

Introduction to Python Programming

An APS workshop for REU students
June 12, 2024

hosted by

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Today, we will go over
the basics of Python

Outline:

What is Python?

Getting Started

Learning by Examples:

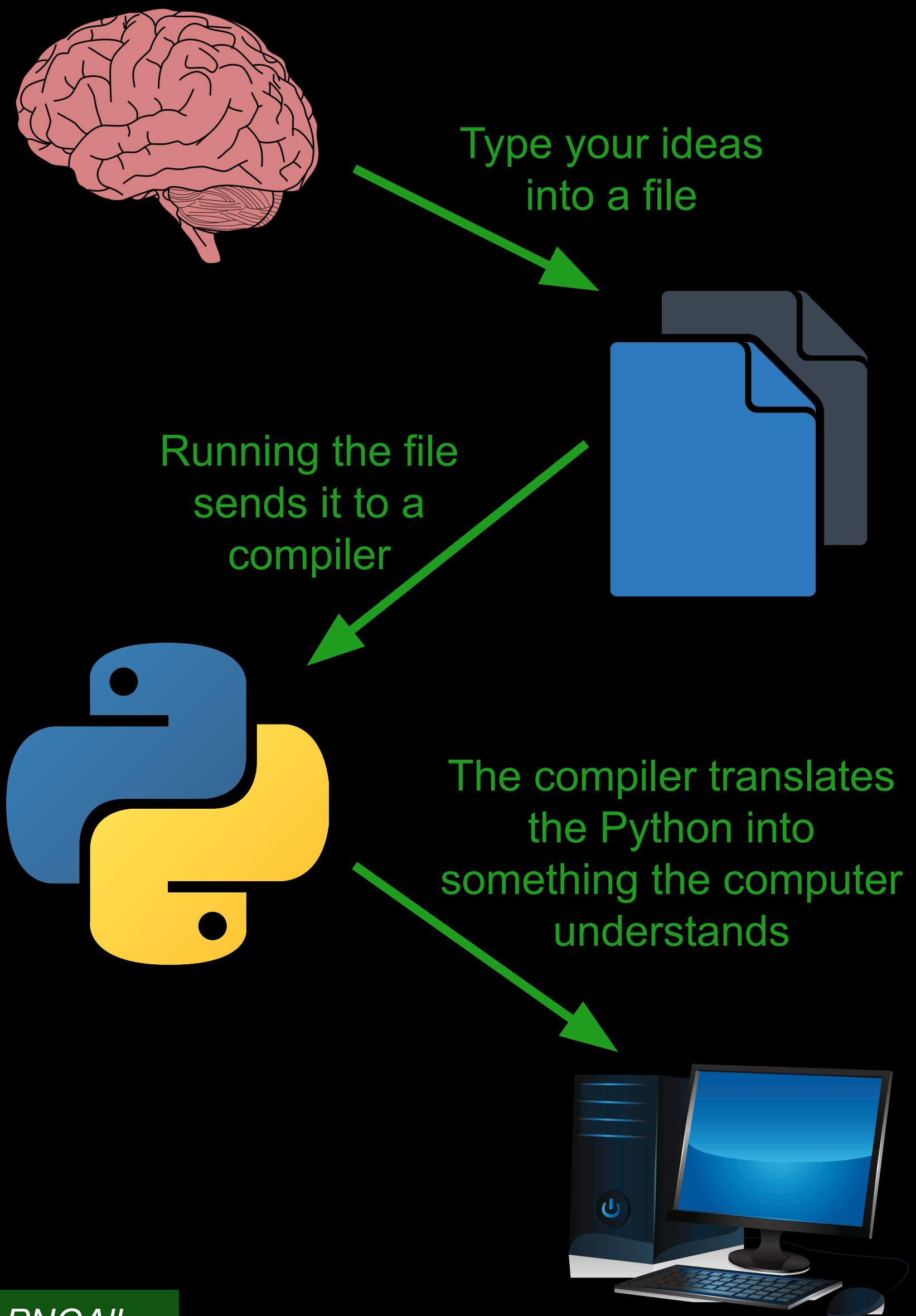
1. Syntax
2. Data Structures
3. Functions
4. Conditionals
5. Libraries

