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Introduction to programming with Python

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Main Goal

- Introduce you to programming
- introduce you to the most essential feature of python programming

Before to start

The name "Python" does not refer to the snake, but it comes from “(Monty) Python"

Why Python?

- Software Quality:
  - Python code is designed to be readable
  - by design python implements readable syntax

Why Python?

- Productivity:
  - python code is typically one-third the size of equivalent C++ or Java code

Why Python?

- Program portability:
  - Python programs run on all major computer platform
  - support for portable GUI, DB, web system

Why Python?

- Support Library:
  - python comes with an extensive collection of libraries, The Standard Library
  - a lot of third-party projects and libraries

Why Python?

Enjoyment

let’s have fun! Programming in python is fun!

Is Python a Scripting language?
NO! But you can use it to write a script

Is Python a Scripting language?

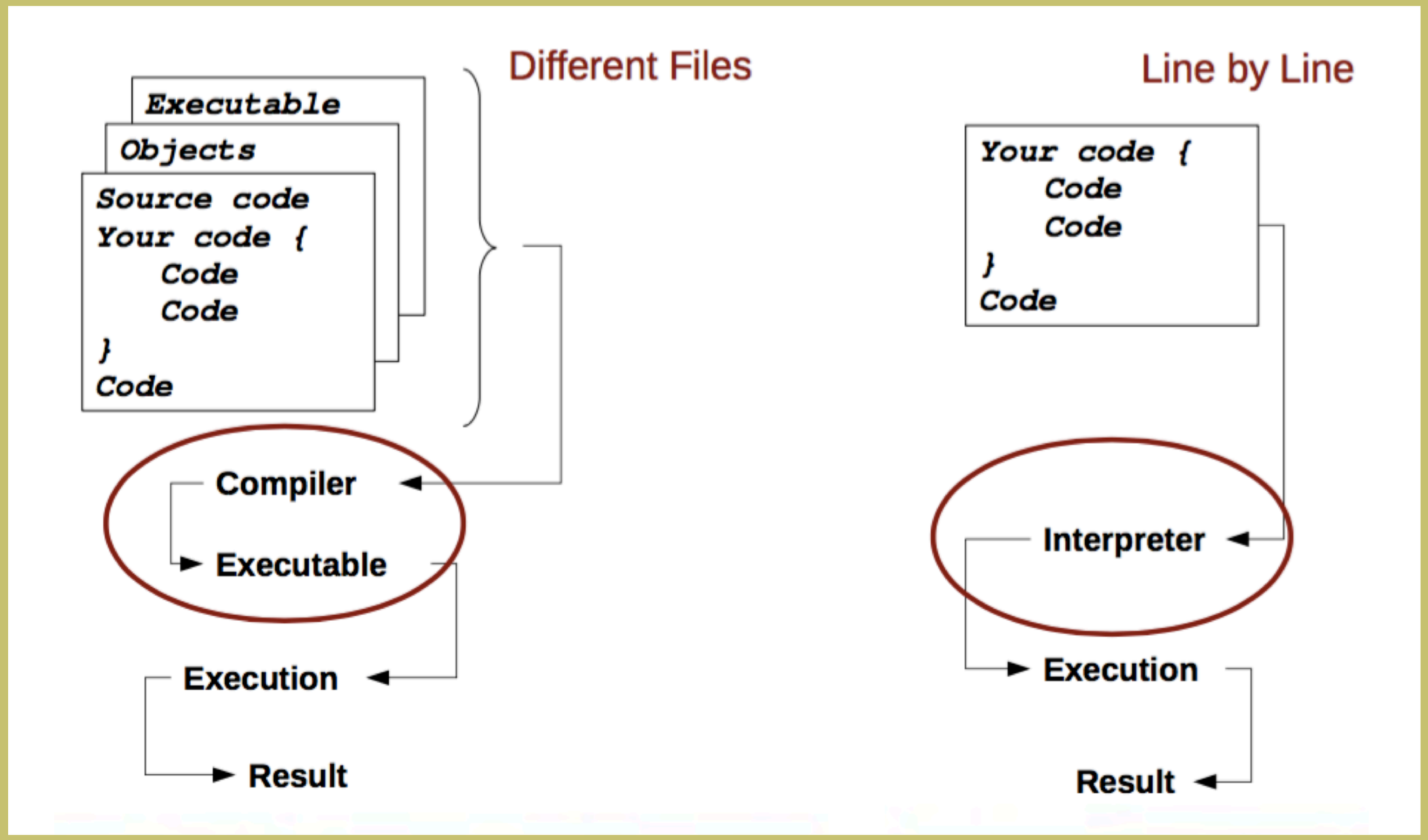
- sometimes applied in scripting roles
- General Purpose programming language that blends procedural, functional and object-oriented paradigms

Who does use python?

