PoL Physics of Life TU Dresden

CENTER FOR SYSTEMS BIOLOGY DRESDEN

The command line

Robert Haase

October 2022

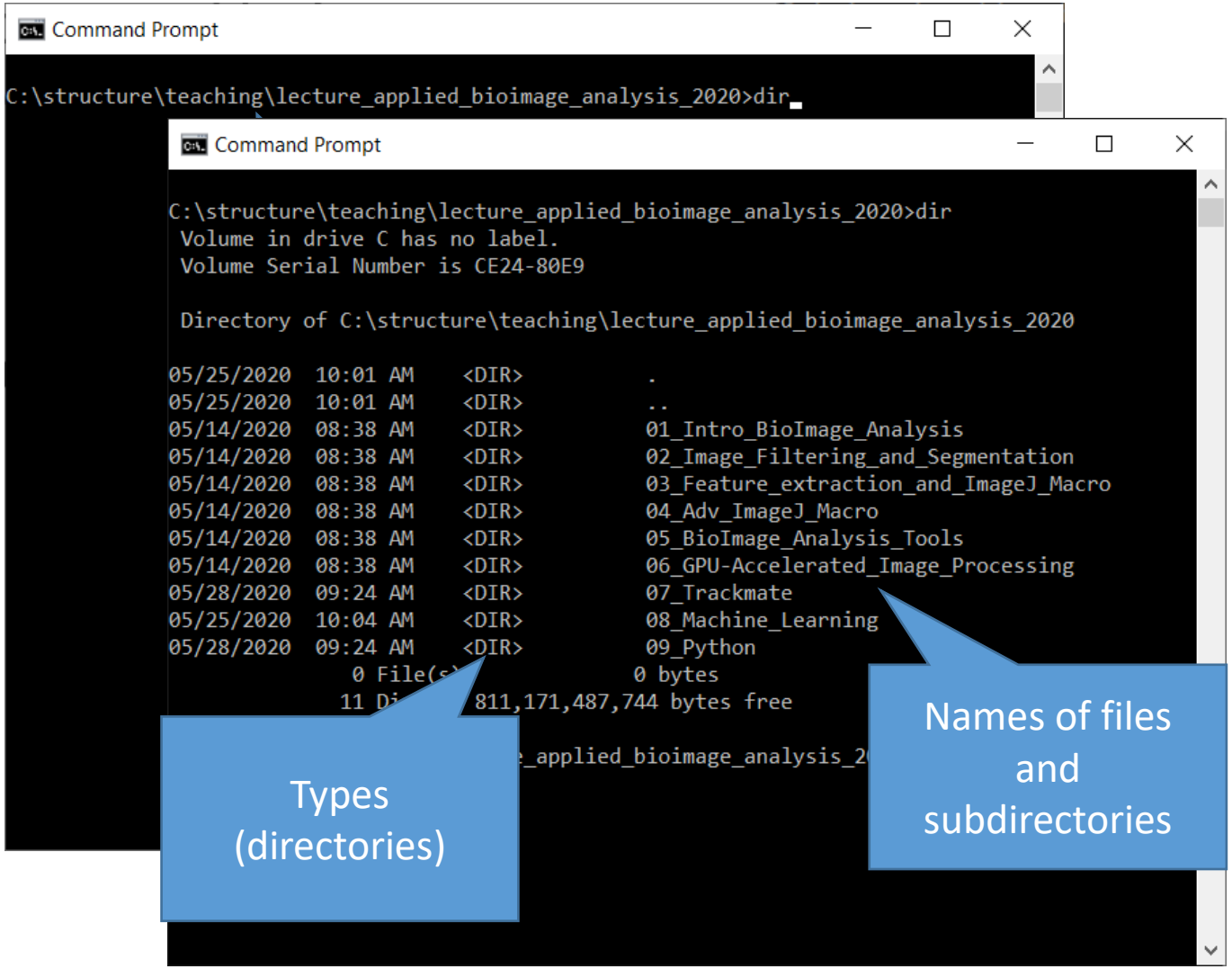
@haesleinhuepf

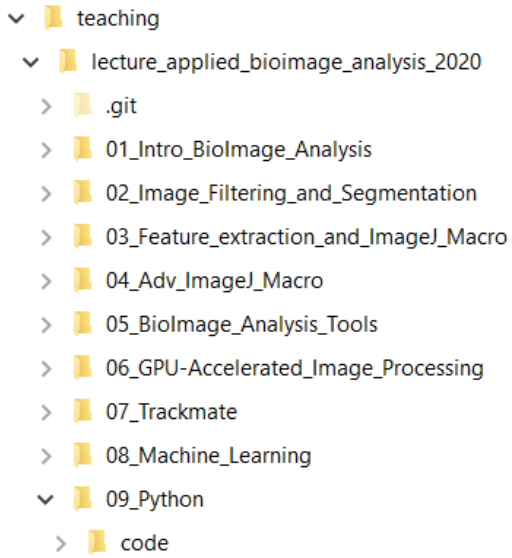
The command line

- A.k.a. the Terminal or Eingabeaufforderung: Welcome to the 20th century!

- The `dir` command tells you what's in the current directory

- On Mac and Linux the command is called `ls -l`



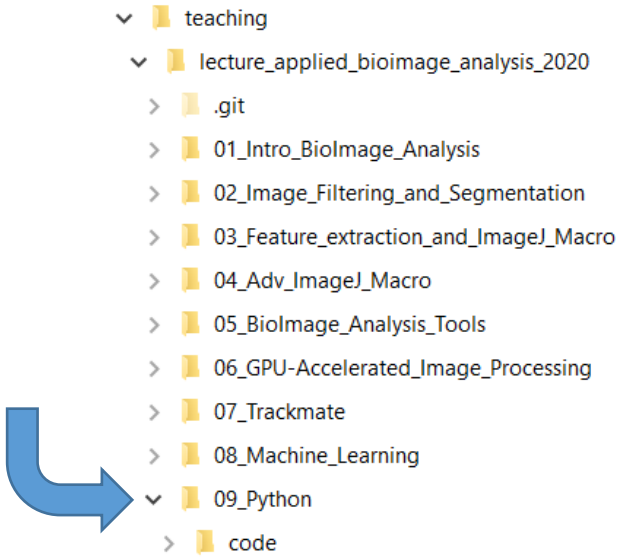


The command line

- A.k.a. the Terminal or Eingabeaufforderung: Welcome to the 20th century!