Moving Forward



**What is
Python?**

Python is a high-level programming language



Python files can be **.py** or **.ipynb**

```
48 import pandas as pd
49
50 # Go back 2 folders, into the "files" folder, and identify Excel sheet
51 path2data = '../..files/sample_data.xlsx'
52
53 # Use pandas to load the Excel data
54 data = pd.read_excel(path2data)
55
56 # Make the Excel column called "x" be the x-values for our plot
57 x = data['x']      # or x = data.x
58
59 # Make the Excel column called "sin_x" be the y-values for our plot
60 y = data['sin_x']  # or y = data.sin_x
61
62 # Plot the data
63 plt.figure()
64 plt.plot(x,y)
```

.py

Here are two things you should notice:

- We have to pay attention to **indentation** now
- If your condition is always True, the loop will run forever!

The cell below will show you how to construct a while loop, and the example will add consecutive numbers until the sum is greater than 10.

```
[ ] current_number = 0 # Start with 0
    current_sum = 0 # Start with a sum of 0

    while current_sum < 10:
        print('%i + %i = %i'%(current_sum, current_number, current_sum + current_number))

        current_sum = current_sum + current_number # Add the number to the sum
        current_number = current_number + 1 # Increase the number by 1

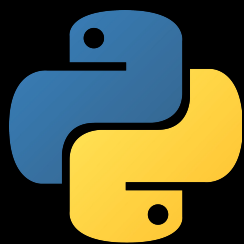
    # This next line won't execute until the loop is done
    print("The sum is %i, and the last number is %i"%(current_sum, current_number))
```

It's possible to make a loop that runs forever, which will eventually crash your computer. That's not ideal. To make sure your while loop stops even if you made a mistake, add another stopping condition based on the number of iterations. Consider the example below. It would run forever without the extra stopping condition because $7 < 8$ is always True.

```
[ ] iteration_max = 1000
    iteration_count = 0

    while 7 < 8 and iteration_count < iteration_max:
        iteration_count += 1
        if iteration_count == iteration_max:
            print('WARNING: Maximum number of iterations reached. Loop terminated.')
```

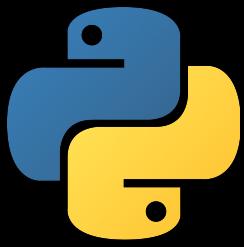
.ipynb



Python is named after...



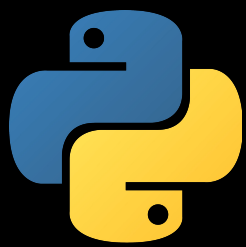
David Clode



Python is named after...



David Clode



Python is named after...



