A LADOK3 Python API

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18th November 2026

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Abstract

We provide a Python wrapper for the LADOK3 REST API. This wrapper provide a useful object-oriented framework for working with LADOK and direct API calls that return the unprocessed JSON data directly from LADOK.

We also provide a command-line interface (CLI) for the library. We then construct some useful (shell) scripts using this CLI. These scripts automates the reporting of results from Canvas to LADOK.

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Chapter 1

Introduction

LADOK (abbreviation of Lokalt Adb–baserat DOKumentationssystem, in Swedish) is the national documentation system for higher education in Sweden. This is the documented source code of `ladok3`, a LADOK3 API wrapper for Python.

The `ladok3` library provides a non-GUI application (a command-line interface, CLI) that, similar to access via a web browser, only provides the user with access to the LADOK data and functionality that they would actually have based on their specific user permissions in LADOK. It can be seem as a very streamlined web browser just for LADOK's web interface. While the library exploits caching to reduce the load on the LADOK server, this represents a subset of the information that would otherwise be obtained via LADOK's web GUI export functions.

You can install the `ladok3` package by running

```
python3 -m pip install ladok3 # to use it in Python, or
pipx install ladok3           # to just use the CLI
```

in the terminal.

Then you can use the CLI by running `ladok` in the terminal. The command has built-in help, simply run `ladok -h` to see the available commands. However, the first thing you want to run after installing the package is

```
ladok login
```

This will set up your credentials for the CLI. However, if you want to use the library in a script, you can read

```
ladok login -h
```

for alternative ways of providing your credentials.

For use in Python scripts, we provide the main class `LadokSession` (Section 9.1). The `LadokSession` class acts like 'factories' and will return objects representing various LADOK data. These data objects' classes inherit the `LadokData` (Section 9.2.1) and `LadokRemoteData` (Section 9.2.3) classes. Data of the type `LadokData` is not expected to change, unlike `LadokRemoteData`, which is. Objects of type `LadokRemoteData` know how to update themselves, i.e., fetch and refresh their data from LADOK. When relevant they can also write data to LADOK, i.e., update entries such as results.

One design criteria is to improve performance. We do this by caching all factory methods of any `LadokSession`. The `LadokSession` itself is also designed to be

cacheable: if the session to LADOK expires, it will automatically reauthenticate to establish a new session.

You can find a quick reference by running

```
pydoc ladok3 # doesn't work if installed with pipx
```

Part I

Example applications

Chapter 2

Transfer results from Canvas to LADOK

In this chapter we'll see some scripts for reporting results from Canvas to LADOK. These scripts are run as cronjobs. This means that they run unattended and only produce output when they need attention.

We want to report results for courses that are titled 'DD2520 VT25', 'DD1310 HT24', 'DD1317 HT24', and similar in Canvas. The advantage to using this command is that it will automatically report the correct dates and everyone who has participated in the grading of each student—as required by regulation. The official tools, like KTH Transfer to Ladok or SUNET's version of the same, don't do this. They don't set the dates correctly, meaning that each individual should have a separate date (date of submission). They also don't register the graders in LADOK. For each results, everyone who participated in the grading process should be registered in LADOK.

We'll have a script ⟨*ladok.sh* (never defined)⟩ that is run by `cron`. It's useful to load our profile, so that we have our normal environment.

4 ⟨`ladok.sh` 4⟩≡

```
1  #!/bin/bash
2  . ${HOME}/.profile
```

This definition is continued in chunk 5a.
Root chunk (not used in this document).

We also want some helper functions and a main function that is only run when the script is run. If the script is sourced, the main function is not run. This way we can use the helper functions in our terminal.

The design is that all functions output lines expected by `ladok report`. This way, we can simply pipe the output of the main function to `ladok -v report -f` to report them. This also makes it easy to debug the script by running it in the terminal and seeing what it would report.

At `-v`, `ladok report` logs three kinds of line, but only two of them call for action from us. It logs an `INFO` line for each result that is now finalised and waiting for us to attest it, and an `ERROR` line for each result whose already-attested grade conflicts with what we want to report—those we must de-attest and update manually in LADOK. Both belong in the cron mail. It also logs a `WARNING` when an attested result's examination date has drifted from the date we recompute from Canvas; but since the attested grade is already correct, that drift needs no action from us. For

a course with many attested results these drift warnings would flood the mail and bury the lines we actually act on, defeating the rule from the start of this chapter that the script should only speak up when it needs attention.

We therefore drop just the drift line. We match on its message rather than on the `WARNING` level on purpose: the date-before-course-start warning is also a `WARNING`, but it signals a genuinely suspect date that we want to keep seeing, so a level-based filter would be too blunt. The drift line is the only `report` log line containing the phrase 'leaving the attested result as-is', which makes it a precise anchor. Because `report` logs to standard error, we merge it into the pipe with `2>&1` before filtering.

5a ⟨`ladok.sh` 4⟩+≡

```
⟨constants 5c⟩
⟨helper functions 6c⟩

main() {
  ⟨main script 8a⟩
}

report_to_ladok() {
  ⟨report while ensuring we have a valid LADOK session 5b⟩
}

# Only run if this is the main script
if [[ "${BASH_SOURCE[0]}" == "${0}" ]]; then
  main "$@" | report_to_ladok 2>&1 \
  | ⟨filter out non-actionable date drift 6a⟩
fi
```

Defines:
`main`, used in chunk 43.
`report_to_ladok`, never used.

To ensure we have a valid LADOK session, we run `ladok student` to `/dev/null` until it succeeds. When it succeeds, we know the MFA has passed and can report the results.

5b ⟨*report while ensuring we have a valid LADOK session* 5b⟩≡

```
local backoff=1
until ladok student $ME; do
  sleep $backoff
  backoff=$((backoff * 2))
done > /dev/null 2> /dev/null
ladok -v report -f
```

This code is used in chunk 5a.
Uses `ME` 5c.

5c ⟨*constants* 5c⟩≡

```
ME=de709f81-a867-11e7-8dbf-78e86dc2470c
```

This definition is continued in chunk 6b.
This code is used in chunk 5a.
Defines:
`ME`, used in chunk 5b.

This will work since only the successful run will exit with zero. Then we can actually run the `ladok report` command to report the results. Only that last command

will consume stdin. We use the exponential backoff to avoid flooding the server, but also to avoid flooding ourselves.

The filter drops the drift line and nothing else. This phrase is coupled to the exact wording of the attested date-drift warning in `report.nw`; if that message ever changes, this pattern must change with it. We append `|| true` because `grep -v` exits non-zero when it selects no lines—which is exactly the quiet, nothing-to-report run we want—and we don't want `cron` to treat that healthy run as a failure.

6a ⟨*filter out non-actionable date drift* 6a⟩≡

```
grep -v "leaving the attested result as-is" || true
```

This code is used in chunk 5a.

We need to report more than once for a course. All students might not be done by the time of reporting. When they're done, we must report the results again[1]. Sometimes a student finishes a course years after it ended. To speed up execution it's better to report results for a sliding window of courses, instead of all courses. For those rare cases when a student finishes a course years after it ended, we can report the results manually for that course again—by importing and invoking the functions below in the terminal.

[1] And students have a right to do this without having to reregister on a later course round.

The window is a regex for the years that we're interested in reporting for, which we put into the course regex, for example `DD1317 ?HT(23|24|25|26)`. We use the current year and the `LOOKBACK` years before it. Including earlier years has two advantages. First, when we pass new year's eve, the autumn courses are still current for a few weeks—but the year is the wrong one. Second, we also report any late results for the past few years without having to do it manually. Course names use two-digit years, so `YEAR` does too.

6b ⟨*constants* 5c⟩+≡

```
YEAR=$(date +%y)
LOOKBACK=3
```

This code is used in chunk 5a.
Defines:
`LOOKBACK`, used in chunk 7.
`YEAR`, used in chunk 7.

To construct the regex for years, we simply take a sequence of years (`24 25`) and make a regex (`(24|25)`) out of it.

The sequence is empty if it starts after it ends. Then the pipeline would output only `(`, which is an invalid regex. Simply outputting nothing would be worse: `HT` followed by nothing matches the course in *every* year. Instead we output `(?!)`, a regex that never matches anything, so no course is selected. This works since `canvaslms` uses Python's regexes, which support the negative lookahead `(?!...)`. We also print a warning, so that the cron mail tells us about the mistake. This also catches four-digit years, like `2023`, since they are larger than any two-digit year.

6c ⟨*helper functions* 6c⟩≡

```
years_regex() {
  local first="$1"
  local last="$2"
  if [[ "$first" -gt "$last" ]]; then
    echo "years_regex: starting year $first is after $last," \
         "no course will match" >&2
    echo -n "(?!)"
    return 1
```

```
    fi
    echo -n "("; \
    seq "$first" "$last" \
    | sed -zE "s/\s/|/g" \
    | sed "s/|$/)/"
}
```

This definition is continued in chunks 7 and 11–13.
This code is used in chunk 5a.
Defines:
`years_regex`, used in chunk 7.

One important aspect is that we don't want to include the current year for autumn courses before August. That's because they will not be published before that, so we'll get a permission error from Canvas. So we'll use two functions, one for spring and one for autumn courses.

To check the month, we must strip the leading zero that `date +%m` gives. Inside `[[ ]]`, bash compares numbers as arithmetic expressions, and there a leading zero means octal. So `08` and `09` are invalid numbers: the test fails with an error in August and September, which would also end up in the cron mail. The prefix `10#` in `$((10#$(date +%m)))` tells bash to read the number in base ten.

Sometimes the grading in a course changes from a certain year. For instance, in tilkry (Section 2.1.5) the INL1Quiz assignment used to give points, but now it gives P/F. The summary of INL1 that `canvaslms results` computes needs P/F grades, so it can't summarize the older rounds. So the window for such a component must not reach back before the year of the change. For this, both functions take an optional starting year. It is a two-digit year, like `YEAR`, and replaces the start of the sliding window, for example `HT$(years_autumn 24)`. If it's not given, we use the sliding window.

7 ⟨*helper functions* 6c⟩+≡

```
years_spring() {
  years_regex "${1:-$((YEAR - LOOKBACK))}" "$YEAR"
}

years_autumn() {
  if [[ $((10#$(date +%m))) -lt 8 ]]; then
    years_regex "${1:-$((YEAR - LOOKBACK - 1))}" $((YEAR - 1))
  else
    years_spring "$@"
  fi
}
```

This code is used in chunk 5a.
Defines:
`years_autumn`, used in chunks 8–10.
`years_spring`, used in chunks 9 and 10.
Uses `LOOKBACK` 6b, `YEAR` 6b, and `years_regex` 6c.

2.1 Reporting results on course components

We want a script that reports the results for all courses, including all previous years, to LADOK. We want to do this for previous years as sometimes they finish assignments years after the course ended.

We'll add a function that takes a course regex and a component regex and reports the results to LADOK. To report the modules, we sometimes need to override the default summary function of `canvaslms`[2]. We want something like ⟨*main script* 8a⟩ below.

[2]For details on `canvaslms results`, see Chapters 10 and 11 in its documentation, found on https://github.com/dbosk/canvaslms/releases/tag/v4.7. Particularly Chapter 11 discusses the summary modules. You can also read `pydoc canvaslms.grades` for a more brief summary.

2.1.1 DD1301 datintro

For the datintro course (DD1301), we simply have four lab assignments in the assignment group LAB1. LAB1 is the only course component in LADOK.

We note however that we need an optional space between the course code (DD1301) and the semester (HT21), because for 2021 IT seems to have omitted the space between them.

Since this course is given in every period, but the Canvas rooms are merged, it should appear only as one course with the semester HT25/VT26. So we use the `years_autumn` function above for the regex for the years.

8a ⟨*main script* 8a⟩≡

```
# datintro
report_components "DD1301 ?HT$(years_autumn)" \
                  LAB1
```

This definition is continued in chunks 8–11 and 13a.
This code is used in chunk 5a.
Uses `report_components` 12a and `years_autumn` 7.

2.1.2 DD1317 prgi

For the prgi (DD1317) course we have four components: KAL1, LAB1, LAB2 and LAB3. In the old version of the course (DD1315), we had MAT1 instead of KAL1.

The LAB1, MAT1 and KAL1 components each contain lab assignments. The students must pass all of them for a grade.

To guard for that accidental space bug above, we make the space between course code and semester optional.

Since this is also an autumn only course, we should give the same regex for the years as for datintro.

8b ⟨*main script* 8a⟩+≡

```
# prgi
# labs
report_components "DD1317 ?HT$(years_autumn)" \
                  "LAB1"
report_components "DD1317 ?HT$(years_autumn)" \
                  "KAL1"
```

This code is used in chunk 5a.
Uses `report_components` 12a and `years_autumn` 7.

The LAB2 component is just an exam. In some older versions it also contains a mandatory survey to get a date in the last week of the course in LADOK. In some versions we also have multiple assignments, one for each time the exam was given (hence maxgradesurvey); but in newer we reuse the same assignment for all re-exams.

The exams are given all around the year. They don't have the semester, but rather a date—so we should match on 2026 instead of 26. These rooms are also

created shortly before the exam, so the errors ought to be fewer if we try to report on an unpublished course.

9a ⟨*main script* 8a⟩+≡

```
# datorprov with optional survey
report_components "DD1317.*LAB2.*20$(years_spring)" \
                  LAB2 \
                  canvaslms.grades.maxgradesurvey
```

This code is used in chunk 5a.
Uses `report_components` 12a and `years_spring` 7.

However, now we have that mandatory survey in the LAB3 component with the project that the students finish last. This project contains three parts:

(1) the specification (P/F),

(2) the peer review (P/F),

(3) the presentation of the project (A–F grades), and

(4) the mandatory survey (numerical).

We use the `canvaslms.grades.conjunctavgsurvey` summary module to get the final grade to be the A–F grade of the presentation, but only if the specification, peer review and survey are all passed.

9b ⟨*main script* 8a⟩+≡

```
# p-uppgift with optional survey
report_components "DD1317 ?HT$(years_autumn)" \
                  LAB3 \
                  canvaslms.grades.conjunctavgsurvey
```

This code is used in chunk 5a.
Uses `report_components` 12a and `years_autumn` 7.

2.1.3 DD1315 prgi2[0-3]

For the old version of the course, we simply have MAT1 instead of KAL1. And there was no mandatory survey. But we run it for a fixed number of years.

9c ⟨*main script* 8a⟩+≡

```
report_components "DD1315 ?HT2[0-3]" \
                  "LAB1"
report_components "DD1315 ?HT2[0-3]" \
                  "MAT1"
report_components "DD1315 ?HT2[0-3]" \
                  "LAB3"
```

This code is used in chunk 5a.
Uses `report_components` 12a.

We don't need to run LAB2 for it, because they have to reregister for the newer course to do LAB2.

2.1.4 DA2215 vetcyb

For vetcyb (DA2215) we have one component: INL1. It's just a few P/F-assignments and a mandatory survey.

This course is given both in autumn and in spring. This means that we should adapt the regex to match spring and autumn separately—with spring and autumn adapted years.

10a ⟨*main script* 8a⟩+≡

```
# vetcyb
SPRING_AUTUMN_YEARS="(HT$(years_autumn)|VT$(years_spring))"
report_components "DA2215 ?${SPRING_AUTUMN_YEARS}" \
                  ^INL1 \
                  canvaslms.grades.conjunctavgsurvey
```

This code is used in chunk 5a.
Defines:
`SPRING_AUTUMN_YEARS`, used in chunk 10b.
Uses `report_components` 12a, `years_autumn` 7, and `years_spring` 7.

However, we also want to report the 'Participation INL1'. But that would require us to rewrite the name of the group to just INL1, so we need to use the `report_alt_components` function. Also, we need to use the `canvaslms.grades.participation` summary module to get the participation grade (since those assignments consist only of complete/incomplete and 0–100 grades).

10b ⟨*main script* 8a⟩+≡

```
# vetcyb participation
report_alt_components "DA2215 ?${SPRING_AUTUMN_YEARS}" \
                      "^Participation INL1" INL1 \
                      canvaslms.grades.participation
```

This code is used in chunk 5a.
Uses `report_alt_components` 11b and `SPRING_AUTUMN_YEARS` 10a.

2.1.5 DD2520 tilkry

For tilkry (DD2520) we have two components: INL1 and LAB1. The INL1 component is just a few P/F-assignments. The LAB1 component is a set of mandatory and optional assignments. The number of optional assignments (and their grades) determine the final grade. So it has a custom summary module: `canvaslms.grades.tilkryLAB1`.

This course is only given in spring, so we only need to match on the spring years.

Until VT23, the INL1Quiz assignment was graded with points, and from VT24 on it is graded P/F. The default summary that gives the INL1 result needs P/F grades, so we start the INL1 window at 24. Once the sliding window starts at 24 or later, the starting year makes no difference, and we can remove it.

10c ⟨*main script* 8a⟩+≡

```
# tilkry
report_components "DD2520 ?VT$(years_spring 24)" \
                  INL1
report_components "DD2520 ?VT$(years_spring)" \
                  LAB1 \
                  canvaslms.grades.tilkryLAB1
```

This code is used in chunk 5a.
Uses `report_components` 12a and `years_spring` 7.

Finally, let's do this also for the courses that I have given previous years.

11a ⟨*main script* 8a⟩+≡

```
# tidigare kurser
# DD1310 - prgm2[1-5]
report_components "DD1310 ?HT2[1-5]" \
                  "LAB1"
report_components "DD1310 ?HT2[1-5]" \
                  "LAB3" \
                  canvaslms.grades.conjunctavgsurvey
```

This code is used in chunk 5a.
Uses `report_components` 12a.

2.2 Getting component results from Canvas to LADOK

To get the results out of Canvas we'll use the `canvaslms results` command. We must install the `canvaslms` tool. We can do this by running:

```
python3 -m pip install canvaslms # to use it with Python, or
pipx install canvaslms           # to only use the CLI
canvaslms login                  # or read `canvaslms login --help`
```

For details on how to extract the results, read `canvaslms results --help` (also read Footnote 2 on page 8).

Course codes always have the same structure, so they're easy to replace. But sometimes we also want to replace the component name with the desired component name in LADOK.

11b ⟨*helper functions* 6c⟩+≡

```
report_alt_components() {
  local course="$1"
  local component="$2"
  local desired_component="$3"
  local summary_module="$4"

  local summary_opt=""
  if [[ -n "$summary_module" ]]; then
    summary_opt="-S $summary_module"
  fi

  # Get the course results from Canvas.
  canvaslms results -c "$course" -A "$component" $summary_opt \
  | ⟨change course column to only course code 12b⟩ \
  | ⟨rename the component column to the desired component 12c⟩
}
```

This code is used in chunk 5a.
Defines:
`report_alt_components`, used in chunks 10b and 12a.

However, let's also add a version where the component name is the same. This will be used most of the time.

12a ⟨*helper functions* 6c⟩+≡
```
report_components() {
  local course="$1"
  local component="$2"
  local summary_module="$3"

  report_alt_components "$course" "$component" "$component" "$summary_module"
}
```
This code is used in chunk 5a.
Defines:
`report_components`, used in chunks 8–11.
Uses `report_alt_components` 11b.

The course code the is the first column of the output from `canvaslms results`. The course code is the first word, separated from the rest by a space. So we simply drop everything after the first space. However, this doesn't work for the cases where IT has forgotten that space between course code and semester.

This means that we can't use `split` in `awk`, since that would need a space of other character to split on. We must instead resort to using regexes to extract the course code.

12b ⟨*change course column to only course code* 12b⟩≡
```
awk -F '\t' -v OFS='\t' '{
    sub(/ ?[HV]T.*/, "", $1)
    print
}'
```
This code is used in chunk 11b.

We can do something similar for the component column, but we simply replace it with the desired component name.

12c ⟨*rename the component column to the desired component* 12c⟩≡
```
awk -F '\t' -v OFS='\t' -v comp="$desired_component" '{ $2=comp; print }'
```
This code is used in chunk 11b.

2.3 Reporting course grade

Now we can set the course grades based on the reported components. We'll have to report one course at a time since the course grade is based on different components in different courses.

We'll use the LADOK data to solve this. This means that when the code above is run, it outputs what `ladok report` should put in LADOK. That means that if anyone there completes the course, we will not see it here. However, that's only good: we can't use those results anyway until they're certified/attested in LADOK.

We simply do this for *all rounds*: We look for students who have no grade on the course, then we look if they have a grade on the component, and if they do, we report that as the course grade. We'll fail for those who have not yet finished the other components of the course or those whose results are not yet attested, but that's acceptable. Then we get an overview of who has leftovers. However, we can

actually filter those out by looking at the latest date of any component—which we'll need anyway for the date of the course.

13a ⟨*main script* 8a⟩+≡

```
report_course DD1315 LAB3
report_course DD1317 LAB3
report_course DD2520 LAB1
```

This code is used in chunk 5a.
Uses `report_course` 13b.

We don't need to report the course grade for the other courses since they have only one component. For courses with only one component, LADOK will automatically set the course grade based on the grade of the single component.

This approach makes for a simpler implementation of `report_course`. We simply extract the course data using `ladok course -l` and then filter it using `awk`. The output data from `ladok course -l` has the following columns (tab separated):

```
course_code  round_code  component  student  grade  date
```

The `-l` option gives us the student's LADOK identifier instead of name.

The course grade is given by the component being the same as the course code. If the course grade is empty but the grade of the component we're interested in is not empty, we report the component grade as the course grade. So we can filter out whoever has no course grade (`-` in the grade column). Then we filter out who of those have a grade on the component.

As for the grade, we need the newest grade on any component for a student. This also allows us to filter out students who have not yet finished all components of the course. The dates are in ISO format (YYYY-MM-DD), so sorting them lexicographically works. If there is no result on a component, the date is blank.

Finally, we report those to LADOK.

13b ⟨*helper functions* 6c⟩+≡

```
report_course() {
  local course="$1"
  local component="$2"

  ladok course -l "$course" \
  | awk -F '\t' -v OFS='\t' \
        -v comp="$component" \
        -v course="$course" \
    '{
       ⟨store course and component grades and dates 14a⟩
     }
     END {
           ⟨print students with component grade but no course grade 15b⟩
         }'
}
```

This code is used in chunk 5a.
Defines:
`report_course`, used in chunk 13a.

We check for the course grade and store if it exists. However, we must ensure that we don't reset an already existing grade, so we only update if we haven't seen a previous course grade.

14a ⟨*store course and component grades and dates* 14a⟩≡

```
if ($3 == $1 && course_grade[$4] == "") {
  course_grade[$4]=$5
}
```

This definition is continued in chunk 14.
This code is used in chunk 13b.

Then we check for the component grade and store it if it exists. However, if we already have a grade, we will not reset it to blank. This can happen if the student is registered on several rounds.

14b ⟨*store course and component grades and dates* 14a⟩+≡

```
else if ($3 == comp && (component_grade[$4] == "-" \
                        || component_grade[$4] == "" \
                        || component_grade[$4] == 0)) {
  component_grade[$4]=$5
}
```

This code is used in chunk 13b.

(We must check for the zero in case `component_grade[$4]` is not set, since that will be the default value of an unset variable in `awk`).

We also store the latest date for *any* component. Here we also want to unset the grade date if there is a date that is blank—since that means one component is not yet finished. But we should only do that for components, not the course grade. However, since a student can be registered on several rounds, for some component, the same component will be blank in one round but not in another. (Otherwise the student would have finished the course already.) This complicates the algorithm a bit.

14c ⟨*store course and component grades and dates* 14a⟩+≡

```
if ($3 != $1) {
  ⟨update component date or reset if missing 15a⟩
}
```

This code is used in chunk 13b.

Now we must keep track of which components are there. The components must be the same for a round, but they can differ between rounds (although they usually don't).

Let's think about the possibilities for a student that has no course grade:

(1) The student is only in one round. Then they should have the same number of dates as the number of components.

(2) The student is in at least two rounds:

  (1) The student has finished all components in one round. Then one round will only be blank. Then they should have the same number of dates as the number of components in that round.

  (2) The student finished one component in one round and the rest in another round. Then both rounds will have blank dates. But they should still have the same number of dates as the number of components in the union of the components of those rounds.

I looked at only the reregistered students' results in LADOK for DD2520:

```
ladok course DD2520 | grep -Ff <(
  ladok course DD2520 | cut -f 4 | sort | uniq -c \
  | grep -v " *3 " | sed -E "s/ *[0-9]+ //"
) | sort -k 4
```

Even for the students who had a date on the course from the year before, all dates belonged to the same round. Even for students who had only one date from a previous round, had that grade and date on the latest round they were registered on. So LADOK automatically moves a result to a new round when a student is reregistered. (Based on this, we assume that a student can't have a date on the same component in two different rounds.)

What we'll do is that we keep track of the latest date for each round for each student. If we find a blank date for a round, we set the date for that round to `-`. This way we can be sure to distinguish between the first (`""`) and second (`"-"`) time we look at dates.

15a ⟨*update component date or reset if missing* 15a⟩≡

```
if ($5 == "-" || $5 == "" || $6 == "")
  component_date[$4][$2] = "-"
else if (component_date[$4][$2] != "-" && $6 > component_date[$4][$2])
  component_date[$4][$2] = $6
```

This code is used in chunk 14c.

(Note that this requires us to use GNU AWK for the multidimensional array syntax.)

Now we want to print the students who have a component grade but no course. But only if they also have a valid date (not `-`) in any round. If they have a date, it should be only from one round. And we want to print them in the format required by `ladok report`:

```
course_code  course_code  student  grade  date
```

15b ⟨*print students with component grade but no course grade* 15b⟩≡

```
for (student in component_grade) { \
  if (course_grade[student] == "-" \
      && component_grade[student] != "-")
  {
    for (round in component_date[student]) {
      if (component_date[student][round] != "-") {
        print course, course, student, component_grade[student], \
                                       component_date[student][round]
        break
      }
    }
  }
}
```

This code is used in chunk 13b.

2.4 The script as a whole

```
#!/bin/bash
. ${HOME}/.profile
ME=de709f81-a867-11e7-8dbf-78e86dc2470c
YEAR=$(date +%y)
LOOKBACK=3
years_regex() {
  local first="$1"
  local last="$2"
  if [[ "$first" -gt "$last" ]]; then
    echo "years_regex: starting year $first is after $last," \
         "no course will match" >&2
    echo -n "(?!)"
    return 1
  fi
  echo -n "("; \
  seq "$first" "$last" \
  | sed -zE "s/\s/|/g" \
  | sed "s/|$/)/"
}
years_spring() {
  years_regex "${1:-$((YEAR - LOOKBACK))}" "$YEAR"
}

years_autumn() {
  if [[ $((10#$(date +%m))) -lt 8 ]]; then
    years_regex "${1:-$((YEAR - LOOKBACK - 1))}" $((YEAR - 1))
  else
    years_spring "$@"
  fi
}
report_alt_components() {
  local course="$1"
  local component="$2"
  local desired_component="$3"
  local summary_module="$4"

  local summary_opt=""
  if [[ -n "$summary_module" ]]; then
    summary_opt="-S $summary_module"
  fi

  # Get the course results from Canvas.
  canvaslms results -c "$course" -A "$component" $summary_opt \
  | awk -F '\t' -v OFS='\t' '{
        sub(/ ?[HV]T.*/, "", $1)
        print
    }' \
  | awk -F '\t' -v OFS='\t' -v comp="$desired_component" '{ $2=comp; print }'
}
```

```
report_components() {
  local course="$1"
  local component="$2"
  local summary_module="$3"

  report_alt_components "$course" "$component" "$component" "$summary_module"
}
report_course() {
  local course="$1"
  local component="$2"

  ladok course -l "$course" \
  | awk -F '\t' -v OFS='\t' \
        -v comp="$component" \
        -v course="$course" \
    '{
       if ($3 == $1 && course_grade[$4] == "") {
         course_grade[$4]=$5
       }
       else if ($3 == comp && (component_grade[$4] == "-" \
                               || component_grade[$4] == "" \
                               || component_grade[$4] == 0)) {
         component_grade[$4]=$5
       }
       if ($3 != $1) {
         if ($5 == "-" || $5 == "" || $6 == "")
           component_date[$4][$2] = "-"
         else if (component_date[$4][$2] != "-" && $6 > component_date[$4][$2])
           component_date[$4][$2] = $6
       }
     }
     END {
           for (student in component_grade) { \
             if (course_grade[student] == "-" \
                 && component_grade[student] != "-")
             {
               for (round in component_date[student]) {
                 if (component_date[student][round] != "-") {
                   print course, course, student, component_grade[student], \
                                                  component_date[student][round]
                   break
                 }
               }
             }
           }
         }'
}

main() {
  # datintro
  report_components "DD1301 ?HT$(years_autumn)" \
```

```
                    LAB1
  # prgi
  # labs
  report_components "DD1317 ?HT$(years_autumn)" \
                    "LAB1"
  report_components "DD1317 ?HT$(years_autumn)" \
                    "KAL1"
  # datorprov with optional survey
  report_components "DD1317.*LAB2.*20$(years_spring)" \
                    LAB2 \
                    canvaslms.grades.maxgradesurvey
  # p-uppgift with optional survey
  report_components "DD1317 ?HT$(years_autumn)" \
                    LAB3 \
                    canvaslms.grades.conjunctavgsurvey
  report_components "DD1315 ?HT2[0-3]" \
                    "LAB1"
  report_components "DD1315 ?HT2[0-3]" \
                    "MAT1"
  report_components "DD1315 ?HT2[0-3]" \
                    "LAB3"
  # vetcyb
  SPRING_AUTUMN_YEARS="(HT$(years_autumn)|VT$(years_spring))"
  report_components "DA2215 ?${SPRING_AUTUMN_YEARS}" \
                    ^INL1 \
                    canvaslms.grades.conjunctavgsurvey
  # vetcyb participation
  report_alt_components "DA2215 ?${SPRING_AUTUMN_YEARS}" \
                        "^Participation INL1" INL1 \
                        canvaslms.grades.participation
  # tilkry
  report_components "DD2520 ?VT$(years_spring 24)" \
                    INL1
  report_components "DD2520 ?VT$(years_spring)" \
                    LAB1 \
                    canvaslms.grades.tilkryLAB1
  # tidigare kurser
  # DD1310 - prgm2[1-5]
  report_components "DD1310 ?HT2[1-5]" \
                    "LAB1"
  report_components "DD1310 ?HT2[1-5]" \
                    "LAB3" \
                    canvaslms.grades.conjunctavgsurvey
  report_course DD1315 LAB3
  report_course DD1317 LAB3
  report_course DD2520 LAB1
}

report_to_ladok() {
  local backoff=1
  until ladok student $ME; do
```

```
    sleep $backoff
    backoff=$((backoff * 2))
  done > /dev/null 2> /dev/null
  ladok -v report -f
}

# Only run if this is the main script
if [[ "${BASH_SOURCE[0]}" == "${0}" ]]; then
  main "$@" | report_to_ladok 2>&1 \
  | grep -v "leaving the attested result as-is" || true
fi
```

Chapter 3

Transfer results from Canvas to LADOK in Python

Here we provide an example program `canvas2ladok.py` which exports results from Canvas to LADOK for the introductory programming course DD1315.

However, a better way to do this is by using the CLI (see Chapter 2 for an even better version):

```
#!/bin/bash

. ${HOME}/.profile

year=22
courses="DD13(10HT${year}|17HT${year})"
components="(LAB[123]|MAT1|KAL1)"

canvaslms results -c "$courses" -A "$components" \
| sed -E "s/ ?[HV]T[0-9]{2}( \(.*\))?//" \
| ladok report -fv
```

But now we'll have a look at how we can do this (well, a simpler version) in Python.

3.1 Overview

We want to get results out of Canvas and put them into LADOK. We want to take each assignment group in Canvas and map into a course component in LADOK. *Assumption*: we assume that all assignments in the Canvas course instance are grouped; and each group must map exactly to the names of the LADOK components.

The course components in LADOK (and assignment groups in Canvas) for the DD1315 course are

- LAB1,
- LAB2,
- LAB3,

- MAT1[1].

[1] URL: https://www.kth.se/student/kurser/kurs/DD1315

The LAB3 component corresponds to a project. In Canvas, it has P/F assignments (e.g., presentation) and one A–F assignment (the project itself). The component grade is based on the project itself, but the other assignments each must have a P too.

For now we will ignore setting the grade on the full course.

When running the program we must be able to access LADOK and Canvas:

- For LADOK, the program reuses the `ladok` command's cached session through `ladok3.session`, so it suffices to run `ladok login` once. Where no cache or keyring is available (e.g., in Docker), set the `LADOK_INST`, `LADOK_USER` and `LADOK_PASS` environment variables, which `ladok3.session` understands as well.
- `CANVAS_SERVER` and `CANVAS_TOKEN` to point to the Canvas server to use and a token to authenticate.

We provide a Docker image for running this program.

3.1.1 Building files

We provide the following files:

- ⟨*canvas2ladok.mk* 21⟩.
- ⟨*Dockerfile* 22a⟩,
- ⟨*canvas2ladok.py* (never defined)⟩,

We provide an include file for GNU make to build all the targets.

21 ⟨*canvas2ladok.mk* 21⟩≡

```
.PHONY: all
all: canvas2ladok.py canvas2ladok

.PHONY: canvas2ladok
canvas2ladok: canvas2ladok.py Dockerfile
  docker build -t canvas2ladok .

Dockerfile: canvas2ladok.nw
  ${NOTANGLE}

.PHONY: clean
clean:
  ${RM} canvas2ladok.pdf canvas2ladok.py
  ${RM} Dockerfile canvas2ladok.mk

.PHONY: distclean
distclean:
  -docker image rm canvas2ladok
```

Root chunk (not used in this document).
Defines:
`all`, used in chunk 22b.
`canvas2ladok`, used in chunk 22a.
`clean`, never used.
`distclean`, never used.
`Dockerfile`, never used.

The Docker image will just contain the `canvas2ladok.py` file and run it by default.

22a ⟨*Dockerfile* 22a⟩≡
```
FROM dbosk/ladok3

RUN pip install --no-cache-dir canvasapi
COPY canvas2ladok.py ./

CMD ["python", "./canvas2ladok.py"]
```
Root chunk (not used in this document).
Uses `canvas2ladok` 21.

3.2 `canvas2ladok.py`: configuration and dependencies

We use the standard structure for the script. We start with the imports and set up our `ladok` and `canvas` objects, these are used to access the two systems.

22b ⟨`canvas2ladok.py` 22b⟩≡
```
import cachetools
from canvasapi import Canvas
import collections
import datetime
import ladok3
import os
import re

ladok = ladok3.session

API_URL = os.environ["CANVAS_SERVER"]
API_KEY = os.environ["CANVAS_TOKEN"]

canvas = Canvas(API_URL, API_KEY)

course_code_ladok = "DD1315"
# We match all course round HT20 and onwards
course_code_canvas = "DD1315[HV]T[2-9][0-9]"
components = [
  "LAB1",
  "LAB2",
  "LAB3",
  "MAT1"
]

⟨classes 25a⟩
⟨functions 23a⟩
```

```
28
29  def main():
30    ⟨main body 24b⟩
31
32  if __name__ == "__main__":
33    main()
```

Root chunk (not used in this document).
Defines:
`API_KEY`, never used.
`API_URL`, never used.
`canvas`, used in chunk 23a.
`components`, used in chunks 23b, 181, 184, 199–201, 204, 207b, 212b, 214, 219–21, 223, 224, 226, 227, 229, 234, and 235b.
`course_code_canvas`, used in chunk 24b.
`course_code_ladok`, used in chunk 24b.
`ladok`, used in chunks 24c, 27, and 1547.
`main`, used in chunk 43.
Uses `all` 21.

3.3 Getting the results out of Canvas

We must first select the course. We do this my matching against a regular expression.

23a ⟨*functions* 23a⟩≡

```
1  @cachetools.cached(cache={})
2  def get_courses(code):
3    pattern = re.compile(code)
4
5    for course in canvas.get_courses():
6      if pattern.match(course.course_code):
7        yield course
8
9    return None
```

This definition is continued in chunks 23–26.
This code is used in chunk 22b.
Defines:
`get_courses`, used in chunk 24b.
Uses `canvas` 22b.

We must process each assignment group (which corresponds to a LADOK component). So we get all relevant objects from Canvas.

23b ⟨*functions* 23a⟩+≡

```
1  def get_components(course):
2    for component in course.get_assignment_groups():
3      if component.name in components:
4        yield component
```

This code is used in chunk 22b.
Defines:
`get_components`, used in chunk 24b.
Uses `components` 22b 179 210.

For each component, we must check which students passed all assignments; we must report the student's LADOK identifier, what grade they should have and the time of submission of the assignment.

24a ⟨*functions* 23a⟩+≡

```
def students_results(course, component):
    ⟨produce results for a component 27⟩
```

This code is used in chunk 22b.
Defines:
`students_results`, used in chunk 24b.

We cover the details in Section 3.6, once we've covered what LADOK needs in Section 3.5.

3.4 The main body

Then we can report those results to LADOK. In summary, we do the following:

24b ⟨*main body* 24b⟩≡

```
for course in get_courses(course_code_canvas):
  for component in get_components(course):
    print(f"{course.course_code} {component.name}")
    component_results = students_results(course, component)
    report_results(course_code_ladok, component.name, component_results)
```

This code is used in chunk 22b.
Uses `course_code_canvas` 22b, `course_code_ladok` 22b, `get_components` 23b, `get_courses` 23a, `report_results` 24c, and `students_results` 24a.

3.5 Putting the results into LADOK

We get a list of results for a component. We simply try to report them to LADOK.

24c ⟨*functions* 23a⟩+≡

```
def report_results(course_code, component_name, results):
  for result in results:
    try:
      student = ladok.get_student(result.person_nr)
      course = student.courses(code=course_code)[0]
      component = course.results(component=component_name)[0]
      if not component.attested:
        component.set_grade(result.grade, result.date)
        component.finalize()
      elif component.grade != result.grade:
        print(f"{student}: attested {component.component} "
          f"result {component.grade} is different from {result.grade}.")
    except Exception as err:
      try:
        print(f"{student}: {err}")
      except ValueError as verr:
        print(f"{verr}: {result.person_nr}: {err}")
```

This code is used in chunk 22b.
Defines:
`report_results`, used in chunk 24b.
Uses `ladok` 22b 1540.

3.6 Producing the list of results

We need the result to have the following data:

25a ⟨*classes* 25a⟩≡
```
Result = collections.namedtuple(
  "Result", ["person_nr", "date", "grade", "grade_scale"])
```
This definition is continued in chunk 25b.
This code is used in chunk 22b.
Defines:
`Result`, used in chunk 27.

Now, given a `component`, we should produce such `Result` tuples.

3.6.1 Produce gradebook

To do this, we must first produce a gradebook that we can filter. The gradebook will use the simpler `Grade` tuple. It will use the student's LADOK ID as the key.

25b ⟨*classes* 25a⟩+≡
```
Grade = collections.namedtuple("Grade", ["grade", "date"])
```
This code is used in chunk 22b.
Defines:
`Grade`, used in chunks 25c, 26b, 127a, 138c, 139a, 148, 150c, and 230.

To create the gradebook, we will first fetch all the users and then fetch all the submissions. Then we will map them together. This way we only need two requests to Canvas, instead of one per user.

25c ⟨*functions* 23a⟩+≡
```
def make_gradebook(course, component):
  gradebook = {}

  users_by_id = {}
  for user in course.get_users(enrollment_type=["student"]):
    users_by_id[user.id] = user
    gradebook[user.integration_id] = {}

  for assignment in assignments_in_component(course, component):
    for submission in assignment.get_submissions():
      try:
        user = users_by_id[submission.user_id].integration_id
      except KeyError:
        # This only happens for the Test Student
        continue

      if not submission.graded_at:
        gradebook[user][assignment.name] = None
        continue

      date = submission.submitted_at or submission.graded_at
      date = datetime.date.fromisoformat(date.split("T")[0]) or None
      graded_date = datetime.date.fromisoformat(
        submission.graded_at.split("T")[0])
      if date > graded_date:
```

```
26          date = graded_date
27
28        gradebook[user][assignment.name] = \
29          Grade(grade=submission.grade, date=date)
30
31    return gradebook
```

This code is used in chunk 22b.
Defines:
make_gradebook, used in chunk 27.
Uses assignments_in_component 26a, Grade 25b 149, and gradebook 27.

Note that for some users, we won't get any submission. And for some other users, we get a submission with no grade and no date.

We the component object doesn't give the assignments it include. We must check each assignment if it belongs to the component or not.

26a ⟨*functions* 23a⟩+≡

```
def assignments_in_component(course, component):
  return filter(
    lambda assignment: assignment.assignment_group_id == component.id,
    course.get_assignments())
```

This code is used in chunk 22b.
Defines:
assignments_in_component, used in chunk 25c.

3.6.2 Assignment grades to component grade

Next, we must filter the gradebook so that only the students who passed all assignments are reported to LADOK with a pass. A student must pass all assignments, the latest date sets the date to use in LADOK. *Assumption:* If some assignments are P/F and some are A–F, then the A–F one should be the grade. There will not be more than one A–F assignment per component.

26b ⟨*functions* 23a⟩+≡

```
def summarize(grades):
  max_grade = "P"
  grade_scale = "PF"
  max_date = datetime.date(year=1970, month=1, day=1)
  for _, grade in grades.items():
    if grade is None or grade.grade is None or grade.grade[0] == "F":
      return None

    if grade.date > max_date:
      max_date = grade.date

    if grade.grade in "ABCDE":
      max_grade = grade.grade
      grade_scale = "AF"

  return (Grade(grade=max_grade, date=max_date), grade_scale)
```

This code is used in chunk 22b.
Defines:
summarize, used in chunk 27.
Uses Grade 25b 149.

3.6.3 Convert to LADOK result form

Lastly, we must put these things together and convert the result to the `Result` format that we need.

27 ⟨*produce results for a component* 27⟩≡

```
to_report = []
gradebook = make_gradebook(course, component)

for ladok_id, grades in gradebook.items():
  try:
    grade, grade_scale = summarize(grades)
  except TypeError as err:
    # Only happens for students who are not done
    continue

  to_report.append(Result(
    person_nr=ladok.get_student(ladok_id).personnummer,
    grade=grade.grade,
    grade_scale=grade_scale,
    date=grade.date))

return to_report
```

This code is used in chunk 24a.
Defines:
`gradebook`, used in chunk 25c.
`to_report`, never used.
Uses `ladok` 22b 1540, `make_gradebook` 25c, `Result` 25a, and `summarize` 26b.

3.7 The script as a whole

```
import cachetools
from canvasapi import Canvas
import collections
import datetime
import ladok3
import os
import re

ladok = ladok3.session

API_URL = os.environ["CANVAS_SERVER"]
API_KEY = os.environ["CANVAS_TOKEN"]

canvas = Canvas(API_URL, API_KEY)

course_code_ladok = "DD1315"
# We match all course round HT20 and onwards
course_code_canvas = "DD1315[HV]T[2-9][0-9]"
components = ["LAB1", "LAB2", "LAB3", "MAT1"]

Result = collections.namedtuple("Result", ["person_nr", "date", "grade", "grade_scale"])
```

```
22  Grade = collections.namedtuple("Grade", ["grade", "date"])
23
24
25  @cachetools.cached(cache={})
26  def get_courses(code):
27      pattern = re.compile(code)
28
29      for course in canvas.get_courses():
30          if pattern.match(course.course_code):
31              yield course
32
33      return None
34
35
36  def get_components(course):
37      for component in course.get_assignment_groups():
38          if component.name in components:
39              yield component
40
41
42  def students_results(course, component):
43      to_report = []
44      gradebook = make_gradebook(course, component)
45
46      for ladok_id, grades in gradebook.items():
47          try:
48              grade, grade_scale = summarize(grades)
49          except TypeError as err:
50              # Only happens for students who are not done
51              continue
52
53          to_report.append(
54              Result(
55                  person_nr=ladok.get_student(ladok_id).personnummer,
56                  grade=grade.grade,
57                  grade_scale=grade_scale,
58                  date=grade.date,
59              )
60          )
61
62      return to_report
63
64
65  def report_results(course_code, component_name, results):
66      for result in results:
67          try:
68              student = ladok.get_student(result.person_nr)
69              course = student.courses(code=course_code)[0]
70              component = course.results(component=component_name)[0]
71              if not component.attested:
72                  component.set_grade(result.grade, result.date)
```

```
                component.finalize()
            elif component.grade != result.grade:
                print(
                    f"{student}: attested {component.component} "
                    f"result {component.grade} is different from {result.grade}."
                )
        except Exception as err:
            try:
                print(f"{student}: {err}")
            except ValueError as verr:
                print(f"{verr}: {result.person_nr}: {err}")


def make_gradebook(course, component):
    gradebook = {}

    users_by_id = {}
    for user in course.get_users(enrollment_type=["student"]):
        users_by_id[user.id] = user
        gradebook[user.integration_id] = {}

    for assignment in assignments_in_component(course, component):
        for submission in assignment.get_submissions():
            try:
                user = users_by_id[submission.user_id].integration_id
            except KeyError:
                # This only happens for the Test Student
                continue

            if not submission.graded_at:
                gradebook[user][assignment.name] = None
                continue

            date = submission.submitted_at or submission.graded_at
            date = datetime.date.fromisoformat(date.split("T")[0]) or None
            graded_date = datetime.date.fromisoformat(
                submission.graded_at.split("T")[0]
            )
            if date > graded_date:
                date = graded_date

            gradebook[user][assignment.name] = Grade(grade=submission.grade, date=date)

    return gradebook


def assignments_in_component(course, component):
    return filter(
        lambda assignment: assignment.assignment_group_id == component.id,
        course.get_assignments(),
    )
```

```
124
125
126 def summarize(grades):
127     max_grade = "P"
128     grade_scale = "PF"
129     max_date = datetime.date(year=1970, month=1, day=1)
130     for _, grade in grades.items():
131         if grade is None or grade.grade is None or grade.grade[0] == "F":
132             return None
133
134         if grade.date > max_date:
135             max_date = grade.date
136
137         if grade.grade in "ABCDE":
138             max_grade = grade.grade
139             grade_scale = "AF"
140
141     return (Grade(grade=max_grade, date=max_date), grade_scale)
142
143
144 def main():
145     for course in get_courses(course_code_canvas):
146         for component in get_components(course):
147             print(f"{course.course_code} {component.name}")
148             component_results = students_results(course, component)
149             report_results(course_code_ladok, component.name, component_results)
150
151
152 if __name__ == "__main__":
153     main()
```

Part II

The command-line interface

Chapter 4

The base interface

This is the documentation of the command-line interface module (`cli`) of the `ladok3` package, ⟨*cli.py* (never defined)⟩.

The command-line interface is divided into subcommands, similar to Git. Currently, we provide the following commands:

data The command outputs all results for all rounds of a course in CSV format.

4.1 Overview of the source code and dependencies

We use `argparse` with `argcomplete` to handle the command-line interface. We use `appdirs` to handle configuration directories on various systems, we set up a global `dirs` that we can use.

32 ⟨cli.py 32⟩≡

```
#!/bin/env python3
"""A command-line interface for LADOK 3"""

import appdirs
import argcomplete, argparse
import base64
from cryptography.fernet import Fernet
from cryptography.hazmat.primitives import hashes
from cryptography.hazmat.primitives.kdf.pbkdf2 import PBKDF2HMAC
import getpass
import io
import json
import keyring
import ladok3
import logging
import os
import pickle
import re
import sys
import traceback
import weblogin
import weblogin.ladok
import weblogin.seamlessaccess as sa
```

```
24
25  ⟨modules 60a⟩
26
27  dirs = appdirs.AppDirs("ladok", "dbosk@kth.se")
28  logger = logging.getLogger(__name__)
29
30  ⟨functions 33b⟩
31  ⟨command-line interface 33a⟩
```

Root chunk (not used in this document).
Defines:
`dirs`, used in chunks 38b, 43, 46b, 48b, 51b, and 59b.
`logger`, used in chunks 33b, 63a, 89c, 92, 93, 98, 99, and 102–104.
Uses `kdf` 45.

4.2 A command-line interface

The idea is that we have the basic command that can take some options and ultimately some subcommand. The subcommands do the heavy lifting. We use a standard Pythonic if-main construction.

33a ⟨command-line interface 33a⟩≡

```
def main():
  """Run the command-line interface for the ladok command"""
  ⟨process command-line options 34a⟩

if __name__ == "__main__":
  try:
    main()
    sys.exit(0)
  except Exception as e:
    err(-1, e)
```

This code is used in chunk 32.
Defines:
`main`, used in chunk 43.
Uses `err` 33b.

We want uniform error handling. We keep the BSD-inspired `err` and `warn` names, but their bodies now delegate to the `logging` module configured below. Two reasons for keeping the names rather than calling `logger.warning` at every call site directly:

(1) Test suites already monkey-patch `warn` to capture diagnostics (e.g. `monkeypatch.setattr(ladok3.cli, "warn", warnings.append)` in this file and in `data.nw`); preserving the symbol keeps those tests working unchanged.

(2) `err` still needs to combine a log message with `sys.exit` in one call, which is awkward to express at every call site.

We drop the `sys.argv[0]:` prefix that the old bodies prepended by hand—the level name now comes from the `logging.basicConfig` format string, and the program name from the shell's process listing.

33b ⟨functions 33b⟩≡

```
def err(rc, msg):
```

```
    """Log an error message and exit with the given return code.

    Args:
        rc (int): Return code to exit with.
        msg (str): Error message to display.
    """
    logger.error(msg)
    sys.exit(rc)

  def warn(msg):
    """Log a warning message.

    Args:
        msg (str): Warning message to display.
    """
    logger.warning(msg)
```

This definition is continued in chunks 34b, 36, 38b, 39, 48b, 50b, 53a, 54c, 56a, and 59b.
This code is used in chunk 32.
Defines:
  `err`, used in chunks 33a, 37b, 53, 54b, and 59b.
  `warn`, used in chunks 39, 41, 43, 46b, 48a, 57b, 65, and 73b.
Uses `logger` 32 62 85.

4.2.1 Process command-line options

The main part done here is to set up a `LadokSession` object `ls`. We can do this in two ways: (1) create a new object using the user's credentials to log in; or (2) restore the `ls` object from a previous run.

We'll use `argparse` to parse the command-line options.

34a ⟨*process command-line options* 34a⟩≡

```
  argp = make_argument_parser()
  argcomplete.autocomplete(argp)
  args = argp.parse_args()
  ⟨configure logging based on verbose flag 50a⟩
  ⟨execute early commands that do not need ls 35a⟩
  ⟨create or restore the LadokSession ls 37b⟩
  ⟨execute subcommand 35b⟩
  ⟨save LadokSession ls 38a⟩
```

This code is used in chunk 33a.
Defines:
  `argp`, used in chunks 34b and 49.
  `args`, used in chunks 35, 37b, 39, 43, 50a, 53a, and 59b.
Uses `make_argument_parser` 34b.

We build the parser in a function of its own rather than inline in `main`. Then a test can parse a real command line with exactly the parser that `main` uses, global options and subcommands included, without logging in to LADOK. That matters where the two levels interact, as when a subcommand accepts an option that the top-level parser also has (Section 6.2.1).

34b ⟨*functions* 33b⟩+≡

```
  def make_argument_parser():
    """Return the argument parser of the `ladok` command, with all
```

```
    subcommands added."""
    argp = argparse.ArgumentParser(
      description="This is a CLI-ification of LADOK3's web GUI.",
      epilog="Copyright (c) 2020 Alexander Baltatzis, "
             "Gerald Q. Maguire Jr.;\n"
             "              2021--2026 Daniel Bosk;\n"
             "              2026 Christian Ohm.\n"
             "Licensed under MIT. "
             "Web: https://github.com/dbosk/ladok3"
    )
    ⟨add global configuration options 49a⟩
    subp = argp.add_subparsers(
      title="commands",
      dest="command",
      required=True
    )
    ⟨add subparsers to subp 52a⟩
    return argp
```

This code is used in chunk 32.
Defines:
`make_argument_parser`, used in chunk 34a.
Uses `argp` 34a.

For each subcommand, we will add a subparser (`subp.add_parser`) that will set the `func` attribute. Then we can execute the correct function and let that function check the remaining arguments. We must also pass on a LADOK session object `ls`.

We note, however, that some subcommands (like `cache` or `login`) don't need the `ls`. The command `login` in particular must run before the `ls` object can be constructed, because its job is to gather credentials when none exist yet. The `cache clear` subcommand should also work even when cache restore is what is currently broken, so we dispatch both commands before touching the cached session. For the remaining commands, we can create the `ls` object with `None` for credentials; the failure will not happen until we make the first request.

35a ⟨*execute early commands that do not need* `ls` 35a⟩≡

```
  if args.command == "login":
    args.func(None, args)
    return

  if args.command == "cache" and args.subcommand == "clear":
    clear_cache(None, args)
    return

```

This code is used in chunk 34a.
Uses `args` 34a and `clear_cache` 59b.

35b ⟨*execute subcommand* 35b⟩≡

```
  if "func" in args:
    args.func(ls, args)
```

This code is used in chunk 34a.
Uses `args` 34a.

4.3 Create the LadokSession `ls`

We have several options for creating the LadokSession object `ls` that must be passed to the subcommand:

(1) The first one is to read the user's credentials (from the keyring, environment or configuration) and create the `ls` object by instantiating the `LadokSession` class.

(2) Read a pickled `LadokSession` object from file.

The second option allows us to save time by not having to reestablish an authenticated session to LADOK. The authentication step takes much more time than individual LADOK requests.

We want to handle authentication for all universities. This means that we must keep track of two things, the institution and the user's credentials[1] at that institution. When we create the LADOK session object, we must supply those credentials to the `weblogin.ladok.SSOlogin` login handler.

[1] Which is usually a username and a password.

This leads to the following approach. `LADOK_INST` is simply a string identifying the institution at SeamlessAccess.org (see documentation of `weblogin`) and `LADOK_VARS` is a dictionary where the keys map to variable names and the values should be substituted in the login forms (see documentation of `weblogin`). We use `LADOK_VARS` as credentials, since it contains the credentials.

The session lifecycle—load credentials, try to restore a cached session, fall back to a fresh `LadokSession`—is shared with the module-level `ladok3.session` and `ladok3.test_session` attributes. We cannot have the CLI use `ladok3.session` directly, because the CLI needs to pass a custom `config_file` path and because the `login` command must work even without credentials. Instead, we factor the shared lifecycle into `get_session`, which both the CLI and `ladok3.session` call.

When no config file is given we fall back to the same default path as the argument parser (`default_config_file`, see the configuration section). An earlier version passed `None` straight into `load_credentials`, whose `open(None)` failed and was silently swallowed there: the module-level `ladok3.session` never saw the configuration file even though the `ladok` command did. Defaulting here rather than in `load_credentials` keeps that function's old cwd-relative default intact for external callers.

36 ⟨*functions* 33b⟩+≡

```
def get_session(config_file=None):
  """Load or create a LadokSession from available credentials.

  Tries to restore a cached session first; if unavailable, creates a fresh
  one from credentials. Returns a tuple of (session, credentials).

  Args:
      config_file (str or None): Path to configuration file, or None for
          the default path (see `default_config_file`).

  Returns:
      tuple: (LadokSession, credentials) where credentials is a dict.

  Raises:
```

```
        ValueError: If the credentials are missing.
    """
    if config_file is None:
      config_file = default_config_file()
    institution, credentials = load_credentials(config_file)
    session = restore_ladok_session(credentials)
    if not session:
      session = ladok3.LadokSession(institution, vars=credentials)
    return session, credentials
```

This code is used in chunk 32.
Defines:
`get_session`, used in chunks 37 and 43.
Uses `default_config_file` 48b, `institution` 54a, `load_credentials` 56a, and `restore_ladok_session` 38b.

Let's verify that `get_session` resolves the default config path and still honours an explicit one.

37a ⟨*test functions* 37a⟩≡

```
def test_get_session_defaults_config_file(monkeypatch):
  recorded = {}

  def fake_load_credentials(filename):
    recorded["filename"] = filename
    return ("Inst", {"username": "u", "password": "p"})

  monkeypatch.setattr(ladok3.cli, "load_credentials",
                      fake_load_credentials)
  monkeypatch.setattr(ladok3.cli, "restore_ladok_session",
                      lambda credentials: "fake session")

  session, credentials = ladok3.cli.get_session()
  assert recorded["filename"] == ladok3.cli.default_config_file()
  assert session == "fake session"

  ladok3.cli.get_session("/tmp/other.json")
  assert recorded["filename"] == "/tmp/other.json"
```

This definition is continued in chunks 43, 46b, 48a, and 51a.
This code is used in chunk 42.
Defines:
`test_get_session_defaults_config_file`, never used.
Uses `default_config_file` 48b, `get_session` 36, `load_credentials` 56a, and `restore_ladok_session` 38b.

The CLI calls `get_session` with the user-supplied config file path. We catch `ValueError` separately because it means that the credentials are missing, which the user must fix (see `ladok login`). A cached session that cannot be decrypted is no such error: we warn and log in afresh, see Section 4.3.1.

37b ⟨*create or restore the LadokSession ls* 37b⟩≡

```
try:
  ls, LADOK_VARS = get_session(args.config_file)
except ValueError as error:
  err(-1, f"Couldn't restore LADOK session: {error}")
```

This code is used in chunk 34a.
Uses `args` 34a, `err` 33b, and `get_session` 36.

38a ⟨*save LadokSession ls* 38a⟩≡

```
store_ladok_session(ls, LADOK_VARS)
```

This code is used in chunk 34a.
Uses `store_ladok_session` 38b.

4.3.1 Saving and restoring the `LadokSession` object

Now we need to implement the `store_ladok_session` and `restore_ladok_session` functions. We will use `pickle` for storing and restoring the object. But we also want to encrypt the stored object using authenticated encryption. That way, we know that we can trust the pickle (which is otherwise a problem).

38b ⟨*functions* 33b⟩+≡

```
def store_ladok_session(ls, credentials):
  """Store a LadokSession object to disk with encryption.

  Saves the session object as an encrypted pickle file in the user's cache directory.
  The credentials are used to derive an encryption key for security.

  Args:
      ls (LadokSession): The session object to store.
      credentials (tuple): Tuple of (institution, vars) used for key derivation.

  Raises:
      ValueError: If credentials are missing or invalid.
  """
  if not os.path.isdir(dirs.user_cache_dir):
    os.makedirs(dirs.user_cache_dir)

  file_path = dirs.user_cache_dir + "/LadokSession"

  pickled_ls = pickle.dumps(ls)
  ⟨encrypt pickled ls 41a⟩

  with open(file_path, "wb") as file:
    file.write(encrypted_ls)

def restore_ladok_session(credentials):
  """Restore a LadokSession object from disk.

  Attempts to load and decrypt a previously stored session object. Returns None
  if no cached session exists or decryption fails.

  Args:
      credentials (tuple): Tuple of (institution, vars) used for key derivation.

  Returns:
      LadokSession or None: The restored session object, or None if unavailable.
  """
  file_path = dirs.user_cache_dir + "/LadokSession"

```

```
    if os.path.isfile(file_path):
      with open(file_path, "rb") as file:
        encrypted_ls = file.read()
        ⟨decrypt encrypted ls 41b⟩
        if pickled_ls:
          ⟨restore pickled ls 41c⟩

    return None
```

This code is used in chunk 32.
Defines:
`restore_ladok_session`, used in chunks 36, 37a, 43, 46b, and 48a.
`store_ladok_session`, used in chunks 38a, 43, 46b, and 48a.
Uses `dirs` 32, `encrypted_ls` 41a, `institution` 54a, and `key` 45.

We don't want to only encrypt the object, we also want to provide integrity for the object. This is to avoid any vulnerabilities with `pickle`. We use the `cryptography` module to handle the encryption. In particular, we use the `cryptography.fernet` protocol which encrypts using AES and signs using HMAC.

One complication remains: a cached session may contain handlers defined in optional packages such as `kthutils`. When the current environment does not have that package installed, a plain `pickle.loads()` aborts before we can even inspect the session. We still want the rest of the cached session—most importantly the cookies—so we retry with a tolerant unpickler that substitutes unknown non-core classes with placeholder handlers. After unpickling we drop those placeholders and warn, so the restored session can be repickled without depending on unavailable modules.

```
⟨functions 33b⟩+≡
class DroppedAutologinHandler(weblogin.AutologinHandler):
  """Placeholder for cached handlers from unavailable optional modules."""

  missing_module = None
  missing_name = None

  def login(self, session, response, args=None, kwargs=None):
    return response

  def need_login(self, response):
    return False


_DROPPED_HANDLER_CLASSES = {}


def dropped_handler_class(module, name):
  """Return a placeholder class for an unavailable cached handler."""
  key = (module, name)
  if key not in _DROPPED_HANDLER_CLASSES:
    safe_name = re.sub(r"\W+", "_", f"{module}_{name}")
    _DROPPED_HANDLER_CLASSES[key] = type(
      f"Dropped_{safe_name}",
      (DroppedAutologinHandler,),
      {"missing_module": module, "missing_name": name})
```

```
    return _DROPPED_HANDLER_CLASSES[key]


class TolerantCacheUnpickler(pickle.Unpickler):
    """Unpickler that tolerates unavailable optional handler classes."""

    CORE_MODULE_PREFIXES = ("ladok3", "weblogin")

    def find_class(self, module, name):
        try:
            return super().find_class(module, name)
        except (AttributeError, ImportError, ModuleNotFoundError):
            if any(module == prefix or module.startswith(f"{prefix}.")
                   for prefix in self.CORE_MODULE_PREFIXES):
                raise
            return dropped_handler_class(module, name)


def tolerant_pickle_loads(data):
    """Load pickle data while replacing unavailable optional handlers."""
    return TolerantCacheUnpickler(io.BytesIO(data)).load()


def drop_unimportable_handlers(ls):
    """Drop placeholder handlers added during tolerant cache restore."""
    try:
        handlers = ls.session._AutologinSession__handlers
    except AttributeError:
        return []

    kept_handlers = []
    dropped_handlers = []
    for handler in handlers:
        if isinstance(handler, DroppedAutologinHandler):
            missing = f"{handler.missing_module}.{handler.missing_name}"
            warn(f"dropped cached handler {missing}: module unavailable")
            dropped_handlers.append(missing)
        else:
            kept_handlers.append(handler)
    handlers[:] = kept_handlers
    return dropped_handlers
```

This code is used in chunk 32.
Defines:
_DROPPED_HANDLER_CLASSES, never used.
drop_unimportable_handlers, used in chunks 41c and 43.
dropped_handler_class, used in chunk 43.
DroppedAutologinHandler, used in chunk 43.
tolerant_pickle_loads, used in chunks 41c and 43.
TolerantCacheUnpickler, never used.
Uses args 34a, key 45, and warn 33b 63a.

We will use the user's LADOK password to generate a cryptographic key. Then we do the encryption/decryption.

41a ⟨*encrypt pickled ls* 41a⟩≡

```
⟨set up kdf and derive key from credentials 45⟩

fernet_protocol = Fernet(key)
encrypted_ls = fernet_protocol.encrypt(pickled_ls)
```

This code is used in chunk 38b.
Defines:
`encrypted_ls`, used in chunks 38b and 41b.
`fernet_protocol`, never used.
Uses `key` 45.

Decryption can fail, and then we warn and treat the cache as missing, so the caller logs in afresh. Fernet verifies a token before decrypting it and raises `InvalidToken` if that fails. It deliberately does not say why: a key derived from other credentials and a damaged file look the same. So the warning cannot say which of the two happened, but we keep it, so that a cache that keeps failing gets noticed rather than silently costing a login on every run. `InvalidToken` carries no message, so formatting `error` alone left the warning ending in a bare colon. When the message is empty we print the exception's class name instead. We still print the message when there is one: we catch any exception here, and only `InvalidToken` is known to have none.

41b ⟨*decrypt encrypted ls* 41b⟩≡

```
⟨set up kdf and derive key from credentials 45⟩

fernet_protocol = Fernet(key)
try:
  pickled_ls = fernet_protocol.decrypt(encrypted_ls)
except Exception as error:
  warn("cache was corrupted, cannot decrypt: "
       f"{str(error) or type(error).__name__}")
  pickled_ls = None

```

This code is used in chunk 38b.
Defines:
`fernet_protocol`, never used.
Uses `encrypted_ls` 41a, `key` 45, and `warn` 33b 63a.

41c ⟨*restore pickled ls* 41c⟩≡

```
try:
  return pickle.loads(pickled_ls)
except (AttributeError,
        ImportError,
        ModuleNotFoundError,
        pickle.UnpicklingError) as error:
  warn("cache refers to unavailable optional classes, retrying without "
       f"those handlers: {error}")
  ls = tolerant_pickle_loads(pickled_ls)
  drop_unimportable_handlers(ls)
  return ls
```

This code is used in chunk 38b.
Uses `drop_unimportable_handlers` 39, `tolerant_pickle_loads` 39, and `warn` 33b 63a.

Let's verify that the tolerant restore path preserves the cache when an optional handler class is unavailable, while still leaving core missing classes as hard failures. To get a cache that refers to a missing module, we make a handler class importable under that module's name, store a session holding it, and then remove the module again before we restore. The cache goes through the real encryption, in a temporary directory.

We also verify that the commands dispatched before session creation really bypass `get_session`.

42 ⟨*test* `cli.py` 42⟩≡

```
import argparse
import contextlib
import io
import logging
import pickle
import sys
import types

import pytest

import ladok3
import ladok3.cli


class RestorableHandler:
  def __init__(self, value):
    self.value = value


@contextlib.contextmanager
def importable_handler(module_name):
  """Make a handler class importable from `module_name` while active.

  Yields a subclass of `RestorableHandler` that pickles as
  `module_name.RestorableHandler`.  Afterwards the module is gone again,
  as in an environment where the optional package isn't installed.
  """
  handler_class = type("RestorableHandler", (RestorableHandler,),
                       {"__module__": module_name})
  parts = module_name.split(".")
  names = [".".join(parts[:i]) for i in range(1, len(parts) + 1)]
  saved = {name: sys.modules.get(name) for name in names}
  for name in names:
    if saved[name] is None or name == module_name:
      sys.modules[name] = types.ModuleType(name)
  sys.modules[module_name].RestorableHandler = handler_class
  try:
    yield handler_class
  finally:
    for name in names:
      if saved[name] is None:
```

```
42          del sys.modules[name]
43        else:
44          sys.modules[name] = saved[name]
45
46
47  class FakeSession:
48    def __init__(self, handlers=None):
49      self._AutologinSession__handlers = list(handlers or [])
50
51
52  class FakeLadokSession:
53    def __init__(self, handlers=None):
54      self.session = FakeSession(handlers)
55
56
57  ⟨test functions 37a⟩
```

Root chunk (not used in this document).
Defines:
`FakeLadokSession`, used in chunk 43.
`FakeSession`, never used.
`importable_handler`, used in chunk 43.
`RestorableHandler`, used in chunk 43.

```
43  ⟨test functions 37a⟩+≡
1   def test_tolerant_pickle_loads_replaces_missing_optional_handlers():
2     with importable_handler("optional.handlers") as handler_class:
3       payload = pickle.dumps(FakeLadokSession([handler_class("cached")]))
4
5     restored = ladok3.cli.tolerant_pickle_loads(payload)
6
7     handler = restored.session._AutologinSession__handlers[0]
8     assert isinstance(handler, ladok3.cli.DroppedAutologinHandler)
9     assert handler.missing_module == "optional.handlers"
10    assert handler.missing_name == "RestorableHandler"
11
12
13  def test_tolerant_pickle_loads_keeps_core_failures():
14    with importable_handler("ladok3.missing") as handler_class:
15      payload = pickle.dumps(FakeLadokSession([handler_class("cached")]))
16
17    with pytest.raises(ModuleNotFoundError):
18      ladok3.cli.tolerant_pickle_loads(payload)
19
20
21  def test_drop_unimportable_handlers_warns_and_prunes(monkeypatch):
22    dropped = ladok3.cli.dropped_handler_class(
23      "optional.handlers", "RestorableHandler")()
24    kept = RestorableHandler("kept")
25    ls = FakeLadokSession([kept, dropped])
26    warnings = []
27
28    monkeypatch.setattr(ladok3.cli, "warn", warnings.append)
```

```
29
30    dropped_handlers = ladok3.cli.drop_unimportable_handlers(ls)
31
32    assert dropped_handlers == ["optional.handlers.RestorableHandler"]
33    assert ls.session._AutologinSession__handlers == [kept]
34    assert warnings == [
35      "dropped cached handler optional.handlers.RestorableHandler: "
36      "module unavailable"
37    ]
38
39
40  def test_restore_ladok_session_retries_with_tolerant_unpickler(monkeypatch,
41                                                                  tmp_path):
42    credentials = {"username": "alice", "password": "secret"}
43    warnings = []
44    monkeypatch.setattr(ladok3.cli, "dirs",
45                        types.SimpleNamespace(user_cache_dir=str(tmp_path)))
46    monkeypatch.setattr(ladok3.cli, "warn", warnings.append)
47
48    with importable_handler("optional.handlers") as handler_class:
49      ladok3.cli.store_ladok_session(
50        FakeLadokSession([handler_class("cached")]), credentials)
51
52    ls = ladok3.cli.restore_ladok_session(credentials)
53
54    assert ls.session._AutologinSession__handlers == []
55    assert len(warnings) == 2
56    assert warnings[0].startswith(
57      "cache refers to unavailable optional classes, retrying without "
58      "those handlers: ")
59    assert warnings[1] == (
60      "dropped cached handler optional.handlers.RestorableHandler: "
61      "module unavailable")
62
63
64  def test_main_runs_login_before_restoring_session(monkeypatch):
65    called = []
66
67    monkeypatch.setattr(ladok3.cli.argcomplete, "autocomplete",
68                        lambda parser: None)
69    monkeypatch.setattr(ladok3.cli.sys, "argv", ["ladok", "login"])
70    monkeypatch.setattr(ladok3.cli,
71                        "update_credentials_in_keyring",
72                        lambda ls, args: called.append((ls, args.command)))
73
74    def fail_get_session(config_file=None):
75      raise AssertionError("get_session should not run")
76
77    monkeypatch.setattr(ladok3.cli, "get_session", fail_get_session)
78
79    ladok3.cli.main()
```

```
80
81    assert called == [(None, "login")]
82
83
84  def test_main_clears_cache_before_restoring_session(monkeypatch):
85    called = []
86
87    monkeypatch.setattr(ladok3.cli.argcomplete, "autocomplete",
88                        lambda parser: None)
89    monkeypatch.setattr(ladok3.cli.sys,
90                        "argv",
91                        ["ladok", "cache", "clear"])
92    monkeypatch.setattr(ladok3.cli,
93                        "clear_cache",
94                        lambda ls, args: called.append((ls, args.command,
95                                                        args.subcommand)))
96
97    def fail_get_session(config_file=None):
98      raise AssertionError("get_session should not run")
99
100   monkeypatch.setattr(ladok3.cli, "get_session", fail_get_session)
101   monkeypatch.setattr(ladok3.cli, "load_credentials",
102                       lambda filename=None: (None, None))
103
104   ladok3.cli.main()
105
106   assert called == [(None, "cache", "clear")]
```

This code is used in chunk 42.
Defines:
`test_drop_unimportable_handlers_warns_and_prunes`, never used.
`test_main_clears_cache_before_restoring_session`, never used.
`test_main_runs_login_before_restoring_session`, never used.
`test_restore_ladok_session_retries_with_tolerant_unpickler`, never used.
`test_tolerant_pickle_loads_keeps_core_failures`, never used.
`test_tolerant_pickle_loads_replaces_missing_optional_handlers`, never used.
Uses `args` 34a, `clear_cache` 59b, `dirs` 32, `drop_unimportable_handlers` 39, `dropped_handler_class` 39, `DroppedAutologinHandler` 39, `FakeLadokSession` 42, `get_session` 36, `importable_handler` 42, `load_credentials` 56a, `main` 5a 22b 33a, `RestorableHandler` 42, `restore_ladok_session` 38b, `store_ladok_session` 38b, `tolerant_pickle_loads` 39, `update_credentials_in_keyring` 53a, and `warn` 33b 63a.

To actually do the key derivation, we use the PBKDF2 based on HMAC. We use the supplied credentials for salt and password.

45 ⟨*set up kdf and derive key from credentials* 45⟩≡

```
1   if not credentials or len(credentials) < 2:
2     raise ValueError(f"Missing credentials, see `ladok login -h`.")
3
4   if isinstance(credentials, dict):
5     try:
6       salt = credentials["username"]
7       passwd = credentials["password"]
8     except KeyError:
9       credentials = list(credentials.values())
```

```
      ⟨get salt and passwd from credentials list 46a⟩
  else:
    ⟨get salt and passwd from credentials list 46a⟩

  kdf = PBKDF2HMAC(
    algorithm=hashes.SHA256(),
    length=32,
    salt=salt.encode("utf-8"),
    iterations=100000
  )
  key = base64.urlsafe_b64encode(kdf.derive(passwd.encode("utf-8")))

```

This code is used in chunk 41.
Defines:
`kdf`, used in chunks 32 and 46b.
`key`, used in chunks 38b, 39, 41, 46b, 53a, 55b, 57, and 58a.
Uses `passwd` 46a and `salt` 46a.

46a ⟨get salt and passwd from credentials list 46a⟩≡

```
  salt = credentials[0]
  passwd = credentials[1]
```

This code is used in chunk 45.
Defines:
`passwd`, used in chunk 45.
`salt`, used in chunks 45 and 46b.

Let's verify the encryption itself, with the real key derivation and the real `Fernet` protocol, storing to a temporary directory. An earlier version of these tests replaced all of the cryptography with stand-ins, so a cache written in plain text would have passed them. We check four properties. A stored session can be restored with the same credentials. The file on disk does not reveal the pickled session: the names of the classes in the pickle must not be readable in it. And the key depends on both the username, which is the salt, and the password: changing either one makes the cache unreadable. Finally, we pin how the key is derived, by decrypting the file with a key we derive ourselves: PBKDF2 with SHA-256 over the password, the username as salt and 100 000 iterations. That is the format of every cache already on users' disks, so a change would make them unreadable; it would also catch a weakened derivation, such as fewer iterations, which the other tests can't see. We use a real `LadokSession`, which logs in only on its first request, so storing it needs no network.

46b ⟨test functions 37a⟩+≡

```
  CACHE_CREDENTIALS = {"username": "tolvan", "password": "secret"}

  @pytest.fixture
  def cache_dir(monkeypatch, tmp_path):
    monkeypatch.setattr(ladok3.cli, "dirs",
                        types.SimpleNamespace(user_cache_dir=str(tmp_path)))
    return tmp_path

  def offline_session():
    return ladok3.LadokSession("KTH Royal Institute of Technology",
                               test_environment=True)

```

```
13  def test_session_cache_round_trip(cache_dir):
14    ls = offline_session()
15    ladok3.cli.store_ladok_session(ls, CACHE_CREDENTIALS)
16
17    restored = ladok3.cli.restore_ladok_session(CACHE_CREDENTIALS)
18
19    assert isinstance(restored, ladok3.LadokSession)
20    assert restored.base_url == ls.base_url
21
22  def test_session_cache_is_encrypted(cache_dir):
23    ladok3.cli.store_ladok_session(offline_session(), CACHE_CREDENTIALS)
24
25    data = (cache_dir / "LadokSession").read_bytes()
26
27    assert b"LadokSession" not in data
28    assert b"ladok3" not in data
29
30  def test_session_cache_key_derivation(cache_dir):
31    from cryptography.fernet import Fernet
32    from cryptography.hazmat.primitives import hashes
33    from cryptography.hazmat.primitives.kdf.pbkdf2 import PBKDF2HMAC
34    import base64
35    ladok3.cli.store_ladok_session(offline_session(), CACHE_CREDENTIALS)
36
37    kdf = PBKDF2HMAC(algorithm=hashes.SHA256(), length=32,
38                     salt=CACHE_CREDENTIALS["username"].encode("utf-8"),
39                     iterations=100000)
40    key = base64.urlsafe_b64encode(
41      kdf.derive(CACHE_CREDENTIALS["password"].encode("utf-8")))
42    pickled = Fernet(key).decrypt((cache_dir / "LadokSession").read_bytes())
43
44    assert isinstance(pickle.loads(pickled), ladok3.LadokSession)
45
46  @pytest.mark.parametrize("credentials", [
47    {"username": "other", "password": "secret"},
48    {"username": "tolvan", "password": "other"},
49  ])
50  def test_session_cache_needs_same_credentials(cache_dir, monkeypatch,
51                                                credentials):
52    warnings = []
53    monkeypatch.setattr(ladok3.cli, "warn", warnings.append)
54    ladok3.cli.store_ladok_session(offline_session(), CACHE_CREDENTIALS)
55
56    assert ladok3.cli.restore_ladok_session(credentials) is None
57    assert len(warnings) == 1
58    assert "cannot decrypt" in warnings[0]
59    assert warnings[0].endswith(": InvalidToken")
```

This code is used in chunk 42.
Defines:
CACHE_CREDENTIALS, used in chunk 48a.
cache_dir, used in chunk 48a.

`offline_session`, used in chunk 48a.
`test_session_cache_is_encrypted`, never used.
`test_session_cache_key_derivation`, never used.
`test_session_cache_needs_same_credentials`, never used.
`test_session_cache_round_trip`, never used.
Uses `dirs` 32, `kdf` 45, `key` 45, `restore_ladok_session` 38b, `salt` 46a, `store_ladok_session` 38b, and `warn` 33b 63a.

A damaged cache file must give the same warning and a fresh login, since Fernet cannot tell it from a wrong key. We damage a stored cache in two ways: flipping one byte, as a disk or copy error would, and cutting it short, as an interrupted write would.

48a ⟨*test functions* 37a⟩+≡

```
@pytest.mark.parametrize("damage", [
  lambda data: data[:-1] + bytes([data[-1] ^ 1]),
  lambda data: data[:len(data) // 2],
], ids=["flipped byte", "truncated"])
def test_session_cache_damaged_file(cache_dir, monkeypatch, damage):
  warnings = []
  monkeypatch.setattr(ladok3.cli, "warn", warnings.append)
  ladok3.cli.store_ladok_session(offline_session(), CACHE_CREDENTIALS)
  cache_file = cache_dir / "LadokSession"
  cache_file.write_bytes(damage(cache_file.read_bytes()))

  assert ladok3.cli.restore_ladok_session(CACHE_CREDENTIALS) is None
  assert len(warnings) == 1
  assert warnings[0].endswith("cannot decrypt: InvalidToken")
```

This code is used in chunk 42.
Defines:
`test_session_cache_damaged_file`, never used.
Uses `CACHE_CREDENTIALS` 46b, `cache_dir` 46b, `offline_session` 46b, `restore_ladok_session` 38b, `store_ladok_session` 38b, and `warn` 33b 63a.

4.4 Configuration

We provide a global configuration file. We want to allow the user to specify different locations for the configuration.

Location of configuration files We want the user to be able to specify the location of the configuration file. The default location is needed in two places: here in the argument parser and in `get_session`, which must fall back to the same path when it is called without an explicit config file (as the module-level `ladok3.session` does). We factor the path into a helper so the two cannot drift apart.

48b ⟨*functions* 33b⟩+≡

```
def default_config_file():
  """Returns the path to the default configuration file."""
  return f"{dirs.user_config_dir}/config.json"
```

This code is used in chunk 32.
Defines:
`default_config_file`, used in chunks 36, 37a, and 49a.
Uses `dirs` 32.

49a ⟨*add global configuration options* 49a⟩≡

```
argp.add_argument("-f", "--config-file",
  default=default_config_file(),
  help="Path to configuration file "
    f"(default: {default_config_file()}) "
    "or set LADOK_USER and LADOK_PASS environment variables.")
```

This definition is continued in chunk 49b.
This code is used in chunk 34b.
Uses `argp` 34a and `default_config_file` 48b.

Since we provide the default value here, we can always rely on it to be available, so we can use `args.config_file` directly when we want to access the configuration file.

Controlling verbosity The CLI used to print warnings and errors with ad-hoc `print(..., file=sys.stderr)` calls. We now route everything through Python's `logging` module so callers can adjust the verbosity in one place instead of grepping the codebase for `args.verbose` checks.

We expose two count-style flags, `-v`/`--verbose` and `-q`/`--quiet`, on the top-level parser so they apply to every subcommand uniformly. Defining them globally is also what lets bulk-reporting silence non-fatal warnings (e.g. "attested result has a different examination date") with a single `-q`, without each subcommand inventing its own suppression flag.

We pattern this port on the sibling `canvaslms` project's `~/devel/edu/canvaslms/src/canvaslms/cli/cli.nw`, so users of both tools see identical `-v`/`-q` semantics.

49b ⟨*add global configuration options* 49a⟩+≡

```
argp.add_argument("-q", "--quiet",
  action="count", default=0,
  help="Decrease verbosity: -q=ERROR only, -qq=CRITICAL only, "
    "-qqq=silent")
argp.add_argument("-v", "--verbose",
  action="count", default=0,
  help="Increase verbosity: -v=INFO, -vv=DEBUG, "
    "-vvv=all library debug")
```

This code is used in chunk 34b.
Uses `argp` 34a.

We compute a *net verbosity* by subtracting the quiet count from the verbose count. Letting `-v` and `-q` offset each other makes the flags compose: a wrapper script that always passes `-vv` for debugging can still be quieted to ordinary `-v` output with a single `-q`, without having to know whether `-vv` was set.

The net verbosity maps to the standard Python logging hierarchy:

Net ≤ -3 **(`-qqq` or more)** Completely silent, no output.

Net $= -2$ **(`-qq`)** `CRITICAL` messages only.

Net $= -1$ **(`-q`)** `ERROR` and `CRITICAL` messages.

Net $= 0$ **(default)** `WARNING` and above.

Net $= 1$ **(`-v`)** `INFO` and above.

Net $= 2$ (`-vv`) `DEBUG` and above.

Net ≥ 3 (`-vvv` or more) `NOTSET` — everything, including third-party library debug output.

We call `logging.basicConfig` exactly once, immediately after parsing arguments, so the very first log call (which may happen inside `get_session` or a subcommand) goes through a configured handler. The `format` string carries the level name so users can distinguish warnings from errors without the legacy `sys.argv[0]:` prefix that `warn`/`err` used to add by hand.

50a ⟨*configure logging based on verbose flag* 50a⟩≡

```
logging.basicConfig(level=logging_level(args.verbose, args.quiet),
                    format='[%(levelname)s] %(message)s')
```

This code is used in chunk 34a.
Uses `args` 34a and `logging_level` 50b.

We put the arithmetic and the mapping in a function of their own, so the tests can call exactly the code that `main` runs, without parsing arguments or configuring the logging system. An earlier version shared only the mapping, as a chunk included both here and in the tests, and the tests computed the net verbosity themselves. A sign error in the subtraction then broke the command line while every test still passed.

50b ⟨*functions* 33b⟩+≡

```
def logging_level(verbose, quiet):
    """Return the logging level for `-v` given `verbose` times and `-q`
    given `quiet` times.  The flags offset each other."""
    net_verbosity = verbose - quiet
    ⟨determine logging level from net verbosity 50c⟩
    return level
```

This code is used in chunk 32.
Defines:
`logging_level`, used in chunks 50a and 51a.

50c ⟨*determine logging level from net verbosity* 50c⟩≡

```
if net_verbosity <= -3:
    level = logging.CRITICAL + 1   # silent
elif net_verbosity == -2:
    level = logging.CRITICAL
elif net_verbosity == -1:
    level = logging.ERROR
elif net_verbosity == 0:
    level = logging.WARNING
elif net_verbosity == 1:
    level = logging.INFO
elif net_verbosity == 2:
    level = logging.DEBUG
else:                              # >= 3: even library logs
    level = logging.NOTSET
```

This code is used in chunk 50b.

Let's pin the net-verbosity arithmetic and the level mapping with tests. The mapping in particular is a small table that's easy to typo when adding a new level later, and the cases with both `-v` and `-q` check that the flags offset each other rather than add up.

51a ⟨*test functions* 37a⟩+≡

```
class TestVerbosityLevelMapping:
  """The full mapping from net verbosity to Python logging levels."""

  @pytest.mark.parametrize("verbose,quiet,expected_level", [
    (0, 3, logging.CRITICAL + 1),  # -qqq: silent
    (0, 2, logging.CRITICAL),      # -qq:  critical only
    (0, 1, logging.ERROR),         # -q:   errors and critical
    (0, 0, logging.WARNING),       # default
    (1, 0, logging.INFO),          # -v
    (2, 0, logging.DEBUG),         # -vv
    (3, 0, logging.NOTSET),        # -vvv: include library logs
    (4, 0, logging.NOTSET),        # -vvvv: still everything
    (2, 1, logging.INFO),          # -vv -q  == -v
    (3, 2, logging.INFO),          # -vvv -qq == -v
  ])
  def test_verbosity_to_logging_level(self, verbose, quiet,
                                      expected_level):
    assert ladok3.cli.logging_level(verbose, quiet) == expected_level
```

This code is used in chunk 42.
Defines:
`TestVerbosityLevelMapping`, never used.
Uses `logging_level` 50b.

4.5 Managing credentials: the `login` command

We want a subcommand to handle the user's credentials for accessing LADOK. In particular, we need the user to be able to change the credentials in the system keyring, e.g., in case the user wrote the wrong password. The rest we don't need to do much about, merely point out the possibilities to the user.

51b ⟨*login description* 51b⟩≡

```
Manages the user's LADOK login credentials. There are three ways to supply the
login credentials, in order of priority:

1) Through the environment: Just set the environment variables

   a) LADOK_INST, the name of the institution, e.g. KTH Royal Institute of
      Technology;

   b) LADOK_VARS, a colon-separated list of environment variables, similarly to
      what's done in `ladok login` --- most don't need this, but can rather set
      LADOK_USER (the username, e.g. dbosk@ug.kth.se) and LADOK_PASS (the
      password) instead.

2) Through the configuration file: Just write

```

```
        {{
          "institution": "the name of the university"
          "username": "the actual username",
          "password": "the actual password"
        }}

    to the file {dirs.user_config_dir}/config.json (default, or use the -f
    option). (The keys 'username' and 'password' can be renamed to correspond to
    the necessary values if the university login system uses other names.)

3) Through the system keyring: Just run `ladok login` and you'll be asked to
    enter the credentials and they will be stored in the keyring. Note that for
    this to work on the WSL platform (and possibly on Windows), you need to
    install the `keyrings.alt` package: `python3 -m pip install keyrings.alt`.

The keyring is the most secure. However, sometimes one want to try different
credentials, so the environment should override the keyring. Also, on WSL the
keyring might require you to enter a password in the terminal---this is very
inconvenient in scripts. However, when logging in, we first try to store the
credentials in the keyring.

If your institution uses Microsoft Authenticator for multi-factor authentication
(MFA), ladok will automatically handle the number-matching challenge. A number
will be displayed that you need to enter in the Authenticator app on your phone.
By default, the number is printed to the terminal. You can set the environment
variable WEBLOGIN_MFA_NOTIFICATION to a command that will display the number as
a notification, e.g. `export WEBLOGIN_MFA_NOTIFICATION=notify-send`.

```

This code is used in chunk 52a.
Uses `dirs` 32 and `institution` 54a.

52a ⟨*add subparsers to subp* 52a⟩≡

```
login_parser = subp.add_parser("login",
  help="Manage login credentials",
  formatter_class=argparse.RawDescriptionHelpFormatter,
  description=f"""
⟨login description 51b⟩
""")

login_parser.set_defaults(func=update_credentials_in_keyring)
```

This definition is continued in chunks 58c and 60.
This code is used in chunk 34b.
Defines:
`login_parser`, never used.
Uses `update_credentials_in_keyring` 53a.

4.5.1 Updating the credentials in the keyring

As stated, if the subcommand is run, we should update the credentials in the keyring.

52b ⟨*login prompt* 52b⟩≡

```
This login process is exactly the same as when you log in using
```

```
  the web browser. You need three things:

    1) The name of your institution, so that it can be uniquely identified.

    2) Your username at your institution. This is sometimes a username (such as
       `dbosk`) or an email address (such as `dbosk@kth.se`). However,
       occasionally, you type in the username in the web browser and it is
       actually complemented: for instance, at KTH, I type in my username `dbosk`
       and then on the password screen, I can see it has been complemented to
       `dbosk@ug.kth.se`. Be observant about that.

    3) Your password at your institution.

```

This code is used in chunk 53a.
Uses `institution` 54a.

If we run this subcommand, also want to clear the cache; otherwise, the cache will keep the outdated credentials.

53a ⟨*functions* 33b⟩+≡

```
def update_credentials_in_keyring(ls, args):
  print("""
⟨login prompt 52b⟩
""")
  while True:
    institution = input("Institution: ")
    ⟨check that institution uniquely identifies on SeamlessAccess 54a⟩

  vars = {
    "username": input("Institution username: "),
    "password": getpass.getpass("Institution password: [input is hidden] ")
  }
  ⟨try to log into LADOK to verify credentials or update vars 54b⟩

  try:
    keyring.set_password("ladok3", "institution", institution)
    keyring.set_password("ladok3", "vars", ";".join(vars.keys()))
    for key, value in vars.items():
      keyring.set_password("ladok3", key, value)
  except Exception as err:
    ⟨print error message about keyring 53b⟩

  clear_cache(ls, args)
```

This code is used in chunk 32.
Defines:
`update_credentials_in_keyring`, used in chunks 43 and 52a.
Uses `args` 34a, `clear_cache` 59b, `err` 33b, `institution` 54a, and `key` 45.

We want to print using the `err` function defined earlier. But this doesn't work due to all exceptions named `err`. However, we can access it using the `globabl()["err"]`.

53b ⟨*print error message about keyring* 53b⟩≡

```
globals()["err"](-1, f"You don't seem to have a working keyring. "
                     f"Use one of the other methods, see "
                     f"`ladok login -h`: {err}.")
```

This code is used in chunk 53a.
Uses `err` 33b.

Now, we want to check that the institution is uniquely identified at SeamlessAccess using the name provided by the user. We do this by looking up the name and asking the user to change if not a unique match.

54a ⟨*check that institution uniquely identifies on SeamlessAccess* 54a⟩≡

```
matches = sa.find_entity_data_by_name(institution)

if not matches:
  print("No match, try again.")
  continue

if len(matches) > 1:
  print("More than one match. Which one?")
  for match in matches:
    print(f"- {match['title']}")
  continue

match = matches[0]

print(f"Matched uniquely, using {match['title']}\n"
      f"            with domain {match['domain']} and\n"
      f"      unique identifier {match['id']}.")

institution = match['id']
break
```

This code is used in chunk 53a.
Defines:
`institution`, used in chunks 36, 38b, and 51–58.
`match`, never used.
`matches`, never used.

Once we're done with the institution, we can try to log in with the credentials. We do this by creating a LADOK session object and try if we can successfully make an API call. If there is an authentication error, we'll get a `weblogin.AuthenticationError` exception that can be used by the user to debug and adjust the variable names needed by their institution's login service.

54b ⟨*try to log into LADOK to verify credentials or update vars* 54b⟩≡

```
while True:
  temp_ls = ladok3.LadokSession(institution, vars=vars)

  try:
    temp_ls.user_info_JSON()
  except weblogin.AuthenticationError as err:
    adjust_vars(vars, err.variables)
  else:
    break
```

This code is used in chunk 53a.
Uses `adjust_vars` 54c, `err` 33b, and `institution` 54a.

54c ⟨*functions* 33b⟩+≡

```
def adjust_vars(vars, form_variables):
```

```
    print("""
  ⟨user instructions to adapt variable names and values 55a⟩
  """)
    input("\nPress return to continue.\n")

    ⟨adjust vars using variables from err 55b⟩
```

This code is used in chunk 32.
Defines:
`adjust_vars`, used in chunk 54b.

An authentication error can be due to several things:

(1) the user entered the username or (more likely) the password incorrectly,

(2) the user's institution uses different names for their form fields than `username` and `password`.

In both cases, we'll ask the user to review the variables and their contents, and adjust if necessary.

55a ⟨user instructions to adapt variable names and values 55a⟩≡

```
Some part of the authentication went wrong. Either you typed your username or
password incorrectly, or your institution requires some adjustments. We'll
guide you through it.

We will show you some variable names and values and give you the opportunity to
change the values according to the name of the variable. For instance, we
assume that the institution call the variable for the username `username`, but
they might call it `användarnamn` instead. You'll have to figure this out.

Remember, the problem might also be that you entered your username as 'dbosk',
when it should be 'dbosk@ug.kth.se' --- or something similar. Use your
institution's login page to figure this out.

Note: Your password will be visible on screen during this process.
```

This code is used in chunk 54c.
Uses `institution` 54a.

We note that `weblogin.ladok.SSOlogin` requires the keys to be casefolded. So we do that too, and present the variables casefolded so that the users use casefolded names when they try to set up environment variables.

55b ⟨adjust vars using variables from err 55b⟩≡

```
for key, value in form_variables.items():
  key = key.casefold()
  new_val = input(f"{key} = '{value}' "
                  f"[enter new value, blank to keep] ")
  if new_val:
    vars[key] = new_val
```

This code is used in chunk 54c.
Uses `key` 45.

4.5.2 Loading user credentials

The `load_credentials` function will try to get the user's LADOK credentials. There are three locations:

(1) the system keyring,

(2) the environment variables: `LADOK_INST`, `LADOK_USER` and `LADOK_PASS`,

(3) the configuration file.

They are given the priority they are listed in above. It tries to fetch the credentials in the given order; if it succeeds, it returns those credentials, otherwise it tries the next. If all fail, the function will return `None` for both. (This is due to how we handle the `login` command.)

56a ⟨*functions* 33b⟩+≡

```
def load_credentials(filename="config.json"):
  """
  Loads credentials from environment or file named filename.
  Returns the tuple (instituation, credential dictionary) that
  can be passed to `LadokSession(instiution, credential dictionary)`.
  """

  ⟨fetch institution from environment 56b⟩
  ⟨fetch username and password from environment 56c⟩
  ⟨fetch vars from environment 57a⟩
  ⟨fetch vars from config file 57c⟩
  ⟨fetch vars from keyring 58a⟩
  ⟨fetch username and password from keyring 58b⟩

  return None, None
```

This code is used in chunk 32.
Defines:
`load_credentials`, used in chunks 36, 37a, and 43.

First in priority is to read from the environment. We try to read the institution. If that fails, we assume we're using the old format that only supported KTH.

56b ⟨*fetch institution from environment* 56b⟩≡

```
try:
  institution = os.environ["LADOK_INST"]
except:
  institution = "KTH Royal Institute of Technology"
```

This code is used in chunk 56a.
Uses `institution` 54a.

56c ⟨*fetch username and password from environment* 56c⟩≡

```
try:
  vars = {
    "username": os.environ["LADOK_USER"],
    "password": os.environ["LADOK_PASS"]
  }
  if institution and vars["username"] and vars["password"]:
    return institution, vars
except:
  pass
```

This code is used in chunk 56a.
Uses `institution` 54a.

If we couldn't read the old `LADOK_USER` and `LADOK_PASS`, we try to read the `vars` from the environment using `LADOK_VARS`. Note that we need the `institution` to be set from `LADOK_INST` above for this.

57a ⟨*fetch vars from environment* 57a⟩≡

```
try:
  vars_keys = os.environ["LADOK_VARS"]

  vars = {}
  for key in vars_keys.split(":"):
    try:
      value = os.environ[key]
      if value:
        vars[key] = value
    except KeyError:
      ⟨print warning about missing variable in LADOK_VARS 57b⟩

  if institution and vars:
    return institution, vars
except:
  pass
```

This code is used in chunk 56a.
Uses `institution` 54a and `key` 45.

Unlike in the other cases, we don't just ignore the exception of the key not existing. Since the user has explicitly specified the variable, we should warn them that it doesn't exist.

57b ⟨*print warning about missing variable in* `LADOK_VARS` 57b⟩≡

```
warn(f"Variable {key} not set, ignoring.")
```

This code is used in chunk 57a.
Uses `key` 45 and `warn` 33b 63a.

If none of the above worked, we try the config file next. We pop the institution from the configuration file (a dictionary), because then the remaining entries will be used as `vars`.

57c ⟨*fetch vars from config file* 57c⟩≡

```
try:
  with open(filename) as conf_file:
    config = json.load(conf_file)

  institution = config.pop("institution",
                           "KTH Royal Institute of Technology")
  return institution, config
except:
  pass
```

This code is used in chunk 56a.
Uses `institution` 54a.

Lastly, if nothing else worked, we try to fetch the institution and vars from the keyring. Note that `keyring` returns `None` if the key doesn't exist, it doesn't raise an exception.

58a ⟨*fetch vars from keyring* 58a⟩≡

```
try:
  institution = keyring.get_password("ladok3", "institution")
  vars_keys = keyring.get_password("ladok3", "vars")

  vars = {}
  for key in vars_keys.split(";"):
    value = keyring.get_password("ladok3", key)
    if value:
      vars[key] = value

  if institution and vars:
    return institution, vars
except:
  pass
```

This code is used in chunk 56a.
Uses `institution` 54a and key 45.

However, if that fails, we fall back on the previous format, that only supported KTH.

58b ⟨*fetch username and password from keyring* 58b⟩≡

```
try:
  institution = "KTH Royal Institute of Technology"
  username = keyring.get_password("ladok3", "username")
  password = keyring.get_password("ladok3", "password")
  if username and password:
    return institution, {"username": username, "password": password}
except:
  pass
```

This code is used in chunk 56a.
Uses `institution` 54a.

4.6 Managing the cache: the `cache` command and subcommands

We need a command to control the cache. For this purpose we provide the `cache` subcommand. This command will in turn have subcommands.

58c ⟨*add subparsers to subp* 52a⟩+≡

```
cache_parser = subp.add_parser("cache",
  help="Manage cache",
  description="Manages the cache of LADOK data"
)
cache_subp = cache_parser.add_subparsers(
  title="subcommands",
  dest="subcommand",
  required=True
)
⟨add subcommands to cache command 59a⟩
```

This code is used in chunk 34b.
Defines:
`cache_parser`, never used.
`cache_subp`, used in chunk 59a.

4.6.1 Clear the cache

Since the cache stores sensitive data (student data) and the login credentials, we want to be able to clear the cache.

59a ⟨*add subcommands to cache command* 59a⟩≡

```
cache_clear = cache_subp.add_parser("clear",
  help="Clear the cache",
  description="Clears everything from the cache"
)
cache_clear.set_defaults(func=clear_cache)
```

This code is used in chunk 58c.
Defines:
`cache_clear`, never used.
Uses `cache_subp` 58c and `clear_cache` 59b.

The `clear_cache` function will clear the cache. We simply remove the existing cache file and then exit. If we don't exit using `sys.exit`, the main program will write the cache back again on its exit.

59b ⟨*functions* 33b⟩+≡

```
def clear_cache(ls, args):
  """Clear the cached LADOK session data.

  Removes the stored encrypted session file from the user's cache directory.
  Silently ignores if the file doesn't exist.

  Args:
      ls (LadokSession): The LADOK session (unused but required by interface).
      args: Command line arguments (unused).
  """
  try:
    os.remove(dirs.user_cache_dir + "/LadokSession")
  except FileNotFoundError as err:
    pass

  sys.exit(0)
```

This code is used in chunk 32.
Defines:
`clear_cache`, used in chunks 35a, 43, 53a, and 59a.
Uses `args` 34a, `dirs` 32, and `err` 33b.

4.7 Other subcommands

To add a subcommand we must add a subparser to the `subp` parser object from above, we do this in ⟨*add subparsers to subp* 52a⟩. Every subcommand exists in a separate module and that module provides the function `add_command_options` that takes `subp` as an argument.

We add the `data` subcommand.

60a ⟨*modules* 60a⟩≡

```
import ladok3.data
```

This definition is continued in chunk 60.
This code is used in chunk 32.

60b ⟨*add subparsers to subp* 52a⟩+≡

```
ladok3.data.add_command_options(subp)
```

This code is used in chunk 34b.

We add the `report` command.

60c ⟨*modules* 60a⟩+≡

```
import ladok3.report
```

This code is used in chunk 32.

60d ⟨*add subparsers to subp* 52a⟩+≡

```
ladok3.report.add_command_options(subp)
```

This code is used in chunk 34b.

We add the `student` command.

60e ⟨*modules* 60a⟩+≡

```
import ladok3.student
```

This code is used in chunk 32.

60f ⟨*add subparsers to subp* 52a⟩+≡

```
ladok3.student.add_command_options(subp)
```

This code is used in chunk 34b.

Chapter 5

The `course` command

We want to compute statistics based on LADOK data.We want to answer the following questions:

(1) What are the grade distribution of a course round?

(2) How do grade distributions differ between years (i.e., rounds) for the same course?

(3) How do grade distributions differ between (similar) courses?

(4) How is the throughput distribution of a course?

(5) How do throughput distributions vary between years?

We provide the module `data` (⟨*data.py* (never defined)⟩) to extract the necessary data from LADOK through the command-line interface. It provides two related subcommands:

`ladok course` Export all results for one course.

`ladok program` Export the results for the students in one or more program rounds across the courses they actually took.

It can be used like this:

```
ladok course DD1315 > DD1315.csv
ladok program CTFYS --round HT25 > CTFYS-HT25.csv
```

These commands produce CSV-formatted data to answer the questions above. The `course` subcommand writes:

- course,
- round,
- component,
- student (pseudonym),
- grade,
- either absolute date or normalized to the course start and finish.

The `program` subcommand prepends a first `Program` column whose value identifies the cohort as the program code together with the program round code and start year.

5.1 The `course` and `program` subcommands

These subcommands run as part of the `ladok3.cli` module. We provide a function `add_command_options` that adds their parser options to a given parser. We need access to LADOK through the `ladok3` module. We will also write data to disk in CSV form, so we need the `csv` module.

62 ⟨`data.py` 62⟩≡

```
import csv
import datetime
import ladok3
import logging
import sys

logger = logging.getLogger(__name__)

⟨functions 63a⟩

def add_command_options(parser):
  """Add the 'course' and 'program' subcommands to the argument parser.

  Creates the subparsers for the data extraction commands together with the
  filtering and output options they need.

  Args:
      parser (ArgumentParser): The parent parser to add the subcommand to.
  """
  ⟨add data parser to parser 68⟩
  ⟨add data command arguments to data parser 69c⟩
  ⟨add program parser to parser 69a⟩
  ⟨add program command arguments to program parser 70b⟩

def course_command(ladok, args):
  """Execute the course data extraction command.

  Args:
      ladok (LadokSession): The LADOK session for data access.
      args: Parsed command line arguments containing course and filter options.
  """
  ⟨produce data about course specified in args 69b⟩

def program_command(ladok, args):
  """Execute the program data extraction command.

  Args:
      ladok (LadokSession): The LADOK session for data access.
      args: Parsed command line arguments containing program and filter options.
```

```
    """
    ⟨produce data about program specified in args 70a⟩
```

Root chunk (not used in this document).
Defines:
`add_command_options`, used in chunks 81b and 109c.
`course_command`, used in chunks 68 and 81b.
`logger`, used in chunks 33b, 63a, 89c, 92, 93, 98, 99, and 102–104.
`program_command`, used in chunk 69a.

Programme exports should survive odd cohort entries that LADOK will not resolve as real student-course results. We keep a local `warn` helper that routes through this module's `logger` rather than importing `ladok3.cli.warn`, because `ladok3.cli` already imports `ladok3.data` (to wire its subparser); the reverse import would close that cycle. Keeping the symbol as a function—instead of inlining `logger.warning(...)` at every call site—also lets existing tests continue to capture warnings with `monkeypatch.setattr(ladok3.data, "warn", warnings.append)`.

63a ⟨*functions* 63a⟩≡

```
def warn(msg):
  """Log a warning message via this module's logger."""
  logger.warning(msg)
```

This definition is continued in chunks 71–73, 75, 77c, 78a, 80b, and 83.
This code is used in chunk 62.
Defines:
`warn`, used in chunks 39, 41, 43, 46b, 48a, 57b, 65, and 73b.
Uses `logger` 32 62 85.

We also provide focused unit tests for the filtering and program-export helpers.

63b ⟨*test* `data.py` 63b⟩≡

```
import datetime
from types import SimpleNamespace

import pytest

import ladok3
import ladok3.data

⟨test helpers 63c⟩
⟨test functions 65⟩
```

Root chunk (not used in this document).

The program-export tests use light-weight fakes so they can exercise the helper logic without contacting LADOK.

63c ⟨*test helpers* 63c⟩≡

```
class FakeGrade:
  def __init__(self, code):
    self.code = code


class FakeResult:
  def __init__(self, component, grade=None, date=None):
    self.component = component
    self.grade = FakeGrade(grade) if grade is not None else None
    self.date = date

```

```
12
13  class FakeCourse:
14    def __init__(self, code, round_code, start, end, components, results,
15                 education_id="education"):
16      self.code = code
17      self.round_code = round_code
18      self.start = start
19      self.end = end
20      self._components = components
21      self._results = results
22      self.education_id = education_id
23
24    def components(self):
25      return self._components
26
27    def results(self):
28      return self._results
29
30
31  class FakeLadokForProgramData:
32    def __init__(self, program_participants=None, course_participations=None,
33                 registrations=None):
34      self._program_participants = program_participants or []
35      self._course_participations = course_participations or {}
36      self._registrations = registrations or []
37
38    def program_round_participants_JSON(self, round_uid):
39      return self._program_participants
40
41    def get_student(self, uid):
42      return SimpleNamespace(
43        ladok_id=uid,
44        personnummer=f"{uid}-pnr",
45        __str__=lambda self: f"student {uid}")
46
47    def student_course_participations_JSON(self, student_uid):
48      return self._course_participations.get(student_uid, [])
49
50    def registrations_on_course_JSON(self, education_id, student_id):
51      return self._registrations
52
53
54  class FakeCourseRegistration:
55    def __init__(self, /, **kwargs):
56      self.code = kwargs["Utbildningskod"]
57      self.round_code = kwargs["Utbildningstillfalleskod"]
58      dates = kwargs["Studieperiod"]
59      self.start = datetime.date.fromisoformat(dates["Startdatum"])
60      self.end = datetime.date.fromisoformat(dates["Slutdatum"])
61      self.education_id = kwargs["UtbildningUID"]
62      self._components = kwargs["components"]
```

```
63      self._results = kwargs["results"]
64
65    def components(self):
66      return self._components
67
68    def results(self):
69      return self._results
```

This code is used in chunk 63b.
Defines:
`FakeCourse`, used in chunks 65, 79b, 95, 98, 99, and 101.
`FakeCourseRegistration`, used in chunk 65.
`FakeGrade`, never used.
`FakeLadokForProgramData`, used in chunk 65.
`FakeResult`, used in chunks 65 and 79b.
Uses `component` 77b and `results` 77b 187a.

We keep the tests focused on the new helpers: cohort labels, round filtering, historical course reconstruction, and exported rows.

65 ⟨*test functions* 65⟩≡

```
def test_filter_program_rounds_keeps_selected_round_codes():
  rounds = [
    {"Utbildningstillfalleskod": "HT25"},
    {"Utbildningstillfalleskod": "HT24"},
  ]

  filtered = list(ladok3.data.filter_program_rounds(rounds, ["HT25"]))

  assert filtered == [{"Utbildningstillfalleskod": "HT25"}]


def test_format_program_round_includes_program_round_and_year():
  label = ladok3.data.format_program_round("CTFYS", {
    "Utbildningstillfalleskod": "HT25",
    "SammanslagenTillfallesperiod": {"Startdatum": "2025-08-25"},
  })

  assert label == "CTFYS HT25 2025"


def test_program_header_prepends_program_column():
  assert ladok3.data.program_header() == [
    "Program", "Course", "Round", "Component", "Student", "Grade",
    "Time"
  ]


def test_program_round_courses_uses_historical_course_participations(monkeypatch):
  component = SimpleNamespace(code="TEN1")
  result = FakeResult(component, "P", "2025-10-01")
  ladok = FakeLadokForProgramData(course_participations={
    "student-1": [{
      "Utbildningsinformation": {
        "Utbildningskod": "DD1315",
```

```
          "Utbildningstillfalleskod": "HT25",
          "UtbildningUID": "education-1",
          "Studieperiod": {
            "Startdatum": "2025-08-25",
            "Slutdatum": "2025-10-15",
          },
          "components": [component],
          "results": [result],
        }
      }]
    })
    student = SimpleNamespace(ladok_id="student-1")

    monkeypatch.setattr(ladok3, "CourseRegistration", FakeCourseRegistration)

    courses = ladok3.data.program_round_courses(ladok, student)

    assert len(courses) == 1
    assert courses[0].code == "DD1315"
    assert courses[0].round_code == "HT25"


  def test_extract_data_for_course_registration_yields_component_grade_and_date():
    component = SimpleNamespace(code="TEN1")
    course = FakeCourse(
      code="DD1315",
      round_code="HT25",
      start=datetime.date(2025, 8, 25),
      end=datetime.date(2025, 10, 15),
      components=[component],
      results=[FakeResult(component, "P", "2025-10-01")],
    )
    args = SimpleNamespace(normalize_date=False, time_limit=None,
                           components=None)

    rows = list(ladok3.data.extract_data_for_course_registration(course, args))

    assert rows == [(component, "P", "2025-10-01")]


  def test_extract_data_for_course_registration_filters_components():
    exam = SimpleNamespace(code="TEN1")
    lab = SimpleNamespace(code="LAB1")
    course = FakeCourse(
      code="DD1315",
      round_code="HT25",
      start=datetime.date(2025, 8, 25),
      end=datetime.date(2025, 10, 15),
      components=[exam, lab],
      results=[
        FakeResult(exam, "P", "2025-10-01"),
```

```
        FakeResult(lab, "P", "2025-09-01"),
      ],
    )
    args = SimpleNamespace(normalize_date=False, time_limit=None,
                           components=["LAB1"])

    rows = list(ladok3.data.extract_data_for_course_registration(course, args))

    assert rows == [(lab, "P", "2025-09-01")]


def test_program_row_prepends_program_label():
    course = SimpleNamespace(code="DD1315", round_code="HT25")
    row = ladok3.data.program_row(
      "CTFYS HT25 2025", course, "student", "TEN1", "P", "2025-10-01")

    assert row == [
      "CTFYS HT25 2025", "DD1315", "HT25", "TEN1", "student", "P",
      "2025-10-01"
    ]


def test_extract_data_for_program_round_warns_and_skips_failed_course(
      monkeypatch):
    class FailingCourse(FakeCourse):
      def results(self):
        raise ladok3.LadokAPIError("not in course")

    component = SimpleNamespace(code="TEN1")
    student = SimpleNamespace(ladok_id="student-1")
    bad_course = FailingCourse(
      code="DD1315",
      round_code="HT25",
      start=datetime.date(2025, 8, 25),
      end=datetime.date(2025, 10, 15),
      components=[component],
      results=[],
    )
    good_course = FakeCourse(
      code="DD1320",
      round_code="HT25",
      start=datetime.date(2025, 8, 25),
      end=datetime.date(2025, 10, 15),
      components=[component],
      results=[FakeResult(component, "P", "2025-10-01")],
    )
    args = SimpleNamespace(
      students=None,
      courses=None,
      ladok_id=False,
      exclude_reregistered=False,
```

```
137       components=None,
138       normalize_date=False,
139       time_limit=None,
140     )
141     warnings = []
142 
143     monkeypatch.setattr(ladok3.data, "program_round_participants",
144                         lambda ladok, program_round: [student])
145     monkeypatch.setattr(ladok3.data, "program_round_courses",
146                         lambda ladok, student: [bad_course, good_course])
147     monkeypatch.setattr(ladok3.data, "warn", warnings.append)
148 
149     rows = list(ladok3.data.extract_data_for_program_round(
150       object(), {"Uid": "program-round"}, args))
151 
152     assert rows == [(good_course, student, component, "P", "2025-10-01")]
153     assert warnings == [
154       "skipping course DD1315 (HT25) for student student-1: not in course"
155     ]
```

This definition is continued in chunks 72b, 79b, and 81b.
This code is used in chunk 63b.
Defines:
`test_extract_data_for_course_registration_filters_components`, never used.
`test_extract_data_for_course_registration_yields_component_grade_and_date`, never used.
`test_extract_data_for_program_round_warns_and_skips_failed_course`, never used.
`test_filter_program_rounds_keeps_selected_round_codes`, never used.
`test_format_program_round_includes_program_round_and_year`, never used.
`test_program_header_prepends_program_column`, never used.
`test_program_round_courses_uses_historical_course_participations`, never used.
`test_program_row_prepends_program_label`, never used.
Uses `component` 77b, `extract_data_for_course_registration` 75, `extract_data_for_program_round` 73b, `FakeCourse` 63c 94b, `FakeCourseRegistration` 63c, `FakeLadokForProgramData` 63c, `FakeResult` 63c, `filter_program_rounds` 72a, `format_program_round` 72a, `program_header` 71, `program_round_courses` 75, `program_round_participants` 75, `program_row` 71, `results` 77b 187a, and `warn` 33b 63a.

5.1.1 Setting up the `course` command options

We add a subparser for `ladok course`. We set it up to use the function `course_command`.

68 ⟨*add data parser to parser* 68⟩≡

```
1  data_parser = parser.add_parser("course",
2    help="Returns course results data in CSV form",
3    description="""
4  Returns the results in CSV form for the students on a course round.
5  By default, the students who take the course, are registered on it or have
6  completed it are included; use --state to select students by state instead.
7  Use --exclude-reregistered to exclude students who reregistered.
8  Use --exclude-credit-transfers to exclude students with credit transfers.
9  """.strip())
10 data_parser.set_defaults(func=course_command)
```

This code is used in chunk 62.
Defines:
`data_parser`, used in chunks 69c, 73a, 76b, 80, and 81a.
Uses `course_command` 62 and `results` 77b 187a.

5.1.2 Setting up the `program` command options

The `program` subcommand exports the course results for one or more cohorts. The cohort is defined by a program code and, optionally, one or more program round codes. We set up that parser to use `program_command`.

69a ⟨*add program parser to parser* 69a⟩≡

```
program_parser = parser.add_parser("program",
  help="Returns program cohort results data in CSV form",
  description="""
Returns the results in CSV form for the students in one or more program rounds.
Each row describes a course result for a student in the cohort.
Use --round to restrict the export to particular program round codes.
""".strip())
program_parser.set_defaults(func=program_command)
```

This code is used in chunk 62.
Defines:
`program_parser`, used in chunk 70b.
Uses `program_command` 62 and `results` 77b 187a.

5.2 Producing course data

We fetch the data from LADOK and print it in CSV format to standard out (`sys.stdout`). This way the user can deal with how to store the data.

69b ⟨*produce data about course specified in args* 69b⟩≡

```
data_writer = csv.writer(sys.stdout, delimiter=args.delimiter)
course_rounds = filter_rounds(
                          ladok.search_course_rounds(code=args.course_code),
                          args.rounds)

if args.header:
  data_writer.writerow(course_header())
for course_round in course_rounds:
  data = extract_data_for_round(ladok, course_round, args)

  for student, component, grade, time in data:
    data_writer.writerow(course_row(course_round, student, component,
                                    grade, time))
```

This code is used in chunk 62.
Defines:
`course_rounds`, never used.
`data_writer`, never used.
Uses `component` 77b, `course_header` 71, `course_row` 71, `extract_data_for_round` 73b, and `filter_rounds` 72a.

We must take a course code and a delimiter as arguments. We also want to know if we want a header or not.

69c ⟨*add data command arguments to data parser* 69c⟩≡

```
data_parser.add_argument("course_code",
  help="The course code of the course for which to export data")

data_parser.add_argument("-d", "--delimiter",
  default="\t",
```

```
    help="The delimiter for the CSV output; "
      "default is a tab character to be compatible with POSIX commands, "
      "use `-d,` or `-d ,` to get comma-separated values.")

data_parser.add_argument("-H", "--header", action="store_true",
                         help="Print a header line with the column names.")
```

This definition is continued in chunks 73a, 76b, 80, and 81a.
This code is used in chunk 62.
Uses data_parser 68.

5.3 Producing program data

The program exporter uses the same row shape as course, but prepends a cohort label. That label includes the program code, the program round code, and the start year, because round codes alone do not always distinguish cohorts clearly.

70a ⟨*produce data about program specified in args* 70a⟩≡

```
data_writer = csv.writer(sys.stdout, delimiter=args.delimiter)
program_rounds = filter_program_rounds(
  ladok.program_rounds_JSON(args.program_code),
  args.rounds)

if args.header:
  data_writer.writerow(program_header())
for program_round in program_rounds:
  program = format_program_round(args.program_code, program_round)
  data = extract_data_for_program_round(ladok, program_round, args)

  for course, student, component, grade, time in data:
    data_writer.writerow(program_row(program, course, student, component,
                                     grade, time))
```

This code is used in chunk 62.
Defines:
  data_writer, never used.
  program_rounds, never used.
Uses component 77b, extract_data_for_program_round 73b, filter_program_rounds 72a, format_program_round 72a, program_header 71, and program_row 71.

The program command keeps the same output-format and filtering options that still make sense for a cohort export. It replaces the course code with a program code and adds a separate course-code filter.

70b ⟨*add program command arguments to program parser* 70b⟩≡

```
program_parser.add_argument("program_code",
  help="The program code of the program for which to export data")

program_parser.add_argument("-d", "--delimiter",
  default="\t",
  help="The delimiter for the CSV output; "
    "default is a tab character to be compatible with POSIX commands, "
    "use `-d,` or `-d ,` to get comma-separated values.")

program_parser.add_argument("-H", "--header", action="store_true",
```

```
                              help="Print a header line with the column names.")

program_parser.add_argument("-r", "--round", dest="rounds", nargs="+",
  help="The program round codes for the rounds to include, "
    "otherwise all rounds will be included.")

program_parser.add_argument("-l", "--ladok-id", action="store_true",
  help="Use the LADOK ID for the student, otherwise the student name and "
       "personnummer will be used.")

program_parser.add_argument("-n", "--normalize-date", action="store_true",
  help="Normalize the date to the start of the course, otherwise the date "
       "is printed as is.")

program_parser.add_argument("-t", "--time-limit", type=float,
  help="The time (normalized) for cutting off results, use `-t 1.0` to cut "
       "off at course end.")

program_parser.add_argument("-s", "--students", nargs="+",
  help="List of personnummer for students to include, otherwise all "
       "students will be included.")

program_parser.add_argument("-c", "--components", nargs="+",
  help="List of component codes for components to include, otherwise all "
       "components will be included.")

program_parser.add_argument("-C", "--courses", nargs="+",
  help="List of course codes for courses to include, otherwise all courses "
    "will be included.")

program_parser.add_argument("-x", "--exclude-reregistered",
  action="store_true",
  help="Exclude students who are reregistered on a course round (i.e., only "
       "include students registered for the first time).")
```

This code is used in chunk 62.
Uses `component` 77b, `program_parser` 69a, and `results` 77b 187a.

The headers and row builders keep the command logic narrow: the command path decides which objects to export, while these helpers define how the CSV should look.

71 ⟨*functions* 63a⟩+≡

```
def course_header():
  """Return the CSV header for course exports."""
  return ["Course", "Round", "Component", "Student", "Grade", "Time"]

def program_header():
  """Return the CSV header for program exports."""
  return ["Program"] + course_header()

def course_row(course, student, component, grade, time):
  """Return one CSV row for a course export."""
```

```
    return [course.code, course.round_code, component, student, grade, time]

def program_row(program, course, student, component, grade, time):
    """Return one CSV row for a program export."""
    return [program] + course_row(course, student, component, grade, time)
```

This code is used in chunk 62.
Defines:
`course_header`, used in chunk 69b.
`course_row`, used in chunk 69b.
`program_header`, used in chunks 65 and 70a.
`program_row`, used in chunks 65 and 70a.
Uses `component` 77b.

We filter the rounds.

72a ⟨*functions* 63a⟩+≡

```
def filter_rounds(all_rounds, desired_rounds):
    """Returns only the round objects with round code in desired_rounds."""
    if not desired_rounds:
        return all_rounds
    return filter(
        lambda x: x.round_code in desired_rounds,
        all_rounds
    )

def filter_program_rounds(all_rounds, desired_rounds):
    """Return only the program rounds with round code in desired_rounds."""
    if not desired_rounds:
        return all_rounds
    return filter(
        lambda x: x["Utbildningstillfalleskod"] in desired_rounds,
        all_rounds
    )

def format_program_round(program_code, program_round):
    """Return a cohort label for a program round."""
    start = datetime.date.fromisoformat(
        program_round["SammanslagenTillfallesperiod"]["Startdatum"])
    return f"{program_code} {program_round['Utbildningstillfalleskod']} {start.year}"
```

This code is used in chunk 62.
Defines:
`filter_program_rounds`, used in chunks 65, 70a, and 72b.
`filter_rounds`, used in chunks 69b and 72b.
`format_program_round`, used in chunks 65 and 70a.

Let's verify both filters: without `--rounds` every round is kept, and with it only the rounds asked for. The first case matters most, since it is the default: a filter that returned nothing there would make every export empty without any error.

72b ⟨*test functions* 65⟩+≡

```
def test_filter_rounds_keeps_all_without_desired_rounds():
    rounds = [SimpleNamespace(round_code="HT25"),
              SimpleNamespace(round_code="VT26")]

    assert list(ladok3.data.filter_rounds(rounds, None)) == rounds
```

```
    assert list(ladok3.data.filter_rounds(rounds, ["VT26"])) == [rounds[1]]


def test_filter_program_rounds_keeps_all_without_desired_rounds():
    rounds = [{"Utbildningstillfalleskod": "HT25"},
              {"Utbildningstillfalleskod": "VT26"}]

    assert list(ladok3.data.filter_program_rounds(rounds, None)) == rounds
    assert list(ladok3.data.filter_program_rounds(rounds, ["HT25"])) \
      == [rounds[0]]
```

This code is used in chunk 63b.
Defines:
`test_filter_program_rounds_keeps_all_without_desired_rounds`, never used.
`test_filter_rounds_keeps_all_without_desired_rounds`, never used.
Uses `filter_program_rounds` 72a and `filter_rounds` 72a.

We need a list of desired rounds.

73a ⟨*add data command arguments to data parser* 69c⟩+≡

```
data_parser.add_argument("-r", "--rounds", nargs="+",
  help="The round codes for the rounds to include, "
    "otherwise all rounds will be included.")
```

This code is used in chunk 62.
Uses `data_parser` 68.

5.4 Extracting data for a round

Now we want to extract data for a given course round. This is done by the function `extract_data_for_round`. We need access to LADOK through the `ladok` object of type `LadokSession`. We also need the course round through the `course_round` object of type `CourseRound`. Programme exports meet a looser kind of input: a cohort can mention a course entry that LADOK later refuses to resolve as a real student-course relation. That should not abort the whole export, so we warn and skip that one course.

73b ⟨*functions* 63a⟩+≡

```
def extract_data_for_round(ladok, course_round, args):
  """Extract student result data for a specific course round.

  Processes a course round to extract student results data in CSV format,
  filtering by students and components as specified in args.

  Args:
      ladok (LadokSession): The LADOK session for data access.
      course_round: The course round object to extract data from.
      args: Command line arguments containing filter options.

  Returns:
      list: List of result data dictionaries for CSV output.
  """
  ⟨compute start and length of the course 77a⟩
  ⟨get the results for the course round 77b⟩

```

```
    students = filter_students(course_round.participants(state=args.state),
                               args.students)

    for student in students:
      student_results = filter_student_results(student,
                                               results)

      ⟨determine if student should be included 82⟩

      components = filter_components(course_round.components(),
                                     args.components)

      for component in components:
        if len(student_results) < 1:
          result_data = None
        else:
          result_data = filter_component_result(component,
                                  student_results[0]["ResultatPaUtbildningar"])

        if not result_data:
          grade = "-"
          normalized_date = None
        else:
          ⟨extract grade and normalized date from result data 79a⟩

        ⟨yield student, component, grade and date 76a⟩

def extract_data_for_program_round(ladok, program_round, args):
  """Extract course result data for one program round.

  Enumerates the students in the selected cohort and then walks their course
  participations so completed courses remain part of the export.
  """
  students = filter_students(
    program_round_participants(ladok, program_round),
    args.students)

  for student in students:
    for course in filter_courses(program_round_courses(ladok, student),
                                 args.courses):
      try:
        results = course.results()
      except ladok3.LadokAPIError as err:
        warn(f"skipping course {course.code} ({course.round_code}) "
             f"for student {student.ladok_id}: {err}")
        continue

      if not should_include(ladok, student, course, results,
                            args.exclude_reregistered):
        continue

```

```
69          for component, grade, time in extract_data_for_course_registration(
70              course, args):
71            yield course, student.ladok_id if args.ladok_id else student, \
72              component, grade, time
```

This code is used in chunk 62.
Defines:
`extract_data_for_program_round`, used in chunks 65 and 70a.
`extract_data_for_round`, used in chunk 69b.
Uses `component` 77b, `extract_data_for_course_registration` 75, `filter_component_result` 78a, `filter_components` 80b, `filter_courses` 75, `filter_student_results` 77c, `filter_students` 80b, `program_round_courses` 75, `program_round_participants` 75, `results` 77b 187a, `should_include` 83a, and `warn` 33b 63a.

