

## Practical 4

### Jumping Rivers

In this question, we are going to use a `for` statement to loop over a large data set and construct some scatter plots. To generate the data, run the following piece of code

```
import jupyterprogramming

exper = jupyterprogramming.datasets.experiment.load_data()

# change the column names
exper.columns = ["measure", "time", "treat"]
```

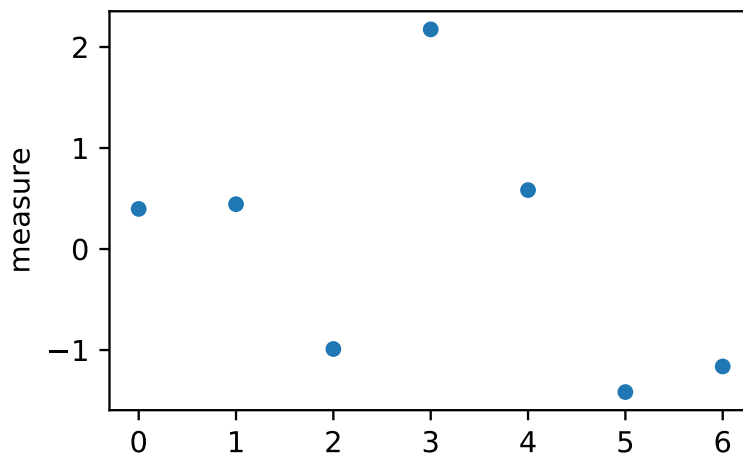
The data frame `exper` represents an experiment, where we have ten treatments:  $A, B, \dots, J$  and measurements at some time points. We want to create a scatter plot of measurement against time, for each treatment type.

2. First we create a scatter plot of one treatment:

```
group = exper[exper.treat == "A"]

import matplotlib.pyplot as plt

group.plot.scatter(x="time", y="measure")
```



3. To generate a scatter-plot for each treatment, we need to iterate over the different treatment types:

```
for i in exper.treat.unique():
    group = exper[exper.treat == i]
```

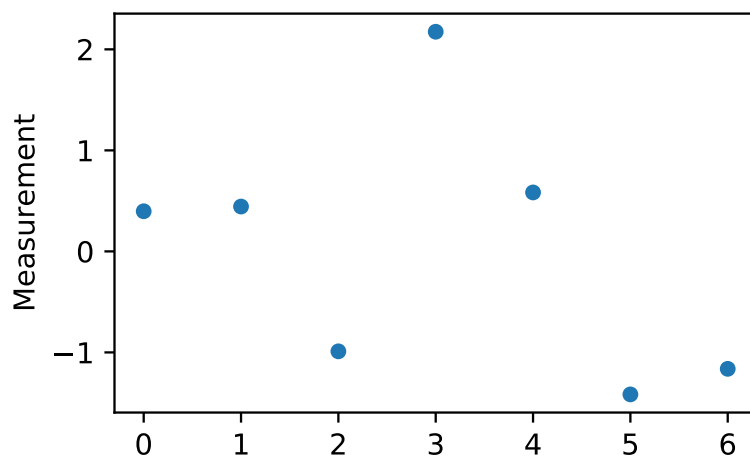
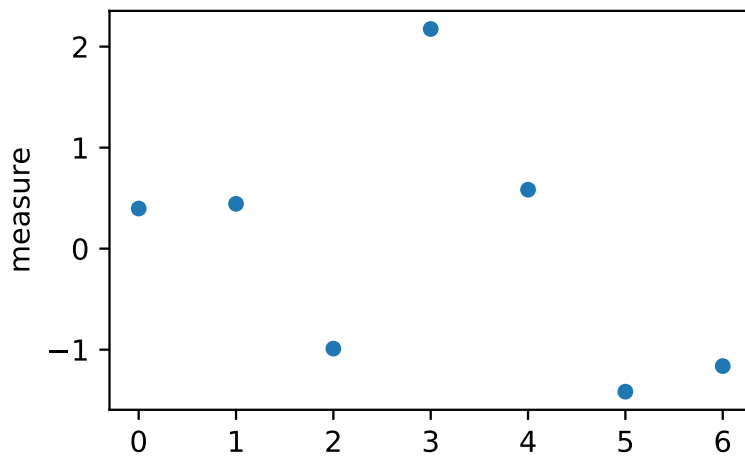
```
group.plot.scatter(x="time", y="measure")
plt.show()
input("Hit enter for next plot")
```

- What does `exper.treat.unique()` give?
- In the `for` loop, what variable is changing? What are its possible values?
- What does the `input()` function do?