David Clode

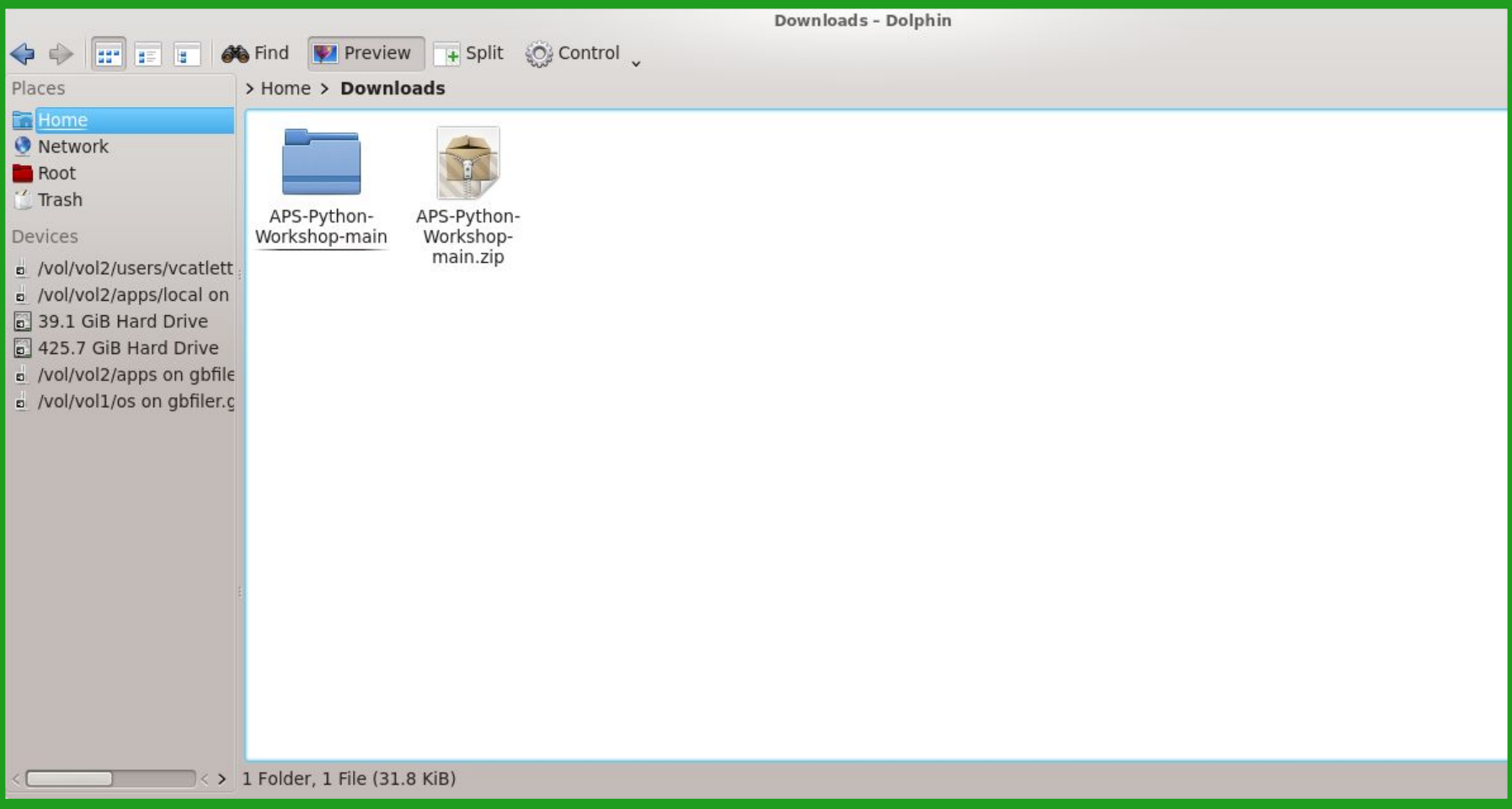