The program exporter needs to recover real `Student` and `CourseRegistration` objects from the lower-level JSON responses. That keeps the rest of the export logic on the same abstractions as the rest of the codebase.

75 ⟨*functions* 63a⟩+≡

```
1  def program_round_participants(ladok, program_round):
2    """Return Student objects for a program round."""
3    participants = ladok.program_round_participants_JSON(program_round["Uid"])
4    return [ladok.get_student(participant["Student"]["Uid"])
5            for participant in participants]
6
7  def program_round_courses(ladok, student):
8    """Return all historical course registrations for a student."""
9    courses = []
10   for registration in ladok.student_course_participations_JSON(student.ladok_id):
11     try:
12       course_data = registration["Utbildningsinformation"]
13     except KeyError:
14       continue
15     courses.append(ladok3.CourseRegistration(
16       ladok=ladok,
17       student=student,
18       **course_data))
19   return courses
20
21 def filter_courses(all_courses, desired_courses):
22   """Return only the course registrations with codes in desired_courses."""
23   if not desired_courses:
24     return all_courses
25   return filter(
26     lambda x: x.code in desired_courses,
27     all_courses
28   )
29
30 def extract_data_for_course_registration(course, args):
31   """Extract result data for one student's course registration."""
32   course_start = course.start
33   course_length = course.end - course_start
34
35   for component in filter_components(course.components(), args.components):
```

```
      result_data = filter_course_registration_result(course, component)
      if not result_data:
        grade = "-"
        normalized_date = None
      else:
        ⟨extract grade and normalized date from result data 79a⟩

      yield component, grade, \
        normalized_date if args.normalize_date \
                        else result_data["Examinationsdatum"] if result_data \
                                                              else None

  def filter_course_registration_result(course, component):
    """Return result data for one component in a course registration."""
    component_results = ladok3.filter_on_keys(course.results(), component=component)
    if not component_results:
      return None

    result = component_results[0]
    if not result.grade or not result.date:
      return None
    return {
      "Betygsgradsobjekt": {"Kod": result.grade.code},
      "Examinationsdatum": result.date,
    }
```

This code is used in chunk 62.
Defines:
`extract_data_for_course_registration`, used in chunks 65, 73b, and 79b.
`filter_course_registration_result`, never used.
`filter_courses`, used in chunk 73b.
`program_round_courses`, used in chunks 65 and 73b.
`program_round_participants`, used in chunks 65 and 73b.
Uses `component` 77b, `course_length` 77a, `course_start` 77a, `filter_components` 80b, and `results` 77b 187a.

We want to yield the data in CSV form, so we simply yield a tuple. The date is either the normalized date or the date from the result data. The student's identifier will be either the LADOK ID or the student name and personnummer, depending on the command line arguments.

76a ⟨*yield* `student, component, grade` *and date* 76a⟩≡

```
  yield student.ladok_id if args.ladok_id \
                         else student, \
        component, \
        grade, \
        normalized_date if args.normalize_date \
                        else result_data["Examinationsdatum"] if result_data \
                                                              else None
```

This code is used in chunk 73b.
Uses `component` 77b.

76b ⟨*add data command arguments to data parser* 69c⟩+≡

```
  data_parser.add_argument("-l", "--ladok-id", action="store_true",
                           help="Use the LADOK ID for the student, "
```

```
                                "otherwise the student name and personnummer "
                                "will be used.")
  data_parser.add_argument("-n", "--normalize-date", action="store_true",
                           help="Normalize the date to the start of the course, "
                                "otherwise the date is printed as is.")
```

This code is used in chunk 62.
Uses data_parser 68.

5.4.1 Get round data

We need the start of the course and the length to be able to normalize the dates for the grades.

77a ⟨*compute start and length of the course* 77a⟩≡

```
  course_start = course_round.start
  course_length = course_round.end - course_start
```

This code is used in chunk 73b.
Defines:
course_length, used in chunks 75 and 79a.
course_start, used in chunks 75 and 79a.

We must get the results for the course round from LADOK. For this we must use an instance ID of a component. However, LADOK returns the results for all components, not just the one requested for.

77b ⟨*get the results for the course round* 77b⟩≡

```
  component = course_round.components()[0]
  results = ladok.search_reported_results_JSON(
    course_round.round_id, component.instance_id)
```

This code is used in chunk 73b.
Defines:
component, used in chunks 63c, 65, 69–71, 73b, 75, 76a, 78, 80c, and 81b.
results, used in chunks 63c, 65, 68–70, 73b, 75, 77–80, 83c, 132a, 171, 197, 199–201, 204, 207a, 214–18, 220, 227a, and 233–38.

Now, we don't iterate over these results. We iterate over the students and the components of a course round. LADOK doesn't report 'none results'. But we want to have a result showing that a student hasn't done anything, that should affect the statistics. Then we must search for a student's result in the batch of results we received from LADOK.

77c ⟨*functions* 63a⟩+≡

```
  def filter_student_results(student, results):
    """Filter results for a specific student.

    Args:
        student: Student object with ladok_id attribute.
        results (list): List of result dictionaries from LADOK.

    Returns:
        list: Filtered list containing only results for the specified student.
    """
    return list(filter(
      lambda x: x["Student"]["Uid"] == student.ladok_id,
      results))
```

This code is used in chunk 62.
Defines:
`filter_student_results`, used in chunk 73b.
Uses `results` 77b 187a.

Similarly, we want to find the result for a particular component.

78a ⟨*functions* 63a⟩+≡
```
def filter_component_result(component, results):
  """Find the result data for a specific course component.

  Searches through results to find the entry matching the given component.

  Args:
      component: Course component object to search for.
      results (list): List of result dictionaries to search through.

  Returns:
      dict or None: Result data for the component, or None if not found.
  """
  for component_result in results:
    ⟨get the component result data 78b⟩
    ⟨check component code in result data 78c⟩
    return result_data

  return None
```
This code is used in chunk 62.
Defines:
`filter_component_result`, used in chunk 73b.
Uses `component` 77b and `results` 77b 187a.

Depending on whether the data is attested or not, we can get the actual grade and date from two different substructures: 'Arbetsunderlag' are results in LADOK that have been entered, but not attested; 'SenastAttesteradeResultat' are results that have been attested. They both have the same structure.

78b ⟨*get the component result data* 78b⟩≡
```
if "Arbetsunderlag" in component_result:
  result_data = component_result["Arbetsunderlag"]
elif "SenastAttesteradeResultat" in component_result:
  result_data = component_result["SenastAttesteradeResultat"]
else:
  continue
```
This code is used in chunk 78a.

The results only refer to the component's instance ID, so we must match the component on that ID. The `course_round` object allows us to do exactly that with the `components` method. We note that we can ignore the grade on the whole course, since that one is determined by the other components.

78c ⟨*check component code in result data* 78c⟩≡
```
if component.instance_id != result_data["UtbildningsinstansUID"]:
  continue
```
This code is used in chunk 78a.
Uses `component` 77b.

Finally, if there is a grade, we can extract the grade and compute the normalized date. However, if there are no results, we set `None`.

We also only consider grades finished during the course. I.e., if the student has finished after the course ended, we set it as not finished. Otherwise, we cannot compare with earlier courses, since then students have had the chance to finish, so we want to see how many didn't finish on time. We use `args.time_limit` to specify this.

Sometimes, there is a result draft without any date, we ignore these completely.

79a ⟨*extract grade and normalized date from result data* 79a⟩≡

```
if "Betygsgradsobjekt" in result_data:
  grade = result_data["Betygsgradsobjekt"]["Kod"]
  try:
    date = datetime.date.fromisoformat(
      result_data["Examinationsdatum"])
  except KeyError:
    normalized_date = None
    grade = "-"
  else:
    normalized_date = (date - course_start) / course_length
    if args.time_limit and normalized_date > args.time_limit:
      grade = "-"
      normalized_date = None
else:
  grade = "-"
  normalized_date = None
```

This code is used in chunks 73b and 75.
Uses `course_length` 77a and `course_start` 77a.

Let's verify the cut-off with a course that runs for 51 days: an exam passed 37 days in is kept, at 37/51 of the course, while a lab passed after the course ended counts as not finished when we cut off at the course end.

79b ⟨*test functions* 65⟩+≡

```
def test_time_limit_counts_late_results_as_not_finished():
  exam = SimpleNamespace(code="TEN1")
  lab = SimpleNamespace(code="LAB1")
  course = FakeCourse(
    code="DD1315",
    round_code="HT25",
    start=datetime.date(2025, 8, 25),
    end=datetime.date(2025, 10, 15),
    components=[exam, lab],
    results=[
      FakeResult(exam, "P", "2025-10-01"),
      FakeResult(lab, "P", "2025-11-01"),
    ],
  )
  args = SimpleNamespace(normalize_date=True, time_limit=1.0,
                         components=None)

  rows = list(ladok3.data.extract_data_for_course_registration(course, args))

```

```
20      assert rows == [(exam, "P", pytest.approx(37 / 51)), (lab, "-", None)]
```

This code is used in chunk 63b.
Defines:
`test_time_limit_counts_late_results_as_not_finished`, never used.
Uses `extract_data_for_course_registration` 75, `FakeCourse` 63c 94b, `FakeResult` 63c, and `results` 77b 187a.

We must add the command line argument for the limit for the normalized date.

80a ⟨*add data command arguments to data parser* 69c⟩+≡

```
data_parser.add_argument("-t", "--time-limit", type=float,
  help="The time (normalized) for cutting off results, "
    "use `-t 1.0` to cut off at course end.")
```

This code is used in chunk 62.
Uses `data_parser` 68 and `results` 77b 187a.

5.4.2 Filtering data

We might not want all data, but specify on the command-line which data to keep. We want to filter on students and components.

80b ⟨*functions* 63a⟩+≡

```
def filter_students(all_students, desired_students):
  """Returns only the students with personnummer in desired_students."""
  if not desired_students:
    return all_students
  return filter(
    lambda x: x.personnummer in desired_students,
    all_students
  )

def filter_components(all_components, desired_components):
  """Returns only the components with a code in the desired_components."""
  if not desired_components:
    return all_components
  return filter(
    lambda x: x.code in desired_components,
    all_components
  )
```

This code is used in chunk 62.
Defines:
`filter_components`, used in chunks 73b and 75.
`filter_students`, used in chunk 73b.

Now, we must also add the suitable command-line options.

80c ⟨*add data command arguments to data parser* 69c⟩+≡

```
data_parser.add_argument("-s", "--students", nargs="+",
  help="List of personnummer for students to include, "
    "otherwise all students will be included.")

data_parser.add_argument("-c", "--components", nargs="+",
  help="List of component codes for components to include, "
    "otherwise all components will be included.")

data_parser.add_argument("-x", "--exclude-reregistered", action="store_true",
```

```
    help="Exclude students who are reregistered on this round "
      "(i.e., only include students registered for the first time).")

data_parser.add_argument("-X", "--exclude-credit-transfers", action="store_true",
    help="Exclude students who have credit transfers on the course "
      "(note: credit transfer may be for only part of the course).")
```

This code is used in chunk 62.
Uses `component` 77b and `data_parser` 68.

5.4.3 Selecting participants by state

By default the export covers the participants that LADOK's participant list gives by default: those who take the course, are registered on it or have completed it, but not those who broke off or have not started. The `--state` option selects the participants in some states instead, by the English names of `ladok3.COURSE_STATES`, and can be repeated. The round asks LADOK once, with the codes that the states translate to on the round's dates (Section 13.5.1). These are the participants' states on the round as LADOK's participant list defines them, which differ from a student's own states in one way that the help text names: interrupted also covers those who broke off early or withdrew after breaking off. Those who never started a round that has ended are in no state here either, so upcoming on such a round selects no one. We give the states as `choices`, so that `argparse` refuses a misspelt state and `argcomplete` completes them.

81a ⟨*add data command arguments to data parser* 69c⟩+≡

```
data_parser.add_argument("--state", action="append",
    choices=list(ladok3.COURSE_STATES),
    help="Include only the participants in this state on the round, "
      "can be repeated; default: ongoing, registered and completed "
      "participants.  The states are those of LADOK's participant list: "
      "interrupted also includes those who broke off early or withdrew "
      "after breaking off.  Students who never started a round that has "
      "ended are in no state, so upcoming selects no one on such a round.")
```

This code is used in chunk 62.
Uses `data_parser` 68.

Let's verify that the option reaches the round's participants, also when repeated, and that the default asks for the default list. We run the real command, with the real parser, against a stand-in LADOK with one round whose participants record how they are asked for; the round has no participants, so nothing else is asked.

81b ⟨*test functions* 65⟩+≡

```
class CourseRoundRecordingParticipants:
    round_id, round_code = "round-uid", "50001"
    start, end = datetime.date(2026, 8, 31), datetime.date(2026, 10, 23)

    def __init__(self):
        self.calls = []

    def components(self):
        return [SimpleNamespace(instance_id="component-uid", code="TEN1")]

    def participants(self, /, **kwargs):
```

```
12      self.calls.append(kwargs)
13      return []
14
15  class LadokWithOneRound:
16    def __init__(self):
17      self.round = CourseRoundRecordingParticipants()
18
19    def search_course_rounds(self, /, **kwargs):
20      return [self.round]
21
22    def search_reported_results_JSON(self, round_id, instance_id):
23      return []
24
25  def parse_course(*arguments):
26    import argparse
27    parser = argparse.ArgumentParser()
28    ladok3.data.add_command_options(parser.add_subparsers())
29    return parser.parse_args(["course", "DD1301", *arguments])
30
31  @pytest.mark.parametrize("arguments,state", [
32    ([], None),
33    (["--state", "interrupted"], ["interrupted"]),
34    (["--state", "ongoing", "--state", "upcoming"], ["ongoing", "upcoming"]),
35  ])
36  def test_course_state_option_reaches_participants(arguments, state, capsys):
37    ladok = LadokWithOneRound()
38    ladok3.data.course_command(ladok, parse_course(*arguments))
39    assert ladok.round.calls == [{"state": state}]
40
41  def test_course_refuses_unknown_state(capsys):
42    with pytest.raises(SystemExit):
43      parse_course("--state", "AVBROTT")
44    assert "interrupted" in capsys.readouterr().err
```

This code is used in chunk 63b.
Defines:
CourseRoundRecordingParticipants, never used.
LadokWithOneRound, never used.
parse_course, never used.
test_course_refuses_unknown_state, never used.
test_course_state_option_reaches_participants, never used.
Uses add_command_options 62 85 105, component 77b, and course_command 62.

5.5 Which students to include

By default, we include all students on a course round. However, for certain analyses, we may want to exclude some students. The user can optionally exclude reregistered students or students with credit transfers using command-line flags.

82 ⟨*determine if student should be included* 82⟩≡

```
1  if not should_include(ladok, student, course_round, student_results,
2                        args.exclude_reregistered, args.exclude_credit_transfers):
3    continue
```

This code is used in chunk 73b.
Uses `should_include` 83a.

We filter students based on the user's choices. If the user has specified `-x` (`--exclude-reregistered`), we exclude students who are reregistered on this round. If the user has specified `-X` (`--exclude-credit-transfers`), we exclude students who have any credit transfer on the course.

83a ⟨*functions* 63a⟩+≡

```
def should_include(ladok, student, course_round, result,
                   exclude_reregistered=False, exclude_credit_transfers=False):
  """Returns True if student should be included, False if to be excluded"""
  if exclude_reregistered and is_reregistered(ladok, student.ladok_id, course_round):
    return False

  if exclude_credit_transfers and has_credit_transfer(result):
    return False

  return True
```

This code is used in chunk 62.
Defines:
`should_include`, used in chunks 73b and 82.
Uses `has_credit_transfer` 83c and `is_reregistered` 83b.

A student should be counted on the first round they were registered on. We check if a student is reregistered by checking if the course round is the first round the student was registered on.

83b ⟨*functions* 63a⟩+≡

```
def is_reregistered(ladok, student_id, course):
  """Check if the student is reregistered on the course round course."""
  registrations = ladok.registrations_on_course_JSON(
    course.education_id, student_id)
  registrations.sort(
    key=lambda x: x["Utbildningsinformation"]["Studieperiod"]["Startdatum"])
  first_reg = registrations[0]
  return first_reg["Utbildningsinformation"]["Utbildningstillfalleskod"] != \
    course.round_code
```

This code is used in chunk 62.
Defines:
`is_reregistered`, used in chunk 83a.

If the student has a credit transfer for any part of the course, we should exclude the student.

83c ⟨*functions* 63a⟩+≡

```
def has_credit_transfer(results):
  """Returns True if there exists a credit tranfer among the results."""
  for result in results:
    for component_result in result["ResultatPaUtbildningar"]:
      if component_result["HarTillgodoraknande"]:
        return True

  return False
```

This code is used in chunk 62.
Defines:
  `has_credit_transfer`, used in chunk 83a.
Uses `results` 77b 187a.

Chapter 6

The `report` command

We want to report results from the command line.We need the following data for each result:

- course identifier,
- course component,
- student identifier,
- grade, and
- date[1];
- grader 1,
- grader 2,
- ...

We provide two ways to do this: The first is to provide positional arguments on the command line. The second is to not provide any positional argument, and in this case we read CSV data from standard input.

[1] Optional, we set today's date if not present.

6.1 The `report` subcommand

This is a subcommand is run as part of the `ladok3.cli` module. We provide a function `add_command_options` that adds the subcommand options to a given parser. We need access to LADOK through the `ladok3` module.

85 ⟨report.py 85⟩≡

```
import argparse
import csv
import datetime
import ladok3
import logging
import sys

logger = logging.getLogger(__name__)

```

```
⟨functions 87a⟩

def add_command_options(parser):
  """Add the 'report' subcommand options to the argument parser.

  Creates a subparser for result reporting with options for single results
  via command line arguments or batch processing via CSV input.

  Args:
      parser (ArgumentParser): The parent parser to add the subcommand to.
  """
  report_parser = parser.add_parser("report",
    help="Reports course results to LADOK",
    description="Reports course results to LADOK"
  )
  report_parser.set_defaults(func=command)
  ⟨add report command arguments to report parser 86b⟩

def command(ladok, args):
  """Execute the result reporting command.

  Args:
      ladok (LadokSession): The LADOK session for data access.
      args: Parsed command line arguments containing result data or CSV options.
  """
  ⟨report results depending on args 104b⟩
```

Root chunk (not used in this document).
Defines:
add_command_options, used in chunks 81b and 109c.
command, used in chunks 87a and 109c.
logger, used in chunks 33b, 63a, 89c, 92, 93, 98, 99, and 102–104.

We also provide unit tests for the reporting logic so we can verify the state machine without contacting LADOK.

86a ⟨test report.py 86a⟩≡

```
import datetime
import logging
import types

import pytest

import ladok3
import ladok3.cli
import ladok3.report

⟨test helpers 94b⟩
⟨test functions 88b⟩
```

Root chunk (not used in this document).

As mentioned above, we provide two ways of doing this.

86b ⟨add report command arguments to report parser 86b⟩≡

```
one_parser = report_parser.add_argument_group(
```

```
    "one result as positional args, only date is optional")
  ⟨add one result group arguments 102d⟩
  many_parser = report_parser.add_argument_group(
    "many results read from standard input as CSV, columns: "
    "course, component, student, grade, date, grader 1, ..., grader N")
  ⟨add many results group arguments 89b⟩
```

This definition is continued in chunks 87c and 88a.
This code is used in chunk 85.
Defines:
many_parser, used in chunk 89b.
one_parser, used in chunks 102 and 103.

6.2 Report the results

We provide two functions, one for each way of reporting the results.

87a ⟨functions 87a⟩≡

```
def report_one_result(ladok, args):
  """Report a single result specified via command line arguments.

  Args:
      ladok (LadokSession): The LADOK session for data access.
      args: Command line arguments containing course, student, component, and grade info.
  """
  ⟨report results given in args 104a⟩

def report_many_results(ladok, args):
  """Report multiple results read from CSV data on stdin.

  Args:
      ladok (LadokSession): The LADOK session for data access.
      args: Command line arguments containing CSV processing options.
  """
  ⟨report results given in stdin 89a⟩
```

This definition is continued in chunk 91a.
This code is used in chunk 85.
Defines:
report_many_results, used in chunk 104b.
report_one_result, used in chunk 104b.
Uses command 85 105.

In both cases, we want to specify whether or not the results should be finalized. We add an option whether we want to finalize the grade for attestation by the examiner. We add this argument outside the two groups, since it's valid for both.

87b ⟨finalize option help 87b⟩≡

```
Finalize the grade (mark as ready/klarmarkera) for examiner to attest.
Note that without this option, no graders will be registered in LADOK.
```

This code is used in chunk 87c.

87c ⟨add report command arguments to report parser 86b⟩+≡

```
report_parser.add_argument("-f", "--finalize",
  help="""⟨finalize option help 87b⟩""",
  action="store_true",
```

```
    default=False
  )
```

This code is used in chunk 85.

6.2.1 The old -v option

report used to have a -v option of its own, which printed the results it reported. The global -v/-q options (Section 4.4) replaced it, so the verbose form is now ladok -v report -f. Scripts written before that, typically run by cron, still say ladok report -fv. Without the old option the parser rejects that as an unknown argument, and the script reports nothing. We therefore accept -v after report as well, as an alias for the global option: it sets the same verbose value, so ladok report -fv and ladok -v report -f mean the same thing. We don't add -q here, since report never had it.

The alias needs default=argparse.SUPPRESS, not the default=0 of the global option. argparse parses a subcommand's arguments into a namespace of its own and then copies every value in it over the top-level namespace. With a default of 0, the copy would reset the count that a global -v had set, so ladok -v report -f would lose its -v. With SUPPRESS the value exists only if -v was given after report, and then it replaces the global count. So ladok -v report -v counts one -v, not two. Adding the two counts would need a dest of its own that main adds to the global count, which no script needs.

88a ⟨*add report command arguments to report parser* 86b⟩+≡

```
report_parser.add_argument("-v", "--verbose",
  action="count",
  default=argparse.SUPPRESS,
  help="Same as the global -v, kept for older scripts that put it "
    "after report."
)
```

This code is used in chunk 85.

Let's verify that both positions give the same verbosity, and that a global -v survives the subcommand. We parse with make_argument_parser, the parser that main uses, because the problem lies in how the two levels interact: a test parser built here would check only our copy of the global options.

88b ⟨*test functions* 88b⟩≡

```
@pytest.mark.parametrize("argv,verbose", [
  (["report", "-f"], 0),
  (["report", "-fv"], 1),
  (["report", "-fvv"], 2),
  (["-v", "report", "-f"], 1),
  (["-vv", "report", "-f"], 2),
  (["-vv", "report", "-fv"], 1),  # report's count replaces the global
])
def test_report_accepts_verbose_at_both_levels(argv, verbose):
  args = ladok3.cli.make_argument_parser().parse_args(argv)
  assert args.verbose == verbose
  assert args.finalize
```

This definition is continued in chunks 95, 98, 99, and 101.
This code is used in chunk 86a.
Defines:
test_report_accepts_verbose_at_both_levels, never used.

6.3 Report many results given in standard input

We want to read CSV data from standard input.

89a ⟨*report results given in stdin* 89a⟩≡
```
data_reader = csv.reader(sys.stdin, delimiter=args.delimiter)
for course_code, component_code, student_id, grade, date, *graders in data_reader:
    ⟨report a result read from stdin 89c⟩
```
This code is used in chunk 87a.
Defines:
data_reader, never used.

We need to add an argument for the delimiter.

89b ⟨*add many results group arguments* 89b⟩≡
```
many_parser.add_argument("-d", "--delimiter",
    default="\t",
    help="The delimiter for the CSV input; "
      "default is a tab character to be compatible with POSIX commands, "
      "use `-d,` or `-d ,` to get comma-separated values.")
```
This code is used in chunk 86b.
Uses many_parser 86b.

Bulk reporting used to define its own `-v` flag here. It is now the alias for the global `-v` (Section 6.2.1), so verbosity behaves identically across every subcommand: a wrapper script that passes `-v` once gets `INFO`-level reporting from both `ladok report` and any other `ladok` subcommand it invokes. The per-row stderr message and the "reported …" confirmation are now produced via this module's `logger` (see below).

Then we can actually report the result using the values read from `stdin`. We catch and log `Exception` per row because a single bad row in a CSV stream—an unknown student, a result that LADOK refuses— must not abort the whole batch. The `try/except` is what gives us "error on one row, continue to the next"; we deliberately log the failure rather than raise so the `for` loop in `report_results_given_in_stdin` keeps iterating.

89c ⟨*report a result read from stdin* 89c⟩≡
```
try:
    set_grade(ladok, args,
              student_id, course_code, component_code, grade, date, graders)
except Exception as err:
    ⟨try to resolve student from ladok using student_id 90⟩
    logger.error(
      f"{course_code} {component_code}={grade} ({date}) {student}: {err}")
```
This code is used in chunk 89a.
Uses logger 32 62 85 and set_grade 91a.

The reason we want to resolve the student from LADOK is that the `student_id` might be a personnummer or a LADOK ID—if the latter, it's not particularly readable for a human and we can't use the LADOK ID in the LADOK web interface when we want to deal with the errors manually. But if we resolve the student, then we get a readable name.

90 ⟨*try to resolve* `student` *from* `ladok` *using* `student_id` 90⟩≡

```
try:
  student = ladok.get_student(student_id)
except Exception:
  student = student_id
```

This code is used in chunks 89c and 104a.

When we set the grade, there are a few cases that should be handled. If the result isn't attested, we can still modify it. We must compare both the requested grade and the effective examination date, since LADOK stores both as part of the reported result. Then, if we want to finalize, we finalize the grade—this allows us to run the command first without `-f` (to set the grade) and then with `-f` (to finalize it) without getting an error. If we've selected the verbose option, then we print what we have reported.

Results in LADOK go through three states:

Draft Can be modified and finalized.

Finalized Ready for examiner attestation, cannot be modified or finalized again.

Attested Fully locked.

If the result is already finalized (but not attested), we compare the requested grade and date with the cached result. A mismatch is the signal that someone may already have corrected the result in LADOK and that we now want to try again. Only then do we refresh that specific result, so we can recover from stale cache state without clearing the whole cached session. If the refreshed state is still finalized and matches, we skip trying to modify or finalize it again—this keeps the command idempotent without refreshing every old result.

If the result is attested, we treat grade and date asymmetrically. A grade mismatch on an attested result is a real conflict the reporter must resolve manually in LADOK (the wrong grade was attested), so we keep raising `LadokValidationError` after the one-shot refresh. A date-only mismatch is not: the attested grade is still correct, and re-attestation just to fix an examination date is rarely worth the manual work. We therefore log a `WARNING` and continue. The warning is silenced by a global `-q` when bulk-reporting against a roster where date drift is expected. If everything matches, we do nothing to the result, but we do confirm the row at `DEBUG` level. This is best for bulk reporting, because then we can always try to report for all students: the default output stays silent for rows that need no action, while a `-vv` run accounts for every row it read. Without that confirmation, an attested-and-matching row was the only case that produced no output at any verbosity, which made it impossible to tell a processed row from one that was never read—for instance when a tab in the input had been mangled.

The confirmation is one level quieter than the one for a finalized result, which we log at `INFO`. The two states differ in whether anything is left to do. A finalized result still waits for the examiner's attestation, so a `-v` run lists it as something to follow up. An attested result is done. In a bulk report most rows are such finished

results from earlier reports, and listing them at `-v` would bury the few rows that still need attention; we want them only when we audit every row with `-vv`.

We want to report errors as exceptions.

91a ⟨*functions* 87a⟩+≡

```
def set_grade(ladok, args,
              student_id, course_code, component_code, grade, date, graders):
  """Set a grade for a student's course component result.

  Handles the logic for setting grades, including checking if results are
  already attested, validating dates, and optionally finalizing results.

  Args:
      ladok (LadokSession): The LADOK session for data access.
      args: Command line arguments with options like verbose and finalize.
      student_id (str): Student identifier (personnummer or LADOK ID).
      course_code (str): Course code (e.g., "DD1315").
      component_code (str): Component code (e.g., "LAB1").
      grade (str): Grade to assign (e.g., "P", "F", "A").
      date (str): Examination date in YYYY-MM-DD format.
      graders (list): List of grader identifiers.

  Raises:
      Exception: If the grade setting fails or validation errors occur.
  """
  student = ladok.get_student(student_id)
  ⟨get course from student and course_code 102a⟩
  ⟨get component from course and component_code 102b⟩
  refreshed_attested_result = False
  refreshed_finalized_result = False

  while True:
    if component.attested:
      ⟨handle attested result 93⟩
    elif component.finalized:
      ⟨handle finalized result 92b⟩
    else:
      ⟨handle draft result 92a⟩
    break
```

This code is used in chunk 85.
Defines:
`set_grade`, used in chunks 89c, 92a, 94b, 95, 98, 99, 101, and 104a.

Draft, finalized, and attested results must be compared on the effective result, not only on the grade code. LADOK treats the examination date as part of the stored result, so a matching grade with a different date still needs an update for drafts and must still be rejected for finalized and attested results. We therefore normalize the requested date in the same way as the write path, and normalize the current date before we compare them.

91b ⟨*normalize requested and current result dates* 91b⟩≡

```
⟨ensure date is a valid date for course 102c⟩
current_date = component.date
```

```
  if isinstance(current_date, str):
    current_date = datetime.date.fromisoformat(current_date)
```

This code is used in chunks 92 and 93.
Defines:
`current_date`, used in chunks 92 and 93.

If the result is a draft, we can set and finalize the grade as usual. The "reported ..." confirmation is logged at `INFO` level so it appears with `ladok -v report` but stays out of the default output; the global `-v`/`-q` flags decide which subset is shown.

92a ⟨*handle draft result* 92a⟩≡

```
⟨normalize requested and current result dates 91b⟩
if component.grade != grade or current_date != date:
  component.set_grade(grade, date)
if args.finalize:
  component.finalize(graders)
logger.info(
  f"{course_code} {student}: reported "
  f"{component.component} = {component.grade} ({date}) "
  f"by {', '.join(graders)}.")
```

This code is used in chunk 91a.
Uses `current_date` 91b, `logger` 32 62 85, and `set_grade` 91a.

If the result is already finalized but not attested, it's waiting for the examiner to attest it. We still need to compare the requested grade and date with the finalized result. Before rejecting a mismatch, we refresh this specific result once. That lets the reporter fix the result in LADOK and then try again without clearing the whole cached session. The cached finalized flag may be stale if someone already moved the result back to draft in LADOK. When the caller asked us to finalize, we also refresh once before treating the cached finalized state as authoritative, otherwise we might skip a needed finalization. If the refreshed state is still finalized and differs, we must fail explicitly. The reporter must first change the finalized result back to draft in LADOK. If they match and the refreshed state is still finalized, the command remains idempotent and we can just report that the result is waiting for attestation in verbose mode.

92b ⟨*handle finalized result* 92b⟩≡

```
⟨normalize requested and current result dates 91b⟩
if (component.grade != grade or current_date != date or args.finalize):
  if not refreshed_finalized_result:
    refreshed_finalized_result = True
    component.pull()
    continue
if component.grade != grade or current_date != date:
  raise ladok3.LadokValidationError(
    f"finalized {component.component} result "
    f"{component.grade} ({component.date}) is different from "
    f"{grade} ({date}); change the finalized result back to "
    "draft in LADOK before changing the grade.")
logger.info(
  f"{course_code} {student}: {component.component} already finalized, "
  f"waiting for attestation.")
```

This code is used in chunk 91a.
Uses `current_date` 91b and `logger` 32 62 85.

If the result is attested, we check whether the grade and date we want to report match the attested result. We split the comparison into two branches with different policies, as motivated above: grade mismatch is fatal, date-only mismatch is a warning.

Before deciding either way we refresh this specific result once, in case the cached attestation is stale. That refresh serves two purposes:

(1) It lets the reporter fix the underlying problem in LADOK (remove the attested result, re-attest with the right date) and re-run the command without clearing the whole cached session. A removed result comes back from the refresh as an empty result (Section 14.2.2), so the next iteration reports the requested grade as a new draft.

(2) If the cached attestation is stale, the next loop iteration will continue from the refreshed draft or finalized state instead, so we don't warn or raise about state that no longer exists.

The two branches share a single `refreshed_attested_result` guard so that one pull suffices for both checks; we want at most one refresh per `set_grade` call regardless of which mismatch triggers it.

We check the grade first because it is the more serious signal—if both the grade and date differ, the reporter sees the grade error, which is the one they need to act on. If only the date differs, we log a `WARNING` including the cached examination date so the reporter can decide whether the drift is worth a manual fix. Finally, if neither check fired, the attested result already is what we were asked to report, and we say so at `DEBUG` level, as motivated above.

93 ⟨*handle attested result* 93⟩≡

```
⟨reject reporting on a fully credit-transferred component 94a⟩
⟨normalize requested and current result dates 91b⟩
if component.grade != grade:
  if not refreshed_attested_result:
    refreshed_attested_result = True
    component.pull()
    continue
  raise ladok3.LadokValidationError(
    f"attested {component.component} result "
    f"{component.grade} ({component.date}) is different from "
    f"{grade} ({date}); remove the attested result in LADOK "
    "before changing the grade.")
if current_date != date:
  if not refreshed_attested_result:
    refreshed_attested_result = True
    component.pull()
    continue
  logger.warning(
    f"{course_code} {student}: attested {component.component} "
    f"{component.grade} has examination date {component.date}, "
    f"not the requested {date}; leaving the attested result as-is.")
logger.debug(
  f"{course_code} {student}: {component.component} already attested "
  f"as {component.grade} ({component.date}).")
```

This code is used in chunk 91a.
Uses `current_date` 91b and `logger` 32 62 85.

A component can also count as attested because it is entirely covered by a credit transfer. Then the refresh-and-compare dance above makes no sense: there is no ordinary attested result to compare grades and dates against, and a transfer-only component has no result payload to refresh, so `pull()` would only turn it into the empty, still transferred, result it already is. We therefore reject such reporting outright, and we do so before even normalizing the date: date normalization can log a warning about dates before the course start, which would be noise for a component we are about to reject anyway.

94a ⟨*reject reporting on a fully credit-transferred component* 94a⟩≡

```
if component.fully_credit_transferred:
  raise ladok3.LadokValidationError(
    f"{component.component} is entirely covered by a credit transfer; "
    "can't report a grade for it.")
```

This code is used in chunk 93.

We can verify the important local branches here: draft results remain editable, matching finalized results stay idempotent, and locked results explain how to change them.

94b ⟨*test helpers* 94b⟩≡

```
class FakeComponent:
  def __init__(self, *, grade=None, attested=False,
               finalized=False, date=None, pull_updates=None,
               pull_exception=None, fully_credit_transferred=False):
    self.component = "DD1315"
    self.grade = grade
    self.attested = attested
    self.finalized = finalized
    self.fully_credit_transferred = fully_credit_transferred
    self.date = date
    self.pull_updates = pull_updates or []
    self.pull_exception = pull_exception
    self.set_calls = []
    self.finalize_calls = []
    self.pull_calls = 0

  def set_grade(self, grade, date):
    self.set_calls.append((grade, date))
    self.grade = grade
    self.date = date

  def finalize(self, graders):
    self.finalize_calls.append(list(graders))

  def pull(self):
    self.pull_calls += 1
    if self.pull_exception:
      raise self.pull_exception
    if self.pull_updates:
      update = self.pull_updates.pop(0)
```

```
      for key, value in update.items():
        setattr(self, key, value)


class FakeCourse:
  def __init__(self, component):
    self.__component = component
    self.start = datetime.date(2024, 1, 15)

  def results(self, /, **kwargs):
    return [self.__component]


class FakeStudent:
  def __init__(self, course):
    self.__course = course

  def courses(self, /, **kwargs):
    return [self.__course]

  def __str__(self):
    return "Test Student"


class FakeLadok:
  def __init__(self, student):
    self.__student = student

  def get_student(self, student_id):
    return self.__student
```

This code is used in chunk 86a.
Defines:
`FakeComponent`, used in chunks 95, 98, 99, and 101.
`FakeCourse`, used in chunks 65, 79b, 95, 98, 99, and 101.
`FakeLadok`, used in chunks 95, 98, 99, and 101.
`FakeStudent`, used in chunks 95, 98, 99, and 101.
Uses `set_grade` 91a.

95 ⟨*test functions* 88b⟩+≡

```
def test_set_grade_updates_draft_result():
  component = FakeComponent()
  course = FakeCourse(component)
  student = FakeStudent(course)
  ladok = FakeLadok(student)
  args = types.SimpleNamespace(finalize=True, verbose=0)

  ladok3.report.set_grade(
    ladok, args, "191212121212", "DD1315", "DD1315", "P",
    "2024-02-01", ["examiner"])

  assert component.set_calls == [("P", datetime.date(2024, 2, 1))]
  assert component.finalize_calls == [["examiner"]]
```

```
14
15
16  def test_set_grade_updates_draft_result_date_without_grade_change():
17    component = FakeComponent(grade="P", date="2024-01-20")
18    course = FakeCourse(component)
19    student = FakeStudent(course)
20    ladok = FakeLadok(student)
21    args = types.SimpleNamespace(finalize=False, verbose=0)
22
23    ladok3.report.set_grade(
24      ladok, args, "191212121212", "DD1315", "DD1315", "P",
25      "2024-02-01", [])
26
27    assert component.set_calls == [("P", datetime.date(2024, 2, 1))]
28    assert component.finalize_calls == []
29
30
31  def test_set_grade_leaves_matching_finalized_result_unchanged():
32    component = FakeComponent(grade="P", finalized=True, date="2024-01-20")
33    course = FakeCourse(component)
34    student = FakeStudent(course)
35    ladok = FakeLadok(student)
36    args = types.SimpleNamespace(finalize=True, verbose=0)
37
38    ladok3.report.set_grade(
39      ladok, args, "191212121212", "DD1315", "DD1315", "P",
40      "2024-01-20", ["examiner"])
41
42    assert component.set_calls == []
43    assert component.finalize_calls == []
44
45
46  def test_set_grade_rejects_finalized_date_change():
47    component = FakeComponent(grade="P", finalized=True, date="2024-01-20")
48    course = FakeCourse(component)
49    student = FakeStudent(course)
50    ladok = FakeLadok(student)
51    args = types.SimpleNamespace(finalize=False, verbose=0)
52
53    with pytest.raises(
54        ladok3.LadokValidationError,
55        match="change the finalized result back to draft in LADOK"):
56      ladok3.report.set_grade(
57        ladok, args, "191212121212", "DD1315", "DD1315", "P",
58        "2024-02-01", [])
59
60    assert component.pull_calls == 1
61    assert component.set_calls == []
62    assert component.finalize_calls == []
63
64
```

```
def test_set_grade_retries_after_stale_finalized_result():
  component = FakeComponent(
    grade="P", finalized=True, date="2024-01-20",
    pull_updates=[{"attested": False, "finalized": False,
                   "grade": "P", "date": "2024-01-20"}])
  course = FakeCourse(component)
  student = FakeStudent(course)
  ladok = FakeLadok(student)
  args = types.SimpleNamespace(finalize=True, verbose=0)

  ladok3.report.set_grade(
    ladok, args, "191212121212", "DD1315", "DD1315", "P",
    "2024-02-01", ["examiner"])

  assert component.pull_calls == 1
  assert component.set_calls == [("P", datetime.date(2024, 2, 1))]
  assert component.finalize_calls == [["examiner"]]


def test_set_grade_finalizes_after_refreshing_matching_finalized_result():
  component = FakeComponent(
    grade="P", finalized=True, date="2024-02-01",
    pull_updates=[{"attested": False, "finalized": False,
                   "grade": "P", "date": "2024-02-01"}])
  course = FakeCourse(component)
  student = FakeStudent(course)
  ladok = FakeLadok(student)
  args = types.SimpleNamespace(finalize=True, verbose=0)

  ladok3.report.set_grade(
    ladok, args, "191212121212", "DD1315", "DD1315", "P",
    "2024-02-01", ["examiner"])

  assert component.pull_calls == 1
  assert component.set_calls == []
  assert component.finalize_calls == [["examiner"]]


def test_set_grade_explains_how_to_change_attested_result():
  component = FakeComponent(
    grade="F", attested=True, finalized=True, date="2024-01-20")
  course = FakeCourse(component)
  student = FakeStudent(course)
  ladok = FakeLadok(student)
  args = types.SimpleNamespace(finalize=True, verbose=0)

  with pytest.raises(
      ladok3.LadokValidationError,
      match="remove the attested result in LADOK"):
    ladok3.report.set_grade(
      ladok, args, "191212121212", "DD1315", "DD1315", "P",
```

```
        "2024-02-01", ["examiner"])

    assert component.set_calls == []
    assert component.finalize_calls == []
```

This code is used in chunk 86a.
Defines:
test_set_grade_explains_how_to_change_attested_result, never used.
test_set_grade_finalizes_after_refreshing_matching_finalized_result, never used.
test_set_grade_leaves_matching_finalized_result_unchanged, never used.
test_set_grade_rejects_finalized_date_change, never used.
test_set_grade_retries_after_stale_finalized_result, never used.
test_set_grade_updates_draft_result, never used.
test_set_grade_updates_draft_result_date_without_grade_change, never used.
Uses FakeComponent 94b, FakeCourse 63c 94b, FakeLadok 94b, FakeStudent 94b, and set_grade 91a.

A fully credit-transferred component is rejected outright: no refresh attempt, no grade comparison, and the message names the credit transfer rather than a mismatching attested result.

98 ⟨*test functions* 88b⟩+≡

```
def test_set_grade_rejects_fully_credit_transferred_component():
    component = FakeComponent(attested=True, fully_credit_transferred=True)
    course = FakeCourse(component)
    student = FakeStudent(course)
    ladok = FakeLadok(student)
    args = types.SimpleNamespace(finalize=False, verbose=0)

    with pytest.raises(
        ladok3.LadokValidationError,
        match="covered by a credit transfer"):
      ladok3.report.set_grade(
        ladok, args, "191212121212", "DD1315", "DD1315", "P",
        "2024-02-01", [])

    assert component.pull_calls == 0
    assert component.set_calls == []
    assert component.finalize_calls == []


def test_set_grade_warns_when_attested_date_differs(caplog):
    component = FakeComponent(
      grade="P", attested=True, finalized=True, date="2024-01-20")
    course = FakeCourse(component)
    student = FakeStudent(course)
    ladok = FakeLadok(student)
    args = types.SimpleNamespace(finalize=True, verbose=0)

    with caplog.at_level(logging.WARNING, logger="ladok3.report"):
      ladok3.report.set_grade(
        ladok, args, "191212121212", "DD1315", "DD1315", "P",
        "2024-02-01", ["examiner"])

    assert component.pull_calls == 1
    assert component.set_calls == []
```

```
    assert component.finalize_calls == []
    warnings = [r for r in caplog.records
                if r.levelno == logging.WARNING
                and r.name == "ladok3.report"]
    assert len(warnings) == 1
    assert "examination date 2024-01-20" in warnings[0].message
    assert "leaving the attested result as-is" in warnings[0].message

```

This code is used in chunk 86a.
Defines:
`test_set_grade_rejects_fully_credit_transferred_component`, never used.
`test_set_grade_warns_when_attested_date_differs`, never used.
Uses `FakeComponent` 94b, `FakeCourse` 63c 94b, `FakeLadok` 94b, `FakeStudent` 94b, `logger` 32 62 85, and `set_grade` 91a.

Rows that need no action are still confirmed, but at different levels: an attested row at `DEBUG` and a finalized row at `INFO`, since only the latter has something left to follow up. We assert the exact list of levels, so that a confirmation logged at the wrong level, or logged twice, fails the test.

99 ⟨*test functions* 88b⟩+≡

```
def test_set_grade_confirms_matching_attested_result(caplog):
    component = FakeComponent(
      grade="P", attested=True, finalized=True, date="2024-02-01")
    course = FakeCourse(component)
    student = FakeStudent(course)
    ladok = FakeLadok(student)
    args = types.SimpleNamespace(finalize=True, verbose=0)

    with caplog.at_level(logging.DEBUG, logger="ladok3.report"):
      ladok3.report.set_grade(
        ladok, args, "191212121212", "DD1315", "DD1315", "P",
        "2024-02-01", ["examiner"])

    assert component.pull_calls == 0
    assert component.set_calls == []
    assert component.finalize_calls == []
    records = [r for r in caplog.records if r.name == "ladok3.report"]
    assert [r.levelno for r in records] == [logging.DEBUG]
    assert "already attested as P (2024-02-01)" in records[0].message


def test_set_grade_confirms_matching_finalized_result_at_info(caplog):
    component = FakeComponent(grade="P", finalized=True, date="2024-01-20")
    course = FakeCourse(component)
    student = FakeStudent(course)
    ladok = FakeLadok(student)
    args = types.SimpleNamespace(finalize=True, verbose=0)

    with caplog.at_level(logging.DEBUG, logger="ladok3.report"):
      ladok3.report.set_grade(
        ladok, args, "191212121212", "DD1315", "DD1315", "P",
        "2024-01-20", ["examiner"])
```

```
33
34    records = [r for r in caplog.records if r.name == "ladok3.report"]
35    assert [r.levelno for r in records] == [logging.INFO]
36    assert "waiting for attestation" in records[0].message
37
38
39  def test_set_grade_attested_date_warning_silent_when_refresh_resolves(caplog):
40    component = FakeComponent(
41      grade="P", attested=True, finalized=True, date="2024-01-20",
42      pull_updates=[{"date": "2024-02-01"}])
43    course = FakeCourse(component)
44    student = FakeStudent(course)
45    ladok = FakeLadok(student)
46    args = types.SimpleNamespace(finalize=True, verbose=0)
47
48    with caplog.at_level(logging.WARNING, logger="ladok3.report"):
49      ladok3.report.set_grade(
50        ladok, args, "191212121212", "DD1315", "DD1315", "P",
51        "2024-02-01", ["examiner"])
52
53    assert component.pull_calls == 1
54    assert component.set_calls == []
55    assert component.finalize_calls == []
56    warnings = [r for r in caplog.records
57                if r.levelno == logging.WARNING
58                and r.name == "ladok3.report"]
59    assert warnings == []
60
61
62  def test_set_grade_attested_date_warning_suppressed_at_error_level(caplog):
63    component = FakeComponent(
64      grade="P", attested=True, finalized=True, date="2024-01-20")
65    course = FakeCourse(component)
66    student = FakeStudent(course)
67    ladok = FakeLadok(student)
68    args = types.SimpleNamespace(finalize=True, verbose=0)
69
70    report_logger = logging.getLogger("ladok3.report")
71    previous_level = report_logger.level
72    report_logger.setLevel(logging.ERROR)
73    try:
74      with caplog.at_level(logging.ERROR, logger="ladok3.report"):
75        ladok3.report.set_grade(
76          ladok, args, "191212121212", "DD1315", "DD1315", "P",
77          "2024-02-01", ["examiner"])
78    finally:
79      report_logger.setLevel(previous_level)
80
81    assert component.pull_calls == 1
82    assert component.set_calls == []
83    # The WARNING record is filtered out by the logger level itself
```

```
    # (mimicking what -q does at the CLI), so caplog never sees it.
    assert [r for r in caplog.records
            if r.name == "ladok3.report"] == []


def test_set_grade_retries_after_stale_attested_result():
    component = FakeComponent(
      grade="F", attested=True, finalized=True, date="2024-01-20",
      pull_updates=[{"attested": False, "finalized": False,
                     "grade": "F", "date": "2024-01-20"}])
    course = FakeCourse(component)
    student = FakeStudent(course)
    ladok = FakeLadok(student)
    args = types.SimpleNamespace(finalize=False, verbose=0)

    ladok3.report.set_grade(
      ladok, args, "191212121212", "DD1315", "DD1315", "P",
      "2024-02-01", [])

    assert component.pull_calls == 1
    assert component.set_calls == [("P", datetime.date(2024, 2, 1))]
    assert component.finalize_calls == []
```

This code is used in chunk 86a.
Defines:
`test_set_grade_attested_date_warning_silent_when_refresh_resolves`, never used.
`test_set_grade_attested_date_warning_suppressed_at_error_level`, never used.
`test_set_grade_confirms_matching_attested_result`, never used.
`test_set_grade_confirms_matching_finalized_result_at_info`, never used.
`test_set_grade_retries_after_stale_attested_result`, never used.
Uses `FakeComponent` 94b, `FakeCourse` 63c 94b, `FakeLadok` 94b, `FakeStudent` 94b, `logger` 32 62 85, and `set_grade` 91a.

When the reporter has removed the locked result in LADOK, the refresh turns the cached result into an empty one (Section 14.2.2), and the loop reports the requested grade as a new result. That needs a real `CourseResult`, so the test is in the chapter on results. A refresh that fails, on the other hand, tells us nothing about the result, so the loop must not guess: the error reaches the reporter and nothing is written.

101 ⟨*test functions* 88b⟩+≡

```
def test_set_grade_propagates_failed_refresh():
    component = FakeComponent(
      grade="F", attested=True, finalized=True, date="2024-01-20",
      pull_exception=ladok3.LadokAPIError("LADOK unavailable"))
    course = FakeCourse(component)
    student = FakeStudent(course)
    ladok = FakeLadok(student)
    args = types.SimpleNamespace(finalize=False, verbose=0)

    with pytest.raises(ladok3.LadokAPIError, match="LADOK unavailable"):
      ladok3.report.set_grade(
        ladok, args, "191212121212", "DD1315", "DD1315", "P",
        "2024-02-01", [])

```

```
15    assert component.pull_calls == 1
16    assert component.set_calls == []
```

This code is used in chunk 86a.
Defines:
test_set_grade_propagates_failed_refresh, never used.
Uses FakeComponent 94b, FakeCourse 63c 94b, FakeLadok 94b, FakeStudent 94b, and set_grade 91a.

Now we simply want to set those objects up. We want to throw exceptions that explain what the problem is if these don't exist.

102a ⟨*get* course *from* student *and* course_code 102a⟩≡

```
try:
  course = student.courses(code=course_code)[0]
except IndexError:
  raise ladok3.LadokNotFoundError(f"{course_code}: No such course for {student}")
```

This code is used in chunk 91a.

102b ⟨*get* component *from* course *and* component_code 102b⟩≡

```
try:
  component = course.results(component=component_code)[0]
except IndexError:
  raise ladok3.LadokNotFoundError(f"{component_code}: no such component for {course_code}")
```

This code is used in chunk 91a.

Finally, we want to ensure the date is correct. The date must be at the earliest the start of the course. The student can't finish any results before the course has started. LADOK will not accept that.

102c ⟨*ensure* date *is a valid date for* course 102c⟩≡

```
if not isinstance(date, datetime.date):
  date = datetime.date.fromisoformat(date)

if date < course.start:
  logger.warning(
    f"{course_code} {component_code}={grade} "
    f"({date}) {student}: "
    f"Grade date ({date}) is before "
    f"course start date ({course.start}), "
    f"using course start date instead.")
  date = course.start
```

This code is used in chunk 91b.
Uses logger 32 62 85.

6.4 Report a result given on command line

If we've chosen to give one result on the command line, then we'll need the following arguments.

We start with the course, component code, the student's ID and grade.

102d ⟨*add one result group arguments* 102d⟩≡

```
one_parser.add_argument("course_code", nargs="?",
  help="The course code (e.g. DD1315) for which the grade is for."
)

one_parser.add_argument("component_code", nargs="?",
```

```
    help="The component code (e.g. LAB1) for which the grade is for. "
         "This can be set to the course code (e.g. DD1315) to set the "
         "final grade for the course. But all components must be "
         "certified (attested) before the course grade can be set."
  )

  one_parser.add_argument("student_id", nargs="?",
    help="Student identifier (personnummer or LADOK ID)."
  )

  one_parser.add_argument("grade", nargs="?",
    help="The grade (e.g. A or P)."
  )
```

This definition is continued in chunk 103.
This code is used in chunk 86b.
Uses one_parser 86b.

We must make them optional like this to make it work with our second alternative (bulk reporting through `stdin`), so we must check ourselves that we got the arguments.

103a ⟨*check that we got all positional arguments* 103a⟩≡

```
  if not (args.course_code and args.component_code and
    args.student_id and args.grade):
    logger.error("report: not all positional args given: "
                 "course_code, component, student, grade")
    sys.exit(1)
```

This code is used in chunk 104a.
Uses logger 32 62 85.

Next, we have the date. To ensure it's a valid date we'll make `argparse` convert it to `datetime` format. If it's not provided, we let `argparse` set it to today's date.

103b ⟨*add one result group arguments* 102d⟩+≡

```
  one_parser.add_argument("date", nargs="?",
    help="Date on ISO format (e.g. 2021-03-18), "
        f"defaults to today's date ({datetime.date.today()}).",
    type=datetime.date.fromisoformat,
    default=datetime.date.today()
  )
```

This code is used in chunk 86b.
Uses one_parser 86b.

Finally, we have the list of graders.

103c ⟨*add one result group arguments* 102d⟩+≡

```
  one_parser.add_argument("graders", nargs="*",
    help="Space separated list of who did the grading, "
         "give each grader as 'First Last <email@institution.se>'.")
```

This code is used in chunk 86b.
Uses one_parser 86b.

Now that we have the arguments, we can just execute the following code using them. The single-result path uses the same logger-based error reporting as the bulk path, so both modes look identical to a wrapper script piping output through the `logging` hierarchy.

104a ⟨*report results given in args* 104a⟩≡

```
⟨check that we got all positional arguments 103a⟩
try:
  set_grade(ladok, args,
            args.student_id, args.course_code, args.component_code,
            args.grade, args.date, args.graders)
except Exception as err:
  student_id = args.student_id
  ⟨try to resolve student from ladok using student_id 90⟩
  logger.error(
    f"{args.course_code} {args.component_code}={args.grade} "
    f"({args.date}) {student}: {err}")
```

This code is used in chunk 87a.
Uses `logger` 32 62 85 and `set_grade` 91a.

6.5 Determine which function to run

We know that if a course code is given as positional argument, then we know that we should report one result from the command line.

104b ⟨*report results depending on args* 104b⟩≡

```
if args.course_code:
  report_one_result(ladok, args)
else:
  report_many_results(ladok, args)
```

This code is used in chunk 85.
Uses `report_many_results` 87a and `report_one_result` 87a.

Chapter 7

The `student` command

We want to show data for a student.For this, we need a student identifier. We want to use it like this:

```
ladok student 700101-1234
```

We also want to optionally print courses.

```
ladok student 700101-1234 -c "DD131[0-9]"
```

And we want to print only the courses in some states, for instance those that the student takes now or will take.

```
ladok student 700101-1234 --state ongoing --state upcoming
```

7.1 The `student` subcommand

This is a subcommand is run as part of the `ladok3.cli` module. We provide a function `add_command_options` that adds the subcommand options to a given parser. We need access to LADOK through the `ladok3` module.

105 ⟨`student.py` 105⟩≡

```
import csv
import ladok3.cli

⟨functions 108a⟩

def add_command_options(parser):
  """Add the 'student' subcommand options to the argument parser.

  Creates a subparser for displaying student information with options
  for course filtering and result display.

  Args:
      parser (ArgumentParser): The parent parser to add the subcommand to.
  """
  student_parser = parser.add_parser("student",
    help="Shows a student's information in LADOK",
    description="""
```

```
18      Show a student's information in LADOK.
19      Shows information like name, personnummer, contact information.
20      """
21    )
22    student_parser.set_defaults(func=command)
23    ⟨add student command arguments to student parser 106a⟩
24
25  def command(ladok, args):
26    """Execute the student information display command.
27
28    Args:
29        ladok (LadokSession): The LADOK session for data access.
30        args: Parsed command line arguments containing student ID and display options.
31    """
32    ⟨print info depending on args 107d⟩
```

Root chunk (not used in this document).
Defines:
add_command_options, used in chunks 81b and 109c.
command, used in chunks 87a and 109c.

7.2 The student command options

7.2.1 The student identifier

As mentioned above, we want to take one positional argument, the student identifier. Since our API (Section 12.1) can handle both personnummer and LADOK ID transparently, we don't have to care about that either.

106a ⟨add student command arguments to student parser 106a⟩≡

```
1  student_parser.add_argument("id",
2    help="The student's ID, either personnummer or LADOK ID"
3  )
```

This definition is continued in chunks 106 and 107.
This code is used in chunk 105.

7.2.2 An optional course identifier

We also want an option for the course code.

106b ⟨add student command arguments to student parser 106a⟩+≡

```
1  student_parser.add_argument("-c", "--course",
2    nargs="?", const=".*",
3    help="A regular expression for which course codes to list, " \
4      "use no value for listing all courses."
5  )
```

This code is used in chunk 105.

7.2.3 An optional course state

The `--state` option selects the courses in a state, by the English names of `ladok3.COURSE_STATES` (Section 12.5.1). We give them as `choices`, so that `argparse` refuses a misspelt state with a list of the right ones and `argcomplete` completes them. The option can be

repeated for several states. A state is enough to list courses: `--state ongoing` lists the ongoing courses without `-c`, and with `-c` the two filters combine.

107a ⟨*add student command arguments to student parser* 106a⟩+≡

```
student_parser.add_argument("--state",
  action="append", choices=list(ladok3.COURSE_STATES),
  help="List only the courses in this state, can be repeated. "
    "Lists courses also without -c.  The state is that of the "
    "student's current registrations with a course code, the same "
    "registrations that -c lists."
)
```

This code is used in chunk 105.

7.2.4 A results flag

We also want a flag for specifying whether or not to include the results of each course.

107b ⟨*add student command arguments to student parser* 106a⟩+≡

```
student_parser.add_argument("-r", "--results",
  action="store_true", default=False,
  help="Set to include results for each course listed."
)
```

This code is used in chunk 105.

7.2.5 A contact information flag

We also want a flag for specifying whether or not to include the student's contact information (email, phone, address).

107c ⟨*add student command arguments to student parser* 106a⟩+≡

```
student_parser.add_argument("--contact",
  action="store_true", default=False,
  help="Include contact information (email, phone, address)."
)
```

This code is used in chunk 105.

7.3 Print the student data

Now that we have the student identifier, we can simply use that to fetch the student from LADOK. Note that we access the `student.alive` attribute just to force pulling the personal data from LADOK to trigger any error in the try-statement.

107d ⟨*print info depending on args* 107d⟩≡

```
try:
  student = ladok.get_student(args.id)
  student.alive
except Exception as err:
  ladok3.cli.err(-1, f"can't fetch student data for {args.id}: {err}")

print_student_data(student, args)

```

```
9   if args.course or args.state:
10    print()
11    print_course_data(student, args)
```

This code is used in chunk 105.
Uses print_course_data 109b and print_student_data 108a.

7.3.1 Printing personal student data

To print the student's personal data, we simply print the most interesting attributes.

108a ⟨*functions* 108a⟩≡

```
1   def print_student_data(student, args):
2     """Prints the student data, all attributes, to stdout.
3
4     Args:
5       student: A Student object with the student's data
6       args: Command line arguments, including flags like --contact
7     """
8     print(f"First name:   {student.first_name}")
9     print(f"Last name:    {student.last_name}")
10    print(f"Personnummer: {student.personnummer}")
11    print(f"LADOK ID:     {student.ladok_id}")
12    print(f"Alive:        {student.alive}")
13    ⟨print info about suspensions for student 108b⟩
14    ⟨print contact info if requested 109a⟩
```

This definition is continued in chunk 109b.
This code is used in chunk 105.
Defines:
print_student_data, used in chunk 107d.

We want to print whether the student is currently suspended or not. We want to make this really clear.

108b ⟨*print info about suspensions for* student 108b⟩≡

```
1   print(f"Suspended:    ", end="")
2   if any(map(lambda x: x.is_current, student.suspensions)):
3     print("YES")
4   else:
5     print("no")
```

This definition is continued in chunk 108c.
This code is used in chunk 108a.

Then we also want to print all the times the student has been suspended. We only want to print this if the student has been suspended at least once.

108c ⟨*print info about suspensions for* student 108b⟩+≡

```
1   if student.suspensions:
2     print(f"Suspenions:   ", end="")
3     for suspension in student.suspensions:
4       print(f"{suspension}", end="\n              ")
5     print()
```

This code is used in chunk 108a.

Now we add the contact information display. We only want to print this if the user has requested it using the `--contact` flag.

109a ⟨*print contact info if requested* 109a⟩≡

```
if args.contact:
  print("Contact information:")
  if student.email:
    print(f"Email:        {student.email}")
  if student.phone:
    print(f"Phone:        {student.phone}")
  if student.address:
    print(f"Address:      {student.address[0]}")
    for line in student.address[1:]:
      print(f"              {line}")
```

This code is used in chunk 108a.

7.3.2 Printing student's course data

To print the student's course data, we simply filter the courses on the options that the user supplies. Without `-c` there is no code to filter on, which happens when only `--state` is given. We then print all courses and, if the flag is set, we also print the results for each course.

109b ⟨*functions* 108a⟩+≡

```
def print_course_data(student, args):
  """Prints the courses"""
  print("Courses:")
  filters = {"code": args.course} if args.course else {}
  for course in student.courses(state=args.state, **filters):
    print(f"{course}")
    if args.results:
      for result in course.results():
        print(f"  {result}")
```

This code is used in chunk 105.
Defines:
`print_course_data`, used in chunk 107d.

7.3.3 Testing the course options

Let's verify that `--state` reaches `Student.courses`, also when repeated and without `-c`, and that a state that does not exist is refused. We parse the options with the real parser and run the real command, against a stand-in LADOK whose one student records how its courses are asked for; the real filtering is tested with the `Student` class (Section 12.5.1).

109c ⟨*test* `student.py` 109c⟩≡

```
import argparse
import ladok3.student
import pytest

def parse(*arguments):
  parser = argparse.ArgumentParser()
  ladok3.student.add_command_options(parser.add_subparsers())
```

```
8     return parser.parse_args(["student", "student-uid", *arguments])
9
10  class StudentRecordingCoursesCalls:
11    first_name, last_name = "Tolvan", "Tolvansson"
12    personnummer, ladok_id = "191212121212", "student-uid"
13    alive, suspensions = True, []
14
15    def __init__(self):
16      self.calls = []
17
18    def courses(self, /, **kwargs):
19      self.calls.append(kwargs)
20      return []
21
22  class LadokWithOneStudent:
23    def __init__(self):
24      self.student = StudentRecordingCoursesCalls()
25
26    def get_student(self, id):
27      return self.student
28
29  @pytest.mark.parametrize("arguments,calls", [
30    ([], []),
31    (["-c"], [{"state": None, "code": ".*"}]),
32    (["--state", "ongoing"], [{"state": ["ongoing"]}]),
33    (["--state", "ongoing", "--state", "upcoming", "-c", "DD13"],
34     [{"state": ["ongoing", "upcoming"], "code": "DD13"}]),
35  ])
36  def test_state_option_reaches_courses(arguments, calls, capsys):
37    ladok = LadokWithOneStudent()
38    ladok3.student.command(ladok, parse(*arguments))
39    assert ladok.student.calls == calls
40
41  def test_unknown_state_is_refused(capsys):
42    with pytest.raises(SystemExit):
43      parse("--state", "pagaende")
44    assert "ongoing" in capsys.readouterr().err
```

Root chunk (not used in this document).
Defines:
`LadokWithOneStudent`, never used.
`parse`, never used.
`StudentRecordingCoursesCalls`, never used.
`test_state_option_reaches_courses`, never used.
`test_unknown_state_is_refused`, never used.
Uses `add_command_options` 62 85 105 and `command` 85 105.

Part III

The Python library

Chapter 8

Overview

This is the documented source code of the LADOK3 API wrapper for Python, the package `ladok3`. We use the standard structure for the script. We start with the imports and then our class definitions follow in ⟨*classes* 119⟩ and some helper functions in ⟨*functions* 126b⟩.

112a ⟨`ladok3.py` 112a⟩≡

```
"""A Python wrapper for the LADOK3 API"""
# -*- coding: utf-8 -*-
import cachetools
import datetime
import functools
import html
import json
import operator
import re
import requests
import threading
import zoneinfo
from collections.abc import Callable
from requests.adapters import HTTPAdapter
from urllib3.util.retry import Retry
import urllib.parse
import weblogin.ladok
import weblogin.microsoft

⟨lazy session attributes 114⟩

⟨constants 128b⟩
⟨classes 119⟩
⟨functions 126b⟩
```

Root chunk (not used in this document).
Uses `wrapper` 209a.

We also provide tests for all functionality in `test_ladok3.py`. These illustrate how to the `ladok3` module and provide testing using `pytest`.

112b ⟨*test* `ladok3.py` 112b⟩≡

```
import datetime
import json
```

```
import ladok3
import os
import pickle
import pytest

⟨test functions 120⟩
```

Root chunk (not used in this document).

We can also test `CourseResult` parsing without a live LADOK session by using small local stubs.

113a ⟨test `course_result.py` 113a⟩≡

```
import datetime
import types

import ladok3
import ladok3.report
import pytest

⟨test course result helpers 212b⟩
⟨test course result functions 214⟩
```

Root chunk (not used in this document).

We also test session sharing between `LadokSession` instances and the module-level `session` and `test_session` attributes. These tests run without live LADOK credentials, so they get their own test file, separate from the live tests in `test_ladok3.py` whose import already requires credentials in the environment.

113b ⟨test `shared_session.py` 113b⟩≡

```
import ladok3
import ladok3.cli

import pytest

⟨shared session test functions 116b⟩
```

Root chunk (not used in this document).

8.1 Convenient access to a cached session

For scripts that use the CLI's cached credentials, we provide a convenient module-level attribute `session`. This allows a one-liner pattern:

```
import ladok3
student = ladok3.session.get_student("191234561234")
```

instead of the usual three-line boilerplate of loading credentials and restoring a cached session manually.

We provide a sibling attribute `test_session` for LADOK's test environment. The documentation build and the API test suite deliberately run against the test environment; before this attribute existed, every such run constructed its own `LadokSession` and performed a full SSO login with an MFA prompt. Every consumer except one should use these two attributes: the exception is `test_ladok3.py`'s module-level login, whose very purpose is to test *establishing* a session, which reusing an established session would defeat.

The session lifecycle—load credentials, try to restore a cached session, fall back to creating a fresh one—is shared with the CLI. Rather than duplicating that logic here, we delegate to `ladok3.cli.get_session`, which encapsulates the three-step process. The helper lives in `cli` because that module already owns the credential-loading and session-caching functions it depends on.

We use Python's module-level `__getattr__` (PEP 562) for lazy loading—importing `ladok3` alone does *not* require credentials; a session is loaded only when `session` or `test_session` is first accessed. We import `ladok3.cli` inside the functions rather than at module level to avoid circular imports, since `cli.py` itself imports `ladok3`.

114 ⟨*lazy session attributes* 114⟩≡

```
_session = None
_credentials = None
_test_session = None

def __getattr__(name):
    global _test_session
    if name == "session":
        return _cached_session()
    if name == "test_session":
        if _test_session is None:
            import ladok3.cli
            prod = _cached_session()
            institution, vars = ladok3.cli.load_credentials(
                ladok3.cli.default_config_file()
            )
            _test_session = LadokSession(
                institution, vars=vars,
                test_environment=True,
                session=prod.session
            )
        return _test_session
    raise AttributeError(
        f"module 'ladok3' has no attribute {name!r}"
    )
```

This definition is continued in chunks 115a and 116a.
This code is used in chunk 112a.
Defines:
`__getattr__`, used in chunk 136b.
`_credentials`, used in chunks 115 and 116.
`_session`, used in chunks 115 and 116.
`_test_session`, used in chunk 116b.
Uses `_cached_session` 115a, `LadokSession` 119, and `name` 179.

The `test_session` attribute does *not* get its own cached session. Instead it is a `LadokSession` facade for the test environment that shares the production session's underlying `weblogin.AutologinSession` (via the `session` constructor argument, Section 9.1). Sharing means sharing the SSO, identity-provider and MFA cookies: if the user has used the `ladok` tool—or anything else that touched `ladok3.session`—the test environment logs in on those cookies without any new MFA prompt; otherwise the first test-environment request authenticates once, and the production session benefits in the same way. It also means there is only *one* thing to cache: the production session's pickle carries the shared session with both environments'

handlers and cookies, and re-deriving the facade after a restore is safe because `add_handler` skips the handlers already present. One consequence is that the shared jar holds an XSRF token for each environment, so each `LadokSession` must pick the token of its own host (Section 16.3.3).

8.1.1 Loading and memoizing the production session

The first access to `session` runs `ladok3.cli.get_session` and memoizes the result, so all later accesses—including the derivation of `test_session`—return the same object.

If `get_session` itself raises we re-raise as a `RuntimeError` with a hint about `ladok login`, chaining the original exception (`raise ... from`) so the real cause stays visible in the traceback. An earlier version swallowed the exception and raised a bare `RuntimeError`, which made cache corruption indistinguishable from missing credentials. We must also handle the case where no exception is raised but no credentials were found anywhere: `load_credentials` then returns `None` values and `get_session` happily constructs a `LadokSession(None)`, which would only fail—confusingly—at the first request. Checking the returned credentials catches that case up front.

115a ⟨*lazy session attributes* 114⟩+≡

```
def _cached_session():
    global _session, _credentials
    if _session is None:
        import atexit
        import ladok3.cli
        try:
            _session, _credentials = (
                ladok3.cli.get_session()
            )
        except Exception as error:
            raise RuntimeError(
                ⟨no-credentials error message 115b⟩
            ) from error
        if _credentials is None:
            _session = None
            raise RuntimeError(
                ⟨no-credentials error message 115b⟩
            )
        atexit.register(_save_session)
    return _session
```

This code is used in chunk 112a.
Defines:
`_cached_session`, used in chunk 114.
Uses `_credentials` 114, `_save_session` 116a, and `_session` 114.

115b ⟨*no-credentials error message* 115b⟩≡

```
"No LADOK credentials found. "
"Run `ladok login` first, or "
"create a session manually with "
"ladok3.LadokSession(...)."
```

This code is used in chunk 115a.
Uses `LadokSession` 119.

8.1.2 Saving the session back on exit

Since LADOK sessions contain OAuth tokens that get refreshed during use, we register an `atexit` handler to save the session back to the cache on process exit. This preserves refreshed tokens for the next invocation, just as the CLI does after every command. Only the production session is saved: the test facade shares the same underlying session object, so its cookies and handlers are pickled as part of the production session.

116a ⟨*lazy session attributes* 114⟩+≡

```
def _save_session():
    if _session is not None and _credentials is not None:
        import ladok3.cli
        ladok3.cli.store_ladok_session(
            _session, _credentials
        )
```

This code is used in chunk 112a.
Defines:
  `_save_session`, used in chunk 115a.
Uses `_credentials` 114 and `_session` 114.

Let's verify the lazy attributes offline by replacing `ladok3.cli.get_session` (and `load_credentials`) with fakes. The fixture also resets the module globals through `monkeypatch`, which restores their previous values on teardown: a fake session leaking out of a test would poison later tests, and—since `_save_session` only writes when `_session` is set—the reset also keeps the `atexit` handler from pickling a fake to the user's real cache.

116b ⟨*shared session test functions* 116b⟩≡

```
@pytest.fixture
def fake_get_session(monkeypatch):
  fake = ladok3.LadokSession("KTH Royal Institute of Technology")
  creds = {"username": "u", "password": "p"}

  monkeypatch.setattr(ladok3.cli, "get_session",
                      lambda config_file=None: (fake, creds))
  monkeypatch.setattr(ladok3.cli, "load_credentials",
                      lambda filename=None:
                        ("KTH Royal Institute of Technology", creds))
  monkeypatch.setattr(ladok3, "_session", None)
  monkeypatch.setattr(ladok3, "_credentials", None)
  monkeypatch.setattr(ladok3, "_test_session", None)
  return fake

def test_module_session_memoizes(fake_get_session):
  assert ladok3.session is fake_get_session
  assert ladok3.session is ladok3.session

def test_module_test_session_shares_session(fake_get_session):
  assert ladok3.test_session.session is ladok3.session.session
  assert ladok3.test_session is ladok3.test_session

def test_module_session_raises_without_credentials(monkeypatch):
  monkeypatch.setattr(ladok3.cli, "get_session",
```

```
                      lambda config_file=None:
                        (ladok3.LadokSession(None), None))
  monkeypatch.setattr(ladok3, "_session", None)
  monkeypatch.setattr(ladok3, "_credentials", None)

  with pytest.raises(RuntimeError):
    ladok3.session

def test_module_session_chains_errors(monkeypatch):
  def boom(config_file=None):
    raise ValueError("cache corrupted")
  monkeypatch.setattr(ladok3.cli, "get_session", boom)
  monkeypatch.setattr(ladok3, "_session", None)

  with pytest.raises(RuntimeError) as excinfo:
    ladok3.session
  assert isinstance(excinfo.value.__cause__, ValueError)
```

This definition is continued in chunk 122c.
This code is used in chunk 113b.
Defines:
`fake_get_session`, never used.
`test_module_session_chains_errors`, never used.
`test_module_session_memoizes`, never used.
`test_module_session_raises_without_credentials`, never used.
`test_module_test_session_shares_session`, never used.
Uses `_credentials` 114, `_session` 114, `_test_session` 114, and `LadokSession` 119.

Chapter 9

Accessing LADOK

To access LADOK we provide a class `LadokSession`. An instance of this class provides the `session` attribute, which is an authenticated session to LADOK's REST API. It uses the `requests` module.

The simplest way to get a session is to use the module-level `ladok3.session` attribute, which handles credential loading, session caching, and cleanup automatically:

```
import ladok3

student = ladok3.session.get_student("123456-1234")
```

For experiments against LADOK's test environment, the sibling attribute `ladok3.test_session` works the same way; it shares the login state with `ladok3.session`, so using both costs at most one login.

For more control, we can use the class directly as follows.

```
import ladok3
import weblogin.kth

ladok = ladok3.LadokSession(
        "KTH Royal Institute of Technology",
        autologin_handlers=[
          weblogin.kth.SAMLlogin(),
          weblogin.kth.UGlogin(os.environ["KTH_LOGIN"],
                               os.environ["KTH_PASSWD"])
        ],
        test_environment=True) # for experiments

```

An alternative way would be to use the general authentication procedure that seems to work at most Swedish universities.

```
import ladok3

ladok = ladok3.LadokSession("KTH Royal Institute of Technology",
                            vars={"username": os.environ["KTH_LOGIN"],
                                  "password": os.environ["KTH_PASSWD"]},
                            test_environment=True) # for experiments
```

Yet another way is to use the `ladok` command's own credential store.

```
import ladok3
import ladok3.cli

ladok = ladok3.LadokSession(*ladok3.cli.load_credentials(),
                            test_environment=True) # for experiments
```

Just note the unpacking $*$ to unpack the tuple that `load_credentials` returns.

This chapter covers how the `LadokSession` class work. The remaining chapters cover what the `ladok` object can be used for. Chapter 12 covers how we can work with student data. Chapter 13 covers how we can work with course data.

9.1 The `LadokSession` class

There are two categories of functionality that we want from the `LadokSession` object. The first is the `session` attribute. This is an active and logged-in session that can be used to query LADOK (REST API over HTTPS). The second is the set of methods to get objects of interest, these methods use the `session` attribute to query data to create the objects. We cover the first (the `session` attribute) in this section and the second (the data methods) in Section 9.2.

We want to provide the attribute `session` which is an active and logged-in session for querying LADOK. We must thus handle authentication to LADOK. The authentication for using LADOK is performed using a university SSO system. We will use the `weblogin` package[1] to handle this. This will guarantee that we're always signed in.

[1] URL: https://github.com/dbosk/weblogin

119 ⟨*classes* 119⟩≡

```
class LadokSession:
  """This is an interface for reading and writing data from and to LADOK."""
  def __init__(self, institution: str, vars: dict | None = None,
               autologin_handlers: list | None = None,
               test_environment: bool = False,
               notification_cmd: str | None = None,
               session: weblogin.AutologinSession | None = None) -> None:
    """
    Creates a session with LADOK.
    - `institution` is the name (str) of the university that will give a unique
      match when searching SeamlessAccess.org (see weblogin.ladok.SSOlogin).
    - `vars` is a dictionary that is passed to weblogin.ladok.SSOlogin to
      supply the login credentials. Usually contains keys 'username' and
      'password', see weblogin.ladok.SSOlogin documentation for details.
    - `autologin_handlers` is a list of weblogin.AutologinHandler objects
      specific to the institution. Usually one for the SAML handler and one for
      the actual login server. (For KTH it's weblogin.kth.SAMLlogin and
      weblogin.kth.UGlogin.) Default value is None, only the
      `weblogin.ladok.SSOlogin` handler will be used.
      A `weblogin.microsoft.AzureMFA` handler is always appended automatically
      to handle Microsoft Authenticator MFA challenges.
    - `test_environment` specifies whether we should use LADOK's test
      environment instead of the production environment.
```

```
    - `notification_cmd` is an optional command (str) used to notify the user
      of the MFA number (e.g. 'notify-send'). The environment variable
      WEBLOGIN_MFA_NOTIFICATION takes precedence if set.
    - `session` is an optional existing weblogin.AutologinSession to reuse
      instead of creating a new one, e.g. another LadokSession's `.session`
      attribute. The handlers above are registered on it with `add_handler`
      (already present handlers are skipped). Sharing a session shares its
      authentication state: the SSO, identity-provider and MFA cookies are
      common, so a session already authenticated in one LADOK environment
      enters the other without a new login or MFA prompt.
    """
    self.__session = None
    ⟨construct the session object from the autologin handlers 121⟩
    ⟨LadokSession constructor body 141⟩

  @property
  def session(self) -> requests.Session:
    """A guaranteed to be active and logged in requests session to LADOK"""
    return self.__session

  @session.setter
  def session(self, new_value: requests.Session) -> None:
    self.__session = new_value

  ⟨LadokSession data methods 147⟩
```

This definition is continued in chunks 125, 130a, 132b, 136b, 137, 140, 148, 149, 154a, 169, 172, 185b, 197, and 204.
This code is used in chunk 112a.
Defines:
`LadokSession`, used in chunks 114–16, 120, 122c, 124b, 132a, 138b, 153, 154a, and 172.
Uses `__init__` 174a, `data` 174b, `name` 179, and `state` 183 202b 212a.

Now let's test this class. Unlike the other live tests, which share the cached session of `ladok3.test_session` (see Chapter 24), this test must establish a session itself: what it verifies is that the credentials passed in `vars` reach the login handlers. It therefore takes its credentials from the environment and logs in afresh, with one MFA prompt. The session comes from a fixture rather than from module level. A session created at import time made the whole module fail to import when the variables were missing, so the offline tests further down in this file never ran. The fixture instead skips this one test, and it creates the session only in a live run.

```
⟨test functions 120⟩≡
LOGIN_VARIABLES = ["LADOK_INST", "LADOK_USER", "LADOK_PASS"]

@pytest.fixture(scope="module")
def fresh_ladok(live):
  missing = [name for name in LOGIN_VARIABLES if name not in os.environ]
  if missing:
    pytest.skip(f"needs {', '.join(missing)} in the environment")
  return ladok3.LadokSession(
         os.environ["LADOK_INST"],
         vars={"username": os.environ["LADOK_USER"],
               "password": os.environ["LADOK_PASS"]},
```

```
            test_environment=True,
            notification_cmd="notify-send")

def test_LadokSession_vars(fresh_ladok):
  assert fresh_ladok.user_info_JSON()
```

This definition is continued in chunks 124b, 127a, 138, 139, 143–45, 150c, 159a, 161c, 162a, 164–68, 170b, 180–82, 184, 185a, 189, 191–95, 201b, 203, and 233–38.
This code is used in chunk 112b.
Defines:
`fresh_ladok`, never used.
`LOGIN_VARIABLES`, never used.
`test_LadokSession_vars`, never used.
Uses `LadokSession` 119 and `name` 179.

9.1.1 Construct the session using `weblogin`

To construct the session, we simply construct a `weblogin.AutologinSession` object. This one requires a list of `weblogin.AutologinHandler` objects.

We simply pass the institution to the constructor of the `weblogin.ladok.SSOlogin` class. We add that to the list of autologin handlers supplied by the user. Due to the internal workings of `weblogin.AutologinSession`, we add it first as a, probably negligible, optimization.

Many Swedish universities use Microsoft's identity platform, which may require multi-factor authentication (MFA) via Microsoft Authenticator. We add a `weblogin.microsoft.AzureMFA` handler at the end of the handler list to handle this transparently. It is placed last because MFA challenges occur after password authentication. The handler is passive: if no MFA challenge is encountered, it does nothing. Users can configure a custom notification command via the `WEBLOGIN_MFA_NOTIFICATION` environment variable.

Normally we construct a fresh `weblogin.AutologinSession` from the handlers. But the caller may instead pass an existing one through the `session` argument. The reason is that the `AutologinSession` holds all authentication state—the cookies for LADOK, for the university's identity provider and for Microsoft's MFA. Two `LadokSession` objects sharing one `AutologinSession` therefore authenticate at most once in total: once the identity-provider cookies exist, `weblogin.ladok.SSOlogin` rides them into the other environment without any new password or MFA prompt. This is what the module-level `ladok3.test_session` attribute uses to piggyback on `ladok3.session`.

121 ⟨*construct the session object from the autologin handlers* 121⟩≡

```
if not vars:
  vars = {}
if not autologin_handlers:
  autologin_handlers = []

autologin_handlers.insert(0,
            weblogin.ladok.SSOlogin(institution, vars=vars,
                                    test_environment=test_environment))

autologin_handlers.append(
            weblogin.microsoft.AzureMFA(notification_cmd=notification_cmd))

```

```
13  if session is not None:
14    ⟨register our handlers on the shared session 122a⟩
15  else:
16    ⟨create a fresh session from the handlers 122b⟩
```

This code is used in chunk 119.

For a shared session we register our handlers with `add_handler`, which skips handlers that are already present. That idempotence matters for the cached-session workflow: a session restored from the CLI's cache already contains the handlers pickled with it, so deriving a `LadokSession` from it again must not accumulate duplicates. We also leave the shared session's configuration alone—it was already set up (retry policy included) when it was first created.

122a ⟨register our handlers on the shared session 122a⟩≡

```
for handler in autologin_handlers:
  session.add_handler(handler)
self.__session = session
```

This code is used in chunk 121.

122b ⟨create a fresh session from the handlers 122b⟩≡

```
self.__session = weblogin.AutologinSession(autologin_handlers)
⟨configure retry policy for the session 124a⟩
```

This code is used in chunk 121.

Let's verify the sharing: deriving a second `LadokSession` from an existing session must reuse the very same `AutologinSession` object and add only the handlers that are new (here: the test environment's `SSOlogin`). Deriving the same facade twice must not grow the handler list further, which is what makes re-derivation from a restored cached session safe.

122c ⟨shared session test functions 116b⟩+≡

```
def test_shared_session_is_same_object():
  prod = ladok3.LadokSession("KTH Royal Institute of Technology")
  test = ladok3.LadokSession("KTH Royal Institute of Technology",
                             test_environment=True,
                             session=prod.session)
  assert test.session is prod.session

def test_shared_session_deduplicates_handlers():
  prod = ladok3.LadokSession("KTH Royal Institute of Technology")
  handlers = prod.session._AutologinSession__handlers
  count = len(handlers)

  ladok3.LadokSession("KTH Royal Institute of Technology",
                      test_environment=True,
                      session=prod.session)
  assert len(handlers) == count + 1

  ladok3.LadokSession("KTH Royal Institute of Technology",
                      test_environment=True,
                      session=prod.session)
  assert len(handlers) == count + 1
```

This code is used in chunk 113b.
Defines:
`test_shared_session_deduplicates_handlers`, never used.
`test_shared_session_is_same_object`, never used.
Uses `LadokSession` 119.

9.1.2 Retry policy for network resilience

Network operations can fail transiently due to temporary connectivity issues, server overload, or other intermittent problems. To make the LADOK API wrapper more robust, we implement an automatic retry mechanism with exponential backoff.

The retry policy addresses the "why" behind network failures: they are often temporary. Rather than immediately failing when encountering a network error or server overload (5xx errors), we wait and try again. The exponential backoff prevents overwhelming an already struggling server while still providing reasonable response times for transient failures.

We use the `urllib3.util.retry.Retry` class, which provides sophisticated retry logic, combined with `requests.adapters.HTTPAdapter` to integrate it into our session. This approach is preferable to manual retry loops because it:

- Handles backoff timing automatically with exponential growth
- Respects HTTP standards (like `Retry-After` headers)
- Integrates seamlessly with the `requests` session infrastructure
- Applies to all HTTP methods uniformly

We configure the retry policy as follows:

Total retries We set a maximum of 10 retry attempts. With exponential backoff starting at 1 second, this allows for approximately 5 minutes of total retry time (1, 2, 4, 8, 16, 32, 64, 128, 256, 300 seconds = ~5 minutes when capped at 300 seconds).

Backoff factor We use a backoff factor of 1, meaning the wait time between retries is $\{\text{backoff factor}\} \times 2^{(\text{retry number} - 1)}$ seconds. The first retry waits 1 second, the second waits 2 seconds, the third waits 4 seconds, and so on.

Maximum backoff We cap the backoff at 300 seconds (5 minutes) to prevent excessively long waits on later retries while still allowing the full retry sequence to span approximately 5 minutes total.

Status forcelist We retry on HTTP status codes 500 (Internal Server Error), 502 (Bad Gateway), 503 (Service Unavailable), and 504 (Gateway Timeout). These indicate temporary server-side issues that often resolve quickly.

Status retries We allow at most 2 retries because of such a status, on top of the total limit above. A dropped connection or an overloaded gateway (502–504) usually clears up within seconds, but a 500 is often deterministic: LADOK fails the same way for the same request every time. For example, when we once sent the wrong XSRF token (Section 16.3.3), every PUT got a 500, and the full ten retries made each failing request wait for about 13 minutes before giving up. That is far too long when a bulk report has one such row per

student. Capping the status retries separately keeps the ten patient retries for network problems while a persistent server error fails within seconds.

Raise on status We turn this off. By default, once the status retries are used up, `urllib3` raises its own `RetryError` ('too many 500 error responses'), and LADOK's explanation of the error is lost. With `raise_on_status=False` we instead get the last response back, so our query methods can report what LADOK said (Section 16.3.2).

Allowed methods We allow retries on all HTTP methods including GET, POST, PUT, and DELETE. While POST/PUT/DELETE are not idempotent by HTTP standards, LADOK's API design makes these operations safe to retry (results are either already recorded or will be recorded on retry).

124a ⟨*configure retry policy for the session* 124a⟩≡

```
retry_strategy = Retry(
    total=10,
    backoff_factor=1,
    backoff_max=300,
    status_forcelist=[500, 502, 503, 504],
    status=2,
    raise_on_status=False,
    allowed_methods=["HEAD", "GET", "PUT", "DELETE", "OPTIONS", "TRACE",
                     "POST"]
)
adapter = HTTPAdapter(max_retries=retry_strategy)
self.__session.mount("http://", adapter)
self.__session.mount("https://", adapter)
```

This code is used in chunk 122b.
Defines:
`adapter`, never used.
`retry_strategy`, never used.

The `mount` method attaches the retry-enabled adapter to both HTTP and HTTPS URLs, ensuring all requests through this session benefit from automatic retries.

The adapter is part of the session object, so it is pickled into the cache along with it. A session restored from the cache therefore keeps the retry policy it was created with; a change to the policy reaches the user's cached session only with the next fresh login (`ladok login`).

Let's verify that a new session fails fast on server errors and hands us the last response instead of raising. Creating the session makes no request, so this test runs offline.

124b ⟨*test functions* 120⟩+≡

```
def test_retry_policy_fails_fast_on_server_errors():
    ls = ladok3.LadokSession("KTH Royal Institute of Technology")
    retry = ls.session.get_adapter(ls.base_url).max_retries
    assert retry.total == 10
    assert retry.status == 2
    assert retry.raise_on_status is False
```

This code is used in chunk 112b.
Defines:
`test_retry_policy_fails_fast_on_server_errors`, never used.
Uses `LadokSession` 119.

9.2 The `LadokSession` data methods

The data methods are essentially factories for various objects mapping to data in LADOK. We will first look at the base classes and then provide methods that return instances of various subclasses.

9.2.1 LADOK data base class: `LadokData`

Some objects will only have read-only attributes, like grade scales, whereas others, like students, will have modifiable attributes, such as results, which must be synced.

We will provide properties for the various attributes. This way we can have read-only properties for attributes that cannot be changed, such as students' names, and read–write properties for attributes that can be changed, such as results.

We also want to serialize the data, so that a program can save objects and get them back later. We use JSON for this: the read-only property `json` turns an object into a JSON-compatible dictionary, and the function `restore` turns that dictionary back into the object (Section 9.2.2).

We provide the `LadokData` class with a constructor that takes keyword arguments (`**kwargs`). These are not used, but just so that we can add `super().__init__(**kwargs)` at the top of every constructor of the child classes.

Thus, we have the following base class.

125 ⟨*classes* 119⟩+≡

```
class LadokData:
  """Base class for LADOK data"""
  def __init__(self, /, **kwargs):
    pass

  def make_properties(self, kwargs):
    """Turn keywords into private attributes and read-only properties"""
    ⟨set up read-only properties 127b⟩

  def __eq__(self, other):
    ⟨compare self and other attribute by attribute, safe for cycles 128a⟩

  def __repr__(self):
    ⟨represent the object by its own attributes 126a⟩

  @property
  def json(self):
    """JSON compatible dictionary of the object and the objects that it
    refers to, which `restore` turns back into an equal object"""
    return _JSONWriter().object(self)
```

This code is used in chunk 112a.
Defines:
`LadokData`, used in chunks 126b, 130–32, 134a, 137, 140, 148, 149, 169, and 185b.
Uses `__init__` 174a, `_JSONWriter` 130a, `attributes` 126a, `data` 174b, and `restore` 132a.

An object is represented by its own data, for instance

```
<GradeScale id=1 code='PF' name='Underkänd, godkänd' grades=[2 x
                                <Grade>]>.
```

Each attribute is shown by the name of its property, and each object that it refers to by its class only. We could show the objects that it refers to as well, as its JSON does (Section 9.2.2), but a `repr` is for a person who looks at one object, in a debugger or a notebook, and the objects behind it can be many: a course round refers to its participants, they to their courses, and those to their components and results. A list of objects, such as a course round's participants, we show by their number and class. The session is left out, since it is the same for all objects. A class can replace this with a form of its own: a course registration is shown on one line by its course code, round and dates, which is how a student's courses are best listed (Section 14.1). That form, too, reads only what the registration got when it was made.

`repr` must not fail, nor ask LADOK for anything: a debugger or pytest calls it when something has already gone wrong, and an object restored without a session cannot ask LADOK (Section 9.2.2). So we read the attributes that the object holds, not its properties, which could fetch what is missing.

126a ⟨*represent the object by its own attributes* 126a⟩≡

```
attributes = [f"{public_name(type(self), key)}={short_repr(value)}"
              for key, value in vars(self).items()
              if key != SESSION_ATTRIBUTE]
return f"<{' '.join([type(self).__name__, *attributes])}>"
```

This code is used in chunk 125.
Defines:
`attributes`, used in chunks 125, 127b, 134b, 139a, 142, 143b, 155, 157, and 160a.
Uses `public_name` 126b, `SESSION_ATTRIBUTE` 131a, and `short_repr` 126b.

126b ⟨*functions* 126b⟩≡

```
def public_name(cls, key):
  """Returns key without the class name that Python mangles into it"""
  for base in cls.__mro__:
    prefix = f"_{base.__name__}__"
    if key.startswith(prefix):
      return key[len(prefix):]
  return key

def short_repr(value):
  """Represents value without the objects that it refers to"""
  if isinstance(value, LadokData):
    return f"<{type(value).__name__}>"
  if isinstance(value, list):
    if value and isinstance(value[0], LadokData) \
        and all(type(item) is type(value[0]) for item in value):
      return f"[{len(value)} x {short_repr(value[0])}]"
    return f"[{', '.join(map(short_repr, value))}]"
  if isinstance(value, dict):
    return "{" + ", ".join(f"{short_repr(key)}: {short_repr(item)}"
                           for key, item in value.items()) + "}"
  return repr(value)
```

This definition is continued in chunks 132a, 134a, 135a, 142–45, 154b, 164a, 191a, and 199a.
This code is used in chunk 112a.
Defines:
`public_name`, used in chunk 126a.
`short_repr`, used in chunk 126a.

Uses `cls` 133b 133c, `LadokData` 125, and `name` 179.

A grade scale must show its own data but not its grades' data, and an object restored without a session must be shown without fetching anything. A student that holds only its LADOK ID would otherwise fetch its name.

127a ⟨*test functions* 120⟩+≡

```
def test_repr_shows_an_object_but_not_the_objects_it_refers_to():
  text = repr(make_grade_scale())
  assert text == ("<GradeScale id=1 code='PF' name='Underkänd, godkänd' "
                  "grades=[2 x <Grade>]>")

def test_repr_asks_nothing_of_ladok():
  student = ladok3.restore({"type": "Student",
                            "_Student__ladok_id": "student-uid"})
  assert repr(student) == "<Student ladok_id='student-uid'>"
```

This code is used in chunk 112b.
Defines:
`test_repr_asks_nothing_of_ladok`, never used.
`test_repr_shows_an_object_but_not_the_objects_it_refers_to`, never used.
Uses `code` 179, `Grade` 25b 149, `GradeScale` 148, `ladok_id` 155, `make_grade_scale` 150c, `name` 179, `restore` 132a, and `Student` 154a.

The `make_properties` method sets up private attributes and read-only properties from keyword arguments, for a subclass that wants to keep data as it comes. No class in this module uses it any longer: the grade scales, grades and suspensions used it to accept their own JSON, until `restore` learnt to rebuild objects without their constructors (Section 9.2.2). We keep it since it is public, for programs that subclass `LadokData`. For each keyword in `kwargs`, we add the private attribute using `setattr(self, ...)` and the corresponding property to the class itself using `setattr(type(self), ...)`. (Note that we only add the property if it doesn't already exist.) We check the names, if the attributes already match the pattern for a private attribute name, we don't 'privatize' it again.

127b ⟨*set up read-only properties* 127b⟩≡

```
for attribute in kwargs:
  # private attributes are named on the form _class__attribute
  priv_attr_prefix = f"_{type(self).__name__}__"
  if priv_attr_prefix in attribute:
    priv_attr_name = attribute
    property_name = attribute.replace(priv_attr_prefix, "")
  else:
    priv_attr_name = priv_attr_prefix + attribute
    property_name = attribute

  setattr(self, priv_attr_name, kwargs[attribute])
  if not hasattr(type(self), property_name):
    setattr(type(self), property_name,
      property(operator.attrgetter(priv_attr_name)))
```

This code is used in chunk 125.
Uses `attributes` 126a.

Equality Two objects are equal when they are of the same class and have equal attributes. Comparing the attribute dictionaries says just that, as long as the objects form a tree. They do not: a student keeps its course registrations and each registration keeps the student; a course keeps its components and each component keeps the course (Section 9.2.2 has the whole picture). Comparing two distinct copies of such a graph, say a student and the same student restored from JSON, would go student, registration, student, registration, and so on, until Python gives up with a `RecursionError`. (Comparing an object with itself never gets that far, since Python's dictionaries take an identical value as equal without calling `__eq__`.)

We break the cycle the way one compares cyclic structures in general: while we compare a pair of objects, we assume that they are equal. If the comparison meets the same pair again further down, it has come back to where it started. Nothing on that path has differed, so the assumption holds as far as the path goes, and the rest of the comparison decides. If anything differs anywhere in the graph, the comparison where it differs returns false, and so does every comparison that led there. We keep the pairs that are being compared in a set per thread, since another thread comparing the same objects makes a comparison of its own, and remove the pair when we are done, also when the comparison raises an exception. The identities, `id`, of the two objects identify the pair; both objects are alive while we compare them, so no other object can have the same identity.

128a ⟨*compare* `self` *and* `other` *attribute by attribute, safe for cycles* 128a⟩≡

```
if self is other:
  return True
if type(self) != type(other):
  return False

pair = (id(self), id(other))
pairs_being_compared = vars(EQUALITY_STATE).setdefault("pairs", set())
if pair in pairs_being_compared:
  return True
pairs_being_compared.add(pair)
try:
  return self.__dict__ == other.__dict__
finally:
  pairs_being_compared.discard(pair)
```

This code is used in chunk 125.
Defines:
`pair`, used in chunk 136a.
`pairs_being_compared`, never used.
Uses `EQUALITY_STATE` 128b.

128b ⟨*constants* 128b⟩≡

```
EQUALITY_STATE = threading.local()
```

This definition is continued in chunks 131a, 190, and 201c.
This code is used in chunk 112a.
Defines:
`EQUALITY_STATE`, used in chunk 128a.

9.2.2 To and from JSON format

We want `restore(obj.json)` to give an object equal to `obj`, of the same class, for every LADOK object, also after a trip through JSON text, such as a file.

```
with open("student.json", "w") as file:
  json.dump(student.json, file)
...
with open("student.json") as file:
  student = ladok3.restore(json.load(file), ladok=ladok3.session)
```

(The command-line interface keeps its session across runs with `pickle` instead, see `store_ladok_session`. JSON is for data that a program wants to keep in a form that people and other programs can read.)

Three properties of the objects make this harder than writing out their attributes.

The objects form a graph. A student keeps its course registrations, and each registration keeps the student. A registration also keeps its components and results, each component keeps its course and each result keeps its component. And objects are shared: one grade scale serves many components and results. Writing the attributes recursively would never end, and writing a shared object once for every use would restore copies where there was one object.

The handles keep a session. The remote data (`LadokRemoteData`, Section 9.2.3)—students, course rounds, course registrations, results—are handles onto state that lives in LADOK. They keep the `LadokSession`, fill their attributes lazily from LADOK and push changes back to it. The session is not data and cannot be written as JSON.

Some values are not JSON. Course rounds have start and end dates, and a suspension has a tuple of dates, but JSON has only strings, numbers, Booleans, lists, objects and null.

The format We write the whole graph that the object refers to, each object once. An object becomes a JSON object with its class in `type`, a number in `$id` and its private attributes, under the names that Python keeps them under, such as `_Student__ladok_id`. When we meet an object a second time, we write only a reference to it, e.g.,`{"$ref": 0}`. (This is the idea of the memo of `pickle` and of the references of JSON Schema.) The values that JSON lacks become objects with a single key that starts with `$` too: `{"$date": "2026-08-31"}`, `{"$datetime": ...}` and `{"$tuple": [...]}`. A student with one course registration then looks like this, shortened.

```
{"type": "Student", "$id": 0,
 "_Student__personnummer": "191212121212",
 "_Student__ladok_id": "student-uid",
 "_Student__courses": [
   {"type": "CourseRegistration", "$id": 1,
    "_CourseInstance__instance_id": "instance-round-ok",
    "_CourseRegistration__student": {"$ref": 0},
    "_CourseRegistration__start": {"$date": "2026-08-31"},
    ...}]}
```

The session is left out. `restore` takes it as an argument instead. Without one, the restored object is a detached snapshot: it has all the data that was written, but it cannot fetch more (Section 9.2.2).

We write the private attributes rather than what the properties return, for two reasons. First, the properties of a handle fetch from LADOK what the object does not have yet. Writing the properties would fetch everything about a student; writing the attributes writes what the object has fetched so far, no more. A student restored with a session then fetches the rest when it is needed, just as the original would have. Second, `restore` can then rebuild an object without calling its constructor, the way `pickle` does: it creates an empty object of the class and gives it the attributes. The constructors take LADOK's data, not ours, and some of them ask LADOK for more, such as a grade scale, so they could not rebuild an object from its JSON anyway.

Unlike `pickle`, `restore` cannot be made to run code by the data: the only objects that it creates are of `LadokData` classes, and all that it does with them is set their attributes. So restoring JSON from a file that one does not fully trust cannot make the program run code of the file's choosing, which restoring a pickle can. The data are another matter: they are only as right as their source, and a handle restored with a session pushes to LADOK whatever it holds.

Writing the graph The `json` property hands the object to a `_JSONWriter`, which remembers the objects that it has written.

130a ⟨*classes* 119⟩+≡

```
class _JSONWriter:
  """Writes a LadokData object, and the objects that it refers to, as
  JSON-compatible data, each object once"""
  def __init__(self):
    self.__ids = {}

  def object(self, ladok_data):
    ⟨write ladok_data, or a reference if it is written already 130b⟩

  def value(self, value, name):
    ⟨write the value of the attribute name as JSON 131b⟩
```

This code is used in chunk 112a.
Defines:
`_JSONWriter`, used in chunks 125 and 132b.
Uses `__init__` 174a, `data` 174b, `ladok_data` 133b, `LadokData` 125, and `name` 179.

The writer numbers the objects in the order that it meets them. It knows an object by its identity, `id`, not by equality: two distinct but equal objects must remain two after the round trip. (Every object is alive while we write, since the graph refers to it, so no identity can be reused for another object.) We number an object before we write its attributes, so that an attribute that leads back to the object becomes a reference. The session is the one attribute that we leave out.

130b ⟨*write* `ladok_data`, *or a reference if it is written already* 130b⟩≡

```
if id(ladok_data) in self.__ids:
  return {"$ref": self.__ids[id(ladok_data)]}
self.__ids[id(ladok_data)] = len(self.__ids)

json_dict = {"type": type(ladok_data).__name__,
             "$id": self.__ids[id(ladok_data)]}
for name, value in vars(ladok_data).items():
  if name != SESSION_ATTRIBUTE:
```

```
9       json_dict[name] = self.value(value, name)
10    return json_dict
```

This code is used in chunk 130a.
Defines:
  `json_dict`, used in chunks 132–34 and 138b.
Uses `ladok_data` 133b, `name` 179, and `SESSION_ATTRIBUTE` 131a.

The session attribute is the private attribute of `LadokRemoteData`, which has the name mangled with that class.

131a ⟨*constants* 128b⟩+≡

```
1  SESSION_ATTRIBUTE = "_LadokRemoteData__ladok"
```

This code is used in chunk 112a.
Defines:
  `SESSION_ATTRIBUTE`, used in chunks 126a, 130b, 133b, and 134b.

For the values, we must check for `datetime.datetime` before `datetime.date`, since a `datetime` is a `date` too. A value of any other type is a bug in the class that keeps it, so we raise an error that names the attribute and the type, but not the value, which may be personal data.

131b ⟨*write the* `value` *of the attribute* `name` *as JSON* 131b⟩≡

```
1  if value is None or isinstance(value, (str, int, float)):
2    return value
3  if isinstance(value, LadokData):
4    return self.object(value)
5  if isinstance(value, list):
6    return [self.value(item, name) for item in value]
7  if isinstance(value, tuple):
8    return {"$tuple": [self.value(item, name) for item in value]}
9  if isinstance(value, datetime.datetime):
10   return {"$datetime": value.isoformat()}
11 if isinstance(value, datetime.date):
12   return {"$date": value.isoformat()}
13 if isinstance(value, dict):
14   ⟨write the dictionary value so that it is not taken for ours 131c⟩
15 raise TypeError(f"cannot write the attribute {name} as JSON: "
16                 f"{type(value).__name__} is not a JSON type")
```

This code is used in chunk 130a.
Uses `LadokData` 125 and `name` 179.

A dictionary among the values is LADOK's own data, such as the name of a course in Swedish and English, `{"sv": ..., "en": ...}`. We write it as it is, unless `restore` would take it for one of ours: one with a `type` key looks like an object and one with a key that starts with `$` looks like a reference or a value that JSON lacks. JSON also allows only strings as keys. We write such a dictionary as a list of key–value pairs under `$dict`.

131c ⟨*write the dictionary* `value` *so that it is not taken for ours* 131c⟩≡

```
1  if all(isinstance(key, str) and key != "type" and not key.startswith("$")
2         for key in value):
3    return {key: self.value(item, name) for key, item in value.items()}
4  return {"$dict": [[self.value(key, name), self.value(item, name)]
5                    for key, item in value.items()]}
```

This code is used in chunk 131b.
Uses `name` 179.

Restoring the graph `restore` reverses the writing with a `_JSONReader`, which remembers the objects by their numbers, so that the references can find them. It works in two passes, for a reason that we will see below: first it creates an empty object for every numbered object in the data, then it gives the objects their attributes.

132a ⟨*functions* 126b⟩+≡

```
def restore(json_dict, ladok=None):
  """Restore a LadokData object from its `json` dictionary.

  `json_dict` is what the object's `json` property returns, also after a
  round trip through JSON text.  The objects that it refers to are restored
  with it, each once, so cycles and shared objects come back as they were.

  Students, courses and results get `ladok` as their LadokSession and fetch
  what the JSON lacks from LADOK, as usual.  Without `ladok` they are
  detached: they have the data in the JSON, and fetching anything else
  raises LadokDetachedError.

  Raises TypeError if a type is not a LadokData class or a key is not a
  private attribute of its class, and ValueError if an object's number, a
  reference or a marked value is malformed.
  """
  reader = _JSONReader(ladok)
  reader.create_objects(json_dict)
  return reader.object(json_dict)
```

This code is used in chunk 112a.
Defines:
`restore`, used in chunks 125, 127a, 133, 134, 136–39, 150c, 168b, 170b, 195c, and 234–38.
Uses `_JSONReader` 132b, `courses` 160a, `data` 174b, `json_dict` 130b, `LadokData` 125, `LadokSession` 119, and `results` 77b 187a.

132b ⟨*classes* 119⟩+≡

```
class _JSONReader:
  """Restores LadokData objects from what _JSONWriter wrote"""
  def __init__(self, ladok):
    self.__session = DETACHED if ladok is None else ladok
    self.__objects = {}

  def create_objects(self, value):
    ⟨create an empty object for every numbered object in value 133a⟩

  def empty_object(self, json_dict):
    ⟨create an empty object of the class in json_dict 133b⟩

  def object(self, json_dict):
    ⟨find the empty object for json_dict 133c⟩
    ⟨give ladok_data the attributes in json_dict 134b⟩
    return ladok_data

  def value(self, value):
    ⟨restore value from JSON 135b⟩
```

This code is used in chunk 112a.
Defines:

_JSONReader, used in chunks 132a and 138b.
Uses __init__ 174a, _JSONWriter 130a, DETACHED 136b, json_dict 130b, ladok_data 133b, and LadokData 125.

A reference must find its object wherever the object is in the data. The writer writes each object in full the first time it meets it, so a reader that went through the data in the order of writing would always have met the object before any reference to it. But we cannot rely on that order: JSON does not order the keys of an object, and tools that sort them, such as `json.dumps(..., sort_keys=True)` or `jq -S`, can move a reference in front of the object that it refers to. That is why the first pass creates an empty object for every numbered object, wherever it is, before the second pass restores any attribute. The first pass goes through everything that can hold an object: the values of every dictionary, ours, LADOK's and the marked ones alike, and the items of every list. It also checks the numbers. The writer numbers the objects with integers, so any other number is not from the writer, nor is a number that two objects have.

133a ⟨*create an empty object for every numbered object in* `value` 133a⟩≡

```
if isinstance(value, list):
  for item in value:
    self.create_objects(item)
elif isinstance(value, dict):
  if "type" in value and "$id" in value:
    number = value["$id"]
    if not isinstance(number, int) or isinstance(number, bool):
      raise ValueError("an object's number must be an integer, "
                       f"not {type(number).__name__}")
    if number in self.__objects:
      raise ValueError(f"two objects numbered {number}")
    self.__objects[number] = self.empty_object(value)
  for item in value.values():
    self.create_objects(item)
```

This code is used in chunk 132b.

We create an object with the class's __new__, which gives an object without attributes, without calling the constructor. A handle gets the session at once, where its constructor would have put it.

133b ⟨*create an empty object of the class in* `json_dict` 133b⟩≡

```
cls = ladok_data_class(json_dict["type"])
ladok_data = cls.__new__(cls)
if isinstance(ladok_data, LadokRemoteData):
  vars(ladok_data)[SESSION_ATTRIBUTE] = self.__session
return ladok_data
```

This code is used in chunk 132b.
Defines:
cls, used in chunks 126b, 134, 135a, and 138a.
ladok_data, used in chunks 130, 132–34, and 138a.
Uses json_dict 130b, ladok_data_class 134a, LadokRemoteData 140, and SESSION_ATTRIBUTE 131a.

In the second pass, a numbered object is the one that the first pass created. An object without a number, which the writer never writes but a person might, we create when we meet it; nothing can refer to it.

133c ⟨*find the empty object for* `json_dict` 133c⟩≡

```
if not isinstance(json_dict, dict) or "type" not in json_dict:
```

```
    raise TypeError("cannot restore a dictionary without a 'type' key")
  if "$id" in json_dict:
    ladok_data = self.__objects[json_dict["$id"]]
  else:
    ladok_data = self.empty_object(json_dict)
  cls = type(ladok_data)
```

This code is used in chunk 132b.
Defines:
`cls`, used in chunks 126b, 134, 135a, and 138a.
Uses `json_dict` 130b, `ladok_data` 133b, and `restore` 132a.

The name in `type` must be that of a `LadokData` class: the class itself or a subclass at any depth. We look for the subclasses when we need them, so a class added later is included without being listed anywhere. Two classes with the same name would make the name ambiguous, so we refuse it, as we refuse a name that no class has.

134a ⟨*functions* 126b⟩+≡

```
def ladok_data_class(type_name):
  """Returns the LadokData class (or subclass) named type_name"""
  classes = {}
  unvisited = [LadokData]
  while unvisited:
    cls = unvisited.pop()
    classes.setdefault(cls.__name__, set()).add(cls)
    unvisited.extend(cls.__subclasses__())

  candidates = classes.get(type_name, set()) \
    if isinstance(type_name, str) else set()
  if len(candidates) != 1:
    raise TypeError(f"cannot restore type {type_name!r}: "
                    f"{len(candidates)} LadokData classes have that name")
  return candidates.pop()
```

This code is used in chunk 112a.
Defines:
`ladok_data_class`, used in chunk 133b.
Uses `cls` 133b 133c, `LadokData` 125, `name` 179, and `restore` 132a.

Each key must name a private attribute of the class or of a class that it inherits from: Python mangles `self.__start` in `CourseRegistration` to `_CourseRegistration__start`, and `self.__code` in `CourseInstance` to `_CourseInstance__code`, also in a registration. We set the attributes directly in the object's dictionary, as `pickle` does, so no key can add a property to the class or reach a property's setter. But a key could still put a value in front of a method, since an object's own attributes take precedence over the class's methods: the key `_Student__get_personal_attributes` would replace the method that fetches a student's name. So we also refuse a key that names something callable in the class. (A class attribute that is data, such as the default of `_CourseInstance__pulled`, is fine to override; that is what the instance does.) The session comes from the argument to `restore`, never from the data. We name the key that we refuse, never its value.

Note that we do not require all attributes to be there: a handle fills its attributes lazily, so its JSON has those that it had fetched.

134b ⟨*give* `ladok_data` *the attributes in* `json_dict` 134b⟩≡

```
for key, value in json_dict.items():
```

```
    if key in ("type", "$id"):
      continue
    if not is_private_attribute_of(cls, key) or key == SESSION_ATTRIBUTE:
      raise TypeError(f"cannot restore {cls.__name__}: "
                      f"{key!r} is not one of its private attributes")
    if callable(getattr(cls, key, None)):
      raise TypeError(f"cannot restore {cls.__name__}: "
                      f"{key!r} is one of its methods")
    vars(ladok_data)[key] = self.value(value)
```

This code is used in chunk 132b.
Uses `attributes` 126a, `cls` 133b 133c, `is_private_attribute_of` 135a, `json_dict` 130b, `ladok_data` 133b, `restore` 132a, and `SESSION_ATTRIBUTE` 131a.

135a ⟨*functions* 126b⟩+≡

```
def is_private_attribute_of(cls, key):
  """Returns True if key is a mangled private name of cls or its bases"""
  if not isinstance(key, str):
    return False
  for base in cls.__mro__:
    prefix = f"_{base.__name__}__"
    if key.startswith(prefix) and key[len(prefix):].isidentifier():
      return True
  return False
```

This code is used in chunk 112a.
Defines:
`is_private_attribute_of`, used in chunk 134b.
Uses `cls` 133b 133c and `name` 179.

For the values, a dictionary with a `type` key is an object and one with a key that starts with `$` is a reference or a marked value, which has exactly one key. Any other dictionary is LADOK's data and keeps its keys.

135b ⟨*restore* `value` *from JSON* 135b⟩≡

```
if isinstance(value, list):
  return [self.value(item) for item in value]
if not isinstance(value, dict):
  return value
if "type" in value:
  return self.object(value)
if not any(isinstance(key, str) and key.startswith("$") for key in value):
  return {key: self.value(item) for key, item in value.items()}

if len(value) != 1:
  raise ValueError(f"a marked value must have a single key, "
                   f"not {sorted(map(str, value))}")
(marker, content), = value.items()
⟨restore the value that marker marks 136a⟩
```

This code is used in chunk 132b.

A reference must be to one of the numbered objects, which the first pass has created. The content of each marker must have the shape that the writer gives it, and we check that shape, so that malformed data gives a `ValueError` that says what is wrong, not whatever error the conversion happens to raise. The keys of a `$dict` must also be hashable after they are restored, which a list, for instance, is not.

136a ⟨*restore the value that* `marker` *marks* 136a⟩≡

```
if marker == "$ref":
  if not isinstance(content, int) or content not in self.__objects:
    raise ValueError(f"reference to object {content!r}, "
                     "which is not in the data")
  return self.__objects[content]
if marker in ("$date", "$datetime"):
  if not isinstance(content, str):
    raise ValueError(f"{marker} must be a string, "
                     f"not {type(content).__name__}")
  if marker == "$date":
    return datetime.date.fromisoformat(content)
  return datetime.datetime.fromisoformat(content)
if marker == "$tuple":
  if not isinstance(content, list):
    raise ValueError(f"$tuple must be a list, not {type(content).__name__}")
  return tuple(self.value(item) for item in content)
if marker == "$dict":
  if not isinstance(content, list) or not all(
      isinstance(pair, list) and len(pair) == 2 for pair in content):
    raise ValueError("$dict must be a list of key--value pairs")
  pairs = [(self.value(key), self.value(item)) for key, item in content]
  try:
    return dict(pairs)
  except TypeError:
    raise ValueError("a key in a $dict is not hashable") from None
raise ValueError(f"unknown marker {marker!r}")
```

This code is used in chunk 135b.
Uses `data` 174b and `pair` 128a.

Detached objects An object restored without a session keeps its data, but the moment it needs LADOK, it must fail, and say why. It needs LADOK by calling a method of its session, so we give it a session that answers every method with an error, a `LadokDetachedError`. We let names that start with an underscore raise `AttributeError` as usual. Tools probe objects for such names and take `AttributeError` to mean that there is none: IPython, for instance, looks for `_repr_html_` and its kin to display an object. (The special methods that `pickle` and `copy` use, such as `__reduce__`, Python looks up on the class, so they never reach `__getattr__`.) For a public name, even `hasattr` raises the error, since `hasattr` catches only `AttributeError`. That is what we want: nothing has reason to ask a session whether it has a method, so any such use must fail loudly too.

All detached objects share one such session, `DETACHED`. The session is part of what `==` compares, by identity, so two detached copies of an object are equal, as they should be. A detached copy is not equal to the original, though, since the original has a real session: to compare them, compare their `json` instead. So that the identity survives pickling too, the detached session pickles as a reference to `DETACHED`, which a string from `__reduce__` means.

136b ⟨*classes* 119⟩+≡

```
class DetachedSession:
  """The session of objects restored from JSON without a LADOK session"""
```

```
    def __getattr__(self, name):
      if name.startswith("_"):
        raise AttributeError(name)
      raise LadokDetachedError(
        f"cannot use LADOK ({name}): the object was restored from JSON "
        "without a LADOK session and has only the data that was in the JSON; "
        "restore it with ladok=... to fetch more")

    def __reduce__(self):
      return "DETACHED"

  DETACHED = DetachedSession()
```

This code is used in chunk 112a.
Defines:
`DETACHED`, used in chunks 132b and 235b.
`DetachedSession`, never used.
Uses `__getattr__` 114, `data` 174b, `name` 179, and `restore` 132a.

Code that hides LADOK's failures from the user must not hide this one. The contact data of a student do that (Section 12.4): if the request fails, the student has no contact data, for that call. For a detached student that would be wrong, so there we let the `LadokDetachedError` through.

Writing JSON text The `json` dictionary goes into `json.dumps` as it is. For a list of objects, or other data with objects in it, we also provide `LadokDataEncoder`, which we give to `json.dumps` as `cls`. It writes every `LadokData` object that it meets as its `json` dictionary, each with its own numbers, and dates in ISO format, e.g., '2024-09-25', the same format as LADOK uses. Since each object gets its own numbers, objects that share parts, such as a student and one of its courses, come back from `restore` as separate graphs, each with its own copy of the shared parts. To keep the objects connected, write the one that the others can be reached from, here the student.

137 ⟨*classes* 119⟩+≡

```
  class LadokDataEncoder(json.JSONEncoder):
    """JSON encoder for LadokData objects.

    Serialises LadokData objects as their `json` dictionaries, which `restore`
    turns back into objects, and dates in ISO format.  Each object is written
    on its own, so objects that share parts are restored as separate graphs;
    write the object that the others can be reached from to keep them
    connected.
    """
    def default(self, object):
      """Convert LadokData objects and dates to JSON-serializable format.

      Args:
          object: The object to encode.

      Returns:
          The `json` dictionary of a LadokData object, the ISO format of a
          date, or the default handling.
```

```
      """
      if isinstance(object, LadokData):
        return object.json
      if isinstance(object, datetime.date):
        return object.isoformat()
      return super().default(object)
```

This code is used in chunk 112a.
Defines:
`LadokDataEncoder`, used in chunk 138a.
Uses `LadokData` 125 and `restore` 132a.

The tests of the round trips use this helper for the trip through JSON text.

138a ⟨*test functions* 120⟩+≡

```
def through_json_text(ladok_data):
  return json.loads(json.dumps(ladok_data, cls=ladok3.LadokDataEncoder))
```

This code is used in chunk 112b.
Defines:
`through_json_text`, used in chunks 139b, 150c, 168b, 170b, 195c, and 234–37.
Uses `cls` 133b 133c, `ladok_data` 133b, and `LadokDataEncoder` 137.

Let's verify that `restore` refuses what it must not restore. The tests of the round trips follow the classes, the values in Sections 11.2 and 12.6 and the handles in Chapter 15, once we have seen the classes. A type must name a `LadokData` class, also when it names a class that exists.

138b ⟨*test functions* 120⟩+≡

```
@pytest.mark.parametrize("type_name",
  ["NoSuchType", "LadokSession", "object", "_JSONReader", 42])
def test_restore_rejects_types_that_are_not_ladok_data(type_name):
  with pytest.raises(TypeError, match="cannot restore type"):
    ladok3.restore({"type": type_name})

def test_restore_rejects_dict_without_type():
  json_dict = {"code": "A"}
  with pytest.raises(TypeError, match="without a 'type' key"):
    ladok3.restore(json_dict)
  assert json_dict == {"code": "A"}
```

This code is used in chunk 112b.
Defines:
`test_restore_rejects_dict_without_type`, never used.
`test_restore_rejects_types_that_are_not_ladok_data`, never used.
Uses `_JSONReader` 132b, `code` 179, `json_dict` 130b, `LadokSession` 119, and `restore` 132a.

The keys must be private attributes of the class, not methods, and not the session. The grade's keys are made up, but have the shape of a grade's JSON. Since a key is set only on the object, the class must not have changed.

138c ⟨*test functions* 120⟩+≡

```
@pytest.mark.parametrize("type_name, key", [
  ("Grade", "foo"),
  ("Grade", "_Student__first_name"),
  ("Grade", "_Grade__"),
  ("Student", "_Student__get_personal_attributes"),
  ("Student", "_LadokRemoteData__ladok"),
  ("Student", "courses"),
])
```

```
def test_restore_rejects_keys_that_are_not_private_attributes(type_name, key):
  with pytest.raises(TypeError, match=repr(key)):
    ladok3.restore({"type": type_name, key: 1})
  assert not hasattr(ladok3.Grade, "foo")
  assert callable(ladok3.Student.courses)
```

This code is used in chunk 112b.
Defines:
`test_restore_rejects_keys_that_are_not_private_attributes`, never used.
Uses `courses` 160a, `Grade` 25b 149, `restore` 132a, and `Student` 154a.

The references and marked values must be well formed.

139a ⟨*test functions* 120⟩+≡

```
@pytest.mark.parametrize("attributes", [
  {"_Grade__code": {"$ref": 5}},
  {"_Grade__code": {"$ref": 0}, "$id": 1},
  {"_Grade__code": {"$ref": [0]}},
  {"_Grade__code": {"$time": "12:00"}},
  {"_Grade__code": {"$date": "2026-08-31", "$tuple": []}},
  {"_Grade__code": {"$date": "not a date"}},
  {"_Grade__code": {"$date": 5}},
  {"_Grade__code": {"$datetime": None}},
  {"_Grade__code": {"$tuple": 5}},
  {"_Grade__code": {"$dict": [1]}},
  {"_Grade__code": {"$dict": [[[1], 2]]}},
  {"$id": [0]},
  {"$id": True},
])
def test_restore_rejects_malformed_references_and_markers(attributes):
  with pytest.raises(ValueError):
    ladok3.restore({"type": "Grade", **attributes})

def test_restore_rejects_duplicate_object_numbers():
  with pytest.raises(ValueError, match="two objects"):
    ladok3.restore({"type": "GradeScale", "$id": 0,
                    "_GradeScale__grades": [{"type": "Grade", "$id": 0}]})
```

This code is used in chunk 112b.
Defines:
`test_restore_rejects_duplicate_object_numbers`, never used.
`test_restore_rejects_malformed_references_and_markers`, never used.
Uses `attributes` 126a, `Grade` 25b 149, `GradeScale` 148, and `restore` 132a.

`json` must refuse an attribute that is not JSON, naming it but not its value. And the dictionaries that look like ours, and the values that JSON lacks, must survive the trip through JSON text. We give a grade such attributes by hand, which no grade has, but any object could have.

139b ⟨*test functions* 120⟩+≡

```
def test_json_rejects_values_that_are_not_json():
  grade = next(iter(make_grade_scale()))
  vars(grade)["_Grade__secret"] = {1, 2, "19121212-1212"}
  with pytest.raises(TypeError, match="_Grade__secret") as error:
    grade.json
  assert "19121212-1212" not in str(error.value)

```

```
8   def test_values_that_json_lacks_round_trip():
9     grade = next(iter(make_grade_scale()))
10    vars(grade)["_Grade__extra"] = {
11      "type": "not ours", "$ref": 0, 1: "integer key",
12      "when": datetime.datetime(2026, 8, 31, 12, 0),
13      "period": (datetime.date(2026, 8, 31), datetime.date(2026, 10, 23)),
14    }
15    vars(grade)["_Grade__other"] = {"type": "not ours either"}
16    for json_data in [grade.json, through_json_text(grade)]:
17      assert ladok3.restore(json_data) == grade
```

This code is used in chunk 112b.
Defines:
`test_json_rejects_values_that_are_not_json`, never used.
`test_values_that_json_lacks_round_trip`, never used.
Uses `make_grade_scale` 150c, `restore` 132a, and `through_json_text` 138a.

9.2.3 LADOK remote data base class: `LadokRemoteData`

The objects that can be modified can also be updated. They can be updated locally, which must be pushed to LADOK; they can be changed remotely, which must be pulled from LADOK. These objects must also keep a LADOK session internally (`self.ladok`). The constructor requires the session. An object restored from JSON gets its session from `restore` instead, or the detached session if it has none (Section 9.2.2).

140 ⟨*classes* 119⟩+≡

```
1   class LadokRemoteData(LadokData):
2     """Base class for remote LADOK data"""
3     def __init__(self, /, **kwargs):
4       super().__init__(**kwargs)
5       self.__ladok = kwargs.pop("ladok")
6
7     @property
8     def ladok(self):
9       return self.__ladok
10
11    def pull(self):
12      """Pull updates for object from LADOK"""
13      raise NotImplementedError("This object doesn't support pulling from LADOK")
14
15    def push(self):
16      """Push changes made to the object to LADOK"""
17      raise NotImplementedError("This object doesn't support pushing to LADOK")
```

This code is used in chunk 112a.
Defines:
`LadokRemoteData`, used in chunks 133b, 154a, 172, and 204.
Uses `__init__` 174a, `data` 174b, `LadokData` 125, and `pull` 176b.

The LADOK session object provides some methods for searching for data, e.g., students. These methods will return instances of `LadokData` or `LadokRemoteData`.