Python main features

- succinct yet readable syntax
- Great introspection
- Great standard library
  - Built-in data structures
  - Language *battery included*
- **Interactive shell**

Python is an Interpreted language



Compiled vs Interpreted Language

Compiled:

Pros

- **Faster** execution
- Can **produce** a distributable **executable** standalone files

Cons

- More **complicated** to build (many files)
- User has to administrate **Memory** usage

Interpreted:

Pros

- **Steep learning curve**
- Takes automatically care of **memory usage**
- Allows fast **prototyping**

Cons

- Usually **slower**
- Does not produce standalone programs

Install python

which version?

- nowadays python has 2 different branch version 2.x and version 3.x
- We'll use the 3.x version
- the python 2.x branch ends support in the next year

Install python

- official python distribution
- Anaconda distribution

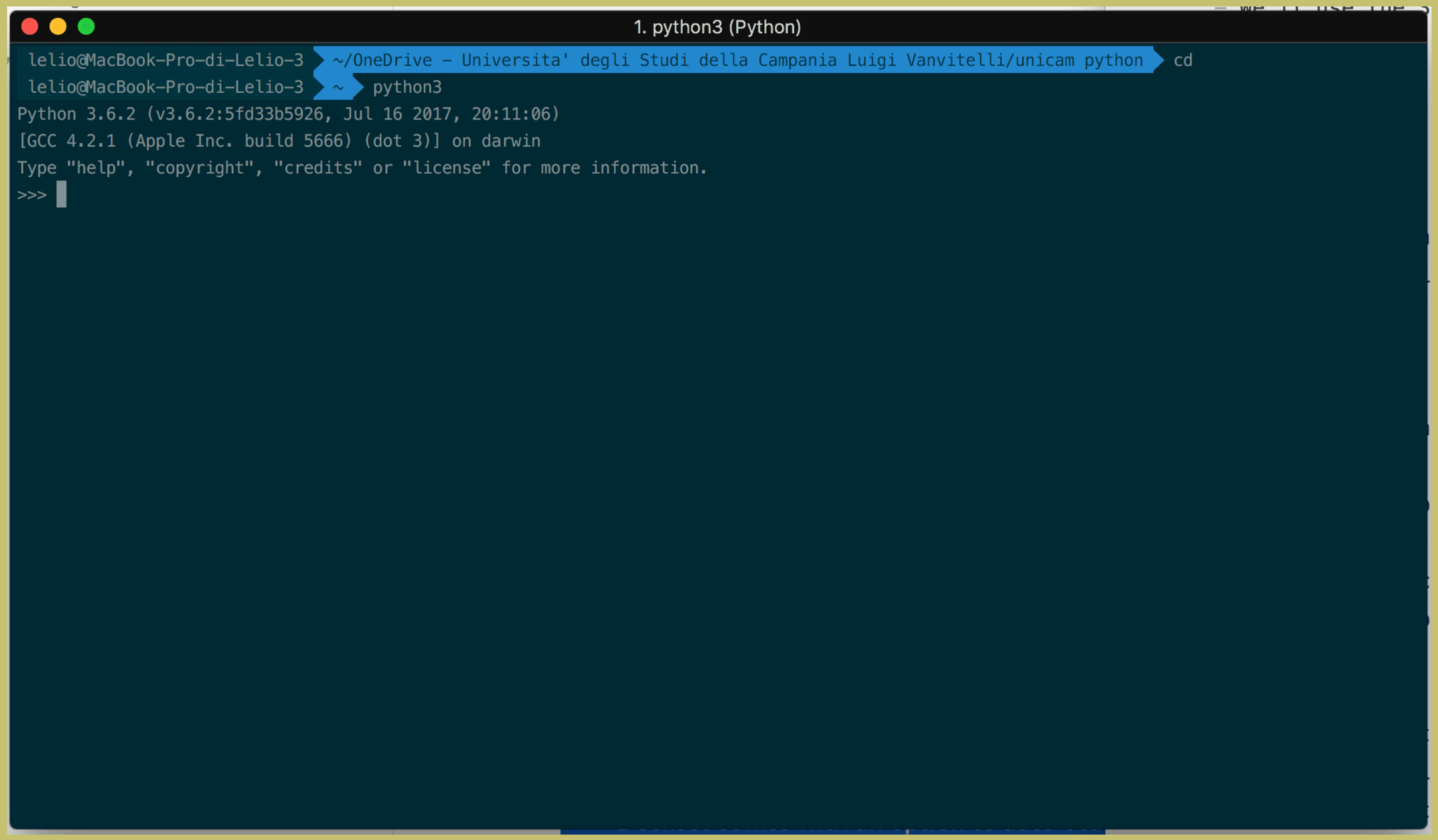
Anaconda python distribution

- Anaconda is a python distribution by Continuum Analytics.
- Anaconda is a completely free enterprise-ready Python distribution for large-scale data processing, predictive analytics, and scientific computing.
- Apart from that, Anaconda ships with easy-to-use installers for almost every platform, that would drastically reduce the burden of setting up the environment (exp. on Windows)