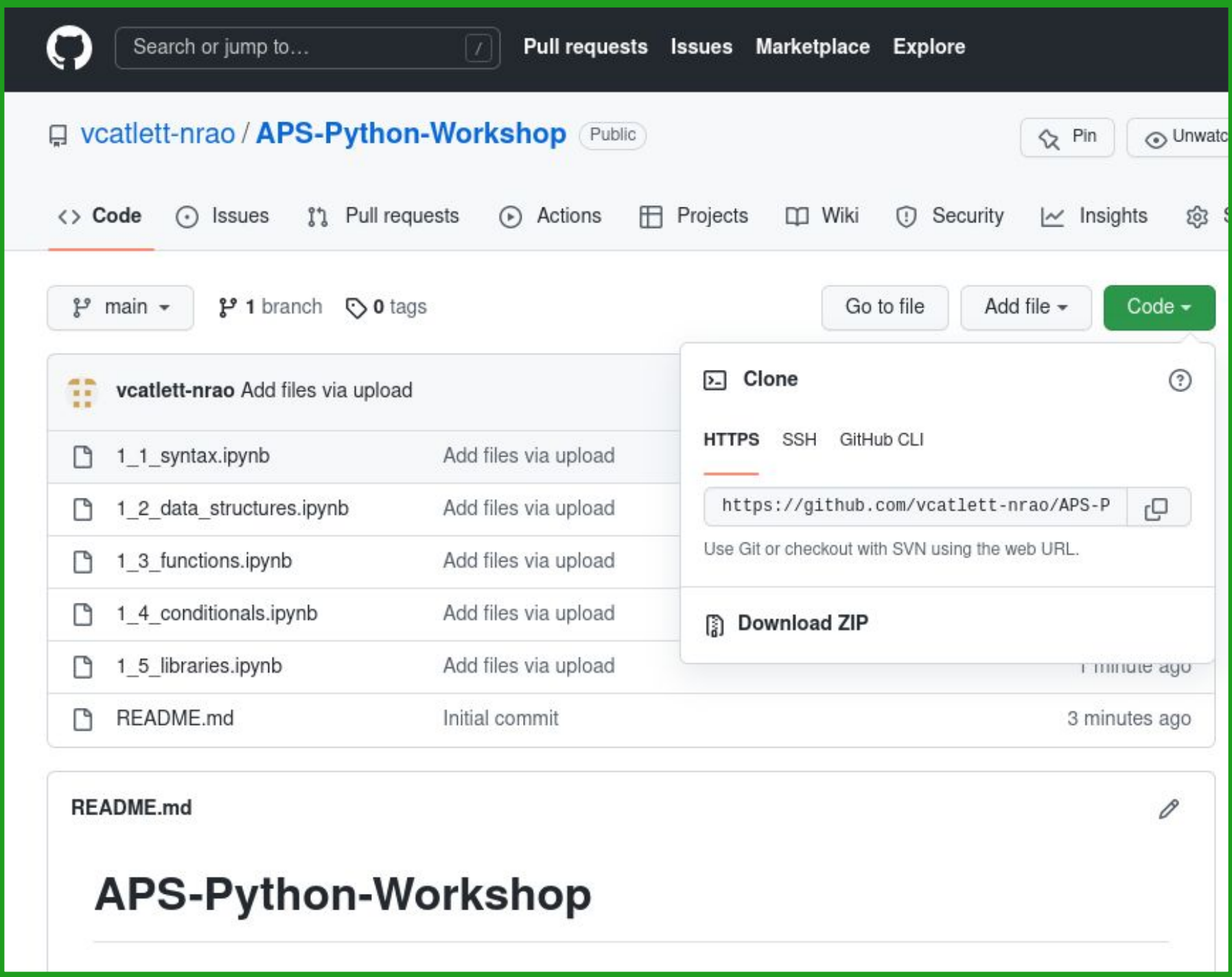


