providing a view on D's items
Inherited from __builtin__.dict

ImmutableDictionary.**viewkeys**() → a set-like object providing a view on D's keys
Inherited from __builtin__.dict

ImmutableDictionary.**viewvalues**() → an object providing a view on D's values
Inherited from __builtin__.dict

Special Methods

ImmutableDictionary.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.dict

ImmutableDictionary.**__contains__**(*k*) → True if D has a key k, else False
Inherited from __builtin__.dict

ImmutableDictionary.**__delitem__**(**args*)

ImmutableDictionary.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.dict

ImmutableDictionary.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.dict

ImmutableDictionary.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.dict

ImmutableDictionary.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.dict

ImmutableDictionary.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.dict

ImmutableDictionary.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.dict

ImmutableDictionary.**__len__**() <==> *len(x)*
Inherited from __builtin__.dict

ImmutableDictionary.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.dict

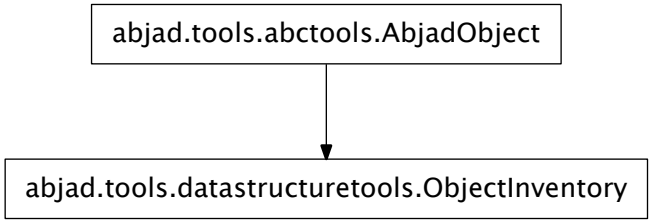
ImmutableDictionary.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.dict

ImmutableDictionary.**__repr__**() <==> *repr(x)*
Inherited from __builtin__.dict

ImmutableDictionary.**__setitem__**(**args*)

datastructuretools.ObjectInventory



class datastructuretools.**ObjectInventory**(*tokens=None*, *name=None*)

New in version 2.8. Ordered collection of custom objects.

Object inventories extend `append()`, `extend()` and `__contains__()` and allow token input.

Object inventories inherit from list and are mutable.

This class is an abstract base class that can not instantiate and should be subclassed.

Read-only Properties

ObjectInventory.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

ObjectInventory.**name**

Read / write name of inventory.

Methods

ObjectInventory.**append**(*token*)

Change *token* to item and append.

ObjectInventory.**count**(*value*) → integer – return number of occurrences of value

Inherited from __builtin__.list

ObjectInventory.**extend**(*tokens*)

Change *tokens* to items and extend.

ObjectInventory.**index**(*value*[, *start*[, *stop*]]) → integer – return first index of value.

Raises ValueError if the value is not present.

Inherited from __builtin__.list

ObjectInventory.**insert**()

L.insert(index, object) – insert object before index

Inherited from __builtin__.list

ObjectInventory.**pop**([*index*]) → item – remove and return item at index (default last).
Raises IndexError if list is empty or index is out of range.

Inherited from __builtin__.list

ObjectInventory.**remove**()
L.remove(value) – remove first occurrence of value. Raises ValueError if the value is not present.

Inherited from __builtin__.list

ObjectInventory.**reverse**()
L.reverse() – reverse *IN PLACE*

Inherited from __builtin__.list

ObjectInventory.**sort**()
L.sort(cmp=None, key=None, reverse=False) – stable sort *IN PLACE*; cmp(x, y) -> -1, 0, 1

Inherited from __builtin__.list

Special Methods

ObjectInventory.**__add__**()
x.__add__(y) <==> x+y

Inherited from __builtin__.list

ObjectInventory.**__contains__**(*token*)

ObjectInventory.**__delitem__**()
x.__delitem__(y) <==> del x[y]

Inherited from __builtin__.list

ObjectInventory.**__delslice__**()
x.__delslice__(i, j) <==> del x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

ObjectInventory.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.list

ObjectInventory.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.list

ObjectInventory.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.list

ObjectInventory.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from __builtin__.list

ObjectInventory.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.list

ObjectInventory.**__iadd__**()
x.__iadd__(y) <==> x+=y

Inherited from __builtin__.list

ObjectInventory.**__imul__**()
x.__imul__(y) <==> x*=y

Inherited from __builtin__.list

ObjectInventory.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.list

ObjectInventory.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.list

ObjectInventory.**__len__**() <==> *len(x)*
Inherited from __builtin__.list

ObjectInventory.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.list

ObjectInventory.**__mul__**()
x.__mul__(n) <==> x*n

Inherited from __builtin__.list

ObjectInventory.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.list

ObjectInventory.**__repr__**()

ObjectInventory.**__reversed__**()
L.__reversed__() – return a reverse iterator over the list

Inherited from __builtin__.list

ObjectInventory.**__rmul__**()
x.__rmul__(n) <==> n*x

Inherited from __builtin__.list

ObjectInventory.**__setitem__**()
x.__setitem__(i, y) <==> x[i]=y

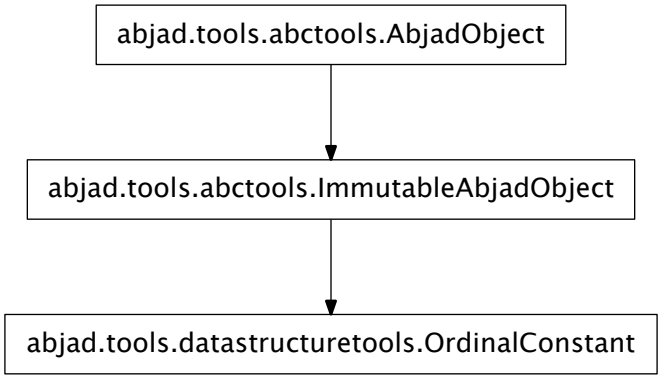
Inherited from __builtin__.list

ObjectInventory.**__setslice__**()
x.__setslice__(i, j, y) <==> x[i:j]=y

Use of negative indices is not supported.

Inherited from __builtin__.list

datastructuretools.OrdinalConstant



class datastructuretools.**OrdinalConstant**(**args*, ***kwargs*)

New in version 1.0. Ordinal constant.

Initialize with *dimension*, *value* and *representation*:

```
>>> from abjad.tools import datastructuretools
```

```
>>> Left = datastructuretools.OrdinalConstant('x', -1, 'Left')
>>> Left
Left
```

```
>>> Right = datastructuretools.OrdinalConstant('x', 1, 'Right')
>>> Right
Right
```

```
>>> Left < Right
True
```

Comparing like-dimensioned ordinal constants is allowed:

```
>>> Up = datastructuretools.OrdinalConstant('y', 1, 'Up')
>>> Up
Up
```

```
>>> Down = datastructuretools.OrdinalConstant('y', -1, 'Down')
>>> Down
Down
```

```
>>> Down < Up
True
```

Comparing differently dimensioned ordinal constants raises an exception:

```
>>> import py.test
```

```
>>> bool(py.test.raises(Exception, 'Left < Up'))
True
```

The `Left`, `Right`, `Center`, `Up` and `Down` constants shown here load into Python's built-in namespace on Abjad import.

These four objects can be used as constant values supplied to keywords.

This behavior is similar to True, False and None.

Ordinal constants are immutable.

Read-only Properties

`OrdinalConstant.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Special Methods

`OrdinalConstant.`**`__eq__`**`(`*expr*`)`
`OrdinalConstant.`**`__ge__`**`(`*expr*`)`

`OrdinalConstant.`**`__gt__`**`(`*expr*`)`

`OrdinalConstant.`**`__le__`**`(`*expr*`)`

`OrdinalConstant.`**`__lt__`**`(`*expr*`)`

`OrdinalConstant.`**`__ne__`**`(`*arg*`)`

True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`OrdinalConstant.`**`__repr__`**`()`

decoratortools

functions

decoratortools.requires

`decoratortools.`**`requires`**`(`**tests*`)`

New in version 2.6. Function decorator to require input parameter *tests*.

Example:

```
>>> from abjad.tools import mathtools
>>> from abjad.tools.decoratortools import requires

>>> @requires(mathtools.is_nonnegative_integer, string)
>>> def multiply_string(n, string): return n * string

>>> multiply_string(2, 'bar')
'barbar'
```

```
>>> multiply_string(2.5, 'bar')
...
AssertionError: is_nonnegative_integer(2.5) does not return true.
```

Decorator target is available like this:

```
>>> multiply_string.func_closure[1].cell_contents
<function multiply_string at 0x104e512a8>
```

Decorator tests are available like this:

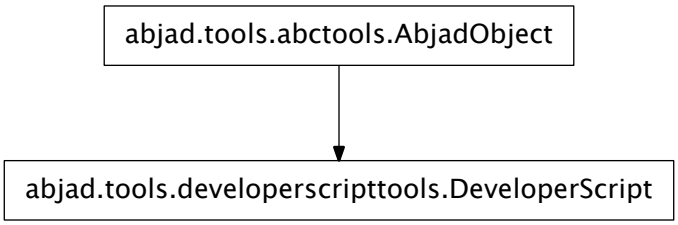
```
>>> multiply_string.func_closure[0].cell_contents
(<function is_nonnegative_integer at 0x104725d70>, <type 'str'>)
```

Return decorated function in the form of function wrapper.

developerscripttools

abstract classes

developerscripttools.DeveloperScript



class developerscripttools.**DeveloperScript**

Abjad object-oriented model of a developer script.

DeveloperScript is the abstract parent from which concrete developer scripts inherit.

Developer scripts can be called from the command line, generally via the *ajv* command.

Developer scripts can be instantiated by other developer scripts in order to share functionality.

Read-only Properties

DeveloperScript.**alias**

The alias to use for the script, useful only if the script defines an abj-dev scripting group as well.

DeveloperScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

DeveloperScript.**formatted_help**

DeveloperScript.**formatted_usage**

DeveloperScript.**formatted_version**

DeveloperScript.**long_description**
The long description, printed after arguments explanations.

DeveloperScript.**program_name**
The name of the script, callable from the command line.

DeveloperScript.**scripting_group**
The script's scripting subcommand group.

DeveloperScript.**short_description**
The short description of the script, printed before arguments explanations.

Also used as a summary in other contexts.

DeveloperScript.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

DeveloperScript.**version**
The version number of the script.

Methods

DeveloperScript.**process_args**(*args*)
DeveloperScript.**setup_argument_parser**()

Special Methods

DeveloperScript.**__call__**(*args=None*)
DeveloperScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DeveloperScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DeveloperScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DeveloperScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DeveloperScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DeveloperScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

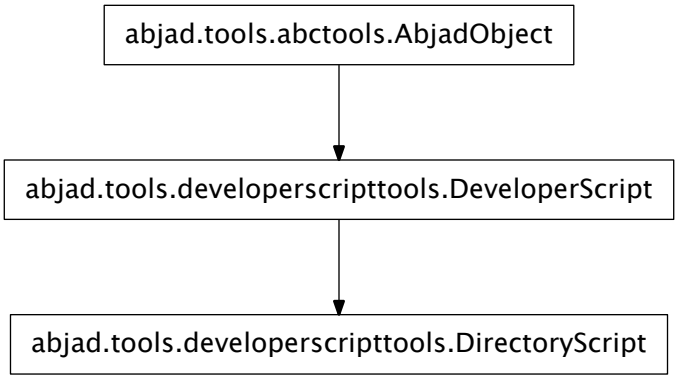
Inherited from abctools.AbjadObject

DeveloperScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.DirectoryScript



class developerscripttools.**DirectoryScript**
DirectoryScript provides utilities for validating file system paths.

DirectoryScript is abstract.

Read-only Properties

DirectoryScript.**alias**
The alias to use for the script, useful only if the script defines an abj-dev scripting group as well.

Inherited from developerscripttools.DeveloperScript

DirectoryScript.**argument_parser**
The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

DirectoryScript.**formatted_help**
Inherited from developerscripttools.DeveloperScript

DirectoryScript.**formatted_usage**
Inherited from developerscripttools.DeveloperScript

DirectoryScript.**formatted_version**
Inherited from developerscripttools.DeveloperScript

DirectoryScript.**long_description**
The long description, printed after arguments explanations.

Inherited from developerscripttools.DeveloperScript

DirectoryScript.**program_name**
The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

DirectoryScript.**scripting_group**
The script's scripting subcommand group.

Inherited from developerscripttools.DeveloperScript

DirectoryScript.**short_description**
The short description of the script, printed before arguments explanations.

Also used as a summary in other contexts.

Inherited from developerscripttools.DeveloperScript

DirectoryScript.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

DirectoryScript.**version**
The version number of the script.

Inherited from developerscripttools.DeveloperScript

Methods

DirectoryScript.**process_args**(*args*)
Inherited from developerscripttools.DeveloperScript

DirectoryScript.**setup_argument_parser**()
Inherited from developerscripttools.DeveloperScript

Special Methods

DirectoryScript.**__call__**(*args=None*)
Inherited from developerscripttools.DeveloperScript

DirectoryScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DirectoryScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DirectoryScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DirectoryScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DirectoryScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DirectoryScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

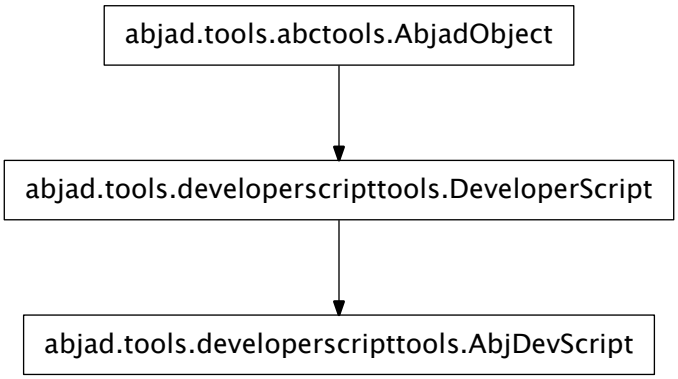
DirectoryScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

concrete classes

developerscripttools.AbjDevScript



class developerscripttools.**AbjDevScript**
AbjDevScript is the commandline entry-point to the Abjad developer scripts catalog.

Can be accessed on the commandline via *abj-dev* or *ajv*:

```
bash$ abj-dev
usage: abj-dev [-h] [--version]
```

```
                {help,list,api,book,clean,count,doctest,grep,new,rename,replace,svn}
                ...

    Entry-point to Abjad developer scripts catalog.

    optional arguments:
      -h, --help            show this help message and exit
      --version             show program's version number and exit

    subcommands:
      {help,list,api,book,clean,count,doctest,grep,new,rename,replace,svn}
        help                print subcommand help
        list                list subcommands
        api                 Build the Abjad APIs.
        book                Preprocess HTML, LaTeX or ReST source with Abjad.
        clean               Clean .pyc, __pycache__ and tmp* files and folders
                            from PATH.
        count               "count"-related subcommands
        doctest             Run doctests on all modules in current path.
        grep                grep PATTERN in PATH
        new                 "new"-related subcommands
        rename              Rename public modules.
        replace             "replace"-related subcommands
        svn                 "svn"-related subcommands
```

ajv supports subcommands similar to *svn*:

```
bash$ ajv count -h
usage: abj-dev count [-h] {linewidths,tools} ...

optional arguments:
  -h, --help          show this help message and exit

count subcommands:
  {linewidths,tools}
    linewidths        Count maximum line-width of all modules in PATH.
    tools             Count tools in PATH.
```

Return *AbjDevScript* instance.

Read-only Properties

AbjDevScript.**alias**

The alias to use for the script, useful only if the script defines an abj-dev scripting group as well.

Inherited from developerscripttools.DeveloperScript

AbjDevScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

AbjDevScript.**developer_script_aliases**

AbjDevScript.**developer_script_classes**

AbjDevScript.**developer_script_program_names**

AbjDevScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

AbjDevScript.**formatted_usage**
Inherited from developerscripttools.DeveloperScript

AbjDevScript.**formatted_version**
Inherited from developerscripttools.DeveloperScript

AbjDevScript.**long_description**

AbjDevScript.**program_name**
The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

AbjDevScript.**scripting_group**
The script's scripting subcommand group.

Inherited from developerscripttools.DeveloperScript

AbjDevScript.**short_description**

AbjDevScript.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

AbjDevScript.**version**

Methods

AbjDevScript.**process_args**(*args*)
AbjDevScript.**setup_argument_parser**(*parser*)

Special Methods

AbjDevScript.**__call__**(*args=None*)
AbjDevScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

AbjDevScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjDevScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

AbjDevScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjDevScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

AbjDevScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

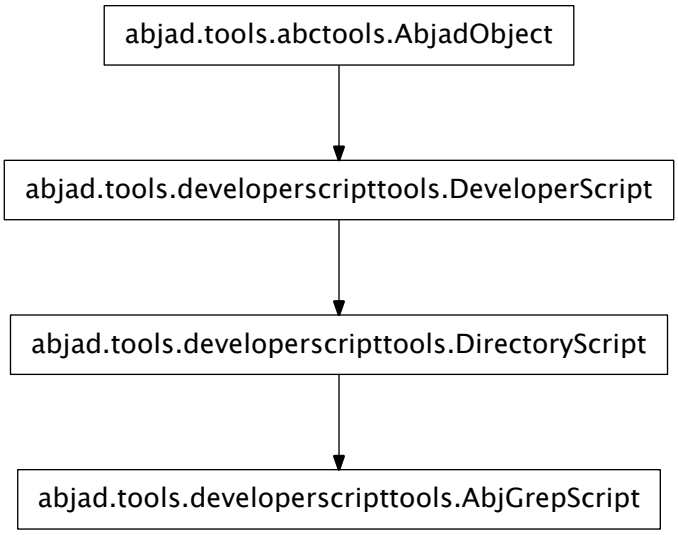
Inherited from abctools.AbjadObject

AbjDevScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.AbjGrepScript



class developerscripttools.**AbjGrepScript**
Run *grep* against a path, ignoring *svn* and docs-related files:

```
bash$ ajv grep -h
usage: abj-grep [-h] [--version] [-W] [-P PATH | -X | -M | -T | -R] pattern

grep PATTERN in PATH

positional arguments:
  pattern               pattern to search for
```

```
optional arguments:
  -h, --help            show this help message and exit
  --version             show program's version number and exit
  -W, --whole-words-only
                        match only whole words, similar to grep's "-w" flag
  -P PATH, --path PATH  grep PATH
  -X, --abjad.tools    grep Abjad abjad.tools directory
  -M, --mainline        grep Abjad mainline directory
  -T, --tools           grep Abjad mainline tools directory
  -R, --root            grep Abjad root directory

If no PATH flag is specified, the current directory will be searched.
```

Return *AbjGrepScript* instance.

Read-only Properties

AbjGrepScript.**alias**

AbjGrepScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

AbjGrepScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

AbjGrepScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

AbjGrepScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

AbjGrepScript.**long_description**

AbjGrepScript.**program_name**

The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

AbjGrepScript.**scripting_group**

AbjGrepScript.**short_description**

AbjGrepScript.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

AbjGrepScript.**version**

Methods

AbjGrepScript.**process_args**(*args*)

AbjGrepScript.**setup_argument_parser**(*parser*)

Special Methods

AbjGrepScript.**__call__**(*args=None*)

Inherited from developerscripttools.DeveloperScript

AbjGrepScript.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

AbjGrepScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

AbjGrepScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

AbjGrepScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

AbjGrepScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

AbjGrepScript.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

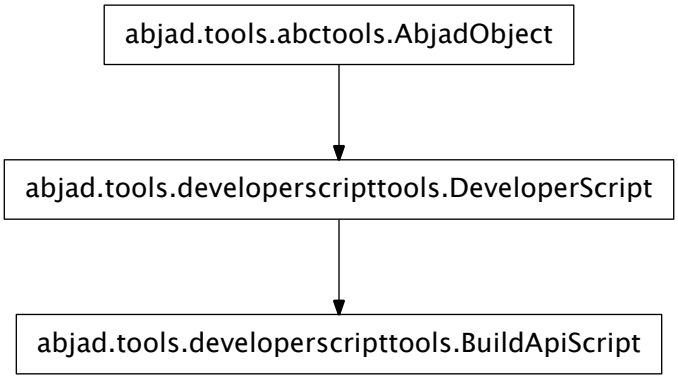
Inherited from `abctools.AbjadObject`

AbjGrepScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

developerscripttools.BuildApiScript



class developerscripttools.**BuildApiScript**

Build the Abjad APIs:

```
bash$ ajv api -h
usage: build-api [-h] [--version] [-M] [-X] [-C] [--format FORMAT]

Build the Abjad APIs.

optional arguments:
  -h, --help          show this help message and exit
  --version           show program's version number and exit
  -M, --mainline      build the mainline API
  -X, --abjad.tools  build the abjad.tools API
  -C, --clean         run "make clean" before building the api
  --format FORMAT     Sphinx builder to use
```

Return *BuildApiScript* instance.

Read-only Properties

BuildApiScript.**alias**

BuildApiScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

BuildApiScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

BuildApiScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

BuildApiScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

BuildApiScript.**long_description**

BuildApiScript.**program_name**
The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

BuildApiScript.**scripting_group**

BuildApiScript.**short_description**

BuildApiScript.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

BuildApiScript.**version**

Methods

BuildApiScript.**process_args**(*args*)
BuildApiScript.**setup_argument_parser**(*parser*)

Special Methods

BuildApiScript.**__call__**(*args=None*)
Inherited from developerscripttools.DeveloperScript
BuildApiScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

BuildApiScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BuildApiScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BuildApiScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BuildApiScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BuildApiScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

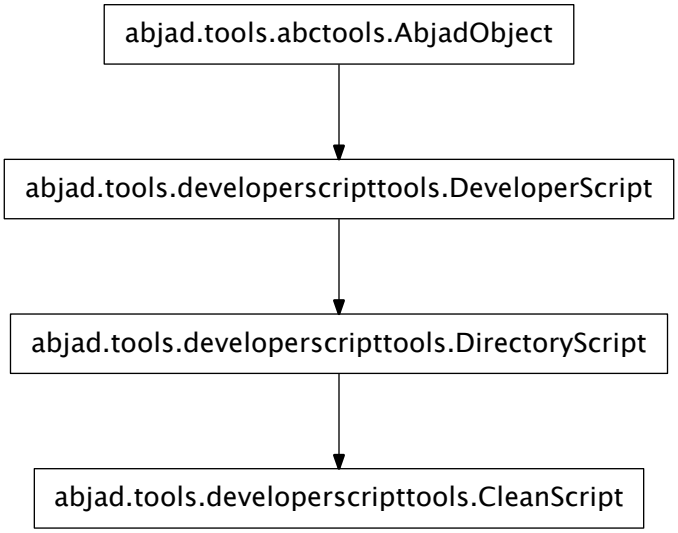
Inherited from abctools.AbjadObject

BuildApiScript.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.CleanScript



class developerscripttools.**CleanScript**
Remove *.pyc files and __pycache__ and tmp* directories recursively in a path:

```
bash$ ajv clean -h
usage: clean [-h] [--version] [--pyc] [--pycache] [--tmp] path

Clean .pyc, __pycache__ and tmp* files and folders from PATH.

positional arguments:
  path        directory tree to be recursed over

optional arguments:
  -h, --help  show this help message and exit
  --version   show program's version number and exit
  --pyc       delete .pyc files
  --pycache   delete __pycache__ folders
  --tmp       delete tmp* folders
```

Return *CleanScript* instance.

Read-only Properties

CleanScript.**alias**
CleanScript.**argument_parser**
The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

CleanScript.**formatted_help**
Inherited from developerscripttools.DeveloperScript

CleanScript.**formatted_usage**
Inherited from developerscripttools.DeveloperScript

CleanScript.**formatted_version**
Inherited from developerscripttools.DeveloperScript

CleanScript.**long_description**

CleanScript.**program_name**
The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

CleanScript.**scripting_group**

CleanScript.**short_description**

CleanScript.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

CleanScript.**version**

Methods

CleanScript.**process_args**(*args*)
CleanScript.**setup_argument_parser**(*parser*)

Special Methods

CleanScript.**__call__**(*args=None*)
Inherited from developerscripttools.DeveloperScript
CleanScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

CleanScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CleanScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

CleanScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CleanScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CleanScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

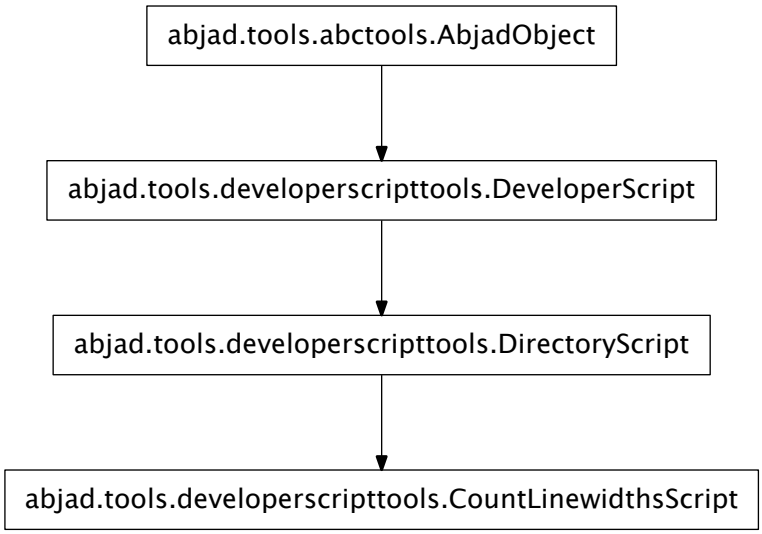
Inherited from abctools.AbjadObject

CleanScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.CountLinewidthsScript



class developerscripttools.**CountLinewidthsScript**
Tabulate the linewidths of modules in a path:

```
bash$ ajv count linewidths -h
usage: count-linewidths [-h] [--version] [-l N] [-o w|m] [-C | -D] [-a | -d]
                        [-gt N | -lt N | -eq N]
                        path

Count maximum line-width of all modules in PATH.

positional arguments:
  path                  directory tree to be recursed over

optional arguments:
  -h, --help            show this help message and exit
  --version             show program's version number and exit
  -l N, --limit N       limit output to last N items
  -o w|m, --order-by w|m
                        order by line width [w] or module name [m]
  -C, --code            count linewidths of all code in module
  -D, --docstrings      count linewidths of all docstrings in module
  -a, --ascending       sort results ascending
  -d, --descending      sort results descending
  -gt N, --greater-than N
                        line widths greater than N
  -lt N, --less-than N  line widths less than N
  -eq N, --equal-to N   line widths equal to N
```

Return *CountLinewidthsScript* instance.

Read-only Properties

CountLinewidthsScript.**alias**

CountLinewidthsScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

CountLinewidthsScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

CountLinewidthsScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

CountLinewidthsScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

CountLinewidthsScript.**long_description**

CountLinewidthsScript.**program_name**

The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

CountLinewidthsScript.**scripting_group**

CountLinewidthsScript.**short_description**

CountLinewidthsScript.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

CountLinewidthsScript.**version**

Methods

CountLinewidthsScript.**process_args**(*args*)
CountLinewidthsScript.**setup_argument_parser**(*parser*)

Special Methods

CountLinewidthsScript.**__call__**(*args=None*)
Inherited from developerscripttools.DeveloperScript

CountLinewidthsScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

CountLinewidthsScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CountLinewidthsScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

CountLinewidthsScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CountLinewidthsScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CountLinewidthsScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

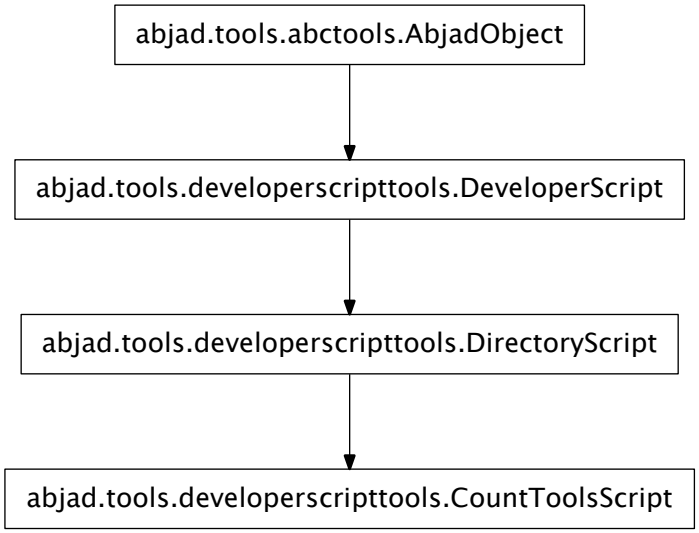
Inherited from abctools.AbjadObject

CountLinewidthsScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.CountToolsScript



class developerscripttools.**CountToolsScript**

Count public and private functions and classes in a path:

```
bash$ ajv count tools -h
usage: count-tools [-h] [--version] path

Count tools in PATH.

positional arguments:
  path        directory tree to be recursed over

optional arguments:
  -h, --help  show this help message and exit
  --version   show program's version number and exit
```

Return *CountToolsScript* instance.

