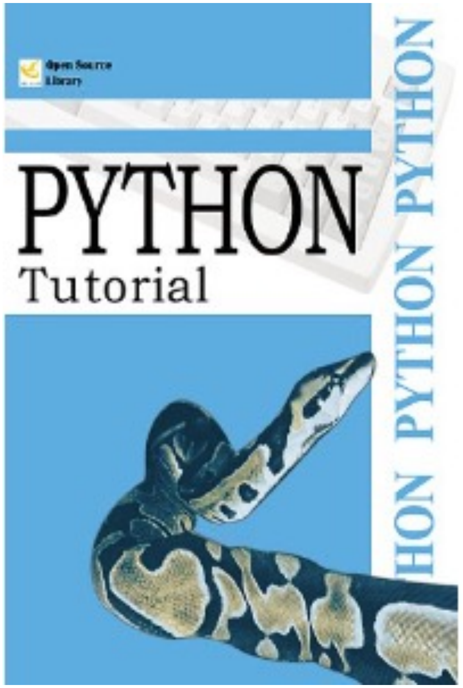
Introduction to Python



Dra. Mª Dolores Rodríguez Moreno

Objectives

Specific Objectives

- Understand the main Python features
- Overview of the language components

Source

- https://docs.python.org/3.10/tutorial/appetite.html
- https://python-textbok.readthedocs.io/en/1.0/index.html
- Python Tutorial - Tapa blanda. GuidoVan Rossum (2012)

Outline

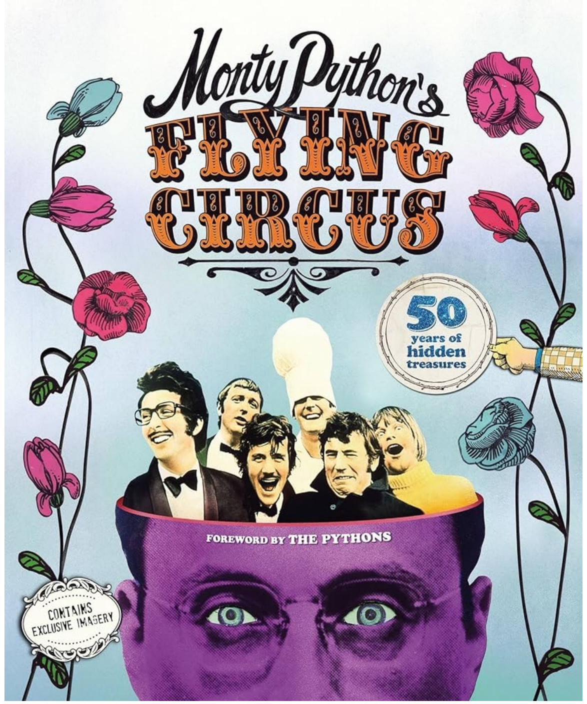
- **Introduction**
- Why Study Python?
- Python Interpreter
- An informal introduction
- Numbers
- Strings
- Lists
- Functions
- Variable Scope

Introduction (I)

- Python was created by Guido van Rossum (TN)
  - Python 2.0: released on 2000
  - Python 3.0: released on 2008. Backwards-incompatible
- Python is:
  - General-purpose: many applications
  - High-level: abstract data structures doing more with less code
  - Interpreted:
    - No compilation needed → directly run the code
    - Interactive mode for testing and debugging
- Emphasizes code *readability* and programmer's *productivity*

Introduction (II)

- Named for the BBC show
- Several paradigms:
  - Procedural: use of instruction sequences to solve problems
  - OOP: creation of classes & objects with attributes/methods
  - Functional: use pure functions: map, lambda, filter
- Extensive Standard Library with modules for various tasks like file I/O, system calls, sockets and more
- Strong Community Support: abundant resources tutorials & forums



Introduction (III)

- Web Development: with frameworks like Django and Flask

- Data Science and Machine Learning: with libraries like Pandas NumPy SciPy TensorFlow Pytorch

- Game Development: with libraries like Pygame

- Embedded Systems: as MicroPython and CircuitPython

Outline

- Introduction
- **Why Study Python?**
- Python Interpreter
- An informal introduction
- Numbers
- Strings
- Lists
- Functions

Why Study Python?

- Automate Tasks:
  - Perform search-and-replace over large text files
  - Rename and rearrange photo files
  - Write custom databases GUI applications or simple games
- For Developers:
  - Faster development cycle compared to C/C++/Java
  - Write test suites efficiently
  - Use Python as an extension language
- Advantages over Other Languages:
  - Simpler than C/C++/Java
  - Available on Windows macOS and Unix
  - Ideal for both small scripts and large programs

Why Study Python?

- Ease of Use
  - Simple syntax, easy to learn and use
  - High-level data types (arrays & dictionaries)
- Modular and Reusable
  - Split programs into reusable modules
  - Large collection of standard modules (fie I/O system calls GUI toolkits)
- Readable and Compact Code
  - Shorter programs than C/C++/Java
  - Indentation for statement grouping
  - No variable or argument declarations needed
- Extensible
  - Add new functions or modules in C
  - Link Python to binary libraries

Why Study Python?

Python

```
#!/usr/bin/python

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

Java

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

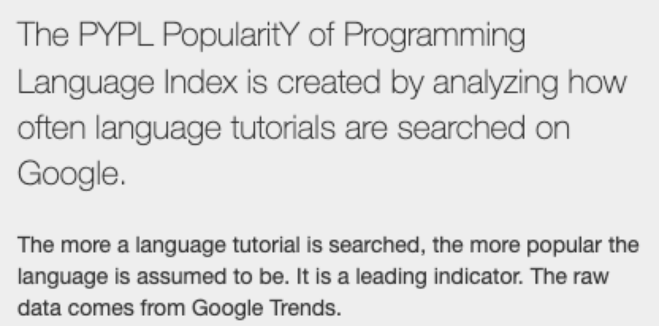
C

