# Introduction to Programming in Python

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HOCHSCHULE
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# Preliminaries

## General Information

- My name is Simon Broda. Email: simon.broda@hslu.ch.
- Format of this course: 14 lectures of 2h each, mix between theory and practice.
- Final grade based on a group assignment (groups of two; 50%) and a final exam (open book, 90min; 50%).
- Additional exercises will be made available but not graded.

# Material

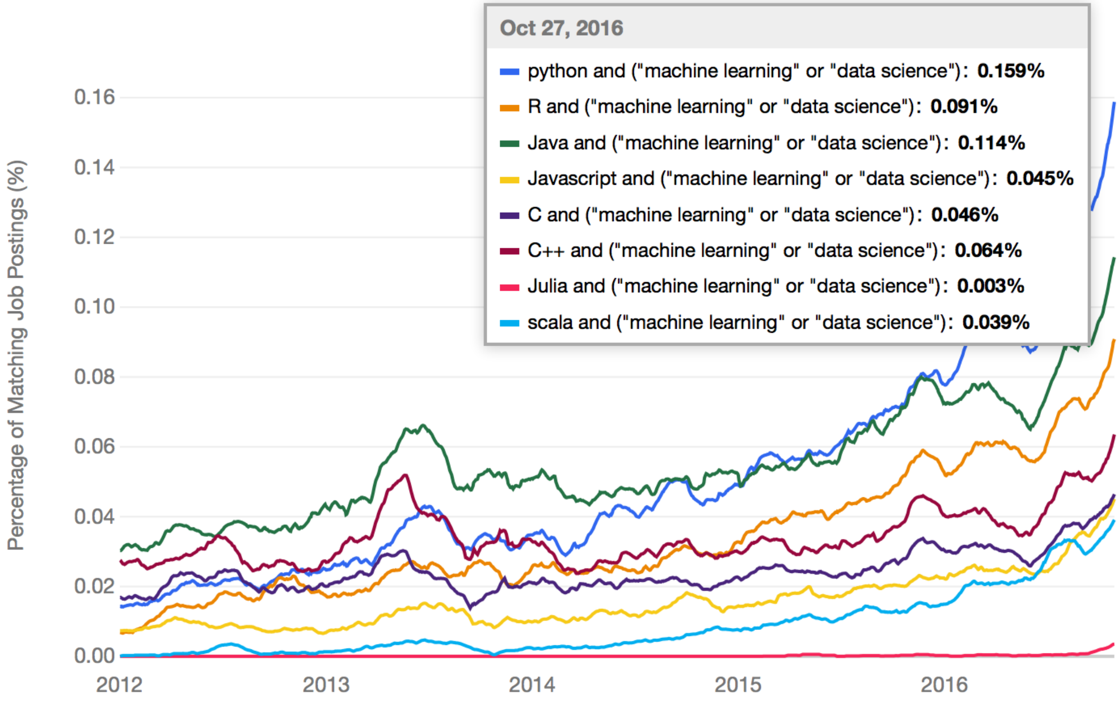
- These lecture slides. Available on Github.
- Website: https://python-course.eu/
- Sources for additional exercises:
    - https://holypython.com/beginner-python-exercises/
    - https://pythonbasics.org/exercises/
- Further reading:
    - Python documentation

# Introduction to Python

## Why Python?

- General purpose programming language, unlike, e.g., Matlab®.
- High-level language with a simple syntax, interactive (*REPL*: read-eval-print loop). Hence ideal for rapid development.
- Vast array of libraries available, including for scientific computing and finance.
- Native Python is usually slower than compiled languages like C++. Alleviated by highly optimized libraries, e.g. NumPy for calculations with arrays.
- Free and open source software. Cross-platform.
- Python skills are a marketable asset: most popular language for data science.

# Job Postings on Indeed.com



Source

But Python can do all kinds of things...

