



# PYTHON SEMINAR 2020

JENS HAHN

THEORETICAL BIOPHYSICS

# TODAY



I git recap

II Environments

III Object orientation

# I. GIT RECAP



github.com/user/repo



remote repository

fork

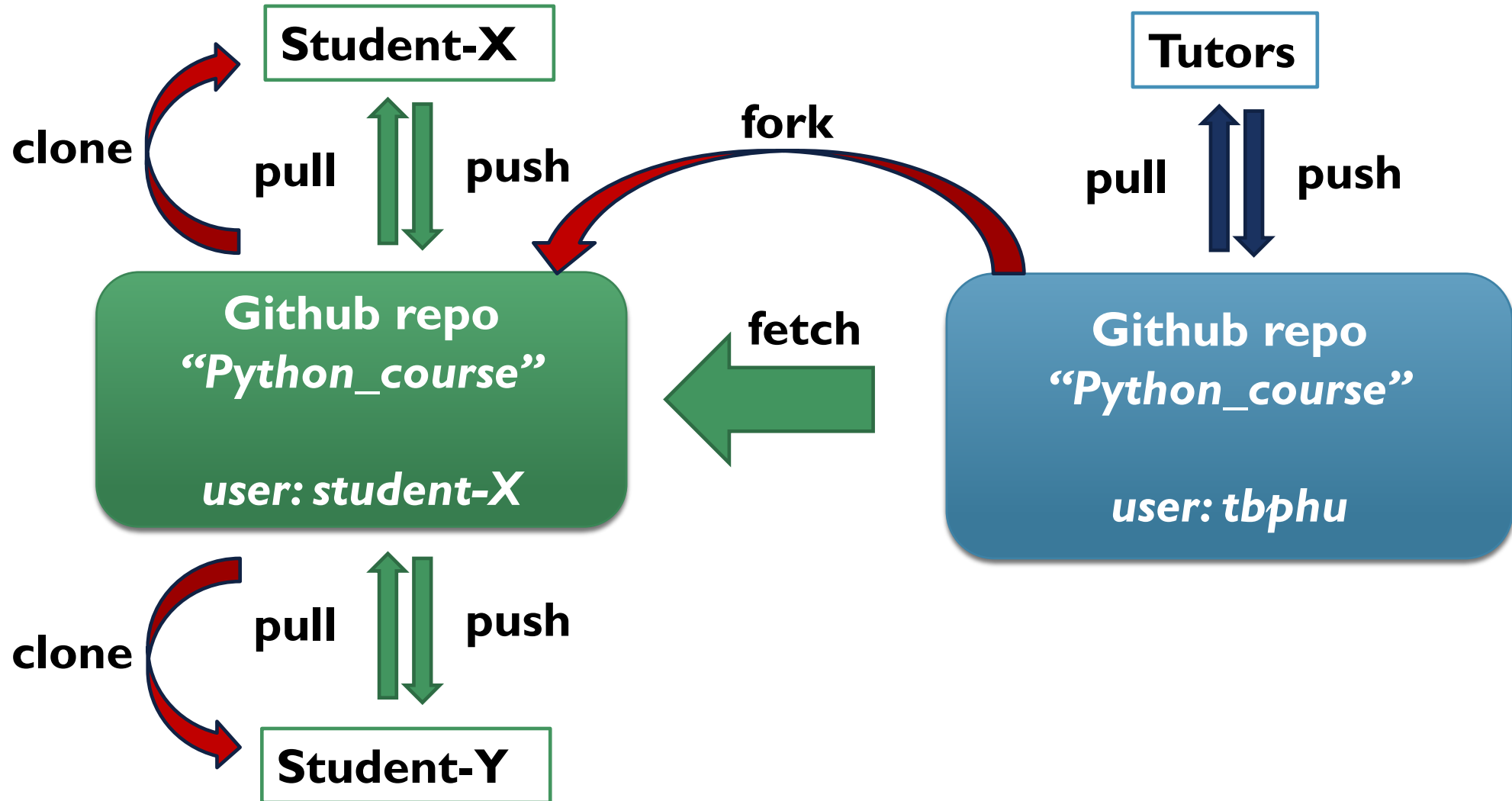


remote repository  
*github.com/me/my\_repo*

clone



local repository  
*/home/Documents/.../repo/*



# I. GIT RECAP



## Tasks

- Fork the repo online (on *github.com*) - get the course material
- Configure *git* (local) - tell *git* who you are
- Clone the forked repo (local) - download course material
- Set another remote repo (local) - update course material