9.2.4 Cached methods

Since the objects that can be updated can update themselves (`LadokRemoteData`), we can cache the factories to speed up interaction with LADOK. Since Python uses references for objects, a cached object will always be up-to-date if the program has made changes to it. This way we don't have to interact with the LADOK servers for every request, but only when necessary.

We will have a shared cache for all methods.

141 ⟨*LadokSession constructor body* 141⟩≡

```
1  self.cache = {}
```

This code is used in chunk 119.

Then we can make the method caching by the following code.

```
1  @cachetools.cachedmethod(
2    operator.attrgetter("cache"),
3    key=functools.partial(cachetools.keys.hashkey, "method"))
4  def method(self, *args):
5    pass
```

However, this construction cannot handle non-hashable objects (e.g., dictionaries and lists) as arguments. But the JSON representation of objects should be possible to make hashable.

9.2.5 Failures must not stick in the cache

The objects that the factories return fill most of their attributes lazily, on first use, and then keep them. The command-line interface pickles the whole session, cache included, after each command and restores it the next time (see `store_ladok_session`). So whatever an object remembers, it remembers across runs.

That is a problem when LADOK fails while an attribute is being built. Suppose that we first set an attribute to an empty list and then fill it from LADOK's response. If the request fails, the exception reaches the user, but the empty list stays behind. The next call finds the attribute set and returns the empty list: the user is told that the student has no such course, long after LADOK works again, until the cache is cleared. (The `cachetools` decorator above does not have this problem, since it stores a value only when the method returns one.)

We therefore follow one rule for every lazily built attribute: we assign it only once its value is complete. We build the value in a local variable and assign it at the end, so that an exception leaves the attribute unset and the next call tries again. Where an object refreshes state that it already has, we instead restore the old state on failure, so that the object holds the old state or the new one, never a mixture. In both cases the exception propagates, so the user still sees what went wrong. The rule applies to a student's courses (Section 12.5) and contact data (Section 12.4), a course's components (Section 13.2.3) and participants (Section 13.5), and a student's results on a course (Section 14.1). The contact data differ in that we deliberately hide the error from the caller, as we explain there.

Chapter 10

Helper functions

We have several helper functions that are useful throughout.

10.1 Filter on keys

Many data methods will filter objects based on attributes. We provide a function that takes a list of objects and a dictionary. Each key in the dictionary corresponds to an attribute for the objects. The value corresponding to the key, is checked for matching.

We will provide the following function, `filter_on_keys`, which does exactly that. This implementation runs through the (remaining) items once per keyword, meaning it's conjunctive — all key–values must match the attribute values of the objects.

We use the function `compare_values` to compare the values, we'll get back to that function below.

142 ⟨*functions* 126b⟩+≡

```
def filter_on_keys(items, /, **kwargs):
  """
  Input:
  - items is a list of objects.
  - kwargs is a dictionary where keys match the attributes of the objects in
    items.

  Output:
  - Only objects where *all* key--value pairs match for the corresponding
    attribues.
  - If values are strings, the value from kwargs is interpreted as a regular
    expression.

  Example:
  student.first_name = "Student"
  student.last_name = "Studentdotter"

  filter_on_keys([student], firt_name="Student")
    gives [student]
  filter_on_keys([student], firt_name="Student", last_name="Studentsson")
```

```
21      gives []
22    """
23    for key in kwargs:
24      items = filter(
25        lambda x: compare_values(operator.attrgetter(key)(x), kwargs[key]),
26        items)
27    return list(items)
```

This code is used in chunk 112a.
Defines:
`filter_on_keys`, used in chunks 143, 147, 148, 160a, 179, 187a, 188a, 197, 201a, and 207b.
Uses `attributes` 126a, `compare_values` 144b, `first_name` 155, `last_name` 155, and `Student` 154a.

We test this function with the following tests.

143a ⟨*test functions* 120⟩+≡

```
def test_filter_on_keys():
  class Object:
    pass

  student1 = Object()
  student1.first_name = "Student"
  student1.last_name = "Studentsdotter"
  student2 = Object()
  student2.first_name = "Student"
  student2.last_name = "Studentsson"

  students = [student1, student2]
  assert ladok3.filter_on_keys(students, first_name="Student") == students
  assert ladok3.filter_on_keys(students,
    first_name="Student", last_name="Studentsdotter") == [student1]
  assert ladok3.filter_on_keys(students,
    last_name="Students(dotter|son)") == students
```

This code is used in chunk 112b.
Defines:
`test_filter_on_keys`, never used.
Uses `filter_on_keys` 142, `first_name` 155, `last_name` 155, and `Student` 154a.

To achieve disjunctive behaviour, we must run `filter_on_keys` once per keyword. However, that causes problems if an item matches on more than one key. The following function solves that problem by not checking an item against more keys once it has matched one key.

143b ⟨*functions* 126b⟩+≡

```
def filter_on_any_key(items, /, **kwargs):
  """
  Input:
  - items is a list of objects.
  - kwargs is a dictionary where keys match the attributes of the objects in
    items.

  Output:
  - Only objects where *any* key--value pairs match for the corresponding
    attribues.
  - If values are strings, the value from kwargs is interpreted as a regular
    expression.
```

```
13
14    Example:
15    student.first_name = "Student"
16    student.last_name = "Studentsdotter"
17
18    filter_on_keys([student], firt_name="Student")
19      gives [student]
20    filter_on_keys([student], firt_name="Student", last_name="Studentsson")
21      gives [student]
22    """
23    matching_items = []
24    for item in items:
25      for key in kwargs:
26        if compare_values(operator.attrgetter(key)(item), kwargs[key]):
27          matching_items.append(item)
28          break
29
30    return matching_items
```

This code is used in chunk 112a.
Defines:
`filter_on_any_key`, used in chunk 144a.
Uses `attributes` 126a, `compare_values` 144b, `filter_on_keys` 142, `first_name` 155, `last_name` 155, and `Student` 154a.

We test this function with the following tests.

144a ⟨*test functions* 120⟩+≡

```
1  def test_filter_on_any_key():
2    class Object:
3      pass
4
5    student1 = Object()
6    student1.first_name = "Student"
7    student1.last_name = "Studentsdotter"
8    student2 = Object()
9    student2.first_name = "Student"
10   student2.last_name = "Studentsson"
11
12   students = [student1, student2]
13   assert ladok3.filter_on_any_key(students,
14     first_name="Student", last_name="Studentsdotter") == students
```

This code is used in chunk 112b.
Defines:
`test_filter_on_any_key`, never used.
Uses `filter_on_any_key` 143b, `first_name` 155, `last_name` 155, and `Student` 154a.

The function `compare_values` is how we compare the values. The reason we don't simply replace it with the `==` operator is that for strings, we actually want to use regular expressions for matching. The downside of this is that we might accidentally get substring matches when we expect exact matches. E.g., `F` will match both `F` and `Fx` unless we specify `^F$`.

144b ⟨*functions* 126b⟩+≡

```
1  def compare_values(val1, val2):
2    """
```

```
    Compares val1 and val2:
    - if val1 and val2 both are strings, then val2 is interpreted as a regular
      expression.
    - otherwise we use ==
    """
    if isinstance(val1, str) and isinstance(val2, str):
      return re.search(val2, val1)

    return val1 == val2
```

This code is used in chunk 112a.
Defines:
compare_values, used in chunks 142, 143b, and 145a.

We test this function with the following tests.

145a ⟨*test functions* 120⟩+≡

```
def test_compare_values():
  assert ladok3.compare_values("Studentsdotter", "^Student")
  assert ladok3.compare_values("Studentsdotter", "dotter")
  assert not ladok3.compare_values("Studentsdotter", "son")
  assert ladok3.compare_values(1, 1)
  assert not ladok3.compare_values(1, 2)
```

This code is used in chunk 112b.
Defines:
test_compare_values, never used.
Uses compare_values 144b and Student 154a.

10.2 Extracting translations

In many cases, LADOK provides several translations. They do that in the form of this JSON structure:

```
{
  "Benamning": [
    {
      "Sprakkod": "sv",
      "Text": "Laborationer",
      "link": []
    },
    {
      "Sprakkod": "en",
      "Text": "Programming Assignments",
      "link": []
    }
  ]
}
```

We provide the function get_translation to get the Text based on a specified Sprakkod.

145b ⟨*functions* 126b⟩+≡

```
def get_translation(lang_code, list_of_translations):
  for translation in list_of_translations:
    if translation["Sprakkod"] == lang_code:
```

```
4         return translation["Text"]
5     raise KeyError(f"no translation for language {lang_code}")
```

This code is used in chunk 112a.
Defines:
`get_translation`, never used.

Chapter 11

Grading scales

LADOK has various grading scales. Whenever we deal with results, we must use them and their identifiers. We provide classes that wraps LADOK's grading scales: `GradeScale` and `Grade`. We also provide a method, `get_grade_scales`, which returns a list of `GradeScale` objects.

11.1 The `get_grade_scales` method

We start with the method that returns the grading-scales objects. This method interacts with LADOK, so we want to cache its responses. We also want to be able to filter the responses, we do this by keyword arguments.

147 ⟨*LadokSession data methods* 147⟩≡

```
@cachetools.cachedmethod(
  operator.attrgetter("cache"),
  key=functools.partial(cachetools.keys.hashkey, "grade_scale"))
def get_grade_scales(self, /, **kwargs):
  """Return a list of (un)filtered grade scales"""
  if len(kwargs) == 0:
    return [GradeScale(**scale_data)
              for scale_data in self.grade_scales_JSON()]

  return filter_on_keys(self.get_grade_scales(), **kwargs)
```

This definition is continued in chunks 153 and 171.
This code is used in chunk 119.
Defines:
  `get_grade_scales`, used in chunks 178, 180, 184, 185b, 207b, and 212b.
Uses `filter_on_keys` 142, `grade_scale` 179, and `GradeScale` 148.

The `grade_scales_JSON` method is part of the LADOK API and is documented in Section 17.1.

11.2 The `GradeScale` and `Grade` classes

We need a class for grade scales. This object should be read only and we never need to update it, so we can base it on `LadokData`. `kwargs` will have the following format:

```
{
```

```
  "Benamning": {
    "sv": "Engradig skala f\u00f6r deltagande",
    "en": "One-grade scale for participation only"
  },
  "Beskrivning": {},
  "Betygsgrader": [
    {
      "Benamning": {
        "sv": "Deltagit",
        "en": "Participated"
      },
      "Dolt": false,
      "GiltigSomSlutbetyg": true,
      "ID": "102041",
      "Kod": "D",
      "Ordningsnummer": 1,
      "link": []
    }
  ],
  "Dolt": true,
  "Giltighetsperiod": {
    "link": []
  },
  "ID": "102040",
  "Kod": "DT",
  "LarosateID": -1,
  "link": []
}
```

This makes the follow class design suitable.

148 ⟨*classes* 119⟩+≡

```
class GradeScale(LadokData):
  """A grade scale"""
  def __init__(self, /, **kwargs):
    super().__init__(**kwargs)

    self.__id = int(kwargs.pop("ID"))
    self.__code = kwargs.pop("Kod")
    self.__name = kwargs.pop("Benamning")["sv"]
    self.__grades = [Grade(**grade_data)
                     for grade_data in kwargs.pop("Betygsgrader")]

  @property
  def id(self):
    return self.__id

  @property
  def code(self):
    return self.__code

  @property
```

```
    def name(self):
      return self.__name

    def grades(self, /, **kwargs):
      """Returns grades filtered on keyword"""
      return filter_on_keys(self.__grades, **kwargs)

    def __contains__(self, grade):
      ⟨test if grade is in grading scale 150a⟩

    def __iter__(self):
      ⟨iterate over grades in grading scale 150b⟩
```

This code is used in chunk 112a.
Defines:
`GradeScale`, used in chunks 127a, 139a, 147, 150c, 180, and 212b.
Uses `__init__` 174a, `code` 179, `filter_on_keys` 142, `Grade` 25b 149, `LadokData` 125, and `name` 179.

Then we need a class for the grades themselves. We construct a grade from the LADOK JSON data. We also implement easy comparison so that we can search for the string 'A' instead of the `Grade` object for the A grade.

149 ⟨*classes* 119⟩+≡

```
class Grade(LadokData):
  """An individual grade part of a grade scale"""
  def __init__(self, /, **json_data):
    """Constructor taking a dictionary (JSON-like) structure"""
    self.__id = int(json_data.pop("ID"))
    self.__code = json_data.pop("Kod")
    self.__accepted = json_data.pop("GiltigSomSlutbetyg")

  @property
  def id(self):
    return self.__id

  @property
  def code(self):
    return self.__code

  def __str__(self):
    return self.code

  @property
  def accepted(self):
    return self.__accepted

  def __eq__(self, other):
    if isinstance(other, str):
      return self.code == other
    return super().__eq__(other)
```

This code is used in chunk 112a.
Defines:
`Grade`, used in chunks 25c, 26b, 127a, 138c, 139a, 148, 150c, and 230.
Uses `__init__` 174a, `__str__` 155, `code` 179, and `LadokData` 125.

Any other comparison is that of `LadokData` (Section 9.2.1), as for course components. (An earlier version raised an error for anything but a grade or a string, so even `grade == None` failed.)

Checking if a grade is in a grading scale We can now easily implement the check if a grade is in a grading scale.

150a ⟨*test if grade is in grading scale* 150a⟩≡

```
return grade in self.__grades
```

This code is used in chunk 148.

This works even if `grade` is a string, thanks to how `__eq__` is implemented in the `Grade` class.

Similarly, we can iterate over the grades in the grading scale.

150b ⟨*iterate over grades in grading scale* 150b⟩≡

```
return iter(self.__grades)
```

This code is used in chunk 148.

Restoring from JSON Grade scales and grades need nothing of their own to be written as JSON and restored (Section 9.2.2). Let's verify the round trip, both directly from `json` and through JSON text. The grade scale is made up but has the shape of LADOK's data above. After the trip through text the grades must be `Grade` objects again, not dictionaries, and membership tests must still work on them.

150c ⟨*test functions* 120⟩+≡

```
def make_grade_scale():
  return ladok3.GradeScale(
    ID="1", Kod="PF", Benamning={"sv": "Underkänd, godkänd"},
    Betygsgrader=[
      {"ID": "11", "Kod": "P", "GiltigSomSlutbetyg": True},
      {"ID": "12", "Kod": "F", "GiltigSomSlutbetyg": False},
    ])

def test_grade_round_trips_through_json():
  grade = next(iter(make_grade_scale()))
  for json_data in [grade.json, through_json_text(grade)]:
    restored = ladok3.restore(json_data)
    assert type(restored) is ladok3.Grade
    assert restored == grade
    assert restored == "P" and restored != "F" and restored != None

def test_grade_scale_round_trips_through_json():
  scale = make_grade_scale()
  for json_data in [scale.json, through_json_text(scale)]:
    restored = ladok3.restore(json_data)
    assert type(restored) is ladok3.GradeScale
    assert all(type(grade) is ladok3.Grade for grade in restored)
    assert restored == scale
    assert "P" in restored and "F" in restored
```

This code is used in chunk 112b.
Defines:
  `make_grade_scale`, used in chunks 127a and 139b.
  `test_grade_round_trips_through_json`, never used.
  `test_grade_scale_round_trips_through_json`, never used.
Uses `Grade` 25b 149, `GradeScale` 148, `restore` 132a, and `through_json_text` 138a.

Chapter 12

Students

This chapter treats how we can work with student data. We can get student data from LADOK using the `LadokSession` class. We first create the `ladok` object, an instance of a LADOK session.

```
import ladok3

ladok = ladok3.test_session  # LADOK's test environment, for experiments
```

This is the same as in Chapter 9: `ladok3.test_session` reuses the cached session against LADOK's test environment.

Next we want to access data of a student. We can refer to the student by personnummer or the unique LADOK ID.

```
me = ladok.get_student("19121212-1212")
me2 = ladok.get_student("de709f81-a867-11e7-8dbf-78e86dc2470c")

print(f"{me.personnummer} {me.last_name}, {me.first_name}")
print(f"{me2.personnummer} {me2.last_name}, {me2.first_name}")
print(f"{me.ladok_id} == {me2.ladok_id}")
print()
```

This gives us objects of the `Student` class. The objects `me` and `me2` both refer to the same person, so the outputs should be the same.

We can see which course instances the student is registered on (throughout history).

```
for course in me.courses():
    print(f"{course.code} {course.name}")
```

We can select a particular course and we can get the results for that course in the same way.

```
course = me.courses(code="DD2395")[0]

print(f"{course.code} results:")
for result in course.results():
    s = f"{course.code}"
    if result.component:
```

```
        s += f" {result.component}"
    s += f" {result.grade}"
    if result.attested:
        s += f" ({result.date})"
    print(s)
print()
```

We can check if the result is attested or not. If it's not attested, we can change it.

```
student = ladok.get_student("1234561234")
datintro = student.courses(code="DD1301")[0]

print(f"{student.personnummer} {student.first_name} {student.last_name}")

for result in datintro.results():
    print(f"{result.component} {result.grade} ({result.date})", end="")
    if not result.attested:
        print("*")
    else:
        print()

print("Changing grades")

try:
    lab1 = datintro.results(component="LAB1")[0]
    lab1.set_grade("P", "2022-11-18")
    lab1.finalize()
except Exception as err:
    print(f"Couldn't change LAB1: {err}")

for result in datintro.results():
    print(f"{result.component} {result.grade} ({result.date})", end="")
    if not result.attested:
        print("*")
    else:
        print()

```

12.1 Getting students from LADOK

Perhaps the main data that we want to access is that of a student. We provide two ways to identify the student. The personal identity number (Swedish *personnummer*) and the unique LADOK identifier. These are so different in format that we can distinguish one from the other. However, we an delegate this job to the `Student` class.

153 ⟨*LadokSession data methods* 147⟩+≡

```
  @cachetools.cachedmethod(
    operator.attrgetter("cache"),
    key=functools.partial(cachetools.keys.hashkey, "get_student"))
  def get_student(self, id):
    """Get a student by unique ID, returns a Student object"""
```

```
    # note that self is the required LadokSession object
    return Student(ladok=self, id=id)
```

This code is used in chunk 119.
Defines:
  `get_student`, used in chunks 188b, 189, 227a, 235b, and 238.
Uses `LadokSession` 119 and `Student` 154a.

12.2 The `Student` class

We can create a `Student` object from an identifier and a `LadokSession` object. Then the `Student` object can fetch data from LADOK and update any changes.

We can determine if an identifier is a personnummer or LADOK ID. Based on either of those unique identifiers we can fetch the rest of the data using the LADOK session `self.ladok`.

154a ⟨*classes* 119⟩+≡

```
class Student(LadokRemoteData):
  """Class representing a student and related data"""
  def __init__(self, /, **kwargs):
    """Requires ladok (a LadokSession object),
    id (either a personnummer or LADOK ID)"""
    super().__init__(**kwargs)
    id = kwargs.pop("id")
    self.__personnummer = format_personnummer(id)
    if not self.__personnummer:
      self.__ladok_id = id
    else:
      self.__ladok_id = None

  def pull(self):
    """pull student data from LADOK"""
    ⟨pull all attributes from LADOK 156a⟩

  ⟨student attribute methods 155⟩
```

This code is used in chunk 112a.
Defines:
  `Student`, used in chunks 127a, 138c, 142–45, 153, 159a, 162a, 165–68, 181, 182a, 184, 185a, 188, 189, 193b, 201b, and 233–35.
Uses `__init__` 174a, `data` 174b, `format_personnummer` 154b, `LadokRemoteData` 140, `LadokSession` 119, `personnummer` 155, and `pull` 176b.

We use the function `format_personnummer` to format a personnummer according to LADOK's requirements. This function returns `None` if it's not a personnummer, in which case we assume that it is a LADOK ID in the code above.

154b ⟨*functions* 126b⟩+≡

```
def format_personnummer(person_nr_raw):
  """Returns None or a LADOK-formated person nr"""
  pnrregex = re.compile(r"^(\d\d)?(\d\d)(\d\d\d\d)[+\-]?(\w\w\w\w)$")
  pnr = pnrregex.match(person_nr_raw)
  if pnr:
    now = datetime.datetime.now()
    if pnr.group(1) == None: # first digits 19 or 20 missing
      if now.year - 2000 >= int(pnr.group(2)) + 5: # must be > 5 years old
```

```
9           return "20" + pnr.group(2) + pnr.group(3) + pnr.group(4)
10        else:
11          return "19" + pnr.group(2) + pnr.group(3) + pnr.group(4)
12      else:
13        return pnr.group(1) + pnr.group(2) + pnr.group(3) + pnr.group(4)
14    else:
15      return None
```

This code is used in chunk 112a.
Defines:
`format_personnummer`, used in chunk 154a.

Note that we must match the start and end in the regex, otherwise we sometimes match parts of LADOK IDs as personnummer.

12.3 Students' personal attributes

The student's personal attributes are the following. We use the helper method `__get_personal_attributes` which pulls all personal attributes, since LADOK returns all of these in one call.

155 ⟨*student attribute methods* 155⟩≡

```
1  def __get_personal_attributes(self):
2    """Helper method that fetches personal attributes"""
3    ⟨pull student attributes from LADOK 156b⟩
4
5  @property
6  def ladok_id(self):
7    """Return the student's LADOK ID"""
8    try:
9      if self.__ladok_id:
10       return self.__ladok_id
11   except:
12     pass
13   self.__get_personal_attributes()
14   return self.__ladok_id
15
16 @property
17 def personnummer(self):
18   """Return the student's personnummer"""
19   try:
20     if self.__personnummer:
21       return self.__personnummer
22   except:
23     pass
24   self.__get_personal_attributes()
25   return self.__personnummer
26
27 @property
28 def first_name(self):
29   """Return the student's first name"""
30   try:
31     return self.__first_name
```

```
    except:
      self.__get_personal_attributes()
    return self.__first_name

  @property
  def last_name(self):
    """Return the student's last name"""
    try:
      return self.__last_name
    except:
      self.__get_personal_attributes()
    return self.__last_name

  def __str__(self):
    return f"{self.personnummer} {self.first_name} {self.last_name}"

  @property
  def alive(self):
    """Return whether student is alive or not"""
    try:
      return self.__alive
    except:
      self.__get_personal_attributes()
    return self.__alive

  ⟨student contact attribute methods 157⟩
```

This definition is continued in chunks 159–63 and 170a.
This code is used in chunk 154a.
Defines:
__get_personal_attributes, used in chunk 156a.
__str__, used in chunks 149, 169, 185b, 197, and 204.
alive, never used.
first_name, used in chunks 142–44 and 235.
ladok_id, used in chunks 127a, 158a, 161a, 163b, 170a, 189, 193b, 199b, 210, 212b, 220, 221, 223, 224, 227b, 229, 231b, and 237a.
last_name, used in chunks 142–44.
personnummer, used in chunks 154a and 156b.
Uses attributes 126a and name 179.

Then we can call that method to update all attributes.

156a ⟨*pull all attributes from LADOK* 156a⟩≡

```
self.__get_personal_attributes()
```

This definition is continued in chunks 160b and 163c.
This code is used in chunk 154a.
Uses __get_personal_attributes 155.

When we pull the student attributes from LADOK, we can use either of the two IDs: `self.personnummer` and `self.ladok_id`. (However, we avoid using the properties above in this code, since we don't want to recursively trigger the fetch ad absurdum.) Depending on which attribute is set, we pull the data differently.

156b ⟨*pull student attributes from LADOK* 156b⟩≡

```
if self.__ladok_id:
  record = self.ladok.get_student_data_by_uid_JSON(self.__ladok_id)
elif self.__personnummer:
```

```
    record = self.ladok.get_student_data_JSON(self.__personnummer)
  else:
    raise AttributeError("neither personnummer, nor LADOK ID set")

  self.__ladok_id = record['Uid']
  self.__personnummer = record['Personnummer'] # twelve digits only
  self.__first_name = record['Fornamn']
  self.__last_name = record['Efternamn']
  self.__alive = not record['Avliden']
```

This code is used in chunk 155.
Uses `personnummer` 155.

12.4 Students' contact attributes

The contact attributes include email, phone number, and postal address information. We use the `__get_contact_attributes` helper method to populate these attributes from a separate LADOK API call.

If LADOK does not give us the contact data, we treat the student as having none: the email and phone are `None` and the address has no lines. That way, for instance, `ladok student --contact` still prints everything else about the student. But we must not *remember* that answer (Section 9.2.5). An earlier version stored the empty values when the request failed, and the cache then kept them: a single server error made the student look as if they had no contact data in every later run. Now we remember only data that LADOK actually returned. After a failure we return the empty values for this call only, and the next call asks LADOK again. The price is that a student whose contact data LADOK always refuses costs a request on each access instead of one in all.

Since a failure leaves nothing to remember, the properties cannot read the private attributes after fetching them, as the personal attributes do. Instead they all go through `__contact_attributes`, which returns the remembered triple or the one that the fetch returns.

157 ⟨*student contact attribute methods* 157⟩≡

```
  @property
  def email(self):
    """Return the student's email address"""
    return self.__contact_attributes()[0]

  @property
  def phone(self):
    """Return the student's phone number"""
    return self.__contact_attributes()[1]

  @property
  def address(self):
    """Return the student's postal address as a list of lines"""
    return self.__contact_attributes()[2]

  def __contact_attributes(self):
    """Returns (email, phone, address), fetching them if needed"""
    try:
```

```
      return self.__email, self.__phone, self.__address
    except AttributeError:
      return self.__get_contact_attributes()

  def __get_contact_attributes(self):
    """Helper method that fetches contact attributes"""
    ⟨pull student contact attributes from LADOK 158a⟩
```

This code is used in chunks 155 and 159b.
Defines:
`__contact_attributes`, never used.
`__get_contact_attributes`, never used.
`address`, used in chunks 158a and 159a.
`email`, used in chunks 158a, 159a, 233–35, and 238.
`phone`, used in chunks 158a and 159a.
Uses `attributes` 126a.

We guard only the request itself. Extracting the attributes from the response cannot fail on missing data, since it checks for every key, so an error there is a bug that should surface rather than be taken for a student without contact data. The exception is a student restored from JSON without a session (Section 9.2.2): it has no LADOK to ask, and an empty answer would claim that the student has no contact data, so we let that error through.

158a ⟨*pull student contact attributes from LADOK* 158a⟩≡

```
try:
  contact_data = self.ladok.get_student_contact_data_JSON(self.ladok_id)
except LadokDetachedError:
  raise
except Exception:
  return None, None, []

⟨extract email, phone and address from contact_data 158b⟩

self.__email, self.__phone, self.__address = email, phone, address
return email, phone, address
```

This code is used in chunk 157.
Uses `address` 157 158b, `email` 157 158b, `ladok_id` 155, and `phone` 157 158b.

LADOK gives lists of email addresses and phone numbers; we take the first entry of each that holds a value. The postal address comes either as one record or as a list of them, in which case we take the first. We turn it into lines as on an envelope, the street lines followed by postal code and town.

158b ⟨*extract* `email`, `phone` *and* `address` *from* `contact_data` 158b⟩≡

```
email = None
if 'Epost' in contact_data and contact_data['Epost']:
  for entry in contact_data['Epost']:
    if 'Adress' in entry:
      email = entry['Adress']
      break

phone = None
if 'Telefon' in contact_data and contact_data['Telefon']:
  for entry in contact_data['Telefon']:
    if 'Nummer' in entry:
```

```
        phone = entry['Nummer']
        break

  address = []
  if 'Postadress' in contact_data and contact_data['Postadress']:
    addr = contact_data['Postadress']
    if isinstance(addr, list) and len(addr) > 0:
      addr = addr[0]
    if isinstance(addr, dict):
      for field in ['Adressrad1', 'Adressrad2', 'Adressrad3']:
        if field in addr and addr[field]:
          address.append(addr[field])
      if addr.get('Postnummer') and addr.get('Postort'):
        address.append(f"{addr['Postnummer']} {addr['Postort']}")
```

This code is used in chunk 158a.
Defines:
`address`, used in chunks 158a and 159a.
`email`, used in chunks 158a, 159a, 233–35, and 238.
`phone`, used in chunks 158a and 159a.

Let's verify that a failed request yields no contact data for that call but is not remembered, so that the next call gets the real data. The fake returns synthetic contact data.

159a ⟨*test functions* 120⟩+≡

```
class FakeLadokForContactData:
  def get_student_contact_data_JSON(self, student_id):
    return {
      "Epost": [{"Adress": "student@example.org"}],
      "Telefon": [{"Nummer": "+46 70 000 00 00"}],
      "Postadress": [{"Adressrad1": "Exempelgatan 1",
                      "Postnummer": "111 11", "Postort": "Exempelstad"}],
    }

def test_failed_contact_data_request_is_not_remembered():
  ladok = FakeLadokForContactData()
  ladok.get_student_contact_data_JSON = fail_first_call(
    ladok.get_student_contact_data_JSON)
  student = ladok3.Student(ladok=ladok, id="student-uid")

  assert student.email is None

  assert student.email == "student@example.org"
  assert student.phone == "+46 70 000 00 00"
  assert student.address == ["Exempelgatan 1", "111 11 Exempelstad"]
```

This code is used in chunk 112b.
Defines:
`FakeLadokForContactData`, used in chunk 233.
`test_failed_contact_data_request_is_not_remembered`, never used.
Uses `address` 157 158b, `email` 157 158b, `fail_first_call` 161c, `phone` 157 158b, and `Student` 154a.

159b ⟨*student attribute methods* 155⟩+≡

```
⟨student contact attribute methods 157⟩
```

This code is used in chunk 154a.

12.5 Students' study-related attributes

The study related attributes are courses and course results. Similarly to above, we use the `__get_study_attributes` helper method to populate all study-related attributes that LADOK returns in one request.

160a ⟨*student attribute methods* 155⟩+≡

```
def __get_study_attributes(self):
  """Helper method to fetch study related attributes"""
  ⟨create a list of the student's course objects 161a⟩

def courses(self, /, state=None, **kwargs):
  """
  Returns a list of courses that the student is registered on.
  Filtered based on keywords, see ladok3.filter_on_keys for details.

  With `state`, only the courses in that state: one of the keys of
  ladok3.COURSE_STATES ("ongoing", "upcoming", "unfinished",
  "completed", "interrupted") or an iterable of them.  Raises
  ValueError for any other name and TypeError if `state` is neither a
  string nor an iterable.  Like the list without `state`, these are
  the student's current registrations that have a course code; LADOK's
  view of a state can hold more participations than that.
  """
  if state is not None:
    return filter_on_keys(self.__courses_in_states(course_states(state)),
                          **kwargs)
  try:
    courses = self.__courses
  except:
    self.__get_study_attributes()
    courses = self.__courses

  return filter_on_keys(courses, **kwargs)
```

This code is used in chunk 154a.
Defines:
`__get_study_attributes`, used in chunk 160b.
`courses`, used in chunks 132a, 138c, 161–68, 181, 182a, 184, 185a, 201b, 227a, and 233–38.
Uses `__courses_in_states` 162b, `attributes` 126a, `code` 179, `COURSE_STATES` 201c, `course_states` 164a, `filter_on_keys` 142, `name` 179, and `state` 183 202b 212a.

Then we can call the last method when we want to pull all attributes too (using the `pull` method).

160b ⟨*pull all attributes from LADOK* 156a⟩+≡

```
self.__get_study_attributes()
```

This code is used in chunk 154a.
Uses `__get_study_attributes` 160a.

To create a list of the student's course registrations, we use the `registrations_JSON` API method. We construct every current registration, even when the caller filters on a single course code. That is cheap: a `CourseRegistration` built from this sparse data sends no request until someone needs what the data lacks, such as the components (Section 13.2.1).

We collect the courses in a local list and assign `self.__courses` only once the list is complete (Section 9.2.5). An earlier version started with `self.__courses` as an empty list and appended to it. When `registrations_JSON` failed with a server error, the empty list stayed behind, `courses` found it, and every later run—through the cache—reported 'No such course'. Now a failure leaves `self.__courses` unset, so the next call to `courses` asks LADOK again. When `pull` refreshes a student that already has a list, a failure leaves the old list in place instead.

161a ⟨*create a list of the student's course objects* 161a⟩≡

```
self.__courses = self.__course_registrations(
  self.ladok.registrations_JSON(self.ladok_id))
```

This code is used in chunk 160a.
Uses `__course_registrations` 161b and `ladok_id` 155.

The same registrations come from LADOK's views of the participations in a state too (Section 12.5.1), so we turn them into `CourseRegistration` objects in a method of their own. We keep only the current registrations that have a course code. Besides the course data in `Utbildningsinformation`, a registration gets what it needs to know its state: the summary in `TillstandKurs` and the withdrawal flag `Aterbud` (Section 14.1.1).

161b ⟨*student attribute methods* 155⟩+≡

```
def __course_registrations(self, participations):
  """Returns CourseRegistration objects for the current participations
  that have a course code"""
  courses = []
  for course in participations:
    if not course['Nuvarande'] or \
      'Utbildningskod' not in course['Utbildningsinformation']:
      continue

    courses.append(CourseRegistration(
      ladok=self.ladok,
      student=self,
      TillstandKurs=course.get("TillstandKurs"),
      Aterbud=course.get("Aterbud"),
      **course["Utbildningsinformation"]))
  return courses
```

This code is used in chunk 154a.
Defines:
  `__course_registrations`, used in chunks 161a and 163b.
Uses `code` 179, `CourseRegistration` 197, and `courses` 160a.

Let's verify that a failed request is retried rather than remembered. We make the first call to a fake LADOK method fail with the kind of server error that LADOK sometimes returns, and let later calls through. That is an injected failure on top of a fake, the only way to get a failure on demand without a live LADOK. We use the helper below for the other lazily built attributes too.

161c ⟨*test functions* 120⟩+≡

```
def fail_first_call(method):
  """Wrap `method` so that its first call fails with a LADOK server error"""
  calls = []
  def method_failing_once(*args, **kwargs):
    calls.append(args)
```

```
      if len(calls) == 1:
        raise ladok3.LadokAPIError("GET request to ... failed: 500")
      return method(*args, **kwargs)
    return method_failing_once
```

This code is used in chunk 112b.
Defines:
`fail_first_call`, used in chunks 159a, 162a, 166c, 184b, 189, 195a, and 201b.

The fake LADOK is the one we use for lazily pulled courses (Section 13.2.1).

162a ⟨*test functions* 120⟩+≡

```
def test_failed_course_list_is_retried():
  ladok = FakeLadokForLazyCourses()
  ladok.registrations_JSON = fail_first_call(ladok.registrations_JSON)
  student = ladok3.Student(ladok=ladok, id="student-uid")

  with pytest.raises(ladok3.LadokAPIError):
    student.courses(code="DD2520")

  course, = student.courses(code="DD2520")
  assert course.code == "DD2520"
```

This code is used in chunk 112b.
Defines:
`test_failed_course_list_is_retried`, never used.
Uses `code` 179, `courses` 160a, `fail_first_call` 161c, `FakeLadokForLazyCourses` 180, and `Student` 154a.

12.5.1 Courses by state

Often we want only the courses in some state, for instance those that the student takes now: `student.courses(state="ongoing")`. The states have English names here, the keys of `COURSE_STATES` (Section 14.1.1), and `state` takes one of them or an iterable of them, such as `{"ongoing", "upcoming"}`. The result is the state filter applied to what `courses` lists: the student's current registrations (`Nuvarande`) that have a course code. Both ways of finding them below apply that filter, so they agree; LADOK's view of a state can hold more participations than that: those that are not current or have no course code.

There are two ways to find them, and we use both. Each registration knows its state by the rule of Section 22.13, so a student that already holds its courses can filter them without asking LADOK. That is free, which matters when a program asks for the ongoing courses of every student in a course round, many of whom it has met before through the command-line interface's cache. But the rule is ours, learnt by comparison, and it calls some cases unknown. LADOK's view of the participations in a state is the authority (Section 22.12). So we filter locally only when the student holds its courses and the rule can place every one of them, and ask LADOK otherwise. (A student that holds its courses from an earlier run judges them by today's date but by the summaries it was given then; like every other attribute of a cached object, they are as fresh as the last `pull`.)

162b ⟨*student attribute methods* 155⟩+≡

```
def __courses_in_states(self, states):
  """Returns the student's courses in the states `states` (English
  names), filtered locally when we can and fetched from LADOK
  otherwise"""
```

```
    ⟨return the courses we hold in states, if the rule can place all 163a⟩
    return [course for state in states
            for course in self.__courses_in_state(COURSE_STATES[state])]
```

This code is used in chunk 154a.
Defines:
  __courses_in_states, used in chunk 160a.
Uses __courses_in_state 163b, COURSE_STATES 201c, courses 160a, and state 183 202b 212a.

We judge all the courses by the same day, so that a call never straddles midnight.

163a ⟨return the courses we hold in states, if the rule can place all 163a⟩≡

```
try:
  courses = self.__courses
except AttributeError:
  courses = None
if courses is not None:
  today = swedish_today()
  placed = [(course, course.state_on(today)) for course in courses]
  if all(state is not UNKNOWN_STATE for _, state in placed):
    return [course for course, state in placed if state in states]
```

This code is used in chunk 162b.
Uses courses 160a, state 183 202b 212a, and state_on 202b.

When we ask LADOK, we build the registrations as `courses` does, from the view of each state, and remember them per state, under LADOK's name, so that the next call for the same state asks nothing. We do not set the student's full list from them, since a view holds only the courses in one state. As for the full list, we remember the list only once it is complete (Section 9.2.5).

163b ⟨student attribute methods 155⟩+≡

```
def __courses_in_state(self, participation_state):
  """Returns the student's courses that LADOK puts in
  `participation_state`, asking LADOK the first time"""
  try:
    return self.__courses_by_state[participation_state]
  except (AttributeError, KeyError):
    pass
  courses = self.__course_registrations(
    self.ladok.student_participations_JSON(self.ladok_id,
                                           state=participation_state))
  try:
    courses_by_state = self.__courses_by_state
  except AttributeError:
    courses_by_state = self.__courses_by_state = {}
  courses_by_state[participation_state] = courses
  return courses
```

This code is used in chunk 154a.
Defines:
  __courses_in_state, used in chunk 162b.
Uses __course_registrations 161b, courses 160a, ladok_id 155, and state 183 202b 212a.

A `pull` fetches the student's courses afresh, so it must also forget the courses that it remembered per state; the next call for a state then asks again or filters the fresh list.

163c ⟨pull all attributes from LADOK 156a⟩+≡

```
self.__courses_by_state = {}
```

This code is used in chunk 154a.

`course_states` checks the states. A plain string names one state: we take it as a single name, not as an iterable of letters. A name that is not a state, misspelt or Swedish, is a `ValueError` that lists the names there are, and the order of the result is that of `COURSE_STATES`, whatever the order of the argument.

164a ⟨*functions* 126b⟩+≡

```
def course_states(state):
  """Returns the English state names in `state`, a name or an iterable of
  names, in the order of COURSE_STATES.  Raises ValueError for a name
  that is not a key of COURSE_STATES and TypeError if `state` is neither
  a string nor an iterable."""
  if isinstance(state, str):
    names = {state}
  else:
    try:
      names = set(state)
    except TypeError as err:
      raise TypeError(f"state must be a state name or an iterable of "
                      f"them, not {type(state).__name__}") from err
  unknown = names - COURSE_STATES.keys()
  if unknown:
    raise ValueError(f"unknown course state "
                     f"{', '.join(sorted(map(repr, unknown)))}, expected "
                     f"one of {', '.join(COURSE_STATES)}")
  return [name for name in COURSE_STATES if name in names]
```

This code is used in chunk 112a.
Defines:
`course_states`, used in chunks 160a and 191a.
Uses `COURSE_STATES` 201c, `name` 179, and `state` 183 202b 212a.

To test the two ways, we need a LADOK that counts what it is asked. The fake below gives a student three current registrations, an ongoing course, a completed one and an upcoming one, and, if we ask for it, a fourth that the rule cannot place: a registration on a round that has not started. Its views per state hold what LADOK would put there. The study periods are relative to today, with weeks of margin, since the registrations judge by the current date.

164b ⟨*test functions* 120⟩+≡

```
class FakeLadokForCourseStates:
  def __init__(self, with_unknown=False):
    self.requests = []
    today = datetime.date.today()
    week = datetime.timedelta(weeks=1)
    running = (today - 8 * week, today + 8 * week)
    ended = (today - 30 * week, today - 10 * week)
    upcoming = (today + 10 * week, today + 30 * week)
    self.by_state = {
      "pagaende": [state_test_registration("round-1", "DD1301",
                                           "registrerad", running)],
      "avslutade": [state_test_registration("round-2", "DD1310",
                                            "avklarad", ended)],
      "kommande": [state_test_registration("round-3", "DD1320",
```

```
                                          "ej_paborjad", upcoming)],
      "oavslutade": [], "avbrott": [],
    }
    self.registrations = [participation
                          for participations in self.by_state.values()
                          for participation in participations]
    if with_unknown:
      unknown = state_test_registration("round-4", "DD1321",
                                        "registrerad", upcoming)
      self.registrations.append(unknown)
      self.by_state["kommande"].append(unknown)

  def registrations_JSON(self, student_id):
    self.requests.append("all")
    return self.registrations

  def student_participations_JSON(self, student_id, state=None):
    self.requests.append(state)
    return self.by_state[state]

  def get_student_data_by_uid_JSON(self, student_id):
    return {"Uid": student_id, "Personnummer": "191212121212",
            "Fornamn": "Tolvan", "Efternamn": "Tolvansson",
            "Avliden": False}

def state_test_registration(round_id, code, summary, dates):
  participation = lazy_test_registration(round_id, code)
  start, end = dates
  participation["Utbildningsinformation"]["Studieperiod"] = {
    "Startdatum": start.isoformat(), "Slutdatum": end.isoformat()}
  participation["TillstandKurs"] = {
    "Sammanfattattillstand":
      f"studiedeltagande.domain.tillstandsdefinition.{summary}"}
  return participation

def codes(courses):
  return [course.code for course in courses]
```

This code is used in chunk 112b.
Defines:
codes, used in chunks 165–68, 191, and 193.
FakeLadokForCourseStates, used in chunks 165–68.
state_test_registration, used in chunk 167b.
Uses __init__ 174a, code 179, courses 160a, lazy_test_registration 180, and state 183 202b 212a.

A student that holds its courses filters them without asking LADOK, also for several states.

165 ⟨*test functions* 120⟩+≡

```
def test_courses_by_state_filters_what_the_student_holds():
  ladok = FakeLadokForCourseStates()
  student = ladok3.Student(ladok=ladok, id="student-uid")
  student.courses()

```

```
    assert codes(student.courses(state="ongoing")) == ["DD1301"]
    assert codes(student.courses(state=["upcoming", "completed"])) \
      == ["DD1310", "DD1320"]
    assert codes(student.courses(state="interrupted")) == []
    assert ladok.requests == ["all"]
```

This code is used in chunk 112b.
Defines:
`test_courses_by_state_filters_what_the_student_holds`, never used.
Uses `codes` 164b, `courses` 160a, `FakeLadokForCourseStates` 164b, `state` 183 202b 212a, and `Student` 154a.

A student that does not hold its courses asks LADOK's view, once per state, and does not take the view for its full list.

166a ⟨*test functions* 120⟩+≡

```
def test_courses_by_state_asks_ladok_once_per_state():
    ladok = FakeLadokForCourseStates()
    student = ladok3.Student(ladok=ladok, id="student-uid")

    assert codes(student.courses(state="ongoing")) == ["DD1301"]
    assert codes(student.courses(state="ongoing", code="DD13")) == ["DD1301"]
    assert ladok.requests == ["pagaende"]
    assert codes(student.courses()) == ["DD1301", "DD1310", "DD1320"]
    assert ladok.requests == ["pagaende", "all"]
```

This code is used in chunk 112b.
Defines:
`test_courses_by_state_asks_ladok_once_per_state`, never used.
Uses `code` 179, `codes` 164b, `courses` 160a, `FakeLadokForCourseStates` 164b, `state` 183 202b 212a, and `Student` 154a.

A student judges the courses it holds by today's date in Sweden. We fix that date far in the future, by replacing `swedish_today` for the test: the ongoing course has then ended unfinished, and the upcoming one, never started, is in no state.

166b ⟨*test functions* 120⟩+≡

```
def test_courses_by_state_judge_by_the_swedish_date(monkeypatch):
    ladok = FakeLadokForCourseStates()
    student = ladok3.Student(ladok=ladok, id="student-uid")
    student.courses()
    monkeypatch.setattr(
      ladok3, "swedish_today",
      lambda now=None: datetime.date.today() + datetime.timedelta(weeks=100))

    assert codes(student.courses(state="unfinished")) == ["DD1301"]
    assert codes(student.courses(state=["ongoing", "upcoming"])) == []
    assert ladok.requests == ["all"]
```

This code is used in chunk 112b.
Defines:
`test_courses_by_state_judge_by_the_swedish_date`, never used.
Uses `codes` 164b, `courses` 160a, `FakeLadokForCourseStates` 164b, `state` 183 202b 212a, and `Student` 154a.

A failed request for a view must not stick (Section 9.2.5): the next call asks again and gets the courses.

166c ⟨*test functions* 120⟩+≡

```
def test_failed_courses_by_state_request_is_retried():
```

```
    ladok = FakeLadokForCourseStates()
    ladok.student_participations_JSON = fail_first_call(
      ladok.student_participations_JSON)
    student = ladok3.Student(ladok=ladok, id="student-uid")

    with pytest.raises(ladok3.LadokAPIError):
      student.courses(state="ongoing")

    assert codes(student.courses(state="ongoing")) == ["DD1301"]
```

This code is used in chunk 112b.
Defines:
`test_failed_courses_by_state_request_is_retried`, never used.
Uses `codes` 164b, `courses` 160a, `fail_first_call` 161c, `FakeLadokForCourseStates` 164b, `state` 183 202b 212a, and `Student` 154a.

A student that holds a course the rule cannot place asks LADOK, which then places it. After a `pull`, the student asks again, since the remembered views are forgotten.

167a ⟨*test functions* 120⟩+≡

```
def test_courses_by_state_asks_ladok_when_the_rule_cannot_tell():
    ladok = FakeLadokForCourseStates(with_unknown=True)
    student = ladok3.Student(ladok=ladok, id="student-uid")
    student.courses()

    assert codes(student.courses(state="upcoming")) == ["DD1320", "DD1321"]
    assert ladok.requests == ["all", "kommande"]
    student.courses(state="upcoming")
    assert ladok.requests == ["all", "kommande"]

    student.pull()
    student.courses(state="upcoming")
    assert ladok.requests == ["all", "kommande", "all", "kommande"]
```

This code is used in chunk 112b.
Defines:
`test_courses_by_state_asks_ladok_when_the_rule_cannot_tell`, never used.
Uses `codes` 164b, `courses` 160a, `FakeLadokForCourseStates` 164b, `pull` 176b, `state` 183 202b 212a, and `Student` 154a.

A registration that the student withdrew from is in no state, even when its summary says that the student broke off, so the student must pass the withdrawal on to the registration.

167b ⟨*test functions* 120⟩+≡

```
def test_courses_by_state_honours_a_withdrawal():
    ladok = FakeLadokForCourseStates()
    today = datetime.date.today()
    withdrawn = state_test_registration(
      "round-5", "DD1331", "avbrott",
      (today - datetime.timedelta(weeks=30),
       today - datetime.timedelta(weeks=10)))
    withdrawn["Aterbud"] = True
    ladok.registrations.append(withdrawn)
    student = ladok3.Student(ladok=ladok, id="student-uid")
    student.courses()
```

```
12
13    assert codes(student.courses(state="interrupted")) == []
14    assert ladok.requests == ["all"]
```

This code is used in chunk 112b.
Defines:
`test_courses_by_state_honours_a_withdrawal`, never used.
Uses `codes` 164b, `courses` 160a, `FakeLadokForCourseStates` 164b, `state` 183 202b 212a, `state_test_registration` 164b, and `Student` 154a.

Names that are not states are refused before anything is asked: a misspelt or Swedish name, a comma-separated string, which is one name that does not exist, and a number.

168a ⟨*test functions* 120⟩+≡

```
@pytest.mark.parametrize("state,error", [
  ("Ongoing", ValueError),
  ("pagaende", ValueError),
  ("ongoing,completed", ValueError),
  (["ongoing", "done"], ValueError),
  (5, TypeError),
])
def test_courses_by_state_refuses_unknown_states(state, error):
  ladok = FakeLadokForCourseStates()
  student = ladok3.Student(ladok=ladok, id="student-uid")
  with pytest.raises(error):
    student.courses(state=state)
  assert ladok.requests == []
```

This code is used in chunk 112b.
Defines:
`test_courses_by_state_refuses_unknown_states`, never used.
Uses `courses` 160a, `FakeLadokForCourseStates` 164b, `state` 183 202b 212a, and `Student` 154a.

The remembered views are attributes like the others, so they must survive the round trips, through JSON (Section 9.2.2) and through `pickle`, as the command-line interface uses: the restored student must give the same courses without asking LADOK.

168b ⟨*test functions* 120⟩+≡

```
def test_courses_by_state_survive_round_trips():
  ladok = FakeLadokForCourseStates()
  student = ladok3.Student(ladok=ladok, id="student-uid")
  student.courses(state="completed")
  assert ladok.requests == ["avslutade"]

  for json_data in [student.json, through_json_text(student)]:
    restored = ladok3.restore(json_data, ladok=ladok)
    assert restored == student
    assert codes(restored.courses(state="completed")) == ["DD1310"]
  assert ladok.requests == ["avslutade"]

  unpickled = pickle.loads(pickle.dumps(student))
  assert codes(unpickled.courses(state="completed")) == ["DD1310"]
  assert unpickled.ladok.requests == ["avslutade"]
```

This code is used in chunk 112b.
Defines:

`test_courses_by_state_survive_round_trips`, never used.
Uses `codes` 164b, `courses` 160a, `FakeLadokForCourseStates` 164b, `restore` 132a, `state` 183 202b 212a, `Student` 154a, and `through_json_text` 138a.

12.6 Is the student suspended?

We also want to know if a student is suspended or not. We can get a list of suspensions for a student. This list looks like this:

```
[
  {"Anteckning": "VJ-2024-...",
   "Giltighetsperiod": {"Slutdatum": "2024-12-03",
                        "Startdatum": "2024-09-25", "link": []},
   "LarosateID": 29,
   "OrsakID": 101450,
   "SenastAndradAv": "someone@kth.se",
   "SenastSparad": "2024-09-24T16:45:56.941",
   "StudentUID": "...",
   "Uid": "...",
   "link": [{"method": "GET",
             "uri": "https://api.ladok.se:443/studentinformation/internal/avstangning/...",
             "mediaType": "application/vnd.ladok+xml",
             "rel": "self"}]
  }
]
```

Let's make a class for this.

169 ⟨*classes* 119⟩+≡

```
class Suspension(LadokData):
  """A suspension"""
  def __init__(self, /, **kwargs):
    super().__init__(**kwargs)
    self.__note = kwargs.pop("Anteckning")
    self.__validity = (
      datetime.date.fromisoformat(kwargs["Giltighetsperiod"]["Startdatum"]),
      datetime.date.fromisoformat(kwargs["Giltighetsperiod"]["Slutdatum"])
    )

  @property
  def note(self):
    """
    The note of the suspension. This is usually a case number.
    """
    return self.__note

  @property
  def validity(self):
    """
    A tuple (start, end) of the validity period of the suspension.
    """
    return self.__validity
```

```
24
25    @property
26    def is_current(self):
27      """
28      Is True if the suspension is currently valid.
29      """
30      return self.validity[0] <= datetime.date.today() <= self.validity[1]
31
32    def __str__(self):
33      return f"{self.validity[0]}--{self.validity[1]}"
```

This code is used in chunk 112a.
Defines:
`Suspension`, used in chunk 170.
Uses `__init__` 174a, `__str__` 155, and `LadokData` 125.

We never cache this result since we always want the most up-to-date version.

170a ⟨*student attribute methods* 155⟩+≡

```
1  @property
2  def suspensions(self):
3    """
4    The list of the students' suspensions.
5    """
6    suspensions = self.ladok.get_student_suspensions_JSON(
7                                                self.ladok_id)["Avstangning"]
8    return [Suspension(**suspension) for suspension in suspensions]
```

This code is used in chunk 154a.
Defines:
`suspensions`, never used.
Uses `ladok_id` 155 and `Suspension` 169.

Restoring from JSON Unlike a grade scale, a suspension keeps values that JSON lacks: the validity period is a tuple of dates. Let's verify that it survives both round trips as a tuple of dates (Section 9.2.2). The suspension is made up; only the two keys that the constructor reads matter.

170b ⟨*test functions* 120⟩+≡

```
1  def test_suspension_round_trips_through_json():
2    suspension = ladok3.Suspension(
3      Anteckning="Dnr 0000-1",
4      Giltighetsperiod={"Startdatum": "2024-09-25",
5                        "Slutdatum": "2024-12-31"})
6
7    for json_data in [suspension.json, through_json_text(suspension)]:
8      restored = ladok3.restore(json_data)
9      assert type(restored) is ladok3.Suspension
10     assert restored == suspension
11     assert restored.validity == (datetime.date(2024, 9, 25),
12                                  datetime.date(2024, 12, 31))
```

This code is used in chunk 112b.
Defines:
`test_suspension_round_trips_through_json`, never used.
Uses `restore` 132a, `Suspension` 169, and `through_json_text` 138a.

Chapter 13

Courses

We can use the course-related classes as follows.

```
#!/usr/bin/python3
# -*- coding: utf-8 -*-
# -*- mode: python; python-indent-offset: 4 -*-
import ladok3

ladok = ladok3.test_session  # LADOK's test environment, for experiments

course_rounds = ladok.search_course_rounds(code="DD1315")

for course_round in course_rounds:
    print(f"{course_round.code} {course_round.start}--{course_round.end}")
print()

course_round = course_rounds[0]
print(f"{course_round.code} {course_round.start}--{course_round.end}")
print(f"round: {course_round.round_id}")
print(f"round code: {course_round.round_code}")
print(f"instance: {course_round.instance_id}")
print(f"education: {course_round.education_id}")
print(f"{course_round.code} components:")
for component in course_round.components():
    print(f"{component.code}: {component.instance_id}")
```

13.1 Course rounds

We can search for courses like this. The result consists of a list of `CourseRound` objects.

171 ⟨*LadokSession data methods* 147⟩+≡

```
  @cachetools.cachedmethod(
    operator.attrgetter("cache"),
    key=functools.partial(cachetools.keys.hashkey, "search_courses"))
  def search_course_rounds(self, /, **kwargs):
    """Query LADOK about course rounds, possible keys:
    code, round_code, name
```

```
    """
    results = self.search_course_rounds_JSON(**kwargs)
    return [CourseRound(ladok=self, **result) for result in results]
```

This code is used in chunk 119.
Defines:
`search_course_rounds`, never used.
Uses `code` 179, `CourseRound` 172, `name` 179, and `results` 77b 187a.

The response consists of this JSON data:

```
{
  "FinansieringsformID": 101050,
  "Slutdatum": "2027-01-11",
  "Startdatum": "2026-08-24",
  "StudielokaliseringID": 135195,
  "StudietaktID": 6,
  "TillfallesKod": "10768",
  "Uid": "9731dce7-c60c-11f0-9aa4-4a24d5f444fb",
  "UndervisningsformID": 1,
  "Utbildningsinstans": {
    "Avvecklad": false,
    "Benamning": [
      {
        "Sprakkod": "sv",
        "Text": "Programmeringsteknik"
      },
      {
        "Sprakkod": "en",
        "Text": "Programming Techniques"
      }
    ],
    "Enhet": "HP",
    "GallerUtbildningUtanAngivenOmfattning": false,
    "Omfattning": 7.5,
    "OrganisationUID": "638add54-dc41-11e8-8cc1-eaeeb71b497f",
    "ResultatPaKursVidAttesteringAvModul": false,
    "Uid": "70d5fdb1-2db7-11ec-bb06-8c8c04c8482a",
    "UtbildningUID": "70d5fdb9-2db7-11ec-bb06-8c8c04c8482a",
    "Utbildningskod": "DD1317",
    "Versionsnummer": 1
  }
}
```

We have two classes that are relevant here, `CourseInstance` and `CourseRound`. The `CourseInstance` corresponds to the data in `Utbildningsinstans` above. And the `CourseRound` is the data 'wrapping around' that of the `CourseInstance`. Thus, we will make `CourseRound` a specialization of `CourseInstance`. This makes sense as it contains additional data, such as start and end date. This class takes care of those and then defers the rest to the `CourseInstance` class (by calling its constructor).

172 ⟨*classes* 119⟩+≡

```
class CourseInstance(LadokRemoteData):
    """Represents a course instance. Must be constructed from at least
```

```
    ladok (a LadokSession object),
    UtbildningsinstansUID (an instance_id from LADOK),
    optionally a data dictionary from LADOK"""
    ⟨CourseInstance methods 174a⟩

  class CourseRound(CourseInstance):
    """Represents a course round"""
    def __init__(self, /, **kwargs):
      """
      Must be constructed from at least:
      Uid, TillfallesKod, Startdatum, Slutdatum
      """
      self.__round_id = kwargs.pop("Uid")
      self.__round_code = kwargs.pop("TillfallesKod")

      self.__start = datetime.date.fromisoformat(kwargs.pop("Startdatum"))
      self.__end = datetime.date.fromisoformat(kwargs.pop("Slutdatum"))

      ⟨prepare kwargs and call CourseInstance constructor 173⟩

    @property
    def round_id(self):
      return self.__round_id

    @property
    def round_code(self):
      return self.__round_code

    @property
    def start(self):
      return self.__start

    @property
    def end(self):
      return self.__end

    ⟨CourseRound data methods 187a⟩
```

This code is used in chunk 112a.
Defines:
`CourseInstance`, used in chunk 197.
`CourseRound`, used in chunks 171 and 189.
Uses `__init__` 174a, `data` 174b, `instance_id` 179, `LadokRemoteData` 140, and `LadokSession` 119.

The `CourseInstance` constructor expects only the `Utbildningsinstans` part of the data. However, the `Uid` should be renamed `UtbildningsinstansUID`. We must also pass on the `ladok` object.

173 ⟨prepare kwargs and call CourseInstance constructor 173⟩≡

```
  instance_data = kwargs.pop("Utbildningsinstans")
  instance_data["UtbildningsinstansUID"] = instance_data.pop("Uid")
  super().__init__(ladok=kwargs.pop("ladok"), **instance_data)
```

This code is used in chunk 172.
Defines:

`instance_data`, never used.
Uses `__init__` 174a.

13.2 Course instances

We have the course instance as the base class. This is essentially an 'instance of a course syllabus'. We know from above that it inherits from `LadokRemoteData` and that it must be initialized with the keywords `ladok` (for its parent) and `UtbildningsinstansUID` (for itself) and optionally some data.

174a ⟨*CourseInstance methods* 174a⟩≡

```
def __init__(self, /, **kwargs):
  self.__instance_id = kwargs.pop("UtbildningsinstansUID")
  super().__init__(**kwargs) # sets self.ladok

  ⟨CourseInstance constructor body 176a⟩
```

This definition is continued in chunks 176, 177, and 179.
This code is used in chunk 172.
Defines:
`__init__`, used in chunks 119, 125, 130a, 132b, 140, 148, 149, 154a, 164b, 169, 172, 173, 180, 185b, 193b, 197, 204, and 212b.

We can fetch the data from LADOK as follows. Note that we need to use the `round_id` from the `CourseRound` object. This works since we never have a `CourseInstance` object on its own, it's always parent of a `CourseRound` object. (And that makes this kind of ugly from an OOP perspective.)

174b ⟨*fetch CourseInstance data from LADOK* 174b⟩≡

```
data = self.ladok.course_round_components_JSON(self.round_id)
```

This code is used in chunk 176b.
Defines:
`data`, used in chunks 119, 125, 130a, 132a, 136, 140, 154a, 172, 176–78, 182, 183, 185a, 203, 204, 207, 210, 212a, and 224.

Then data will be populated with the following values:


```
{
  "AntalRegistrerade": 0,
  "Benamning": {
    "sv": "Programmeringsteknik och Matlab",
    "en": "Programming Techniques and Matlab"
  },
  "BetygsskalaID": 131657,
  "Enhet": "HP",
  "GallerUtbildningUtanAngivenOmfattning": false,
  "IngaendeMoment": [
    {
      "Benamning": {
        "sv": "Laborationer",
        "en": "Programming Assignments"
      },
      "BetygsskalaID": 131656,
      "Enhet": "HP",
      "GallerUtbildningUtanAngivenOmfattning": false,
      "KravPaProjekttitel": false,
```

```
      "Omfattning": 1.5,
      "ResultatrapporteringMojlig": true,
      "UtbildningUID": "38a66848-73d8-11e8-afa7-8e408e694e54",
      "UtbildningsinstansUID": "38a6416f-73d8-11e8-b4e0-063f9afb40e3",
      "Utbildningskod": "LAB1"
    },
    {
      "Benamning": {
        "sv": "Laborationer",
        "en": "Programming Assignments"
      },
      "BetygsskalaID": 131656,
      "Enhet": "HP",
      "GallerUtbildningUtanAngivenOmfattning": false,
      "KravPaProjekttitel": false,
      "Omfattning": 1.5,
      "ResultatrapporteringMojlig": true,
      "UtbildningUID": "38a1d44d-73d8-11e8-afa7-8e408e694e54",
      "UtbildningsinstansUID": "38a1867d-73d8-11e8-b4e0-063f9afb40e3",
      "Utbildningskod": "LAB2"
    },
    {
      "Benamning": {
        "sv": "Laborationer",
        "en": "Programming Assignments"
      },
      "BetygsskalaID": 131657,
      "Enhet": "HP",
      "GallerUtbildningUtanAngivenOmfattning": false,
      "KravPaProjekttitel": false,
      "Omfattning": 3.0,
      "ResultatrapporteringMojlig": true,
      "UtbildningUID": "389b1e62-73d8-11e8-afa7-8e408e694e54",
      "UtbildningsinstansUID": "389b1dda-73d8-11e8-b4e0-063f9afb40e3",
      "Utbildningskod": "LAB3"
    },
    {
      "Benamning": {
        "sv": "Laborationer",
        "en": "Programming Assignments"
      },
      "BetygsskalaID": 131656,
      "Enhet": "HP",
      "GallerUtbildningUtanAngivenOmfattning": false,
      "KravPaProjekttitel": false,
      "Omfattning": 1.5,
      "ResultatrapporteringMojlig": true,
      "UtbildningUID": "387c99a9-73d8-11e8-afa7-8e408e694e54",
      "UtbildningsinstansUID": "387c7248-73d8-11e8-b4e0-063f9afb40e3",
      "Utbildningskod": "MAT1"
    }
```

```
    ],
    "KravPaProjekttitel": false,
    "Kurstillfalleskod": "51872",
    "Omfattning": 7.5,
    "ResultatrapporteringMojlig": true,
    "Slutdatum": "2022-01-17 ",
    "Startdatum": "2021-08-30 ",
    "Studietaktsbenamning": {
      "sv": "Kvartsfart",
      "en": "One-quarter-time"
    },
    "Takt": 25,
    "Undervisningsformbenamning": {
      "sv": "Normal",
      "en": "Normal teaching"
    },
    "UtbildningUID": "38ab2393-73d8-11e8-afa7-8e408e694e54",
    "UtbildningsinstansUID": "9f30cc02-d6b5-11e8-8fd5-cf9d2c5c41ba",
    "Utbildningskod": "DD1315",
    "Versionsnummer": 2
}
```

Now that we have all data in `data`, we can assign its values to the private attributes. We note, however, that some course instances lack both `Versionsnummer` and `Omfattning`. It seems like faux courses are created to document when students go on Exchanges. These faux courses have a name and code, but no credits or version of syllabus. Consequently they don't have any grading scales either.

Our approach will be to try to assign the attributes using `kwargs`, and if that fails, we will fetch the data (pull from LADOK) once it is needed. If that pull fails with missing data, then we will assume that it's one of these faux courses.

176a ⟨*CourseInstance constructor body* 176a⟩≡

```
try:
  self.__assign_attr(kwargs.copy())
except Exception:
  self.__assign_sparse(kwargs)
```

This code is used in chunk 174a.
Uses `__assign_attr` 176b and `__assign_sparse` 177a.

176b ⟨*CourseInstance methods* 174a⟩+≡

```
def __assign_attr(self, data):
  ⟨assign CourseInstance data to private attributes 178b⟩

def __pull_attributes(self):
  ⟨fetch CourseInstance data from LADOK 174b⟩
  ⟨assign pulled CourseInstance data, or keep the old on failure 183⟩

def pull(self):
  self.__pull_attributes()

def __assign_faux(self, data):
  ⟨assign faux CourseInstance data to private attributes 178c⟩
```

This code is used in chunk 172.
Defines:
  `__assign_attr`, used in chunks 176a and 183.
  `__assign_faux`, used in chunk 183.
  `__pull_attributes`, used in chunk 177a.
  `pull`, used in chunks 140, 154a, 167a, 182a, 184a, 204, 220, 221, 223, 224, 226b, 227b, 229, 233, 235b, and 238.
Uses `data` 174b.

13.2.1 Pulling course data only when it is needed

An earlier version pulled at once, in the constructor. That made constructing a course cost one request, and the data we most often construct from is sparse. A student's registrations (Section 12.5) carry the course's name, code and education ID, but not its credits, syllabus version, grade scale or components. Since `Student.courses` constructs every course the student is registered on before it filters on the code, reporting one result for one course sent one components request for each of the student's courses. It also meant that if LADOK failed to deliver the components of *any* of them, we could report on none of them.

We therefore keep what the sparse data has and pull the rest on first use. Filtering courses on their code then costs no requests, and only the course we actually work with is pulled, so another course's failure no longer affects it. The attributes that the sparse data lacks call `__ensure_pulled` before they read their value. We keep the sparse name, code and education ID in the same private attributes as the pulled values, so that the properties need no special case: a pull simply overwrites them.

We pass `__assign_attr` a copy of `kwargs` above, because it pops the values it uses and may fail halfway, after taking the name and the code. And we catch `Exception` rather than everything, so that, for instance, an interrupt from the user is not mistaken for sparse data.

177a ⟨*CourseInstance methods* 174a⟩+≡

```
def __assign_sparse(self, data):
  self.__pulled = False
  self.__name = data.get("Benamning")
  self.__code = data.get("Utbildningskod")
  self.__education_id = data.get("UtbildningUID")

def __ensure_pulled(self):
  if not self.__pulled:
    self.__pull_attributes()
```

This code is used in chunk 172.
Defines:
  `__assign_sparse`, used in chunk 176a.
  `__ensure_pulled`, used in chunk 179.
Uses `__pull_attributes` 176b, `__pulled` 177b, and `data` 174b.

A course that was complete from the start needs no flag of its own, so we let a class attribute supply the default. That default also matters for the cache: a course pickled by an earlier version has no `__pulled` attribute, but it was always complete, so it should count as pulled. Python falls back to the class attribute when an instance lacks one.

177b ⟨*CourseInstance methods* 174a⟩+≡

```
__pulled = True
```

This code is used in chunk 172.
Defines:
`__pulled`, used in chunks 177a and 183.

By trial-and-error, it seems like the faux courses has none of the attributes that the real courses have. However, we try our best.

178a ⟨*assign common CourseInstance data to private attributes* 178a⟩≡

```
self.__components = []
⟨add course components to self.__components 182b⟩
```

This code is used in chunk 178.

178b ⟨*assign CourseInstance data to private attributes* 178b⟩≡

```
⟨assign common CourseInstance data to private attributes 178a⟩

self.__name = data.pop("Benamning")
self.__code = data.pop("Utbildningskod")

self.__credits = data.pop("Omfattning")
self.__unit = data.pop("Enhet")

self.__version = data.pop("Versionsnummer")

self.__education_id = data.pop("UtbildningUID")

self.__grade_scale = self.ladok.get_grade_scales(
  id=data.pop("BetygsskalaID"))
```

This code is used in chunk 176b.
Uses `data` 174b and `get_grade_scales` 147.

178c ⟨*assign faux CourseInstance data to private attributes* 178c⟩≡

```
⟨assign common CourseInstance data to private attributes 178a⟩

self.__name = data.pop("Benamning", None)
self.__code = data.pop("Utbildningskod", None)

self.__credits = data.pop("Omfattning", None)
self.__unit = data.pop("Enhet", None)

self.__version = data.pop("Versionsnummer", None)

self.__education_id = data.pop("UtbildningUID", None)

try:
  self.__grade_scale = self.ladok.get_grade_scales(
    id=data.pop("BetygsskalaID"))
except KeyError:
  self.__grade_scale = None
```

This code is used in chunk 176b.
Uses `data` 174b and `get_grade_scales` 147.

Finally, we want to have properties to access the private attributes. The name, code and education ID are usually there already, so those properties pull only when the value is missing; the others always make sure that we have pulled (Section 13.2.1).

179 ⟨*CourseInstance methods* 174a⟩+≡

```
@property
def instance_id(self):
  return self.__instance_id

@property
def education_id(self):
  if self.__education_id is None:
    self.__ensure_pulled()
  return self.__education_id

@property
def code(self):
  if self.__code is None:
    self.__ensure_pulled()
  return self.__code

@property
def name(self):
  if self.__name is None:
    self.__ensure_pulled()
  return self.__name["en"]

@property
def version(self):
  self.__ensure_pulled()
  return self.__version

@property
def grade_scale(self):
  self.__ensure_pulled()
  return self.__grade_scale

@property
def credits(self):
  self.__ensure_pulled()
  return self.__credits

@property
def unit(self):
  self.__ensure_pulled()
  return self.__unit

def components(self, /, **kwargs):
  """Returns the list of components, filtered on keywords"""
  self.__ensure_pulled()
```

```
46      return filter_on_keys(self.__components, **kwargs)
```

This code is used in chunk 172.
Defines:
`code`, used in chunks 127a, 138b, 148, 149, 160–62, 164b, 166a, 171, 180–82, 184, 185, 191a, 193b, 197, 201, 230, and 231a.
`components`, used in chunks 23b, 181, 184, 199–201, 204, 207b, 212b, 214, 219–21, 223, 224, 226, 227, 229, 234, and 235b.
`credits`, used in chunks 181a, 182a, 184, 185, and 204.
`education_id`, used in chunks 180, 185b, 199b, 210, 212b, and 233.
`grade_scale`, used in chunks 147, 185b, 204, 208, 230, 234, and 236b.
`instance_id`, used in chunks 172, 185b, 201a, 207b, 208, 210–12, and 231b.
`name`, used in chunks 114, 119, 120, 126b, 127a, 130, 131, 134–36, 148, 155, 160a, 164a, 171, 181a, 185, 188a, 191a, and 201c.
`unit`, used in chunk 185b.
`version`, never used.
Uses `__ensure_pulled` 177a and `filter_on_keys` 142.

Let's verify the two properties we want from pulling lazily. We give a student two current registrations, built from the sparse data that `registrations_JSON` returns, and a fake LADOK that counts the components requests and can fail them for chosen course rounds. (Later tests also ask it for the student's results; it has none recorded.)

180 ⟨*test functions* 120⟩+≡

```
class FakeLadokForLazyCourses:
  def __init__(self, broken_rounds=()):
    self.components_requests = []
    self.__broken_rounds = set(broken_rounds)
    self.__grade_scale = ladok3.GradeScale(
      ID=1, Kod="PF", Benamning={"sv": "Pass/fail"},
      Betygsgrader=[{"ID": 11, "Kod": "P", "GiltigSomSlutbetyg": True}])

  def registrations_JSON(self, student_id):
    return [lazy_test_registration("round-ok", "DD1315"),
            lazy_test_registration("round-broken", "DD2520")]

  def course_round_components_JSON(self, round_id):
    self.components_requests.append(round_id)
    if round_id in self.__broken_rounds:
      raise ladok3.LadokAPIError("PUT request to ... failed: 500")
    return {
      "UtbildningsinstansUID": f"instance-{round_id}",
      "UtbildningUID": f"education-{round_id}",
      "Utbildningskod": "DD1315",
      "Benamning": {"sv": "Kurs", "en": "Course"},
      "Omfattning": 7.5,
      "Enhet": "hp",
      "Versionsnummer": "1",
      "BetygsskalaID": 1,
    }

  def get_grade_scales(self, /, **kwargs):
    return [self.__grade_scale]

  def student_results_JSON(self, student_id, education_id):
```

```
32      return {"Kursversioner": [{"VersionensModuler": [],
33                                 "VersionensKurs": {}}]}
34
35  def lazy_test_registration(round_id, code):
36    return {
37      "Nuvarande": True,
38      "Utbildningsinformation": {
39        "UtbildningstillfalleUID": round_id,
40        "Utbildningstillfalleskod": "50001",
41        "Studieperiod": {"Startdatum": "2026-08-31",
42                         "Slutdatum": "2026-10-23"},
43        "UtbildningsinstansUID": f"instance-{round_id}",
44        "UtbildningUID": f"education-{round_id}",
45        "Utbildningskod": code,
46        "Benamning": {"sv": "Kurs", "en": "Course"},
47      },
48    }
```

This code is used in chunk 112b.
Defines:
`FakeLadokForLazyCourses`, used in chunks 162a, 181, 182a, 184, 185a, 201b, 203, and 233.
`lazy_test_registration`, used in chunks 164b and 203.
Uses `__init__` 174a, `code` 179, `education_id` 179, `get_grade_scales` 147, and `GradeScale` 148.

First, finding a student's course by its code costs no requests, and the course is pulled once, when we first need data it lacks.

181a ⟨*test functions* 120⟩+≡

```
1  def test_finding_a_course_sends_no_components_request():
2    ladok = FakeLadokForLazyCourses()
3    student = ladok3.Student(ladok=ladok, id="student-uid")
4
5    course, = student.courses(code="DD1315")
6    assert course.name == "Course"
7    assert ladok.components_requests == []
8
9    assert course.credits == 7.5
10   assert course.components()
11   assert ladok.components_requests == ["round-ok"]
```

This code is used in chunk 112b.
Defines:
`test_finding_a_course_sends_no_components_request`, never used.
Uses `code` 179, `components` 22b 179 210, `courses` 160a, `credits` 179, `FakeLadokForLazyCourses` 180, `name` 179, and `Student` 154a.

Second, a course whose components LADOK fails to deliver no longer stops us from working with another course; the failure surfaces only when we use the broken course itself.

181b ⟨*test functions* 120⟩+≡

```
1  def test_broken_course_does_not_affect_another():
2    ladok = FakeLadokForLazyCourses(broken_rounds={"round-broken"})
3    student = ladok3.Student(ladok=ladok, id="student-uid")
4
5    course, = student.courses(code="DD1315")
6    assert course.components()
```

```
7
8     broken, = student.courses(code="DD2520")
9     with pytest.raises(ladok3.LadokAPIError):
10      broken.components()
```

This code is used in chunk 112b.
Defines:
`test_broken_course_does_not_affect_another`, never used.
Uses `code` 179, `components` 22b 179 210, `courses` 160a, `FakeLadokForLazyCourses` 180, and `Student` 154a.

Finally, a course pickled by an earlier version lacks the `__pulled` attribute but is complete; it must not be pulled again. We mimic one by removing the attribute from a pulled course.

182a ⟨*test functions* 120⟩+≡

```
1  def test_course_without_pulled_flag_counts_as_pulled():
2    ladok = FakeLadokForLazyCourses()
3    course, = ladok3.Student(ladok=ladok, id="student-uid").courses(
4      code="DD1315")
5    course.pull()
6    del course._CourseInstance__pulled
7
8    assert course.credits == 7.5
9    assert ladok.components_requests == ["round-ok"]
```

This code is used in chunk 112b.
Defines:
`test_course_without_pulled_flag_counts_as_pulled`, never used.
Uses `code` 179, `courses` 160a, `credits` 179, `FakeLadokForLazyCourses` 180, `pull` 176b, and `Student` 154a.

13.2.2 Course components

We need to add the courses components to the course instance. That is things like LAB1 or EXA1 that make up the course in LADOK.

182b ⟨*add course components to* `self.__components` 182b⟩≡

```
1  if "IngaendeMoment" in data:
2    self.__components += [CourseComponent(
3        ladok=self.ladok, course=self,
4        **component) for component in data["IngaendeMoment"]]
```

This definition is continued in chunk 182c.
This code is used in chunk 178a.
Uses `CourseComponent` 185b and `data` 174b.

We also add the course itself as a component. This is to handle the grade on the course itself. Once all the components have a grade, the course itself will get a grade. This component represents that grade. It will get the course code as its code.

182c ⟨*add course components to* `self.__components` 182b⟩+≡

```
1  try:
2    course_component_data = data.copy()
3    course_component_data["ladok"] = self.ladok
4    self.__components.append(CourseComponent(course=self,
5                                             **course_component_data))
6  except KeyError:
7    pass
```

This code is used in chunk 178a.
Uses `CourseComponent` 185b and `data` 174b.

13.2.3 When a pull fails

Now that we have seen what `__assign_attr` does, we can see how a pull can fail halfway. It first replaces the components with a new list and fills it, and then it pops the remaining values from the data one by one. Both the components and the course need grade scales, which may cost requests of their own. An earlier version simply ran

```
try:
  self.__assign_attr(data)
except:
  self.__assign_faux(data)
self.__pulled = True
```

and that went wrong in three ways.

A failed refresh left partial state. `pull` also refreshes a course that has already been pulled. If it failed after the components had been replaced by an empty list, `__pulled` was still true, so the course reported no components—and `results` no such component—until the cache was cleared (Section 9.2.5).

A failed request was taken for a faux course. The bare `except` sent every failure, a server error included, to `__assign_faux`, which then marked the course as pulled.

The faux fallback got data with values missing. `__assign_attr` pops the values that it uses. A faux course has a name and a code, but no credits, so `__assign_attr` popped the name and the code before it failed on the credits. `__assign_faux` then found neither and set both to `None`, and the `name` property failed on the `None`.

We fix the last two by catching only `KeyError` and by giving `__assign_attr` a copy of the data, as the constructor already does. Catching only `KeyError` is enough because faux data differs from real data only in lacking keys: `__assign_faux` does the same as `__assign_attr` except that it tolerates missing values. Any other exception would occur in `__assign_faux` too, unless it came from a transient failure, and a transient failure is exactly what we must not take for a faux course.

We fix the first by taking a snapshot of the instance's attributes and restoring it if anything fails, the same technique that `CourseResult` uses for its refresh (Section 14.2.2). A shallow copy of `self.__dict__` suffices, because the assignment only rebinds attributes; even the components go into a new list. For a course that has not been pulled before, the restored state includes `__pulled` being false, so the next use pulls again. We set `__pulled` inside the guarded block, so that it is part of the transaction, and we restore on any exception, interrupts included, since restoring and re-raising is right for all of them.

183 ⟨*assign pulled CourseInstance data, or keep the old on failure* 183⟩≡

```
  state = self.__dict__.copy()
  try:
    try:
```

```
      self.__assign_attr(data.copy())
    except KeyError:
      self.__assign_faux(data)
    self.__pulled = True
  except BaseException:
    self.__dict__.clear()
    self.__dict__.update(state)
    raise
```

This code is used in chunk 176b.
Defines:
`state`, used in chunks 119, 160a, 162–68, 188a, 191–95, 203, 224, and 227a.
Uses `__assign_attr` 176b, `__assign_faux` 176b, `__pulled` 177b, and `data` 174b.

Let's verify each of the three. First, a refresh that fails, here because the grade scales cannot be fetched, keeps the components and the other values that the course already had.

184a ⟨*test functions* 120⟩+≡

```
def always_fail_with_500(*args, **kwargs):
  raise ladok3.LadokAPIError("GET request to ... failed: 500")

def test_failed_course_refresh_keeps_old_state():
  ladok = FakeLadokForLazyCourses()
  course, = ladok3.Student(ladok=ladok, id="student-uid").courses(
    code="DD1315")
  course.pull()

  ladok.get_grade_scales = always_fail_with_500
  with pytest.raises(ladok3.LadokAPIError):
    course.pull()

  assert course.components(code="DD1315")
  assert course.credits == 7.5
```

This code is used in chunk 112b.
Defines:
`always_fail_with_500`, never used.
`test_failed_course_refresh_keeps_old_state`, never used.
Uses `code` 179, `components` 22b 179 210, `courses` 160a, `credits` 179, `FakeLadokForLazyCourses` 180, `get_grade_scales` 147, `pull` 176b, and `Student` 154a.

Second, when the first pull of a course fails, the error reaches the caller and the next use pulls again.

184b ⟨*test functions* 120⟩+≡

```
def test_failed_first_course_pull_is_retried():
  ladok = FakeLadokForLazyCourses()
  ladok.get_grade_scales = fail_first_call(ladok.get_grade_scales)
  course, = ladok3.Student(ladok=ladok, id="student-uid").courses(
    code="DD1315")

  with pytest.raises(ladok3.LadokAPIError):
    course.components()

  assert course.components(code="DD1315")
  assert course.credits == 7.5
```

This code is used in chunk 112b.
Defines:
`test_failed_first_course_pull_is_retried`, never used.
Uses `code` 179, `components` 22b 179 210, `courses` 160a, `credits` 179, `fail_first_call` 161c, `FakeLadokForLazyCourses` 180, `get_grade_scales` 147, and `Student` 154a.

Third, a faux course keeps the name and the code when it is pulled. We make the fake LADOK return faux data by dropping the credits, the syllabus version and the grade scale.

185a ⟨*test functions* 120⟩+≡

```
class FakeLadokForFauxCourses(FakeLadokForLazyCourses):
  def course_round_components_JSON(self, round_id):
    data = super().course_round_components_JSON(round_id)
    for key in ["Omfattning", "Enhet", "Versionsnummer", "BetygsskalaID"]:
      del data[key]
    return data

def test_pulled_faux_course_keeps_name_and_code():
  ladok = FakeLadokForFauxCourses()
  course, = ladok3.Student(ladok=ladok, id="student-uid").courses(
    code="DD1315")

  assert course.credits is None
  assert course.name == "Course"
  assert course.code == "DD1315"
```

This code is used in chunk 112b.
Defines:
`FakeLadokForFauxCourses`, never used.
`test_pulled_faux_course_keeps_name_and_code`, never used.
Uses `code` 179, `courses` 160a, `credits` 179, `data` 174b, `FakeLadokForLazyCourses` 180, `name` 179, and `Student` 154a.

13.3 Course components

The `CourseComponent` class will make the attributes available. We specify the most interesting ones and let the `LadokData` constructor turn the rest into properties as well, so that they are available for the curious.

Turns out that some course components don't have any credits. This is probably a consequence of being a component in a course with no credits, e.g., one of those faux courses to register exchange studies.

185b ⟨*classes* 119⟩+≡

```
class CourseComponent(LadokData):
  """Represents a course component of a course registration"""
  def __init__(self, /, **kwargs):
    super().__init__(**kwargs)

    self.__course = kwargs.pop("course")

    if "UtbildningsinstansUID" in kwargs:
      self.__instance_id = kwargs.pop("UtbildningsinstansUID")
    else:
      self.__instance_id = kwargs.pop("Uid")
```

```
12
13      self.__education_id = kwargs.pop("UtbildningUID")
14
15      self.__code = kwargs.pop("Utbildningskod")
16      description = kwargs.pop("Benamning")
17      if isinstance(description, dict):
18        self.__description = description["sv"]
19      else:
20        self.__description = description
21
22      self.__credits = kwargs.pop("Omfattning", None)
23      self.__unit = kwargs.pop("Enhet", None)
24
25      ladok = kwargs.pop("ladok")
26      grade_scale_id = kwargs.pop("BetygsskalaID")
27      self.__grade_scale = ladok.get_grade_scales(id=grade_scale_id)[0]
28
29    @property
30    def course(self):
31      return self.__course
32
33    @property
34    def instance_id(self):
35      return self.__instance_id
36
37    @property
38    def education_id(self):
39      return self.__education_id
40
41    @property
42    def code(self):
43      """Returns the name of the component (as in syllabus)"""
44      return self.__code
45
46    @property
47    def description(self):
48      """Returns description of component (as in syllabus)"""
49      return self.__description
50
51    @property
52    def unit(self):
53      """Returns the unit for the credits"""
54      return self.__unit
55
56    @property
57    def credits(self):
58      """Returns the number of credits"""
59      return self.__credits
60
61    @property
62    def grade_scale(self):
```

```
63      return self.__grade_scale
64
65    def __str__(self):
66      return self.code
67
68    def __eq__(self, other):
69      if isinstance(other, str):
70        return self.code == other
71      return super().__eq__(other)
```

This code is used in chunk 112a.
Defines:
`CourseComponent`, used in chunks 182 and 212b.
Uses `__init__` 174a, `__str__` 155, `code` 179, `credits` 179, `education_id` 179, `get_grade_scales` 147, `grade_scale` 179, `instance_id` 179, `LadokData` 125, `name` 179, and `unit` 179.

We have the latter method, `__eq__`, so that we can filter on keys and compare with strings. Any other comparison is that of `LadokData` (Section 9.2.1): an object of another class is unequal, where comparing the attribute dictionaries directly failed with an `AttributeError` for an object without one. (The cycle from the component to its course and back would be safe either way, since the course's comparison guards it.)

13.4 Results for a course round

We can access the results of all the students during a course round. We do this through the method `results`, which takes keyword arguments to possibly filter the results.

187a ⟨*CourseRound data methods* 187a⟩≡

```
def results(self, /, **kwargs):
  """Returns all students' results on the course"""
  try:
    self.__results
  except:
    self.__fetch_results()

  return filter_on_keys(self.__results, **kwargs)
```

This definition is continued in chunks 187, 188, and 193a.
This code is used in chunk 172.
Defines:
`results`, used in chunks 63c, 65, 68–70, 73b, 75, 77–80, 83c, 132a, 171, 197, 199–201, 204, 207a, 214–18, 220, 227a, and 233–38.
Uses `__fetch_results` 187b and `filter_on_keys` 142.

To fetch the results from LADOK, we must do the following query.

187b ⟨*CourseRound data methods* 187a⟩+≡

```
def __fetch_results(self):
  raise NotImplementedError(
    f"{type(self).__name__}.__fetch_results not implemented")
```

This code is used in chunk 172.
Defines:
`__fetch_results`, used in chunk 187a.

13.5 Participants for a course round

We want to get a list of participants for a course round, i.e., a list of `Student` objects.

188a ⟨*CourseRound data methods* 187a⟩+≡

```
def participants(self, /, state=None, today=None, **kwargs):
  """Returns a Student object for each participant in the course.

  Without `state`, the participants that LADOK's participant list gives
  by default.  With `state`, an English state name or an iterable of
  them (see ladok3.COURSE_STATES), the participants in those states on
  this round as LADOK's participant list defines them, judged on `today`
  (default: the current date in Sweden).  Raises ValueError for any
  other name and TypeError if `state` is neither a string nor an
  iterable.

  Filtered on the other keywords, see ladok3.filter_on_keys.
  """
  if state is not None:
    return filter_on_keys(self.__participants_in_states(state, today),
                          **kwargs)
  try:
    self.__participants
  except:
    self.__fetch_participants()

  return filter_on_keys(self.__participants, **kwargs)
```

This code is used in chunk 172.
Defines:
`participants`, used in chunks 188b, 189, 191a, 193–95, and 237a.
Uses `__fetch_participants` 188b, `__participants_in_states` 193a, `COURSE_STATES` 201c, `filter_on_keys` 142, `name` 179, `state` 183 202b 212a, and `Student` 154a.

When we fetch the participants, we don't create new `Student` objects. We use the `get_student` method of the LADOK session object to fetch objects from the cache if they already exist. We build the whole list before we assign it (Section 9.2.5). An earlier version assigned an empty list first and appended to it, so a failed `participants_JSON` left the course round without participants, in the cache too.

188b ⟨*CourseRound data methods* 187a⟩+≡

```
def __fetch_participants(self):
  self.__participants = self.__students(
    self.ladok.participants_JSON(self.round_id))

def __students(self, participants):
  """Returns the Student objects for LADOK's participant records"""
  return [self.ladok.get_student(student["Student"]["Uid"])
          for student in participants]
```

This code is used in chunk 172.
Defines:
`__fetch_participants`, used in chunk 188a.
`__students`, used in chunk 193a.
Uses `get_student` 153, `participants` 188a, and `Student` 154a.

Let's verify that a failed request for the participants is retried. We need a course round, which we construct from the data that `search_course_rounds` gets from LADOK, but only as much as the constructor needs; the rest it would pull on first use.

189 ⟨*test functions* 120⟩+≡

```
class FakeLadokForParticipants:
  def participants_JSON(self, round_id):
    return [{"Student": {"Uid": "student-uid"}}]

  def get_student(self, id):
    return ladok3.Student(ladok=self, id=id)

def make_test_course_round(ladok):
  return ladok3.CourseRound(
    ladok=ladok, Uid="round-uid", TillfallesKod="50001",
    Startdatum="2026-08-31", Slutdatum="2026-10-23",
    Utbildningsinstans={"Uid": "instance-uid",
                        "UtbildningUID": "education-uid",
                        "Utbildningskod": "DD1315",
                        "Benamning": {"sv": "Kurs", "en": "Course"}})

def test_failed_participants_request_is_retried():
  ladok = FakeLadokForParticipants()
  ladok.participants_JSON = fail_first_call(ladok.participants_JSON)
  course_round = make_test_course_round(ladok)

  with pytest.raises(ladok3.LadokAPIError):
    course_round.participants()

  student, = course_round.participants()
  assert student.ladok_id == "student-uid"
```

This code is used in chunk 112b.
Defines:
`FakeLadokForParticipants`, used in chunks 193b and 237a.
`make_test_course_round`, used in chunks 194, 195, and 237a.
`test_failed_participants_request_is_retried`, never used.
Uses `CourseRound` 172, `fail_first_call` 161c, `get_student` 153, `ladok_id` 155, `participants` 188a, and `Student` 154a.

13.5.1 Participants by state

Often we want only some of a round's participants, for instance those who take it now or those who broke off: `course_round.participants(state=...)`, with the English state names of a student's courses (Section 12.5.1).

A student can tell the state of each of its own courses (Section 14.1.1), but asking each participant would cost a request per student. LADOK's participant list can filter on the server instead, in the one request that lists the participants, by the participant's `deltagaretillstand` on the round (Section 20.5). So we ask once per round.

The participant list has a vocabulary of its own, though, and it does not name a student's states. We compared the two on 2026-10-20: the participant list's filter on

DD1301's rounds of 2026, which had all started or ended, and on a running round of DD1317, against the state of each sampled participant's own registration on the round (Section 22.13).

`REGISTRERAD` (registered) holds the students who take the course: they are ongoing while the round runs (4 of 4 on DD1317, which had 177 registered students) and unfinished once it has ended (15 of 15).

`EJ_PABORJAD` (not started) holds the students who have not started: they are upcoming until the round has ended (3 of 3 on rounds that had not started, and on the running round too). On a round that has ended the code still holds them, while their own registrations are in no state (7 of 7). We follow the students' side: on a round that has ended, upcoming has no code, so these students are in no state here either, and asking for the upcoming participants of such a round gives no one.

`AVKLARAD` (completed) is completed (15 of 15, and 2 of 2 on the running round).

`AVBROTT` (broken off) holds the interrupted students (3), but also those who broke off early (`tidigtavbrott`) and those who withdrew after breaking off, whose own registrations are in no state (10).

`PAGAENDE` (ongoing, literally) held no one on the running round, so it does not mean what its name says, and we do not know what it means. We never send it for a state, but it stays in the participant list's default.

So the round's dates translate a state to a code, just as they translate a registration's summary to a state on the student's side. Two states do not depend on the dates; the other three do, by where today falls relative to the round, with the same convention as on the student's side (both the first and the last day count as running). A state that has no code on a round, such as ongoing on a round that has ended, holds no one there.

190 ⟨*constants* 128b⟩+≡

```
PARTICIPANT_CODE_BY_STATE = {
  "completed": "AVKLARAD",
  "interrupted": "AVBROTT",
}

PARTICIPANT_CODE_BY_STATE_AND_TIMING = {
  ("ongoing", "running"): "REGISTRERAD",
  ("unfinished", "ended"): "REGISTRERAD",
  ("upcoming", "upcoming"): "EJ_PABORJAD",
  ("upcoming", "running"): "EJ_PABORJAD",
}
```

This code is used in chunk 112a.
Defines:
`PARTICIPANT_CODE_BY_STATE`, used in chunks 191 and 192.
`PARTICIPANT_CODE_BY_STATE_AND_TIMING`, used in chunks 191a and 192b.

`participant_codes` translates the states to the codes for a round. It checks the states as `Student.courses` does, and gives the codes in the order of `COURSE_STATES`, so that the same states give the same request, whatever order they were asked for in. It also gives each code once. With the tables as they are, no two states share a code on the same day, since ongoing and unfinished are told apart by the dates; but the tables are what we have learnt so far, and if two states came to share a code, it must still be sent once.

191a ⟨*functions* 126b⟩+≡

```
def participant_codes(state, start, end, today=None):
  """Returns the deltagaretillstand codes of LADOK's participant list
  that select the participants in `state` (an English state name or an
  iterable of them, see COURSE_STATES) on a round from `start` to `end`,
  judged on `today` (default: today in Sweden).  Each code once; an
  empty list if no participant can be in those states on that day."""
  timing = round_timing(start, end, today)
  codes = []
  for name in course_states(state):
    code = PARTICIPANT_CODE_BY_STATE.get(name) \
      or PARTICIPANT_CODE_BY_STATE_AND_TIMING.get((name, timing))
    if code and code not in codes:
      codes.append(code)
  return codes
```

This code is used in chunk 112a.
Defines:
`participant_codes`, used in chunks 191–93.
Uses `code` 179, `codes` 164b, `COURSE_STATES` 201c, `course_states` 164a, `name` 179, `PARTICIPANT_CODE_BY_STATE` 190, `PARTICIPANT_CODE_BY_STATE_AND_TIMING` 190, `participants` 188a, and `state` 183 202b 212a.

Let's verify the translation on a round from 31 August 2026 to 15 January 2027, judged before it starts, while it runs, on its first and last days, and after it has ended.

191b ⟨*test functions* 120⟩+≡

```
ROUND_START = datetime.date(2026, 8, 31)
ROUND_END = datetime.date(2027, 1, 15)
ALL_STATES = ["ongoing", "upcoming", "unfinished", "completed",
              "interrupted"]

@pytest.mark.parametrize("today,codes", [
  (datetime.date(2026, 8, 1), ["EJ_PABORJAD", "AVKLARAD", "AVBROTT"]),
  (ROUND_START, ["REGISTRERAD", "EJ_PABORJAD", "AVKLARAD", "AVBROTT"]),
  (datetime.date(2026, 10, 20),
   ["REGISTRERAD", "EJ_PABORJAD", "AVKLARAD", "AVBROTT"]),
  (ROUND_END, ["REGISTRERAD", "EJ_PABORJAD", "AVKLARAD", "AVBROTT"]),
  (datetime.date(2027, 2, 1), ["REGISTRERAD", "AVKLARAD", "AVBROTT"]),
])
def test_participant_codes_of_all_states(today, codes):
  assert ladok3.participant_codes(ALL_STATES, ROUND_START, ROUND_END,
                                  today) == codes

@pytest.mark.parametrize("state,today,codes", [
  ("ongoing", datetime.date(2026, 10, 20), ["REGISTRERAD"]),
  ("ongoing", datetime.date(2026, 8, 1), []),
```

```
    ("ongoing", datetime.date(2027, 2, 1), []),
    ("unfinished", datetime.date(2027, 2, 1), ["REGISTRERAD"]),
    ("unfinished", datetime.date(2026, 10, 20), []),
    ("upcoming", datetime.date(2026, 8, 1), ["EJ_PABORJAD"]),
    ("upcoming", datetime.date(2026, 10, 20), ["EJ_PABORJAD"]),
    ("upcoming", datetime.date(2027, 2, 1), []),
    ("completed", datetime.date(2026, 8, 1), ["AVKLARAD"]),
    ("interrupted", datetime.date(2027, 2, 1), ["AVBROTT"]),
])
def test_participant_codes_of_one_state(state, today, codes):
    assert ladok3.participant_codes(state, ROUND_START, ROUND_END,
                                    today) == codes
```

This code is used in chunk 112b.
Defines:
ALL_STATES, never used.
ROUND_END, used in chunk 192a.
ROUND_START, used in chunk 192a.
test_participant_codes_of_all_states, never used.
test_participant_codes_of_one_state, never used.
Uses codes 164b, participant_codes 191a, and state 183 202b 212a.

Two states that share a code send it once. No two states do with the tables as they are, so we change a table for the test.

192a ⟨*test functions* 120⟩+≡

```
def test_participant_codes_send_a_shared_code_once(monkeypatch):
    monkeypatch.setitem(ladok3.PARTICIPANT_CODE_BY_STATE,
                        "interrupted", "AVKLARAD")
    assert ladok3.participant_codes(["completed", "interrupted"],
                                    ROUND_START, ROUND_END,
                                    datetime.date(2026, 10, 20)) \
        == ["AVKLARAD"]
```

This code is used in chunk 112b.
Defines:
test_participant_codes_send_a_shared_code_once, never used.
Uses PARTICIPANT_CODE_BY_STATE 190, participant_codes 191a, ROUND_END 191b, and ROUND_START 191b.

Every English state must have a code on some day, and nothing else may.

192b ⟨*test functions* 120⟩+≡

```
def test_participant_codes_cover_the_course_states():
    states = set(ladok3.PARTICIPANT_CODE_BY_STATE) \
        | {state for state, _ in ladok3.PARTICIPANT_CODE_BY_STATE_AND_TIMING}
    assert states == set(ladok3.COURSE_STATES)
```

This code is used in chunk 112b.
Defines:
test_participant_codes_cover_the_course_states, never used.
Uses COURSE_STATES 201c, PARTICIPANT_CODE_BY_STATE 190, PARTICIPANT_CODE_BY_STATE_AND_TIMING 190, and state 183 202b 212a.

The list of participants in some states is a list of its own. It must not replace the default list, which holds other states, so we keep the lists per request, under the tuple of codes: asking for `{"completed", "ongoing"}` and then for `["ongoing", "completed"]` costs one request. Like the default list, a remembered list is kept for as long as the round object lives, also in the command-line interface's cache:

the round's `pull` refreshes the course data, not the participants. That is a trade-off, not only a saving. After the round has ended, unfinished means the code that ongoing meant while it ran, so it returns the list fetched then, not who is registered now. A program that needs the current list must use a new round object; `search_course_rounds` caches its rounds in the session, so that means clearing the session's cache too. The key is a tuple rather than a set, since the round must survive the round trip through JSON (Section 9.2.2), which can write a tuple but not a set. States without a code on the round select no one and need no request; sent to LADOK, an empty filter would mean something else. As for the default list, we remember a list only once it is complete (Section 9.2.5).

193a ⟨*CourseRound data methods* 187a⟩+≡

```
def __participants_in_states(self, state, today):
  """Returns the participants in `state` on `today`, asking LADOK once
  per set of codes"""
  codes = tuple(participant_codes(state, self.start, self.end, today))
  if not codes:
    return []
  try:
    return self.__participants_by_codes[codes]
  except (AttributeError, KeyError):
    pass
  participants = self.__students(self.ladok.participants_JSON(
    self.round_id, participant_states=list(codes)))
  try:
    participants_by_codes = self.__participants_by_codes
  except AttributeError:
    participants_by_codes = self.__participants_by_codes = {}
  participants_by_codes[codes] = participants
  return participants
```

This code is used in chunk 172.
Defines:
`__participants_in_states`, used in chunk 188a.
Uses `__students` 188b, `codes` 164b, `participant_codes` 191a, `participants` 188a, and `state` 183 202b 212a.

To test this, we need a LADOK whose participant list records the codes that it is asked for. It gives one participant per code, so that the result shows which codes it was given. The test round runs from 31 August to 23 October 2026, so we judge it on 20 October 2026.

193b ⟨*test functions* 120⟩+≡

```
class FakeLadokForParticipantStates(FakeLadokForParticipants):
  def __init__(self):
    self.requests = []

  def participants_JSON(self, round_id, **kwargs):
    self.requests.append(kwargs.get("participant_states"))
    codes = kwargs.get("participant_states") or ["DEFAULT"]
    return [{"Student": {"Uid": f"student-{code}"}} for code in codes]

def ids(students):
  return [student.ladok_id for student in students]
```

```
12
13  RUNNING_DAY = datetime.date(2026, 10, 20)
```

This code is used in chunk 112b.
Defines:
`FakeLadokForParticipantStates`, used in chunks 194 and 195.
`ids`, used in chunks 194 and 195.
`RUNNING_DAY`, used in chunks 194 and 195.
Uses `__init__` 174a, `code` 179, `codes` 164b, `FakeLadokForParticipants` 189, `ladok_id` 155, and `Student` 154a.

A request asks for exactly the codes of the states, once per set of codes, and does not touch the default list. A state without a code on the round asks nothing.

194a ⟨*test functions* 120⟩+≡

```
def test_participants_by_state_ask_once_per_set_of_codes():
  ladok = FakeLadokForParticipantStates()
  course_round = make_test_course_round(ladok)

  assert ids(course_round.participants(state="interrupted",
                                       today=RUNNING_DAY)) \
    == ["student-AVBROTT"]
  assert ids(course_round.participants(state={"completed", "ongoing"},
                                       today=RUNNING_DAY)) \
    == ["student-REGISTRERAD", "student-AVKLARAD"]
  course_round.participants(state=["ongoing", "completed"],
                            today=RUNNING_DAY)
  course_round.participants(state="interrupted", today=RUNNING_DAY)
  assert course_round.participants(state="unfinished",
                                   today=RUNNING_DAY) == []
  assert ladok.requests == [["AVBROTT"], ["REGISTRERAD", "AVKLARAD"]]

  assert ids(course_round.participants()) == ["student-DEFAULT"]
  assert ladok.requests == [["AVBROTT"], ["REGISTRERAD", "AVKLARAD"], None]
```

This code is used in chunk 112b.
Defines:
`test_participants_by_state_ask_once_per_set_of_codes`, never used.
Uses `FakeLadokForParticipantStates` 193b, `ids` 193b, `make_test_course_round` 189, `participants` 188a, `RUNNING_DAY` 193b, and `state` 183 202b 212a.

After the round, unfinished asks for the code that ongoing asked for while the round ran, and gets the remembered list.

194b ⟨*test functions* 120⟩+≡

```
def test_participants_by_state_share_a_request_for_the_same_codes():
  ladok = FakeLadokForParticipantStates()
  course_round = make_test_course_round(ladok)

  ongoing = course_round.participants(state="ongoing", today=RUNNING_DAY)
  unfinished = course_round.participants(state="unfinished",
                                         today=datetime.date(2026, 11, 1))
  assert ids(unfinished) == ids(ongoing) == ["student-REGISTRERAD"]
  assert ladok.requests == [["REGISTRERAD"]]
```

This code is used in chunk 112b.
Defines:
`test_participants_by_state_share_a_request_for_the_same_codes`, never used.

Uses FakeLadokForParticipantStates 193b, ids 193b, make_test_course_round 189, participants 188a, RUNNING_DAY 193b, and state 183 202b 212a.

A failed request must not stick here either: the next call asks again and gets the participants.

195a ⟨*test functions* 120⟩+≡

```
def test_failed_participants_by_state_request_is_retried():
  ladok = FakeLadokForParticipantStates()
  ladok.participants_JSON = fail_first_call(ladok.participants_JSON)
  course_round = make_test_course_round(ladok)

  with pytest.raises(ladok3.LadokAPIError):
    course_round.participants(state="completed", today=RUNNING_DAY)

  assert ids(course_round.participants(state="completed",
                                       today=RUNNING_DAY)) \
    == ["student-AVKLARAD"]
```

This code is used in chunk 112b.
Defines:
test_failed_participants_by_state_request_is_retried, never used.
Uses fail_first_call 161c, FakeLadokForParticipantStates 193b, ids 193b, make_test_course_round 189, participants 188a, RUNNING_DAY 193b, and state 183 202b 212a.

The round refuses what a student refuses, before it asks.

195b ⟨*test functions* 120⟩+≡

```
@pytest.mark.parametrize("state,error", [
  ("Ongoing", ValueError), ("AVBROTT", ValueError), (5, TypeError)])
def test_participants_by_state_refuse_unknown_states(state, error):
  ladok = FakeLadokForParticipantStates()
  course_round = make_test_course_round(ladok)
  with pytest.raises(error):
    course_round.participants(state=state, today=RUNNING_DAY)
  assert ladok.requests == []
```

This code is used in chunk 112b.
Defines:
test_participants_by_state_refuse_unknown_states, never used.
Uses FakeLadokForParticipantStates 193b, make_test_course_round 189, participants 188a, RUNNING_DAY 193b, and state 183 202b 212a.

The lists per set of codes are attributes like the others, so they must survive the round trips through JSON and `pickle` without asking again.

195c ⟨*test functions* 120⟩+≡

```
def test_participants_by_state_survive_round_trips():
  ladok = FakeLadokForParticipantStates()
  course_round = make_test_course_round(ladok)
  states = ["completed", "interrupted"]
  course_round.participants(state=states, today=RUNNING_DAY)

  for json_data in [course_round.json, through_json_text(course_round)]:
    restored = ladok3.restore(json_data, ladok=ladok)
    assert restored == course_round
    assert ids(restored.participants(state=states, today=RUNNING_DAY)) \
      == ["student-AVKLARAD", "student-AVBROTT"]
  unpickled = pickle.loads(pickle.dumps(course_round))
```

```
13      unpickled.participants(state=states, today=RUNNING_DAY)
14      assert unpickled.ladok.requests == [["AVKLARAD", "AVBROTT"]]
15      assert ladok.requests == [["AVKLARAD", "AVBROTT"]]
```

This code is used in chunk 112b.
Defines:
`test_participants_by_state_survive_round_trips`, never used.
Uses `FakeLadokForParticipantStates` 193b, `ids` 193b, `make_test_course_round` 189, `participants` 188a, `restore` 132a, `RUNNING_DAY` 193b, `state` 183 202b 212a, and `through_json_text` 138a.

Chapter 14

Course objects related to students

14.1 Course registrations and a student's results

Students register for a course. The `CourseRegistration` class represents this data from LADOK. This is the object that must be used to get results for a student. This object keeps more info than the course instance.

We note that some registrations lack the 'Utbildningstillfalleskod' attribute. This happens on 'custom courses' like Erasmus exchanges. If that's the case, we use the value `None` in its place.

197 ⟨*classes* 119⟩+≡

```
class CourseRegistration(CourseInstance):
  """Represents a student's participation in a course instance"""
  def __init__(self, /, **kwargs):
    self.__student = kwargs.pop("student")

    # ett Ladok-ID för kursomgången
    self.__round_id = kwargs.pop("UtbildningstillfalleUID")
    self.__round_code = kwargs.pop("Utbildningstillfalleskod", None)

    dates = kwargs.pop("Studieperiod")
    self.__start = datetime.date.fromisoformat(dates["Startdatum"])
    self.__end = datetime.date.fromisoformat(dates["Slutdatum"])

    ⟨keep what the state rule needs from kwargs 202a⟩

    super().__init__(**kwargs)

  @property
  def round_id(self):
    """Returns LADOK ID for the course round (kursomgång)"""
    return self.__round_id

  @property
  def round_code(self):
    """Returns the human-readable round code (tillfälleskod)"""
    return self.__round_code

```

```
28    @property
29    def start(self):
30      return self.__start
31
32    @property
33    def end(self):
34      return self.__end
35
36    def __str__(self):
37      return f"{self.code} {self.round_code or ''} ({self.start}--{self.end})"
38
39    def __repr__(self):
40      return f"{self.code}:{self.round_code or ''}:{self.start}--{self.end}"
41
42    ⟨CourseRegistration state methods 202b⟩
43
44    def results(self, /, **kwargs):
45      """Returns the student's results on the course, filtered on keywords"""
46      try:
47        return filter_on_keys(self.__results, **kwargs)
48      except:
49        self.__fill_results()
50      return filter_on_keys(self.__results, **kwargs)
51
52    def __fill_results(self):
53      """Helper method to fetch results from LADOK"""
54      results = []
55      ⟨pull existing CourseResult objects from LADOK 199b⟩
56      ⟨add new CourseResult objects for missing components 201a⟩
57      self.__results = results
58
59    def push(self):
60      """Pushes any new results"""
61      for result in self.results():
62        result.push()
```

This code is used in chunk 112a.
Defines:
`CourseRegistration`, used in chunks 161b, 203, and 212b.
Uses `__init__` 174a, `__str__` 155, `code` 179, `CourseInstance` 172, `filter_on_keys` 142, and `results` 77b 187a.

`__fill_results` collects the results in the local list `results` and assigns `self.__results` only when the list is complete (Section 9.2.5). Filling it takes several requests: one for the student's results and, since we pull courses lazily (Section 13.2.1), one for the course's components the first time the steps below call `self.components`. An earlier version assigned `self.__results` an empty list first and appended to it. When one of those requests failed, the empty or partial list stayed behind, and `results` found no result for the component—which `ladok report` reports as 'no such component'—in every later run, through the cache. Now a failure leaves `self.__results` unset, and the next call to `results` fills it again.

We can pull these from LADOK as well. We construct `CourseResult` objects using a `CourseRegistration` object. From the response we get from LADOK,

we construct `CourseResult` objects that deal with the details. LADOK attaches a `ResultatPaUtbildning` wrapper to every module, even to modules where the student has no recorded result yet. When there is no result, that wrapper carries only a credit-transfer summary (`HarTillgodoraknande`, `TotalTillgodoraknadOmfattning`, and the like) and none of the nested entries that hold an actual grade. The presence of `ResultatPaUtbildning` is therefore not enough to conclude that a result exists; we must find one of the definitive nested entries, `SenastAttesteradeResultat` (attested) or `Arbetsunderlag` (a work copy). We capture that test once in `has_recorded_result` and reuse it on the refresh path below, so both paths agree on what counts as a result.

Entries without a recorded result must be skipped so the later ⟨*add new CourseResult objects for missing components* 201a⟩ step can create the expected empty placeholder. But once a definitive entry is present, we do have an existing result. If that payload is then malformed, we must fail loudly here rather than pretending the result is missing and later trying to create a duplicate.

199a ⟨*functions* 126b⟩+≡

```
def has_recorded_result(entry):
  """Return True if a VersionensModuler/VersionensKurs entry carries an
  actual recorded result---an attested result (SenastAttesteradeResultat) or
  a work copy (Arbetsunderlag)---as opposed to LADOK's always-present
  credit-transfer summary, which has neither."""
  results = entry.get("ResultatPaUtbildning")
  if not results:
    return False
  return "SenastAttesteradeResultat" in results or "Arbetsunderlag" in results
```

This code is used in chunk 112a.
Defines:
`has_recorded_result`, used in chunks 199b, 200b, and 210.
Uses `results` 77b 187a and `transfer` 210.

The summary we skip past is not noise, however. It is the only place where LADOK tells us about credit transfers (tillgodoräknanden) on the component. A student whose component is covered by a credit transfer has no ordinary result on it, so without the summary the component would show up as an empty placeholder—indistinguishable from a component the student simply has not done yet. That invites reporting a grade for work the student has already been credited for. We therefore remember each skipped entry's wrapper, keyed by the component instance it belongs to, and hand it to the placeholder constructor below. (Modules that *do* have a recorded result can still carry a partial credit transfer; for those the `CourseResult` constructor reads the summary straight off the wrapper it already receives.)

(It's a bit unclear why `Kursversioner` is a list, so far it has always worked to take the first.)

199b ⟨*pull existing CourseResult objects from LADOK* 199b⟩≡

```
response = self.ladok.student_results_JSON(
  self.__student.ladok_id, self.education_id
)["Kursversioner"][0]

credit_transfers = {}

for result in response["VersionensModuler"]:
```

```
    if not has_recorded_result(result):
      ⟨remember result's credit-transfer summary 200a⟩
      continue
    try:
      results.append(CourseResult(ladok=self.ladok,
                                  components=self.components(),
                                  student=self.__student,
                                  **result))
    except (TypeError, KeyError, IndexError) as err:
      raise LadokError(f"couldn't parse existing module result: {result}") \
        from err
```

This definition is continued in chunk 200b.
This code is used in chunk 197.
Defines:
`credit_transfers`, used in chunks 200a and 201a.
`response`, used in chunks 200b, 212b, and 231.
Uses `components` 22b 179 210, `CourseResult` 204, `education_id` 179, `has_recorded_result` 199a, `ladok_id` 155, and `results` 77b 187a.

We key the remembered summaries on the wrapper entry's top-level `UtbildningsinstansUID` because that is the identifier the placeholder step below can match against a component's `instance_id`. Should LADOK omit it from an entry, the summary is simply never attached and the component looks untouched—the behaviour we had before surfacing transfers—so a missing identifier degrades gracefully instead of failing.

200a ⟨*remember* `result`*'s credit-transfer summary* 200a⟩≡

```
credit_transfers[result.get("UtbildningsinstansUID")] = \
  result.get("ResultatPaUtbildning")
```

This code is used in chunks 199b and 200b.
Uses `credit_transfers` 199b.

As with the components, the course grade itself is a special case. That data is not in `VersionensModuler`, but in `VersionensKurs`. But we can do the same with it, just as we could with the components. (And this works since it's a component in `self.components()`.) When the course entry has no recorded result either, we remember its credit-transfer summary just like for the modules—a fully transferred course is precisely the case where no ordinary course grade will ever appear.

200b ⟨*pull existing CourseResult objects from LADOK* 199b⟩+≡

```
if has_recorded_result(response["VersionensKurs"]):
  try:
    results.append(CourseResult(ladok=self.ladok,
                                components=self.components(),
                                student=self.__student,
                                **response["VersionensKurs"]))
  except (TypeError, KeyError, IndexError) as err:
    raise LadokError(
      "couldn't parse existing course result: "
      f"{response['VersionensKurs']}") from err
else:
  result = response["VersionensKurs"]
  ⟨remember result's credit-transfer summary 200a⟩
```

This code is used in chunk 197.
Uses `components` 22b 179 210, `CourseResult` 204, `has_recorded_result` 199a, `response` 199b 210, and `results` 77b 187a.

Now we can see which components from `self.components` are missing from `results` and just add empty results for those. Each placeholder also receives any credit-transfer summary we remembered for its component instance, so that a transferred component is visibly different from one the student has not started.

201a ⟨*add new CourseResult objects for missing components* 201a⟩≡

```
for component in self.components():
  if not list(filter_on_keys(results, component=component.code)):
    results.append(
      CourseResult(
        ladok=self.ladok,
        component=component,
        credit_transfer=credit_transfers.get(component.instance_id),
        student=self.__student))
```

This code is used in chunk 197.
Uses `code` 179, `components` 22b 179 210, `CourseResult` 204, `credit_transfers` 199b, `filter_on_keys` 142, `instance_id` 179, and `results` 77b 187a.

Let's verify that a failure while filling the results is not remembered (Section 14.1). This is the case that made `ladok report` answer 'no such component': the student's results arrive, but the course's components, which the course pulls on first use, fail. The fake LADOK for lazily pulled courses returns no recorded results, so the course grade gets an empty placeholder.

201b ⟨*test functions* 120⟩+≡

```
def test_failed_results_fill_is_retried():
  ladok = FakeLadokForLazyCourses()
  ladok.course_round_components_JSON = fail_first_call(
    ladok.course_round_components_JSON)
  course, = ladok3.Student(ladok=ladok, id="student-uid").courses(
    code="DD1315")

  with pytest.raises(ladok3.LadokAPIError):
    course.results(component="DD1315")

  result, = course.results(component="DD1315")
  assert result.grade is None
```

This code is used in chunk 112b.
Defines:
`test_failed_results_fill_is_retried`, never used.
Uses `code` 179, `courses` 160a, `fail_first_call` 161c, `FakeLadokForLazyCourses` 180, `results` 77b 187a, and `Student` 154a.

14.1.1 The state of a registration

A registration knows in which state the student's participation is: ongoing, upcoming, unfinished, completed or interrupted. LADOK names these states in Swedish, and its views of a student's participations in each state use those names (Section 22.12). The classes give them English names, from one table, which the command-line interface uses too.

201c ⟨*constants* 128b⟩+≡

```
COURSE_STATES = {
  "ongoing": "pagaende",
  "upcoming": "kommande",
  "unfinished": "oavslutade",
  "completed": "avslutade",
  "interrupted": "avbrott",
}
COURSE_STATE_OF_PARTICIPATION_STATE = {
  ladok_name: name for name, ladok_name in COURSE_STATES.items()}
```

This code is used in chunk 112a.
Defines:
`COURSE_STATE_OF_PARTICIPATION_STATE`, used in chunk 202b.
`COURSE_STATES`, used in chunks 160a, 162b, 164a, 188a, 191a, 192b, and 202b.
Uses `name` 179.

The registration computes its state with the rule of Section 22.13, from what LADOK's participation says: the summary, whether the student withdrew, and the round's dates, which the registration keeps already. We keep the summary and the withdrawal from the participation, outside the `Utbildningsinformation` that the rest of the constructor reads, so the student classes pass them as keywords of their own.

202a ⟨*keep what the state rule needs from* `kwargs` 202a⟩≡

```
state_data = kwargs.pop("TillstandKurs", None) or {}
self.__state_summary = state_data.get("Sammanfattattillstand")
self.__withdrawn = is_withdrawn({"Aterbud": kwargs.pop("Aterbud", None),
                                 "TillstandKurs": state_data})
```

This code is used in chunk 197.
Defines:
`state_data`, never used.
Uses `__state_summary` 202b and `__withdrawn` 202b.

The state is computed, not kept, since it changes with the date: a registration that is ongoing today is unfinished once the round has ended. It is either one of the English names, `None` when LADOK puts the participation in no state, or `UNKNOWN_STATE` when the rule cannot tell. `state_on` takes the date to judge by, so that a caller who classifies many registrations can judge them all by the same day.

A registration made by an earlier version, pickled in the command-line interface's cache or written as JSON, has no summary. Its state must then be unknown, not guessed, so class attributes supply the defaults, as for `__pulled` (Section 13.2.1).

202b ⟨*CourseRegistration state methods* 202b⟩≡

```
__state_summary = None
__withdrawn = False

@property
def state(self):
  """The state of the student's participation, judged today in Sweden:
  one of "ongoing", "upcoming", "unfinished", "completed", "interrupted"
  (the keys of COURSE_STATES), None if LADOK puts it in no state, or
  ladok3.UNKNOWN_STATE if that cannot be told without asking LADOK."""
  return self.state_on()

def state_on(self, today=None):
  """The state of the student's participation on the date `today`
```

```
    (default: today in Sweden), see `state`."""
    state = state_of_participation(self.__state_summary,
                                   self.__start, self.__end, today,
                                   withdrawn=self.__withdrawn)
    return COURSE_STATE_OF_PARTICIPATION_STATE.get(state, state)
```

This code is used in chunk 197.
Defines:
`__state_summary`, used in chunk 202a.
`__withdrawn`, used in chunk 202a.
`state`, used in chunks 119, 160a, 162–68, 188a, 191–95, 203, 224, and 227a.
`state_on`, used in chunks 163a and 203.
Uses `COURSE_STATE_OF_PARTICIPATION_STATE` 201c and `COURSE_STATES` 201c.

Let's verify that a registration translates the rule's states to English, passes `None` and the unknown state on, and that a registration without a summary, like one from an earlier version, is unknown.

203 ⟨*test functions* 120⟩+≡

```
def make_registration_in_state(summary, start="2026-08-31",
                               end="2027-01-15", **participation):
  data = lazy_test_registration("round-state", "DD1301")
  data["Utbildningsinformation"]["Studieperiod"] = {"Startdatum": start,
                                                    "Slutdatum": end}
  if summary:
    participation["TillstandKurs"] = {
      "Sammanfattattillstand":
        f"studiedeltagande.domain.tillstandsdefinition.{summary}"}
  return ladok3.CourseRegistration(ladok=FakeLadokForLazyCourses(),
                                   student=None, **participation,
                                   **data["Utbildningsinformation"])

def test_course_registration_state() -> None:
  today = datetime.date(2026, 10, 20)
  ongoing = make_registration_in_state("registrerad")
  completed = make_registration_in_state("avklarad")
  withdrawn = make_registration_in_state("avbrott", Aterbud=True)
  not_started = make_registration_in_state("ej_paborjad")
  registered_early = make_registration_in_state(
    "registrerad", start="2027-01-19", end="2027-06-04")
  old = make_registration_in_state(None)

  assert ongoing.state_on(today) == "ongoing"
  assert ongoing.state_on(datetime.date(2027, 1, 16)) == "unfinished"
  assert withdrawn.state_on(today) is None
  assert not_started.state_on(today) == "upcoming"
  assert registered_early.state_on(today) is ladok3.UNKNOWN_STATE
  assert old.state_on(today) is ladok3.UNKNOWN_STATE
  assert completed.state_on(today) == "completed"
```

This code is used in chunk 112b.
Defines:
`make_registration_in_state`, never used.
`test_course_registration_state`, never used.
Uses `CourseRegistration` 197, `data` 174b, `FakeLadokForLazyCourses` 180, `lazy_test_registration` 180, `state` 183 202b 212a, and `state_on` 202b.

14.2 Course results

The `CourseResult` objects have the following form. We have two cases: the result exists in LADOK and the result doesn't exist in LADOK. The difference is in how results are pushed to LADOK, i.e., the implementation of the `push` method.

204 ⟨*classes* 119⟩+≡

```
class CourseResult(LadokRemoteData):
  """Represents a result on a course module"""
  def __init__(self, /, **kwargs):
    """To construct this object we must give existing data, i.e.
    Arbetsunderlag or SenastAttesteradeResultat directly from LADOK."""
    super().__init__(**kwargs)

    self.__student = kwargs.pop("student")

    self.__attested = False
    self.__finalized = False
    if "component" in kwargs:
      self.__component = kwargs.pop("component")
      self.__extract_credit_transfer(kwargs.pop("credit_transfer", None))
      self.__populate_attributes()
    elif "components" in kwargs and "ResultatPaUtbildning" in kwargs:
      components = kwargs.pop("components")

      results = kwargs.pop("ResultatPaUtbildning")
      self.__extract_credit_transfer(results)

      data, attested = self.__choose_result_data(results, fallback=kwargs)

      self.__attested = attested
      self.__finalized = attested
      self.__populate_attributes(**data, components=components)
    else:
      raise TypeError("not enough keys given to construct object")

  def __populate_attributes(self, /, **data):
    if not data:
      ⟨populate CourseResult attributes for empty result 208⟩
    else:
      ⟨populate CourseResult attributes from data 207b⟩

  def __extract_credit_transfer(self, wrapper):
    ⟨extract credit-transfer summary from wrapper 209a⟩

  def __choose_result_data(self, results, fallback=None):
    ⟨return definitive CourseResult data 207a⟩

  def __pull_result_data(self):
    ⟨fetch current CourseResult data from LADOK 210⟩

```

```
45    @property
46    def component(self):
47      """Returns the component the results is for"""
48      return self.__component
49
50    @property
51    def grade_scale(self):
52      """Returns the grade scale for the component"""
53      return self.__grade_scale
54
55    @property
56    def grade(self):
57      """Returns the grade set for the component"""
58      return self.__grade
59
60    def set_grade(self, grade, date):
61      """Sets a new grade and date for the component"""
62      if self.attested:
63        raise AttributeError("can't change already attested grade")
64      if self.finalized:
65        raise AttributeError("can't change finalized grade without "
66                             "un-finalizing first")
67
68      ⟨set the grade for CourseResult 230⟩
69
70      self.__modified = True
71      self.push()
72
73    def finalize(self, graders=[], notify=False):
74      """Finalizes the set grade"""
75      if self.modified:
76        self.push()
77
78      ⟨finalize the grade for CourseResult 231c⟩
79
80    @property
81    def modified(self):
82      """Returns True if there are unpushed changes"""
83      return self.__modified
84
85    @property
86    def date(self):
87      """Returns the date of the grade"""
88      return self.__date
89
90    @property
91    def attested(self):
92      """Returns True if the grade has been attested in LADOK, or if the
93      whole component is covered by a credit transfer"""
94      return self.__attested or self.fully_credit_transferred
95
```

```
96    @property
97    def finalized(self):
98      """Returns True if the grade has been finalized (klarmarkerad) in LADOK,
99      or if the whole component is covered by a credit transfer"""
100     try:
101       finalized = self.__finalized
102     except AttributeError: # can occur with an old cache
103       finalized = self.__attested
104     return finalized or self.fully_credit_transferred
105
106   @property
107   def credit_transferred(self):
108     """Returns True if the student has a credit transfer for this component"""
109     try:
110       return self.__credit_transferred
111     except AttributeError: # can occur with an old cache
112       return False
113
114   @property
115   def fully_credit_transferred(self):
116     """Returns True if the component is entirely covered by a credit
117     transfer"""
118     try:
119       return self.__fully_credit_transferred
120     except AttributeError: # can occur with an old cache
121       return False
122
123   @property
124   def transferred_credits(self):
125     """Returns the number of credits covered by credit transfers"""
126     try:
127       return self.__transferred_credits
128     except AttributeError: # can occur with an old cache
129       return 0.0
130
131   def __str__(self):
132     result = f"{self.component} {self.grade} " \
133              f"{self.date}{'*' if not self.attested else ''}"
134     ⟨append credit-transfer marker to result 209b⟩
135     return result
136
137   def pull(self):
138     """Refresh the result from LADOK.
139
140     If LADOK no longer has a result for the component, for instance because
141     it was removed in LADOK, the object becomes an empty result, so that
142     the next `set_grade` creates a new result."""
143     data, attested, transfer = self.__pull_result_data()
144     ⟨replace CourseResult attributes transactionally 212a⟩
145
146   def push(self):
```

```
147       if self.__uid:
148         ⟨push the existing CourseResult grade data to LADOK 231a⟩
149       else:
150         ⟨push the new CourseResult grade data to LADOK 231b⟩
151       self.__modified = False
```

This code is used in chunk 112a.
Defines:
`CourseResult`, used in chunks 199–201, 214, 219–21, 223, 224, 227b, and 229.
Uses `__init__` 174a, `__str__` 155, `components` 22b 179 210, `credits` 179, `data` 174b, `grade_scale` 179, `LadokRemoteData` 140, `pull` 176b, `results` 77b 187a, `transfer` 210, and `wrapper` 209a.