- The `cd` command let's you move between different directories.

- With `cd <pathname>` you go into a sub-directory



Command Prompt

```
C:\structure\teaching\lecture_applied_bioimage_analysis_2020>cd 09_Python
```

Command Prompt

```
C:\structure\teaching\lecture_applied_bioimage_analysis_2020>cd 09_Python

C:\structure\teaching\lecture_applied_bioimage_analysis_2020\09_Python>dir
```

Command Prompt

```
C:\structure\teaching\lecture_applied_bioimage_analysis_2020>cd 09_Python

C:\structure\teaching\lecture_applied_bioimage_analysis_2020\09_Python>dir
 Volume in drive C has no label.
 Volume Serial Number is CE24-80E9

 Directory of C:\structure\teaching\lecture_applied_bioimage_analysis_2020\09_Python

05/28/2020  09:24 AM    <DIR>          .
05/28/2020  09:24 AM    <DIR>          ..
05/28/2020  09:24 AM        26,985,803 09_Switching_from_ImageJ_to_Python.pptx
05/28/2020  09:42 AM    <DIR>          code
05/14/2020  11:52 AM         9,169,920 python_installation.pptx
               2 File(s)     36,155,723 bytes
               3 Dir(s)  811,170,570,240 bytes free

C:\structure\teaching\lecture_appli bioimage_analysis_ 09_Python>
```

File size in bytes

File names

The command line

- A.k.a. the Terminal or Eingabeaufforderung: Welcome to the 20th century!

- The `mkdir` command creates new directories.

Command Prompt

```
C:\structure\teaching\lecture_applied_bioimage_analysis_2
020\09_Python\code>mkdir exercise_1
```

Command Prompt

```
C:\structure\teaching\lecture_applied_bioimage_analysis_2
020\09_Python\code>cd exercise_1
```

Select Command Prompt

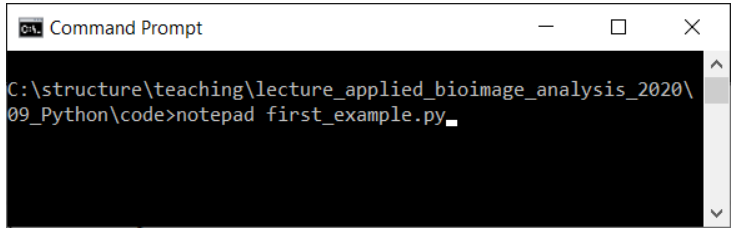
```
C:\structure\teaching\lecture_applied_bioimage_analysis_2
020\09_Python\code\exercise_1>dir
 Volume in drive C has no label.
 Volume Serial Number is CE24-80E9

 Directory of C:\structure\teaching\lecture_applied_bioim
age_analysis_2020\09_Python\code\exercise_1

05/28/2020  10:37 AM    <DIR>          .
05/28/2020  10:37 AM    <DIR>          ..
               0 File(s)              0 bytes
               2 Dir(s)  811,143,049,216 bytes free

C:\structure\teaching\lecture_applied_bioimage_analysis_2
020\09_Python\code\exercise_1>
```

