# An informal introduction to Python

Videogames Technology
Asignatura transversal

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## Objectives

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

# Table of Contents


1. Introduction
   - What is Python?
   - Features
   - Why Python?
   - History
   - Installation
2. The Python interpreter
   - Python operation modes
   - Non-interactive
   - Interactive
3. An informal introduction
   - Variables
   - Numbers
   - Strings
   - Lists
4. Control flow
   - Conditions
   - While loop
5. Examples
   - Example 1: Multiplication table

# Introduction

## What is Python?

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

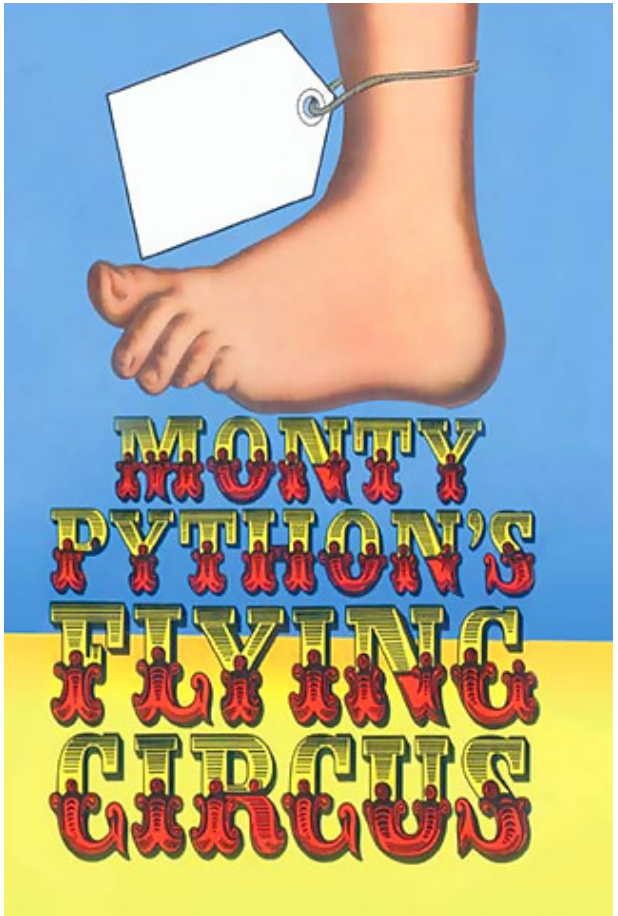
- *General-purpose*: Many applications.
- *High-level*: Abstract data structures, doing more with less code.
- *Interpreted*: No need to compile.


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

# Introduction

## Features

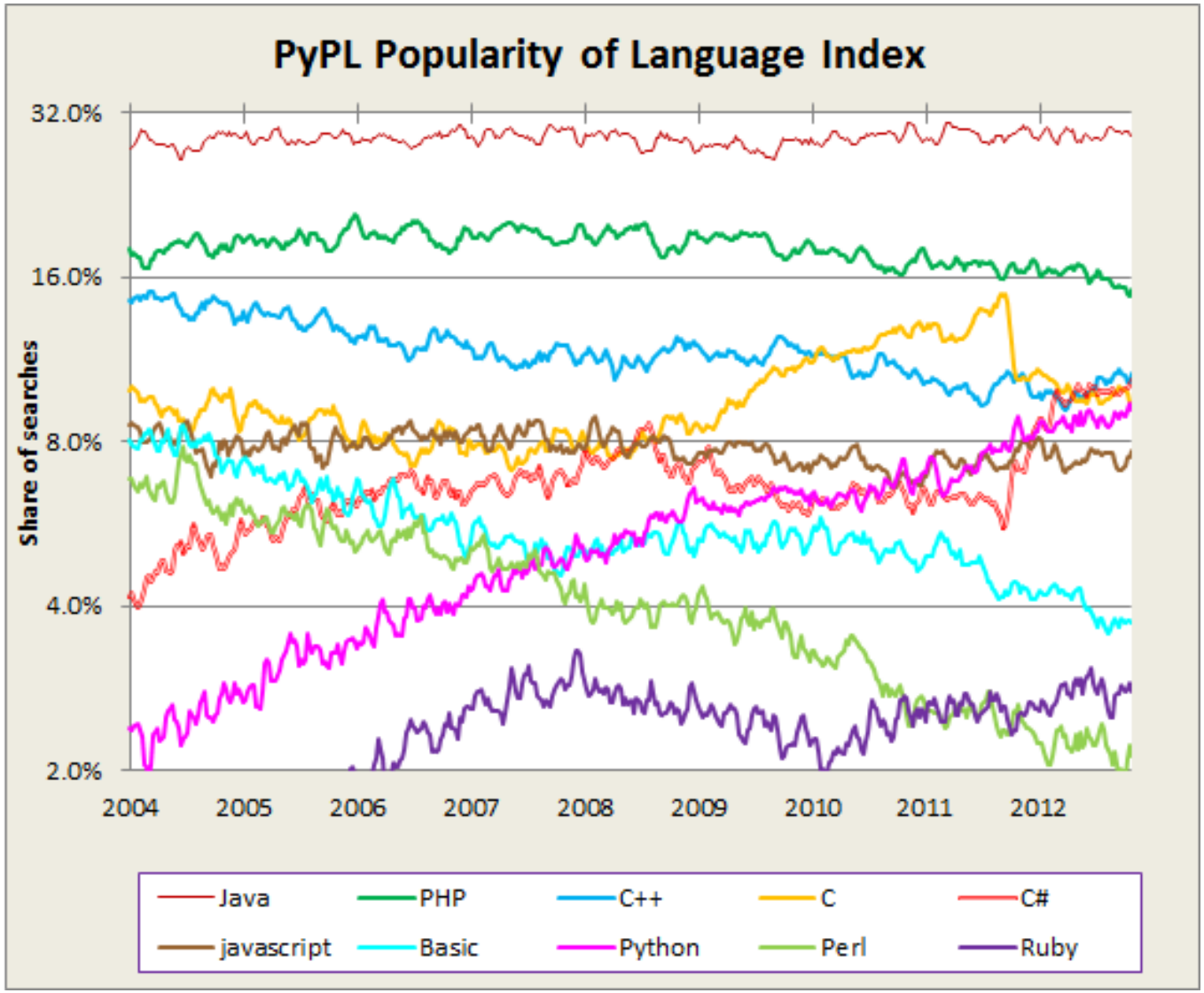
- Several paradigms
  - OO, imperative and functional
- Dynamic typing
- Interpreted
- Minimalistic syntax
- Portable
- Extensible - Bindings to other languages
- Embeddable
- Application domains
  - Web, robotics, data science, game development, admin ...




