

# An informal introduction to Python

Inteligencia Artificial en los Sistemas de Control Autónomo  
Máster en Ciencia y Tecnología desde el Espacio

Departamento de Automática

## Objectives

1. Understand the main Python features, strengths and weaknesses
2. Overview the main Python statements
3. Being able to program naïve Python scripts

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# Introduction

## What is Python?

Python is a general-purpose, high-level, interpreted programming language

- General-purpose: Many applications.
- High-level: Abstract data structures, doing more with less code.
- Interpreted: No need to compile.

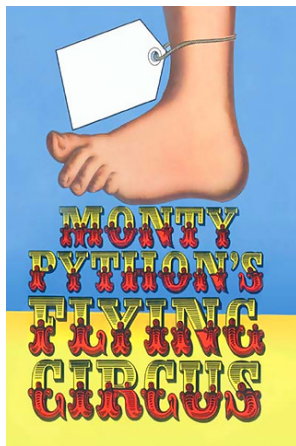


It emphasizes code **readability** and programmer's productivity

# Introduction

## Features

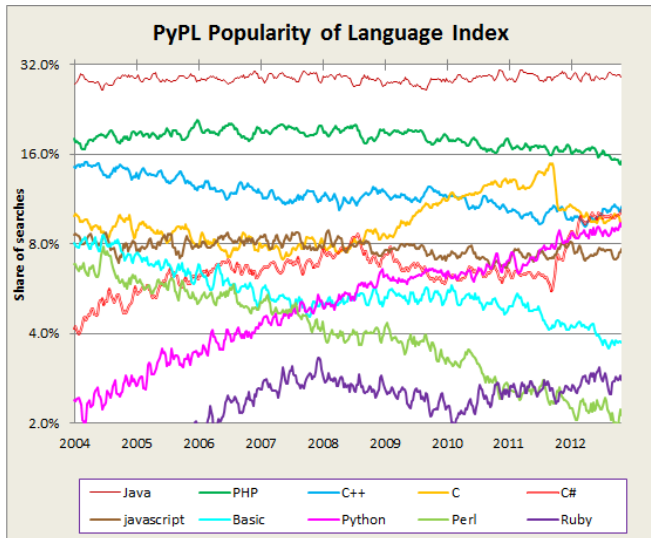
- Several paradigms
  - OO, imperative and functional
- Dynamic typing
- Interpreted
- Minimalistic syntax
- Portable
- Extensible - Bindings to other languages
- Embeddable
- Application domains
  - Web, robotics, data science, game development, admin ...



Want to know other Monty Python's contribution to Computer Science? [Click here](#)

# Introduction

## Why Python? (I)



(Source)

# Introduction

## Why Python? (II)

### Hello world! examples

#### Python

```
#!/usr/bin/python

print("Hello , world!")
```

#### Java

```
public class HelloWorld {
    public static void main(String[]
        args) {
        System.out.println("Hello , world
            !");
    }
}
```

#### C

```
#include <stdio.h>

int main()
{
    printf("Hello , world!\n");
}
```

#### C++

```
#include <iostream>

int main()
{
    std::cout << "Hello , world!\n"
        ;
}
```

# Introduction

## Why Python? (III)

### More reasons to love Python

- Very easy to learn ...
  - ... yet extremely powerful
  - Clearer syntax compared to almost anything else
- Facilities in development
  - Wide standard library: <http://docs.python.org/library/>
  - Great number of modules.
  - Almost any software library has its associated wrapping in order to its access from Python.
- Interactive mode
  - Rapid testing and development
- Most languages are made to make big and fast programs
  - Python was designed to ease programmers' life
- It is free software!



# Introduction

## Where Python is used?

- In Google. One of the development official languages
- In YouTube.
- In BitTorrent.
- In animation: DreamWorks Animation, Pixar, Industrial Light & Magic.
- Red HatFedora Installer (Anaconda).
- And much more ...: <http://www.python.org/about/success/>

# Introduction

Where python is not suitable?

But ... Python is not perfect.

- It is not good for ...
  - Applications that require high computing capacity.
  - Programming of low level (system-programming): programming of kernels, drivers, etc.
  - Very big programs (open discussion).

# Introduction

## History

- Python was created by Guido van Rossum in the Netherlands
- Python 2.0: Released on 2000
- Python 3.0: Released on 2008. Backwards-incompatible

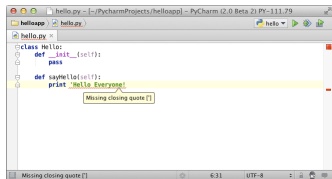
Python 2.X is still very popular, but Python 3.X is the future



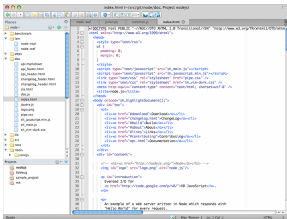
# Introduction

## Installation

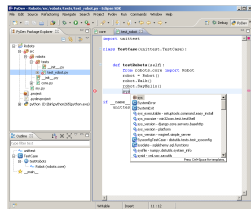
- If you have a good OS such as Linux or Mac, you already have Python!
- Otherwise (Windows), you have to install it
  - Visit <https://www.python.org/downloads/>
- Bad news: There is no "standard" IDE
  - PyCharm, Komodo, PyDev, ...
  - <http://wiki.python.org/moin/PythonEditors>



PyCharm



Komodo



PyDev

# The Python interpreter

## Python operation modes

Python is an interpreted language, i.e., it needs an interpreter.

- Interpreted = it is not compiled = it needs no compilation.
- Faster development, slower execution.

Two operation modes:

- **Interactive:** The interpreter reads the program from the `stdin` (usually the keyboard).
- **Non-interactive:** The interpreter reads the program from a file (also known as `script`).