If we get the data from LADOK, then we can fill in all the attributes. We also need to check if the result has been finalized (klarmarkerad). LADOK uses `ProcessStatus` to indicate the state of a result:

1. Draft (Utkast) — can be modified and finalized.
2. Finalized (Klarmarkerad) — ready for examiner attestation, cannot be finalized again.

An attested result has no `ProcessStatus` since it's stored in `SenastAttesteradeResultat` rather than `Arbetsunderlag`. Sometimes LADOK returns both `Arbetsunderlag` and `SenastAttesteradeResultat` for the same result. The attested result is the definitive state in LADOK, while the work copy only describes a later attempt to change it. We therefore prefer `SenastAttesteradeResultat` whenever it is present. Some construction paths still carry the definitive fields on the surrounding wrapper, so the constructor may fall back to that payload. A fresh LADOK response, however, should always contain one of the nested entries; if it does not, we fail loudly instead of guessing.

207a ⟨return definitive CourseResult data 207a⟩≡

```
if "SenastAttesteradeResultat" in results:
  return results["SenastAttesteradeResultat"], True
if "Arbetsunderlag" in results:
  return results["Arbetsunderlag"], False
if fallback is not None:
  return fallback, False
raise KeyError("missing definitive result data")
```

This code is used in chunk 204.
Uses `data` 174b and `results` 77b 187a.

207b ⟨populate CourseResult attributes from data 207b⟩≡

```
self.__uid = data.pop("Uid", None)
self.__instance_id = data.pop("UtbildningsinstansUID")
self.__results_id = data.pop("ResultatUID", None)
self.__study_results_id = data.pop("StudieresultatUID", None)

process_status = data.pop("ProcessStatus", None)
if process_status == 2:
  self.__finalized = True

try:
  grade = data.pop("Betygsgrad", None)
  grade_scale_id = data.pop("BetygsskalaID")
```

```
  except KeyError:
    grade_scale_id = int(data["Betygsskala"]["ID"])

  self.__date = data.pop("Examinationsdatum", None)
  self.__grade_scale = self.ladok.get_grade_scales(id=grade_scale_id)[0]
  if grade:
    self.__grade = self.__grade_scale.grades(id=grade)[0]
  else:
    self.__grade = None

  if "components" in data:
    components = data.pop("components")
    component_list = filter_on_keys(components, instance_id=self.__instance_id)
    self.__component = component_list[0] if component_list \
                                         else None

  self.__last_modified = data.pop("SenasteResultatandring", None)
  self.__modified = False
```

This code is used in chunk 204.
Defines:
process_status, never used.
Uses components 22b 179 210, data 174b, filter_on_keys 142, get_grade_scales 147, and instance_id 179.

However, if this is a completely new result, it doesn't exist in LADOK. Then we lack quite a few of the attributes. A new result is neither finalized nor attested. It has none of LADOK's identifiers for a result either. We set them to None explicitly, rather than leaving them unset, because a refresh can turn an existing result into an empty one (Section 14.2.2). Without uid, push creates a new result and takes the new identifiers from LADOK's answer; until then, nothing in the object refers to the removed result.

208 ⟨*populate CourseResult attributes for empty result* 208⟩≡

```
  self.__uid = None
  self.__results_id = None
  self.__study_results_id = None
  self.__instance_id = self.__component.instance_id

  self.__date = None
  self.__grade_scale = self.__component.grade_scale
  self.__grade = None

  self.__finalized = False
  self.__modified = False
  self.__last_modified = None
```

This code is used in chunk 204.
Uses grade_scale 179 and instance_id 179.

14.2.1 Credit transfers

Both construction paths run the ResultatPaUtbildning wrapper (or the remembered summary for a placeholder) through __extract_credit_transfer. LADOK's summary distinguishes three things we want to surface: whether any credit trans-

fer exists at all (`HarTillgodoraknande`), whether the whole component is covered (`HeltTillgodoraknad`), and how many credits the transfers amount to (`TotalTillgodoraknadOmfattning`). We default each to its 'no transfer' value so that a placeholder without any remembered summary—and a wrapper that predates these fields—behaves exactly like one that explicitly says there is no transfer.

209a ⟨*extract credit-transfer summary from* `wrapper` 209a⟩≡

```
wrapper = wrapper or {}
self.__credit_transferred = wrapper.get("HarTillgodoraknande", False)
self.__fully_credit_transferred = wrapper.get("HeltTillgodoraknad", False)
self.__transferred_credits = wrapper.get("TotalTillgodoraknadOmfattning", 0.0)
```

This code is used in chunk 204.
Defines:
`wrapper`, used in chunks 112a, 204, and 224.

The corresponding properties guard against `AttributeError` for the same reason `finalized` does: `CourseResult` objects are cached and restored, so an object written by an older version of this package lacks the private attributes. Falling back to the 'no transfer' defaults keeps such caches usable until they are refreshed.

A credit transfer is a formal decision in LADOK: it appears among a student's results only once it has been decided, that is, attested. An undecided transfer case is not counted in the summary, so a transfer we see here is an attested one. A component that is entirely covered by such a transfer can never receive an ordinary grade—there is nothing left to grade—so `attested` and `finalized` report `True` for it. This makes the existing guard in `set_grade` refuse to change the grade, exactly as for an ordinarily attested result. A *partially* transferred component keeps `attested` as `False`: the remaining credits can still be graded through this very result, and reporting them must not be blocked. The scope is each result's own component: a fully transferred `LAB1` locks `LAB1` alone, while its sibling modules and the course grade follow their own summaries. We compute this in the `attested` and `finalized` properties rather than setting the private attributes, so the transfer can never be overwritten by the ordinary result-state bookkeeping in the constructor and in `pull`.

When the user lists results, a transferred component must not look like an untouched one, so `__str__` appends a marker. A fully transferred component gets a definite label, since no ordinary grade will ever appear there; because it now counts as attested, the not-yet-attested asterisk also disappears from its listing. A partial transfer shows the credited amount when LADOK reports one, so the user can see how much of the component remains.

209b ⟨*append credit-transfer marker to* `result` 209b⟩≡

```
if self.fully_credit_transferred:
    result += " (fully credit transferred)"
elif self.credit_transferred:
    if self.transferred_credits:
        result += f" (credit transfer: {self.transferred_credits})"
    else:
        result += " (credit transfer)"
```

This code is used in chunk 204.
Uses `transfer` 210.

14.2.2 Refreshing a result

Because a refresh can fail, `pull()` must not clear the cached state until LADOK has returned a replacement payload. We therefore parse the response first and only then repopulate the object. To refresh just one result, we do not need to rebuild the entire student or course object graph. Instead, we ask LADOK for the current result payload for the surrounding course and then extract the entry for this component. The wrapper objects in `VersionensModuler` and `VersionensKurs` do not always repeat the component identifier in a stable place, but the definitive result payload does. We therefore choose that nested payload first and match on its `UtbildningsinstansUID`. That keeps the retry path in `report.set_grade` narrowly scoped to the result whose cached attestation might be stale. We reuse `has_recorded_result` here for the same reason as on the fill path: the credit-transfer summary on a sibling module without a result must be skipped, not parsed—otherwise refreshing one component would crash on another component that happens to have no result yet. Along with the definitive result data we also return the matched entry's wrapper, so that a refresh renews the credit-transfer summary together with the grade state instead of leaving it stale.

210 ⟨*fetch current CourseResult data from LADOK* 210⟩≡

```
response = self.ladok.student_results_JSON(
  self.__student.ladok_id, self.__component.course.education_id
)["Kursversioner"][0]
components = self.__component.course.components()
transfer = None

for result in response["VersionensModuler"]:
  if not has_recorded_result(result):
    ⟨remember result's summary if it is for this component 211b⟩
    continue
  try:
    data, attested = self.__choose_result_data(
      result["ResultatPaUtbildning"])
    if data["UtbildningsinstansUID"] != self.__component.instance_id:
      continue
  except KeyError as err:
    raise LadokError(f"couldn't parse existing module result: {result}") \
      from err
  return dict(data, components=components), attested, \
    result["ResultatPaUtbildning"]

course_result = response["VersionensKurs"]
if has_recorded_result(course_result):
  try:
    data, attested = self.__choose_result_data(
      course_result["ResultatPaUtbildning"])
    if data["UtbildningsinstansUID"] == self.__component.instance_id:
      return dict(data, components=components), attested, \
        course_result["ResultatPaUtbildning"]
  except KeyError as err:
    raise LadokError(
```

```
        "couldn't parse existing course result: "
        f"{course_result}") from err
  else:
    result = course_result
    ⟨remember result's summary if it is for this component 211b⟩

  ⟨return an empty result, since LADOK has none 211a⟩
```

This code is used in chunk 204.
Defines:
components, used in chunks 23b, 181, 184, 199–201, 204, 207b, 212b, 214, 219–21, 223, 224, 226, 227, 229, 234, and 235b.
course_result, never used.
response, used in chunks 200b, 212b, and 231.
transfer, used in chunks 199a, 204, 209b, 211, 212a, and 216.
Uses data 174b, education_id 179, has_recorded_result 199a, instance_id 179, and ladok_id 155.

A result removed in LADOK

The loop above can end without finding any result for the component. That happens when someone has removed the result in LADOK since we cached it. The typical case is the one in `report.set_grade`: LADOK refuses to change an attested result, so the reporter removes it in LADOK's web interface in order to report a new grade, and runs `ladok report` again.

An earlier version raised `LadokNotFoundError` here. That made the reporter's re-run stop on the cached copy of the very result they had just removed, and only clearing the whole cache got them past it. The refresh was meant to spare them exactly that.

The right answer is to make the object what a fresh fetch would make it. When `CourseRegistration` fills its results from the same payload, a component without a recorded result gets an empty placeholder (⟨*add new CourseResult objects for missing components* 201a⟩). So we return empty data, and the transactional replacement below turns this object into such a placeholder: `__populate_attributes` with no data takes the empty-result path, which keeps the component and forgets the removed result's identifiers. We must change the object itself rather than replace it, since it is the object that sits in the cached result list. Because the placeholder has no `uid`, the next `set_grade` makes `push` create a new result in LADOK instead of updating the removed one.

211a ⟨*return an empty result, since LADOK has none* 211a⟩≡

```
  return {}, False, transfer
```

This code is used in chunk 210.
Uses transfer 210.

Like the fill path, the placeholder should carry the credit-transfer summary of its component, so that a transferred component still looks transferred after the reset. LADOK keeps a module's entry after a draft result is removed; we saw that in the recording of `test_remove_result_draft_JSON`, where the entry is left with only the summary. (Should an entry be dropped instead, `transfer` stays `None` and the placeholder has no transfer, as on the fill path.) We match the entry on its top-level `UtbildningsinstansUID`, the same key that ⟨*remember* `result`*'s credit-transfer summary* 200a⟩ uses on the fill path.

211b ⟨*remember* `result`*'s summary if it is for this component* 211b⟩≡

```
  if result.get("UtbildningsinstansUID") == self.__component.instance_id:
```

```
    transfer = result.get("ResultatPaUtbildning")
```

This code is used in chunk 210.
Uses `instance_id` 179 and `transfer` 210.

Even after LADOK has returned a replacement payload, repopulating the object can still fail while resolving auxiliary data such as the grade scale. Refresh should therefore either leave us with the new state or with the old one, never a mixture of both. Because this code only rebinds attributes on the result itself, a shallow snapshot of `self.__dict__` is enough to roll back a failed refresh.

212a ⟨*replace CourseResult attributes transactionally* 212a⟩≡

```
state = self.__dict__.copy()
try:
  self.__attested = attested
  self.__finalized = attested
  self.__extract_credit_transfer(transfer)
  self.__populate_attributes(**data)
except Exception:
  self.__dict__.clear()
  self.__dict__.update(state)
  raise
```

This code is used in chunk 204.
Defines:
`state`, used in chunks 119, 160a, 162–68, 188a, 191–95, 203, 224, and 227a.
Uses `data` 174b and `transfer` 210.

Let's verify that an attested result remains authoritative even when LADOK also returns a work copy in `Arbetsunderlag`. The helper registration below starts from the same sparse registration data we get in `Utbildningsinformation`. Real `CourseRegistration` objects then pull richer component data through `course_round_components_JSON`, so the fake LADOK session provides that too.

212b ⟨*test course result helpers* 212b⟩≡

```
class FakeLadokForCourseResult:
  def __init__(self, student_results_response=None,
               course_round_components_response=None):
    self.__grade_scale = ladok3.GradeScale(
      ID=1,
      Kod="PF",
      Benamning={"sv": "Pass/fail"},
      Betygsgrader=[
        {"ID": 10, "Kod": "F", "GiltigSomSlutbetyg": False},
        {"ID": 11, "Kod": "P", "GiltigSomSlutbetyg": True},
      ])
    self.__student_results_response = student_results_response
    self.created = []
    if course_round_components_response is None:
      self.__course_round_components_response = {
        "UtbildningsinstansUID": "course-instance",
        "UtbildningUID": "course-education",
        "Utbildningskod": "DD1315",
        "Benamning": {"sv": "Course grade", "en": "Course grade"},
        "Omfattning": 7.5,
        "Enhet": "hp",
```

```
        "Versionsnummer": "1",
        "BetygsskalaID": 1,
      }
    else:
      self.__course_round_components_response = course_round_components_response

  def get_grade_scales(self, /, **kwargs):
    if kwargs and kwargs.get("id") != self.__grade_scale.id:
      return []
    return [self.__grade_scale]

  def course_round_components_JSON(self, round_id):
    return self.__course_round_components_response

  def student_results_JSON(self, student_id, education_id):
    return self.__student_results_response

  def set_student_results_response(self, response):
    self.__student_results_response = response

  ⟨FakeLadokForCourseResult write methods 226a⟩


def make_course_component_for_test(ladok):
  return ladok3.CourseComponent(
    ladok=ladok,
    course=types.SimpleNamespace(
      instance_id="course-instance",
      education_id="course-education",
      components=lambda **kwargs: []),
    UtbildningsinstansUID="component-instance",
    UtbildningUID="course-education",
    Utbildningskod="DD1315",
    Benamning={"sv": "Course grade"},
    BetygsskalaID=1)


def make_course_registration_for_test(ladok):
  return ladok3.CourseRegistration(
    ladok=ladok,
    student=types.SimpleNamespace(ladok_id="student-uid"),
    UtbildningstillfalleUID="round-instance",
    Utbildningstillfalleskod="20241",
    Studieperiod={
      "Startdatum": "2024-01-15",
      "Slutdatum": "2024-06-05",
    },
    UtbildningsinstansUID="course-instance",
    UtbildningUID="course-education",
    Utbildningskod="DD1315",
    Benamning={"sv": "Course grade", "en": "Course grade"})
```

This code is used in chunk 113a.
Defines:
`FakeLadokForCourseResult`, used in chunks 214–21, 223, 224, 226, 227, and 229.
`make_course_component_for_test`, used in chunks 214, 219–21, 223, 224, 226, 227, and 229.
`make_course_registration_for_test`, used in chunks 214–18 and 220.
Uses `__init__` 174a, `components` 22b 179 210, `CourseComponent` 185b, `CourseRegistration` 197, `education_id` 179, `get_grade_scales` 147, `GradeScale` 148, `instance_id` 179, `ladok_id` 155, and `response` 199b 210.

214 ⟨*test course result functions* 214⟩≡

```
def test_attested_result_wins_over_arbetsunderlag():
  ladok = FakeLadokForCourseResult()
  component = make_course_component_for_test(ladok)

  result = ladok3.CourseResult(
    ladok=ladok,
    student=object(),
    components=[component],
    ResultatPaUtbildning={
      "Arbetsunderlag": {
        "Uid": "draft-uid",
        "UtbildningsinstansUID": "component-instance",
        "ResultatUID": "draft-result",
        "StudieresultatUID": "study-result",
        "ProcessStatus": 1,
        "Betygsgrad": 10,
        "BetygsskalaID": 1,
        "Examinationsdatum": "2024-02-01",
      },
      "SenastAttesteradeResultat": {
        "Uid": "attested-uid",
        "UtbildningsinstansUID": "component-instance",
        "ResultatUID": "attested-result",
        "StudieresultatUID": "study-result",
        "Betygsgrad": 11,
        "BetygsskalaID": 1,
        "Examinationsdatum": "2024-01-15",
      },
    })

  assert result.attested == True
  assert result.finalized == True
  assert result.grade == "P"
  assert result.date == "2024-01-15"
  assert result.component == component


def test_course_registration_skips_course_entry_without_result():
  ladok = FakeLadokForCourseResult(
    student_results_response={
      "Kursversioner": [{
        "VersionensModuler": [],
```

```
          "VersionensKurs": {},
        }],
      })
    course = make_course_registration_for_test(ladok)

    results = course.results(component="DD1315")

    assert len(results) == 1
    assert results[0].grade == None
    assert results[0].attested == False
```

This definition is continued in chunks 215–21, 223, 224, 226, 227, and 229.
This code is used in chunk 113a.
Defines:
`test_attested_result_wins_over_arbetsunderlag`, never used.
`test_course_registration_skips_course_entry_without_result`, never used.
Uses `components` 22b 179 210, `CourseResult` 204, `FakeLadokForCourseResult` 212b, `make_course_component_for_test` 212b, `make_course_registration_for_test` 212b, and `results` 77b 187a.

The same must hold when the wrapper is present but carries only a credit-transfer summary. This is the shape that triggered the original crash: a sibling module had a `ResultatPaUtbildning` with neither `Arbetsunderlag` nor `SenastAttesteradeResultat`, only the always-present credit-transfer fields. We skip it and fall back to an empty placeholder instead of failing to parse.

215 ⟨*test course result functions* 214⟩+≡

```
def test_course_registration_skips_credit_transfer_only_module():
  ladok = FakeLadokForCourseResult(
    student_results_response={
      "Kursversioner": [{
        "VersionensModuler": [{
          "Kod": "OTHER",
          "UtbildningsinstansUID": "other-component",
          "ResultatPaUtbildning": {
            "HarTillgodoraknande": False,
            "HeltTillgodoraknad": False,
            "OvrigaResultat": [],
            "TotalTillgodoraknadOmfattning": 0.0,
            "UtbildningUID": "course-education",
          },
        }],
        "VersionensKurs": {},
      }],
    })
  course = make_course_registration_for_test(ladok)

  results = course.results(component="DD1315")

  assert len(results) == 1
  assert results[0].grade == None
  assert results[0].attested == False
```

This code is used in chunk 113a.
Defines:
`test_course_registration_skips_credit_transfer_only_module`, never used.

Uses `FakeLadokForCourseResult` 212b, `make_course_registration_for_test` 212b, and `results` 77b 187a.

When the summary reports an actual transfer, the placeholder must surface it. Here the module `LAB1` is partially covered by a credit transfer: LADOK reports `HarTillgodoraknande` with a credited amount but no recorded result. The placeholder for `LAB1` must carry the transfer, while the untouched course-grade placeholder must not.

216 ⟨*test course result functions* 214⟩+≡

```
def test_course_registration_shows_module_credit_transfer():
  ladok = FakeLadokForCourseResult(
    student_results_response={
      "Kursversioner": [{
        "VersionensModuler": [{
          "Kod": "LAB1",
          "UtbildningsinstansUID": "lab-instance",
          "ResultatPaUtbildning": {
            "HarTillgodoraknande": True,
            "HeltTillgodoraknad": False,
            "OvrigaResultat": [],
            "TotalTillgodoraknadOmfattning": 1.5,
            "UtbildningUID": "course-education",
          },
        }],
        "VersionensKurs": {},
      }],
    },
    course_round_components_response={
      "UtbildningsinstansUID": "course-instance",
      "UtbildningUID": "course-education",
      "Utbildningskod": "DD1315",
      "Benamning": {"sv": "Course grade", "en": "Course grade"},
      "Omfattning": 7.5,
      "Enhet": "hp",
      "Versionsnummer": "1",
      "BetygsskalaID": 1,
      "IngaendeMoment": [{
        "UtbildningsinstansUID": "lab-instance",
        "UtbildningUID": "lab-education",
        "Utbildningskod": "LAB1",
        "Benamning": {"sv": "Lab"},
        "Omfattning": 1.5,
        "Enhet": "hp",
        "BetygsskalaID": 1,
      }],
    })
  course = make_course_registration_for_test(ladok)

  lab_results = course.results(component="LAB1")

  assert len(lab_results) == 1
```

```
    assert lab_results[0].grade == None
    assert lab_results[0].credit_transferred == True
    assert lab_results[0].fully_credit_transferred == False
    assert lab_results[0].transferred_credits == 1.5
    assert lab_results[0].attested == False
    assert "credit transfer: 1.5" in str(lab_results[0])
    assert "*" in str(lab_results[0])

    course_results = course.results(component="DD1315")

    assert course_results[0].credit_transferred == False
    assert "credit transfer" not in str(course_results[0])
```

This code is used in chunk 113a.
Defines:
`test_course_registration_shows_module_credit_transfer`, never used.
Uses `FakeLadokForCourseResult` 212b, `make_course_registration_for_test` 212b, `results` 77b 187a, and `transfer` 210.

A course that is transferred in its entirety never gets an ordinary course grade, so the transfer must show on the course-grade placeholder built from `VersionensKurs`.

217 ⟨*test course result functions* 214⟩+≡

```
def test_course_registration_shows_full_course_credit_transfer():
  ladok = FakeLadokForCourseResult(
    student_results_response={
      "Kursversioner": [{
        "VersionensModuler": [],
        "VersionensKurs": {
          "UtbildningsinstansUID": "course-instance",
          "ResultatPaUtbildning": {
            "HarTillgodoraknande": True,
            "HeltTillgodoraknad": True,
            "OvrigaResultat": [],
            "TotalTillgodoraknadOmfattning": 7.5,
            "UtbildningUID": "course-education",
          },
        },
      }],
    })
  course = make_course_registration_for_test(ladok)

  results = course.results(component="DD1315")

  assert len(results) == 1
  assert results[0].grade == None
  assert results[0].credit_transferred == True
  assert results[0].fully_credit_transferred == True
  assert results[0].transferred_credits == 7.5
  assert results[0].attested == True
  assert results[0].finalized == True
  assert "fully credit transferred" in str(results[0])
  assert "*" not in str(results[0])
```

This code is used in chunk 113a.

Defines:
`test_course_registration_shows_full_course_credit_transfer`, never used.
Uses `FakeLadokForCourseResult` 212b, `make_course_registration_for_test` 212b, and `results` 77b 187a.

An attested transfer must lock only its own component. Here `LAB1` is entirely covered by a transfer while `LAB2` and the course grade are untouched: `LAB1` counts as attested (so `set_grade` refuses it), but `LAB2` and the course grade must remain gradable.

218 ⟨*test course result functions* 214⟩+≡

```
def test_full_module_credit_transfer_locks_only_that_module():
  ladok = FakeLadokForCourseResult(
    student_results_response={
      "Kursversioner": [{
        "VersionensModuler": [{
          "Kod": "LAB1",
          "UtbildningsinstansUID": "lab1-instance",
          "ResultatPaUtbildning": {
            "HarTillgodoraknande": True,
            "HeltTillgodoraknad": True,
            "TotalTillgodoraknadOmfattning": 1.5,
            "UtbildningUID": "course-education",
          },
        }],
        "VersionensKurs": {},
      }],
    },
    course_round_components_response={
      "UtbildningsinstansUID": "course-instance",
      "UtbildningUID": "course-education",
      "Utbildningskod": "DD1315",
      "Benamning": {"sv": "Course grade", "en": "Course grade"},
      "Omfattning": 7.5,
      "Enhet": "hp",
      "Versionsnummer": "1",
      "BetygsskalaID": 1,
      "IngaendeMoment": [
        {
          "UtbildningsinstansUID": "lab1-instance",
          "UtbildningUID": "lab1-education",
          "Utbildningskod": "LAB1",
          "Benamning": {"sv": "Lab 1"},
          "Omfattning": 1.5,
          "Enhet": "hp",
          "BetygsskalaID": 1,
        },
        {
          "UtbildningsinstansUID": "lab2-instance",
          "UtbildningUID": "lab2-education",
          "Utbildningskod": "LAB2",
          "Benamning": {"sv": "Lab 2"},
          "Omfattning": 1.5,
```

```
            "Enhet": "hp",
            "BetygsskalaID": 1,
          },
        ],
      })
    course = make_course_registration_for_test(ladok)

    lab1 = course.results(component="LAB1")[0]
    lab2 = course.results(component="LAB2")[0]
    course_grade = course.results(component="DD1315")[0]

    assert lab1.attested == True
    assert lab1.finalized == True
    assert "*" not in str(lab1)

    assert lab2.attested == False
    assert lab2.finalized == False
    assert course_grade.attested == False
    assert course_grade.finalized == False

    with pytest.raises(AttributeError, match="attested"):
      lab1.set_grade("P", "2024-02-01")
```

This code is used in chunk 113a.
Defines:
`test_full_module_credit_transfer_locks_only_that_module`, never used.
Uses `FakeLadokForCourseResult` 212b, `make_course_registration_for_test` 212b, and `results` 77b 187a.

A component can also have both an ordinary result and a partial credit transfer. Then the wrapper holds a definitive nested entry *and* the transfer fields, and the constructor must pick up both.

219 ⟨*test course result functions* 214⟩+≡

```
def test_course_result_extracts_credit_transfer_with_recorded_result():
  ladok = FakeLadokForCourseResult()
  component = make_course_component_for_test(ladok)

  result = ladok3.CourseResult(
    ladok=ladok,
    student=object(),
    components=[component],
    ResultatPaUtbildning={
      "HarTillgodoraknande": True,
      "HeltTillgodoraknad": False,
      "TotalTillgodoraknadOmfattning": 1.5,
      "SenastAttesteradeResultat": {
        "Uid": "attested-uid",
        "UtbildningsinstansUID": "component-instance",
        "ResultatUID": "attested-result",
        "StudieresultatUID": "study-result",
        "Betygsgrad": 11,
        "BetygsskalaID": 1,
        "Examinationsdatum": "2024-01-15",
```

```
        },
      })

    assert result.grade == "P"
    assert result.credit_transferred == True
    assert result.transferred_credits == 1.5
```

This code is used in chunk 113a.
Defines:
`test_course_result_extracts_credit_transfer_with_recorded_result`, never used.
Uses `components` 22b 179 210, `CourseResult` 204, `FakeLadokForCourseResult` 212b, and `make_course_component_for_test` 212b.

Genuinely malformed payloads must still surface loudly. A present `Arbetsunderlag` that fails to parse is a real error, not an absent result, so we keep raising for it rather than silently skipping.

220 ⟨*test course result functions* 214⟩+≡

```
def test_course_registration_surfaces_malformed_course_results():
  ladok = FakeLadokForCourseResult(
    student_results_response={
      "Kursversioner": [{
        "VersionensModuler": [{
          "ResultatPaUtbildning": {
            "Arbetsunderlag": {},
          },
        }],
        "VersionensKurs": {},
      }],
    })
  course = make_course_registration_for_test(ladok)

  with pytest.raises(
      ladok3.LadokError,
      match="couldn't parse existing module result"):
    course.results(component="DD1315")


def test_pull_course_result_refreshes_stale_attestation():
  ladok = FakeLadokForCourseResult(
    student_results_response={
      "Kursversioner": [{
        "VersionensModuler": [{
          "ResultatPaUtbildning": {
            "Arbetsunderlag": {
              "Uid": "draft-uid",
              "UtbildningsinstansUID": "component-instance",
              "ResultatUID": "draft-result",
              "StudieresultatUID": "study-result",
              "ProcessStatus": 1,
              "Betygsgrad": 10,
              "BetygsskalaID": 1,
              "Examinationsdatum": "2024-02-01",
            },
```

```
            },
          }],
          "VersionensKurs": {},
        }],
      })
    component = make_course_component_for_test(ladok)
    component.course.components = lambda **kwargs: [component]

    result = ladok3.CourseResult(
      ladok=ladok,
      student=types.SimpleNamespace(ladok_id="student-uid"),
      components=[component],
      ResultatPaUtbildning={
        "SenastAttesteradeResultat": {
          "Uid": "attested-uid",
          "UtbildningsinstansUID": "component-instance",
          "ResultatUID": "attested-result",
          "StudieresultatUID": "study-result",
          "Betygsgrad": 11,
          "BetygsskalaID": 1,
          "Examinationsdatum": "2024-01-15",
        },
      })

    result.pull()

    assert result.attested == False
    assert result.finalized == False
    assert result.grade == "F"
    assert result.date == "2024-02-01"
```

This code is used in chunk 113a.
Defines:
`test_course_registration_surfaces_malformed_course_results`, never used.
`test_pull_course_result_refreshes_stale_attestation`, never used.
Uses `components` 22b 179 210, `CourseResult` 204, `FakeLadokForCourseResult` 212b, `ladok_id` 155, `make_course_component_for_test` 212b, `make_course_registration_for_test` 212b, `pull` 176b, and `results` 77b 187a.

A refresh must survive sibling modules that have no recorded result. This is the exact regression from the field report: refreshing one component iterated over a sibling whose `ResultatPaUtbildning` held only a credit-transfer summary and crashed on it. Here the credit-transfer-only sibling comes first, before the target module, so the refresh has to skip it and still find the target's work copy.

221 ⟨*test course result functions* 214⟩+≡

```
def test_pull_course_result_skips_credit_transfer_only_sibling():
  ladok = FakeLadokForCourseResult(
    student_results_response={
      "Kursversioner": [{
        "VersionensModuler": [
          {
            "Kod": "OTHER",
            "UtbildningsinstansUID": "other-component",
```

```
            "ResultatPaUtbildning": {
              "HarTillgodoraknande": False,
              "HeltTillgodoraknad": False,
              "OvrigaResultat": [],
              "TotalTillgodoraknadOmfattning": 0.0,
              "UtbildningUID": "course-education",
            },
          },
          {
            "ResultatPaUtbildning": {
              "Arbetsunderlag": {
                "Uid": "draft-uid",
                "UtbildningsinstansUID": "component-instance",
                "ResultatUID": "draft-result",
                "StudieresultatUID": "study-result",
                "ProcessStatus": 1,
                "Betygsgrad": 10,
                "BetygsskalaID": 1,
                "Examinationsdatum": "2024-02-01",
              },
            },
          },
        ],
        "VersionensKurs": {},
      }],
    })
  component = make_course_component_for_test(ladok)
  component.course.components = lambda **kwargs: [component]

  result = ladok3.CourseResult(
    ladok=ladok,
    student=types.SimpleNamespace(ladok_id="student-uid"),
    components=[component],
    ResultatPaUtbildning={
      "SenastAttesteradeResultat": {
        "Uid": "attested-uid",
        "UtbildningsinstansUID": "component-instance",
        "ResultatUID": "attested-result",
        "StudieresultatUID": "study-result",
        "Betygsgrad": 11,
        "BetygsskalaID": 1,
        "Examinationsdatum": "2024-01-15",
      },
    })

  result.pull()

  assert result.attested == False
  assert result.finalized == False
  assert result.grade == "F"
  assert result.date == "2024-02-01"
```

This code is used in chunk 113a.
Defines:
`test_pull_course_result_skips_credit_transfer_only_sibling`, never used.
Uses `components` 22b 179 210, `CourseResult` 204, `FakeLadokForCourseResult` 212b, `ladok_id` 155, `make_course_component_for_test` 212b, and `pull` 176b.

A refresh must also renew the credit-transfer summary, not just the grade state. The cached result below knows of no transfer, but the fresh response reports a partial one alongside the work copy; after `pull()` the transfer must be visible.

223 ⟨*test course result functions* 214⟩+≡

```
def test_pull_course_result_refreshes_credit_transfer():
  ladok = FakeLadokForCourseResult(
    student_results_response={
      "Kursversioner": [{
        "VersionensModuler": [{
          "ResultatPaUtbildning": {
            "HarTillgodoraknande": True,
            "HeltTillgodoraknad": False,
            "TotalTillgodoraknadOmfattning": 1.5,
            "Arbetsunderlag": {
              "Uid": "draft-uid",
              "UtbildningsinstansUID": "component-instance",
              "ResultatUID": "draft-result",
              "StudieresultatUID": "study-result",
              "ProcessStatus": 1,
              "Betygsgrad": 10,
              "BetygsskalaID": 1,
              "Examinationsdatum": "2024-02-01",
            },
          },
        }],
        "VersionensKurs": {},
      }],
    })
  component = make_course_component_for_test(ladok)
  component.course.components = lambda **kwargs: [component]

  result = ladok3.CourseResult(
    ladok=ladok,
    student=types.SimpleNamespace(ladok_id="student-uid"),
    components=[component],
    ResultatPaUtbildning={
      "Arbetsunderlag": {
        "Uid": "draft-uid",
        "UtbildningsinstansUID": "component-instance",
        "ResultatUID": "draft-result",
        "StudieresultatUID": "study-result",
        "ProcessStatus": 1,
        "Betygsgrad": 10,
        "BetygsskalaID": 1,
        "Examinationsdatum": "2024-02-01",
      },
```

```
43        })
44
45      assert result.credit_transferred == False
46
47      result.pull()
48
49      assert result.credit_transferred == True
50      assert result.fully_credit_transferred == False
51      assert result.transferred_credits == 1.5
```

This code is used in chunk 113a.
Defines:
`test_pull_course_result_refreshes_credit_transfer`, never used.
Uses `components` 22b 179 210, `CourseResult` 204, `FakeLadokForCourseResult` 212b, `ladok_id` 155, `make_course_component_for_test` 212b, and `pull` 176b.

A result that the user removed in LADOK must not stop the refresh. This is the field report behind Section 14.2.2: the user removed an attested result with a lower grade in LADOK's web interface, and the next `ladok report` stopped on the cached copy until the cache was cleared.

After a removal, LADOK can answer in more than one shape, and the reset must handle each of them. The recording of `test_remove_result_draft_JSON` shows one: after a draft is removed, the module entry stays, but its wrapper holds only the credit-transfer summary. The course grade keeps its summary in `VersionensKurs` instead, and we should not rely on the entry staying at all, so we also try an answer without it. In every shape we add a sibling module that is fully credit transferred: the reset must pick its own component's summary, not just any summary, or the sibling's transfer would lock the component against reporting. The fake answers in these shapes; that recording is at the level of the API methods, and recording the same case at this level would mean removing a result in LADOK's test environment in an attended live run for each shape.

224 ⟨*test course result functions* 214⟩+≡

```
1   def make_cached_result_for_test(ladok, component, state="attested"):
2     """Return a result for `component` as it was cached before the user
3     removed it in LADOK: an attested or a finalized F."""
4     data = {
5       "Uid": f"{state}-uid",
6       "UtbildningsinstansUID": "component-instance",
7       "ResultatUID": f"{state}-result",
8       "StudieresultatUID": "study-result",
9       "Betygsgrad": 10,
10      "BetygsskalaID": 1,
11      "Examinationsdatum": "2024-01-15",
12    }
13    if state == "attested":
14      wrapper = {"SenastAttesteradeResultat": data}
15    else:
16      wrapper = {"Arbetsunderlag": dict(data, ProcessStatus=2)}
17    return ladok3.CourseResult(
18      ladok=ladok,
19      student=types.SimpleNamespace(ladok_id="student-uid"),
20      components=[component],
21      ResultatPaUtbildning=wrapper)
```

```
22
23
24  PARTIAL_TRANSFER = {
25    "HarTillgodoraknande": True,
26    "HeltTillgodoraknad": False,
27    "TotalTillgodoraknadOmfattning": 1.5,
28  }
29
30  def results_after_removal_for_test(shape="module entry kept"):
31    """Return LADOK's answer after the component's result was removed, in
32    one of the shapes in `REMOVAL_SHAPES`."""
33    modules = [{
34      "UtbildningsinstansUID": "sibling-instance",
35      "ResultatPaUtbildning": {
36        "HarTillgodoraknande": True,
37        "HeltTillgodoraknad": True,
38        "TotalTillgodoraknadOmfattning": 3.0,
39      },
40    }]
41    course = {}
42    own_entry = {"UtbildningsinstansUID": "component-instance",
43                 "ResultatPaUtbildning": dict(PARTIAL_TRANSFER)}
44    if shape == "module entry kept":
45      modules.append(own_entry)
46    elif shape == "course entry kept":
47      course = own_entry
48    return {"Kursversioner": [{"VersionensModuler": modules,
49                               "VersionensKurs": course}]}
50
51  REMOVAL_SHAPES = {
52    "module entry kept": 1.5,
53    "course entry kept": 1.5,
54    "entry dropped": 0.0,
55  }
56
57
58  @pytest.mark.parametrize("shape", REMOVAL_SHAPES)
59  def test_pull_course_result_becomes_empty_if_result_removed(shape):
60    ladok = FakeLadokForCourseResult()
61    component = make_course_component_for_test(ladok)
62    component.course.components = lambda **kwargs: [component]
63    result = make_cached_result_for_test(ladok, component)
64    assert result.attested and result.grade == "F"
65
66    ladok.set_student_results_response(results_after_removal_for_test(shape))
67    result.pull()
68
69    assert result.grade is None
70    assert result.date is None
71    assert result.attested == False
72    assert result.finalized == False
```

```
73      assert result.fully_credit_transferred == False
74      assert result.transferred_credits == REMOVAL_SHAPES[shape]
75      assert result.credit_transferred == bool(REMOVAL_SHAPES[shape])
```

This code is used in chunk 113a.
Defines:
`make_cached_result_for_test`, used in chunks 226b and 227a.
`PARTIAL_TRANSFER`, never used.
`REMOVAL_SHAPES`, never used.
`results_after_removal_for_test`, used in chunks 226b and 227a.
`test_pull_course_result_becomes_empty_if_result_removed`, never used.
Uses `components` 22b 179 210, `CourseResult` 204, `data` 174b, `FakeLadokForCourseResult` 212b, `ladok_id` 155, `make_course_component_for_test` 212b, `pull` 176b, `state` 183 202b 212a, and `wrapper` 209a.

Becoming empty is only half of the fix; the point is that the next grade creates a new result in LADOK. If the object kept the deleted result's identifier, `push` would try to update a result that no longer exists. The fake therefore records every result it is asked to create and refuses every update.

226a ⟨`FakeLadokForCourseResult` *write methods* 226a⟩≡

```
def create_result_JSON(self, student_id, course_instance_id, component_id,
                       grade_id, date):
  self.created.append(
    (student_id, course_instance_id, component_id, grade_id, date))
  return {
    "Uid": "new-uid",
    "UtbildningsinstansUID": component_id,
    "ResultatUID": "new-result",
    "StudieresultatUID": "study-result",
    "ProcessStatus": 1,
    "Betygsgrad": grade_id,
    "BetygsskalaID": 1,
    "Examinationsdatum": date,
  }

def update_result_JSON(self, result_id, *args, **kwargs):
  raise AssertionError(f"tried to update removed result {result_id}")
```

This code is used in chunk 212b.
Defines:
`create_result_JSON`, used in chunks 231b and 570.
`update_result_JSON`, used in chunks 231a and 573.

226b ⟨*test course result functions* 214⟩+≡

```
def test_course_result_removed_in_ladok_is_created_anew():
  ladok = FakeLadokForCourseResult()
  component = make_course_component_for_test(ladok)
  component.course.components = lambda **kwargs: [component]
  result = make_cached_result_for_test(ladok, component)
  ladok.set_student_results_response(results_after_removal_for_test())

  result.pull()
  result.set_grade("P", "2024-02-01")

  assert ladok.created == [("student-uid", "course-instance",
                            "component-instance", 11, "2024-02-01")]
```

```
    assert result.grade == "P"
    assert result.attested == False
```

This code is used in chunk 113a.
Defines:
`test_course_result_removed_in_ladok_is_created_anew`, never used.
Uses `components` 22b 179 210, `FakeLadokForCourseResult` 212b, `make_cached_result_for_test` 224, `make_course_component_for_test` 212b, `pull` 176b, and `results_after_removal_for_test` 224.

Finally, the whole flow from the field report, through `ladok3.report.set_grade` with a real `CourseResult`: the cached result is a locked F, the user has removed it in LADOK and now reports a P. The cached result can be attested or only finalized; both branches of `set_grade` refresh the result and must then create the new one. (The tests of `set_grade` itself, in the report chapter, replace the result by a fake whose `pull` just sets attributes, so they cannot see this.) Only the student and the course around the result are stand-ins.

227a ⟨*test course result functions* 214⟩+≡

```
@pytest.mark.parametrize("state", ["attested", "finalized"])
def test_report_after_removed_result_creates_new_result(state):
    ladok = FakeLadokForCourseResult()
    component = make_course_component_for_test(ladok)
    component.course.components = lambda **kwargs: [component]
    result = make_cached_result_for_test(ladok, component, state)
    course = types.SimpleNamespace(start=datetime.date(2024, 1, 15),
                                   results=lambda **kwargs: [result])
    student = types.SimpleNamespace(courses=lambda **kwargs: [course])
    ladok.get_student = lambda student_id: student
    ladok.set_student_results_response(results_after_removal_for_test())
    args = types.SimpleNamespace(finalize=False, verbose=0)

    ladok3.report.set_grade(ladok, args, "191212121212", "DD1315", "DD1315",
                            "P", "2024-02-01", [])

    assert ladok.created == [("student-uid", "course-instance",
                              "component-instance", 11, "2024-02-01")]
    assert result.grade == "P"
```

This code is used in chunk 113a.
Defines:
`test_report_after_removed_result_creates_new_result`, never used.
Uses `components` 22b 179 210, `courses` 160a, `FakeLadokForCourseResult` 212b, `get_student` 153, `make_cached_result_for_test` 224, `make_course_component_for_test` 212b, `results` 77b 187a, `results_after_removal_for_test` 224, and `state` 183 202b 212a.

The transactional refresh must still keep the old state when the refresh really fails. This test used to provoke the failure with a result missing from LADOK's answer; now that a missing result is a valid answer, it fails the request itself instead, which is what a network or server error does.

227b ⟨*test course result functions* 214⟩+≡

```
def test_pull_course_result_keeps_state_if_refresh_fails():
    ladok = FakeLadokForCourseResult()
    def fail(*args, **kwargs):
        raise ladok3.LadokAPIError("LADOK unavailable")
    ladok.student_results_JSON = fail
    component = make_course_component_for_test(ladok)
```

```
    component.course.components = lambda **kwargs: [component]

    result = ladok3.CourseResult(
      ladok=ladok,
      student=types.SimpleNamespace(ladok_id="student-uid"),
      components=[component],
      ResultatPaUtbildning={
        "SenastAttesteradeResultat": {
          "Uid": "attested-uid",
          "UtbildningsinstansUID": "component-instance",
          "ResultatUID": "attested-result",
          "StudieresultatUID": "study-result",
          "Betygsgrad": 11,
          "BetygsskalaID": 1,
          "Examinationsdatum": "2024-01-15",
        },
      })

    with pytest.raises(ladok3.LadokAPIError, match="LADOK unavailable"):
      result.pull()

    assert result.attested == True
    assert result.finalized == True
    assert result.grade == "P"
    assert result.date == "2024-01-15"


def test_pull_course_result_keeps_state_if_population_fails():
    ladok = FakeLadokForCourseResult()
    component = make_course_component_for_test(ladok)
    component.course.components = lambda **kwargs: [component]

    result = ladok3.CourseResult(
      ladok=ladok,
      student=types.SimpleNamespace(ladok_id="student-uid"),
      components=[component],
      ResultatPaUtbildning={
        "SenastAttesteradeResultat": {
          "Uid": "attested-uid",
          "UtbildningsinstansUID": "component-instance",
          "ResultatUID": "attested-result",
          "StudieresultatUID": "study-result",
          "Betygsgrad": 11,
          "BetygsskalaID": 1,
          "Examinationsdatum": "2024-01-15",
        },
      })

    ladok.set_student_results_response({
      "Kursversioner": [{
        "VersionensModuler": [{
```

```
          "ResultatPaUtbildning": {
            "Arbetsunderlag": {
              "Uid": "draft-uid",
              "UtbildningsinstansUID": "component-instance",
              "ResultatUID": "draft-result",
              "StudieresultatUID": "study-result",
              "ProcessStatus": 1,
              "Betygsgrad": 10,
              "BetygsskalaID": 99,
              "Examinationsdatum": "2024-02-01",
            },
          },
        }],
        "VersionensKurs": {},
      }],
    })

    with pytest.raises(IndexError):
      result.pull()

    assert result.attested == True
    assert result.finalized == True
    assert result.grade == "P"
    assert result.date == "2024-01-15"
```

This code is used in chunk 113a.
Defines:
`test_pull_course_result_keeps_state_if_population_fails`, never used.
`test_pull_course_result_keeps_state_if_refresh_fails`, never used.
Uses `components` 22b 179 210, `CourseResult` 204, `FakeLadokForCourseResult` 212b, `ladok_id` 155, `make_course_component_for_test` 212b, and `pull` 176b.

A malformed result on the refresh path is different from an absent one. A wrapper with no nested entries means 'no result yet' and is skipped (see `test_pull_course_result_skips_credit_transfer_on`) but a nested entry that is present and cannot be parsed—here an empty `Arbetsunderlag` missing its `UtbildningsinstansUID`—is a real error we must still surface loudly.

229 ⟨*test course result functions* 214⟩+≡

```
def test_pull_course_result_surfaces_malformed_refresh_payload():
  ladok = FakeLadokForCourseResult(
    student_results_response={
      "Kursversioner": [{
        "VersionensModuler": [{
          "ResultatPaUtbildning": {
            "Arbetsunderlag": {},
          },
        }],
        "VersionensKurs": {},
      }],
    })
  component = make_course_component_for_test(ladok)
  component.course.components = lambda **kwargs: [component]

  result = ladok3.CourseResult(
```

```
      ladok=ladok,
      student=types.SimpleNamespace(ladok_id="student-uid"),
      components=[component],
      ResultatPaUtbildning={
        "SenastAttesteradeResultat": {
          "Uid": "attested-uid",
          "UtbildningsinstansUID": "component-instance",
          "ResultatUID": "attested-result",
          "StudieresultatUID": "study-result",
          "Betygsgrad": 11,
          "BetygsskalaID": 1,
          "Examinationsdatum": "2024-01-15",
        },
      })

    with pytest.raises(
        ladok3.LadokError,
        match="couldn't parse existing module result"):
      result.pull()
```

This code is used in chunk 113a.
Defines:
`test_pull_course_result_surfaces_malformed_refresh_payload`, never used.
Uses `components` 22b 179 210, `CourseResult` 204, `FakeLadokForCourseResult` 212b, `ladok_id` 155, `make_course_component_for_test` 212b, and `pull` 176b.

14.2.3 Setting the grade

We can accept the grade either as a grade object or as a string. We must check both values for correctness before we update either of the attributes — otherwise we might end up in an inconsistent state.

230 ⟨*set the grade for CourseResult* 230⟩≡

```
if isinstance(grade, Grade) and grade not in self.grade_scale.grades():
  raise TypeError(f"The grade {grade} is not in"
    f"the scale {self.grade_scale.code}")
elif isinstance(grade, str):
  try:
    grade = self.grade_scale.grades(code=grade)[0]
  except:
    raise TypeError(
      f"The grade {grade} is not in the scale {self.grade_scale.code}")
else:
  raise TypeError(f"Can't use type {type(grade)} for grade")

if isinstance(date, str):
  date = datetime.date.fromisoformat(date)
elif not isinstance(date, datetime.date):
  raise TypeError(f"Type {type(date)} not supported for date")

self.__grade = grade
self.__date = date
```

This code is used in chunk 204.
Uses code 179, Grade 25b 149, and grade_scale 179.

14.2.4 Working with existing results

To push an updated result to LADOK, we do the following.

231a ⟨*push the existing CourseResult grade data to LADOK* 231a⟩≡

```
try:
  response = self.ladok.update_result_JSON(
    self.__uid, self.grade.id, self.date.isoformat(), self.__last_modified
  )
except Exception as err:
  raise LadokError(
    f"couldn't update {self.component.code} to {self.grade} ({self.date})"
    f" to LADOK: {err}"
  )

self.__populate_attributes(**response)
```

This code is used in chunk 204.
Uses code 179, response 199b 210, and update_result_JSON 226a 572b.

14.2.5 Adding new results

We treat new results differently. Since we don't update an already existing item, we must add a new result to LADOK. Particularly, we must add something to the student's study results.

231b ⟨*push the new CourseResult grade data to LADOK* 231b⟩≡

```
try:
  response = self.ladok.create_result_JSON(
    self.__student.ladok_id,
    self.__component.course.instance_id,
    self.__component.instance_id,
    self.grade.id, self.date.isoformat()
  )
except Exception as err:
  raise LadokError("Couldn't register "
    f"{self.component} {self.grade} {self.date}: {err}")

self.__populate_attributes(**response)
```

This code is used in chunk 204.
Uses create_result_JSON 226a 569, instance_id 179, ladok_id 155, and response 199b 210.

14.2.6 Finalizing a result

When we finalize the result, we must know who reported the result.

231c ⟨*finalize the grade for CourseResult* 231c⟩≡

```
reporter_id = self.ladok.user_info_JSON()["AnvandareUID"]

if notify:
  response = self.ladok.finalize_result_JSON(
```

```
      self.__results_id, self.__last_modified, reporter_id, reporter_id,
      others=graders
    )
  else:
    response = self.ladok.finalize_result_JSON(
      self.__results_id, self.__last_modified, reporter_id,
      others=graders
    )

  self.__populate_attributes(**response)
```

This code is used in chunk 204.
Defines:
`reporter_id`, used in chunks 570 and 578a.
Uses `response` 199b 210.

Chapter 15

Round trips through JSON

Now that we have seen all the classes, we can verify that the objects that refer to each other survive the round trip through JSON (Section 9.2.2): a student with its course registrations, their components and results, and a course round with its participants.

We need a LADOK that answers everything that a student fetches. We extend the fake for lazily pulled courses (Section 13.2.1) with the fictive Tolvan's personal data, the synthetic contact data (Section 12.4) and an attested course grade on each course. The grade is on the course itself, which is also one of its components, so the result refers to a component that refers back to the course.

233 ⟨*test functions* 120⟩+≡

```
class FakeLadokForRoundTrips(FakeLadokForLazyCourses):
  def get_student_data_by_uid_JSON(self, student_id):
    return {"Uid": student_id, "Personnummer": "191212121212",
            "Fornamn": "Tolvan", "Efternamn": "Tolvansson",
            "Avliden": False}

  def get_student_contact_data_JSON(self, student_id):
    return FakeLadokForContactData().get_student_contact_data_JSON(
      student_id)

  def student_results_JSON(self, student_id, education_id):
    round_id = education_id[len("education-"):]
    result = {
      "Uid": f"result-{round_id}",
      "UtbildningsinstansUID": f"instance-{round_id}",
      "ResultatUID": f"result-{round_id}",
      "StudieresultatUID": f"study-result-{round_id}",
      "Betygsgrad": 11,
      "BetygsskalaID": 1,
      "Examinationsdatum": "2026-10-23",
    }
    return {"Kursversioner": [{
      "VersionensModuler": [],
      "VersionensKurs": {
        "UtbildningsinstansUID": f"instance-{round_id}",
        "ResultatPaUtbildning": {"SenastAttesteradeResultat": result},
```

```
        },
      }]}

def course_student(course):
  return vars(course)["_CourseRegistration__student"]

def fully_loaded_student(ladok):
  student = ladok3.Student(ladok=ladok, id="student-uid")
  student.pull()
  student.email
  for course in student.courses():
    course.results()
  return student
```

This code is used in chunk 112b.
Defines:
`course_student`, used in chunks 234–36.
`FakeLadokForRoundTrips`, used in chunks 234–37.
`fully_loaded_student`, used in chunks 234, 236, and 237b.
Uses `courses` 160a, `education_id` 179, `email` 157 158b, `FakeLadokForContactData` 159a, `FakeLadokForLazyCourses` 180, `pull` 176b, `results` 77b 187a, and `Student` 154a.

A student that has fetched everything must come back equal, with the same structure: the course must refer back to the very student that we restored, not to a copy, the result's component to that course, and both courses must share one grade scale, as the originals do. (A registration has no property for its student, so the test reads the private attribute. We find the courses by their rounds, since the fake gives the components of every course the same code.) The restored student has all its data, so it must not ask LADOK for anything, which we check by the components requests that the fake counts.

234 ⟨*test functions* 120⟩+≡

```
def test_student_round_trips_through_json():
  ladok = FakeLadokForRoundTrips()
  student = fully_loaded_student(ladok)
  requests_before = list(ladok.components_requests)

  for json_data in [student.json, through_json_text(student)]:
    restored = ladok3.restore(json_data, ladok=ladok)
    assert type(restored) is ladok3.Student
    assert restored is not student
    assert restored == student
    assert restored.json == student.json

    assert restored.email == "student@example.org"
    course = restored.courses(round_id="round-ok")[0]
    assert course_student(course) is restored
    assert type(course.start) is datetime.date
    result, = course.results()
    assert result.grade == "P"
    assert result.component.course is course
    other_course = restored.courses(round_id="round-broken")[0]
    assert result.grade_scale is \
      other_course.components()[0].grade_scale
```

```
23
24      assert ladok.components_requests == requests_before
```

This code is used in chunk 112b.
Defines:
  `test_student_round_trips_through_json`, never used.
Uses `components` 22b 179 210, `course_student` 233, `courses` 160a, `email` 157 158b, `FakeLadokForRoundTrips` 233, `fully_loaded_student` 233, `grade_scale` 179, `restore` 132a, `results` 77b 187a, `Student` 154a, and `through_json_text` 138a.

A student that has fetched little must fetch the rest through the session that we restore it with, just as the original would.

235a ⟨*test functions* 120⟩+≡

```
1   def test_restored_student_fetches_what_it_lacks():
2     ladok = FakeLadokForRoundTrips()
3     student = ladok3.Student(ladok=ladok, id="student-uid")
4
5     restored = ladok3.restore(through_json_text(student), ladok=ladok)
6
7     assert restored.first_name == "Tolvan"
8     course = restored.courses(round_id="round-ok")[0]
9     assert course_student(course) is restored
10    result, = course.results()
11    assert result.grade == "P"
```

This code is used in chunk 112b.
Defines:
  `test_restored_student_fetches_what_it_lacks`, never used.
Uses `course_student` 233, `courses` 160a, `FakeLadokForRoundTrips` 233, `first_name` 155, `restore` 132a, `results` 77b 187a, `Student` 154a, and `through_json_text` 138a.

Without a session, the student has what it had fetched and fails on the rest (Section 9.2.2). The contact data are the case that would otherwise go unnoticed, since a failure there gives empty contact data. Two detached copies are equal, also after pickling, but not equal to the original, which has a session.

235b ⟨*test functions* 120⟩+≡

```
1   def test_detached_student_has_only_its_data():
2     ladok = FakeLadokForRoundTrips()
3     student = ladok3.Student(ladok=ladok, id="student-uid")
4     student.pull()
5
6     restored = ladok3.restore(through_json_text(student))
7
8     assert restored.json == student.json
9     assert restored != student
10    assert ladok3.restore(student.json) == restored
11    assert pickle.loads(pickle.dumps(restored)) == restored
12
13    assert restored.first_name == "Tolvan"
14    course = restored.courses(round_id="round-ok")[0]
15    assert course.round_code == "50001"
16    with pytest.raises(ladok3.LadokDetachedError):
17      restored.email
18    with pytest.raises(ladok3.LadokDetachedError):
19      course.components()
```

```
    assert not hasattr(ladok3.DETACHED, "_repr_html_")
    with pytest.raises(ladok3.LadokDetachedError):
      hasattr(ladok3.DETACHED, "get_student")
```

This code is used in chunk 112b.
Defines:
`test_detached_student_has_only_its_data`, never used.
Uses `components` 22b 179 210, `courses` 160a, `DETACHED` 136b, `email` 157 158b, `FakeLadokForRoundTrips` 233, `first_name` 155, `get_student` 153, `pull` 176b, `restore` 132a, `Student` 154a, and `through_json_text` 138a.

The keys of a JSON object have no order, and tools may sort them or otherwise reorder them. So `restore` must not depend on the order of the keys. We reverse the keys of every object, which moves references in front of the objects that they refer to, and we also try sorted keys.

236a ⟨*test functions* 120⟩+≡

```
def reversed_keys(value):
  if isinstance(value, dict):
    return {key: reversed_keys(value[key]) for key in reversed(value)}
  if isinstance(value, list):
    return [reversed_keys(item) for item in value]
  return value

def test_restore_does_not_depend_on_key_order():
  ladok = FakeLadokForRoundTrips()
  student = fully_loaded_student(ladok)

  for json_data in [reversed_keys(student.json),
                    json.loads(json.dumps(student.json, sort_keys=True))]:
    restored = ladok3.restore(json_data, ladok=ladok)
    assert restored == student
    assert course_student(restored.courses()[0]) is restored
```

This code is used in chunk 112b.
Defines:
`reversed_keys`, never used.
`test_restore_does_not_depend_on_key_order`, never used.
Uses `course_student` 233, `courses` 160a, `FakeLadokForRoundTrips` 233, `fully_loaded_student` 233, and `restore` 132a.

The parts of the student's graph must also round-trip on their own, each bringing the part of the graph that it refers to.

236b ⟨*test functions* 120⟩+≡

```
@pytest.mark.parametrize("part",
  ["course", "component", "result", "grade scale"])
def test_parts_of_a_student_round_trip(part):
  ladok = FakeLadokForRoundTrips()
  course = fully_loaded_student(ladok).courses(round_id="round-ok")[0]
  result, = course.results()
  original = {"course": course, "component": result.component,
              "result": result, "grade scale": result.grade_scale}[part]

  for json_data in [original.json, through_json_text(original)]:
    restored = ladok3.restore(json_data, ladok=ladok)
    assert type(restored) is type(original)
    assert restored == original
```

This code is used in chunk 112b.
Defines:
`test_parts_of_a_student_round_trip`, never used.
Uses `courses` 160a, `FakeLadokForRoundTrips` 233, `fully_loaded_student` 233, `grade_scale` 179, `restore` 132a, `results` 77b 187a, and `through_json_text` 138a.

A course round with its participants takes another path to students (Section 13.5).

237a ⟨*test functions* 120⟩+≡

```
def test_course_round_with_participants_round_trips():
  ladok = FakeLadokForParticipants()
  course_round = make_test_course_round(ladok)
  course_round.participants()

  for json_data in [course_round.json, through_json_text(course_round)]:
    restored = ladok3.restore(json_data, ladok=ladok)
    assert restored == course_round
    assert type(restored.start) is datetime.date
    student, = restored.participants()
    assert student.ladok_id == "student-uid"
```

This code is used in chunk 112b.
Defines:
`test_course_round_with_participants_round_trips`, never used.
Uses `FakeLadokForParticipants` 189, `ladok_id` 155, `make_test_course_round` 189, `participants` 188a, `restore` 132a, and `through_json_text` 138a.

Finally, the equality that the round trips rely on (Section 9.2.1). Two students fetched separately are distinct graphs with cycles, and they are equal. A difference deep in the graph, in a result of the second course, must make them unequal, compared either way.

237b ⟨*test functions* 120⟩+≡

```
def test_equality_of_graphs_with_cycles():
  ladok = FakeLadokForRoundTrips()
  student = fully_loaded_student(ladok)
  assert student == fully_loaded_student(ladok)

  changed = ladok3.restore(student.json, ladok=ladok)
  assert student == changed
  result, = changed.courses(round_id="round-broken")[0].results()
  vars(result)["_CourseResult__last_modified"] = "changed"
  assert student != changed
  assert changed != student
```

This code is used in chunk 112b.
Defines:
`test_equality_of_graphs_with_cycles`, never used.
Uses `courses` 160a, `FakeLadokForRoundTrips` 233, `fully_loaded_student` 233, `restore` 132a, and `results` 77b 187a.

15.1 A student from LADOK

The fakes give the objects only the values that we wrote into them. LADOK's own data may hold values that the fakes lack, of a type that `json` refuses or that `restore` gives back as another type. So we also round-trip a real student from LADOK's test environment, with everything that a student fetches: personal and contact data,

courses, their components and results, and the grade scales. In replay, the test runs on the recorded responses, which are pseudonymized (Section 24.5.1); in a live run, on the data of the day.

The student is real, so the test must not show its data, and pytest shows the values of a failed comparison. We therefore compare first and assert only the outcome.

238 ⟨*test functions* 120⟩+≡

```
round_trip_student_uid = "de709f81-a867-11e7-8dbf-78e86dc2470c"

@pytest.mark.vcr
def test_a_student_from_ladok_round_trips(ladok):
  student = ladok.get_student(round_trip_student_uid)
  student.pull()
  student.email
  courses = student.courses()
  assert courses, "the test student has no courses to round-trip"
  for course in courses:
    course.results()
  json_text = json.dumps(student.json)

  restored = ladok3.restore(json.loads(json_text), ladok=ladok)
  restored_equals_student = restored == student
  assert restored_equals_student, "the restored student differs"

  detached = ladok3.restore(json.loads(json_text))
  detached_has_same_json = json.dumps(detached.json) == json_text
  assert detached_has_same_json, "the detached student's JSON differs"
```

This code is used in chunk 112b.
Defines:
`round_trip_student_uid`, never used.
`test_a_student_from_ladok_round_trips`, never used.
Uses `courses` 160a, `email` 157 158b, `get_student` 153, `pull` 176b, `restore` 132a, and `results` 77b 187a.

Part IV

API calls

Chapter 16

Overview of helper functions and methods

We will now document some possible API calls to LADOK. We also document the tests of these functions to illustrate their use.

16.1 Example outputs and test code for the API

We will provide both example outputs and test code. The test code is the test cases we want to be able to run with `pytest` later. We will design the test functions in such a way that we can reuse them to show the example outputs from the API requests.

We will use the following to test the API methods. Each test that talks to LADOK takes the session as its `ladok` argument, a fixture that reuses the cached test-environment session through `ladok3.test_session` (see Chapter 24). Running the API tests against LADOK then requires no MFA at all when the cache is warm. By default, though, the tests don't talk to LADOK: they replay the responses recorded in `tests/cassettes/test_api`, which is what the `vcr` mark on every test in the file asks for. The few tests that send no request at all, such as those of our own validation and pagination, take `offline_ladok` instead, a session that never logs in.

240 ⟨*test* `api.py` 240⟩≡

```
import datetime
import email.utils
import json
import ladok3
import ladok3.report
import pickle
import pytest
import types

pytestmark = pytest.mark.vcr

student_uid = "de709f81-a867-11e7-8dbf-78e86dc2470c"
dasak_instance_id = "39c56d6a-73d8-11e8-b4e0-063f9afb40e3"
dasak_education_id = "39cf7fb4-73d8-11e8-afa7-8e408e694e54"
dasak_round_id = "79a8cb1b-73da-11e8-b4e0-063f9afb40e3"
```

```
LAB1_uid = "39ca27fe-73d8-11e8-afa7-8e408e694e54"
LAB1_instance_id = "39ca2861-73d8-11e8-b4e0-063f9afb40e3"
KTH_org_id = "2474f616-dc41-11e8-8cc1-eaeeb71b497f"
DD1301_student_uid = "3e76e4f7-f049-11eb-8cb6-0bb93b844502"
DD1317_running_round_id = "9731dce7-c60c-11f0-9aa4-4a24d5f444fb"
DD1317_running_round_dates = (datetime.date(2026, 8, 24),
                              datetime.date(2027, 1, 11))

⟨test functions 245a⟩
```

This definition is continued in chunk 1477.
Root chunk (not used in this document).
Defines:
`dasak_education_id`, used in chunks 287b, 474b, and 561b.
`dasak_instance_id`, used in chunks 499b, 501b, 550b, 553, and 1513–15.
`dasak_round_id`, used in chunks 549, 550b, 556, 559b, and 585c.
`DD1301_student_uid`, used in chunk 1510.
`DD1317_running_round_dates`, used in chunk 586.
`DD1317_running_round_id`, used in chunk 586.
`KTH_org_id`, used in chunks 576 and 601b.
`LAB1_instance_id`, used in chunks 550b, 553, 556, and 559b.
`LAB1_uid`, never used.
`pytestmark`, never used.
`student_uid`, used in chunks 283–87, 474b, 478b, 561b, 585c, 1483a, 1491a, 1492, 1501b, 1510, and 1526a.

We will then add `test_X()` functions in the ⟨*test functions* 245a⟩ code block that will perform the tests. These test functions will also show how to use the functions. Also we will include example output from the function calls in the tests. This is useful for development and when LADOK changes anything in the API.

16.2 Exception classes

LADOK operations can fail in various ways, and it's important to handle these failures gracefully with meaningful error messages. To provide better error handling and debugging capabilities, we define a hierarchy of custom exception classes that represent different types of errors that can occur when working with the LADOK API.

All custom exceptions inherit from a base `LadokError` class, which in turn inherits from Python's built-in `Exception` class. This ensures backward compatibility while providing enhanced error handling capabilities.

16.2.1 Exception class hierarchy

The exception hierarchy is designed to allow applications to catch specific types of errors while still maintaining the ability to catch all LADOK-related errors with a single exception handler.

`LadokError` Base exception class for all LADOK-related errors.

`LadokValidationError` For data validation errors (invalid person numbers, grades, etc.).

`LadokAPIError` For API/HTTP related errors (network failures, unexpected responses).

`LadokServerError` A subclass of `LadokAPIError` for requests that LADOK refused with an explanation (uses `response.json()["Meddelande"]`).

`LadokNotFoundError` For resource not found errors (missing courses, components, etc.).

`LadokDetachedError` For objects restored from JSON without a session that need LADOK (Section 9.2.2).

Usage example:

```
import ladok3

try:
    student = ladok3.session.get_student("invalid-person-nr")
except ladok3.LadokValidationError as e:
    print(f"Invalid data provided: {e}")
except ladok3.LadokServerError as e:
    print(f"LADOK server returned error: {e}")
except ladok3.LadokAPIError as e:
    print(f"Network/API failure: {e}")
except ladok3.LadokError as e:
    print(f"General LADOK error: {e}")
```

This example should yield at least a validation error, since we supply an invalid personnummer to `.get_student`.

16.2.2 Exception class definitions

The exception classes are defined as follows:

242 ⟨*classes* 242⟩≡

```
class LadokError(Exception):
    """
    Base exception class for all LADOK-related errors.

    This is the parent class for all LADOK-specific exceptions. It can be used
    to catch any LADOK-related error in a single exception handler while still
    allowing more specific error handling when needed.

    All other LADOK exception classes inherit from this class, ensuring
    backward compatibility with existing code that catches generic exceptions.
    """
    pass

class LadokValidationError(LadokError):
    """
    Exception for data validation errors.

    This exception is raised when input data fails validation before being
    sent to the LADOK API. This includes format validation, business rule
    validation, and other client-side checks that can be performed without
```

```
    contacting the server.

    Examples:
    - Invalid Swedish personal numbers (personnummer)
    - Invalid grade values for a specific grading scale
    - Missing required fields
    - Date format errors
    """
    pass

class LadokAPIError(LadokError):
    """
    Exception for API/HTTP related errors.

    This exception is raised when there are problems with the HTTP communication
    to the LADOK API or when the API returns unexpected responses. This includes
    network connectivity issues, HTTP protocol errors, and malformed responses.

    Examples:
    - Network connectivity failures
    - HTTP status codes indicating client or server errors
    - Malformed JSON responses
    - Authentication failures
    - Timeouts
    """
    pass

class LadokNotFoundError(LadokError):
    """
    Exception for resource not found errors.

    This exception is raised when a requested resource cannot be found in LADOK.
    This is typically used for HTTP 404 responses or when searching for entities
    that don't exist.

    Examples:
    - Course instances that don't exist
    - Students not found in the system
    - Course components that are not part of a course
    - Non-existent course rounds
    """
    pass

class LadokDetachedError(LadokError):
    """
    Exception for objects restored from JSON without a LADOK session.

    Such an object has the data that was in the JSON.  This exception is
    raised when it needs more from LADOK; restore it with a session
    (`restore(json_dict, ladok=...)`) to fetch more.
```

```
    """
    pass
```

This definition is continued in chunk 244.
Root chunk (not used in this document).
Defines:
  `LadokAPIError`, used in chunks 244, 246–49, 254–56, 263, 285–87, 474a, 478a, 495a, 499a, 501a, 502a, 547a, 548, 550a, 552, 555, 559a, 561a, 569, 572b, 574, 575b, 577a, 578a, 580, 582–84, 589a, 601a, 1483a, 1491a, 1492, 1501b, 1514c, and 1515b.
  `LadokDetachedError`, never used.
  `LadokError`, never used.
  `LadokNotFoundError`, used in chunk 547a.
  `LadokValidationError`, used in chunks 282, 579b, 1512b, and 1513.

A `LadokServerError` is a special kind of `LadokAPIError`: the request failed, but LADOK itself explains why. We make it a subclass for the sake of existing code. For a long time the query methods never raised `LadokServerError` at all: they raised it inside a bare `try/except` that immediately caught it again, so every failure surfaced as a `LadokAPIError`. Code that catches `LadokAPIError` to skip a failing request, for instance when exporting a whole programme's results, therefore relies on it covering LADOK's refusals as well. As a subclass, `LadokServerError` keeps such handlers working, while new code can catch the more specific error. The subclass must be defined after its parent, which is why it comes last. There is one consequence for handlers that treat the two differently, such as the usage example above or the API methods below that add context to an error before raising it again: they must catch `LadokServerError` first. Python tries the `except` clauses in order, and a clause for `LadokAPIError` also matches its subclass, so listed first it would turn every server error into a plain API error.

244 ⟨*classes* 242⟩+≡

```
class LadokServerError(LadokAPIError):
    """
    Exception for server-side LADOK errors.

    This exception is raised when the LADOK server returns an error response,
    typically containing an error message in the response JSON under the
    "Meddelande" key. This indicates that the request reached the server
    successfully, but the server was unable to process it due to business
    logic constraints or data validation issues on the server side.

    It is a subclass of ‘LadokAPIError‘, since it is also a failed API
    request, so handlers for ‘LadokAPIError‘ catch it too.

    Examples:
    - Attempting to register a grade for a student not enrolled in the course
    - Trying to access data that the authenticated user doesn’t have permission to view
    - Server-side validation failures
    """
    pass
```

Defines:
  `LadokServerError`, used in chunks 245a, 248, 249, 285a, 286a, 501a, 550a, 552, 561a, 569, 572b, 577a, 578a, 580, 582a, and 583a.
Uses `LadokAPIError` 242.

Let's verify that such a method lets a server error through as one, with its context added. We take `get_student_contact_data_JSON` as an example and replace its query with one that LADOK refuses, so the test runs offline.

245a ⟨*test functions* 245a⟩≡

```
def test_api_method_keeps_server_error_type(monkeypatch) -> None:
  ls = ladok3.LadokSession("KTH Royal Institute of Technology")
  def refused(*args, **kwargs):
    raise ladok3.LadokServerError("GET request to ... failed: Nekad")
  monkeypatch.setattr(ls, "get_query", refused)
  with pytest.raises(ladok3.LadokServerError,
                     match="contact data for student s-uid.*Nekad"):
    ls.get_student_contact_data_JSON("s-uid")
```

This definition is continued in chunks 247b, 248b, 255, 256b, 260, 261, 264, 283–87, 474b, 478b, 495b, 499b, 501b, 502b, 547b, 549, 550b, 553, 556, 559b, 561b, 570, 572a, 573, 575–79, 581–83, 585, 586, 588, 589b, 601b, 686a, 687, 695, 817b, 910b, 985b, 1039, 1041b, 1045, 1047b, 1178b, 1180b, 1223b, 1253b, 1281b, 1288b, 1289b, 1296b, 1300, 1313b, 1331b, 1464, 1468b, 1469b, 1478–80, 1482, 1483b, 1487b, 1489–91, 1493, 1502b, and 1506–16.
This code is used in chunk 240.
Defines:
`test_api_method_keeps_server_error_type`, never used.
Uses `get_query` 249, `get_student_contact_data_JSON` 285a, and `LadokServerError` 244.

16.3 HTTP queries to LADOK

We will make all queries to LADOK over HTTP as they provide a REST API. This means that we must keep track of some headers and whether we use the test or production system.

16.3.1 Data about the LADOK session

The data that we must keep track of is which URL to use, i.e., which system to access: the production system or test system. To run against the test environment, change the base URL to

`https://start.test.ladok.se`[1]

[1] According to https://ladok.se/drift-och-support/produktionsmiljo-for-nya-ladok.

245b ⟨*LadokSession constructor body* 245b⟩≡

```
self.base_url = "https://start.ladok.se" if not test_environment \
                                          else "https://start.test.ladok.se"
self.base_gui_url = self.base_url + "/gui"
self.base_gui_proxy_url = self.base_gui_url + "/proxy"
```

This definition is continued in chunks 245c and 253b.
Root chunk (not used in this document).

We also set the headers that we will accept.

245c ⟨*LadokSession constructor body* 245b⟩+≡

```
self.headers = { 'Accept' : 'application/vnd.ladok-resultat+json, \
application/vnd.ladok-kataloginformation+json, \
application/vnd.ladok-studentinformation+json, \
application/vnd.ladok-studiedeltagande+json, \
application/vnd.ladok-utbildningsinformation+json, \
application/vnd.ladok-examen+json, \
```

```
  application/vnd.ladok-extintegration+json, \
  application/vnd.ladok-uppfoljning+json, \
  application/vnd.ladok-extra+json, \
  application/json, \
  text/plain'}
```

16.3.2 GET, PUT and POST queries

To make things easier, we will add four methods: `get_query`, `put_query`, `post_query` and `del_query`, which are shortcuts to make GET, PUT, POST and DEL queries to LADOK.

We note that we must record the time of the last GET request to track the freshness of the XSRF token. The other requests track that by the use of the XSRF token itself. We'll get back to this in Section 16.3.3.

A successful HTTP status does not guarantee that we actually received LADOK JSON. When an authenticated session expires, LADOK may redirect us to an HTML login page and still finish with `200 OK`. If we were to call `response.json()` unconditionally in that situation, the user would only see a low-level decoding failure. We therefore decode successful responses through a small helper that raises `LadokAPIError` with the final URL and content type when the body is not JSON.

The raw-text case needs one extra wrinkle. The `weblogin` session wrapper is helpful for JSON endpoints because it can inspect HTML responses and trigger a login flow when LADOK silently redirects us. But the same wrapper also feeds all text responses to its HTML detectors, and XML with an encoding declaration causes `lxml.html` to raise before our code gets the body. We therefore let `get_query_text` force authentication with an ordinary JSON request first, then make the raw request through `requests.Session.request(self.session, ...)`: that still uses the same authenticated `self.session` object (same cookies, same MFA-backed login), but bypasses `AutologinSession.request`'s HTML detection layer.

246 ⟨*functions* 246⟩≡

```
  def response_json_or_error(
      response: requests.Response, path: str, method: str) -> dict | list:
    """Return JSON from [[response]] or raise contextual [[LadokAPIError]]."""
    try:
      return response.json()
    except ValueError as err:
      content_type = response.headers.get("content-type", "<missing>")
      raise LadokAPIError(
        f"{method} request to {path} returned non-JSON response "
        f"from {response.url} (Content-Type: {content_type}): "
        f"{compact_body(response.text)}") from err
```

This definition is continued in chunks 247a, 248a, 257, 258, 260b, 1502a, and 1504–7.
Root chunk (not used in this document).
Defines:
`response_json_or_error`, used in chunks 247b and 249.
Uses `compact_body` 247a and `LadokAPIError` 242.

A whole HTML page in an error message buries the one line that matters, so we squeeze its whitespace and cut it short.

247a ⟨*functions* 246⟩+≡

```
def compact_body(text: str, limit: int = 120) -> str:
  """Return ‘text‘ on one line, shortened to at most ‘limit‘ characters."""
  body = " ".join(text.split())
  if len(body) > limit:
    body = body[:limit - 3] + "..."
  return body
```

Defines:
`compact_body`, used in chunks 246 and 248a.

Let’s verify the improved error reporting with a synthetic HTML login page. The helper should raise `LadokAPIError` rather than leaking a bare JSON decoding exception.

247b ⟨*test functions* 245a⟩+≡

```
def test_response_json_or_error_reports_html_login_pages() -> None:
  class Response:
    url = "https://start.ladok.se/gui/loggain"
    headers = {"content-type": "text/html;charset=UTF-8"}
    text = "<html><title>Ladok - start</title></html>"

    def json(self):
      raise ValueError("not json")

  try:
    ladok3.response_json_or_error(Response(), "/studentinformation", "GET")
  except ladok3.LadokAPIError as err:
    assert "non-JSON response" in str(err)
    assert "text/html;charset=UTF-8" in str(err)
    assert "https://start.ladok.se/gui/loggain" in str(err)
  else:
    assert False
```

This code is used in chunk 240.
Defines:
`test_response_json_or_error_reports_html_login_pages`, never used.
Uses `LadokAPIError` 242 and `response_json_or_error` 246.

Reporting a failed request

The helper above deals with a successful status that carries the wrong kind of body; the query methods must also report requests that fail outright. When LADOK refuses a request, it usually explains why in the `Meddelande` field of a JSON body, and that explanation is what the user needs to see. But not every failure carries such a body. The requests that sent the wrong XSRF token (Section 16.3.3), for instance, got an HTML ‘Application error’ page with status 500. Since our retry policy hands such final responses back to us (Section 9.1.2), we must expect them here. An earlier version put the whole response body into the message, which for such a page meant a screenful of HTML. We therefore use LADOK’s own message when there is one, and otherwise the status and a shortened body. The two cases also differ in kind. With a `Meddelande`, LADOK understood the request and refused

it, which is what `LadokServerError` stands for (Section 16.2); without one, we only know that the request failed, a plain `LadokAPIError`.

All five query methods below fail the same way, so they share this helper. It returns the exception rather than raising it, so that each method ends with an explicit `raise` and the reader sees where its control flow stops.

248a ⟨*functions* 246⟩+≡

```
def query_error(response: requests.Response, path: str,
                method: str) -> LadokAPIError:
  """Return an exception describing the failed ‘response‘.

  If the body is LADOK JSON with an error message (‘Meddelande‘), returns a
  ‘LadokServerError‘ with that message. Otherwise returns a ‘LadokAPIError‘
  with the HTTP status and a shortened body.
  """
  failed = f"{method} request to {path} failed"
  try:
    message = response.json()["Meddelande"]
  except (ValueError, KeyError, TypeError):
    return LadokAPIError(f"{failed}: {response.status_code} {response.reason}: "
                         f"{compact_body(response.text)}")
  return LadokServerError(f"{failed}: {message}")
```

Defines:
`query_error`, used in chunks 248b and 249.
Uses `compact_body` 247a, `LadokAPIError` 242, and `LadokServerError` 244.

Let's verify both kinds of failure: an HTML error page from the proxy and a JSON refusal from LADOK.

248b ⟨*test functions* 245a⟩+≡

```
class FakeFailedResponse:
  def __init__(self, status_code, reason, text, json_data=None):
    self.status_code = status_code
    self.reason = reason
    self.text = text
    self.__json_data = json_data

  def json(self):
    if self.__json_data is None:
      raise ValueError("not json")
    return self.__json_data

def test_query_error_shortens_html_error_pages() -> None:
  page = ("<!DOCTYPE html>\n<html>\n<head>\n"
          "<title>Ladok - Application error</title>\n"
          + "<meta>\n" * 100 + "</head></html>")
  err = ladok3.query_error(
    FakeFailedResponse(500, "Internal Server Error", page),
    "/resultat/internal/kurstillfalle/moment", "PUT")
  assert type(err) is ladok3.LadokAPIError
  assert "PUT request to /resultat/internal/kurstillfalle/moment" in str(err)
  assert "500 Internal Server Error" in str(err)
  assert "Application error" in str(err)
```

```
24    assert "\n" not in str(err)
25    assert len(str(err)) < 250
26
27  def test_query_error_uses_ladok_message() -> None:
28    err = ladok3.query_error(
29      FakeFailedResponse(400, "Bad Request", '{"Meddelande": "..."}',
30                         {"Meddelande": "Resultatet är redan attesterat"}),
31      "/resultat/internal/resultat/uppdatera/1", "PUT")
32    assert isinstance(err, ladok3.LadokServerError)
33    assert isinstance(err, ladok3.LadokAPIError)
34    assert str(err).endswith("failed: Resultatet är redan attesterat")
```

This code is used in chunk 240.
Defines:
`FakeFailedResponse`, never used.
`test_query_error_shortens_html_error_pages`, never used.
`test_query_error_uses_ladok_message`, never used.
Uses `LadokAPIError` 242, `LadokServerError` 244, and `query_error` 248a.

249 ⟨*LadokSession data methods* 249⟩≡

```
  def get_query(self, path: str,
                content_type: str = "application/vnd.ladok-resultat+json"
                ) -> dict | list:
    """
    Make GET query to LADOK server and return JSON data.

    Args:
      path: API endpoint path
      content_type: HTTP Content-Type header value

    Returns:
      JSON data from the response

    Raises:
      LadokServerError: If the server returns an error message
      LadokAPIError: If the request fails or returns an error status
    """
    headers = self.headers.copy()
    headers["Content-Type"] = content_type

    ⟨record time of request 253c⟩

    response = self.session.get(
      url=self.base_gui_proxy_url + path,
      headers=headers)

    if response.ok:
      return response_json_or_error(response, path, "GET")
    raise query_error(response, path, "GET")

  def get_query_text(self, path: str, accept: str) -> str:
    """
```

```
    Make GET query to LADOK and return the raw response text.

    Use this when an endpoint serves a non-JSON representation (e.g.\
    XML) that we want to hand to the caller for parsing.  The Accept
    header is set explicitly because [[self.headers]] only advertises
    the JSON variants.

    Args:
      path:   API endpoint path
      accept: HTTP Accept header value, e.g.
              'application/xml, text/xml;q=0.9'

    Returns:
      response.text from the LADOK response

    Raises:
      LadokServerError: If the server returns an error message
      LadokAPIError: If the request fails or returns an error status
    """
    headers = self.headers.copy()
    headers.pop("Content-Type", None)
    headers["Accept"] = accept

    self.user_info_JSON()
    ⟨record time of request 253c⟩

    response = requests.Session.request(
      self.session,
      "GET",
      url=self.base_gui_proxy_url + path,
      headers=headers)

    if response.ok:
      if "html" in response.headers.get("content-type", "").lower():
        raise LadokAPIError(
          f"GET request to {path} returned unexpected HTML from "
          f"{response.url}")
      return response.text
    raise query_error(response, path, "GET")

  def put_query(self, path: str, put_data: dict | list,
                content_type: str = "application/vnd.ladok-resultat+json"
                ) -> dict | list:
    """
    Make PUT query to LADOK server and return JSON data.

    Args:
      path: API endpoint path
      put_data: Data to send in request body
      content_type: HTTP Content-Type header value
```

```
    Returns:
      JSON data from the response

    Raises:
      LadokServerError: If the server returns an error message
      LadokAPIError: If the request fails or returns an error status
    """
    headers = self.headers.copy()
    headers["Content-Type"] = content_type
    headers["X-XSRF-TOKEN"] = self.xsrf_token
    headers["Referer"] = self.base_gui_url

    response = self.session.put(
      url=self.base_gui_proxy_url + path,
      json=put_data,
      headers=headers)

    if response.ok:
      return response_json_or_error(response, path, "PUT")
    raise query_error(response, path, "PUT")

  def post_query(self, path: str, post_data: dict | list,
                 content_type: str = "application/vnd.ladok-resultat+json"
                 ) -> dict | list:
    """
    Make POST query to LADOK server and return JSON data.

    Args:
      path: API endpoint path
      post_data: Data to send in request body
      content_type: HTTP Content-Type header value

    Returns:
      JSON data from the response

    Raises:
      LadokServerError: If the server returns an error message
      LadokAPIError: If the request fails or returns an error status
    """
    headers = self.headers.copy()
    headers["Content-Type"] = content_type
    headers["X-XSRF-TOKEN"] = self.xsrf_token
    headers["Referer"] = self.base_gui_url

    response = self.session.post(
      url=self.base_gui_proxy_url + path,
      json=post_data,
      headers=headers)
```

```
    if response.ok:
      return response_json_or_error(response, path, "POST")
    raise query_error(response, path, "POST")

  def del_query(self, path: str) -> bool | dict | list | requests.Response:
    """
    Returns DELETE query response for path on the LADOK server.

    Args:
        path (str): API endpoint path

    Returns:
      True, if success but no content is returned.
      JSON data from the response, if any.
      Otherwise the response object.

    Raises:
        LadokServerError: If the server returns an error message
        LadokAPIError: If the request fails or returns an error status
    """
    headers = self.headers.copy()
    headers["X-XSRF-TOKEN"] = self.xsrf_token

    response = self.session.delete(url=self.base_gui_proxy_url+path,
                                   headers=headers)

    if response.status_code == requests.codes.no_content:
      return True
    if response.ok:
      try:
        return response.json()
      except:
        return response
    raise query_error(response, path, "DELETE")
```

This definition is continued in chunks 253a, 256a, 263, 282, 283b, 285–87, 474a, 478a, 495a, 499a, 501a, 502a, 547a, 548, 550a, 552, 555, 559a, 561a, 569, 572b, 574, 575b, 577a, 578a, 580, 582–84, 589a, 601a, 685, 686b, 694, 817a, 910a, 985a, 1038, 1041a, 1044, 1047a, 1178a, 1180a, 1223a, 1253a, 1281a, 1288a, 1289a, 1296a, 1299, 1313a, 1331a, 1463, 1468a, 1469a, 1478–81, 1483a, 1487–92, 1501b, 1512b, 1514, and 1515b.

Root chunk (not used in this document).

Defines:

`del_query`, used in chunk 583a.
`get_query`, used in chunks 245a, 263, 283b, 285–87, 474a, 495a, 499a, 501a, 561a, 575b, 577a, 1478–80, 1483a, 1488a, 1489b, 1491a, 1501b, 1512b, 1514, and 1515b.
`get_query_text`, used in chunk 1487a.
`post_query`, used in chunk 569.
`put_query`, used in chunks 550a, 552, 555, 559a, 572b, 574, 578a, 580, 582a, 584, 585b, and 1481.

Uses `LadokAPIError` 242, `LadokServerError` 244, `query_error` 248a, `response_json_or_error` 246, `user_info_JSON` 577a, and `xsrf_token` 253a.

16.3.3 The XSRF token

We note that the PUT, POST and DEL queries require an XSRF token. They all get it through `self.xsrf_token`. We provide a property for that. LADOK sets the XSRF token when we make our first request. If we haven't made any request, we don't have one. Also, if too long time passes between requests, the existing XSRF token will be invalidated by LADOK.

253a ⟨*LadokSession data methods* 249⟩+≡
```
@property
def xsrf_token(self) -> str:
  """
  Get a fresh XSRF token for authenticated requests.

  LADOK requires XSRF tokens for PUT, POST, and DELETE requests. This property
  ensures the token is fresh and valid, triggering a re-login if necessary.

  Returns:
      str: A valid XSRF token for use in authenticated requests.
  """
  ⟨ensure the XSRF token is fresh 253d⟩
  ⟨return the XSRF token of our own LADOK environment 254⟩
```
Defines:
`xsrf_token`, used in chunks 249 and 255.
Uses `token` 254.

Now, we must ensure there is a fresh XSRF token. There are two cases:

(1) If we don't have an XSRF token, this means that we must log in to get one. Since we use `weblogin`, we'll simply perform a GET request, i.e., one that doesn't require an XSRF token.

(2) If we have one, it might be expired due to a timeout. In this case, we must log in again to get a new one.

This means that we want to keep track of when the last request happened, so we can determine if our XSRF token is fresh or not.

253b ⟨*LadokSession constructor body* 245b⟩+≡
```
self.__access_time = None
self.__timeout = datetime.timedelta(minutes=15)
```

253c ⟨*record time of request* 253c⟩≡
```
self.__access_time = datetime.datetime.now()
```
This code is used in chunks 249 and 253d.

We note here that we assume that whenever the XSRF token is requested, a PUT, POST or DEL request will soon follow. Hence, we can update the time of the last request whenever the XSRF token is read.

253d ⟨*ensure the XSRF token is fresh* 253d⟩≡
```
if (not self.__access_time
    or datetime.datetime.now()-self.__access_time > self.__timeout):
  self.user_info_JSON() # trigger login
else:
  ⟨record time of request 253c⟩
```

This code is used in chunk 253a.
Uses user_info_JSON 577a.

Which XSRF token is ours

A fresh token is not enough; it must also be the token of the right LADOK environment. Each environment sets its own XSRF-TOKEN cookie, scoped to its own host: start.ladok.se for production and start.test.ladok.se for the test environment. Both cookies can end up in the same cookie jar. That is no accident: ladok3.test_session shares the production session's underlying session, and with it the cookie jar, so that the test environment can log in on the production SSO cookies (Section 8.1). That shared jar is then pickled into the cache, so once a test run or a documentation build has touched the test environment, every later production session restored from the cache carries both tokens.

Contrast two ways of reading the token from such a jar. An earlier version flattened the jar into a dictionary with get_dict(). A dictionary has room for only one XSRF-TOKEN, so the cookie that the jar lists last wins. The jar lists its cookies sorted by domain, and start.test.ladok.se sorts after start.ladok.se, so the test environment's token always won. A production session then sent the test environment's token with every PUT, POST and DELETE request, and LADOK answered each of them with an 'Application error' (status 500). GET requests carry no token, so they kept working, which made the problem look like a fault in a particular LADOK endpoint rather than in our session.

Instead we ask the jar for the cookie that our own host set. This works because the jar records the domain of every cookie, and LADOK sets its token on the bare host name, without a leading dot, so the domain matches the host of self.base_url exactly. We derive the host inside the property rather than storing it in the constructor: sessions restored from the cache are unpickled, not constructed, so an attribute that only the constructor sets would be missing on them. We deliberately leave out the path. Should our host ever set a second token on another path, the jar raises CookieConflictError instead of silently choosing one of them, and a loud failure is what we want for an ambiguous token. If our host has set no token at all, we tell the user to log in again, rather than failing with a bare KeyError.

254 ⟨*return the XSRF token of our own LADOK environment* 254⟩≡

```
host = urllib.parse.urlparse(self.base_url).hostname
token = self.session.cookies.get("XSRF-TOKEN", domain=host)
if token is None:
  raise LadokAPIError(
    f"no XSRF token from {host}; log in again with 'ladok login'")
return token
```

This code is used in chunk 253a.
Defines:
  host, used in chunk 1512b.
  token, used in chunks 253a and 255.
Uses LadokAPIError 242.

Let's verify that a production session and a test-environment session that share one cookie jar each get their own token. We set both tokens the way LADOK does and mark both sessions as recently used, so that the freshness check makes no request and the test runs offline. With get_dict(), the production session would get the test token here.

255a ⟨*test functions* 245a⟩+≡

```
def make_sessions_sharing_one_jar():
  prod = ladok3.LadokSession("KTH Royal Institute of Technology")
  test = ladok3.LadokSession("KTH Royal Institute of Technology",
                             test_environment=True,
                             session=prod.session)
  for session in (prod, test):
    session._LadokSession__access_time = datetime.datetime.now()
  return prod, test

def test_xsrf_token_comes_from_own_environment() -> None:
  prod, test = make_sessions_sharing_one_jar()
  prod.session.cookies.set("XSRF-TOKEN", "prod-token",
                           domain="start.ladok.se", path="/gui")
  prod.session.cookies.set("XSRF-TOKEN", "test-token",
                           domain="start.test.ladok.se", path="/gui")
  assert prod.xsrf_token == "prod-token"
  assert test.xsrf_token == "test-token"
```

This code is used in chunk 240.
Defines:
`make_sessions_sharing_one_jar`, used in chunk 255b.
`test_xsrf_token_comes_from_own_environment`, never used.
Uses `token` 254 and `xsrf_token` 253a.

The other environment's token must not stand in for a missing one of our own.

255b ⟨*test functions* 245a⟩+≡

```
def test_xsrf_token_missing_for_own_environment() -> None:
  prod, test = make_sessions_sharing_one_jar()
  prod.session.cookies.set("XSRF-TOKEN", "test-token",
                           domain="start.test.ladok.se", path="/gui")
  with pytest.raises(ladok3.LadokAPIError, match="ladok login"):
    prod.xsrf_token
```

This code is used in chunk 240.
Defines:
`test_xsrf_token_missing_for_own_environment`, never used.
Uses `LadokAPIError` 242, `make_sessions_sharing_one_jar` 255a, `token` 254, and `xsrf_token` 253a.

16.3.4 Paginating across multiple result pages

Many LADOK endpoints return a fixed-size page of results plus a `TotaltAntalPoster` field giving the total count. If a caller wants *all* results — e.g. all course rounds for a course code, all participants in a programme round, all examination occasions for a course — they have to walk every page.

The naive workaround is to ask for an enormous `limit` (we used 400 in places below). That stops working the moment a query genuinely crosses the limit, and it fails silently: the caller gets the first 400 items and never finds out the rest exist. We instead provide a `_all_pages` helper that walks pages until the running total matches the server's `TotaltAntalPoster`, so the caller-facing methods can stay parameterless and always return the complete list.

The helper takes a `request_fn(page, limit)` callable rather than a URL and content-type pair. This lets it work with both `get_query` (URL query-string pagination) and `put_query` (body-field pagination, used by `occasion_results_JSON`)

without having to duplicate the looping logic — the closure captures whatever endpoint-specific machinery the caller needs.

If the response is missing either `key` or `TotaltAntalPoster`, we raise `LadokAPIError` in the same 'fail loud on schema drift' style as the rest of this module: a paginated endpoint that suddenly stops returning `TotaltAntalPoster` is exactly the kind of change the caller needs to see, not silently swallow.

256a ⟨*LadokSession data methods* 249⟩+≡

```
def _all_pages(self,
               request_fn: Callable[[int, int], dict],
               key: str = "Resultat",
               page_size: int = 400) -> list:
  """Concatenate every page of a paginated LADOK endpoint.

  request_fn(page, limit) must return the raw response dict
  containing ‘key‘ (a list of items) and ’TotaltAntalPoster’ (total
  number of items across all pages, 1-based page numbering).

  Returns the flat list of items.  Raises LadokAPIError if any page
  is missing the expected keys.
  """
  items = []
  page = 1
  while True:
    data = request_fn(page, page_size)
    try:
      chunk = data[key]
      total = data["TotaltAntalPoster"]
    except KeyError as err:
      err.add_note(f"Response data: {data}")
      raise LadokAPIError(
        f"Paginated response missing ’{key}’ or "
        f"’TotaltAntalPoster’ on page {page}"
      ) from err
    items.extend(chunk)
    if len(items) >= total or not chunk:
      return items
    page += 1
```

Defines:
  `_all_pages`, used in chunks 256b and 1478–81.
Uses `LadokAPIError` 242.

The recordings can't test the loop: in the test environment every list we ask for fits on one page, so a helper that stopped after the first page would still pass them. We therefore test it offline, with a `request_fn` that serves a list of five items two at a time, just as LADOK would with a page size of two. A page that comes back empty must end the loop too, even if the total promises more items, or a total that is too high would make us ask for pages for ever.

256b ⟨*test functions* 245a⟩+≡

```
def test_all_pages_walks_every_page(offline_ladok) -> None:
  items = list(range(5))
```

```
    pages = []

    def request_fn(page, limit):
      pages.append(page)
      start = (page - 1) * limit
      return {"Resultat": items[start:start + limit],
              "TotaltAntalPoster": len(items)}

    assert offline_ladok._all_pages(request_fn, page_size=2) == items
    assert pages == [1, 2, 3]

  def test_all_pages_stops_at_an_empty_page(offline_ladok) -> None:
    def request_fn(page, limit):
      assert page <= 2, "asked for another page after an empty one"
      return {"Resultat": [page] if page == 1 else [],
              "TotaltAntalPoster": 5}

    assert offline_ladok._all_pages(request_fn, page_size=2) == [1]

  def test_all_pages_rejects_unpaginated_response(offline_ladok) -> None:
    with pytest.raises(ladok3.LadokAPIError, match="TotaltAntalPoster"):
      offline_ladok._all_pages(lambda page, limit: {"Resultat": []})
```

This code is used in chunk 240.
Defines:
`test_all_pages_rejects_unpaginated_response`, never used.
`test_all_pages_stops_at_an_empty_page`, never used.
`test_all_pages_walks_every_page`, never used.
Uses `_all_pages` 256a and `LadokAPIError` 242.

16.4 Cleaning data for printing

We sometimes want to print the data, for instance, example output in this document. For this reason we introduce some cleaning functions. These recursively transcends the JSON structure removing the data that should be removed.

257 ⟨*functions* 246⟩+≡

```
  def clean_data(json_obj: dict | list) -> dict | list:
    """
    Clean a JSON object by removing internal links and pseudonymizing personal data.

    Args:
        json_obj (dict or list): The JSON data to clean.

    Returns:
        dict or list: The cleaned JSON object.
    """
    remove_links(json_obj)
    pseudonymize(json_obj)
    return json_obj
```

Defines:
`clean_data`, never used.
Uses `pseudonymize` 260b and `remove_links` 258.

The `remove_links` functions removes the `link` key–value pairs. The `link` values contains URLs for all requests that data are based on.

258 ⟨*functions* 246⟩+≡

```
def remove_links(json_obj: dict | list) -> None:
  """
  Recursively removes all "link" keys and values
  """
  if isinstance(json_obj, dict):
    if "link" in json_obj:
      json_obj.pop("link")
    for key, value in json_obj.items():
      remove_links(value)
  elif isinstance(json_obj, list):
    for item in json_obj:
      remove_links(item)
```

Defines:
`remove_links`, used in chunk 257.

The `pseudonymize` function replaces the data that identify or describe a person with dummy entries. Most of the fields it covers describe the student: name, personnummer, date of birth, sex, whether the student is alive, and contact details. Two more fields are easy to miss precisely because they do *not* describe the student. LADOK stamps most records with audit metadata, and `SenastAndradAv` ('last changed by') names the *staff member* who last touched the record, as their institutional email address—an audit of the rendered example outputs in this documentation found real staff addresses leaking through it. Pseudonymization has to protect staff as well as students, so we replace it like any other email address. Examination occasions carry a similar field, `SkapadAv` ('created by'), with the username of the staff member who created the occasion. Similarly, the delivery-preference records use the bare key `Epost` where student records use `Epostadress`, so we must cover both spellings.

Result records name people in three more places. `Beslutsfattare` ('decision maker') is the examiner who decided the result, and `OvrigaMedverkande` ('other contributors') is a newline-separated list of the teachers who took part in the grading. `Anteckning` ('note') is free text, found on suspensions and results, and free text can name anyone, so we replace it wholesale rather than trying to find names in it. The same goes for the free text of an examination occasion, `OvrigInformation` ('other information'). When we report a result, we send `Beslutsfattare` as a list of UIDs (see `finalize_result_JSON`), but LADOK returns it as the examiner's name. We therefore replace only the string form and keep a list of UIDs, which carries no name. `Attestant` is whoever certified (attested) the result in LADOK, who need not be the one who decided it. It comes in two shapes too: result histories give a record, whose name fields the rules above already replace, but attestation views give a plain string with the name. So we replace its string form in the same way.

Where there is no examiner to name, LADOK puts its own text in these fields, 'Uppgift om examinator saknas/Not applicable'. That text names no one, and a dummy name in its place would show an examiner where LADOK says there is none, so we keep it.

The function only knows the keys it lists. If LADOK adds a field that names a person, that field goes through untouched until someone adds it here. This is why

the documentation's example outputs are scanned before we publish them (the `check-doc-privacy` target in the top-level `Makefile`): the scan counts the distinct values per key, so a new key that carries names stands out even though this function doesn't know about it. The count has two blind spots, though. It only helps when the examples show several people: an example about one student gives each of that student's fields one value, just as a pseudonym has one value. And it counts only text values, so a number or a truth value, such as the student's sex (`KonID`) or whether the student is deceased (`Avliden`), never shows up in it at all. So every field that describes a person must be listed here, whether or not the scan would notice it.

We keep the replacements in a table, so a new key is a one-line change. The names are deliberately unrealistic ('Studentzadeh') and the personnummer and date of birth are the fictive Tolvan's, so that no one mistakes the documentation's examples for real records. The sex becomes the neutral o and every student is alive: neither belongs in an example.

259 ⟨*constants* 259⟩≡

```
PSEUDONYMS = {
  "Fornamn": "Student",
  "Efternamn": "Studentzadeh",
  "Personnummer": "19121212-1212",
  "Fodelsedata": "1912-12-12",
  "KonID": 0,
  "Avliden": False,
  "Epostadress": "user@domain.se",
  "Epost": "user@domain.se",
  "Anvandarnamn": "user@domain.se",
  "Utdelningsadress": "Stora vägen 1",
  "Postnummer": "12345",
  "Postort": "Byn",
  "Telefonnummer": "0701234567",
  "SenastAndradAv": "user@domain.se",
  "SkapadAv": "user@domain.se",
  "Anteckning": "Anteckning",
  "OvrigInformation": "Övrig information",
  "OvrigaMedverkande": "Medarbetare",
}

PSEUDONYMS_IF_STRING = {
  "Beslutsfattare": "Examinator",
  "Attestant": "Examinator",
}
NO_EXAMINER_TEXTS = {"Uppgift om examinator saknas/Not applicable"}
```

This definition is continued in chunks 260a, 585a, 1501a, 1503, and 1504a.
Root chunk (not used in this document).
Defines:
`NO_EXAMINER_TEXTS`, used in chunk 260b.
`PSEUDONYMS`, used in chunk 260b.
`PSEUDONYMS_IF_STRING`, used in chunk 260b.

Two keys say something about a person by being there at all: `Skyddsstatus` marks a protected identity ('sekretessmarkering') and `FolkbokforingsbevakningTillOchMed`

says that LADOK watches the population register for changes to the student. A dummy value would still show that the record has the key, so we remove these keys instead, as `remove_links` does with the links.

260a ⟨*constants* 259⟩+≡

```
REMOVED_KEYS = ["Skyddsstatus", "FolkbokforingsbevakningTillOchMed"]
```

Defines:
`REMOVED_KEYS`, used in chunk 260b.

260b ⟨*functions* 246⟩+≡

```
def pseudonymize(json_obj: dict | list) -> None:
  """
  Recursively pseudonymizes a JSON data record in place.

  Replaces the values of the keys in ‘PSEUDONYMS‘ (names, personnummer,
  date of birth, sex, contact details, free text) and the string values of
  the keys in ‘PSEUDONYMS_IF_STRING‘, and removes the keys in
  ‘REMOVED_KEYS‘.  UIDs are kept.
  """
  if isinstance(json_obj, dict):
    for key in REMOVED_KEYS:
      json_obj.pop(key, None)
    for key, pseudonym in PSEUDONYMS.items():
      if key in json_obj:
        json_obj[key] = pseudonym
    for key, pseudonym in PSEUDONYMS_IF_STRING.items():
      value = json_obj.get(key)
      if isinstance(value, str) and value not in NO_EXAMINER_TEXTS:
        json_obj[key] = pseudonym
    for value in json_obj.values():
      pseudonymize(value)
  elif isinstance(json_obj, list):
    for item in json_obj:
      pseudonymize(item)
```

Defines:
`pseudonymize`, used in chunks 257, 260, and 261.
Uses `NO_EXAMINER_TEXTS` 259, `PSEUDONYMS` 259, `PSEUDONYMS_IF_STRING` 259, and `REMOVED_KEYS` 260a.

Let’s verify that both keys are removed, also from nested records, and that nothing else in the record is touched.

260c ⟨*test functions* 245a⟩+≡

```
@pytest.mark.parametrize("key", ["Skyddsstatus",
                                 "FolkbokforingsbevakningTillOchMed"])
def test_pseudonymize_removes(key) -> None:
  data = {key: "2027-01-01", "Rattigheter": [{key: "SEKRETESS"}]}
  ladok3.pseudonymize(data)
  assert data == {"Rattigheter": [{}]}
```

This code is used in chunk 240.
Defines:
`test_pseudonymize_removes`, never used.
Uses `pseudonymize` 260b.

Let's verify that every field we promise to replace is replaced, also when the record is nested. The observed leaks were in nested records: `SenastAndradAv` inside a *list* of Rättigheter records, so we put each field both at the top level and inside a list of records. We list the fields here independently of `PSEUDONYMS`: a test that looped over the table itself would still pass if someone deleted an entry from it. It is not enough that the value changes, since a transformation of it, say the name spelt backwards, would also be a change. We therefore pseudonymize two different people and require the same result for both: then nothing of the original can remain.

261a ⟨*test functions* 245a⟩+≡

```
PSEUDONYMIZED_KEYS = [
  "Fornamn", "Efternamn", "Personnummer", "Epostadress", "Epost",
  "Anvandarnamn", "Utdelningsadress", "Postnummer", "Postort",
  "Telefonnummer", "SenastAndradAv", "Anteckning", "OvrigaMedverkande",
  "Beslutsfattare", "Fodelsedata", "KonID", "Avliden", "SkapadAv",
  "OvrigInformation", "Attestant",
]

@pytest.mark.parametrize("key", PSEUDONYMIZED_KEYS)
def test_pseudonymize_replaces(key) -> None:
  first = {key: "Anna Andersson", "Rattigheter": [{key: "Anna Andersson"}]}
  second = {key: "Bo Berg", "Rattigheter": [{key: "Bo Berg"}]}
  ladok3.pseudonymize(first)
  ladok3.pseudonymize(second)
  assert first[key] not in ("Anna Andersson", "Bo Berg")
  assert first == second
```

This code is used in chunk 240.
Defines:
`PSEUDONYMIZED_KEYS`, never used.
`test_pseudonymize_replaces`, never used.
Uses `pseudonymize` 260b.

The UIDs must survive: they are what lets a reader follow the same student or course round from one example output to the next. The list form of `Beslutsfattare` is such a list of UIDs.

261b ⟨*test functions* 245a⟩+≡

```
def test_pseudonymize_keeps_uids() -> None:
  uid = "00000000-0000-0000-0000-000000000001"
  data = {"Uid": uid, "StudentUID": uid, "Beslutsfattare": [uid]}
  ladok3.pseudonymize(data)
  assert data == {"Uid": uid, "StudentUID": uid, "Beslutsfattare": [uid]}
```

This code is used in chunk 240.
Defines:
`test_pseudonymize_keeps_uids`, never used.
Uses `pseudonymize` 260b.

The record form of `Attestant` in a result history must keep its UID too, while its name fields are replaced. And LADOK's own text that the examiner is missing names no one, so it must come through as it is, for both fields.

261c ⟨*test functions* 245a⟩+≡

```
def test_pseudonymize_keeps_the_attestant_record() -> None:
  uid = "00000000-0000-0000-0000-000000000002"
  data = {"Attestant": {"Fornamn": "Anna", "Efternamn": "Andersson",
```

```
                          "Anvandarnamn": "anna@example.org", "Uid": uid}}
    ladok3.pseudonymize(data)
    assert data["Attestant"] == {"Fornamn": "Student",
                                 "Efternamn": "Studentzadeh",
                                 "Anvandarnamn": "user@domain.se", "Uid": uid}

@pytest.mark.parametrize("key", ["Attestant", "Beslutsfattare"])
def test_pseudonymize_keeps_the_missing_examiner_text(key) -> None:
    data = {key: "Uppgift om examinator saknas/Not applicable"}
    ladok3.pseudonymize(data)
    assert data == {key: "Uppgift om examinator saknas/Not applicable"}
```

This code is used in chunk 240.
Defines:
`test_pseudonymize_keeps_the_attestant_record`, never used.
`test_pseudonymize_keeps_the_missing_examiner_text`, never used.
Uses `pseudonymize` 260b.

Chapter 17

Grade-related API calls

17.1 grade_scales_JSON

To request the grading scales from LADOK, we request all of them and return a list of JSON data objects containing the grading scale data.

263 ⟨*LadokSession data methods* 249⟩+≡

```
def grade_scales_JSON(self) -> list:
  """
  Fetch all grading scales from LADOK.

  This returns the JSON variant's standard subset.  Use
  [[grade_scales_all_text()]] when the caller needs the broader XML response,
  including institution-specific scales.

  Returns:
      list: A list of JSON objects containing grading scale data from LADOK.

  Raises:
      Exception: If the request fails or returns an error status.
  """
  data = self.get_query(
    "/kataloginformation/internal/grunddata/betygsskala",
    content_type="application/vnd.ladok-kataloginformation+json;charset=UTF-8"
  )

  try:
    return data["Betygsskala"]
  except KeyError as err:
    err.add_note(f"Response data: {data}")
    raise LadokAPIError(f"Unexpected response format when fetching grading scales: "
                        f"missing 'Betygsskala' key") from err
```

Defines:
grade_scales_JSON, used in chunks 264 and 1487a.
Uses get_query 249, grade_scales_all_text 1487a, and LadokAPIError 242.

We add the following test. Every grade scale should have an ID, a code and its grades, and no ID should occur twice, since the grades of a result refer to their scale by ID.

264 ⟨*test functions* 245a⟩+≡

```
def test_grade_scales_JSON(ladok) -> None:
  scales = ladok.grade_scales_JSON()
  assert scales
  assert all(scale["ID"] and scale["Kod"] and scale["Betygsgrader"]
             for scale in scales)
  assert len({scale["ID"] for scale in scales}) == len(scales)
```

This code is used in chunk 240.
Defines:
`test_grade_scales_JSON`, never used.
Uses `grade_scales_JSON` 263.

The output looks like this.

```
[
  {
    "Benamning": {
      "sv": "Engradig skala för deltagande",
      "en": "One-grade scale for participation only"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Deltagit",
          "en": "Participated"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "102041",
        "Kod": "D",
        "Ordningsnummer": 1
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {},
    "ID": "102040",
    "Kod": "DT",
    "LarosateID": -1
  },
  {
    "Benamning": {
      "sv": "Engradig skala",
      "en": "One-grade scale"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
```

```
          "sv": "Godkänd",
          "en": "Pass"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "1907",
        "Kod": "G",
        "Ordningsnummer": 2
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {},
    "ID": "1",
    "Kod": "FOG",
    "LarosateID": -1
  },
  {
    "Benamning": {
      "sv": "Fyrgradig skala, sifferbetyg",
      "en": "Four-grade scale, digits"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Mycket väl godkänd",
          "en": "Pass with distinction"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "102036",
        "Kod": "5",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Väl godkänd",
          "en": "Pass with credit"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "102037",
        "Kod": "4",
        "Ordningsnummer": 2
      },
      {
        "Benamning": {
          "sv": "Godkänd",
          "en": "Pass"
        },
        "Dolt": false,
```

```
        "GiltigSomSlutbetyg": true,
        "ID": "102038",
        "Kod": "3",
        "Ordningsnummer": 3
      },
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Fail"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "102039",
        "Kod": "U",
        "Ordningsnummer": 4
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {},
    "ID": "102035",
    "Kod": "TH",
    "LarosateID": -1
  },
  {
    "Benamning": {
      "sv": "Tvågradig skala",
      "en": "Two-grade scale"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Godkänd",
          "en": "Pass"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "2302",
        "Kod": "G",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Fail"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "2303",
        "Kod": "U",
        "Ordningsnummer": 2
```

```
        }
      ],
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "2",
      "Kod": "UG",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Fyrgradig skala, bokstavsbetyg",
        "en": "Four-grade scale, letters"
      },
      "Beskrivning": {},
      "Betygsgrader": [
        {
          "Benamning": {
            "sv": "Med beröm godkänd",
            "en": "Pass with distinction"
          },
          "Dolt": false,
          "GiltigSomSlutbetyg": true,
          "ID": "102031",
          "Kod": "AB",
          "Ordningsnummer": 1
        },
        {
          "Benamning": {
            "sv": "Icke utan beröm godkänd",
            "en": "Pass with credit"
          },
          "Dolt": false,
          "GiltigSomSlutbetyg": true,
          "ID": "102032",
          "Kod": "BA",
          "Ordningsnummer": 2
        },
        {
          "Benamning": {
            "sv": "Godkänd",
            "en": "Pass"
          },
          "Dolt": false,
          "GiltigSomSlutbetyg": true,
          "ID": "102033",
          "Kod": "B",
          "Ordningsnummer": 3
        },
        {
          "Benamning": {
            "sv": "Underkänd",
```

```
          "en": "Fail"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "102034",
        "Kod": "U",
        "Ordningsnummer": 4
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {},
    "ID": "102030",
    "Kod": "UM",
    "LarosateID": -1
  },
  {
    "Benamning": {
      "sv": "Tregradig skala",
      "en": "Three-grade scale"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Väl godkänd",
          "en": "Pass with distinction"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "101313",
        "Kod": "VG",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Godkänd",
          "en": "Pass"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "101314",
        "Kod": "G",
        "Ordningsnummer": 2
      },
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Fail"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
```

```
        "ID": "101315",
        "Kod": "U",
        "Ordningsnummer": 3
      }
    ],
    "Dolt": false,
    "Giltighetsperiod": {},
    "ID": "101312",
    "Kod": "UV",
    "LarosateID": -1
  },
  {
    "Benamning": {
      "sv": "Z_Felaktig",
      "en": "Three-grade scale"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Väl godkänd",
          "en": "Pass with distinction"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "101311",
        "Kod": "VG",
        "Ordningsnummer": 1
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {
      "Slutdatum": "0001-01-01"
    },
    "ID": "101310",
    "Kod": "UVX",
    "LarosateID": -1
  },
  {
    "Benamning": {
      "sv": "Sjugradig betygsskala",
      "en": "Seven point grading scale"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Utmärkt",
          "en": "Excellent"
        },
        "Dolt": false,
```

```
        "GiltigSomSlutbetyg": true,
        "ID": "131661",
        "Kod": "A",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Mycket bra",
          "en": "Very Good"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131667",
        "Kod": "B",
        "Ordningsnummer": 2
      },
      {
        "Benamning": {
          "sv": "Bra",
          "en": "Good"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131673",
        "Kod": "C",
        "Ordningsnummer": 3
      },
      {
        "Benamning": {
          "sv": "Tillfredsställande",
          "en": "Satisfactory"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131679",
        "Kod": "D",
        "Ordningsnummer": 4
      },
      {
        "Benamning": {
          "sv": "Tillräcklig",
          "en": "Sufficient"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131691",
        "Kod": "E",
        "Ordningsnummer": 5
      },
      {
        "Benamning": {
```

```
          "sv": "Underkänd",
          "en": "Not satisfactory"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "131696",
        "Kod": "FX",
        "Ordningsnummer": 6
      },
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Failed"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "131697",
        "Kod": "F",
        "Ordningsnummer": 7
      }
    ],
    "Dolt": false,
    "Giltighetsperiod": {
      "Startdatum": "2007-07-01"
    },
    "ID": "131657",
    "Kod": "AF",
    "LarosateID": 29
  },
  {
    "Benamning": {
      "sv": "GD",
      "en": "GD"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Godkänd",
          "en": "Pass"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131680",
        "Kod": "G",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Deltagit",
          "en": "Attended"
```

```
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131688",
        "Kod": "D",
        "Ordningsnummer": 2
      },
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Not satisfactory"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "131689",
        "Kod": "U",
        "Ordningsnummer": 3
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {},
    "ID": "131650",
    "Kod": "GD",
    "LarosateID": 29
  },
  {
    "Benamning": {
      "sv": "MH",
      "en": "MH"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Fem+",
          "en": "Five+"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131660",
        "Kod": "55",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Fem",
          "en": "Five"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131664",
```

```
        "Kod": "50",
        "Ordningsnummer": 2
      },
      {
        "Benamning": {
          "sv": "Fyra+",
          "en": "Four+"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131674",
        "Kod": "45",
        "Ordningsnummer": 3
      },
      {
        "Benamning": {
          "sv": "Fyra",
          "en": "Four"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131678",
        "Kod": "40",
        "Ordningsnummer": 4
      },
      {
        "Benamning": {
          "sv": "Fem++",
          "en": "Five++"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131692",
        "Kod": "60",
        "Ordningsnummer": 5
      },
      {
        "Benamning": {
          "sv": "Tre+",
          "en": "Three+"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131693",
        "Kod": "35",
        "Ordningsnummer": 6
      },
      {
        "Benamning": {
          "sv": "Tre",
          "en": "Three"
```

```
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131694",
        "Kod": "30",
        "Ordningsnummer": 7
      },
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Not satisfactory"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "131695",
        "Kod": "U",
        "Ordningsnummer": 8
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {},
    "ID": "131651",
    "Kod": "MH",
    "LarosateID": 29
  },
  {
    "Benamning": {
      "sv": "Okänd betygsskala",
      "en": "Unknown grading scale"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Not satisfactory"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "131672",
        "Kod": "FX",
        "Ordningsnummer": 1
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {
      "Slutdatum": "2018-06-19"
    },
    "ID": "131654",
    "Kod": "OKÄND",
    "LarosateID": 29
```

```
  },
  {
    "Benamning": {
      "sv": "Tvågradig betygsskala",
      "en": "Two point grading scale"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Godkänd",
          "en": "Pass"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131658",
        "Kod": "P",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Failed"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "131663",
        "Kod": "F",
        "Ordningsnummer": 2
      }
    ],
    "Dolt": false,
    "Giltighetsperiod": {},
    "ID": "131656",
    "Kod": "PF",
    "LarosateID": 29
  },
  {
    "Benamning": {
      "sv": "SS",
      "en": "SS"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Sex",
          "en": "Six"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
```

```
        "ID": "131665",
        "Kod": "6",
        "Ordningsnummer": 1
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {},
    "ID": "131653",
    "Kod": "SS",
    "LarosateID": 29
  },
  {
    "Benamning": {
      "sv": "TH",
      "en": "TH"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Fem",
          "en": "Five"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131675",
        "Kod": "5",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Fyra",
          "en": "Four"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131677",
        "Kod": "4",
        "Ordningsnummer": 2
      },
      {
        "Benamning": {
          "sv": "Tre",
          "en": "Three"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131682",
        "Kod": "3",
        "Ordningsnummer": 3
      },
```

```
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Not satisfactory"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "131690",
        "Kod": "U",
        "Ordningsnummer": 4
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {
      "Slutdatum": "2018-06-19"
    },
    "ID": "131669",
    "Kod": "TH",
    "LarosateID": 29
  },
  {
    "Benamning": {
      "sv": "TP",
      "en": "TP"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Fem",
          "en": "Five"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131666",
        "Kod": "5",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Fyra",
          "en": "Four"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131698",
        "Kod": "4",
        "Ordningsnummer": 2
      },
      {
        "Benamning": {
```

```
          "sv": "Tre",
          "en": "Three"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131699",
        "Kod": "3",
        "Ordningsnummer": 3
      },
      {
        "Benamning": {
          "sv": "Godkänd",
          "en": "Pass"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131700",
        "Kod": "G",
        "Ordningsnummer": 4
      },
      {
        "Benamning": {
          "sv": "Deltagit",
          "en": "Attended"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131701",
        "Kod": "D",
        "Ordningsnummer": 5
      },
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Not satisfactory"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "131702",
        "Kod": "U",
        "Ordningsnummer": 6
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {},
    "ID": "131652",
    "Kod": "TP",
    "LarosateID": 29
  },
  {
    "Benamning": {
```

```
      "sv": "UV",
      "en": "UV"
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Väl godkänd",
          "en": "Pass with Distinction"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131670",
        "Kod": "VG",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Godkänd",
          "en": "Pass"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131671",
        "Kod": "G",
        "Ordningsnummer": 2
      },
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Not satisfactory"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "131676",
        "Kod": "U",
        "Ordningsnummer": 3
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {
      "Slutdatum": "2018-06-19"
    },
    "ID": "131668",
    "Kod": "UV",
    "LarosateID": 29
  },
  {
    "Benamning": {
      "sv": "XX",
      "en": "XX"
```

```
    },
    "Beskrivning": {},
    "Betygsgrader": [
      {
        "Benamning": {
          "sv": "Sju",
          "en": "Seven"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131659",
        "Kod": "7",
        "Ordningsnummer": 1
      },
      {
        "Benamning": {
          "sv": "Sex",
          "en": "Six"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131662",
        "Kod": "6",
        "Ordningsnummer": 2
      },
      {
        "Benamning": {
          "sv": "Fem",
          "en": "Five"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131681",
        "Kod": "5",
        "Ordningsnummer": 3
      },
      {
        "Benamning": {
          "sv": "Fyra",
          "en": "Four"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131683",
        "Kod": "4",
        "Ordningsnummer": 4
      },
      {
        "Benamning": {
          "sv": "Tre",
          "en": "Tree"
```

```
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131684",
        "Kod": "3",
        "Ordningsnummer": 5
      },
      {
        "Benamning": {
          "sv": "Godkänd",
          "en": "Pass"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131685",
        "Kod": "G",
        "Ordningsnummer": 6
      },
      {
        "Benamning": {
          "sv": "Deltagit",
          "en": "Attended"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": true,
        "ID": "131686",
        "Kod": "D",
        "Ordningsnummer": 7
      },
      {
        "Benamning": {
          "sv": "Underkänd",
          "en": "Not satisfactory"
        },
        "Dolt": false,
        "GiltigSomSlutbetyg": false,
        "ID": "131687",
        "Kod": "U",
        "Ordningsnummer": 8
      }
    ],
    "Dolt": true,
    "Giltighetsperiod": {},
    "ID": "131655",
    "Kod": "XX",
    "LarosateID": 29
  }
]
```

Chapter 18

Student-related API calls

Here we have collected API-calls related to students.

18.1 `get_student_data_JSON` and `get_student_data_by_uid_JSON`

This method fetches the basic information about a student based on personnummer. To pull the data based on personnummer we must actually form a search query. (This code is a merge of a slight adaptation of the code by Baltatzis and that of Chip.)

282 ⟨*LadokSession data methods* 249⟩+≡

```
######################################################################
#
# get_student_data_JSON
#
# person_nr          - personnummer, flera format accepteras enligt regex:
#                      (\d\d)?(\d\d)(\d\d\d\d)[+\-]?(\w\w\w\w)
#
# lang               - language code 'en' or 'sv', defaults to 'sv'
#
# RETURNERAR en dictionary med för- och efternamn and more
def get_student_data_JSON(self, person_nr_raw: str, lang: str = 'sv') -> dict:
  """
  Get student data from LADOK using a Swedish personal number (personnummer).

  Args:
      person_nr_raw (str): Swedish personal number in format YYYYMMDD-XXXX or similar
      lang (str, optional): Language code 'en' or 'sv'. Defaults to 'sv'.

  Returns:
      dict: Student data dictionary containing name, contact info, and more.

  Raises:
      Exception: If the personal number format is invalid.
      ValueError: If student cannot be found or multiple matches found.
  """
  person_nr =  format_personnummer(person_nr_raw)
```

```
    if not person_nr: raise LadokValidationError('Invalid person nr ' + person_nr_raw)

    response = self.session.get(
      url=self.base_gui_proxy_url +
        "/studentinformation/internal/student/filtrera"
        f"?personnummer={person_nr}"
        "&limit=2&page=1"
        "&orderby=EFTERNAMN_ASC&orderby=FORNAMN_ASC"
        "&orderby=PERSONNUMMER_ASC",
      headers=self.headers)

    if response.status_code == requests.codes.ok:
      record = response.json()["Resultat"]
    else:
      raise ValueError(
        f"can't find student based on personnummer {person_nr}: "
        f"bad response: {response.text}")

    if len(record) != 1:
      raise ValueError(
        f"can't find student based on personnummer {person_nr}: "
        f"not a unique match: {record}")

    return record[0]
```

Defines:
`get_student_data_JSON`, used in chunk 283a.
Uses `LadokValidationError` 242.