# I. LAST STEPS FOR GIT

```
git fetch upstream  
git merge upstream/master
```

- Set upstream : **just a name**

```
git remote add upstream https://github.com/tbphu/Python\_course.git
```

- Configure git: **just once**

- `git config --global user.email "jens.hahn@hu-berlin.de"`
- `git config --global user.name "Jens Hahn"`

## II. ENVIRONMENTS



### Different ways to use Python:

- |            |   |                         |   |                    |
|------------|---|-------------------------|---|--------------------|
| ■ Console  | - | direct input, not saved | - | testing, fast      |
| ■ Script   | - | indirect input, saved   | - | programs, complex  |
| ■ Notebook | - | direct input, saved     | - | documentation, I/O |

## II. CONSOLE



### QtConsole

The screenshot shows the Jupyter QtConsole application window. The title bar reads 'Jupyter QtConsole'. The menu bar includes 'File', 'Edit', 'View', 'Kernel', 'Window', and 'Help'. The main text area displays the following information: 'Jupyter QtConsole 4.4.3', 'Python 3.7.2 (default, Feb 21 2019, 17:35:59) [MSC v.1915 64 bit (AMD64)]', 'Type 'copyright', 'credits' or 'license' for more information', and 'IPython 7.3.0 -- An enhanced Interactive Python. Type '?' for help.' Below this, the prompt 'In [1]:' is visible.

### Command-line (Eingabeaufforderung)

The screenshot shows a Windows command prompt window with the title 'C:\WINDOWS\system32\cmd.exe - python'. The text displayed is as follows: 'Microsoft Windows [Version 10.0.17134.706]', '(c) 2018 Microsoft Corporation. All rights reserved.', 'C:\Users\Hahn>python', 'Python 3.7.2 (default, Feb 21 2019, 17:35:59) [MSC v.1915 64 bit (AMD64)] :: Anaconda, Inc. on win32', 'Warning:', 'This Python interpreter is in a conda environment, but the environment has not been activated. Libraries may fail to load. To activate this environment please see <https://conda.io/activation>', 'Type "help", "copyright", "credits" or "license" for more information.', and '>>>'.



## II. SCRIPTING



### Notepad, Notepad++

```
Untitled - Notepad
File Edit Format View Help

import numpy as np
import matplotlib.pyplot as plt

def meep():
    print('meep')
    return None
```

### Sublime Text

```
C:\Data\GitHub\Python_course\plot_example.py (Python_course) - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help

FOLDERS
Python_course
├── slides
├── solution
│   ├── agentbased.py
│   ├── agentbased_expanded.py
│   ├── assignment_1.py
│   ├── assignment_2.py
│   ├── assignment_4.py
│   ├── homework_1.py
│   ├── homework_2.py
│   ├── homework_2_sol.py
│   └── plot_example.py
└── plot_fourier_series.py
    └── rock_paper_scissors.py

plot_example.py
1 import matplotlib.pyplot as plt
2
3
4 measured_ccm = [1500, 1234, 1432, 1324, 1543]
5 simulated_ccm = [1600, 1114, 1632, 1111, 2333]
6
7 measured_cb = [200, 500, 333, 444]
8 simulated_cb = [188, 100, 123, 444]
9
10 fig = plt.figure()
11 plt.plot([0, 2500], [0, 2500], Label=None, color='k', alpha=0.3, linewidth=3)
12 plt.scatter(measured_ccm, simulated_ccm, Label='Central Carbon Metabolism')
13 plt.annotate('important enzyme',
14             xy=(1234, 1114),
15             xytext=(200, 1500),
16             arrowprops=dict(facecolor='black', width=2, headwidth=8))
17 plt.scatter(measured_cb, simulated_cb, Label='Cofactor Biosynthesis')
18 plt.text(1800, 200, "I am a string.")
19 plt.xlim(0, 2500)
20 plt.ylim(0, 2500)
21 plt.legend()
22 plt.xlabel('Measured Protein Abundance [copies/cell]')
23 plt.ylabel('Simulated Protein Abundance [copies/cell]')
24 plt.show()
25
26
```

