

Introduction to Python

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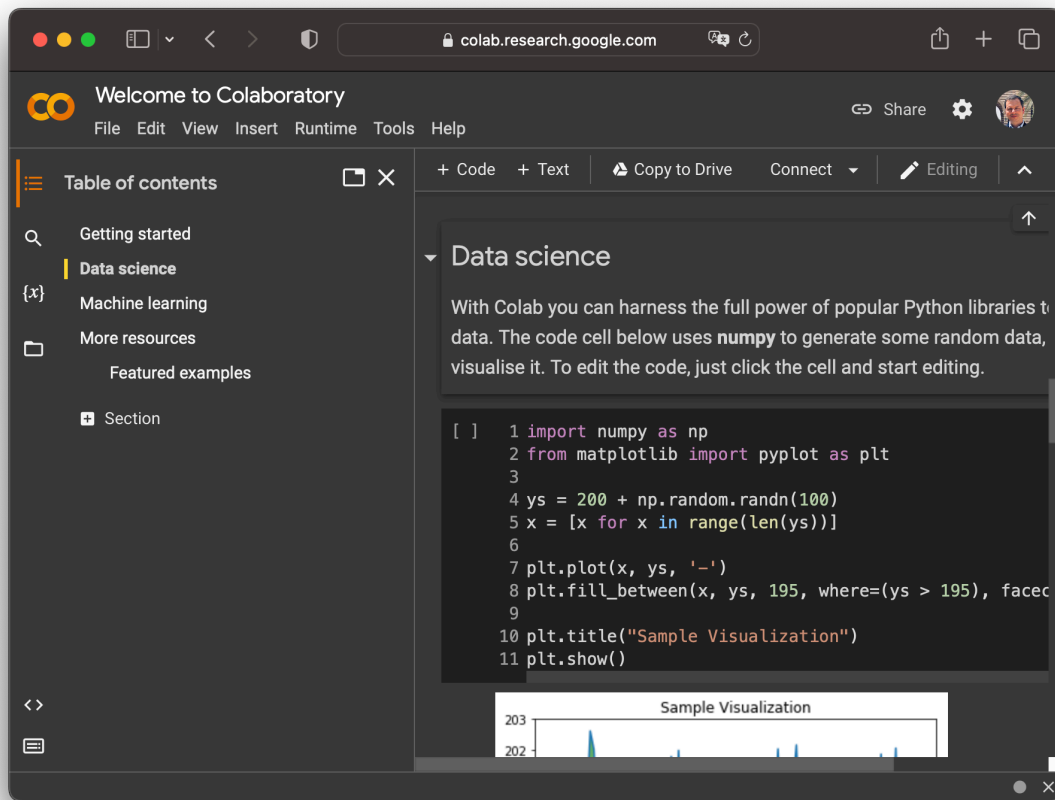
0.1 Why is it called Python?

When he began implementing Python, [Guido van Rossum](#) (left) was also reading the published scripts from [Monty Python's Flying Circus](#) (Right), a BBC comedy series from the 1970s. Van Rossum thought he needed a name that was short, unique, and slightly mysterious, so he decided to call the language Python. [Source: General Python FAQ]