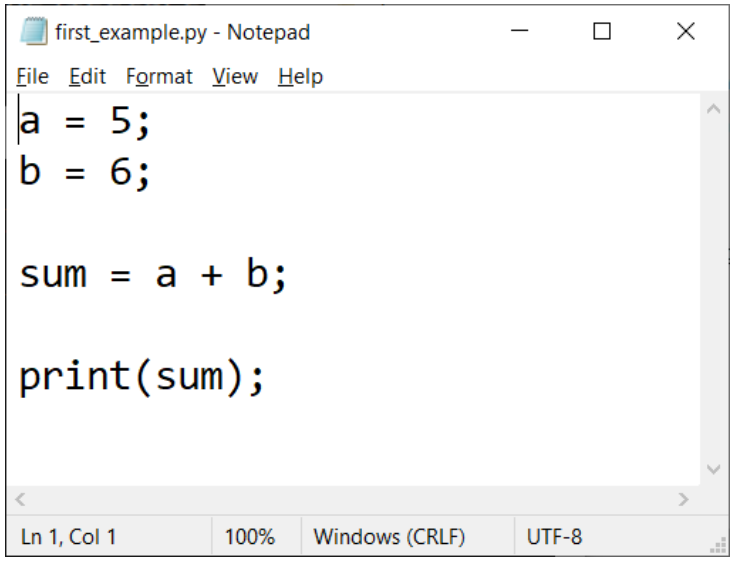
The command line

- Windows specific

- Notepad text editor

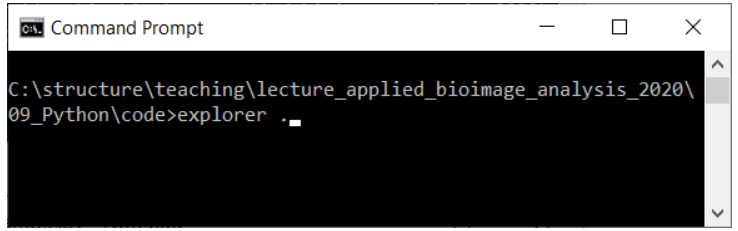
```
notepad <filename>
```

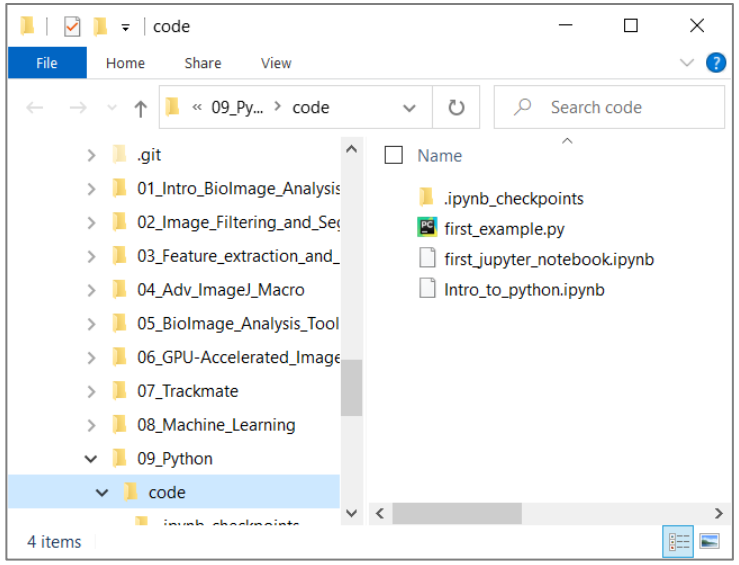




- Windows Explorer

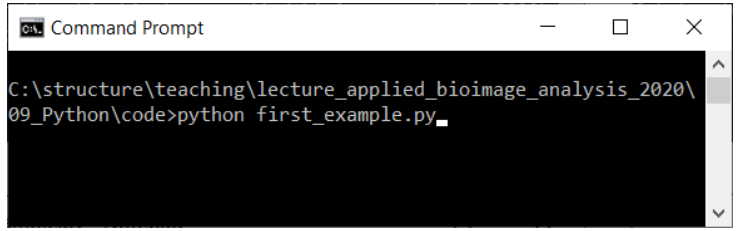
```
explorer .
```

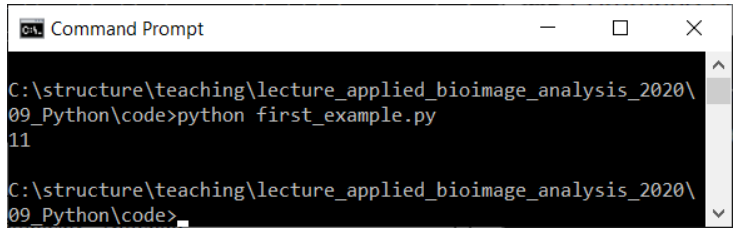




- Execute Python script

```
python <filename>
```





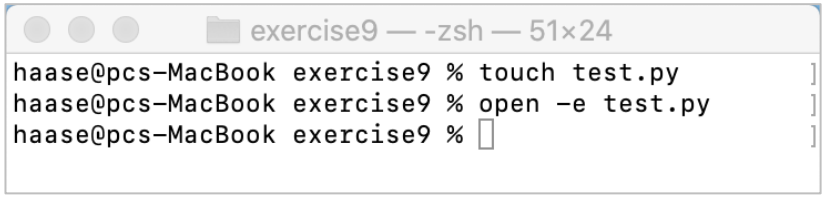
The command line

- Mac OS specific

- Text editor

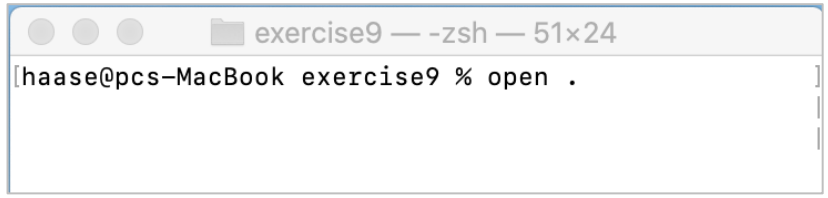
Create a new file

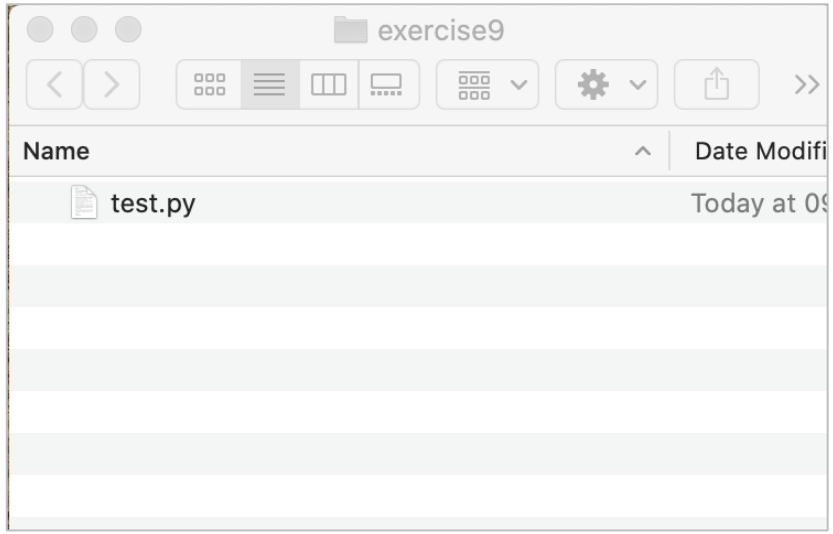
```
touch <filename>
open -e <filename>
```