Read-only Properties

CountToolsScript.**alias**

CountToolsScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

CountToolsScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

CountToolsScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

CountToolsScript.**formatted_version**
Inherited from developerscripttools.DeveloperScript

CountToolsScript.**long_description**

CountToolsScript.**program_name**
The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

CountToolsScript.**scripting_group**

CountToolsScript.**short_description**

CountToolsScript.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

CountToolsScript.**version**

Methods
CountToolsScript.**process_args**(*args*)
CountToolsScript.**setup_argument_parser**(*parser*)

Special Methods
CountToolsScript.**__call__**(*args=None*)
Inherited from developerscripttools.DeveloperScript
CountToolsScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

CountToolsScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CountToolsScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

CountToolsScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CountToolsScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

CountToolsScript.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

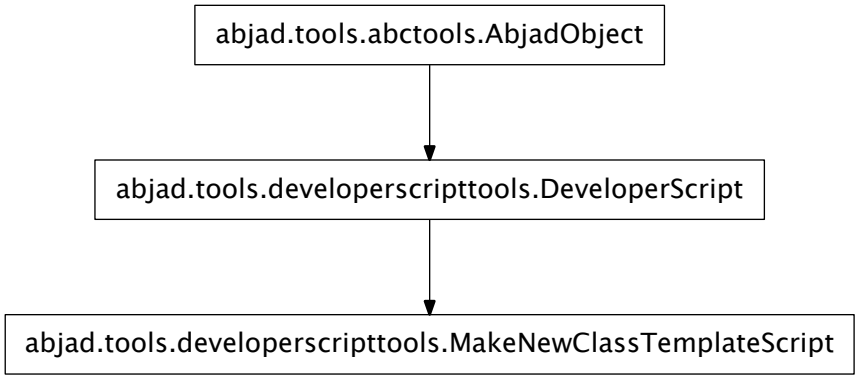
Inherited from `abctools.AbjadObject`

CountToolsScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

developerscripttools.MakeNewClassTemplateScript



class developerscripttools.**MakeNewClassTemplateScript**
Create class stubs, complete with test subdirectory:

```
bash$ ajv new class -h
usage: make-new-class-template [-h] [--version] (-X | -M) name

Make a new class template file.

positional arguments:
  name                tools package qualified class name

optional arguments:
  -h, --help          show this help message and exit
  --version           show program's version number and exit
  -X, --abjad.tools  use the Abjad abjad.tools path
  -M, --mainline      use the Abjad mainline tools path
```

Return *MakeNewClassTemplateScript* instance.

Read-only Properties
MakeNewClassTemplateScript.**alias**

MakeNewClassTemplateScript.**argument_parser**
The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

MakeNewClassTemplateScript.**formatted_help**
Inherited from developerscripttools.DeveloperScript

MakeNewClassTemplateScript.**formatted_usage**
Inherited from developerscripttools.DeveloperScript

MakeNewClassTemplateScript.**formatted_version**
Inherited from developerscripttools.DeveloperScript

MakeNewClassTemplateScript.**long_description**

MakeNewClassTemplateScript.**program_name**
The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

MakeNewClassTemplateScript.**scripting_group**

MakeNewClassTemplateScript.**short_description**

MakeNewClassTemplateScript.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

MakeNewClassTemplateScript.**version**

Methods

MakeNewClassTemplateScript.**process_args**(*args*)
MakeNewClassTemplateScript.**setup_argument_parser**(*parser*)

Special Methods

MakeNewClassTemplateScript.**__call__**(*args=None*)
Inherited from developerscripttools.DeveloperScript
MakeNewClassTemplateScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MakeNewClassTemplateScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MakeNewClassTemplateScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MakeNewClassTemplateScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MakeNewClassTemplateScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MakeNewClassTemplateScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

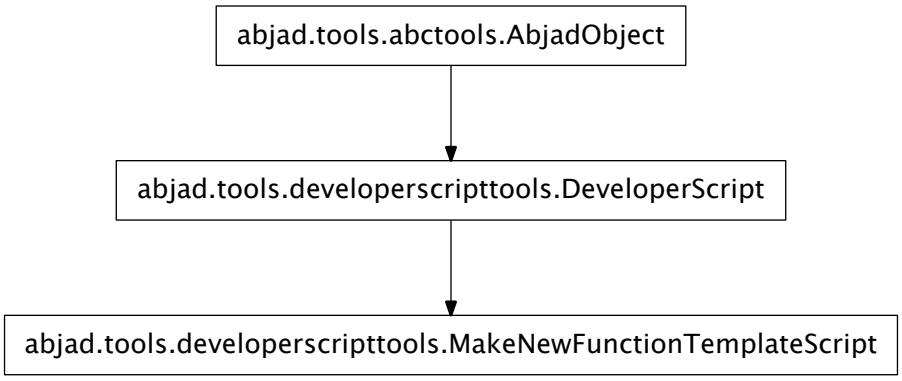
Inherited from abctools.AbjadObject

MakeNewClassTemplateScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.MakeNewFunctionTemplateScript



class developerscripttools.**MakeNewFunctionTemplateScript**
Create function stub files:

```
bash$ ajv new function -h
usage: make-new-function-template [-h] [--version] (-X | -M) name

Make a new function template file.

positional arguments:
  name                tools package qualified function name
```

```
optional arguments:
  -h, --help          show this help message and exit
  --version           show program's version number and exit
  -X, --abjad.tools  use the Abjad abjad.tools path
  -M, --mainline      use the Abjad mainline tools path
```

Return *MakeNewFunctionTemplateScript* instance.

Read-only Properties

MakeNewFunctionTemplateScript.**alias**

MakeNewFunctionTemplateScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

MakeNewFunctionTemplateScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

MakeNewFunctionTemplateScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

MakeNewFunctionTemplateScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

MakeNewFunctionTemplateScript.**long_description**

MakeNewFunctionTemplateScript.**program_name**

The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

MakeNewFunctionTemplateScript.**scripting_group**

MakeNewFunctionTemplateScript.**short_description**

MakeNewFunctionTemplateScript.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

MakeNewFunctionTemplateScript.**version**

Methods

MakeNewFunctionTemplateScript.**process_args**(*args*)

MakeNewFunctionTemplateScript.**setup_argument_parser**(*parser*)

Special Methods

MakeNewFunctionTemplateScript.**__call__**(*args=None*)

Inherited from developerscripttools.DeveloperScript

MakeNewFunctionTemplateScript.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MakeNewFunctionTemplateScript.__ge__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MakeNewFunctionTemplateScript.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MakeNewFunctionTemplateScript.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MakeNewFunctionTemplateScript.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MakeNewFunctionTemplateScript.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

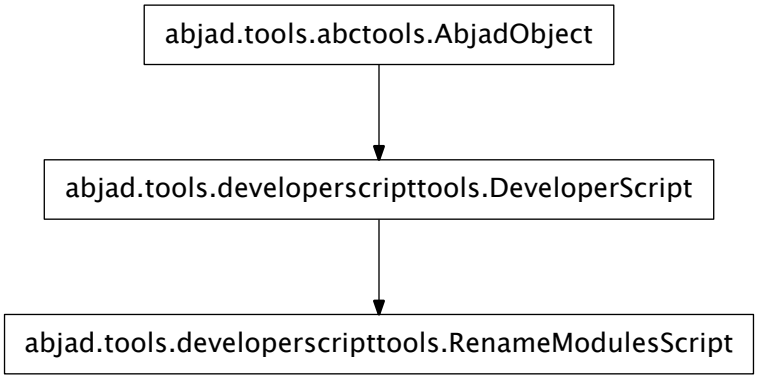
Inherited from abctools.AbjadObject

MakeNewFunctionTemplateScript.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.RenameModulesScript



class developerscripttools.**RenameModulesScript**

Rename classes and functions.

Handle renaming the module and package, as well as any tests, documentation or mentions of the class throughout the Abjad codebase:

```
$ ajv rename -h
usage: rename-modules [-h] [--version] (-C | -F)

Rename public modules.

optional arguments:
  -h, --help       show this help message and exit
  --version        show program's version number and exit
  -C, --classes    rename classes
  -F, --functions  rename functions
```

Return *RenameModulesScript* instance.

Read-only Properties

RenameModulesScript.**alias**

RenameModulesScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

RenameModulesScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

RenameModulesScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

RenameModulesScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

RenameModulesScript.**long_description**

RenameModulesScript.**program_name**
The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

RenameModulesScript.**scripting_group**

RenameModulesScript.**short_description**

RenameModulesScript.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

RenameModulesScript.**version**

Methods

RenameModulesScript.**process_args**(*args*)
RenameModulesScript.**setup_argument_parser**(*parser*)

Special Methods

RenameModulesScript.**__call__**(*args=None*)
Inherited from developerscripttools.DeveloperScript
RenameModulesScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

RenameModulesScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RenameModulesScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

RenameModulesScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RenameModulesScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

RenameModulesScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

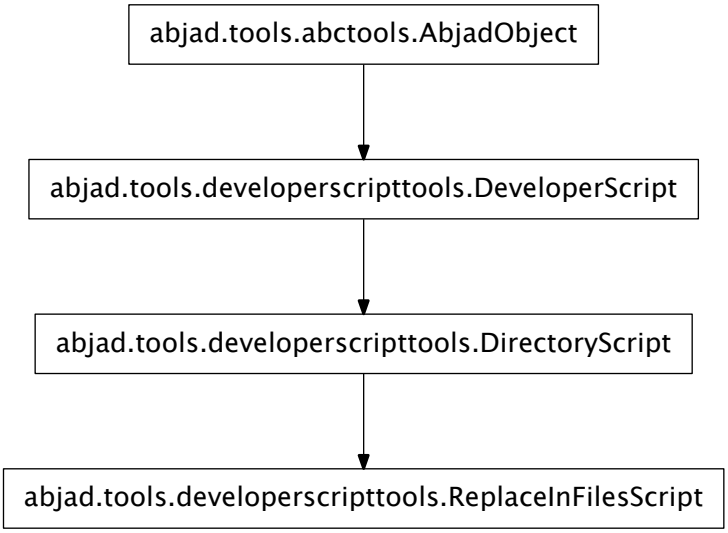
RenameModulesScript.__repr__()

Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.ReplaceInFilesScript



class developerscripttools.**ReplaceInFilesScript**

Replace text in files recursively:

```
bash$ ajv replace text -h
usage: replace-in-files [-h] [--version] [--verbose] [-Y] [-R] [-W]
                        [-F PATTERN] [-D PATTERN]
                        path old new

Replace text.

positional arguments:
  path                  directory tree to be recursed over
  old                   old text
  new                   new text

optional arguments:
  -h, --help            show this help message and exit
  --version             show program's version number and exit
  --verbose             print replacement info even when --force flag is set.
  -Y, --force           force "yes" to every replacement
  -R, --regex           treat "old" as a regular expression
```

```
-W, --whole-words-only
                      match only whole words, similar to grep's "-w" flag
-F PATTERN, --without-files PATTERN
                      Exclude files matching pattern(s)
-D PATTERN, --without-dirs PATTERN
                      Exclude folders matching pattern(s)
```

Multiple patterns for excluding files or folders can be specified by restating the *–without-files* or *–without-dirs* commands:

```
bash$ ajv replace text . foo bar -F *.txt -F *.rst -F *.htm
```

Return *ReplaceInFilesScript* instance.

Read-only Properties

ReplaceInFilesScript.**alias**

ReplaceInFilesScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

ReplaceInFilesScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

ReplaceInFilesScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

ReplaceInFilesScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

ReplaceInFilesScript.**long_description**

ReplaceInFilesScript.**program_name**

The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

ReplaceInFilesScript.**scripting_group**

ReplaceInFilesScript.**short_description**

ReplaceInFilesScript.**skipped_directories**

ReplaceInFilesScript.**skipped_files**

ReplaceInFilesScript.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

ReplaceInFilesScript.**version**

Methods

ReplaceInFilesScript.**process_args**(*args*)

ReplaceInFilesScript.**setup_argument_parser**(*parser*)

Special Methods

ReplaceInFilesScript.**__call__**(*args=None*)
Inherited from developerscripttools.DeveloperScript

ReplaceInFilesScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ReplaceInFilesScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReplaceInFilesScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ReplaceInFilesScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReplaceInFilesScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReplaceInFilesScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

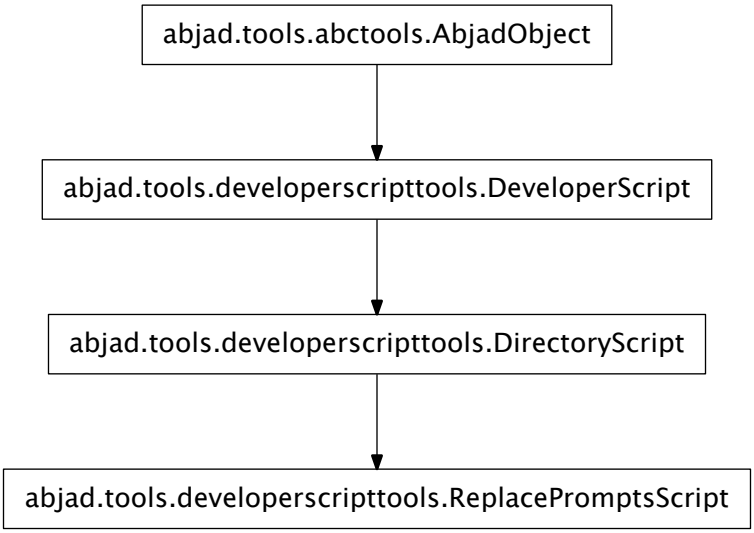
Inherited from abctools.AbjadObject

ReplaceInFilesScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.ReplacePromptsScript



class developerscripttools.**ReplacePromptsScript**

Replace prompts in code examples recursively:

```
bash$ ajv replace prompts -h
usage: replace-prompts [-h] [--version] [-PA | -AP] path

Replace prompts.

positional arguments:
  path                  directory tree to be recursed over

optional arguments:
  -h, --help            show this help message and exit
  --version             show program's version number and exit
  -PA, --python-to-abjad
                        replace Python (">>>") prompts with Abjad ("abjad>")
                        prompts
  -AP, --abjad-to-python
                        replace Abjad ("abjad>") prompts with Python (">>>")
                        prompts

examples:

  Replace Python prompts with Abjad prompts in the current directory:

  $ abj-dev replace prompts --python-to-abjad .

  Replace Abjad prompts with Python prompts in the grandparent directory:

  $ abj-dev replace prompts --abjad-to-python ../..
```

ReplacePromptsScript uses *ReplaceInFilesScript* for its replacement functionality.

Return *ReplacePromptsScript* instance.

Read-only Properties

ReplacePromptsScript.**alias**

ReplacePromptsScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

ReplacePromptsScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

ReplacePromptsScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

ReplacePromptsScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

ReplacePromptsScript.**long_description**

ReplacePromptsScript.**program_name**

The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

ReplacePromptsScript.**scripting_group**

ReplacePromptsScript.**short_description**

ReplacePromptsScript.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

ReplacePromptsScript.**version**

Methods

ReplacePromptsScript.**process_args**(*args*)

ReplacePromptsScript.**setup_argument_parser**(*parser*)

Special Methods

ReplacePromptsScript.**__call__**(*args=None*)

Inherited from developerscripttools.DeveloperScript

ReplacePromptsScript.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ReplacePromptsScript.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReplacePromptsScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ReplacePromptsScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReplacePromptsScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReplacePromptsScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

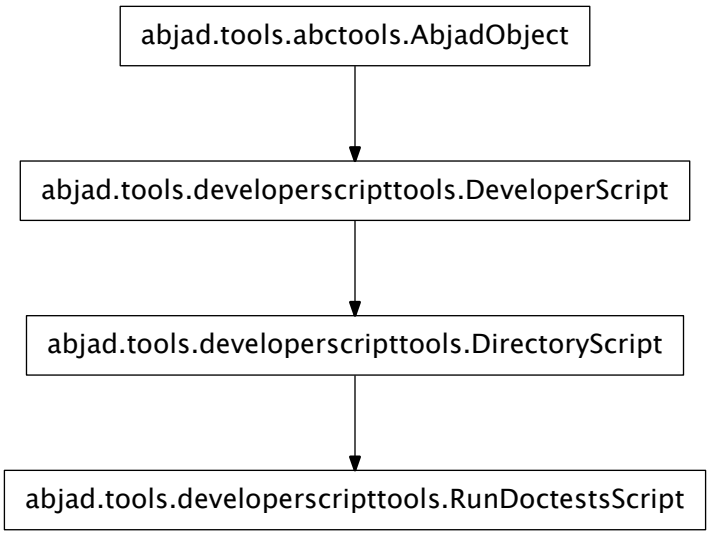
Inherited from abctools.AbjadObject

ReplacePromptsScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.RunDoctestsScript



class developerscripttools.**RunDoctestsScript**

Run doctests on all Python files in current directory recursively:

```
bash$ ajv doctest -h
usage: run-doctests [-h] [--version]

Run doctests on all modules in current path.

optional arguments:
  -h, --help  show this help message and exit
  --version   show program's version number and exit
```

Return *RunDoctestsScript* instance.

Read-only Properties

RunDoctestsScript.**alias**

RunDoctestsScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

RunDoctestsScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

RunDoctestsScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

RunDoctestsScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

RunDoctestsScript.**long_description**

RunDoctestsScript.**program_name**

The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

RunDoctestsScript.**scripting_group**

RunDoctestsScript.**short_description**

RunDoctestsScript.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

RunDoctestsScript.**version**

Methods

RunDoctestsScript.**process_args**(*args*)

RunDoctestsScript.**setup_argument_parser**(*parser*)

Special Methods

RunDoctestsScript.**__call__**(*args=None*)

Inherited from developerscripttools.DeveloperScript

RunDoctestsScript.__**eq**__(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

RunDoctestsScript.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

RunDoctestsScript.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

RunDoctestsScript.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

RunDoctestsScript.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

RunDoctestsScript.__**ne**__(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

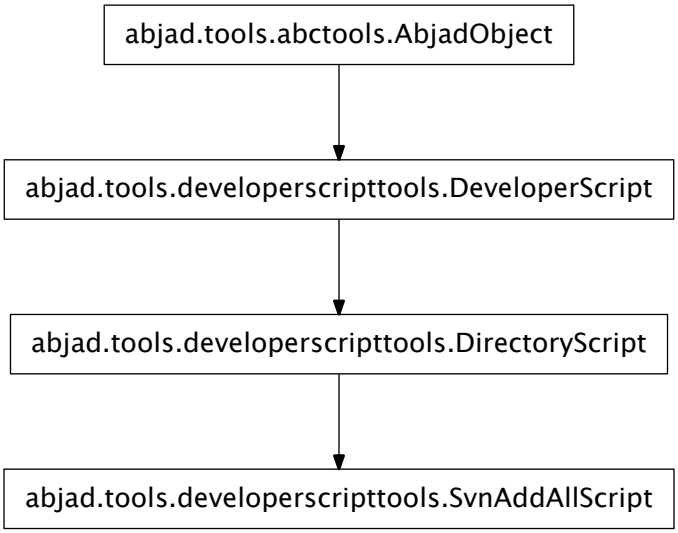
Inherited from `abctools.AbjadObject`

RunDoctestsScript.__**repr**__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

developerscripttools.SvnAddAllScript



class developerscripttools.**SvnAddAllScript**

Run *svn add* on all unversioned files in path:

```
bash$ ajv svn add -h
usage: svn-add-all [-h] [--version] path

"svn add" all unversioned files in PATH.

positional arguments:
  path        directory tree to be recursed over

optional arguments:
  -h, --help  show this help message and exit
  --version   show program's version number and exit
```

Return *SvnAddAllScript* instance.

Read-only Properties

SvnAddAllScript.**alias**

SvnAddAllScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

SvnAddAllScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

SvnAddAllScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

SvnAddAllScript.**formatted_version**
Inherited from developerscripttools.DeveloperScript

SvnAddAllScript.**long_description**

SvnAddAllScript.**program_name**
The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

SvnAddAllScript.**scripting_group**

SvnAddAllScript.**short_description**

SvnAddAllScript.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

SvnAddAllScript.**version**

Methods
SvnAddAllScript.**process_args**(*args*)
SvnAddAllScript.**setup_argument_parser**(*parser*)

Special Methods
SvnAddAllScript.**__call__**(*args=None*)
Inherited from developerscripttools.DeveloperScript
SvnAddAllScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

SvnAddAllScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SvnAddAllScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SvnAddAllScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SvnAddAllScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SvnAddAllScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

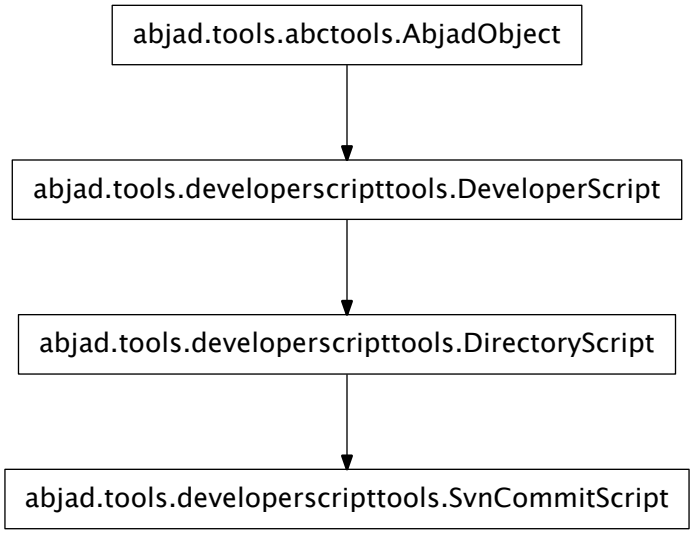
Inherited from abctools.AbjadObject

SvnAddAllScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.SvnCommitScript



class developerscripttools.**SvnCommitScript**
Run *svn commit*, using the commit message stored in the *.abjad* directory.

The commit message will be printed to the terminal, and must be manually accepted or rejected before proceeding:

```
bash$ ajv svn ci -h
usage: svn-commit [-h] [--version] path

"svn commit", using previously written commit message.

positional arguments:
  path        commit the path PATH

optional arguments:
  -h, --help  show this help message and exit
  --version   show program's version number and exit
```

Return *SvnCommitScript* instance.

Read-only Properties

SvnCommitScript.**alias**

SvnCommitScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

SvnCommitScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

SvnCommitScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

SvnCommitScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

SvnCommitScript.**long_description**

SvnCommitScript.**program_name**

The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

SvnCommitScript.**scripting_group**

SvnCommitScript.**short_description**

SvnCommitScript.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

SvnCommitScript.**version**

Methods

SvnCommitScript.**process_args**(*args*)

SvnCommitScript.**setup_argument_parser**(*parser*)

Special Methods

SvnCommitScript.**__call__**(*args=None*)

Inherited from developerscripttools.DeveloperScript

SvnCommitScript.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

SvnCommitScript.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SvnCommitScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SvnCommitScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SvnCommitScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SvnCommitScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

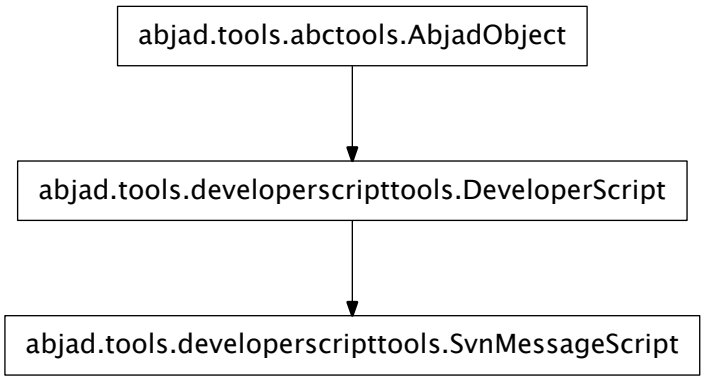
Inherited from abctools.AbjadObject

SvnCommitScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

developerscripttools.SvnMessageScript



class developerscripttools.**SvnMessageScript**
Edit a temporary *svn* commit message, stored in the *.abjad* directory:

```
bash$ ajv svn msg -h
usage: svn-message [-h] [--version] [-C]

Write commit message for future commit usage.

optional arguments:
  -h, --help   show this help message and exit
  --version    show program's version number and exit
  -C, --clean  delete previous commit message before editing
```

Return *SvnMessageScript* instance.

Read-only Properties

SvnMessageScript.**alias**

SvnMessageScript.**argument_parser**

The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

SvnMessageScript.**commit_message_path**

SvnMessageScript.**formatted_help**

Inherited from developerscripttools.DeveloperScript

SvnMessageScript.**formatted_usage**

Inherited from developerscripttools.DeveloperScript

SvnMessageScript.**formatted_version**

Inherited from developerscripttools.DeveloperScript

SvnMessageScript.**long_description**

SvnMessageScript.**program_name**

The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

SvnMessageScript.**scripting_group**

SvnMessageScript.**short_description**

SvnMessageScript.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

SvnMessageScript.**version**

Methods

SvnMessageScript.**process_args**(*args*)

SvnMessageScript.**setup_argument_parser**(*parser*)

Special Methods

SvnMessageScript.**__call__**(*args=None*)

Inherited from developerscripttools.DeveloperScript

SvnMessageScript.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

SvnMessageScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

SvnMessageScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

SvnMessageScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

SvnMessageScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

SvnMessageScript.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

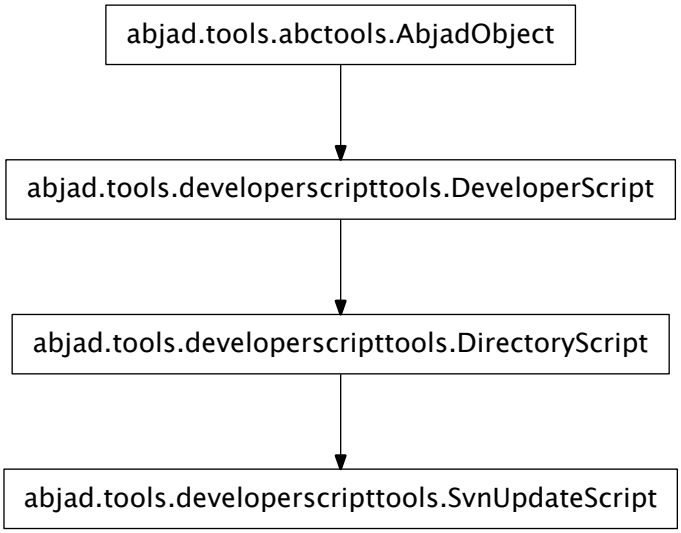
Inherited from `abctools.AbjadObject`

SvnMessageScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

developerscripttools.SvnUpdateScript



class developerscripttools.**SvnUpdateScript**

Run *svn up* on various Abjad paths:

```
bash$ ajv svn up -h
usage: svn-update [-h] [--version] [-C] [-P PATH | -E | -M | -R]

"svn update" various paths.

optional arguments:
  -h, --help            show this help message and exit
  --version             show program's version number and exit
  -C, --clean           remove .pyc files and __pycache__ directories before
                        updating
  -P PATH, --path PATH  update the path PATH
  -E, --abjad.tools    update Abjad abjad.tools directory
  -M, --mainline        update Abjad mainline directory
  -R, --root            update Abjad root directory

If no path flag is specified, the current directory will be updated.
```

It is usually most useful to run the script with the *–clean* flag, in case there are incoming deletes, as *svn* will not delete directories containing unversioned files, such as .pyc:

```
bash$ ajv svn up -C -R
```

Return *SvnUpdateScript* instance.

Read-only Properties

SvnUpdateScript.**alias**

SvnUpdateScript.**argument_parser**
The script's instance of argparse.ArgumentParser.

Inherited from developerscripttools.DeveloperScript

SvnUpdateScript.**formatted_help**
Inherited from developerscripttools.DeveloperScript

SvnUpdateScript.**formatted_usage**
Inherited from developerscripttools.DeveloperScript

SvnUpdateScript.**formatted_version**
Inherited from developerscripttools.DeveloperScript

SvnUpdateScript.**long_description**

SvnUpdateScript.**program_name**
The name of the script, callable from the command line.

Inherited from developerscripttools.DeveloperScript

SvnUpdateScript.**scripting_group**

SvnUpdateScript.**short_description**

SvnUpdateScript.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

SvnUpdateScript.**version**

Methods

SvnUpdateScript.**process_args**(*args*)
SvnUpdateScript.**setup_argument_parser**(*parser*)

Special Methods

SvnUpdateScript.**__call__**(*args=None*)
Inherited from developerscripttools.DeveloperScript
SvnUpdateScript.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

SvnUpdateScript.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SvnUpdateScript.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SvnUpdateScript.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SvnUpdateScript.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SvnUpdateScript.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

SvnUpdateScript.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

functions

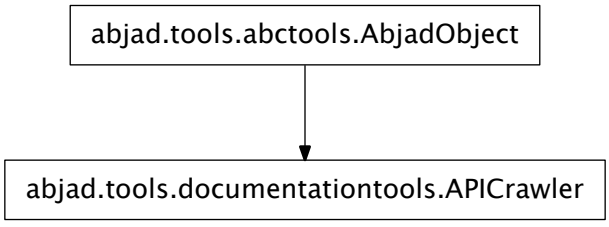
developerscripttools.get_developer_script_classes

developerscripttools.**get_developer_script_classes**()
Return a list of all developer script classes.

documentationtools

concrete classes

documentationtools.APICrawler



class documentationtools.**APICrawler**(*code_root, docs_root, root_package_name, ignored_directories=['test', '.svn', '__pycache__'], prefix='abjad.tools.'*)

Generates directories containing ReST to parallel directories containing code.

Read-only Properties

APICrawler.**code_root**

APICrawler.**docs_root**

APICrawler.**module_crawler**

APICrawler.**prefix**

APICrawler.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

APICrawler.**__call__**()

Crawl *code_root* and generate corresponding ReST in *docs_root* while ignoring ignored directories.

APICrawler.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

APICrawler.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

APICrawler.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

APICrawler.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

APICrawler.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

APICrawler.**__ne__**(*arg*)

True when id(self) does not equal id(arg).

Return boolean.