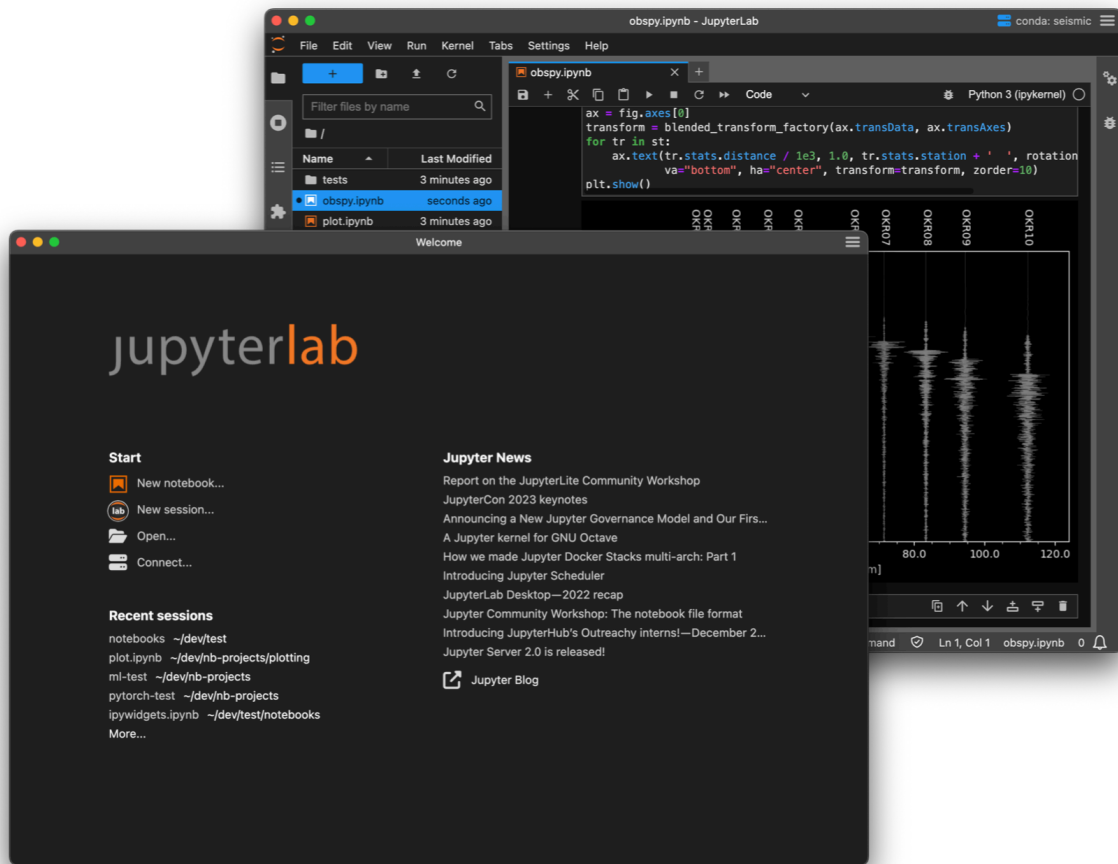
0.2 Working with Python using Google Colab

Homepage: <https://colab.research.google.com/> (runs online, cloud-computing like)

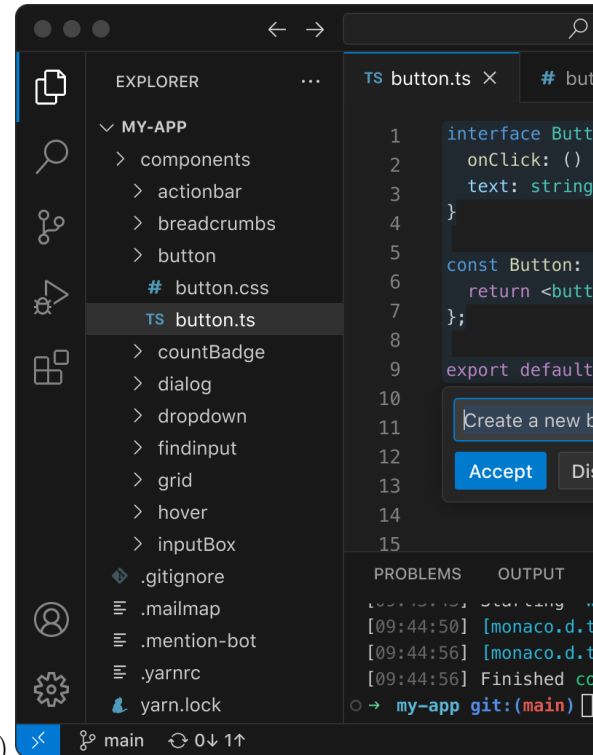


0.3 Working with Python using JupyterLab Desktop

Homepage: <https://github.com/jupyterlab/jupyterlab-desktop> (runs offline, desktop)