Get Anaconda

https://www.continuum.io/downloads

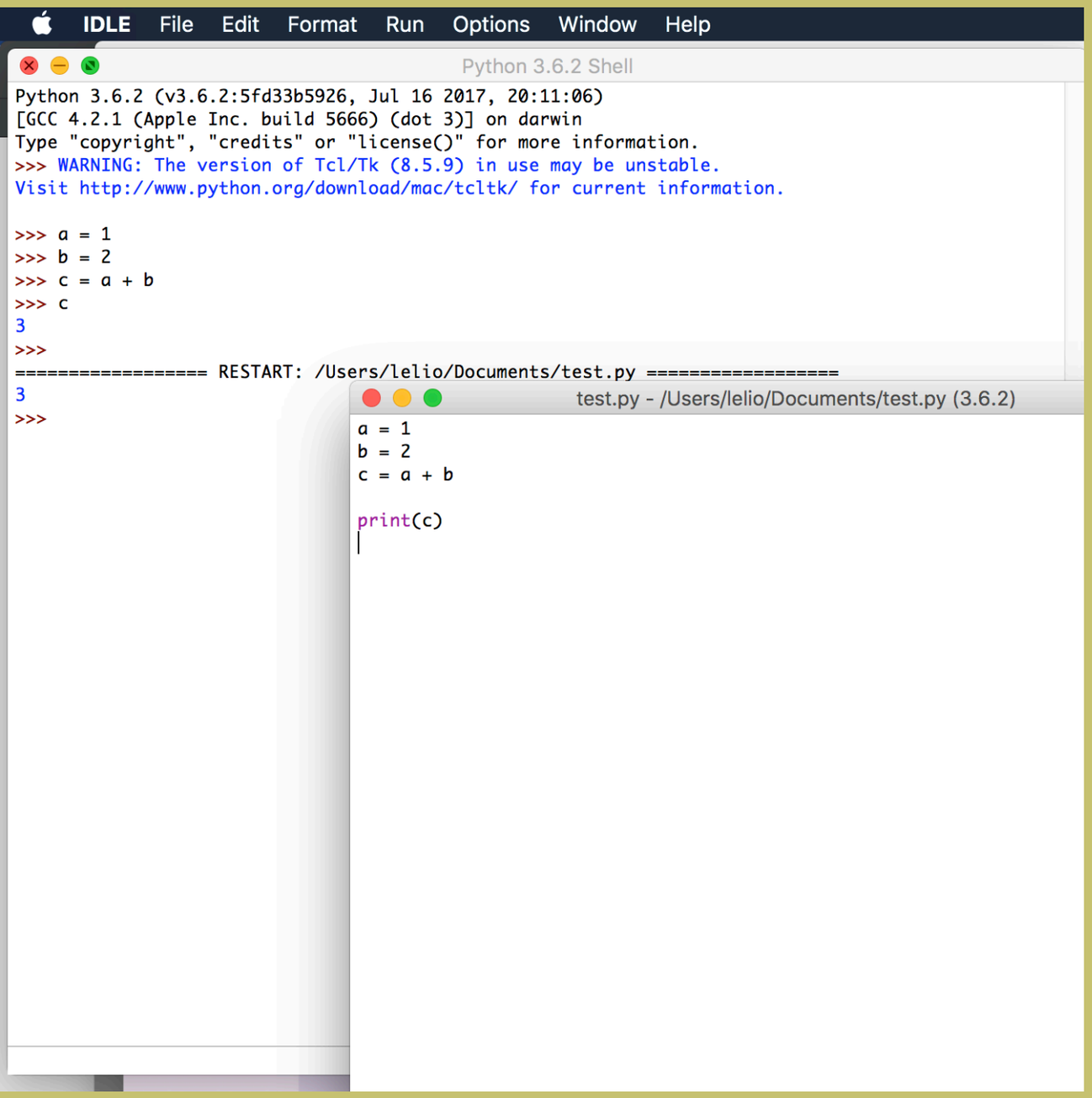
Open the terminal and type python3



Python Shell

- python shell is useful for testing
- executes immediately the commands that you type
- it doesn't save the code

IDLE Editor



- default editor installed with python
- simple and efficient

For a more serious job

- Atom (open source)
- Pycharm (free and pro)

save your file with a .py extension

execute it with the command:

```
python3 filename.py
```

Variables

a variable holds a value

```
message = "Hello python world"
print(message)
```

Excercise

write your first program:

store and print your own version of "Hello world"

Python 3.6.2 Shell

```
Python 3.6.2 (v3.6.2:5fd33b5926, Jul 16 2017, 20:11:06)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "copyright", "credits" or "license()" for more information.
>>> message = "Hello python world"

>>> print(message)
Hello python world
>>>
```

Ln: 8 Col: 4

Exercise

Store a message in a variable, and then print that message.

Store a new message in the same variable, and then print that new message.

you can change the value of a variable at any point

```
message = "Hello python world"
print(message)

message = "Hello python"
print(message)
```

Python 3.6.2 Shell

```
Python 3.6.2 (v3.6.2:5fd33b5926, Jul 16 2017, 20:11:06)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "copyright", "credits" or "license()" for more information.
>>> message = "Hello python world"

>>> print(message)
Hello python world
>>>