# II. NOTEBOOK



## Jupyter Notebooks

```
File Edit View History Bookmarks Tools Help
Home x Untitled x +
localhost:8888/localhost:8888/...
Meistbesucht News TBP I-Stuff Social Paper Union VM
File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

In [1]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

In [30]: df = pd.read_csv('./Downloads/results.tsv', '\t', header=None)

In [37]: df[5].median()

Out[37]: 353.0

In [38]: df[5].mean()

Out[38]: 441.4512416717141

In [ ]:
```

## JupyterLab

JupyterLab

localhost:8889/lab

Meistbesucht News TBP I-Stuff Social Paper Union VM Files - OneDrive Teaching | Romanczu...

File Edit View Run Kernel Tabs Settings Help

20190309\_proteome\_calcu x 20190312\_weighted\_length x Untitled.ipynb x

Python 3

Downloads > GEXcomparison

Name	Last Modified
20190312_we...	a month ago
Untitled.ipynb	6 days ago
20190312_sg...	a month ago
Ghaemmagh...	a month ago
Kulak.xlsx	a month ago
Lahtvee.xlsx	2 years ago
S1.xlsx	a year ago

```
[3]: for i in range(10):
      yield i
      print(type(i))

File "<ipython-input-3-2c7ff5c8ce8d>", line 2
      yield i
      ^
SyntaxError: 'yield' outside function

[5]: def make(N):

      for i in range(N):
          yield i

[7]: mygenerator = [x*x for x in range(10)]

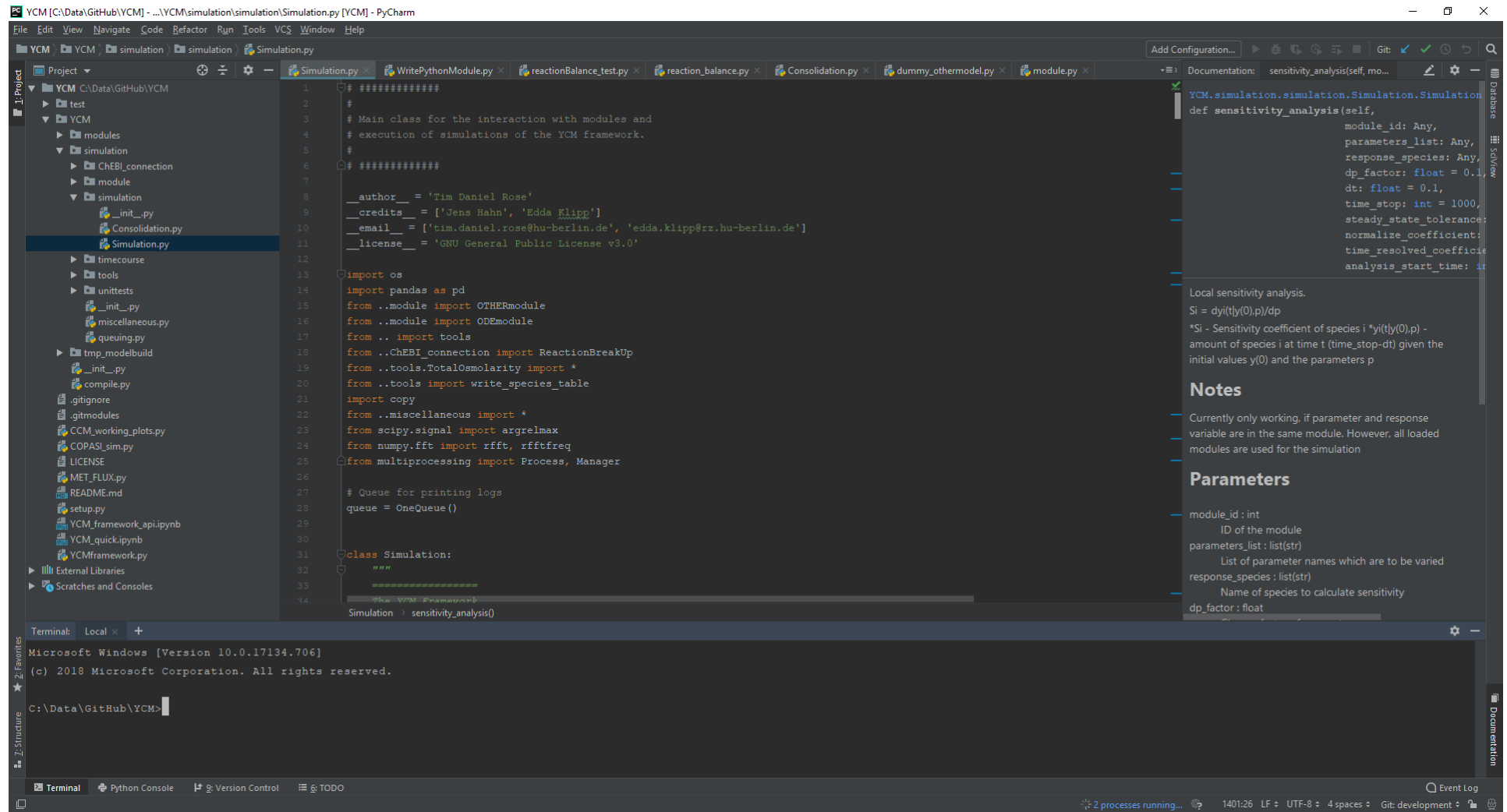
[10]: for i in mygenerator:
        print(i)

0
1
4
9
16
25
```