### Questions

1. The default axis labels aren't great. So we can change the  $x$ -axis label using `plt.xlabel()`:

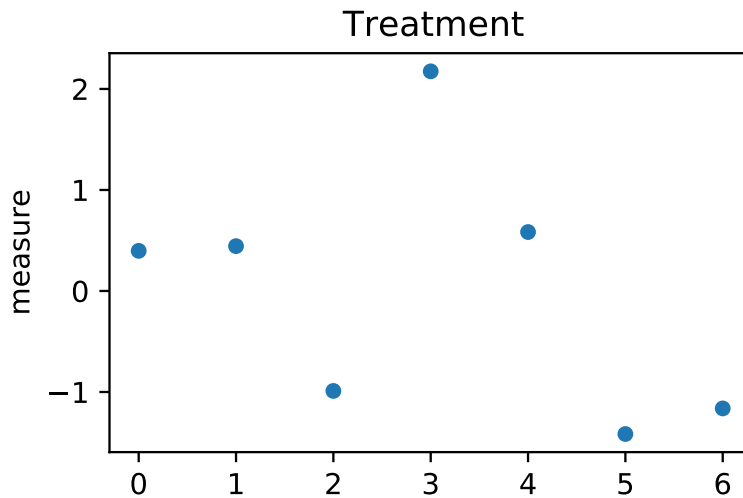
```
group.plot.scatter(x="time", y="measure")
plt.xlabel("Time")
```



Use the `ylab` argument to alter the  $y$ -axis label.

2. To add a title to a plot we use the `plt.title()` argument, viz:

```
group.plot.scatter(x="time", y="measure")
plt.title("Treatment")
```



3. We can concatenate strings/characters using `+`,

```
"Treatment "+"A"
```

Rather than have a static title, make the title of each plot display the treatment type.

4. The  $y$ -axis range should really be the same in all graphics. Add a `ylim` argument to fix the range.

**Hint:** Work out the range before the `for` loop.

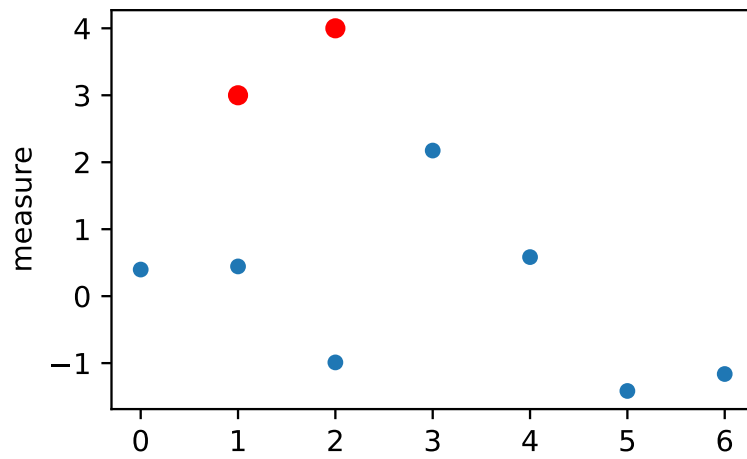
5. At each iteration, use the `print()` function to print the average measurement level across all time points.

**Hint:** You will have to convert the mean to a string, to do this use the `str()` function.

6. On each graph, highlight any observations with a blue point if they are larger than the mean + standard deviations or less than the mean - standard deviations. Store your graph as a variable, then use the `.scatter()` method to plot additional points.

**Hint:** You don't need `if` statements here. Just subset your data frame and pass this new data frame to the `points` function. For example, to highlight the points (1,3) and (2, 4) we use the command:

```
p = group.plot.scatter(x="time", y="measure")
p.scatter([1, 2], [3, 4], color="red")
```



7.. Put your code, i.e. the `for` loop and plotting commands, in a function which takes the data frame as an argument.