Lecture 01: Introduction to Python

February 6, 2023

1 Introduction to Python

Slides modified from Pierian Data

2 What is Python and why use it

- **high-level**,
- **interpreted**,
- **general-purpose** programming language that is used for a wide range of applications.
- It is **easy to learn**, and
- **powerful**.

3 Why is it called Python?

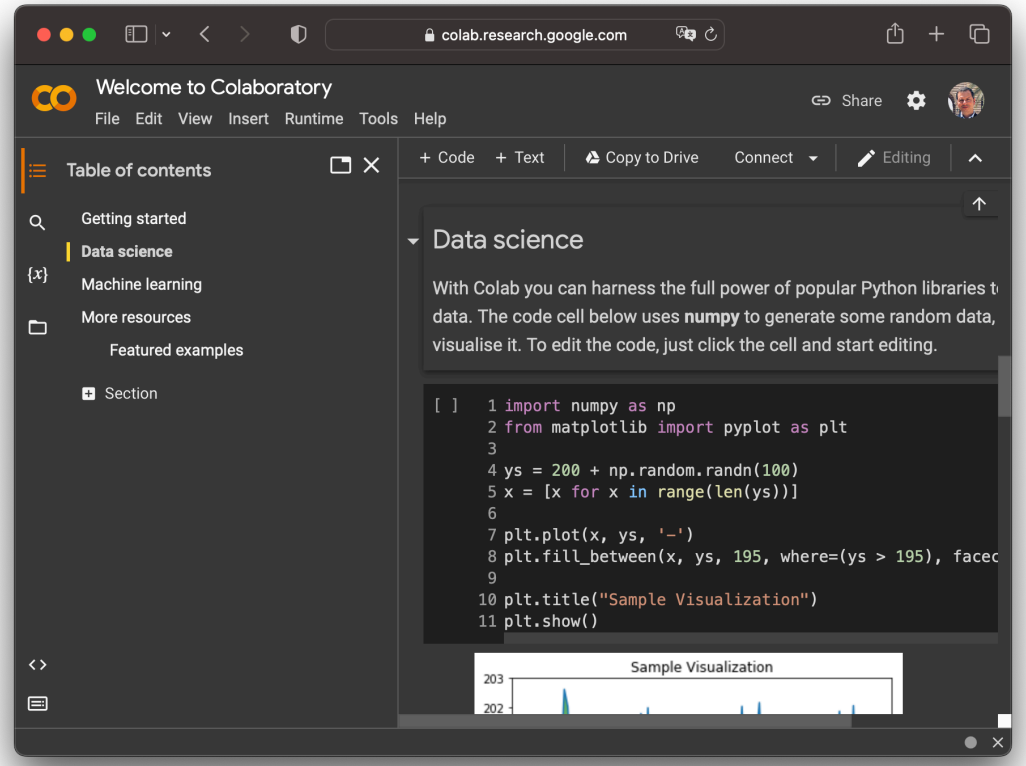
When he began implementing Python, Guido van Rossum was also reading the published scripts from "Monty Python's Flying Circus", a BBC comedy series from the 1970s. Van Rossum thought he needed a name that was short, unique, and slightly mysterious, so he decided to call the language Python. –General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

[1]:
```
from IPython.display import display, Image
display(Image(filename="images/python.png"))
```

4 Working with Python using Google Colab

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

[2]:
```
display(Image(filename="images/colab.png"))
```



5 Working with Python using JupyterLab Desktop

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

[3]:
```
display(Image(url="https://raw.githubusercontent.com/jupyterlab/
↪jupyterlab-desktop/master/media/jupyterlab-desktop.png"))
```

```
<IPython.core.display.Image object>
```

6 First Things First

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

[4]:
```
print ("Hello World!")
```

```
Hello World!
```

7 Variable

A variable is a named storage location used to hold a value. The value of a variable can be changed and it can be used in expressions and operations

8 Variable Assignment

- names can not start with a number
- names can not contain spaces, use _ intead
- names can not contain any of these symbols: `'",<>/?|\!@#%^&*~-+`
- accoding to Style Guide for Python Code (PEP8), it's considered best practice that names are lowercase with underscores
- avoid using Python built-in keywords like `list` and `str`
- avoid using the single characters `l` (lowercase letter el), `O` (uppercase letter oh) and `I` (uppercase letter eye) as they can be confused with 1 and 0

9 Dynamic Typing

Python uses *dynamic typing*, meaning you can reassign variables to different data types. This makes Python very flexible in assigning data types; it differs from other languages that are statically typed.

[5]:
```
my_cat = 2
my_cat
```

[5]:
```
2
```

[6]:
```
my_cat = ['Basbousa', 'Lucy']
my_cat
```

[6]:
```
['Basbousa', 'Lucy']
```

10 Pros and Cons of Dynamic Typing

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

11 Assigning Variables

Variable assignment follows `name = object`, where a single equals sign `=` is an assignment operator

[7]:
```
a = 5
a
```

[7]:
```
5
```

12 Reassigning Variables

Python lets you reassign variables with a reference to the same object.

[8]:
```
a = a + 10
a
```

[8]: 15

There's actually a shortcut for this. Python lets you add, subtract, multiply and divide numbers with reassignment using `+=`, `-=`, `*=`, and `/=`.

