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CODING FOR DATA ANALYSIS AND VISUALISATION

An intro to working with Python, Jupyter Notebook and Pandas

OBJECTIVES

- **How to use Jupyter Notebook for data analysis**
- **How to write Python code**
- **Using Pandas library to explore and visualise data**
- **Using Seaborn library to visualise data**

The aim of this course is to provide you with some fundamental skills to enable you to utilise modern open-source (free!) tools to read, clean, transform and visualise data.

We will start with an introduction to Jupyter Notebook, an open-source web application that allows the creation and sharing of documents that contain live code, equations, visualisations and more.

Next, we will explore the Python programming language and work with some of its basic data structures such as: lists, dictionaries, sets and files.

Following that we will use Pandas library to do some EDA (Exploratory Data Analysis).

Finally, we will use the Seaborn library to visualise the data.

I hope you enjoy the course!

Gav

DATA ANALYSIS

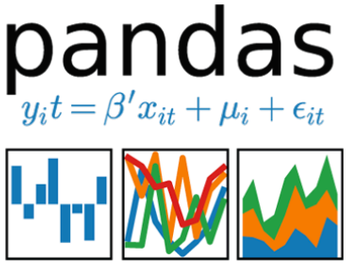
Data analysis is a process of inspecting, cleansing, transforming and modeling data with the goal of discovering useful information, informing conclusion and supporting decision-making.

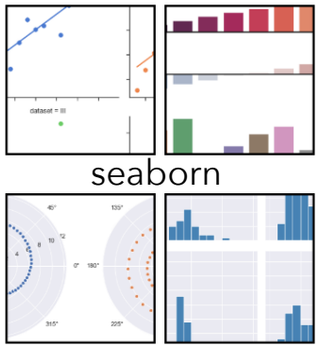
During this course you will learn how to create sample data and also how to load existing data such as **csv** files.

You will then **clean** your data, and transform data in pandas **DataFrames**.

After exploring DataFrames you will **visualise** your data and test some of your new skills!

Why Python?





The reason we use Python for these sessions is because it is a **general-purpose programming language**.

This means it can be used for many other purposes outside of data analysis including:

Web development

GUI (Graphical User Interface) development

Scripting

You may only use it for data analysis for now but the above options become available to you once you understand Python and maybe want to broaden your skill set.

Other domain-specific languages such as **R** are great for statistical work but are not general-purpose languages

Using **Jupyter Notebooks** is a great way to organise and present data analysis and is easy to use and open-source.

The libraries we will use on this course **Pandas, Matplotlib** and **Seaborn** are also open-source and very popular and powerful packages for data analysis/data science work.

Time	Area	Topics
09:30 - 10:00	Intro to course	Objectives of course Housekeeping Installation issues
10:00 - 11:00	Tools	Anaconda Jupyter Notebook Basics Python Basics
11:00 - 11:15	Break	
11:15 - 13:00	Python	More Python Basics
13:00 - 14:00	Lunch	
14:00 - 15:00	Pandas	Intro to Pandas Creating data Reading data Cleaning data Transforming and aggregating data
15:00 - 16:00	Matplotlib and Seaborn	Visualisation of data
16:00 - 16:30	Feedback/reflections	Complete feedback forms Reflections

```
## Coding for Data Analysis and Visualisation

A one-day course designed to introduce learners to the
following:

    Jupyter Notebook
    Python
    Pandas
    Matplotlib
    Seaborn
```

```
### Topics covered

Using Jupyter Notebook

    - What is Jupyter?
    - Creating notebooks
    - Running cells
    - Cell types
```

Content (2/3)

```
Python

    - What is Python?
    - Lists
        - Indexing
        - Slicing
        - Sorting

    - Dictionaries
        - Keys
        - Values
        - Methods
        - Printing keys and values

    - Files
        - Opening files
        - Readlines
        - Slicing
        - Len
        - strip()
        - lower()
        - Removing duplicates
```

Content (3/3)

```
Using Pandas

    - What is pandas?
    - Dataframes
    - head()
    - info()
    - tail()
    - describe()
    - Exploratory Data Analysis
    - Reading data
    - Cleaning data
    - Transforming data
    - Visualising data

Using Matplotlib and Seaborn
    - Visualising data
```

HOW TO USE JUPYTER NOTEBOOK FOR DATA ANALYSIS

What is Jupyter Notebook?

The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. Uses include: data cleaning and transformation, numerical simulation, statistical modeling, data visualization, machine learning, and much more (https://jupyter.org).

Throughout the course we will be using Jupyter Notebook to execute (run) all the Python code and pandas code so as to keep all our experiments in one place.

We can use Jupyter's **markdown** cells to add comments and descriptions and we can place **visualisations** such as **Box Plots** and **Histograms** inline with our code experiments.