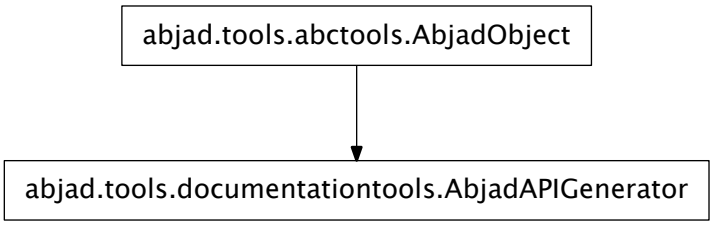
Inherited from abctools.AbjadObject

APICrawler.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

documentationtools.AbjadAPIGenerator



class documentationtools.**AbjadAPIGenerator**
Creates Abjad's API ReST:

- writes ReST pages for individual classes and functions
- writes the API index ReST
- handles sorting tools packages into composition, manual-loading and unstable
- handles ignoring private tools packages

Returns *AbjadAPIGenerator* instance.

Read-only Properties

AbjadAPIGenerator.**code_tools_path**
Path to Abjad tools package.

AbjadAPIGenerator.**docs_api_index_path**
Path to index.rst for Abjad API.

AbjadAPIGenerator.**docs_tools_path**
Path to tools directory inside docs.

AbjadAPIGenerator.**package_prefix**

AbjadAPIGenerator.**root_package**

AbjadAPIGenerator.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

AbjadAPIGenerator.**tools_package_path_index**

Special Methods

AbjadAPIGenerator.**__call__**(*verbose=False*)

AbjadAPIGenerator.**__eq__**(*arg*)

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

AbjadAPIGenerator.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

AbjadAPIGenerator.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

AbjadAPIGenerator.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

AbjadAPIGenerator.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

AbjadAPIGenerator.**__ne__**(*arg*)

True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

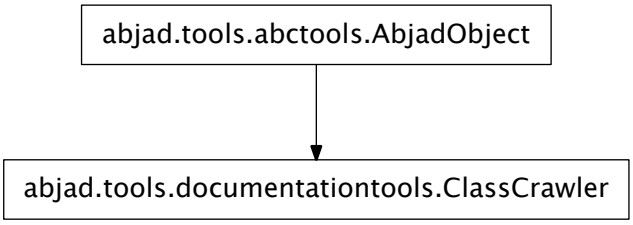
AbjadAPIGenerator.**__repr__**()

Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

documentationtools.ClassCrawler



class documentationtools.**ClassCrawler**(*code_root*, *include_private_objects=False*, *root_package_name=None*)

Read-only Properties

ClassCrawler.**code_root**

ClassCrawler.**include_private_objects**

ClassCrawler.**module_crawler**

ClassCrawler.**root_package_name**

ClassCrawler.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ClassCrawler.**__call__**()

ClassCrawler.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ClassCrawler.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ClassCrawler.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ClassCrawler.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`ClassCrawler.__lt__(arg)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`ClassCrawler.__ne__(arg)`
True when `id(self)` does not equal `id(arg)`.

Return boolean.

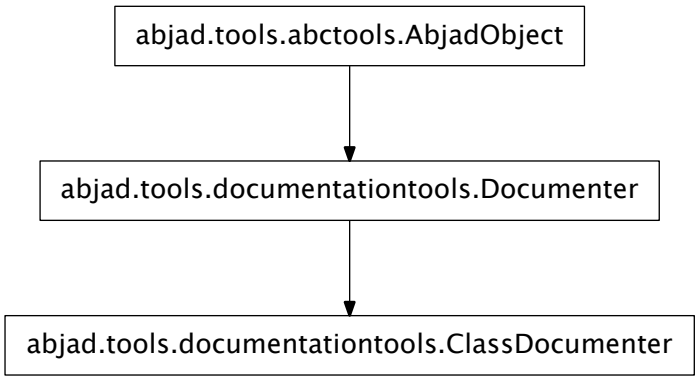
Inherited from `abctools.AbjadObject`

`ClassCrawler.__repr__()`
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

documentationtools.ClassDocumenter



class `documentationtools.ClassDocumenter(obj, prefix='abjad.tools.')`
ClassDocumenter generates an ReST API entry for a given class:

```
>>> from abjad.tools import notetools
>>> from abjad.tools.documentationtools import ClassDocumenter

>>> documenter = ClassDocumenter(notetools.Note)
>>> rest = documenter()
```

Returns `ClassDocumenter` instance.

Read-only Properties

ClassDocumenter.**data**

ClassDocumenter.**inherited_attributes**

ClassDocumenter.**is_abstract**

ClassDocumenter.**methods**

ClassDocumenter.**module_name**
Inherited from documentationtools.Documenter

ClassDocumenter.**object**
Inherited from documentationtools.Documenter

ClassDocumenter.**prefix**
Inherited from documentationtools.Documenter

ClassDocumenter.**readonly_properties**

ClassDocumenter.**readwrite_properties**

ClassDocumenter.**special_methods**

ClassDocumenter.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ClassDocumenter.**__call__**()
Generate documentation.

Returns string.

ClassDocumenter.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ClassDocumenter.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ClassDocumenter.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ClassDocumenter.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ClassDocumenter.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ClassDocumenter.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

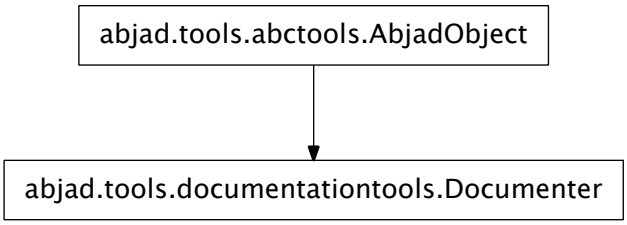
Inherited from abctools.AbjadObject

ClassDocumenter.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

documentationtools.Documenter



class documentationtools.**Documenter**(*obj*, *prefix='abjad.tools.'*)
Documenter is an abstract base class for documentation classes.

Read-only Properties

Documenter.**module_name**

Documenter.**object**

Documenter.**prefix**

Documenter.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

Documenter.**__call__**()

Documenter.__**eq**__(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

Documenter.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

Documenter.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

Documenter.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

Documenter.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

Documenter.__**ne**__(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

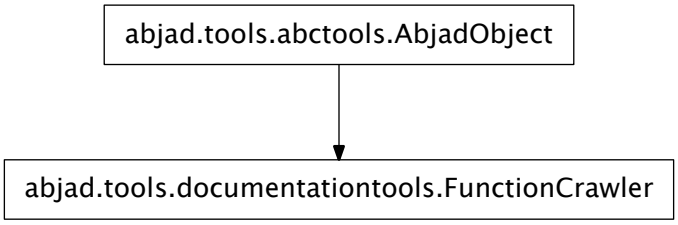
Inherited from `abctools.AbjadObject`

Documenter.__**repr**__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

documentationtools.FunctionCrawler



class documentationtools.**FunctionCrawler**(*code_root*, *include_private_objects=False*, *root_package_name=None*)

Read-only Properties

FunctionCrawler.**code_root**

FunctionCrawler.**include_private_objects**

FunctionCrawler.**module_crawler**

FunctionCrawler.**root_package_name**

FunctionCrawler.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

FunctionCrawler.**__call__**()

FunctionCrawler.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

FunctionCrawler.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

FunctionCrawler.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

FunctionCrawler.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`FunctionCrawler.__lt__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`FunctionCrawler.__ne__`(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

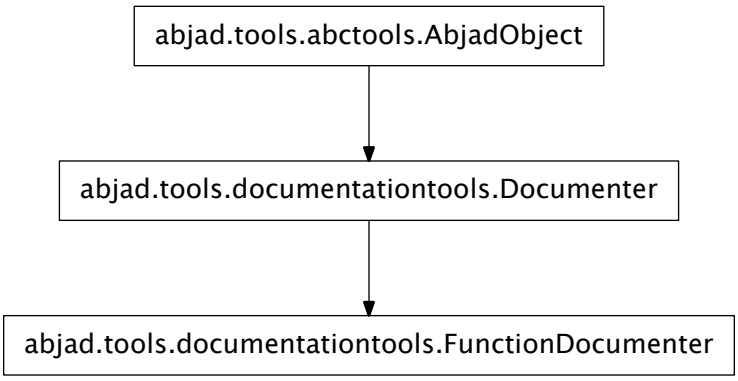
Inherited from `abctools.AbjadObject`

`FunctionCrawler.__repr__`()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

documentationtools.FunctionDocumenter



class `documentationtools.FunctionDocumenter`(*obj*, *prefix='abjad.tools.'*)
FunctionDocumenter generates an ReST entry for a given function:

```
>>> from abjad.tools.documentationtools import *

>>> from abjad.tools.notetools import make_notes
>>> documenter = FunctionDocumenter(make_notes)
>>> print documenter()
notetools.make_notes
====================

.. autofunction:: abjad.tools.notetools.make_notes.make_notes
```

Returns `FunctionDocumenter`` instance.

Read-only Properties

`FunctionDocumenter.`**`module_name`**
Inherited from `documentationtools.Documenter`

`FunctionDocumenter.`**`object`**
Inherited from `documentationtools.Documenter`

`FunctionDocumenter.`**`prefix`**
Inherited from `documentationtools.Documenter`

`FunctionDocumenter.`**`storage_format`**
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Special Methods

`FunctionDocumenter.`**`__call__`**`()`
Generate documentation.

Returns string.

`FunctionDocumenter.`**`__eq__`**`(`*arg*`)`
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`FunctionDocumenter.`**`__ge__`**`(`*arg*`)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`FunctionDocumenter.`**`__gt__`**`(`*arg*`)`
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`FunctionDocumenter.`**`__le__`**`(`*arg*`)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`FunctionDocumenter.`**`__lt__`**`(`*arg*`)`
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`FunctionDocumenter.`**`__ne__`**`(`*arg*`)`
True when `id(self)` does not equal `id(arg)`.

Return boolean.

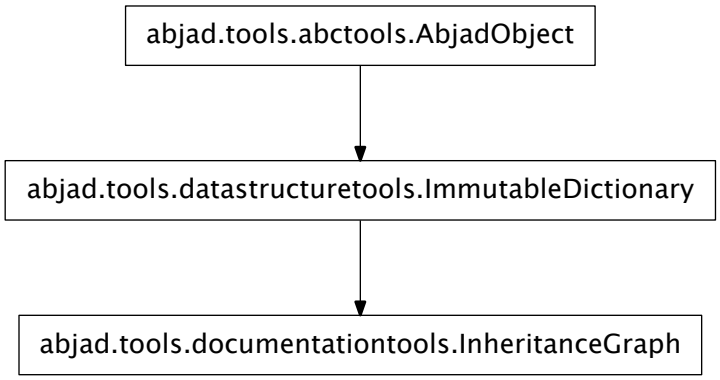
Inherited from `abctools.AbjadObject`

FunctionDocumenter.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

documentationtools.InheritanceGraph



class documentationtools.**InheritanceGraph**(**args*, ***kwargs*)
Generates a graph of a class or collection of classes as a dictionary of parent-children relationships:

```
>>> from abjad.tools.documentationtools import InheritanceGraph

>>> class A(object): pass
...
>>> class B(A): pass
...
>>> class C(B): pass
...
>>> class D(B): pass
...
>>> class E(C, D): pass
...
>>> class F(A): pass
...

>>> graph = InheritanceGraph(F, E)

>>> result = sorted(graph.items(), key=lambda x: x[0].__name__)
>>> for parent, children in result:
...     parent, tuple(sorted(children, key=lambda x: x.__name__))
(<class '__main__.A'>, (<class '__main__.B'>, <class '__main__.F'>))
(<class '__main__.B'>, (<class '__main__.C'>, <class '__main__.D'>))
(<class '__main__.C'>, (<class '__main__.E'>,))
(<class '__main__.D'>, (<class '__main__.E'>,))
(<class '__main__.E'>, ())
```

```
(<class '__main__.F'>, ())
(<type 'object'>, (<class '__main__.A'>,))
```

`InheritanceGraph` may be instantiated from one or more instances, classes or modules. If instantiated from a module, all public classes in that module will be taken into the graph.

A *root_class* keyword may be defined at instantiation, which filters out all klasses from the graph which do not inherit from that *root_class* (or are not already the *root_class*):

```
>>> graph = InheritanceGraph(A, B, C, D, E, F, root_class=B)
>>> for parent, children in sorted(graph.items()):
...     parent, tuple(sorted(children))
(<class '__main__.B'>, (<class '__main__.C'>, <class '__main__.D'>))
(<class '__main__.C'>, (<class '__main__.E'>,))
(<class '__main__.D'>, (<class '__main__.E'>,))
(<class '__main__.E'>, ())
```

Returns `InheritanceGraph` instance.

Read-only Properties

`InheritanceGraph.`**`graphviz_format`**

`InheritanceGraph.`**`root_class`**

`InheritanceGraph.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`InheritanceGraph.`**`clear`**`()` → None. Remove all items from D.

Inherited from `__builtin__.dict`

`InheritanceGraph.`**`copy`**`()` → a shallow copy of D

Inherited from `__builtin__.dict`

`InheritanceGraph.`**`get`**`(`$k[, d]$`)` → D[k] if k in D, else d. d defaults to None.

Inherited from `__builtin__.dict`

`InheritanceGraph.`**`has_key`**`(`k`)` → True if D has a key k, else False

Inherited from `__builtin__.dict`

`InheritanceGraph.`**`items`**`()` → list of D's (key, value) pairs, as 2-tuples

Inherited from `__builtin__.dict`

`InheritanceGraph.`**`iteritems`**`()` → an iterator over the (key, value) items of D

Inherited from `__builtin__.dict`

`InheritanceGraph.`**`iterkeys`**`()` → an iterator over the keys of D

Inherited from `__builtin__.dict`

`InheritanceGraph.`**`itervalues`**`()` → an iterator over the values of D

Inherited from `__builtin__.dict`

`InheritanceGraph.`**`keys`**`()` → list of D's keys

Inherited from `__builtin__.dict`

`InheritanceGraph.`**`pop`**`(`$k[, d]$`)` → v, remove specified key and return the corresponding value.

If key is not found, d is returned if given, otherwise KeyError is raised

Inherited from __builtin__.dict

InheritanceGraph.**popitem**() → (k, v), remove and return some (key, value) pair as a 2-tuple; but raise KeyError if D is empty.

Inherited from __builtin__.dict

InheritanceGraph.**setdefault**(*k*[, *d*]) → D.get(k,d), also set D[k]=d if k not in D
Inherited from __builtin__.dict

InheritanceGraph.**update**([*E*], ***F*) → None. Update D from dict/iterable E and F.
If E present and has a .keys() method, does: for k in E: D[k] = E[k] If E present and lacks .keys() method, does: for (k, v) in E: D[k] = v In either case, this is followed by: for k in F: D[k] = F[k]

Inherited from __builtin__.dict

InheritanceGraph.**values**() → list of D's values
Inherited from __builtin__.dict

InheritanceGraph.**viewitems**() → a set-like object providing a view on D's items
Inherited from __builtin__.dict

InheritanceGraph.**viewkeys**() → a set-like object providing a view on D's keys
Inherited from __builtin__.dict

InheritanceGraph.**viewvalues**() → an object providing a view on D's values
Inherited from __builtin__.dict

Special Methods

InheritanceGraph.**__cmp__**(*y*) <==> *cmp(x, y)*
Inherited from __builtin__.dict

InheritanceGraph.**__contains__**(*k*) → True if D has a key k, else False
Inherited from __builtin__.dict

InheritanceGraph.**__delitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

InheritanceGraph.**__eq__**()
x.__eq__(y) <==> x==y

Inherited from __builtin__.dict

InheritanceGraph.**__ge__**()
x.__ge__(y) <==> x>=y

Inherited from __builtin__.dict

InheritanceGraph.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from __builtin__.dict

InheritanceGraph.**__gt__**()
x.__gt__(y) <==> x>y

Inherited from __builtin__.dict

InheritanceGraph.**__iter__**() <==> *iter(x)*
Inherited from __builtin__.dict

InheritanceGraph.**__le__**()
x.__le__(y) <==> x<=y

Inherited from __builtin__.dict

InheritanceGraph.**__len__**() <==> *len(x)*
Inherited from __builtin__.dict

InheritanceGraph.**__lt__**()
x.__lt__(y) <==> x<y

Inherited from __builtin__.dict

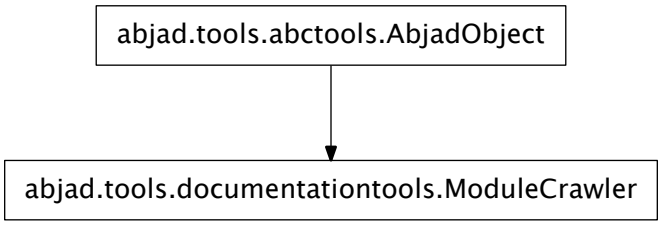
InheritanceGraph.**__ne__**()
x.__ne__(y) <==> x!=y

Inherited from __builtin__.dict

InheritanceGraph.**__repr__**() <==> *repr(x)*
Inherited from __builtin__.dict

InheritanceGraph.**__setitem__**(**args*)
Inherited from datastructuretools.ImmutableDictionary

documentationtools.ModuleCrawler



class documentationtools.**ModuleCrawler**(*code_root='.', ignored_directories=['test', '.svn', '__pycache__'], root_package_name=None*)
Crawls *code_root*, yielding all module objects whose name begins with *root_package_name*.

Return *ModuleCrawler* instance.

Read-only Properties
ModuleCrawler.**code_root**
ModuleCrawler.**ignored_directories**

ModuleCrawler.**root_package_name**

ModuleCrawler.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

ModuleCrawler.__**eq**__(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

ModuleCrawler.__**ge**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

ModuleCrawler.__**gt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

ModuleCrawler.__**iter**__()

ModuleCrawler.__**le**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

ModuleCrawler.__**lt**__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

ModuleCrawler.__**ne**__(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

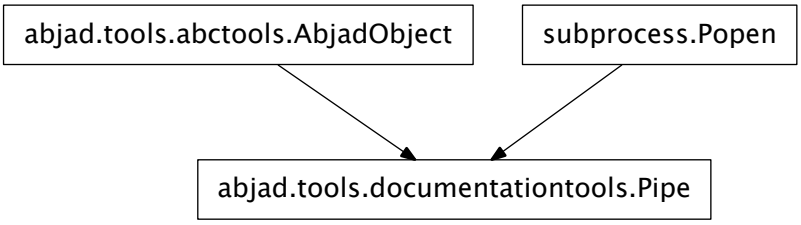
Inherited from `abctools.AbjadObject`

ModuleCrawler.__**repr**__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

documentationtools.Pipe



class documentationtools.**Pipe**(*executable='python', arguments=['-i'], timeout=0*)

A two-way, non-blocking pipe for interprocess communication:

```
>>> from abjad.tools.documentationtools import Pipe

>>> pipe = Pipe('python', ['-i'])
>>> pipe.writeline('my_list = [1, 2, 3]')
>>> pipe.writeline('print my_list')
```

Return *Pipe* instance.

Read-only Properties

Pipe.**arguments**

Pipe.**executable**

Pipe.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Pipe.**timeout**

Methods

Pipe.**close**()

Close the pipe.

Pipe.**communicate**(*input=None*)

Interact with process: Send data to stdin. Read data from stdout and stderr, until end-of-file is reached. Wait for process to terminate. The optional input argument should be a string to be sent to the child process, or None, if no data should be sent to the child.

communicate() returns a tuple (stdout, stderr).

Inherited from subprocess.Popen

Pipe.**kill**()

Kill the process with SIGKILL

Inherited from subprocess.Popen

Pipe.**poll**()
Inherited from subprocess.Popen

Pipe.**read**()
Read from the pipe.

Pipe.**read_wait**(*seconds=0.01*)
Try to read from the pipe. Wait *seconds* if nothing comes out, and repeat.

Should be used with caution, as this may loop forever.

Pipe.**send_signal**(*sig*)
Send a signal to the process

Inherited from subprocess.Popen

Pipe.**terminate**()
Terminate the process with SIGTERM

Inherited from subprocess.Popen

Pipe.**wait**()
Wait for child process to terminate. Returns returncode attribute.

Inherited from subprocess.Popen

Pipe.**write**(*data*)
Write *data* into the pipe.

Pipe.**write_line**(*data*)
Write *data* into the pipe, terminated by a newline.

Special Methods

Pipe.**__del__**(*_maxint=9223372036854775807*, *_active=*[])
Inherited from subprocess.Popen

Pipe.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from abctools.AbjadObject

Pipe.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Pipe.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Pipe.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Pipe.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Pipe.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Pipe.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

functions

documentationtools.make_ligeti_example_lilypond_file

documentationtools.**make_ligeti_example_lilypond_file**(*music=None*)
New in version 2.9. Make Ligeti example LilyPond file.

Return LilyPond file.

documentationtools.make_reference_manual_lilypond_file

documentationtools.**make_reference_manual_lilypond_file**(*music=None*)
New in version 2.9. Make reference manual LilyPond file.

```
>>> from abjad.tools import documentationtools

>>> score = Score([Staff('c d e f')])
>>> lilypond_file = documentationtools.make_reference_manual_lilypond_file(score)

>>> f(lilypond_file)
% Abjad revision 5653
% 2012-05-19 11:21

\version "2.15.37"
\language "english"
\include "/Users/trevorbaca/Documents/abjad/trunk/abjad/cfg/abjad.scm"

\layout {
    indent = #0
    ragged-right = ##t
    \context {
        \Score
        \remove Bar_number_engraver
        \override SpacingSpanner #'strict-grace-spacing = ##t
        \override SpacingSpanner #'strict-note-spacing = ##t
        \override SpacingSpanner #'uniform-stretching = ##t
        \override TupletBracket #'bracket-visibility = ##t
```

```
            \override TupletBracket #'minimum-length = #3
            \override TupletBracket #'padding = #2
            \override TupletBracket #'springs-and-rods = #ly:spanner::set-spacing-rods
            \override TupletNumber #'text = #tuplet-number::calc-fraction-text
            proportionalNotationDuration = #(ly:make-moment 1 32)
            tupletFullLength = True
        }
    }

    \score {
        \new Score <<
            \new Staff {
                c4
                d4
                e4
                f4
            }
        >>
    }
```

Return LilyPond file.

documentationtools.make_text_alignment_example_lilypond_file

documentationtools.**make_text_alignment_example_lilypond_file**(*music=None*)

New in version 2.9. Make text-alignment example LilyPond file with *music*.

```
>>> from abjad.tools import documentationtools

>>> score = Score([Staff('c d e f')])
>>> lilypond_file = documentationtools.make_text_alignment_example_lilypond_file(score)

>>> f(lilypond_file)
% Abjad revision 5651
% 2012-05-19 10:04

\version "2.15.37"
\language "english"
\include "/Users/trevorbaca/Documents/abjad/trunk/abjad/cfg/abjad.scm"

#(set-global-staff-size 18)

\layout {
    indent = #0
    ragged-right = ##t
    \context {
        \Score
        \remove Bar_number_engraver
        \remove Default_bar_line_engraver
        \override Clef #'transparent = ##t
        \override SpacingSpanner #'strict-grace-spacing = ##t
        \override SpacingSpanner #'strict-note-spacing = ##t
        \override SpacingSpanner #'uniform-stretching = ##t
        \override TextScript #'staff-padding = #4
        proportionalNotationDuration = #(ly:make-moment 1 32)
    }
}
```

```
\paper {
    bottom-margin = #10
    left-margin = #10
    line-width = #150
    system-system-spacing = #'(
        (basic_distance . 0) (minimum_distance . 0) (padding . 15) (stretchability . 0))
}

\score {
    \new Score <<
        \new Staff {
            c4
            d4
            e4
            f4
        }
    >>
}
```

Return LilyPond file.

exceptiontools

concrete classes

exceptiontools.AssignabilityError

class tools.**AssignabilityError**
Duration can not be assigned to note, rest or chord.

Special Methods

AssignabilityError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

AssignabilityError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

AssignabilityError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

`AssignabilityError.__repr__()` <==> *repr(x)*
Inherited from `exceptions.BaseException`

`AssignabilityError.__setattr__()`
x.__setattr__('name', value) <==> x.name = value

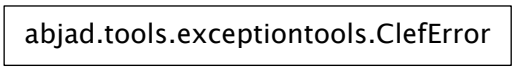
Inherited from `exceptions.BaseException`

`AssignabilityError.__setstate__()`
Inherited from `exceptions.BaseException`

`AssignabilityError.__str__()` <==> *str(x)*
Inherited from `exceptions.BaseException`

`AssignabilityError.__unicode__()`
Inherited from `exceptions.BaseException`

exceptiontools.ClefError



class `tools.ClefError`
General clef error.

Special Methods

`ClefError.__delattr__()`
x.__delattr__('name') <==> del x.name

Inherited from `exceptions.BaseException`

`ClefError.__getitem__()`
x.__getitem__(y) <==> x[y]

Inherited from `exceptions.BaseException`

`ClefError.__getslice__()`
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from `exceptions.BaseException`

`ClefError.__repr__()` <==> *repr(x)*
Inherited from `exceptions.BaseException`

`ClefError.__setattr__()`
x.__setattr__('name', value) <==> x.name = value

Inherited from `exceptions.BaseException`

`ClefError.__setstate__()`
Inherited from `exceptions.BaseException`

ClefError.__**str**__() <==> *str(x)*
Inherited from exceptions.BaseException

ClefError.__**unicode**__()
Inherited from exceptions.BaseException

exceptiontools.ContainmentError

class tools.**ContainmentError**
General containment error.

Special Methods
ContainmentError.__**delattr**__()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException
ContainmentError.__**getitem**__()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

ContainmentError.__**getslice**__()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

ContainmentError.__**repr**__() <==> *repr(x)*
Inherited from exceptions.BaseException

ContainmentError.__**setattr**__()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

ContainmentError.__**setstate**__()
Inherited from exceptions.BaseException

ContainmentError.__**str**__() <==> *str(x)*
Inherited from exceptions.BaseException

ContainmentError.__**unicode**__()
Inherited from exceptions.BaseException

exceptiontools.ContextContainmentError

abjad.tools.exceptiontools.ContextContainmentError

class tools.**ContextContainmentError**
Context can not contain other context.

Special Methods

ContextContainmentError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

ContextContainmentError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

ContextContainmentError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

ContextContainmentError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

ContextContainmentError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

ContextContainmentError.**__setstate__**()
Inherited from exceptions.BaseException

ContextContainmentError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

ContextContainmentError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.ContiguityError

abjad.tools.exceptiontools.ContiguityError

class tools.**ContiguityError**
Input is not contiguous.

Special Methods

ContiguityError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

ContiguityError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

ContiguityError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

ContiguityError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

ContiguityError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

ContiguityError.**__setstate__**()
Inherited from exceptions.BaseException

ContiguityError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

ContiguityError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.CyclicNodeError

abjad.tools.exceptiontools.CyclicNodeError

class tools.**CyclicNodeError**
Node is in cyclic relationship.

Special Methods

CyclicNodeError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

CyclicNodeError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

CyclicNodeError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

CyclicNodeError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

CyclicNodeError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

CyclicNodeError.**__setstate__**()
Inherited from exceptions.BaseException

CyclicNodeError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

CyclicNodeError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.DurationError

abjad.tools.exceptiontools.DurationError

class tools.**DurationError**
General duration error.

Special Methods

DurationError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

DurationError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

DurationError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

DurationError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

DurationError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

DurationError.**__setstate__**()
Inherited from exceptions.BaseException

DurationError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

DurationError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.ExtraMarkError

abjad.tools.exceptiontools.ExtraMarkError

class tools.**ExtraMarkError**
More than one mark is found for single-mark operation.

Special Methods

ExtraMarkError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

ExtraMarkError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

ExtraMarkError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

ExtraMarkError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

ExtraMarkError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

ExtraMarkError.**__setstate__**()
Inherited from exceptions.BaseException

ExtraMarkError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

ExtraMarkError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.ExtraNamedComponentError

abjad.tools.exceptiontools.ExtraNamedComponentError

class tools.**ExtraNamedComponentError**
More than one component with the same name is found..

Special Methods

ExtraNamedComponentError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

ExtraNamedComponentError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

ExtraNamedComponentError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

ExtraNamedComponentError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

ExtraNamedComponentError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

ExtraNamedComponentError.**__setstate__**()
Inherited from exceptions.BaseException

ExtraNamedComponentError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

ExtraNamedComponentError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.ExtraNoteHeadError

abjad.tools.exceptiontools.ExtraNoteHeadError

class tools.**ExtraNoteHeadError**
More than one note head found for single-note head operation.

Special Methods

ExtraNoteHeadError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

ExtraNoteHeadError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

ExtraNoteHeadError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

ExtraNoteHeadError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

ExtraNoteHeadError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

ExtraNoteHeadError.**__setstate__**()
Inherited from exceptions.BaseException

ExtraNoteHeadError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

ExtraNoteHeadError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.ExtraPitchError

abjad.tools.exceptiontools.ExtraPitchError

class tools.**ExtraPitchError**
More than one pitch found for single-pitch operation.

Special Methods

ExtraPitchError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

ExtraPitchError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

ExtraPitchError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

ExtraPitchError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

ExtraPitchError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

ExtraPitchError.**__setstate__**()
Inherited from exceptions.BaseException

ExtraPitchError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

ExtraPitchError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.ExtraSpannerError

abjad.tools.exceptiontools.ExtraSpannerError

class tools.**ExtraSpannerError**
More than one spanner found for single-spanner operation.

Special Methods

ExtraSpannerError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

ExtraSpannerError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

ExtraSpannerError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

ExtraSpannerError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

ExtraSpannerError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

ExtraSpannerError.**__setstate__**()
Inherited from exceptions.BaseException

ExtraSpannerError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

ExtraSpannerError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.GraceContainerError

abjad.tools.exceptiontools.GraceContainerError

class tools.**GraceContainerError**
General grace container error.

Special Methods

GraceContainerError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

GraceContainerError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

GraceContainerError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

GraceContainerError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

GraceContainerError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

GraceContainerError.**__setstate__**()
Inherited from exceptions.BaseException

GraceContainerError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

GraceContainerError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.ImpreciseTempoError

abjad.tools.exceptiontools.ImpreciseTempoError

class tools.**ImpreciseTempoError**
TempoMark is imprecise.