In [ ]:

```
# uncomment the next line if you don't have googlesearch installed yet
#!conda install -c conda-forge -y googlesearch
from googlesearch import search
query = "best course for python"
for i in search(query, tld="com", num=10, stop=10, pause=2):
    print(i)
```

In [ ]:

```
#!pip install instaloader
import instaloader
import glob
from IPython.display import Image

d = instaloader.Instaloader()
profile_name = 'loredana'
d.download_profile(profile_name, profile_pic_only = True)
for filename in glob.iglob('./' + profile_name + '/*.jpg', recursive=False):
    pil_img = Image(filename)
    display(pil_img)
    break
```

In [ ]:

```
#!conda install -c conda-forge -y pytube
#!pip install moviepy
from pytube import YouTube
from IPython.display import Audio
import moviepy.editor as mp
url = "https://www.youtube.com/watch?v=gdsUKphmB3Y"
yt = YouTube(url)
ys = yt.streams.get_highest_resolution()
a = ys.download("./")
clip = mp.VideoFileClip(a)
clip.audio.write_audiofile('out.mp3')
Audio("out.mp3", autoplay=True)
```

These examples are taken from https://dev.to/unitybuddy/9-amazing-things-to-do-with-python-1ln5. Check it out, there are more!

# Obtaining Python

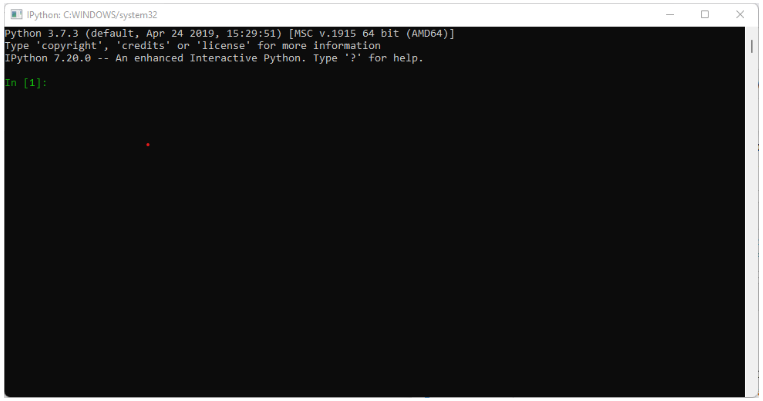
- Anaconda is a Python distribution, developed by Continuum Analytics, and specifically designed for scientific computing.
- Comes with its own package manager (conda). Many important packages (the *SciPy stack*) are pre-installed.
- We will install it together right now. You can find it here. I recommend adding it to your `PATH` upon installation.
- Optional: Install the RISE plugin to allow viewing notebooks as slide shows:

In [ ]:

```
# uncomment the next line to install. Note: "!" executes shell commands.
# !conda install -c conda-forge -y rise
```

# IPython Shell

- Python features a *read-eval-print loop* (REPL) which allows you to interact with it.
- The most bare-bones method of interactive use is via the *IPython shell*: You can start it by entering `ipython` on the command line (Windows; just enter `cmd` in the start menu search) or the terminal (MacOS; start it using Launchpad).