```
#include <stdio.h>

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

C++

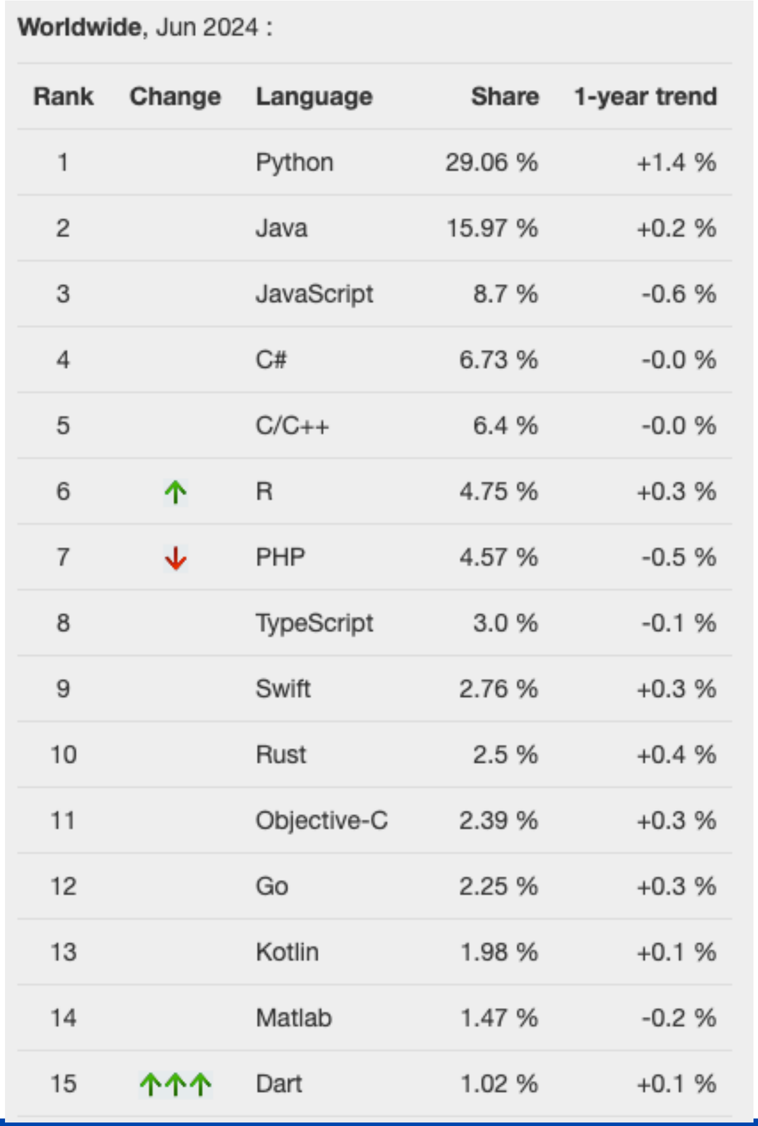
```
#include <iostream>

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

Popularity



The PYPL PopularitY of Programming Language Index is created by analyzing how often language tutorials are searched on Google.

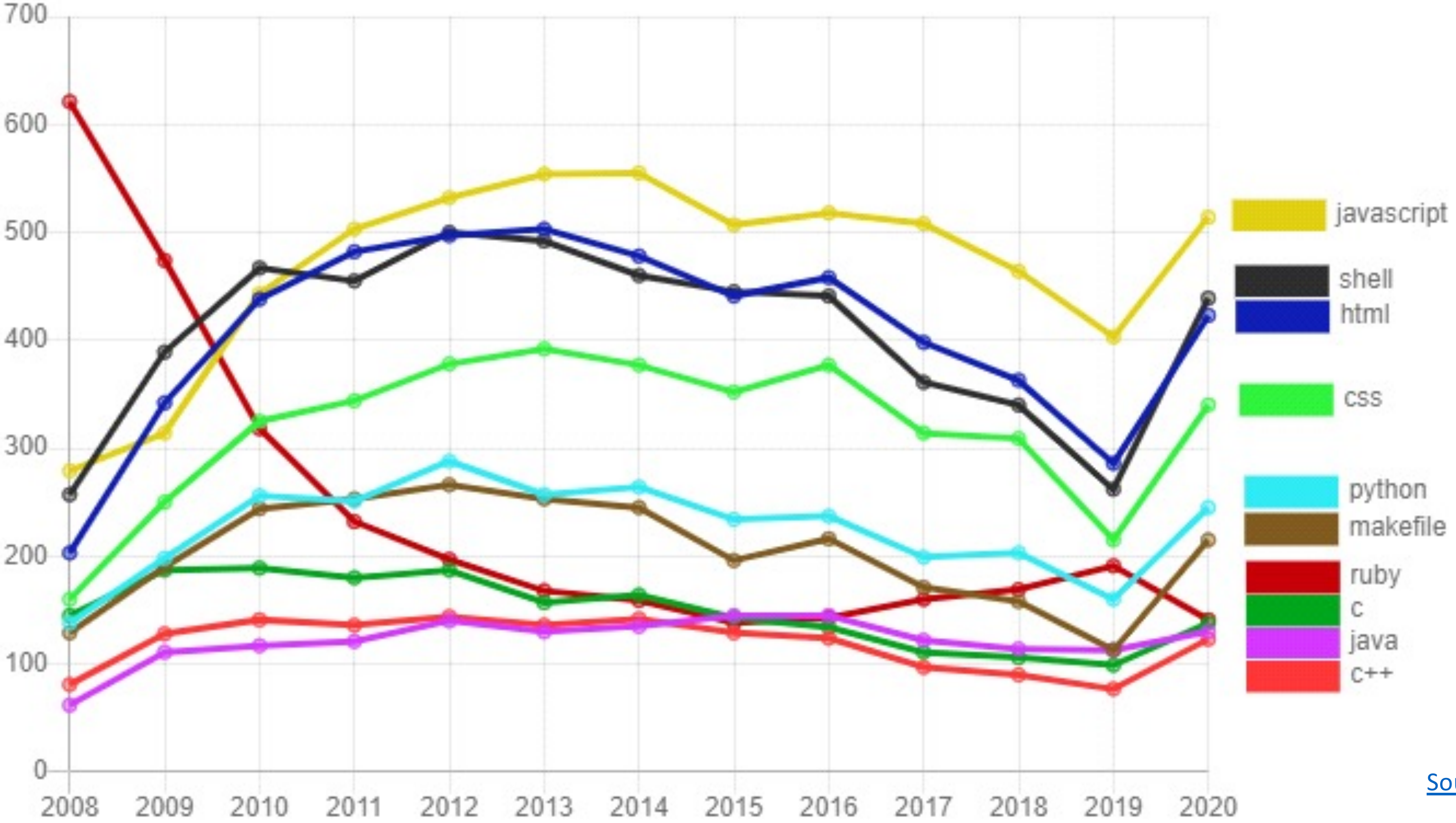
The more a language tutorial is searched, the more popular the language is assumed to be. It is a leading indicator. The raw data comes from Google Trends.



Worldwide, Jun 2024 :

Rank	Change	Language	Share	1-year trend
1		Python	29.06 %	+1.4 %
2		Java	15.97 %	+0.2 %
3		JavaScript	8.7 %	-0.6 %
4		C#	6.73 %	-0.0 %
5		C/C++	6.4 %	-0.0 %
6	↑	R	4.75 %	+0.3 %
7	↓	PHP	4.57 %	-0.5 %
8		TypeScript	3.0 %	-0.1 %
9		Swift	2.76 %	+0.3 %
10		Rust	2.5 %	+0.4 %
11		Objective-C	2.39 %	+0.3 %
12		Go	2.25 %	+0.3 %
13		Kotlin	1.98 %	+0.1 %
14		Matlab	1.47 %	-0.2 %
15	↑↑↑	Dart	1.02 %	+0.1 %

Popularity



Source: Orlowska et al (2021)

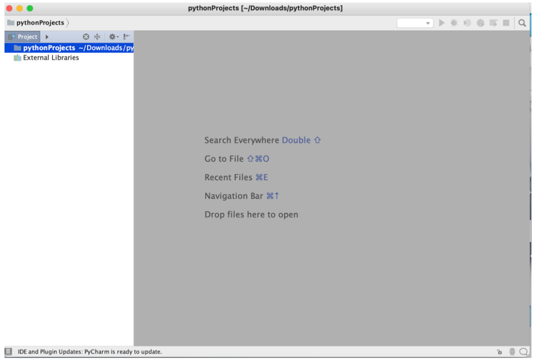
Programming Languages popularity over time (GitHub)

Outline

- Introduction
- Why Study Python?
- **Python Interpreter**
- An informal introduction
- Numbers
- Strings
- Lists
- Functions

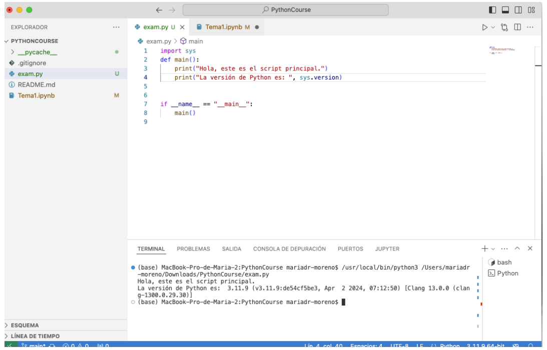
Python Interpreter (I)

- If you have a Linux or Mac you already have Python!
- If you have Windows you have to install it
- There is no standard IDE



pythonProjects [~/Downloads/pythonProjects]
pythonProjects
Project
pythonProjects ~/Downloads/py
External Libraries
Search Everywhere Double ⇧
Go to File ⇧⌘O
Recent Files ⌘E
Navigation Bar ⌘↑
Drop files here to open
IDE and Plugin Updates: PyCharm is ready to update.

PyCharm