- Finder

```
open .
```





- Execute Python script

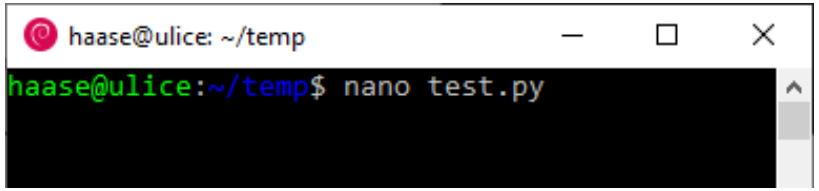
```
python <filename>
```

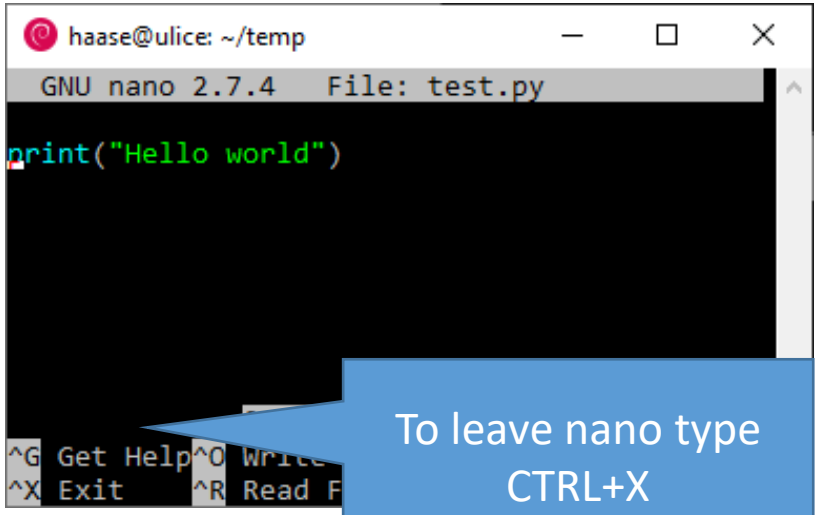
The command line

- Linux specific

- Nano text editor

`nano <filename>`

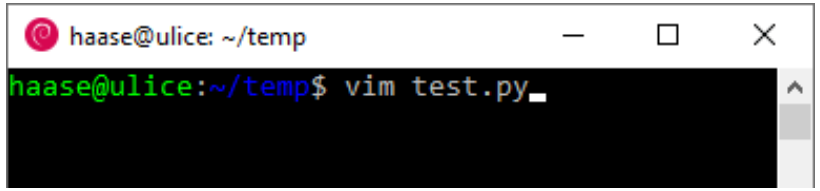


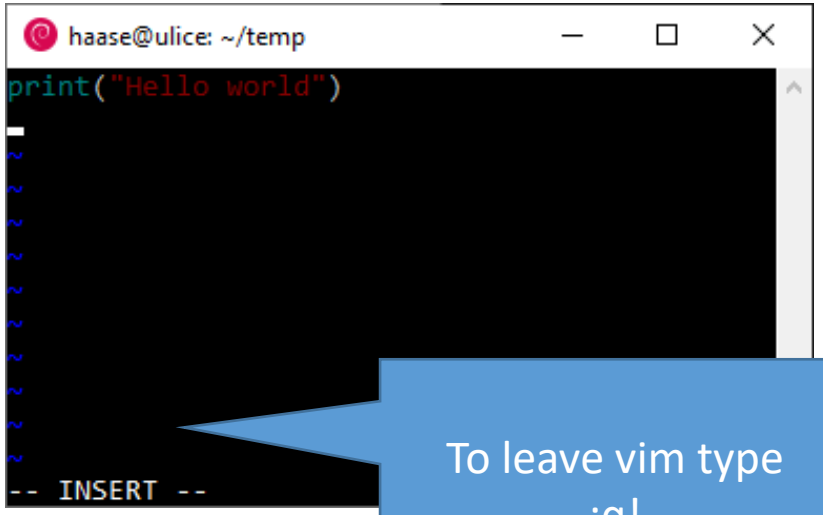


To leave nano type
CTRL+X
N

- vim

`vim <filename>`

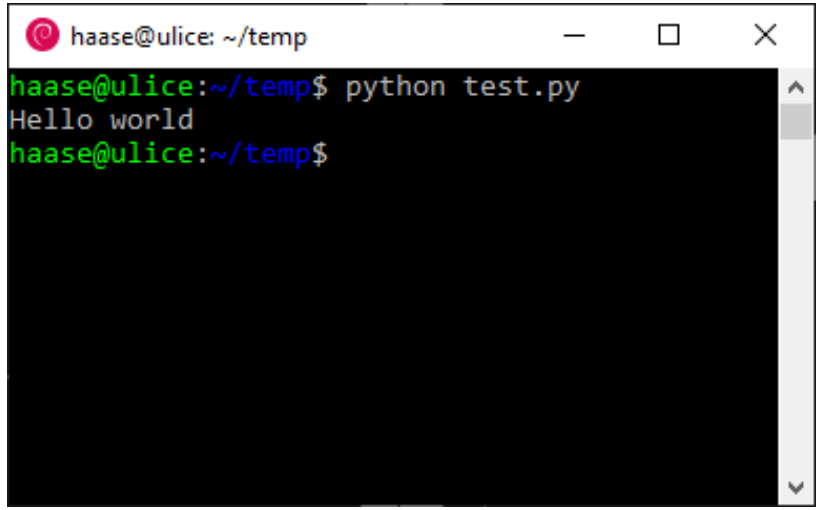




To leave vim type
:q!

