

Python in a nutshell

Christophe Pallier

Using Python interactively

You can use Python in two ways:

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

- Open a terminal and start `ipython`
- Type the following lines
`import turtle`
`turtle.circle(50)`
`turtle.forward(100)`
`turtle.circle(50)`
`turtle.right(90)`
`turtle.forward(100)`
`turtle.right(90)`
`turtle.heading()`

...

This is ok if you need to quickly test an idea. But as soon as you quit `ipython`, 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 program, that is, a series of commands ;

- start Atom
- Type the following lines
`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)`
- save the buffer under the filename `myscript.py`

- *run* with a python interpreter, for example by typing `python myprogram.py` on a command line (or `%run myprogram.py` in ipython).

Remark: * 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`, and run it:

```
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, dictionaries):

```
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 instruction 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

Exercise: 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("Too high!")
    guess = raw_input("Your guess? ")

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

Exercise (depeing

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)

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
```