How to use Jupyter Notebook for data analysis

Installation Instructions

To install Jupyter Notebook there are two paths we can take :

Path A: Install Jupyter using Anaconda and condo

Download Anaconda (Python 3.7 version)

Following the instructions on the download page to install

To run search for Anaconda Navigator

Path B: Install Jupyter using pip (experienced Python users only)

```
pip3 install --upgrade pip
```

```
pip3 install jupyter
```

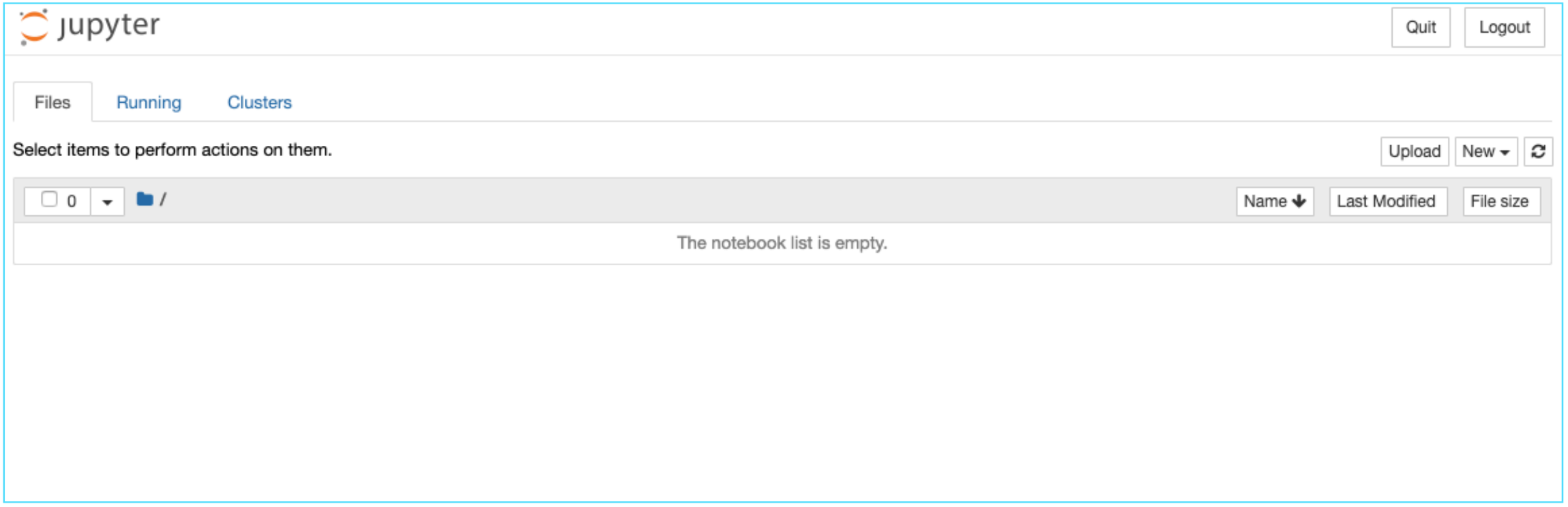
Run Jupyter Notebook with command:

```
jupyter notebook
```

How to use Jupyter Notebook for data analysis

Creating Notebooks

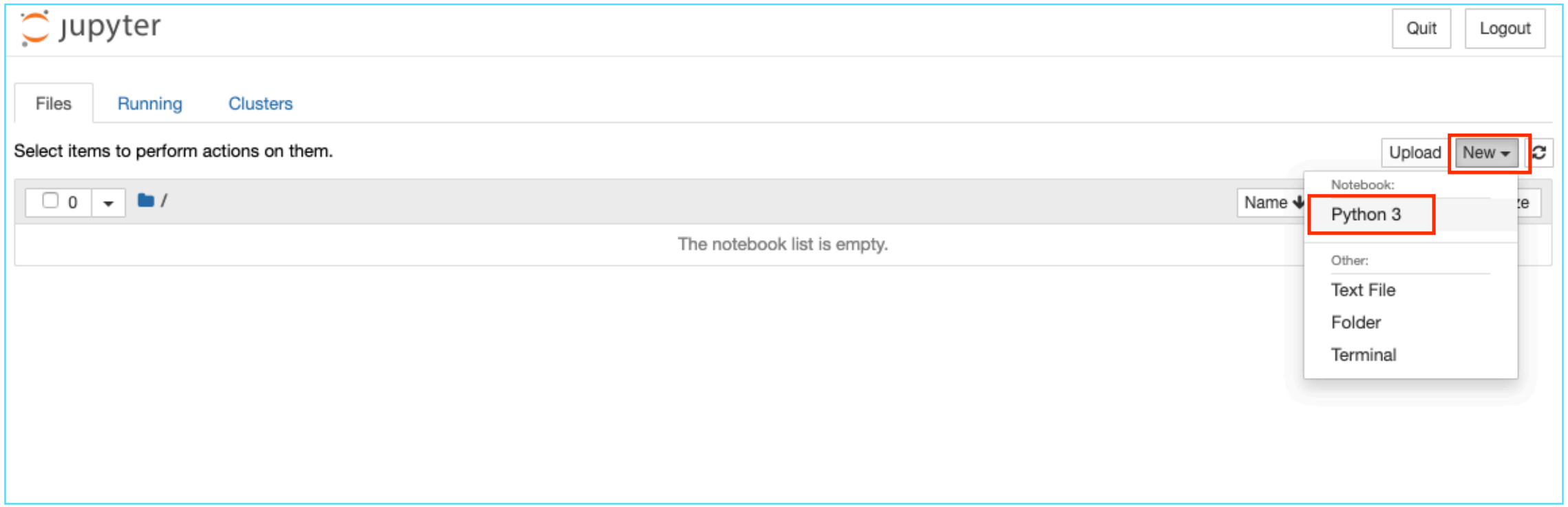
After following the installation steps and running command ***jupyter notebook***
you should be presented with a web page that looks **similar** to this one:



How to use Jupyter Notebook for data analysis

Creating Notebooks

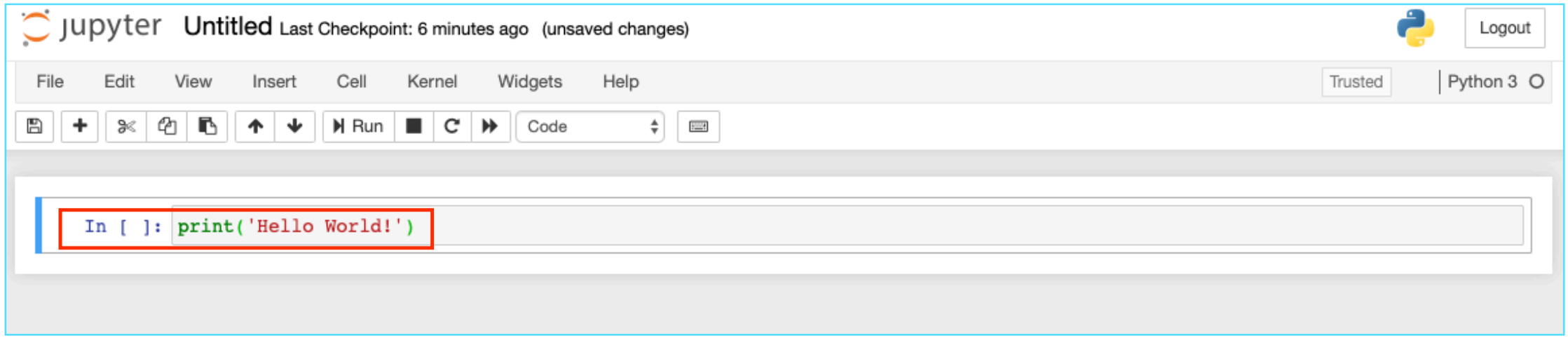
To open a **new notebook** click on **New** then **Python 3**:

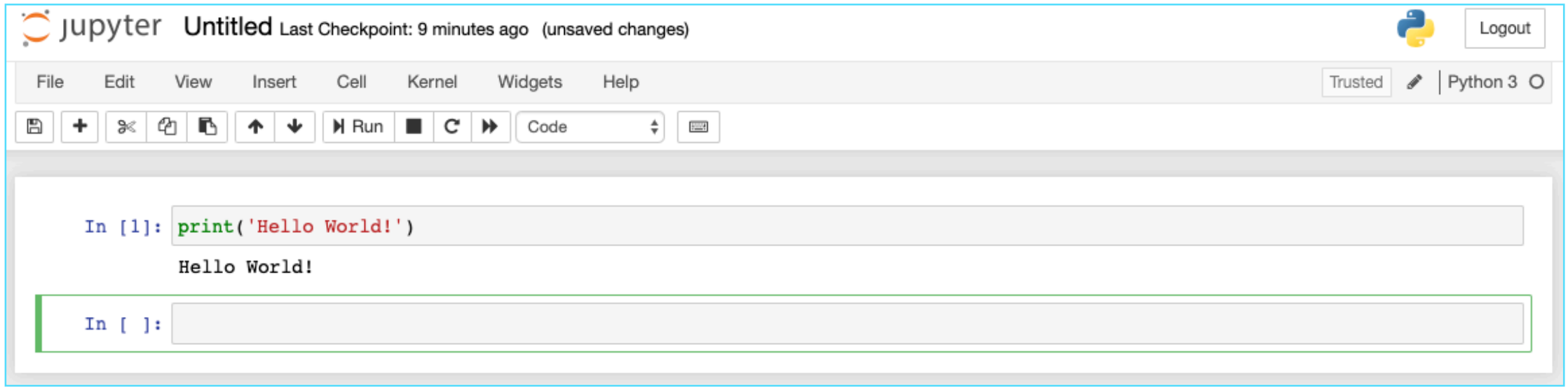


How to use Jupyter Notebook for data analysis

Running Cells

To run a cell, first type some code (see example below) then press the key combination **shift** and **enter** to run that code