## II. IDE Integrated Development Environment



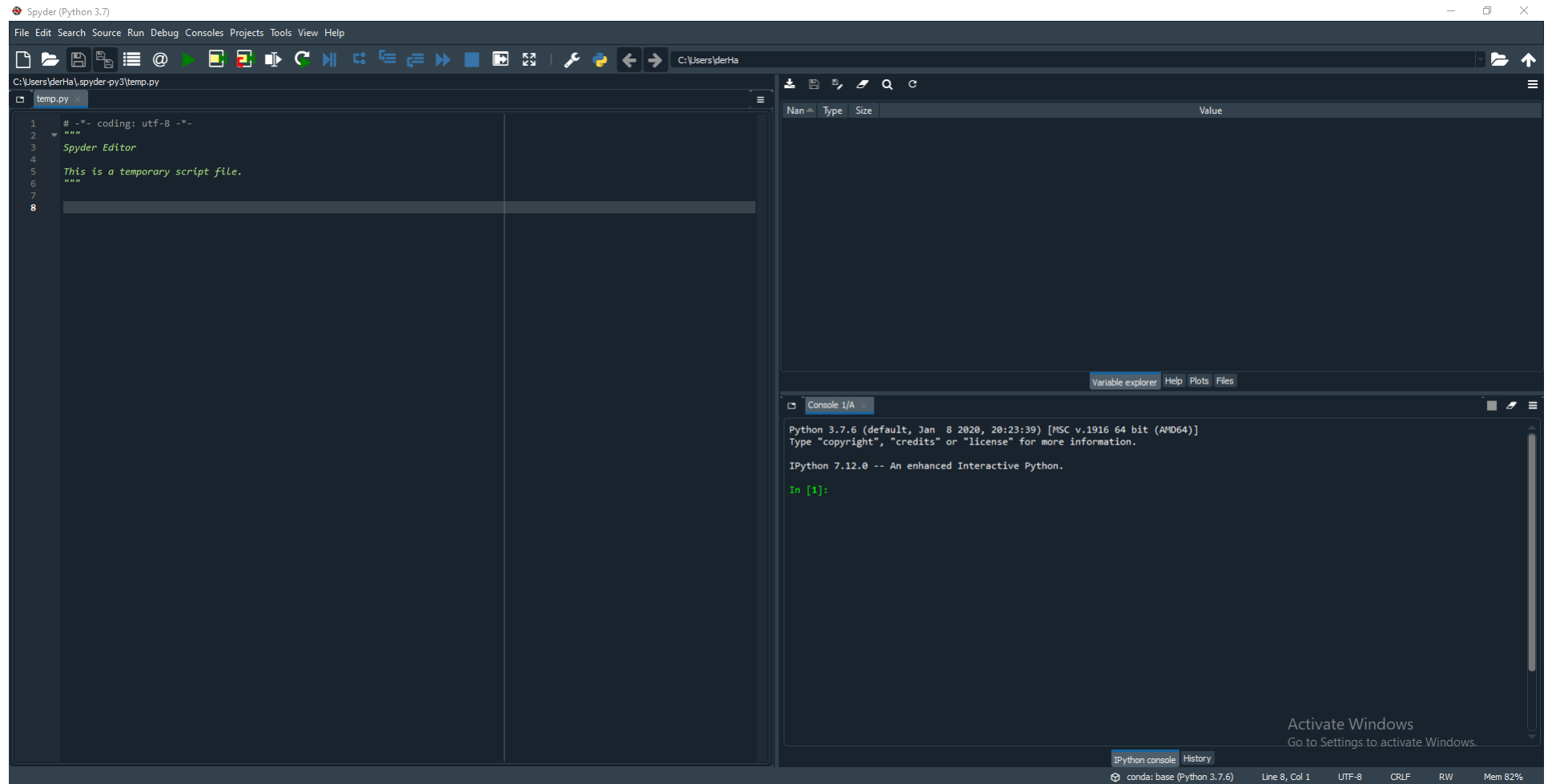
PyCharm  
(Jetbrains)