>>> message = "Hello python"
>>> print(message)
Hello python
>>> |
```

Ln: 12 Col: 4

Naming Rules

- Variable can only contain letters, numbers, underscores
- Variable names can start with a letter or an underscore, but not with a number
- Spaces are not allowed in variable names
- we use underscores characters for that
- You cannot use Python Keywords as names
- Variable names should be descriptive
- Can contain Unicode Literals
  - $\pi = 3.141592653589793$

your first error: Name Error

Python 3.6.2 Shell

```
Python 3.6.2 (v3.6.2:5fd33b5926, Jul 16 2017, 20:11:06)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "copyright", "credits" or "license()" for more information.
>>> message = "Hello python world"

>>> print(message)
Hello python world
>>>
>>> message = "Hello python"
>>> print(message)
Hello python
>>> print(mesage)
Traceback (most recent call last):
  File "<pyshell#5>", line 1, in <module>
    print(mesage)
NameError: name 'mesage' is not defined
>>>
```

Ln: 17 Col: 4

What are we missing?

```
message = "Hello python world"
print(message)

message = "Hello python"
print(message)
```

??Type declaration??

Python Typing Mechanism

Dynamic Typing

- It is not required to specify the types of variables/functions
- it is automatically inferred by operations

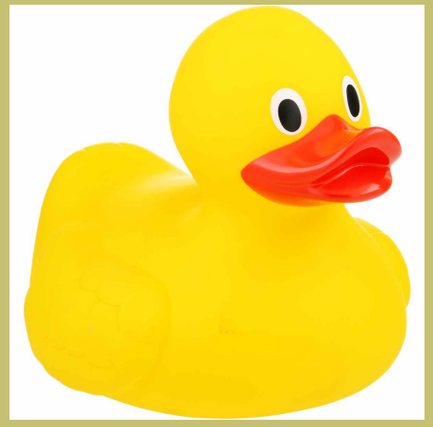
Strong Typing

- Once the type has been inferred, it cannot change without explicit CAST

Python Typing Mechanism

Duck typing

If it walks like a Duck, it quacks like a Duck



then

It's a Duck (**inference**)