```python
import sys
def main():
    print("Hola, este es el script principal.")
    print("La versión de Python es: ", sys.version)


if __name__ == "__main__":
    main()
```

```
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ /usr/local/bin/python3 /Users/mariadr
-moreno/Downloads/PythonCourse/exam.py
Hola, este es el script principal.
La versión de Python es:  3.11.9 (v3.11.9:de54cf5be3, Apr  2 2024, 07:12:50) [Clang 13.0.0 (clan
g-1300.0.29.30)]
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ 
```

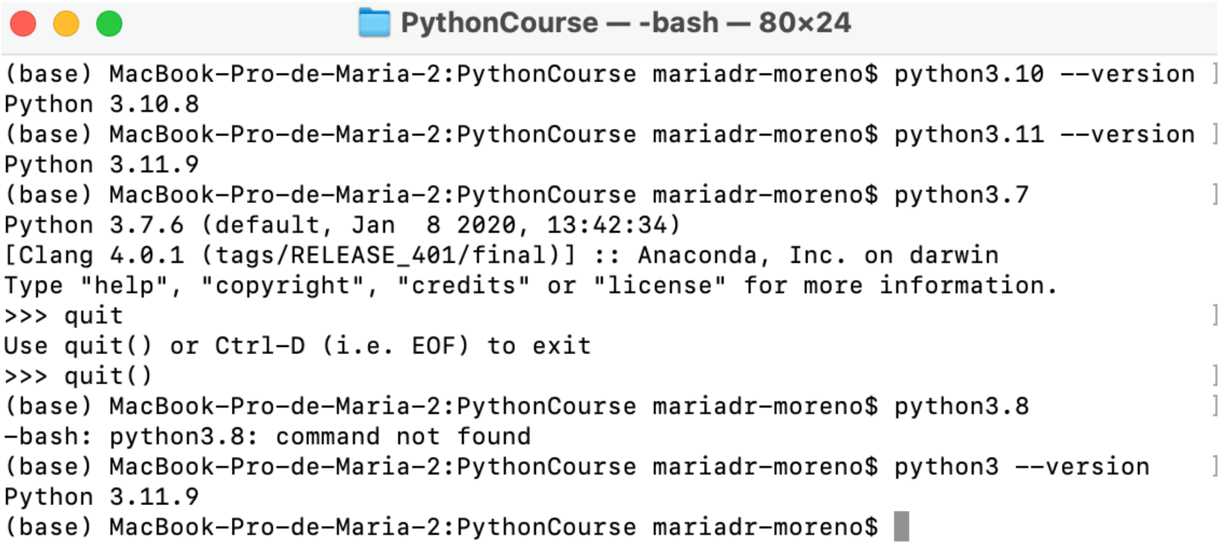
Visual Studio Code

Python Interpreter (II)

- Python is an interpreted language, i.e. , it needs an interpreter
  - Interpreted = it is not compiled = it needs no compilation
  - Faster development, slower execution
- Three operation modes:
  - Interactive: the interpreter reads the program from the stdin . From a terminal: usually the keyboard
  - Non-interactive: the interpreter reads the program from a file (.py) → Script. A python script is a sequence of python instructions stored in a .py
  - Mixed: from a Jupiter Notebook (.ipynb)

Interactive (I)

- Just run Python
- Different names for different versions to avoid conflicts
- python   python3.7   …



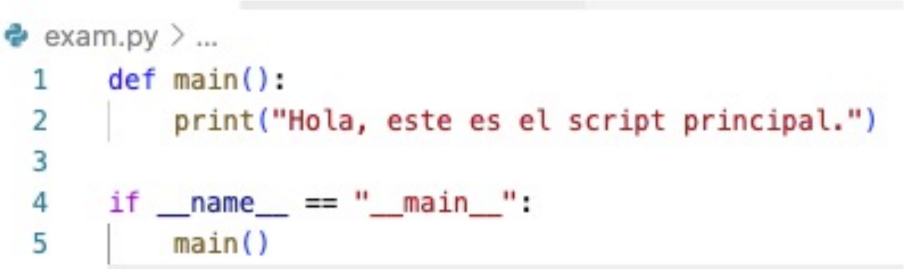
```
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ python3.10 --version
Python 3.10.8
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ python3.11 --version
Python 3.11.9
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ python3.7
Python 3.7.6 (default, Jan  8 2020, 13:42:34)
[Clang 4.0.1 (tags/RELEASE_401/final)] :: Anaconda, Inc. on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> quit
Use quit() or Ctrl-D (i.e. EOF) to exit
>>> quit()
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ python3.8
-bash: python3.8: command not found
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ python3 --version
Python 3.11.9
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$
```

>>>

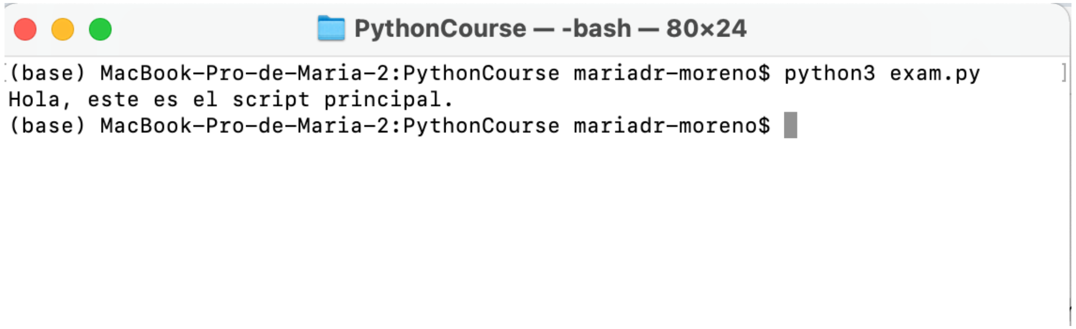
- The programmer executes as s/he writes code down

Non Interactive (I)

- The program is in a plain text file
- It can be edited with any text editor
- Extension ".py"
- By default UTF-8 encoding

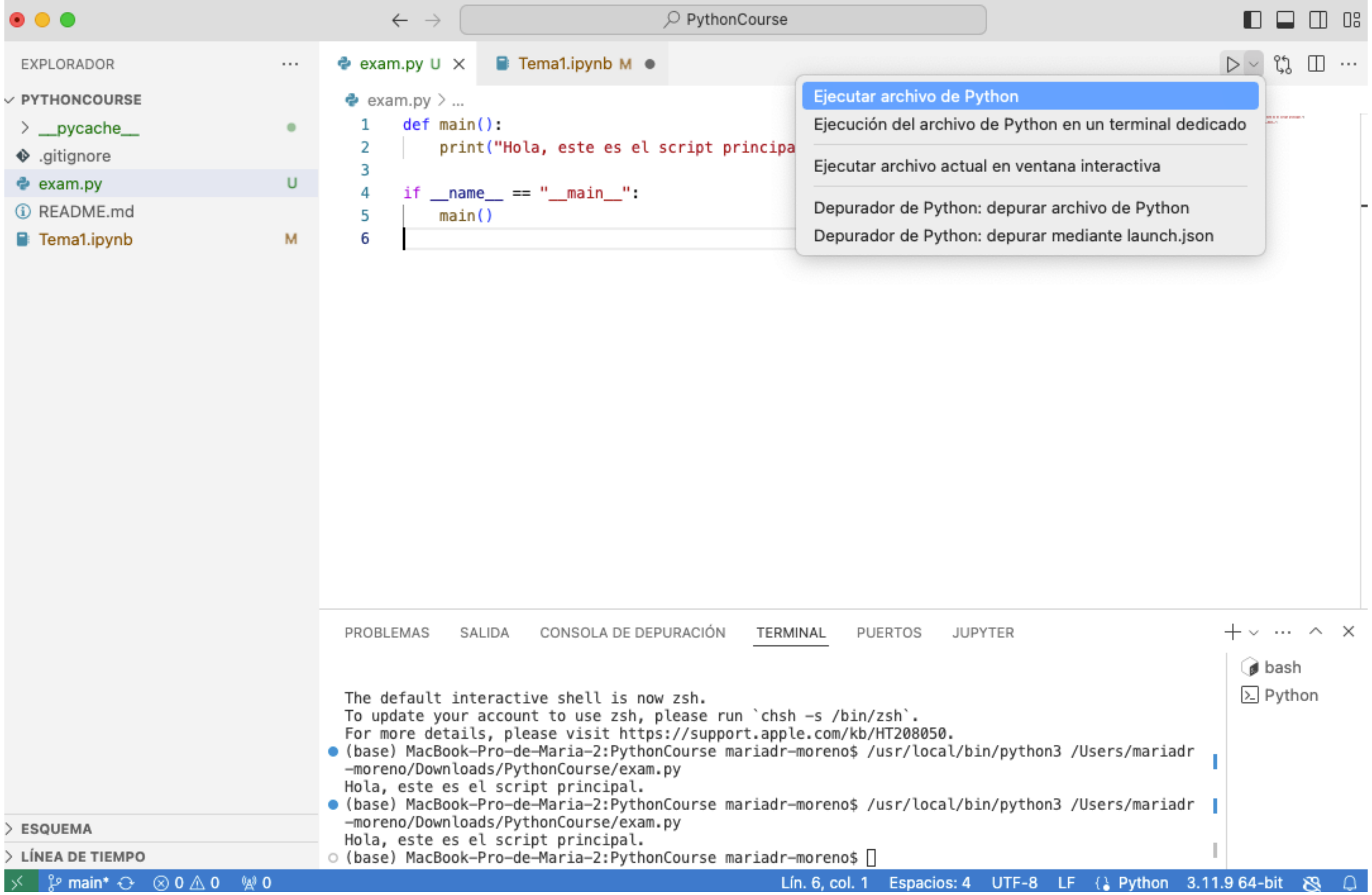