Special Methods

ImpreciseTempoError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

ImpreciseTempoError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

ImpreciseTempoError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

ImpreciseTempoError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

ImpreciseTempoError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

ImpreciseTempoError.**__setstate__**()
Inherited from exceptions.BaseException

ImpreciseTempoError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

ImpreciseTempoError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.InputSpecificationError

abjad.tools.exceptiontools.InputSpecificationError

class tools.**InputSpecificationError**
Input is badly formed.

Special Methods

InputSpecificationError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

InputSpecificationError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

InputSpecificationError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

InputSpecificationError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

InputSpecificationError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

InputSpecificationError.**__setstate__**()
Inherited from exceptions.BaseException

InputSpecificationError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

InputSpecificationError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.InstrumentError

abjad.tools.exceptiontools.InstrumentError

class tools.**InstrumentError**
General instrument error.

Special Methods

InstrumentError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

InstrumentError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

InstrumentError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

InstrumentError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

InstrumentError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

InstrumentError.**__setstate__**()
Inherited from exceptions.BaseException

InstrumentError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

InstrumentError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.IntervalError

abjad.tools.exceptiontools.IntervalError

class tools.**IntervalError**
General pitch interval error.

Special Methods

IntervalError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

IntervalError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

IntervalError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

IntervalError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

IntervalError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

IntervalError.**__setstate__**()
Inherited from exceptions.BaseException

IntervalError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

IntervalError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.LilyPondParserError

abjad.tools.exceptiontools.LilyPondParserError

class tools.**LilyPondParserError**
Can not parse input.

Special Methods

LilyPondParserError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

LilyPondParserError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

LilyPondParserError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

LilyPondParserError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

LilyPondParserError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

LilyPondParserError.**__setstate__**()
Inherited from exceptions.BaseException

LilyPondParserError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

LilyPondParserError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.LineBreakError

abjad.tools.exceptiontools.LineBreakError

class tools.**LineBreakError**
General link break error.

Special Methods

LineBreakError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

LineBreakError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

LineBreakError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

LineBreakError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

LineBreakError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

LineBreakError.**__setstate__**()
Inherited from exceptions.BaseException

LineBreakError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

LineBreakError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MarkError

abjad.tools.exceptiontools.MarkError

class tools.**MarkError**
General mark error.

Special Methods

MarkError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MarkError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MarkError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MarkError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MarkError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MarkError.**__setstate__**()
Inherited from exceptions.BaseException

MarkError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MarkError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MeasureContiguityError

abjad.tools.exceptiontools.MeasureContiguityError

class tools.**MeasureContiguityError**
Measures must be contiguous.

Special Methods

MeasureContiguityError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MeasureContiguityError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MeasureContiguityError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MeasureContiguityError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MeasureContiguityError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MeasureContiguityError.**__setstate__**()
Inherited from exceptions.BaseException

MeasureContiguityError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MeasureContiguityError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MeasureError

abjad.tools.exceptiontools.MeasureError

class tools.**MeasureError**
General measure error.

Special Methods

MeasureError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MeasureError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MeasureError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MeasureError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MeasureError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MeasureError.**__setstate__**()
Inherited from exceptions.BaseException

MeasureError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MeasureError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MissingComponentError

abjad.tools.exceptiontools.MissingComponentError

class tools.**MissingComponentError**
No component found.

Special Methods

MissingComponentError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MissingComponentError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MissingComponentError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MissingComponentError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MissingComponentError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MissingComponentError.**__setstate__**()
Inherited from exceptions.BaseException

MissingComponentError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MissingComponentError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MissingInstrumentError

abjad.tools.exceptiontools.MissingInstrumentError

class tools.**MissingInstrumentError**
No instrument found.

Special Methods

MissingInstrumentError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MissingInstrumentError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MissingInstrumentError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MissingInstrumentError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MissingInstrumentError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MissingInstrumentError.**__setstate__**()
Inherited from exceptions.BaseException

MissingInstrumentError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MissingInstrumentError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MissingMarkError

abjad.tools.exceptiontools.MissingMarkError

class tools.**MissingMarkError**
No mark found.

Special Methods

MissingMarkError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MissingMarkError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MissingMarkError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MissingMarkError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MissingMarkError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MissingMarkError.**__setstate__**()
Inherited from exceptions.BaseException

MissingMarkError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MissingMarkError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MissingMeasureError

abjad.tools.exceptiontools.MissingMeasureError

class tools.**MissingMeasureError**
No measure found.

Special Methods

MissingMeasureError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MissingMeasureError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MissingMeasureError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MissingMeasureError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MissingMeasureError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MissingMeasureError.**__setstate__**()
Inherited from exceptions.BaseException

MissingMeasureError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MissingMeasureError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MissingNamedComponentError

abjad.tools.exceptiontools.MissingNamedComponentError

class tools.**MissingNamedComponentError**
No named component found.

Special Methods

MissingNamedComponentError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MissingNamedComponentError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MissingNamedComponentError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MissingNamedComponentError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MissingNamedComponentError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MissingNamedComponentError.**__setstate__**()
Inherited from exceptions.BaseException

MissingNamedComponentError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MissingNamedComponentError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MissingNoteHeadError

abjad.tools.exceptiontools.MissingNoteHeadError

class tools.**MissingNoteHeadError**
No note head found.

Special Methods

MissingNoteHeadError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MissingNoteHeadError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MissingNoteHeadError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MissingNoteHeadError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MissingNoteHeadError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MissingNoteHeadError.**__setstate__**()
Inherited from exceptions.BaseException

MissingNoteHeadError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MissingNoteHeadError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MissingPitchError

abjad.tools.exceptiontools.MissingPitchError

class tools.**MissingPitchError**
No pitch found.

Special Methods

MissingPitchError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MissingPitchError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MissingPitchError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MissingPitchError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MissingPitchError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MissingPitchError.**__setstate__**()
Inherited from exceptions.BaseException

MissingPitchError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MissingPitchError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MissingSpannerError

abjad.tools.exceptiontools.MissingSpannerError

class tools.**MissingSpannerError**
No spanner found.

Special Methods

MissingSpannerError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MissingSpannerError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MissingSpannerError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MissingSpannerError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MissingSpannerError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MissingSpannerError.**__setstate__**()
Inherited from exceptions.BaseException

MissingSpannerError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MissingSpannerError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MissingTempoError

abjad.tools.exceptiontools.MissingTempoError

class tools.**MissingTempoError**
No tempo found.

Special Methods

MissingTempoError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MissingTempoError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MissingTempoError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MissingTempoError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MissingTempoError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MissingTempoError.**__setstate__**()
Inherited from exceptions.BaseException

MissingTempoError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MissingTempoError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.MusicContentsError

abjad.tools.exceptiontools.MusicContentsError

class tools.**MusicContentsError**
General container contents error.

Special Methods

MusicContentsError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

MusicContentsError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

MusicContentsError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

MusicContentsError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

MusicContentsError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

MusicContentsError.**__setstate__**()
Inherited from exceptions.BaseException

MusicContentsError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

MusicContentsError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.NegativeDurationError

abjad.tools.exceptiontools.NegativeDurationError

class tools.**NegativeDurationError**
Component duration must be positive.

Special Methods

NegativeDurationError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

NegativeDurationError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

NegativeDurationError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

NegativeDurationError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

NegativeDurationError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

NegativeDurationError.**__setstate__**()
Inherited from exceptions.BaseException

NegativeDurationError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

NegativeDurationError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.NonbinaryTimeSignatureConversionError

abjad.tools.exceptiontools.NonbinaryTimeSignatureConversionError

class tools.**NonbinaryTimeSignatureConversionError**
Nonbinary time signature has no binary equivalent.

Special Methods

NonbinaryTimeSignatureConversionError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

NonbinaryTimeSignatureConversionError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

NonbinaryTimeSignatureConversionError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

NonbinaryTimeSignatureConversionError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

NonbinaryTimeSignatureConversionError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

NonbinaryTimeSignatureConversionError.**__setstate__**()
Inherited from exceptions.BaseException

NonbinaryTimeSignatureConversionError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

NonbinaryTimeSignatureConversionError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.NonbinaryTimeSignatureSuppressionError

abjad.tools.exceptiontools.NonbinaryTimeSignatureSuppressionError

class tools.**NonbinaryTimeSignatureSuppressionError**
Suppressing nonbinary time signature will miscalculate duration of measure contents.

Special Methods

NonbinaryTimeSignatureSuppressionError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

NonbinaryTimeSignatureSuppressionError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

NonbinaryTimeSignatureSuppressionError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

NonbinaryTimeSignatureSuppressionError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

NonbinaryTimeSignatureSuppressionError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

NonbinaryTimeSignatureSuppressionError.**__setstate__**()
Inherited from exceptions.BaseException

NonbinaryTimeSignatureSuppressionError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

NonbinaryTimeSignatureSuppressionError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.NoteHeadError

abjad.tools.exceptiontools.NoteHeadError

class tools.**NoteHeadError**
General note head error.

Special Methods

NoteHeadError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

NoteHeadError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

NoteHeadError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

NoteHeadError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

NoteHeadError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

NoteHeadError.**__setstate__**()
Inherited from exceptions.BaseException

NoteHeadError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

NoteHeadError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.OverfullContainerError

abjad.tools.exceptiontools.OverfullContainerError

class tools.**OverfullContainerError**
Container contents duration is greater than container target duration.

Special Methods

OverfullContainerError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

OverfullContainerError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

OverfullContainerError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

OverfullContainerError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

OverfullContainerError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

OverfullContainerError.**__setstate__**()
Inherited from exceptions.BaseException

OverfullContainerError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

OverfullContainerError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.ParallelError

abjad.tools.exceptiontools.ParallelError

class tools.**ParallelError**
Parallel containers must contain contexts only.

Special Methods

ParallelError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

ParallelError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

ParallelError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

ParallelError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

ParallelError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

ParallelError.**__setstate__**()
Inherited from exceptions.BaseException

ParallelError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

ParallelError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.PartitionError

abjad.tools.exceptiontools.PartitionError

class tools.**PartitionError**
General partition error.

Special Methods

PartitionError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

PartitionError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

PartitionError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

PartitionError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

PartitionError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

PartitionError.**__setstate__**()
Inherited from exceptions.BaseException

PartitionError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

PartitionError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.PitchError

abjad.tools.exceptiontools.PitchError

class tools.**PitchError**
General pitch error.

Special Methods

PitchError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

PitchError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

PitchError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

PitchError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

PitchError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

PitchError.**__setstate__**()
Inherited from exceptions.BaseException

PitchError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

PitchError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.SchemeParserFinishedException

abjad.tools.exceptiontools.SchemeParserFinishedException

class tools.**SchemeParserFinishedException**
SchemeParser has finished parsing.

Special Methods

SchemeParserFinishedException.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

SchemeParserFinishedException.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

SchemeParserFinishedException.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

SchemeParserFinishedException.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

SchemeParserFinishedException.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

SchemeParserFinishedException.**__setstate__**()
Inherited from exceptions.BaseException

SchemeParserFinishedException.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

SchemeParserFinishedException.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.SpacingError

abjad.tools.exceptiontools.SpacingError

class tools.**SpacingError**
General spacing error.

Special Methods

SpacingError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

SpacingError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

SpacingError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

SpacingError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

SpacingError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

SpacingError.**__setstate__**()
Inherited from exceptions.BaseException

SpacingError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

SpacingError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.SpannerError

abjad.tools.exceptiontools.SpannerError

class tools.**SpannerError**
General spanner error.

Special Methods

SpannerError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

SpannerError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

SpannerError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

SpannerError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

SpannerError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

SpannerError.**__setstate__**()
Inherited from exceptions.BaseException

SpannerError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

SpannerError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.SpannerPopulationError

abjad.tools.exceptiontools.SpannerPopulationError

class tools.**SpannerPopulationError**

Spanner contents incorrect.

Spanner may be missing component it is assumed to have.

Spanner may have a component it is assumed not to have.

Special Methods

SpannerPopulationError.**__delattr__**()

x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

SpannerPopulationError.**__getitem__**()

x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

SpannerPopulationError.**__getslice__**()

x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

SpannerPopulationError.**__repr__**() <==> *repr(x)*

Inherited from exceptions.BaseException

SpannerPopulationError.**__setattr__**()

x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

SpannerPopulationError.**__setstate__**()

Inherited from exceptions.BaseException

SpannerPopulationError.**__str__**() <==> *str(x)*

Inherited from exceptions.BaseException

SpannerPopulationError.**__unicode__**()

Inherited from exceptions.BaseException

exceptiontools.StaffContainmentError

abjad.tools.exceptiontools.StaffContainmentError

class tools.**StaffContainmentError**
Staves must not contain staff groups, scores or other staves.

Special Methods

StaffContainmentError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

StaffContainmentError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

StaffContainmentError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

StaffContainmentError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

StaffContainmentError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

StaffContainmentError.**__setstate__**()
Inherited from exceptions.BaseException

StaffContainmentError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

StaffContainmentError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.TempoError

abjad.tools.exceptiontools.TempoError

class tools.**TempoError**
General tempo error.

Special Methods

TempoError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

TempoError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

TempoError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

TempoError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

TempoError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

TempoError.**__setstate__**()
Inherited from exceptions.BaseException

TempoError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

TempoError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.TieChainError

abjad.tools.exceptiontools.TieChainError

class tools.**TieChainError**
General tie chain error.

Special Methods

TieChainError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

TieChainError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

TieChainError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

TieChainError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

TieChainError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

TieChainError.**__setstate__**()
Inherited from exceptions.BaseException

TieChainError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

TieChainError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.TimeSignatureAssignmentError

abjad.tools.exceptiontools.TimeSignatureAssignmentError

class tools.**TimeSignatureAssignmentError**
Can not assign time signature to dynamic measure.

Special Methods

TimeSignatureAssignmentError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

TimeSignatureAssignmentError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

TimeSignatureAssignmentError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

TimeSignatureAssignmentError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

TimeSignatureAssignmentError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

TimeSignatureAssignmentError.**__setstate__**()
Inherited from exceptions.BaseException

TimeSignatureAssignmentError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

TimeSignatureAssignmentError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.TimeSignatureError

abjad.tools.exceptiontools.TimeSignatureError

class tools.**TimeSignatureError**
General time signature error.

Special Methods

TimeSignatureError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

TimeSignatureError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

TimeSignatureError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

TimeSignatureError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

TimeSignatureError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

TimeSignatureError.**__setstate__**()
Inherited from exceptions.BaseException

TimeSignatureError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

TimeSignatureError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.TonalHarmonyError

abjad.tools.exceptiontools.TonalHarmonyError

class tools.**TonalHarmonyError**
General tonal harmony error.

Special Methods

TonalHarmonyError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

TonalHarmonyError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

TonalHarmonyError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

TonalHarmonyError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

TonalHarmonyError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

TonalHarmonyError.**__setstate__**()
Inherited from exceptions.BaseException

TonalHarmonyError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

TonalHarmonyError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.TupletError

abjad.tools.exceptiontools.TupletError

class tools.**TupletError**
Geneal tuplet error.

Special Methods

TupletError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

TupletError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

TupletError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

TupletError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

TupletError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

TupletError.**__setstate__**()
Inherited from exceptions.BaseException

TupletError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

TupletError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.TupletFuseError

abjad.tools.exceptiontools.TupletFuseError

class `tools.`**`TupletFuseError`**
Tuplets must carry same multiplier and be same type in order to fuse correctly.

Special Methods

`TupletFuseError.`**`__delattr__`**`()`
x.__delattr__('name') <==> del x.name

Inherited from `exceptions.BaseException`

`TupletFuseError.`**`__getitem__`**`()`
x.__getitem__(y) <==> x[y]

Inherited from `exceptions.BaseException`

`TupletFuseError.`**`__getslice__`**`()`
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from `exceptions.BaseException`

`TupletFuseError.`**`__repr__`**`()` <==> *repr(x)*
Inherited from `exceptions.BaseException`

`TupletFuseError.`**`__setattr__`**`()`
x.__setattr__('name', value) <==> x.name = value

Inherited from `exceptions.BaseException`

`TupletFuseError.`**`__setstate__`**`()`
Inherited from `exceptions.BaseException`

`TupletFuseError.`**`__str__`**`()` <==> *str(x)*
Inherited from `exceptions.BaseException`

`TupletFuseError.`**`__unicode__`**`()`
Inherited from `exceptions.BaseException`

exceptiontools.TypographicWhitespaceError

abjad.tools.exceptiontools.TypographicWhitespaceError

class tools.**TypographicWhitespaceError**
Whitespace after leaf confuses LilyPond timekeeping.

Special Methods

TypographicWhitespaceError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

TypographicWhitespaceError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

TypographicWhitespaceError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

TypographicWhitespaceError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

TypographicWhitespaceError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

TypographicWhitespaceError.**__setstate__**()
Inherited from exceptions.BaseException

TypographicWhitespaceError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

TypographicWhitespaceError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.UnboundedTimeIntervalError

abjad.tools.exceptiontools.UnboundedTimeIntervalError

class tools.**UnboundedTimeIntervalError**
Time interval has no bounds.

Special Methods

UnboundedTimeIntervalError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

UnboundedTimeIntervalError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

UnboundedTimeIntervalError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

UnboundedTimeIntervalError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

UnboundedTimeIntervalError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

UnboundedTimeIntervalError.**__setstate__**()
Inherited from exceptions.BaseException

UnboundedTimeIntervalError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

UnboundedTimeIntervalError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.UndefinedSpacingError

abjad.tools.exceptiontools.UndefinedSpacingError

class `tools.`**`UndefinedSpacingError`**
No spacing value found.

Special Methods

`UndefinedSpacingError.`**`__delattr__`**`()`
x.__delattr__('name') <==> del x.name

Inherited from `exceptions.BaseException`

`UndefinedSpacingError.`**`__getitem__`**`()`
x.__getitem__(y) <==> x[y]

Inherited from `exceptions.BaseException`

`UndefinedSpacingError.`**`__getslice__`**`()`
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from `exceptions.BaseException`

`UndefinedSpacingError.`**`__repr__`**`()` <==> *repr(x)*
Inherited from `exceptions.BaseException`

`UndefinedSpacingError.`**`__setattr__`**`()`
x.__setattr__('name', value) <==> x.name = value

Inherited from `exceptions.BaseException`

`UndefinedSpacingError.`**`__setstate__`**`()`
Inherited from `exceptions.BaseException`

`UndefinedSpacingError.`**`__str__`**`()` <==> *str(x)*
Inherited from `exceptions.BaseException`

`UndefinedSpacingError.`**`__unicode__`**`()`
Inherited from `exceptions.BaseException`

exceptiontools.UnderfullContainerError

abjad.tools.exceptiontools.UnderfullContainerError

class tools.**UnderfullContainerError**
Container contents duration is less than container target duration.

Special Methods

UnderfullContainerError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

UnderfullContainerError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

UnderfullContainerError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

UnderfullContainerError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

UnderfullContainerError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

UnderfullContainerError.**__setstate__**()
Inherited from exceptions.BaseException

UnderfullContainerError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

UnderfullContainerError.**__unicode__**()
Inherited from exceptions.BaseException

exceptiontools.VoiceContainmentError

abjad.tools.exceptiontools.VoiceContainmentError

class tools.**VoiceContainmentError**
Voice must not contain staves, staff groups or scores.

Special Methods

VoiceContainmentError.**__delattr__**()
x.__delattr__('name') <==> del x.name

Inherited from exceptions.BaseException

VoiceContainmentError.**__getitem__**()
x.__getitem__(y) <==> x[y]

Inherited from exceptions.BaseException

VoiceContainmentError.**__getslice__**()
x.__getslice__(i, j) <==> x[i:j]

Use of negative indices is not supported.

Inherited from exceptions.BaseException

VoiceContainmentError.**__repr__**() <==> *repr(x)*
Inherited from exceptions.BaseException

VoiceContainmentError.**__setattr__**()
x.__setattr__('name', value) <==> x.name = value

Inherited from exceptions.BaseException

VoiceContainmentError.**__setstate__**()
Inherited from exceptions.BaseException

VoiceContainmentError.**__str__**() <==> *str(x)*
Inherited from exceptions.BaseException

VoiceContainmentError.**__unicode__**()
Inherited from exceptions.BaseException

formattools

functions

formattools.get_all_format_contributions

formattools.**get_all_format_contributions**(*component*)
Get all format contributions for *component* as a nested dictionary structure.

Return dict.

formattools.get_all_mark_format_contributions

formattools.**get_all_mark_format_contributions**(*component*)
Get all mark format contributions as nested dictionaries.

The first level of keys represent format slots.

The second level of keys represent format contributor ('articulations', 'markup', etc.).

Return dict.

formattools.get_articulation_format_contributions

formattools.**get_articulation_format_contributions**(*component*)
New in version 2.0. Get articulation format contributions for *component*.

Return list.

formattools.get_comment_format_contributions_for_slot

formattools.**get_comment_format_contributions_for_slot**(*component*, *slot*)
New in version 2.0. Get comment format contributions for *component* at *slot*.

Return list.

formattools.get_context_mark_format_contributions_for_slot

formattools.**get_context_mark_format_contributions_for_slot**(*component*, *slot*)
New in version 2.0. Get context mark format contributions for *component* at *slot*.

Return list.

formattools.get_context_mark_format_pieces

formattools.**get_context_mark_format_pieces**(*mark*)
Get context mark format pieces for *mark*.

Return list.

formattools.get_context_setting_format_contributions

formattools.**get_context_setting_format_contributions**(*component*)
New in version 2.0. Get context setting format contributions for *component*.

Return sorted list.

formattools.get_grob_override_format_contributions

formattools.**get_grob_override_format_contributions**(*component*)
New in version 2.0. Get grob override format contributions for *component*.

Return alphabetized list of LilyPond grob overrides.

formattools.get_grob_revert_format_contributions

formattools.**get_grob_revert_format_contributions**(*component*)
New in version 2.0. Get grob revert format contributions.

Return alphabetized list of LilyPond grob reverts.

formattools.get_lilypond_command_mark_format_contributions_for_slot

formattools.**get_lilypond_command_mark_format_contributions_for_slot**(*component*, *slot*)
New in version 2.0. Get LilyPond command mark format contributions for *component* at *slot*.

Return list.

formattools.get_markup_format_contributions

formattools.**get_markup_format_contributions**(*component*)
New in version 2.0. Get markup format contributions for *component*.

Return list.

formattools.get_spanner_format_contributions

formattools.**get_spanner_format_contributions**(*leaf*)
Get spanner format contributions for *leaf* as a dictionary of format_slot:contributions key:value pairs.

Return dict.

formattools.get_spanner_format_contributions_for_slot

formattools.**get_spanner_format_contributions_for_slot**(*leaf*, *slot*)
New in version 2.0. Get spanner format contributions for *leaf* at *slot*.

Return list.

formattools.get_stem_tremolo_format_contributions

formattools.**get_stem_tremolo_format_contributions**(*component*)
New in version 2.0. Get stem tremolo format contributions for *component*.

Return list.

formattools.is_formattable_context_mark_for_component

formattools.**is_formattable_context_mark_for_component**(*mark*, *component*)
Return True if ContextMark *mark* can format for *component*.

formattools.report_spanner_format_contributions

formattools.**report_spanner_format_contributions**(*spanner*, *screen=True*)
New in version 2.9. Report spanner format contributions for every leaf to which spanner attaches.

```
>>> staff = Staff("c8 d e f")
>>> spanner = beamtools.BeamSpanner(staff[:])

>>> formattools.report_spanner_format_contributions(spanner)
c8  before: []
     after: []
     right: ['[']

d8  before: []
     after: []
     right: []

e8  before: []
     after: []
     right: []

f8  before: []
     after: []
     right: [']']
```

Return none or return string.

importtools

functions

importtools.import_structured_package

importtools.**import_structured_package**(*path*, *namespace*, *package_root_name='abjad'*)
New in version 2.9. Import public names from *path* into *namespace*.

This is the custom function that all Abjad packages use to import public classes and functions on startup.

The function will work for any package laid out like Abjad packages.

Set *package_root_name* to the root any Abjad-like package structure.

Return none.

introspectiontools

functions

introspectiontools.get_current_function_name

introspectiontools.**get_current_function_name**()

New in version 2.10. Get current function name:

```
>>> from abjad.tools import introspectiontools

>>> def foo():
...         function_name = introspectiontools.get_current_function_name()
...         print 'Function name is {!r}.'.format(function_name)

>>> foo()
Function name is 'foo'.
```

Call this function within the implementation of any ofther function.

Returns enclosing function name as a string or else none.

introspectiontools.klass_to_tools_package_qualified_klass_name

introspectiontools.**klass_to_tools_package_qualified_klass_name**(*klass*)

New in version 2.10. Change *klass* to tools package-qualified class name:

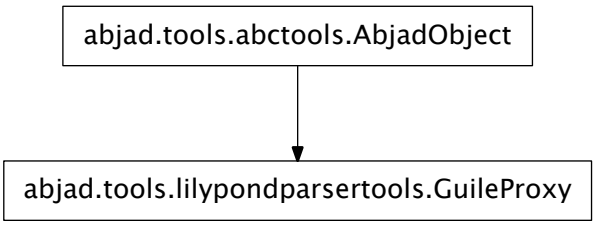
```
>>> from abjad.tools import introspectiontools

>>> introspectiontools.klass_to_tools_package_qualified_klass_name(Note)
'notetools.Note'
```

Return string.

lilypondparsertools

concrete classes

lilypondparsertools.GuileProxy



class lilypondparsertools.**GuileProxy**(*client*)

Emulates LilyPond music functions.

Used internally by LilyPondParser.

Not composer-safe.

Read-only Properties

GuileProxy.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

GuileProxy.**acciaccatura**(*music*)

GuileProxy.**appoggiatura**(*music*)

GuileProxy.**bar**(*string*)

GuileProxy.**breathe**()

GuileProxy.**clef**(*string*)

GuileProxy.**grace**(*music*)

GuileProxy.**key**(*notename_pitch*, *number_list*)

GuileProxy.**language**(*string*)

GuileProxy.**makeClusters**(*music*)

GuileProxy.**mark**(*label*)

GuileProxy.**oneVoice**()

GuileProxy.**relative**(*pitch*, *music*)

GuileProxy.**skip**(*duration*)

GuileProxy.**slashedGraceContainer**(*music*)

GuileProxy.**time**(*number_list*, *fraction*)

GuileProxy.**times**(*fraction*, *music*)

GuileProxy.**transpose**(*from_pitch*, *to_pitch*, *music*)

GuileProxy.**voiceFour**()

GuileProxy.**voiceOne**()

GuileProxy.**voiceThree**()

GuileProxy.**voiceTwo**()

Special Methods

GuileProxy.**__call__**(*function_name*, *args*)

GuileProxy.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

GuileProxy.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GuileProxy.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

GuileProxy.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GuileProxy.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

GuileProxy.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

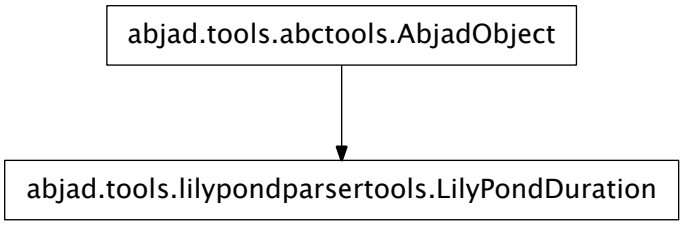
Inherited from abctools.AbjadObject

GuileProxy.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

lilypondparsertools.LilyPondDuration



class lilypondparsertools.**LilyPondDuration**(*duration*, *multiplier=None*)
Model of a duration in LilyPond.

Not composer-safe.

Used internally by LilyPondParser.

Read-only Properties

LilyPondDuration.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

LilyPondDuration.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

LilyPondDuration.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondDuration.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

LilyPondDuration.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondDuration.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondDuration.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

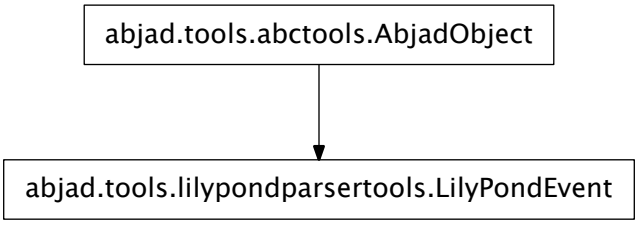
Inherited from abctools.AbjadObject

LilyPondDuration.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

lilypondparsertools.LilyPondEvent



class `lilypondparsertools.`**`LilyPondEvent`**(*name*, ***kwargs*)

Model of an arbitrary event in LilyPond.

Not composer-safe.

Used internally by LilyPondParser.

Read-only Properties

`LilyPondEvent.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Special Methods

`LilyPondEvent.`**`__eq__`**(*arg*)

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`LilyPondEvent.`**`__ge__`**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`LilyPondEvent.`**`__gt__`**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`LilyPondEvent.`**`__le__`**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

LilyPondEvent.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

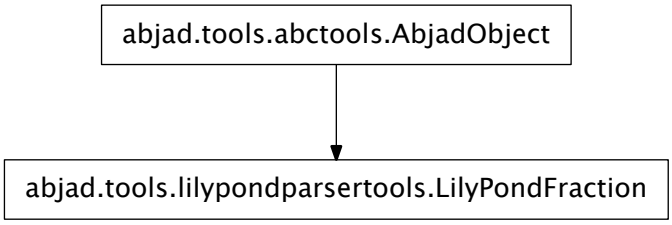
LilyPondEvent.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

LilyPondEvent.**__repr__**()

lilypondparsertools.LilyPondFraction



class lilypondparsertools.**LilyPondFraction**(*numerator*, *denominator*)
Model of a fraction in LilyPond.

Not composer-safe.

Used internally by LilyPondParser.