## II. IDE Integrated Development Environment



### Spyder (Anaconda)



# III. HOW IT WORKS



## Python code interpretation

- Python version 2 or 3?
- Python implementations (Cpython, PyPy...)
- How to get from source code to machine code?
- Interpreted or compiled language?

## Python internals

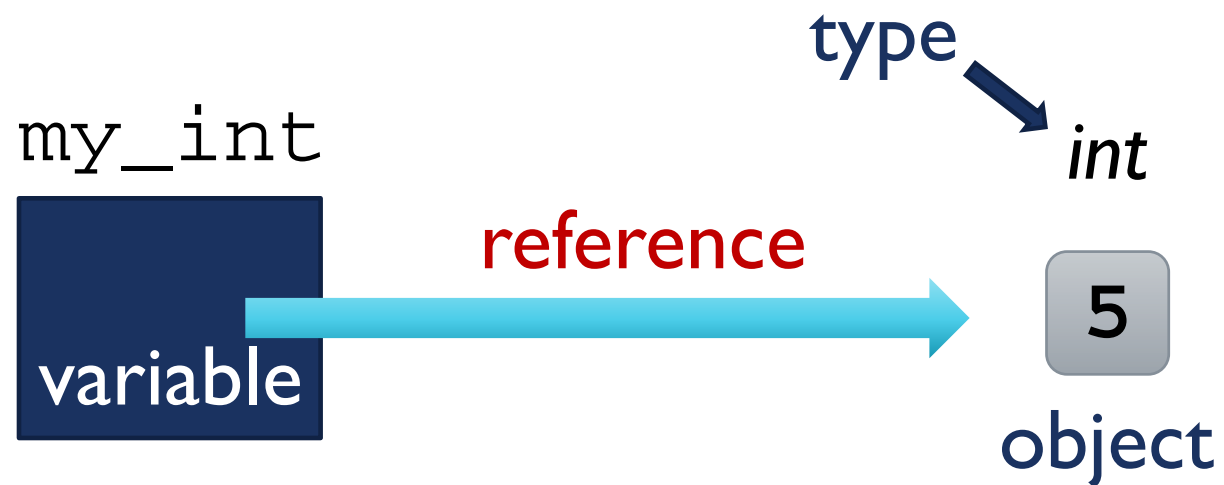
- What is an *object* in Python?
- How are *object* types set?
- Mutable vs. immutable objects?