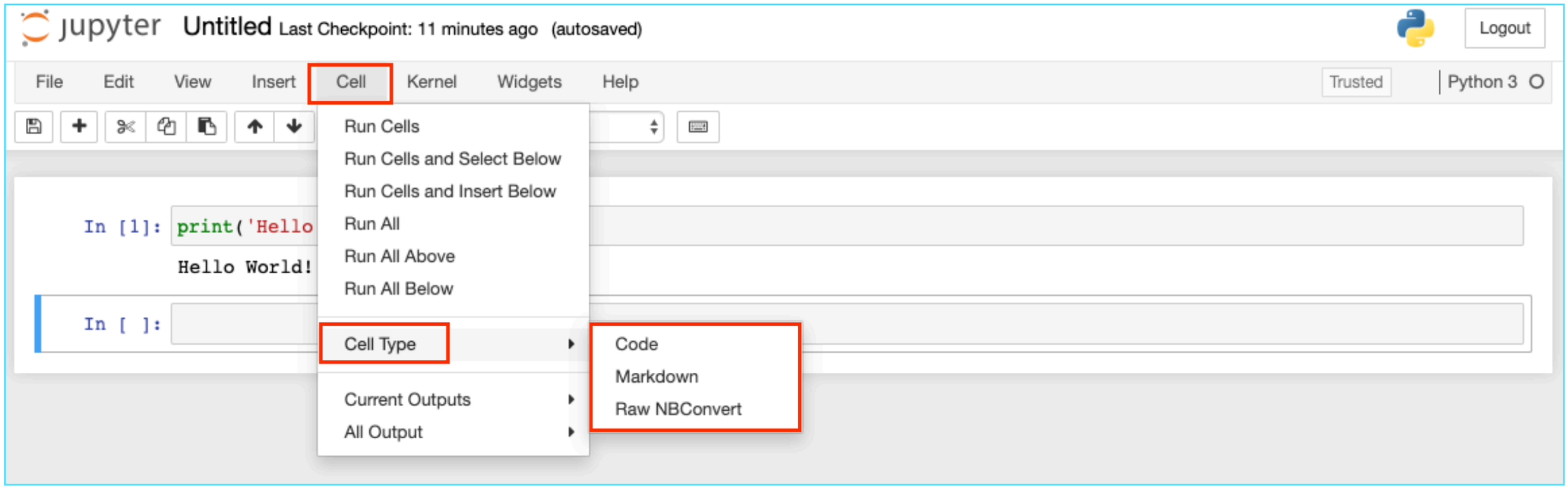




How to use Jupyter Notebook for data analysis

Cell Types

Cells in a notebook can be of a different type. During the course we will be using both the **code** cell type and the **markdown** cell type.



More about **cell types**:

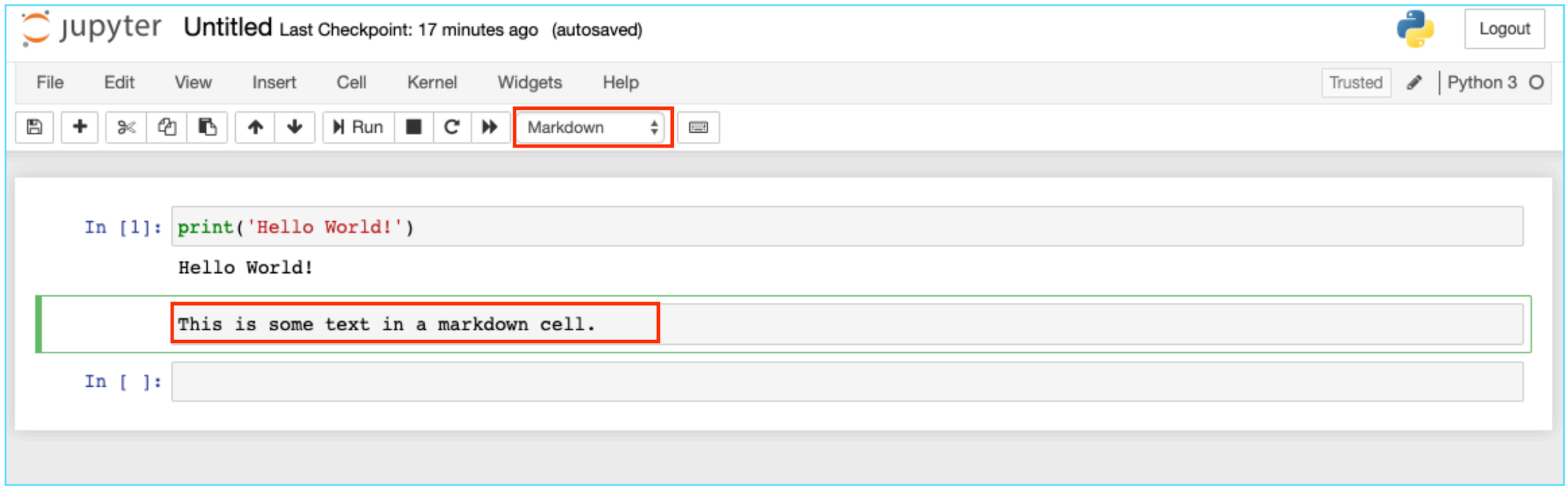
The **code** cell type is used when you want to execute/run some Python or pandas code in the notebook

The **markdown** cell type is used when you want to enter some plain text into the notebook (see example on the next page)

How to use Jupyter Notebook for data analysis

Markdown cells

Use cells of type **markdown** to enter explanatory text into your notebook:



More about **markdown**:

Markdown is a markup language (think a light version of HTML) often used to write web documents.

For some guidance on markdown syntax go here:

https://www.markdownguide.org/basic-syntax

HOW TO WRITE PYTHON CODE

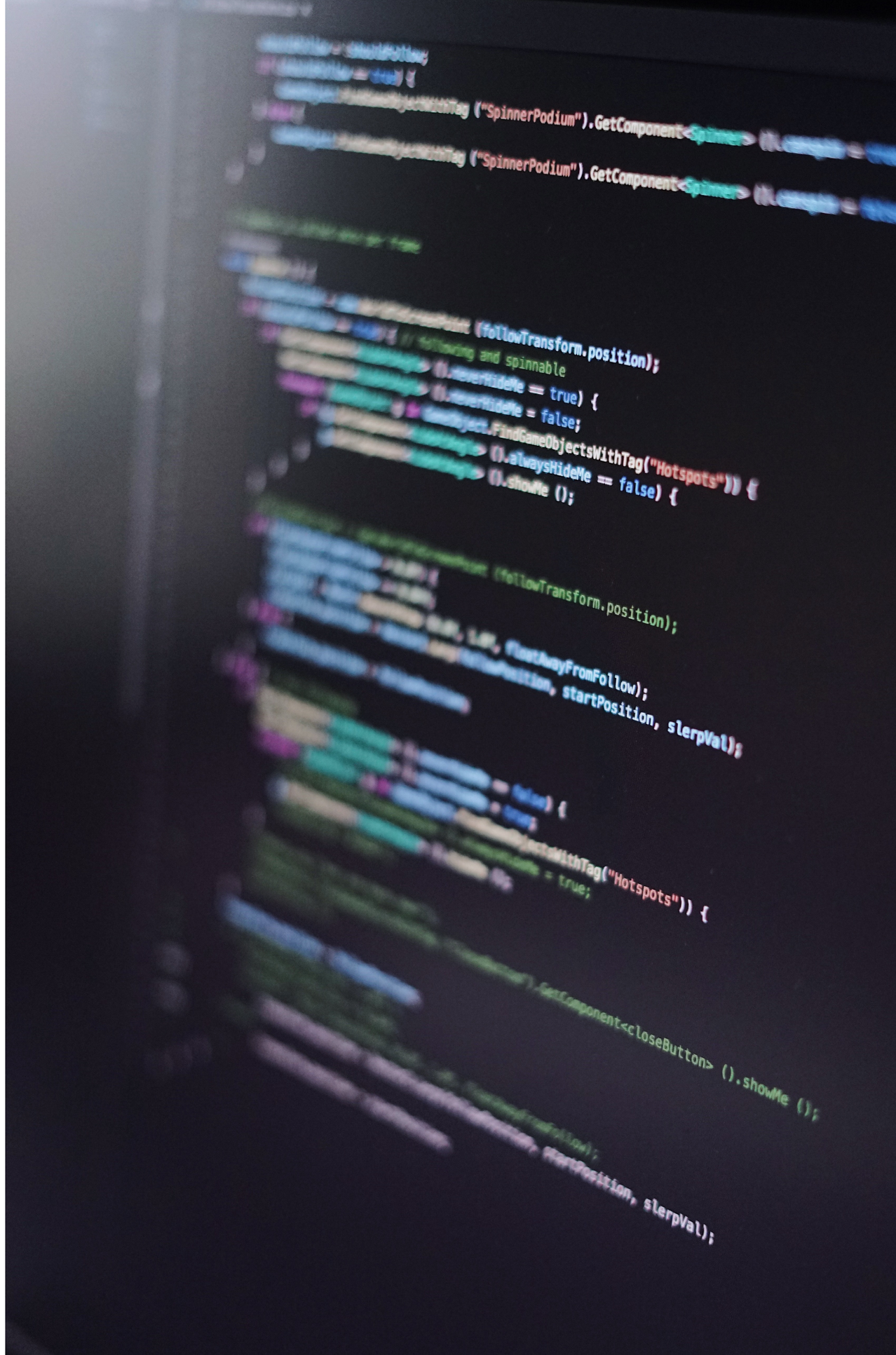
What is Python?