```python
def main():
    print("Hola, este es el script principal.")

if __name__ == "__main__":
    main()
```



```
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ python3 exam.py
Hola, este es el script principal.
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ 
```

Non Interactive (II)

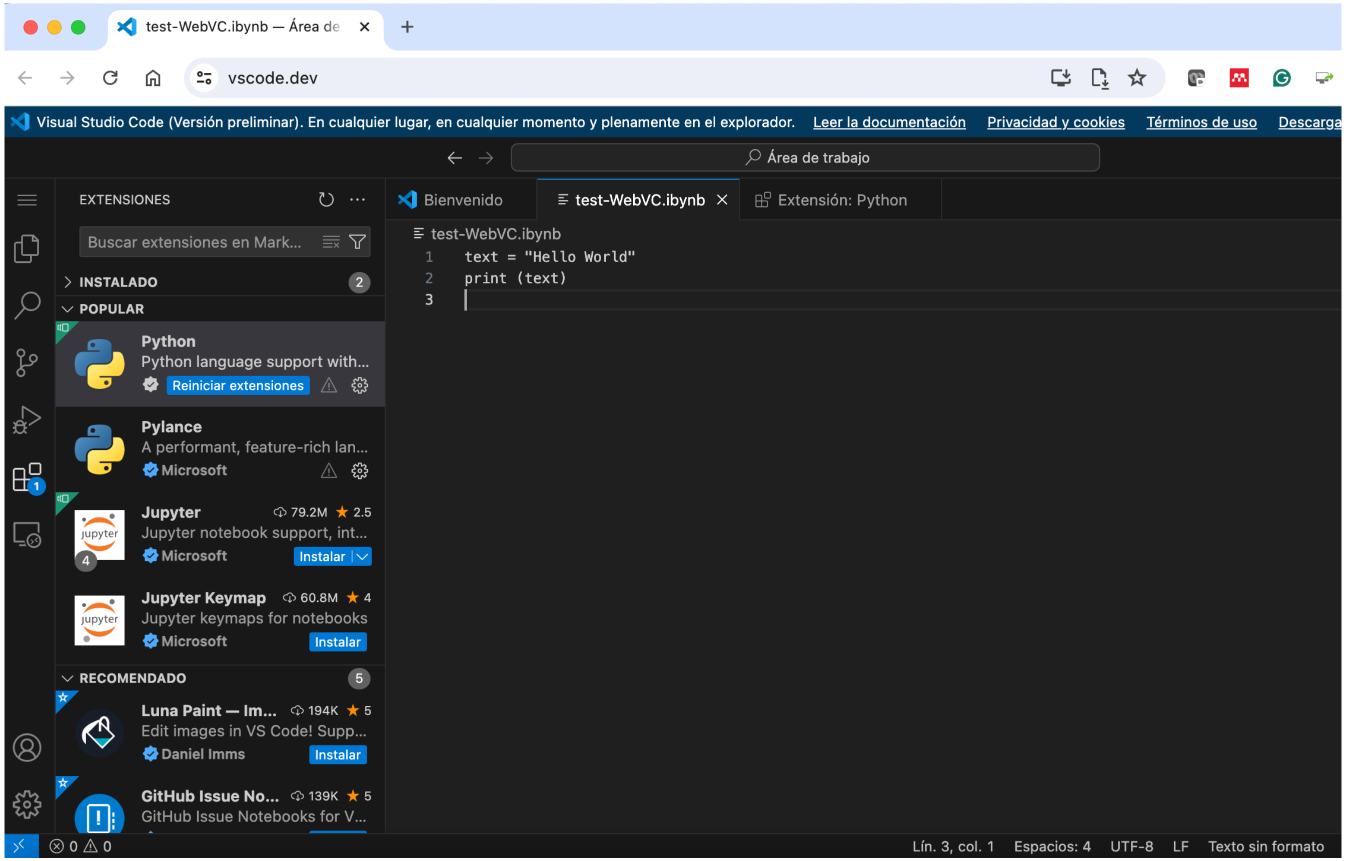