To test this function, we look a student up by personnummer and check that we get the student we expected. Rather than writing a personnummer into the test, we take it from the student's own record, looked up by UID, so the test holds no personal data and keeps working when the test environment changes. The request carries the personnummer in its URL, so the test is never recorded and runs only live (Chapter 24).

283a ⟨*test functions* 245a⟩+≡

```
def test_get_student_data_JSON(live, ladok) -> None:
  personnummer = ladok.get_student_data_by_uid_JSON(student_uid)["Personnummer"]
  record = ladok.get_student_data_JSON(personnummer)
  assert record["Uid"] == student_uid
```

This code is used in chunk 240.
Defines:
`test_get_student_data_JSON`, never used.
Uses `get_student_data_by_uid_JSON` 283b, `get_student_data_JSON` 282, and `student_uid` 240 1517a.

We also have the corresponding for LADOK's UID, which fetches the record directly.

283b ⟨*LadokSession data methods* 249⟩+≡

```
    ########################################################################
    #
    # get_student_data_by_uid_JSON
    #
```

```
  # uid                - Ladok ID
  #
  # RETURNERAR en dictionary med för- och efternamn and more
  def get_student_data_by_uid_JSON(self, uid: str) -> dict:
    """
    Get student data from LADOK using a LADOK UID.

    Args:
        uid (str): The student's unique LADOK identifier.

    Returns:
        dict: Student data dictionary containing personal information.

    Raises:
        AttributeError: If student cannot be found by the given UID.
    """
    data = self.get_query(
      f"/studentinformation/internal/student/{uid}",
      content_type="application/vnd.ladok-studentinformation+json;charset=UTF-8")

    return data
```

Defines:
`get_student_data_by_uid_JSON`, used in chunks 283a and 284.
Uses `get_query` 249.

To test this function, we do the following.

284 ⟨*test functions* 245a⟩+≡

```
def test_get_student_data_by_uid_JSON(ladok) -> None:
  assert ladok.get_student_data_by_uid_JSON(student_uid)["Uid"] == student_uid
```

This code is used in chunk 240.
Defines:
`test_get_student_data_by_uid_JSON`, never used.
Uses `get_student_data_by_uid_JSON` 283b and `student_uid` 240 1517a.

The result is the same for both method.


```
{
  "Avliden": false,
  "Efternamn": "Studentzadeh",
  "ExterntUID": "0b95cffc-3ba4-405f-b8d6-5edf2e014420",
  "FelVidEtableringExternt": false,
  "Fodelsedata": "1912-12-12",
  "Fornamn": "Student",
  "HarSamordningsnummer": false,
  "KonID": 0,
  "Personnummer": "19121212-1212",
  "SenastAndradAv": "user@domain.se",
  "SenastSparad": "2026-02-09T21:00:49.778",
  "Uid": "de709f81-a867-11e7-8dbf-78e86dc2470c"
}
```

18.2 get_student_contact_data_JSON

We want to get the contact info for a student from LADOK. This data includes email, postal address and phone number. It also includes when they were last updated.

285a ⟨*LadokSession data methods* 249⟩+≡

```
def get_student_contact_data_JSON(self, student_id: str) -> dict:
  """
  Returns contact data for student with student_id, returns JSON
  """
  try:
    return self.get_query(
      f"/studentinformation/internal/student/{student_id}/kontaktuppgifter",
      "application/vnd.ladok-studentinformation+json"
    )
  except LadokServerError as err:
    raise LadokServerError(f"LADOK server error when getting contact data for "
                           f"student {student_id}: {err}") from err
  except LadokAPIError as err:
    raise LadokAPIError(f"Failed to get contact data for "
                        f"student {student_id}: {err}") from err
```

Defines:
get_student_contact_data_JSON, used in chunks 245a and 285b.
Uses get_query 249, LadokAPIError 242, and LadokServerError 244.

We test this function.

285b ⟨*test functions* 245a⟩+≡

```
def test_get_student_contact_data_JSON(ladok) -> None:
  contact = ladok.get_student_contact_data_JSON(student_uid)
  assert contact["StudentUID"] == student_uid
```

This code is used in chunk 240.
Defines:
test_get_student_contact_data_JSON, never used.
Uses get_student_contact_data_JSON 285a and student_uid 240 1517a.

The output is as follows.


```
{
  "Epostadress": "user@domain.se",
  "EpostadressSenastAndrad": "2018-06-19T17:42:23.441",
  "LarosateID": -1,
  "Postadresser": [
    {
      "PostadressTyp": "FOLKBOKFORINGSADRESS",
      "Utdelningsadress": "Stora vägen 1",
      "Postnummer": "12345",
      "Postort": "Byn",
      "Land": "Sverige",
      "SenastAndrad": "2018-09-21T14:20:24.679"
    }
  ],
  "SenastAndradAv": "user@domain.se",
  "SenastSparad": "2018-06-19T17:42:23.457",
```

```
  "StudentUID": "de709f81-a867-11e7-8dbf-78e86dc2470c",
  "Telefonnummer": "0701234567",
  "TelefonnummerSenastAndrad": "2018-06-19T17:42:23.441",
  "Uid": "2ad333ce-a894-11e7-8f03-147ba8e44f36"
}
```

18.3 get_student_suspensions_JSON

We want to check if any student is suspended from studies. We can get a list of all suspension periods from LADOK.

286a ⟨*LadokSession data methods* 249⟩+≡

```
def get_student_suspensions_JSON(self, student_id: str) -> dict:
  """
  Returns suspensions from studies for student with student_id,
  returns JSON
  """
  try:
    return self.get_query(
      f"/studentinformation/internal/avstangning/student/{student_id}",
      "application/vnd.ladok-studentinformation+json"
    )
  except LadokServerError as err:
    raise LadokServerError(f"LADOK server error when getting suspensions for "
                           f"student {student_id}: {err}") from err
  except LadokAPIError as err:
    raise LadokAPIError(f"Failed to get suspensions for "
                        f"student {student_id}: {err}") from err
```

Defines:
  get_student_suspensions_JSON, used in chunk 286b.
Uses get_query 249, LadokAPIError 242, and LadokServerError 244.

We test this function.

286b ⟨*test functions* 245a⟩+≡

```
def test_get_student_suspensions_JSON(ladok) -> None:
  suspensions = ladok.get_student_suspensions_JSON(student_uid)["Avstangning"]
  assert isinstance(suspensions, list)
  assert all(suspension["StudentUID"] == student_uid
             for suspension in suspensions)
```

This code is used in chunk 240.
Defines:
  test_get_student_suspensions_JSON, never used.
Uses get_student_suspensions_JSON 286a and student_uid 240 1517a.

The output looks like this.

```
{
  "Avstangning": []
}
```

18.4 registrations_JSON

This methods returns *all* registrations for a student, i.e., registrations on courses and programmes.

287a ⟨*LadokSession data methods* 249⟩+≡

```
def registrations_JSON(self, student_id: str) -> list:
  """
  Return all registrations for student with ID student_id.
  """
  data = self.get_query(
    "/studiedeltagande/internal/tillfallesdeltagande/kurstillfallesdeltagande"
      f"/student/{student_id}",
    "application/vnd.ladok-studiedeltagande+json"
  )

  try:
    return data["Tillfallesdeltaganden"]
  except KeyError as err:
    err.add_note(f"Response data: {data}")
    raise LadokAPIError(f"Unexpected response format when fetching registrations for "
                        f"student {student_id}: missing 'Tillfallesdeltaganden' key") from err
```

Defines:
registrations_JSON, used in chunks 287b, 474b, and 1501b.
Uses get_query 249 and LadokAPIError 242.

We provide the following test.

287b ⟨*test functions* 245a⟩+≡

```
def test_registrations_JSON(ladok) -> None:
  results = ladok.registrations_JSON(student_uid)
  assert len({result["Uid"] for result in results}) == len(results)
  assert any(result["Utbildningsinformation"]["UtbildningUID"]
               == dasak_education_id
             for result in results)
```

This code is used in chunk 240.
Defines:
test_registrations_JSON, never used.
Uses dasak_education_id 240, registrations_JSON 287a, and student_uid 240 1517a.

The output looks like this.

```
[
  {
    "Aterbud": false,
    "Avklarad": false,
    "HarTillgodoraknande": false,
    "LarosateID": 29,
    "Nuvarande": true,
    "Paborjad": true,
    "Perioddeltaganden": [
      {
        "Anpassat": false,
        "Omfattningsvarde": "0.0",
        "Periodbenamningar": {},
```

```
      "PerioddeltagandeUID": "e2bbf16e-73db-11e8-b9fd-0a821ba7448e",
      "Periodindex": 1,
      "Registreringsperiod": {
        "Slutdatum": "2014-12-31",
        "Startdatum": "2014-07-21"
      },
      "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
      "UtbildningsPeriodFran": "2014-07-21",
      "UtbildningsPeriodTill": "2014-12-31"
    },
    {
      "Anpassat": false,
      "Omfattningsvarde": "0.0",
      "Periodbenamningar": {},
      "PerioddeltagandeUID": "e2bbf16f-73db-11e8-b9fd-0a821ba7448e",
      "Periodindex": 2,
      "Registreringsperiod": {
        "Slutdatum": "2015-06-30",
        "Startdatum": "2015-01-01"
      },
      "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
      "UtbildningsPeriodFran": "2015-01-01",
      "UtbildningsPeriodTill": "2015-06-30"
    },
    {
      "Anpassat": false,
      "Omfattningsvarde": "0.0",
      "Periodbenamningar": {},
      "PerioddeltagandeUID": "e2bbf170-73db-11e8-b9fd-0a821ba7448e",
      "Periodindex": 3,
      "Registreringsperiod": {
        "Slutdatum": "2015-12-31",
        "Startdatum": "2015-07-01"
      },
      "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
      "UtbildningsPeriodFran": "2015-07-01",
      "UtbildningsPeriodTill": "2015-12-31"
    },
    {
      "Anpassat": false,
      "Omfattningsvarde": "0.0",
      "Periodbenamningar": {},
      "PerioddeltagandeUID": "e2bbf171-73db-11e8-b9fd-0a821ba7448e",
      "Periodindex": 4,
      "Registreringsperiod": {
        "Slutdatum": "2016-06-30",
        "Startdatum": "2016-01-01"
      },
      "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
      "UtbildningsPeriodFran": "2016-01-01",
      "UtbildningsPeriodTill": "2016-06-30"
```

```
      },
      {
        "Anpassat": false,
        "Omfattningsvarde": "0.0",
        "Periodbenamningar": {},
        "PerioddeltagandeUID": "e2bbf172-73db-11e8-b9fd-0a821ba7448e",
        "Periodindex": 5,
        "Registreringsperiod": {
          "Slutdatum": "2016-12-31",
          "Startdatum": "2016-07-01"
        },
        "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
        "UtbildningsPeriodFran": "2016-07-01",
        "UtbildningsPeriodTill": "2016-12-31"
      },
      {
        "Anpassat": false,
        "Omfattningsvarde": "0.0",
        "Periodbenamningar": {},
        "PerioddeltagandeUID": "e2bbf173-73db-11e8-b9fd-0a821ba7448e",
        "Periodindex": 6,
        "Registreringsperiod": {
          "Slutdatum": "2017-06-30",
          "Startdatum": "2017-01-01"
        },
        "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
        "UtbildningsPeriodFran": "2017-01-01",
        "UtbildningsPeriodTill": "2017-06-30"
      },
      {
        "Anpassat": false,
        "Omfattningsvarde": "0.0",
        "Periodbenamningar": {},
        "PerioddeltagandeUID": "e2bbf174-73db-11e8-b9fd-0a821ba7448e",
        "Periodindex": 7,
        "Registreringsperiod": {
          "Slutdatum": "2017-12-31",
          "Startdatum": "2017-07-01"
        },
        "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
        "UtbildningsPeriodFran": "2017-07-01",
        "UtbildningsPeriodTill": "2017-12-31"
      },
      {
        "Anpassat": false,
        "Omfattningsvarde": "0.0",
        "Periodbenamningar": {},
        "PerioddeltagandeUID": "e2bbf175-73db-11e8-b9fd-0a821ba7448e",
        "Periodindex": 8,
        "Registreringsperiod": {
          "Slutdatum": "2018-06-30",
```

```
            "Startdatum": "2018-01-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2018-01-01",
          "UtbildningsPeriodTill": "2018-06-30"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "1f617c1b-bfdd-11e8-8049-fd7fef4b484c",
          "Periodindex": 9,
          "Registreringsperiod": {
            "Slutdatum": "2018-12-31",
            "Startdatum": "2018-07-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2018-07-01",
          "UtbildningsPeriodTill": "2018-12-31"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "1f617c1c-bfdd-11e8-8049-fd7fef4b484c",
          "Periodindex": 10,
          "Registreringsperiod": {
            "Slutdatum": "2019-06-30",
            "Startdatum": "2019-01-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2019-01-01",
          "UtbildningsPeriodTill": "2019-06-30"
        },
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            "en": "Full-time"
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            },
            {
              "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
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            }
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              "Varde": "grupp.for.utsokning.grundavanceradniva"
            },
            {
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        "Sjalvstandig": true
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          "en": "Full-time"
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        "ID": 24,
        "Kod": "2007AKURS",
        "RegelverkForUtbildningstyp": {
          "Regelvarden": [
            {
              "Regelnamn": "commons.domain.regel.krav_modul_for_status_komplett",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.avbrottsregel",
              "Varde": "20"
            },
            {
              "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
              "Varde": "grupp.for.utsokning.grundavanceradniva"
            },
            {
              "Regelnamn": "commons.domain.regel.informationsbehorighet.grundavancerad",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.kan_ha_plan_for_utbildning",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.kan_ha_litteraturlista",
              "Varde": "true"
            }
          ]
        },
        "Sjalvstandig": true
      },
      "Utbildningsversion": 3
    }
  }
]
```

18.5 registrations_on_course_JSON

This method returns all registrations for a particular course for a particular student. This way we can check if a student has been registered several times on a course.

474a ⟨*LadokSession data methods* 249⟩+≡

```
def registrations_on_course_JSON(
    self, course_education_id: str, student_id: str) -> list:
  """
  Return a list of registrations on course with education_id for student with
  student_id. JSON format.
  """
  data = self.get_query(
    "/studiedeltagande/internal/tillfallesdeltagande"
      f"/utbildning/{course_education_id}/student/{student_id}",
    "application/vnd.ladok-studiedeltagande+json"
  )

  try:
    return data["Tillfallesdeltaganden"]
  except KeyError as err:
    err.add_note(f"Response data: {data}")
    raise LadokAPIError(f"Unexpected response format when fetching registrations for "
                        f"student {student_id} on course {course_education_id}: "
                        f"missing 'Tillfallesdeltaganden' key") from err
```

Defines:
registrations_on_course_JSON, used in chunk 474b.
Uses get_query 249 and LadokAPIError 242.

We add the following test.

474b ⟨*test functions* 245a⟩+≡

```
def test_registrations_on_course_JSON(ladok) -> None:
  results = ladok.registrations_on_course_JSON(dasak_education_id, student_uid)
  all_registrations = ladok.registrations_JSON(student_uid)
  assert results
  assert all(result["Utbildningsinformation"]["UtbildningUID"]
                == dasak_education_id
             for result in results)
  assert ({result["Uid"] for result in results}
          <= {result["Uid"] for result in all_registrations})
```

This code is used in chunk 240.
Defines:
test_registrations_on_course_JSON, never used.
Uses dasak_education_id 240, registrations_JSON 287a, registrations_on_course_JSON 474a, and student_uid 240 1517a.

The output looks like this.

```
[
  {
    "Aterbud": false,
    "Avklarad": true,
    "Godkannandedatum": "2010-04-07",
    "HarTillgodoraknande": false,
```

```
    "LarosateID": 29,
    "Nuvarande": true,
    "Paborjad": true,
    "Perioddeltaganden": [
      {
        "Anpassat": false,
        "Omfattningsvarde": "6.0",
        "Periodbenamningar": {},
        "PerioddeltagandeUID": "9940554d-73f2-11e8-b9fd-0a821ba7448e",
        "Periodindex": 1,
        "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
        "UtbildningsPeriodFran": "2010-01-18",
        "UtbildningsPeriodTill": "2010-03-21"
      }
    ],
    "Sparrad": false,
    "Studiestrukturreferens": "6cd8b548-73e0-11e8-b9fd-0a821ba7448e,6ce3ffb8-73e0-11e8-b9fd-0a821ba7448e",
    "SummeradGodkandOmfattning": "6.0",
    "SummeradHeltTillgodoraknadOmfattning": "0.0",
    "SummeradTillgodoraknadOmfattning": "0.0",
    "TillstandKurs": {
      "Sammanfattat": "studiedeltagande.domain.tillstandsdefinition.avklarad",
      "Sammanfattattillstand": "studiedeltagande.domain.tillstandsdefinition.avklarad",
      "Tillfallesdeltagande": "studiedeltagande.domain.tillstandsdefinition.paborjad",
      "Utbildning": "studiedeltagande.domain.tillstandsdefinition.avklarad"
    },
    "Uid": "99402e3c-73f2-11e8-b9fd-0a821ba7448e",
    "Utbildningsinformation": {
      "AntalPerioder": 1,
      "Benamning": {
        "sv": "Datasäkerhet",
        "en": "Computer Security"
      },
      "Enhetskod": "HP",
      "FinansieringsformID": 101050,
      "LarosateID": 29,
      "Omfattningsvarde": "6.0",
      "PeriodIOrdning": "0",
      "Perioder": [
        {
          "Index": 1,
          "Omfattningsvarde": "6.0",
          "Slutdatum": "2010-03-21",
          "Startdatum": "2010-01-18",
          "Uid": "79a9402f-73da-11e8-afa7-8e408e694e54"
        }
      ],
      "SarskildSekretessprovning": false,
      "Studielokalisering": {
        "sv": "Stockholm",
        "en": "Stockholm"
```

```
      },
      "Studielokaliseringrepresentation": {
        "Benamningar": {
          "sv": "Stockholm",
          "en": "Stockholm"
        },
        "Giltighetsperiod": {
          "Slutdatum": "2019-01-14",
          "Startdatum": "1917-10-19"
        },
        "ID": 131778,
        "Kod": "0180"
      },
      "StudieordningID": "1",
      "Studieperiod": {
        "Slutdatum": "2010-03-21",
        "Startdatum": "2010-01-18"
      },
      "Studietakt": {
        "Benamning": {
          "sv": "Helfart",
          "en": "Full-time"
        },
        "Takt": 100
      },
      "Undervisningsform": {
        "Benamningar": {
          "sv": "Normal",
          "en": "Normal teaching"
        },
        "Giltighetsperiod": {},
        "ID": 1
      },
      "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
      "UtbildningensOmfattningsvarde": "6.0",
      "UtbildningsinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
      "Utbildningskod": "DD2395",
      "UtbildningstillfalleUID": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
      "Utbildningstillfalleskod": "81099",
      "Utbildningstillfallestyp": {
        "Benamningar": {
          "sv": "Kurstillfälle",
          "en": "Course instance"
        },
        "Giltighetsperiod": {},
        "Grundtyp": "KURS",
        "ID": 52,
        "Kod": "2007KTF",
        "RegelverkForUtbildningstyp": {
          "Regelvarden": [
            {
```

```
            "Regelnamn": "commons.domain.regel.kan.utannonseras",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.atgard_vid_overskriden_terminsgrans",
            "Varde": "varning"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.grundavancerad",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
            "Varde": "true"
          }
        ]
      },
      "Sjalvstandig": false
    },
    "Utbildningstyp": {
      "Benamningar": {
        "sv": "Kurs, avancerad nivå",
        "en": "Course, Second-cycle"
      },
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": 24,
      "Kod": "2007AKURS",
      "RegelverkForUtbildningstyp": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.krav_modul_for_status_komplett",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.avbrottsregel",
            "Varde": "20"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.grundavancerad",
            "Varde": "true"
          },
          {
```

```
              "Regelnamn": "commons.domain.regel.kan_ha_plan_for_utbildning",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.kan_ha_litteraturlista",
              "Varde": "true"
            }
          ]
        },
        "Sjalvstandig": true
      },
      "Utbildningsversion": 1
    }
  }
]
```

18.6 studystructure_student_JSON

We also want to get a student's study structure, that is programmes that they are admitted to.

478a ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def studystructure_student_JSON(self, uid: str) -> dict:
    """
    Returns a dictionary of student information. This contains programmes that
    the student is admitted to.
    """
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/studiedeltagande/internal/studiestruktur/student/'+uid,
      headers=self.headers)
    if r.status_code == 200:
      return r.json()
    raise LadokAPIError(f"can't get study structure for student {uid}: {r.text}")
```

Defines:
studystructure_student_JSON, used in chunk 478b.
Uses LadokAPIError 242.

Let's add a test. The student's study structures each wrap a programme participation, so we check that there is at least one and that each has a participation.

478b ⟨*test functions* 245a⟩+≡

```
def test_studystructure_student_JSON(ladok) -> None:
  structures = ladok.studystructure_student_JSON(student_uid)["Studiestrukturer"]
  assert structures
  assert all(structure["Tillfallesdeltagande"]["Uid"]
             for structure in structures)
```

This code is used in chunk 240.
Defines:
`test_studystructure_student_JSON`, never used.
Uses `student_uid` 240 1517a and `studystructure_student_JSON` 478a.

The output looks like this:


```
{
  "Studiestrukturer": [
    {
      "Barn": [],
      "Referens": "8d2faf86-73d9-11e8-b9fd-0a821ba7448e,null",
      "Tillfallesdeltagande": {
        "Aterbud": false,
        "Avklarad": false,
        "HarPagandeUppehall": false,
        "LarosateID": 29,
        "Nuvarande": true,
        "Paborjad": true,
        "SenareDel": false,
        "Sparrad": false,
        "Studiestrukturreferens": "8d2faf86-73d9-11e8-b9fd-0a821ba7448e,null",
        "SummeradGodkandOmfattning": "16.0",
        "SummeradHeltTillgodoraknadOmfattning": "24.0",
        "SummeradTillgodoraknadOmfattning": "0.0",
        "Tillganglighet": {
          "RegistreringTillgangligtFranOchMed": "2014-07-01",
          "ValTillgangligtFranOchMed": "2014-07-01"
        },
        "TillstandKurspaketering": {
          "Sammanfattat": "studiedeltagande.domain.tillstandsdefinition.ejpagaende.pga.inaktivitet",
          "Tillfallesdeltagande": "studiedeltagande.domain.tillstandsdefinition.ejpagaende.pga.inaktivitet
          "Utbildning": "studiedeltagande.domain.tillstandsdefinition.pagaende"
        },
        "Uid": "8d2faf85-73d9-11e8-b9fd-0a821ba7448e",
        "Utbildningsinformation": {
          "AntalPerioder": 1,
          "AvsesLedaTill": "DOKTORSEXAMEN",
          "Benamning": {
            "sv": "Datalogi",
            "en": "Computer Science"
          },
          "Enhetskod": "HP",
          "LarosateID": 29,
          "Omfattningsvarde": "240.0",
          "PeriodIOrdning": "0",
          "Perioder": [
            {
              "Index": 1,
              "Omfattningsvarde": "240.0",
              "Slutdatum": "9999-12-31",
              "Startdatum": "2014-07-21",
```

```
            "Uid": "d5eb2e64-73d8-11e8-afa7-8e408e694e54"
          }
        ],
        "SarskildSekretessprovning": false,
        "SenareDel": false,
        "SpecificeratOmfattningsvarde": "240.0",
        "StudieordningID": "1",
        "Studieperiod": {
          "Startdatum": "2014-07-21"
        },
        "UtbildningUID": "8d323cdf-73d8-11e8-afa7-8e408e694e54",
        "UtbildningensOmfattningsvarde": "240.0",
        "UtbildningsinstansUID": "8d31c808-73d8-11e8-b4e0-063f9afb40e3",
        "Utbildningskod": "DATALOGI",
        "UtbildningssamarbeteID": 134769,
        "UtbildningstillfalleUID": "d5eab999-73d8-11e8-b4e0-063f9afb40e3",
        "Utbildningstillfalleskod": "KONV-02DB8",
        "Utbildningstillfallestyp": {
          "Benamningar": {
            "sv": "\u00c4mnestillf\u00e4lle, forskarniv\u00e5",
            "en": "Subject instance, Third-cycle"
          },
          "Giltighetsperiod": {},
          "Grundtyp": "KURSPAKETERING",
          "ID": 101957,
          "Kod": "2007FATF",
          "RegelverkForUtbildningstyp": {
            "Regelvarden": [
              {
                "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
                "Varde": "grupp.for.utsokning.forskarniva"
              },
              {
                "Regelnamn": "commons.domain.regel.informationsbehorighet.forskarutbildning",
                "Varde": "true"
              }
            ]
          },
          "Sjalvstandig": false
        },
        "Utbildningstyp": {
          "Benamningar": {
            "sv": "\u00c4mne, forskarniv\u00e5",
            "en": "Subject, Third-cycle"
          },
          "Giltighetsperiod": {},
          "Grundtyp": "KURSPAKETERING",
          "ID": 101956,
          "Kod": "2007FA",
          "RegelverkForUtbildningstyp": {
            "Regelvarden": [
```

```
                {
                  "Regelnamn": "commons.domain.regel.kan_ha_plan_for_utbildning",
                  "Varde": "true"
                },
                {
                  "Regelnamn": "commons.domain.regel.forvald.omfattning",
                  "Varde": "240"
                },
                {
                  "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
                  "Varde": "grupp.for.utsokning.forskarniva"
                },
                {
                  "Regelnamn": "commons.domain.regel.informationsbehorighet.forskarutbildning",
                  "Varde": "true"
                }
              ]
            },
            "Sjalvstandig": true
          },
          "Utbildningsversion": 1
        },
        "YtterstaPaketeringen": true
      },
      "Utbildningsinformation": {
        "AntalPerioder": 1,
        "AvsesLedaTill": "DOKTORSEXAMEN",
        "Benamning": {
          "sv": "Datalogi",
          "en": "Computer Science"
        },
        "Enhetskod": "HP",
        "LarosateID": 29,
        "Omfattningsvarde": "240.0",
        "PeriodIOrdning": "0",
        "Perioder": [
          {
            "Index": 1,
            "Omfattningsvarde": "240.0",
            "Slutdatum": "9999-12-31",
            "Startdatum": "2014-07-21",
            "Uid": "d5eb2e64-73d8-11e8-afa7-8e408e694e54"
          }
        ],
        "SarskildSekretessprovning": false,
        "SenareDel": false,
        "SpecificeratOmfattningsvarde": "240.0",
        "StudieordningID": "1",
        "Studieperiod": {
          "Startdatum": "2014-07-21"
        },
```

```
        "UtbildningUID": "8d323cdf-73d8-11e8-afa7-8e408e694e54",
        "UtbildningensOmfattningsvarde": "240.0",
        "UtbildningsinstansUID": "8d31c808-73d8-11e8-b4e0-063f9afb40e3",
        "Utbildningskod": "DATALOGI",
        "UtbildningssamarbeteID": 134769,
        "UtbildningstillfalleUID": "d5eab999-73d8-11e8-b4e0-063f9afb40e3",
        "Utbildningstillfalleskod": "KONV-02DB8",
        "Utbildningstillfallestyp": {
          "Benamningar": {
            "sv": "\u00c4mnestillf\u00e4lle, forskarniv\u00e5",
            "en": "Subject instance, Third-cycle"
          },
          "Giltighetsperiod": {},
          "Grundtyp": "KURSPAKETERING",
          "ID": 101957,
          "Kod": "2007FATF",
          "RegelverkForUtbildningstyp": {
            "Regelvarden": [
              {
                "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
                "Varde": "grupp.for.utsokning.forskarniva"
              },
              {
                "Regelnamn": "commons.domain.regel.informationsbehorighet.forskarutbildning",
                "Varde": "true"
              }
            ]
          },
          "Sjalvstandig": false
        },
        "Utbildningstyp": {
          "Benamningar": {
            "sv": "\u00c4mne, forskarniv\u00e5",
            "en": "Subject, Third-cycle"
          },
          "Giltighetsperiod": {},
          "Grundtyp": "KURSPAKETERING",
          "ID": 101956,
          "Kod": "2007FA",
          "RegelverkForUtbildningstyp": {
            "Regelvarden": [
              {
                "Regelnamn": "commons.domain.regel.kan_ha_plan_for_utbildning",
                "Varde": "true"
              },
              {
                "Regelnamn": "commons.domain.regel.forvald.omfattning",
                "Varde": "240"
              },
              {
                "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
```

```
                "Varde": "grupp.for.utsokning.forskarniva"
              },
              {
                "Regelnamn": "commons.domain.regel.informationsbehorighet.forskarutbildning",
                "Varde": "true"
              }
            ]
          },
          "Sjalvstandig": true
        },
        "Utbildningsversion": 1
      }
    },
    {
      "Barn": [
        {
          "Barn": [],
          "Referens": "6cd8b548-73e0-11e8-b9fd-0a821ba7448e,6ce3ffb8-73e0-11e8-b9fd-0a821ba7448e",
          "ReferensTillForalder": "6cd8b548-73e0-11e8-b9fd-0a821ba7448e,null",
          "Tillfallesdeltagande": {
            "Aterbud": false,
            "Avklarad": true,
            "Godkannandedatum": "2012-04-26",
            "HarPagandeUppehall": false,
            "LarosateID": 29,
            "Nuvarande": true,
            "Paborjad": true,
            "Sparrad": false,
            "Studiestrukturreferens": "6cd8b548-73e0-11e8-b9fd-0a821ba7448e,6ce3ffb8-73e0-11e8-b9fd-0a821b
            "SummeradGodkandOmfattning": "300.0",
            "SummeradHeltTillgodoraknadOmfattning": "0.0",
            "SummeradTillgodoraknadOmfattning": "34.5",
            "Tillganglighet": {
              "RegistreringTillgangligtFranOchMed": "2006-08-28",
              "ValTillgangligtFranOchMed": "2006-08-28"
            },
            "TillstandKurspaketering": {
              "Sammanfattat": "studiedeltagande.domain.tillstandsdefinition.avklarad",
              "Tillfallesdeltagande": "studiedeltagande.domain.tillstandsdefinition.ejpagaende.pga.inaktiv
              "Utbildning": "studiedeltagande.domain.tillstandsdefinition.avklarad"
            },
            "Uid": "6ce3ffb6-73e0-11e8-b9fd-0a821ba7448e",
            "Utbildningsinformation": {
              "AntalPerioder": 1,
              "Benamning": {
                "sv": "Matematik och IT-datateknik",
                "en": "Mathematics and Information Technology and Computer Science"
              },
              "Enhetskod": "HP-K",
              "FinansieringsformID": 101050,
              "LarosateID": 29,
```

```
            "Omfattningsvarde": "300.0",
            "PeriodIOrdning": "0",
            "Perioder": [
              {
                "Index": 1,
                "Omfattningsvarde": "300.0",
                "Slutdatum": "2011-05-28",
                "Startdatum": "2006-08-30",
                "Uid": "54d35cc2-73db-11e8-afa7-8e408e694e54"
              }
            ],
            "SarskildSekretessprovning": false,
            "SenareDel": false,
            "Studielokalisering": {
              "sv": "Stockholm",
              "en": "Stockholm"
            },
            "Studielokaliseringrepresentation": {
              "Benamningar": {
                "sv": "Stockholm",
                "en": "Stockholm"
              },
              "Giltighetsperiod": {
                "Slutdatum": "2019-01-14",
                "Startdatum": "1917-10-19"
              },
              "ID": 131778,
              "Kod": "0180"
            },
            "StudieordningID": "2",
            "Studieperiod": {
              "Slutdatum": "2011-05-28",
              "Startdatum": "2006-08-30"
            },
            "Studietakt": {
              "Benamning": {
                "sv": "Helfart",
                "en": "Full-time"
              },
              "Takt": 100
            },
            "Undervisningsform": {
              "Benamningar": {
                "sv": "Normal",
                "en": "Normal teaching"
              },
              "Giltighetsperiod": {},
              "ID": 1
            },
            "UtbildningUID": "a0bbeaf4-73d8-11e8-afa7-8e408e694e54",
            "UtbildningensOmfattningsvarde": "300.0",
```

```
            "UtbildningsinstansUID": "a0bbeaf2-73d8-11e8-afa7-8e408e694e54",
            "Utbildningskod": "MADA",
            "UtbildningstillfalleUID": "54d30e44-73db-11e8-b4e0-063f9afb40e3",
            "Utbildningstillfalleskod": "32118",
            "Utbildningstillfallestyp": {
              "Benamningar": {
                "sv": "Inriktningstillf\u00e4lle",
                "en": "Specialisation instance"
              },
              "Giltighetsperiod": {},
              "Grundtyp": "KURSPAKETERING",
              "ID": 101961,
              "Kod": "1993INRTF",
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                  },
                  {
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                    "Varde": "true"
                  }
                ]
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                "en": "Specialisation"
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                  {
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                  }
                ]
```

```
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                {
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                }
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                {
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      "HarPagandeUppehall": false,
      "LarosateID": 29,
      "Nuvarande": true,
      "Paborjad": true,
      "SenareDel": false,
      "Sparrad": false,
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        "Utbildning": "studiedeltagande.domain.tillstandsdefinition.avklarad"
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      "Kod": "0180"
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        "en": "Full-time"
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    "Undervisningsform": {
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        "en": "Normal teaching"
```

```
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    "UtbildningsinstansUID": "a0ae2f1d-73d8-11e8-afa7-8e408e694e54",
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          },
          {
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          {
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          {
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        ]
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        "en": "Programme"
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      "Giltighetsperiod": {},
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                },
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                  "Varde": "grupp.for.utsokning.grundavanceradniva"
                },
                {
                  "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
                  "Varde": "true"
                },
                {
                  "Regelnamn": "commons.domain.regel.informationsbehorighet.grundavancerad",
                  "Varde": "true"
                }
              ]
            },
            "Sjalvstandig": true
          },
          "Utbildningsversion": 1
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        "YtterstaPaketeringen": true
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        "AntalPerioder": 1,
        "Benamning": {
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          "en": "Master of Science in Engineering and of Education"
        },
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        "PeriodIOrdning": "0",
        "Perioder": [
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            "Uid": "d674e59d-73da-11e8-afa7-8e408e694e54"
          }
        ],
        "SarskildSekretessprovning": false,
        "SenareDel": false,
```

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          "en": "Stockholm"
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            "en": "Stockholm"
          },
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            "Startdatum": "1917-10-19"
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          "ID": 131778,
          "Kod": "0180"
        },
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        "Studietakt": {
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            "en": "Full-time"
          },
          "Takt": 100
        },
        "Undervisningsform": {
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            "en": "Normal teaching"
          },
          "Giltighetsperiod": {},
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        "UtbildningensOmfattningsvarde": "300.0",
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        "Utbildningskod": "CL",
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        "Utbildningstillfallestyp": {
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                  "Varde": "true"
                },
                {
                  "Regelnamn": "commons.domain.regel.atgard_vid_orimligt_omfattningsvarde",
                  "Varde": "varning"
                },
                {
                  "Regelnamn": "commons.domain.regel.informationsbehorighet.grundavancerad",
                  "Varde": "true"
                },
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                }
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            "Sjalvstandig": false
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              "en": "Programme"
            },
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                },
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                  "Varde": "grupp.for.utsokning.grundavanceradniva"
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                  "Varde": "true"
                },
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```

```
760                 "Varde": "true"
761               }
762             ]
763           },
764           "Sjalvstandig": true
765         },
766         "Utbildningsversion": 1
767       }
768     }
769   ]
770 }
```

Chapter 19

Course-related API calls

19.1 search_course_rounds_JSON

We want to search for course rounds by one or more keys.

495a ⟨*LadokSession data methods* 249⟩+≡

```
def search_course_rounds_JSON(self, /, **kwargs) -> list:
  """Query LADOK about course rounds, possible keys:
  code, round_code, name
  """
  url = "/resultat/internal/kurstillfalle/filtrera?"

  if "code" in kwargs:
    url += f"kurskod={kwargs['code']}&"
  if "name" in kwargs:
    url += f"benamning={kwargs['name']}&"
  if "round_code" in kwargs:
    url += f"tillfalleskod={kwargs['round_code']}&"

  url += "page=1&limit=400&sprakkod=sv"

  data = self.get_query(url)

  try:
    return data["Resultat"]
  except KeyError as err:
    err.add_note(f"Response data: {data}")
    raise LadokAPIError(f"Unexpected response format when searching for course rounds: "
                        f"missing 'Resultat' key") from err
```

Defines:
search_course_rounds_JSON, used in chunk 495b.
Uses get_query 249 and LadokAPIError 242.

We add the following test.

495b ⟨*test functions* 245a⟩+≡

```
def test_search_course_rounds_JSON(ladok) -> None:
  results = ladok.search_course_rounds_JSON(code="DD1317")
  assert results
```

This code is used in chunk 240.
Defines:
`test_search_course_rounds_JSON`, never used.
Uses `search_course_rounds_JSON` 495a.

The output looks like this.


```
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    "StudietaktID": 6,
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    "UndervisningsformID": 1,
    "Utbildningsinstans": {
      "Avvecklad": false,
      "Benamning": [
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          "Sprakkod": "sv",
          "Text": "Programmeringsteknik"
        },
        {
          "Sprakkod": "en",
          "Text": "Programming Techniques"
        }
      ],
      "Enhet": "HP",
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      "OrganisationUID": "638add54-dc41-11e8-8cc1-eaeeb71b497f",
      "ResultatPaKursVidAttesteringAvModul": false,
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      "UtbildningUID": "70d5fdb9-2db7-11ec-bb06-8c8c04c8482a",
      "Utbildningskod": "DD1317",
      "Versionsnummer": 1
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  {
    "FinansieringsformID": 101050,
    "Slutdatum": "2026-01-12",
    "Startdatum": "2025-08-25",
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    "StudietaktID": 6,
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    "Uid": "c2e79045-b95c-11ef-9553-beecfac44351",
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    "Utbildningsinstans": {
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```

```
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    "Startdatum": "2024-08-26",
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```

```
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          "Text": "Programmeringsteknik"
        },
        {
          "Sprakkod": "en",
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148           "Text": "Programming Techniques"
149         }
150       ],
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152       "GallerUtbildningUtanAngivenOmfattning": false,
153       "Omfattning": 7.5,
154       "OrganisationUID": "638add54-dc41-11e8-8cc1-eaeeb71b497f",
155       "ResultatPaKursVidAttesteringAvModul": false,
156       "Uid": "70d5fdb1-2db7-11ec-bb06-8c8c04c8482a",
157       "UtbildningUID": "70d5fdb9-2db7-11ec-bb06-8c8c04c8482a",
158       "Utbildningskod": "DD1317",
159       "Versionsnummer": 1
160     }
161   }
162 ]
```

19.2 course_rounds_JSON

This method fetches all course rounds that uses the given course instance.

499a ⟨*LadokSession data methods* 249⟩+≡

```
def course_rounds_JSON(self, course_instance_id: str) -> list:
  """Requires course instance ID"""
  data = self.get_query(
    f"/resultat/internal/kurstillfalle/kursinstans/{course_instance_id}"
  )

  try:
    return data["Utbildningstillfalle"]
  except KeyError as err:
    err.add_note(f"Response data: {data}")
    raise LadokAPIError(f"Unexpected response format when fetching course rounds for "
                        f"instance {course_instance_id}: missing 'Utbildningstillfalle' key") from err
```

Defines:
course_rounds_JSON, used in chunk 499b.
Uses get_query 249 and LadokAPIError 242.

We test this method as follows.

499b ⟨*test functions* 245a⟩+≡

```
def test_course_rounds_JSON(ladok) -> None:
  results = ladok.course_rounds_JSON(dasak_instance_id)
  assert results
  assert all(result["Utbildningsinstans"]["Uid"] == dasak_instance_id
             for result in results)
```

This code is used in chunk 240.
Defines:
test_course_rounds_JSON, never used.
Uses course_rounds_JSON 499a and dasak_instance_id 240.

The output looks like this.

```
[
  {
```

```
    "FinansieringsformID": 131738,
    "Slutdatum": "2019-01-14",
    "Startdatum": "2018-10-29",
    "StudielokaliseringID": 131778,
    "StudietaktID": 5,
    "TillfallesKod": "10069",
    "Uid": "79b4b213-73da-11e8-b4e0-063f9afb40e3",
    "UndervisningsformID": 1,
    "Utbildningsinstans": {
      "Avvecklad": false,
      "Benamning": [
        {
          "Sprakkod": "sv",
          "Text": "Datasäkerhet"
        },
        {
          "Sprakkod": "en",
          "Text": "Computer Security"
        }
      ],
      "Enhet": "HP",
      "GallerUtbildningUtanAngivenOmfattning": false,
      "Omfattning": 6.0,
      "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
      "ResultatPaKursVidAttesteringAvModul": false,
      "Uid": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
      "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
      "Utbildningskod": "DD2395",
      "Versionsnummer": 1
    }
  },
  {
    "FinansieringsformID": 102075,
    "Slutdatum": "2008-01-11",
    "Startdatum": "2007-08-31",
    "StudielokaliseringID": 131778,
    "StudietaktID": 1,
    "TillfallesKod": "X0054",
    "Uid": "79a48556-73da-11e8-b4e0-063f9afb40e3",
    "UndervisningsformID": 1,
    "Utbildningsinstans": {
      "Avvecklad": false,
      "Benamning": [
        {
          "Sprakkod": "sv",
          "Text": "Datasäkerhet"
        },
        {
          "Sprakkod": "en",
          "Text": "Computer Security"
        }
```

```
      ],
      "Enhet": "HP",
      "GallerUtbildningUtanAngivenOmfattning": false,
      "Omfattning": 6.0,
      "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
      "ResultatPaKursVidAttesteringAvModul": false,
      "Uid": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
      "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
      "Utbildningskod": "DD2395",
      "Versionsnummer": 1
    }
  }
]
```

19.3 course_instance_JSON

This method fetches the data for a given course instance. It requires the course instance ID. (This is a slightly rewritten version of Maguire's original method.)

501a ⟨*LadokSession data methods* 249⟩+≡

```
def course_instance_JSON(self, instance_id: str) -> dict:
  """
  Returns course instance data for a course with instance ID instance_id
  """
  try:
    return self.get_query(
      f"/resultat/internal/utbildningsinstans/kursinstans/{instance_id}"
    )
  except LadokServerError as err:
    raise LadokServerError(f"LADOK server error when getting course instance data for "
                           f"{instance_id}: {err}") from err
  except LadokAPIError as err:
    raise LadokAPIError(f"Failed to get course instance data for "
                        f"{instance_id}: {err}") from err
```

Defines:
course_instance_JSON, used in chunks 501b and 570.
Uses get_query 249, LadokAPIError 242, and LadokServerError 244.

We add the following test.

501b ⟨*test functions* 245a⟩+≡

```
def test_course_instance_JSON(ladok) -> None:
  assert ladok.course_instance_JSON(dasak_instance_id)["Uid"] \
    == dasak_instance_id
```

This code is used in chunk 240.
Defines:
test_course_instance_JSON, never used.
Uses course_instance_JSON 501a and dasak_instance_id 240.

The output looks like this.

```
{
  "Avvecklad": false,
  "Benamning": [
```

```
    {
      "Sprakkod": "sv",
      "Text": "Datasäkerhet"
    },
    {
      "Sprakkod": "en",
      "Text": "Computer Security"
    }
  ],
  "BetygsskalaID": 131657,
  "Enhet": "HP",
  "GallerUtbildningUtanAngivenOmfattning": false,
  "KravPaHanvisningTillBeslutshandling": false,
  "KravPaProjekttitel": false,
  "Omfattning": 6.0,
  "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
  "ResultatPaKursVidAttesteringAvModul": false,
  "Uid": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
  "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
  "Utbildningskod": "DD2395",
  "Versionsnummer": 1
}
```

19.4 course_instances_JSON

We can get a list of course instances for a given course code.

502a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def course_instances_JSON(self, course_code: str, lang: str = 'sv') -> dict:
  """
  Returns a list of dictionaries with course instances for a given course code.
  The course code is a string such as "DD1310". The language code is 'en' or
  'sv'.

  Note that there seems to be a limit of 403 for the number of pages.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url + '/resultat/internal/kurstillfalle/filtrera?kurskod=' +
      course_code + '&page=1&limit=100&skipCount=false&sprakkod=' + lang, # not sure about this one /CO
    headers=self.headers)
  if r.status_code == requests.codes.ok:
    return r.json()
  raise LadokAPIError(f"failed to get course instances for {course_code}: {r.text}")
```

Defines:
course_instances_JSON, used in chunk 502b.
Uses LadokAPIError 242.

Let's add a test. Every course instance returned should be one of the course we asked for, and the count should cover all of them on one page.

502b ⟨*test functions* 245a⟩+≡

```
def test_course_instances_JSON(ladok) -> None:
```

```
    r = ladok.course_instances_JSON('DD2395')
    assert r["Resultat"]
    assert r["TotaltAntalPoster"] == len(r["Resultat"])
    assert all(result["Utbildningsinstans"]["Utbildningskod"] == "DD2395"
               for result in r["Resultat"])
```

This code is used in chunk 240.
Defines:
`test_course_instances_JSON`, never used.
Uses `course_instances_JSON` 502a.

The output looks like this:


```
{
  "Resultat": [
    {
      "FinansieringsformID": 101050,
      "Slutdatum": "2026-10-23",
      "Startdatum": "2026-08-24",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
      "TillfallesKod": "11547",
      "Uid": "c0608917-c9de-11f0-a255-650837bd40cf",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "638add54-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "0e358c21-03f0-11f0-a627-6c90d47f45b9",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 3
      }
    },
    {
      "FinansieringsformID": 131738,
      "Slutdatum": "2026-10-23",
      "Startdatum": "2026-08-24",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
```

```
      "TillfallesKod": "12514",
      "Uid": "280f3c38-f829-11f0-baf3-b60aecf94bb9",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "638add54-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "0e358c21-03f0-11f0-a627-6c90d47f45b9",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 3
      }
    },
    {
      "FinansieringsformID": 131738,
      "Slutdatum": "2025-10-24",
      "Startdatum": "2025-08-25",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
      "TillfallesKod": "10148",
      "Uid": "530db250-edfd-11ef-a5d7-577d306f467c",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "2474f616-dc41-11e8-8cc1-eaeeb71b497f",
```

```
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "55ec9709-d6c5-11e8-8fd5-cf9d2c5c41ba",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 2
      }
    },
    {
      "FinansieringsformID": 101050,
      "Slutdatum": "2025-10-24",
      "Startdatum": "2025-08-25",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
      "TillfallesKod": "50301",
      "Uid": "88ef281a-b958-11ef-9553-beecfac44351",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "2474f616-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "55ec9709-d6c5-11e8-8fd5-cf9d2c5c41ba",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 2
      }
    },
    {
      "FinansieringsformID": 101050,
      "Slutdatum": "2024-10-27",
      "Startdatum": "2024-08-26",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
      "TillfallesKod": "50258",
      "Uid": "4e53bc95-9510-11ee-89bd-fb7e5a884889",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
```

```
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "2474f616-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "55ec9709-d6c5-11e8-8fd5-cf9d2c5c41ba",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 2
      }
    },
    {
      "FinansieringsformID": 131738,
      "Slutdatum": "2024-10-27",
      "Startdatum": "2024-08-26",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
      "TillfallesKod": "50771",
      "Uid": "8831875c-c039-11ee-808d-44099ccf4330",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "2474f616-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "55ec9709-d6c5-11e8-8fd5-cf9d2c5c41ba",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 2
      }
```

```
    },
    {
      "FinansieringsformID": 131738,
      "Slutdatum": "2023-10-27",
      "Startdatum": "2023-08-28",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
      "TillfallesKod": "50689",
      "Uid": "2ab9eec3-b103-11ed-9558-ce533d014043",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "2474f616-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "55ec9709-d6c5-11e8-8fd5-cf9d2c5c41ba",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 2
      }
    },
    {
      "FinansieringsformID": 101050,
      "Slutdatum": "2023-10-27",
      "Startdatum": "2023-08-28",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
      "TillfallesKod": "51358",
      "Uid": "a6252c41-7c82-11ed-ba16-099432b5488e",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
```

```
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "2474f616-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "55ec9709-d6c5-11e8-8fd5-cf9d2c5c41ba",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 2
      }
    },
    {
      "FinansieringsformID": 131738,
      "Slutdatum": "2022-10-28",
      "Startdatum": "2022-08-29",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
      "TillfallesKod": "50537",
      "Uid": "ae6da0f4-9582-11ec-823c-971220ed4206",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "2474f616-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "55ec9709-d6c5-11e8-8fd5-cf9d2c5c41ba",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 2
      }
    },
    {
      "FinansieringsformID": 101050,
      "Slutdatum": "2022-10-28",
      "Startdatum": "2022-08-29",
      "StudielokaliseringID": 135195,
```

```
      "StudietaktID": 4,
      "TillfallesKod": "52315",
      "Uid": "a3f17d37-7454-11ec-bef7-64c095574187",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "2474f616-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "55ec9709-d6c5-11e8-8fd5-cf9d2c5c41ba",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 2
      }
    },
    {
      "FinansieringsformID": 131716,
      "Slutdatum": "2021-10-29",
      "Startdatum": "2021-08-30",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
      "TillfallesKod": "50843",
      "Uid": "0ef5ff29-c8f4-11eb-b055-c7e161b04731",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
```

```
        "OrganisationUID": "2474f616-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "55ec9709-d6c5-11e8-8fd5-cf9d2c5c41ba",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 2
      }
    },
    {
      "FinansieringsformID": 101050,
      "Slutdatum": "2021-10-29",
      "Startdatum": "2021-08-30",
      "StudielokaliseringID": 135195,
      "StudietaktID": 4,
      "TillfallesKod": "51273",
      "Uid": "c1bf15d8-3eaa-11eb-b960-5f936a674375",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
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        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 1
      }
    },
    {
      "Slutdatum": "2009-01-10",
      "Startdatum": "2008-08-29",
      "TillfallesKod": "KONV-009CAF",
      "Uid": "016ef16a-73db-11e8-b4e0-063f9afb40e3",
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
```

```
        "Versionsnummer": 1
      }
    },
    {
      "FinansieringsformID": 101050,
      "Slutdatum": "2008-05-26",
      "Startdatum": "2008-01-14",
      "StudielokaliseringID": 131778,
      "StudietaktID": 1,
      "TillfallesKod": "DD038",
      "Uid": "79a48557-73da-11e8-b4e0-063f9afb40e3",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
          {
            "Sprakkod": "en",
            "Text": "Computer Security"
          }
        ],
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "Omfattning": 6.0,
        "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
        "ResultatPaKursVidAttesteringAvModul": false,
        "Uid": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "Utbildningskod": "DD2395",
        "Versionsnummer": 1
      }
    },
    {
      "FinansieringsformID": 101050,
      "Slutdatum": "2008-01-11",
      "Startdatum": "2007-08-31",
      "StudielokaliseringID": 131778,
      "StudietaktID": 1,
      "TillfallesKod": "DD038",
      "Uid": "79a48555-73da-11e8-b4e0-063f9afb40e3",
      "UndervisningsformID": 1,
      "Utbildningsinstans": {
        "Avvecklad": false,
        "Benamning": [
          {
            "Sprakkod": "sv",
            "Text": "Datas\u00e4kerhet"
          },
```

```
            {
              "Sprakkod": "en",
              "Text": "Computer Security"
            }
          ],
          "Enhet": "HP",
          "GallerUtbildningUtanAngivenOmfattning": false,
          "Omfattning": 6.0,
          "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
          "ResultatPaKursVidAttesteringAvModul": false,
          "Uid": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
          "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
          "Utbildningskod": "DD2395",
          "Versionsnummer": 1
        }
      },
      {
        "FinansieringsformID": 102075,
        "Slutdatum": "2008-01-11",
        "Startdatum": "2007-08-31",
        "StudielokaliseringID": 131778,
        "StudietaktID": 1,
        "TillfallesKod": "X0054",
        "Uid": "79a48556-73da-11e8-b4e0-063f9afb40e3",
        "UndervisningsformID": 1,
        "Utbildningsinstans": {
          "Avvecklad": false,
          "Benamning": [
            {
              "Sprakkod": "sv",
              "Text": "Datas\u00e4kerhet"
            },
            {
              "Sprakkod": "en",
              "Text": "Computer Security"
            }
          ],
          "Enhet": "HP",
          "GallerUtbildningUtanAngivenOmfattning": false,
          "Omfattning": 6.0,
          "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
          "ResultatPaKursVidAttesteringAvModul": false,
          "Uid": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
          "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
          "Utbildningskod": "DD2395",
          "Versionsnummer": 1
        }
      }
    ],
    "TotaltAntalPoster": 73
}
```

19.5 instance_info

This function gets a course instance by the combination of course code (e.g., DD1310) and the five digit round code (e.g., 50429).

547a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def instance_info(
    self, course_code: str, instance_code: str, lang: str = 'sv') -> dict:
  """
  Returns a dictionary of course instance information.

  course_code        - course code, such as "DD1310"

  instance_code      - instance of the course ('TillfallesKod')

  lang               - language code 'en' or 'sv', defaults to 'sv'
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/resultat/internal/kurstillfalle/filtrera?kurskod=' + course_code +
        '&page=1&limit=25&skipCount=false&sprakkod=' + lang,
    headers=self.headers)
  if r.status_code == requests.codes.ok:
    rj=r.json()
    for course in rj['Resultat']:
      if course['TillfallesKod'] == instance_code:
        return course
    # If we get here, the course instance was not found
    raise LadokNotFoundError(f"course instance {instance_code} not found for course {course_code}")
  raise LadokAPIError(f"failed to search for course instance {course_code}/{instance_code}: {r.text}")
```

Defines:
instance_info, used in chunk 547b.
Uses LadokAPIError 242 and LadokNotFoundError 242.

Let's add a test. The round we get should be the one with the round code we asked for, on the course we asked for.

547b ⟨*test functions* 245a⟩+≡

```
def test_instance_info(ladok) -> None:
  r = ladok.instance_info('DD1310', '50429')
  assert r["TillfallesKod"] == "50429"
  assert r["Utbildningsinstans"]["Utbildningskod"] == "DD1310"
```

This code is used in chunk 240.
Defines:
test_instance_info, never used.
Uses instance_info 547a.

The output looks like this:

```
{
  "FinansieringsformID": 101050,
  "Slutdatum": "2025-01-13",
  "Startdatum": "2024-08-26",
```

```
  "StudielokaliseringID": 135195,
  "StudietaktID": 7,
  "TillfallesKod": "50429",
  "Uid": "da99b691-8f70-11ee-b4f1-bdc8f0e04f23",
  "UndervisningsformID": 1,
  "Utbildningsinstans": {
    "Avvecklad": false,
    "Benamning": [
      {
        "Sprakkod": "sv",
        "Text": "Programmeringsteknik"
      },
      {
        "Sprakkod": "en",
        "Text": "Programming Techniques"
      }
    ],
    "Enhet": "HP",
    "GallerUtbildningUtanAngivenOmfattning": false,
    "Omfattning": 6.0,
    "OrganisationUID": "638add54-dc41-11e8-8cc1-eaeeb71b497f",
    "ResultatPaKursVidAttesteringAvModul": false,
    "Uid": "4cf550c7-d6b5-11e8-8fd5-cf9d2c5c41ba",
    "UtbildningUID": "386a70fa-73d8-11e8-afa7-8e408e694e54",
    "Utbildningskod": "DD1310",
    "Versionsnummer": 2
  }
}
```

19.6 instance_info_uid

This function returns the same as above (instance_info) but uses the course's LADOK ID. This ID can be found as the sis_course_id in Canvas.

548 ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def instance_info_uid(self, instance_uid: str) -> dict:
    """
    Returns a dictionary of course instance information.

    instance_uid: course's Uid (from course_integration_id or
                  sis_course_id in Canvas)
    """
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/resultat/internal/kurstillfalle/'+instance_uid,
      headers=self.headers)
    if r.status_code == requests.codes.ok:
      return r.json()
    raise LadokAPIError(f"failed to get course instance info for {instance_uid}: {r.text}")
```

Defines:

`instance_info_uid`, used in chunk 549.
Uses `LadokAPIError` 242.

Let's add a test. The round we get should be the one we asked for, and the codes it refers to (study pace, funding, form of teaching, location) should all exist in the corresponding code tables (Section 21.1).

549 ⟨*test functions* 245a⟩+≡

```
def test_instance_info_uid(ladok) -> None:
  r = ladok.instance_info_uid(dasak_round_id)
  assert r["Uid"] == dasak_round_id
  assert str(r["StudietaktID"]) in code_table_ids(
    ladok.studietakt_JSON(), "Studietakt")
  assert str(r["FinansieringsformID"]) in code_table_ids(
    ladok.finansieringsform_JSON(), "Finansieringsform")
  assert str(r["UndervisningsformID"]) in code_table_ids(
    ladok.undervisningsform_JSON(), "Undervisningsform")
  assert str(r["StudielokaliseringID"]) in code_table_ids(
    ladok.studielokalisering_JSON(), "Studielokalisering")
```

This code is used in chunk 240.
Defines:
`test_instance_info_uid`, never used.
Uses `code_table_ids` 588, `dasak_round_id` 240, `finansieringsform_JSON` 1253a, `instance_info_uid` 548, `studielokalisering_JSON` 1299, `studietakt_JSON` 1223a, and `undervisningsform_JSON` 1044.

The output looks like this:


```
{
  "FinansieringsformID": 101050,
  "Slutdatum": "2010-03-21",
  "Startdatum": "2010-01-18",
  "StudielokaliseringID": 131778,
  "StudietaktID": 1,
  "TillfallesKod": "81099",
  "Uid": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
  "UndervisningsformID": 1,
  "Utbildningsinstans": {
    "Avvecklad": false,
    "Benamning": [
      {
        "Sprakkod": "sv",
        "Text": "Datas\u00e4kerhet"
      },
      {
        "Sprakkod": "en",
        "Text": "Computer Security"
      }
    ],
    "Enhet": "HP",
    "GallerUtbildningUtanAngivenOmfattning": false,
    "Omfattning": 6.0,
    "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
    "ResultatPaKursVidAttesteringAvModul": false,
    "Uid": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
```

```
    "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
    "Utbildningskod": "DD2395",
    "Versionsnummer": 1
  }
}
```

19.7 Course components

There are two ways to get the components for a course.

19.7.1 course_round_components_JSON

This method fetches the course components of a course round from LADOK. It requires the course round ID. This one includes data such as the number of registered students as well, unlike the method in the next section.

550a ⟨*LadokSession data methods* 249⟩+≡

```
def course_round_components_JSON(self, round_id: str) -> list:
  """
  Fetch course components for a given course round.

  Args:
      round_id (str): The unique identifier of the course round.

  Returns:
      list: A list of course component JSON objects.

  Raises:
      LadokServerError: If the request fails or server returns an error message.
  """
  data = self.put_query(
    "/resultat/internal/kurstillfalle/moment",
    {"Identitet": [round_id]}
  )

  try:
    return data["MomentPerKurstillfallen"][0]["Moment"]
  except (KeyError, IndexError) as err:
    err.add_note(f"Response data: {data}")
    raise LadokAPIError(f"Unexpected response format when fetching components for "
                        f"round {round_id}: {type(err).__name__}") from err
```

Defines:
course_round_components_JSON, used in chunk 550b.
Uses LadokAPIError 242, LadokServerError 244, and put_query 249.

We add the following test.

550b ⟨*test functions* 245a⟩+≡

```
def test_course_round_components_JSON(ladok) -> None:
  components = ladok.course_round_components_JSON(dasak_round_id)
  assert components["UtbildningsinstansUID"] == dasak_instance_id
  assert any(component["UtbildningsinstansUID"] == LAB1_instance_id
             for component in components["IngaendeMoment"])
```

This code is used in chunk 240.
Defines:
`test_course_round_components_JSON`, never used.
Uses `course_round_components_JSON` 550a, `dasak_instance_id` 240, `dasak_round_id` 240, and `LAB1_instance_id` 240.

The output looks like this.


```
{
  "AntalRegistrerade": 0,
  "Benamning": {
    "sv": "Datasäkerhet",
    "en": "Computer Security"
  },
  "BetygsskalaID": 131657,
  "Enhet": "HP",
  "GallerUtbildningUtanAngivenOmfattning": false,
  "IngaendeMoment": [
    {
      "Benamning": {
        "sv": "Laborationer",
        "en": "Laboratory Work"
      },
      "BetygsskalaID": 131656,
      "Enhet": "HP",
      "GallerUtbildningUtanAngivenOmfattning": false,
      "KravPaProjekttitel": false,
      "Omfattning": 3.0,
      "ResultatrapporteringMojlig": true,
      "UtbildningUID": "39ca27fe-73d8-11e8-afa7-8e408e694e54",
      "UtbildningsinstansUID": "39ca2861-73d8-11e8-b4e0-063f9afb40e3",
      "Utbildningskod": "LAB1"
    },
    {
      "Benamning": {
        "sv": "Tentamen",
        "en": "Examination"
      },
      "BetygsskalaID": 131657,
      "Enhet": "HP",
      "GallerUtbildningUtanAngivenOmfattning": false,
      "KravPaProjekttitel": false,
      "Omfattning": 3.0,
      "ResultatrapporteringMojlig": true,
      "UtbildningUID": "39c593d1-73d8-11e8-afa7-8e408e694e54",
      "UtbildningsinstansUID": "39c5947b-73d8-11e8-b4e0-063f9afb40e3",
      "Utbildningskod": "TEN1"
    }
  ],
  "KravPaProjekttitel": false,
  "Kurstillfalleskod": "81099",
  "Omfattning": 6.0,
  "ResultatrapporteringMojlig": true,
```

```
  "Slutdatum": "2010-03-21 ",
  "Startdatum": "2010-01-18 ",
  "Studietaktsbenamning": {
    "sv": "Helfart",
    "en": "Full-time"
  },
  "Takt": 100,
  "Undervisningsformbenamning": {
    "sv": "Normal",
    "en": "Normal teaching"
  },
  "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
  "UtbildningsinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
  "Utbildningskod": "DD2395",
  "Versionsnummer": 1
}
```

19.7.2 course_instance_components_JSON

This method fetches the course components for a course instance, i.e., a version of the syllabus.

552 ⟨*LadokSession data methods* 249⟩+≡

```
def course_instance_components_JSON(self, course_instance_id: str) -> dict:
  """
  Fetch course components for a given course instance.

  Args:
      course_instance_id (str): The unique identifier of the course instance.

  Returns:
      dict: JSON object containing course instance components.

  Raises:
      LadokServerError: If the request fails or server returns an error message.
  """
  data = self.put_query(
    "/resultat/internal/utbildningsinstans/moduler",
    {"Identitet": [course_instance_id]}
  )

  try:
    return data["Utbildningsinstans"][0]
  except (KeyError, IndexError) as err:
    err.add_note(f"Response data: {data}")
    raise LadokAPIError(f"Unexpected response format when fetching components for "
                        f"instance {course_instance_id}: {type(err).__name__}") from err
```

Defines:
course_instance_components_JSON, used in chunk 553.
Uses LadokAPIError 242, LadokServerError 244, and put_query 249.

We add the following test code.

553 ⟨*test functions* 245a⟩+≡

```
def test_course_instance_components_JSON(ladok) -> None:
  components = ladok.course_instance_components_JSON(dasak_instance_id)
  assert components["Uid"] == dasak_instance_id
  assert any(module["Uid"] == LAB1_instance_id
             for module in components["Moduler"])
```

This code is used in chunk 240.
Defines:
`test_course_instance_components_JSON`, never used.
Uses `course_instance_components_JSON` 552, `dasak_instance_id` 240, and `LAB1_instance_id` 240.

The output looks like this.


```
{
  "Avvecklad": false,
  "Benamning": [
    {
      "Sprakkod": "sv",
      "Text": "Datasäkerhet"
    },
    {
      "Sprakkod": "en",
      "Text": "Computer Security"
    }
  ],
  "BetygsskalaID": 131657,
  "Enhet": "HP",
  "GallerUtbildningUtanAngivenOmfattning": false,
  "KravPaHanvisningTillBeslutshandling": false,
  "KravPaProjekttitel": false,
  "Moduler": [
    {
      "Avvecklad": false,
      "Benamning": [
        {
          "Sprakkod": "sv",
          "Text": "Laborationer"
        },
        {
          "Sprakkod": "en",
          "Text": "Laboratory Work"
        }
      ],
      "BetygsskalaID": 131656,
      "Enhet": "HP",
      "GallerUtbildningUtanAngivenOmfattning": false,
      "KravPaHanvisningTillBeslutshandling": false,
      "KravPaProjekttitel": false,
      "Moduler": [],
      "Omfattning": 3.0,
      "OrganisationUID": "638add54-dc41-11e8-8cc1-eaeeb71b497f",
```

```
      "ResultatPaKursVidAttesteringAvModul": false,
      "Uid": "39ca2861-73d8-11e8-b4e0-063f9afb40e3",
      "UtbildningUID": "39ca27fe-73d8-11e8-afa7-8e408e694e54",
      "Utbildningskod": "LAB1",
      "Versionsnummer": 1
    },
    {
      "Avvecklad": false,
      "Benamning": [
        {
          "Sprakkod": "sv",
          "Text": "Tentamen"
        },
        {
          "Sprakkod": "en",
          "Text": "Examination"
        }
      ],
      "BetygsskalaID": 131657,
      "Enhet": "HP",
      "GallerUtbildningUtanAngivenOmfattning": false,
      "KravPaHanvisningTillBeslutshandling": false,
      "KravPaProjekttitel": false,
      "Moduler": [],
      "Omfattning": 3.0,
      "OrganisationUID": "638add54-dc41-11e8-8cc1-eaeeb71b497f",
      "ResultatPaKursVidAttesteringAvModul": false,
      "Uid": "39c5947b-73d8-11e8-b4e0-063f9afb40e3",
      "UtbildningUID": "39c593d1-73d8-11e8-afa7-8e408e694e54",
      "Utbildningskod": "TEN1",
      "Versionsnummer": 1
    }
  ],
  "Omfattning": 6.0,
  "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
  "ResultatPaKursVidAttesteringAvModul": false,
  "Uid": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
  "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
  "Utbildningskod": "DD2395",
  "Versionsnummer": 1
}
```

Chapter 20

Results-related API calls

In this chapter we look at how to fetch results from LADOK and report new results to LADOK.

20.1 Reported results

There are two ways to get results for a course. One method gives more data than the other.

20.1.1 search_reported_results_JSON

This method searches for student results for a given component on a given course round.

555 ⟨*LadokSession data methods* 249⟩+≡

```
  def search_reported_results_JSON(
      self, course_round_id: str, component_instance_id: str) -> list:
    """Requires:
    course_round_id: round_id for a course,
    component_instance_id: instance_id for a component of the course.
    """
    put_data = {
      "Filtrering": ["OBEHANDLADE", "UTKAST", "ATTESTERADE"],
      "KurstillfallenUID": [course_round_id],
      "OrderBy": [
        "EFTERNAMN_ASC",
        "FORNAMN_ASC",
        "PERSONNUMMER_ASC"
      ],
      "Limit": 400,
      "Page": 1,
      "StudenterUID": []
    }

    data = self.put_query(
      "/resultat/internal/studieresultat/rapportera"
        f"/utbildningsinstans/{component_instance_id}/sok",
```

```
      put_data)

    try:
      return data["Resultat"]
    except KeyError as err:
      err.add_note(f"Response data: {data}")
      raise LadokAPIError(f"Unexpected response format when searching for results for "
                          f"round {course_round_id}, component {component_instance_id}: "
                          f"missing 'Resultat' key") from err
```

Defines:
search_reported_results_JSON, used in chunks 556 and 559b.
Uses LadokAPIError 242 and put_query 249.

We write the following test.

556 ⟨*test functions* 245a⟩+≡

```
def test_search_reported_results_JSON(ladok) -> None:
  results = ladok.search_reported_results_JSON(dasak_round_id,
    LAB1_instance_id)
  assert results
  assert all(result["AktuelltKurstillfalle"] == dasak_round_id
             for result in results)
```

This code is used in chunk 240.
Defines:
test_search_reported_results_JSON, never used.
Uses dasak_round_id 240, LAB1_instance_id 240, and search_reported_results_JSON 555.

The output looks like this.


```
[
  {
    "AktuellKursinstans": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
    "AktuelltKurstillfalle": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
    "KursUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
    "Rapporteringskontext": {
      "BetygsskalaID": 131656,
      "GallerUtbildningUtanAngivenOmfattning": false,
      "KravPaHanvisningTillBeslutshandling": false,
      "KravPaProjekttitel": false,
      "UtbildningUID": "39ca27fe-73d8-11e8-afa7-8e408e694e54",
      "UtbildningsinstansUID": "39ca2861-73d8-11e8-b4e0-063f9afb40e3"
    },
    "ResultatPaUtbildningar": [
      {
        "HarFleraAttesteradeResultat": false,
        "HarTillgodoraknande": false,
        "HeltTillgodoraknad": false,
        "KanExkluderas": false,
        "SenastAttesteradeResultat": {
          "Anteckning": "Anteckning",
          "ArDokumenteratBeslut": false,
          "Beslutsdatum": "2010-04-07",
          "Beslutsfattare": "Uppgift om examinator saknas/Not applicable",
          "Betygsgrad": 131658,
```

```
          "Betygsgradsobjekt": {
            "GiltigSomSlutbetyg": true,
            "ID": 131658,
            "Kod": "P"
          },
          "BetygsskalaID": 131656,
          "Examinationsdatum": "2010-04-07",
          "ForbereddForBorttag": false,
          "KursinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
          "KurstillfalleUID": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
          "Noteringar": [],
          "Noteringsdefinitioner": [],
          "ProcessStatus": 3,
          "ResultatUID": "34b536b2-7410-11e8-b046-cb26945c40f5",
          "SenasteResultatandring": "2018-06-20T00:29:18.739",
          "StudentUID": "de709f81-a867-11e7-8dbf-78e86dc2470c",
          "StudieresultatUID": "a4a4be29-73f2-11e8-b046-cb26945c40f5",
          "Uid": "34b536b2-7410-11e8-b046-cb26945c40f5",
          "UtbildningsinstansUID": "39ca2861-73d8-11e8-b4e0-063f9afb40e3"
        },
        "TotalTillgodoraknadOmfattning": 0.0,
        "UtbildningUID": "39ca27fe-73d8-11e8-afa7-8e408e694e54"
      },
      {
        "HarFleraAttesteradeResultat": false,
        "HarTillgodoraknande": false,
        "HeltTillgodoraknad": false,
        "KanExkluderas": false,
        "SenastAttesteradeResultat": {
          "Anteckning": "Anteckning",
          "ArDokumenteratBeslut": false,
          "Beslutsdatum": "2010-03-18",
          "Beslutsfattare": "Uppgift om examinator saknas/Not applicable",
          "Betygsgrad": 131661,
          "Betygsgradsobjekt": {
            "GiltigSomSlutbetyg": true,
            "ID": 131661,
            "Kod": "A"
          },
          "BetygsskalaID": 131657,
          "Examinationsdatum": "2010-03-18",
          "ForbereddForBorttag": false,
          "KursinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
          "KurstillfalleUID": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
          "Noteringar": [],
          "Noteringsdefinitioner": [],
          "ProcessStatus": 3,
          "ResultatUID": "34b780dc-7410-11e8-b046-cb26945c40f5",
          "SenasteResultatandring": "2018-06-20T00:29:18.754",
          "StudentUID": "de709f81-a867-11e7-8dbf-78e86dc2470c",
          "StudieresultatUID": "a4a4be29-73f2-11e8-b046-cb26945c40f5",
```

```
            "Uid": "34b780dc-7410-11e8-b046-cb26945c40f5",
            "UtbildningsinstansUID": "39c5947b-73d8-11e8-b4e0-063f9afb40e3"
          },
          "TotalTillgodoraknadOmfattning": 0.0,
          "UtbildningUID": "39c593d1-73d8-11e8-afa7-8e408e694e54"
        },
        {
          "HarFleraAttesteradeResultat": false,
          "HarTillgodoraknande": false,
          "HeltTillgodoraknad": false,
          "KanExkluderas": false,
          "SenastAttesteradeResultat": {
            "Anteckning": "Anteckning",
            "ArDokumenteratBeslut": false,
            "Beslutsdatum": "2010-04-07",
            "Beslutsfattare": "Examinator",
            "Betygsgrad": 131661,
            "Betygsgradsobjekt": {
              "GiltigSomSlutbetyg": true,
              "ID": 131661,
              "Kod": "A"
            },
            "BetygsskalaID": 131657,
            "Examinationsdatum": "2010-04-07",
            "ForbereddForBorttag": false,
            "KursinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
            "KurstillfalleUID": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
            "Noteringar": [],
            "Noteringsdefinitioner": [],
            "ProcessStatus": 3,
            "ResultatUID": "d274ed3f-741a-11e8-b046-cb26945c40f5",
            "SenasteResultatandring": "2018-06-20T01:45:18.367",
            "StudentUID": "de709f81-a867-11e7-8dbf-78e86dc2470c",
            "StudieresultatUID": "a4a4be29-73f2-11e8-b046-cb26945c40f5",
            "Uid": "d274ed3f-741a-11e8-b046-cb26945c40f5",
            "UtbildningsinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3"
          },
          "TotalTillgodoraknadOmfattning": 0.0,
          "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54"
        }
      ],
      "Student": {
        "Efternamn": "Studentzadeh",
        "Fornamn": "Student",
        "Personnummer": "19121212-1212",
        "Uid": "de709f81-a867-11e7-8dbf-78e86dc2470c"
      },
      "Uid": "a4a4be29-73f2-11e8-b046-cb26945c40f5"
    }
]
```

20.1.2 search_course_results_JSON

Another method, which gives slightly different results is the following.

559a ⟨*LadokSession data methods* 249⟩+≡

```
  def search_course_results_JSON(
      self, course_round_id: str, component_instance_id: str) -> list:
    """
    Retrieve course results for a specific component in a course round.

    Args:
        course_round_id (str): The unique identifier of the course round.
        component_instance_id (str): The unique identifier of the component instance.

    Returns:
        list: List of course result JSON objects.

    Raises:
        LadokAPIError: If the request fails.
    """
    put_data = {
      "KurstillfallenUID": [course_round_id],
      "Tillstand": ["REGISTRERAD", "AVKLARAD", "AVBROTT"],
      "OrderBy": ["EFTERNAMN_ASC", "FORNAMN_ASC"],
      "Limit": 400,
      "Page": 1,
    }

    data = self.put_query(
      "/resultat/internal/resultatuppfoljning/resultatuppfoljning/sok",
      put_data)

    try:
      return data["Resultat"]
    except KeyError as err:
      err.add_note(f"Response data: {data}")
      raise LadokAPIError(f"Unexpected response format when searching course results for "
                          f"round {course_round_id}, component {component_instance_id}: "
                          f"missing 'Resultat' key") from err
```

Defines:
search_course_results_JSON, used in chunk 559b.
Uses LadokAPIError 242 and put_query 249.

We test this by the following.

559b ⟨*test functions* 245a⟩+≡

```
def test_search_course_results_JSON(ladok) -> None:
  results = ladok.search_course_results_JSON(dasak_round_id, LAB1_instance_id)
  reported = ladok.search_reported_results_JSON(dasak_round_id,
    LAB1_instance_id)
  assert results
  assert all(result["KurstillfalleUID"] == dasak_round_id
             for result in results)
```

```
    assert ({result["Student"]["Uid"] for result in results}
            == {result["Student"]["Uid"] for result in reported})
```

This code is used in chunk 240.
Defines:
`test_search_course_results_JSON`, never used.
Uses `dasak_round_id` 240, `LAB1_instance_id` 240, `search_course_results_JSON` 559a, and `search_reported_results_JSON` 555.

The output looks like this.


```
[
  {
    "KurstillfalleUID": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
    "LarosateID": 29,
    "Resultat": [
      {
        "Betygsgradskod": "P",
        "Examinationsdatum": "2010-04-07",
        "LarosateID": 29,
        "SenastAndradAv": "user@domain.se",
        "SenastSparad": "2018-06-20T00:29:18.755",
        "Uid": "34b536b2-7410-11e8-b046-cb26945c40f5",
        "UtbildningUID": "39ca27fe-73d8-11e8-afa7-8e408e694e54",
        "UtbildningsinstansUID": "39ca2861-73d8-11e8-b4e0-063f9afb40e3"
      },
      {
        "Betygsgradskod": "A",
        "Examinationsdatum": "2010-03-18",
        "LarosateID": 29,
        "SenastAndradAv": "user@domain.se",
        "SenastSparad": "2018-06-20T00:29:18.755",
        "Uid": "34b780dc-7410-11e8-b046-cb26945c40f5",
        "UtbildningUID": "39c593d1-73d8-11e8-afa7-8e408e694e54",
        "UtbildningsinstansUID": "39c5947b-73d8-11e8-b4e0-063f9afb40e3"
      },
      {
        "Betygsgradskod": "A",
        "Examinationsdatum": "2010-04-07",
        "LarosateID": 29,
        "SenastAndradAv": "user@domain.se",
        "SenastSparad": "2018-06-20T01:45:18.369",
        "Uid": "d274ed3f-741a-11e8-b046-cb26945c40f5",
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "UtbildningsinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3"
      }
    ],
    "Student": {
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student",
      "Personnummer": "19121212-1212",
      "Uid": "de709f81-a867-11e7-8dbf-78e86dc2470c"
    },
    "Tillstand": "AVKLARAD"
```

```
  }
]
```

20.2 Results for a student: student_results_JSON

This method pulls results for an individual student for a particular course. LADOK changed this API request in 2022.

561a ⟨*LadokSession data methods* 249⟩+≡

```
def student_results_JSON(
    self, student_id: str, course_education_id: str) -> dict:
  """Returns the results for a student on a course"""
  try:
    return self.get_query(
      "/resultat/internal/studentenskurser/kursinformation"
      f"/student/{student_id}/kursUID/{course_education_id}"
    )
  except LadokServerError as err:
    raise LadokServerError(f"LADOK server error when getting results for "
                           f"student {student_id} on course {course_education_id}: "
                           f"{err}") from err
  except LadokAPIError as err:
    raise LadokAPIError(f"Failed to get results for student {student_id} "
                        f"on course {course_education_id}: {err}") from err
```

Defines:
student_results_JSON, used in chunks 561b and 570.
Uses get_query 249, LadokAPIError 242, and LadokServerError 244.

We test this in the following way.

561b ⟨*test functions* 245a⟩+≡

```
def test_student_results_JSON(ladok) -> None:
  results = ladok.student_results_JSON(student_uid, dasak_education_id)
  assert results["StudentUID"] == student_uid
  assert results["UtbildningUID"] == dasak_education_id
```

This code is used in chunk 240.
Defines:
test_student_results_JSON, never used.
Uses dasak_education_id 240, student_results_JSON 561a, and student_uid 240 1517a.

The output looks like this.

```
{
  "GallandeKurstillfalle": {
    "Slutdatum": "2010-03-21",
    "Startdatum": "2010-01-18",
    "StudielokaliseringID": 131778,
    "StudietaktID": 1,
    "TillfallesKod": "81099",
    "Uid": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
    "UndervisningsformID": 1
  },
  "Kursversioner": [
    {
```

```
      "ArAktuellVersion": true,
      "ArAvvecklad": false,
      "GallandeKurstillfalleUID": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
      "HarTillgodoraknandePaHelaKursen": false,
      "Kursversion": 1,
      "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
      "UtbildningsinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
      "VersionensKurs": {
        "Betygsskala": {
          "Benamning": {
            "sv": "Sjugradig betygsskala",
            "en": "Seven point grading scale"
          },
          "Beskrivning": {},
          "Betygsgrad": [
            {
              "Benamning": {
                "sv": "Utmärkt",
                "en": "Excellent"
              },
              "GiltigSomSlutbetyg": true,
              "ID": 131661,
              "Kod": "A"
            },
            {
              "Benamning": {
                "sv": "Mycket bra",
                "en": "Very Good"
              },
              "GiltigSomSlutbetyg": true,
              "ID": 131667,
              "Kod": "B"
            },
            {
              "Benamning": {
                "sv": "Bra",
                "en": "Good"
              },
              "GiltigSomSlutbetyg": true,
              "ID": 131673,
              "Kod": "C"
            },
            {
              "Benamning": {
                "sv": "Tillfredsställande",
                "en": "Satisfactory"
              },
              "GiltigSomSlutbetyg": true,
              "ID": 131679,
              "Kod": "D"
            },
```

```
            {
              "Benamning": {
                "sv": "Tillräcklig",
                "en": "Sufficient"
              },
              "GiltigSomSlutbetyg": true,
              "ID": 131691,
              "Kod": "E"
            },
            {
              "Benamning": {
                "sv": "Underkänd",
                "en": "Not satisfactory"
              },
              "GiltigSomSlutbetyg": false,
              "ID": 131696,
              "Kod": "FX"
            },
            {
              "Benamning": {
                "sv": "Underkänd",
                "en": "Failed"
              },
              "GiltigSomSlutbetyg": false,
              "ID": 131697,
              "Kod": "F"
            }
          ],
          "Dolt": false,
          "Giltighetsperiod": {
            "Startdatum": "2007-07-01"
          },
          "ID": "131657",
          "Kod": "AF"
        },
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "HarTillgodoraknandePaHelaUtbildningen": false,
        "Kod": "DD2395",
        "KravPaHanvisningTillBeslutshandling": false,
        "KravPaProjekttitel": false,
        "KursenHarAvbrott": false,
        "Omfattning": 6.0,
        "OrganisationUID": "ea8a551c-73d6-11e8-8c58-f9aa7f7e4fb6",
        "ResultatPaKursVidAttesteringAvModul": false,
        "ResultatPaUtbildning": {
          "HarTillgodoraknande": false,
          "HeltTillgodoraknad": false,
          "KanExkluderas": false,
          "OvrigaResultat": [],
          "SenastAttesteradeResultat": {
```

```
            "Anteckning": "Anteckning",
            "ArDokumenteratBeslut": false,
            "Beslutsdatum": "2010-04-07",
            "Beslutsfattare": "Examinator",
            "Betygsgrad": 131661,
            "Betygsgradsobjekt": {
              "Benamning": {
                "sv": "Utmärkt",
                "en": "Excellent"
              },
              "GiltigSomSlutbetyg": true,
              "ID": 131661,
              "Kod": "A"
            },
            "BetygsskalaID": 131657,
            "Examinationsdatum": "2010-04-07",
            "ForbereddForBorttag": false,
            "KursinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
            "KurstillfalleUID": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
            "Noteringar": [],
            "Noteringsdefinitioner": [],
            "ProcessStatus": 3,
            "ResultatUID": "d274ed3f-741a-11e8-b046-cb26945c40f5",
            "SenasteResultatandring": "2018-06-20T01:45:18.367",
            "StudentUID": "de709f81-a867-11e7-8dbf-78e86dc2470c",
            "StudieresultatUID": "a4a4be29-73f2-11e8-b046-cb26945c40f5",
            "Uid": "d274ed3f-741a-11e8-b046-cb26945c40f5",
            "UtbildningsinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3"
          },
          "TotalTillgodoraknadOmfattning": 0.0,
          "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54"
        },
        "Tillgodoraknanden": [],
        "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54",
        "UtbildningsinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
        "Utbildningsinstansbenamningar": {
          "sv": "Datasäkerhet",
          "en": "Computer Security"
        }
      },
      "VersionensModuler": [
        {
          "Betygsskala": {
            "Benamning": {
              "sv": "Sjugradig betygsskala",
              "en": "Seven point grading scale"
            },
            "Beskrivning": {},
            "Betygsgrad": [
              {
                "Benamning": {
```

```
                    "sv": "Utmärkt",
                    "en": "Excellent"
                  },
                  "GiltigSomSlutbetyg": true,
                  "ID": 131661,
                  "Kod": "A"
                },
                {
                  "Benamning": {
                    "sv": "Mycket bra",
                    "en": "Very Good"
                  },
                  "GiltigSomSlutbetyg": true,
                  "ID": 131667,
                  "Kod": "B"
                },
                {
                  "Benamning": {
                    "sv": "Bra",
                    "en": "Good"
                  },
                  "GiltigSomSlutbetyg": true,
                  "ID": 131673,
                  "Kod": "C"
                },
                {
                  "Benamning": {
                    "sv": "Tillfredsställande",
                    "en": "Satisfactory"
                  },
                  "GiltigSomSlutbetyg": true,
                  "ID": 131679,
                  "Kod": "D"
                },
                {
                  "Benamning": {
                    "sv": "Tillräcklig",
                    "en": "Sufficient"
                  },
                  "GiltigSomSlutbetyg": true,
                  "ID": 131691,
                  "Kod": "E"
                },
                {
                  "Benamning": {
                    "sv": "Underkänd",
                    "en": "Not satisfactory"
                  },
                  "GiltigSomSlutbetyg": false,
                  "ID": 131696,
                  "Kod": "FX"
```

```
            },
            {
              "Benamning": {
                "sv": "Underkänd",
                "en": "Failed"
              },
              "GiltigSomSlutbetyg": false,
              "ID": 131697,
              "Kod": "F"
            }
          ],
          "Dolt": false,
          "Giltighetsperiod": {
            "Startdatum": "2007-07-01"
          },
          "ID": "131657",
          "Kod": "AF"
        },
        "Enhet": "HP",
        "GallerUtbildningUtanAngivenOmfattning": false,
        "HarTillgodoraknandePaHelaUtbildningen": false,
        "Kod": "TEN1",
        "KravPaHanvisningTillBeslutshandling": false,
        "KravPaProjekttitel": false,
        "KursenHarAvbrott": false,
        "Omfattning": 3.0,
        "OrganisationUID": "638add54-dc41-11e8-8cc1-eaeeb71b497f",
        "ResultatPaKursVidAttesteringAvModul": false,
        "ResultatPaUtbildning": {
          "HarTillgodoraknande": false,
          "HeltTillgodoraknad": false,
          "KanExkluderas": false,
          "OvrigaResultat": [],
          "SenastAttesteradeResultat": {
            "Anteckning": "Anteckning",
            "ArDokumenteratBeslut": false,
            "Beslutsdatum": "2010-03-18",
            "Beslutsfattare": "Uppgift om examinator saknas/Not applicable",
            "Betygsgrad": 131661,
            "Betygsgradsobjekt": {
              "Benamning": {
                "sv": "Utmärkt",
                "en": "Excellent"
              },
              "GiltigSomSlutbetyg": true,
              "ID": 131661,
              "Kod": "A"
            },
            "BetygsskalaID": 131657,
            "Examinationsdatum": "2010-03-18",
            "ForbereddForBorttag": false,
```

```
            "KursinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
            "KurstillfalleUID": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
            "Noteringar": [],
            "Noteringsdefinitioner": [],
            "ProcessStatus": 3,
            "ResultatUID": "34b780dc-7410-11e8-b046-cb26945c40f5",
            "SenasteResultatandring": "2018-06-20T00:29:18.754",
            "StudentUID": "de709f81-a867-11e7-8dbf-78e86dc2470c",
            "StudieresultatUID": "a4a4be29-73f2-11e8-b046-cb26945c40f5",
            "Uid": "34b780dc-7410-11e8-b046-cb26945c40f5",
            "UtbildningsinstansUID": "39c5947b-73d8-11e8-b4e0-063f9afb40e3"
          },
          "TotalTillgodoraknadOmfattning": 0.0,
          "UtbildningUID": "39c593d1-73d8-11e8-afa7-8e408e694e54"
        },
        "Tillgodoraknanden": [],
        "UtbildningUID": "39c593d1-73d8-11e8-afa7-8e408e694e54",
        "UtbildningsinstansUID": "39c5947b-73d8-11e8-b4e0-063f9afb40e3",
        "Utbildningsinstansbenamningar": {
          "sv": "Tentamen",
          "en": "Examination"
        }
      },
      {
        "Betygsskala": {
          "Benamning": {
            "sv": "Tvågradig betygsskala",
            "en": "Two point grading scale"
          },
          "Beskrivning": {},
          "Betygsgrad": [
            {
              "Benamning": {
                "sv": "Godkänd",
                "en": "Pass"
              },
              "GiltigSomSlutbetyg": true,
              "ID": 131658,
              "Kod": "P"
            },
            {
              "Benamning": {
                "sv": "Underkänd",
                "en": "Failed"
              },
              "GiltigSomSlutbetyg": false,
              "ID": 131663,
              "Kod": "F"
            }
          ],
          "Dolt": false,
```

```
            "Giltighetsperiod": {},
            "ID": "131656",
            "Kod": "PF"
          },
          "Enhet": "HP",
          "GallerUtbildningUtanAngivenOmfattning": false,
          "HarTillgodoraknandePaHelaUtbildningen": false,
          "Kod": "LAB1",
          "KravPaHanvisningTillBeslutshandling": false,
          "KravPaProjekttitel": false,
          "KursenHarAvbrott": false,
          "Omfattning": 3.0,
          "OrganisationUID": "638add54-dc41-11e8-8cc1-eaeeb71b497f",
          "ResultatPaKursVidAttesteringAvModul": false,
          "ResultatPaUtbildning": {
            "HarTillgodoraknande": false,
            "HeltTillgodoraknad": false,
            "KanExkluderas": false,
            "OvrigaResultat": [],
            "SenastAttesteradeResultat": {
              "Anteckning": "Anteckning",
              "ArDokumenteratBeslut": false,
              "Beslutsdatum": "2010-04-07",
              "Beslutsfattare": "Uppgift om examinator saknas/Not applicable",
              "Betygsgrad": 131658,
              "Betygsgradsobjekt": {
                "Benamning": {
                  "sv": "Godkänd",
                  "en": "Pass"
                },
                "GiltigSomSlutbetyg": true,
                "ID": 131658,
                "Kod": "P"
              },
              "BetygsskalaID": 131656,
              "Examinationsdatum": "2010-04-07",
              "ForbereddForBorttag": false,
              "KursinstansUID": "39c56d6a-73d8-11e8-b4e0-063f9afb40e3",
              "KurstillfalleUID": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3",
              "Noteringar": [],
              "Noteringsdefinitioner": [],
              "ProcessStatus": 3,
              "ResultatUID": "34b536b2-7410-11e8-b046-cb26945c40f5",
              "SenasteResultatandring": "2018-06-20T00:29:18.739",
              "StudentUID": "de709f81-a867-11e7-8dbf-78e86dc2470c",
              "StudieresultatUID": "a4a4be29-73f2-11e8-b046-cb26945c40f5",
              "Uid": "34b536b2-7410-11e8-b046-cb26945c40f5",
              "UtbildningsinstansUID": "39ca2861-73d8-11e8-b4e0-063f9afb40e3"
            },
            "TotalTillgodoraknadOmfattning": 0.0,
            "UtbildningUID": "39ca27fe-73d8-11e8-afa7-8e408e694e54"
```

```
          },
          "Tillgodoraknanden": [],
          "UtbildningUID": "39ca27fe-73d8-11e8-afa7-8e408e694e54",
          "UtbildningsinstansUID": "39ca2861-73d8-11e8-b4e0-063f9afb40e3",
          "Utbildningsinstansbenamningar": {
            "sv": "Laborationer",
            "en": "Laboratory Work"
          }
        }
      ]
    }
  ],
  "NoteringsdefinitionerKoppladeTillResultat": [],
  "ResultatUtanKopplingTillKursversion": [],
  "StudentUID": "de709f81-a867-11e7-8dbf-78e86dc2470c",
  "UtbildningUID": "39cf7fb4-73d8-11e8-afa7-8e408e694e54"
}
```

20.3 Modifying results

We have two alternatives: add a new result or update an existing result draft.

20.3.1 create_result_JSON

This method is used to create a new result. This result will be a draft. It must later be finalized and then attested.

Note that since this is a new result, we must provide the `StudieresultatUID` where we want to add the result. When we've done this, we'll get a `ResultatUID` back in the response. From then on, it's the `ResultatUID` that's interesting.

Note also that we can use `course_instance_id` as `component_id`, this will set the result on the whole course.

569 ⟨*LadokSession data methods* 249⟩+≡

```
def create_result_JSON(self,
      student_id: str, course_instance_id: str, component_id: str,
      grade_id: int, date: str,
      project_title: str | None = None) -> dict:
  """
  Creates a new result
  """
  try:
    return self.post_query(
      f"/resultat/internal/resultat/student/{student_id}"
      f"/kursinstans/{course_instance_id}"
      f"/utbildningsinstans/{component_id}"
      f"/skapa",
      {
        "Betygsgrad": grade_id,
        "Examinationsdatum": date,
        "Projekttitel": project_title
      }
```

```
    )
  except LadokServerError as err:
    raise LadokServerError(f"LADOK server error when creating result for "
                           f"student {student_id} on component {component_id}: "
                           f"{err}") from err
  except LadokAPIError as err:
    raise LadokAPIError(f"Failed to create result for student {student_id} "
                        f"on component {component_id}: {err}") from err
```

Defines:
`create_result_JSON`, used in chunks 231b and 570.
Uses `LadokAPIError` 242, `LadokServerError` 244, and `post_query` 249.

These write tests change a real student's record in the test environment, so each test must leave the record as it found it, also when it fails halfway. A result goes through up to three states, and each one needs its own step to undo:

Draft is removed with `remove_result_draft_JSON`.

Finalized must first be turned back into a draft with `finalized_result_to_draft_JSON`, and then removed.

Attested needs the examiner to remove the attestation, which LADOK guards with a forced new login, MFA included. LADOK's API allows it, but ladok3 does not implement attestation yet; the flow and a plan are in issue 63 on GitHub.

`remove_lab_result` walks the test student's LAB1 result back through these steps, whatever state it is in. It reads the state from LADOK rather than from the test, since a failed test may have stopped between two steps. An attested result it leaves alone, failing and saying what to do by hand. The tests never attest, so that only happens if someone attests a result that a failed run left behind.

Each test gets its result from a fixture: `draft_result` creates a draft, and `finalized_result` finalizes that draft. The fixture calls `remove_lab_result` both before creating the result, to clear anything an aborted run left behind, and after the test, also when the test failed. An earlier version instead chained the tests through module variables: one test created the result, the next updated it, and so on, with the last one removing it. A single test could not run on its own, and a failure in the middle left the result in LADOK.

570 ⟨*test functions* 245a⟩+≡

```
datintro_student_uid = "76291c55-d24a-11ea-a4db-82cca4dd4b3e"
datintro_instance_id = "2179e02c-d6b5-11e8-8fd5-cf9d2c5c41ba"
datintro_LAB1_id = "385a4428-73d8-11e8-b4e0-063f9afb40e3"

DRAFT = 1
FINALIZED = 2
PASS_GRADE_ID = 131663
FAIL_GRADE_ID = 131658

def lab_result(ladok):
  """Return the test student's LAB1 result on DATINTRO as a pair: the work
  copy (draft or finalized) and the attested result, each None if absent."""
  education_id = ladok.course_instance_JSON(
    datintro_instance_id)["UtbildningUID"]
```

```
    results = ladok.student_results_JSON(datintro_student_uid, education_id)
    for version in results["Kursversioner"]:
      for module in version["VersionensModuler"]:
        if module["UtbildningsinstansUID"] == datintro_LAB1_id:
          wrapper = module.get("ResultatPaUtbildning", {})
          return (wrapper.get("Arbetsunderlag"),
                  wrapper.get("SenastAttesteradeResultat"))
    return None, None

  def remove_lab_result(ladok):
    """Walk the test student's LAB1 result back to nothing: a finalized
    result goes back to draft, a draft is removed.  Fail if it is attested,
    since ladok3 can't remove attestations yet (issue 63); a draft on top of
    the attested result is then left too."""
    draft, attested = lab_result(ladok)
    if attested:
      pytest.fail(f"LAB1 result {attested['Uid']} of the test student is "
                  "attested; remove the attestation in LADOK's web "
                  "interface, then rerun")
    if draft is None:
      return
    if draft["ProcessStatus"] == FINALIZED:
      draft = ladok.finalized_result_to_draft_JSON(
        draft["Uid"], draft["SenasteResultatandring"])
    ladok.remove_result_draft_JSON(draft["Uid"])

  @pytest.fixture
  def draft_result(ladok):
    remove_lab_result(ladok)
    result = ladok.create_result_JSON(
      datintro_student_uid, datintro_instance_id, datintro_LAB1_id,
      PASS_GRADE_ID, "2022-11-29")
    yield result
    remove_lab_result(ladok)

  @pytest.fixture
  def finalized_result(ladok, draft_result):
    return ladok.finalize_result_JSON(
      draft_result["Uid"], draft_result["SenasteResultatandring"],
      reporter_id)
```

This code is used in chunk 240.
Defines:
`datintro_instance_id`, used in chunk 579.
`datintro_LAB1_id`, never used.
`datintro_student_uid`, used in chunk 579.
`DRAFT`, used in chunks 572a, 573, and 582b.
`draft_result`, used in chunks 572a, 573, 575a, 578b, and 583b.
`FAIL_GRADE_ID`, used in chunks 573 and 581.
`FINALIZED`, used in chunks 578b and 581.
`finalized_result`, used in chunks 579, 581, and 582b.
`lab_result`, used in chunks 572a, 578b, and 583b.
`PASS_GRADE_ID`, used in chunk 572a.
`remove_lab_result`, never used.

Uses `course_instance_JSON` 501a, `create_result_JSON` 226a 569, `finalize_result_JSON` 578a, `finalized_result_to_draft_JSON` 582a, `remove_result_draft_JSON` 583a, `reporter_id` 231c 578b, and `student_results_JSON` 561a.

Creating a result should give us a draft with the grade and date we asked for, and LADOK should now list it as the student's LAB1 result.

572a ⟨*test functions* 245a⟩+≡

```
@pytest.mark.mutates
def test_create_result_JSON(ladok, draft_result) -> None:
  assert draft_result["ProcessStatus"] == DRAFT
  assert draft_result["Betygsgrad"] == PASS_GRADE_ID
  assert draft_result["Examinationsdatum"] == "2022-11-29"
  draft, _ = lab_result(ladok)
  assert draft["Uid"] == draft_result["Uid"]
```

This code is used in chunk 240.
Defines:
`test_create_result_JSON`, never used.
Uses `DRAFT` 570, `draft_result` 570, `lab_result` 570, and `PASS_GRADE_ID` 570.

The output looks like this.

```
{
  "ArDokumenteratBeslut": false,
  "Betygsgrad": 131663,
  "Betygsgradsobjekt": {
    "GiltigSomSlutbetyg": false,
    "ID": 131663,
    "Kod": "F"
  },
  "BetygsskalaID": 131656,
  "Examinationsdatum": "2022-11-27",
  "ForbereddForBorttag": false,
  "KursinstansUID": "2179e02c-d6b5-11e8-8fd5-cf9d2c5c41ba",
  "KurstillfalleUID": "e058a850-1a94-11ea-a622-3565135944de",
  "Noteringar": [],
  "Noteringsdefinitioner": [],
  "ProcessStatus": 1,
  "ResultatUID": "ba248230-cc84-11f1-b463-33e2d8c54565",
  "SenasteResultatandring": "2026-10-20T14:49:45.590",
  "StudentUID": "76291c55-d24a-11ea-a4db-82cca4dd4b3e",
  "StudieresultatUID": "c052ecf9-e2d6-11ea-8f88-9c9fd6664756",
  "Uid": "ba248230-cc84-11f1-b463-33e2d8c54565",
  "UtbildningsinstansUID": "385a4428-73d8-11e8-b4e0-063f9afb40e3"
}
```

LADOK changed this API request in 2022.

20.3.2 `update_result_JSON`

This method updates an existing result draft. Note that we cannot use this method to update a finalized result. Note also that we use the `ResultatUID` and not the `StudieresultatUID` as we did for `create_result_JSON`.

572b ⟨*LadokSession data methods* 249⟩+≡

```
  def update_result_JSON(self,
        result_id: str, grade_id: int, date: str,
        last_modified: str,
        notes: list | None = None) -> dict:
    """Update an existing result draft in LADOK.

    Note: Cannot be used to update finalized results. Uses ResultatUID, not StudieresultatUID.

    Args:
        result_id (str): The unique result identifier (ResultatUID).
        grade_id (int): The numeric grade identifier from the grade scale.
        date (str): Examination date in YYYY-MM-DD format.
        last_modified (str): Last modification timestamp to prevent conflicts.
        notes (list, optional): List of notes to attach to the result.

    Returns:
        dict: Updated result data from LADOK.

    Raises:
        Exception: If the update request fails or is rejected by LADOK.
    """
    if notes is None:
      notes = []
    try:
      return self.put_query(
        f"/resultat/internal/resultat/uppdatera/{result_id}",
        {
          'Betygsgrad': grade_id,
          'Examinationsdatum': date,
          'Noteringar': notes,
          'SenasteResultatandring': last_modified
        }
      )
    except LadokServerError as err:
      raise LadokServerError(f"LADOK server error when updating result "
                             f"{result_id}: {err}") from err
    except LadokAPIError as err:
      raise LadokAPIError(f"Failed to update result {result_id}: {err}") from err
```

Defines:
update_result_JSON, used in chunks 231a and 573.
Uses LadokAPIError 242, LadokServerError 244, and put_query 249.

We test this in the following way.

573 ⟨*test functions* 245a⟩+≡

```
@pytest.mark.mutates
def test_update_result_JSON(ladok, draft_result) -> None:
  result = ladok.update_result_JSON(
    draft_result["Uid"], FAIL_GRADE_ID, "2022-11-28",
    draft_result["SenasteResultatandring"])

  assert result["Uid"] == draft_result["Uid"]
```

```
    assert result["ProcessStatus"] == DRAFT
    assert result["Betygsgrad"] == FAIL_GRADE_ID
    assert result["Examinationsdatum"] == "2022-11-28"
```

This code is used in chunk 240.
Defines:
`test_update_result_JSON`, never used.
Uses `DRAFT` 570, `draft_result` 570, `FAIL_GRADE_ID` 570, and `update_result_JSON` 226a 572b.

The output looks like this.

```
{
  "ArDokumenteratBeslut": false,
  "Betygsgrad": 131658,
  "Betygsgradsobjekt": {
    "GiltigSomSlutbetyg": true,
    "ID": 131658,
    "Kod": "P"
  },
  "BetygsskalaID": 131656,
  "Examinationsdatum": "2022-11-29",
  "ForbereddForBorttag": false,
  "KursinstansUID": "2179e02c-d6b5-11e8-8fd5-cf9d2c5c41ba",
  "KurstillfalleUID": "e058a850-1a94-11ea-a622-3565135944de",
  "Noteringar": [],
  "Noteringsdefinitioner": [],
  "ProcessStatus": 1,
  "ResultatUID": "ba248230-cc84-11f1-b463-33e2d8c54565",
  "SenasteResultatandring": "2026-10-20T14:49:45.652",
  "StudentUID": "76291c55-d24a-11ea-a4db-82cca4dd4b3e",
  "StudieresultatUID": "c052ecf9-e2d6-11ea-8f88-9c9fd6664756",
  "Uid": "ba248230-cc84-11f1-b463-33e2d8c54565",
  "UtbildningsinstansUID": "385a4428-73d8-11e8-b4e0-063f9afb40e3"
}
```

20.4 Finalizing a result

Here we cover the API calls needed to finalize (klarmarkera) a result in LADOK. To finalize a result, we first need to know the possible reporters and attestants. However, normally that's us, so we want to find the info of the currently logged in LADOK user.

20.4.1 `result_attestants_JSON` and `result_reporters_JSON`

To finalize a result, we must know two things: who is reporting and who can attest. We start with who can attest.

574 ⟨*LadokSession data methods* 249⟩+≡

```
def result_attestants_JSON(self, result_id: str) -> list:
  """Returns a list of result attestants"""
  data = self.put_query(
    "/resultat/internal/anvandare/resultatrattighet/attestanter/kurstillfallesrapportering",
    {"Identitet": [result_id]}
  )
```

```
    try:
      return data["Anvandare"]
    except KeyError as err:
      err.add_note(f"Response data: {data}")
      raise LadokAPIError(f"Unexpected response format when fetching attestants for "
                          f"result {result_id}: missing 'Anvandare' key") from err
```

Defines:
result_attestants_JSON, used in chunk 575a.
Uses LadokAPIError 242 and put_query 249.

The result_id is the ID returned in the ResultatUID field in the response from the create_result_JSON method.

LADOK changed this API request in 2022: the internal is mandatory part of the path.

We can test this in the following way.

575a ⟨*test functions* 245a⟩+≡

```
@pytest.mark.mutates
def test_result_attestants_JSON(ladok, draft_result) -> None:
  attestants = ladok.result_attestants_JSON(draft_result["Uid"])
  assert attestants
  assert len({attestant["Uid"] for attestant in attestants}) \
    == len(attestants)
```

This code is used in chunk 240.
Defines:
test_result_attestants_JSON, never used.
Uses draft_result 570 and result_attestants_JSON 574.

The output looks like this.

```
[
  {
    "Anvandarnamn": "user@domain.se",
    "Efternamn": "Studentzadeh",
    "Fornamn": "Student",
    "Uid": "0ad46a6f-f058-11e6-914e-6af6ab854a1a"
  },
  {
    "Anvandarnamn": "user@domain.se",
    "Efternamn": "Studentzadeh",
    "Fornamn": "Student",
    "Uid": "21f4667a-e864-11ea-adbf-a14961264cf0"
  }
]
```

Now, we get a list of who can report (basically anyone registered in the entire organization).

575b ⟨*LadokSession data methods* 249⟩+≡

```
def result_reporters_JSON(self, organization_id: str) -> list:
  """Returns a list of who can report results in an organization"""
  data = self.get_query(
    "/kataloginformation/internal/anvandare/organisation/" +
      organization_id + "/resultatrapportorer",
```

```
      "application/vnd.ladok-kataloginformation+json"
    )

    try:
      return data["Anvandare"]
    except KeyError as err:
      err.add_note(f"Response data: {data}")
      raise LadokAPIError(f"Unexpected response format when fetching reporters for "
                          f"organization {organization_id}: missing 'Anvandare' key") from err
```

Defines:
result_reporters_JSON, used in chunk 576.
Uses get_query 249 and LadokAPIError 242.

We test this method as follows.

576 ⟨*test functions* 245a⟩+≡

```
def test_result_reporters_JSON(ladok) -> None:
  reporters = ladok.result_reporters_JSON(KTH_org_id)
  me = ladok.user_info_JSON()
  assert len({reporter["Uid"] for reporter in reporters}) == len(reporters)
  assert me["AnvandareUID"] in {reporter["Uid"] for reporter in reporters}
```

This code is used in chunk 240.
Defines:
test_result_reporters_JSON, never used.
Uses KTH_org_id 240, result_reporters_JSON 575b, and user_info_JSON 577a.

The output looks like this.


```
[
  {
    "AnvandareStatus": "AKTIV",
    "Anvandarnamn": "user@domain.se",
    "Efternamn": "Studentzadeh",
    "Fornamn": "Student",
    "LarosateID": 29,
    "Uid": "7c3b78ca-5790-11e9-aa01-33005ebe4882"
  },
  {
    "AnvandareStatus": "AKTIV",
    "Anvandarnamn": "user@domain.se",
    "Efternamn": "Studentzadeh",
    "Fornamn": "Student",
    "LarosateID": 29,
    "Uid": "c2c14b87-3a90-11e9-98c7-6e9130f64812"
  },
  {
    "AnvandareStatus": "AKTIV",
    "Anvandarnamn": "user@domain.se",
    "Efternamn": "Studentzadeh",
    "Fornamn": "Student",
    "LarosateID": 29,
    "Uid": "ab6ef714-15fb-11e7-a1a0-8cb7e2bc425d"
  }
]
```

20.4.2 user_info_JSON

Usually, we want to set the reporter to the logged-in user. We can use the following API call to get information about the logged-in user.

577a ⟨*LadokSession data methods* 249⟩+≡

```
def user_info_JSON(self) -> dict:
  """
  Get information about the currently logged-in user.

  Returns:
      dict: User information including name, roles, and permissions.

  Raises:
      Exception: If the request fails or returns an error status.
  """
  try:
    return self.get_query(
      "/kataloginformation/internal/anvandare/anvandarinformation",
      "application/vnd.ladok-kataloginformation+json"
    )
  except LadokServerError as err:
    raise LadokServerError(f"LADOK server error when getting user info: "
                           f"{err}") from err
  except LadokAPIError as err:
    raise LadokAPIError(f"Failed to get user info: {err}") from err
```

Defines:
user_info_JSON, used in chunks 249, 253d, 576, 577b, and 589b.
Uses get_query 249, LadokAPIError 242, and LadokServerError 244.

We test this as follows.

577b ⟨*test functions* 245a⟩+≡

```
def test_user_info_JSON(ladok) -> None:
  me_teacher = ladok.user_info_JSON()
  assert me_teacher["Uid"]
  assert me_teacher["AnvandareUID"]
```

This code is used in chunk 240.
Defines:
test_user_info_JSON, never used.
Uses user_info_JSON 577a.

The output looks like this.

```
{
  "AnvandareUID": "21f4667a-e864-11ea-adbf-a14961264cf0",
  "Epost": "user@domain.se",
  "Leveranspreferenser": [],
  "Uid": "25c8c6d7-e864-11ea-adbf-a14961264cf0"
}
```

20.4.3 finalize_result_JSON

Finally, we can finalize the reported grade. If attestant_id is not None, then LADOK will send a notification to that person. (LADOK changed this API request

in 2022.)

578a ⟨*LadokSession data methods* 249⟩+≡

```
  def finalize_result_JSON(self,
      result_id: str, last_modified: str, reporter_id: str,
      attestant_ids: list | None = None,
      others: list | None = None) -> dict:
    """Marks a result as finalized (klarmarkera)"""
    if attestant_ids is None:
      attestant_ids = []
    if others is None:
      others = []
    try:
      return self.put_query(
        f"/resultat/internal/resultat/klarmarkera/{result_id}",
        {
          "Beslutsfattare": attestant_ids,
          "KlarmarkeradAvUID": reporter_id,
          "RattadAv": [],
          "OvrigaMedverkande": "\n".join(set(others)),
          "ResultatetsSenastSparad": last_modified
        }
      )
    except LadokServerError as err:
      raise LadokServerError(f"LADOK server error when finalizing result "
                             f"{result_id}: {err}") from err
    except LadokAPIError as err:
      raise LadokAPIError(f"Failed to finalize result {result_id}: {err}") from err
```

Defines:
`finalize_result_JSON`, used in chunks 570 and 578b.
Uses `LadokAPIError` 242, `LadokServerError` 244, `put_query` 249, and `reporter_id` 231c 578b.

This method returns a copy of the finalized result.

We test this in the following way.

578b ⟨*test functions* 245a⟩+≡

```
reporter_id = "21f4667a-e864-11ea-adbf-a14961264cf0"

@pytest.mark.mutates
def test_finalize_result_JSON(ladok, draft_result) -> None:
  result = ladok.finalize_result_JSON(
    draft_result["Uid"], draft_result["SenasteResultatandring"], reporter_id)

  assert result["Uid"] == draft_result["Uid"]
  assert result["ProcessStatus"] == FINALIZED
  draft, _ = lab_result(ladok)
  assert draft["ProcessStatus"] == FINALIZED
```

This code is used in chunk 240.
Defines:
`reporter_id`, used in chunks 570 and 578a.
`test_finalize_result_JSON`, never used.
Uses `draft_result` 570, `finalize_result_JSON` 578a, `FINALIZED` 570, and `lab_result` 570.

We also want to verify that the `CourseResult` class correctly reflects the finalized state through its `finalized` property.

579a ⟨*test functions* 245a⟩+≡

```
@pytest.mark.mutates
def test_finalized_CourseResult(ladok, finalized_result) -> None:
  """Verify CourseResult.finalized property after finalization."""
  ladok.cache.clear()
  student = ladok.get_student(datintro_student_uid)

  courses = [c for c in student.courses()
             if c.instance_id == datintro_instance_id]
  assert len(courses) > 0, "Student should have course participation"
  lab_results = courses[0].results(component="LAB1")

  assert len(lab_results) == 1
  assert lab_results[0].finalized
  assert not lab_results[0].attested
```

This code is used in chunk 240.
Defines:
`test_finalized_CourseResult`, never used.
Uses `datintro_instance_id` 570, `datintro_student_uid` 570, and `finalized_result` 570.

We can also verify that the reporting helper refuses to silently accept a different result once LADOK has a finalized value waiting for attestation. It gets its own finalized result from the `finalized_result` fixture.

579b ⟨*test functions* 245a⟩+≡

```
@pytest.mark.mutates
def test_report_set_grade_rejects_mismatching_finalized_result(
    ladok, finalized_result) -> None:
  ladok.cache.clear()
  student = ladok.get_student(datintro_student_uid)

  courses = [c for c in student.courses()
             if c.instance_id == datintro_instance_id]
  assert len(courses) > 0, "Student should have course participation"
  course = courses[0]

  lab_results = [r for r in course.results(component="LAB1")
                 if r.finalized and not r.attested]
  assert len(lab_results) > 0, "Should have a finalized LAB1 result"

  result = lab_results[0]
  args = type("Args", (), {"finalize": False, "verbose": 0})()

  with pytest.raises(
      ladok3.LadokValidationError,
      match="change the finalized result back to draft in LADOK"):
    ladok3.report.set_grade(
      ladok, args, datintro_student_uid, course.code, result.component.code,
      str(result.grade), "2022-11-30", [])
```

This code is used in chunk 240.
Defines:

test_report_set_grade_rejects_mismatching_finalized_result, never used.
Uses datintro_instance_id 570, datintro_student_uid 570, finalized_result 570, and LadokValidationError 242.

The output looks like this.

```
{
  "ArDokumenteratBeslut": false,
  "Betygsgrad": 131658,
  "Betygsgradsobjekt": {
    "GiltigSomSlutbetyg": true,
    "ID": 131658,
    "Kod": "P"
  },
  "BetygsskalaID": 131656,
  "Examinationsdatum": "2022-11-29",
  "ForbereddForBorttag": false,
  "KursinstansUID": "2179e02c-d6b5-11e8-8fd5-cf9d2c5c41ba",
  "KurstillfalleUID": "e058a850-1a94-11ea-a622-3565135944de",
  "Noteringar": [],
  "Noteringsdefinitioner": [],
  "ProcessStatus": 2,
  "ResultatUID": "ba248230-cc84-11f1-b463-33e2d8c54565",
  "SenasteResultatandring": "2026-10-20T14:49:45.893",
  "StudentUID": "76291c55-d24a-11ea-a4db-82cca4dd4b3e",
  "StudieresultatUID": "c052ecf9-e2d6-11ea-8f88-9c9fd6664756",
  "Uid": "ba248230-cc84-11f1-b463-33e2d8c54565",
  "UtbildningsinstansUID": "385a4428-73d8-11e8-b4e0-063f9afb40e3"
}
```

20.4.4 update_finalized_result_JSON

To update an already finalised result, we can use the following API call. The only difference from the call above (Section 20.3.2) is that the URL uses `uppdateraklarmarkerat` instead of just `uppdatera`.

580 ⟨*LadokSession data methods* 249⟩+≡

```
  def update_finalized_result_JSON(self,
        result_id: str, grade_id: int, date: str,
        last_modified: str,
        notes: list | None = None) -> dict:
    if notes is None:
      notes = []
    try:
      return self.put_query(
        f"/resultat/internal/resultat/uppdateraklarmarkerat/{result_id}",
        {
          'Betygsgrad': grade_id,
          'Examinationsdatum': date,
          'Noteringar': notes,
          'SenasteResultatandring': last_modified
        }
      )
```

```
    except LadokServerError as err:
      raise LadokServerError(f"LADOK server error when updating finalized result "
                             f"{result_id}: {err}") from err
    except LadokAPIError as err:
      raise LadokAPIError(f"Failed to update finalized result {result_id}: "
                          f"{err}") from err
```

Defines:
`update_finalized_result_JSON`, used in chunk 581.
Uses `LadokAPIError` 242, `LadokServerError` 244, and `put_query` 249.

We test this in the following way.

581 ⟨*test functions* 245a⟩+≡

```
@pytest.mark.mutates
def test_update_finalized_result_JSON(ladok, finalized_result) -> None:
  result = ladok.update_finalized_result_JSON(
    finalized_result["Uid"], FAIL_GRADE_ID, "2022-11-28",
    finalized_result["SenasteResultatandring"])

  assert result["Uid"] == finalized_result["Uid"]
  assert result["ProcessStatus"] == FINALIZED
  assert result["Betygsgrad"] == FAIL_GRADE_ID
  assert result["Examinationsdatum"] == "2022-11-28"
```

This code is used in chunk 240.
Defines:
`test_update_finalized_result_JSON`, never used.
Uses `FAIL_GRADE_ID` 570, `FINALIZED` 570, `finalized_result` 570, and `update_finalized_result_JSON` 580.

The output looks like this.


```
{
  "ArDokumenteratBeslut": false,
  "Betygsgrad": 131658,
  "Betygsgradsobjekt": {
    "GiltigSomSlutbetyg": true,
    "ID": 131658,
    "Kod": "P"
  },
  "BetygsskalaID": 131656,
  "Examinationsdatum": "2022-11-29",
  "ForbereddForBorttag": false,
  "KursinstansUID": "2179e02c-d6b5-11e8-8fd5-cf9d2c5c41ba",
  "KurstillfalleUID": "e058a850-1a94-11ea-a622-3565135944de",
  "Noteringar": [],
  "Noteringsdefinitioner": [],
  "ProcessStatus": 2,
  "ResultatUID": "ba248230-cc84-11f1-b463-33e2d8c54565",
  "SenasteResultatandring": "2026-10-20T14:49:46.031",
  "StudentUID": "76291c55-d24a-11ea-a4db-82cca4dd4b3e",
  "StudieresultatUID": "c052ecf9-e2d6-11ea-8f88-9c9fd6664756",
  "Uid": "ba248230-cc84-11f1-b463-33e2d8c54565",
  "UtbildningsinstansUID": "385a4428-73d8-11e8-b4e0-063f9afb40e3"
}
```

20.4.5 finalized_result_to_draft_JSON

We can also change a result from finalized back to draft status.

582a ⟨*LadokSession data methods* 249⟩+≡

```
  def finalized_result_to_draft_JSON(
      self, result_id: str, last_modified: str) -> dict:
    try:
      return self.put_query(
        f"/resultat/internal/resultat/tillbakatillutkast/{result_id}",
        {
          'ResultatUID': result_id,
          'ResultatetsSenastSparad': last_modified
        }
      )
    except LadokServerError as err:
      raise LadokServerError(f"LADOK server error when changing finalized result "
                             f"{result_id} to draft: {err}") from err
    except LadokAPIError as err:
      raise LadokAPIError(f"Failed to change finalized result {result_id} to draft: "
                          f"{err}") from err
```

Defines:
finalized_result_to_draft_JSON, used in chunks 570 and 582b.
Uses LadokAPIError 242, LadokServerError 244, and put_query 249.

We test this in the following way.

582b ⟨*test functions* 245a⟩+≡

```
@pytest.mark.mutates
def test_finalized_result_to_draft_JSON(ladok, finalized_result) -> None:
  result = ladok.finalized_result_to_draft_JSON(
    finalized_result["Uid"], finalized_result["SenasteResultatandring"])

  assert result["Uid"] == finalized_result["Uid"]
  assert result["ProcessStatus"] == DRAFT
```

This code is used in chunk 240.
Defines:
test_finalized_result_to_draft_JSON, never used.
Uses DRAFT 570, finalized_result 570, and finalized_result_to_draft_JSON 582a.

The output looks like this.


```
{
  "ArDokumenteratBeslut": false,
  "Betygsgrad": 131658,
  "Betygsgradsobjekt": {
    "GiltigSomSlutbetyg": true,
    "ID": 131658,
    "Kod": "P"
  },
  "BetygsskalaID": 131656,
  "Examinationsdatum": "2022-11-29",
  "ForbereddForBorttag": false,
  "KurstillfalleUID": "e058a850-1a94-11ea-a622-3565135944de",
  "Noteringar": [],
```

```
  "Noteringsdefinitioner": [],
  "ProcessStatus": 1,
  "ResultatUID": "ba248230-cc84-11f1-b463-33e2d8c54565",
  "SenasteResultatandring": "2026-10-20T14:49:46.093",
  "StudentUID": "76291c55-d24a-11ea-a4db-82cca4dd4b3e",
  "StudieresultatUID": "c052ecf9-e2d6-11ea-8f88-9c9fd6664756",
  "Uid": "ba248230-cc84-11f1-b463-33e2d8c54565",
  "UtbildningsinstansUID": "385a4428-73d8-11e8-b4e0-063f9afb40e3"
}
```

20.4.6 remove_result_draft_JSON

We can also change a result from finalized back to draft status.

583a ⟨*LadokSession data methods* 249⟩+≡

```
def remove_result_draft_JSON(self, result_id: str) -> None:
  try:
    data = self.del_query(
      f"/resultat/internal/resultat/tabort/{result_id}"
    )
  except LadokServerError as err:
    raise LadokServerError(f"LADOK server error when removing "
                           f"draft result {result_id}: "
                           f"{err}") from err
  except LadokAPIError as err:
    raise LadokAPIError(f"LADOK request to remove draft result "
                        f"{result_id} failed: {err}") from err
```

Defines:
  remove_result_draft_JSON, used in chunks 570 and 583b.
Uses del_query 249, LadokAPIError 242, and LadokServerError 244.

We test this in the following way.

583b ⟨*test functions* 245a⟩+≡

```
@pytest.mark.mutates
def test_remove_result_draft_JSON(ladok, draft_result) -> None:
  ladok.remove_result_draft_JSON(draft_result["Uid"])

  draft, attested = lab_result(ladok)
  assert draft is None and attested is None
```

This code is used in chunk 240.
Defines:
  test_remove_result_draft_JSON, never used.
Uses draft_result 570, lab_result 570, and remove_result_draft_JSON 583a.

There is no output.

20.5 participants_JSON

The method returns JSON data containing a list of students (the participants in the course round). (This is an extension of Maguire's original participants_JSON method. The essential difference is keyword arguments to filter which students to include.)

LADOK filters the list by the participants' `deltagaretillstand`, a list of codes. The flags below each add one code; `participant_states` takes the codes themselves, which is what the course rounds use to select the participants in some states (Section 13.5.1). Without any keyword we send LADOK's own default. A list of codes counts as a keyword even when it is empty, so an empty list is sent as it is rather than replaced by the default; the course rounds never send one.

584 ⟨*LadokSession data methods* 249⟩+≡

```
def participants_JSON(self, course_round_id: str, /, **kwargs) -> list:
  """Returns JSON record containing participants in a course identified by
  round ID.
  Filters in kwargs: not_started, ongoing, registered, finished, cancelled,
  and participant_states, a list of deltagaretillstand codes (e.g.
  ["REGISTRERAD", "AVKLARAD"]).  Returns at most PARTICIPANTS_LIMIT
  participants."""
  participants_types = list(kwargs.get("participant_states", []))
  if "not_started" in kwargs and kwargs["not_started"]:
    participants_types.append("EJ_PABORJAD")
  if "ongoing" in kwargs and kwargs["ongoing"]:
    participants_types.append("PAGAENDE")
  if "registered" in kwargs and kwargs["registered"]:
    participants_types.append("REGISTRERAD")
  if "finished" in kwargs and kwargs["finished"]:
    participants_types.append("AVKLARAD")
  if "cancelled" in kwargs and kwargs["cancelled"]:
    participants_types.append("AVBROTT")
  # 'ATERBUD', # Withdrawal
  # 'PAGAENDE_MED_SPARR', # on-going block exists
  # 'EJ_PAGAENDE_TILLFALLESBYTE', # not on-going due to instance exchange
  # 'UPPEHALL', # not on-going due to approved leave from studies

  if not kwargs:
    participants_types = ["PAGAENDE", "REGISTRERAD", "AVKLARAD"]

  put_data = {
    'page': 1,
    'limit': PARTICIPANTS_LIMIT,
    'orderby': ['EFTERNAMN_ASC',
                'FORNAMN_ASC',
                'PERSONNUMMER_ASC',
                'KONTROLLERAD_KURS_ASC'],
    'deltagaretillstand': participants_types,
    'utbildningstillfalleUID': [course_round_id]
  }

  response = self.put_query(
    '/studiedeltagande/internal/deltagare/kurstillfalle',
    put_data,
    "application/vnd.ladok-studiedeltagande+json")
  try:
```

```
    return response["Resultat"]
  except KeyError as err:
    err.add_note(f"Response data: {response}")
    raise LadokAPIError(f"Unexpected response format when fetching participants for "
                        f"round {course_round_id}: missing 'Resultat' key") from err
```

Defines:
  `participants_JSON`, used in chunks 585 and 586.
Uses `LadokAPIError` 242, `PARTICIPANTS_LIMIT` 585a, and `put_query` 249.