[9]:
```
a += 10
a
```

[9]: 25

[10]:
```
a *= 2
a
```

[10]: 50

13 Determining variable type with `type()`

You can check what type of object is assigned to a variable using Python's built-in type() function. Common data types include:

[11]:
```
type(a)
```

[11]: `int`

14 Numbers

Basically there are two types of numbers: - 2 is interger `int` - 2.0 is floating point `float`

Example	Number Type
1,2,-5,1000	Integers
1.2,-0.5,2e2,3E2	Floating point

[12]:
```
type(2)
```

[12]: `int`

[13]:
```
type(2.0)
```

[13]: `float`

Basic Arithmetic 1/2

[14]:
```
2+1 # Addition
```

[14]: 3

[15]:
```
2-1 # Subtraction
```

[15]: 1

[16]:
```
2*2 # Multiplication
```

[16]: 4

[17]:
```
3/2 # Division
```

[17]: 1.5

Basic Arithmetic 2/2

[18]:
```
3//2 # Floor division (It returns the result of division rounded down to the␣
↪nearest integer)
```

[18]: 1

[19]:
```
2**3 # Powers
```

[19]: 8

Question: how to calculate the sequare root of 16?

15 Order of Operations

[20]:
```
2 + 10 * 10 + 3
```

[20]: 105

[21]:
```
(2+10) * (10+3)
```

[21]: 156

16 Strings

Strings in Python are **text**, such as names, stored as a sequence or a list of characters. For example, Python understands the string `'AUC'` to be a sequence of letters in a specific order. This means we will be able to use indexing to grab particular letters (like the first letter `A`, or the last letter `C`).

17 Creating a String

To create a string in Python you need to use either single quotes `'` or double quotes `"`.

[22]:
```
'Hello'
```

[22]:
```
'Hello'
```

[23]:
```
'Hello World!'
```

[23]:
```
'Hello World!'
```

[24]:
```
"This is also a string"
```

[24]:
```
'This is also a string'
```

[25]:
```
'I'm using single quotes, but this will create an error'
```

```
  Cell In[25], line 1
    'I'm using single quotes, but this will create an error'
       ^
SyntaxError: invalid syntax
```

[26]:
```
'Now I\'m ready to use the single quotes inside a string!' # Using escape␣
↪character
```

[26]:
```
"Now I'm ready to use the single quotes inside a string!"
```

[27]:
```
"Now I'm ready to use the single quotes inside a string!" # Using double quotes
```

[27]:
```
"Now I'm ready to use the single quotes inside a string!"
```

18 Printing a String

Using Jupyter notebook with just a string in a cell will automatically output strings, but the correct way to display strings in your output is by using a `print` function.

[28]:
```
'Hello World'
```

[28]:
```
'Hello World'
```

[29]:
```
'Hello World 1'
'Hello World 2'
```

[29]:
```
'Hello World 2'
```

[30]:
```
print('Hello World 1')
print('Hello World 2')
```

```
Hello World 1
Hello World 2
```

[31]:
```
print('Hello World 1\nHello World 2') # using \n for new line
```

```
Hello World 1
Hello World 2
```

19 String Indexing 1/3

Since strings are a sequence, we can use brackets `[]` after an object to call its index. We should also note that indexing **starts at 0** for Python.

[32]:
```
name = 'Emma'
name
```

[32]: `'Emma'`

[33]:
```
name[0]
```

[33]: `'E'`

[34]:
```
name[1]
```

[34]: `'m'`

[35]:
```
name[-1]
```

[35]: `'a'`

20 String Indexing 2/3

[36]:
```
name[:2]
```

[36]: `'Em'`

[37]:
```
name[2:]
```

[37]: `'ma'`

[38]:
```
name[::1]
```

[38]: `'Emma'`

21 String Indexing 3/3

[39]:
```
name[::2]
```

[39]: `'Em'`

What will be the ouptut of `name[::-1]`

22 String Properties 1/2

String are **immutable** i.e., once a string is created, the elements within it can not be changed or replaced.

[40]:
```
name
```

[40]:
```
'Emma'
```

[41]:
```
name[0] = 'e'
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[41], line 1
----> 1 name[0] = 'e'

TypeError: 'str' object does not support item assignment
```

23 String Properties 2/2

So if we need to chane the value of a string, we need to **reassign**:

[42]:
```
name = name + " Stone"
name
```

[42]:
```
'Emma Stone'
```

[43]:
```
display(Image(url="https://api.time.com/wp-content/uploads/2016/12/
 ↪emma-stone-lalaland.jpg", width = 400) )
```

```
<IPython.core.display.Image object>
```

String Properties 3/3

[44]:
```
name * 5
```

[44]:
```
'Emma StoneEmma StoneEmma StoneEmma StoneEmma Stone'
```

24 Bulit-in String Method

In Python, we can call objects' methods with a period and then the method name in the following form: `object.method(parameters)`. And here are some built-in methods in strings:

[45]:
```
name.upper() # Convert to upper case
```

[45]:
```
'EMMA STONE'
```

[46]:
```
name.lower() # Convert to lower case
```

[46]:
```
'emma stone'
```

[47]:
```
name.split()  # Split by a separator (the default are white spaces)
```

[47]:
```
['Emma', 'Stone']
```

[48]:
```
name.replace("m", "M")
```

[48]:
```
'EMMa Stone'
```

[49]:
```
print("Thank you!")
```

```
Thank you!
```

[50]:
```
display(Image(url="https://miro.medium.com/v2/resize:fit:800/format:webp/
↪0*6GbsTL8b7L2EBvu1.jpg", width = 300))
```

```
<IPython.core.display.Image object>
```

[ ]:
```

```