# III.ASSIGNMENTS (ZUWEISUNGEN)



5 is more than just a number!!

```
my_int = 5
```



# III.ASSIGNMENTS (ZUWEISUNGEN)

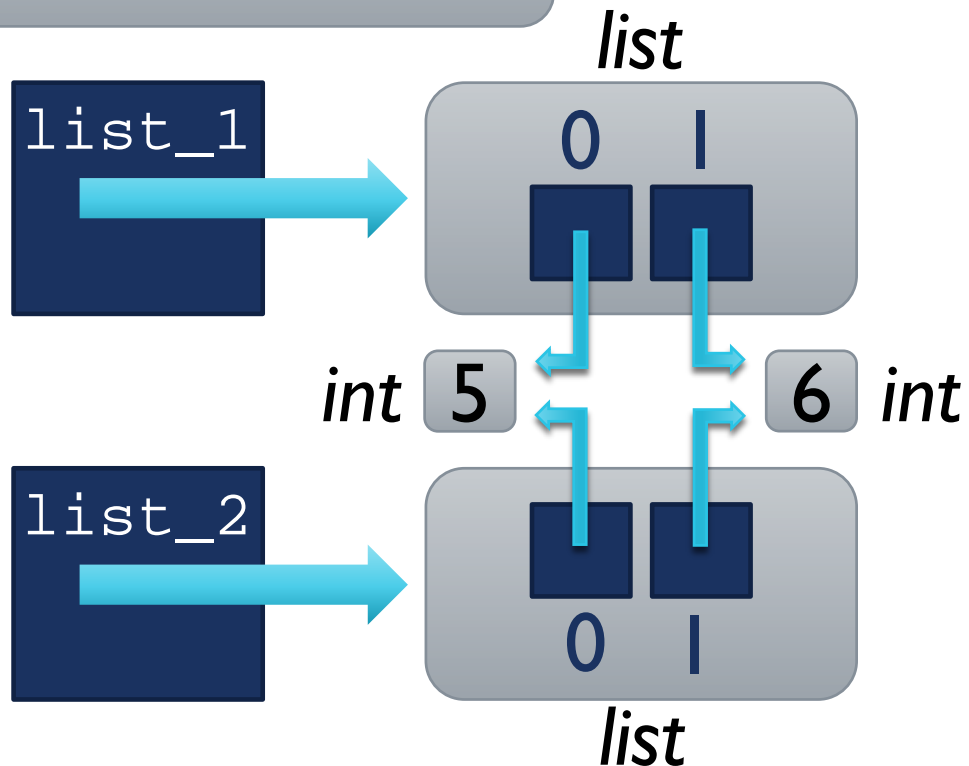


- Duck typing
  - Python choses the *object type* automatically!
- Object
  - Every *object* has *attributes* and *methods* (functions)
- Attention!!
  - *objects* can be **mutable** or **immutable**

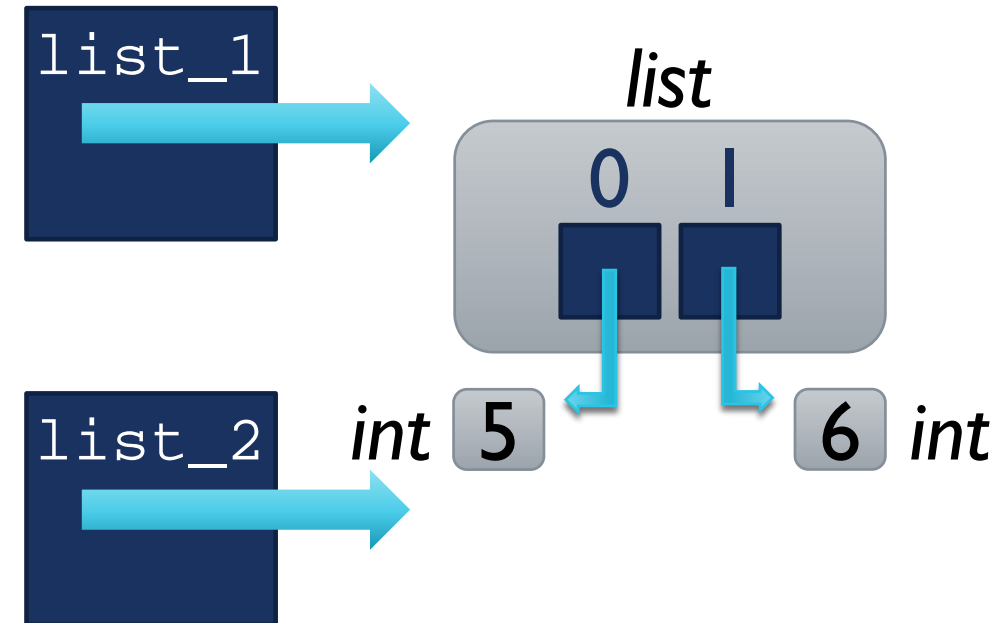
# III.ASSIGNMENTS (ZUWEISUNGEN)



```
list_1 = [5,6]  
list_2 = [5,6]
```



```
list_1 = [5,6]  
list_2 = list_1
```