```python
def main():
    print("Hola, este es el script principa

if __name__ == "__main__":
    main()

```

```
The default interactive shell is now zsh.
To update your account to use zsh, please run `chsh -s /bin/zsh`.
For more details, please visit https://support.apple.com/kb/HT208050.
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ /usr/local/bin/python3 /Users/mariadr
-moreno/Downloads/PythonCourse/exam.py
Hola, este es el script principal.
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ /usr/local/bin/python3 /Users/mariadr
-moreno/Downloads/PythonCourse/exam.py
Hola, este es el script principal.
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ 
```

Non Interactive (III)

- Visual Code Web
- https://vscode.dev/



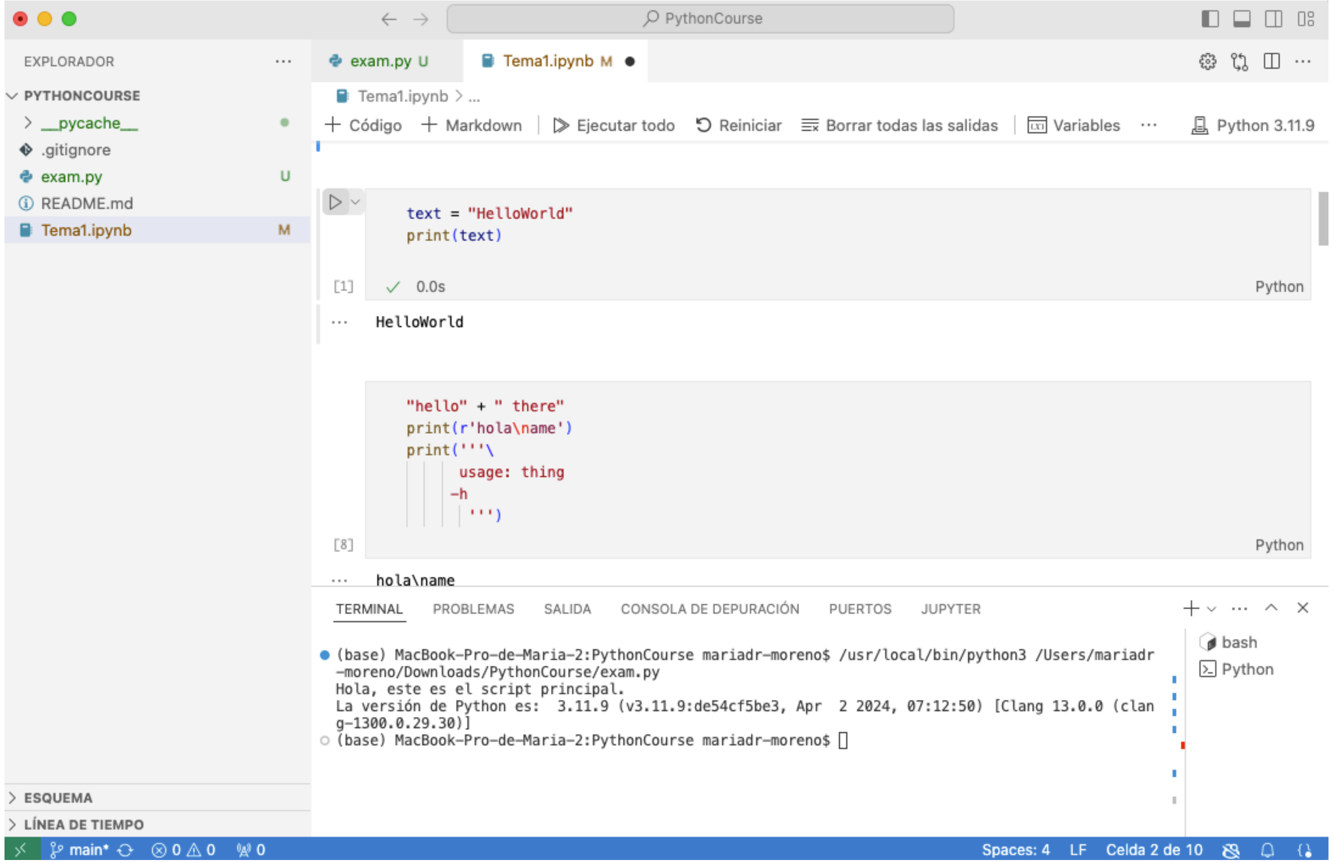
Visual Studio Code (Versión preliminar). En cualquier lugar, en cualquier momento y plenamente en el explorador.

test-WebVC.ibynb

```
text = "Hello World"
print (text)
```

Mixed(I)

- Using a Jupiter Notebook
- .ipynb



```python
text = "HelloWorld"
print(text)
```

```
HelloWorld
```

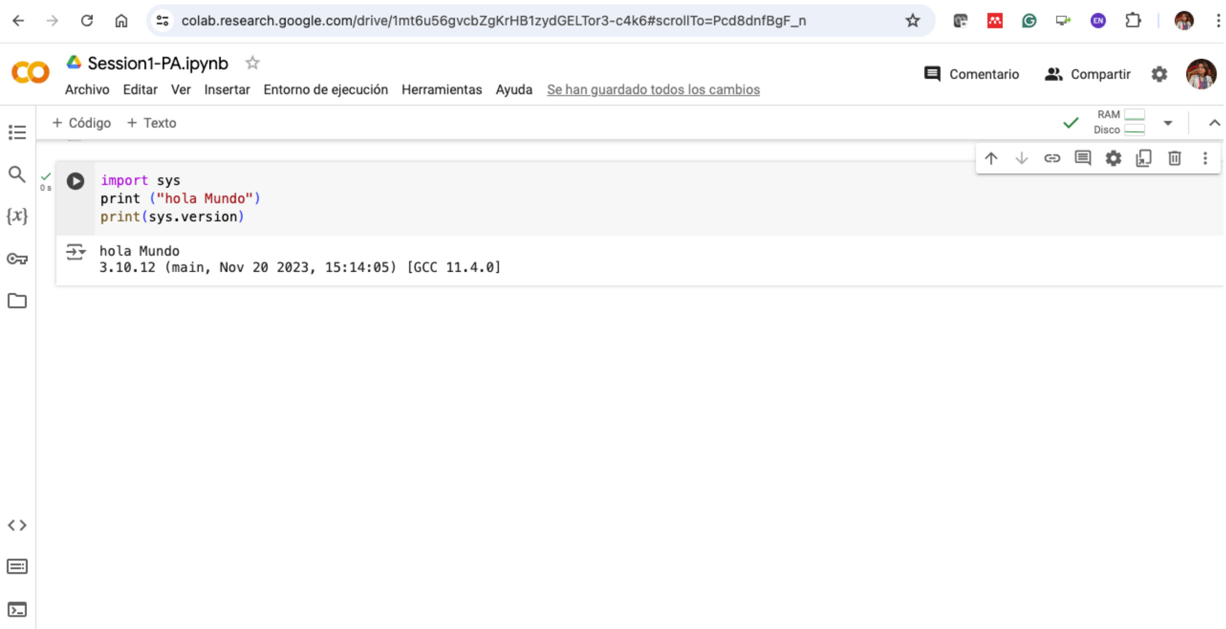
```python
"hello" + " there"
print(r'hola\name')
print('''\
      usage: thing
    -h
      ''')
```