- Execute Python script

`python <filename>`



PoL
Physics of Life
TU Dresden

CENTER FOR
SYSTEMS BIOLOGY
DRESDEN

jupyter lab

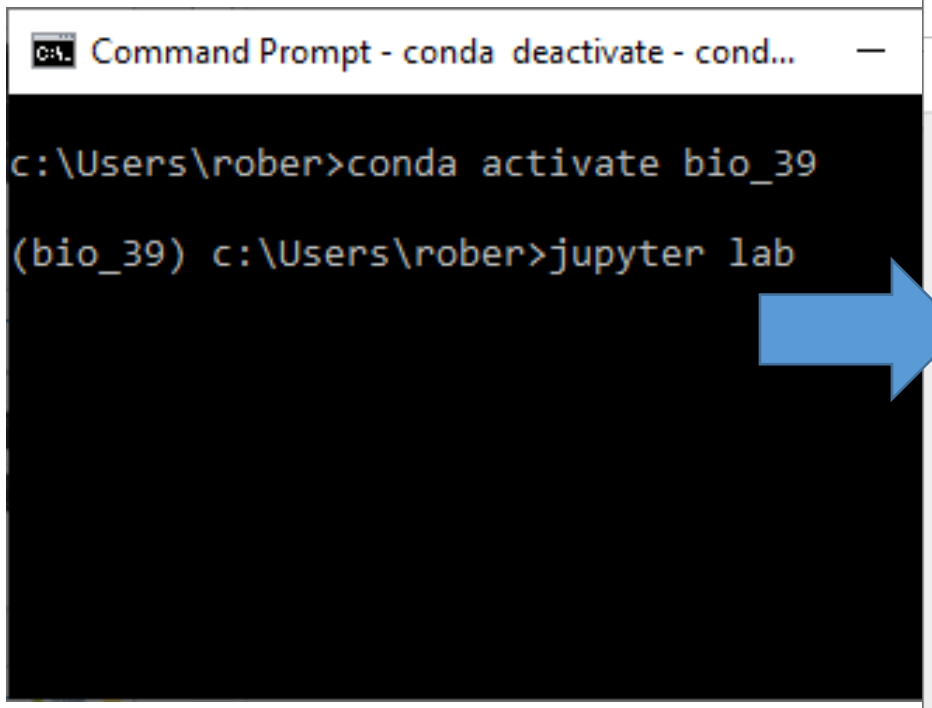
Robert Haase

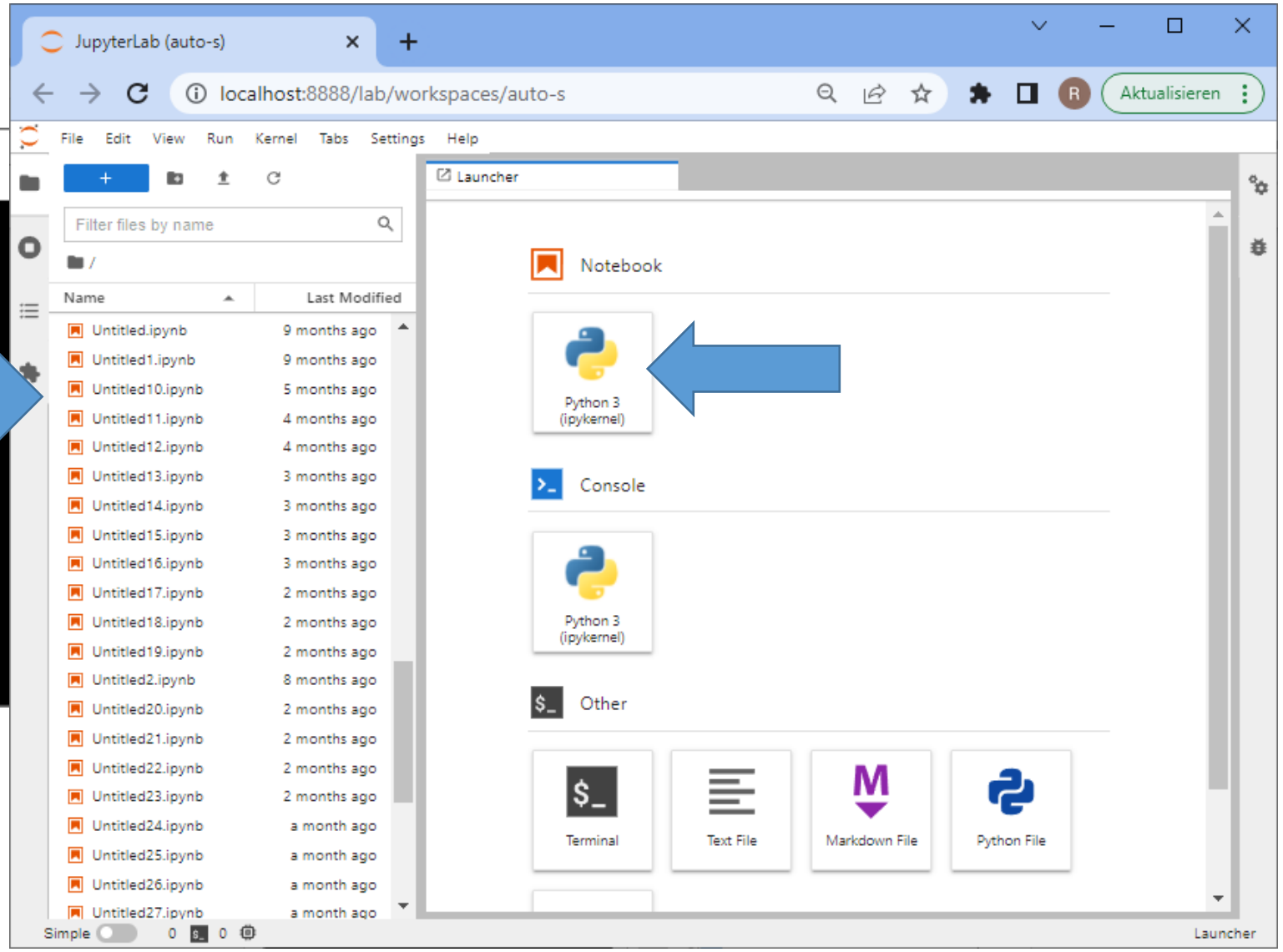
October 2022