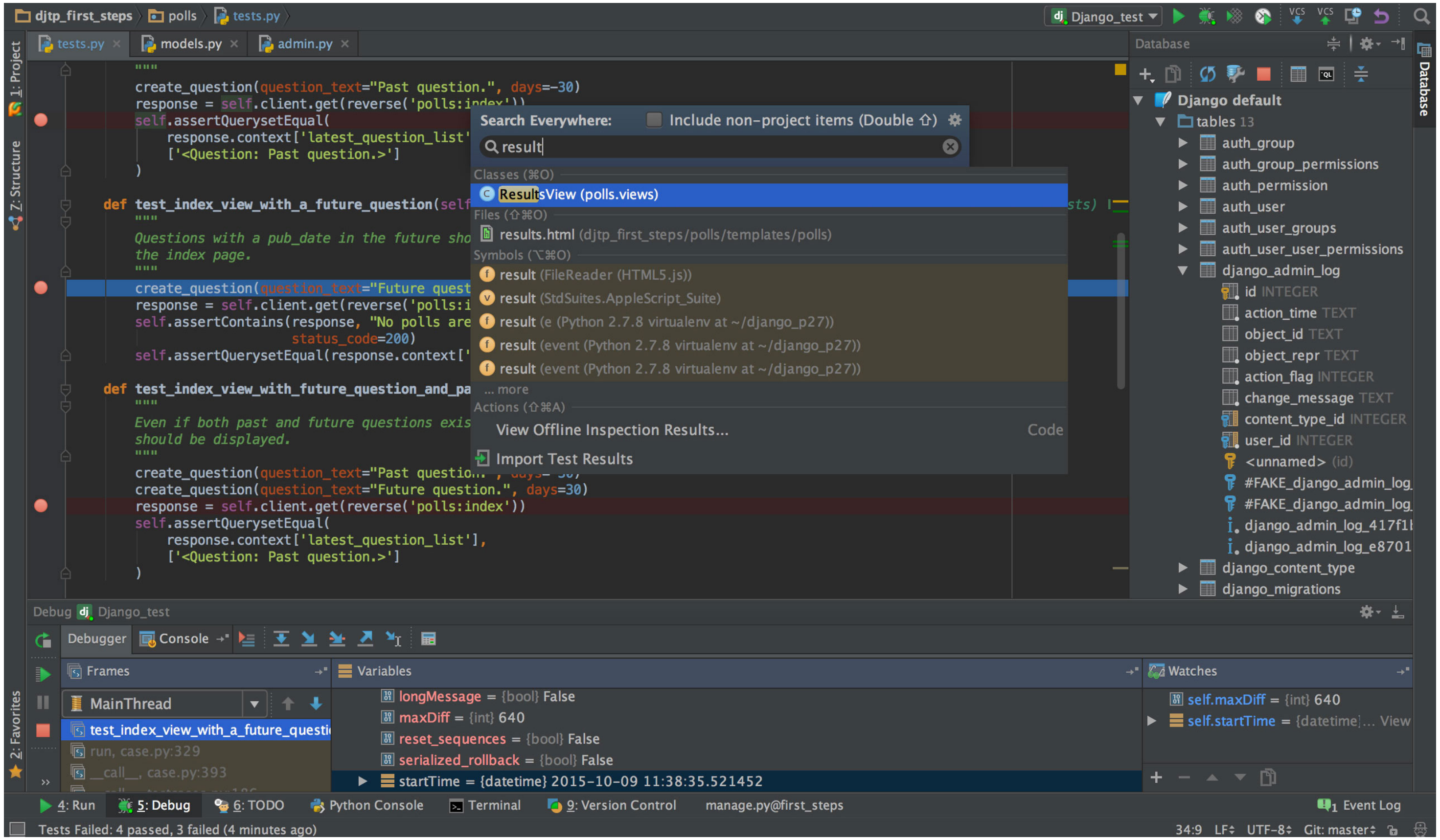
```
Python 3.7.3 (default, Apr 24 2019, 15:29:51) [MSC v.1915 64 bit (AMD64)]
Type 'copyright', 'credits' or 'license' for more information
IPython 7.20.0 -- An enhanced Interactive Python. Type '?' for help.

In [1]:
```

- For now, you can treat it as a fancy calculater. Try entering `2+2`. Use `quit()` or `exit()` to quit, `help()` for Python's interactive help.