Python is a high-level programming language.

As far as programming languages go it is very human readable and therefore easier to learn than other languages.

Python is commonly used in the **Data Analysis/Data Science** fields and as such has access to many external libraries that support these activities including **NumPy, Matplotlib** and **Pandas.**

Here, we will explore some of Python's basic syntax, data structures and how to work with files.

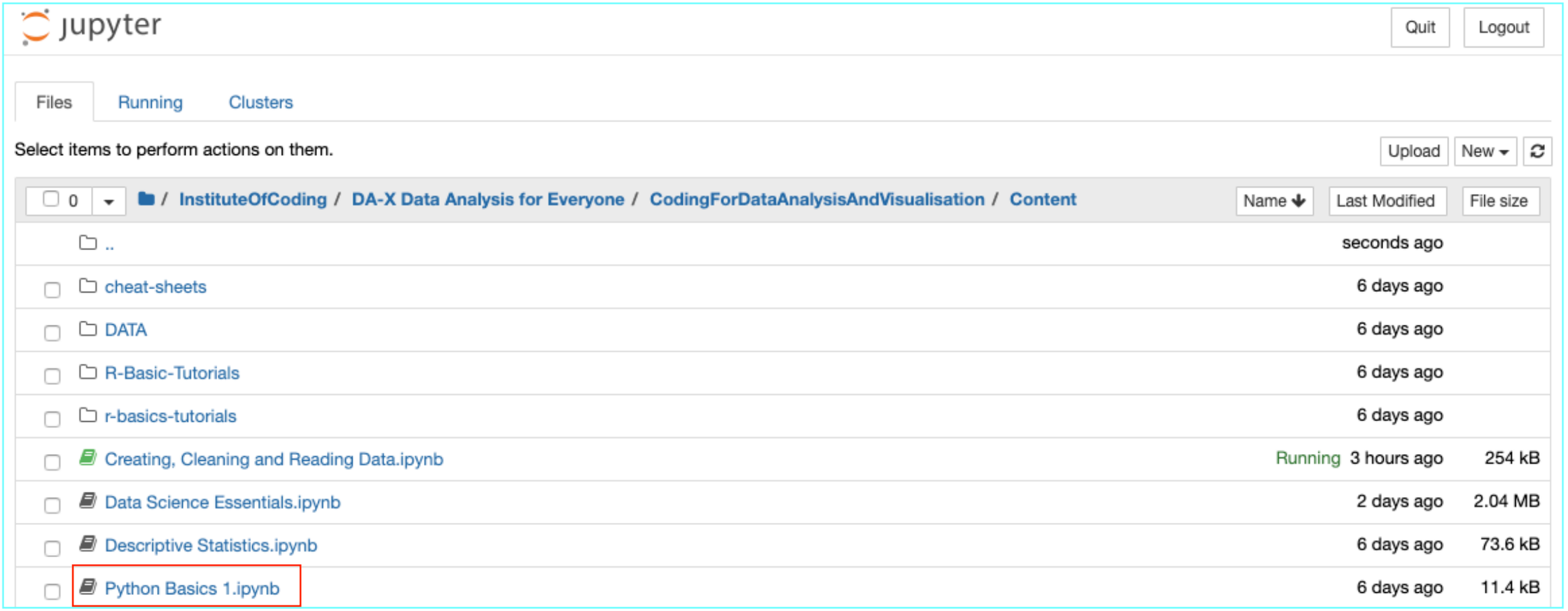


How to write Python code

Using Jupyter Notebook to run Python commands

Python Basics 1

Open the file **Python Basics 1.ipynb** by browsing for file in Jupyter Notebook

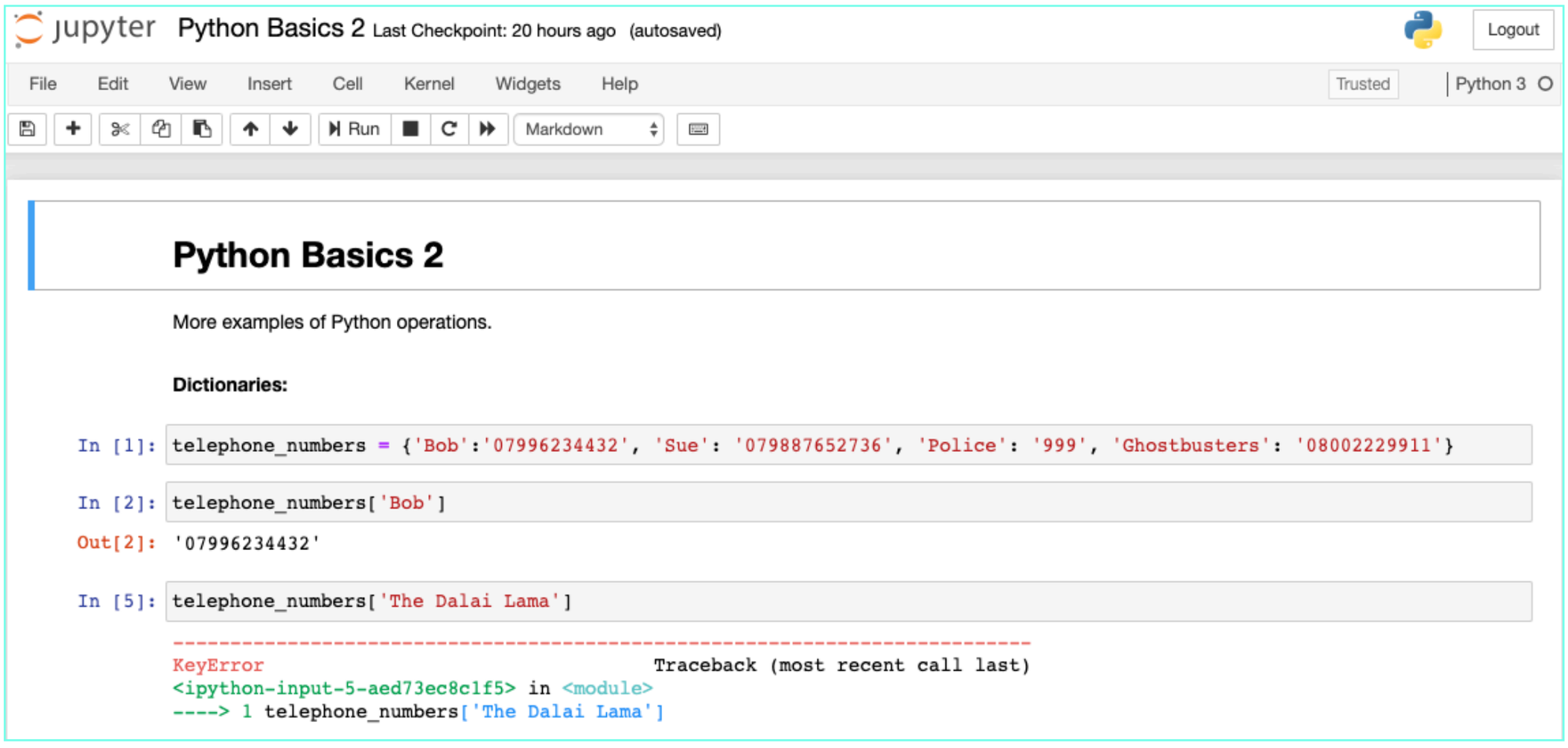


How to write Python code

Using Jupyter Notebook to run Python commands

Python Basics 2

Open the file **Python Basics 2.ipynb** by browsing for file in Jupyter Notebook

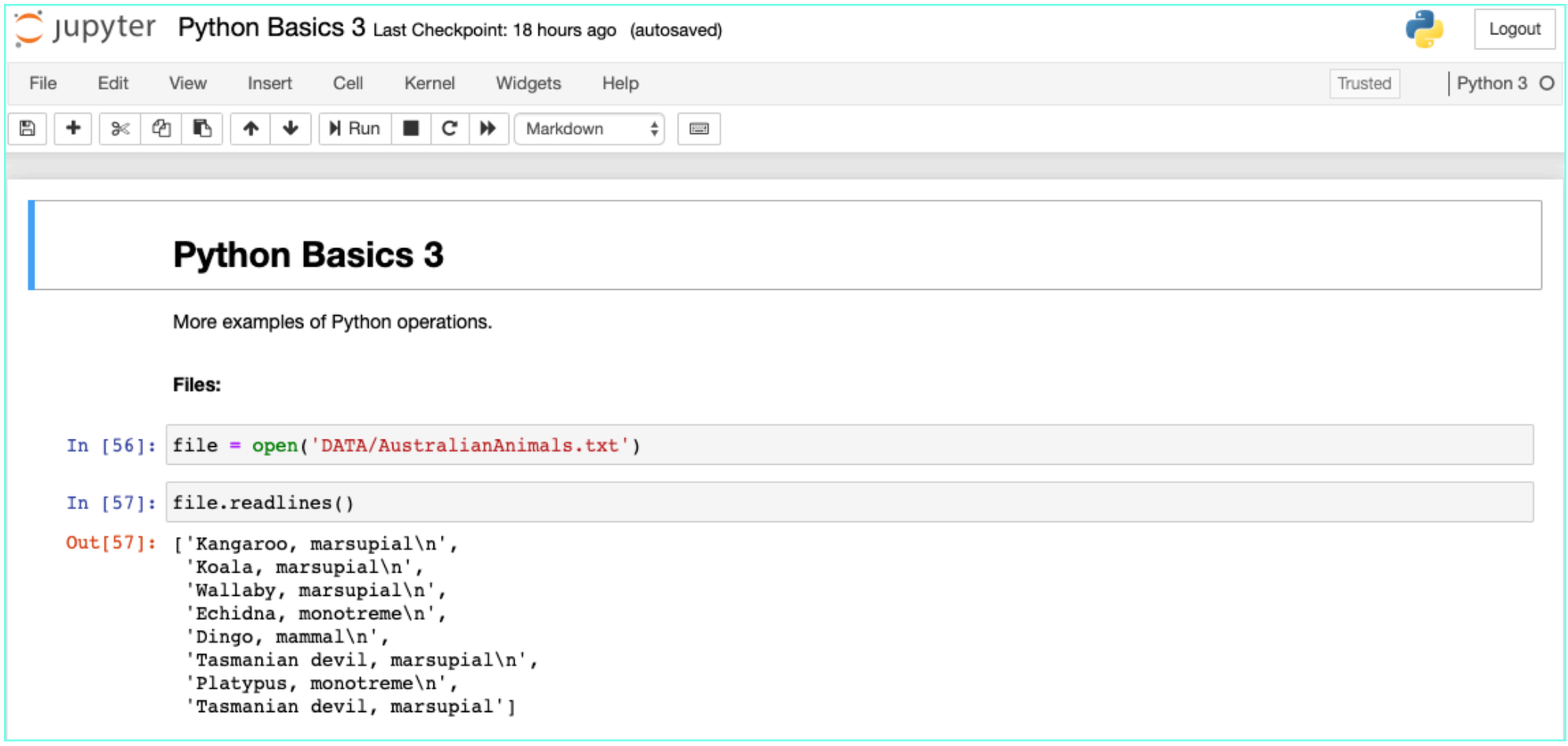