0.4 Working with Python using Visual Source Code



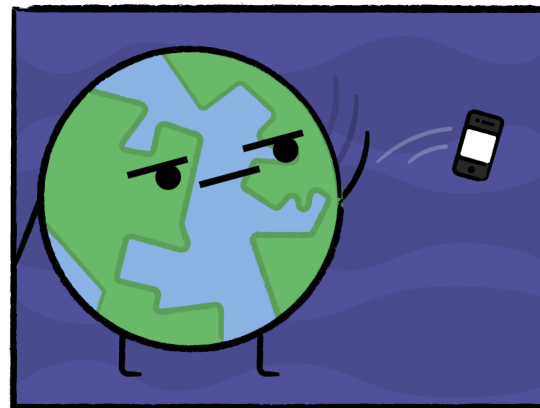
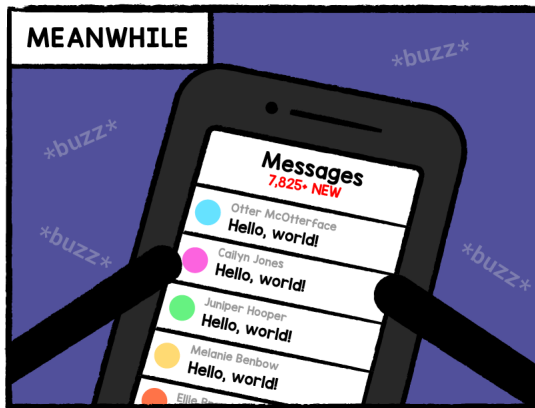
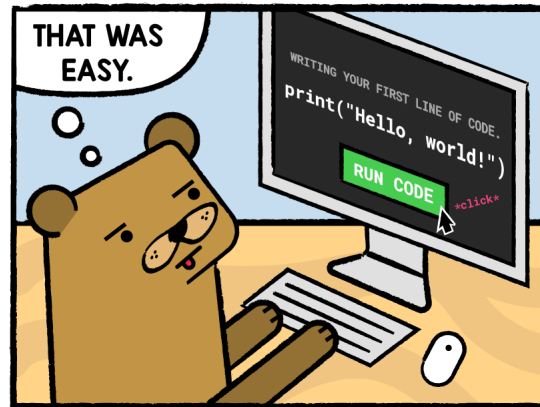
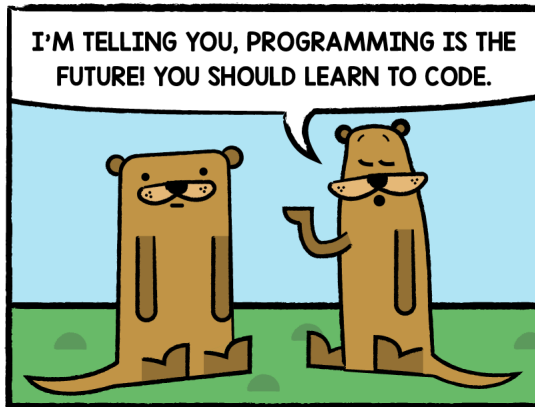
Homepage: <https://code.visualstudio.com/> (runs offline, desktop)

0.5 First Things First

As with any programming course, here is the Hello World! in Python.

```
1 print ("Hello World!")
```

Hello World!



0.6 Variables in Python

Variables are containers for storing data values. In Python, variables are created the moment you assign a value to it.

0.7 Example

```

1 x = 5
2 name = "Alice"
  
```

0.8 Naming Conventions

- Variables names must start with a letter or an underscore.
- Can contain letters, numbers, and underscores.
- Case-sensitive (`age`, `Age`, and `AGE` are three different variables).

1 Data Types in Python

Python has various data types including:

- **Integers:** `int` (e.g., 5)
- **Floating-point numbers:** `float` (e.g., 5.0)
- **Strings:** `str` (e.g., "Hello, World!")
- **Booleans:** `bool` (e.g., `True` or `False`)

1.1 Dynamic Typing

Python is dynamically typed, which means the type of a variable is determined at runtime.

```
1 x = 4          # x is an integer
2 x = "Sally"    # x is now a string
```

- Pros of Dynamic Typing:
 - very easy to work with
 - faster development time
- Cons of Dynamic Typing:
 - may result in unexpected bugs!