@haesleinhuepf

Jupyter lab

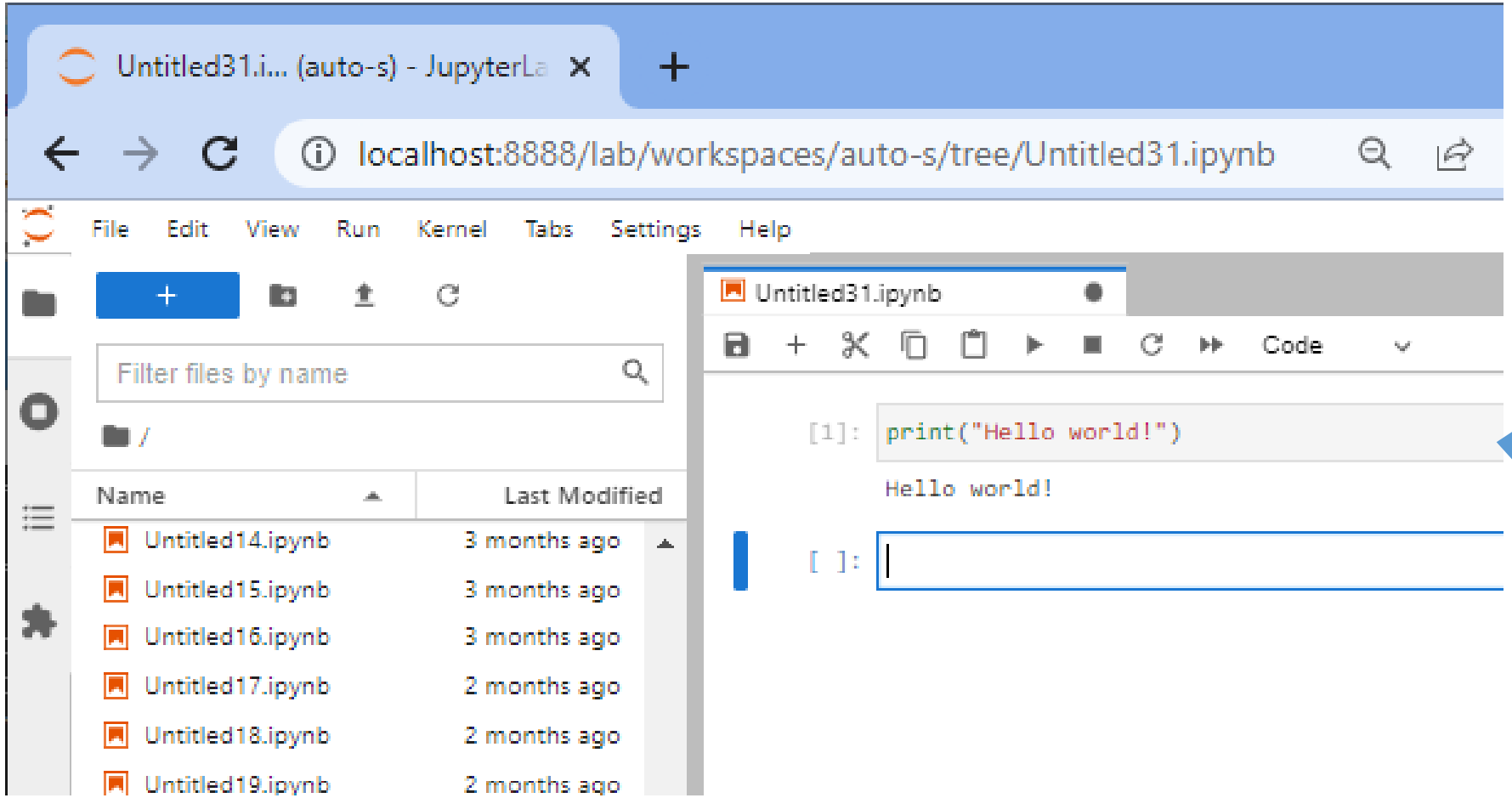
- Our programming environment for this semester





Jupyter lab

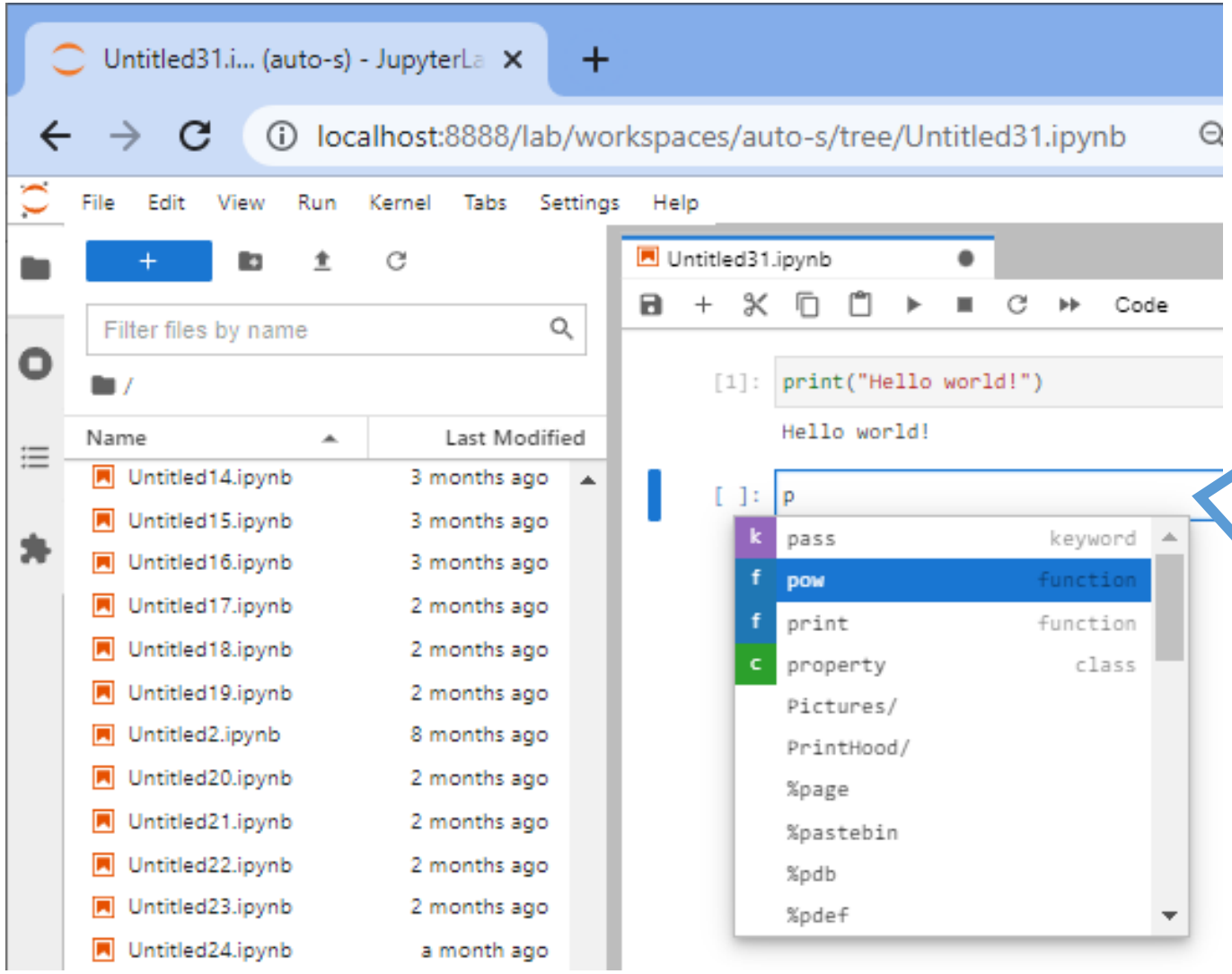
- Execute code cell-by-cell and see results instantaneously