Netflix

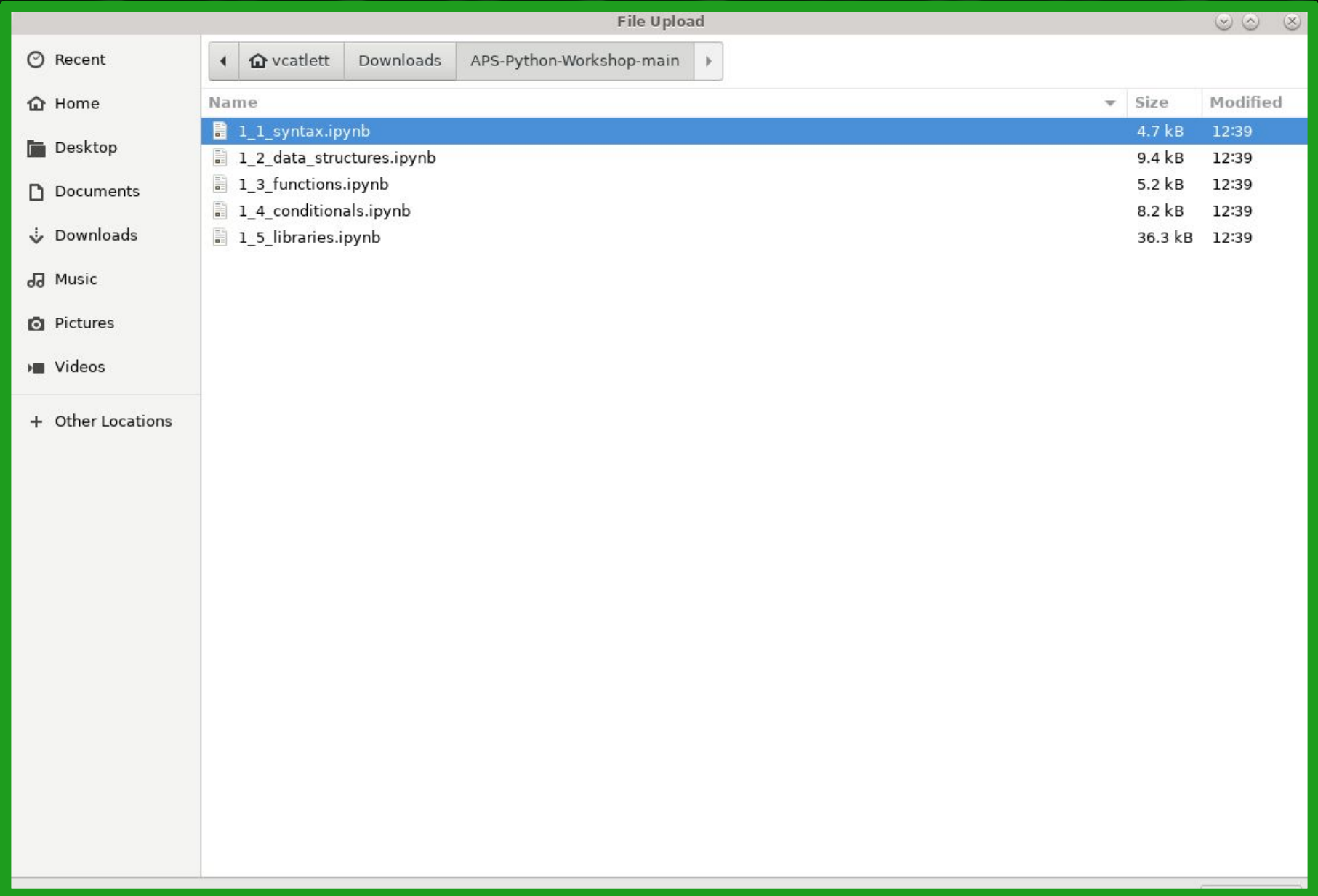