```
hola\name
```

```
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ /usr/local/bin/python3 /Users/mariadr
-moreno/Downloads/PythonCourse/exam.py
Hola, este es el script principal.
La versión de Python es:  3.11.9 (v3.11.9:de54cf5be3, Apr  2 2024, 07:12:50) [Clang 13.0.0 (clan
g-1300.0.29.30)]
(base) MacBook-Pro-de-Maria-2:PythonCourse mariadr-moreno$ 
```

Mixed(II)

- Google Collab
- https://colab.research.google.com/



colab.research.google.com/drive/1mt6u56gvcbZgKrHB1zydGELTor3-c4k6#scrollTo=Pcd8dnfBgF_n
Session1-PA.ipynb
Archivo Editar Ver Insertar Entorno de ejecución Herramientas Ayuda
Se han guardado todos los cambios
Comentario
Compartir
+ Código + Texto
RAM
Disco
0 s

```
import sys
print ("hola Mundo")
print(sys.version)
```

```
hola Mundo
3.10.12 (main, Nov 20 2023, 15:14:05) [GCC 11.4.0]
```

Outline

- Introduction
- Why Study Python?
- Python Interpreter
- **An informal introduction**
- Numbers
- Strings
- Lists
- Functions

Keywords

- Reserved words with specific purposes and cannot be used for other purposes
- Examples of Python keywords:

`False`	`class`	`finally`	`is`	`return`
`None`	`continue`	`for`	`lambda`	`try`
`True`	`def`	`from`	`nonlocal`	`while`
`and`	`del`	`global`	`not`	`with`
`as`	`elif`	`if`	`or`	`yield`
`assert`	`else`	`import`	`pass`	`break`
`except`	`in`	`raise`		

Identifier Names

- Names given to entities like variables functions and classes
- Rules for forming identifiers:
  - May contain letters numbers or underscore (_)
  - Cannot start with a number
  - Cannot be a keyword
- Guidelines for naming:
  - Be descriptive
  - Avoid unnecessary abbreviations
  - Follow naming conventions

Naming conventions (I): Overview

The Python community has these recommended naming conventions

- joined_lower for functions, methods and attributes
- joined_lower or ALL_CAPS for constants
- StudlyCaps for classes
- Attributes: interface, _internal, __private

Naming conventions (II): examples

Variable Names:

- Use lowercase letters
- Separate words with underscores (_)
- Example: my_variable, total_sum, count

Function Names:

- Use lowercase letters
- Separate words with underscores (_)
- Example: my_function(), calculate_total(), get_user_input()

Class Names:

- Use CamelCase (capitalize the first letter of each word)
- Do not use underscores (_)
- Example: MyClass, UserProfile, DataAnalyzer

Naming conventions (III)

Constant Names:

- Use all uppercase letters
- Separate words with underscores (_)
- Example: MAX_VALUE, PI, DEFAULT_TIMEOUT

Module and Package Names:

- Use lowercase letters
- Can use underscores (_) if necessary to improve readability
- Example: my_module.py, user_profile.py, data_analyzer.py

Method Names:

- Follow the same convention as function names
- Use lowercase letters and separate words with underscores (_)
- Example: get_user_name(), calculate_total(), save_data()

Naming conventions (IV)

Private Variable and Method Names:

- Prefix with a single underscore (_) to indicate they are intended for hierachy use
- Prefix with a doble underscore (__) to indicate they are intended for internal use
- Example: __my_private_variable

Special Method Names:

- Use double underscores (__) before and after the name
- These are also known as "dunder" methods or magic methods
- Example: __init__(), __str__(), __repr__()

Example of identifiers

Invalid

Person Record

DEFAULT-HEIGHT

class

2totalweight

Example of identifiers

Invalid	**Reason**
Person Record	Identifier contains a space
DEFAULT-HEIGHT	Identifier contains a dash
class	Identifier is a keyword
2totalweight	Identifier starts with a number

Indentation and Semicolons

- Indentation to delimit blocks of code
- No need for {}
- No need for semicolons “;” to mark the end of instructions
- Can be used to put multiple instructions on a single line (not recommended)

```
## Individual instructions -- no semicolons
print("Hello!")

print("Here's a new instruction")

a = 2

# This instruction spans more than one line

b = [1        2        3

     4        5        6]

# This is legal but we should NOT do it

c = 1; d = 5

print(“Here's another”,  c  d)
```

Whitespace & Colons

- Whitespace matters:
  - Indentation must be consistent
  - Use tabs or white spaces (don't mix them)
  - IDE can handle for you
- 'pass' is an empty command used for empty indentation block
- Colons (":") start of a new block in many constructs e.g. function definitions then clauses

Comment

- Comments start with # and continue until the end of the line
- Used to describe what the program does and how it works
- More than 1 line use """ ... """

```
# This is a multiline comment

# Each line starts with a hash (#)

# and continues until the end of the line.

print("Hello        World!")

"""

This is a multiline comment.

It spans multiple lines.

However    this is typically used for docstrings. See next slide!

"""

print("Hello        World!")
```

Docstrings

- Type of multiline comment used to document modules   classes functions and methods
- They are written using triple quotes ("""" or "") and can span multiple lines
- Different from regular comments because they are stored as an attribute of the object they document and can be accessed programmatically using tools like help() or __doc__

```
def greet(name):

     """"

    This function greets the person whose name is passed as an argument.

    Parameters:

        name (str): The name of the person to greet.

    Returns:

        None

    """"

    print("Hola       ", name, ” !")

# Using the help function to access the docstring

help(greet)

print(greet.__doc__)
```

Flow of control

- The order in which the computer executes instructions
- Example of flow of control
- Decide what is wrong

```
a=4; b=5
# this function definition starts a new block
def print_numbers(a, b):
    # this instruction is inside the block
    print(“Numbers are:”  a  b)
# this if statement starts a new block
if it_is_tuesday:
    # this is inside the block
    print("It's Tuesday!")
# this is outside the block!
print("Print this no matter what")
```

Exercise

- The following Python program is not indented correctly
- Re-write it so that it is correct

```
def happy_day(day):
if day == "monday":
return ":("
if day != "monday":
return ":D"

print(happy_day("sunday"))
print(happy_day("monday"))
```

Reading and Writing

- For reading use “input”
- It reads a string

- For writing use “print”

```
first_number = input("Enter the first number: ")



print("The number is”, first_number)
```

Assignment(I)

- *Binding a variable* in Python means setting a *name* to hold a *reference* to some *object*

  Assignment creates references not copies

- Names in Python do not have an intrinsic type; objects have types
  - Python determines the type of the reference automatically based on what data is assigned to it
  - Basic types: numbers (int, float, complex), strings, Booleans, Bytes (bytes, bytearray)
- You create a name the first time it appears on the left side of an assignment expression: `y = 5`
- A reference is deleted via garbage collection after any names bound to it have passed out of scope
- Python uses *reference semantics* (more later)

Assignment (II)

- You can assign multiple names at the same time
- This makes it easy to swap values

- Assignments can be chained

```
x, y = 2, 3
```

```
a = b = x = 2
```

Built-in Types

- Types of information Python can handle:
  - integers
  - floating numbers
  - strings
  - boolean
  - complex
  - NoneType

- char is not a data-type instead is a string

