Python in a nutshell

Christophe Pallier

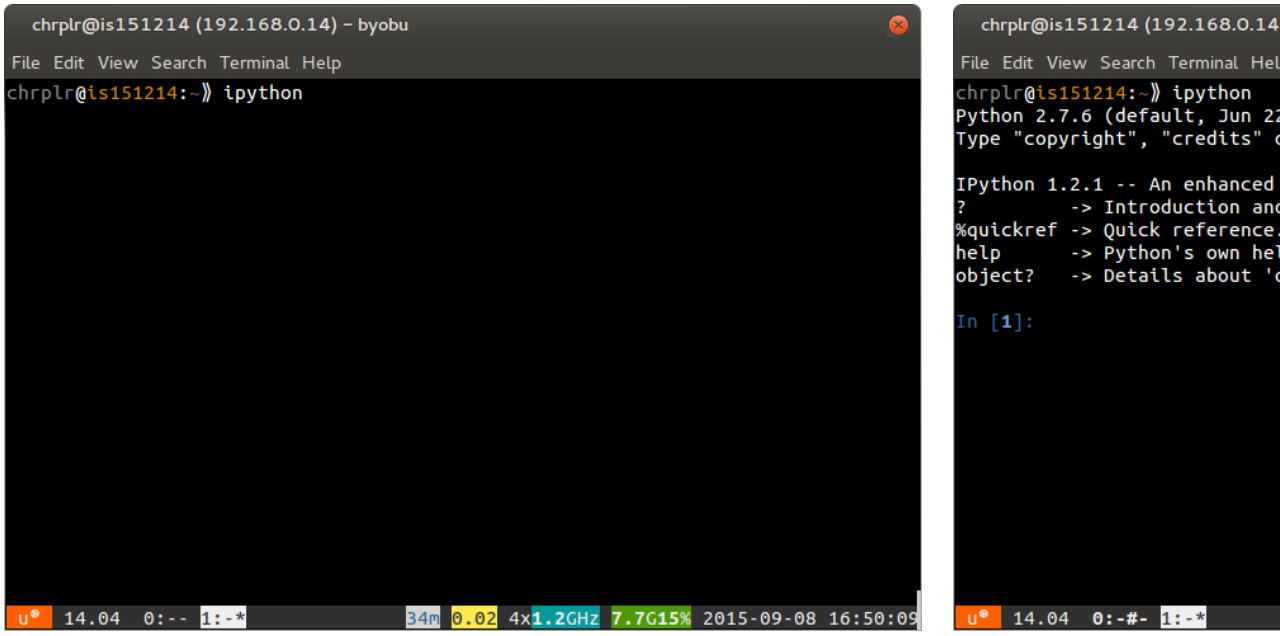
Contents

Using Python interactively

You can use Python in two ways:

- **Interactively**, e.g. by launching `ipython` in a terminal, and typing python commands that are *interpreted* and *executed* when you press 'Enter'.

1. Open a command line window (a.k.a. Terminal):
   - Ubuntu-Linux: Ctrl-Alt-T https://help.ubuntu.com/community/UsingTheTerminal
   - MacOSX: http://www.wikihow.com/Get-to-the-Command-Line-on-a-Mac,
   - Windows: http://windows.microsoft.com/en-us/windows-vista/open-a-command-prompt-window
2. Type `ipython` on the command-line and press `Enter`:



3. You are now talking to ipython. Enter the following commands:

```
import turtle
turtle.circle(50)
turtle;forward(100)
turtle.circle(50)

turtle.right(90)
turtle.forward(100)
turtle.right(90)
turtle.heading()
```

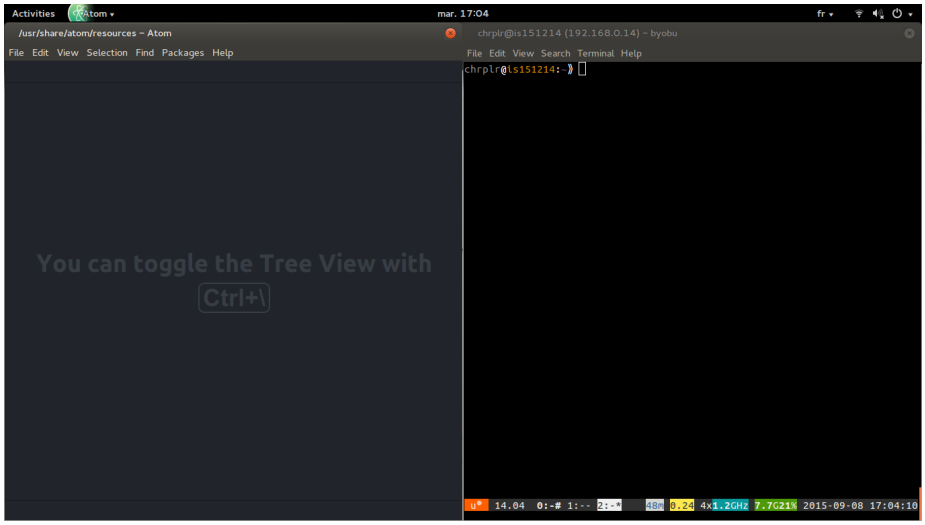
. . .