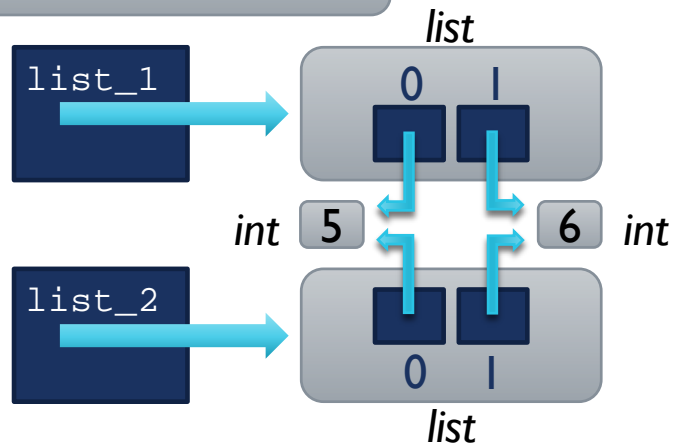
# III. COMPARISONS (VERGLEICHE)



```
list_1 == list_2
```

```
list_1 is list_2
```

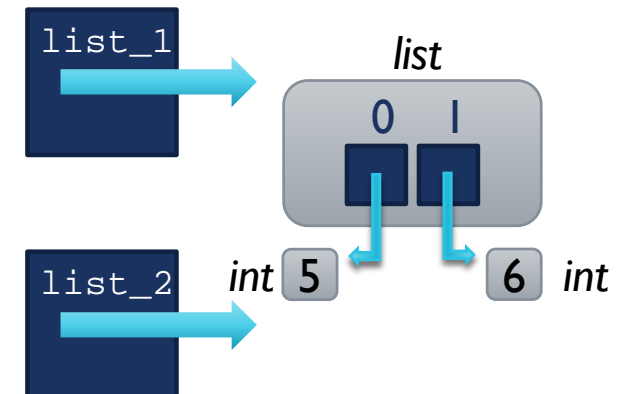
```
list_1 = [5,6]  
list_2 = [5,6]
```



```
list_1 == list_2
```

```
list_1 is list_2
```

```
list_1 = [5,6]  
list_2 = list_1
```

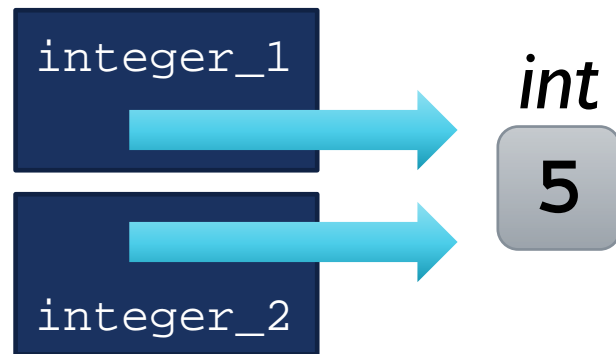


# III. MUTABLE VS. IMMUTABLE



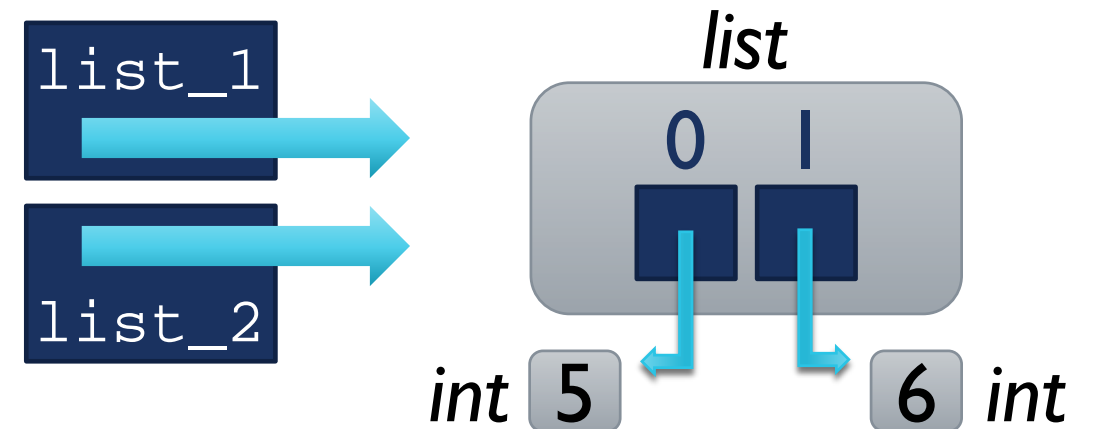
```
integer_1 = 5  
integer_2 = integer_1
```

```
integer_2 = integer_2 + 1
```



```
list_1 = [5,6]  
list_2 = list_1
```