Numeric Type

Integer: 345, 1, -32

Float: 1.2, 1.32, 19e5, 12.1e-6

boolean: True, False

You can use parenthesis to modify the standard order of operation

```
standard_order = 4+5*2
print(standard_order)
14

my_order = (4+5)*4
print(my_order)
18
```

Operations

- + adition
- - subtraction
- * multiplication
- / division

Exercise

```
a = 4
b = 2
c = 1.5

a / b     a + b     c / b     a / b
```

Python 3.6.2 Shell

```
Python 3.6.2 (v3.6.2:5fd33b5926, Jul 16 2017, 20:11:06)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "copyright", "credits" or "license()" for more information.
>>> a=4
>>> b=2
>>> c=1.5
>>> a/b
2.0
>>> a+b
6
>>> c/b
0.75
>>> a/b
2.0
>>>
```

Ln: 15 Col: 4

how to check the type?

```
a = 4
b = 2
c = a / b
print(c)
2.0
type(c)
<class 'float'>
type(a)
<class 'int'>
type(b)
<class 'int'>
```

When the operands are of different type, the python interpreter before converts them into the most complex type, and then it executes the calculation.

Integer operator

```
a = 4
b = 2
c = a // b
print(c)
2
type(c)
<class 'int'>
```

other operations

- ** pow operator
- % modulus (remainder operator)

Exercise

Given 3 numbers (12, 32, 2.0) write a program that print:

- the sum
- the multiplication

Exercise

- Given the base = 10 and the height = 15 of a triangle, write a program that prints the area.
- Given 2 dates (2019-02-28, 2019-04-20) write a program that prints the days between them
- Given the radius = 5 of a circle, write a program that prints the area and the circumference

Booleans and Logical Tests

- True and False are Python keywords
- bool type in Python corresponds to int
- True = 1
- False = 0

Logical operators

- **==** equality
- **!=** inequality
- **>** greater than
- **>=** greater than or equal to
- **<** less than
- **<=** less than or equal to
- **in** test if an item is in a list

Equality

```
5 == 5
True

3 == 5
False

5 == 5.0
True

'lelio' == 'lelio'
True

'lelio == Lelio'
False
```

Inequality

Two items are unequal if they do not have the same value

```
'alpha' != 'beta'
True

1.0 != 1
False

1 != 2
True
```

Other Logical Tests

```
10>3
True

10>=10
True

10>=3
True

10>=11
False

10<3
False

3<10
True

3<=10
True

10<=10
True
```

Logical operators

and not or

Use them to write more complex logical tests

```
a == b and a !=b
False

a == b or not a == b
True
```

True and False python's definition

- False: False (bool), None, 0, empty object
- True: everything else (number > 0, a not empty object or string, etc..)

Python operator precedence

- * % / //
- + -
- < <= > >= == !=
- not
- and
- or

To force the precedence order, you can use the parentheses

Comments

```
# this is a comment
a = 20  # this is a comment too
```

To Comment your code is a good habit!

Make sure that you add a comment to your code when:
- you want to remember why you write your code in that manner
- when there more than one way to solve a problem

write comments short and clear!

Strings

Strings are sets of characters

To define a string you can use single or double quotes

```
string = "this is a string"
string = 'this is a string too'
```

You can combine single and double when you have a string that contains a quotation:

[.auto-scale: false]

```python
quote = "Einstein once said:'Try
not to become a man of success,
but rather try to become a man
of value.'"
```

String Combination

```
first_name = "Lelio"
last_name = "Campanile"

full_name = first_name + " " + last_name
print(full_name)
Lelio Campanile
```

String Combination

```
string = full_name + " is my full name"
print(string)
Lelio Campanile is my full name

string_multiplication = "=" * 20
print(string_multiplication)
====================
```

Exercise

- Find a quote that you like. Store the quote in a variable, with an appropriate introduction such as "Ken Thompson once said, 'One of my most productive days was throwing away 1000 lines of code'". Print the quote.
- Store your first name and last name in separate variables, and then combine them to print out your full name.
- Use concatenation to make a sentence about you, and store that sentence in a variable.

Exercise

- Store the results of at least 5 different calculations in separate variables. Make sure you use each operation at least once.
- Print a series of informative statements, such as "The result of the calculation 5+7 is 12."

```
a = 1
b = 1

str_a = str(a)

print("this is a cast " + str(a))
this is a cast 1

print("this is a cast " + str_a)
this is a cast 1
```