1.2 Boolean Variables and Logic Operations

Boolean variables in Python are defined by two constant objects `True` and `False`. Understanding how boolean operations work is crucial for control flow in programming.

1.2.1 Truth Table

- **AND** operation (`True` if both are true)
- **OR** operation (`True` if at least one is true)
- **NOT** operation (Inverts the Boolean value)

1.3 Types of Operators

- **Arithmetic Operators:** +, -, *, /, //, %, ** for basic math operations.
- **Comparison Operators:** ==, !=, <, >, <=, >= for comparing values.
- **Logical Operators:** and, or, not for boolean logic.
- **Assignment Operators:** =, +=, -=, *=, /=, etc., to assign values to variables.
- **Membership Operators:** in, not in, to check membership in sequences.

1.4 Examples

- 5 + 3 results in 8 (Arithmetic)
- 5 == 3 results in False (Comparison)
- True and False results in False (Logical)

1.5 Type Conversion

You can convert between different types using Python's built-in functions like `int()`, `float()`, and `str()`.

```
1 int(5.4) # Converts to integer
2 str(20) # Converts to string
3 float("3.14") # Converts to float
```

1.6 Working with Strings

Strings in Python are used to handle textual data. They can be enclosed in either single quotes ('...') or double quotes ("...").

1.7 Operations

- Concatenation: 'Hello ' + 'world!'
- Repetition: 'Ha' * 3
- Indexing: 'Hello'[1] returns 'e'
- Slicing: 'Hello'[1:4] returns 'ell'

1.8 Useful String Methods

- `.upper()`, `.lower()`, `.strip()`, `.split()`, `.replace()`, `.find()`, `.join()`, `.count()`, `.startswith()`, `.endswith()`
- An even more comprehensive list of string methods in Python can be found:
 - here: [Python String Functions at Digital Ocean](#), and
 - here: [Python String Methods at Geeks for Geeks](#)
 - BTW, both are excellent resources for additional documentation and examples.

2 Introduction to Lists

Lists in Python are used to store multiple items in a single variable. Lists are ordered, changeable, and allow duplicate values.

2.1 Creating a List

```
1 my_list = [1, 2, 3]
2 names = ["Alice", "Bob", "Charlie"]
```

2.2 Accessing Elements

- Access by index: `my_list[0]` returns 1.
- Slicing: `names[1:3]` returns ['Bob', 'Charlie'].

2.3 List Operations

- Append: `my_list.append(4)`
- Remove: `my_list.remove(1)`
- Sort: `names.sort()`

3 Advanced Variable Usage

Understanding variable scopes and mutability is crucial for Python programming.

3.1 Variable Scope

- **Global Scope:** Variables defined at the top-level of a script or module are global.
- **Local Scope:** Variables created within a function are local to that function.

3.2 Mutability

- **Immutable types:** `int`, `float`, `bool`, `str`. Changing the value creates a new object.
- **Mutable types:** `list`, `dict`, `set`. They can be changed in place without creating a new object.

4 In-depth Data Types

Exploring Python's built-in data types reveals the language's flexibility.

4.1 Sequences

- **Tuples:** Immutable and ordered. `my_tuple = (1, 2, 3)`
- **Ranges:** Immutable sequence of numbers. `range(1, 10)`

4.2 Mapping Type

- **Dictionaries:** Key-value pairs. `my_dict = {"name": "Alice", "age": 30}`

4.3 Set Types

- **Sets:** Unordered collection of unique elements. `my_set = {1, 2, 3}`
- **Frozen Sets:** Immutable version of a set. `frozen_set = frozenset([1, 2, 3])`

4.4 Escape Characters

- Use `\` to insert special characters, e.g.,
- new line:

```
1 print ("Hello\nWorld!")
```

```
Hello
World!
```

- tab:

```
1 print ("Hello\tWorld!")
```

```
Hello   World!
```

4.5 Summary

- Python is awesome
- Python uses **dynamic typing**
- Parentheses () are for calling **functions**
- Square brackets [] are are indexing **lists**
- Strings are **immutable** lists
- Lists start indexing at **zero**