# The Python interpreter

## Non-interactive

The program is in a plain text file.

- It can be edited with any text editor.
- Extension ``.py".
- Execution permission (`chmod u+x myscript.py`).
- By default, UTF-8 encoding.

The first line must be `#!/usr/bin/python`

- It is the interpreter location.
- If not present, the interpreted must be invoked.

script.py

```
#!/usr/bin/python  
  
print("Hello , world!")
```

```
python script.py  
./script.py
```

# The Python interpreter

## Interactive

Just run `python`

- Different names for different versions to avoid conflicts.
- `python`, `python3.4`, ...

```
localhost:~ user$ python3.4
Python 3.4.2 (v3.4.2:ab2c023a9432, Oct 5 2014, 20:42:22)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

The programmer executes as he writes code down.

# An informal introduction

## Variables (I)

**Variable:** A name that refers a value.

- No need to declare variables (Python is weakly typed!).
- Python automatically assigns types.
- Basic types: Numbers, strings and booleans.

**Complex data structures:**

- Lists, tuples, dictionaries, associative arrays.

### Variables

```
variable = value
```



# An informal introduction

## Variables (II)

Hint: `type()` returns data type.

```
>>> integer = 4
>>> float = 2.3
>>> integer + float
6.3
>>> string = "Spam"
>>> boolean = True
>>> a = b = c = 0
>>> b
0
>>> type(integer)
<type 'int'>
```

# An informal introduction

## Numbers (I)

**Number types:** Integer, float and complex.

```
>>> num = 1+3j
>>> num
(1+3j)
```

SIGN	OPERATOR	SIGN	OPERATOR
=	Assignment	//	Floor division <sup>†</sup>
+	Add	**	Exponent
-	Substraction	+=	Assign +
*	Multiplication	-=	Assign -
/	Division	*=	Assign *
%	Modulus	/=	Assign /

<sup>†</sup>Only Python 3.x

# An informal introduction

## Numbers (II)

### ArithmeticDemo.py

```
a = int(input("Number: "))
b = float(input("Number: "))
c = (a * b) / 2
c += 1
d = c ** 2
print("Result c: ", c)
print("Result d: ", d)
```

New Python elements:

- The `input()` function.
- The `int()` and `float()` functions.

# An informal introduction

## Strings (I)

```
>>> 'hello'
'hello'
>>> "hello"
'hello'
```

Strings are delimited with single or double quotes, they can be used together.

Triple quotes to define multi-line strings.

```
>>> """hello
... there are multiple lines"""
'hello\nthere are multiple lines'
```

As C, C++ or Java, `\n` means carriage return.

# An informal introduction

## Strings (II)

Of course, variables can contain strings.

```
>>> text = "hello"
>>> print(text)
hello
```

New Python elements:

- The `print()` function.

# An informal introduction

## Strings (III)

### Strings contatenation

```
>>> "hello" + " there"
'hello there'
>>> "hello" "there"
'hellothere'
```

### Variables with strings

```
>>> a = "hello"
>>> b = " there"
>>> a + b
'hello there'
```

### String length

```
>>> len("hello")
5
```

# An informal introduction

## Strings (IV)

Strings can be used as a sequence of characters: Slice notation.

- Quite common in Python data structures.
- It uses indices (as an array). First index is 0.

```
>>> a = "hello"
>>> a[2]
'l'
>>> a[2:]
'llo'
>>> a[:2]
'he'
>>> a[2:] + a[:2]
'llohe'
>>> a[2:4]
'll'
```

# An informal introduction

## Lists (I)

**List:** An ordered collection of mutable data.

- Very powerful data structure, similar to an array.
- Ordered: Data in the list have a location.
- Mutable: Data can be modified.
- Data types can be different.

### List initialization

```
variable = [data1, data2, ..., dataN]
```



# An informal introduction

## Lists (II)

Definition example

```
>>> a = ['spam', 'eggs', 123]
>>> a
['spam', 'eggs', 123]
```

Slice notation and the `len()` function work on lists

```
>>> a[2]
123
>>> a[1:]
['eggs', 123]
>>> a + a[2:len(a)]
['spam', 'eggs', 123, 123]
```

# Control flow

## Conditions (I)

Conditional statements implement decision making

- Decide some code has to be executed or not.
- The result is a boolean.
- Execute code if condition is satisfied.

### if statement

```
if condition:
    # Some code
else:
    # Some other code
```

New Python elements:

- Comments begin with '#'.
- **Indentation plays a mayor role: It defines code bodies.**

# Control flow

## Conditions (II)

### Condition example

```
temperature = float(input('What is the temperature? '))
if temperature > 70:
    print('Wear shorts.')
else:
    print('Wear long pants.')
print('Get some exercise outside.')
```

(Source)

New Python element:

- Comparison operators.

# Control flow

## Conditions (III)

SIGN	OPERATOR	SIGN	OPERATOR
==	Equal	and	Logical and
!=	Not equal	or	Logical or
>	Greater	not	Logical not
<	Lower		
>=	Greater or equal		
<=	Lower or equal		

Example: ((age > 18) or (name == 'Biggus Dickus'))

# Control flow

## While loop

### Fibonacci series

```
#!/usr/bin/python

a, b = 0, 1 # Init variables

while b < 10: # This is a loop
    print("b = ", b)
    print("a = ", a) # Indentation is very important here!
    a, b = b, a+b
```

New Python elements:

- Multiple assignments.

# Examples

## Example 1: Multiplication table

### multi.py

```
table = 8
start = 1
max = 10
s = '-' * 20
print (s)
print ('The table of 8')
print (s)
i = start
while i <= max:
    result = i * table
    print (i, ' * ', table, ' = ', result)
    i = i + 1
print (s)
print ('Done counting...')
print (s)
```

Source

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