Read-only Properties

LilyPondFraction.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Special Methods

LilyPondFraction.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

LilyPondFraction.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondFraction.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

LilyPondFraction.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondFraction.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondFraction.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

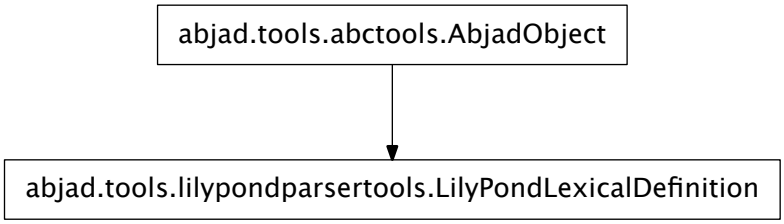
Inherited from abctools.AbjadObject

LilyPondFraction.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

lilypondparsertools.LilyPondLexicalDefinition



class lilypondparsertools.**LilyPondLexicalDefinition**(*client*)
The lexical definition of LilyPond's syntax.

Effectively equivalent to LilyPond's lexer.ll file.

Not composer-safe.

Used internally by LilyPondParser.

Read-only Properties

LilyPondLexicalDefinition.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

LilyPondLexicalDefinition.**push_signature**(*signature*, *t*)
LilyPondLexicalDefinition.**scan_bare_word**(*t*)

LilyPondLexicalDefinition.**scan_escaped_word**(*t*)

LilyPondLexicalDefinition.**t_651_a**(*t*)
(((-?[0-9]+).[0-9]*)|(-?.[0-9]+))

LilyPondLexicalDefinition.**t_651_b**(*t*)
-[0-9]+

LilyPondLexicalDefinition.**t_661**(*t*)
-.

LilyPondLexicalDefinition.**t_666**(*t*)
[0-9]+

LilyPondLexicalDefinition.**t_ANY_165**(*t*)
r

LilyPondLexicalDefinition.**t_INITIAL_643**(*t*)
[a-zA-Z200-377](([a-zA-Z200-377]|_)|[0-9])|-)*

LilyPondLexicalDefinition.**t_INITIAL_646**(*t*)
\[a-zA-Z200-377](([a-zA-Z200-377]|_)|[0-9])|-)*

LilyPondLexicalDefinition.**t_INITIAL_markup_notes_210**(*t*)
%{

LilyPondLexicalDefinition.**t_INITIAL_markup_notes_214**(*t*)
%[^{nr][^nr]*[nr]

LilyPondLexicalDefinition.**t_INITIAL_markup_notes_216**(*t*)
%[^{nr]

LilyPondLexicalDefinition.**t_INITIAL_markup_notes_218**(*t*)
%[nr]

LilyPondLexicalDefinition.**t_INITIAL_markup_notes_220**(*t*)
%[^{nr][^nr]*

LilyPondLexicalDefinition.**t_INITIAL_markup_notes_222**(*t*)
[

]

LilyPondLexicalDefinition.**t_INITIAL_markup_notes_227**(*t*)
“

LilyPondLexicalDefinition.**t_INITIAL_markup_notes_353**(*t*)
#

LilyPondLexicalDefinition.**t_INITIAL_markup_notes_353_boolean**(*t*)
##(t|f)

LilyPondLexicalDefinition.**t_INITIAL_markup_notes_353_identifier**(*t*)
#'[a-zA-Z200-377](([a-zA-Z200-377]|_)|[0-9])|-)*

LilyPondLexicalDefinition.**t_INITIAL_notes_233**(*t*)
\version[ntfr]*

LilyPondLexicalDefinition.**t_INITIAL_notes_387**(*t*)
<<

LilyPondLexicalDefinition.**t_INITIAL_notes_390**(*t*)
>>

LilyPondLexicalDefinition.**t_INITIAL_notes_396**(*t*)
<

LilyPondLexicalDefinition.**t_INITIAL_notes_399**(*t*)
>

LilyPondLexicalDefinition.**t_INITIAL_notes_686**(*t*)
\.

LilyPondLexicalDefinition.**t_error**(*t*)

LilyPondLexicalDefinition.**t_longcomment_291**(*t*)
[^%]+

LilyPondLexicalDefinition.**t_longcomment_293**(*t*)
%+[^}%]*

LilyPondLexicalDefinition.**t_longcomment_296**(*t*)
%}

LilyPondLexicalDefinition.**t_longcomment_error**(*t*)

LilyPondLexicalDefinition.**t_markup_545**(*t*)
\score

LilyPondLexicalDefinition.**t_markup_548**(*t*)
\([a-zA-Z200-377]|[-_])+

LilyPondLexicalDefinition.**t_markup_601**(*t*)
[^#{}"\ tnrf]+

LilyPondLexicalDefinition.**t_markup_error**(*t*)

LilyPondLexicalDefinition.**t_newline**(*t*)
n+

LilyPondLexicalDefinition.**t_notes_417**(*t*)
[a-zA-Z200-377]+

LilyPondLexicalDefinition.**t_notes_421**(*t*)
\[a-zA-Z200-377]+

LilyPondLexicalDefinition.**t_notes_424**(*t*)
[0-9]+/[0-9]+

LilyPondLexicalDefinition.**t_notes_428**(*t*)
[0-9]+//

LilyPondLexicalDefinition.**t_notes_428b**(*t*)
[0-9]+

LilyPondLexicalDefinition.**t_notes_433**(*t*)
\[0-9]+

LilyPondLexicalDefinition.**t_notes_error**(*t*)

LilyPondLexicalDefinition.**t_quote_440**(*t*)
[nt\”’]

LilyPondLexicalDefinition.**t_quote_443**(*t*)
[^\”“]+

LilyPondLexicalDefinition.**t_quote_446**(*t*)
“

LilyPondLexicalDefinition.**t_quote_456**(*t*)
.

LilyPondLexicalDefinition.**t_quote_XXX**(*t*)
\”

LilyPondLexicalDefinition.**t_quote_error**(*t*)

LilyPondLexicalDefinition.**t_scheme_error**(*t*)

LilyPondLexicalDefinition.**t_version_242**(*t*)
“[^”]*”

LilyPondLexicalDefinition.**t_version_278**(*t*)
(.ln)

LilyPondLexicalDefinition.**t_version_341**(*t*)
“[^”]*

LilyPondLexicalDefinition.**t_version_error**(*t*)

Special Methods

LilyPondLexicalDefinition.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

LilyPondLexicalDefinition.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

LilyPondLexicalDefinition.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

LilyPondLexicalDefinition.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

LilyPondLexicalDefinition.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondLexicalDefinition.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

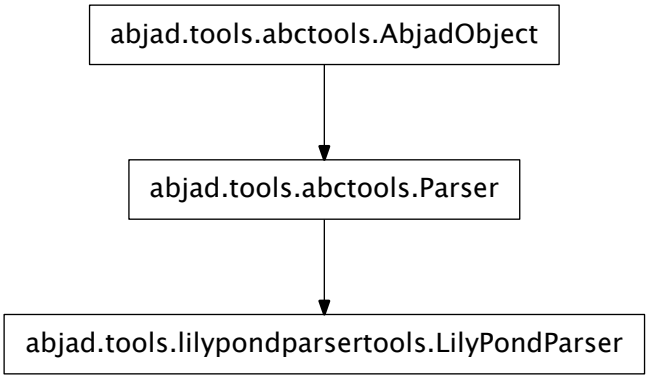
Inherited from abctools.AbjadObject

LilyPondLexicalDefinition.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

lilypondparsertools.LilyPondParser



class lilypondparsertools.**LilyPondParser**(*default_language='english'*, *debug=False*)
Parses a subset of LilyPond input syntax:

```
>>> from abjad.tools.lilypondparsertools import LilyPondParser
>>> parser = LilyPondParser()
>>> input = r"\new Staff { c'4 ( d'8 e' fs'2) \fermata }"
>>> result = parser(input)
>>> f(result)
\new Staff {
    c'4 (
    d'8
    e'8
    fs'2 -\fermata )
}
```

LilyPondParser defaults to English note names, but any of the other languages supported by LilyPond may be used:

```
>>> parser = LilyPondParser('nederlands')
>>> input = '{ c des e fis }'
>>> result = parser(input)
```

```
>>> f(result)
{
    c4
    df4
    e4
    fs4
}
```

Briefly, LilyPondParser understands theses aspects of LilyPond syntax:

- Notes, chords, rests, skips and multi-measure rests
- Durations, dots, and multipliers
- All pitchnames, and octave ticks
- Simple markup (i.e. `c'4 ^ "hello!"`)
- Most articulations
- Most spanners, including beams, slurs, phrasing slurs, ties, and glissandi
- Most context types via `\new` and `\context`, as well as context ids (i.e. `\new Staff = "foo" { }`)
- Variable assignment (i.e. `global = { \time 3/4 } \new Staff { \global }`)
- **Many music functions:**
  - `\acciaccatura`
  - `\appoggiatura`
  - `\bar`
  - `\breathe`
  - `\clef`
  - `\grace`
  - `\key`
  - `\transpose`
  - `\language`
  - `\makeClusters`
  - `\mark`
  - `\oneVoice`
  - `\relative`
  - `\skip`
  - `\slashedGrace`
  - `\time`
  - `\times`
  - `\transpose`
  - `\voiceOne`, `\voiceTwo`, `\voiceThree`, `\voiceFour`

LilyPondParser currently **DOES NOT** understand many other aspects of LilyPond syntax:

- \markup
- \book, \bookpart, \header, \layout, \midi and \paper
- \repeat and \alternative
- Lyrics
- \chordmode, \drummode or \figuremode
- Property operations, such as \override, \revert, \set, \unset, and \once
- Music functions which generate or extensively mutate musical structures
- Embedded Scheme statements (anything beginning with #)

Returns LilyPondParser instance.

Read-only Properties

LilyPondParser.**available_languages**

Tuple of pitch-name languages supported by LilyPondParser:

```
>>> from abjad.tools.lilypondparsertools import LilyPondParser
>>> parser = LilyPondParser()
>>> parser.available_languages
('catalan', 'deutsch', 'english', 'espanol', 'italiano', 'nederlands',
'norsk', 'portugues', 'suomi', 'svenska', 'vlaams')
```

Return tuple.

LilyPondParser.**debug**

True if the parser runs in debugging mode.

Inherited from abctools.Parser

LilyPondParser.**lexer**

The parser's PLY Lexer instance.

Inherited from abctools.Parser

LilyPondParser.**lexer_rules_object**

LilyPondParser.**logger**

The parser's Logger instance.

Inherited from abctools.Parser

LilyPondParser.**logger_path**

The output path for the parser's logfile.

Inherited from abctools.Parser

LilyPondParser.**output_path**

The output path for files associated with the parser.

Inherited from abctools.Parser

LilyPondParser.**parser**

The parser's PLY LRParser instance.

Inherited from abctools.Parser

LilyPondParser.**parser_rules_object**

LilyPondParser.**pickle_path**
The output path for the parser's pickled parsing tables.

Inherited from abctools.Parser

LilyPondParser.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Read/write Properties

LilyPondParser.**default_language**
Read/write attribute to set parser's default pitch-name language:

```
>>> from abjad.tools.lilypondparsertools import LilyPondParser
>>> parser = LilyPondParser()
>>> parser.default_language
'english'
>>> parser('{ c df e fs }')
{c4, df4, e4, fs4}
>>> parser.default_language = 'nederlands'
>>> parser.default_language
'nederlands'
>>> parser('{ c des e fis }')
{c4, df4, e4, fs4}
```

Methods

LilyPondParser.**tokenize**(*input_string*)
Tokenize *input string* and print results.

Inherited from abctools.Parser

Special Methods

LilyPondParser.**__call__**(*input_string*)
LilyPondParser.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

LilyPondParser.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondParser.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

LilyPondParser.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondParser.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondParser.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

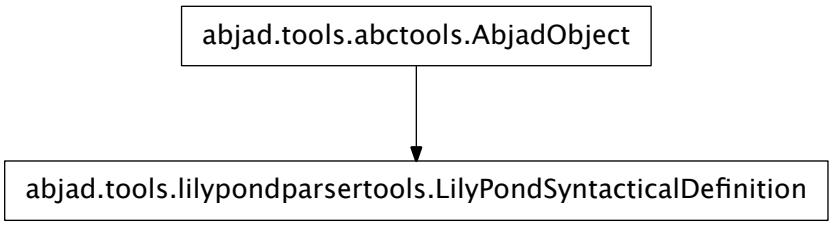
Inherited from abctools.AbjadObject

LilyPondParser.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

lilypondparsertools.LilyPondSyntacticalDefinition



class lilypondparsertools.**LilyPondSyntacticalDefinition**(*client*)
The syntactical definition of LilyPond's syntax.

Effectively equivalent to LilyPond's parser.yy file.

Not composer-safe.

Used internally by LilyPondParser.

Read-only Properties

LilyPondSyntacticalDefinition.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

LilyPondSyntacticalDefinition.**p_assignment__assignment_id__Chr61__identifier_init**(*p*)
assignment : assignment_id '=' identifier_init

LilyPondSyntacticalDefinition.**p_assignment__embedded_scm**(*p*)
assignment : embedded_scm

LilyPondSyntacticalDefinition.**p_assignment_id__STRING**(*p*)
assignment_id : STRING

LilyPondSyntacticalDefinition.**p_bare_number__REAL__NUMBER_IDENTIFIER**(*p*)
bare_number : REAL NUMBER_IDENTIFIER

LilyPondSyntacticalDefinition.**p_bare_number__UNSIGNED__NUMBER_IDENTIFIER**(*p*)
bare_number : UNSIGNED NUMBER_IDENTIFIER

LilyPondSyntacticalDefinition.**p_bare_number__bare_number_closed**(*p*)
bare_number : bare_number_closed

LilyPondSyntacticalDefinition.**p_bare_number_closed__NUMBER_IDENTIFIER**(*p*)
bare_number_closed : NUMBER_IDENTIFIER

LilyPondSyntacticalDefinition.**p_bare_number_closed__REAL**(*p*)
bare_number_closed : REAL

LilyPondSyntacticalDefinition.**p_bare_number_closed__UNSIGNED**(*p*)
bare_number_closed : UNSIGNED

LilyPondSyntacticalDefinition.**p_bare_unsigned__UNSIGNED**(*p*)
bare_unsigned : UNSIGNED

LilyPondSyntacticalDefinition.**p_braced_music_list__Chr123__music_list__Chr125**(*p*)
braced_music_list : '{' music_list '}'

LilyPondSyntacticalDefinition.**p_chord_body__ANGLE_OPEN__chord_body_elements__ANGLE_CLOSE**(*p*)
chord_body : ANGLE_OPEN chord_body_elements ANGLE_CLOSE

LilyPondSyntacticalDefinition.**p_chord_body_element__music_function_chord_body**(*p*)
chord_body_element : music_function_chord_body

LilyPondSyntacticalDefinition.**p_chord_body_element__pitch__exclamations__questions__octave_**
chord_body_element : pitch exclamations questions octave_check post_events

LilyPondSyntacticalDefinition.**p_chord_body_elements__Empty**(*p*)
chord_body_elements :

LilyPondSyntacticalDefinition.**p_chord_body_elements__chord_body_elements__chord_body_eleme**
chord_body_elements : chord_body_elements chord_body_element

LilyPondSyntacticalDefinition.**p_closed_music__complex_music_prefix__closed_music**(*p*)
closed_music : complex_music_prefix closed_music

LilyPondSyntacticalDefinition.**p_closed_music__music_bare**(*p*)
closed_music : music_bare

LilyPondSyntacticalDefinition.**p_command_element__Chr124**(*p*)
command_element : '|'

LilyPondSyntacticalDefinition.**p_command_element__E_BACKSLASH**(*p*)
command_element : E_BACKSLASH

LilyPondSyntacticalDefinition.**p_command_element__command_event**(*p*)
command_element : command_event

LilyPondSyntacticalDefinition.**p_command_event__tempo_event**(*p*)
command_event : tempo_event

LilyPondSyntacticalDefinition.**p_complex_music__complex_music_prefix__music**(*p*)
complex_music : complex_music_prefix music

LilyPondSyntacticalDefinition.**p_complex_music__music_function_call**(*p*)
complex_music : music_function_call

LilyPondSyntacticalDefinition.**p_complex_music_prefix__CONTEXT__simple_string__optional_id_**
complex_music_prefix : CONTEXT simple_string optional_id optional_context_mod

LilyPondSyntacticalDefinition.**p_complex_music_prefix__NEWCONTEXT__simple_string__optional_**
complex_music_prefix : NEWCONTEXT simple_string optional_id optional_context_mod

LilyPondSyntacticalDefinition.**p_composite_music__complex_music**(*p*)
composite_music : complex_music

LilyPondSyntacticalDefinition.**p_composite_music__music_bare**(*p*)
composite_music : music_bare

LilyPondSyntacticalDefinition.**p_context_change__CHANGE__STRING__Chr61__STRING**(*p*)
context_change : CHANGE STRING '=' STRING

LilyPondSyntacticalDefinition.**p_context_def_spec_block__CONTEXT__Chr123__context_def_spec_b**
context_def_spec_block : CONTEXT '{' context_def_spec_body '}'

LilyPondSyntacticalDefinition.**p_context_def_spec_body__CONTEXT_DEF_IDENTIFIER**(*p*)
context_def_spec_body : CONTEXT_DEF_IDENTIFIER

LilyPondSyntacticalDefinition.**p_context_def_spec_body__Empty**(*p*)
context_def_spec_body :

LilyPondSyntacticalDefinition.**p_context_def_spec_body__context_def_spec_body__context_mod**(*p*
context_def_spec_body : context_def_spec_body context_mod

LilyPondSyntacticalDefinition.**p_context_def_spec_body__context_def_spec_body__context_modi**
context_def_spec_body : context_def_spec_body context_modification

LilyPondSyntacticalDefinition.**p_context_def_spec_body__context_def_spec_body__embedded_scm**
context_def_spec_body : context_def_spec_body embedded_scm

LilyPondSyntacticalDefinition.**p_context_mod__property_operation**(*p*)
context_mod : property_operation

LilyPondSyntacticalDefinition.**p_context_mod_list__Empty**(*p*)
context_mod_list :

LilyPondSyntacticalDefinition.**p_context_mod_list__context_mod_list__CONTEXT_MOD_IDENTIFIER**
context_mod_list : context_mod_list CONTEXT_MOD_IDENTIFIER

LilyPondSyntacticalDefinition.**p_context_mod_list__context_mod_list__context_mod**(*p*)
context_mod_list : context_mod_list context_mod

LilyPondSyntacticalDefinition.**p_context_mod_list__context_mod_list__embedded_scm**(*p*)
context_mod_list : context_mod_list embedded_scm

LilyPondSyntacticalDefinition.**p_context_modification__CONTEXT_MOD_IDENTIFIER**(*p*)
context_modification : CONTEXT_MOD_IDENTIFIER

LilyPondSyntacticalDefinition.**p_context_modification__WITH__CONTEXT_MOD_IDENTIFIER**(*p*)
context_modification : WITH CONTEXT_MOD_IDENTIFIER

LilyPondSyntacticalDefinition.**p_context_modification__WITH__Chr123__context_mod_list__Chr12**
context_modification : WITH '{' context_mod_list '}'

LilyPondSyntacticalDefinition.**p_context_modification__WITH__embedded_scm_closed**(*p*)
context_modification : WITH embedded_scm_closed

LilyPondSyntacticalDefinition.**p_context_prop_spec__simple_string**(*p*)
context_prop_spec : simple_string

LilyPondSyntacticalDefinition.**p_context_prop_spec__simple_string__Chr46__simple_string**(*p*)
context_prop_spec : simple_string '.' simple_string

LilyPondSyntacticalDefinition.**p_direction_less_char__Chr126**(*p*)
direction_less_char : '~'

LilyPondSyntacticalDefinition.**p_direction_less_char__Chr40**(*p*)
direction_less_char : '('

LilyPondSyntacticalDefinition.**p_direction_less_char__Chr41**(*p*)
direction_less_char : ')'

LilyPondSyntacticalDefinition.**p_direction_less_char__Chr91**(*p*)
direction_less_char : '['

LilyPondSyntacticalDefinition.**p_direction_less_char__Chr93**(*p*)
direction_less_char : ']'

LilyPondSyntacticalDefinition.**p_direction_less_char__E_ANGLE_CLOSE**(*p*)
direction_less_char : E_ANGLE_CLOSE

LilyPondSyntacticalDefinition.**p_direction_less_char__E_ANGLE_OPEN**(*p*)
direction_less_char : E_ANGLE_OPEN

LilyPondSyntacticalDefinition.**p_direction_less_char__E_CLOSE**(*p*)
direction_less_char : E_CLOSE

LilyPondSyntacticalDefinition.**p_direction_less_char__E_EXCLAMATION**(*p*)
direction_less_char : E_EXCLAMATION

LilyPondSyntacticalDefinition.**p_direction_less_char__E_OPEN**(*p*)
direction_less_char : E_OPEN

LilyPondSyntacticalDefinition.**p_direction_less_event__EVENT_IDENTIFIER**(*p*)
direction_less_event : EVENT_IDENTIFIER

LilyPondSyntacticalDefinition.**p_direction_less_event__direction_less_char**(*p*)
direction_less_event : direction_less_char

LilyPondSyntacticalDefinition.**p_direction_less_event__event_function_event**(*p*)
direction_less_event : event_function_event

LilyPondSyntacticalDefinition.**p_direction_less_event__tremolo_type**(*p*)
direction_less_event : tremolo_type

LilyPondSyntacticalDefinition.**p_direction_reqd_event__gen_text_def**(*p*)
direction_reqd_event : gen_text_def

LilyPondSyntacticalDefinition.**p_direction_reqd_event__script_abbreviation**(*p*)
direction_reqd_event : script_abbreviation

LilyPondSyntacticalDefinition.**p_dots__Empty**(*p*)
dots :

LilyPondSyntacticalDefinition.**p_dots__dots__Chr46**(*p*)
dots : dots '.'

LilyPondSyntacticalDefinition.**p_duration_length__multiplied_duration**(*p*)
duration_length : multiplied_duration

LilyPondSyntacticalDefinition.**p_embedded_scm__embedded_scm_bare**(*p*)
embedded_scm : embedded_scm_bare

LilyPondSyntacticalDefinition.**p_embedded_scm__scm_function_call**(*p*)
embedded_scm : scm_function_call

LilyPondSyntacticalDefinition.**p_embedded_scm_arg__embedded_scm_bare_arg**(*p*)
embedded_scm_arg : embedded_scm_bare_arg

LilyPondSyntacticalDefinition.**p_embedded_scm_arg__music_arg**(*p*)
embedded_scm_arg : music_arg

LilyPondSyntacticalDefinition.**p_embedded_scm_arg__scm_function_call**(*p*)
embedded_scm_arg : scm_function_call

LilyPondSyntacticalDefinition.**p_embedded_scm_arg_closed__closed_music**(*p*)
embedded_scm_arg_closed : closed_music

LilyPondSyntacticalDefinition.**p_embedded_scm_arg_closed__embedded_scm_bare_arg**(*p*)
embedded_scm_arg_closed : embedded_scm_bare_arg

LilyPondSyntacticalDefinition.**p_embedded_scm_arg_closed__scm_function_call_closed**(*p*)
embedded_scm_arg_closed : scm_function_call_closed

LilyPondSyntacticalDefinition.**p_embedded_scm_bare__SCM_IDENTIFIER**(*p*)
embedded_scm_bare : SCM_IDENTIFIER

LilyPondSyntacticalDefinition.**p_embedded_scm_bare__SCM_TOKEN**(*p*)
embedded_scm_bare : SCM_TOKEN

LilyPondSyntacticalDefinition.**p_embedded_scm_bare_arg__STRING**(*p*)
embedded_scm_bare_arg : STRING

LilyPondSyntacticalDefinition.**p_embedded_scm_bare_arg__STRING_IDENTIFIER**(*p*)
embedded_scm_bare_arg : STRING_IDENTIFIER

LilyPondSyntacticalDefinition.**p_embedded_scm_bare_arg__context_def_spec_block**(*p*)
embedded_scm_bare_arg : context_def_spec_block

LilyPondSyntacticalDefinition.**p_embedded_scm_bare_arg__context_modification**(*p*)
embedded_scm_bare_arg : context_modification

LilyPondSyntacticalDefinition.**p_embedded_scm_bare_arg__embedded_scm_bare**(*p*)
embedded_scm_bare_arg : embedded_scm_bare

LilyPondSyntacticalDefinition.**p_embedded_scm_bare_arg__full_markup**(*p*)
embedded_scm_bare_arg : full_markup

LilyPondSyntacticalDefinition.**p_embedded_scm_bare_arg__full_markup_list**(*p*)
embedded_scm_bare_arg : full_markup_list

LilyPondSyntacticalDefinition.**p_embedded_scm_bare_arg__output_def**(*p*)
embedded_scm_bare_arg : output_def

LilyPondSyntacticalDefinition.**p_embedded_scm_bare_arg__score_block**(*p*)
embedded_scm_bare_arg : score_block

LilyPondSyntacticalDefinition.**p_embedded_scm_chord_body__SCM_FUNCTION__music_function_chord**
embedded_scm_chord_body : SCM_FUNCTION music_function_chord_body_arglist

LilyPondSyntacticalDefinition.**p_embedded_scm_chord_body__bare_number**(*p*)
embedded_scm_chord_body : bare_number

LilyPondSyntacticalDefinition.**p_embedded_scm_chord_body__chord_body_element**(*p*)
embedded_scm_chord_body : chord_body_element

LilyPondSyntacticalDefinition.**p_embedded_scm_chord_body__embedded_scm_bare_arg**(*p*)
embedded_scm_chord_body : embedded_scm_bare_arg

LilyPondSyntacticalDefinition.**p_embedded_scm_chord_body__fraction**(*p*)
embedded_scm_chord_body : fraction

LilyPondSyntacticalDefinition.**p_embedded_scm_closed__embedded_scm_bare**(*p*)
embedded_scm_closed : embedded_scm_bare

LilyPondSyntacticalDefinition.**p_embedded_scm_closed__scm_function_call_closed**(*p*)
embedded_scm_closed : scm_function_call_closed

LilyPondSyntacticalDefinition.**p_error**(*p*)

LilyPondSyntacticalDefinition.**p_event_chord__CHORD_REPETITION__optional_notemode_duration__**
event_chord : CHORD_REPETITION optional_notemode_duration post_events

LilyPondSyntacticalDefinition.**p_event_chord__MULTI_MEASURE_REST__optional_notemode_duration**
event_chord : MULTI_MEASURE_REST optional_notemode_duration post_events

LilyPondSyntacticalDefinition.**p_event_chord__command_element**(*p*)
event_chord : command_element

LilyPondSyntacticalDefinition.**p_event_chord__note_chord_element**(*p*)
event_chord : note_chord_element

LilyPondSyntacticalDefinition.**p_event_chord__simple_chord_elements__post_events**(*p*)
event_chord : simple_chord_elements post_events

LilyPondSyntacticalDefinition.**p_event_function_event__EVENT_FUNCTION__function_arglist_clos**
event_function_event : EVENT_FUNCTION function_arglist_closed

LilyPondSyntacticalDefinition.**p_exclamations__Empty**(*p*)
exclamations :

LilyPondSyntacticalDefinition.**p_exclamations__exclamations__Chr33**(*p*)
exclamations : exclamations '!'