We ask for one page of at most 400 participants. A round with more is cut off; we name the limit so that the tests can tell when a list may be.

585a ⟨*constants* 259⟩+≡
```
PARTICIPANTS_LIMIT = 400
```

Defines:
  `PARTICIPANTS_LIMIT`, used in chunks 584 and 586.

Let's verify what we send, without LADOK: we call the method on a stand-in for the session that records the request. The codes in `participant_states` are sent as they are, before those of any flags; no keyword at all sends the default, but an empty list of codes is sent as it is.

585b ⟨*test functions* 245a⟩+≡
```
class SessionRecordingPuts:
  def __init__(self):
    self.sent = []

  def put_query(self, path, data, content_type):
    self.sent.append(data["deltagaretillstand"])
    return {"Resultat": []}

@pytest.mark.parametrize("kwargs,codes", [
  ({}, ["PAGAENDE", "REGISTRERAD", "AVKLARAD"]),
  ({"participant_states": ["EJ_PABORJAD", "AVBROTT"]},
   ["EJ_PABORJAD", "AVBROTT"]),
  ({"cancelled": True, "participant_states": ["AVKLARAD"]},
   ["AVKLARAD", "AVBROTT"]),
  ({"finished": True}, ["AVKLARAD"]),
  ({"participant_states": []}, []),
])
def test_participants_JSON_sends_the_codes(kwargs, codes) -> None:
  session = SessionRecordingPuts()
  assert ladok3.LadokSession.participants_JSON(session, "round", **kwargs) \
    == []
  assert session.sent == [codes]
```

This code is used in chunk 240.
Defines:
  `SessionRecordingPuts`, never used.
  `test_participants_JSON_sends_the_codes`, never used.
Uses `participants_JSON` 584 and `put_query` 249.

We test this as follows.

585c ⟨*test functions* 245a⟩+≡
```
def test_participants_JSON(ladok) -> None:
  results = ladok.participants_JSON(dasak_round_id)
```

```
    assert len({result["Uid"] for result in results}) == len(results)
    assert all(result["UtbildningstillfalleUID"] == dasak_round_id
               for result in results)
    assert any(result["Student"]["Uid"] == student_uid for result in results)
```

This code is used in chunk 240.
Defines:
  `test_participants_JSON`, never used.
Uses `dasak_round_id` 240, `participants_JSON` 584, and `student_uid` 240 1517a.

The output looks like this.

```
[
  {
    "Avklarad": true,
    "FleraDeltagandenPaSammaUtbildning": false,
    "KodRotpaketering": "CL",
    "Nuvarande": true,
    "Paborjad": true,
    "Student": {
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student",
      "Personnummer": "19121212-1212",
      "Uid": "de709f81-a867-11e7-8dbf-78e86dc2470c"
    },
    "Studiestrukturreferens": "6cd8b548-73e0-11e8-b9fd-0a821ba7448e,6ce3ffb8-73e0-11e8-b9fd-0a821ba7448e",
    "TillfallesantagningUID": "99402e3c-73f2-11e8-b9fd-0a821ba7448e",
    "TillstandI18n": "studiedeltagande.studenthantering.deltagare.tillstand.avklarad",
    "TillstandKurs": {
      "Sammanfattat": "studiedeltagande.domain.tillstandsdefinition.avklarad",
      "Sammanfattattillstand": "studiedeltagande.domain.tillstandsdefinition.avklarad",
      "Tillfallesdeltagande": "studiedeltagande.domain.tillstandsdefinition.paborjad",
      "Utbildning": "studiedeltagande.domain.tillstandsdefinition.avklarad"
    },
    "Uid": "99402e3c-73f2-11e8-b9fd-0a821ba7448e",
    "UtbildningstillfalleUID": "79a8cb1b-73da-11e8-b4e0-063f9afb40e3"
  }
]
```

Against LADOK, we check the participant list's codes on a round of DD1317 that runs from 24 August 2026 to 11 January 2027, so that the code for the ongoing participants is among those we ask for. We ask for the participants of each state, with the codes that the round's dates give for it on the day of the answers (Section 22.13), and for those with the one code that no state uses, `PAGAENDE`. What must hold on any day from the start of the round: each participant is in at most one of these lists, and LADOK's default list is the union of the lists of `PAGAENDE`, `REGISTRERAD` and `AVKLARAD`, since those are the codes it defaults to, and `REGISTRERAD` is ongoing or unfinished, whichever the day makes it. No list may be full, since a full list may have been cut off (`PARTICIPANTS_LIMIT`). We compare the students' LADOK IDs and assert on counts, so that a failure shows no one.

586 ⟨*test functions* 245a⟩+≡

```
def test_participant_states_partition_a_round(ladok, recording,
                                              vcr) -> None:
```

```
    today = date_of_answers(recording, vcr)
    start, end = DD1317_running_round_dates

    def students(**kwargs):
      participants = ladok.participants_JSON(DD1317_running_round_id,
                                             **kwargs)
      assert len(participants) < ladok3.PARTICIPANTS_LIMIT
      return {participant["Student"]["Uid"] for participant in participants}

    by_state = {}
    for state in ladok3.COURSE_STATES:
      codes = ladok3.participant_codes(state, start, end, today)
      by_state[state] = students(participant_states=codes) if codes else set()
    pagaende = students(participant_states=["PAGAENDE"])
    default = students()

    lists = [pagaende, *by_state.values()]
    assert sum(map(len, lists)) == len(set().union(*lists))
    assert len(default ^ (pagaende | by_state["ongoing"]
                          | by_state["unfinished"]
                          | by_state["completed"])) == 0
```

This code is used in chunk 240.
Defines:
`test_participant_states_partition_a_round`, never used.
Uses `date_of_answers` 1510, `DD1317_running_round_dates` 240, `DD1317_running_round_id` 240, `participants_JSON` 584, and `PARTICIPANTS_LIMIT` 585a.

Chapter 21

Other API calls

The following API calls were explored and written by Chip Maguire. Bosk has merely added tests and generated example output, as well as minor reformatting of the code.

21.1 Code tables

Most of the calls in this chapter fetch one of LADOK's code tables: the teaching languages, the municipalities, the forms of funding and so on. They all have the same form, a dictionary with a single list of entries, each with an `ID`, a code (`Kod`) and a name (`Benamning`). The `ID` is what other records refer to, for instance a course round's `StudietaktID`. Note that the tables give the `ID` as a string, while the records that refer to it use an integer, so we compare them as strings.

We test the tables with the same two checks: the table must have entries, each with an ID and a code, and no ID may occur twice. These hold for any version of the data in the test environment, so the tests need not know what the tables contain. Where a table refers to another one, its test also checks that every reference resolves, which is what a program using the tables relies on.

588 ⟨*test functions* 245a⟩+≡

```
def assert_code_table(response, key):
  """Check that `response` holds a code table under `key`: a non-empty
  list of entries, each with an ID and a code, and no ID twice."""
  table = response[key]
  assert table
  assert all(entry["ID"] and entry["Kod"] for entry in table)
  ids = [entry["ID"] for entry in table]
  assert len(set(ids)) == len(ids)

def code_table_ids(response, key):
  """Return the IDs in the code table under `key`, as strings."""
  return {str(entry["ID"]) for entry in response[key]}
```

This code is used in chunk 240.
Defines:
`assert_code_table`, used in chunks 686a, 687, 817b, 910b, 985b, 1039, 1041b, 1045, 1047b, 1178b, 1180b, 1223b, 1253b, 1281b, 1288b, 1289b, 1296b, 1300, 1313b, 1331b, 1464, and 1469b.
`code_table_ids`, used in chunks 549, 817b, 1041b, 1289b, and 1300.

21.2 grading_rights

We can get a list of our rights in LADOK.

589a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def grading_rights(self) -> list:
  """
  Returns a list of dictionaries with the grading rights of the logged in user.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/resultat/internal/resultatrattighet/listaforinloggadanvandare',
    headers=self.headers)
  if r.status_code == requests.codes.ok:
    return r.json()['Resultatrattighet']
  raise LadokAPIError(f"failed to get grading rights: {r.text}")
```

Defines:
grading_rights, used in chunk 589b.
Uses LadokAPIError 242.

Let's add a test. The rights we get are the logged-in user's own, so each should name that user.

589b ⟨*test functions* 245a⟩+≡

```
def test_grading_rights(ladok) -> None:
  r = ladok.grading_rights()
  me = ladok.user_info_JSON()
  assert r
  assert all(right["Anvandare"]["Uid"] == me["AnvandareUID"] for right in r)
```

This code is used in chunk 240.
Defines:
test_grading_rights, never used.
Uses grading_rights 589a and user_info_JSON 577a.

The output looks like this:


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    "Benamning": "DA2215 Theory of Science and Scientific methods in Cybersecurity",
    "Gruppavgransningar": [],
    "KursUID": "b790ea69-5065-11ed-9bb3-15472a47482f",
    "Kursinstansavgransningar": [],
    "Kurstillfallesavgransningar": [],
    "Medarbetartyp": "ATTESTANT",
    "Modulavgransningar": [],
    "Organisation": {
      "Benamning": {
        "sv": "EECS/Teoretisk datalogi",
        "en": "EECS/Theoretical Computer Science"
      },
      "Kod": "JHT",
```

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      "Uid": "638add54-dc41-11e8-8cc1-eaeeb71b497f"
    },
    "RattighetenAvser": "HEL_KURS_OCH_MODUL_RESULTAT",
    "RattighetenSaknarPraktiskMening": false,
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    "SenastSparad": "2026-01-30T08:35:47.190",
    "Studentavgransningar": [],
    "Uid": "4af089ea-fdae-11f0-9bee-4a6818304b91",
    "Utbildningstypbenamning": {
      "sv": "Kurs, avancerad niv\u00e5",
      "en": "Course, Second-cycle"
    }
  },
  {
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    "Anvandare": {
      "Anvandarnamn": "user@domain.se",
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student",
      "Uid": "21f4667a-e864-11ea-adbf-a14961264cf0"
    },
    "AviseraVidKlarForHelkurs": false,
    "AvserAvveckladKurs": true,
    "Benamning": "DD1315 Programming Techniques and Matlab",
    "Gruppavgransningar": [],
    "KursUID": "38ab2393-73d8-11e8-afa7-8e408e694e54",
    "Kursinstansavgransningar": [],
    "Kurstillfallesavgransningar": [],
    "Medarbetartyp": "ATTESTANT",
    "Modulavgransningar": [],
    "Organisation": {
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        "sv": "EECS/Datavetenskap",
        "en": "EECS/Computer Science"
      },
      "Kod": "JH",
      "Uid": "2474f616-dc41-11e8-8cc1-eaeeb71b497f"
    },
    "RattighetenAvser": "HEL_KURS_OCH_MODUL_RESULTAT",
    "RattighetenSaknarPraktiskMening": false,
    "SenastAndradAv": "user@domain.se",
    "SenastSparad": "2020-09-24T13:46:48.089",
    "Studentavgransningar": [],
    "Uid": "a0c3d8c7-fe5b-11ea-a46d-46a9df314f55",
    "Utbildningstypbenamning": {
      "sv": "Kurs, grundniv\u00e5",
      "en": "Course, First-cycle"
    }
  }
]
```

21.3 organization_info_JSON

We can get information about the organization.

601a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def organization_info_JSON(self) -> dict:
  """
  Returns a dictionary of organization information for the entire institution
  of the logged in user.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url + '/resultat/internal/organisation/utanlankar',
    headers=self.headers)
  if r.status_code == requests.codes.ok:
    return r.json()
  raise LadokAPIError(f"failed to get organization info: {r.text}")
```

Defines:
`organization_info_JSON`, used in chunk 601b.
Uses `LadokAPIError` 242.

Let's add a test. KTH's own organisational unit should be among the units.

601b ⟨*test functions* 245a⟩+≡

```
def test_organization_info_JSON(ladok) -> None:
  r = ladok.organization_info_JSON()
  assert KTH_org_id in {unit["Uid"] for unit in r["Organisation"]}
```

This code is used in chunk 240.
Defines:
`test_organization_info_JSON`, never used.
Uses `KTH_org_id` 240 and `organization_info_JSON` 601a.

The output looks like this:


```
{
  "Organisation": [
    {
      "Benamning": {
        "sv": "KTH Universitetsf\u00f6rvaltning/SI",
        "en": "KTH Student's Office/SI"
      },
      "Kod": "100",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e83d5892-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Arkitekturskolan",
        "en": "KTH School of Architecture"
      },
      "Kod": "110",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e842afc9-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
```

```
      "Benamning": {
        "sv": "KTH Mark och vattenteknik",
        "en": "KTH Land & Water Resources Engineering"
      },
      "Kod": "120",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8482e10-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Byggkonstruktion",
        "en": "KTH Structural Engineering"
      },
      "Kod": "130",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e84dac57-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Byggvetenskap",
        "en": "KTH Civil and Architectural Engineering"
      },
      "Kod": "140",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e857705e-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Inst f byggv.sk., anv ej  - nu inst 140",
        "en": "- No translation available -"
      },
      "Kod": "1401",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e85ceea5-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Geodesi o fotogrammetri",
        "en": "KTH Geodesy and Photogrammetry"
      },
      "Kod": "150",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8637e5c-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Fastigheter och byggande",
        "en": "KTH Real Estate & Construction Managem"
      },
      "Kod": "160",
      "Organisationsenhetstyp": "INSTITUTION",
```

```
      "Uid": "e8688773-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Infrastruktur",
        "en": "KTH Infrastructure"
      },
      "Kod": "165",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e86d908a-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Milj\u00f6 och naturresursinformation",
        "en": "- No translation available -"
      },
      "Kod": "170",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8730dd1-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Byggd milj\u00f6",
        "en": "KTH Built Environment"
      },
      "Kod": "180",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e875f408-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Universitetsf\u00f6rvaltning/A",
        "en": "KTH Student's Office/A"
      },
      "Kod": "190",
      "Organisationsenhetstyp": "INSTITUTION",
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    },
    {
      "Benamning": {
        "sv": "KTH Universitetsf\u00f6rvaltning/DEF",
        "en": "KTH Student's Office/DEF"
      },
      "Kod": "200",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e87c83c6-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Alfv\u00e9nlaboratoriet",
        "en": "KTH Alfv\u00e9n Laboratory"
```

```
      },
      "Kod": "210",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e880063d-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Alfv\u00e9nlaboratoriet, anv ej - nu inst 210",
        "en": "Dept. of Alfv\u00e9n Laboratory"
      },
      "Kod": "2101",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e883d6d4-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Mikroelektronik & informat.teknik",
        "en": "KTH Microelectronics & Inform.Techn"
      },
      "Kod": "220",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8870b2b-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Elektrotekniska system",
        "en": "KTH Electrical Engineering"
      },
      "Kod": "230",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e889f162-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Numerisk analys o datalogi",
        "en": "KTH Num Analysis & Computing Science"
      },
      "Kod": "240",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e88cd799-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Signaler, sensorer och system",
        "en": "KTH Signals, Sensors and System"
      },
      "Kod": "250",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e88f6fb0-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
```

```
        "Benamning": {
          "sv": "Forskarskola - S3",
          "en": "Signals, Sensors and Systems"
        },
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        "Organisationsenhetstyp": "INSTITUTION",
        "Uid": "e89255e7-73d6-11e8-8c58-f9aa7f7e4fb6"
      },
      {
        "Benamning": {
          "sv": "KTH Tal, musik och h\u00f6rsel",
          "en": "KTH Speech, Music and Hearing"
        },
        "Kod": "260",
        "Organisationsenhetstyp": "INSTITUTION",
        "Uid": "e895632e-73d6-11e8-8c58-f9aa7f7e4fb6"
      },
      {
        "Benamning": {
          "sv": "KTH Teoretisk elektroteknik",
          "en": "KTH Electromagnetic Theory"
        },
        "Kod": "280",
        "Organisationsenhetstyp": "INSTITUTION",
        "Uid": "e8982255-73d6-11e8-8c58-f9aa7f7e4fb6"
      },
      {
        "Benamning": {
          "sv": "KTH Data- och systemvetenskap",
          "en": "KTH Computer and Systems Sciences"
        },
        "Kod": "290",
        "Organisationsenhetstyp": "INSTITUTION",
        "Uid": "e89ae17c-73d6-11e8-8c58-f9aa7f7e4fb6"
      },
      {
        "Benamning": {
          "sv": "KTH Universitetsf\u00f6rvaltning/KKB",
          "en": "KTH Student's Office/KKB"
        },
        "Kod": "300",
        "Organisationsenhetstyp": "INSTITUTION",
        "Uid": "e89dc7b3-73d6-11e8-8c58-f9aa7f7e4fb6"
      },
      {
        "Benamning": {
          "sv": "KTH Bioteknologi",
          "en": "KTH Biotechnology"
        },
        "Kod": "310",
        "Organisationsenhetstyp": "INSTITUTION",
```

```
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    },
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        "en": "KTH Chemistry"
      },
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      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8a3e241-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Kemiteknik",
        "en": "KTH Chemical Eng. and Technology"
      },
      "Kod": "330",
      "Organisationsenhetstyp": "INSTITUTION",
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    },
    {
      "Benamning": {
        "sv": "KTH Fiber- och polymerteknologi",
        "en": "KTH Fiber and Polymer Technology"
      },
      "Kod": "350",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8a9d5bf-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
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        "sv": "KTH Universitetsf\u00f6rvaltning/MMT",
        "en": "KTH Student's Office/MMT"
      },
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    },
    {
      "Benamning": {
        "sv": "KTH Energiteknik",
        "en": "KTH Energy Technology"
      },
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      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8aff04d-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Farkost och flyg",
        "en": "KTH Aeronautical and Vehicle Eng."
```

```
      },
      "Kod": "420",
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      "Uid": "e8b2af74-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH H\u00e5llfasthetsl\u00e4ra",
        "en": "KTH Solid Mechanics"
      },
      "Kod": "430",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8b5207b-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Industriell ekonomi och organisation",
        "en": "KTH Industrial Economics & Management"
      },
      "Kod": "440",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8b7b892-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Maskinkonstruktion",
        "en": "KTH Machine Design"
      },
      "Kod": "450",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8ba50a9-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Industriell produktion",
        "en": "KTH Production Engineering"
      },
      "Kod": "460",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8bd0fd0-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Metallernas gjutning",
        "en": "Casting of Metals"
      },
      "Kod": "466",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8bfcef7-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
```

```
      "Benamning": {
        "sv": "KTH Materialvetenskap",
        "en": "KTH Materials Science and Engineering"
      },
      "Kod": "470",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8c2dc3e-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Metallurgi",
        "en": "KTH Metallurgy"
      },
      "Kod": "475",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8c5e985-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Milj\u00f6skydd och arbetsvetenskap",
        "en": "KTH Environmental Tech. & Work Science"
      },
      "Kod": "480",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8c8cfbc-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Industriell produktion",
        "en": "KTH Production Engineering"
      },
      "Kod": "490",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8cbb5f3-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Metallernas bearbetning",
        "en": "- No translation available -"
      },
      "Kod": "495",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8ce9c2a-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Universitetsf\u00f6rvaltning/DEF",
        "en": "KTH Student's Office/DEF"
      },
      "Kod": "500",
      "Organisationsenhetstyp": "INSTITUTION",
```

```
      "Uid": "e8d15b51-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Fysik",
        "en": "KTH Physics"
      },
      "Kod": "510",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8d3f368-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Matematik",
        "en": "KTH Mathematics"
      },
      "Kod": "520",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8d6b28f-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Mekanik",
        "en": "KTH Mechanics"
      },
      "Kod": "530",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8d9e6e6-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Ingenj\u00f6rsskolan",
        "en": "College of Engineering"
      },
      "Kod": "600",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8ddb77d-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Till\u00e4mpad IT",
        "en": "KTH Applied Information Technology"
      },
      "Kod": "620",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8e22354-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Utbildn.enh. i Skrubba",
        "en": "College of Engineering"
```

```
      },
      "Kod": "630",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8e4bb6b-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Kemiteknik",
        "en": "KTH Chemical Engineering and Technology"
      },
      "Kod": "640",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8e72c72-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH Syd",
        "en": "KTH Syd"
      },
      "Kod": "655",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8eaaee9-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "M\u00e4lardalens H\u00f6gskola",
        "en": "- No translation available -"
      },
      "Kod": "710",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8ed6e10-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Mitth\u00f6gskolan",
        "en": "- No translation available -"
      },
      "Kod": "720",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8f00627-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "H\u00f6gskolan i G\u00e4vle",
        "en": "- No translation available -"
      },
      "Kod": "730",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8f2772e-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
```

```
      "Benamning": {
        "sv": "H\u00f6gskolan Dalarna",
        "en": "- No translation available -"
      },
      "Kod": "740",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8f53655-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Karolinska institutet",
        "en": "- No translation available -"
      },
      "Kod": "750",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8f7a75c-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "CITEC",
        "en": "- No translation available -"
      },
      "Kod": "820",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8fa3f73-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Spr\u00e5k och didaktik",
        "en": "- No translation available -"
      },
      "Kod": "821",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "e8fd25aa-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
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      "Kod": "VDC",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec69eae5-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
```

```
      "Benamning": {
        "sv": "KTH/Universitetsf\u00f6rvaltningen/VoS",
        "en": "KTH/University Administration, Sweden"
      },
      "Kod": "VDDA",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec6fb753-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH/Universitetsf\u00f6rvaltningen/Personalavdelningen",
        "en": "KTH University Administration"
      },
      "Kod": "VDDH",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec729d8a-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Universitetsf\u00f6rvaltningen/Kommunikationsavdelningen (KOM)",
        "en": "University Administration"
      },
      "Kod": "VDE",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec7583c1-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Universitetsf\u00f6rvaltningen/Fakultetens kansli",
        "en": "University Administration"
      },
      "Kod": "VDG",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec78b818-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH/Universitetsf\u00f6rvaltningen/Avdelningen f\u00f6r studentservice",
        "en": "KTH/University Administration"
      },
      "Kod": "VDH",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec7c137f-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Universitetsf\u00f6rvaltningen/Enheten f\u00f6r externa relationer",
        "en": "University Administration"
      },
      "Kod": "VDI",
      "Organisationsenhetstyp": "INSTITUTION",
```

```
      "Uid": "ec7f47d6-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH/Universitetsf\u00f6rvaltningen/Juridiska avdelningen",
        "en": "KTH/University Administration/Legal Department"
      },
      "Kod": "VDJ",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec82a33d-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Universitetsf\u00f6rvaltningen/IRO - Internationella relationer",
        "en": "University Administration"
      },
      "Kod": "VDK",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec853b54-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH/Universitetsf\u00f6rvaltningen/Lokalserviceavdelningen",
        "en": "KTH/University Administration"
      },
      "Kod": "VDO",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec895a0b-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Universitetsf\u00f6rvaltningen/IT-enheten",
        "en": "University Administration"
      },
      "Kod": "VDP",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec8c1932-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "Universitetsf\u00f6rvaltningen/KTH N\u00e4ringslivssamverkan",
        "en": "- No translation available -"
      },
      "Kod": "VDU",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec8f4d89-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH/Universitetsf\u00f6rvaltningen/AUA",
        "en": "KTH University Administration"
```

```
      },
      "Kod": "VDV",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec6cd11c-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH/Universitetsf\u00f6rvaltningen/AUA/Antagningsgruppen",
        "en": "KTH Admissions Office"
      },
      "Kod": "VDVA",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec92a8f0-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH/Universitetsf\u00f6rvaltningen/AUA/Examensgruppen",
        "en": "KTH Degree Administration Office"
      },
      "Kod": "VDVB",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec95b637-73d6-11e8-8c58-f9aa7f7e4fb6"
    },
    {
      "Benamning": {
        "sv": "KTH/Universitetsf\u00f6rvaltningen/AUA/VoS",
        "en": "KTH University Administration"
      },
      "Kod": "VDVC",
      "Organisationsenhetstyp": "INSTITUTION",
      "Uid": "ec99119e-73d6-11e8-8c58-f9aa7f7e4fb6"
    }
  ]
}
```

21.4 larosatesinformation_JSON

685 ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def larosatesinformation_JSON(self) -> dict:
  """
  Returns a dictionary of the university or college information.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/kataloginformation/internal/grunddata/larosatesinformation',
    headers=self.headers).json()
  return r
```

Defines:
larosatesinformation_JSON, used in chunk 686a.

Let's add a test. The response is a code table (Section 21.1).

686a ⟨*test functions* 245a⟩+≡

```
def test_larosatesinformation_JSON(ladok) -> None:
  r = ladok.larosatesinformation_JSON()
  assert_code_table(r, "Larosatesinformation")
```

This code is used in chunk 240.
Defines:
`test_larosatesinformation_JSON`, never used.
Uses `assert_code_table` 588 and `larosatesinformation_JSON` 685.

The output looks like this:

```
{
  "Larosatesinformation": [
    {
      "Benamning": {
        "sv": "Kungliga Tekniska h\u00f6gskolan",
        "en": "KTH Royal Institute of Technology"
      },
      "Beskrivning": {},
      "Dolt": false,
      "ExtraAttribut": [],
      "Giltighetsperiod": {},
      "ID": "29",
      "Kod": "KTH",
      "LankTillWebbplats": {
        "Url": "https://www.kth.se/"
      },
      "LankTillWebbplatsEngelskSida": {
        "Url": "https://www.kth.se/en"
      },
      "LarosateID": 29,
      "OrtID": 18,
      "Postadress": {
        "Postnummer": "12345",
        "Postort": "Byn"
      },
      "Telefonnummer": "0701234567"
    }
  ]
}
```

21.5 undervisningssprak_JSON

686b ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def undervisningssprak_JSON(self) -> dict:
  """
  Returns a dictionary of teaching languages.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
```

```
        '/kataloginformation/internal/grunddata/undervisningssprak',
      headers=self.headers).json()
    return r
```

Defines:
undervisningssprak_JSON, used in chunk 687.

Let's add a test. The response is a code table (Section 21.1).

687 ⟨*test functions* 245a⟩+≡

```
def test_undervisningssprak_JSON(ladok) -> None:
  r = ladok.undervisningssprak_JSON()
  assert_code_table(r, "Undervisningssprak")
```

This code is used in chunk 240.
Defines:
test_undervisningssprak_JSON, never used.
Uses assert_code_table 588 and undervisningssprak_JSON 686b.

The output looks like this:


```
{
  "Undervisningssprak": [
    {
      "Benamning": {
        "sv": "Ryska",
        "en": "Russian"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "4",
      "Kod": "RUS",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Franska",
        "en": "French"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "109810",
      "Kod": "FRE",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Kurdiska",
        "en": "Kurdish"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "150757",
```

```
      "Kod": "KUR",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Turkiska",
        "en": "Turkish"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "150759",
      "Kod": "TUR",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Me\u00e4nkieli",
        "en": "Me\u00e4nkieli"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "151967",
      "Kod": "FIT",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Polska",
        "en": "Polish"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "152516",
      "Kod": "POL",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Jiddisch",
        "en": "Yiddish"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "160526",
      "Kod": "YID",
      "LarosateID": -1
    },
```

```
    {
      "Benamning": {
        "sv": "Tjeckiska",
        "en": "Czech"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "161671",
      "Kod": "CES",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Litauiska",
        "en": "Lithuanian"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "161673",
      "Kod": "LIT",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Engelska",
        "en": "English"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "2",
      "Kod": "ENG",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Teckenspr\u00e5k",
        "en": "Sign Language"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "5",
      "Kod": "SGN",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Spanska",
```

```
        "en": "Spanish"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "3",
      "Kod": "SPA",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Svenska",
        "en": "Swedish"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "1",
      "Kod": "SWE",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Danska",
        "en": "Danish"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "109804",
      "Kod": "DAN",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Finska",
        "en": "Finnish"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "109805",
      "Kod": "FIN",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Italienska",
        "en": "Italian"
      },
      "Beskrivning": {},
```

```
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "109806",
      "Kod": "ITA",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Japanska",
        "en": "Japanese"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "109807",
      "Kod": "JPN",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Norska",
        "en": "Norwegian"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "109808",
      "Kod": "NOR",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Portugisiska",
        "en": "Portugese"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "109809",
      "Kod": "POR",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Tyska",
        "en": "German"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "109811",
```

```
      "Kod": "GER",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Kinesiska",
        "en": "Chinese"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "111033",
      "Kod": "CHI",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Flerspr\u00e5kig undervisning",
        "en": "Multiple languages"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "150758",
      "Kod": "MUL",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Persiska",
        "en": "Persian"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "150907",
      "Kod": "PER",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Isl\u00e4ndska",
        "en": "Icelandic"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "151538",
      "Kod": "ISL",
      "LarosateID": -1
    },
```

```
    {
      "Benamning": {
        "sv": "Samiska",
        "en": "Sami"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "151968",
      "Kod": "SMI",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Rum\u00e4nska",
        "en": "Romanian"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "159549",
      "Kod": "RUM",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Grekiska (modern)",
        "en": "Greek (modern)"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "160825",
      "Kod": "ELL",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Nederl\u00e4ndska",
        "en": "Dutch"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "161660",
      "Kod": "NLD",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Lettiska",
```

```
342         "en": "Latvian"
343       },
344       "Beskrivning": {},
345       "Dolt": true,
346       "Giltighetsperiod": {},
347       "ID": "161672",
348       "Kod": "LAT",
349       "LarosateID": -1
350     },
351     {
352       "Benamning": {
353         "sv": "Ukrainska",
354         "en": "Ukrainian"
355       },
356       "Beskrivning": {},
357       "Dolt": true,
358       "Giltighetsperiod": {},
359       "ID": "161674",
360       "Kod": "UKR",
361       "LarosateID": -1
362     },
363     {
364       "Benamning": {
365         "sv": "Arabiska",
366         "en": "Arabic"
367       },
368       "Beskrivning": {},
369       "Dolt": true,
370       "Giltighetsperiod": {},
371       "ID": "111032",
372       "Kod": "ARA",
373       "LarosateID": -1
374     }
375   ]
376 }
```

21.6 i18n_translation_JSON

694 ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def i18n_translation_JSON(self, lang: str = 'sv') -> dict:
  """
  Returns a dictionary of i18n translations used in Ladok3.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/kataloginformation/internal/i18n/oversattningar/sprakkod/' + lang,
    headers=self.headers).json()
  return r
```

Defines:

`i18n_translation_JSON`, used in chunk 695.

Let's add a test. Each translation should have a text, and no translation key should occur twice.

695 ⟨*test functions* 245a⟩+≡

```
def test_i18n_translation_JSON(ladok) -> None:
  r = ladok.i18n_translation_JSON()
  translations = r["Oversattningar"]
  assert translations
  assert all("Text" in translation for translation in translations)
  keys = [translation["I18nNyckel"] for translation in translations]
  assert len(set(keys)) == len(keys)
```

This code is used in chunk 240.
Defines:
`test_i18n_translation_JSON`, never used.
Uses `i18n_translation_JSON` 694.

The output looks like this:

```
{
  "Oversattningar": [
    {
      "I18nNyckel": "commons.fel.detaljkod.utbildningsinformationsstruktur",
      "Text": "Struktur"
    },
    {
      "I18nNyckel": "systemaktivitet.bevakning.lasa",
      "Text": "Bevakning: L\u00e4s grundinformation"
    },
    {
      "I18nNyckel": "studentarende.besluta",
      "Text": "Besluta och avsluta"
    },
    {
      "I18nNyckel": "kataloginformation.grunddatakategori.lan.beskrivning",
      "Text": "Regionalt f\u00f6rvaltningsomr\u00e5de, administrativ och geografisk indelning av Sverige.
    },
    {
      "I18nNyckel": "systemaktivitet.studentinformation.nationell.sokning.pa.student",
      "Text": "Studentinformation: S\u00f6ka student i hela Ladok - nationell r\u00e4ttighetsniv\u00e5"
    },
    {
      "I18nNyckel": "systemaktivitet.studiedeltagande.forbereda_tillfallesbyte.student",
      "Text": "Student-Studiedeltagande: F\u00f6rbered tillf\u00e4llesbyte"
    },
    {
      "I18nNyckel": "systemaktivitet.studiedeltagande.lasa_studieval",
      "Text": "Studiedeltagande: Studieval - endast l\u00e4sa"
    },
    {
      "I18nNyckel": "kataloginformation.fel.detaljkod.lokaltext",
      "Text": "Lokal text"
    },
```

```
    {
      "I18nNyckel": "systemaktivitet.resultat.bereda_avslag_studentarende",
      "Text": "Tillgodor\u00e4knande: Bereda avslag"
    },
    {
      "I18nNyckel": "arendestod.fel.detaljkod.fordelningsfilter",
      "Text": "F\u00f6rdelningsfilter"
    },
    {
      "I18nNyckel": "kataloginformation.fel.detaljkod.bestalld_tidpunkt",
      "Text": "Best\u00e4lld tidpunkt"
    },
    {
      "I18nNyckel": "systemaktivitet.examen.hantera.nationell.bevisinformation",
      "Text": "Bevis: Hantera nationell bevisinformation"
    },
    {
      "I18nNyckel": "systemaktivitet.resultat.tabort.attesterat_resultat",
      "Text": "Resultat: Ta bort attesterat resultat"
    },
    {
      "I18nNyckel": "systemaktivitet.resultat.handlagga_tillgodoraknande",
      "Text": "Tillgodor\u00e4knande: Bereda tillgodor\u00e4knande f\u00f6r del av kurs inkl. klarmarkera"
    },
    {
      "I18nNyckel": "systemaktivitet.resultat.aktivitetstillfalle.se_anonym_student.student",
      "Text": "Student-Resultat: Se student med anonymkod"
    },
    {
      "I18nNyckel": "commons.domain.anvandarnamn",
      "Text": "Anv\u00e4ndarnamn (EPPN)"
    },
    {
      "I18nNyckel": "commons.fel.detaljkod.autentisering_return_uri",
      "Text": "URI f\u00f6r att slutf\u00f6ra \u00e5tg\u00e4rd som kr\u00e4ver autentisering"
    },
    {
      "I18nNyckel": "commons.domain.larosate.hkr",
      "Text": "H\u00f6gskolan Kristianstad"
    },
    {
      "I18nNyckel": "systemaktivitet.studentinformation.nationell.sokning.pa.student.lokal",
      "Text": "Studentinformation: S\u00f6ka student i hela Ladok - lokal r\u00e4ttighetsniv\u00e5"
    },
    {
      "I18nNyckel": "systemaktivitet.examen.bevisansokan.av.student.student",
      "Text": "Student-Bevis: Bevisans\u00f6kan av student"
    },
    {
      "I18nNyckel": "kataloginformation.grunddatakategori.definitionavantagningsomgang.beskrivning",
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      "I18nNyckel": "commons.fel.detaljkod.autentiseringstyp",
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      "Text": "F\u00f6rhandsgranska dokumentkonfiguration"
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    },
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    {
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    },
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    },
    {
      "I18nNyckel": "kataloginformation.grunddatakategori.undervisningstid.beskrivning",
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    },
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    },
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    },
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    },
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    },
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    },
    {
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      "Text": "\u00d6rebro universitet"
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      "Text": "Grupp"
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    },
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      "Text": "Bevis: Bereda avslag"
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    },
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      "Text": "Obligatorisk"
    },
    {
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    },
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    {
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      "Text": "Systemaktivitet"
    },
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    },
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    },
    {
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      "Text": "Menyval: Avslutad utbildning"
    },
    {
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    },
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      "Text": "Personnummer"
    },
    {
      "I18nNyckel": "kataloginformation.grunddatakategori.praktiktyp.beskrivning",
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      "Text": "Spara \u00e4mnesklass p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemaktivitet.arendestod.hantera.bilagor",
```

```
      "Text": "\u00c4rendest\u00f6d: Hantera bilagor (gammal l\u00f6sning)"
    },
    {
      "I18nNyckel": "systemaktivitet.resultat.administrera_resultatrapportorer",
      "Text": "Resultat: Administrera resultatrapport\u00f6rer"
    },
    {
      "I18nNyckel": "systemfunktion.id.10056",
      "Text": "Spara typ av extern part p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10057",
      "Text": "Spara externpart p\u00e5 lokal niv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10050",
      "Text": "Spara f\u00f6rdjupningsniv\u00e5 p\u00e5 lokal niv\u00e5"
    },
    {
      "I18nNyckel": "commons.domain.regel.utbildningstypsgrupp.yh.utbildning",
      "Text": "YH-Utbildning"
    },
    {
      "I18nNyckel": "systemfunktion.id.10051",
      "Text": "Spara f\u00f6rdjupningsniv\u00e5 p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemaktivitet.common.basbehorighet",
      "Text": "Common: basbeh\u00f6righet f\u00f6r att anv\u00e4nda systemet"
    },
    {
      "I18nNyckel": "commons.domain.regel.utbildningstypsgrupp.forskarutbildning",
      "Text": "Forskarniv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10058",
      "Text": "Spara externpart p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "commons.domain.utbildningstillfallestyp.programtillfalle",
      "Text": "Programtillf\u00e4lle"
    },
    {
      "I18nNyckel": "systemfunktion.id.10059",
      "Text": "Spara successiv f\u00f6rdjupning p\u00e5 lokal niv\u00e5"
    },
    {
      "I18nNyckel": "systemaktivitet.studiedeltagande.dokumentera_avbrott_pa_kurs",
      "Text": "Studiedeltagande: Dokumentera avbrott p\u00e5 kurs"
    },
    {
```

```
      "I18nNyckel": "systemaktivitet.isp.soka_isp",
      "Text": "Individuell studieplan: S\u00f6ka individuell studieplan"
    },
    {
      "I18nNyckel": "systemfunktion.id.10060",
      "Text": "Spara successiv f\u00f6rdjupning p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemaktivitet.kataloginformation.organisation.skriv",
      "Text": "Kataloginformation: Hantera l\u00e4ros\u00e4tets organisationsstruktur"
    },
    {
      "I18nNyckel": "commons.domain.regel.sjalvstandig",
      "Text": "Sj\u00e4lvst\u00e4ndig"
    },
    {
      "I18nNyckel": "systemfunktion.id.10065",
      "Text": "Spara lokalm\u00e4rkning p\u00e5 lokal niv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10066",
      "Text": "Spara studiefinansiering p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10067",
      "Text": "Spara studiefinansiering p\u00e5 lokal niv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10068",
      "Text": "Spara nationell examensgrupp"
    },
    {
      "I18nNyckel": "systemfunktion.id.10061",
      "Text": "Spara studielokalisering p\u00e5 lokal niv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10062",
      "Text": "Spara enhet p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10063",
      "Text": "Spara utbytesprogram p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10064",
      "Text": "Spara utbytesprogram p\u00e5 lokal niv\u00e5"
    },
    {
      "I18nNyckel": "systemaktivitet.arendestod.hantera.arende.avliden.vid.sokning",
      "Text": "Studentinformation: Hantera avliden\u00e4rende vid s\u00f6kning (kompletterande)"
    },
```

```
    {
      "I18nNyckel": "systemfunktion.id.10069",
      "Text": "Spara undervisningsspr\u00e5k p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemaktivitet.utbildningsinformation.makulera_litteraturlista",
      "Text": "Utbildningsinformation: Makulera litteraturlista"
    },
    {
      "I18nNyckel": "systemaktivitet.kataloginformation.grunddata.administrera.lokal",
      "Text": "Kataloginformation: Hantera grunddata - lokal r\u00e4ttighetsniv\u00e5"
    },
    {
      "I18nNyckel": "systemaktivitet.kataloginformationbehorighet.anvandare.skriv",
      "Text": "Beh\u00f6righetshantering: Hantera anv\u00e4ndare - lokal r\u00e4ttighetsniv\u00e5"
    },
    {
      "I18nNyckel": "commons.domain.studieperiod",
      "Text": "Studieperiod"
    },
    {
      "I18nNyckel": "kataloginformation.grunddatakategori.undervisningsform",
      "Text": "Undervisningsform"
    },
    {
      "I18nNyckel": "systemaktivitet.studiedeltagande.pingintegration_lasa_ej_paborjade_tillfallesantagnin
      "Text": "Studiedeltagande: Pingintegration l\u00e4sa ej p\u00e5b\u00f6rjade tillf\u00e4llesantagning
    },
    {
      "I18nNyckel": "systemfunktion.id.10071",
      "Text": "Spara organisationsenhetstyp p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemaktivitet.examen.administrera.lokal.installning.modul.i.bevis",
      "Text": "Bevis: Hantera inst\u00e4llningar f\u00f6r moduler i bevis"
    },
    {
      "I18nNyckel": "arendestod.fel.detaljkod.handlaggare",
      "Text": "Handl\u00e4ggare"
    },
    {
      "I18nNyckel": "systemfunktion.id.10076",
      "Text": "Spara utbildningsregel p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10077",
      "Text": "Spara orsak till ej avgitsskyldig p\u00e5 nationell niv\u00e5"
    },
    {
      "I18nNyckel": "systemfunktion.id.10078",
      "Text": "Spara orsak till avst\u00e4ngning p\u00e5 nationell niv\u00e5"
```

```
6206      },
6207      {
6208        "I18nNyckel": "commons.domain.larosate.cth",
6209        "Text": "Chalmers tekniska h\u00f6gskola"
6210      },
6211      {
6212        "I18nNyckel": "systemfunktion.id.10079",
6213        "Text": "Spara tj\u00e4nstekonfigurationsobjekt p\u00e5 lokal niv\u00e5"
6214      },
6215      {
6216        "I18nNyckel": "andringslogg.andringsloggtyp.aktivitetstillfalle",
6217        "Text": "Aktivitetstillf\u00e4lle"
6218      },
6219      {
6220        "I18nNyckel": "systemfunktion.id.10073",
6221        "Text": "Spara konfiguration av autentisering p\u00e5 lokal niv\u00e5"
6222      },
6223      {
6224        "I18nNyckel": "systemaktivitet.utbildningsinformation.redigera_publicerade_attributvarden_i_plan",
6225        "Text": "Utbildningsinformation: Redigera publicerade attributv\u00e4rden i plan"
6226      },
6227      {
6228        "I18nNyckel": "systemfunktion.id.10074",
6229        "Text": "H\u00e4mta konfiguration av autentisering p\u00e5 lokal niv\u00e5"
6230      }
6231    ]
6232  }
```

21.7 svenskorter_JSON

817a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def svenskorter_JSON(self) -> dict:
  """
  Returns a dictionary of Swedish places with their KommunID.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url + '/kataloginformation/internal/grunddata/svenskort',
    headers=self.headers).json()
  return r
```

Defines:
svenskorter_JSON, used in chunks 817b and 1300.

Let's add a test. The response is a code table (Section 21.1). Every place also refers to a municipality, which must exist in the municipality table.

817b ⟨*test functions* 245a⟩+≡

```
def test_svenskorter_JSON(ladok) -> None:
  r = ladok.svenskorter_JSON()
  assert_code_table(r, "SvenskOrt")
  assert ({str(place["KommunID"]) for place in r["SvenskOrt"]}
          <= code_table_ids(ladok.kommuner_JSON(), "Kommun"))
```

This code is used in chunk 240.
Defines:
`test_svenskorter_JSON`, never used.
Uses `assert_code_table` 588, `code_table_ids` 588, `kommuner_JSON` 910a, and `svenskorter_JSON` 817a.

The output looks like this:


```
{
  "SvenskOrt": [
    {
      "Benamning": {
        "sv": "Borl\u00e4nge",
        "en": "Borl\u00e4nge"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "263",
      "Kod": "T6444",
      "KommunID": "232",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Upplands V\u00e4sby",
        "en": "Upplands V\u00e4sby"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "1",
      "Kod": "T0384",
      "KommunID": "1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Vallentuna",
        "en": "Vallentuna"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "2",
      "Kod": "T0388",
      "KommunID": "2",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "\u00c5kersberga",
        "en": "\u00c5kersberga"
```

```
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "3",
      "Kod": "T0408",
      "KommunID": "3",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Gustavsberg",
        "en": "Gustavsberg"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "4",
      "Kod": "T0172",
      "KommunID": "4",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Jakobsberg",
        "en": "Jakobsberg"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "5",
      "Kod": "TX016",
      "KommunID": "5",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Eker\u00f6",
        "en": "Eker\u00f6"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "6",
      "Kod": "T0150",
      "KommunID": "6",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Flemingsberg",
```

```
        "en": "Flemingsberg"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "7",
      "Kod": "TX012",
      "KommunID": "7",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Tumba (Botkyrka)",
        "en": "Tumba (Botkyrka)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "8",
      "Kod": "T0372",
      "KommunID": "8",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "R\u00f6nninge",
        "en": "R\u00f6nninge"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "9",
      "Kod": "TX028",
      "KommunID": "9",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Handen",
        "en": "Handen"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "10",
      "Kod": "TX014",
      "KommunID": "10",
      "LarosateID": -1
    },
    {
      "Benamning": {
```

```
        "sv": "Bollmora/Tyres\u00f6 centrum",
        "en": "Bollmora/Tyres\u00f6 centrum"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "11",
      "Kod": "TX008",
      "KommunID": "11",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Kungs\u00e4ngen ",
        "en": "Kungs\u00e4ngen "
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "12",
      "Kod": "T0220",
      "KommunID": "12",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Nykvarn",
        "en": "Nykvarn"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "13",
      "Kod": "T0260",
      "KommunID": "13",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "T\u00e4by",
        "en": "T\u00e4by"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "14",
      "Kod": "T0288",
      "KommunID": "14",
      "LarosateID": -1
    },
    {
```

```
      "Benamning": {
        "sv": "Stockholm (Danderyd)",
        "en": "Stockholm (Danderyd)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "15",
      "Kod": "L0162",
      "KommunID": "15",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Rotebro",
        "en": "Rotebro"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "16",
      "Kod": "TX026",
      "KommunID": "16",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Sollentuna",
        "en": "Sollentuna"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "17",
      "Kod": "T0316",
      "KommunID": "16",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Stockholm",
        "en": "Stockholm"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "18",
      "Kod": "T0336",
      "KommunID": "17",
      "LarosateID": -1
    },
```

```
    {
      "Benamning": {
        "sv": "J\u00e4rna",
        "en": "J\u00e4rna"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "19",
      "Kod": "T0204",
      "KommunID": "18",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "S\u00f6dert\u00e4lje",
        "en": "S\u00f6dert\u00e4lje"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "20",
      "Kod": "T0356",
      "KommunID": "18",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Stockholm (Nacka)",
        "en": "Stockholm (Nacka)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "21",
      "Kod": "L0182",
      "KommunID": "19",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Saltsj\u00f6baden",
        "en": "Saltsj\u00f6baden"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "22",
      "Kod": "T0296",
      "KommunID": "19",
      "LarosateID": -1
```

```
    },
    {
      "Benamning": {
        "sv": "\u00c4lta",
        "en": "\u00c4lta"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "23",
      "Kod": "T0416",
      "KommunID": "19",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Malmk\u00f6ping",
        "en": "Malmk\u00f6ping"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "47",
      "Kod": "T0796",
      "KommunID": "39",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Katrineholm",
        "en": "Katrineholm"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "48",
      "Kod": "T0784",
      "KommunID": "40",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Eskilstuna",
        "en": "Eskilstuna"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "49",
      "Kod": "T0740",
      "KommunID": "41",
```

```
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Torsh\u00e4lla",
        "en": "Torsh\u00e4lla"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "50",
      "Kod": "T0880",
      "KommunID": "41",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Mariefred",
        "en": "Mariefred"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "51",
      "Kod": "T0800",
      "KommunID": "42",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Str\u00e4ngn\u00e4s",
        "en": "Str\u00e4ngn\u00e4s"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "52",
      "Kod": "T0868",
      "KommunID": "42",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Trosa",
        "en": "Trosa"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "53",
      "Kod": "T0884",
```

```
      "KommunID": "43",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Vagnh\u00e4rad",
        "en": "Vagnh\u00e4rad"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "54",
      "Kod": "T0896",
      "KommunID": "43",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "\u00d6desh\u00f6g",
        "en": "\u00d6desh\u00f6g"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "55",
      "Kod": "T1332",
      "KommunID": "44",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Kisa",
        "en": "Kisa"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "56",
      "Kod": "T1132",
      "KommunID": "46",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Boxholm",
        "en": "Boxholm"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "57",
```

```
      "Kod": "T1040",
      "KommunID": "47",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "\u00c5tvidaberg",
        "en": "\u00c5tvidaberg"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "58",
      "Kod": "T1328",
      "KommunID": "48",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Finsp\u00e5ng",
        "en": "Finsp\u00e5ng"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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```

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```

```
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      "KommunID": "275",
      "LarosateID": -1
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        "en": "Burtr\u00e4sk"
      },
      "Beskrivning": {},
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```

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      },
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        "en": "G\u00e4llivare"
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```

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      },
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      },
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        "en": "Pite\u00e5"
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        "en": "Str\u00f6msholm"
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        "en": "Garpenberg"
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      "Beskrivning": {},
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        "en": "F\u00e4rila"
      },
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      "LarosateID": -1
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        "en": "S\u00f6r\u00e5ker"
      },
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      "Giltighetsperiod": {},
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      "LarosateID": -1
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        "en": "V\u00e4stra Bispg\u00e5rden"
      },
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      "Dolt": false,
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      "LarosateID": -1
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        "en": "Hammerdal"
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      "KommunID": "257",
      "LarosateID": -1
    },
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        "en": "Hemavan"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "KommunID": "268",
      "LarosateID": -1
    },
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        "en": "T\u00e4rnaby"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
```

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        "en": "Ammarn\u00e4s"
      },
      "Beskrivning": {},
      "Dolt": false,
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      "KommunID": "269",
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    },
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        "en": "Norrbyn"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101201",
      "Kod": "TX814",
      "KommunID": "274",
      "LarosateID": -1
    },
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        "en": "Vuollerim"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "T8920",
      "KommunID": "279",
      "LarosateID": -1
    },
    {
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        "sv": "S\u00f6dra Sunderbyn",
        "en": "S\u00f6dra Sunderbyn"
      },
      "Beskrivning": {},
      "Dolt": false,
```

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    },
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        "en": "Abisko"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "S9013",
      "KommunID": "290",
      "LarosateID": -1
    },
    {
      "Benamning": {
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        "en": "\u00d6sterbymo"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "T1336",
      "KommunID": "45",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Stockholm (Huddinge)",
        "en": "Stockholm (Huddinge)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "L0126",
      "KommunID": "7",
      "LarosateID": -1
    },
    {
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        "sv": "Stockholm (Botkyrka)",
        "en": "Stockholm (Botkyrka)"
      },
      "Beskrivning": {},
```

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      "ID": "110990",
      "Kod": "L0127",
      "KommunID": "8",
      "LarosateID": -1
    },
    {
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        "en": "Stockholm (Haninge)"
      },
      "Beskrivning": {},
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      "LarosateID": -1
    },
    {
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        "sv": "G\u00f6teborg (Partille)",
        "en": "G\u00f6teborg (Partille)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "L1402",
      "KommunID": "136",
      "LarosateID": -1
    },
    {
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        "sv": "Alnarp",
        "en": "Alnarp"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "121570",
      "Kod": "TX400",
      "KommunID": "104",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Knivsta",
        "en": "Knivsta"
      },
```

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      "KommunID": "29",
      "LarosateID": -1
    },
    {
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        "en": "F\u00e5r\u00f6sund"
      },
      "Beskrivning": {},
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      "KommunID": "90",
      "LarosateID": -1
    },
    {
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        "en": "Burl\u00f6v"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "149908",
      "Kod": "L1231",
      "KommunID": "98",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Salem",
        "en": "Salem"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "151548",
      "Kod": "L0128",
      "KommunID": "9",
      "LarosateID": -1
    }
  ]
}
```

21.8 kommuner_JSON

910a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def kommuner_JSON(self) -> dict:
  """
  Returns a dictionary of Swedish municipalities.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url + '/kataloginformation/internal/grunddata/kommun',
    headers=self.headers).json()
  return r
```

Defines:
kommuner_JSON, used in chunks 817b and 910b.

Let's add a test. The response is a code table (Section 21.1).

910b ⟨*test functions* 245a⟩+≡

```
def test_kommuner_JSON(ladok) -> None:
  r = ladok.kommuner_JSON()
  assert_code_table(r, "Kommun")
```

This code is used in chunk 240.
Defines:
test_kommuner_JSON, never used.
Uses assert_code_table 588 and kommuner_JSON 910a.

The output looks like this:

```
{
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        "en": "Landskrona"
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      "Beskrivning": {},
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        "en": "Helsingborg"
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      "Beskrivning": {},
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        "en": "Simrishamn"
      },
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        "en": "Mellerud"
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        "en": "Lilla Edet"
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        "en": "Mark"
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        "en": "Malung-S\u00e4len"
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      "LarosateID": -1
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        "en": "Orsa"
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      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "227",
      "Kod": "2034",
      "LanID": 16,
      "LarosateID": -1
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        "en": "Smedjebacken"
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      "Beskrivning": {},
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      "LarosateID": -1
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        "en": "Mora"
      },
      "Beskrivning": {},
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      "Giltighetsperiod": {},
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      "Kod": "2062",
      "LanID": 16,
      "LarosateID": -1
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        "en": "Falun"
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      "Beskrivning": {},
      "Dolt": false,
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      "LanID": 16,
      "LarosateID": -1
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```

```
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      "LarosateID": -1
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      "Benamning": {
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        "en": "Skellefte\u00e5"
      },
      "Beskrivning": {},
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      "LanID": 20,
      "LarosateID": -1
    },
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      "Benamning": {
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        "en": "Arvidsjaur"
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      "Beskrivning": {},
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      "LanID": 21,
      "LarosateID": -1
    },
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        "en": "Arjeplog"
      },
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        "en": "Jokkmokk"
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      "LanID": 21,
      "LarosateID": -1
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      "Benamning": {
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        "en": "\u00d6verkalix"
      },
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      "Dolt": false,
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      "Kod": "2513",
      "LanID": 21,
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Kalix",
        "en": "Kalix"
      },
      "Beskrivning": {},
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      "Giltighetsperiod": {},
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      "Kod": "2514",
      "LanID": 21,
      "LarosateID": -1
    },
    {
```

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      "Benamning": {
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        "en": "\u00d6vertorne\u00e5"
      },
      "Beskrivning": {},
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      "Giltighetsperiod": {},
      "ID": "282",
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      "LanID": 21,
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Pajala",
        "en": "Pajala"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "LanID": 21,
      "LarosateID": -1
    },
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        "sv": "G\u00e4llivare",
        "en": "G\u00e4llivare"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "284",
      "Kod": "2523",
      "LanID": 21,
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "\u00c4lvsbyn",
        "en": "\u00c4lvsbyn"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "285",
      "Kod": "2560",
      "LanID": 21,
      "LarosateID": -1
    },
```

```
    {
      "Benamning": {
        "sv": "Lule\u00e5",
        "en": "Lule\u00e5"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "286",
      "Kod": "2580",
      "LanID": 21,
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Pite\u00e5",
        "en": "Pite\u00e5"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "287",
      "Kod": "2581",
      "LanID": 21,
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Boden",
        "en": "Boden"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "288",
      "Kod": "2582",
      "LanID": 21,
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Haparanda",
        "en": "Haparanda"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "289",
      "Kod": "2583",
      "LanID": 21,
      "LarosateID": -1
```

```
3801      }
3802    ]
3803  }
```

21.9 lander_JSON

985a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def lander_JSON(self) -> dict:
  """
  Returns a dictionary of countries.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url + '/kataloginformation/internal/grunddata/land',
    headers=self.headers).json()
  return r
```

Defines:
lander_JSON, used in chunk 985b.

Let's add a test. The response is a code table (Section 21.1).

985b ⟨*test functions* 245a⟩+≡

```
def test_lander_JSON(ladok) -> None:
  r = ladok.lander_JSON()
  assert_code_table(r, "Land")
```

This code is used in chunk 240.
Defines:
test_lander_JSON, never used.
Uses assert_code_table 588 and lander_JSON 985a.

The output looks like this:


```
{
  "Land": [
    {
      "Benamning": {
        "sv": "Sverige",
        "en": "Sweden"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "184",
      "Kod": "SE",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "F\u00f6renade Arabemiraten",
        "en": "United Arab Emirates"
      },
      "Beskrivning": {},
      "Dolt": false,
```

```
      "Giltighetsperiod": {},
      "ID": "1",
      "Kod": "AE",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Afghanistan",
        "en": "Afghanistan"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "2",
      "Kod": "AF",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Albanien",
        "en": "Albania"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "3",
      "Kod": "AL",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Armenien",
        "en": "Armenia"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "4",
      "Kod": "AM",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Angola",
        "en": "Angola"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "5",
      "Kod": "AO",
```

```
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Argentina",
        "en": "Argentina"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "6",
      "Kod": "AR",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "\u00d6sterrike",
        "en": "Austria"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "7",
      "Kod": "AT",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Australien",
        "en": "Australia"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "8",
      "Kod": "AU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Azerbajdzjan",
        "en": "Azerbaijan"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "9",
      "Kod": "AZ",
      "LarosateID": -1
    },
    {
```

```
      "Benamning": {
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        "en": "Bosnia and Herzegovina"
      },
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      "Dolt": false,
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      "Kod": "BA",
      "LarosateID": -1
    },
    {
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        "en": "Chile"
      },
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        "en": "Cameroon"
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      "Beskrivning": {},
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      "Giltighetsperiod": {},
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    {
      "Benamning": {
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        "en": "China"
      },
      "Beskrivning": {},
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      "Giltighetsperiod": {},
      "ID": "35",
      "Kod": "CN",
      "LarosateID": -1
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    {
      "Benamning": {
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        "en": "Colombia"
```

```
      },
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      "LarosateID": -1
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        "en": "Costa Rica"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "37",
      "Kod": "CR",
      "LarosateID": -1
    },
    {
      "Benamning": {
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        "en": "Cuba"
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      "Beskrivning": {},
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      "Giltighetsperiod": {},
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      "Kod": "CU",
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    },
    {
      "Benamning": {
        "sv": "Kap Verde",
        "en": "Cape Verde"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "39",
      "Kod": "CV",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Cypern",
        "en": "Cyprus"
      },
      "Beskrivning": {},
      "Dolt": false,
```

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      "Giltighetsperiod": {},
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    {
      "Benamning": {
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        "en": "Czech Republic"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "CZ",
      "LarosateID": -1
    },
    {
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        "sv": "Tyskland",
        "en": "Germany"
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      "Giltighetsperiod": {},
      "ID": "42",
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      "LarosateID": -1
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    {
      "Benamning": {
        "sv": "Danmark",
        "en": "Denmark"
      },
      "Beskrivning": {},
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      "Giltighetsperiod": {},
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      "Kod": "DK",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Israel",
        "en": "Israel"
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        "en": "India"
      },
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      "Dolt": false,
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      "ID": "78",
      "Kod": "IN",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Irak",
        "en": "Iraq"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "IQ",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Iran",
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      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "LarosateID": -1
    },
    {
      "Benamning": {
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        "en": "Iceland"
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      "Giltighetsperiod": {},
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      "LarosateID": -1
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    {
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    {
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        "en": "Jamaica"
      },
      "Beskrivning": {},
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      "Giltighetsperiod": {},
      "ID": "83",
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      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Jordanien",
        "en": "Jordan"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "84",
      "Kod": "JO",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Japan",
        "en": "Japan"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "85",
      "Kod": "JP",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Kenya",
        "en": "Kenya"
```

```
      },
      "Beskrivning": {},
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      "Giltighetsperiod": {},
      "ID": "86",
      "Kod": "KE",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Kirgizistan",
        "en": "Kyrgyzstan"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "87",
      "Kod": "KG",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Lesotho",
        "en": "Lesotho"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "99",
      "Kod": "LS",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Litauen",
        "en": "Lithuania"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "100",
      "Kod": "LT",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Luxemburg",
        "en": "Luxembourg"
      },
      "Beskrivning": {},
      "Dolt": false,
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      "Giltighetsperiod": {},
      "ID": "101",
      "Kod": "LU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Lettland",
        "en": "Latvia"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "102",
      "Kod": "LV",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Libyen",
        "en": "Libya"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "103",
      "Kod": "LY",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Marocko",
        "en": "Morocco"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "104",
      "Kod": "MA",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Monaco",
        "en": "Monaco"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "105",
      "Kod": "MC",
```

```
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Moldavien",
        "en": "Moldova"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "106",
      "Kod": "MD",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Montenegro",
        "en": "Montenegro"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "107",
      "Kod": "ME",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Madagaskar",
        "en": "Madagascar"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "108",
      "Kod": "MG",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Nordmakedonien",
        "en": "North Macedonia"
      },
      "Beskrivning": {
        "sv": "F\u00f6re 2019-02-12 Makedonien eller F\u00f6re detta jugoslaviska republiken Makedonien"
      },
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "109",
      "Kod": "MK",
      "LarosateID": -1
```

```
    },
    {
      "Benamning": {
        "sv": "Peru",
        "en": "Peru"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "132",
      "Kod": "PE",
      "LarosateID": -1
    },
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        "en": "Zimbabwe"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "183",
      "Kod": "ZW",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Amerikanska Jungfru\u00f6rana",
        "en": "U.S. Virgin Islands"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101010",
      "Kod": "VI",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Amerikanska Samoa",
        "en": "American Samoa"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101011",
      "Kod": "AS",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Andorra",
        "en": "Andorra"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101012",
      "Kod": "AD",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Antigua och Barbuda",
        "en": "Antigua and Barbuda"
      },
```

```
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101013",
      "Kod": "AG",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Aruba",
        "en": "Aruba"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101014",
      "Kod": "AW",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Bermuda",
        "en": "Bermuda"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101015",
      "Kod": "BM",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Cayman\u00f6arna",
        "en": "Cayman Islands"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101016",
      "Kod": "KY",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Turks- och Caicos\u00f6arna",
        "en": "Turks and Caicos Islands"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
```

```
      "ID": "101039",
      "Kod": "TC",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Tuvalu",
        "en": "Tuvalu"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101040",
      "Kod": "TV",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "V\u00e4stsahara",
        "en": "Western Sahara"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101041",
      "Kod": "EH",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "\u00c5land",
        "en": "\u00c5land Islands"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101042",
      "Kod": "AX",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "San Marino",
        "en": "San Marino"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101090",
      "Kod": "SM",
      "LarosateID": -1
```

```
    },
    {
      "Benamning": {
        "sv": "Vanuatu",
        "en": "Vanuatu"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101130",
      "Kod": "VU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Europeiska unionen",
        "en": "European Union"
      },
      "Beskrivning": {
        "sv": "Anv\u00e4nds f\u00f6r European Universities Alliances och andra EU-initierade verksamheter"
      },
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "153940",
      "Kod": "EU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Maldiverna",
        "en": "Maldives"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "155075",
      "Kod": "MV",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Brittiska Jungfru\u00f6arna",
        "en": "British Virgin Islands"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "162230",
      "Kod": "VG",
      "LarosateID": -1
    },
```

```
    {
      "Benamning": {
        "sv": "Saint Vincent och Grenadinerna",
        "en": "Saint Vincent and the Grenadines"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "164277",
      "Kod": "VC",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Turkmenistan",
        "en": "Turkmenistan"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "165",
      "Kod": "TM",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Tunisien",
        "en": "Tunisia"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "166",
      "Kod": "TN",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Turkiet",
        "en": "Turkey"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "167",
      "Kod": "TR",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Trinidad och Tobago",
```

```
        "en": "Trinidad and Tobago"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "168",
      "Kod": "TT",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Taiwan",
        "en": "Taiwan"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "169",
      "Kod": "TW",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Tanzania",
        "en": "Tanzania"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "170",
      "Kod": "TZ",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Ukraina",
        "en": "Ukraine"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "171",
      "Kod": "UA",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Uganda",
        "en": "Uganda"
      },
      "Beskrivning": {},
```

```
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "172",
      "Kod": "UG",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "USA",
        "en": "USA"
      },
      "Beskrivning": {
        "sv": "F\u00f6renta staterna/United States of America"
      },
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "173",
      "Kod": "US",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Uruguay",
        "en": "Uruguay"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "174",
      "Kod": "UY",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Uzbekistan",
        "en": "Uzbekistan"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "175",
      "Kod": "UZ",
      "LarosateID": -1
    }
  ]
}
```

21.10 undervisningstid_JSON

1038 ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def undervisningstid_JSON(self) -> dict:
    """
    Returns a dictionary of teaching times.
    """
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/kataloginformation/internal/grunddata/undervisningstid',
      headers=self.headers).json()
    return r
```

Defines:
`undervisningstid_JSON`, used in chunk 1039.

Let's add a test. The response is a code table (Section 21.1).

1039 ⟨*test functions* 245a⟩+≡

```
def test_undervisningstid_JSON(ladok) -> None:
  r = ladok.undervisningstid_JSON()
  assert_code_table(r, "Undervisningstid")
```

This code is used in chunk 240.
Defines:
`test_undervisningstid_JSON`, never used.
Uses `assert_code_table` 588 and `undervisningstid_JSON` 1038.

The output looks like this:

```
{
  "Undervisningstid": [
    {
      "Benamning": {
        "sv": "Blandad undervisningstid",
        "en": "Mixed-time"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "101051",
      "Kod": "BLA",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Dagtid",
        "en": "Day-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101052",
      "Kod": "DAG",
      "LarosateID": -1
    },
    {
      "Benamning": {
```

```
        "sv": "Eftermiddagstid",
        "en": "Afternoon-time"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "101053",
      "Kod": "EFT",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Ingen undervisningstid",
        "en": "No teaching"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2016-04-30"
      },
      "ID": "101054",
      "Kod": "ING",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Ingen schemalagd undervisning",
        "en": "No scheduled teaching"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "164218",
      "Kod": "ISU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Kv\u00e4llstid",
        "en": "Evening-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101055",
      "Kod": "KV\u00c4",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Veckoslut",
```

```
        "en": "Weekends"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101056",
      "Kod": "VSL",
      "LarosateID": -1
    }
  ]
}
```

21.11 successivfordjupning_JSON

1041a ⟨*LadokSession data methods* 249⟩+≡

```
# RETURNERAR JSON of Successive Specializations
def successivfordjupning_JSON(self) -> dict:
  """
  Returns a dictionary of Successive Specializations.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/kataloginformation/internal/grunddata/successivfordjupning',
    headers=self.headers).json()
  return r
```

Defines:
successivfordjupning_JSON, used in chunk 1041b.

Let's add a test. The response is a code table (Section 21.1). The levels it refers to must exist in the table of levels.

1041b ⟨*test functions* 245a⟩+≡

```
def test_successivfordjupning_JSON(ladok) -> None:
  r = ladok.successivfordjupning_JSON()
  assert_code_table(r, "SuccessivFordjupning")
  assert ({str(entry["NivaInomStudieordningID"])
           for entry in r["SuccessivFordjupning"]
           if entry.get("NivaInomStudieordningID") is not None}
          <= code_table_ids(ladok.nivainomstudieordning_JSON(),
                            "NivaInomStudieordning"))
```

This code is used in chunk 240.
Defines:
test_successivfordjupning_JSON, never used.
Uses assert_code_table 588, code_table_ids 588, nivainomstudieordning_JSON 1178a, and successivfordjupning_JSON 1041a.

The output looks like this:

```
{
  "SuccessivFordjupning": [
    {
      "Benamning": {
        "sv": "Avancerad niv\u00e5, inneh\u00e5ller examensarbete f\u00f6r magisterexamen",
```

```
        "en": "Second cycle, contains degree project for Master of Arts/Master of Science (60 credits)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "1",
      "Kod": "A1E",
      "LarosateID": -1,
      "NivaInomStudieordningID": 2
    },
    {
      "Benamning": {
        "sv": "Avancerad niv\u00e5, har kurs/er p\u00e5 avancerad niv\u00e5 som f\u00f6rkunskapskrav",
        "en": "Second cycle, has second-cycle course/s as entry requirements"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "2",
      "Kod": "A1F",
      "LarosateID": -1,
      "NivaInomStudieordningID": 2
    },
    {
      "Benamning": {
        "sv": "Avancerad niv\u00e5, har endast kurs/er p\u00e5 grundniv\u00e5 som f\u00f6rkunskapskrav",
        "en": "Second cycle, has only first-cycle course/s as entry requirements"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "3",
      "Kod": "A1N",
      "LarosateID": -1,
      "NivaInomStudieordningID": 2
    },
    {
      "Benamning": {
        "sv": "Avancerad niv\u00e5, inneh\u00e5ller examensarbete f\u00f6r masterexamen",
        "en": "Second cycle, contains degree project for Master of Arts/Master of Science (120 credits)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "4",
      "Kod": "A2E",
      "LarosateID": -1,
      "NivaInomStudieordningID": 2
    },
    {
      "Benamning": {
```

```
        "sv": "Avancerad niv\u00e5, kursens f\u00f6rdjupning kan inte klassificeras",
        "en": "Second cycle, in-depth level of the course cannot be classified"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "5",
      "Kod": "AXX",
      "LarosateID": -1,
      "NivaInomStudieordningID": 2
    },
    {
      "Benamning": {
        "sv": "Grundniv\u00e5, inneh\u00e5ller s\u00e4rskilt utformat examensarbete f\u00f6r h\u00f6gskole
        "en": "First cycle, contains specially designed degree project for Higher Education Diploma"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "6",
      "Kod": "G1E",
      "LarosateID": -1,
      "NivaInomStudieordningID": 1
    },
    {
      "Benamning": {
        "sv": "Grundniv\u00e5, har mindre \u00e4n 60 hp kurs/er p\u00e5 grundniv\u00e5 som f\u00f6rkunskap
        "en": "First cycle, has less than 60 credits in first-cycle course/s as entry requirements"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "7",
      "Kod": "G1F",
      "LarosateID": -1,
      "NivaInomStudieordningID": 1
    },
    {
      "Benamning": {
        "sv": "Grundniv\u00e5, har endast gymnasiala f\u00f6rkunskapskrav",
        "en": "First cycle, has only upper-secondary level entry requirements"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "8",
      "Kod": "G1N",
      "LarosateID": -1,
      "NivaInomStudieordningID": 1
    },
    {
```

```
      "Benamning": {
        "sv": "Grundniv\u00e5, har minst 60 hp kurs/er p\u00e5 grundniv\u00e5 som f\u00f6rkunskapskrav, in
        "en": "First cycle, has at least 60 credits in first-cycle course/s as entry requirements, contain
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "9",
      "Kod": "G2E",
      "LarosateID": -1,
      "NivaInomStudieordningID": 1
    },
    {
      "Benamning": {
        "sv": "Grundniv\u00e5, har minst 60 hp kurs/er p\u00e5 grundniv\u00e5 som f\u00f6rkunskapskrav",
        "en": "First cycle, has at least 60 credits in first-cycle course/s as entry requirements"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "10",
      "Kod": "G2F",
      "LarosateID": -1,
      "NivaInomStudieordningID": 1
    },
    {
      "Benamning": {
        "sv": "Grundniv\u00e5, kursens f\u00f6rdjupning kan inte klassificeras",
        "en": "First cycle, in-depth level of the course cannot be classified"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "11",
      "Kod": "GXX",
      "LarosateID": -1,
      "NivaInomStudieordningID": 1
    }
  ]
}
```


21.12 undervisningsform_JSON

1044 ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def undervisningsform_JSON(self) -> dict:
    """
    Returns forms of education.
    """
    r = self.session.get(
```

```
      url=self.base_gui_proxy_url +
        '/kataloginformation/internal/grunddata/undervisningsform',
      headers=self.headers).json()
    return r
```

Defines:
`undervisningsform_JSON`, used in chunks 549 and 1045.

Let's add a test. The response is a code table (Section 21.1).

1045 ⟨*test functions* 245a⟩+≡

```
def test_undervisningsform_JSON(ladok) -> None:
  r = ladok.undervisningsform_JSON()
  assert_code_table(r, "Undervisningsform")
```

This code is used in chunk 240.
Defines:
`test_undervisningsform_JSON`, never used.
Uses `assert_code_table` 588 and `undervisningsform_JSON` 1044.

The output looks like this:


```
{
  "Undervisningsform": [
    {
      "Benamning": {
        "sv": "Distans",
        "en": "Distance learning"
      },
      "Beskrivning": {
        "sv": "Obligatoriska tr\u00e4ffar kan f\u00f6rekomma"
      },
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "2",
      "Kod": "DST",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Ingen undervisning",
        "en": "No teaching"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2016-04-30"
      },
      "ID": "4",
      "Kod": "ING",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "IT-baserad distansutbildning",
        "en": "Web-based distance learning"
```

```
      },
      "Beskrivning": {
        "sv": "Ingen platsbunden undervisning"
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2016-04-30"
      },
      "ID": "3",
      "Kod": "ITD",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Normal",
        "en": "Normal teaching"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "1",
      "Kod": "NML",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "IT-baserad distans",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133253",
      "Kod": "ITD",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Undervisningsomr\u00e5det",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133252",
      "Kod": "LU",
      "LarosateID": 29
```

```
    }
  ]
}
```

21.13 LokalaPerioder_JSON

1047a ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def LokalaPerioder_JSON(self) -> dict:
    """
    Returns local periods.
    """
    r = self.session.get(
      url=self.base_gui_proxy_url + '/kataloginformation/internal/grunddata/period',
      headers=self.headers).json()
    return r
```

Defines:
LokalaPerioder_JSON, used in chunk 1047b.

Let's add a test. The response is a code table (Section 21.1). No period should end before it starts.

1047b ⟨*test functions* 245a⟩+≡

```
def test_LokalaPerioder_JSON(ladok) -> None:
  r = ladok.LokalaPerioder_JSON()
  assert_code_table(r, "Period")
  assert all(period["FromDatum"] <= period["TomDatum"]
             for period in r["Period"])
```

This code is used in chunk 240.
Defines:
test_LokalaPerioder_JSON, never used.
Uses assert_code_table 588 and LokalaPerioder_JSON 1047a.

The output looks like this:


```
{
  "Period": [
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1937",
        "en": "Last six months of 1937"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1937-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1937-12-31",
        "Startdatum": "1937-07-01"
      },
      "ID": "29522",
      "Kod": "1937H",
      "LarosateID": 29,
      "PeriodtypID": 3,
```

```
      "TomDatum": "1937-12-31"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1950",
        "en": "Last six months of 1950"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1950-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1950-12-31",
        "Startdatum": "1950-07-01"
      },
      "ID": "29182",
      "Kod": "1950H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1950-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1950",
        "en": "First six months of 1950"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1950-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1950-06-30",
        "Startdatum": "1950-01-01"
      },
      "ID": "29254",
      "Kod": "1950V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1950-06-30"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1951",
        "en": "Last six months of 1951"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1951-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1951-12-31",
        "Startdatum": "1951-07-01"
      },
      "ID": "29183",
```

```
      "Kod": "1951H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1951-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1951",
        "en": "First six months of 1951"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1951-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1951-06-30",
        "Startdatum": "1951-01-01"
      },
      "ID": "29255",
      "Kod": "1951V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1951-06-30"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1952",
        "en": "Last six months of 1952"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1952-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1952-12-31",
        "Startdatum": "1952-07-01"
      },
      "ID": "29184",
      "Kod": "1952H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1952-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1952",
        "en": "First six months of 1952"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1952-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1952-06-30",
```

```
          "Startdatum": "1952-01-01"
        },
        "ID": "29256",
        "Kod": "1952V",
        "LarosateID": 29,
        "PeriodtypID": 3,
        "TomDatum": "1952-06-30"
      },
      {
        "Benamning": {
          "sv": "Andra halv\u00e5r 1953",
          "en": "Last six months of 1953"
        },
        "Beskrivning": {},
        "Dolt": false,
        "FromDatum": "1953-07-01",
        "Giltighetsperiod": {
          "Slutdatum": "1953-12-31",
          "Startdatum": "1953-07-01"
        },
        "ID": "29185",
        "Kod": "1953H",
        "LarosateID": 29,
        "PeriodtypID": 3,
        "TomDatum": "1953-12-31"
      },
      {
        "Benamning": {
          "sv": "F\u00f6rsta halv\u00e5r 1953",
          "en": "First six months of 1953"
        },
        "Beskrivning": {},
        "Dolt": false,
        "FromDatum": "1953-01-01",
        "Giltighetsperiod": {
          "Slutdatum": "1953-06-30",
          "Startdatum": "1953-01-01"
        },
        "ID": "29257",
        "Kod": "1953V",
        "LarosateID": 29,
        "PeriodtypID": 3,
        "TomDatum": "1953-06-30"
      },
      {
        "Benamning": {
          "sv": "F\u00f6rsta halv\u00e5r 1967",
          "en": "First six months of 1967"
        },
        "Beskrivning": {},
        "Dolt": false,
```

```
      "FromDatum": "1967-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1967-06-30",
        "Startdatum": "1967-01-01"
      },
      "ID": "29271",
      "Kod": "1967V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1967-06-30"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1968",
        "en": "Last six months of 1968"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1968-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1968-12-31",
        "Startdatum": "1968-07-01"
      },
      "ID": "29200",
      "Kod": "1968H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1968-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1968",
        "en": "First six months of 1968"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1968-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1968-06-30",
        "Startdatum": "1968-01-01"
      },
      "ID": "29272",
      "Kod": "1968V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1968-06-30"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1969",
        "en": "Last six months of 1969"
```

```
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1969-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1969-12-31",
        "Startdatum": "1969-07-01"
      },
      "ID": "29201",
      "Kod": "1969H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1969-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1969",
        "en": "First six months of 1969"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1969-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1969-06-30",
        "Startdatum": "1969-01-01"
      },
      "ID": "29273",
      "Kod": "1969V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1969-06-30"
    },
    {
      "Benamning": {
        "sv": "Kalender\u00e5r 1970",
        "en": "Calendar year 1970"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1970-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1970-12-31",
        "Startdatum": "1970-01-01"
      },
      "ID": "29101",
      "Kod": "1970",
      "LarosateID": 29,
      "PeriodtypID": 1,
      "TomDatum": "1970-12-31"
    },
    {
```

```
      "Benamning": {
        "sv": "Andra halv\u00e5r 1970",
        "en": "Last six months of 1970"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1970-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1970-12-31",
        "Startdatum": "1970-07-01"
      },
      "ID": "29202",
      "Kod": "1970H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1970-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1970",
        "en": "First six months of 1970"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1970-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1970-06-30",
        "Startdatum": "1970-01-01"
      },
      "ID": "29274",
      "Kod": "1970V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1970-06-30"
    },
    {
      "Benamning": {
        "sv": "Kalender\u00e5r 1971",
        "en": "Calendar year 1971"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1971-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1971-12-31",
        "Startdatum": "1971-01-01"
      },
      "ID": "29102",
      "Kod": "1971",
      "LarosateID": 29,
      "PeriodtypID": 1,
```

```
      "TomDatum": "1971-12-31"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1971",
        "en": "Last six months of 1971"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1971-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1971-12-31",
        "Startdatum": "1971-07-01"
      },
      "ID": "29203",
      "Kod": "1971H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1971-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1983",
        "en": "First six months of 1983"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1983-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1983-06-30",
        "Startdatum": "1983-01-01"
      },
      "ID": "29287",
      "Kod": "1983V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1983-06-30"
    },
    {
      "Benamning": {
        "sv": "Kalender\u00e5r 1984",
        "en": "Calendar year 1984"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1984-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1984-12-31",
        "Startdatum": "1984-01-01"
      },
      "ID": "29115",
```

```
      "Kod": "1984",
      "LarosateID": 29,
      "PeriodtypID": 1,
      "TomDatum": "1984-12-31"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1984",
        "en": "Last six months of 1984"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1984-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1984-12-31",
        "Startdatum": "1984-07-01"
      },
      "ID": "29216",
      "Kod": "1984H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1984-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1984",
        "en": "First six months of 1984"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1984-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1984-06-30",
        "Startdatum": "1984-01-01"
      },
      "ID": "29288",
      "Kod": "1984V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1984-06-30"
    },
    {
      "Benamning": {
        "sv": "Kalender\u00e5r 1985",
        "en": "Calendar year 1985"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1985-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1985-12-31",
```

```
        "Startdatum": "1985-01-01"
      },
      "ID": "29116",
      "Kod": "1985",
      "LarosateID": 29,
      "PeriodtypID": 1,
      "TomDatum": "1985-12-31"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1985",
        "en": "Last six months of 1985"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1985-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1985-12-31",
        "Startdatum": "1985-07-01"
      },
      "ID": "29217",
      "Kod": "1985H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1985-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1985",
        "en": "First six months of 1985"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1985-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1985-06-30",
        "Startdatum": "1985-01-01"
      },
      "ID": "29289",
      "Kod": "1985V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1985-06-30"
    },
    {
      "Benamning": {
        "sv": "Kalender\u00e5r 1986",
        "en": "Calendar year 1986"
      },
      "Beskrivning": {},
      "Dolt": false,
```

```
      "FromDatum": "1986-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1986-12-31",
        "Startdatum": "1986-01-01"
      },
      "ID": "29117",
      "Kod": "1986",
      "LarosateID": 29,
      "PeriodtypID": 1,
      "TomDatum": "1986-12-31"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1986",
        "en": "Last six months of 1986"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1986-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1986-12-31",
        "Startdatum": "1986-07-01"
      },
      "ID": "29218",
      "Kod": "1986H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1986-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1995",
        "en": "First six months of 1995"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1995-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1995-06-30",
        "Startdatum": "1995-01-01"
      },
      "ID": "29299",
      "Kod": "1995V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1995-06-30"
    },
    {
      "Benamning": {
        "sv": "Kalender\u00e5r 1996",
        "en": "Calendar year 1996"
```

```
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1996-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1996-12-31",
        "Startdatum": "1996-01-01"
      },
      "ID": "29127",
      "Kod": "1996",
      "LarosateID": 29,
      "PeriodtypID": 1,
      "TomDatum": "1996-12-31"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1996",
        "en": "Last six months of 1996"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1996-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1996-12-31",
        "Startdatum": "1996-07-01"
      },
      "ID": "29228",
      "Kod": "1996H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1996-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1996",
        "en": "First six months of 1996"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1996-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1996-06-30",
        "Startdatum": "1996-01-01"
      },
      "ID": "29300",
      "Kod": "1996V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1996-06-30"
    },
    {
```

```
      "Benamning": {
        "sv": "Kalender\u00e5r 1997",
        "en": "Calendar year 1997"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1997-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1997-12-31",
        "Startdatum": "1997-01-01"
      },
      "ID": "29128",
      "Kod": "1997",
      "LarosateID": 29,
      "PeriodtypID": 1,
      "TomDatum": "1997-12-31"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1997",
        "en": "Last six months of 1997"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1997-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1997-12-31",
        "Startdatum": "1997-07-01"
      },
      "ID": "29229",
      "Kod": "1997H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1997-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 1997",
        "en": "First six months of 1997"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1997-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1997-06-30",
        "Startdatum": "1997-01-01"
      },
      "ID": "29301",
      "Kod": "1997V",
      "LarosateID": 29,
      "PeriodtypID": 3,
```

```
      "TomDatum": "1997-06-30"
    },
    {
      "Benamning": {
        "sv": "Kalender\u00e5r 1998",
        "en": "Calendar year 1998"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1998-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "1998-12-31",
        "Startdatum": "1998-01-01"
      },
      "ID": "29129",
      "Kod": "1998",
      "LarosateID": 29,
      "PeriodtypID": 1,
      "TomDatum": "1998-12-31"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 1998",
        "en": "Last six months of 1998"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1998-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "1998-12-31",
        "Startdatum": "1998-07-01"
      },
      "ID": "29230",
      "Kod": "1998H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "1998-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 2007",
        "en": "First six months of 2007"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2007-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "2007-06-30",
        "Startdatum": "2007-01-01"
      },
      "ID": "29311",
```

```
      "Kod": "2007V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "2007-06-30"
    },
    {
      "Benamning": {
        "sv": "Kalender\u00e5r 2008",
        "en": "Calendar year 2008"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2008-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "2008-12-31",
        "Startdatum": "2008-01-01"
      },
      "ID": "29139",
      "Kod": "2008",
      "LarosateID": 29,
      "PeriodtypID": 1,
      "TomDatum": "2008-12-31"
    },
    {
      "Benamning": {
        "sv": "Andra halv\u00e5r 2008",
        "en": "Last six months of 2008"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2008-07-01",
      "Giltighetsperiod": {
        "Slutdatum": "2008-12-31",
        "Startdatum": "2008-07-01"
      },
      "ID": "29240",
      "Kod": "2008H",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "2008-12-31"
    },
    {
      "Benamning": {
        "sv": "F\u00f6rsta halv\u00e5r 2008",
        "en": "First six months of 2008"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2008-01-01",
      "Giltighetsperiod": {
        "Slutdatum": "2008-06-30",
```

```
        "Startdatum": "2008-01-01"
      },
      "ID": "29312",
      "Kod": "2008V",
      "LarosateID": 29,
      "PeriodtypID": 3,
      "TomDatum": "2008-06-30"
    },
    {
      "Benamning": {
        "sv": "Kalender\u00e5r 2009",
        "en": "Calendar year 2009"
      },
      "Beskrivning": {},
      "Dolt": false,
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      "Kod": "HT2011",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2012-01-14"
    },
    {
      "Benamning": {
        "sv": "H\u00f6sttermin 2012",
        "en": "Autumn semester 2012"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2012-08-24",
      "Giltighetsperiod": {
        "Slutdatum": "2013-01-04",
        "Startdatum": "2012-08-24"
      },
      "ID": "133046",
      "Kod": "HT2012",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2013-01-04"
    },
    {
```

```
      "Benamning": {
        "sv": "H\u00f6sttermin 2013",
        "en": "Autumn semester 2013"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2013-09-02",
      "Giltighetsperiod": {
        "Slutdatum": "2014-01-18",
        "Startdatum": "2013-09-02"
      },
      "ID": "133047",
      "Kod": "HT2013",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2014-01-18"
    },
    {
      "Benamning": {
        "sv": "H\u00f6sttermin 2014",
        "en": "Autumn semester 2014"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2014-09-01",
      "Giltighetsperiod": {
        "Slutdatum": "2015-01-19",
        "Startdatum": "2014-09-01"
      },
      "ID": "133050",
      "Kod": "HT2014",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2015-01-19"
    },
    {
      "Benamning": {
        "sv": "H\u00f6sttermin 2015",
        "en": "Autumn semester 2015"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2015-08-31",
      "Giltighetsperiod": {
        "Slutdatum": "2016-01-18",
        "Startdatum": "2015-08-31"
      },
      "ID": "133048",
      "Kod": "HT2015",
      "LarosateID": 29,
      "PeriodtypID": 2,
```

```
      "TomDatum": "2016-01-18"
    },
    {
      "Benamning": {
        "sv": "H\u00f6sttermin 2016",
        "en": "Autumn semester 2016"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2016-08-29",
      "Giltighetsperiod": {
        "Slutdatum": "2017-01-16",
        "Startdatum": "2016-08-29"
      },
      "ID": "133049",
      "Kod": "HT2016",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2017-01-16"
    },
    {
      "Benamning": {
        "sv": "H\u00f6sttermin 2017",
        "en": "Autumn semester 2017"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2017-08-28",
      "Giltighetsperiod": {
        "Slutdatum": "2018-01-15",
        "Startdatum": "2017-08-28"
      },
      "ID": "133053",
      "Kod": "HT2017",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2018-01-15"
    },
    {
      "Benamning": {
        "sv": "H\u00f6sttermin 2018",
        "en": "Autumn semester 2018"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2018-08-27",
      "Giltighetsperiod": {
        "Slutdatum": "2019-01-14",
        "Startdatum": "2018-08-27"
      },
      "ID": "133052",
```

```
      "Kod": "HT2018",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2019-01-14"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 1972",
        "en": "Spring semester 1972"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1972-01-20",
      "Giltighetsperiod": {
        "Slutdatum": "1972-08-14",
        "Startdatum": "1972-01-20"
      },
      "ID": "133130",
      "Kod": "VT1972",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "1972-08-14"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 1973",
        "en": "Spring semester 1973"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1973-01-20",
      "Giltighetsperiod": {
        "Slutdatum": "1973-08-14",
        "Startdatum": "1973-01-20"
      },
      "ID": "133132",
      "Kod": "VT1973",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "1973-08-14"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 1974",
        "en": "Spring semester 1974"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1974-01-20",
      "Giltighetsperiod": {
        "Slutdatum": "1974-08-14",
```

```
        "Startdatum": "1974-01-20"
      },
      "ID": "133136",
      "Kod": "VT1974",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "1974-08-14"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 1975",
        "en": "Spring semester 1975"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1975-01-20",
      "Giltighetsperiod": {
        "Slutdatum": "1975-08-14",
        "Startdatum": "1975-01-20"
      },
      "ID": "133131",
      "Kod": "VT1975",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "1975-08-14"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 1976",
        "en": "Spring semester 1976"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1976-01-20",
      "Giltighetsperiod": {
        "Slutdatum": "1976-08-14",
        "Startdatum": "1976-01-20"
      },
      "ID": "133134",
      "Kod": "VT1976",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "1976-08-14"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 1977",
        "en": "Spring semester 1977"
      },
      "Beskrivning": {},
      "Dolt": false,
```

```
      "FromDatum": "1977-01-20",
      "Giltighetsperiod": {
        "Slutdatum": "1977-08-14",
        "Startdatum": "1977-01-20"
      },
      "ID": "133139",
      "Kod": "VT1977",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "1977-08-14"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 1978",
        "en": "Spring semester 1978"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1978-01-20",
      "Giltighetsperiod": {
        "Slutdatum": "1978-08-14",
        "Startdatum": "1978-01-20"
      },
      "ID": "133138",
      "Kod": "VT1978",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "1978-08-14"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 1979",
        "en": "Spring semester 1979"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1979-01-20",
      "Giltighetsperiod": {
        "Slutdatum": "1979-08-14",
        "Startdatum": "1979-01-20"
      },
      "ID": "133140",
      "Kod": "VT1979",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "1979-08-14"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 1980",
        "en": "Spring semester 1980"
```

```
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1980-01-20",
      "Giltighetsperiod": {
        "Slutdatum": "1980-08-14",
        "Startdatum": "1980-01-20"
      },
      "ID": "133143",
      "Kod": "VT1980",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "1980-08-14"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 1999",
        "en": "Spring semester 1999"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "1999-01-18",
      "Giltighetsperiod": {
        "Slutdatum": "1999-06-05",
        "Startdatum": "1999-01-18"
      },
      "ID": "133157",
      "Kod": "VT1999",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "1999-06-05"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2000",
        "en": "Spring semester 2000"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2000-01-17",
      "Giltighetsperiod": {
        "Slutdatum": "2000-06-03",
        "Startdatum": "2000-01-17"
      },
      "ID": "133101",
      "Kod": "VT2000",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2000-06-03"
    },
    {
```

```
      "Benamning": {
        "sv": "V\u00e5rtermin 2001",
        "en": "Spring semester 2001"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2001-01-15",
      "Giltighetsperiod": {
        "Slutdatum": "2001-06-02",
        "Startdatum": "2001-01-15"
      },
      "ID": "133097",
      "Kod": "VT2001",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2001-06-02"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2002",
        "en": "Spring semester 2002"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2002-01-14",
      "Giltighetsperiod": {
        "Slutdatum": "2002-06-01",
        "Startdatum": "2002-01-14"
      },
      "ID": "133102",
      "Kod": "VT2002",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2002-06-01"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2003",
        "en": "Spring semester 2003"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2003-01-14",
      "Giltighetsperiod": {
        "Slutdatum": "2003-06-06",
        "Startdatum": "2003-01-14"
      },
      "ID": "133103",
      "Kod": "VT2003",
      "LarosateID": 29,
      "PeriodtypID": 2,
```

```
      "TomDatum": "2003-06-06"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2004",
        "en": "Spring semester 2004"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2004-01-19",
      "Giltighetsperiod": {
        "Slutdatum": "2004-06-01",
        "Startdatum": "2004-01-19"
      },
      "ID": "133100",
      "Kod": "VT2004",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2004-06-01"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2005",
        "en": "Spring semester 2005"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2005-01-17",
      "Giltighetsperiod": {
        "Slutdatum": "2005-06-04",
        "Startdatum": "2005-01-17"
      },
      "ID": "133099",
      "Kod": "VT2005",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2005-06-04"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2006",
        "en": "Spring semester 2006"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2006-01-18",
      "Giltighetsperiod": {
        "Slutdatum": "2006-05-30",
        "Startdatum": "2006-01-18"
      },
      "ID": "133105",
```

```
      "Kod": "VT2006",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2006-05-30"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2007",
        "en": "Spring semester 2007"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2007-01-17",
      "Giltighetsperiod": {
        "Slutdatum": "2007-05-28",
        "Startdatum": "2007-01-17"
      },
      "ID": "133106",
      "Kod": "VT2007",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2007-05-28"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2027",
        "en": "Spring semester 2027"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2027-01-12",
      "Giltighetsperiod": {
        "Slutdatum": "2027-05-31",
        "Startdatum": "2027-01-12"
      },
      "ID": "153190",
      "Kod": "VT2027",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2027-05-31"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2028",
        "en": "Spring semester 2028"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2028-01-18",
      "Giltighetsperiod": {
        "Slutdatum": "2028-06-02",
```

```
        "Startdatum": "2028-01-18"
      },
      "ID": "156664",
      "Kod": "VT2028",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2028-06-02"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2029",
        "en": "Spring semester 2029"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2029-01-15",
      "Giltighetsperiod": {
        "Slutdatum": "2029-06-03",
        "Startdatum": "2029-01-15"
      },
      "ID": "159035",
      "Kod": "VT2029",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2029-06-03"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2030",
        "en": "Spring semester 2030"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2030-01-21",
      "Giltighetsperiod": {
        "Slutdatum": "2030-06-09",
        "Startdatum": "2030-01-21"
      },
      "ID": "161510",
      "Kod": "VT2030",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2030-06-09"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2031",
        "en": "Spring semester 2031"
      },
      "Beskrivning": {},
      "Dolt": false,
```

```
      "FromDatum": "2031-01-20",
      "Giltighetsperiod": {
        "Slutdatum": "2031-06-08",
        "Startdatum": "2031-01-20"
      },
      "ID": "161512",
      "Kod": "VT2031",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2031-06-08"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2032",
        "en": "Spring semester 2032"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2032-01-19",
      "Giltighetsperiod": {
        "Slutdatum": "2032-06-06",
        "Startdatum": "2032-01-19"
      },
      "ID": "164875",
      "Kod": "VT2032",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2032-06-06"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2033",
        "en": "Spring semester 2033"
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2033-01-17",
      "Giltighetsperiod": {
        "Slutdatum": "2033-06-05",
        "Startdatum": "2033-01-17"
      },
      "ID": "164878",
      "Kod": "VT2033",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2033-06-05"
    },
    {
      "Benamning": {
        "sv": "V\u00e5rtermin 2035",
        "en": "Spring semester 2035"
```

```
      },
      "Beskrivning": {},
      "Dolt": false,
      "FromDatum": "2035-01-15",
      "Giltighetsperiod": {
        "Slutdatum": "2035-06-03",
        "Startdatum": "2035-01-15"
      },
      "ID": "164880",
      "Kod": "VT2035",
      "LarosateID": 29,
      "PeriodtypID": 2,
      "TomDatum": "2035-06-03"
    }
  ]
}
```

21.14 nivainomstudieordning_JSON

1178a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def nivainomstudieordning_JSON(self) -> dict:
  """
  Returns education levels.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/kataloginformation/internal/grunddata/nivainomstudieordning',
    headers=self.headers).json()
  return r
```

Defines:
nivainomstudieordning_JSON, used in chunks 1041b and 1178b.

Let's add a test. The response is a code table (Section 21.1).

1178b ⟨*test functions* 245a⟩+≡

```
def test_nivainomstudieordning_JSON(ladok) -> None:
  r = ladok.nivainomstudieordning_JSON()
  assert_code_table(r, "NivaInomStudieordning")
```

This code is used in chunk 240.
Defines:
test_nivainomstudieordning_JSON, never used.
Uses assert_code_table 588 and nivainomstudieordning_JSON 1178a.

The output looks like this:

```
{
  "NivaInomStudieordning": [
    {
      "Benamning": {
        "sv": "Grundniv\u00e5",
        "en": "First cycle"
      },
```

```
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2007-07-01"
      },
      "ID": "1",
      "Kod": "1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Avancerad niv\u00e5",
        "en": "Second cycle"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2007-07-01"
      },
      "ID": "2",
      "Kod": "2",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Forskarniv\u00e5",
        "en": "Third cycle"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2007-07-01"
      },
      "ID": "3",
      "Kod": "3",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Forskarutbildning",
        "en": "Postgraduate level"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2007-06-30",
        "Startdatum": "1977-07-01"
      },
      "ID": "5",
      "Kod": "F",
      "LarosateID": -1
```

```
    },
    {
      "Benamning": {
        "sv": "Grundutbildning",
        "en": "Undergraduate level"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2007-06-30",
        "Startdatum": "1977-07-01"
      },
      "ID": "4",
      "Kod": "G",
      "LarosateID": -1
    }
  ]
}
```

21.15 amnesgrupp_JSON

1180a ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def amnesgrupp_JSON(self) -> dict:
    """
    Returns subject area groups.
    """
    r = self.session.get(
      url=self.base_gui_proxy_url + '/kataloginformation/internal/grunddata/amnesgrupp',
      headers=self.headers).json()
    return r
```

Defines:
amnesgrupp_JSON, used in chunk 1180b.

Let's add a test. The response is a code table (Section 21.1).

1180b ⟨*test functions* 245a⟩+≡

```
def test_amnesgrupp_JSON(ladok) -> None:
  r = ladok.amnesgrupp_JSON()
  assert_code_table(r, "Amnesgrupp")
```

This code is used in chunk 240.
Defines:
test_amnesgrupp_JSON, never used.
Uses amnesgrupp_JSON 1180a and assert_code_table 588.

The output looks like this:

```
{
  "Amnesgrupp": [
    {
      "Benamning": {
        "sv": "Arkivvetenskap",
        "en": "Archival Science"
```

```
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "10",
      "Kod": "AV1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "\u00d6vrigt inom beteendevetenskap",
        "en": "Other Subjects within Behavioural Science"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "11",
      "Kod": "BE9",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Biologi",
        "en": "Biology"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "12",
      "Kod": "BI1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Bosniska/kroatiska/serbiska",
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        "en": "Energy Technology"
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        "en": "Education"
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        "en": "Social Studies"
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        "en": "Theology"
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        "en": "Dental Technology and Oral Health"
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      "Giltighetsperiod": {},
      "ID": "168",
      "Kod": "TR1",
      "LarosateID": -1
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    {
      "Benamning": {
        "sv": "Teknik i samh\u00e4llsperspektiv",
        "en": "Technology from a Social Perspective"
      },
      "Beskrivning": {},
      "Dolt": false,
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        "en": "Wood Physics and Wood Technology"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "TT1",
      "LarosateID": -1
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        "sv": "Turism- och fritidsvetenskap",
        "en": "Tourism and Recreation Studies"
      },
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      "LarosateID": -1
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    {
      "Benamning": {
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        "en": "Pharmacy"
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```
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      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "37",
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        "en": "Business Administration"
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      "Giltighetsperiod": {},
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      "Kod": "FE1",
      "LarosateID": -1
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    {
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        "sv": "F\u00f6rfattande",
        "en": "Creative Writing"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "FF1",
      "LarosateID": -1
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    {
      "Benamning": {
        "sv": "Folkh\u00e4lsovetenskap",
        "en": "Public Health"
      },
      "Beskrivning": {},
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      "Kod": "FH1",
      "LarosateID": -1
    },
    {
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        "sv": "Finska",
        "en": "Finnish"
      },
      "Beskrivning": {},
      "Dolt": false,
```

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      "LarosateID": -1
    },
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        "sv": "Filosofi",
        "en": "Philosophy"
      },
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      "Dolt": false,
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    {
      "Benamning": {
        "sv": "Farmakologi",
        "en": "Pharmacology"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "43",
      "Kod": "FK1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Fri konst",
        "en": "Fine Art"
      },
      "Beskrivning": {},
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      "Kod": "FK2",
      "LarosateID": -1
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    {
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        "sv": "Flerspr\u00e5kigt inriktade \u00e4mnen",
        "en": "Subjects with Multilingual Focus"
      },
      "Beskrivning": {},
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      "Giltighetsperiod": {},
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        "sv": "Sociologi",
        "en": "Sociology"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "145",
      "Kod": "SO1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Socialantropologi",
        "en": "Social Anthropology"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "146",
      "Kod": "SO2",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Spanska",
        "en": "Spanish"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "147",
      "Kod": "SP1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "\u00d6vriga spr\u00e5k",
        "en": "Other Languages"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "148",
      "Kod": "SP2",
      "LarosateID": -1
    },
    {
```

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      "Benamning": {
        "sv": "Svenska som andraspr\u00e5k",
        "en": "Swedish as a Second Language"
      },
      "Beskrivning": {},
      "Dolt": false,
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      "ID": "149",
      "Kod": "SS1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Socialt arbete och social omsorg",
        "en": "Social Work and Social Welfare"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "150",
      "Kod": "SS2",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Statistik",
        "en": "Statistics"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "151",
      "Kod": "ST1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Statsvetenskap",
        "en": "Political Science"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "152",
      "Kod": "ST2",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Svenska/nordiska spr\u00e5k",
        "en": "Swedish/Scandinavian Languages"
```

```
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "153",
      "Kod": "SV1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Tr\u00e4dg\u00e5rdsvetenskap",
        "en": "Horticultural Science"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "172",
      "Kod": "TV1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "\u00d6vriga tv\u00e4rvetenskapliga studier",
        "en": "Other Interdisciplinary Studies"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "173",
      "Kod": "TV9",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Textilteknologi",
        "en": "Textile Technology"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "174",
      "Kod": "TX1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Tyska",
        "en": "German"
      },
      "Beskrivning": {},
      "Dolt": false,
```

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      "Giltighetsperiod": {},
      "ID": "175",
      "Kod": "TY1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Ungerska",
        "en": "Hungarian"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "176",
      "Kod": "UN1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Utbildningsvetenskap/didaktik allm\u00e4nt",
        "en": "Educational Sciences/General Didactics"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "177",
      "Kod": "UV1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Utbildningsvetenskap teoretiska \u00e4mnen",
        "en": "Educational Sciences/Theoretical Subjects"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "178",
      "Kod": "UV2",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Utbildningsvetenskap praktisk-estetiska \u00e4mnen",
        "en": "Educational Sciences/Practical Subjects"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "179",
      "Kod": "UV3",
```

```
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Veterin\u00e4rmedicin",
        "en": "Veterinary Medicine"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "180",
      "Kod": "VE1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "V\u00e4g- och vattenbyggnad",
        "en": "Civil Engineering"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "181",
      "Kod": "VV1",
      "LarosateID": -1
    }
  ]
}
```

21.16 studietakt_JSON

1223a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def studietakt_JSON(self) -> dict:
  """
  Returns study paces.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url + '/kataloginformation/internal/grunddata/studietakt',
    headers=self.headers).json()
  return r
```

Defines:
studietakt_JSON, used in chunks 549 and 1223b.

Let's add a test. The response is a code table (Section 21.1).

1223b ⟨*test functions* 245a⟩+≡

```
def test_studietakt_JSON(ladok) -> None:
  r = ladok.studietakt_JSON()
  assert_code_table(r, "Studietakt")
```

This code is used in chunk 240.
Defines:
`test_studietakt_JSON`, never used.
Uses `assert_code_table` 588 and `studietakt_JSON` 1223a.

The output looks like this:

```
{
  "Studietakt": [
    {
      "Benamning": {
        "sv": "Tiondelsfart",
        "en": "One-tenth-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "8",
      "Kod": "10",
      "LarosateID": -1,
      "Takt": 10
    },
    {
      "Benamning": {
        "sv": "Helfart",
        "en": "Full-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "1",
      "Kod": "100",
      "LarosateID": -1,
      "Takt": 100
    },
    {
      "Benamning": {
        "sv": "\u00c5ttondelsfart",
        "en": "One-eight-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "128190",
      "Kod": "12",
      "LarosateID": -1,
      "Takt": 12
    },
    {
      "Benamning": {
        "sv": "Sj\u00e4ttedelsfart",
        "en": "One-sixth-time"
```

```
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "7",
      "Kod": "17",
      "LarosateID": -1,
      "Takt": 17
    },
    {
      "Benamning": {
        "sv": "Kvartsfart",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "6",
      "Kod": "25",
      "LarosateID": -1,
      "Takt": 25
    },
    {
      "Benamning": {
        "sv": "Tredjedelsfart",
        "en": "One-third-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "5",
      "Kod": "33",
      "LarosateID": -1,
      "Takt": 33
    },
    {
      "Benamning": {
        "sv": "Halvfart",
        "en": "Half-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "4",
      "Kod": "50",
      "LarosateID": -1,
      "Takt": 50
    },
    {
      "Benamning": {
        "sv": "Tv\u00e5tredjedelsfart",
```

```
        "en": "Two-thirds-time"
      },
      "Beskrivning": {
        "sv": "\u00c4ndras till \"Tv\u00e5tredjedelsfart\" efter fullbordad produktionss\u00e4ttning."
      },
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "3",
      "Kod": "67",
      "LarosateID": -1,
      "Takt": 67
    },
    {
      "Benamning": {
        "sv": "Trekvartsfart",
        "en": "Three-quarters-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "2",
      "Kod": "75",
      "LarosateID": -1,
      "Takt": 75
    },
    {
      "Benamning": {
        "sv": "Noll",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": false,
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        "Slutdatum": "2018-06-19"
      },
      "ID": "133268",
      "Kod": "0",
      "LarosateID": 29,
      "Takt": 0
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    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
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```

```
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      "Takt": 1
    },
    {
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        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
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      },
      "ID": "133282",
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      "LarosateID": 29,
      "Takt": 11
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
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      },
      "ID": "133281",
      "Kod": "13",
      "LarosateID": 29,
      "Takt": 13
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133278",
      "Kod": "14",
      "LarosateID": 29,
      "Takt": 14
    },
    {
      "Benamning": {
```

```
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133283",
      "Kod": "15",
      "LarosateID": 29,
      "Takt": 15
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
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      },
      "ID": "133280",
      "Kod": "16",
      "LarosateID": 29,
      "Takt": 16
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
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      },
      "ID": "133289",
      "Kod": "18",
      "LarosateID": 29,
      "Takt": 18
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
```

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      },
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      "Takt": 19
    },
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        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
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      },
      "ID": "133271",
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      "LarosateID": 29,
      "Takt": 2
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133285",
      "Kod": "20",
      "LarosateID": 29,
      "Takt": 20
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133287",
      "Kod": "21",
      "LarosateID": 29,
      "Takt": 21
```

```
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133290",
      "Kod": "22",
      "LarosateID": 29,
      "Takt": 22
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133284",
      "Kod": "23",
      "LarosateID": 29,
      "Takt": 23
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133286",
      "Kod": "24",
      "LarosateID": 29,
      "Takt": 24
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
```

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      "Dolt": false,
      "Giltighetsperiod": {
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      },
      "ID": "133288",
      "Kod": "26",
      "LarosateID": 29,
      "Takt": 26
    },
    {
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        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133291",
      "Kod": "27",
      "LarosateID": 29,
      "Takt": 27
    },
    {
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        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
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      },
      "ID": "133292",
      "Kod": "28",
      "LarosateID": 29,
      "Takt": 28
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133294",
```

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      "Kod": "29",
      "LarosateID": 29,
      "Takt": 29
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133274",
      "Kod": "3",
      "LarosateID": 29,
      "Takt": 3
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133293",
      "Kod": "30",
      "LarosateID": 29,
      "Takt": 30
    },
    {
      "Benamning": {
        "sv": "Kvartstid",
        "en": "One-quarter-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133296",
      "Kod": "31",
      "LarosateID": 29,
      "Takt": 31
    },
    {
      "Benamning": {
```

```
        "sv": "Kvartstid",
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      "LarosateID": 29,
      "Takt": 9
    },
    {
      "Benamning": {
        "sv": "N\u00e4stan heltid",
        "en": "Almost full-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133350",
      "Kod": "90",
      "LarosateID": 29,
      "Takt": 90
    },
    {
      "Benamning": {
        "sv": "N\u00e4stan heltid",
        "en": "Almost full-time"
      },
```

```
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133352",
      "Kod": "91",
      "LarosateID": 29,
      "Takt": 91
    },
    {
      "Benamning": {
        "sv": "N\u00e4stan heltid",
        "en": "Almost full-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133358",
      "Kod": "92",
      "LarosateID": 29,
      "Takt": 92
    },
    {
      "Benamning": {
        "sv": "N\u00e4stan heltid",
        "en": "Almost full-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133353",
      "Kod": "93",
      "LarosateID": 29,
      "Takt": 93
    },
    {
      "Benamning": {
        "sv": "N\u00e4stan heltid",
        "en": "Almost full-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133354",
```

```
      "Kod": "94",
      "LarosateID": 29,
      "Takt": 94
    },
    {
      "Benamning": {
        "sv": "N\u00e4stan heltid",
        "en": "Almost full-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133351",
      "Kod": "95",
      "LarosateID": 29,
      "Takt": 95
    },
    {
      "Benamning": {
        "sv": "N\u00e4stan heltid",
        "en": "Almost full-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133355",
      "Kod": "96",
      "LarosateID": 29,
      "Takt": 96
    },
    {
      "Benamning": {
        "sv": "N\u00e4stan heltid",
        "en": "Almost full-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133357",
      "Kod": "97",
      "LarosateID": 29,
      "Takt": 97
    },
    {
      "Benamning": {
```

```
        "sv": "N\u00e4stan heltid",
        "en": "Almost full-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133356",
      "Kod": "98",
      "LarosateID": 29,
      "Takt": 98
    },
    {
      "Benamning": {
        "sv": "N\u00e4stan heltid",
        "en": "Almost full-time"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "133359",
      "Kod": "99",
      "LarosateID": 29,
      "Takt": 99
    }
  ]
}
```

21.17 finansieringsform_JSON

1253a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def finansieringsform_JSON(self) -> dict:
  """
  Returns forms of financing.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/kataloginformation/internal/grunddata/finansieringsform',
    headers=self.headers).json()
  return r
```

Defines:
finansieringsform_JSON, used in chunks 549 and 1253b.

Let's add a test. The response is a code table (Section 21.1).

1253b ⟨*test functions* 245a⟩+≡

```
def test_finansieringsform_JSON(ladok) -> None:
  r = ladok.finansieringsform_JSON()
```

```
    assert_code_table(r, "Finansieringsform")
```

This code is used in chunk 240.
Defines:
`test_finansieringsform_JSON`, never used.
Uses `assert_code_table` 588 and `finansieringsform_JSON` 1253a.

The output looks like this:


```
{
  "Finansieringsform": [
    {
      "Benamning": {
        "sv": "Aspirantutbildning",
        "en": "Bridging programme for graduates with foreign qualifications"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2016-06-30"
      },
      "ID": "102078",
      "Kod": "A",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Bas\u00e5rsutbildning",
        "en": "Foundation year programme"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "102085",
      "Kod": "B",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Distanskonsortiekurs",
        "en": "Distance consortium course"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2016-06-30"
      },
      "ID": "102080",
      "Kod": "D",
      "LarosateID": -1
    },
    {
      "Benamning": {
```

```
        "sv": "Fortbildningskurs f\u00f6r skolpersonal",
        "en": "Continuing professional development course for teachers"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2016-06-30"
      },
      "ID": "102076",
      "Kod": "F",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Flexibla v\u00e4gar in i l\u00e4raryrket",
        "en": "Flexible roads into the teaching profession"
      },
      "Beskrivning": {
        "sv": "Regeringsuppdrag \u00e5t Ume\u00e5 universitet att leda ett arbete med att ta fram\ninsatse
      },
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "149937",
      "Kod": "FVI",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Kombinationsutbildning",
        "en": "Combined education"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2016-06-30"
      },
      "ID": "102077",
      "Kod": "KB",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Finansiering via KK-stiftelsen",
        "en": "Funded by the Knowledge Foundation"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "136090",
      "Kod": "KK",
      "LarosateID": -1
```

```
    },
    {
      "Benamning": {
        "sv": "Kompletterande pedagogisk utbildning till grundl\u00e4rar- eller \u00e4mnesl\u00e4rarexamen
        "en": "Supplementary pedagogical education aiming to a degree in primary education or a degree in
      },
      "Beskrivning": {
        "sv": "SFS 2021:1336 F\u00f6rs\u00f6ksverksamhet med kompletterande pedagogisk utbildning som lede
      },
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "153256",
      "Kod": "KPL",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Livsl\u00e5ngt l\u00e4rande",
        "en": "Life long learning"
      },
      "Beskrivning": {
        "sv": "S\u00e4rskild satsning fr.o.m. 2021 enligt l\u00e4ros\u00e4tenas regleringsbrev"
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2021-01-01"
      },
      "ID": "151411",
      "Kod": "LL",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "NT/SVUX-utbildning",
        "en": "Adult education in science and applied science"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2016-06-30"
      },
      "ID": "102075",
      "Kod": "NT",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "N\u00e4tuniversitetet",
        "en": "Net university course"
      },
      "Beskrivning": {},
```

```
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2016-06-30"
      },
      "ID": "102079",
      "Kod": "NU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Ordinarie anslagsfinansiering",
        "en": "Regular government funding"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "101050",
      "Kod": "ORD",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Sommarkurs",
        "en": "Summer course"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "102074",
      "Kod": "S",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "S\u00e4rskild utbildningssatsning 2020",
        "en": "Special effort on education 2020"
      },
      "Beskrivning": {
        "sv": "S\u00e4rskild satsning p\u00e5 sommarkurser och beh\u00f6righetsgivande utbildning 2020 (Re
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2021-06-30",
        "Startdatum": "2020-01-01"
      },
      "ID": "150163",
      "Kod": "S20",
      "LarosateID": -1
    },
    {
      "Benamning": {
```

```
        "sv": "S\u00e4rskild satsning p\u00e5 sommarkurser 2021",
        "en": "Special effort on summer courses 2021"
      },
      "Beskrivning": {
        "sv": "S\u00e4rskild satsning p\u00e5 sommarkurser 2021 (Regeringens proposition 2020/21:99)"
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2021-12-31",
        "Startdatum": "2021-01-01"
      },
      "ID": "151754",
      "Kod": "S21",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Sommarkurser inom l\u00e4raromr\u00e5det f\u00f6r examen, beh\u00f6righet och kompetensutve
        "en": "Sommer courses within the education area aiming to qualifcation and competence development"
      },
      "Beskrivning": {
        "sv": "Regeringsbeslut U2019/04118/UH. Ers\u00e4tter uppdraget att anordna fler relevanta sommarku
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Startdatum": "2020-01-01"
      },
      "ID": "154263",
      "Kod": "SSL",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Vetenskap utan gr\u00e4nser",
        "en": "Science without borders"
      },
      "Beskrivning": {
        "sv": "Se regleringsbrev"
      },
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "102083",
      "Kod": "SWB",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "S\u00e4rskild l\u00e4rarutbildning",
        "en": "Special education for teachers in vocational subjects"
      },
      "Beskrivning": {
```

```
        "sv": "SFS 2005:568 S\u00e4rskild utbildning av l\u00e4rare i yrkes\u00e4mnen"
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2010-01-01",
        "Startdatum": "2005-08-01"
      },
      "ID": "102084",
      "Kod": "S\u00c4L",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Uppdragsutbildning",
        "en": "Contract education"
      },
      "Beskrivning": {
        "sv": "Anv\u00e4nds i Ladok f\u00f6r all uppdragsutbildning som inte s\u00e4rskiljs genom annan fi
      },
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "102042",
      "Kod": "U",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Kompletterande utbildning f\u00f6r personer med utl\u00e4ndsk examen",
        "en": "Complementary education for persons with foreign degrees"
      },
      "Beskrivning": {
        "sv": "SFS 2008:1101 H\u00f6gskoleutbildning som kompletterar avslutad utl\u00e4ndsk utbildning"
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Startdatum": "2009-01-15"
      },
      "ID": "106370",
      "Kod": "UKU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Utlandsutbildade l\u00e4rares vidareutbildning",
        "en": "Complementary education for foreign teachers"
      },
      "Beskrivning": {
        "sv": "Best\u00e4lld utbildning fr\u00e5n Stockholms universitet (tidigare L\u00e4rarh\u00f6gskola
      },
      "Dolt": true,
      "Giltighetsperiod": {},
```

```
      "ID": "102081",
      "Kod": "ULV",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Uppdragsutbildning polis",
        "en": "Contract education - Police education"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "143695",
      "Kod": "UPU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Vidareutbildning av obeh\u00f6riga l\u00e4rare",
        "en": "Complementary education for unqualified teachers"
      },
      "Beskrivning": {
        "sv": "SFS 2011:689"
      },
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "102082",
      "Kod": "VAL",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "X Anv\u00e4nds ej",
        "en": "X Anv\u00e4nds ej"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "153396",
      "Kod": "XXX",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Alumn, med examen fr KTH (ej HST-HPR)",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "131704",
```

```
      "Kod": "ALU",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Best\u00e4lld utbildning f\u00f6r externa doktorander (ej HST-HPR)",
        "en": "Contracted course for external doctoral students (ej HST-HPR)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2020-08-01"
      },
      "ID": "150896",
      "Kod": "BDR",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "zzzz Best\u00e4lld utbildning f\u00f6r externa doktorander",
        "en": "zzzz Contracted course for external doctoral students"
      },
      "Beskrivning": {
        "sv": "BDR ers\u00e4tter denna"
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2020-08-01",
        "Startdatum": "2020-08-01"
      },
      "ID": "150875",
      "Kod": "BESTUTBDOKT",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Beijing Jiaotong Technical University",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "131708",
      "Kod": "BJT",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Tekniskt bas\u00e5r NT-SVUX",
```

```
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "131712",
      "Kod": "BNT",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Best\u00e4lld utbilning Chalmers (ej HST-HPR)",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "131703",
      "Kod": "CTH",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "EIT-InnoEnergy (vissa p\u00e5 distans \u00e5r 2, ej KTH)",
        "en": "EIT-InnoEnergy"
      },
      "Beskrivning": {
        "sv": "MJ2504 \u00e4r en obligatorisk kurs f\u00f6r \u00e5r 2 p\u00e5 programmet TMESM, studenter
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2017-08-01"
      },
      "ID": "148345",
      "Kod": "EIS",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "EJ HST/HPR",
        "en": "EJ HST/HPR"
      },
      "Beskrivning": {
        "sv": "F\u00f6r \u00e5taganden och kurstillf\u00e4llen som ej ska generera HST/HPR, tex f\u00f6r \
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2024-01-01"
      },
```

```
      "ID": "159831",
      "Kod": "EJH",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Erasmus M Utresa KTH koord (ej HST-HPR)",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "131709",
      "Kod": "EMK",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Examensarb. utomlands (ej HST-HPR)",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "131707",
      "Kod": "EXA",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "\u00d6verbryggande kurs",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "131705",
      "Kod": "FB",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Fortbildningskurser f\u00f6r gymnasiel\u00e4rare",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
```

```
      },
      "ID": "131710",
      "Kod": "FBL",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "KI-student, deltar i FOV-kurs",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "131706",
      "Kod": "FKI",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "\u00d6verbryggande n\u00e4tkurs",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2018-06-19"
      },
      "ID": "131711",
      "Kod": "FN\u00c4",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Forsk.stud.kurser utb. niv\u00e5 1 och 2",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "131716",
      "Kod": "FOA",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Forskarkurs (ej HST-HPR)",
        "en": "Phd course (ej HST-HPR)"
      },
      "Beskrivning": {},
```

```
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "131713",
      "Kod": "FOR",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Fortbildning och vidareutbildning",
        "en": "- No translation available -"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "131717",
      "Kod": "FOV",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "F\u00e4ltstudie i Palestina (ABE-skolan, V12)",
        "en": "- No translation available -"
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      "LarosateID": 29
    }
  ]
}
```

21.18 utbildningsomrade_JSON

1281a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def utbildningsomrade_JSON(self) -> dict:
  """
  Returns subject areas.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/kataloginformation/internal/grunddata/utbildningsomrade',
    headers=self.headers).json()
  return r
```

Defines:
utbildningsomrade_JSON, used in chunk 1281b.

Let's add a test. The response is a code table (Section 21.1).

1281b ⟨*test functions* 245a⟩+≡

```
def test_utbildningsomrade_JSON(ladok) -> None:
  r = ladok.utbildningsomrade_JSON()
  assert_code_table(r, "Utbildningsomrade")
```

This code is used in chunk 240.
Defines:
test_utbildningsomrade_JSON, never used.
Uses assert_code_table 588 and utbildningsomrade_JSON 1281a.

The output looks like this:


```
{
  "Utbildningsomrade": [
    {
      "Benamning": {
        "sv": "Dansomr\u00e5det",
        "en": "Dance"
      },
      "Beskrivning": {
        "sv": "Inf\u00f6rdes fr\u00e5n budget\u00e5ret 1994/95. Tidigare fanns bara ett konstn\u00e4rligt
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Startdatum": "1994-07-01"
      },
      "ID": "1",
      "Kod": "DA",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Designomr\u00e5det",
        "en": "Design"
      },
      "Beskrivning": {
        "sv": "Inf\u00f6rdes fr\u00e5n budget\u00e5ret 1994/95. Tidigare fanns bara ett konstn\u00e4rligt
```

```
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1994-07-01"
      },
      "ID": "2",
      "Kod": "DE",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Humanistiska omr\u00e5det",
        "en": "Humanities"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "4",
      "Kod": "HU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Idrottsliga omr\u00e5det",
        "en": "Sports"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "5",
      "Kod": "ID",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Juridiska omr\u00e5det",
        "en": "Law"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "6",
      "Kod": "JU",
      "LarosateID": -1
    },
```

```
    {
      "Benamning": {
        "sv": "Konstomr\u00e5det",
        "en": "Fine arts"
      },
      "Beskrivning": {
        "sv": "Inf\u00f6rdes fr\u00e5n budget\u00e5ret 1994/95. Tidigare fanns bara ett konstn\u00e4rligt
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Startdatum": "1994-07-01"
      },
      "ID": "7",
      "Kod": "KO",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Undervisningsomr\u00e5det",
        "en": "Education"
      },
      "Beskrivning": {
        "sv": "Avser utbildning inom det allm\u00e4nna utbildningsomr\u00e5det och den utbildningsvetenska
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "9",
      "Kod": "LU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Medicinska omr\u00e5det",
        "en": "Medicine"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "10",
      "Kod": "ME",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Mediaomr\u00e5det",
        "en": "Media"
      },
```

```
      "Beskrivning": {
        "sv": "Inf\u00f6rdes fr\u00e5n budget\u00e5ret 1994/95. Tidigare fanns bara ett konstn\u00e4rligt
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1994-07-01"
      },
      "ID": "11",
      "Kod": "MM",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Musikomr\u00e5det",
        "en": "Music"
      },
      "Beskrivning": {
        "sv": "Inf\u00f6rdes fr\u00e5n budget\u00e5ret 1994/95. Tidigare fanns bara ett konstn\u00e4rligt
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1994-07-01"
      },
      "ID": "12",
      "Kod": "MU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Naturvetenskapliga omr\u00e5det",
        "en": "Natural sciences"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "13",
      "Kod": "NA",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Odontologiska omr\u00e5det",
        "en": "Dentistry"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
```

```
      "ID": "14",
      "Kod": "OD",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Operaomr\u00e5det",
        "en": "Opera"
      },
      "Beskrivning": {
        "sv": "Inf\u00f6rdes fr\u00e5n budget\u00e5ret 1994/95. Tidigare fanns bara ett konstn\u00e4rligt
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Startdatum": "1994-07-01"
      },
      "ID": "15",
      "Kod": "OP",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Samh\u00e4llsvetenskapliga omr\u00e5det",
        "en": "Social sciences"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "16",
      "Kod": "SA",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Teateromr\u00e5det",
        "en": "Theatre"
      },
      "Beskrivning": {
        "sv": "Inf\u00f6rdes fr\u00e5n budget\u00e5ret 1994/95. Tidigare fanns bara ett konstn\u00e4rligt
      },
      "Dolt": true,
      "Giltighetsperiod": {
        "Startdatum": "1994-07-01"
      },
      "ID": "18",
      "Kod": "TA",
      "LarosateID": -1
    },
    {
```

```
      "Benamning": {
        "sv": "Tekniska omr\u00e5det",
        "en": "Technology"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "19",
      "Kod": "TE",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Teologiska omr\u00e5det",
        "en": "Theology"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "20",
      "Kod": "TL",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Verksamhetsf\u00f6rlagd utbildning",
        "en": "Placement"
      },
      "Beskrivning": {
        "sv": "Avser verksamhetsf\u00f6rlagd utbildning inom l\u00e4rar- och f\u00f6rskoll\u00e4rarutbildn
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2013-01-01"
      },
      "ID": "25",
      "Kod": "VU",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "V\u00e5rdomr\u00e5det",
        "en": "Health care"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
```

```
        "Startdatum": "1993-07-01"
      },
      "ID": "22",
      "Kod": "V\u00c5",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Information saknas",
        "en": "Information missing"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "23",
      "Kod": "XX",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "\u00d6vriga omr\u00e5den",
        "en": "Other fields"
      },
      "Beskrivning": {
        "sv": "Avser journalist- och bibliotekarieutbildningar samt praktiska och estetiska kurser inom l\
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "24",
      "Kod": "\u00d6V",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Farmaceutiska omr\u00e5det",
        "en": "Pharmacy"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Startdatum": "1993-07-01"
      },
      "ID": "3",
      "Kod": "FA",
      "LarosateID": -1
    }
  ]
}
```

21.19 kravpatidigarestudier_JSON

1288a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def kravpatidigarestudier_JSON(self) -> dict:
  """
  Returns requirements for earlier studies.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/kataloginformation/internal/grunddata/kravpatidigarestudier',
    headers=self.headers).json()
  return r
```

Defines:
kravpatidigarestudier_JSON, used in chunk 1288b.