SHIFT + ENTER to execute a code cell

Jupyter lab

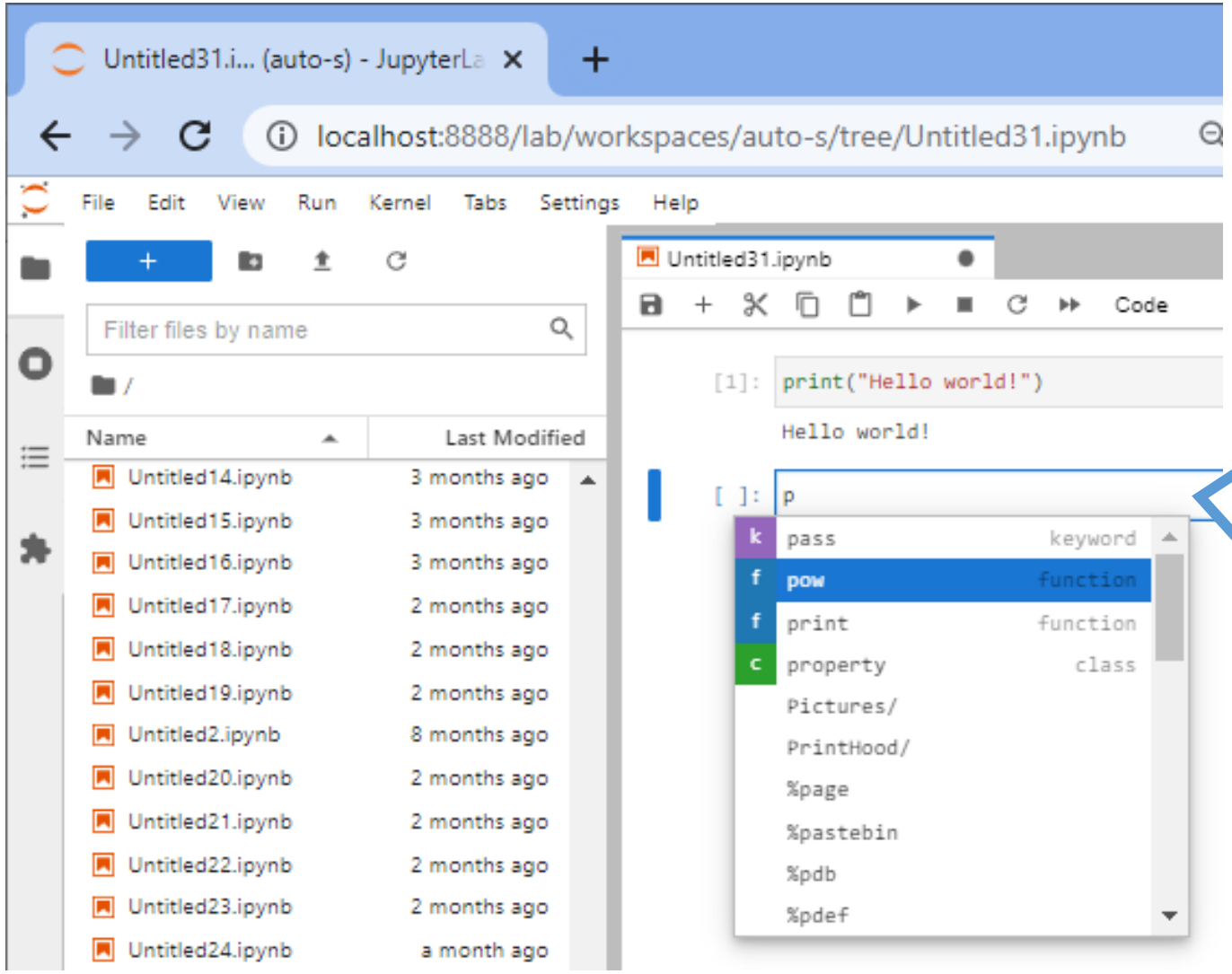
- Context-specific help, auto-completion



TAB
to open auto-completion

Jupyter lab

- Context-specific help, auto-completion



TAB
to open auto-completion

Jupyter lab

- Help / “docstrings”

Untitled31.i... (auto-s) - JupyterLa

localhost:8888/lab/workspaces/auto-s/tree/Untitled31.ipynb

File Edit View Run Kernel Tabs Settings Help

Filter files by name

/

Name	Last Modified
Untitled14.ipynb	3 months ago
Untitled15.ipynb	3 months ago
Untitled16.ipynb	3 months ago
Untitled17.ipynb	2 months ago
Untitled18.ipynb	2 months ago
Untitled19.ipynb	2 months ago
Untitled2.ipynb	8 months ago
Untitled20.ipynb	2 months ago
Untitled21.ipynb	2 months ago