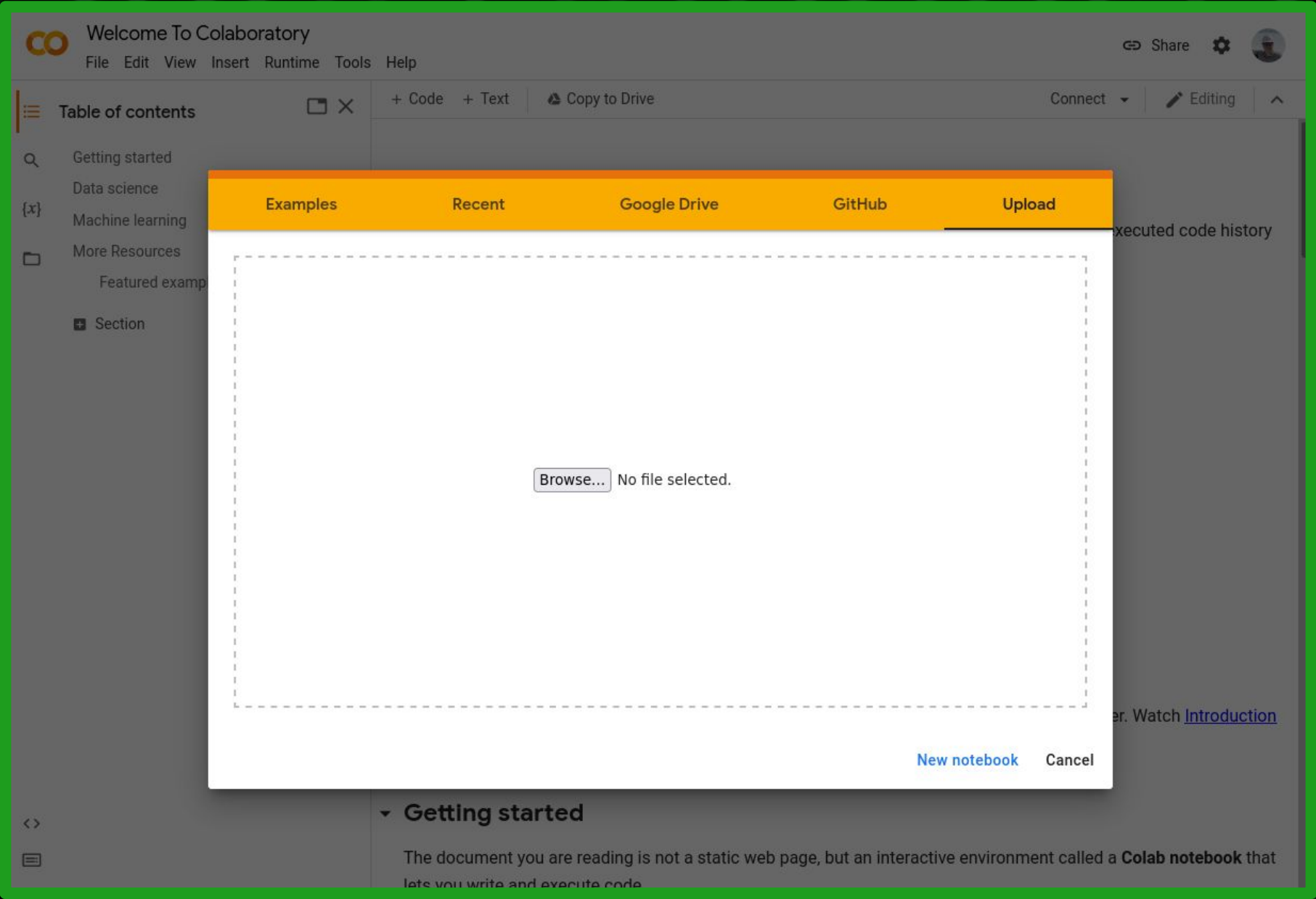