Let's add a test. The response is a code table (Section 21.1).

1288b ⟨*test functions* 245a⟩+≡

```
def test_kravpatidigarestudier_JSON(ladok) -> None:
  r = ladok.kravpatidigarestudier_JSON()
  assert_code_table(r, "KravPaTidigareStudier")
```

This code is used in chunk 240.
Defines:
test_kravpatidigarestudier_JSON, never used.
Uses assert_code_table 588 and kravpatidigarestudier_JSON 1288a.

The output looks like this:


```
{
  "KravPaTidigareStudier": [
    {
      "Benamning": {
        "sv": "Tidigare h\u00f6gskolestudier kr\u00e4vs",
        "en": "University studies required"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "uh",
      "Giltighetsperiod": {},
      "ID": "1",
      "Kod": "UH",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Inga tidigare h\u00f6gskolestudier kr\u00e4vs",
        "en": "Upper secondary or equivalent"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "grundlaggande",
      "Giltighetsperiod": {},
      "ID": "2",
```

```
      "Kod": "GR",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Ingen grundl\u00e4ggande beh\u00f6righet kr\u00e4vs",
        "en": "No general entry requirements needed"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "inga",
      "Giltighetsperiod": {},
      "ID": "3",
      "Kod": "IN",
      "LarosateID": -1
    }
  ]
}
```

21.20 studieordning_JSON

1289a ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def studieordning_JSON(self) -> dict:
    """
    Returns study regulations.
    """
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/kataloginformation/internal/grunddata/studieordning',
      headers=self.headers).json()
    return r
```

Defines:
studieordning_JSON, used in chunk 1289b.

Let's add a test. The response is a code table (Section 21.1). The units it refers to must exist in the table of units.

1289b ⟨*test functions* 245a⟩+≡

```
def test_studieordning_JSON(ladok) -> None:
  r = ladok.studieordning_JSON()
  assert_code_table(r, "Studieordning")
  assert ({str(entry["EnhetID"]) for entry in r["Studieordning"]
           if entry.get("EnhetID") is not None}
          <= code_table_ids(ladok.enhet_JSON(), "Enhet"))
```

This code is used in chunk 240.
Defines:
test_studieordning_JSON, never used.
Uses assert_code_table 588, code_table_ids 588, enhet_JSON 1296a, and studieordning_JSON 1289a.

The output looks like this:


```
{
  "Studieordning": [
    {
      "Benamning": {
        "sv": "H\u00f6gskoleutbildning, 2007 \u00e5rs studieordning",
        "en": "Higher education, study regulation of 2007"
      },
      "Beskrivning": {},
      "Dolt": false,
      "EnhetID": 2,
      "Giltighetsperiod": {
        "Startdatum": "2007-07-01"
      },
      "ID": "1",
      "Kod": "H\u00d607",
      "LarosateID": -1,
      "UtbildningsformID": 1
    },
    {
      "Benamning": {
        "sv": "H\u00f6gskoleutbildning, 1993 \u00e5rs studieordning",
        "en": "Higher education, study regulation of 1993"
      },
      "Beskrivning": {
        "sv": "Avser i Ladok 1993 \u00e5rs studieordning inklusive dess f\u00f6reg\u00e5ngare"
      },
      "Dolt": false,
      "EnhetID": 9,
      "Giltighetsperiod": {},
      "ID": "2",
      "Kod": "H\u00d693",
      "LarosateID": -1,
      "UtbildningsformID": 1
    },
    {
      "Benamning": {
        "sv": "Beh\u00f6righetsgivande f\u00f6rutbildning (timmar)",
        "en": "Access education (hours)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "EnhetID": 5,
      "Giltighetsperiod": {},
      "ID": "12",
      "Kod": "\u00d6VBT",
      "LarosateID": -1,
      "UtbildningsformID": 100970
    },
    {
```

```
      "Benamning": {
        "sv": "Beh\u00f6righetsgivande f\u00f6rutbildning (po\u00e4ng)",
        "en": "Access education (fup)"
      },
      "Beskrivning": {
        "sv": "Utbildning enligt f\u00f6rordning (2018:1519) om beh\u00f6righetsgivande och h\u00f6gskolei
      },
      "Dolt": false,
      "EnhetID": 4,
      "Giltighetsperiod": {},
      "ID": "3",
      "Kod": "F\u00d6PO",
      "LarosateID": -1,
      "UtbildningsformID": 2
    },
    {
      "Benamning": {
        "sv": "Beh\u00f6righetsgivande f\u00f6rutbildning (veckor)",
        "en": "Access education (weeks)"
      },
      "Beskrivning": {
        "sv": "Utbildning enligt f\u00f6rordning (2018:1519) om beh\u00f6righetsgivande och h\u00f6gskolei
      },
      "Dolt": false,
      "EnhetID": 1,
      "Giltighetsperiod": {},
      "ID": "4",
      "Kod": "F\u00d6VE",
      "LarosateID": -1,
      "UtbildningsformID": 2
    },
    {
      "Benamning": {
        "sv": "H\u00f6gskoleintern utbildning (ORU)",
        "en": "Internal education (ORU)"
      },
      "Beskrivning": {
        "sv": "Intern utbildning vid \u00d6rebro universitet"
      },
      "Dolt": false,
      "EnhetID": 6,
      "Giltighetsperiod": {
        "Slutdatum": "2007-06-30",
        "Startdatum": "2004-01-01"
      },
      "ID": "15",
      "Kod": "\u00d6VHI",
      "LarosateID": -1,
      "UtbildningsformID": 100970
    },
    {
```

```
      "Benamning": {
        "sv": "\u00c4ldre utbildning vid F\u00f6rsvarsh\u00f6gskolan",
        "en": "Older defence education"
      },
      "Beskrivning": {
        "sv": "Utbildning enligt f\u00f6rordningen (1996:1476) med instruktion f\u00f6r F\u00f6rsvarsh\u00
      },
      "Dolt": false,
      "EnhetID": 10,
      "Giltighetsperiod": {
        "Slutdatum": "2007-12-31"
      },
      "ID": "16",
      "Kod": "\u00d6VFU",
      "LarosateID": -1,
      "UtbildningsformID": 100970
    },
    {
      "Benamning": {
        "sv": "Kvalificerad yrkesutbildning",
        "en": "Post-secondary vocational education and training"
      },
      "Beskrivning": {
        "sv": "Utbildning enligt f\u00f6rordningen (2001:1131) om kvalificerad yrkesutbildning (upph\u00e4
      },
      "Dolt": false,
      "EnhetID": 7,
      "Giltighetsperiod": {
        "Slutdatum": "2013-12-31"
      },
      "ID": "13",
      "Kod": "KY02",
      "LarosateID": -1,
      "UtbildningsformID": 100968
    },
    {
      "Benamning": {
        "sv": "Preparandutbildning",
        "en": "Preparatory education"
      },
      "Beskrivning": {
        "sv": "Utbildning enligt f\u00f6rordningen (1985:681) om preparandutbildning i svenska (upph\u00e4
      },
      "Dolt": false,
      "EnhetID": 6,
      "Giltighetsperiod": {
        "Slutdatum": "1993-06-30"
      },
      "ID": "14",
      "Kod": "\u00d6VPR",
      "LarosateID": -1,
```

```
      "UtbildningsformID": 100970
    },
    {
      "Benamning": {
        "sv": "Uppdragsutbildning, \u00d6vrig utbildning (timmar)",
        "en": "Contract education (hours)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "EnhetID": 5,
      "Giltighetsperiod": {
        "Slutdatum": "2018-12-31"
      },
      "ID": "9",
      "Kod": "\u00d6VUT",
      "LarosateID": -1,
      "UtbildningsformID": 100970
    },
    {
      "Benamning": {
        "sv": "Yrkesh\u00f6gskoleutbildning",
        "en": "Higher vocational education"
      },
      "Beskrivning": {
        "sv": "Utbildning enligt f\u00f6rordning (2009:130) om yrkesh\u00f6gskolan"
      },
      "Dolt": false,
      "EnhetID": 8,
      "Giltighetsperiod": {
        "Startdatum": "2009-07-01"
      },
      "ID": "5",
      "Kod": "YH09",
      "LarosateID": -1,
      "UtbildningsformID": 4
    },
    {
      "Benamning": {
        "sv": "Uppdragsutbildning (h\u00f6gskolepo\u00e4ng)",
        "en": "Contract education (credits)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "EnhetID": 2,
      "Giltighetsperiod": {
        "Startdatum": "2007-07-01"
      },
      "ID": "17",
      "Kod": "UPHP",
      "LarosateID": -1,
      "UtbildningsformID": 100928
```

```
    },
    {
      "Benamning": {
        "sv": "Uppdragsutbildning (veckor)",
        "en": "Contract education (weeks)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "EnhetID": 1,
      "Giltighetsperiod": {},
      "ID": "18",
      "Kod": "UPVE",
      "LarosateID": -1,
      "UtbildningsformID": 100928
    },
    {
      "Benamning": {
        "sv": "Polisutbildning, motsvarande h\u00f6gskoleutbildning",
        "en": "Police education, equal to Higher education"
      },
      "Beskrivning": {
        "sv": "Polisutbildning som uppfyller kvalitetskraven f\u00f6r h\u00f6gskoleutbildning"
      },
      "Dolt": false,
      "EnhetID": 2,
      "Giltighetsperiod": {
        "Startdatum": "2018-07-01"
      },
      "ID": "135370",
      "Kod": "PU18",
      "LarosateID": -1,
      "UtbildningsformID": 100969
    },
    {
      "Benamning": {
        "sv": "Uppdragsutbildning (timmar)",
        "en": "Contract education (hours)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "EnhetID": 5,
      "Giltighetsperiod": {
        "Startdatum": "2019-01-01"
      },
      "ID": "147898",
      "Kod": "UPTI",
      "LarosateID": -1,
      "UtbildningsformID": 100928
    },
    {
      "Benamning": {
```

```
        "sv": "Samverkansutbildning",
        "en": "Collaborative education"
      },
      "Beskrivning": {
        "sv": "Utbildning som bedrivs i samverkan mellan h\u00f6gskola och folkh\u00f6gskola."
      },
      "Dolt": false,
      "EnhetID": 1,
      "Giltighetsperiod": {},
      "ID": "161480",
      "Kod": "PISU",
      "LarosateID": -1,
      "UtbildningsformID": 161479
    },
    {
      "Benamning": {
        "sv": "Pastoralteologisk utbildning",
        "en": "Pastoral education"
      },
      "Beskrivning": {},
      "Dolt": false,
      "EnhetID": 1,
      "Giltighetsperiod": {},
      "ID": "162110",
      "Kod": "PIPT",
      "LarosateID": -1,
      "UtbildningsformID": 161479
    },
    {
      "Benamning": {
        "sv": "MBA vid HHS",
        "en": "MBA at SSE"
      },
      "Beskrivning": {
        "sv": "Avgiftsbelagda utbildningar vid Handelsh\u00f6gskolan i Stockholm som avses leda fram till
      },
      "Dolt": false,
      "EnhetID": 1,
      "Giltighetsperiod": {},
      "ID": "165023",
      "Kod": "PIHE",
      "LarosateID": -1,
      "UtbildningsformID": 161479
    },
    {
      "Benamning": {
        "sv": "Polisutbildning",
        "en": "Police education"
      },
      "Beskrivning": {
        "sv": "Polisutbildning som ej uppfyller alla kvalitetskrav f\u00f6r h\u00f6gskoleutbildning."
```

```
      },
      "Dolt": false,
      "EnhetID": 2,
      "Giltighetsperiod": {},
      "ID": "109831",
      "Kod": "PU99",
      "LarosateID": -1,
      "UtbildningsformID": 100969
    },
    {
      "Benamning": {
        "sv": "\u00d6-Fel",
        "en": "\u00d6-Fel"
      },
      "Beskrivning": {},
      "Dolt": false,
      "EnhetID": 1,
      "Giltighetsperiod": {
        "Slutdatum": "1900-01-01"
      },
      "ID": "138710",
      "Kod": "FEL",
      "LarosateID": -1,
      "UtbildningsformID": 100970
    }
  ]
}
```

21.21 enhet_JSON

1296a ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def enhet_JSON(self) -> dict:
    """
    Returns credit units.
    """
    r = self.session.get(
      url=self.base_gui_proxy_url + '/kataloginformation/internal/grunddata/enhet',
      headers=self.headers).json()
    return r
```

Defines:
enhet_JSON, used in chunks 1289b and 1296b.

Let's add a test. The response is a code table (Section 21.1).

1296b ⟨*test functions* 245a⟩+≡

```
def test_enhet_JSON(ladok) -> None:
  r = ladok.enhet_JSON()
  assert_code_table(r, "Enhet")
```

This code is used in chunk 240.
Defines:
test_enhet_JSON, never used.

Uses `assert_code_table` 588 and `enhet_JSON` 1296a.

The output looks like this:


```
{
  "Enhet": [
    {
      "Benamning": {
        "sv": "Po\u00e4ng (\u00d6vrig utbildning)",
        "en": "Credit points"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2018-01-01"
      },
      "Helarsvarde": 40,
      "ID": "6",
      "Kod": "AUP",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "F\u00f6rutbildningspo\u00e4ng",
        "en": "Pre-education credits"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Helarsvarde": 60,
      "ID": "4",
      "Kod": "FUP",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "H\u00f6gskolepo\u00e4ng",
        "en": "Credits"
      },
      "Beskrivning": {
        "sv": "\u00d6versattes 2007-2010 med Higher education credits"
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2007-07-01"
      },
      "Helarsvarde": 60,
      "ID": "2",
      "Kod": "HP",
      "LarosateID": -1
    },
    {
```

```
      "Benamning": {
        "sv": "Konverterade h\u00f6gskolepo\u00e4ng",
        "en": "Converted credits"
      },
      "Beskrivning": {
        "sv": "Enheten po\u00e4ng konverterades till h\u00f6gskolepo\u00e4ng i Ladok f\u00f6r 1993 \u00e5r
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2007-06-30"
      },
      "Helarsvarde": 60,
      "ID": "9",
      "Kod": "HP-K",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Interna po\u00e4ng",
        "en": "Internal credits"
      },
      "Beskrivning": {
        "sv": "Har enbart anv\u00e4nts av F\u00f6rsvarsh\u00f6gskolan"
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2016-07-01"
      },
      "Helarsvarde": 60,
      "ID": "10",
      "Kod": "IP",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "KY-po\u00e4ng",
        "en": "KY credits"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Slutdatum": "2013-12-31",
        "Startdatum": "2002-01-01"
      },
      "Helarsvarde": 40,
      "ID": "7",
      "Kod": "KYP",
      "LarosateID": -1
    },
    {
      "Benamning": {
```

```
        "sv": "Timmar",
        "en": "Hours"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Helarsvarde": 1600,
      "ID": "5",
      "Kod": "T",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Veckor",
        "en": "Weeks"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Helarsvarde": 40,
      "ID": "1",
      "Kod": "V",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Yrkesh\u00f6gskolepo\u00e4ng",
        "en": "HVE credits"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2009-07-01"
      },
      "Helarsvarde": 200,
      "ID": "8",
      "Kod": "YHP",
      "LarosateID": -1
    }
  ]
}
```

21.22 studielokalisering_JSON

⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def studielokalisering_JSON(self) -> dict:
    """
    Returns study locations.
    """
```

```
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/kataloginformation/internal/grunddata/studielokalisering',
      headers=self.headers).json()
    return r
```

Defines:
`studielokalisering_JSON`, used in chunks 549 and 1300.

Let's add a test. The response is a code table (Section 21.1). The places it refers to must exist in the table of places.

1300 ⟨*test functions* 245a⟩+≡

```
def test_studielokalisering_JSON(ladok) -> None:
  r = ladok.studielokalisering_JSON()
  assert_code_table(r, "Studielokalisering")
  assert ({str(entry["OrtID"]) for entry in r["Studielokalisering"]
           if entry.get("OrtID") is not None}
          <= code_table_ids(ladok.svenskorter_JSON(), "SvenskOrt"))
```

This code is used in chunk 240.
Defines:
`test_studielokalisering_JSON`, never used.
Uses `assert_code_table` 588, `code_table_ids` 588, `studielokalisering_JSON` 1299, and `svenskorter_JSON` 817a.

The output looks like this:


```
{
  "Studielokalisering": [
    {
      "Benamning": {
        "sv": "J\u00e4rf\u00e4lla",
        "en": "J\u00e4rf\u00e4lla"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "1996-06-30",
        "Startdatum": "1994-08-01"
      },
      "ID": "131775",
      "Kod": "0123",
      "LarosateID": 29,
      "OrtID": 5
    },
    {
      "Benamning": {
        "sv": "Huddinge",
        "en": "Huddinge"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2019-01-14",
        "Startdatum": "2002-01-01"
```

```
      },
      "ID": "131779",
      "Kod": "0126",
      "LarosateID": 29,
      "OrtID": 109830
    },
    {
      "Benamning": {
        "sv": "T\u00e4by",
        "en": "T\u00e4by"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "1999-12-31",
        "Startdatum": "1900-01-01"
      },
      "ID": "131774",
      "Kod": "0160",
      "LarosateID": 29,
      "OrtID": 14
    },
    {
      "Benamning": {
        "sv": "Stockholm",
        "en": "Stockholm"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2019-01-14",
        "Startdatum": "1917-10-19"
      },
      "ID": "131778",
      "Kod": "0180",
      "LarosateID": 29,
      "OrtID": 18
    },
    {
      "Benamning": {
        "sv": "Nyk\u00f6ping",
        "en": "Nyk\u00f6ping"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2005-06-30",
        "Startdatum": "2005-01-01"
      },
      "ID": "131777",
      "Kod": "0480",
```

```
      "LarosateID": 29,
      "OrtID": 44
    },
    {
      "Benamning": {
        "sv": "Valdemarsvik",
        "en": "Valdemarsvik"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "1999-12-31",
        "Startdatum": "1900-01-01"
      },
      "ID": "131780",
      "Kod": "0563",
      "LarosateID": 29,
      "OrtID": 60
    },
    {
      "Benamning": {
        "sv": "Visby",
        "en": "Visby"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2000-12-31",
        "Startdatum": "1991-08-01"
      },
      "ID": "131781",
      "Kod": "0980",
      "LarosateID": 29,
      "OrtID": 108
    },
    {
      "Benamning": {
        "sv": "\u00c4ngelholm",
        "en": "\u00c4ngelholm"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "1997-12-31",
        "Startdatum": "1997-12-31"
      },
      "ID": "131782",
      "Kod": "1292",
      "LarosateID": 29,
      "OrtID": 154
    },
```

```
    {
      "Benamning": {
        "sv": "\u00d6rebro",
        "en": "\u00d6rebro"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "1998-06-30",
        "Startdatum": "1996-08-01"
      },
      "ID": "131786",
      "Kod": "1880",
      "LarosateID": 29,
      "OrtID": 237
    },
    {
      "Benamning": {
        "sv": "V\u00e4ster\u00e5s",
        "en": "V\u00e4ster\u00e5s"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "1999-12-31",
        "Startdatum": "1994-08-01"
      },
      "ID": "131783",
      "Kod": "1980",
      "LarosateID": 29,
      "OrtID": 248
    },
    {
      "Benamning": {
        "sv": "Sundsvall",
        "en": "Sundsvall"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "1997-12-31",
        "Startdatum": "1996-08-01"
      },
      "ID": "131785",
      "Kod": "2281",
      "LarosateID": 29,
      "OrtID": 281
    },
    {
      "Benamning": {
        "sv": "\u00d6rnsk\u00f6ldsvik",
```

```
        "en": "\u00d6rnsk\u00f6ldsvik"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "1997-12-31",
        "Startdatum": "1997-01-01"
      },
      "ID": "131788",
      "Kod": "2284",
      "LarosateID": 29,
      "OrtID": 284
    },
    {
      "Benamning": {
        "sv": "KTH Flemingsberg",
        "en": "KTH Flemingsberg"
      },
      "Beskrivning": {
        "sv": "\"campus\" Flemingsberg"
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2018-06-20"
      },
      "ID": "135198",
      "Kod": "FLEMINGSB",
      "LarosateID": 29,
      "OrtID": 7
    },
    {
      "Benamning": {
        "sv": "G\u00e4llivare",
        "en": "G\u00e4llivare"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2024-01-13"
      },
      "ID": "157820",
      "Kod": "GALLIVARE",
      "LarosateID": 29,
      "OrtID": 320
    },
    {
      "Benamning": {
        "sv": "KI Flemingsberg",
        "en": "KI Flemingsberg"
      },
      "Beskrivning": {},
```

```
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2018-06-20"
      },
      "ID": "135192",
      "Kod": "KI_FLEMINGS",
      "LarosateID": 29,
      "OrtID": 7
    },
    {
      "Benamning": {
        "sv": "KI Solna",
        "en": "KI Solna"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2018-06-20"
      },
      "ID": "135193",
      "Kod": "KI_SOLNA",
      "LarosateID": 29,
      "OrtID": 25
    },
    {
      "Benamning": {
        "sv": "Ludvika",
        "en": "Ludvika"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2024-01-13"
      },
      "ID": "157824",
      "Kod": "LUDVIKA",
      "LarosateID": 29,
      "OrtID": 267
    },
    {
      "Benamning": {
        "sv": "Norrt\u00e4lje",
        "en": "Norrt\u00e4lje"
      },
      "Beskrivning": {
        "sv": "L\u00e4rcentrum, Tekniskt bas\u00e5r"
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2025-02-18"
      },
```

```
        "ID": "161536",
        "Kod": "NORRTAN",
        "LarosateID": 29,
        "OrtID": 28
      },
      {
        "Benamning": {
          "sv": "\u00d6rnsk\u00f6ldsvik",
          "en": "\u00d6rnsk\u00f6ldsvik"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {
          "Startdatum": "2024-01-13"
        },
        "ID": "157828",
        "Kod": "ORNSKOLDSVI",
        "LarosateID": 29,
        "OrtID": 284
      },
      {
        "Benamning": {
          "sv": "Oskarshamn",
          "en": "Oskarshamn"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {
          "Startdatum": "2024-01-13"
        },
        "ID": "157826",
        "Kod": "OSKARSHAMN",
        "LarosateID": 29,
        "OrtID": 103
      },
      {
        "Benamning": {
          "sv": "Smedjebacken",
          "en": "Smedjebacken"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {
          "Startdatum": "2024-01-13"
        },
        "ID": "157825",
        "Kod": "SMEDJEBACK",
        "LarosateID": 29,
        "OrtID": 260
      },
      {
```

```
      "Benamning": {
        "sv": "KTH S\u00f6dert\u00e4lje",
        "en": "KTH S\u00f6dert\u00e4lje"
      },
      "Beskrivning": {
        "sv": "\"Campus\" S\u00f6dert\u00e4lje"
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2018-06-20"
      },
      "ID": "135196",
      "Kod": "SODERTALJE",
      "LarosateID": 29,
      "OrtID": 20
    },
    {
      "Benamning": {
        "sv": "S\u00f6dert\u00e4lje",
        "en": "S\u00f6dert\u00e4lje"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2019-01-14",
        "Startdatum": "1987-01-01"
      },
      "ID": "131771",
      "Kod": "0181",
      "LarosateID": 29,
      "OrtID": 20
    },
    {
      "Benamning": {
        "sv": "Norrt\u00e4lje",
        "en": "Norrt\u00e4lje"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2005-06-30",
        "Startdatum": "1997-08-01"
      },
      "ID": "131776",
      "Kod": "0188",
      "LarosateID": 29,
      "OrtID": 28
    },
    {
      "Benamning": {
        "sv": "AlbaNova",
```

```
        "en": "AlbaNova"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2018-06-20"
      },
      "ID": "135190",
      "Kod": "ALBANOVA",
      "LarosateID": 29,
      "OrtID": 18
    },
    {
      "Benamning": {
        "sv": "\u00c5re",
        "en": "\u00c5re"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2024-01-13"
      },
      "ID": "157819",
      "Kod": "ARE",
      "LarosateID": 29,
      "OrtID": 290
    },
    {
      "Benamning": {
        "sv": "Konstfack",
        "en": "University of Arts, Crafts and Design"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2018-08-27"
      },
      "ID": "147750",
      "Kod": "KONSTFACK",
      "LarosateID": 29,
      "OrtID": 18
    },
    {
      "Benamning": {
        "sv": "KTH Campus",
        "en": "KTH Campus"
      },
      "Beskrivning": {
        "sv": "\"Campus\" Valhallav\u00e4gen"
      },
      "Dolt": false,
```

```
      "Giltighetsperiod": {
        "Startdatum": "2018-06-20"
      },
      "ID": "135195",
      "Kod": "KTHCAMPUS",
      "LarosateID": 29,
      "OrtID": 18
    },
    {
      "Benamning": {
        "sv": "Pajala",
        "en": "Pajala"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2024-01-13"
      },
      "ID": "157823",
      "Kod": "PAJALA",
      "LarosateID": 29,
      "OrtID": 319
    },
    {
      "Benamning": {
        "sv": "KTH Solna",
        "en": "KTH Solna"
      },
      "Beskrivning": {
        "sv": "SciLife Labs, Solna",
        "en": "SciLife Labs, Solna"
      },
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2018-06-18"
      },
      "ID": "135610",
      "Kod": "SCILIFELAB",
      "LarosateID": 29,
      "OrtID": 25
    },
    {
      "Benamning": {
        "sv": "Botkyrka",
        "en": "Botkyrka"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "1997-12-31",
        "Startdatum": "1997-08-01"
```

```
      },
      "ID": "131772",
      "Kod": "0127",
      "LarosateID": 29,
      "OrtID": 110990
    },
    {
      "Benamning": {
        "sv": "Haninge",
        "en": "Haninge"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2016-06-30",
        "Startdatum": "1994-08-01"
      },
      "ID": "131773",
      "Kod": "0136",
      "LarosateID": 29,
      "OrtID": 110991
    },
    {
      "Benamning": {
        "sv": "Falun",
        "en": "Falun"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "1998-12-31",
        "Startdatum": "1994-08-01"
      },
      "ID": "131787",
      "Kod": "2080",
      "LarosateID": 29,
      "OrtID": 263
    },
    {
      "Benamning": {
        "sv": "G\u00e4vle",
        "en": "G\u00e4vle"
      },
      "Beskrivning": {},
      "Dolt": true,
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        "Slutdatum": "1998-12-31",
        "Startdatum": "1997-08-01"
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      "ID": "131784",
      "Kod": "2180",
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      "LarosateID": 29,
      "OrtID": 273
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        "sv": "Handelsh\u00f6gskolan",
        "en": "Stockholm School of Economics"
      },
      "Beskrivning": {},
      "Dolt": false,
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      "OrtID": 18
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        "en": "Jokkmokk"
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      "Kod": "JOKKMOKK",
      "LarosateID": 29,
      "OrtID": 315
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        "sv": "Kiruna",
        "en": "Kiruna"
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      "Beskrivning": {},
      "Dolt": false,
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      "LarosateID": 29,
      "OrtID": 326
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    {
      "Benamning": {
        "sv": "KTH Kista",
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```
        "en": "KTH Kista"
      },
      "Beskrivning": {
        "sv": "\"Campus\" Kista"
      },
      "Dolt": false,
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      "OrtID": 18
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      "LarosateID": 29,
      "OrtID": 44
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        "en": "Nyn\u00e4shamn"
      },
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      "OrtID": 32
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        "en": "Stockholm University"
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642         "Dolt": false,
643         "Giltighetsperiod": {
644           "Startdatum": "2018-06-20"
645         },
646         "ID": "135197",
647         "Kod": "SU",
648         "LarosateID": 29,
649         "OrtID": 18
650       },
651       {
652         "Benamning": {
653           "sv": "S\u00f6dert\u00e4lje",
654           "en": "S\u00f6dert\u00e4lje"
655         },
656         "Beskrivning": {
657           "sv": "L\u00e4rcentrum, Teknisk bas\u00e5r"
658         },
659         "Dolt": false,
660         "Giltighetsperiod": {
661           "Startdatum": "2025-02-18"
662         },
663         "ID": "161537",
664         "Kod": "TALJE",
665         "LarosateID": 29,
666         "OrtID": 20
667       }
668     ]
669   }
```

21.23 antagningsomgang_JSON

1313a ⟨*LadokSession data methods* 249⟩+≡

```
# added by GQMJr
def antagningsomgang_JSON(self) -> dict:
  """
  Returns the admission round.
  """
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/kataloginformation/internal/grunddata/antagningsomgang',
    headers=self.headers).json()
  return r
```

Defines:
antagningsomgang_JSON, used in chunk 1313b.

Let's add a test. The response is a code table (Section 21.1).

1313b ⟨*test functions* 245a⟩+≡

```
1 def test_antagningsomgang_JSON(ladok) -> None:
2   r = ladok.antagningsomgang_JSON()
3   assert_code_table(r, "Antagningsomgang")
```

This code is used in chunk 240.
Defines:
`test_antagningsomgang_JSON`, never used.
Uses `antagningsomgang_JSON` 1313a and `assert_code_table` 588.

The output looks like this:

```
{
  "Antagningsomgang": [
    {
      "Benamning": {
        "sv": "Anm\u00e4lan till kurs inom program HT2024",
        "en": "Application to courses within programme autumn term 2024"
      },
      "Beskrivning": {},
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      "Giltighetsperiod": {},
      "ID": "159238",
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      "SistaAnnonseringsdag": "2024-05-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Anm\u00e4lan till kurs inom program HT2025",
        "en": "Application to courses within programme autumn term 2025"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "LarosateID": 29,
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      "SistaAnnonseringsdag": "2025-05-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
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        "en": "Application to courses within programme autumn term 2026"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "29AKPHT26",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2026-05-18",
      "SistaAnnonseringsdag": "2026-05-18",
```

```
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
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        "en": "Civilingenj\u00f6rsval f\u00f6r studenter p\u00e5 civilingenj\u00f6r \u00f6ppen ing\u00e5ng
      },
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      "Studieavgiftsbelagd": true
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        "en": "Civilingenj\u00f6rsval f\u00f6r studenter p\u00e5 civilingenj\u00f6r \u00f6ppen ing\u00e5ng
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      "LarosateID": 29,
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      "SistaAnnonseringsdag": "2025-05-26",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
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        "en": "Civilingenj\u00f6rsval f\u00f6r studenter p\u00e5 civilingenj\u00f6r \u00f6ppen ing\u00e5ng
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    {
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```

```
      },
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      "Studieavgiftsbelagd": true
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    {
      "Benamning": {
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        "en": "Masterval f\u00f6r civilingenj\u00f6rer p\u00e5 KTH"
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      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "29MASVAL26",
      "LarosateID": 29,
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        "sv": "H\u00f6sterminen 2023",
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      },
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      "Dolt": false,
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      "Kod": "HT2023",
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      "SistaAnnonseringsdag": "2023-01-09",
      "Studieavgiftsbelagd": true
    },
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        "en": "Autumn Semester 2024"
      },
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      "Giltighetsperiod": {},
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      "SistaAnnonseringsdag": "2025-01-09",
      "Studieavgiftsbelagd": true
    },
    {
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        "en": "Autumn Semester 2025"
      },
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      "SistaAnnonseringsdag": "2026-01-09",
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        "en": "International Courses and Programmes Autumn Semester 2024"
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        "en": "International Master Programmes Autumn Semester 2019"
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      },
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    {
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      "Giltighetsperiod": {},
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      "LarosateID": 29,
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      "SistaAnnonseringsdag": "2024-08-19",
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      "Giltighetsperiod": {},
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    {
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        "en": "Application to courses within programme HT2021"
      },
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      "Giltighetsperiod": {},
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      "Kod": "29AKPHT21",
      "LarosateID": 29,
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      "SistaAnnonseringsdag": "2021-05-17",
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    },
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        "en": "Application to courses within programme HT2022"
      },
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      "Giltighetsperiod": {},
      "ID": "153586",
      "Kod": "29AKPHT22",
      "LarosateID": 29,
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      "SistaAnnonseringsdag": "2022-05-16",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Anm\u00e4lan till kurs inom program HT2023",
        "en": "Application to courses within programme autumn term 2023"
```

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      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
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      "Kod": "29AKPHT23",
      "LarosateID": 29,
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      "SistaAnnonseringsdag": "2023-05-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "H\u00f6stterminen 2018",
        "en": "Autumn semester 2018"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "135280",
      "Kod": "HT2018",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2018-04-16",
      "SistaAnnonseringsdag": "2019-04-16",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "H\u00f6stterminen 2019",
        "en": "Autumn Semester 2019"
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      "Beskrivning": {
        "sv": "Prelimin\u00e4r sista anm\u00e4lningsdag"
      },
      "Dolt": true,
      "Giltighetsperiod": {},
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      "Kod": "HT2019",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2019-04-15",
      "SistaAnnonseringsdag": "2020-01-10",
      "Studieavgiftsbelagd": true
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        "en": "Autumn semester 2022"
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      "Dolt": true,
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      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "H\u00f6sterminen 2026",
        "en": "Autumn Semester 2026"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "HT2026",
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      "SistaAnnonseringsdag": "2026-01-09",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "H\u00f6sterminen 2027",
        "en": "Autumn Semester 2027"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "HT2027",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2027-04-15",
      "SistaAnnonseringsdag": "2027-01-29",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Internationella kurser och program h\u00f6sterminen 2018",
        "en": "International Courses and Programmes Autumn Semester 2018"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "135281",
      "Kod": "IKHT18",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2018-01-15",
      "SistaAnnonseringsdag": "2019-01-15",
      "Studieavgiftsbelagd": true
```

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    },
    {
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        "sv": "Internationella kurser och program h\u00f6sterminen 2025",
        "en": "International Courses and Programmes Autumn Semester 2025"
      },
      "Beskrivning": {},
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      "Giltighetsperiod": {},
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      "SistaAnmalningsdag": "2026-01-15",
      "SistaAnnonseringsdag": "2026-05-15",
      "Studieavgiftsbelagd": true
    },
    {
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        "sv": "Internationella masterprogram h\u00f6sterminen 2027",
        "en": "International Master's Programmes Autumn Semester 2027"
      },
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      "SistaAnnonseringsdag": "2027-05-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Skolverket L\u00e4rarlyftet HT2026",
        "en": "Skolverket L\u00e4rarlyftet HT2026"
      },
      "Beskrivning": {},
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      "SistaAnnonseringsdag": "2026-09-30",
      "Studieavgiftsbelagd": false
    },
    {
      "Benamning": {
        "sv": "Sommarterminen 2026",
        "en": "Summer Session 2026"
      },
```

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      "Giltighetsperiod": {},
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      "SistaAnnonseringsdag": "2025-08-19",
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    {
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        "en": "Summer Session 2027"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "165019",
      "Kod": "ST2027",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2027-03-15",
      "SistaAnnonseringsdag": "2027-08-19",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "V\u00e5rterminen 2019",
        "en": "Spring Semester 2019"
      },
      "Beskrivning": {
        "sv": "Prelimin\u00e4r sista anm\u00e4lningsdag"
      },
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "135893",
      "Kod": "VT2019",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2018-10-15",
      "SistaAnnonseringsdag": "2019-06-30",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "V\u00e5rterminen 2025",
        "en": "Spring Semester 2025"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "160016",
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      "Kod": "VT2025",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2024-10-15",
      "SistaAnnonseringsdag": "2025-06-09",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "V\u00e5rterminen 2026",
        "en": "Spring Semester 2026"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "VT2026",
      "LarosateID": 29,
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      "SistaAnnonseringsdag": "2026-06-09",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "V\u00e5rterminen 2027",
        "en": "Spring Semester 2027"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "VT2027",
      "LarosateID": 29,
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      "SistaAnnonseringsdag": "2027-05-31",
      "Studieavgiftsbelagd": true
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    {
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        "sv": "Anm\u00e4lan till kurs inom program VT2022",
        "en": "Application to courses within programme VT2022"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "152554",
      "Kod": "29AKPVT22",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2021-11-15",
      "SistaAnnonseringsdag": "2022-04-30",
      "Studieavgiftsbelagd": true
    },
```

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      },
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      "Giltighetsperiod": {},
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      "SistaAnnonseringsdag": "2023-04-30",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Anm\u00e4lan till kurs inom program VT2024",
        "en": "Application to courses within programme spring term 2024"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "156506",
      "Kod": "29AKPVT24",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2023-11-15",
      "SistaAnnonseringsdag": "2024-05-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Internationella kurser och program h\u00f6sterminen 2025",
        "en": "International Courses and Programmes Autumn Semester 2025"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "160018",
      "Kod": "IKHT25",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2025-01-15",
      "SistaAnnonseringsdag": "2024-03-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Internationella kurser och program h\u00f6sterminen 2026",
        "en": "International Courses and Programmes Autumn Semester 2026"
      },
      "Beskrivning": {},
```

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      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "IKHT26",
      "LarosateID": 29,
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      "SistaAnnonseringsdag": "2024-03-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Internationella kurser och program h\u00f6stterminen 2027",
        "en": "International Courses and Programmes Autumn Semester 2027"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "166112",
      "Kod": "IKHT27",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2027-01-15",
      "SistaAnnonseringsdag": "2027-05-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Anm\u00e4lan till kurs inom program p\u00e5 KTH HT2018",
        "en": "Anm\u00e4lan till kurs inom program p\u00e5 KTH HT2018"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "135279",
      "Kod": "29AKPHT18",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2018-05-15",
      "SistaAnnonseringsdag": "2019-05-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Anm\u00e4lan till kurs inom program p\u00e5 KTH HT2019",
        "en": "Application to courses within programme at KTH HT2019"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "148458",
      "Kod": "29AKPHT19",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2019-05-15",
```

```
      "SistaAnnonseringsdag": "2020-05-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Anm\u00e4lan till kurs inom program p\u00e5 KTH HT2020",
        "en": "Application to courses within programme at KTH HT2020"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "150233",
      "Kod": "29AKPHT20",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2020-05-15",
      "SistaAnnonseringsdag": "2021-05-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Antagning till kurs inom program KTH VT2019",
        "en": "Application to courses within programme at KTH VT2019"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "142134",
      "Kod": "29AKPVT19",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2018-11-15",
      "SistaAnnonseringsdag": "2019-02-28",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Antagning till kurs inom program KTH VT2020",
        "en": "Application to courses within programme at KTH VT2020"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "149508",
      "Kod": "29AKPVT20",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2019-11-15",
      "SistaAnnonseringsdag": "2019-12-31",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "Antagning tilll kurs inom program VT2021",
```

```
          "en": "Application to courses within programme VT2021"
        },
        "Beskrivning": {},
        "Dolt": true,
        "Giltighetsperiod": {},
        "ID": "150872",
        "Kod": "29AKPVT21",
        "LarosateID": 29,
        "SistaAnmalningsdag": "2020-11-16",
        "SistaAnnonseringsdag": "2020-12-31",
        "Studieavgiftsbelagd": true
      },
      {
        "Benamning": {
          "sv": "Anm\u00e4lan till kurs inom program VT2025",
          "en": "Application to courses within programme spring term 2025"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {},
        "ID": "160413",
        "Kod": "29AKPVT25",
        "LarosateID": 29,
        "SistaAnmalningsdag": "2024-11-15",
        "SistaAnnonseringsdag": "2025-05-15",
        "Studieavgiftsbelagd": true
      },
      {
        "Benamning": {
          "sv": "Anm\u00e4lan till kurs inom program VT2026",
          "en": "Application to courses within programme spring term 2026"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {},
        "ID": "163385",
        "Kod": "29AKPVT26",
        "LarosateID": 29,
        "SistaAnmalningsdag": "2025-11-17",
        "SistaAnnonseringsdag": "2026-05-15",
        "Studieavgiftsbelagd": true
      },
      {
        "Benamning": {
          "sv": "Anm\u00e4lan till kurs inom program VT2027",
          "en": "Application to courses within programme spring term 2027"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {},
        "ID": "165606",
```

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      "Kod": "29AKPVT27",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2026-11-16",
      "SistaAnnonseringsdag": "2027-05-15",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "V\u00e5rterminen 2022",
        "en": "Spring Semester 2022"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "152326",
      "Kod": "VT2022",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2021-10-15",
      "SistaAnnonseringsdag": "2022-06-10",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "V\u00e5rterminen 2023",
        "en": "Spring Semester 2023"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "154117",
      "Kod": "VT2023",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2022-10-17",
      "SistaAnnonseringsdag": "2023-06-09",
      "Studieavgiftsbelagd": true
    },
    {
      "Benamning": {
        "sv": "V\u00e5rterminen 2024",
        "en": "Spring Semester 2024"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "156324",
      "Kod": "VT2024",
      "LarosateID": 29,
      "SistaAnmalningsdag": "2023-10-16",
      "SistaAnnonseringsdag": "2024-06-09",
      "Studieavgiftsbelagd": true
    }
```

```
862   ]
863 }
```

21.24 utbildningstyp_JSON

1331a ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def utbildningstyp_JSON(self) -> dict:
    """
    Returns types of education.

    For information about these, see

      https://ladok.se/wp-content/uploads/2018/01/Funktionsbeskrivning_095.pdf
    """
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/kataloginformation/internal/grunddata/utbildningstyp',
      headers=self.headers).json()
    return r
```

Defines:
utbildningstyp_JSON, used in chunk 1331b.

Let's add a test. The response is a code table (Section 21.1).

1331b ⟨*test functions* 245a⟩+≡

```
1 def test_utbildningstyp_JSON(ladok) -> None:
2   r = ladok.utbildningstyp_JSON()
3   assert_code_table(r, "Utbildningstyp")
```

This code is used in chunk 240.
Defines:
test_utbildningstyp_JSON, never used.
Uses assert_code_table 588 and utbildningstyp_JSON 1331a.

The output looks like this:


```
1  {
2    "Utbildningstyp": [
3      {
4        "AvserTillfalle": false,
5        "Benamning": {
6          "sv": "Individuell kurs, grundniv\u00e5, inresande",
7          "en": "Individual first-cycle course, incoming student"
8        },
9        "Beskrivning": {},
10       "Dolt": false,
11       "Giltighetsperiod": {},
12       "Grundtyp": "KURS",
13       "ID": "101380",
14       "Kod": "2007IKURS",
15       "LarosateID": -1,
16       "NivaInomStudieordningID": 1,
17       "Regelverk": {
```

```
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.utbytesstudier",
            "Uid": "50a8d758-ee40-11e8-9270-17395ad8480f",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.versionshanteras",
            "Uid": "50a8d75a-ee40-11e8-9270-17395ad8480f",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.overfors.nya.endast.som.merit",
            "Uid": "50a8d757-ee40-11e8-9270-17395ad8480f",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.avbrottsregel",
            "Uid": "50a8d75c-ee40-11e8-9270-17395ad8480f",
            "Varde": "20"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "50a8d75b-ee40-11e8-9270-17395ad8480f",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.individuell",
            "Uid": "50a8d759-ee40-11e8-9270-17395ad8480f",
            "Varde": "true"
          }
        ],
        "Uid": "7c76367b-7a6b-11e6-8419-0812bb95460f"
      },
      "Sorteringsordning": 10,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        3,
        4
      ]
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Individuellt kurstillf\u00e4lle",
        "en": "Individual course instance"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
```

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      "Grundtyp": "KURS",
      "ID": "101381",
      "Kod": "2007IKTF",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "97513edc-b803-11ed-8cb2-324fb1124949",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.individuell",
            "Uid": "97513edd-b803-11ed-8cb2-324fb1124949",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.atgard_vid_overskriden_terminsgrans",
            "Uid": "97513ee0-b803-11ed-8cb2-324fb1124949",
            "Varde": "varning"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.grundavancerad",
            "Uid": "97513ede-b803-11ed-8cb2-324fb1124949",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.overfors.nya.endast.som.merit",
            "Uid": "97513edf-b803-11ed-8cb2-324fb1124949",
            "Varde": "true"
          }
        ],
        "Uid": "ce31accb-7a6b-11e6-8419-0812bb95460f"
      },
      "Sorteringsordning": 10,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [
        105630,
        22,
        106390,
        105631,
        101380,
        24
      ],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Kurstillf\u00e4lle",
        "en": "Course instance"
```

```
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "ID": "101382",
      "Kod": "FUPKTF",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
            "Uid": "727b99a4-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "727b99a2-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "grupp.for.utsokning.forutbildning"
          },
          {
            "Regelnamn": "commons.domain.regel.kan.utannonseras",
            "Uid": "727b99a3-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.forutbildning",
            "Uid": "727b99a1-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "true"
          }
        ],
        "Uid": "72f09f80-8562-11e6-92a1-a50a597744a2"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 3,
      "TillfalleInomUtbildningstyper": [
        101378
      ],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Utbytes\u00e5tagande, utresande",
        "en": "Exchange load, outgoing student"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": "101730",
```

```
      "Kod": "2007UAT",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "8d3ebf55-ee3f-11e8-9270-17395ad8480f",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.avbrottsregel",
            "Uid": "8d3ebf56-ee3f-11e8-9270-17395ad8480f",
            "Varde": "20"
          },
          {
            "Regelnamn": "commons.domain.regel.resultat",
            "Uid": "8d3ebf54-ee3f-11e8-9270-17395ad8480f",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.utbytesstudier",
            "Uid": "8d3ebf51-ee3f-11e8-9270-17395ad8480f",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.overfors.nya.endast.som.merit",
            "Uid": "8d3ebf52-ee3f-11e8-9270-17395ad8480f",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.versionshanteras",
            "Uid": "8d3ebf53-ee3f-11e8-9270-17395ad8480f",
            "Varde": "false"
          }
        ],
        "Uid": "6c9d565e-9a8f-11e6-a0ec-9788925c400e"
      },
      "Sorteringsordning": 11,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Individuellt tillf\u00e4lle f\u00f6r utbytes\u00e5tagande, utresande",
        "en": "Individual exchange load instance, outgoing student"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
```

```
      "Grundtyp": "KURS",
      "ID": "101731",
      "Kod": "2007UATTF",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.grupp.overfors.nya.endast.som.merit",
            "Uid": "693cdf03-ee3e-11e8-9270-17395ad8480f",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.utbytesstudier",
            "Uid": "693cdf01-ee3e-11e8-9270-17395ad8480f",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.individuell",
            "Uid": "693cdf02-ee3e-11e8-9270-17395ad8480f",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "693cdf00-ee3e-11e8-9270-17395ad8480f",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          }
        ],
        "Uid": "0b3ddbad-9a90-11e6-a0ec-9788925c400e"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [
        101730,
        104308
      ],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Individuellt \u00e5tagande, forskarniv\u00e5",
        "en": "Individual load, Third-cycle"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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        "en": "Individual load instance, Third-cycle"
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        "en": "Course instance"
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        "en": "Course"
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            "Varde": "grupp.for.utsokning.forutbildning"
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        "en": "Course instance"
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            "Varde": "grupp.for.utsokning.forutbildning"
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        "en": "Course"
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        "en": "Course instance"
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        "en": "Programme"
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          "en": "Module"
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        "Beskrivning": {},
        "Dolt": false,
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              "Varde": "false"
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              "Varde": "false"
            },
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              "Varde": "grupp.for.utsokning.polisutbildning"
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          "en": "Course"
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            },
            {
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            }
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            "Varde": "true"
          },
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            "Uid": "7fd914b9-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "grupp.for.utsokning.polisutbildning"
          }
        ],
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      "UtbildningstyperInomUtbildningstyp": []
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        "en": "Programme instance"
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      "Beskrivning": {},
      "Dolt": false,
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            "Varde": "grupp.for.utsokning.polisutbildning"
          }
        ],
        "Uid": "9d3c5242-99f6-11e7-953e-c08a46b0419e"
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      "Sorteringsordning": 50,
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      "UtbildningstyperInomUtbildningstyp": [
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        138693,
        109973
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    },
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      "Dolt": false,
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      ]
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    {
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        "en": "Course"
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            "Varde": "true"
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      "StudieordningID": 17,
      "TillfalleInomUtbildningstyper": [
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      "UtbildningstyperInomUtbildningstyp": [
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          101992,
          101994
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      {
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          "en": "Programme instance"
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        "Beskrivning": {},
        "Dolt": false,
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        "Benamning": {
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          "en": "Module without scope"
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        "Beskrivning": {},
        "Dolt": false,
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              "Varde": "grupp.for.utsokning.forskarniva"
            },
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              "Varde": "false"
            },
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              "Varde": "true"
            },
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              "Varde": "true"
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              "Uid": "d31a4083-e80a-11e8-b1f1-65de97d74aa5",
              "Varde": "false"
            },
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              "Uid": "d31a4086-e80a-11e8-b1f1-65de97d74aa5",
              "Varde": "false"
            }
          ],
          "Uid": "0441f5ba-1b3f-11e6-aff0-464044604cb6"
        },
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        "StudieordningID": 1,
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        "UtbildningstyperInomUtbildningstyp": []
      },
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        "Benamning": {
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          "en": "Module"
        },
        "Beskrivning": {},
        "Dolt": false,
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      "ID": "4",
      "Kod": "2007MOD",
      "LarosateID": -1,
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            "Varde": "true"
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            "Uid": "b18301be-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "false"
          },
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            "Varde": "true"
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            "Varde": "grupp.for.utsokning.forskarniva"
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            "Varde": "grupp.for.utsokning.grundavanceradniva"
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            "Varde": "true"
          }
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      "Benamning": {
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        "en": "Course, First-cycle"
      },
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      "Grundtyp": "KURS",
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      "NivaInomStudieordningID": 1,
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        "Regelvarden": [
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            "Uid": "cd705d5f-eef3-11ed-8ea0-65f2d2a34a25",
            "Varde": "true"
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          {
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            "Uid": "cd705d5e-eef3-11ed-8ea0-65f2d2a34a25",
            "Varde": "true"
          },
          {
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            "Varde": "true"
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            "Varde": "true"
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            "Varde": "true"
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            "Uid": "cd705d60-eef3-11ed-8ea0-65f2d2a34a25",
            "Varde": "20"
          }
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      "StudieordningID": 1,
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        4
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    },
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      "AvserTillfalle": false,
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        "sv": "Kurs, avancerad niv\u00e5",
        "en": "Course, Second-cycle"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "NivaInomStudieordningID": 2,
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            "Varde": "true"
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            "Varde": "true"
          },
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            "Uid": "e15c2843-eef3-11ed-8ea0-65f2d2a34a25",
            "Varde": "20"
          },
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            "Uid": "e15c283e-eef3-11ed-8ea0-65f2d2a34a25",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
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            "Varde": "true"
          },
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              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.krav_modul_for_status_komplett",
              "Uid": "e15c2844-eef3-11ed-8ea0-65f2d2a34a25",
              "Varde": "true"
            }
          ],
          "Uid": "0491c386-1b3f-11e6-aff0-464044604cb6"
        },
        "Sorteringsordning": 2,
        "StudieordningID": 1,
        "TillfalleInomUtbildningstyper": [],
        "UtbildningstyperInomUtbildningstyp": [
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          4
        ]
      },
      {
        "AvserTillfalle": true,
        "Benamning": {
          "sv": "Kurstillf\u00e4lle",
          "en": "Course instance"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {},
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        "ID": "52",
        "Kod": "2007KTF",
        "LarosateID": -1,
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          "Regelvarden": [
            {
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              "Uid": "6e4cc1b1-b803-11ed-8cb2-324fb1124949",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.kan.utannonseras",
              "Uid": "6e4cc1b2-b803-11ed-8cb2-324fb1124949",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.atgard_vid_overskriden_terminsgrans",
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              "Varde": "varning"
            },
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            {
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              "Varde": "grupp.for.utsokning.grundavanceradniva"
            },
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              "Varde": "true"
            }
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        },
        "Sorteringsordning": 1,
        "StudieordningID": 1,
        "TillfalleInomUtbildningstyper": [
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          24
        ],
        "UtbildningstyperInomUtbildningstyp": []
      },
      {
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        "Benamning": {
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          "en": "Programme"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {},
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        "Kod": "2007PRG",
        "LarosateID": -1,
        "Regelverk": {
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              "Varde": "true"
            },
            {
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              "Uid": "28074797-5350-11f0-91e2-3ba1697c4b13",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
              "Uid": "28074798-5350-11f0-91e2-3ba1697c4b13",
              "Varde": "grupp.for.utsokning.grundavanceradniva"
            },
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              "Uid": "28074799-5350-11f0-91e2-3ba1697c4b13",
              "Varde": "true"
            }
          ],
          "Uid": "04b37c62-1b3f-11e6-aff0-464044604cb6"
        },
        "Sorteringsordning": 4,
        "StudieordningID": 1,
        "TillfalleInomUtbildningstyper": [],
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          101291,
          162240,
          22,
          101270,
          24,
          101375
        ]
      },
      {
        "AvserTillfalle": true,
        "Benamning": {
          "sv": "Programtillf\u00e4lle",
          "en": "Programme instance"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {},
        "Grundtyp": "KURSPAKETERING",
        "ID": "94",
        "Kod": "2007PRGTF",
        "LarosateID": -1,
        "Regelverk": {
          "Regelvarden": [
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              "Uid": "3f1debe7-5350-11f0-91e2-3ba1697c4b13",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
              "Uid": "3f1debe8-5350-11f0-91e2-3ba1697c4b13",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.atgard_vid_orimligt_omfattningsvarde",
              "Uid": "3f1debe6-5350-11f0-91e2-3ba1697c4b13",
              "Varde": "varning"
            },
            {
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            "Uid": "3f1debea-5350-11f0-91e2-3ba1697c4b13",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.kan.utannonseras",
            "Uid": "3f1debe9-5350-11f0-91e2-3ba1697c4b13",
            "Varde": "true"
          }
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        "Uid": "04ba5a38-1b3f-11e6-aff0-464044604cb6"
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      "Sorteringsordning": 50,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [
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      ],
      "UtbildningstyperInomUtbildningstyp": [
        101291,
        105632,
        52,
        22,
        101382,
        101378,
        101381,
        152635,
        152633,
        162242,
        101375,
        101290,
        101374,
        101292,
        162240,
        101270,
        101377,
        101961,
        24,
        152634
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      "Benamning": {
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        "en": "Programme instance"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURSPAKETERING",
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      "LarosateID": -1,
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            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
            "Uid": "cca17b78-9c8e-11f1-b16e-ea3ce3ef4825",
            "Varde": "true"
          }
        ],
        "Uid": "2fb0819c-0ae3-11e7-9666-bc4d0f6c4981"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 2,
      "TillfalleInomUtbildningstyper": [
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      ],
      "UtbildningstyperInomUtbildningstyp": [
        101965,
        101374,
        105632,
        52,
        101382,
        101966,
        101381,
        101961,
        138460
      ]
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Kurstillf\u00e4lle, grundutbildning",
        "en": "Course instance, Undergraduate"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": "101374",
      "Kod": "1993GKTF",
      "LarosateID": -1,
      "Regelverk": {
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          {
            "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
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            "Uid": "acbe75b7-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "acbe75b8-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          }
        ],
        "Uid": "ba8d0d32-7a4f-11e6-8419-0812bb95460f"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 2,
      "TillfalleInomUtbildningstyper": [
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      ],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Utbytesavtal",
        "en": "Exchange agreement"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURSPAKETERING",
      "ID": "101375",
      "Kod": "2007UA",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.har.omfattning",
            "Uid": "fa69a5ba-6f95-11eb-998b-eb07df7e45d0",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.utbytesstudier",
            "Uid": "fa69a5bb-6f95-11eb-998b-eb07df7e45d0",
            "Varde": "true"
          }
        ],
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      },
      "Sorteringsordning": 7,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        101291,
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          22,
          78,
          151503,
          24,
          101954
        ]
      },
      {
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        "Benamning": {
          "sv": "Utbytestillf\u00e4lle, inresande",
          "en": "Exchange instance, incoming students"
        },
        "Beskrivning": {},
        "Dolt": false,
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        "ID": "101376",
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        "LarosateID": -1,
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            {
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              "Uid": "b972256e-fb9f-11ec-8340-1c3a6877401a",
              "Varde": "true"
            },
            {
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              "Uid": "b972256d-fb9f-11ec-8340-1c3a6877401a",
              "Varde": "true"
            },
            {
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              "Uid": "b96fb46b-fb9f-11ec-8340-1c3a6877401a",
              "Varde": "true"
            }
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          "Uid": "d66d0f7a-ed35-11e6-9e0c-466dbe4e475f"
        },
        "Sorteringsordning": 50,
        "StudieordningID": 1,
        "TillfalleInomUtbildningstyper": [
          101375
        ],
        "UtbildningstyperInomUtbildningstyp": [
          101291,
          52,
          22,
          101382,
          101378,
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          94,
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          101381,
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          148962,
          152633,
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          151504,
          101951,
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          107510,
          101955,
          151503,
          101950,
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              "Varde": "true"
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        "en": "Course"
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            "Varde": "true"
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            "Varde": "true"
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              "Varde": "grupp.for.utsokning.forutbildning"
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          101379
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          "en": "Module"
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        "Beskrivning": {},
        "Dolt": false,
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              "Varde": "false"
            },
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            }
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        "UtbildningstyperInomUtbildningstyp": []
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        "Benamning": {
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          "en": "Research project"
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        "Beskrivning": {
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        },
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        "NivaInomStudieordningID": 3,
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              "Varde": "grupp.for.utsokning.forskarniva"
            },
            {
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              "Varde": "true"
            },
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            }
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        },
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        4
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        "en": "Research project instance"
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        "en": "Course, Third-cycle"
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            "Varde": "grupp.for.utsokning.forskarniva"
          },
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            "Varde": "true"
          },
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            "Varde": "true"
          }
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      "StudieordningID": 1,
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      "UtbildningstyperInomUtbildningstyp": [
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        4
      ]
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    {
      "AvserTillfalle": true,
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        "en": "Course instance, Third-cycle"
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            "Varde": "grupp.for.utsokning.forskarniva"
          },
          {
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            "Varde": "true"
          }
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      "UtbildningstyperInomUtbildningstyp": []
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        "en": "Subject, Third-cycle"
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            "Varde": "grupp.for.utsokning.forskarniva"
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        151503,
        101375,
        101954
      ]
    },
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        "en": "Subject instance, Third-cycle"
      },
      "Beskrivning": {},
      "Dolt": false,
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            "Varde": "true"
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        138461,
        152632,
        101375,
        110915,
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        101968,
        151504,
        101951,
        107510,
        101955,
        101377,
        151503,
        152631
      ]
    },
    {
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      "Benamning": {
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        "en": "Individual exchange load, outgoing third-cycle student"
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      "Dolt": false,
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            "Varde": "true"
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          }
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      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Individuellt tillf\u00e4lle f\u00f6r utbytes\u00e5tagande, forskarniv\u00e5, utresande",
        "en": "Individual exchange load instance, outgoing third-cycle student"
      },
      "Beskrivning": {},
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          },
          {
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            "Varde": "grupp.for.utsokning.forskarniva"
          }
        ],
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      },
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      "StudieordningID": 1,
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      "UtbildningstyperInomUtbildningstyp": []
    },
    {
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      "Benamning": {
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        "en": "Specialisation"
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      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "1993INR",
      "LarosateID": -1,
      "NivaInomStudieordningID": 4,
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        "Regelvarden": [
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            "Uid": "08f04168-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "false"
          },
          {
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            "Varde": "true"
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            "Varde": "grupp.for.utsokning.grundavanceradniva"
          }
        ],
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    },
    {
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      "Benamning": {
        "sv": "Inriktningstillf\u00e4lle",
        "en": "Specialisation instance"
      },
      "Beskrivning": {},
      "Dolt": false,
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            "Varde": "true"
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            "Varde": "grupp.for.utsokning.grundavanceradniva"
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        101965,
        101374,
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        101382,
        101381,
        101964,
        101377,
        138460,
        101375
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      ]
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
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        "en": "Individual course, incoming student"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "ID": "101962",
      "Kod": "1993IKURS",
      "LarosateID": -1,
      "NivaInomStudieordningID": 4,
      "Regelverk": {
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            "Varde": "true"
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        101963
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        "en": "Subject instance, doctoral studies"
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        107510,
        101955,
        101377
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      "Beskrivning": {},
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            "Varde": "true"
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        101378,
        164114,
        101974,
        164115
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    },
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        "en": "Course, Second-cycle"
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            "Varde": "true"
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            }
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          101990,
          101991
        ]
      },
      {
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        "Benamning": {
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          "en": "Course instance"
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              "Varde": "true"
            },
            {
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              "Varde": "true"
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            },
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        "UtbildningstyperInomUtbildningstyp": []
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          "en": "Specialisation"
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              "Varde": "false"
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              "Varde": "true"
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            "Varde": "true"
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        101992
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        "en": "Course"
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            "Varde": "grupp.for.utsokning.forutbildning"
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        102072
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        22,
        102073,
        102009,
        102072
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        "en": "Specialisation"
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          22,
          102009
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              "Varde": "20"
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              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.grupp.overfors.nya.endast.som.merit",
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              "Varde": "true"
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        "StudieordningID": 2,
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        "UtbildningstyperInomUtbildningstyp": []
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      {
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          "en": "Individual exchange load instance, outgoing student"
        },
        "Beskrivning": {},
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            "Varde": "true"
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              "Varde": "20"
            }
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        "StudieordningID": 1,
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        "UtbildningstyperInomUtbildningstyp": []
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          "en": "HVE programme instance"
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        "Kod": "YHUTBTF",
        "LarosateID": -1,
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              "Varde": "grupp.for.utsokning.yhutbildning"
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      "UtbildningstyperInomUtbildningstyp": [
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        109980
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            "Varde": "grupp.for.utsokning.yhutbildning"
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            "Varde": "true"
          }
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      "TillfalleInomUtbildningstyper": [
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      "UtbildningstyperInomUtbildningstyp": []
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        "en": "Research project (scope not specified)"
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      },
      "Dolt": false,
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      "NivaInomStudieordningID": 3,
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        "en": "Exchange load instance, outgoing student"
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        "en": "Programme"
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      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "FHSPRG",
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        "en": "Programme instance"
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        121174
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      "Benamning": {
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        "en": "Specialisation"
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      "Dolt": false,
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            "Varde": "false"
          }
        ],
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      ]
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      "Benamning": {
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        "en": "Specialisation instance"
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      "LarosateID": -1,
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      "UtbildningstyperInomUtbildningstyp": [
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        "en": "Course"
      },
      "Beskrivning": {},
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      "Sorteringsordning": 1,
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      "UtbildningstyperInomUtbildningstyp": [
        121177
      ]
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      "Benamning": {
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        "en": "Module without scope"
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            "Varde": "false"
          },
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            "Uid": "d9eb3f30-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "grupp.for.utsokning.polisutbildning"
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            "Varde": "false"
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            }
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          "en": "Course instance"
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            },
            {
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              "Varde": "true"
            },
            {
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              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
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        "sv": "Program",
        "en": "Programme"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "LarosateID": -1,
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            "Varde": "grupp.for.utsokning.polisutbildning"
          },
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            "Varde": "true"
          },
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            "Varde": "true"
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            "Varde": "true"
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      "StudieordningID": 135370,
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          138693
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          "en": "Programme instance"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {},
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        "Kod": "PU18PRGTF",
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              "Varde": "true"
            },
            {
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              "Uid": "94de0550-8360-11ec-b5c0-b03dbaf5459c",
              "Varde": "grupp.for.utsokning.polisutbildning"
            },
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          138692,
          109972,
          138693,
          109973
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        "en": "Course package"
      },
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      "Dolt": false,
      "Giltighetsperiod": {},
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          },
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            "Varde": "true"
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            "Varde": "true"
          },
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            "Regelnamn": "commons.domain.regel.informationsbehorighet.forutbildning",
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            "Varde": "true"
          }
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      "StudieordningID": 3,
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        22,
        101378
      ]
    },
    {
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        "sv": "Kurspakettillf\u00e4lle",
        "en": "Course package instance"
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      "Dolt": false,
      "Giltighetsperiod": {},
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      "LarosateID": -1,
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            "Uid": "318c0ba1-0509-11ee-b40a-f28ad46341da",
            "Varde": "true"
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            "Varde": "true"
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            "Varde": "true"
          },
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            "Uid": "318c0ba3-0509-11ee-b40a-f28ad46341da",
            "Varde": "varning"
          },
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            "Varde": "true"
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            "Varde": "grupp.for.utsokning.forutbildning"
          }
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        22,
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        101378
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        "en": "Module"
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            "Varde": "grupp.for.utsokning.uppdragsutbildning"
          },
          {
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            "Varde": "false"
          },
          {
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            "Varde": "false"
          },
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      "Benamning": {
        "sv": "Kurs",
```

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        "en": "Course"
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      "Beskrivning": {},
      "Dolt": false,
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      "ID": "161486",
      "Kod": "PISKURS",
      "LarosateID": -1,
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            "Varde": "true"
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            "Varde": "true"
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            "Uid": "9147212d-edeb-11ef-827b-ee188a544698",
            "Varde": "15"
          },
          {
            "Regelnamn": "commons.domain.regel.kan_ha_litteraturlista",
            "Uid": "9147212a-edeb-11ef-827b-ee188a544698",
            "Varde": "true"
          }
        ],
        "Uid": "5d93f8fe-e879-11ef-870b-0958b8b64637"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 161480,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
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        161487
      ]
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
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        "en": "Module without scope"
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      "Beskrivning": {},
      "Dolt": false,
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            "Varde": "false"
          },
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            "Varde": "false"
          },
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            "Varde": "false"
          }
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    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Kurstillf\u00e4lle",
        "en": "Course instance"
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      "Beskrivning": {},
      "Dolt": false,
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      "TillfalleInomUtbildningstyper": [
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      "Benamning": {
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        "en": "Module"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "MODUL",
      "ID": "161528",
      "Kod": "PISMOD",
      "LarosateID": -1,
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            "Uid": "82a114c6-eddb-11ef-827b-ee188a544698",
            "Varde": "false"
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          {
            "Regelnamn": "commons.domain.regel.har.omfattning",
            "Uid": "82a162e8-eddb-11ef-827b-ee188a544698",
            "Varde": "true"
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            "Regelnamn": "commons.domain.regel.sjalvstandig",
            "Uid": "82a162e7-eddb-11ef-827b-ee188a544698",
            "Varde": "false"
          }
        ],
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      "StudieordningID": 161480,
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      "UtbildningstyperInomUtbildningstyp": []
    },
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      "Benamning": {
        "sv": "Kurs",
        "en": "Course"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": "162240",
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      "LarosateID": -1,
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            "Uid": "60541f96-3712-11f0-acdb-b265373e47d4",
            "Varde": "true"
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            "Regelnamn": "commons.domain.regel.kan_ha_plan_for_utbildning",
            "Uid": "60541f98-3712-11f0-acdb-b265373e47d4",
            "Varde": "true"
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            "Uid": "60541f97-3712-11f0-acdb-b265373e47d4",
            "Varde": "true"
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            "Uid": "60541f99-3712-11f0-acdb-b265373e47d4",
            "Varde": "true"
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            "Uid": "60541f95-3712-11f0-acdb-b265373e47d4",
            "Varde": "15"
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      "StudieordningID": 162110,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        162241
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    },
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      "Benamning": {
        "sv": "Modul",
        "en": "Module"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "MODUL",
      "ID": "162241",
      "Kod": "PIPTMOD",
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            "Varde": "true"
          },
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            "Regelnamn": "commons.domain.regel.sjalvstandig",
            "Uid": "2f6b3788-3712-11f0-acdb-b265373e47d4",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.versionshanteras",
            "Uid": "2f6b3787-3712-11f0-acdb-b265373e47d4",
            "Varde": "false"
          }
        ],
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      "StudieordningID": 162110,
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      "UtbildningstyperInomUtbildningstyp": []
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      "Benamning": {
        "sv": "Kurstillf\u00e4lle",
        "en": "Course instance"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": "162242",
      "Kod": "PIPTKTF",
      "LarosateID": -1,
      "Regelverk": {
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        "Uid": "54192bad-3712-11f0-acdb-b265373e47d4"
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      "StudieordningID": 162110,
      "TillfalleInomUtbildningstyper": [
        162240
      ],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
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      "Benamning": {
        "sv": "Inriktning",
        "en": "Specialisation"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURSPAKETERING",
      "ID": "101270",
      "Kod": "2007INR",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
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            "Uid": "0b529b0b-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "0b529b09-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
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            "Uid": "0b529b08-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
            "Uid": "0b529b0a-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "true"
          }
        ],
        "Uid": "0d66222a-7084-11e6-b9af-3b90d480415d"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        101291,
        22,
        24,
        101375
      ]
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Inriktningstillf\u00e4lle",
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        "en": "Specialisation instance"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "ID": "101290",
      "Kod": "2007INRTF",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
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            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "757f6b24-32a9-11ed-9f62-5d776d184866",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
            "Uid": "757f6b26-32a9-11ed-9f62-5d776d184866",
            "Varde": "true"
          },
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            "Uid": "757f6b25-32a9-11ed-9f62-5d776d184866",
            "Varde": "true"
          }
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        "Uid": "6942171b-f8fa-11e6-bfa5-278fa0454831"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 1,
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      ],
      "UtbildningstyperInomUtbildningstyp": [
        101291,
        105632,
        52,
        22,
        101382,
        101381,
        152635,
        152633,
        101375,
        101374,
        101292,
        101377,
        24,
        152634
      ]
    },
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      "Benamning": {
        "sv": "Kurspaket",
        "en": "Course package"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURSPAKETERING",
      "ID": "101291",
      "Kod": "2007KP",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
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            "Uid": "bb699c14-0505-11ee-b40a-f28ad46341da",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "bb697502-0505-11ee-b40a-f28ad46341da",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.grundavancerad",
            "Uid": "bb699c13-0505-11ee-b40a-f28ad46341da",
            "Varde": "true"
          }
        ],
        "Uid": "32f1032b-ec60-11e6-8a84-352cf9f6431e"
      },
      "Sorteringsordning": 5,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        22,
        24
      ]
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Kurspakettillf\u00e4lle",
        "en": "Course package instance"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURSPAKETERING",
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      "Kod": "2007KPTF",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
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            "Uid": "f675e22a-0505-11ee-b40a-f28ad46341da",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.ar_kurspaket",
            "Uid": "f676093d-0505-11ee-b40a-f28ad46341da",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "f675e229-0505-11ee-b40a-f28ad46341da",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.kan.utannonseras",
            "Uid": "f675e22b-0505-11ee-b40a-f28ad46341da",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.atgard_vid_orimligt_omfattningsvarde",
            "Uid": "f675e22c-0505-11ee-b40a-f28ad46341da",
            "Varde": "varning"
          }
        ],
        "Uid": "0019a8ab-4c22-11e7-8c70-788c557b416a"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [
        101291
      ],
      "UtbildningstyperInomUtbildningstyp": [
        52,
        22,
        101381,
        24
      ]
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Kurs, grundutbildning",
        "en": "Course, Undergraduate"
      },
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      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": "101370",
      "Kod": "1993GKURS",
      "LarosateID": -1,
      "NivaInomStudieordningID": 4,
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            "Uid": "63db66ad-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "true"
          },
          {
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            "Uid": "63db66ae-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.avbrottsregel",
            "Uid": "63db66af-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "20"
          }
        ],
        "Uid": "bb2b5d6c-8622-11e6-89f6-efd50fc84e85"
      },
      "Sorteringsordning": 1,
      "StudieordningID": 2,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        101371
      ]
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Modul",
        "en": "Module"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "MODUL",
      "ID": "101371",
      "Kod": "1993MOD",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
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            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
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            "Uid": "af4dac0a-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "false"
          },
          {
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            "Uid": "af4dac07-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.sjalvstandig",
            "Uid": "af4dac09-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "false"
          }
        ],
        "Uid": "9babbd6c-7a4e-11e6-8419-0812bb95460f"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 2,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": []
    },
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      "Benamning": {
        "sv": "Program",
        "en": "Programme"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "1993PRG",
      "LarosateID": -1,
      "NivaInomStudieordningID": 4,
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        "Regelvarden": [
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            "Uid": "d85257cc-9c8e-11f1-b16e-ea3ce3ef4825",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
            "Uid": "d85257cb-9c8e-11f1-b16e-ea3ce3ef4825",
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            "Varde": "true"
          }
        ],
        "Uid": "a6c1681c-ec5f-11e6-8a84-352cf9f6431e"
      },
      "Sorteringsordning": 4,
      "StudieordningID": 2,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        101960
      ]
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Inriktning",
        "en": "Specialisation"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURSPAKETERING",
      "ID": "101973",
      "Kod": "FUPINR",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "5c401d43-c4d3-11e9-ae13-dc75864a44bd",
            "Varde": "grupp.for.utsokning.forutbildning"
          },
          {
            "Regelnamn": "commons.domain.regel.sjalvstandig",
            "Uid": "5c401d46-c4d3-11e9-ae13-dc75864a44bd",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.forutbildning",
            "Uid": "5c401d44-c4d3-11e9-ae13-dc75864a44bd",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
            "Uid": "5c401d45-c4d3-11e9-ae13-dc75864a44bd",
            "Varde": "true"
          }
        ],
        "Uid": "35cbcf80-a76a-11e6-bc5d-3b8bbccc4a18"
      },
      "Sorteringsordning": 50,
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      "StudieordningID": 3,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        22,
        101378
      ]
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Inriktningstillf\u00e4lle",
        "en": "Specialisation instance"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURSPAKETERING",
      "ID": "101974",
      "Kod": "FUPINRTF",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
            "Uid": "ad81a8cc-e4b3-11f0-b251-01189c9f465b",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.forutbildning",
            "Uid": "ad81a8ce-e4b3-11f0-b251-01189c9f465b",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "ad81a8cd-e4b3-11f0-b251-01189c9f465b",
            "Varde": "grupp.for.utsokning.forutbildning"
          }
        ],
        "Uid": "45803524-8d66-11e7-ab6f-ced203c74a20"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 3,
      "TillfalleInomUtbildningstyper": [
        101973
      ],
      "UtbildningstyperInomUtbildningstyp": [
        52,
        22,
        101382,
        101378,
        164114,
```

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          164115
        ]
      },
      {
        "AvserTillfalle": false,
        "Benamning": {
          "sv": "Modul",
          "en": "Module"
        },
        "Beskrivning": {},
        "Dolt": false,
        "Giltighetsperiod": {},
        "Grundtyp": "MODUL",
        "ID": "101975",
        "Kod": "YHMOD",
        "LarosateID": -1,
        "Regelverk": {
          "Regelvarden": [
            {
              "Regelnamn": "commons.domain.regel.sjalvstandig",
              "Uid": "d020fded-e80a-11e8-b1f1-65de97d74aa5",
              "Varde": "false"
            },
            {
              "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
              "Uid": "d020fdee-e80a-11e8-b1f1-65de97d74aa5",
              "Varde": "grupp.for.utsokning.yhutbildning"
            },
            {
              "Regelnamn": "commons.domain.regel.versionshanteras",
              "Uid": "d020fdf0-e80a-11e8-b1f1-65de97d74aa5",
              "Varde": "false"
            },
            {
              "Regelnamn": "commons.domain.regel.informationsbehorighet.yh.utbildning",
              "Uid": "d020fdef-e80a-11e8-b1f1-65de97d74aa5",
              "Varde": "true"
            }
          ],
          "Uid": "39072f3e-a76b-11e6-bc5d-3b8bbccc4a18"
        },
        "Sorteringsordning": 50,
        "StudieordningID": 5,
        "TillfalleInomUtbildningstyper": [],
        "UtbildningstyperInomUtbildningstyp": []
      },
      {
        "AvserTillfalle": false,
        "Benamning": {
          "sv": "Modul utan omfattning",
          "en": "Module without scope"
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      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "MODUL",
      "ID": "101976",
      "Kod": "FUPMUO",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
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            "Uid": "d7c726f5-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "grupp.for.utsokning.forutbildning"
          },
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            "Varde": "false"
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            "Varde": "false"
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            "Varde": "true"
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      "StudieordningID": 17,
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            "Varde": "false"
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            "Varde": "true"
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      "StudieordningID": 17,
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      "UtbildningstyperInomUtbildningstyp": []
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          "Varde": "grupp.for.utsokning.uppdragsutbildning"
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          "Varde": "true"
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          "Varde": "20"
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          "Varde": "true"
        }
      ],
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    "StudieordningID": 17,
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    "UtbildningstyperInomUtbildningstyp": [
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      101991
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          "en": "Module"
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        "Beskrivning": {},
        "Dolt": false,
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        "ID": "102001",
        "Kod": "UPTMOD",
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              "Varde": "false"
            }
          ],
          "Uid": "9e9f8b6d-a81e-11e6-b02f-d0cc883a47fa"
        },
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        "StudieordningID": 9,
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        "UtbildningstyperInomUtbildningstyp": []
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      {
        "AvserTillfalle": true,
        "Benamning": {
          "sv": "Kurstillf\u00e4lle",
          "en": "Course instance"
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        "Beskrivning": {},
        "Dolt": false,
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        "Kod": "UPTKTF",
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      "UtbildningstyperInomUtbildningstyp": []
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        "en": "Module"
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      "Giltighetsperiod": {},
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      "Kod": "PREPMOD",
      "LarosateID": -1,
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            "Uid": "c2b8d4af-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "false"
          },
          {
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            "Uid": "c2b8d4ae-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "false"
          }
        ],
        "Uid": "2232e7df-a820-11e6-b02f-d0cc883a47fa"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 14,
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      "UtbildningstyperInomUtbildningstyp": []
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      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Kurs",
        "en": "Course"
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      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "StudieordningID": 14,
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      ]
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      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Kurstillf\u00e4lle",
        "en": "Course instance"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "ID": "102005",
      "Kod": "PREPKTF",
      "LarosateID": -1,
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      },
      "Sorteringsordning": 50,
      "StudieordningID": 14,
      "TillfalleInomUtbildningstyper": [
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      ],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Kurs",
        "en": "Course"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "UPVKURS",
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            "Varde": "true"
          },
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            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.kan_ha_plan_for_utbildning",
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            "Varde": "true"
          },
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            "Uid": "2f028b07-e0de-11ec-bb44-ad608ddd4f32",
            "Varde": "grupp.for.utsokning.uppdragsutbildning"
          }
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      "Sorteringsordning": 1,
      "StudieordningID": 18,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        102007
      ]
    },
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      "Benamning": {
        "sv": "Modul",
        "en": "Module"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
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      "ID": "102007",
      "Kod": "UPVMOD",
      "LarosateID": -1,
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            "Uid": "cd8c219f-e80a-11e8-b1f1-65de97d74aa5",
            "Varde": "false"
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              "Varde": "grupp.for.utsokning.uppdragsutbildning"
            },
            {
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              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.versionshanteras",
              "Uid": "cd8c219e-e80a-11e8-b1f1-65de97d74aa5",
              "Varde": "false"
            }
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        "Sorteringsordning": 50,
        "StudieordningID": 18,
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        "UtbildningstyperInomUtbildningstyp": []
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          "en": "Course, First-cycle (including attributes from the study regulation of 1993)"
        },
        "Beskrivning": {
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        },
        "Dolt": false,
        "Giltighetsperiod": {},
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        "ID": "105630",
        "Kod": "0793GKURS",
        "LarosateID": -1,
        "NivaInomStudieordningID": 1,
        "Regelverk": {
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            {
              "Regelnamn": "commons.domain.regel.avbrottsregel",
              "Uid": "720d29c2-e979-11e8-9df7-dac5c1184137",
              "Varde": "20"
            },
            {
              "Regelnamn": "commons.domain.regel.ingar.i.grupp.overfors.till.nya",
              "Uid": "720d29c3-e979-11e8-9df7-dac5c1184137",
              "Varde": "true"
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            "Varde": "grupp.for.utsokning.grundavanceradniva"
          }
        ],
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      },
      "Sorteringsordning": 50,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        4,
        101371
      ]
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
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        "en": "Course, Second-cycle (including attributes from the study regulation of 1993)"
      },
      "Beskrivning": {
        "sv": "Anv\u00e4nds endast f\u00f6r konverterad information."
      },
      "Dolt": false,
      "Giltighetsperiod": {},
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      "ID": "105631",
      "Kod": "0793AKURS",
      "LarosateID": -1,
      "NivaInomStudieordningID": 2,
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            "Varde": "true"
          },
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            "Uid": "f543b5b9-e979-11e8-9df7-dac5c1184137",
            "Varde": "20"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "f543b5bb-e979-11e8-9df7-dac5c1184137",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          }
        ],
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      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        4,
        101371
      ]
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Kurstillf\u00e4lle (inkl. attribut fr\u00e5n 1993 \u00e5rs studieordning)",
        "en": "Course instance (including attributes from the study regulation of 1993)"
      },
      "Beskrivning": {
        "sv": "Anv\u00e4nds endast f\u00f6r konverterad information."
      },
      "Dolt": false,
      "Giltighetsperiod": {},
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      "Kod": "0793KTF",
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            "Varde": "true"
          },
          {
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            "Uid": "8695db9c-e97a-11e8-9df7-dac5c1184137",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          }
        ],
        "Uid": "64be0104-152b-11e7-a285-7b8b33c24a2b"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [
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        105631
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      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
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        "en": "Individual second-cycle course, incoming student"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": "106390",
      "Kod": "2007AIKURS",
      "LarosateID": -1,
      "NivaInomStudieordningID": 2,
      "Regelverk": {
        "Regelvarden": [
          {
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            "Uid": "0088e809-ee40-11e8-9270-17395ad8480f",
            "Varde": "20"
          },
          {
            "Regelnamn": "commons.domain.regel.versionshanteras",
            "Uid": "0088e805-ee40-11e8-9270-17395ad8480f",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "0088e807-ee40-11e8-9270-17395ad8480f",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.utbytesstudier",
            "Uid": "0088e806-ee40-11e8-9270-17395ad8480f",
            "Varde": "true"
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          {
            "Regelnamn": "commons.domain.regel.grupp.overfors.nya.endast.som.merit",
            "Uid": "0088e804-ee40-11e8-9270-17395ad8480f",
            "Varde": "true"
          },
          {
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            "Uid": "0088e808-ee40-11e8-9270-17395ad8480f",
            "Varde": "true"
          }
        ],
        "Uid": "7d95f13b-36f7-11e7-a3b7-78a0d3b54280"
      },
      "Sorteringsordning": 11,
      "StudieordningID": 1,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        3,
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        4
      ]
    },
    {
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      "Benamning": {
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        "en": "Individual course instance, Third-cycle"
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            "Varde": "true"
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            "Varde": "true"
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            "Varde": "grupp.for.utsokning.forskarniva"
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      "Benamning": {
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        "en": "Programme (including attributes from the study regulation of 1993)"
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      "LarosateID": -1,
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            "Varde": "grupp.for.utsokning.grundavanceradniva"
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        "en": "Programme instance (including attributes from the study regulation of 1993)"
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          52,
          101961
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          "en": "Course instance"
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            "Varde": "false"
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        "en": "Module"
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            "Varde": "false"
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        "en": "Course"
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        "en": "Course instance"
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        "en": "Course, Third-cycle (including first-cycle and second-cycle attributes)"
      },
      "Beskrivning": {
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            "Varde": "grupp.for.utsokning.forskarniva"
          }
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      "Benamning": {
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        "en": "Course instance, Third-cycle (including first-cycle and second-cycle attributes)"
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            "Varde": "grupp.for.utsokning.forskarniva"
          }
        ],
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      },
      "Sorteringsordning": 50,
      "StudieordningID": 1,
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      "UtbildningstyperInomUtbildningstyp": []
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        "en": "Course"
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              "Varde": "grupp.for.utsokning.uppdragsutbildning"
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          "en": "Course instance"
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              "Varde": "true"
            },
            {
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              "Varde": "true"
            }
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              "Varde": "grupp.for.utsokning.forutbildning"
            },
            {
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              "Varde": "true"
            },
            {
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            }
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        ],
        "UtbildningstyperInomUtbildningstyp": []
      },
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        "AvserTillfalle": false,
        "Benamning": {
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          "en": "Module without specified scope"
        },
        "Beskrivning": {},
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            "Varde": "grupp.for.utsokning.forskarniva"
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            "Varde": "false"
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            "Varde": "true"
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            "Varde": "false"
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            "Varde": "true"
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            "Varde": "true"
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      "Sorteringsordning": 50,
      "StudieordningID": 1,
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      "UtbildningstyperInomUtbildningstyp": []
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      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Individuellt kurstillf\u00e4lle, inresande",
        "en": "Individual course instance, incoming student"
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      },
      "Beskrivning": {
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      },
      "Dolt": false,
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      "Kod": "2007IKTFI",
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            "Varde": "true"
          },
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            "Uid": "e1e7b173-9d6b-11e9-b505-4ba9574641db",
            "Varde": "grupp.for.utsokning.grundavanceradniva"
          },
          {
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            "Uid": "e1e91105-9d6b-11e9-b505-4ba9574641db",
            "Varde": "true"
          },
          {
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            "Uid": "e1e91106-9d6b-11e9-b505-4ba9574641db",
            "Varde": "true"
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      "StudieordningID": 1,
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        101380
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      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
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        "en": "Course package, Third-cycle"
      },
      "Beskrivning": {},
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            "Varde": "grupp.for.utsokning.forskarniva"
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            "Varde": "true"
          },
          {
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            "Varde": "true"
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      "Sorteringsordning": 50,
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        101950,
        110915,
        101954
      ]
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
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        "en": "Course package instance, Third-cycle"
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      "Beskrivning": {},
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            {
              "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
              "Uid": "20ba58ab-0506-11ee-b40a-f28ad46341da",
              "Varde": "grupp.for.utsokning.forskarniva"
            },
            {
              "Regelnamn": "commons.domain.regel.informationsbehorighet.forskarutbildning",
              "Uid": "20ba58ac-0506-11ee-b40a-f28ad46341da",
              "Varde": "true"
            }
          ],
          "Uid": "8831a6c3-6f89-11eb-998b-eb07df7e45d0"
        },
        "Sorteringsordning": 50,
        "StudieordningID": 1,
        "TillfalleInomUtbildningstyper": [
          151503
        ],
        "UtbildningstyperInomUtbildningstyp": [
          101953,
          101951,
          107510,
          101952,
          101955,
          110915,
          101954
        ]
      },
      {
        "AvserTillfalle": true,
        "Benamning": {
          "sv": "Tillf\u00e4lle f\u00f6r utbytes\u00e5tagande, utresande",
          "en": "Exchange load instance, outgoing student"
        },
        "Beskrivning": {
          "sv": "Tillagd f\u00f6r konvertering av uppgifter fr\u00e5n Handelsh\u00f6gskolan. "
        },
        "Dolt": false,
        "Giltighetsperiod": {},
        "Grundtyp": "KURS",
        "ID": "163852",
        "Kod": "1993UATTFR",
        "LarosateID": -1,
        "Regelverk": {
          "Regelvarden": [],
          "Uid": "a75b2896-bbd6-11f0-b3d6-e5914bbf41cf"
```

```
      },
      "Sorteringsordning": 50,
      "StudieordningID": 2,
      "TillfalleInomUtbildningstyper": [
        103210
      ],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Deltagande utan omfattning",
        "en": "Participation without scope"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": "164114",
      "Kod": "FUPDU",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.forutbildning",
            "Uid": "5411c6d4-e4b5-11f0-b251-01189c9f465b",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.versionshanteras",
            "Uid": "5411c6d0-e4b5-11f0-b251-01189c9f465b",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "5411c6d1-e4b5-11f0-b251-01189c9f465b",
            "Varde": "grupp.for.utsokning.forutbildning"
          },
          {
            "Regelnamn": "commons.domain.regel.individuell",
            "Uid": "5411c6d3-e4b5-11f0-b251-01189c9f465b",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.resultat",
            "Uid": "5411c6d5-e4b5-11f0-b251-01189c9f465b",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.har.omfattning",
            "Uid": "5411c6d2-e4b5-11f0-b251-01189c9f465b",
```

```
            "Varde": "false"
          }
        ],
        "Uid": "08337750-e4a6-11f0-b251-01189c9f465b"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 3,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Tillf\u00e4lle f\u00f6r deltagande utan omfattning",
        "en": "Course instance for participation without scope"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": "164115",
      "Kod": "FUPDUTF",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.informationsbehorighet.forutbildning",
            "Uid": "1c513bd6-e4b3-11f0-b251-01189c9f465b",
            "Varde": "true"
          },
          {
            "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
            "Uid": "1c513bd8-e4b3-11f0-b251-01189c9f465b",
            "Varde": "grupp.for.utsokning.forutbildning"
          },
          {
            "Regelnamn": "commons.domain.regel.har.omfattning",
            "Uid": "1c513bd7-e4b3-11f0-b251-01189c9f465b",
            "Varde": "false"
          }
        ],
        "Uid": "1c513bd5-e4b3-11f0-b251-01189c9f465b"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 3,
      "TillfalleInomUtbildningstyper": [
        164114
      ],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
```

```
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Kurs utan omfattning",
        "en": "Course without scope"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": "165024",
      "Kod": "PIHKUO",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.har.omfattning",
            "Uid": "2a99ac57-534c-11f1-ba64-311624e54e2f",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.versionshanteras",
            "Uid": "2a99ac56-534c-11f1-ba64-311624e54e2f",
            "Varde": "true"
          }
        ],
        "Uid": "c872df0f-534b-11f1-ba64-311624e54e2f"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 165023,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        165025
      ]
    },
    {
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Modul utan omfattning",
        "en": "Module without scope"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "MODUL",
      "ID": "165025",
      "Kod": "PIHMUO",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.versionshanteras",
```

```
            "Uid": "12ac2f99-534c-11f1-ba64-311624e54e2f",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.har.omfattning",
            "Uid": "12ac2f98-534c-11f1-ba64-311624e54e2f",
            "Varde": "false"
          },
          {
            "Regelnamn": "commons.domain.regel.sjalvstandig",
            "Uid": "12ac2f9a-534c-11f1-ba64-311624e54e2f",
            "Varde": "false"
          }
        ],
        "Uid": "12ac2f97-534c-11f1-ba64-311624e54e2f"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 165023,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": []
    },
    {
      "AvserTillfalle": true,
      "Benamning": {
        "sv": "Kurstillf\u00e4lle",
        "en": "Course instance"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURS",
      "ID": "165026",
      "Kod": "PIHKTF",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.kan.utannonseras",
            "Uid": "7798f9fd-534c-11f1-ba64-311624e54e2f",
            "Varde": "false"
          }
        ],
        "Uid": "7798f9fc-534c-11f1-ba64-311624e54e2f"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 165023,
      "TillfalleInomUtbildningstyper": [
        165024
      ],
      "UtbildningstyperInomUtbildningstyp": []
    },
```

```
    {
      "AvserTillfalle": false,
      "Benamning": {
        "sv": "Program",
        "en": "Programme"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "Grundtyp": "KURSPAKETERING",
      "ID": "165027",
      "Kod": "PIHPRG",
      "LarosateID": -1,
      "Regelverk": {
        "Regelvarden": [
          {
            "Regelnamn": "commons.domain.regel.kan_ha_plan_for_utbildning",
            "Uid": "bdc721d9-534c-11f1-ba64-311624e54e2f",
            "Varde": "true"
          }
        ],
        "Uid": "bdc721d8-534c-11f1-ba64-311624e54e2f"
      },
      "Sorteringsordning": 50,
      "StudieordningID": 165023,
      "TillfalleInomUtbildningstyper": [],
      "UtbildningstyperInomUtbildningstyp": [
        165024
      ]
    }
  ]
}
```

21.25 aktivitetstillfallestyp_JSON

1463 ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def aktivitetstillfallestyp_JSON(self) -> dict:
    """
    Returns the activity types.
    """
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/kataloginformation/internal/grunddata/aktivitetstillfallestyp',
      headers=self.headers).json()
    return r
```

Defines:
aktivitetstillfallestyp_JSON, used in chunk 1464.

Let's add a test. The response is a code table (Section 21.1).

1464 ⟨*test functions* 245a⟩+≡

```
def test_aktivitetstillfallestyp_JSON(ladok) -> None:
    r = ladok.aktivitetstillfallestyp_JSON()
    assert_code_table(r, "Aktivitetstillfallestyp")
```

This code is used in chunk 240.
Defines:
`test_aktivitetstillfallestyp_JSON`, never used.
Uses `aktivitetstillfallestyp_JSON` 1463 and `assert_code_table` 588.

The output looks like this:

```
{
  "Aktivitetstillfallestyp": [
    {
      "Benamning": {
        "sv": "Digital omtentamen (LIS)",
        "en": "E-examination, resit (LIS)"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "151857",
      "Kod": "GDOT",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Digital tentamen (LIS)",
        "en": "E-examination (LIS)"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {},
      "ID": "151856",
      "Kod": "GDT",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Verksamhetsf\u00f6rlagd utbildning (LIS)",
        "en": "Placement (LIS)"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "164128",
      "Kod": "GVFU",
      "LarosateID": -1
    },
    {
      "Benamning": {
```

```
        "sv": "\u00d6vrigt aktivitetstillf\u00e4lle",
        "en": "Unspecified activity"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {},
      "ID": "1",
      "Kod": "\u00d6V",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "Examination i datorsal - omtentamen",
        "en": "Re-exam, digital on-campus"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2022-06-15"
      },
      "ID": "153882",
      "Kod": "EXDAOMTENTA",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Examination i datorsal - tentamen",
        "en": "Exam, digital on-campus"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2022-06-15"
      },
      "ID": "153881",
      "Kod": "EXDATENTA",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Examination i datorsal \u2013 kontrollskrivning",
        "en": "Partial exam, digital on-campus"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2022-06-15"
      },
      "ID": "153880",
      "Kod": "EXDATKS",
      "LarosateID": 29
```

```
    },
    {
      "Benamning": {
        "sv": "FX-komplettering",
        "en": "FX-Suppplementary Qualification"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2020-10-05"
      },
      "ID": "150909",
      "Kod": "FX",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Hemtentamen",
        "en": "Unsupervised examination"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2022-06-15"
      },
      "ID": "153887",
      "Kod": "HEMTENTA",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Kontrollskrivning",
        "en": "Partial Exam"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-14",
        "Startdatum": "2018-06-20"
      },
      "ID": "135201",
      "Kod": "KS",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Muntlig examination",
        "en": "Oral exam"
      },
      "Beskrivning": {},
      "Dolt": false,
```

```
      "Giltighetsperiod": {
        "Startdatum": "2022-06-15"
      },
      "ID": "153886",
      "Kod": "MUNTA",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Omtentamen",
        "en": "Re-examination"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-14",
        "Startdatum": "2018-06-20"
      },
      "ID": "135200",
      "Kod": "OMTENTA",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Salsexamination \u2013 kontrollskrivning",
        "en": "Partial exam, written on-campus"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2022-06-15"
      },
      "ID": "153883",
      "Kod": "SALEXKS",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Salsexamination - omtentamen",
        "en": "Re-exam, written on-campus"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2022-06-15"
      },
      "ID": "153885",
      "Kod": "SALEXOMTENT",
      "LarosateID": 29
    },
    {
```

```
      "Benamning": {
        "sv": "Salsexamination \u2013 tentamen",
        "en": "Exam, written on-campus"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Giltighetsperiod": {
        "Startdatum": "2022-06-15"
      },
      "ID": "153884",
      "Kod": "SALEXTENTA",
      "LarosateID": 29
    },
    {
      "Benamning": {
        "sv": "Tentamen",
        "en": "Examination"
      },
      "Beskrivning": {},
      "Dolt": true,
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-14",
        "Startdatum": "2018-06-20"
      },
      "ID": "135199",
      "Kod": "TENTAMEN",
      "LarosateID": 29
    }
  ]
}
```

21.26 catalog_service_index_JSON

1468a ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def catalog_service_index_JSON(self) -> dict:
    """
    Returns the catalog service index.
    """
    r = self.session.get(
      url=self.base_gui_proxy_url + '/kataloginformation/internal/service/index',
      headers=self.headers).json()
    return r
```

Defines:
catalog_service_index_JSON, used in chunk 1468b.

Let's add a test. The index should name the catalogue information service.

1468b ⟨*test functions* 245a⟩+≡

```
def test_catalog_service_index_JSON(ladok) -> None:
  r = ladok.catalog_service_index_JSON()
  assert "kataloginformation" in r["ServiceName"]
```

This code is used in chunk 240.
Defines:
test_catalog_service_index_JSON, never used.
Uses catalog_service_index_JSON 1468a.

The output looks like this:

```
{
  "ServiceName": "Ladok3 intern REST-tj\u00e4nst f\u00f6r kataloginformation"
}
```

21.27 omradesbehorighet_JSON

1469a ⟨*LadokSession data methods* 249⟩+≡

```
  # added by GQMJr
  def omradesbehorighet_JSON(self) -> dict:
    """
    Returns områdesbehörighet. See

      https://antagning.se/globalassets/omradesbehoriger-hogskolan.pdf

    for more information.
    """
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/kataloginformation/internal/grunddata/omradesbehorighet',
      headers=self.headers).json()
    return r
```

Defines:
omradesbehorighet_JSON, used in chunk 1469b.

Let's add a test. The response is a code table (Section 21.1).

1469b ⟨*test functions* 245a⟩+≡

```
def test_omradesbehorighet_JSON(ladok) -> None:
  r = ladok.omradesbehorighet_JSON()
  assert_code_table(r, "Omradesbehorighet")
```

This code is used in chunk 240.
Defines:
test_omradesbehorighet_JSON, never used.
Uses assert_code_table 588 and omradesbehorighet_JSON 1469a.

The output looks like this:

```
{
  "Omradesbehorighet": [
    {
      "Benamning": {
        "sv": "Endast grundl\u00e4ggande beh\u00f6righet",
        "en": "General entry requirements only"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "0",
      "Giltighetsperiod": {
```

```
        "Slutdatum": "2022-06-01"
      },
      "ID": "0",
      "Kod": "0",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A2/2",
        "en": "A2/2"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "2",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "2",
      "Kod": "2",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A3/3",
        "en": "A3/3"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "3",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "3",
      "Kod": "3",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A4/4",
        "en": "A4/4"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "4",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "4",
      "Kod": "4",
      "LarosateID": -1
    },
```

```
    {
      "Benamning": {
        "sv": "A5/5",
        "en": "A5/5"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "5",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "5",
      "Kod": "5",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A6 a/6 a",
        "en": "A6 a/6 a"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "6 a",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "7",
      "Kod": "6A",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A6 c/6 a",
        "en": "A6 c/6 c"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "6 c",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "9",
      "Kod": "6C",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A8/8",
        "en": "A8/8"
      },
      "Beskrivning": {},
```

```
      "Dolt": false,
      "Emilvarde": "8",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "11",
      "Kod": "8",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A10/10",
        "en": "A10/10"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "10",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "13",
      "Kod": "10",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A12/12",
        "en": "A12/12"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "12",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "15",
      "Kod": "12",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A11/14",
        "en": "A11/14"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "14",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "17",
```

```
      "Kod": "14",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A15/17",
        "en": "A15/17"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "17",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "20",
      "Kod": "17",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A1/1",
        "en": "A1/1"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "1",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "1",
      "Kod": "1",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A6/6",
        "en": "A6/6"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "6",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "6",
      "Kod": "6",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A6 b/6 a",
```

```
        "en": "A6 b/6 b"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "6 b",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "8",
      "Kod": "6B",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A7/7",
        "en": "A7/7"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "7",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "10",
      "Kod": "7",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A9/9",
        "en": "A9/9"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "9",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "12",
      "Kod": "9",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A11/11",
        "en": "A11/11"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "11",
      "Giltighetsperiod": {
```

```
        "Slutdatum": "2022-06-01"
      },
      "ID": "14",
      "Kod": "11",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A13/13",
        "en": "A13/13"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "13",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "16",
      "Kod": "13",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A14/15",
        "en": "A14/15"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "15",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "18",
      "Kod": "15",
      "LarosateID": -1
    },
    {
      "Benamning": {
        "sv": "A14/16",
        "en": "A14/16"
      },
      "Beskrivning": {},
      "Dolt": false,
      "Emilvarde": "16",
      "Giltighetsperiod": {
        "Slutdatum": "2022-06-01"
      },
      "ID": "19",
      "Kod": "16",
      "LarosateID": -1
    }
```

```
318     ]
319 }
```

Chapter 22

Program cohort access and examination results

Two new capabilities allow the extraction of cohort-level data that complements the existing per-student and per-course-round queries.

(1) **Program cohort**: listing the students admitted to a *program round* (*utbildningstillfälle*) for a given admission semester (e.g. HT25 = autumn 2025). In LADOK's internal terminology the enrolment is a *kurspaketeringstillfälle* (course-package round), but it is identified by the program-round UID returned by the `utbildningsinformation` service.

(2) **Examination occasion results**: listing every student registered for an *aktivitetstillfälle* together with their reported result.

These UIDs from the test environment are used in the tests below.

1477 ⟨*test* `api.py` 240⟩+≡

```
# CTFYS HT25 program round (utbildningsinformation service)
CTFYS_round_id  = "c651ef07-2031-11f0-a301-a2036b2340f3"
# SH1014 written exam on 2026-01-07 and its associated course round
SH1014_occasion_id = "01fe3c80-324b-11f0-8a2b-a6b448f445fa"
SH1014_round_id    = "9ade5891-bba7-11ef-9553-beecfac44351"
# Student with multiple SH1014/TEN1 attempts: first F (2025-01-07), then C (2026-01-07)
SH1014_retake_student_uid = "134e3c18-0e50-11ed-8f4d-87c157374df8"
```

Defines:
`CTFYS_round_id`, used in chunks 1478b, 1479b, 1489a, and 1516.
`SH1014_occasion_id`, used in chunks 1480b and 1482.
`SH1014_retake_student_uid`, used in chunks 1483b, 1491b, 1493, and 1502b.
`SH1014_round_id`, used in chunks 1482 and 1490.

22.1 `program_rounds_JSON`

To identify which program round corresponds to a given admission semester we first need all rounds for a program code. The `utbildningsinformation` service provides this via a GET to the `utbildningstillfalle/filtrera` endpoint.

Each item in the returned `Resultat` list includes:

`[Uid]` The round's unique identifier, used to fetch participants.

`[SammanslagenTillfallesperiod]` Contains `Startdatum` and `Slutdatum` — used to identify the admission semester.

`[Utbildningstillfalleskod]` The short round code, e.g. `OP116`.

`[StartperiodID]` An integer identifying the starting period.

The caller can filter the returned list by `Startdatum` to pick the round for a particular semester (e.g. HT25 = month ≥ 7 of year 2025). We use `_all_pages` (Section 16.3.4) so the full list is returned regardless of how many programme rounds the code has had — no caller has to think about page numbers.

1478a ⟨*LadokSession data methods* 249⟩+≡

```
def program_rounds_JSON(self, program_code: str) -> list:
  """Return all programme rounds for a programme code.

  Each round contains 'Uid', 'SammanslagenTillfallesperiod',
  'Utbildningstillfalleskod', etc.  Filter by 'SammanslagenTillfallesperiod.
  Startdatum' to pick the round for a particular admission semester.
  """
  return self._all_pages(lambda page, limit: self.get_query(
    f"/utbildningsinformation/internal/utbildningstillfalle/filtrera"
    f"?utbildningskod={program_code}&sprakkod=sv"
    f"&page={page}&limit={limit}",
    "application/vnd.ladok-utbildningsinformation+json"
  ))
```

Defines:
`program_rounds_JSON`, used in chunks 1478b and 1479a.
Uses `_all_pages` 256a and `get_query` 249.

The test verifies that `CTFYS_round_id` appears among the returned programme rounds.

1478b ⟨*test functions* 245a⟩+≡

```
def test_program_rounds_JSON(ladok) -> None:
  rounds = ladok.program_rounds_JSON("CTFYS")
  assert len(rounds) > 0
  round_uids = [r["Uid"] for r in rounds]
  assert CTFYS_round_id in round_uids
```

This code is used in chunk 240.
Defines:
`test_program_rounds_JSON`, never used.
Uses `CTFYS_round_id` 1477 and `program_rounds_JSON` 1478a.

22.2 `program_round_participants_JSON`

Given a program-round UID we fetch its participants from the `studiedeltagande` service. The endpoint path uses `kurspaketeringstillfalle` (course-package round) — the internal LADOK term for a programme-round enrolment — rather than `utbildningstillfalle`. The caller supplies the UID returned by `program_rounds_JSON`. Like that method we walk all pages with `_all_pages` (Section 16.3.4); a popular programme has hundreds of admitted students per cohort and the default 400-per-page limit is not always enough.

Each participant entry contains:

`Student` Sub-object with `Uid`, `Fornamn`, `Efternamn`, and `Personnummer`.

`TillstandKurspaketering` Participation status codes, e.g. `pagaende` (active), `ej_paborjad` (admitted, not yet started).

`SummeradGodkandOmfattning` Approved ECTS credits accumulated so far.

1479a ⟨*LadokSession data methods* 249⟩+≡

```
def program_round_participants_JSON(self, round_uid: str) -> list:
  """Return all participants enrolled in a programme round.

  round_uid is a UID from program_rounds_JSON.
  """
  return self._all_pages(lambda page, limit: self.get_query(
    f"/studiedeltagande/internal/deltagare/kurspaketeringstillfalle"
    f"/{round_uid}"
    f"?page={page}&limit={limit}"
    f"&orderby=NAMN_ASC&orderby=PERSONNUMMER_ASC",
    "application/vnd.ladok-studiedeltagande+json"
  ))
```

Defines:
`program_round_participants_JSON`, used in chunk 1479b.
Uses `_all_pages` 256a, `get_query` 249, and `program_rounds_JSON` 1478a.

1479b ⟨*test functions* 245a⟩+≡

```
def test_program_round_participants_JSON(ladok) -> None:
  participants = ladok.program_round_participants_JSON(CTFYS_round_id)
  assert len(participants) > 0
  first = participants[0]
  assert "Student" in first
  assert "Uid" in first["Student"]
  assert "Personnummer" in first["Student"]
```

This code is used in chunk 240.
Defines:
`test_program_round_participants_JSON`, never used.
Uses `CTFYS_round_id` 1477 and `program_round_participants_JSON` 1479a.

22.3 `examination_occasions_JSON`

Examination occasions (*aktivitetstillfälle*) are listed via the `resultat` service. A single occasion covers one exam event, e.g. a written examination of course SH1014 on a specific date. Walking all pages with `_all_pages` (Section 16.3.4) matters here because courses that have run for a long time accumulate many occasions and a fixed page size will hide older ones.

We use the search that LADOK's own web client uses, `aktivitetstillfalle/filtrera/lattvikt` ('lightweight'). Until LADOK's update of 20 October 2026 we used `aktivitetstillfalle/filtrera`, with the same parameters. Since that update, it refuses the course code with a validation error ('Incorrect format' for a 'Unique identifier'), so it evidently wants a UID that the web client does not send. The lightweight search takes the course code and gives the same list, with somewhat fewer fields.

Key fields returned for each occasion:

`Uid` Occasion UID, required for result retrieval.

`Aktivitetstillfallesalternativ` The alternatives of the occasion, each with its examination date(s) in `Datumperiod`, as `Startdatum` / `Slutdatum`, and its times in `Starttid` / `Sluttid`.

`AntalAnmalda` Number of registered students.

`KurstillfalleUIDer` Course-round UIDs associated with this occasion; pass these to `occasion_results_JSON`.

`AktivitetstillfallestypID` The type of the occasion, such as a written examination, as an ID among the activity-occasion types (`aktivitetstillfallestyp_JSON`). The old search also gave the type's name, in `AktivitetstillfallestypBenamning`.

1480a ⟨*LadokSession data methods* 249⟩+≡

```
def examination_occasions_JSON(self, course_code: str) -> list:
  """Return all examination occasions for a course."""
  return self._all_pages(lambda page, limit: self.get_query(
    f"/resultat/internal/aktivitetstillfalle/filtrera/lattvikt"
    f"?kurskod={course_code}&page={page}&limit={limit}",
    "application/vnd.ladok-resultat+json"
  ))
```

Defines:
`examination_occasions_JSON`, used in chunk 1480b.
Uses `_all_pages` 256a and `get_query` 249.

The test checks the fields that the description above promises, for every occasion, and that the course's known occasion is among them.

1480b ⟨*test functions* 245a⟩+≡

```
def test_examination_occasions_JSON(ladok) -> None:
  occasions = ladok.examination_occasions_JSON("SH1014")
  assert len(occasions) > 0
  occasion_uids = [o["Uid"] for o in occasions]
  assert SH1014_occasion_id in occasion_uids
  for occasion in occasions:
    assert isinstance(occasion["KurstillfalleUIDer"], list)
    assert isinstance(occasion["AktivitetstillfallestypID"], int)
    for alternative in occasion["Aktivitetstillfallesalternativ"]:
      assert "Startdatum" in alternative["Datumperiod"]
```

This code is used in chunk 240.
Defines:
`test_examination_occasions_JSON`, never used.
Uses `examination_occasions_JSON` 1480a and `SH1014_occasion_id` 1477.

22.4 `occasion_results_JSON`

Student results at an examination occasion are fetched by a PUT to `studieresultat/rapportera/aktivitetstillfalle/{u`. Unlike the per-component search in `search_reported_results_JSON`, this endpoint requires the course-round UID(s) in the body field `KurstillfallenUID`.

The `Filtrering` list selects which result statuses to include:

`OBEHANDLADE` Registered but no grade entered.

`UTKAST` Draft grade entered, not yet certified.

`ATTESTERADE` Certified (finalized) results.

This is the only paginated endpoint we use that takes `Page` and `Limit` in a JSON body rather than a URL query string. The `_all_pages` helper (Section 16.3.4) accommodates this without any extra plumbing because it takes a `request_fn(page, limit)` closure rather than a URL — the closure builds the appropriate `put_data` dict for each page.

Each item in the returned list contains:

`Student` Sub-object with `Uid`, `Fornamn`, `Efternamn`.

`ResultatPaUtbildningar` List of result objects. When a certified result exists, `SenastAttesteradeResultat` holds the grade with sub-fields `Betygsgradsobjekt.Kod` (e.g. `A`–`F` or `P`/`F`) and `Examinationsdatum`.

`Rapporteringskontext` Contains `UtbildningsinstansUID` — the component-instance UID required if you need to report further results.

1481 ⟨*LadokSession data methods* 249⟩+≡

```
  def occasion_results_JSON(self, occasion_uid: str,
                            course_round_uids: list[str],
                            filtrering: list[str] | None = None) -> list:
    """Return all student results for an examination occasion.

    Args:
      occasion_uid:       UID of the examination occasion
      course_round_uids:  list of course-round UIDs for the occasion
                          (taken from the occasion's KurstillfalleUIDer)
      filtrering:         list of result-status codes to include; defaults
                          to all three ['OBEHANDLADE','UTKAST','ATTESTERADE']
    """
    if filtrering is None:
      filtrering = ["OBEHANDLADE", "UTKAST", "ATTESTERADE"]
    return self._all_pages(lambda page, limit: self.put_query(
      f"/resultat/internal/studieresultat/rapportera"
      f"/aktivitetstillfalle/{occasion_uid}/sok",
      {
        "Filtrering": filtrering,
        "KurstillfallenUID": course_round_uids,
        "OrderBy": ["EFTERNAMN_ASC", "FORNAMN_ASC", "PERSONNUMMER_ASC"],
        "Limit": limit,
        "Page": page,
      }
    ))
```

Defines:
`occasion_results_JSON`, used in chunk 1482.
Uses `_all_pages` 256a and `put_query` 249.

1482 ⟨*test functions* 245a⟩+≡

```
def test_occasion_results_JSON(ladok) -> None:
    results = ladok.occasion_results_JSON(
      SH1014_occasion_id, [SH1014_round_id])
    assert len(results) > 0
    first = results[0]
    assert "Student" in first
    assert "ResultatPaUtbildningar" in first
```

This code is used in chunk 240.
Defines:
`test_occasion_results_JSON`, never used.
Uses `occasion_results_JSON` 1481, `SH1014_occasion_id` 1477, and `SH1014_round_id` 1477.

22.5 `student_result_history_JSON`

The preceding methods answer the question "who sat which exam and what did they get?" from the perspective of an *occasion*. But for analysing student progress we often need the opposite perspective: given a student, what is their *complete* result history across every course and every attempt?

The LADOK GUI presents exactly this on a student's historik (history) tab. Discovering the underlying endpoint took a detour through the hypermedia links embedded in the `resultatuppfoljning/sok` response: each `Student` object carries a link with relation `resultat/historik` pointing to `/resultat/internal/historik/student/{uid}`.

Structure of the response

The endpoint returns a single key `Historikposter`, a flat list of result events ordered newest-first. Each event captures one grade action and contains:

`[Sammanfattning]` A human-readable summary in Swedish and English, e.g. "Modern fysik 4.0 hp SH1014 / Tentamen 4.0 hp TEN1". Course-level entries (finalization of a whole course) have no slash-separated component; component-level entries do.

`[Examinationsdatum]` The date the examination took place.

`[BetyggradID]` Numeric identifier of the grade; combine with `BetygsskalaID` to resolve the letter code (A–F, P/F, etc.).

`[AvserOmfattning]` Credits the result covers (0.0 for course-level finalization entries).

`[Handelse]` The event type: `skapad` (created), `borttagen` (deleted/retracted), or `rattad` (corrected).

`[Historiktyp]` Always `resultat.domain.historiktyp.resultat` for grade results.

`[Attestant, Beslutsfattare]` Who certified and who decided the grade.

`[link]` Contains a `historik/pakurs` relation linking to the per-course variant of this endpoint (`historik/student/{uid}/kurs/{kurs\_uid}`).

Crucially, *all* attempts appear, including failed ones and subsequently corrected results. A student who failed TEN1 in January 2025 and passed in January 2026 will have two separate entries for TEN1 — one with the failing grade and one with the passing grade — plus a third entry for the course-level finalization that only appears once the student has passed.

1483a ⟨*LadokSession data methods* 249⟩+≡

```
def student_result_history_JSON(self, student_uid: str) -> list:
  """Return all result history events for a student.

  Uses GET /resultat/internal/historik/student/{uid}.

  Returns a list of Historikposter (history events) covering every
  course and component the student has received a grade in, newest
  first.  All attempts are included --- failed grades, corrected
  results, and retracted entries appear alongside passing grades.
  """
  data = self.get_query(
    f"/resultat/internal/historik/student/{student_uid}")
  try:
    return data["Historikposter"]
  except KeyError as err:
    err.add_note(f"Response data: {data}")
    raise LadokAPIError(
      f"Unexpected response format when fetching result history "
      f"for student {student_uid}: missing 'Historikposter' key"
    ) from err
```

Defines:
`student_result_history_JSON`, used in chunk 1483b.
Uses `get_query` 249, `LadokAPIError` 242, and `student_uid` 240 1517a.

We test with a student who has two TEN1 entries for SH1014: a failing grade from January 2025 and a passing C from January 2026.

1483b ⟨*test functions* 245a⟩+≡

```
def test_student_result_history_JSON(ladok) -> None:
  history = ladok.student_result_history_JSON(SH1014_retake_student_uid)
  assert isinstance(history, list)
  assert len(history) > 0
  # Every entry must have the core fields
  for entry in history:
    assert "Sammanfattning" in entry
    assert "Examinationsdatum" in entry
    assert "Historiktyp" in entry
    assert "Handelse" in entry
  # Verify that multiple SH1014/TEN1 attempts are present
  sh1014_ten1 = [
    e for e in history
    if "SH1014" in e.get("Sammanfattning", {}).get("sv", "")
    and "TEN1" in e.get("Sammanfattning", {}).get("sv", "")
  ]
  assert len(sh1014_ten1) >= 2, (
```

```
      f"Expected at least 2 SH1014/TEN1 entries (F then C), got {len(sh1014_ten1)}"
    )
```

This code is used in chunk 240.
Defines:
`test_student_result_history_JSON`, never used.
Uses `SH1014_retake_student_uid` 1477 and `student_result_history_JSON` 1483a.

The output for our test student looks like this (showing only the SH1014 entries for brevity):


```
[
  {
    "Anteckning": "Anteckning",
    "ArDokumenteratBeslut": false,
    "Attestant": {
      "Anvandarnamn": "user@domain.se",
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student",
      "Uid": "f2d27335-ac41-11e8-b1aa-6e51ae9f4f77"
    },
    "AvserOmfattning": 0.0,
    "Beslutsdatum": "2026-02-09",
    "Beslutsfattare": {
      "Anvandarnamn": "user@domain.se",
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student",
      "Uid": "f2d27335-ac41-11e8-b1aa-6e51ae9f4f77"
    },
    "BetyggradID": 131673,
    "BetygsskalaID": 131657,
    "Examinationsdatum": "2026-01-07",
    "ExterntBeslut": false,
    "Handelse": "resultat.domain.historik.handelse.skapad",
    "Handelsetid": "2026-02-09T08:17:37.440",
    "Historiktyp": "resultat.domain.historiktyp.resultat",
    "Hogerspaltsanvandare": {
      "Anvandarnamn": "user@domain.se",
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student",
      "Uid": "f2d27335-ac41-11e8-b1aa-6e51ae9f4f77"
    },
    "KlarmarkeradAvAnvandare": {
      "Anvandarnamn": "user@domain.se",
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student"
    },
    "Klarmarkeringsdatum": "2026-02-09T08:17:37.440",
    "OvrigaMedverkande": "Medarbetare",
    "RattadAv": [
      {
        "Anvandarnamn": "user@domain.se",
        "Efternamn": "Studentzadeh",
```

```
        "Fornamn": "Student"
      }
    ],
    "Sammanfattning": {
      "sv": "Modern fysik 4.0 hp SH1014",
      "en": "Modern Physics 4.0 hp SH1014"
    }
  },
  {
    "Anteckning": "Anteckning",
    "ArDokumenteratBeslut": false,
    "Attestant": {
      "Anvandarnamn": "user@domain.se",
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student",
      "Uid": "f2d27335-ac41-11e8-b1aa-6e51ae9f4f77"
    },
    "AvserOmfattning": 4.0,
    "Beslutsdatum": "2026-02-09",
    "Beslutsfattare": {
      "Anvandarnamn": "user@domain.se",
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student",
      "Uid": "f2d27335-ac41-11e8-b1aa-6e51ae9f4f77"
    },
    "BetyggradID": 131673,
    "BetygsskalaID": 131657,
    "Enhet": "HP",
    "Examinationsdatum": "2026-01-07",
    "ExterntBeslut": false,
    "Handelse": "resultat.domain.historik.handelse.skapad",
    "Handelsetid": "2026-02-09T08:17:35.079",
    "Historiktyp": "resultat.domain.historiktyp.resultat",
    "Hogerspaltsanvandare": {
      "Anvandarnamn": "user@domain.se",
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student",
      "Uid": "f2d27335-ac41-11e8-b1aa-6e51ae9f4f77"
    },
    "KlarmarkeradAvAnvandare": {
      "Anvandarnamn": "user@domain.se",
      "Efternamn": "Studentzadeh",
      "Fornamn": "Student"
    },
    "Klarmarkeringsdatum": "2026-02-09T08:03:21.899",
    "OvrigaMedverkande": "Medarbetare",
    "RattadAv": [
      {
        "Anvandarnamn": "user@domain.se",
        "Efternamn": "Studentzadeh",
        "Fornamn": "Student"
```

```
        }
      ],
      "Sammanfattning": {
        "sv": "Modern fysik 4.0 hp SH1014 / Tentamen 4.0 hp TEN1",
        "en": "Modern Physics 4.0 hp SH1014 / Exam 4.0 hp TEN1"
      }
    },
    {
      "ArDokumenteratBeslut": false,
      "Attestant": {
        "Anvandarnamn": "user@domain.se",
        "Efternamn": "Studentzadeh",
        "Fornamn": "Student",
        "Uid": "f2d27335-ac41-11e8-b1aa-6e51ae9f4f77"
      },
      "AvserOmfattning": 4.0,
      "Beslutsdatum": "2025-02-25",
      "Beslutsfattare": {
        "Anvandarnamn": "user@domain.se",
        "Efternamn": "Studentzadeh",
        "Fornamn": "Student",
        "Uid": "f2d27335-ac41-11e8-b1aa-6e51ae9f4f77"
      },
      "BetyggradID": 131697,
      "BetygsskalaID": 131657,
      "Enhet": "HP",
      "Examinationsdatum": "2025-01-07",
      "ExterntBeslut": false,
      "Handelse": "resultat.domain.historik.handelse.skapad",
      "Handelsetid": "2025-02-25T02:17:54.826",
      "Historiktyp": "resultat.domain.historiktyp.resultat",
      "Hogerspaltsanvandare": {
        "Anvandarnamn": "user@domain.se",
        "Efternamn": "Studentzadeh",
        "Fornamn": "Student",
        "Uid": "f2d27335-ac41-11e8-b1aa-6e51ae9f4f77"
      },
      "KlarmarkeradAvAnvandare": {
        "Anvandarnamn": "user@domain.se",
        "Efternamn": "Studentzadeh",
        "Fornamn": "Student"
      },
      "Klarmarkeringsdatum": "2025-02-25T02:15:12.291",
      "RattadAv": [
        {
          "Anvandarnamn": "user@domain.se",
          "Efternamn": "Studentzadeh",
          "Fornamn": "Student"
        }
      ],
      "Sammanfattning": {
```

```
      "sv": "Modern fysik 4.0 hp SH1014 / Tentamen 4.0 hp TEN1",
      "en": "Modern Physics 4.0 hp SH1014 / Exam 4.0 hp TEN1"
    }
  }
]
```

22.6 grade_scales_all_text

grade_scales_JSON (Section 17.1) returns the standard grade scales the LADOK JSON variant exposes — but not all of them. Empirically, the same endpoint `/kataloginformation/internal/grunddata/betygsskala` queried with an XML `Accept` header returns a strictly larger set: it includes institution-specific scales such as KTH's seven-point A–F scale that the JSON variant omits. Why the JSON representation filters and the XML one doesn't is undocumented, and the situation may change — future maintainers should periodically retry the JSON endpoint and collapse the two methods into one if the asymmetry goes away.

We deliberately return the raw response *text* rather than parse the XML here. Parsing belongs in the caller because (a) consumers of this method already need to walk a heterogeneous mix of standard and institution-specific scales, and (b) we don't want to add an `xml.etree` dependency to this module just to expose one endpoint variant. The thin get_query_text helper carries the request, reusing get_query's session and error mapping so a failure here raises the same LadokServerError / LadokAPIError callers already handle.

1487a ⟨*LadokSession data methods* 249⟩+≡

```
  def grade_scales_all_text(self) -> str:
    """Fetch ALL grade scales as raw XML, including institution-specific ones.

    Uses GET /kataloginformation/internal/grunddata/betygsskala with an
    explicit Accept: application/xml header.  Without this, the server
    returns JSON (the standard 17-scale subset), which omits institution-
    specific scales such as KTH's A--F scale.

    Returns the raw XML response text for the caller to parse.  Use
    grade_scales_JSON() if you only need the standard subset and want
    it pre-parsed.
    """
    return self.get_query_text(
      "/kataloginformation/internal/grunddata/betygsskala",
      accept="application/xml, text/xml;q=0.9, */*;q=0.1",
    )
```

Defines:
grade_scales_all_text, used in chunks 263 and 1487b.
Uses get_query_text 249 and grade_scales_JSON 263.

We sanity-check that the response is XML rather than empty or HTML (an HTML response would indicate the session has been redirected to a login page, which get_query_text doesn't otherwise detect).

1487b ⟨*test functions* 245a⟩+≡

```
def test_grade_scales_all_text(ladok) -> None:
  text = ladok.grade_scales_all_text()
```

```
    assert text
    assert "<?xml" in text or "<betygsskala" in text.lower() \
        or "<Betygsskala" in text
```

This code is used in chunk 240.
Defines:
  test_grade_scales_all_text, never used.
Uses grade_scales_all_text 1487a.