This way of using Python is fine if you need to quickly test an idea. But as soon as you quit `ipython` (by pressing `Ctrl-D`), you lose all traces of what you have done. To avoid that, you want to use the **Edit-run** approach

Using a editor (Edit-run cycle)

Using a **text editor**, e.g. *atom*, you write a python script, that is, a series of commands, that you save in a file; then you gie this file to interpret to Python. Here is how:

1. Open a Text-Editor (e.g. Atom) and a Terminal window side-by-side:



2. Create a `New File` in the Editor and enter the following text:

```
import turtle
turtle.circle(50)
turtle.forward(50)
turtle.left(120)
turtle.forward(100)
turtle.left(120)
turtle.forward(100)
turtle.left(120)
turtle.forward(50)
```

3. Using 'File/Save as', save the this text under the filename `myscript.py` in your personal (home) directory

- *run* with a python interpreter, by typing `python myscript.py` on a command line of the Terminal. Try it now.

Important: you must make sure that the current working direcoty of the terminal is the same directory where the file myscript.py has been saved. Otherwise, you will get an error message such as 'No such file or directory'. To fix this problem, you must use the 'cd' command to navigate the directory structure.

Remarks:

- You can learn more about Turtle graphics by reading the documentation at https://docs.python.org/2/library/turtle.html
- there exist a third approach which combines interactivity and persistence — the `ipython notebook`. Like Mathematica, handy for numerical processing.

First programs

Warming up

Create a script `hello.py` in the editor, save it and run it on the command-line:

```
name = raw_input('What is your name?')
print('Hello ' + name + '!')
```

Concepts: string constant, variable (name), affectation, string concatenation with '+'

. . .

```
# multiplication by successive addition
a, b = 10, 5
sum = 0
while (a > 0):
    sum = sum + b
    a = a - 1
print(sum)
```

Concepts: multiple affectation, modifying a variable, while loop, indentation for blocks,

Types

Do the following in interactive mode (ipython):

```
type(10)
type(10.5)
type('bonjour')

a = 20
type(a)
```

Concept: types

```
print(10 + 5)
print("10" + "5")
print("10" + 5)
```

10 is an integer, 10.0 is a float, "10" is a string. It is possible to convert from one type to another:

```
print('Il y a ' + str(10) + ' ans...')
print(int("10"))
```

. . .

```
num = raw_input('entrez en nombre')
print(num)
```

Question: `num` est-il un nombre ou une chaîne de caractères?

Exercices: faire les exercices 2.3 et 2.4 de *How to think like a computer scientist?*

Complex types (lists, dictionnaries):

```
type([1, 2, 3])
type(['a', 'b', 'c'])
```

. . .

```
seq1 = ['jean', 'marie', 'paul']
seq1[0]
seq1[1]
seq1[2]
```

. . .

```
dico = {'windows':0, 'macos':0, 'linux':1}
type(dico)
dico['windows']
dico['macos']
dico['linux']
```

for Loops

```
for x in [1, 2, 3, 4]:
    print(x*x + 2*x + 1)
```

Concept: for loop

. . .

```
numbers = [1, 2, 5, 10]
y = [(x*x + 2*x + 1) for x in numbers]
y
```

concept: lists (or sequences)

See http://effbot.org/zone/python-list.htm

. . .

```
for _ in range(100):
    print('All work and no play makes Jack a dull boy')
```

Concepts: range to generate a list of numbers, 'for' loop, indentation of instuction block

. . .

```
for name in ('Jack', 'John', 'Tim'):
    for _ in range(10):
        print('All work and no play makes ' + name + ' a dull boy!')
```

Concepts: list of strings, double imbrication

Exercice: write a program that computes the sum of the first n integers (1+2+...+n)

```
n = 100
for i in range(1, n+1)
    sum = sum + i
print(sum)
```

Guess a number

Type this program in a text editor, save it as a Python script (with extension .py) and run it.

```
# guess a number
import random

target = random.randint(1, 100)

print("I am thinking about a number between 1 and 100")

guess = raw_input("Your guess? ")

while guess != target:
    if guess < target:
        print("Too low!")
    else:
        print("Tow high!")
    guess = raw_input("Your guess? ")

print("You win! The number was indeed " + target)
```

Programs (a.k.a scripts)

- A program typically consists in a series of *instructions* (aka *commands*).
- The main types of instructions are:
  - Function calls
  - Assignments to variables
  - Testing and branching instructions

Note that Python scripts also often contain sections of module importation and function definitions (to be explained later)

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function calls

```
from math import sin, pi
print(sin(pi/2))
```

```
from turtle import circle, forward
circle(50)
forward(100)
circle(50)
```

The arguments of functions can be constants, variables, other function calls.

```
print(34)
myvar = 36
print(myvar)
print(math.sin(myvar))
```

Assignments

```
a = 24
b = 'bonjour'
c = ['aga', 'bobo', 'glop']
```

- variables are names that point to objects in memory

```
a = 3
b = a
print a, b
a = 4 # a points to a new object
print a, b
```

```
a = [1, 2, 3]
b = a    # points to the same object (a list)
c = a[:] # makes a copy
a[0] = 10
print a, b, c
```

Testing and branching

```
response = 'no'
if response == 'ok':
    print 'accepted'
else:
    print 'rejected'

n = 0
while n < 10:
      n = n + 1
print n
```