An introduction to Python

Thibaut Lunet, Aitor Pérez

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How to get Python (+ useful packages ...)

We are going to use the **miniconda** installer, which is cross-platform and provides package management, together with the **spyder** IDE.

1. Go to https://conda.io/miniconda.html
   (or Google search : "miniconda download")
2. Depending on the operating system, download installer (Python 2.7)
3. Install Python and required packages
   - Mac OS X or Unix:
     3.1 Open a terminal
     3.2 Run "bash Miniconda[...].sh", and yes for all ...
     3.3 Open a new terminal, or run "source ~/.bashrc"
     3.4 Run "conda install spyder numpy scipy matplotlib sympy"
   - Windows:
     3.1 Double-click on the .exe file, and yes for all ...
     3.2 Open "conda prompt" terminal (installed with miniconda)
     3.3 Run "conda install spyder numpy scipy matplotlib sympy"

History

XXX slkdjlksj

Python vs. every one else (Matlab, Fortran, C++, ...)

- License-free and open-source ($\neq$ Matlab)
- Huge users community, many (free) packages for many applications
- Extremely easy of use for non-I-love-programming people ($\neq$ Fortran, C, C++)
- Easy interface with other (more-efficient) programming languages $\Rightarrow$ computation can be accelerated using Fortran, C, C++ library ...
- Can scale to very large problems (parallel computing, ...)
- Structured and friendly ways for developing library ($\neq$ Matlab)

Python = many advantages, with very few drawbacks !

Functioning principles

XXX dsdskldj

Practical tools

Using python console

```
lunet@matlnx13: ~/Recherche/Enseignement/python-math/examples
lunet@matlnx13:examples$ python
Python 3.6.4 |Anaconda, Inc.| (default, Jan 16 2018, 18:10:19)
[GCC 7.2.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

Running a script

```
lunet@matlnx13: ~/Recherche/Enseignement/python-math/examples
lunet@matlnx13:examples$ python helloWorld.py
1 + 1 = 2
   YAILLLLLE !

lunet@matlnx13:examples$
```

All-in-One solution $\Rightarrow$ **Spyder** !

Hello World!

All the examples and python files are available at:
https://gitlab.unige.ch/Thibaut.Lunet/python-math

A first easy step ...

1. Launch Spyder
   - Windows : double click on an icon somewhere ...
   - Mac OS X or Unix : run "spyder" in terminal
2. Discover a wonderful environment #woaaah
3. Go to lower right corner $\rightarrow$ IPython console
   - write "1+1"
   - press enter ...
4. Go to text editor (middle)
   - write "print('hello world')
   - save and run the file ...

Basic variables types and operations

```
# Integer
i1 = 1
i2 = 7 % 3  # i2 = 1

# Float -- by default, double precision !
f1 = 0.5
f2 = f1/7  # f2 = 0.07142857142857142

# Complex
c1 = 1+1j
c2 = c1 + f1 + i1  # Automatic conversion, c2 = 2.5 + 1j

# String
s1 = 'salut'
s2 = 'toi'
s3 = s1 + s2  # s3 = 'saluttoi'

# Boolean
b1 = True
b2 = (i1 != 1)*b1 + (i1 == 1)*(f1 < 10)*(f2 >= 0)  # b2 = True
```

Lists

```
# List
l1 = [1, 2, 5, 6]
# Access elements : l1[0] = 1, l1[2] = 5, l1[-1] = 6
# Slice : l1[1:3] = [2, 5]

# Nested list
l2 = [ ['vive', 'la'], ['saucisse', 2], 'Toulouse']
# Extract sub-list : l2[0] = ['vive', 'la']
# Access element : l2[0][1] = 'la', l2[1][0] = 'saucisse'
```

Python allows to use list comprehension:

```
[3*n + 1 for n in range(0, 10) if n % 2 == 0]
# returns [1, 7, 13, 19, 25]
```

Exercise 1

Rewrite the `filter_positive` function and reduce it to one line.

Dictionary

TODO

Tabs matter !

```
# For loop
for i in range(5):
    print('i = {}'.format(i))

# If condition
if 1 == 2:
    print('Tocard')
elif 1 == 0:  # Not mandatory
    print('Toujours pas')
else:  # Not mandatory
    print("OK d'accord")

# While loop
i = 0
while i < 10:
    print('TAIHOOO-'+str(i))
    i += 1
    if i == 5:
        break  # Allows to escape from the while loop
```

Function definition

```
def funcA(a, b=1):
    return a + b
# funcA(0.5, 2) = funcA(0.5, b=2) = 2.5
# funcA(1) = 1.5
# funcA() -> ERROR
```

to be continued ...

File I/O

XXX sdjhj

Exercise 3 - Numpy?

XXX Maybe a small numpy example?