22.7 Shared helper: _utbildningstillfalle_JSON

In LADOK, utbildningstillfalle ('education round') is the umbrella term that covers both *course* rounds (kurstillfalle) and *programme* rounds (kurspaketeringstillfalle) — both kinds are stored as utbildningstillfalle records by the utbildningsinformation service, and one endpoint serves both:

```
GET /utbildningsinformation/internal/utbildningstillfalle/{uid}.
```

The two public wrappers below (program_round_by_uid_JSON and course_round_utbildningsinformation_JSON) call this same endpoint; their value is in the *intent* they expose at the call site — a reader who sees program_round_by_uid_JSON(uid) knows the caller expects programme-round metadata, not just 'some utbildningstillfälle record'. We keep the wrappers thin so the URL and Accept-header live in exactly one place; if LADOK ever restructures this endpoint, only the helper changes.

1488a ⟨*LadokSession data methods* 249⟩+≡

```
  def _utbildningstillfalle_JSON(self, uid: str) -> dict:
    """Fetch an utbildningstillfalle record (course or programme round).

    Internal helper.  Uses GET
    /utbildningsinformation/internal/utbildningstillfalle/{uid}.

    Most callers should use the intent-revealing wrappers
    program_round_by_uid_JSON or course_round_utbildningsinformation_JSON
    instead of calling this directly.
    """
    return self.get_query(
      f"/utbildningsinformation/internal/utbildningstillfalle/{uid}",
      "application/vnd.ladok-utbildningsinformation+json",
    )
```

Defines:
  _utbildningstillfalle_JSON, used in chunks 1488b and 1490b.
Uses course_round_utbildningsinformation_JSON 1490b, get_query 249, and program_round_by_uid_JSON 1488b.

22.8 program_round_by_uid_JSON

Fetch the full metadata record for a single programme round by its Ladok UUID. The response includes Benamning, UtbildningsinstansUID, a hypermedia link array (used to follow the struktur link), and the admission and study start periods.

1488b ⟨*LadokSession data methods* 249⟩+≡

```
  def program_round_by_uid_JSON(self, round_uid: str) -> dict:
    """Fetch full details of a programme round by its Ladok UUID.

    Uses GET /utbildningsinformation/internal/utbildningstillfalle/{uid}.
    """
    return self._utbildningstillfalle_JSON(round_uid)
```

Defines:
  program_round_by_uid_JSON, used in chunks 1488a, 1489a, and 1516.
Uses _utbildningstillfalle_JSON 1488a.

This test also covers _utbildningstillfalle_JSON indirectly — the wrapper is one line, so any failure in the helper's URL or content-type shows up here first.

1489a ⟨*test functions* 245a⟩+≡

```
def test_program_round_by_uid_JSON(ladok) -> None:
  record = ladok.program_round_by_uid_JSON(CTFYS_round_id)
  assert record["Uid"] == CTFYS_round_id
  assert "UtbildningsinstansUID" in record
```

This code is used in chunk 240.
Defines:
  test_program_round_by_uid_JSON, never used.
Uses CTFYS_round_id 1477 and program_round_by_uid_JSON 1488b.

22.9 course_round_details_JSON

Fetch the basic metadata record for a course round. Useful when only the round UUID is known (e.g. discovered from a student's participation list) and the course code, round code, or start date must be resolved.

The course code may appear at Utbildningskod directly or nested under Utbildning.Utbildningskod, depending on the Ladok version.

1489b ⟨*LadokSession data methods* 249⟩+≡

```
  def course_round_details_JSON(self, round_uid: str) -> dict:
    """Fetch full details of a single course round by its Ladok UUID.

    Uses GET /resultat/internal/kurstillfalle/{uid}.

    Returns a dict containing at least Uid, TillfallesKod /
    Utbildningstillfalleskod, and Startdatum.  The course code may appear
    at Utbildningskod or nested under Utbildning.Utbildningskod.
    """
    return self.get_query(
      f"/resultat/internal/kurstillfalle/{round_uid}",
      "application/vnd.ladok-resultat+json",
    )
```

Defines:
  course_round_details_JSON, used in chunk 1490a.
Uses get_query 249.

The test uses `SH1014_round_id` (a course round of SH1014, the same round whose examination occasion we use elsewhere).

1490a ⟨*test functions* 245a⟩+≡

```
def test_course_round_details_JSON(ladok) -> None:
    record = ladok.course_round_details_JSON(SH1014_round_id)
    assert record["Uid"] == SH1014_round_id
```

This code is used in chunk 240.
Defines:
`test_course_round_details_JSON`, never used.
Uses `course_round_details_JSON` 1489b and `SH1014_round_id` 1477.

22.10 course_round_utbildningsinformation_JSON

Fetch the *utbildningsinformation* record for a course round. This calls the same endpoint as `program_round_by_uid_JSON` (via the shared `_utbildningstillfalle_JSON` helper) — a course round and a programme round are both `utbildningstillfalle` records. The reason for the separate wrapper is that the typical caller *wants* a course round here and *reads* the `Tillfallesperioder` list it returns, breaking the course's credit weight down across the study sub-periods (P1–P4 in the Swedish academic calendar). Unlike `course_round_details_JSON` (which calls `/resultat/` for the result-flavoured view), this endpoint exposes the period structure.

1490b ⟨*LadokSession data methods* 249⟩+≡

```
def course_round_utbildningsinformation_JSON(self, round_uid: str) -> dict:
    """Fetch the utbildningsinformation record for a course round.

    Uses GET /utbildningsinformation/internal/utbildningstillfalle/{uid}.

    Returns Tillfallesperioder --- a list of study sub-periods, each with a
    Lasperiodsfordelning.Fordelningsposter list that maps period codes
    (e.g. 'P1', 'P2') to their HP contribution.
    """
    return self._utbildningstillfalle_JSON(round_uid)
```

Defines:
`course_round_utbildningsinformation_JSON`, used in chunks 1488a and 1490c.
Uses `_utbildningstillfalle_JSON` 1488a.

The presence of `Tillfallesperioder` is what distinguishes this view from `course_round_details_JSON` — so we assert on that key.

1490c ⟨*test functions* 245a⟩+≡

```
def test_course_round_utbildningsinformation_JSON(ladok) -> None:
    record = ladok.course_round_utbildningsinformation_JSON(SH1014_round_id)
    assert record["Uid"] == SH1014_round_id
    assert "Tillfallesperioder" in record
```

This code is used in chunk 240.
Defines:
`test_course_round_utbildningsinformation_JSON`, never used.
Uses `course_round_utbildningsinformation_JSON` 1490b and `SH1014_round_id` 1477.

22.11 student_program_participations_JSON

Returns all programme-round participations for a student. Each entry carries an `Utbildningsinformation` sub-dict with the programme code, round UUID, round code, name, and study periods. Used both to auto-discover master programme enrolments and to locate the enrollment-history URI for each student–programme pair.

We unwrap the `Tillfallesdeltaganden` list and raise `LadokAPIError` if it is absent: every other `*_JSON` method in this module follows the same 'fail loud on schema drift' pattern (see `grade_scales_JSON` and `course_rounds_JSON`) so that callers see a clear error if LADOK changes the response shape, rather than silently receiving an empty list and assuming the student has no enrolments.

1491a ⟨*LadokSession data methods* 249⟩+≡

```
def student_program_participations_JSON(self, student_uid: str) -> list:
  """Return all programme-round participations for a student.

  Uses GET /studiedeltagande/internal/paborjadutbilding/kurspaketering/
  student/{uid}.

  Each item in the returned list has an Utbildningsinformation sub-dict
  with Utbildningskod, UtbildningstillfalleUID, Utbildningstillfalleskod,
  Benamning, and Perioder.
  """
  data = self.get_query(
    f"/studiedeltagande/internal/paborjadutbilding/kurspaketering"
    f"/student/{student_uid}",
    "application/vnd.ladok-studiedeltagande+json",
  )
  try:
    return data["Tillfallesdeltaganden"]
  except KeyError as err:
    err.add_note(f"Response data: {data}")
    raise LadokAPIError(
      f"Unexpected response format when fetching programme "
      f"participations for student {student_uid}: missing "
      f"'Tillfallesdeltaganden' key"
    ) from err
```

Defines:
`student_program_participations_JSON`, used in chunk 1491b.
Uses `get_query` 249, `LadokAPIError` 242, and `student_uid` 240 1517a.

We use `SH1014_retake_student_uid` for this test — a student we know has at least programme enrolment.

1491b ⟨*test functions* 245a⟩+≡

```
def test_student_program_participations_JSON(ladok) -> None:
  participations = ladok.student_program_participations_JSON(
    SH1014_retake_student_uid)
  assert isinstance(participations, list)
```

This code is used in chunk 240.
Defines:
`test_student_program_participations_JSON`, never used.

Uses `SH1014_retake_student_uid` 1477 and `student_program_participations_JSON` 1491a.

22.12 A student's course participations

Which course rounds does a student take part in? The question comes in two forms. Sometimes we want every course round the student has ever taken, for instance to export the results of a programme's students. More often we want the ones in some state: the courses the student takes now, the ones they will start, the ones they finished. This section treats the first form, and the next one (Section 22.13) the second.

LADOK used to answer the first form with an endpoint of its own, `/studiedeltagande/internal/deltagare/kurstillf` and the first version of `student_course_participations_JSON`, contributed in pull request #129, used it. LADOK has since removed that endpoint. It answers `404 Not Found` for every account, and the answer comes from the web server itself, as an HTML page. LADOK refuses a resource that exists but is forbidden in its own voice, with a JSON body that carries a `Meddelande`, so this 404 means that the path is gone, not that the account lacks some role. Christian Ohm ('cohm') established this on 2026-08-22 with an account that holds programme-level roles: the endpoint answered exactly as a path he had made up.

Every participation is in `registrations_JSON` instead, which reads the student's course-round participations (`kurstillfallesdeltagande`). Every entry that we have recorded from it is a course, but we keep the filter on `Utbildningsinformation.Utbildningstillfallestyp.Grund` being `KURS` as a guard, since the method promises courses. If an entry lacks that discriminator, we raise `LadokAPIError` with the entry attached rather than skip it: skipping would make a change in LADOK's format look like a student without courses. The method takes a `state` too, which we come to below; without one it returns every course participation the student ever had.

1492 ⟨*LadokSession data methods* 249⟩+≡

```
  def student_course_participations_JSON(self, student_uid: str,
                                         state: str | None = None) -> list:
    """Return a student's course-round participations.

    Without 'state', every course participation the student ever had:
    ongoing, upcoming, completed and abandoned ones.  With 'state', one of
    PARTICIPATION_STATES, only those that LADOK puts in that state, e.g.
    "pagaende" for the ongoing ones.  Raises ValueError for any other
    state.

    Each item typically contains:
      - Uid: the participation's UUID
      - Utbildningsinformation.UtbildningstillfalleUID: the course round UUID
      - Utbildningsinformation.Utbildningskod: the course code
      - Utbildningsinformation.Studieperiod: the round's start and end
      - TillstandKurs.Sammanfattattillstand: the participation's state summary
    """
    participations = []
    for participation in self.student_participations_JSON(student_uid,
                                                          state=state):
      try:
```

```
        grundtyp = participation["Utbildningsinformation"][
          "Utbildningstillfallestyp"]["Grundtyp"]
      except KeyError as err:
        err.add_note(f"Participation data: {participation}")
        raise LadokAPIError(
          f"Unexpected participation format when fetching course "
          f"participations for student {student_uid}: missing "
          f"'Utbildningsinformation.Utbildningstillfallestyp.Grundtyp'"
        ) from err
      if grundtyp == "KURS":
        participations.append(participation)
    return participations
```

Defines:
`student_course_participations_JSON`, used in chunks 1493 and 1502b.
Uses `LadokAPIError` 242, `PARTICIPATION_STATES` 1501a, `student_participations_JSON` 1501b, and `student_uid` 240 1517a.

The retake student took SH1014 multiple times, so we expect their course-round participations to include at least one entry.

1493 ⟨*test functions* 245a⟩+≡

```
def test_student_course_participations_JSON(ladok) -> None:
  participations = ladok.student_course_participations_JSON(
    SH1014_retake_student_uid)
  assert isinstance(participations, list)
  assert len(participations) > 0
  assert all(
    p["Utbildningsinformation"]["Utbildningstillfallestyp"]["Grundtyp"]
    == "KURS"
    for p in participations)
```

This code is used in chunk 240.
Defines:
`test_student_course_participations_JSON`, never used.
Uses `SH1014_retake_student_uid` 1477 and `student_course_participations_JSON` 1492.

The output looks like this (showing only the first entry for brevity; note the `TillstandKurs` summary and the `Studieperiod`, which the next section uses):

```
[
  {
    "Aterbud": false,
    "Avklarad": false,
    "HarTillgodoraknande": false,
    "LarosateID": 29,
    "Nuvarande": true,
    "Paborjad": true,
    "Perioddeltaganden": [
      {
        "Anpassat": false,
        "Omfattningsvarde": "0.0",
        "Periodbenamningar": {},
        "PerioddeltagandeUID": "e2bbf16e-73db-11e8-b9fd-0a821ba7448e",
        "Periodindex": 1,
        "Registreringsperiod": {
```

```
            "Slutdatum": "2014-12-31",
            "Startdatum": "2014-07-21"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2014-07-21",
          "UtbildningsPeriodTill": "2014-12-31"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "e2bbf16f-73db-11e8-b9fd-0a821ba7448e",
          "Periodindex": 2,
          "Registreringsperiod": {
            "Slutdatum": "2015-06-30",
            "Startdatum": "2015-01-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2015-01-01",
          "UtbildningsPeriodTill": "2015-06-30"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "e2bbf170-73db-11e8-b9fd-0a821ba7448e",
          "Periodindex": 3,
          "Registreringsperiod": {
            "Slutdatum": "2015-12-31",
            "Startdatum": "2015-07-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2015-07-01",
          "UtbildningsPeriodTill": "2015-12-31"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "e2bbf171-73db-11e8-b9fd-0a821ba7448e",
          "Periodindex": 4,
          "Registreringsperiod": {
            "Slutdatum": "2016-06-30",
            "Startdatum": "2016-01-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2016-01-01",
          "UtbildningsPeriodTill": "2016-06-30"
        },
        {
          "Anpassat": false,
```

```
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "e2bbf172-73db-11e8-b9fd-0a821ba7448e",
          "Periodindex": 5,
          "Registreringsperiod": {
            "Slutdatum": "2016-12-31",
            "Startdatum": "2016-07-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2016-07-01",
          "UtbildningsPeriodTill": "2016-12-31"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "e2bbf173-73db-11e8-b9fd-0a821ba7448e",
          "Periodindex": 6,
          "Registreringsperiod": {
            "Slutdatum": "2017-06-30",
            "Startdatum": "2017-01-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2017-01-01",
          "UtbildningsPeriodTill": "2017-06-30"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "e2bbf174-73db-11e8-b9fd-0a821ba7448e",
          "Periodindex": 7,
          "Registreringsperiod": {
            "Slutdatum": "2017-12-31",
            "Startdatum": "2017-07-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2017-07-01",
          "UtbildningsPeriodTill": "2017-12-31"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "e2bbf175-73db-11e8-b9fd-0a821ba7448e",
          "Periodindex": 8,
          "Registreringsperiod": {
            "Slutdatum": "2018-06-30",
            "Startdatum": "2018-01-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
```

```
          "UtbildningsPeriodFran": "2018-01-01",
          "UtbildningsPeriodTill": "2018-06-30"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "1f617c1b-bfdd-11e8-8049-fd7fef4b484c",
          "Periodindex": 9,
          "Registreringsperiod": {
            "Slutdatum": "2018-12-31",
            "Startdatum": "2018-07-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2018-07-01",
          "UtbildningsPeriodTill": "2018-12-31"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "1f617c1c-bfdd-11e8-8049-fd7fef4b484c",
          "Periodindex": 10,
          "Registreringsperiod": {
            "Slutdatum": "2019-06-30",
            "Startdatum": "2019-01-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2019-01-01",
          "UtbildningsPeriodTill": "2019-06-30"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "a0976dac-b515-11e9-a427-41cc12dd4dc3",
          "Periodindex": 11,
          "Registreringsperiod": {
            "Slutdatum": "2019-12-31",
            "Startdatum": "2019-07-01"
          },
          "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
          "UtbildningsPeriodFran": "2019-07-01",
          "UtbildningsPeriodTill": "2019-12-31"
        },
        {
          "Anpassat": false,
          "Omfattningsvarde": "0.0",
          "Periodbenamningar": {},
          "PerioddeltagandeUID": "f9598cf9-3158-11ea-88ee-aa17e0384779",
          "Periodindex": 12,
```

```
        "Registreringsperiod": {
          "Slutdatum": "2020-06-30",
          "Startdatum": "2020-01-01"
        },
        "Tillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
        "UtbildningsPeriodFran": "2020-01-01",
        "UtbildningsPeriodTill": "2020-06-30"
      }
    ],
    "Sparrad": false,
    "Studiestrukturreferens": "8d2faf86-73d9-11e8-b9fd-0a821ba7448e,null",
    "SummeradGodkandOmfattning": "0.0",
    "SummeradHeltTillgodoraknadOmfattning": "0.0",
    "SummeradTillgodoraknadOmfattning": "0.0",
    "TillstandKurs": {
      "Sammanfattat": "studiedeltagande.domain.tillstandsdefinition.registrerad",
      "Sammanfattattillstand": "studiedeltagande.domain.tillstandsdefinition.registrerad",
      "Tillfallesdeltagande": "studiedeltagande.domain.tillstandsdefinition.paborjad",
      "Utbildning": "studiedeltagande.domain.tillstandsdefinition.paborjad"
    },
    "Uid": "e2ba1cad-73db-11e8-b9fd-0a821ba7448e",
    "Utbildningsinformation": {
      "AntalPerioder": 12,
      "Benamning": {
        "sv": "Doktorsavhandling",
        "en": "Doctoral thesis"
      },
      "Enhetskod": "HP",
      "LarosateID": 29,
      "PeriodIOrdning": "0",
      "Perioder": [
        {
          "Index": 1,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2014-12-31",
          "Startdatum": "2014-07-21",
          "Uid": "89a69d8d-73db-11e8-afa7-8e408e694e54"
        },
        {
          "Index": 2,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2015-06-30",
          "Startdatum": "2015-01-01",
          "Uid": "89a69d8e-73db-11e8-afa7-8e408e694e54"
        },
        {
          "Index": 3,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2015-12-31",
          "Startdatum": "2015-07-01",
          "Uid": "89a69d8f-73db-11e8-afa7-8e408e694e54"
```

```
        },
        {
          "Index": 4,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2016-06-30",
          "Startdatum": "2016-01-01",
          "Uid": "89a69d90-73db-11e8-afa7-8e408e694e54"
        },
        {
          "Index": 5,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2016-12-31",
          "Startdatum": "2016-07-01",
          "Uid": "89a69d91-73db-11e8-afa7-8e408e694e54"
        },
        {
          "Index": 6,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2017-06-30",
          "Startdatum": "2017-01-01",
          "Uid": "89a69d92-73db-11e8-afa7-8e408e694e54"
        },
        {
          "Index": 7,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2017-12-31",
          "Startdatum": "2017-07-01",
          "Uid": "89a69d93-73db-11e8-afa7-8e408e694e54"
        },
        {
          "Index": 8,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2018-06-30",
          "Startdatum": "2018-01-01",
          "Uid": "89a69d94-73db-11e8-afa7-8e408e694e54"
        },
        {
          "Index": 9,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2018-12-31",
          "Startdatum": "2018-07-01",
          "Uid": "1f28dff3-bfdd-11e8-8180-6b9d2e0d4d07"
        },
        {
          "Index": 10,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2019-06-30",
          "Startdatum": "2019-01-01",
          "Uid": "1f28dff4-bfdd-11e8-8180-6b9d2e0d4d07"
        },
        {
```

```
          "Index": 11,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2019-12-31",
          "Startdatum": "2019-07-01",
          "Uid": "9fb60ee3-b515-11e9-9999-748409b84dd2"
        },
        {
          "Index": 12,
          "Omfattningsvarde": "0.0",
          "Slutdatum": "2020-06-30",
          "Startdatum": "2020-01-01",
          "Uid": "f82ad0dd-3158-11ea-a989-1ea254964e91"
        }
      ],
      "SarskildSekretessprovning": false,
      "StudieordningID": "1",
      "Studieperiod": {
        "Slutdatum": "2020-06-30",
        "Startdatum": "2014-07-21"
      },
      "UtbildningUID": "89a64ff2-73db-11e8-b4e0-063f9afb40e3",
      "UtbildningsinstansUID": "89a67674-73db-11e8-afa7-8e408e694e54",
      "UtbildningstillfalleUID": "89a64ff3-73db-11e8-b4e0-063f9afb40e3",
      "Utbildningstillfallestyp": {
        "Benamningar": {
          "sv": "Tillfälle för forskningsarbete",
          "en": "Research project instance"
        },
        "Giltighetsperiod": {},
        "Grundtyp": "KURS",
        "ID": 101953,
        "Kod": "2007VFTF",
        "RegelverkForUtbildningstyp": {
          "Regelvarden": [
            {
              "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
              "Varde": "grupp.for.utsokning.forskarniva"
            },
            {
              "Regelnamn": "commons.domain.regel.individuell",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.studieperiod.kan.laggas.till",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.informationsbehorighet.forskarutbildning",
              "Varde": "true"
            }
          ]
```

```
        },
        "Sjalvstandig": false
      },
      "Utbildningstyp": {
        "Benamningar": {
          "sv": "Forskningsarbete (utan angiven omfattning)",
          "en": "Research project (scope not specified)"
        },
        "Giltighetsperiod": {},
        "Grundtyp": "KURS",
        "ID": 110915,
        "Kod": "2007VFUO",
        "RegelverkForUtbildningstyp": {
          "Regelvarden": [
            {
              "Regelnamn": "commons.domain.regel.informationsbehorighet.forskarutbildning",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.dokumentera_beslut_om_resultat",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.ej.angiven.omfattning",
              "Varde": "true"
            },
            {
              "Regelnamn": "commons.domain.regel.grupp.for.utsokning",
              "Varde": "grupp.for.utsokning.forskarniva"
            }
          ]
        },
        "Sjalvstandig": true
      },
      "Utbildningsversion": 1
    }
  }
]
```


22.12.1 Participations in a state

LADOK does answer the second form. The student resource links to five views of the student's participations, one per state, at `/studiedeltagande/internal/tillfallesdeltagande/`*state*`/student/{uid}`:

`pagaende` the ongoing ones;

`kommande` the upcoming ones;

`oavslutade` the unfinished ones, whose round has ended without the student completing the course;

`avslutade` the completed ones;

`avbrott` the ones the student broke off.

They need no special roles, cohm found, and they answer like `registrations_JSON`: a `Tillfallesdeltaganden` list of entries of the same shape. (A completed participation also carries its `Godkannandedatum`.) The views never overlap, but together they need not hold every participation: a student who withdrew before the round started (`aterbud`) or broke off early (`tidigtavbrott`) is in none of them, nor is one who never started a round that has ended.

We use LADOK's Swedish names for the states, since they are what LADOK calls them and what the paths contain; the classes give them English names (Section 14.1.1).

1501a ⟨*constants* 259⟩+≡

```
PARTICIPATION_STATES = ("pagaende", "kommande", "oavslutade", "avslutade",
                        "avbrott")
```

Defines:
`PARTICIPATION_STATES`, used in chunks 1492, 1501b, 1502a, 1504b, 1507b, 1510, and 1511.

`student_participations_JSON` returns these views as LADOK gives them, and every participation through `registrations_JSON` when no state is given; `student_course_participations_JSON` above keeps the courses of either. The student classes use this method directly, since they keep every registration that `registrations_JSON` returns (Section 12.5). A state that LADOK does not have would be sent to it as a path that does not exist, and its 404 would tell the caller less than we can, so we refuse it first, with a `ValueError` that lists the states there are.

1501b ⟨*LadokSession data methods* 249⟩+≡

```
def student_participations_JSON(self, student_uid: str,
                                state: str | None = None) -> list:
  """Return a student's participations, all of them or those in a state.

  Without 'state', the same as registrations_JSON(student_uid).  With
  'state', one of PARTICIPATION_STATES ("pagaende", "kommande",
  "oavslutade", "avslutade", "avbrott"), LADOK's view of the
  participations in that state.  Raises ValueError for any other state.
  """
  if state is None:
    return self.registrations_JSON(student_uid)
  check_participation_state(state)
  data = self.get_query(
    f"/studiedeltagande/internal/tillfallesdeltagande/{state}"
    f"/student/{student_uid}",
    "application/vnd.ladok-studiedeltagande+json")
  try:
    return data["Tillfallesdeltaganden"]
  except KeyError as err:
    err.add_note(f"Response data: {data}")
    raise LadokAPIError(
      f"Unexpected response format when fetching {state} participations "
      f"for student {student_uid}: missing 'Tillfallesdeltaganden' key"
    ) from err
```

Defines:
`student_participations_JSON`, used in chunks 1492, 1507b, and 1510.

Uses `check_participation_state` 1502a, `get_query` 249, `LadokAPIError` 242, `PARTICIPATION_STATES` 1501a, `registrations_JSON` 287a, and `student_uid` 240 1517a.

1502a ⟨*functions* 246⟩+≡

```
def check_participation_state(state) -> None:
  """Raise ValueError unless ‘state‘ is one of PARTICIPATION_STATES."""
  if state not in PARTICIPATION_STATES:
    raise ValueError(f"unknown participation state {state!r}, expected "
                     f"one of {’, ’.join(PARTICIPATION_STATES)}")
```

Defines:
`check_participation_state`, used in chunks 1501b and 1507b.
Uses `PARTICIPATION_STATES` 1501a.

An unknown state must be refused before any request is sent. The `offline_ladok` session cannot reach LADOK, so a request would fail the test with a network error instead.

1502b ⟨*test functions* 245a⟩+≡

```
@pytest.mark.parametrize("state", ["ongoing", "Pagaende", ""])
def test_unknown_participation_state_is_refused(offline_ladok, state) -> None:
  with pytest.raises(ValueError, match="pagaende"):
    offline_ladok.student_course_participations_JSON(
      SH1014_retake_student_uid, state=state)
```

This code is used in chunk 240.
Defines:
`test_unknown_participation_state_is_refused`, never used.
Uses `SH1014_retake_student_uid` 1477 and `student_course_participations_JSON` 1492.

22.13 The state of a participation

LADOK’s views tell us the state of a participation, but only by asking. A program that already holds a student’s participations, as a `Student` does once it has listed its courses, can tell the states without asking, from two things that every participation carries: its summary, `TillstandKurs.Sammanfattattillstand`, a string such as `studiedeltagande.domain.tillstandsdefinition.registrerad` whose last component says how far the student has come, and the round’s study period, `Utbildningsinformation.Studieperiod`, which together with today’s date says whether the round has started or ended.

We cannot read LADOK’s rule anywhere, so we learnt it by comparison. On 2026-10-20 we compared the five views with the summary and study period of every participation of nine students in LADOK’s test environment, 135 participations, and of the 13 participants of DD1301’s 2026 rounds who had broken off, and every one of them agreed with the following rule. Those rounds had all started or ended, so on the same day we also sampled the participants of a running round, DD1317’s: the registered students are `pagaende`, those who completed are `avslutade`, and those who have not started are `kommande`, as long as the round runs.

A withdrawal comes first: a participation that the student withdrew from before the start (`Aterbud` is true, or `TillstandKurs.Tillfallesdeltagande` ends in `aterbud`) is in no state, whatever its summary says. We saw one whose summary was `avbrott`: the student had withdrawn, and LADOK listed it in no view.

`avklarad` (completed) is `avslutade`, whatever the dates.

`avbrott` (broken off) is `avbrott`.

`aterbud` (withdrawn before the start) and `tidigtavbrott` (broken off early) are in no state.

`registrerad`, `omregistrerad` (registered, or registered again) are `pagaende` while the round runs and `oavslutade` once it has ended.

`ej_paborjad` (not started) is `kommande` until the round has ended, also while it runs, and in no state once it has ended.

Every other case we call unknown: a registration on a round that has not started, a summary we have not seen, a summary or study period that is missing. LADOK must put these somewhere, but we have not seen where, and a guess would be wrong without anyone noticing. The unknown state is therefore a value of its own, `UNKNOWN_STATE`, distinct from `None`, which means that LADOK puts the participation in no state. The callers can then ask LADOK when the rule does not know, and that is what the student classes do (Section 12.5).

The days on which a round starts or ends were not among the dates we compared. We take the round to run on both, which is what the words suggest, but we have not verified it.

Whether we filter here or LADOK does, the result should be the same; we do both for different reasons. Filtering what we already hold costs no request, which matters when a program lists the states of every student in a course round. LADOK's views are the authority, though, and the only way to learn the state of a participation that the rule cannot place. The recorded test below keeps the two together: it compares the views with our rule, so a change in LADOK's rule fails it in the next live run.

After the withdrawal, the rule is two tables: one for the summaries whose state does not depend on the dates, and one for those whose state does, keyed by the summary and where today falls relative to the round. A pair that is in neither table is unknown.

1503 ⟨*constants* 259⟩+≡

```
STATE_BY_SUMMARY = {
  "avklarad": "avslutade",
  "avbrott": "avbrott",
  "aterbud": None,
  "tidigtavbrott": None,
}

STATE_BY_SUMMARY_AND_TIMING = {
  ("registrerad", "running"): "pagaende",
  ("omregistrerad", "running"): "pagaende",
  ("registrerad", "ended"): "oavslutade",
  ("omregistrerad", "ended"): "oavslutade",
  ("ej_paborjad", "upcoming"): "kommande",
  ("ej_paborjad", "running"): "kommande",
  ("ej_paborjad", "ended"): None,
}
```

Defines:
`STATE_BY_SUMMARY`, used in chunk 1504b.
`STATE_BY_SUMMARY_AND_TIMING`, used in chunk 1504b.

The unknown state must be one object that cannot be mistaken for a state or for `None`. A string such as `unknown` could be taken for a state name and passed on to LADOK; an object of a class of its own can only be compared with itself. It survives `pickle` as itself, since its `__reduce__` names the module attribute, so a program that pickles the states it found can still compare them with `is`. The constants come before the classes in the module, so the class is defined here, with its one instance.

1504a ⟨*constants* 259⟩+≡

```
class _UnknownState:
  """The state of a participation that our rule cannot place"""
  def __repr__(self):
    return "ladok3.UNKNOWN_STATE"

  def __reduce__(self):
    return "UNKNOWN_STATE"

UNKNOWN_STATE = _UnknownState()
```

Defines:
`_UnknownState`, never used.
`UNKNOWN_STATE`, used in chunks 1504b, 1507c, 1509, and 1510.

`state_of_participation` applies the rule to a summary, a study period and whether the student withdrew. It takes `today` as an argument so that the tests can fix the date; without it, the rule uses today's date in Sweden (`swedish_today` below). The dates matter only for some summaries, so a missing date makes the state unknown only when the rule needs it.

1504b ⟨*functions* 246⟩+≡

```
def state_of_participation(summary, start, end, today=None, /,
                           withdrawn=False):
  """Return the state LADOK puts a participation in.

  'summary' is TillstandKurs.Sammanfattattillstand (only its last dotted
  component matters), 'start' and 'end' the round's study period as
  datetime.date objects, 'today' the date to judge by (default: today
  in Sweden) and 'withdrawn' whether the student withdrew before the
  start (Aterbud).  Returns one of PARTICIPATION_STATES, None if LADOK
  puts the participation in no state, or UNKNOWN_STATE if the rule
  cannot tell.
  """
  if withdrawn:
    return None
  if not isinstance(summary, str):
    return UNKNOWN_STATE
  summary = summary.rsplit(".", 1)[-1]
  if summary in STATE_BY_SUMMARY:
    return STATE_BY_SUMMARY[summary]
  if start is None or end is None:
    return UNKNOWN_STATE
  timing = round_timing(start, end, today)
  return STATE_BY_SUMMARY_AND_TIMING.get((summary, timing), UNKNOWN_STATE)
```

Defines:
`state_of_participation`, used in chunk 1505b.

Uses PARTICIPATION_STATES 1501a, round_timing 1505a, STATE_BY_SUMMARY 1503, STATE_BY_SUMMARY_AND_TIMING 1503, and UNKNOWN_STATE 1504a.

Where today falls relative to a round is a question of its own, which is not only about participations, so it is a function of its own. The round runs from its first day to its last, both included (see above).

1505a ⟨*functions* 246⟩+≡

```
def round_timing(start, end, today=None):
  """Return "upcoming", "running" or "ended": where ‘today‘ (default:
  today in Sweden) falls relative to a round from ‘start‘ to ‘end‘, both
  days included in the round."""
  if today is None:
    today = swedish_today()
  if today < start:
    return "upcoming"
  if today <= end:
    return "running"
  return "ended"
```

Defines:
round_timing, used in chunks 1504b, 1507a, and 1510.
Uses swedish_today 1506a.

participation_state applies the rule to a participation as LADOK returns it. A date that is missing or not a date leaves the date None, which the rule treats as missing. The withdrawal shows in two places, the flag Aterbud and the last component of TillstandKurs.Tillfallesdeltagande; either one is enough.

1505b ⟨*functions* 246⟩+≡

```
def participation_state(participation: dict, today=None):
  """Return the state LADOK puts ‘participation‘ in, see
  state_of_participation."""
  tillstand = participation.get("TillstandKurs") or {}
  period = (participation.get("Utbildningsinformation") or {}) \
             .get("Studieperiod") or {}
  return state_of_participation(tillstand.get("Sammanfattattillstand"),
                                iso_date_or_none(period.get("Startdatum")),
                                iso_date_or_none(period.get("Slutdatum")),
                                today,
                                withdrawn=is_withdrawn(participation))

def is_withdrawn(participation: dict) -> bool:
  """Return True if the student withdrew from ‘participation‘ before
  the start (Aterbud)."""
  if participation.get("Aterbud") is True:
    return True
  tillstand = (participation.get("TillstandKurs") or {}) \
                .get("Tillfallesdeltagande")
  return isinstance(tillstand, str) \
    and tillstand.rsplit(".", 1)[-1] == "aterbud"

def iso_date_or_none(text):
  """Return the date in the ISO string ‘text‘, or None if there is none."""
```

```
    try:
      return datetime.date.fromisoformat(text)
    except (TypeError, ValueError):
      return None
```

Defines:
  `is_withdrawn`, never used.
  `iso_date_or_none`, used in chunk 1510.
  `participation_state`, used in chunks 1507–10.
Uses `state_of_participation` 1504b.

Which day is today? LADOK's dates are Swedish: a round that ends on 11 January ends at midnight in Sweden. The machine that runs the program need not be in Sweden, and a server often keeps UTC, which is an hour or two behind; judged by its date, a round would still run for the first hours of the day after it ended. So when the caller gives no date, we take today's date in Sweden. The function takes the instant as an argument, so that the tests can fix it. Python's `zoneinfo` reads the time zones from the operating system, and Windows has none to read, so on Windows we depend on the `tzdata` package, which carries them (see `pyproject.toml`).

1506a ⟨*functions* 246⟩+≡

```
  def swedish_today(now=None) -> datetime.date:
    """Return the date in Sweden at the instant ‘now‘, an aware datetime
    (default: the current instant)."""
    if now is None:
      now = datetime.datetime.now(datetime.timezone.utc)
    return now.astimezone(zoneinfo.ZoneInfo("Europe/Stockholm")).date()
```

Defines:
  `swedish_today`, used in chunks 1505–7 and 1510.

Let's verify the date near midnight in UTC, in summer time, when Sweden is two hours ahead, and in winter time, when it is one hour ahead.

1506b ⟨*test functions* 245a⟩+≡

```
1  @pytest.mark.parametrize("now,today", [
2    (datetime.datetime(2026, 10, 19, 21, 59, tzinfo=datetime.timezone.utc),
3     datetime.date(2026, 10, 19)),
4    (datetime.datetime(2026, 10, 19, 22, 0, tzinfo=datetime.timezone.utc),
5     datetime.date(2026, 10, 20)),
6    (datetime.datetime(2026, 12, 31, 22, 59, tzinfo=datetime.timezone.utc),
7     datetime.date(2026, 12, 31)),
8    (datetime.datetime(2026, 12, 31, 23, 0, tzinfo=datetime.timezone.utc),
9     datetime.date(2027, 1, 1)),
10 ])
11 def test_swedish_today(now, today) -> None:
12   assert ladok3.swedish_today(now) == today
```

This code is used in chunk 240.
Defines:
  `test_swedish_today`, never used.
Uses `swedish_today` 1506a.

The functions that default to today must take the Swedish date. We fix it by replacing `swedish_today` for the test, since the clock is the one thing we cannot record or make real: on 1 February 2027 a round that ended on 15 January has ended, and its registered students are unfinished.

1507a ⟨*test functions* 245a⟩+≡

```
def test_defaults_judge_by_the_swedish_date(monkeypatch) -> None:
  monkeypatch.setattr(ladok3, "swedish_today",
                      lambda now=None: datetime.date(2027, 2, 1))
  registered = make_participation("registrerad", RUNNING)
  assert ladok3.round_timing(*map(datetime.date.fromisoformat, RUNNING)) \
    == "ended"
  assert ladok3.participations_in_state([registered], "oavslutade") \
    == [registered]
```

This code is used in chunk 240.
Defines:
`test_defaults_judge_by_the_swedish_date`, never used.
Uses `make_participation` 1507c, `participations_in_state` 1507b, `round_timing` 1505a, `RUNNING` 1507c, and `swedish_today` 1506a.

To filter a list of participations, we classify each of them on the same day, so that a list never straddles midnight.

1507b ⟨*functions* 246⟩+≡

```
def participations_in_state(participations: list, state: str,
                            today=None) -> list:
  """Return the participations that our rule puts in ‘state‘, one of
  PARTICIPATION_STATES, judged on ‘today‘ (default: today in Sweden).

  Participations that the rule cannot place are left out; ask LADOK
  (LadokSession.student_participations_JSON) for those.
  """
  check_participation_state(state)
  if today is None:
    today = swedish_today()
  return [participation for participation in participations
          if participation_state(participation, today) == state]
```

Defines:
`participations_in_state`, used in chunks 1507a, 1509b, and 1510.
Uses `check_participation_state` 1502a, `participation_state` 1505b, `PARTICIPATION_STATES` 1501a, `student_participations_JSON` 1501b, and `swedish_today` 1506a.

Let's verify the rule, row by row, on a fixed date. Each case is a participation as LADOK returns it, with the full summary token, so that we also check that only the last component counts. The cases mark the dates relative to the fixed date: a round that has ended, one that runs, one that has not started, and the two boundary days.

1507c ⟨*test functions* 245a⟩+≡

```
TODAY = datetime.date(2026, 10, 20)
ENDED = ("2026-01-19", "2026-06-05")
RUNNING = ("2026-08-31", "2027-01-15")
UPCOMING = ("2027-01-19", "2027-06-04")
STARTS_TODAY = ("2026-10-20", "2027-01-15")
ENDS_TODAY = ("2026-08-31", "2026-10-20")

def make_participation(summary, dates):
  start, end = dates
  return {
    "TillstandKurs": {"Sammanfattattillstand":
                      f"studiedeltagande.domain.tillstandsdefinition."
```

```
                          f"{summary}"},
      "Utbildningsinformation": {"Studieperiod": {"Startdatum": start,
                                                  "Slutdatum": end}},
    }

@pytest.mark.parametrize("summary,dates,state", [
    ("avklarad", ENDED, "avslutade"),
    ("avklarad", RUNNING, "avslutade"),
    ("avbrott", RUNNING, "avbrott"),
    ("avbrott", ENDED, "avbrott"),
    ("registrerad", RUNNING, "pagaende"),
    ("omregistrerad", RUNNING, "pagaende"),
    ("registrerad", ENDED, "oavslutade"),
    ("omregistrerad", ENDED, "oavslutade"),
    ("ej_paborjad", UPCOMING, "kommande"),
    ("ej_paborjad", RUNNING, "kommande"),
    ("ej_paborjad", ENDED, None),
    ("aterbud", UPCOMING, None),
    ("aterbud", RUNNING, None),
    ("aterbud", ENDED, None),
    ("tidigtavbrott", RUNNING, None),
    ("tidigtavbrott", ENDED, None),
    ("registrerad", STARTS_TODAY, "pagaende"),
    ("registrerad", ENDS_TODAY, "pagaende"),
    ("registrerad", UPCOMING, ladok3.UNKNOWN_STATE),
    ("omregistrerad", UPCOMING, ladok3.UNKNOWN_STATE),
    ("nagot_nytt", RUNNING, ladok3.UNKNOWN_STATE),
])
def test_participation_state(summary, dates, state) -> None:
    participation = make_participation(summary, dates)
    assert ladok3.participation_state(participation, TODAY) == state
```

This code is used in chunk 240.
Defines:
ENDED, used in chunk 1509b.
ENDS_TODAY, never used.
make_participation, used in chunks 1507–9 and 1511.
RUNNING, used in chunks 1507–9 and 1511.
STARTS_TODAY, never used.
test_participation_state, never used.
TODAY, used in chunks 1508, 1509, and 1511.
UPCOMING, used in chunks 1509b and 1511.
Uses participation_state 1505b and UNKNOWN_STATE 1504a.

A withdrawal puts a participation in no state whatever its summary, and whichever of its two marks it carries.

1508 ⟨*test functions* 245a⟩+≡

```
@pytest.mark.parametrize("summary", ["avbrott", "registrerad", "avklarad"])
def test_withdrawn_participation_is_in_no_state(summary) -> None:
    flagged = make_participation(summary, RUNNING)
    flagged["Aterbud"] = True
    marked = make_participation(summary, RUNNING)
    marked["TillstandKurs"]["Tillfallesdeltagande"] = \
      "studiedeltagande.domain.tillstandsdefinition.aterbud"
```

```
    not_withdrawn = make_participation(summary, RUNNING)
    not_withdrawn["Aterbud"] = False

    assert ladok3.participation_state(flagged, TODAY) is None
    assert ladok3.participation_state(marked, TODAY) is None
    assert ladok3.participation_state(not_withdrawn, TODAY) is not None
```

This code is used in chunk 240.
Defines:
`test_withdrawn_participation_is_in_no_state`, never used.
Uses `make_participation` 1507c, `participation_state` 1505b, `RUNNING` 1507c, and `TODAY` 1507c.

A participation that lacks what the rule needs is unknown, and so is one whose date is not a date; but a completed participation needs no dates.

1509a ⟨*test functions* 245a⟩+≡

```
def test_participation_state_without_the_data_is_unknown() -> None:
    registered = make_participation("registrerad", RUNNING)
    del registered["Utbildningsinformation"]["Studieperiod"]["Slutdatum"]
    malformed = make_participation("registrerad", ("2026-08-31", "snart"))
    completed = make_participation("avklarad", RUNNING)
    del completed["Utbildningsinformation"]

    assert ladok3.participation_state(registered, TODAY) \
      is ladok3.UNKNOWN_STATE
    assert ladok3.participation_state(malformed, TODAY) \
      is ladok3.UNKNOWN_STATE
    assert ladok3.participation_state({"Uid": "x"}, TODAY) \
      is ladok3.UNKNOWN_STATE
    assert ladok3.participation_state(completed, TODAY) == "avslutade"
```

This code is used in chunk 240.
Defines:
`test_participation_state_without_the_data_is_unknown`, never used.
Uses `make_participation` 1507c, `participation_state` 1505b, `RUNNING` 1507c, `TODAY` 1507c, and `UNKNOWN_STATE` 1504a.

The filter keeps exactly the participations in the state, in their order, leaves out the unknown ones, and refuses a state that LADOK does not have. The unknown state must also come back as itself from `pickle`.

1509b ⟨*test functions* 245a⟩+≡

```
def test_participations_in_state() -> None:
    participations = [make_participation("registrerad", RUNNING),
                      make_participation("avklarad", ENDED),
                      make_participation("registrerad", UPCOMING),
                      make_participation("omregistrerad", RUNNING)]
    assert ladok3.participations_in_state(
      participations, "pagaende", TODAY) == [participations[0],
                                             participations[3]]
    assert ladok3.participations_in_state(
      participations, "kommande", TODAY) == []
    with pytest.raises(ValueError):
      ladok3.participations_in_state(participations, "ongoing", TODAY)

def test_unknown_state_survives_pickle() -> None:
    assert pickle.loads(pickle.dumps(ladok3.UNKNOWN_STATE)) \
```

```
16      is ladok3.UNKNOWN_STATE
```

This code is used in chunk 240.
Defines:
  test_participations_in_state, never used.
  test_unknown_state_survives_pickle, never used.
Uses ENDED 1507c, make_participation 1507c, participations_in_state 1507b, RUNNING 1507c, TODAY 1507c, UNKNOWN_STATE 1504a, and UPCOMING 1507c.

Finally, against LADOK: the views must not overlap, and where our rule places a participation, it must place it where LADOK does. We take two students: one who took DD1301 and has participations in all five states, and the test student of most other tests.

The rule declines some cases, and which ones a student has depends on the day: before a term starts, many students are registered on rounds that have not started. Those are not wrong, only undecided, so we check less about them: each must be in at most one of LADOK's views, and if not, the failure names its summary and where the day falls relative to its round, the case that the rule would need to learn. For the participations that the rule places, we compare by state, by their UIDs: those in LADOK's view, less the undecided ones, must be exactly those that our rule puts in the state. We assert on counts and state names, so that a failure shows how many differ, not who.

The rule must judge by the date on which LADOK answered. In a live run or a recording, that is today; in a replay, it is the date of the recording, which we read from the `Date` header of its first response. (Judging a replay by the date of the replay would fail the test as soon as one of the rounds started or ended after the recording.) The header is in UTC, and LADOK's dates are Swedish, so we convert, with `swedish_today`.

1510 ⟨*test functions* 245a⟩+≡

```
def date_of_answers(recording, cassette) -> datetime.date:
  """The Swedish date on which LADOK gave the test's answers"""
  if recording:
    return ladok3.swedish_today()
  return ladok3.swedish_today(email.utils.parsedate_to_datetime(
    cassette.responses[0]["headers"]["Date"][0]))

@pytest.mark.parametrize("student", [DD1301_student_uid, student_uid],
                         ids=["DD1301_student", "student"])
def test_participation_states_agree_with_ladok(ladok, recording, vcr,
                                               student) -> None:
  everything = ladok.student_participations_JSON(student)
  today = date_of_answers(recording, vcr)
  views = {state: {participation["Uid"] for participation
                   in ladok.student_participations_JSON(student, state=state)}
           for state in ladok3.PARTICIPATION_STATES}
  assert_views_agree_with_rule(everything, views, today)

def assert_views_agree_with_rule(everything, views, today):
  """Assert that LADOK's `views` (state: set of participation UIDs) do not
  overlap, hold each participation that our rule cannot place at most
  once, and otherwise hold exactly what our rule puts in each state."""
  undecided = [participation for participation in everything
               if ladok3.participation_state(participation, today)
```

```
                    is ladok3.UNKNOWN_STATE]
  for participation in undecided:
    in_views = sum(participation["Uid"] in uids for uids in views.values())
    assert in_views <= 1, \
      f"{case_of(participation, today)} is in {in_views} views"
  undecided_uids = {participation["Uid"] for participation in undecided}

  seen = set()
  for state, uids in views.items():
    by_ladok = uids - undecided_uids
    by_rule = {participation["Uid"] for participation
               in ladok3.participations_in_state(everything, state, today)}
    assert (state, len(by_ladok - by_rule), len(by_rule - by_ladok)) \
      == (state, 0, 0)
    assert len(uids & seen) == 0
    seen |= uids

def case_of(participation, today):
  """The summary of `participation` and where `today` falls relative to
  its round: LADOK's state names only, nothing about the student."""
  summary = (participation.get("TillstandKurs") or {}) \
              .get("Sammanfattattillstand") or "no summary"
  period = (participation.get("Utbildningsinformation") or {}) \
             .get("Studieperiod") or {}
  start = ladok3.iso_date_or_none(period.get("Startdatum"))
  end = ladok3.iso_date_or_none(period.get("Slutdatum"))
  timing = ladok3.round_timing(start, end, today) \
    if start and end else "no dates"
  return (summary.rsplit(".", 1)[-1], timing)
```

This code is used in chunk 240.
Defines:
assert_views_agree_with_rule, used in chunk 1511.
case_of, never used.
date_of_answers, used in chunks 586 and 1512a.
test_participation_states_agree_with_ladok, never used.
Uses DD1301_student_uid 240, iso_date_or_none 1505b, participation_state 1505b, PARTICIPATION_STATES 1501a, participations_in_state 1507b, round_timing 1505a, student_participations_JSON 1501b, student_uid 240 1517a, swedish_today 1506a, and UNKNOWN_STATE 1504a.

The recordings of these two students hold no participation that the rule cannot place, so the replay does not exercise that part of the comparison. We check it on participations of our own: a registration on a round that has not started, which the rule cannot place, may be in one of LADOK's views, but not in two, and the failure names the case; a placed participation must be in the view of its state.

1511 ⟨*test functions* 245a⟩+≡

```
def test_views_may_hold_what_the_rule_cannot_place() -> None:
  placed = make_participation("registrerad", RUNNING)
  undecided = make_participation("registrerad", UPCOMING)
  placed["Uid"], undecided["Uid"] = "placed", "undecided"
  empty = {state: set() for state in ladok3.PARTICIPATION_STATES}

  assert_views_agree_with_rule(
```

```
      [placed, undecided],
      {**empty, "pagaende": {"placed"}, "kommande": {"undecided"}}, TODAY)
    with pytest.raises(AssertionError, match="registrerad.*upcoming"):
      assert_views_agree_with_rule(
        [placed, undecided],
        {**empty, "pagaende": {"placed", "undecided"},
         "kommande": {"undecided"}}, TODAY)
    with pytest.raises(AssertionError):
      assert_views_agree_with_rule([placed, undecided], empty, TODAY)
```

This code is used in chunk 240.
Defines:
`test_views_may_hold_what_the_rule_cannot_place`, never used.
Uses `assert_views_agree_with_rule` 1510, `make_participation` 1507c, `PARTICIPATION_STATES` 1501a, `RUNNING` 1507c, `TODAY` 1507c, and `UPCOMING` 1507c.

A replay that judged by the wrong date would fail only when a round starts or ends between the recording and the replay, long after the mistake. So we check the date on its own, with a cassette that holds one answer, given late in the evening of 19 October 2026 in UTC: in Sweden it was already the 20th.

1512a ⟨*test functions* 245a⟩+≡

```
def test_date_of_answers_is_the_swedish_date_of_the_recording() -> None:
  cassette = types.SimpleNamespace(responses=[
    {"headers": {"Date": ["Mon, 19 Oct 2026 22:30:00 GMT"]}}])
  assert date_of_answers(False, cassette) == datetime.date(2026, 10, 20)
```

This code is used in chunk 240.
Defines:
`test_date_of_answers_is_the_swedish_date_of_the_recording`, never used.
Uses `date_of_answers` 1510.

22.14 `fetch_linked_uri_JSON`

Several Ladok responses include hypermedia links whose `href` values are full URIs pointing to the API host (e.g. `https://api.test.ladok.se:443/utbildningsinformation/...`). This helper strips the scheme and host so the request can be routed through the GUI proxy, which is what carries our session credentials — the API host itself doesn't see them.

We validate the input rather than letting string surgery silently chew on arbitrary text. The reason: if `uri` is malformed or points at some host other than LADOK's API, the caller would proxy a request for data that did not come from LADOK at all. By rejecting non-URI input up front and insisting that the host matches the current environment's LADOK API host, we keep the helper as narrow as the situations that actually call it.

The default content-type is left to `get_query` (which negotiates JSON broadly via `self.headers`). Earlier we hard-coded `utbildningsinformation+json`, but the helper is meant to follow *any* hypermedia link — baking one service's content-type in silently mis-described links from the `resultat` or `studiedeltagande` services and is exactly the kind of 'convenient default' that hides bugs. Callers who really do know the content-type should pass it explicitly.

1512b ⟨*LadokSession data methods* 249⟩+≡

```
def fetch_linked_uri_JSON(self, uri: str,
                          content_type: str | None = None) -> dict | list:
```

```
    """Fetch a Ladok hypermedia URI via the GUI proxy.

    Strips the scheme and host from uri, then delegates to get_query().
    Use this when a Ladok response embeds a full URI in a link array, e.g.
    https://api.test.ladok.se:443/utbildningsinformation/internal/struktur/{uid}.

    Raises LadokValidationError if uri is not an http(s) URI for the current
    LADOK API host.
    """
    parsed = urllib.parse.urlparse(uri)
    if parsed.scheme not in ("http", "https") or not parsed.path:
      raise LadokValidationError(
        f"fetch_linked_uri_JSON: not an http(s) URI with a path: {uri!r}")
    expected_host = urllib.parse.urlparse(
      self.base_url.replace("start.", "api.", 1)).hostname
    if parsed.hostname != expected_host:
      raise LadokValidationError(
        f"fetch_linked_uri_JSON: unexpected host {parsed.hostname!r}, "
        f"expected {expected_host!r}")
    path = parsed.path
    if parsed.query:
      path += f"?{parsed.query}"
    if content_type is None:
      return self.get_query(path)
    return self.get_query(path, content_type)
```

Defines:
  `fetch_linked_uri_JSON`, used in chunk 1513.
Uses `get_query` 249, `host` 254, and `LadokValidationError` 242.

The validation test ensures a non-URI input is rejected up front (rather than silently issuing a partial-path GET). The happy-path test constructs a URI in the same shape as a real LADOK hypermedia link and verifies it resolves through the proxy.

1513 ⟨*test functions* 245a⟩+≡

```
def test_fetch_linked_uri_JSON_rejects_non_uri(offline_ladok) -> None:
  with pytest.raises(ladok3.LadokValidationError):
    offline_ladok.fetch_linked_uri_JSON("not a uri")

def test_fetch_linked_uri_JSON_rejects_wrong_host(offline_ladok) -> None:
  with pytest.raises(ladok3.LadokValidationError):
    offline_ladok.fetch_linked_uri_JSON(
      f"https://example.com/utbildningsinformation/internal/"
      f"utbildningsinstans/{dasak_instance_id}")

def test_fetch_linked_uri_JSON_follows_link(ladok) -> None:
  uri = ("https://api.test.ladok.se:443/utbildningsinformation"
         f"/internal/utbildningsinstans/{dasak_instance_id}")
  record = ladok.fetch_linked_uri_JSON(
    uri, content_type="application/vnd.ladok-utbildningsinformation+json")
  assert record["Uid"] == dasak_instance_id
```

This code is used in chunk 240.
Defines:
`test_fetch_linked_uri_JSON_follows_link`, never used.
`test_fetch_linked_uri_JSON_rejects_non_uri`, never used.
`test_fetch_linked_uri_JSON_rejects_wrong_host`, never used.
Uses `dasak_instance_id` 240, `fetch_linked_uri_JSON` 1512b, and `LadokValidationError` 242.

22.15 `utbildningsinstans_JSON`

Fetches the education-instance (*utbildningsinstans*) record for the given UID. An education instance represents an abstract programme or track definition, as opposed to a specific round with an admission year. The record includes `Utbildningskod`, `Benamning`, and a hypermedia link array that can point to subordinate instances.

1514a ⟨*LadokSession data methods* 249⟩+≡

```
def utbildningsinstans_JSON(self, inst_uid: str) -> dict:
  """Fetch an education-instance record by its UID.

  Uses GET /utbildningsinformation/internal/utbildningsinstans/{uid}.
  """
  return self.get_query(
    f"/utbildningsinformation/internal/utbildningsinstans/{inst_uid}",
    "application/vnd.ladok-utbildningsinformation+json",
  )
```

Defines:
`utbildningsinstans_JSON`, used in chunk 1514.
Uses `get_query` 249.

1514b ⟨*test functions* 245a⟩+≡

```
def test_utbildningsinstans_JSON(ladok) -> None:
  record = ladok.utbildningsinstans_JSON(dasak_instance_id)
  assert record["Uid"] == dasak_instance_id
```

This code is used in chunk 240.
Defines:
`test_utbildningsinstans_JSON`, never used.
Uses `dasak_instance_id` 240 and `utbildningsinstans_JSON` 1514a.

22.16 `utbildningsinstans_underliggande_JSON`

Returns the list of subordinate (*underliggande*) education instances for a given parent instance. Used to enumerate the master specialisation options and track options that belong to a programme instance. Each element is a minimal `{"Uid": "..."}` dict; call `utbildningsinstans_JSON` to retrieve the full record.

1514c ⟨*LadokSession data methods* 249⟩+≡

```
def utbildningsinstans_underliggande_JSON(self, inst_uid: str) -> list:
  """Return subordinate education-instance UIDs for a parent instance.

  Uses GET /utbildningsinformation/internal/utbildningsinstans/
  underliggande?uid={uid}.

  Each element in the returned list is a minimal dict with at least
```

```
    {'Uid': '<uuid>'}.  Fetch the full record with utbildningsinstans_JSON.
    """
    data = self.get_query(
      f"/utbildningsinformation/internal/utbildningsinstans"
      f"/underliggande?uid={inst_uid}",
      "application/vnd.ladok-utbildningsinformation+json",
    )
    try:
      return data["Utbildningsinstans"]
    except KeyError as err:
      err.add_note(f"Response data: {data}")
      raise LadokAPIError(
        f"Unexpected response format when fetching subordinate "
        f"education instances for {inst_uid}: missing "
        f"'Utbildningsinstans' key"
      ) from err
```

Defines:
  `utbildningsinstans_underliggande_JSON`, used in chunk 1515a.
Uses `get_query` 249, `LadokAPIError` 242, and `utbildningsinstans_JSON` 1514a.

A leaf course instance has no subordinates and returns an empty list; a programme instance returns its tracks/specialisations. We don't assert a particular length — only that the response unwraps cleanly to a list.

1515a ⟨*test functions* 245a⟩+≡

```
def test_utbildningsinstans_underliggande_JSON(ladok) -> None:
  subs = ladok.utbildningsinstans_underliggande_JSON(dasak_instance_id)
  assert isinstance(subs, list)
```

This code is used in chunk 240.
Defines:
  `test_utbildningsinstans_underliggande_JSON`, never used.
Uses `dasak_instance_id` 240 and `utbildningsinstans_underliggande_JSON` 1514c.

22.17 utbildningstillfalle_lista_JSON

Returns all programme rounds (*utbildningstillfälle*) for a given education instance. Used when resolving which rounds of a master specialisation programme correspond to a given bachelor cohort's admission year.

1515b ⟨*LadokSession data methods* 249⟩+≡

```
  def utbildningstillfalle_lista_JSON(self, inst_uid: str) -> list:
    """Return all programme rounds for an education instance.

    Uses GET /utbildningsinformation/internal/utbildningstillfalle/lista/{uid}.
    """
    data = self.get_query(
      f"/utbildningsinformation/internal/utbildningstillfalle/lista/{inst_uid}",
      "application/vnd.ladok-utbildningsinformation+json",
    )
    try:
      return data["Utbildningstillfalle"]
    except KeyError as err:
```

```
        err.add_note(f"Response data: {data}")
        raise LadokAPIError(
          f"Unexpected response format when listing programme rounds "
          f"for instance {inst_uid}: missing 'Utbildningstillfalle' key"
        ) from err
```

Defines:
`utbildningstillfalle_lista_JSON`, used in chunk 1516.
Uses `get_query` 249 and `LadokAPIError` 242.

To exercise this method we need an `utbildningsinstans` UID for a programme (one that has rounds). We discover it from `program_round_by_uid_JSON` for the CTFYS test cohort: the round record carries an `UtbildningsinstansUID` pointing back at its parent instance, and listing the rounds of that instance must include the round we started from.

1516 ⟨*test functions* 245a⟩+≡

```
def test_utbildningstillfalle_lista_JSON(ladok) -> None:
    round_record = ladok.program_round_by_uid_JSON(CTFYS_round_id)
    inst_uid = round_record["UtbildningsinstansUID"]
    rounds = ladok.utbildningstillfalle_lista_JSON(inst_uid)
    assert isinstance(rounds, list)
    assert any(r.get("Uid") == CTFYS_round_id for r in rounds)
```

This code is used in chunk 240.
Defines:
`test_utbildningstillfalle_lista_JSON`, never used.
Uses `CTFYS_round_id` 1477, `program_round_by_uid_JSON` 1488b, and `utbildningstillfalle_lista_JSON` 1515b.

Chapter 23

Baltatzis' and Maguire's original `LadokSession` methods

Below are the original `LadokSession` methods by Baltatzis and Maguire. These are merely kept for backwards compatibility.

Their tests go into a file of their own, `test_undoc.py`. Each test file is tangled from one source file only, so test chunks here would otherwise never reach a test file. Like the other live tests, they take the session as the `ladok` fixture (Chapter 24), and they use the same test student as the tests of the API calls.

1517a ⟨*test* `undoc.py` 1517a⟩≡

```
import ladok3
import pytest

pytestmark = pytest.mark.vcr

student_uid = "de709f81-a867-11e7-8dbf-78e86dc2470c"

⟨test functions 1526a⟩
```

Root chunk (not used in this document).
Defines:
`pytestmark`, never used.
`student_uid`, used in chunks 283–87, 474b, 478b, 561b, 585c, 1483a, 1491a, 1492, 1501b, 1510, and 1526a.

The one missing is the constructor, that has been replaced by the code above. Also, the code has been adapted to use `self.session` instead of `self.__session` etc.

23.1 `get_results`, `save_result`

1517b ⟨*LadokSession data methods* 1517b⟩≡

```
################################################################
#
# LadokSession
#
# get_results      returnerar en dictionary med momentnamn och resultat
# save_result      sparar resultat för en student som utkast
#
```

```
# The original LadokSession code is from Alexander Baltatzis <alba@kth.se> on
# 2020-07-20
#
# I (Gerald Q. Maguire Jr.) have extended on 2020-07-21 and later with the code
# as noted below.
#
# I (Daniel Bosk) adapted (on 2021-01-08) the methods to a refactored
# LadokSession class.

######################################################################
#
# get_results
#
# person_nr          - personnummer, siffror i strängformat
#            t.ex. 191212121212
# course_code          - kurskod t.ex. DD1321
#
# RETURNERAR en dictionary från ladok med momentnamn, resultat
#
# {'LABP': {'date': '2019-01-14', 'grade': 'P', 'status': 'attested'},
#  'LABD': {'date': '2019-03-23', 'grade': 'E', 'status': 'pending(1)'},
#  'TEN1': {'date': '2019-03-13', 'grade': 'F', 'status': 'pending(2)'}}
#
#  status:  kan ha följande värden vilket gissningsvis betyder:
#           attested   - attesterad
#           pending(1) - utkast
#           pending(2) - klarmarkerad
#
def get_results(self, person_nr_raw, course_code):
  person_nr_raw = str(person_nr_raw)
  person_nr =  format_personnummer(person_nr_raw)
  if not person_nr: raise LadokValidationError('Invalid person nr ' + person_nr_raw)

  student_data = self.__get_student_data(person_nr)

  student_course = next(x
    for x in self.__get_student_courses(student_data['id'])
      if x['code'] == course_code)

  # get attested results
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/resultat/studentresultat/attesterade/student/' +
        student_data['id'],
    headers=self.headers).json()

  results_attested_current_course = None
  results = {}  # return value

  for course in r['StudentresultatPerKurs']:
```

```
      if course['KursUID'] == student_course['education_id']:
        results_attested_current_course = course['Studentresultat']
        break


    if results_attested_current_course:
      for result in results_attested_current_course:
        try:
            d = { 'grade' : result['Betygsgradskod'],
                  'status': 'attested',
                  'date'  : result['Examinationsdatum'] }
            results[ result['Utbildningskod'] ] = d
        except:
            pass  # tillgodoräknanden har inga betyg och då är result['Utbildningskod'] == None

    # get pending results
    r = self.session.get(
      url=self.base_gui_proxy_url + '/resultat/resultat/resultat/student/' +
        student_data['id'] + '/kurs/' + student_course['education_id'] +
          '?resultatstatus=UTKAST&resultatstatus=KLARMARKERAT',
      headers=self.headers).json()

    for result in r['Resultat']:
        r = self.session.get(
          url=self.base_gui_proxy_url + '/resultat/utbildningsinstans/' +
            result['UtbildningsinstansUID'],
          headers=self.headers).json()
        d_grade = result['Betygsgradsobjekt']['Kod']
        d_status = "pending(" + str(result['ProcessStatus']) + ")"
        # utkast har inte datum tydligen ...
        d_date = "0" if 'Examinationsdatum' not in result \
                     else result['Examinationsdatum']
        d = { 'grade' : d_grade ,
              'status': d_status,
              'date'  : d_date      }
        results[ r['Utbildningskod'] ] = d
    return results

##########################################################################
#
# save_result
#
# person_nr           - personnummer, flera format accepteras enligt regex:
#                       (\d\d)?(\d\d)(\d\d\d\d)[+\-]?(\w\w\w\w)
# course_code         - kurskod t.ex. DD1321
# course_moment       - ladokmoment/kursbetyg t.ex. TEN1, LAB1, DD1321 (!)
#                       om labmomententet är samma som course_code så sätts kursbetyg!
# result_date         - betygsdatum, flera format accepteras enligt regex
#                       (\d\d)?(\d\d)-?(\d\d)-?(\d\d)
# grade_code          - det betyg som ska sättas
```

```
  # grade_scale         - betygsskala t.ex. AF eller PF. Möjliga betygsskalor
  #                       listas i self.__grade_scales.
  #
  # RETURNERAR True om det gått bra, kastar (förhoppningsvis) undantag
  #            om det går dåligt.
  def save_result(self, person_nr_raw, course_code, course_moment,
    result_date_raw, grade_raw, grade_scale):
    if grade_raw in ["AF", "PF"]:
        raise LadokValidationError('Invalid grade: ' + grade_raw + ' looks like a grade_scale')

    if (grade_raw == 'P' and grade_scale == "AF") or \
       (grade_raw in "ABCDE" and grade_scale == "PF"):
      raise LadokValidationError('Invalid grade: ' + grade_raw +
        ' does not match grade_scale ' + grade_scale)

    person_nr =  format_personnummer(person_nr_raw)
    if not person_nr: raise LadokValidationError('Invalid person nr ' + person_nr_raw)

    result_date = self.__validate_date(result_date_raw)
    if not result_date:
      raise LadokValidationError('Invalid grade date: ' + result_date_raw + ' pnr: ' +
        person_nr_raw + ' moment: ' + course_moment)

    student_data = self.__get_student_data(person_nr)
    student_course = next(x
      for x in self.__get_student_courses(student_data['id'])
        if x['code'] == course_code)

    # momentkod = kurskod => vi hanterar kursbetyg
    if course_moment == student_course['code']:
        course_moment_id = student_course['instance_id']
    else:
        for x in self.__get_student_course_moments(student_course['round_id'],
          student_data['id']):
          if x['code'] == course_moment:
            course_moment_id = x['course_moment_id']

    student_course_results = self.__get_student_course_results(
      student_course['round_id'], student_data['id'])

    grade_scale = self.__get_grade_scale_by_code(grade_scale)
    grade = grade_scale.grades(code=grade_raw)[0]

    headers = self.headers.copy()
    headers['Content-Type'] = 'application/vnd.ladok-resultat+json'
    headers['X-XSRF-TOKEN'] = self.__get_xsrf_token()
    headers['Referer'] = self.base_gui_url

    previous_result = None
```

```
    for result in student_course_results['results']:
        if result['pending'] is not None:
            if result['pending']['moment_id'] == course_moment_id:
                previous_result = result['pending']
                break

    # uppdatera befintligt utkast
    if previous_result:
        put_data = {
            'Resultat': [{
                'ResultatUID': previous_result['id'],
                'Betygsgrad': grade.id,
                'Noteringar': [],
                'BetygsskalaID': grade_scale.id,
                'Examinationsdatum': result_date,
                'SenasteResultatandring': previous_result['last_modified']
            }]
        }

        r = self.session.put(
          url=self.base_gui_proxy_url + '/resultat/studieresultat/uppdatera',
          json=put_data,
          headers=headers)

    # lägg in nytt betygsutkast
    else:
        post_data = {
            'Resultat': [{
                'StudieresultatUID': student_course_results['id'],
                'UtbildningsinstansUID': course_moment_id,
                'Betygsgrad': grade.id,
                'Noteringar': [],
                'BetygsskalaID': grade_scale.id,
                'Examinationsdatum': result_date
            }]
        }
        r = self.session.post(
          url=self.base_gui_proxy_url + '/resultat/studieresultat/skapa',
          json=post_data,
          headers=headers)

    if not 'Resultat' in r.json():
      raise LadokServerError("Couldn't register " +
        course_moment + "=" + grade_raw + " " + result_date_raw + ": " +
          r.json()["Meddelande"])

    return True
```

This definition is continued in chunks 1522–26.
Root chunk (not used in this document).
Defines:

`get_results`, never used.
`save_result`, never used.
Uses `__get_grade_scale_by_code` 1526b, `__get_student_course_moments` 1526b, `__get_student_course_results` 1526b, `__get_student_courses` 1526b, `__get_student_data` 1526b, `__get_xsrf_token` 1526b, and `__validate_date` 1526b.

23.2 `get_student_data`, `get_student_name`

1522 ⟨*LadokSession data methods* 1517b⟩+≡

```
  ########################################################################
  #
  # get_student_data
  #
  # person_nr           - personnummer, flera format accepteras enligt regex:
  #                       (\d\d)?(\d\d)(\d\d\d\d)[+\-]?(\w\w\w\w)
  #
  # RETURNERAR {'id': 'xxxx', 'first_name': 'x', 'last_name': 'y', 'person_nr': 'xxx', 'alive': True}

  def get_student_data(self, person_nr_raw):
    person_nr =  format_personnummer(person_nr_raw)

    if not person_nr: raise LadokValidationError('Invalid person nr ' + person_nr_raw)

    student_data = self.__get_student_data(person_nr)
    return student_data

  ########################################################################
  #
  # get_student_name
  #
  # person_nr           - personnummer, flera format accepteras enligt regex:
  #                       (\d\d)?(\d\d)(\d\d\d\d)[+\-]?(\w\w\w\w)
  #
  # RETURNERAR en dictionary med för- och efternamn
  #
  # {"first_name" : 'Anna', "last_name : 'Andersson'}
  #
  def get_student_name(self, person_nr_raw):
    person_nr =  format_personnummer(person_nr_raw)

    if not person_nr: raise LadokValidationError('Invalid person nr ' + person_nr_raw)

    student_data = self.__get_student_data(person_nr)
    return {
      "first_name": student_data["first_name"],
      "last_name" : student_data["last_name"]
    }
```

Defines:
`get_student_data`, never used.
`get_student_name`, never used.
Uses `__get_student_data` 1526b.

23.3 all_grading_scale

This is just to maintain the old method name.

1523a ⟨LadokSession data methods 1517b⟩+≡

```
# added by GQMJr
#############################################################################
#
# all_grading_scale
#
#
# RETURNERAR en dictionary of the grading scales
def all_grading_scale(self):
  return self.get_grade_scales()
```

Defines:
all_grading_scale, never used.

23.4 change_locale

This probably changes the default locale in the LADOK web interface. And that might affect the default languages in responses. Needs testing though.

1523b ⟨LadokSession data methods 1517b⟩+≡

```
# added by GQMJr
#############################################################################
#
# change_locale
#
# lang               - language code 'en' or 'sv', defaults to 'sv'
#
# RETURNERAR reponse to the request
def change_locale(self, lang = 'sv'):
  r = self.session.get(
    url=self.base_gui_url+'/services/i18n/changeLocale?lang='+lang,
    headers=self.headers).json()
  return r
```

Defines:
change_locale, never used.

23.5 period_info_JSON

This no longer works. We should investigate if there is another API call to get this information.

1523c ⟨LadokSession data methods 1517b⟩+≡

```
# added by GQMJr
#############################################################################
#
# period_info_JSON
#
# RETURNERAR JSON of /resultat/grunddata/period
```

```
  def period_info_JSON(self):
    r = self.session.get(
      url=self.base_gui_proxy_url + '/resultat/internal/grunddata/period',
      # doesn't work, but also not after adding 'internal/' between 'resultat/'
      # and 'grunddata' /CO
      headers=self.headers).json()
    return r
```

Defines:
period_info_JSON, never used.

23.6 organisation_by_uid_JSON

1524a ⟨*LadokSession data methods* 1517b⟩+≡

```
  # added by GQMJr
  ########################################################################
  #
  # organisation_by_uid_JSON
  #
  # organisationUid           -- organization's UID
  #
  # RETURNERAR JSON of selected organization
  def organisation_by_uid_JSON(self, organisationUid):
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/kataloginformation/organisation/'+organisationUid,
      headers=self.headers).json()
    return r

  # returns:
  # {   'Benamning': {'en': 'EECS/Computer Science', 'sv': 'EECS/Datavetenskap'},
  # 'Giltighetsperiod': {'Startdatum': '2019-01-01', 'link': []},
  # 'Organisationsenhetstyp': 1,
  # 'Organisationskod': 'JH',
  # 'Uid': '2474f616-dc41-11e8-8cc1-eaeeb71b497f',
  # 'link': [   {   'mediaType': 'application/vnd.ladok+xml,application/vnd.ladok-kataloginformation+xml,a
  #                 'method': 'GET',
  #                 'rel': 'self',
  #                 'uri': 'https://api.ladok.se:443/kataloginformation/organisation/2474f616-dc41-11e8-8c
```

Defines:
organisation_by_uid_JSON, never used.

23.7 examen_student_uid_JSON

This doesn't work anymore.

1524b ⟨*LadokSession data methods* 1517b⟩+≡

```
  # added by GQMJr
  def examen_student_uid_JSON(self, studentUID):
    """
    Returns the student's degree.
```

```
    """
    r = self.session.get(
      url=self.base_gui_proxy_url + 'examen/internal/student/+studentUID',
      headers=self.headers).json()
    return r
```

Defines:
examen_student_uid_JSON, never used.

23.8 student_participation_JSON

This doesn't seem to work anymore.

1525a ⟨*LadokSession data methods* 1517b⟩+≡

```
  # added by GQMJr
  def student_participation_JSON (self, studentUID):
    """
    Returns the student's participation in courses.
    """
    headers = self.headers.copy()
    headers['Content-Type'] = 'application/vnd.ladok-studiedeltagande'
    headers['Accept'] += ', application/vnd.ladok-studiedeltagande'
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/studiedeltagande/internal/tillfallesdeltagande' +
        '/kurstillfallesdeltagande/' + studentUID,
      headers=self.headers)
    return r.json()
```

Defines:
student_participation_JSON, never used.

23.9 hamtaStudieResultatForStudent_JSON

This method returned all study results of a student, under `Resultat`. LADOK removed the endpoint behind it in its update of 20 October 2026; it now answers with a 404 and an HTML error page. The results of a student are still available, course by course, through `student_results_JSON`.

We keep the method for backwards compatibility, but it must fail clearly. It used to decode the response as JSON without looking at it, so the HTML page gave a `JSONDecodeError`, which tells the caller nothing about LADOK. It now goes through `get_query`, like the methods of the API chapters, which turns a failed request into a `LadokAPIError` that names the path and the status. That error is also what a caller that handles LADOK's errors already catches.

1525b ⟨*LadokSession data methods* 1517b⟩+≡

```
  # added by GQMJr
  def hamtaStudieResultatForStudent_JSON (self, studentUID):
    """
    Returns the study results for a student.

    LADOK removed this endpoint on 2026-10-20, so this raises LadokAPIError;
```

```
    use student_results_JSON for a student's results on a course.
    """
    return self.get_query(
      '/resultat/internal/studieresultat/resultat/student/' + studentUID)
```

Defines:
`hamtaStudieResultatForStudent_JSON`, used in chunk 1526a.

Let's verify that the method fails with LADOK's error. In a live run, the test also tells us if LADOK brings the endpoint back. We expect a `LadokAPIError` and not one of its subclasses, since a 404 carries no message from LADOK.

1526a ⟨*test functions* 1526a⟩≡

```
def test_hamtaStudieResultatForStudent_JSON(ladok):
  with pytest.raises(ladok3.LadokAPIError, match="404") as error:
    ladok.hamtaStudieResultatForStudent_JSON(student_uid)
  assert type(error.value) is ladok3.LadokAPIError
```

This code is used in chunk 1517a.
Defines:
`test_hamtaStudieResultatForStudent_JSON`, never used.
Uses `hamtaStudieResultatForStudent_JSON` 1525b and `student_uid` 240 1517a.

23.10 Helper methods

1526b ⟨*LadokSession data methods* 1517b⟩+≡

```
  ######################################################################
  ##
  ## private methods
  ##

  def __get_xsrf_token(self):
    return self.xsrf_token

  def get_xsrf_token(self):
    return self.xsrf_token


  # returns None or a LADOK-formated date
  def __validate_date(self, date_raw):
    datregex = re.compile(r"(\d\d)?(\d\d)-?(\d\d)-?(\d\d)")
    dat = datregex.match(date_raw)
    if dat:
      if dat.group(1) == None: # add 20, ladok3 won't survive till 2100
        return "20" + dat.group(2) + "-" + dat.group(3) + "-" + dat.group(4)
      else:
        return dat.group(1) + dat.group(2) + \
          "-" + dat.group(3) + "-" + dat.group(4)
    else:
      return None

  def __get_grade_scale_by_id(self, grade_scale_id):
    return next(grade_scale
      for grade_scale in self.get_grade_scales()
```

```
      if grade_scale.id == grade_scale_id)


def __get_grade_scale_by_code(self, grade_scale_code):
  return next(grade_scale
    for grade_scale in self.get_grade_scales()
      if grade_scale.code == grade_scale_code)


def __get_grade_by_id(self, grade_id):
  for grade_scale in self.get_grade_scales():
    for grade in grade_scale.grades():
      if grade.id == grade_id:
        return grade

  return None


def __get_student_data(self, person_nr):
  r = self.session.get(
    url=self.base_gui_proxy_url +
      '/studentinformation/student/filtrera?limit=2&orderby=EFTERNAMN_ASC&orderby=FORNAMN_ASC&orderby=PE
        + person_nr + '&skipCount=false&sprakkod=sv',
    headers=self.headers).json()['Resultat']

  if len(r) != 1: return None

  r = r[0]
  # from schemas/schemas.ladok.se-studentinformation.xsd
  #   <xs:complexType name="Student">
  #   <xs:complexContent>
  #     <xs:extension base="base:BaseEntitet">
  #       <xs:sequence>
  #         <xs:element name="Avliden" type="xs:boolean"/>
  #         <xs:element minOccurs="0" name="Efternamn" type="xs:string"/>
  #         <xs:element minOccurs="0" name="ExterntUID" type="xs:string"/>
  #         <xs:element name="FelVidEtableringExternt" type="xs:boolean"/>
  #         <xs:element minOccurs="0" name="Fodelsedata" type="xs:string"/>
  #         <xs:element minOccurs="0" name="Fornamn" type="xs:string"/>
  #         <xs:element minOccurs="0" name="KonID" type="xs:int"/>
  #         <xs:element minOccurs="0" name="Personnummer" type="xs:string"/>
  #         <xs:element minOccurs="0" name="Skyddsstatus" type="xs:string"/>
  #         <xs:element minOccurs="0" ref="si:UnikaIdentifierare"/>
  #       </xs:sequence>
  #     </xs:extension>
  #   </xs:complexContent>
  # </xs:complexType>

  return {
    'id':         r['Uid'], # Ladok-ID
```

```
      'first_name': r['Fornamn'],
      'last_name':  r['Efternamn'],
      'person_nr':  r['Personnummer'], # tolv siffror, utan bindestreck eller plustecken
      'alive':  not r['Avliden']
    }

  # detta är egentligen kurstillfällen, inte kurser (ID-numret är alltså ett ID-nummer för ett kurstillfäl
  def __get_student_courses(self, student_id):
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/studiedeltagande/tillfallesdeltagande/kurstillfallesdeltagande/student/'
          + student_id,
      headers=self.headers).json()

    results = []

    for course in r['Tillfallesdeltaganden']:
      if not course['Nuvarande'] or \
         'Utbildningskod' not in course['Utbildningsinformation']:
        continue

      results.append({
        'id': course['Uid'],
        'round_id': course['Utbildningsinformation']['UtbildningstillfalleUID'], # ett Ladok-ID för kursom
        'education_id': course['Utbildningsinformation']['UtbildningUID'], # ett Ladok-ID för något annat
        'instance_id': course['Utbildningsinformation']['UtbildningsinstansUID'], # ett Ladok-ID för att r
        'code': course['Utbildningsinformation']['Utbildningskod'], # kurskod KOPPS
        'name': course['Utbildningsinformation']['Benamning']['sv']
      })

    return results


  def __get_student_course_moments(self, course_round_id, student_id):
    r = self.session.get(
      url=self.base_gui_proxy_url +
        '/resultat/kurstillfalle/' + str(course_round_id) +
          '/student/' + str(student_id) + '/moment',
      headers=self.headers).json()

    return [{
      'course_moment_id': moment['UtbildningsinstansUID'],
      'code': moment['Utbildningskod'],
      'education_id': moment['UtbildningUID'],
      'name': moment['Benamning']['sv']
    } for moment in r['IngaendeMoment']]


  def __get_student_course_results(self, course_round_id, student_id):
    r = self.session.get(
```

```
      url=self.base_gui_proxy_url +
        '/resultat/studieresultat/student/' + student_id +
          '/utbildningstillfalle/' + course_round_id,
      headers=self.headers).json()

    return {
      'id': r['Uid'],
      'results': [{
        'education_id': result['UtbildningUID'],
        'pending': {
          'id': result['Arbetsunderlag']['Uid'],
          'moment_id': result['Arbetsunderlag']['UtbildningsinstansUID'],
          'grade': self.__get_grade_by_id(result['Arbetsunderlag']['Betygsgrad']),
          'date': result['Arbetsunderlag']['Examinationsdatum'],
          'grade_scale': self.__get_grade_scale_by_id(result['Arbetsunderlag']['BetygsskalaID']),
          # behövs vid uppdatering av betygsutkast
          'last_modified': result['Arbetsunderlag']['SenasteResultatandring']
        } if 'Arbetsunderlag' in result else None,
        'attested': {
          'id': result['SenastAttesteradeResultat']['Uid'],
          'moment_id': result['SenastAttesteradeResultat']['UtbildningsinstansUID'],
          'grade': self.__get_grade_by_id(result['SenastAttesteradeResultat']['Betygsgrad']),
          'date': result['SenastAttesteradeResultat']['Examinationsdatum'],
          'grade_scale': self.__get_grade_scale_by_id(result['SenastAttesteradeResultat']['BetygsskalaID']
        } if 'SenastAttesteradeResultat' in result else None
      } for result in r['ResultatPaUtbildningar']]
    }
```

Defines:
- `__get_grade_by_id`, never used.
- `__get_grade_scale_by_code`, used in chunk 1517b.
- `__get_grade_scale_by_id`, never used.
- `__get_student_course_moments`, used in chunk 1517b.
- `__get_student_course_results`, used in chunk 1517b.
- `__get_student_courses`, used in chunk 1517b.
- `__get_student_data`, used in chunks 1517b and 1522.
- `__get_xsrf_token`, used in chunk 1517b.
- `__validate_date`, used in chunk 1517b.
- `get_xsrf_token`, never used.

Part V

Testing

Chapter 24

Testing

The tests live in the same files as the code they verify, right after it, and `make test` tangles them into `tests/test_*.py` and runs `pytest`. This chapter covers what the individual tests share: how a test gets a LADOK session, how the tests that talk to LADOK can run without it, and how we keep personal data out of what we record.

24.1 Three kinds of tests

The tests fall into three groups, by what they need from LADOK.

Offline tests exercise our own code: parsing, the command-line interface, the reporting logic, session sharing. They use real objects where they can and small local stand-ins where a LADOK response is needed. They need no network and no credentials.

Read tests send requests to LADOK and check the responses. Most of them are in the chapters on the API calls.

Write tests create, update, finalize and remove results. They are marked `mutates`.

LADOK's test environment is not a sandbox filled with made-up data. It is a copy of production, synced again every week, so the students in it are real people and a write changes a real record until the next sync. Logging in also takes multi-factor authentication, which needs a person at hand. Yet we want `make test` to check the code that talks to LADOK, offline and without anyone at hand.

We therefore record LADOK's responses once and replay them. The read and write tests run in three modes, with the same test code:

Replay is the default: `make test`. Each test that talks to LADOK gets its responses from a recording, a *cassette* in `tests/cassettes`. No request leaves the machine, and no credentials are needed. A test without a cassette is skipped, with the reason.

Live is `make test PYTESTFLAGS=--live`. Every test runs against LADOK's test environment, and the responses are recorded afresh, but into a temporary directory, never over the cassettes in `tests/cassettes`. Afterwards we compare the structure of the fresh recordings with the ones we replay (Section 24.6). This tells us when LADOK has changed under us, which a replay never can.

Recording is `make test PYTESTFLAGS=--record-mode=once`, which records the cassettes that are missing, or `--record-mode=rewrite`, which records them all again. It talks to LADOK like a live run but writes to `tests/cassettes`.

Write tests change data, so they reach LADOK only when we also give `--live-writes`; in replay they replay like the others.

The cassettes are not in the repository. Even pseudonymized, they hold the records of whole groups of real students (the participants of a course round, their grades and dates), linked by LADOK's UIDs, and whoever holds the key can undo the pseudonyms. They therefore stay on the machine that recorded them, and `tests/.gitignore` keeps them out of git. Anyone who can log in to LADOK's test environment can record their own (Section 24.7); without cassettes, the tests that talk to LADOK are skipped, and the offline tests still run. Both live runs and recording need the key that pseudonymizes the recordings (Section 24.5.1).

Earlier, the test modules created their session at import time. That had two bad effects. Without credentials, the import failed, so `pytest` could not collect the module, and its offline tests never ran either. With credentials, a plain `make test` was a live run: it logged in, could prompt for MFA and wrote results, and `make publish` runs `make test` before every release. Taking the session from a fixture fixes both problems. A fixture runs only when a test asks for it, so it can skip that test or hand it an offline session instead of failing the import.

24.2 The shared test configuration

`pytest` reads command-line options and shared fixtures from a file `conftest.py` in the test directory, which we tangle from here. The recording itself is done by the `pytest-recording` plugin, which wraps `vcrpy`. A test marked `@pytest.mark.vcr` gets a cassette named after the test, and `--record-mode` chooses between replaying and recording. We add the live mode, the LADOK session, and the privacy protection.

The scrubbing and the drift comparison come from `vcr_support.py`. It is not ours: it is a helper from the `testing` skill for Claude Code, committed unchanged in `tests/` so that it can be updated from its source (the copy is from commit d2de183 of the skills repository). Everything that is specific to LADOK we pass to it from here.

1532 ⟨`conftest.py` 1532⟩≡

```
"""Shared pytest configuration for ladok3's tests.

Tangled from src/ladok3/testing.nw; edit that file, not this one.
"""
import datetime
import hashlib
import json
import os
import re
import shutil
import sys
import urllib.parse
from pathlib import Path

```

```
import ladok3
import pytest
import yaml

sys.path.insert(0, str(Path(__file__).resolve().parent))
import vcr_support  # noqa: E402

pytest_plugins = ["pytester"]

⟨constants 1535a⟩
⟨command-line options 1533b⟩
⟨test configuration 1534a⟩
⟨collection rules 1536a⟩
⟨fixtures 1537⟩
⟨checks after the run 1544⟩
```

Root chunk (not used in this document).
Defines:
`pytest_plugins`, never used.

The configuration is code like any other, and parts of it guard against writing to real records and leaking personal data, so it has tests of its own, in `test_testing.py`. They import the functions from `conftest`, which `pytest` has already loaded. Some of them run `pytest` itself on a small test file, through the `pytester` fixture, which comes in a plugin that we enable above.

1533a ⟨*test* `testing.py` 1533a⟩≡

```
import json

import pytest
import yaml

import conftest

⟨test functions 1535c⟩
```

Root chunk (not used in this document).

Replay must never reach the network, not even by mistake. In `pyproject.toml` we therefore give `pytest` the options `--block-network --allowed-hosts=127.0.0.1,::1,localhost`: any request to another host then fails, unless a live run or a recording turns the block off.

24.3 Choosing the mode

The two live options are separate because they carry different risks. A read test only looks at the data, while a write test changes it.

1533b ⟨*command-line options* 1533b⟩≡

```
def pytest_addoption(parser):
  group = parser.getgroup("ladok3")
  group.addoption(
    "--live", action="store_true",
    help="run the tests against LADOK's test environment, record into a "
         "temporary directory and compare with the cassettes "
```

```
          "(attended: may prompt for MFA)")
  group.addoption(
    "--live-writes", action="store_true",
    help="with --live or --record-mode, also run the tests that change "
         "data in LADOK's test environment")
  group.addoption(
    "--live-dir", default=None,
    help="where --live records, as --live-dir=PATH "
         "(default: a private directory under the temporary directory)")
```

This code is used in chunk 1532.
Defines:
`pytest_addoption`, never used.
Uses `live` 1541b.

A live run is a recording that goes elsewhere. We set the record mode to `all`, so every request goes to LADOK, and turn the network block off. We have to set the options themselves rather than the fixtures, because `pytest-recording` reads its network block from the options. Recording needs the pseudonymization key; without it we refuse to start rather than record anyone's data in clear.

1534a ⟨*test configuration* 1534a⟩≡

```
def pytest_configure(config):
  config.addinivalue_line(
    "markers",
    "mutates: the test changes data in LADOK; reaches LADOK only with "
    "--live-writes")
  config._recorded_dirs = set()
  if config.getoption("--live"):
    config.option.record_mode = "all"
    config.option.block_network = False
    config._live_dir = live_directory(config)
    prepare_live_dir(config._live_dir, Path(str(config.rootpath)).resolve())
  if record_mode_of(config) != "none" \
      and not os.environ.get(vcr_support.KEY_ENV):
    pytest.exit(f"refusing to record: set {vcr_support.KEY_ENV} so that "
                "personal data is pseudonymized", returncode=2)


def record_mode_of(config):
  """Return the record mode, `none` meaning replay."""
  return config.getoption("--record-mode") or "none"
```

This definition is continued in chunks 1534b and 1535b.
This code is used in chunk 1532.
Defines:
`pytest_configure`, never used.
`record_mode_of`, used in chunks 1536a and 1541c.
Uses `live` 1541b, `live_directory` 1534b, and `prepare_live_dir` 1535b.

The live recordings hold real people's data, pseudonymized, so they go in a private directory outside the repository rather than in the shared temporary directory. The directory name includes a hash of the project's path, so two checkouts don't share one.

1534b ⟨*test configuration* 1534a⟩+≡

```
def live_directory(config):
```

```
    """Return the directory that a live run records into."""
    root = Path(str(config.rootpath))
    tag = hashlib.sha256(str(root.resolve()).encode()).hexdigest()[:10]
    return Path(config.getoption("--live-dir")
                or vcr_support.private_dir()
                   / f"{root.name}-{tag}-live-cassettes").resolve()
```

This code is used in chunk 1532.
Defines:
`live_directory`, used in chunk 1534a.
Uses `live` 1541b.

A live run starts with an empty directory, so that recordings from an earlier run can't hide that a request is no longer made. Emptying a directory is dangerous if the path is mistyped, so we only empty a directory that an earlier live run wrote, as shown by a marker file, and we never accept a directory that contains the project.

1535a ⟨*constants* 1535a⟩≡

```
LIVE_MARKER_FILE = ".pytest-live-cassettes"
```

This definition is continued in chunks 1542 and 1546a.
This code is used in chunk 1532.
Defines:
`LIVE_MARKER_FILE`, used in chunks 1535b and 1545.
Uses `live` 1541b.

1535b ⟨*test configuration* 1534a⟩+≡

```
def prepare_live_dir(live_dir, root):
  """Empty `live_dir` for a live run, if an earlier live run made it."""
  if live_dir == root or live_dir in root.parents:
    pytest.exit(f"refusing --live-dir={live_dir}: it contains the project",
                returncode=2)
  if live_dir.exists() and any(live_dir.iterdir()):
    if not (live_dir / LIVE_MARKER_FILE).exists():
      pytest.exit(f"refusing to empty --live-dir={live_dir}: it has files "
                  "that an earlier live run did not write", returncode=2)
    shutil.rmtree(live_dir)
  live_dir.mkdir(parents=True, exist_ok=True)
  (live_dir / LIVE_MARKER_FILE).write_text(
    "written by pytest --live; safe to delete\n")
```

This code is used in chunk 1532.
Defines:
`prepare_live_dir`, used in chunks 1534a and 1535c.
Uses `live` 1541b and `LIVE_MARKER_FILE` 1535a.

Let's verify that a live run empties only its own directory.

1535c ⟨*test functions* 1535c⟩≡

```
def test_prepare_live_dir_empties_only_its_own(tmp_path):
  project = tmp_path / "project"
  live = tmp_path / "live"
  conftest.prepare_live_dir(live, project)
  (live / "old.yaml").write_text("from an earlier live run")
  conftest.prepare_live_dir(live, project)
  assert not (live / "old.yaml").exists()

def test_prepare_live_dir_refuses_foreign_files(tmp_path):
  live = tmp_path / "live"
```

```
    live.mkdir()
    (live / "precious.txt").write_text("not ours")
    with pytest.raises(pytest.exit.Exception):
      conftest.prepare_live_dir(live, tmp_path / "project")
    assert (live / "precious.txt").exists()

  def test_prepare_live_dir_refuses_the_project(tmp_path):
    with pytest.raises(pytest.exit.Exception):
      conftest.prepare_live_dir(tmp_path, tmp_path / "project")
```

This definition is continued in chunks 1536b, 1538b, 1543a, and 1547.
This code is used in chunk 1533a.
Defines:
`test_prepare_live_dir_empties_only_its_own`, never used.
`test_prepare_live_dir_refuses_foreign_files`, never used.
`test_prepare_live_dir_refuses_the_project`, never used.
Uses `live` 1541b and `prepare_live_dir` 1535b.

A `mutates` test is skipped when it would reach LADOK, in a live run or while recording, unless we asked for writes. In replay it runs: then its writes go to the cassette, not to LADOK.

1536a ⟨*collection rules* 1536a⟩≡

```
def pytest_collection_modifyitems(config, items):
  talks_to_ladok = record_mode_of(config) != "none"
  if not talks_to_ladok or config.getoption("--live-writes"):
    return
  skip_writes = pytest.mark.skip(
    reason="changes data in LADOK; add --live-writes")
  for item in items:
    if "mutates" in item.keywords:
      item.add_marker(skip_writes)
```

This code is used in chunk 1532.
Defines:
`pytest_collection_modifyitems`, never used.
Uses `live` 1541b and `record_mode_of` 1534a.

Let's verify the rule in each mode, by running `pytest` on a small test file with this configuration. The inner run replaces the login fixture, so it never logs in to LADOK, whatever mode it is in.

1536b ⟨*test functions* 1535c⟩+≡

```
INNER_TESTS = """
import pytest

@pytest.fixture(scope="session", autouse=True)
def live_ladok():
  return "the inner run never logs in"

@pytest.mark.mutates
def test_writes():
  pass

def test_reads():
  pass
"""
```

```
15
16  @pytest.mark.parametrize("options,passed,skipped", [
17    ([], 2, 0),
18    (["--live"], 1, 1),
19    (["--live", "--live-writes"], 2, 0),
20  ])
21  def test_mutates_tests_reach_ladok_only_with_live_writes(
22      pytester, monkeypatch, tmp_path, options, passed, skipped):
23    monkeypatch.setenv("TEST_PSEUDONYM_KEY", "a key for the inner run")
24    pytester.makeconftest(pathlib_text(conftest.__file__))
25    pytester.makepyfile(test_inner=INNER_TESTS)
26    result = pytester.runpytest_inprocess(
27      *options, f"--live-dir={tmp_path / 'live'}", "-p", "no:cacheprovider")
28    result.assert_outcomes(passed=passed, skipped=skipped)
29
30  def pathlib_text(path):
31    with open(path, encoding="utf-8") as file:
32      return file.read()
```

This code is used in chunk 1533a.
Defines:
`INNER_TESTS`, never used.
`live_ladok`, used in chunk 1540.
`pathlib_text`, never used.
`test_mutates_tests_reach_ladok_only_with_live_writes`, never used.
`test_reads`, never used.
`test_writes`, never used.
Uses `live` 1541b.

24.4 Sessions for the tests

When we talk to LADOK, all tests share one session, `ladok3.test_session`. It reuses the cached login from `ladok login` (Section 8.1), so a live run usually needs no new MFA prompt.

The login must not end up in a cassette. The SAML response that the login posts back to LADOK is the signed identity of whoever logged in, and no scrubber can read it. We therefore log in before any cassette opens. `pytest-recording` opens a test's cassette in a function-scoped fixture, and `pytest` sets up session-scoped fixtures before function-scoped ones, so a session-scoped fixture that makes the first request does the login outside every cassette. It must be `autouse`, because a fixture that a test asks for by name may be set up after the cassette is already open. When there are no stored credentials, `ladok3.test_session` raises `RuntimeError`. The tests that need LADOK are then skipped rather than failed, since the problem is the machine's set-up, not the code; the fixture itself must not skip, because skipping an `autouse` fixture would skip the offline tests too. Any other error is left to fail, because it may well be a bug in the login code.

1537 ⟨*fixtures* 1537⟩≡

```
1  @pytest.fixture(scope="session")
2  def recording(record_mode):
3    """True when the tests talk to LADOK: a live run or a recording."""
4    return record_mode != "none"
5
```

```
6
7  @pytest.fixture(scope="session", autouse=True)
8  def live_ladok(recording, pytestconfig):
9    """The logged-in session for LADOK's test environment, or the reason why
10   there is none.  Logs in before any cassette opens."""
11   if not recording:
12     return "replaying"
13   return log_in_for_tests(lambda: ladok3.test_session,
14                           into_project=not pytestconfig.getoption("--live"))
```

This definition is continued in chunks 1538–41 and 1543b.
This code is used in chunk 1532.
Defines:
`live_ladok`, used in chunk 1540.
`recording`, used in chunks 1540 and 1543b.
Uses `live` 1541b and `log_in_for_tests` 1538a.

Skipping is right for a live run, which records into a directory of its own. It is wrong when we record into the project's cassettes. With `--record-mode=rewrite`, `pytest-recording` deletes a test's cassette when it opens it, and that happens before the `ladok` fixture learns that there is no login and skips. A run whose login failed then deletes the very cassettes that it was meant to renew, and still exits successfully, reporting only skips. So when we record into the project, a failed login stops the whole run, here, before any cassette opens.

One `RuntimeError` is not a missing login: `RecursionError`. It is how a login that loops ends, so it is a bug, and we let it fail. This is not hypothetical. A `weblogin` handler that another program had added to the cached session once replayed a one-time step of the login, over and over, for a quarter of an hour; the `RecursionError` at the end was taken for missing credentials, the tests were skipped, and the run recording them deleted their cassettes.

1538a ⟨*fixtures* 1537⟩+≡

```
1  def log_in_for_tests(get_session, into_project):
2    """Return the logged-in session from `get_session()`, or the reason why
3    there is none.  Stops the run instead when we record into the project's
4    cassettes, which a skipped test could delete."""
5    try:
6      session = get_session()
7      session.user_info_JSON()
8    except RecursionError:
9      raise
10   except RuntimeError as err:
11     if into_project:
12       pytest.exit(f"cannot log in to LADOK, so nothing is recorded: {err}",
13                   returncode=1)
14     return f"cannot log in to LADOK: {err}"
15   return session
```

This code is used in chunk 1532.
Defines:
`log_in_for_tests`, used in chunks 1537 and 1538b.

Let's verify the three outcomes with a login that fails the way a missing login does, and with one that fails the way a looping login does. We inject the failures: the real login would need credentials and LADOK.

1538b ⟨*test functions* 1535c⟩+≡

```
def no_stored_credentials():
  raise RuntimeError("no stored credentials")

def test_failed_login_stops_a_recording_into_the_project():
  with pytest.raises(pytest.exit.Exception):
    conftest.log_in_for_tests(no_stored_credentials, into_project=True)

def test_failed_login_skips_the_ladok_tests_of_a_live_run():
  reason = conftest.log_in_for_tests(no_stored_credentials,
                                     into_project=False)
  assert "no stored credentials" in reason

def test_a_login_that_loops_is_a_bug_not_a_missing_login():
  def looping_login():
    raise RecursionError("maximum recursion depth exceeded")

  with pytest.raises(RecursionError):
    conftest.log_in_for_tests(looping_login, into_project=False)
```

This code is used in chunk 1533a.
Defines:
`no_stored_credentials`, never used.
`test_a_login_that_loops_is_a_bug_not_a_missing_login`, never used.
`test_failed_login_skips_the_ladok_tests_of_a_live_run`, never used.
`test_failed_login_stops_a_recording_into_the_project`, never used.
Uses `log_in_for_tests` 1538a.

In replay, the tests get a session that never logs in. It needs one thing that a logged-in session has: LADOK's `XSRF-TOKEN` cookie, which the write requests send back (Section 16.3.3). The cassettes keep the cookie but not its value, so a placeholder is enough. Its value can be anything, but its domain cannot. A session takes only the token that its own host set, so that the test environment's token never stands in for production's (Section 16.3.3). A cookie set without a domain is not one that any host set, so the session would not find it and every write request would fail before it is sent. We therefore set the placeholder the way LADOK sets the real cookie: on the bare host name of the session's `base_url`, derived the same way the session derives it when it looks the token up.

1539 ⟨*fixtures* 1537⟩+≡

```
@pytest.fixture(scope="session")
def replay_ladok():
  """A session for LADOK's test environment that never logs in."""
  session = ladok3.LadokSession("KTH Royal Institute of Technology",
                                test_environment=True)
  host = urllib.parse.urlparse(session.base_url).hostname
  session.session.cookies.set("XSRF-TOKEN", vcr_support.SECRET_PLACEHOLDER,
                              domain=host)
  return session
```

This code is used in chunk 1532.
Defines:
`replay_ladok`, used in chunks 1540 and 1541a.

The tests ask for `ladok` and get whichever session fits the mode. In replay, a test without a cassette is skipped: without one, its first request would only fail on the network block. A test that uses `ladok` must be marked `vcr`, though, or it is never

recorded: it would be skipped in replay for ever and talk to LADOK unrecorded in a live run, outside the drift check. We fail such a test rather than let it skip quietly.

Each test starts with an empty cache. `LadokSession` caches some responses, such as the grade scales, and the session is shared by all tests. Without clearing it, what a test requests, and therefore what its cassette holds, would depend on which tests ran before it: a test recorded after another that filled the cache would, when run alone, make a request that its cassette lacks.

The XSRF token needs the same care. Before a PUT, POST or DELETE, `LadokSession` makes a request to refresh the token if it has made none in the last 15 minutes (Section 16.3.3). While recording, the shared session has always just been used, so that request never happens; a replay session made a moment ago has not been used at all, so it would. We therefore mark the replay session as just used, before each test. This reaches into a private attribute, which is the price of keeping the freshness rule out of the public interface.

Finally, in replay we check that the test made every request its cassette holds. By default `vcrpy` only answers the requests that come; it doesn't notice one that never comes. A write test whose DELETE was never sent would then still pass, because the requests after it replay the recorded state, in which the result is gone. The check runs after the test's other fixtures are torn down, since they were set up after `ladok`, so it covers the cleanup's requests too.

1540 ⟨*fixtures* 1537⟩+≡

```
@pytest.fixture
def ladok(request, recording, live_ladok, vcr,
          vcr_cassette_dir, default_cassette_name):
  """The LADOK session for a test: logged in when talking to LADOK, an
  offline one that replays the test's cassette otherwise."""
  if request.node.get_closest_marker("vcr") is None:
    pytest.fail("a test that uses the ladok fixture must be marked vcr")
  if recording:
    if isinstance(live_ladok, str):
      pytest.skip(live_ladok)
    live_ladok.cache.clear()
    yield live_ladok
    return
  cassette_file = Path(vcr_cassette_dir) / f"{default_cassette_name}.yaml"
  if not cassette_file.exists():
    pytest.skip("no recording; record it with --record-mode=once, "
                "or run with --live")
  session = request.getfixturevalue("replay_ladok")
  session.cache.clear()
  session._LadokSession__access_time = datetime.datetime.now()
  yield session
  assert vcr.all_played, (
    f"the test made {vcr.play_count} of the {len(vcr)} requests recorded "
    "in its cassette")
```

This code is used in chunk 1532.
Defines:
`ladok`, used in chunks 24c, 27, and 1547.
Uses `live` 1541b, `live_ladok` 1536b 1537, `recording` 1537, `replay_ladok` 1539, and `vcr_cassette_dir` 1541c.

Some tests check validation that happens before any request is sent, for instance that `fetch_linked_uri_JSON` refuses a link to another host. They need a `LadokSession` object but no recording. Creating the object makes no request, since the login happens on the first request, so they get the replay session in every mode. If one of them sent a request by mistake, the network block would fail it.

1541a ⟨*fixtures* 1537⟩+≡

```
@pytest.fixture(scope="session")
def offline_ladok(replay_ladok):
  """A session that never logs in, for tests that send no request."""
  return replay_ladok
```

This code is used in chunk 1532.
Defines:
`offline_ladok`, never used.
Uses `replay_ladok` 1539.

A few tests must not be recorded at all and run only live; they ask for the `live` fixture, which skips them otherwise. One logs in afresh, to test the login itself. Another sends a personnummer in the URL: the recording would pseudonymize it with the key, so the cassette could only be replayed by someone holding the key.

1541b ⟨*fixtures* 1537⟩+≡

```
@pytest.fixture(scope="session")
def live(request):
  """Skip the requesting test unless pytest runs with `--live`."""
  if not request.config.getoption("--live"):
    pytest.skip("runs only against LADOK; run with --live")
```

This code is used in chunk 1532.
Defines:
`live`, used in chunks 1533–37, 1540, 1541c, 1544, and 1548.

24.5 Recording

Each test module gets its own cassette directory under `tests/cassettes`, named after the module. In a live run the same relative path is used, but under the live directory. We note which directories were written, so that we can scan them and, in a live run, compare them after the run.

1541c ⟨*fixtures* 1537⟩+≡

```
@pytest.fixture(scope="module")
def vcr_cassette_dir(request):
  module = Path(request.node.path)
  committed = module.parent / "cassettes" / module.stem
  config = request.config
  if config.getoption("--live"):
    target = config._live_dir / committed.relative_to(config.rootpath)
    config._recorded_dirs.add((committed, target))
    return str(target)
  if record_mode_of(config) != "none":
    config._recorded_dirs.add((committed, committed))
  return str(committed)
```

This code is used in chunk 1532.
Defines:
`vcr_cassette_dir`, used in chunk 1540.
Uses `live` 1541b and `record_mode_of` 1534a.

24.5.1 Pseudonymization

The responses we record are about real people. `vcr_support` scrubs each response before it is written: secrets such as cookies and tokens are removed, names, email addresses, usernames and personnummer are replaced by pseudonyms, and free text is replaced wholesale, since prose can name anyone. The pseudonyms are keyed hashes, so the same person gets the same pseudonym in every cassette, and only someone with the key can link a pseudonym to a person. The key, in the environment variable `TEST_PSEUDONYM_KEY`, must therefore never be committed; keep it in the keyring. It must also stay the same between recordings, or every pseudonym changes and a re-recording becomes impossible to review.

`vcr_support` already knows LADOK's main field names, such as `Fornamn`, `Personnummer` and `SenastAndradAv`. We adjust its lists in a few places.

`[Uid ]` is a login name in many services, so `vcr_support` replaces it. In LADOK it is the opaque identifier of a record, which is what lets a reader follow a student or a course round from one response to the next, and the tests request records by it. We keep it.

`[OvrigaMedverkande ]` ('other contributors') lists the teachers who took part in grading a result, as free text.

`[Fodelsedata ]` is the student's date of birth.

`[FolkbokforingsbevakningTillOchMed ]` is the date until which LADOK watches the population register for changes to the student.

`[SkapadAv ]` ('created by') is the username of the staff member who created an examination occasion, like `SenastAndradAv`, which `vcr_support` treats as an email address.

`[OvrigInformation ]` ('other information') is the free text of an examination occasion.

`[Attestant ]` is whoever certified (attested) a result. As a record, its name fields are replaced like any other name; as a plain string, which LADOK's attestation views give, it is the name itself, like `Beslutsfattare`, which `vcr_support` already knows. Both can instead hold LADOK's text that the examiner is missing, which names no one. The pseudonymizer replaces that too, and notes its words as originals, so a later scan may flag them where they occur in public text: a false alarm, which errs on the safe side.

The pseudonymizer replaces text only. A student's sex (`KonID`) and whether the student is deceased (`Avliden`) are a number and a truth value, so they are recorded as they are. The cassettes stay on the machine that recorded them (Section 24.7), and the documentation's examples go through `pseudonymize`, which replaces them.

1542 ⟨*constants* 1535a⟩+≡

```
LADOK_NAME_KEYS = vcr_support.NAME_KEYS | {"attestant"}
LADOK_LOGIN_KEYS = vcr_support.LOGIN_KEYS - {"uid"}
LADOK_EMAIL_KEYS = vcr_support.EMAIL_KEYS | {"skapadav"}
LADOK_FREE_TEXT_KEYS = vcr_support.FREE_TEXT_KEYS \
  | {"ovrigamedverkande", "ovriginformation"}
LADOK_CONTACT_KEYS = vcr_support.CONTACT_KEYS \
  | {"fodelsedata", "folkbokforingsbevakningtillochmed"}
```

This code is used in chunk 1532.
Defines:
`LADOK_CONTACT_KEYS`, used in chunk 1543b.
`LADOK_EMAIL_KEYS`, used in chunk 1543b.
`LADOK_FREE_TEXT_KEYS`, used in chunk 1543b.
`LADOK_LOGIN_KEYS`, used in chunk 1543b.
`LADOK_NAME_KEYS`, used in chunk 1543b.

Every field that we add must be replaced when a response is recorded. We give the pseudonymizer one record with all of them, as LADOK would send them, and require that none of the values survives.

1543a ⟨*test functions* 1535c⟩+≡

```
LADOK_FIELDS = {
  "OvrigaMedverkande": "Anna Andersson\nBo Berg",
  "Fodelsedata": "1912-12-12",
  "FolkbokforingsbevakningTillOchMed": "2027-01-01",
  "SkapadAv": "examiner",
  "OvrigInformation": "Ask Anna Andersson about the room.",
  "Attestant": "Bo Berg",
}

def test_recordings_replace_ladoks_own_fields(pseudonymizer):
  scrubbed = pseudonymizer.scrub_json(dict(LADOK_FIELDS))
  for key, value in LADOK_FIELDS.items():
    assert scrubbed[key] != value, key
```

This code is used in chunk 1533a.
Defines:
`LADOK_FIELDS`, never used.
`test_recordings_replace_ladoks_own_fields`, never used.
Uses `pseudonymizer` 1543b.

The pseudonymizer also notes every original value it replaced, in a private file outside the repository, so that the scan after the run (Section 24.6) can look for any of them that slipped through elsewhere. In replay nothing is written, and any key will do.

1543b ⟨*fixtures* 1537⟩+≡

```
@pytest.fixture(scope="session")
def pseudonymizer(request, recording):
  key = os.environ.get(vcr_support.KEY_ENV, "")
  originals = Path(os.environ.get(vcr_support.ORIGINALS_ENV)
                   or vcr_support.default_originals_path(
                        request.config.rootpath))
  request.config._originals_path = originals
  return vcr_support.Pseudonymizer(
    (key or "replay-only").encode(),
    originals if recording else None,
    name_keys=LADOK_NAME_KEYS,
    login_keys=LADOK_LOGIN_KEYS,
    email_keys=LADOK_EMAIL_KEYS,
    free_text_keys=LADOK_FREE_TEXT_KEYS,
    contact_keys=LADOK_CONTACT_KEYS)


```

```
@pytest.fixture
def vcr_config(pseudonymizer):
  return pseudonymizer.vcr_config()
```

This code is used in chunk 1532.
Defines:
`pseudonymizer`, used in chunk 1543a.
`vcr_config`, never used.
Uses `LADOK_CONTACT_KEYS` 1542, `LADOK_EMAIL_KEYS` 1542, `LADOK_FREE_TEXT_KEYS` 1542, `LADOK_LOGIN_KEYS` 1542, `LADOK_NAME_KEYS` 1542, `originals` 1545, and `recording` 1537.

By default `vcrpy` matches a request to a recorded one by its method and URL. That is enough for reading, but not for writing: a write test that sent the wrong grade would get the recorded response, with the right grade, and pass. The configuration from `vcr_support` therefore matches the body too, so that in replay a write must send exactly what was recorded.

24.6 Checks after the run

After a run that recorded anything, we scan what was written for personal data and secrets: every original value that the pseudonymizer replaced, and anything shaped like an email address, a personnummer or a token. A hit fails the run and is reported as a file, a line and a redacted stub, never the value.

After a live run we also compare the fresh recordings with the ones we replay. The comparison looks at structure only: status codes, content types, and the paths and types of the keys in the JSON bodies, never the values. A removed key, a changed type or a request that is no longer made is *drift*: the cassettes no longer describe LADOK, and the tests that replay them may pass on behaviour that LADOK has dropped. Drift fails the run. The fix is to adapt the code if needed and then record the affected tests again with `--record-mode=rewrite -k` *test*, never to edit a cassette by hand.

1544 ⟨*checks after the run* 1544⟩≡

```
def pytest_sessionfinish(session, exitstatus):
  config = session.config
  pairs = getattr(config, "_recorded_dirs", set())
  if not pairs:
    return
  reporter = config.pluginmanager.get_plugin("terminalreporter")

  def write(message, **markup):
    if reporter:
      reporter.write_line(message, **markup)
    else:
      print(message)

  ⟨scan the recordings for personal data 1545⟩
  if config.getoption("--live"):
    ⟨compare the live recordings with the cassettes 1548⟩
```

This definition is continued in chunk 1546b.
This code is used in chunk 1532.
Defines:
`pytest_sessionfinish`, never used.
Uses `live` 1541b.

The list of originals holds every value the pseudonymizer replaced, and not all of them identify anyone. A student's city (`Postort`) is replaced as contact data, and the words of a free-text note are replaced with it. The first recording found such values hundreds of times: a city in the names of courses given there, a short word in the translation table, and `POST` as the method of the write requests.

Finding a value in LADOK's own public text says nothing about a person, so when we scan a cassette we allow the originals that occur in the public text of *that cassette*: in course and code-table names (`Benamning` and its `sv` and `en` texts), in codes (`Kod`), in the translation table (`Text`), and as HTTP methods. Responses from the code tables, the translation table and the course information (`PUBLIC_PATHS`) hold no people, so all of their text counts as public. So do the HTTP headers, apart from cookies and credentials: a short word recorded as an original once turned up in every cassette, as the `max` of `Cache-Control: max-age=0`. The staff lists, which the catalogue service also serves, are not among them. Allowing per cassette matters: the table of Swedish places holds many words that are also surnames, and allowing those in every cassette would let a surname that the scrubber missed in a student's record go unnoticed. Within one cassette, a surname that is also a word in a course name there is still allowed; that is the price of not reading the cassettes by eye.

The cassettes store characters outside ASCII escaped, as in `Malm\xF6`, and the scan reads the file as it is stored, so it sees the part before an escape as a word of its own; we therefore also take the words of the public text in its escaped form, with the escapes themselves taken out, or the `n` of an escaped line break would stick to the next word.

1545 ⟨*scan the recordings for personal data* 1545⟩≡

```
originals = vcr_support.read_list(getattr(config, "_originals_path", None))
written_files = [path for _, written in sorted(pairs)
                 for path in vcr_support.iter_files([written])
                 if path.name != LIVE_MARKER_FILE]
needles = vcr_support.Needles(originals)
leaks = []
for path in written_files:
  allow = public_originals(originals, path)
  leaks += [(path, where, kind, hit)
            for where, kind, hit in vcr_support.scan_file(path, needles,
                                                          allow=allow)]
if leaks:
  write("PRIVACY: the recordings contain personal data or secrets (values "
        "redacted below). Extend the key lists in testing.nw, delete the "
        "cassettes, and record again.", red=True)
  for path, where, kind, hit in leaks:
    write(f"  {path}:{where}: {kind} {hit}")
  session.exitstatus = 1
```

This code is used in chunk 1544.
Defines:
`leaks`, never used.
`needles`, never used.
`originals`, used in chunks 1543b, 1546b, and 1547.
`written_files`, never used.
Uses `LIVE_MARKER_FILE` 1535a and `public_originals` 1546b.

We collect the public text from the response bodies in the cassette.

1546a ⟨*constants* 1535a⟩+≡

```
PUBLIC_TEXT_KEYS = {"sv", "en", "Text", "Benamning", "Kod"}
HTTP_METHODS = {"GET", "POST", "PUT", "DELETE", "PATCH", "HEAD", "OPTIONS"}
PUBLIC_PATHS = ("/kataloginformation/internal/grunddata/",
                "/kataloginformation/internal/i18n/",
                "/kataloginformation/internal/service/",
                "/utbildningsinformation/internal/utbildningsinstans",
                "/utbildningsinformation/internal/utbildningstillfalle",
                "/utbildningsinformation/internal/struktur/")
PRIVATE_HEADERS = {"cookie", "set-cookie", "authorization",
                   "x-xsrf-token", "x-csrf-token"}
ESCAPE_SEQUENCE = r"\\(?:x[0-9A-Fa-f]{2}|u[0-9A-Fa-f]{4}|U[0-9A-Fa-f]{8}|.)"
```

This code is used in chunk 1532.
Defines:
ESCAPE_SEQUENCE, used in chunk 1546b.
HTTP_METHODS, used in chunk 1546b.
PRIVATE_HEADERS, used in chunk 1546b.
PUBLIC_PATHS, used in chunk 1546b.
PUBLIC_TEXT_KEYS, used in chunk 1546b.

1546b ⟨*checks after the run* 1544⟩+≡

```
def public_originals(originals, cassette):
  """Return the originals that occur in LADOK's public text in `cassette`,
  or that are HTTP methods."""
  text = "\n".join(public_text(cassette)).lower()
  words = set(re.findall(r"\w+", text))
  escaped = re.sub(ESCAPE_SEQUENCE, " ", yaml.safe_dump(text))
  words |= set(re.findall(r"\w+", escaped))
  phrases = vcr_support.Needles(original for original in originals
                                if original.lower() not in words)
  found = {match.lower() for line in text.splitlines()
           for _, _, match in phrases.finditer(line)}
  return [original for original in originals
          if original.upper() in HTTP_METHODS
          or original.lower() in words
          or original.lower() in found]


def public_text(cassette):
  """Yield the public strings in the JSON response bodies of `cassette`:
  all of them from `PUBLIC_PATHS`, otherwise those under
  `PUBLIC_TEXT_KEYS`."""
  try:
    interactions = yaml.safe_load(cassette.read_text())["interactions"]
  except (yaml.YAMLError, KeyError, TypeError):
    return
  for interaction in interactions:
    yield from public_header_values(interaction)
    try:
      body = json.loads(interaction["response"]["body"]["string"])
    except (KeyError, TypeError, ValueError):
```

```
        continue
      uri = interaction.get("request", {}).get("uri", "")
      public = any(path in uri for path in PUBLIC_PATHS)
      yield from strings_under(body, PUBLIC_TEXT_KEYS, inside=public)


def public_header_values(interaction):
  """Yield the values of the request and response headers, except those
  that carry cookies or credentials."""
  for part in ("request", "response"):
    headers = (interaction.get(part) or {}).get("headers") or {}
    for name, values in headers.items():
      if name.lower() in PRIVATE_HEADERS:
        continue
      for value in values if isinstance(values, list) else [values]:
        if isinstance(value, str):
          yield value


def strings_under(data, keys, inside=False):
  """Yield the strings in `data` that sit under one of `keys`."""
  if isinstance(data, dict):
    for key, value in data.items():
      yield from strings_under(value, keys, inside or key in keys)
  elif isinstance(data, list):
    for item in data:
      yield from strings_under(item, keys, inside)
  elif inside and isinstance(data, str):
    yield data
```

This code is used in chunk 1532.
Defines:
`public_header_values`, never used.
`public_originals`, used in chunks 1545 and 1547.
`public_text`, never used.
`strings_under`, never used.
Uses `ESCAPE_SEQUENCE` 1546a, `HTTP_METHODS` 1546a, `originals` 1545, `PRIVATE_HEADERS` 1546a, `PUBLIC_PATHS` 1546a, and `PUBLIC_TEXT_KEYS` 1546a.

Let's verify the allow list with two small cassettes that both contain the original 'Hammar', invented for the test. In the table of municipalities it is part of a public place name, written with an escaped 'ö' as in the real cassettes, so it is allowed there. In a list of students it sits in a name field that the scrubber missed, so it must be reported, even though the other cassette shows that it is also a word in a place name. 'Max' occurs in a `Cache-Control` header and is allowed; 'Maxine' occurs only in a cookie, which is not public, and is not.

1547 ⟨*test functions* 1535c⟩+≡

```
def write_cassette(path, uri, body):
  interaction = {"request": {"uri": uri, "method": "GET"},
                 "response": {
                   "headers": {"Cache-Control": ["no-cache, max-age=0"],
                               "Set-Cookie": ["Maxine=redacted"]},
                   "body": {"string": json.dumps(body, ensure_ascii=False)}}}
```

```
    path.write_text(yaml.safe_dump({"interactions": [interaction]}))
    return path

  def test_public_originals_are_allowed_per_cassette(tmp_path):
    places = write_cassette(
      tmp_path / "places.yaml",
      "https://start.test.ladok.se/gui/proxy"
      "/kataloginformation/internal/grunddata/kommun",
      {"Kommun": [{"ID": "1", "Kod": "1880",
                   "Benamning": {"sv": "Hammarö", "en": "Hammarö"}}]})
    students = write_cassette(
      tmp_path / "students.yaml",
      "https://start.test.ladok.se/gui/proxy"
      "/studiedeltagande/internal/deltagare",
      {"Resultat": [{"Student": {"Smeknamn": "Hammar"},
                     "Benamning": {"sv": "Datorteknik"}}]})
    originals = ["Hammar", "POST", "Datorteknik", "Max", "Maxine"]

    assert "Hammar" in conftest.public_originals(originals, places)
    assert "Hammar" not in conftest.public_originals(originals, students)
    assert set(conftest.public_originals(originals, students)) \
      == {"POST", "Datorteknik", "Max"}
```

This code is used in chunk 1533a.
Defines:
`test_public_originals_are_allowed_per_cassette`, never used.
`write_cassette`, never used.
Uses `ladok` 22b 1540, `originals` 1545, and `public_originals` 1546b.

1548 ⟨*compare the live recordings with the cassettes* 1548⟩≡

```
  drift = []
  for committed, live in sorted(pairs):
    if committed.exists() and live.exists():
      drift += vcr_support.compare_directories(committed, live)
  for severity, name, key, message in drift:
    if message != "not re-recorded in the live run":
      write(f"  {severity}: {name} {key}: {message}",
            red=severity == "drift")
  if any(severity == "drift" for severity, *_ in drift):
    write("DRIFT: LADOK no longer matches the cassettes. Fix the "
          "code if needed, then record the affected tests again with "
          "--record-mode=rewrite -k <test> and review the diff.", red=True)
    session.exitstatus = 1
  else:
    write(f"live: no structural drift ({config._live_dir})", green=True)
```

This code is used in chunk 1544.
Defines:
`drift`, never used.
Uses `live` 1541b.

24.7 Recording your own cassettes

To record, we need a login to LADOK's test environment, through `ladok login`, and a pseudonymization key. Any long random string will do as a key, but it must stay the same between recordings and it must never be written to the repository or printed. With GNOME Keyring we can create one without ever seeing it:

```
python3 -c "import secrets; print(secrets.token_urlsafe(32), end='')" \
  | secret-tool store --label='ladok3 test pseudonymization key' \
      service ladok3 key test-pseudonym
```

Then we record the cassettes that are missing, writes included, reading the key from the keyring for this command only:

```
TEST_PSEUDONYM_KEY="$(secret-tool lookup service ladok3 key test-pseudonym)" \
  make test PYTESTFLAGS="--record-mode=once --live-writes"
```

A live run takes the key the same way, with `PYTESTFLAGS=--live`. The recording fails if the scan afterwards finds personal data (Section 24.6); then extend the key lists in Section 24.5.1, delete the cassettes and record again.

The tests use records in KTH's part of the test environment: a test student, the courses DD2395 and DD1301, their rounds and LAB1 modules, KTH's organisational unit and a result reporter. Their UIDs are constants in the tests of the API calls. At another institution, those constants must be replaced by records there, and the write tests need a login with the right to report results on the module they write to.