Getting Started

Download the session materials from my GitHub and unzip them



Upload the .ipynb files into Google Colab



Syntax

1_1_syntax.ipynb

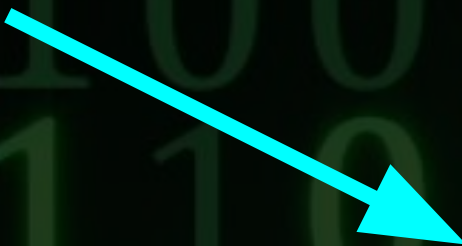
Data Structures

1_2_data_structures.ipynb


Functions

1_3_functions.ipynb

A code function is like a math one:
it takes inputs and gives outputs

$$f(x) = |x|$$


```
y = abs(x)
```

$$f(x) = x^2$$


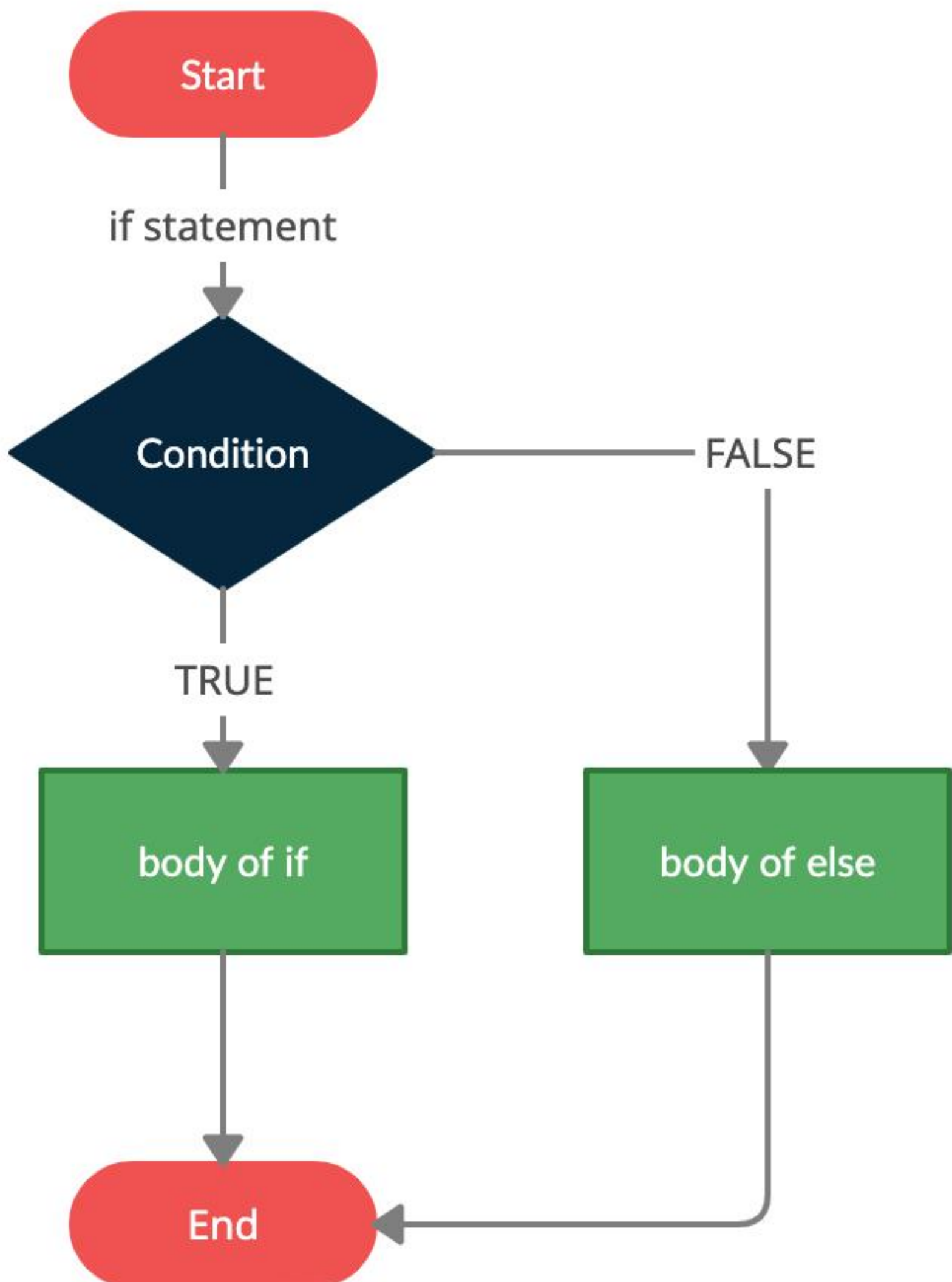
```
def f(x):  
    y = x**2  
    return y
```