```
print(type(1))      # <class 'int'>

print(type("a"))    # <class 'str’>

print(type(2.45))   # <class 'float’>

print(type(True))   # <class bool’>

print(type(4 + 4j))#<class 'complex’>

print(type(x))      #<class 'NoneType’>

print(type(´c´))    # <class ‘str’>
```

Cast Types

- Cannot do arithmetic operations on variables of different types
- Casting: the operation of converting a variable to a different type
  - int()
  - float()
  - str()

Outline

- Introduction
- Why Study Python?
- Python Interpreter
- An informal introduction
- **Numbers**
- Strings
- Lists
- Functions
- Variable Scope

Numbers

- Integer numbers: e.g. 1 5 -34
- Operators:

Sign	Operator	Sign	Operator
=	Assignment	//	Floor division
+	Add	**	Exponent
-	Substration	+=	Assign +
*	Multiplication	-=	Assign -
/	Division	*=	Assign *
%	Modulus	/=	Assign /

Operator Precedence

- Similar rules as other languages

<table>
<tr><th></th></tr>
<tr><td>() (Parentheses)</td></tr>
<tr><td>** (Exponentiation)</td></tr>
<tr><td>+x -x ~x (Unary plus Unary minus Bitwise NOT)</td></tr>
<tr><td>* / // % (Multiplication Division Floor Division Modulus)</td></tr>
<tr><td>+ - (Addition Subtraction)</td></tr>
<tr><td><< >> (Bitwise Shift Operators)</td></tr>
<tr><td>& (Bitwise AND)</td></tr>
</table>

<table>
<tr><th></th></tr>
<tr><td>^ (Bitwise XOR)</td></tr>
<tr><td>| (Bitwise OR)</td></tr>
<tr><td>Comparison operators: == != > >= < <= is is not in not in</td></tr>
<tr><td>not (Logical NOT)</td></tr>
<tr><td>and (Logical AND)</td></tr>
<tr><td>or (Logical OR)</td></tr>
</table>

Examples

```
# Exponentiation has the highest precedence

result = 2 ** 3 ** 2

# Equivalent to: 2 ** (3 ** 2) = 2 ** 9 = 512

# Multiplication and division have higher precedence than
addition and subtraction

result = 2 + 3 * 4 # Equivalent to: 2 + (3 * 4) = 2 + 12 =
14

# Parentheses can be used to override the default precedence

result = (2 + 3) * 4 # Equivalent to: 5 * 4 = 20
```

```
a = int(input("Number: "))

b = float(input("Number: "))

d = a * b /2

d += 1

C = d **2

print("Result c y d"   c   d)
```

Wooclap

Outline

- Introduction
- Why Study Python?
- Python Interpreter
- An informal introduction
- Numbers
- **Strings**
- Lists
- Functions
- Variable Scope

Strings (I)

- Can enclose in double or single quote
  - ‘ ’ # a string with a single quote
  - ” “ # a string with a double quote
- Triple quotes can cross end of line boundaries

'''
a two line

    string'''

- Strings are **immutable**
- Strings are objects of the “str” class

String Operations

- Concatenation: combining strings using the + operator
- Repetition: repeating a string using the * operator
- Indexing: accessing individual characters using indices []
- Slicing: extracting substrings using slice notation [:]

Examples

```
## Concatenation
hello = "Hello"
world = "World"
greet = hello + " " + world  # "Hello World"
# Repetition
laugh = "Ha"
repeated_laugh = laugh * 3  # "HaHaHa"
```

Indexing Operations

- Index starts with CERO (0)
- Index can be negative
- If -1 starts from the end until the length is reached
- Control you don´t overpass the limit → error

Examples

```
greet = ”Hola" + " " + "Spain”  #length of the string = 10

# Indexing

char = greet[1]  # ‘o’

char1 = greet[-1] # ‘n’

char2 = greet[-11] # Error: -11 → is bigger than 10 (0-9)

greet[0] = "H" # Error
```

Slicing Operations

- Strings can be used as a sequence of characters

```
greet = "hola" + " " + ”Spain"

# Slicing

greet[2:] #'la Spain'

greet[:2] #'ho'

greet[2:] + greet[:2] #'la Spainho'

greet[2:4] #'la'
```

String Methods

- Strings have built-in methods for various operations
- Function: len()
- Common methods:
  - upper()
  - lower()
  - strip()
  - replace()
  - split()
  - join()
  - find()
  - count()

Examples of methods

```
s = "  Hello, World!  "

# Convert to uppercase

upper_s = s.upper()  # "  HELLO, WORLD!  "

# Convert to lowercase

lower_s = s.lower()  # "  hello, world!  "

# Strip whitespace

stripped_s = s.strip()  # "Hello, World!”

# Replace substring

replaced_s = s.replace("World", "Python")#” Hello, Python!  "
```

```
# Split into a list

split_s = s.split(",")  # ["  Hello", " World!  "]

# Join list into a string

joined_s = " ".join(["Hello", "World"])  # "Hello World"

# Find substring

index = s.find("World")  # 8

# Count occurrences

count = s.count("l")  # 3
```

Examples of len

```
# Length of an empty string

empty_string = ""

print(len(empty_string))  # Output: 0

# Length of a string with spaces

string_with_spaces = "Hello, World! "

print(len(string_with_spaces))  # Output: 14

# Using len() with other data types

my_list = [1, 2, 3, 4, 5]

print(len(my_list))  # Output: 5
```

String Formatting

- Formatting strings use *placeholders* or *f-strings*
- Placeholders:
  - % operator
  - str.format() method
- f-strings: introduced in Python 3.6, use {} to embed expressions inside string literals

Examples

```
name = "Alice"

age = 30

# Using % operator

formatted_str = "My name is %s and I am %d years old." % (name, age)

# Using str.format() method

formatted_str = "My name is {} and I am {} years old.".format(name, age)

# Using f-strings

formatted_str = f"My name is {name} and I am {age} years old."
```

Escape Sequences

- Special sequences in strings to represent certain characters
- Common escape sequences:

Sequence	Meaning
\\	literal backslash
\'	single quote
\"	double quote
\n	newline
\t	tab

Examples

```
# Literal backslash

backslash_str = "This is a backslash: \\"

print(backslash_str)  # Output: This is a backslash: \

# Single quote

single_quote_str = 'It\'s a single quote.'

print(single_quote_str)  # Output: It's a single quote.

# Double quote

double_quote_str = "He said, \"Hello!\""

print(double_quote_str)  # Output: He said, "Hello!"
```

```
# Newline

newline_str = "First line\nSecond line"

print(newline_str)

# Output:

# First line

# Second line

# Tab

tab_str = "Column1\tColumn2"

print(tab_str)  # Output: Column1   Column2
```

Wooclap

Outline

- Introduction
- Why Study Python?
- Python Interpreter
- An informal introduction
- Numbers
- Strings
- **Lists**
- Functions
- Variable Scope

Lists (I)

- We use [ ] to respresent a list
- An ordered collection of **mutable** data
  - Ordered: data in the list have a location
  - Mutable: data can be modified
  - Data types can be different
- Concatenation & Repetition
- Slice & Indexing notation

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

print(a)

print(a[2])          # 123

print(a[1:])         # ['eggs’, 123]

print(a + a[2:])     # ['spam’,'eggs’,123,123]

a[0] = "jam”         # ['jam','eggs',123, 123]

print(a*2)           # ['jam', 'eggs', 123, 123, 'jam’,

                     # 'eggs', 123, 123]
```

List Methods

- List have built-in methods for various operations
- Function: len()
- Common methods:
  - append()
  - extend()
  - insert()
  - remove()
  - pop()
  - clear()
  - index()
  - count()
  - sort()
  - reverse()