Untitled31.ipynb

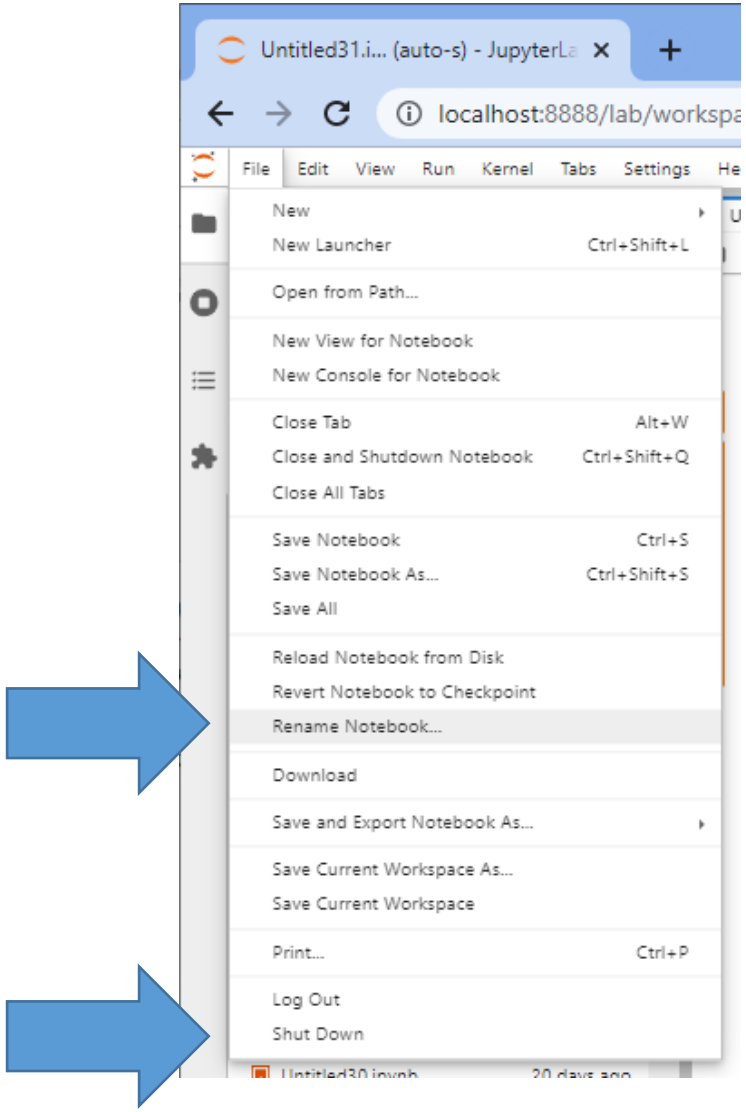
Code

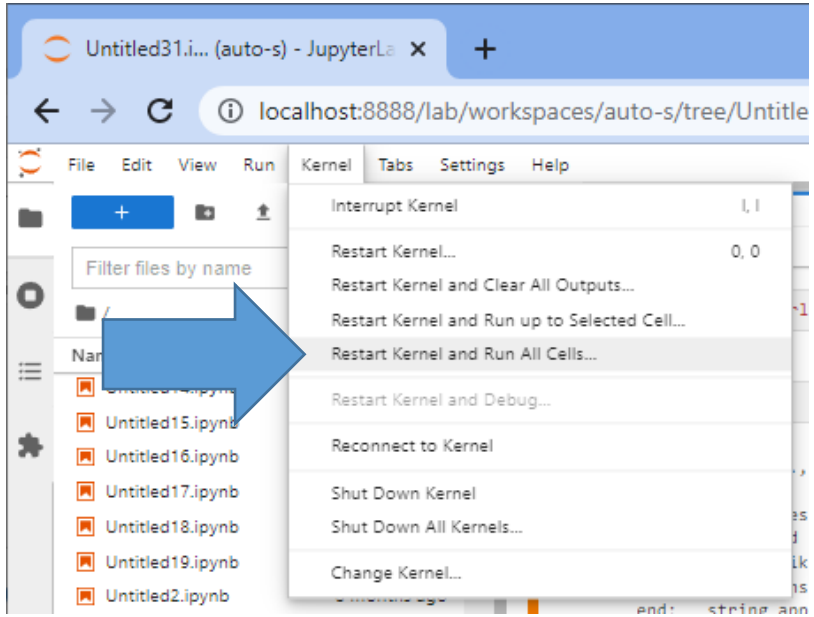
```
[1]: print("Hello world!")

Hello world!

[3]: print?

Docstring:
print(value, ..., sep=' ', end='\n', file=sys.stdout, flush=False)

Prints the values to a stream, or to sys.stdout by default.
Optional keyword arguments:
file:  a file-like object (stream); defaults to the current sys.stdout.
sep:   string inserted between values, default a space.
end:   string appended after the last value, default a newline.
flush: whether to forcibly flush the stream.
Type:      builtin_function_or_method
```

? to read what a function does

Jupyter lab

- Saving / renaming / closing





Enforcing a “clean” execution state is important for ensuring reproducibility and repeatability

PoL Physics of Life TU Dresden

CENTER FOR SYSTEMS BIOLOGY DRESDEN

Python programming basics

Robert Haase

October 2022

@haesleinhuepf

Working with variables

- Variables can hold numeric values and you can do math with them

```
# initialize program
a = 5
b = 3

# run algorithm on given parameters
sum = a + b

# print out result
print (sum)
```

```
8
```

Mathematical operations

- Math commands supplement operators to be able to implement any form of calculations

- Power

```
pow(3, 2)
```

```
]: 9
```

- Absolute

```
abs(-8)
```

```
]: 8
```

- Rounding

```
round(4.6)
```

```
]: 5
```

Be careful with some of them!

```
round(4.5)
```

```
]: 4
```

https://en.wikipedia.org/wiki/Rounding#Round_half_to_even

Comments

Comments should contain additional information such as

- User documentation
  - What does the program do?
  - How can this program be used?
- Your name / institute in case a reader has a question
- Comment why things are done.
- Do not comment what is written in the code already!

```
#
# This program sums up two numbers.
#
# Usage:
# * Run it in Python 3.8
#
# Author: Robert Haase, PoL TUD
#         Robert.haase@tu-dresden.de
# April 2021

# initialise program
a = 1
b = 2.5

# run complicated algorithm
final_result = a + b

# print the final result
print( final_result )
```

Working with variables and string values

- Also strings as values for variables are supported

Single and double quotes allowed

```
firstname = "Robert"
lastname = 'Haase'

print("Hello " + firstname + " " + lastname)
```

```
Hello Robert Haase
```

Working with variables and string values

- Also strings as values for variables are supported
- When combining strings and numbers, you need to explicitly define what you want to do.

```python
# mixing types

a = 5
b = "2"

print (a + b)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-4-51629e6a285f> in <module>
      4 b = "2"
      5
----> 6 print (a + b)

TypeError: unsupported operand type(s) for +: 'int' and 'str'
```

```python
# mixing types

a = "5"
b = 2

print (a + b)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-5-85ae49867097> in <module>
      4 b = 2
      5
----> 6 print (a + b)

TypeError: can only concatenate str (not "int") to str
```

```python
# mixing types to make numbers

a = 5
b = "2"

print (a + int(b))
```

```
7
```

```python
# mixing types to make strings

a = "5"
b = 2

print (a + str(b))
```

```
52
```

- Conversion to a floating point number: float()