# Writing Python Programs

- Apart from using it interactively, we can also write Python *programs* so we can rerun the code later.
- A Python program (called a *script* or a *module*) is just a text file, typically with the file extension `.py`.
- It contains Python commands and comments (introduced by the `#` character)
- To execute a program, do `run filename.py` in IPython (you may need to navigate to the right directory by using the `cd` command).
- While it is possible to code Python using just the REPL and a text editor, many people prefer to use an *integrated development environment* (IDE).
- Anaconda comes with an IDE called *Spyder* (Scientific PYthon Development EnviRonment), which integrates an editor, an IPython shell, and other useful tools.
- An alternative is PyCharm, which we will be using later in this course.



```
        """
        create_question(question_text="Past question.", days=-30)
        response = self.client.get(reverse('polls:index'))
        self.assertQuerysetEqual(
            response.context['latest_question_list'
            ['<Question: Past question.>']
        )

    def test_index_view_with_a_future_question(self
        """
        Questions with a pub_date in the future sho
        the index page.
        """
        create_question(question_text="Future quest
        response = self.client.get(reverse('polls:i
        self.assertContains(response, "No polls are
                            status_code=200)
        self.assertQuerysetEqual(response.context['

    def test_index_view_with_future_question_and_pa
        """
        Even if both past and future questions exis
        should be displayed.
        """
        create_question(question_text="Past questio
        create_question(question_text="Future question.", days=30)
        response = self.client.get(reverse('polls:index'))
        self.assertQuerysetEqual(
            response.context['latest_question_list'],
            ['<Question: Past question.>']
        )
```

Search Everywhere: □ Include non-project items (Double ⇧)

result

Classes (⌘O)
- ResultsView (polls.views)

Files (⇧⌘O)
- results.html (djtp_first_steps/polls/templates/polls)

Symbols (⌥⌘O)
- result (FileReader (HTML5.js))
- result (StdSuites.AppleScript_Suite)
- result (e (Python 2.7.8 virtualenv at ~/django_p27))
- result (event (Python 2.7.8 virtualenv at ~/django_p27))
- result (event (Python 2.7.8 virtualenv at ~/django_p27))

... more

Actions (⇧⌘A)
- View Offline Inspection Results... Code
- Import Test Results

Django default
- tables 13
  - auth_group
  - auth_group_permissions
  - auth_permission
  - auth_user
  - auth_user_groups
  - auth_user_user_permissions
  - django_admin_log
    - id INTEGER
    - action_time TEXT
    - object_id TEXT
    - object_repr TEXT
    - action_flag INTEGER
    - change_message TEXT
    - content_type_id INTEGER
    - user_id INTEGER
    - <unnamed> (id)
    - #FAKE_django_admin_log
    - #FAKE_django_admin_log
    - django_admin_log_417f1l
    - django_admin_log_e8701
  - django_content_type
  - django_migrations

MainThread
- test_index_view_with_a_future_questi
- run, case.py:329
- __call__, case.py:393