Want to know other Monty Python's contribution to Computer Science? Click here

# Introduction

## Why Python? (I)

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# 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
  - Clearner 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 oficial 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

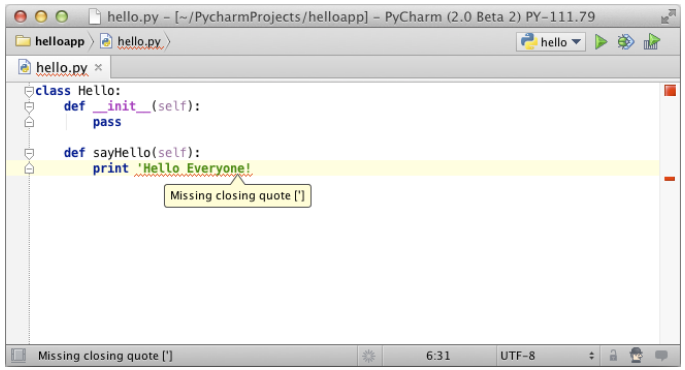
- Python was created by Guido van Rossum in the Netherlands
- Python 2.0: Released on 2000
- Python 3.0: Released on 2008. Backwards-incompatible

Python 2.X is still very popular, but Python 3.X is the future (deprecated from 2020)

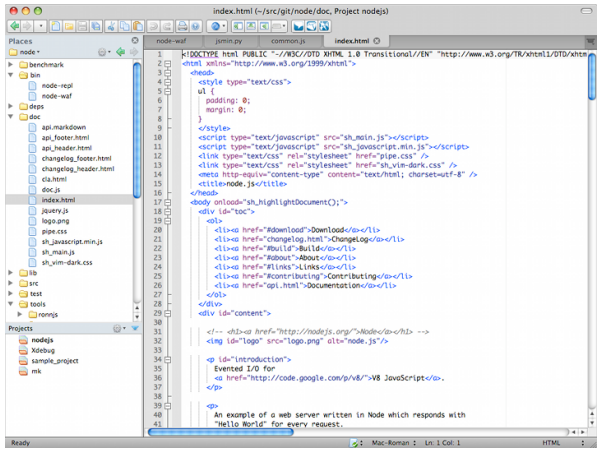
# Introduction

## Installation

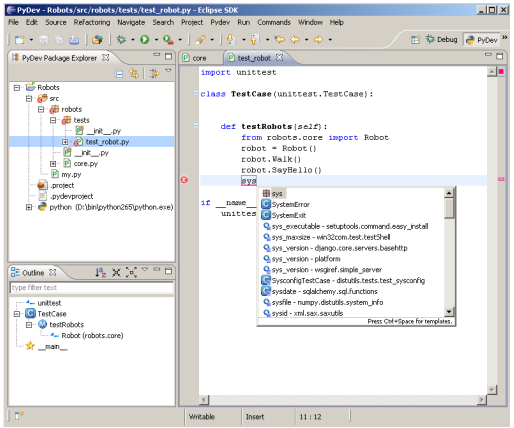
- If you have a good OS such as Linux or Mac, you already have Python!
- Otherwise (Windows), you have to install it
  - Visit `https://www.python.org/downloads/`
- Bad news: There is no "standard" IDE
  - PyCharm, Komodo, PyDev, ...
  - `http://wiki.python.org/moin/PythonEditors`




PyCharm




Komodo




PyDev

# The Python interpreter

## Python operation modes

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

- Interpreted = it is not complied = 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[1] |
| + | Add | ** | Exponent |
| - | Substration | += | Assign + |
| * | Multiplication | -= | Assign - |
| / | Division | *= | Assign * |
| % | Modulus | /= | Assign / |

[1] 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)  # Identation 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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