LilyPondSyntacticalDefinition.**p_fingering__UNSIGNED**(*p*)
fingering : UNSIGNED

LilyPondSyntacticalDefinition.**p_fraction__FRACTION**(*p*)
fraction : FRACTION

LilyPondSyntacticalDefinition.**p_fraction__UNSIGNED__Chr47__UNSIGNED**(*p*)
fraction : UNSIGNED '/' UNSIGNED

LilyPondSyntacticalDefinition.**p_full_markup__MARKUP_IDENTIFIER**(*p*)
full_markup : MARKUP_IDENTIFIER

LilyPondSyntacticalDefinition.**p_full_markup__MARKUP__markup_top**(*p*)
full_markup : MARKUP markup_top

LilyPondSyntacticalDefinition.**p_full_markup_list__MARKUPLIST_IDENTIFIER**(*p*)
full_markup_list : MARKUPLIST_IDENTIFIER

LilyPondSyntacticalDefinition.**p_full_markup_list__MARKUPLIST__markup_list**(*p*)
full_markup_list : MARKUPLIST markup_list

LilyPondSyntacticalDefinition.**p_function_arglist__function_arglist_common**(*p*)
function_arglist : function_arglist_common

LilyPondSyntacticalDefinition.**p_function_arglist__function_arglist_nonbackup**(*p*)
function_arglist : function_arglist_nonbackup

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_DURATION__**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_DURATION function_arglist_closed_keep duration_length

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_PITCH__fu**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_PITCH function_arglist_keep pitch_also_in_chords

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_SCM__funct**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_backup BACKUP

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_SCM__funct**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed_keep '-' NUMBER_IDENTIFIER

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_SCM__funct**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed_keep '-' REAL

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_SCM__funct**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed_keep '-' UNSIGNED

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_SCM__funct**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed_keep FRACTION

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_SCM__funct**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed_keep NUMBER_IDENTIFIER

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_SCM__funct**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed_keep REAL

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_SCM__funct**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed_keep UNSIGNED

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_SCM__funct**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed_keep post_event_nofinger

LilyPondSyntacticalDefinition.**p_function_arglist_backup__EXPECT_OPTIONAL__EXPECT_SCM__funct**
function_arglist_backup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_keep embedded_scm_arg_closed

LilyPondSyntacticalDefinition.**p_function_arglist_backup__function_arglist_backup__REPARSE__**
function_arglist_backup : function_arglist_backup REPARSE bare_number

LilyPondSyntacticalDefinition.**p_function_arglist_backup__function_arglist_backup__REPARSE__**
function_arglist_backup : function_arglist_backup REPARSE embedded_scm_arg_closed

LilyPondSyntacticalDefinition.**p_function_arglist_backup__function_arglist_backup__REPARSE__**
function_arglist_backup : function_arglist_backup REPARSE fraction

LilyPondSyntacticalDefinition.**p_function_arglist_bare__EXPECT_DURATION__function_arglist_cl**
function_arglist_bare : EXPECT_DURATION function_arglist_closed_optional duration_length

LilyPondSyntacticalDefinition.**p_function_arglist_bare__EXPECT_NO_MORE_ARGS**(*p*)
function_arglist_bare : EXPECT_NO_MORE_ARGS

LilyPondSyntacticalDefinition.**p_function_arglist_bare__EXPECT_OPTIONAL__EXPECT_DURATION__fu**
function_arglist_bare : EXPECT_OPTIONAL EXPECT_DURATION function_arglist_skip DEFAULT

LilyPondSyntacticalDefinition.**p_function_arglist_bare__EXPECT_OPTIONAL__EXPECT_PITCH__funct**
function_arglist_bare : EXPECT_OPTIONAL EXPECT_PITCH function_arglist_skip DEFAULT

LilyPondSyntacticalDefinition.**p_function_arglist_bare__EXPECT_OPTIONAL__EXPECT_SCM__functio**
function_arglist_bare : EXPECT_OPTIONAL EXPECT_SCM function_arglist_skip DEFAULT

LilyPondSyntacticalDefinition.**p_function_arglist_bare__EXPECT_PITCH__function_arglist_optio**
function_arglist_bare : EXPECT_PITCH function_arglist_optional pitch_also_in_chords

LilyPondSyntacticalDefinition.**p_function_arglist_closed__function_arglist_closed_common**(*p*)
function_arglist_closed : function_arglist_closed_common

LilyPondSyntacticalDefinition.**p_function_arglist_closed__function_arglist_nonbackup**(*p*)
function_arglist_closed : function_arglist_nonbackup

LilyPondSyntacticalDefinition.**p_function_arglist_closed_common__EXPECT_SCM__function_arglis**
function_arglist_closed_common : EXPECT_SCM function_arglist_closed_optional '-' NUMBER_IDENTIFIER

LilyPondSyntacticalDefinition.**p_function_arglist_closed_common__EXPECT_SCM__function_arglis**
function_arglist_closed_common : EXPECT_SCM function_arglist_closed_optional '-' REAL

LilyPondSyntacticalDefinition.**p_function_arglist_closed_common__EXPECT_SCM__function_arglis**
function_arglist_closed_common : EXPECT_SCM function_arglist_closed_optional '-' UNSIGNED

LilyPondSyntacticalDefinition.**p_function_arglist_closed_common__EXPECT_SCM__function_arglis**
function_arglist_closed_common : EXPECT_SCM function_arglist_closed_optional bare_number

LilyPondSyntacticalDefinition.**p_function_arglist_closed_common__EXPECT_SCM__function_arglis**
function_arglist_closed_common : EXPECT_SCM function_arglist_closed_optional fraction

LilyPondSyntacticalDefinition.**p_function_arglist_closed_common__EXPECT_SCM__function_arglis**
function_arglist_closed_common : EXPECT_SCM function_arglist_closed_optional post_event_nofinger

LilyPondSyntacticalDefinition.**p_function_arglist_closed_common__EXPECT_SCM__function_arglis**
function_arglist_closed_common : EXPECT_SCM function_arglist_optional embedded_scm_arg_closed

LilyPondSyntacticalDefinition.**p_function_arglist_closed_common__function_arglist_bare**(*p*)
function_arglist_closed_common : function_arglist_bare

LilyPondSyntacticalDefinition.**p_function_arglist_closed_keep__function_arglist_backup**(*p*)
function_arglist_closed_keep : function_arglist_backup

LilyPondSyntacticalDefinition.**p_function_arglist_closed_keep__function_arglist_closed_commo**
function_arglist_closed_keep : function_arglist_closed_common

LilyPondSyntacticalDefinition.**p_function_arglist_closed_optional__EXPECT_OPTIONAL__EXPECT_D**
function_arglist_closed_optional : EXPECT_OPTIONAL EXPECT_DURATION function_arglist_closed_optional

LilyPondSyntacticalDefinition.**p_function_arglist_closed_optional__EXPECT_OPTIONAL__EXPECT_P**
function_arglist_closed_optional : EXPECT_OPTIONAL EXPECT_PITCH function_arglist_closed_optional

LilyPondSyntacticalDefinition.**p_function_arglist_closed_optional__function_arglist_backup__**
function_arglist_closed_optional : function_arglist_backup BACKUP

LilyPondSyntacticalDefinition.**p_function_arglist_closed_optional__function_arglist_closed_k**
function_arglist_closed_optional : function_arglist_closed_keep %prec FUNCTION_ARGLIST

LilyPondSyntacticalDefinition.**p_function_arglist_common__EXPECT_SCM__function_arglist_close**
function_arglist_common : EXPECT_SCM function_arglist_closed_optional bare_number

LilyPondSyntacticalDefinition.**p_function_arglist_common__EXPECT_SCM__function_arglist_close**
function_arglist_common : EXPECT_SCM function_arglist_closed_optional fraction

LilyPondSyntacticalDefinition.**p_function_arglist_common__EXPECT_SCM__function_arglist_close**
function_arglist_common : EXPECT_SCM function_arglist_closed_optional post_event_nofinger

LilyPondSyntacticalDefinition.**p_function_arglist_common__EXPECT_SCM__function_arglist_optio**
function_arglist_common : EXPECT_SCM function_arglist_optional embedded_scm_arg

LilyPondSyntacticalDefinition.**p_function_arglist_common__function_arglist_bare**(*p*)
function_arglist_common : function_arglist_bare

LilyPondSyntacticalDefinition.**p_function_arglist_common__function_arglist_common_minus**(*p*)
function_arglist_common : function_arglist_common_minus

LilyPondSyntacticalDefinition.**p_function_arglist_common_minus__EXPECT_SCM__function_arglist**
function_arglist_common_minus : EXPECT_SCM function_arglist_closed_optional '-' NUMBER_IDENTIFIER

LilyPondSyntacticalDefinition.**p_function_arglist_common_minus__EXPECT_SCM__function_arglist**
function_arglist_common_minus : EXPECT_SCM function_arglist_closed_optional '-' REAL

LilyPondSyntacticalDefinition.**p_function_arglist_common_minus__EXPECT_SCM__function_arglist**
function_arglist_common_minus : EXPECT_SCM function_arglist_closed_optional '-' UNSIGNED

LilyPondSyntacticalDefinition.**p_function_arglist_common_minus__function_arglist_common_minu**
function_arglist_common_minus : function_arglist_common_minus REPARSE bare_number

LilyPondSyntacticalDefinition.**p_function_arglist_keep__function_arglist_backup**(*p*)
function_arglist_keep : function_arglist_backup

LilyPondSyntacticalDefinition.**p_function_arglist_keep__function_arglist_common**(*p*)
function_arglist_keep : function_arglist_common

LilyPondSyntacticalDefinition.**p_function_arglist_nonbackup__EXPECT_OPTIONAL__EXPECT_DURATIO**
function_arglist_nonbackup : EXPECT_OPTIONAL EXPECT_DURATION function_arglist_closed duration_length

LilyPondSyntacticalDefinition.**p_function_arglist_nonbackup__EXPECT_OPTIONAL__EXPECT_PITCH__**
function_arglist_nonbackup : EXPECT_OPTIONAL EXPECT_PITCH function_arglist pitch_also_in_chords

LilyPondSyntacticalDefinition.**p_function_arglist_nonbackup__EXPECT_OPTIONAL__EXPECT_SCM__fu**
function_arglist_nonbackup : EXPECT_OPTIONAL EXPECT_SCM function_arglist embedded_scm_arg_closed

LilyPondSyntacticalDefinition.**p_function_arglist_nonbackup__EXPECT_OPTIONAL__EXPECT_SCM__fu**
function_arglist_nonbackup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed '-' NUMBER_IDENTIFIER

LilyPondSyntacticalDefinition.**p_function_arglist_nonbackup__EXPECT_OPTIONAL__EXPECT_SCM__fu**
function_arglist_nonbackup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed '-' REAL

LilyPondSyntacticalDefinition.**p_function_arglist_nonbackup__EXPECT_OPTIONAL__EXPECT_SCM__fu**
function_arglist_nonbackup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed '-' UNSIGNED

LilyPondSyntacticalDefinition.**p_function_arglist_nonbackup__EXPECT_OPTIONAL__EXPECT_SCM__fu**
function_arglist_nonbackup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed FRACTION

LilyPondSyntacticalDefinition.**p_function_arglist_nonbackup__EXPECT_OPTIONAL__EXPECT_SCM__fu**
function_arglist_nonbackup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed bare_number_closed

LilyPondSyntacticalDefinition.**p_function_arglist_nonbackup__EXPECT_OPTIONAL__EXPECT_SCM__fu**
function_arglist_nonbackup : EXPECT_OPTIONAL EXPECT_SCM function_arglist_closed post_event_nofinger

LilyPondSyntacticalDefinition.**p_function_arglist_optional__EXPECT_OPTIONAL__EXPECT_DURATION**
function_arglist_optional : EXPECT_OPTIONAL EXPECT_DURATION function_arglist_optional

LilyPondSyntacticalDefinition.**p_function_arglist_optional__EXPECT_OPTIONAL__EXPECT_PITCH__f**
function_arglist_optional : EXPECT_OPTIONAL EXPECT_PITCH function_arglist_optional

LilyPondSyntacticalDefinition.**p_function_arglist_optional__function_arglist_backup__BACKUP**
function_arglist_optional : function_arglist_backup BACKUP

LilyPondSyntacticalDefinition.**p_function_arglist_optional__function_arglist_keep**(*p*)
function_arglist_optional : function_arglist_keep %prec FUNCTION_ARGLIST

LilyPondSyntacticalDefinition.**p_function_arglist_skip__EXPECT_OPTIONAL__EXPECT_DURATION__fu**
function_arglist_skip : EXPECT_OPTIONAL EXPECT_DURATION function_arglist_skip %prec FUNCTION_ARGLIST

LilyPondSyntacticalDefinition.**p_function_arglist_skip__EXPECT_OPTIONAL__EXPECT_PITCH__funct**
function_arglist_skip : EXPECT_OPTIONAL EXPECT_PITCH function_arglist_skip %prec FUNCTION_ARGLIST

LilyPondSyntacticalDefinition.**p_function_arglist_skip__EXPECT_OPTIONAL__EXPECT_SCM__functio**
function_arglist_skip : EXPECT_OPTIONAL EXPECT_SCM function_arglist_skip %prec FUNCTION_ARGLIST

LilyPondSyntacticalDefinition.**p_function_arglist_skip__function_arglist_common**(*p*)
function_arglist_skip : function_arglist_common

LilyPondSyntacticalDefinition.**p_gen_text_def__full_markup**(*p*)
gen_text_def : full_markup

LilyPondSyntacticalDefinition.**p_gen_text_def__simple_string**(*p*)
gen_text_def : simple_string

LilyPondSyntacticalDefinition.**p_grouped_music_list__sequential_music**(*p*)
grouped_music_list : sequential_music

LilyPondSyntacticalDefinition.**p_grouped_music_list__simultaneous_music**(*p*)
grouped_music_list : simultaneous_music

LilyPondSyntacticalDefinition.**p_identifier_init__context_def_spec_block**(*p*)
identifier_init : context_def_spec_block

LilyPondSyntacticalDefinition.**p_identifier_init__context_modification**(*p*)
identifier_init : context_modification

LilyPondSyntacticalDefinition.**p_identifier_init__embedded_scm**(*p*)
identifier_init : embedded_scm

LilyPondSyntacticalDefinition.**p_identifier_init__full_markup**(*p*)
identifier_init : full_markup

LilyPondSyntacticalDefinition.**p_identifier_init__full_markup_list**(*p*)
identifier_init : full_markup_list

LilyPondSyntacticalDefinition.**p_identifier_init__music**(*p*)
identifier_init : music

LilyPondSyntacticalDefinition.**p_identifier_init__number_expression**(*p*)
identifier_init : number_expression

LilyPondSyntacticalDefinition.**p_identifier_init__output_def**(*p*)
identifier_init : output_def

LilyPondSyntacticalDefinition.**p_identifier_init__post_event_nofinger**(*p*)
identifier_init : post_event_nofinger

LilyPondSyntacticalDefinition.**p_identifier_init__score_block**(*p*)
identifier_init : score_block

LilyPondSyntacticalDefinition.**p_identifier_init__string**(*p*)
identifier_init : string

LilyPondSyntacticalDefinition.**p_lilypond__Empty**(*p*)
lilypond :

LilyPondSyntacticalDefinition.**p_lilypond__lilypond__assignment**(*p*)
lilypond : lilypond assignment

LilyPondSyntacticalDefinition.**p_lilypond__lilypond__error**(*p*)
lilypond : lilypond error

LilyPondSyntacticalDefinition.**p_lilypond__lilypond__toplevel_expression**(*p*)
lilypond : lilypond toplevel_expression

LilyPondSyntacticalDefinition.**p_lilypond_header__HEADER__Chr123__lilypond_header_body__Chr**
lilypond_header : HEADER '{' lilypond_header_body '}'

LilyPondSyntacticalDefinition.**p_lilypond_header_body__Empty**(*p*)
lilypond_header_body :

LilyPondSyntacticalDefinition.**p_lilypond_header_body__lilypond_header_body__assignment**(*p*)
lilypond_header_body : lilypond_header_body assignment

LilyPondSyntacticalDefinition.**p_markup__markup_head_1_list__simple_markup**(*p*)
markup : markup_head_1_list simple_markup

LilyPondSyntacticalDefinition.**p_markup__simple_markup**(*p*)
markup : simple_markup

LilyPondSyntacticalDefinition.**p_markup_braced_list__Chr123__markup_braced_list_body__Chr12**
markup_braced_list : '{' markup_braced_list_body '}'

LilyPondSyntacticalDefinition.**p_markup_braced_list_body__Empty**(*p*)
markup_braced_list_body :

LilyPondSyntacticalDefinition.**p_markup_braced_list_body__markup_braced_list_body__markup**(*p*)
markup_braced_list_body : markup_braced_list_body markup

LilyPondSyntacticalDefinition.**p_markup_braced_list_body__markup_braced_list_body__markup_li**
markup_braced_list_body : markup_braced_list_body markup_list

LilyPondSyntacticalDefinition.**p_markup_command_basic_arguments__EXPECT_MARKUP_LIST__markup_**
markup_command_basic_arguments : EXPECT_MARKUP_LIST markup_command_list_arguments markup_list

LilyPondSyntacticalDefinition.**p_markup_command_basic_arguments__EXPECT_NO_MORE_ARGS**(*p*)
markup_command_basic_arguments : EXPECT_NO_MORE_ARGS

LilyPondSyntacticalDefinition.**p_markup_command_basic_arguments__EXPECT_SCM__markup_command_**
markup_command_basic_arguments : EXPECT_SCM markup_command_list_arguments embedded_scm_closed

LilyPondSyntacticalDefinition.**p_markup_command_list__MARKUP_LIST_FUNCTION__markup_command_l**
markup_command_list : MARKUP_LIST_FUNCTION markup_command_list_arguments

LilyPondSyntacticalDefinition.**p_markup_command_list_arguments__EXPECT_MARKUP__markup_comma**
markup_command_list_arguments : EXPECT_MARKUP markup_command_list_arguments markup

LilyPondSyntacticalDefinition.**p_markup_command_list_arguments__markup_command_basic_argume**
markup_command_list_arguments : markup_command_basic_arguments

LilyPondSyntacticalDefinition.**p_markup_composed_list__markup_head_1_list__markup_braced_lis**
markup_composed_list : markup_head_1_list markup_braced_list

LilyPondSyntacticalDefinition.**p_markup_head_1_item__MARKUP_FUNCTION__EXPECT_MARKUP__markup_**
markup_head_1_item : MARKUP_FUNCTION EXPECT_MARKUP markup_command_list_arguments

LilyPondSyntacticalDefinition.**p_markup_head_1_list__markup_head_1_item**(*p*)
markup_head_1_list : markup_head_1_item

LilyPondSyntacticalDefinition.**p_markup_head_1_list__markup_head_1_list__markup_head_1_item**
markup_head_1_list : markup_head_1_list markup_head_1_item

LilyPondSyntacticalDefinition.**p_markup_list__MARKUPLIST_IDENTIFIER**(*p*)
markup_list : MARKUPLIST_IDENTIFIER

LilyPondSyntacticalDefinition.**p_markup_list__markup_braced_list**(*p*)
markup_list : markup_braced_list

LilyPondSyntacticalDefinition.**p_markup_list__markup_command_list**(*p*)
markup_list : markup_command_list

LilyPondSyntacticalDefinition.**p_markup_list__markup_composed_list**(*p*)
markup_list : markup_composed_list

LilyPondSyntacticalDefinition.**p_markup_list__markup_scm__MARKUPLIST_IDENTIFIER**(*p*)
markup_list : markup_scm MARKUPLIST_IDENTIFIER

LilyPondSyntacticalDefinition.**p_markup_scm__embedded_scm_bare__BACKUP**(*p*)
markup_scm : embedded_scm_bare BACKUP

LilyPondSyntacticalDefinition.**p_markup_top__markup_head_1_list__simple_markup**(*p*)
markup_top : markup_head_1_list simple_markup

LilyPondSyntacticalDefinition.**p_markup_top__markup_list**(*p*)
markup_top : markup_list

LilyPondSyntacticalDefinition.**p_markup_top__simple_markup**(*p*)
markup_top : simple_markup

LilyPondSyntacticalDefinition.**p_multiplied_duration__multiplied_duration__Chr42__FRACTION**(*p*
multiplied_duration : multiplied_duration '*' FRACTION

LilyPondSyntacticalDefinition.**p_multiplied_duration__multiplied_duration__Chr42__bare_unsig**
multiplied_duration : multiplied_duration '*' bare_unsigned

LilyPondSyntacticalDefinition.**p_multiplied_duration__steno_duration**(*p*)
multiplied_duration : steno_duration

LilyPondSyntacticalDefinition.**p_music__composite_music**(*p*)
music : composite_music %prec COMPOSITE

LilyPondSyntacticalDefinition.**p_music__simple_music**(*p*)
music : simple_music

LilyPondSyntacticalDefinition.**p_music_arg__composite_music**(*p*)
music_arg : composite_music %prec COMPOSITE

LilyPondSyntacticalDefinition.**p_music_arg__simple_music**(*p*)
music_arg : simple_music

LilyPondSyntacticalDefinition.**p_music_bare__MUSIC_IDENTIFIER**(*p*)
music_bare : MUSIC_IDENTIFIER

LilyPondSyntacticalDefinition.**p_music_bare__grouped_music_list**(*p*)
music_bare : grouped_music_list

LilyPondSyntacticalDefinition.**p_music_function_call__MUSIC_FUNCTION__function_arglist**(*p*)
music_function_call : MUSIC_FUNCTION function_arglist

LilyPondSyntacticalDefinition.**p_music_function_chord_body__MUSIC_FUNCTION__music_function_c**
music_function_chord_body : MUSIC_FUNCTION music_function_chord_body_arglist

LilyPondSyntacticalDefinition.**p_music_function_chord_body_arglist__EXPECT_SCM__music_functi**
music_function_chord_body_arglist : EXPECT_SCM music_function_chord_body_arglist embedded_scm_chord_body

LilyPondSyntacticalDefinition.**p_music_function_chord_body_arglist__function_arglist_bare**(*p*)
music_function_chord_body_arglist : function_arglist_bare

LilyPondSyntacticalDefinition.**p_music_function_event__MUSIC_FUNCTION__function_arglist_clos**
music_function_event : MUSIC_FUNCTION function_arglist_closed

LilyPondSyntacticalDefinition.**p_music_list__Empty**(*p*)
music_list :

LilyPondSyntacticalDefinition.**p_music_list__music_list__embedded_scm**(*p*)
music_list : music_list embedded_scm

LilyPondSyntacticalDefinition.**p_music_list__music_list__error**(*p*)
music_list : music_list error

LilyPondSyntacticalDefinition.**p_music_list__music_list__music**(*p*)
music_list : music_list music

LilyPondSyntacticalDefinition.**p_music_property_def__simple_music_property_def**(*p*)
music_property_def : simple_music_property_def

LilyPondSyntacticalDefinition.**p_note_chord_element__chord_body__optional_notemode_duration_**
note_chord_element : chord_body optional_notemode_duration post_events

LilyPondSyntacticalDefinition.**p_number_expression__number_expression__Chr43__number_term**(*p*)
number_expression : number_expression '+' number_term

LilyPondSyntacticalDefinition.**p_number_expression__number_expression__Chr45__number_term**(*p*)
number_expression : number_expression '-' number_term

LilyPondSyntacticalDefinition.**p_number_expression__number_term**(*p*)
number_expression : number_term

LilyPondSyntacticalDefinition.**p_number_factor__Chr45__number_factor**(*p*)
number_factor : '-' number_factor

LilyPondSyntacticalDefinition.**p_number_factor__bare_number**(*p*)
number_factor : bare_number

LilyPondSyntacticalDefinition.**p_number_term__number_factor**(*p*)
number_term : number_factor

LilyPondSyntacticalDefinition.**p_number_term__number_factor__Chr42__number_factor**(*p*)
number_term : number_factor '*' number_factor

LilyPondSyntacticalDefinition.**p_number_term__number_factor__Chr47__number_factor**(*p*)
number_term : number_factor '/' number_factor

LilyPondSyntacticalDefinition.**p_octave_check__Chr61**(*p*)
octave_check : '='

LilyPondSyntacticalDefinition.**p_octave_check__Chr61__sub_quotes**(*p*)
octave_check : '=' sub_quotes

LilyPondSyntacticalDefinition.**p_octave_check__Chr61__sup_quotes**(*p*)
octave_check : '=' sup_quotes

LilyPondSyntacticalDefinition.**p_octave_check__Empty**(*p*)
octave_check :

LilyPondSyntacticalDefinition.**p_optional_context_mod__Empty**(*p*)
optional_context_mod :

LilyPondSyntacticalDefinition.**p_optional_context_mod__context_modification**(*p*)
optional_context_mod : context_modification

LilyPondSyntacticalDefinition.**p_optional_id__Chr61__simple_string**(*p*)
optional_id : '=' simple_string

LilyPondSyntacticalDefinition.**p_optional_id__Empty**(*p*)
optional_id :

LilyPondSyntacticalDefinition.**p_optional_notemode_duration__Empty**(*p*)
optional_notemode_duration :

LilyPondSyntacticalDefinition.**p_optional_notemode_duration__multiplied_duration**(*p*)
optional_notemode_duration : multiplied_duration

LilyPondSyntacticalDefinition.**p_optional_rest__Empty**(*p*)
optional_rest :

LilyPondSyntacticalDefinition.**p_optional_rest__REST**(*p*)
optional_rest : REST

LilyPondSyntacticalDefinition.**p_output_def__output_def_body__Chr125**(*p*)
output_def : output_def_body '}'

LilyPondSyntacticalDefinition.**p_output_def_body__output_def_body__assignment**(*p*)
output_def_body : output_def_body assignment

LilyPondSyntacticalDefinition.**p_output_def_body__output_def_head_with_mode_switch__Chr123**(*p*
output_def_body : output_def_head_with_mode_switch '{'

LilyPondSyntacticalDefinition.**p_output_def_body__output_def_head_with_mode_switch__Chr123__**
output_def_body : output_def_head_with_mode_switch '{' OUTPUT_DEF_IDENTIFIER

LilyPondSyntacticalDefinition.**p_output_def_head__LAYOUT**(*p*)
output_def_head : LAYOUT

LilyPondSyntacticalDefinition.**p_output_def_head__MIDI**(*p*)
output_def_head : MIDI

LilyPondSyntacticalDefinition.**p_output_def_head__PAPER**(*p*)
output_def_head : PAPER

LilyPondSyntacticalDefinition.**p_output_def_head_with_mode_switch__output_def_head**(*p*)
output_def_head_with_mode_switch : output_def_head

LilyPondSyntacticalDefinition.**p_pitch__PITCH_IDENTIFIER**(*p*)
pitch : PITCH_IDENTIFIER

LilyPondSyntacticalDefinition.**p_pitch__steno_pitch**(*p*)
pitch : steno_pitch

LilyPondSyntacticalDefinition.**p_pitch_also_in_chords__pitch**(*p*)
pitch_also_in_chords : pitch

LilyPondSyntacticalDefinition.**p_pitch_also_in_chords__steno_tonic_pitch**(*p*)
pitch_also_in_chords : steno_tonic_pitch

LilyPondSyntacticalDefinition.**p_post_event__Chr45__fingering**(*p*)
post_event : '-' fingering

LilyPondSyntacticalDefinition.**p_post_event__post_event_nofinger**(*p*)
post_event : post_event_nofinger

LilyPondSyntacticalDefinition.**p_post_event_nofinger__Chr94__fingering**(*p*)
post_event_nofinger : '^' fingering

LilyPondSyntacticalDefinition.**p_post_event_nofinger__Chr95__fingering**(*p*)
post_event_nofinger : '_' fingering

LilyPondSyntacticalDefinition.**p_post_event_nofinger__EXTENDER**(*p*)
post_event_nofinger : EXTENDER

LilyPondSyntacticalDefinition.**p_post_event_nofinger__HYPHEN**(*p*)
post_event_nofinger : HYPHEN

LilyPondSyntacticalDefinition.**p_post_event_nofinger__direction_less_event**(*p*)
post_event_nofinger : direction_less_event

LilyPondSyntacticalDefinition.**p_post_event_nofinger__script_dir__direction_less_event**(*p*)
post_event_nofinger : script_dir direction_less_event

LilyPondSyntacticalDefinition.**p_post_event_nofinger__script_dir__direction_reqd_event**(*p*)
post_event_nofinger : script_dir direction_reqd_event

LilyPondSyntacticalDefinition.**p_post_event_nofinger__script_dir__music_function_event**(*p*)
post_event_nofinger : script_dir music_function_event

LilyPondSyntacticalDefinition.**p_post_event_nofinger__string_number_event**(*p*)
post_event_nofinger : string_number_event

LilyPondSyntacticalDefinition.**p_post_events__Empty**(*p*)
post_events :

LilyPondSyntacticalDefinition.**p_post_events__post_events__post_event**(*p*)
post_events : post_events post_event

LilyPondSyntacticalDefinition.**p_property_operation__OVERRIDE__simple_string__property_path_**
property_operation : OVERRIDE simple_string property_path '=' scalar

LilyPondSyntacticalDefinition.**p_property_operation__REVERT__simple_string__embedded_scm**(*p*)
property_operation : REVERT simple_string embedded_scm

LilyPondSyntacticalDefinition.**p_property_operation__STRING__Chr61__scalar**(*p*)
property_operation : STRING '=' scalar

LilyPondSyntacticalDefinition.**p_property_operation__UNSET__simple_string**(*p*)
property_operation : UNSET simple_string

LilyPondSyntacticalDefinition.**p_property_path__property_path_revved**(*p*)
property_path : property_path_revved

LilyPondSyntacticalDefinition.**p_property_path_revved__embedded_scm_closed**(*p*)
property_path_revved : embedded_scm_closed

LilyPondSyntacticalDefinition.**p_property_path_revved__property_path_revved__embedded_scm_cl**
property_path_revved : property_path_revved embedded_scm_closed

LilyPondSyntacticalDefinition.**p_questions__Empty**(*p*)
questions :

LilyPondSyntacticalDefinition.**p_questions__questions__Chr63**(*p*)
questions : questions '?'

LilyPondSyntacticalDefinition.**p_scalar__bare_number**(*p*)
scalar : bare_number

LilyPondSyntacticalDefinition.**p_scalar__embedded_scm_arg**(*p*)
scalar : embedded_scm_arg

LilyPondSyntacticalDefinition.**p_scalar_closed__bare_number**(*p*)
scalar_closed : bare_number

LilyPondSyntacticalDefinition.**p_scalar_closed__embedded_scm_arg_closed**(*p*)
scalar_closed : embedded_scm_arg_closed

LilyPondSyntacticalDefinition.**p_scm_function_call__SCM_FUNCTION__function_arglist**(*p*)
scm_function_call : SCM_FUNCTION function_arglist

LilyPondSyntacticalDefinition.**p_scm_function_call_closed__SCM_FUNCTION__function_arglist_cl**
scm_function_call_closed : SCM_FUNCTION function_arglist_closed %prec FUNCTION_ARGLIST

LilyPondSyntacticalDefinition.**p_score_block__SCORE__Chr123__score_body__Chr125**(*p*)
score_block : SCORE '{' score_body '}'

LilyPondSyntacticalDefinition.**p_score_body__SCORE_IDENTIFIER**(*p*)
score_body : SCORE_IDENTIFIER

LilyPondSyntacticalDefinition.**p_score_body__music**(*p*)
score_body : music

LilyPondSyntacticalDefinition.**p_score_body__score_body__lilypond_header**(*p*)
score_body : score_body lilypond_header

LilyPondSyntacticalDefinition.**p_score_body__score_body__output_def**(*p*)
score_body : score_body output_def

LilyPondSyntacticalDefinition.**p_script_abbreviation__ANGLE_CLOSE**(*p*)
script_abbreviation : ANGLE_CLOSE

LilyPondSyntacticalDefinition.**p_script_abbreviation__Chr124**(*p*)
script_abbreviation : '|'

LilyPondSyntacticalDefinition.**p_script_abbreviation__Chr43**(*p*)
script_abbreviation : '+'

LilyPondSyntacticalDefinition.**p_script_abbreviation__Chr45**(*p*)
script_abbreviation : '-'

LilyPondSyntacticalDefinition.**p_script_abbreviation__Chr46**(*p*)
script_abbreviation : '.'