Examples of methods

```
fruits = ["apple", "banana", "cherry"]

# Append an element

fruits.append("date")  # ["apple", "banana", "cherry", "date"]

# Extend list with another list

fruits.extend(["elderberry", "fig"])  # ["apple", "banana", "cherry", "date", "elderberry", "fig"]

# Insert an element at a specific position

fruits.insert(1, "blueberry")  # ["apple", "blueberry", "banana", "cherry", "date", "elderberry", "fig"]

# Remove an element

fruits.remove("banana")  # ["apple", "blueberry", "cherry", "date", "elderberry", "fig"]
```

Examples of methods

```
# Pop an element (remove and return it)
popped_fruit = fruits.pop()  # "fig", ["apple", "blueberry", "cherry", "date", "elderberry"]
# Clear the list
fruits.clear()  # []
# Index of an element
index_of_cherry = fruits.index("cherry")  # 2
# Count occurrences of an element
count_of_apple = fruits.count("apple")  # 1
# Sort the list           fruits.sort()  # ["apple", "banana", "cherry", "date"]
# Reverse the list        fruits.reverse()  # ["date", "cherry", "banana", "apple"]
```

Wooclap

Outline

- Introduction
- Why Study Python?
- Python Interpreter
- An informal introduction
- Numbers
- Strings
- Lists
- **Functions**
- Variable Scope

Functions

- Functions are reusable blocks of code that perform a specific task
- Functions help in organizing code and avoiding repetition
- Define using the **def** followed by the function name and ()
  - **Parameters**: variables listed inside the parentheses in the function definition
  - **Arguments**: values passed to the function when it is called
  - Functions can have **default parameters**, allowing some arguments to be optional
- Return a value using the ***return*** statement
  - You can return 1 or more values separated by ","
  - If no return statement is used, the function returns **None** by default

Example

Function

```
# Function without return statement
def say_hello():

    print("Hello, World!")

# Function with 1 return value
def square(number=3):

   return number ** 2

#Function with 2 return values
def calcular(valores):

   suma = sum(valores)

   promedio = suma / len(valores)

return suma, promedio
```

```
print(square(4))  # Output: 16

print(square())  # Output: 9

result = say_hello()

print(result)  # Prints the string and print None

print(square.__doc__) # No doc “”” CAD “””-- None

help(square)

total, media = calcular([1, 2, 3])

print(f"Sum: {total}, Average: {media}")
```

Annotations

- A way of associating arbitrary metadata with function arguments and return values
- Purpose:
  - Provide additional information about the types and purposes of function arguments and return values
  - Improve code readability and support type hinting

Example: Annotations

```
def function_name(arg1: annotation1, arg2: annotation2) -> return_annotation:

    pass
```

Combined with Default Values

Example: Annotations

```
def greet(name: str = "World") -> str:
    return f"Hello, {name}!”

def filtrar_pares(salida: list = []) -> list:
    return [i for i in salida if i % 2 == 0]

print(filtrar_pares([1, 2, 3, 4, 5, 6])) # Output: [2, 4, 6]
greet() # Output: Hello, World!
```

Main Function

- The main() function serves as the entry point for a Python program
- Helps in organizing code and makes it easier to understand and maintain
- Useful for defining a clear starting point for the program's execution
- Why Use main()?
  - Readability: makes the program structure clear and logical
  - Modularity: encapsulates the main logic of the program in a single function
  - Reusability: allows for parts of the code to be reused or tested separately
  - Best Practices: aligns with common programming conventions and prepares for larger projects

Example

```
def main():
    # Main logic of the program
    # Example: Calling functions, performing tasks, etc.
    pass


if __name__ == "__main__":
    main()
```

Exercise

Write a function called *process_text* that takes a string and a list of words as arguments. The function should:

- Convert the string to lowercase
- Remove leading and trailing whitespace
- Replace any word in the string that matches an element in the list of words with asterisks (*)
- Provide default values for the text and words to replace
- Return the processed string and the number of words replaced
- Call the *process_text* from a main function

Exercise: Output

```
# Function output with default values

Processed text: "this is a default text with ****** and *******
words."

Number of words replaced: 2

# User input and function output with custom values

Processed text: "python is an amazing programming language.
python is popular."

Number of words replaced: 3
```

Outline

- Introduction
- Why Study Python?
- Python Interpreter
- An informal introduction
- Numbers
- Strings
- Lists
- Functions
- **Variable Scope**

Variable Scope

- Region of the code a variable is accessible
- Variables declared in one part of the code may not be accessible in another
- 4 main types:
  1. **Local Scope:** variables defined inside a function, only accessible within that function
  2. **Enclosing Scope:** variables in the local scope of enclosing functions, often used in nested functions (**nonlocal** keyword)
  3. **Global Scope:** variables defined at the top level of a script or module, or explicitly declared as global using the **global** keyword. Accessed from any part of the code
  4. **Built-in Scope:** special reserved keywords and functions that are part of built-in namespace. E.g. len("Hello")

Example

```
#Local Scope

def my_function():

    x = 10

    print(x)  # This will print 10

my_function()

print(x)  # This will raise an error
```

```
#Enclosing Scope

def outer_function():

    x = 10  # Variable in the enclosing scope

    def inner_function():

        nonlocal x

        x += 5

        print(f"Inside inner_function: {x}")  # 15

    inner_function()

    print(f"Inside outer_function: {x}")  # 15

outer_function()
```

Example

```
#Global Scope (I)

x = 30

def my_function():

    print(x)  # This will print 30

my_function()

print(x)  # This will print 30
```

```
#Global Scope (II)

x = 20

def my_function():

    global x

    x+=1

    print(x)  # This will print 21

my_function()

x+=1

print(x)  # This will print 22
```

Exercise…

Create a Python program that manages a to-do list using global, local, and nonlocal variables, and demonstrates the use of built-in functions. Include a main() function

Global Variable: named **tasks** which will be a *list* to store the tasks. Functions:

- add_task(task): add a new task to the global tasks list
- remove_task(task): remove a task from the global tasks list if it exists
- list_tasks(): list all tasks stored in the global tasks list
- task_manager(): manage the operations of adding, modifying, and listing tasks
  - Modifies the first task in the tasks list
  - Uses the nonlocal keyword to refer to the tasks variable defined in the task_manager scope

...Exercise

main() Function: define a main() function that calls task_manager() to execute the main logic of the program

Use of Built-in Functions: use the built-in enumerate function in list_tasks() to number the tasks

Points to Consider:

- Global variables (tasks) are accessible and modifiable from any function in the script
- Local variables are defined within functions and are only accessible within those functions
- The nonlocal keyword is used within modify_task() to refer to the tasks variable from the task_manager scope

Example of the output…

```
Task 'Buy milk' added.
Task 'Call the doctor' added.
Task 'Exercise' added.
Task list:
1. Buy milk
2. Call the doctor
3. Exercise
Task 'Buy milk' modified to 'Buy milk (modi)'
```

```
Task list:
1. Buy milk (modified)
2. Call the doctor
3. Exercise
Task 'Exercise' removed.
Task list:
1. Buy milk (modified)
2. Call the doctor
```

Exercise (II)

Write a program that takes a sentence from the user, converts the entire sentence to lowercase, removes leading and trailing whitespace, counts the number of words, and replaces a specific word with another

Escribe un programa que tome una frase del usuario, convierta toda la frase a minúsculas, elimine los espacios en blanco al principio y al final, cuente el número de palabras y reemplace una palabra específica por otra.