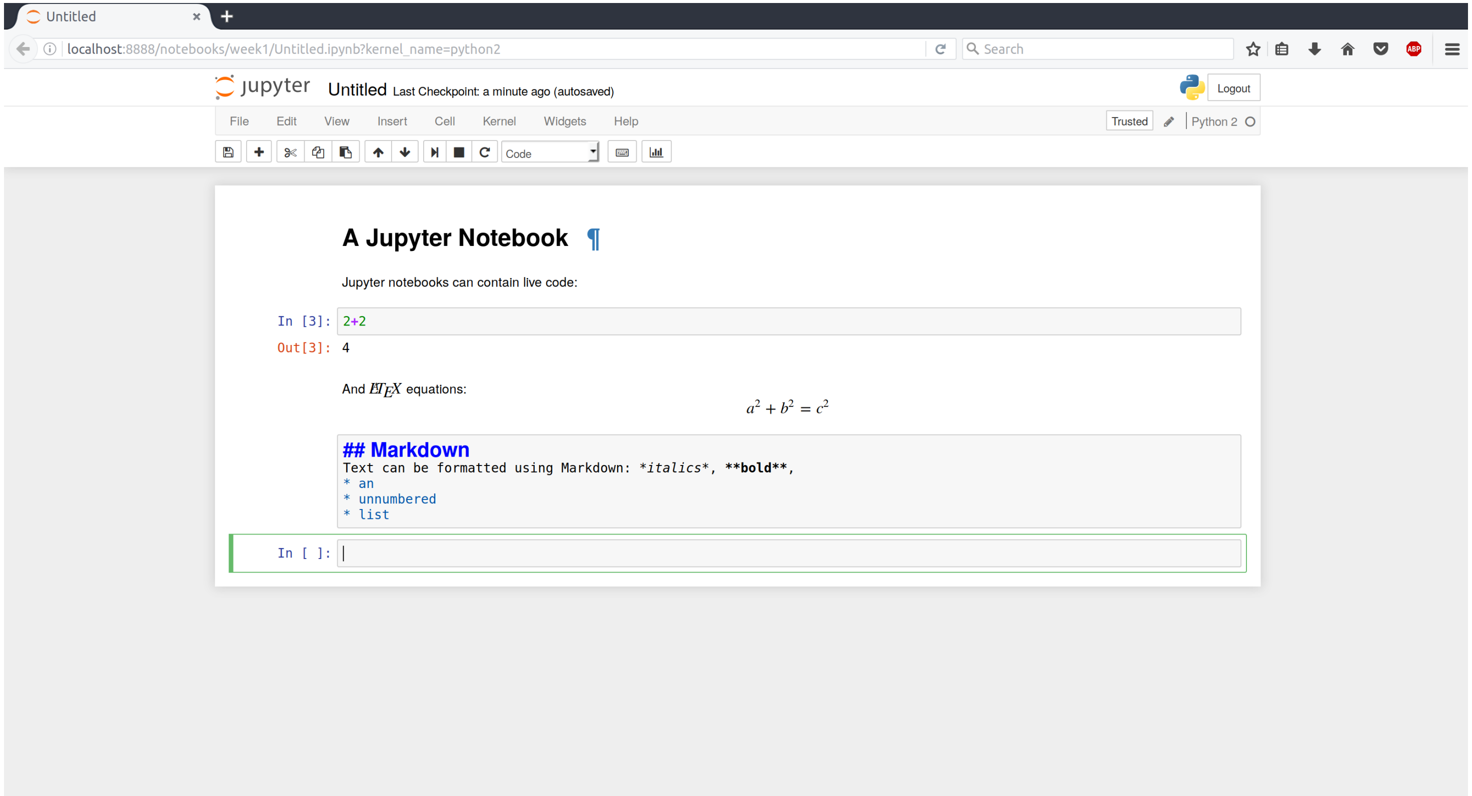
```
longMessage = {bool} False
maxDiff = {int} 640
reset_sequences = {bool} False
serialized_rollback = {bool} False
▶ startTime = {datetime} 2015-10-09 11:38:35.521452
```

```
self.maxDiff = {int} 640
▶ self.startTime = {datetime}... View
```

Tests Failed: 4 passed, 3 failed (4 minutes ago)    34:9  LF÷  UTF-8÷  Git: master÷

# Jupyter Notebooks

- Another option is the *Jupyter notebook* (JUlia PYThon (e) R, formerly known as IPython notebook); this is what we will use in the coming weeks.
- It's a web app that allows you to create documents (`*.ipynb`) that contain text (formatted in Markdown), live code, and equations (formatted in $\LaTeX$).
- In fact these very slides are based on Jupyter notebooks. You can find them on my Github page.
- You can start Jupyter either from the Anaconda Navigator, or by typing `jupyter notebook` in the command line / terminal.


Untitled
localhost:8888/notebooks/week1/Untitled.ipynb?kernel_name=python2
Search
jupyter
Untitled Last Checkpoint: a minute ago (autosaved)
Logout
File
Edit
View
Insert
Cell
Kernel
Widgets
Help
Trusted
Python 2
Code

# A Jupyter Notebook ¶

Jupyter notebooks can contain live code:

```
In [3]: 2+2
Out[3]: 4
```

And $\LaTeX$ equations:

$$a^2 + b^2 = c^2$$

```
## Markdown
Text can be formatted using Markdown: *italics*, **bold**,
* an
* unnumbered
* list
```

```
In [ ]: |
```

- A notebook consists of cells, each of which is either designated as Markdown (for text and equations), or as code.
- You should take a moment to familiarize yourself with the keyboard shortcuts. E.g., `enter` enters edit mode, `esc` enters command mode, `ctrl-enter` evaluates a cell, `shift-enter` evaluates a cell and selects the one below.
- Useful references:
    - Jupyter documentation;
    - Markdown cheat sheet;
    - Latex math cheat sheet.