LilyPondSyntacticalDefinition.**p_script_abbreviation__Chr94**(*p*)
script_abbreviation : '^'

LilyPondSyntacticalDefinition.**p_script_abbreviation__Chr95**(*p*)
script_abbreviation : '_'

LilyPondSyntacticalDefinition.**p_script_dir__Chr45**(*p*)
script_dir : '-'

LilyPondSyntacticalDefinition.**p_script_dir__Chr94**(*p*)
script_dir : '^'

LilyPondSyntacticalDefinition.**p_script_dir__Chr95**(*p*)
script_dir : '_'

LilyPondSyntacticalDefinition.**p_sequential_music__SEQUENTIAL__braced_music_list**(*p*)
sequential_music : SEQUENTIAL braced_music_list

LilyPondSyntacticalDefinition.**p_sequential_music__braced_music_list**(*p*)
sequential_music : braced_music_list

LilyPondSyntacticalDefinition.**p_simple_chord_elements__simple_element**(*p*)
simple_chord_elements : simple_element

LilyPondSyntacticalDefinition.**p_simple_element__RESTNAME__optional_notemode_duration**(*p*)
simple_element : RESTNAME optional_notemode_duration

LilyPondSyntacticalDefinition.**p_simple_element__pitch__exclamations__questions__octave_chec**
simple_element : pitch exclamations questions octave_check optional_notemode_duration optional_rest

LilyPondSyntacticalDefinition.**p_simple_markup__MARKUP_FUNCTION__markup_command_basic_argume**
simple_markup : MARKUP_FUNCTION markup_command_basic_arguments

LilyPondSyntacticalDefinition.**p_simple_markup__MARKUP_IDENTIFIER**(*p*)
simple_markup : MARKUP_IDENTIFIER

LilyPondSyntacticalDefinition.**p_simple_markup__SCORE__Chr123__score_body__Chr125**(*p*)
simple_markup : SCORE '{' score_body '}'

LilyPondSyntacticalDefinition.**p_simple_markup__STRING**(*p*)
simple_markup : STRING

LilyPondSyntacticalDefinition.**p_simple_markup__STRING_IDENTIFIER**(*p*)
simple_markup : STRING_IDENTIFIER

LilyPondSyntacticalDefinition.**p_simple_markup__markup_scm__MARKUP_IDENTIFIER**(*p*)
simple_markup : markup_scm MARKUP_IDENTIFIER

LilyPondSyntacticalDefinition.**p_simple_music__context_change**(*p*)
simple_music : context_change

LilyPondSyntacticalDefinition.**p_simple_music__event_chord**(*p*)
simple_music : event_chord

LilyPondSyntacticalDefinition.**p_simple_music__music_property_def**(*p*)
simple_music : music_property_def

LilyPondSyntacticalDefinition.**p_simple_music_property_def__OVERRIDE__context_prop_spec__pro**
simple_music_property_def : OVERRIDE context_prop_spec property_path '=' scalar

LilyPondSyntacticalDefinition.**p_simple_music_property_def__REVERT__context_prop_spec__embed**
simple_music_property_def : REVERT context_prop_spec embedded_scm

LilyPondSyntacticalDefinition.**p_simple_music_property_def__SET__context_prop_spec__Chr61__s**
simple_music_property_def : SET context_prop_spec '=' scalar

LilyPondSyntacticalDefinition.**p_simple_music_property_def__UNSET__context_prop_spec**(*p*)
simple_music_property_def : UNSET context_prop_spec

LilyPondSyntacticalDefinition.**p_simple_string__STRING**(*p*)
simple_string : STRING

LilyPondSyntacticalDefinition.**p_simple_string__STRING_IDENTIFIER**(*p*)
simple_string : STRING_IDENTIFIER

LilyPondSyntacticalDefinition.**p_simultaneous_music__DOUBLE_ANGLE_OPEN__music_list__DOUBLE_A**
simultaneous_music : DOUBLE_ANGLE_OPEN music_list DOUBLE_ANGLE_CLOSE

LilyPondSyntacticalDefinition.**p_simultaneous_music__SIMULTANEOUS__braced_music_list**(*p*)
simultaneous_music : SIMULTANEOUS braced_music_list

LilyPondSyntacticalDefinition.**p_start_symbol__lilypond**(*p*)
start_symbol : lilypond

LilyPondSyntacticalDefinition.**p_steno_duration__DURATION_IDENTIFIER__dots**(*p*)
steno_duration : DURATION_IDENTIFIER dots

LilyPondSyntacticalDefinition.**p_steno_duration__bare_unsigned__dots**(*p*)
steno_duration : bare_unsigned dots

LilyPondSyntacticalDefinition.**p_steno_pitch__NOTENAME_PITCH**(*p*)
steno_pitch : NOTENAME_PITCH

LilyPondSyntacticalDefinition.**p_steno_pitch__NOTENAME_PITCH__sub_quotes**(*p*)
steno_pitch : NOTENAME_PITCH sub_quotes

LilyPondSyntacticalDefinition.**p_steno_pitch__NOTENAME_PITCH__sup_quotes**(*p*)
steno_pitch : NOTENAME_PITCH sup_quotes

LilyPondSyntacticalDefinition.**p_steno_tonic_pitch__TONICNAME_PITCH**(*p*)
steno_tonic_pitch : TONICNAME_PITCH

LilyPondSyntacticalDefinition.**p_steno_tonic_pitch__TONICNAME_PITCH__sub_quotes**(*p*)
steno_tonic_pitch : TONICNAME_PITCH sub_quotes

LilyPondSyntacticalDefinition.**p_steno_tonic_pitch__TONICNAME_PITCH__sup_quotes**(*p*)
steno_tonic_pitch : TONICNAME_PITCH sup_quotes

LilyPondSyntacticalDefinition.**p_string__STRING**(*p*)
string : STRING

LilyPondSyntacticalDefinition.**p_string__STRING_IDENTIFIER**(*p*)
string : STRING_IDENTIFIER

LilyPondSyntacticalDefinition.**p_string__string__Chr43__string**(*p*)
string : string '+' string

LilyPondSyntacticalDefinition.**p_string_number_event__E_UNSIGNED**(*p*)
string_number_event : E_UNSIGNED

LilyPondSyntacticalDefinition.**p_sub_quotes__Chr44**(*p*)
sub_quotes : ‘,’

LilyPondSyntacticalDefinition.**p_sub_quotes__sub_quotes__Chr44**(*p*)
sub_quotes : sub_quotes ‘,’

LilyPondSyntacticalDefinition.**p_sup_quotes__Chr39**(*p*)
sup_quotes : ‘’‘

LilyPondSyntacticalDefinition.**p_sup_quotes__sup_quotes__Chr39**(*p*)
sup_quotes : sup_quotes ‘’‘

LilyPondSyntacticalDefinition.**p_tempo_event__TEMPO__scalar**(*p*)
tempo_event : TEMPO scalar

LilyPondSyntacticalDefinition.**p_tempo_event__TEMPO__scalar_closed__steno_duration__Chr61__t**
tempo_event : TEMPO scalar_closed steno_duration ‘=’ tempo_range

LilyPondSyntacticalDefinition.**p_tempo_event__TEMPO__steno_duration__Chr61__tempo_range**(*p*)
tempo_event : TEMPO steno_duration ‘=’ tempo_range

LilyPondSyntacticalDefinition.**p_tempo_range__bare_unsigned**(*p*)
tempo_range : bare_unsigned

LilyPondSyntacticalDefinition.**p_tempo_range__bare_unsigned__Chr126__bare_unsigned**(*p*)
tempo_range : bare_unsigned ‘~’ bare_unsigned

LilyPondSyntacticalDefinition.**p_toplevel_expression__composite_music**(*p*)
toplevel_expression : composite_music

LilyPondSyntacticalDefinition.**p_toplevel_expression__full_markup**(*p*)
toplevel_expression : full_markup

LilyPondSyntacticalDefinition.**p_toplevel_expression__full_markup_list**(*p*)
toplevel_expression : full_markup_list

LilyPondSyntacticalDefinition.**p_toplevel_expression__lilypond_header**(*p*)
toplevel_expression : lilypond_header

LilyPondSyntacticalDefinition.**p_toplevel_expression__output_def**(*p*)
toplevel_expression : output_def

LilyPondSyntacticalDefinition.**p_toplevel_expression__score_block**(*p*)
toplevel_expression : score_block

LilyPondSyntacticalDefinition.**p_tremolo_type__Chr58**(*p*)
tremolo_type : ‘:’

LilyPondSyntacticalDefinition.**p_tremolo_type__Chr58__bare_unsigned**(*p*)
tremolo_type : ‘:’ bare_unsigned

Special Methods

LilyPondSyntacticalDefinition.**__eq__**(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

LilyPondSyntacticalDefinition.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondSyntacticalDefinition.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

LilyPondSyntacticalDefinition.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondSyntacticalDefinition.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

LilyPondSyntacticalDefinition.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

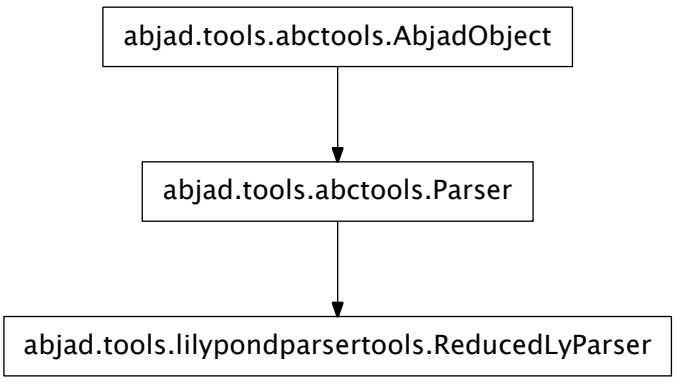
Inherited from abctools.AbjadObject

LilyPondSyntacticalDefinition.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

lilypondparsertools.ReducedLyParser



class lilypondparsertools.**ReducedLyParser**(*debug=False*)
Parses the "reduced-ly" syntax, a modified subset of LilyPond syntax:

```
>>> from abjad.tools import lilypondparsertools

>>> parser = lilypondparsertools.ReducedLyParser()
```

Understands LilyPond-like representation of notes, chords and rests:

```
>>> string = "c'4 r8. <b d' fs'>16"
>>> result = parser(string)
>>> f(result)
{
    c'4
    r8.
    <b d' fs'>16
}
```

Also parses bare duration as notes on middle-C, and negative bare durations as rests:

```
>>> string = '4 -8 16. -32'
>>> result = parser(string)
>>> f(result)
{
    c'4
    r8
    c'16.
    r32
}
```

Note that the leaf syntax is greedy, and therefore duration specifiers following pitch specifiers will be treated as part of the same expression. The following produces 2 leaves, rather than 3:

```
>>> string = "4 d' 4"
>>> result = parser(string)
>>> f(result)
{
    c'4
    d'4
}
```

Understands LilyPond-like default durations:

```
>>> string = "c'4 d' e' f'"
>>> result = parser(string)
>>> f(result)
{
    c'4
    d'4
    e'4
    f'4
}
```

Also understands various types of container specifications.

Can create arbitrarily nested tuplets:

```
>>> string = "2/3 { 4 4 3/5 { 8 8 8 } }"
>>> result = parser(string)
>>> f(result)
{
    \times 2/3 {
        c'4
```

```
        c'4
        \fraction \times 3/5 {
            c'8
            c'8
            c'8
        }
    }
}
```

Can also create empty *FixedDurationContainers*:

```
>>> string = '{1/4} {2/4} {3/4} {4/4}'
>>> result = parser(string)
>>> for x in result: x
...
FixedDurationContainer(Duration(1, 4), [])
FixedDurationContainer(Duration(1, 2), [])
FixedDurationContainer(Duration(3, 4), [])
FixedDurationContainer(Duration(1, 1), [])
```

Can create measures too:

```
>>> string = '| 4/4 4 4 4 4 || 3/8 8 8 8 |'
>>> result = parser(string)
>>> for x in result: x
...
Measure(4/4, [c'4, c'4, c'4, c'4])
Measure(3/8, [c'8, c'8, c'8])
```

Finally, understands ties, slurs and beams:

```
>>> string = 'c16 [ ( d ~ d ) f ]'
>>> result = parser(string)
>>> f(result)
{
    c16 [ (
    d16 ~
    d16 )
    f16 ]
}
```

Return *ReducedLyParser* instance.

Read-only Properties

`ReducedLyParser.`**`debug`**

True if the parser runs in debugging mode.

Inherited from `abctools.Parser`

`ReducedLyParser.`**`lexer`**

The parser's PLY Lexer instance.

Inherited from `abctools.Parser`

`ReducedLyParser.`**`lexer_rules_object`**

`ReducedLyParser.`**`logger`**

The parser's Logger instance.

Inherited from `abctools.Parser`

ReducedLyParser.**logger_path**
The output path for the parser's logfile.

Inherited from abctools.Parser

ReducedLyParser.**output_path**
The output path for files associated with the parser.

Inherited from abctools.Parser

ReducedLyParser.**parser**
The parser's PLY LRParser instance.

Inherited from abctools.Parser

ReducedLyParser.**parser_rules_object**

ReducedLyParser.**pickle_path**
The output path for the parser's pickled parsing tables.

Inherited from abctools.Parser

ReducedLyParser.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

ReducedLyParser.**p_apostrophes__APOSTROPHE**(*p*)
apostrophes : APOSTROPHE

ReducedLyParser.**p_apostrophes__apostrophes__APOSTROPHE**(*p*)
apostrophes : apostrophes APOSTROPHE

ReducedLyParser.**p_beam__BRACKET_L**(*p*)
beam : BRACKET_L

ReducedLyParser.**p_beam__BRACKET_R**(*p*)
beam : BRACKET_R

ReducedLyParser.**p_chord_body__chord_pitches**(*p*)
chord_body : chord_pitches

ReducedLyParser.**p_chord_body__chord_pitches__positive_leaf_duration**(*p*)
chord_body : chord_pitches positive_leaf_duration

ReducedLyParser.**p_chord_pitches__CARAT_L__pitches__CARAT_R**(*p*)
chord_pitches : CARAT_L pitches CARAT_R

ReducedLyParser.**p_commas__COMMA**(*p*)
commas : COMMA

ReducedLyParser.**p_commas__commas__commas**(*p*)
commas : commas COMMA

ReducedLyParser.**p_component__container**(*p*)
component : container

ReducedLyParser.**p_component__fixed_duration_container**(*p*)
component : fixed_duration_container

ReducedLyParser.**p_component__leaf**(*p*)
component : leaf

ReducedLyParser.**p_component__tuplet**(*p*)
component : tuplet

ReducedLyParser.**p_component_list__EMPTY**(*p*)
component_list :

ReducedLyParser.**p_component_list__component_list__component**(*p*)
component_list : component_list component

ReducedLyParser.**p_container__BRACE_L__component_list__BRACE_R**(*p*)
container : BRACE_L component_list BRACE_R

ReducedLyParser.**p_dots__EMPTY**(*p*)
dots :

ReducedLyParser.**p_dots__dots__DOT**(*p*)
dots : dots DOT

ReducedLyParser.**p_error**(*p*)

ReducedLyParser.**p_fixed_duration_container__BRACE_L__FRACTION__BRACE_R**(*p*)
fixed_duration_container : BRACE_L FRACTION BRACE_R

ReducedLyParser.**p_leaf__leaf_body__post_events**(*p*)
leaf : leaf_body post_events

ReducedLyParser.**p_leaf_body__chord_body**(*p*)
leaf_body : chord_body

ReducedLyParser.**p_leaf_body__note_body**(*p*)
leaf_body : note_body

ReducedLyParser.**p_leaf_body__rest_body**(*p*)
leaf_body : rest_body

ReducedLyParser.**p_measure__PIPE__FRACTION__component_list__PIPE**(*p*)
measure : PIPE FRACTION component_list PIPE

ReducedLyParser.**p_negative_leaf_duration__INTEGER_N__dots**(*p*)
negative_leaf_duration : INTEGER_N dots

ReducedLyParser.**p_note_body__pitch**(*p*)
note_body : pitch

ReducedLyParser.**p_note_body__pitch__positive_leaf_duration**(*p*)
note_body : pitch positive_leaf_duration

ReducedLyParser.**p_note_body__positive_leaf_duration**(*p*)
note_body : positive_leaf_duration

ReducedLyParser.**p_pitch__PITCHNAME**(*p*)
pitch : PITCHNAME

ReducedLyParser.**p_pitch__PITCHNAME__apostrophes**(*p*)
pitch : PITCHNAME apostrophes

ReducedLyParser.**p_pitch__PITCHNAME__commas**(*p*)
pitch : PITCHNAME commas

ReducedLyParser.**p_pitches__pitch**(*p*)
pitches : pitch

ReducedLyParser.**p_pitches__pitches__pitch**(*p*)
pitches : pitches pitch

ReducedLyParser.**p_positive_leaf_duration__INTEGER_P__dots**(*p*)
positive_leaf_duration : INTEGER_P dots

ReducedLyParser.**p_post_event__beam**(*p*)
post_event : beam

ReducedLyParser.**p_post_event__slur**(*p*)
post_event : slur

ReducedLyParser.**p_post_event__tie**(*p*)
post_event : tie

ReducedLyParser.**p_post_events__EMPTY**(*p*)
post_events :

ReducedLyParser.**p_post_events__post_events__post_event**(*p*)
post_events : post_events post_event

ReducedLyParser.**p_rest_body__RESTNAME**(*p*)
rest_body : RESTNAME

ReducedLyParser.**p_rest_body__RESTNAME__positive_leaf_duration**(*p*)
rest_body : RESTNAME positive_leaf_duration

ReducedLyParser.**p_rest_body__negative_leaf_duration**(*p*)
rest_body : negative_leaf_duration

ReducedLyParser.**p_slur__PAREN_L**(*p*)
slur : PAREN_L

ReducedLyParser.**p_slur__PAREN_R**(*p*)
slur : PAREN_R

ReducedLyParser.**p_start__EMPTY**(*p*)
start :

ReducedLyParser.**p_start__start__component**(*p*)
start : start component

ReducedLyParser.**p_start__start__measure**(*p*)
start : start measure

ReducedLyParser.**p_tie__TILDE**(*p*)
tie : TILDE

ReducedLyParser.**p_tuplet__FRACTION__container**(*p*)
tuplet : FRACTION container

ReducedLyParser.**t_FRACTION**(*t*)
([1-9]d*/[1-9]d*)

ReducedLyParser.**t_INTEGER_N**(*t*)
(-[1-9]d*)

ReducedLyParser.**t_INTEGER_P**(*t*)
([1-9]d*)

ReducedLyParser.**t_PITCHNAME**(*t*)
[a-g](ff|ss|f|s|tqf|tqs|qs|qf)?

ReducedLyParser.**t_error**(*t*)

ReducedLyParser.**t_newline**(*t*)
n+

ReducedLyParser.**tokenize**(*input_string*)
Tokenize *input string* and print results.

Inherited from abctools.Parser

Special Methods

ReducedLyParser.**__call__**(*input_string*)
Parse *input_string* and return result.

Inherited from abctools.Parser

ReducedLyParser.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ReducedLyParser.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReducedLyParser.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ReducedLyParser.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReducedLyParser.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ReducedLyParser.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

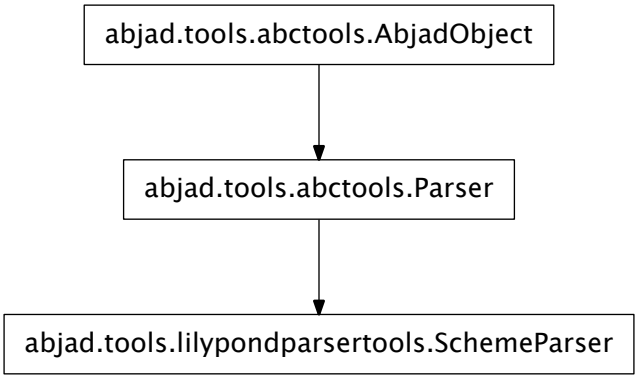
Inherited from abctools.AbjadObject

ReducedLyParser.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

lilypondparsertools.SchemeParser



class lilypondparsertools.**SchemeParser**(*debug=False*)

SchemeParser mimics how LilyPond's embedded Scheme parser behaves.

It parses a single Scheme expression and then stops, by raising a *SchemeParserFinishedException*.

The parsed expression and its exact length in characters are cached on the *SchemeParser* instance.

It is intended to be used only in conjunction with *LilyPondParser*.

Returns *SchemeParser* instance.

Read-only Properties

SchemeParser.**debug**

True if the parser runs in debugging mode.

Inherited from abctools.Parser

SchemeParser.**lexer**

The parser's PLY Lexer instance.

Inherited from abctools.Parser

SchemeParser.**lexer_rules_object**

SchemeParser.**logger**

The parser's Logger instance.

Inherited from abctools.Parser

SchemeParser.**logger_path**

The output path for the parser's logfile.

Inherited from abctools.Parser

SchemeParser.**output_path**

The output path for files associated with the parser.

Inherited from abctools.Parser

SchemeParser.**parser**
The parser's PLY LRParser instance.

Inherited from abctools.Parser

SchemeParser.**parser_rules_object**

SchemeParser.**pickle_path**
The output path for the parser's pickled parsing tables.

Inherited from abctools.Parser

SchemeParser.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

SchemeParser.**p_boolean__BOOLEAN**(*p*)
boolean : BOOLEAN

SchemeParser.**p_constant__boolean**(*p*)
constant : boolean

SchemeParser.**p_constant__number**(*p*)
constant : number

SchemeParser.**p_constant__string**(*p*)
constant : string

SchemeParser.**p_data__EMPTY**(*p*)
data :

SchemeParser.**p_data__data__datum**(*p*)
data : data datum

SchemeParser.**p_datum__constant**(*p*)
datum : constant

SchemeParser.**p_datum__list**(*p*)
datum : list

SchemeParser.**p_datum__symbol**(*p*)
datum : symbol

SchemeParser.**p_datum__vector**(*p*)
datum : vector

SchemeParser.**p_error**(*p*)

SchemeParser.**p_expression__QUOTE__datum**(*p*)
expression : QUOTE datum

SchemeParser.**p_expression__constant**(*p*)
expression : constant

SchemeParser.**p_expression__variable**(*p*)
expression : variable

SchemeParser.**p_form__expression**(*p*)
form : expression

SchemeParser.**p_forms__EMPTY**(*p*)
forms :

SchemeParser.**p_forms__forms__form**(*p*)
forms : forms form

SchemeParser.**p_list__L_PAREN__data__R_PAREN**(*p*)
list : L_PAREN data R_PAREN

SchemeParser.**p_list__L_PAREN__data__datum__PERIOD__datum__R_PAREN**(*p*)
list : L_PAREN data datum PERIOD datum R_PAREN

SchemeParser.**p_number__DECIMAL**(*p*)
number : DECIMAL

SchemeParser.**p_number__INTEGER**(*p*)
number : INTEGER

SchemeParser.**p_program__forms**(*p*)
program : forms

SchemeParser.**p_string__STRING**(*p*)
string : STRING

SchemeParser.**p_symbol__IDENTIFIER**(*p*)
symbol : IDENTIFIER

SchemeParser.**p_variable__IDENTIFIER**(*p*)
variable : IDENTIFIER

SchemeParser.**p_vector__HASH__L_PAREN__data__R_PAREN**(*p*)
vector : HASH L_PAREN data R_PAREN

SchemeParser.**t_BOOLEAN**(*t*)
#(T|F|t|f)

SchemeParser.**t_DECIMAL**(*t*)
(((-?[0-9]+).[0-9]*)|(-?.[0-9]+))

SchemeParser.**t_HASH**(*t*)
#

SchemeParser.**t_IDENTIFIER**(*t*)
([A-Za-z!$%&*/<>?~_^:=][A-Za-z0-9!$%&*/<>?~_^:=]*|[+-]|...)

SchemeParser.**t_INTEGER**(*t*)
(-?[0-9]+)

SchemeParser.**t_L_PAREN**(*t*)
(

SchemeParser.**t_R_PAREN**(*t*)
)

SchemeParser.**t_anything**(*t*)
.

SchemeParser.**t_error**(*t*)

SchemeParser.**t_newline**(*t*)
n+

SchemeParser.**t_quote**(*t*)
‘

SchemeParser.**t_quote_440**(*t*)
\[nt\”’]

SchemeParser.**t_quote_443**(*t*)
[^\”“]+

SchemeParser.**t_quote_446**(*t*)
“

SchemeParser.**t_quote_456**(*t*)
.

SchemeParser.**t_quote_error**(*t*)

SchemeParser.**t_whitespace**(*t*)
[tr]+

SchemeParser.**tokenize**(*input_string*)
Tokenize *input string* and print results.

Inherited from abctools.Parser

Special Methods

SchemeParser.**__call__**(*input_string*)
Parse *input_string* and return result.

Inherited from abctools.Parser

SchemeParser.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

SchemeParser.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeParser.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SchemeParser.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeParser.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SchemeParser.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

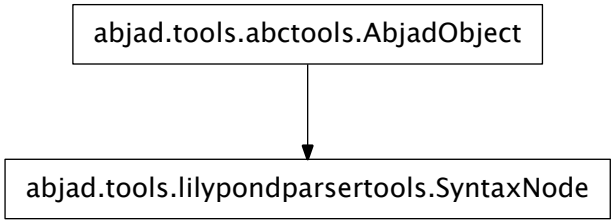
Inherited from `abctools.AbjadObject`

`SchemeParser.__repr__()`
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

lilypondparsertools.SyntaxNode



class `lilypondparsertools.SyntaxNode`(*type*, *value*=[ ])
A node in an abstract syntax tree (AST).

Not composer-safe.

Used internally by LilyPondParser.

Read-only Properties

`SyntaxNode.storage_format`
Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Special Methods

`SyntaxNode.__eq__`(*arg*)
True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`SyntaxNode.__ge__`(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`SyntaxNode.__getitem__`(*item*)

SyntaxNode.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

SyntaxNode.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SyntaxNode.**__len__**()

SyntaxNode.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

SyntaxNode.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

SyntaxNode.**__repr__**()

SyntaxNode.**__str__**()

functions

lilypondparsertools.lilypond_enharmonic_transpose

lilypondparsertools.**lilypond_enharmonic_transpose**(*pitch_a*, *pitch_b*, *pitch_c*)
Transpose *pitch_c* by the distance between *pitch_b* and *pitch_a*.

This function was reverse-engineered from LilyPond's source code.

Return NamedChromaticPitch.

lilypondparsertools.parse_reduced_ly_syntax

lilypondparsertools.**parse_reduced_ly_syntax**(*string*)
Parse the reduced LilyPond rhythmic syntax:

```
>>> from abjad.tools import lilypondparsertools

>>> string = '4 -4. 8.. 5/3 { } 4'
>>> result = lilypondparsertools.parse_reduced_ly_syntax(string)

>>> for x in result:
...     x
...
Note("c'4")
Rest('r4.')
Note("c'8..")
```

```
Tuplet(5/3, [])
Note("c'4")
```

Return list.

offsettools

functions

offsettools.update_offset_values_of_component

offsettools.**update_offset_values_of_component**(*component*)
New in version 2.9. Update prolated offset values of *component*.

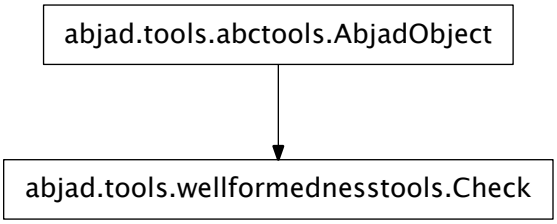
offsettools.update_offset_values_of_component_in_seconds

offsettools.**update_offset_values_of_component_in_seconds**(*component*)
New in version 2.9. Update offset values of *component* in seconds.

wellformednesstools

abstract classes

wellformednesstools.Check



class wellformednesstools.**Check**

Read-only Properties

Check.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

Check.**check**(*expr*)

Check.**report**(*expr*)

Check.**violators**(*expr*)

Special Methods

Check.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Check.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Check.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

Check.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Check.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

Check.**__ne__**(*arg*)

True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

Check.**__repr__**()

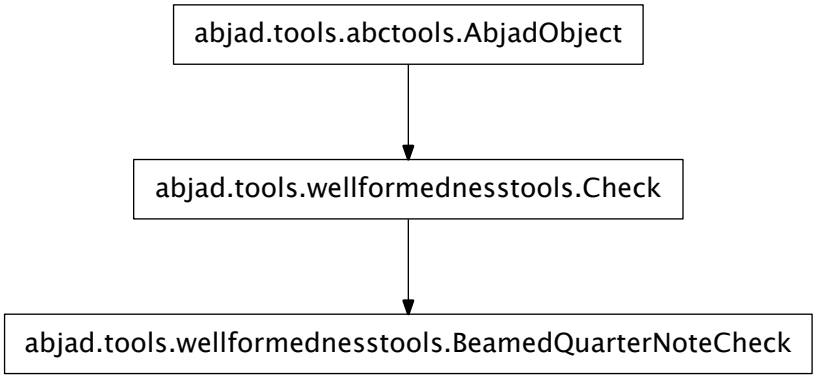
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

concrete classes

wellformednesstools.BeamedQuarterNoteCheck



class wellformednesstools.**BeamedQuarterNoteCheck**

Read-only Properties

BeamedQuarterNoteCheck.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

BeamedQuarterNoteCheck.**check**(*expr*)

Inherited from wellformednesstools.Check

BeamedQuarterNoteCheck.**report**(*expr*)

Inherited from wellformednesstools.Check

BeamedQuarterNoteCheck.**violators**(*expr*)

Inherited from wellformednesstools.Check

Special Methods

BeamedQuarterNoteCheck.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

BeamedQuarterNoteCheck.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BeamedQuarterNoteCheck.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

BeamedQuarterNoteCheck.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BeamedQuarterNoteCheck.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

BeamedQuarterNoteCheck.**__ne__**(*arg*)
True when `id(self)` does not equal `id(arg)`.