They can be
built-in, **user-defined**, or imported

Conditionals

1_4_conditionals.ipynb

A **conditional** lets you evaluate blocks of code *only if* something is True



Libraries

1_5_libraries.ipynb

A **library** is a neatly-packaged collection of someone else's code



Real Python



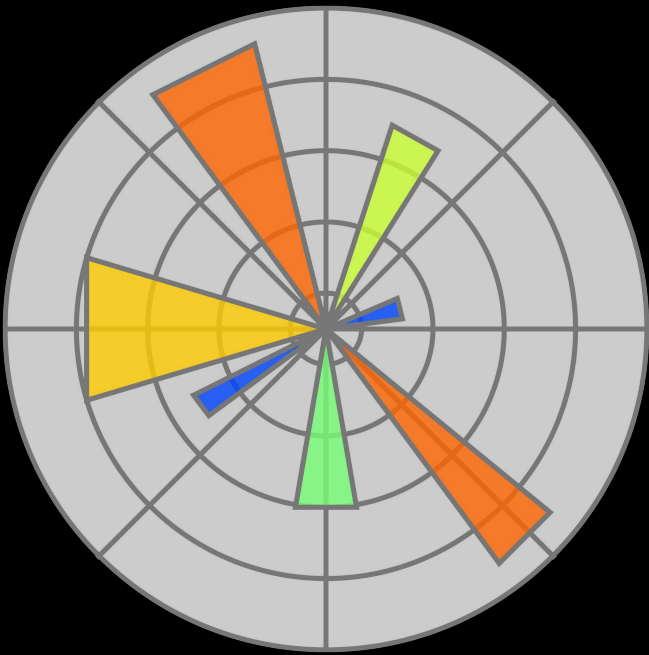
It's all managed
by **pip**

Python Software Foundation

**We will use
NumPy, Matplotlib, and SciPy**



NumPy
Contains lots of
math functions



Matplotlib
Lets you make nice
plots of data



SciPy
Even more math
functions than
NumPy

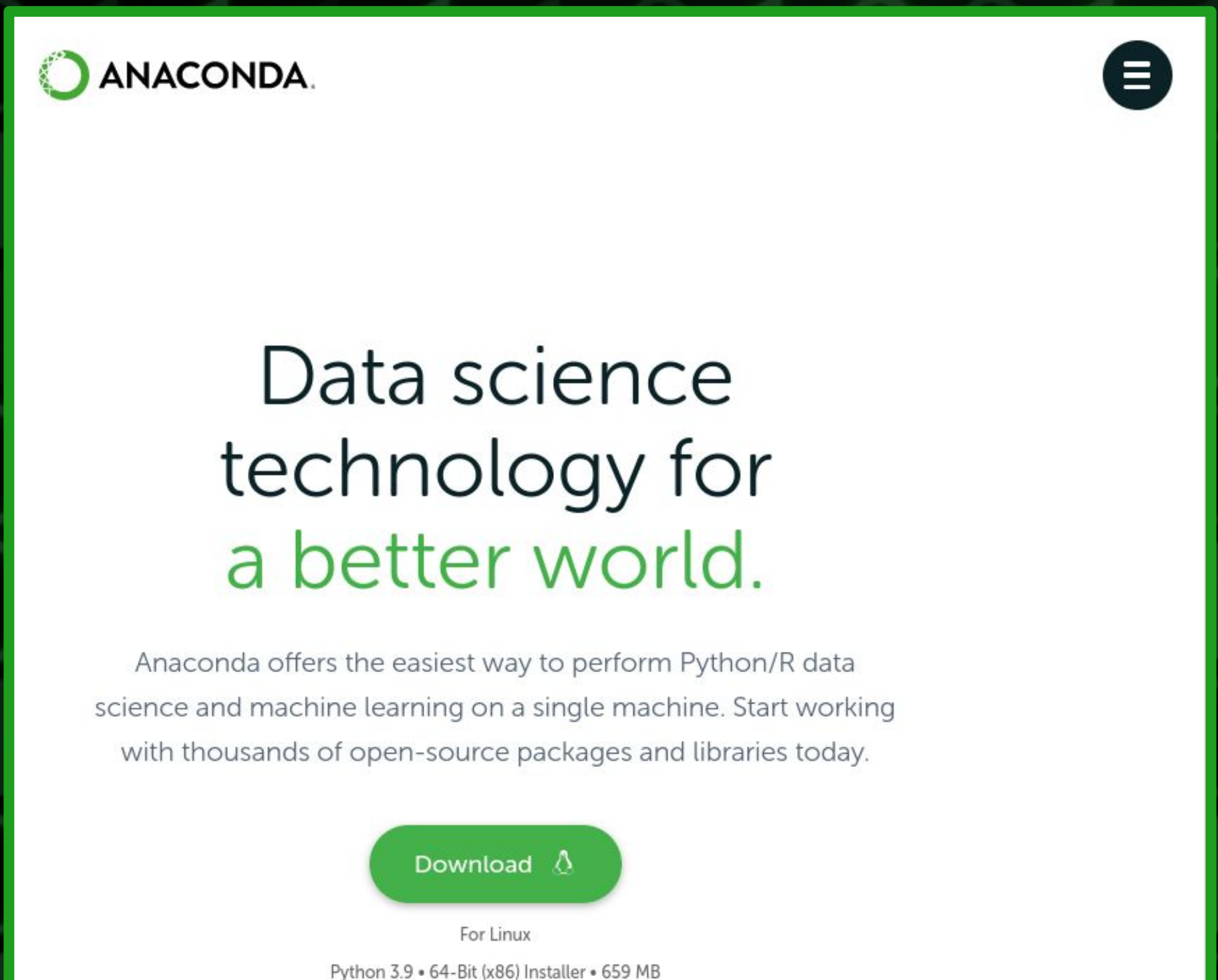


**Now
What?**

You can use online editors or download Python onto your computer



The screenshot shows the Python.org homepage. At the top is a navigation bar with links: Python, PSF, Docs, PyPI, Jobs, and Community. Below this is the Python logo, a 'Donate' button, a search bar with a 'GO' button, and a 'Socialize' button. A secondary navigation bar contains links for About, Downloads, Documentation, Community, Success Stories, News, and Events. The main content area features a large banner with the text 'Download the latest source release' and a button to 'Download Python 3.10.5'. Below the button, there is text about downloading Python for different operating systems (Windows, Linux/UNIX, macOS, Other) and links to 'Prereleases' and 'Docker images'. The banner also includes an illustration of two parachutes against a blue sky with clouds.



The screenshot shows the Anaconda website. At the top left is the Anaconda logo, and at the top right is a hamburger menu icon. The main heading reads 'Data science technology for a better world.' Below this, a paragraph states: 'Anaconda offers the easiest way to perform Python/R data science and machine learning on a single machine. Start working with thousands of open-source packages and libraries today.' At the bottom, there is a large green 'Download' button with a small icon of a person. Below the button, it says 'For Linux' and 'Python 3.9 • 64-Bit (x86) Installer • 659 MB'.