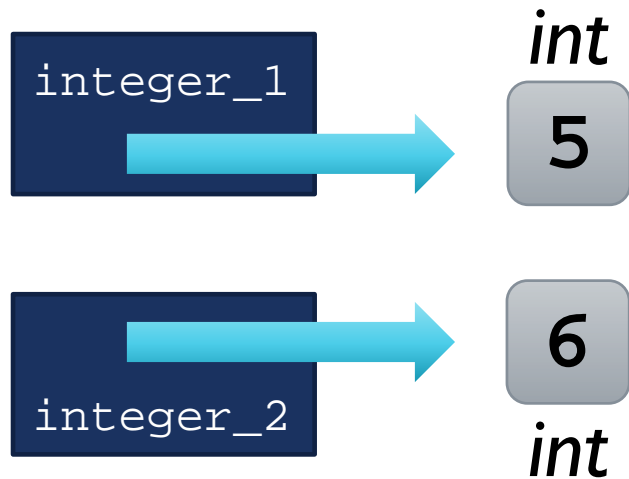
```
list_1.append(3)
```



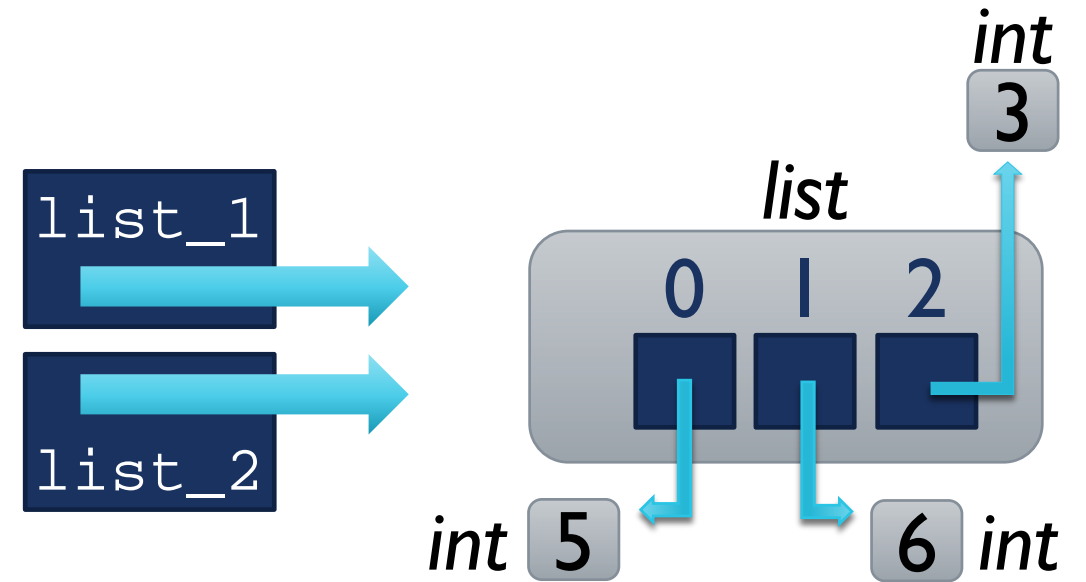
# III. MUTABLE VS. IMMUTABLE



```
integer_2 = integer_2 + 1
```



```
list_1.append(3)
```



### III. HANDS ON ASSIGNMENTS



- Fetch from *upstream* - get the assignment
- Open `assignment_1.py` - do the assignment
- Run file in Python - check your results
- Push to forked repo - get the assignment in YOUR repo

# III. FURTHER READING



## Python versions

- Pick a Python Interpreter

<https://docs.python-guide.org/starting/which-python/>

- Interpreted or Compiled?

<http://net-informations.com/python/iq/interpreted.htm>

## Python internal

- The *id* of an object in Python

<https://www.programiz.com/python-programming/methods/built-in/id>

- Mutable vs. immutable objects

<https://towardsdatascience.com/https-towardsdatascience-com-python-basics-mutable-vs-immutable-objects-829a0cb1530a>