Return boolean.

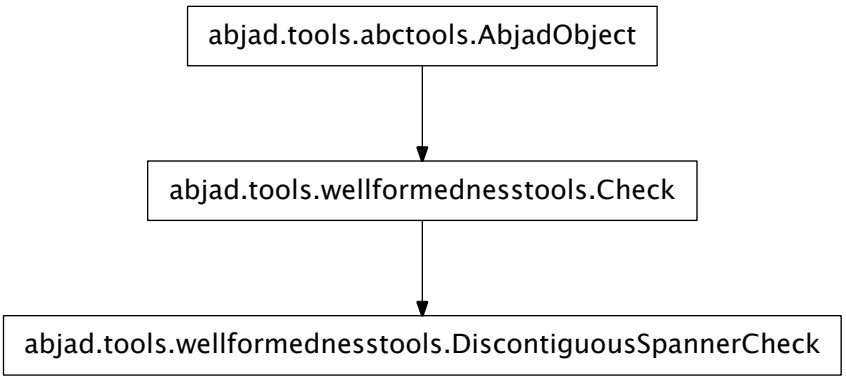
Inherited from abctools.AbjadObject

BeamedQuarterNoteCheck.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.DiscontiguousSpannerCheck



class wellformednesstools.**DiscontiguousSpannerCheck**
There are now two different types of spanner. Most spanners demand that spanner components be thread-contiguous. But a few special spanners (like Tempo) do not make such a demand. The check here consults the experimental *_contiguity_constraint*.

Read-only Properties

DiscontiguousSpannerCheck.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

DiscontiguousSpannerCheck.**check**(*expr*)

Inherited from wellformednesstools.Check

DiscontiguousSpannerCheck.**report**(*expr*)

Inherited from wellformednesstools.Check

DiscontiguousSpannerCheck.**violators**(*expr*)

Inherited from wellformednesstools.Check

Special Methods

DiscontiguousSpannerCheck.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DiscontiguousSpannerCheck.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiscontiguousSpannerCheck.**__gt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DiscontiguousSpannerCheck.**__le__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiscontiguousSpannerCheck.**__lt__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DiscontiguousSpannerCheck.**__ne__**(*arg*)

True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

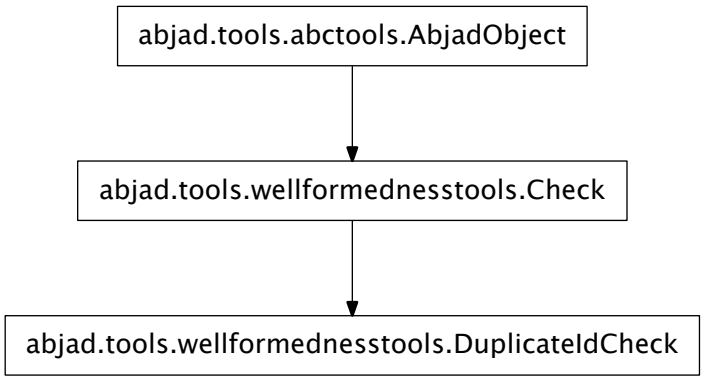
DiscontiguousSpannerCheck.**__repr__**()

Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.DuplicateIdCheck



class wellformednesstools.**DuplicateIdCheck**

Read-only Properties

DuplicateIdCheck.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

DuplicateIdCheck.**check**(*expr*)

Inherited from wellformednesstools.Check

DuplicateIdCheck.**report**(*expr*)

Inherited from wellformednesstools.Check

DuplicateIdCheck.**violators**(*expr*)

Inherited from wellformednesstools.Check

Special Methods

DuplicateIdCheck.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

DuplicateIdCheck.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DuplicateIdCheck.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

DuplicateIdCheck.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DuplicateIdCheck.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

DuplicateIdCheck.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

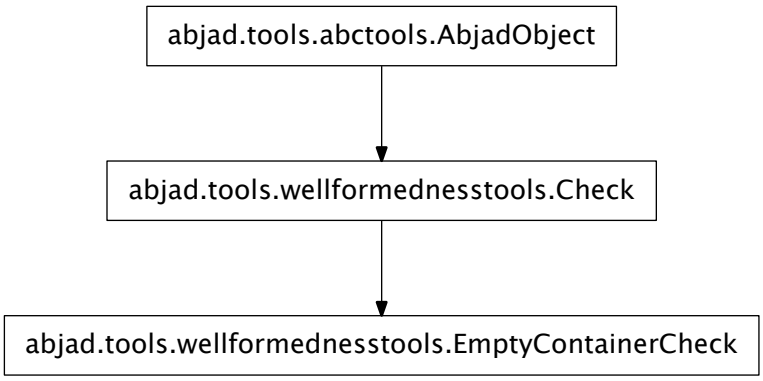
Inherited from abctools.AbjadObject

DuplicateIdCheck.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.EmptyContainerCheck



class wellformednesstools.**EmptyContainerCheck**

Read-only Properties

EmptyContainerCheck.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

EmptyContainerCheck.**check**(*expr*)
Inherited from wellformednesstools.Check

EmptyContainerCheck.**report**(*expr*)
Inherited from wellformednesstools.Check

EmptyContainerCheck.**violators**(*expr*)
Inherited from wellformednesstools.Check

Special Methods

EmptyContainerCheck.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

EmptyContainerCheck.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

EmptyContainerCheck.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

EmptyContainerCheck.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

EmptyContainerCheck.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

EmptyContainerCheck.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

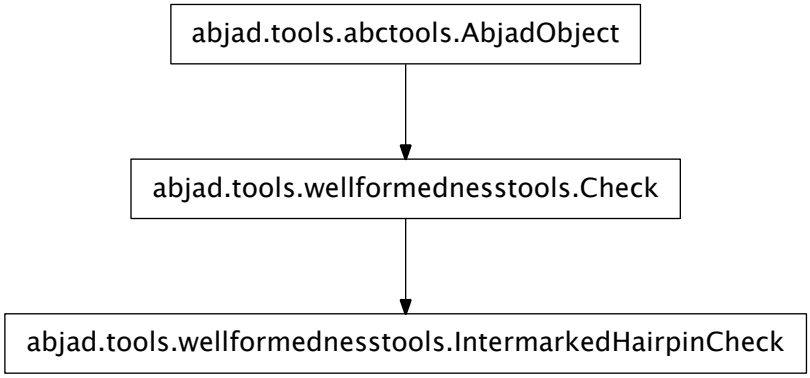
Inherited from abctools.AbjadObject

EmptyContainerCheck.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.IntermarkedHairpinCheck



class wellformednesstools.**IntermarkedHairpinCheck**

Are there any dynamic marks in the middle of a hairpin?

Read-only Properties

IntermarkedHairpinCheck.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

IntermarkedHairpinCheck.**check**(*expr*)

Inherited from wellformednesstools.Check

IntermarkedHairpinCheck.**report**(*expr*)

Inherited from wellformednesstools.Check

IntermarkedHairpinCheck.**violators**(*expr*)

Inherited from wellformednesstools.Check

Special Methods

IntermarkedHairpinCheck.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

IntermarkedHairpinCheck.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

IntermarkedHairpinCheck.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

IntermarkedHairpinCheck.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

IntermarkedHairpinCheck.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

IntermarkedHairpinCheck.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

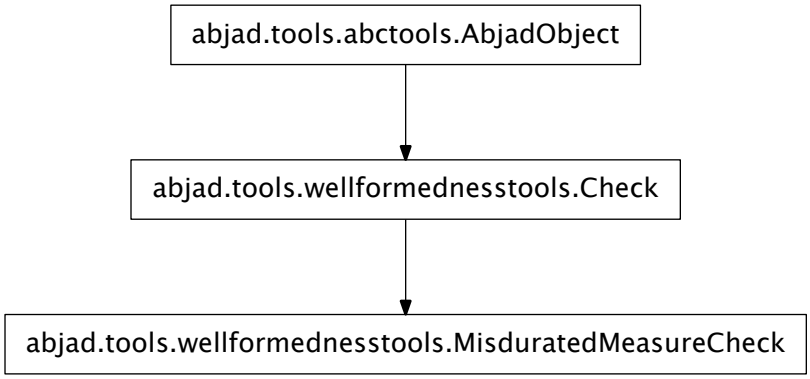
Inherited from abctools.AbjadObject

IntermarkedHairpinCheck.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.MisduratedMeasureCheck



class wellformednesstools.**MisduratedMeasureCheck**
Does the (pre)prolated duration of the measure match its meter?

Read-only Properties

MisduratedMeasureCheck.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

MisduratedMeasureCheck.**check**(*expr*)
Inherited from wellformednesstools.Check

MisduratedMeasureCheck.**report**(*expr*)
Inherited from wellformednesstools.Check

MisduratedMeasureCheck.**violators**(*expr*)
Inherited from wellformednesstools.Check

Special Methods

MisduratedMeasureCheck.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MisduratedMeasureCheck.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MisduratedMeasureCheck.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MisduratedMeasureCheck.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MisduratedMeasureCheck.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MisduratedMeasureCheck.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

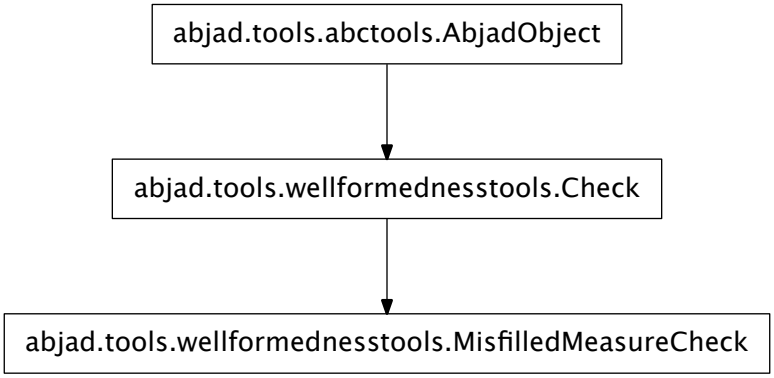
Inherited from abctools.AbjadObject

MisduratedMeasureCheck.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.MisfilledMeasureCheck



class wellformednesstools.**MisfilledMeasureCheck**
Check that time signature duration equals measure contents duration for every measure.

Read-only Properties

MisfilledMeasureCheck.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

MisfilledMeasureCheck.**check**(*expr*)
Inherited from wellformednesstools.Check

MisfilledMeasureCheck.**report**(*expr*)
Inherited from wellformednesstools.Check

MisfilledMeasureCheck.**violators**(*expr*)
Inherited from wellformednesstools.Check

Special Methods

MisfilledMeasureCheck.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MisfilledMeasureCheck.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MisfilledMeasureCheck.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MisfilledMeasureCheck.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MisfilledMeasureCheck.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MisfilledMeasureCheck.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

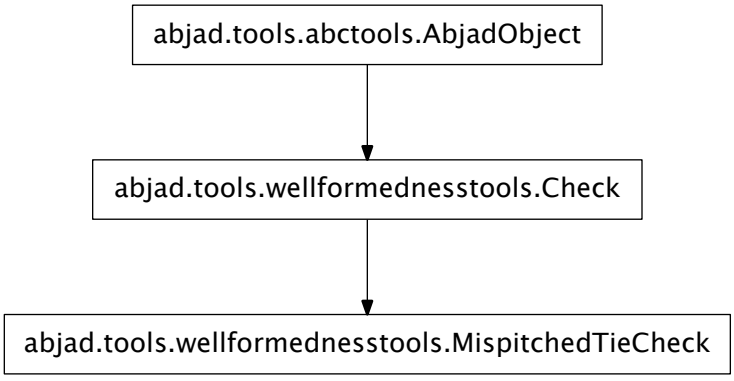
Inherited from abctools.AbjadObject

MisfilledMeasureCheck.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.MispitchedTieCheck



class wellformednesstools.**MispitchedTieCheck**

Read-only Properties

MispitchedTieCheck.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

MispitchedTieCheck.**check**(*expr*)
Inherited from wellformednesstools.Check

MispitchedTieCheck.**report**(*expr*)
Inherited from wellformednesstools.Check

MispitchedTieCheck.**violators**(*expr*)
Inherited from wellformednesstools.Check

Special Methods

MispitchedTieCheck.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MispitchedTieCheck.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MispitchedTieCheck.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MispitchedTieCheck.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MispitchedTieCheck.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MispitchedTieCheck.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

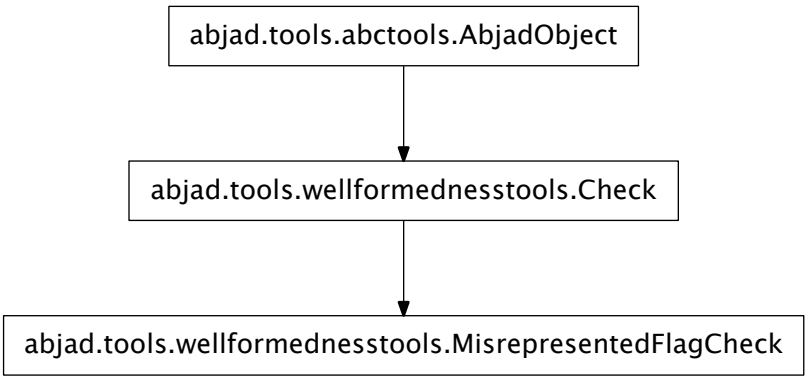
Inherited from abctools.AbjadObject

MispitchedTieCheck.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.MisrepresentedFlagCheck



class wellformednesstools.**MisrepresentedFlagCheck**

Read-only Properties

MisrepresentedFlagCheck.**storage_format**

Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

MisrepresentedFlagCheck.**check**(*expr*)

Inherited from wellformednesstools.Check

MisrepresentedFlagCheck.**report**(*expr*)

Inherited from wellformednesstools.Check

MisrepresentedFlagCheck.**violators**(*expr*)

Inherited from wellformednesstools.Check

Special Methods

MisrepresentedFlagCheck.**__eq__**(*arg*)

True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MisrepresentedFlagCheck.**__ge__**(*arg*)

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MisrepresentedFlagCheck.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MisrepresentedFlagCheck.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MisrepresentedFlagCheck.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MisrepresentedFlagCheck.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

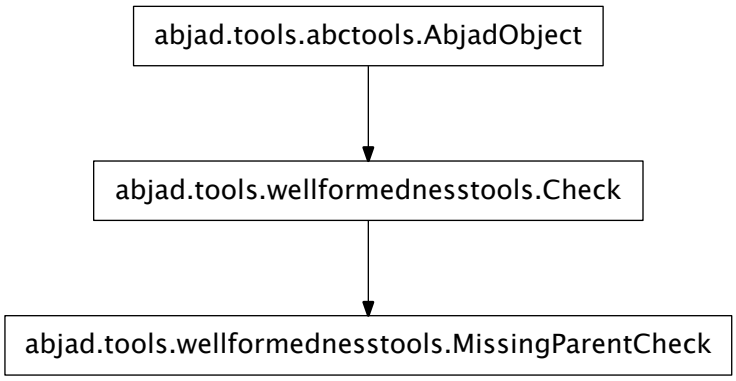
Inherited from abctools.AbjadObject

MisrepresentedFlagCheck.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.MissingParentCheck



class wellformednesstools.**MissingParentCheck**
Each node except the root needs a parent.

Read-only Properties

MissingParentCheck.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

MissingParentCheck.**check**(*expr*)
Inherited from wellformednesstools.Check

MissingParentCheck.**report**(*expr*)
Inherited from wellformednesstools.Check

MissingParentCheck.**violators**(*expr*)
Inherited from wellformednesstools.Check

Special Methods

MissingParentCheck.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

MissingParentCheck.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MissingParentCheck.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

MissingParentCheck.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MissingParentCheck.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

MissingParentCheck.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

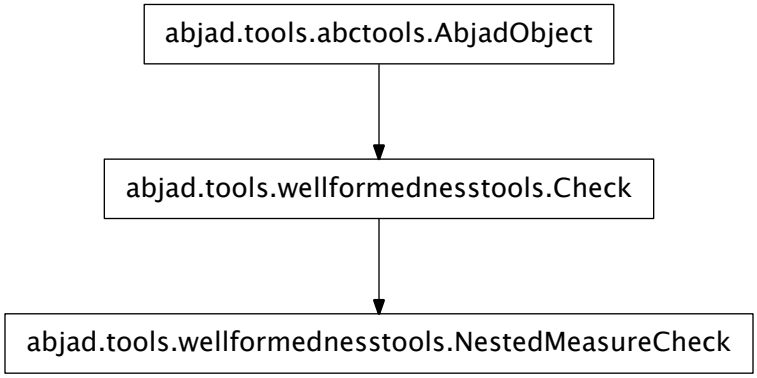
Inherited from abctools.AbjadObject

MissingParentCheck.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from `abctools.AbjadObject`

wellformednesstools.NestedMeasureCheck



class `wellformednesstools.`**`NestedMeasureCheck`**

Do we have any nested measures?

Read-only Properties

`NestedMeasureCheck.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`NestedMeasureCheck.`**`check`**`(`*expr*`)`

Inherited from `wellformednesstools.Check`

`NestedMeasureCheck.`**`report`**`(`*expr*`)`

Inherited from `wellformednesstools.Check`

`NestedMeasureCheck.`**`violators`**`(`*expr*`)`

Inherited from `wellformednesstools.Check`

Special Methods

`NestedMeasureCheck.`**`__eq__`**`(`*arg*`)`

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`NestedMeasureCheck.`**`__ge__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NestedMeasureCheck.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

NestedMeasureCheck.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NestedMeasureCheck.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

NestedMeasureCheck.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

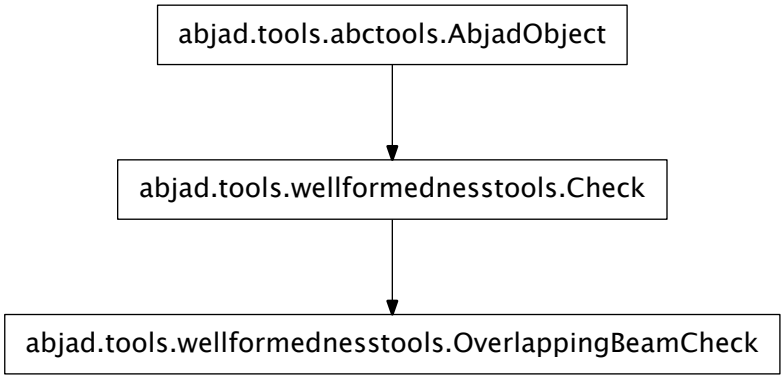
Inherited from abctools.AbjadObject

NestedMeasureCheck.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.OverlappingBeamCheck



class wellformednesstools.**OverlappingBeamCheck**
Beams must not overlap.

Read-only Properties

`OverlappingBeamCheck.`**`storage_format`**

Storage format of Abjad object.

Return string.

Inherited from `abctools.AbjadObject`

Methods

`OverlappingBeamCheck.`**`check`**`(`*expr*`)`

Inherited from `wellformednesstools.Check`

`OverlappingBeamCheck.`**`report`**`(`*expr*`)`

Inherited from `wellformednesstools.Check`

`OverlappingBeamCheck.`**`violators`**`(`*expr*`)`

Inherited from `wellformednesstools.Check`

Special Methods

`OverlappingBeamCheck.`**`__eq__`**`(`*arg*`)`

True when `id(self)` equals `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

`OverlappingBeamCheck.`**`__ge__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`OverlappingBeamCheck.`**`__gt__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception

Inherited from `abctools.AbjadObject`

`OverlappingBeamCheck.`**`__le__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`OverlappingBeamCheck.`**`__lt__`**`(`*arg*`)`

Abjad objects by default do not implement this method.

Raise exception.

Inherited from `abctools.AbjadObject`

`OverlappingBeamCheck.`**`__ne__`**`(`*arg*`)`

True when `id(self)` does not equal `id(arg)`.

Return boolean.

Inherited from `abctools.AbjadObject`

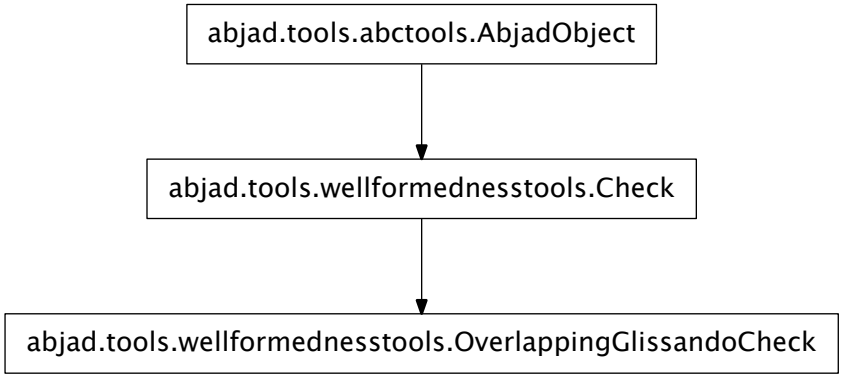
`OverlappingBeamCheck.`**`__repr__`**`()`

Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.OverlappingGlissandoCheck



class wellformednesstools.**OverlappingGlissandoCheck**
Glissandi must not overlap. Dove-tailed glissandi are OK.

Read-only Properties

OverlappingGlissandoCheck.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

OverlappingGlissandoCheck.**check**(*expr*)
Inherited from wellformednesstools.Check

OverlappingGlissandoCheck.**report**(*expr*)
Inherited from wellformednesstools.Check

OverlappingGlissandoCheck.**violators**(*expr*)
Inherited from wellformednesstools.Check

Special Methods

OverlappingGlissandoCheck.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

OverlappingGlissandoCheck.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OverlappingGlissandoCheck.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

OverlappingGlissandoCheck.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OverlappingGlissandoCheck.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OverlappingGlissandoCheck.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

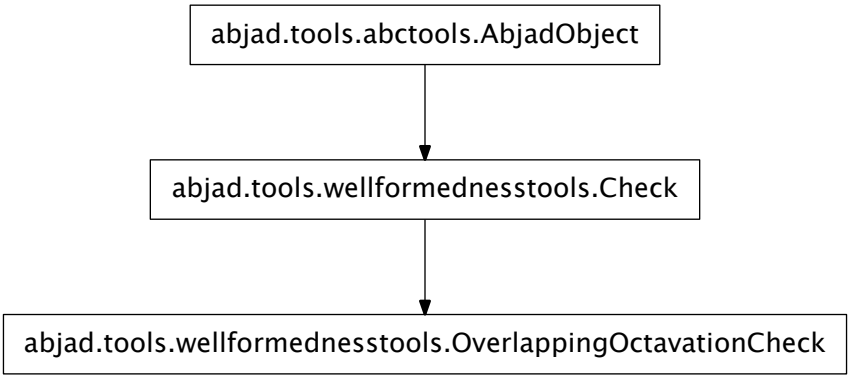
Inherited from abctools.AbjadObject

OverlappingGlissandoCheck.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.OverlappingOctavationCheck



class wellformednesstools.**OverlappingOctavationCheck**
Octavation spanners must not overlap.

Read-only Properties

OverlappingOctavationCheck.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

OverlappingOctavationCheck.**check**(*expr*)
Inherited from wellformednesstools.Check

OverlappingOctavationCheck.**report**(*expr*)
Inherited from wellformednesstools.Check

OverlappingOctavationCheck.**violators**(*expr*)
Inherited from wellformednesstools.Check

Special Methods

OverlappingOctavationCheck.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

OverlappingOctavationCheck.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OverlappingOctavationCheck.**__gt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

OverlappingOctavationCheck.**__le__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OverlappingOctavationCheck.**__lt__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

OverlappingOctavationCheck.**__ne__**(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

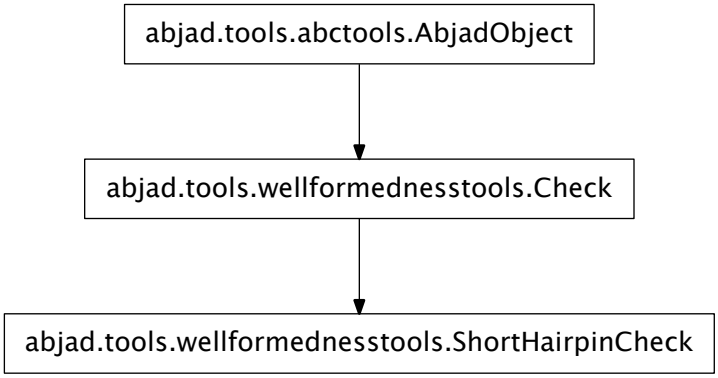
Inherited from abctools.AbjadObject

OverlappingOctavationCheck.**__repr__**()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

wellformednesstools.ShortHairpinCheck



class wellformednesstools.**ShortHairpinCheck**
Hairpins must span at least two leaves.

Read-only Properties

ShortHairpinCheck.**storage_format**
Storage format of Abjad object.

Return string.

Inherited from abctools.AbjadObject

Methods

ShortHairpinCheck.**check**(*expr*)
Inherited from wellformednesstools.Check

ShortHairpinCheck.**report**(*expr*)
Inherited from wellformednesstools.Check

ShortHairpinCheck.**violators**(*expr*)
Inherited from wellformednesstools.Check

Special Methods

ShortHairpinCheck.**__eq__**(*arg*)
True when id(self) equals id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ShortHairpinCheck.**__ge__**(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ShortHairpinCheck.__gt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception

Inherited from abctools.AbjadObject

ShortHairpinCheck.__le__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ShortHairpinCheck.__lt__(*arg*)
Abjad objects by default do not implement this method.

Raise exception.

Inherited from abctools.AbjadObject

ShortHairpinCheck.__ne__(*arg*)
True when id(self) does not equal id(arg).

Return boolean.

Inherited from abctools.AbjadObject

ShortHairpinCheck.__repr__()
Interpreter representation of Abjad object defaulting to class name, mandatory arguments, keyword arguments.

Return string.

Inherited from abctools.AbjadObject

functions

wellformednesstools.list_checks

wellformednesstools.**list_checks**()
New in version 2.8. List checks:

```
>>> from abjad.tools import wellformednesstools

>>> for check in wellformednesstools.list_checks(): check
...
BeamedQuarterNoteCheck()
DiscontiguousSpannerCheck()
DuplicateIdCheck()
EmptyContainerCheck()
IntermarkedHairpinCheck()
MisduratedMeasureCheck()
MisfilledMeasureCheck()
MispitchedTieCheck()
MisrepresentedFlagCheck()
MissingParentCheck()
NestedMeasureCheck()
OverlappingBeamCheck()
OverlappingGlissandoCheck()
```

```
OverlappingOctavationCheck()
ShortHairpinCheck()
```

Return list of checks.

BIBLIOGRAPHY

[Adan2006] Víctor Adán. Music <-> Geometry <-> Meta-Music. Draft February 12, 2006.

[AgonAssayagBresson2006] Carlos Agon, Gérard Assayag, Jean Bresson. The OM Composer's Book 1. Éditions Delatour, Paris. 2006.

[AgonHaddadAssayag2002] Carlos Agon, Karim Haddad & Gerard Assayag. Répresentation et rendu de structures rhythmiques. Journées d'Informatique Musicale, 9th ed., Marseille, 29 - 31 May 2002.

[Alegant1993] Brian Alegant. The seventy-seven partitions of the aggregate: Analytical and theoretical implications. Doctoral Dissertation. The University of Rochester, Eastman School of Muisc. 1993.

[Ariza2005] Christopher Ariza. An Open Design for Computer-Aided Algorithmic Music Composition: athenaCL. Dissertation.com, Boca Raton. 2005.

[BacaAdan2007] Trevor Bača & Víctor Adán. Cuepatlahto and Lascaux: two approaches to the formalized control of musical score. Draft June 7, 2007.

[BressonAgonAssayag2008] Jean Bresson, Carlos Agon, Gérard Assayag. The OM Composer's Book 2. Éditions Delatour, Paris. 2008

[Carter2002] Eliot Carter. Harmony Book. Nicholas Hopkins and John F. Link, eds. Carl Fischer, New York. 2002.

[Haddad] Karim Haddad. Le Temps comme Territoire: pour une géographie temporelle.

[Kampela1998] Arthur Kampela. Uma Faca Só Lâmina. Doctoral Dissertation. Columbia University, NY, NY. 1998.

[Malt2008] Mikhaïl Malt. Some Considerations on Brian Ferneyhough's Musical Language Through His Use of CAC – Part I: Time and Rhythmic Structures. In Bresson, Agon and Assayag (2008).

[Morris1987] Robert Morris. Composition with Pitch-Classes. Yale University Press, New Haven. 1987.

[Nauert1997] Paul Nauert. Timespan Formation in Nonmetric, Posttonal Music. Doctoral Dissertation. Columbia University, NY, NY. 1997.

[NienhuysNieuwenhuizen2003] Han-Wen Nienhuys & Jan Nieuwenhuizen. Lilypond: A system for automated music engraving. Proceedings of the XIV Colloquium on Musical Informatics. Firenze, Italy. May 8 - 10, 2003.

[Ross1987] Ted Ross. Teach Yourself The Art of Music Engraving and Processing. Hansen House, Miami Beach. 1987.

[Selfridge-Field1997] Eleanor Selfridge-Field, ed. Beyond MIDI: The Handbook of Musical Codes. The MIT Press. Cambridge, Massachusetts. 1997.

[Valle] Andrea Valle. GeoGraphy: Notazione musicale e composizione algorithmica. Centro Interdipartimentale di Ricerca sulla Multimedialità e l'Audiovisivo. Università degli Studi di Torino.

[WulfsonBarrettWinter] Harris Wulfson, G. Douglas Barrett & Michael Winter. Automatic Notation Generators.

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