How to write Python code

Using Jupyter Notebook to run Python commands

Python Basics 3

Open the file **Python Basics 3.ipynb** by browsing for file in Jupyter Notebook



USING PANDAS LIBRARY TO EXPLORE AND VISUALISE DATA

pandas *is an open source, BSD-licensed library providing high-performance, easy-to-use data structures and data analysis tools for the Python programming language (*https://pandas.pydata.org/about.html*).*

Pandas

Examples using Jupyter Notebook to run pandas commands to do EDA (Exploratory Data Analysis) and Visualisation

Open the file **Descriptive Statistics.ipynb** by browsing for file in Jupyter Notebook

Descriptive Statistics with Pandas

Import pandas (Data Analysis Library) and matplotlib (Plotting Library)

Renaming as 'pd' and 'plt' is not strictly neccesary but can help reduce typing.

In [343]:
```
import pandas as pd
import matplotlib.pyplot as plt
```

Create sample data

If required we can create sample data driectly using pandas. Below is a list of column names:

In [344]:
```
columnNames = ['Student Name',
               'January Calories',
               'February Calories',
               'March Calories',
               'Total Calories'
               ]
```

Below is a list of lists that represents the individual rows in a table:

In [345]:
```
calories_per_month = [['Bob',56000, 61000, 55000, 172000],
                      ['Sue', 49000, 51000, 48000, 148000],
                      ['Barack', 50000, 51000, 52000, 153000],
                      ['Boris', 70000, 69000, 75000, 214000],
                      ['Nancy', 41000, 47000, 43000, 131000]]
```

Pandas

Examples using Jupyter Notebook to run pandas commands to Create, Clean, and Read data

Open the file **Creating, Cleaning and Reading Data.ipynb** by browsing for file in Jupyter Notebook

Creating Data

Creating sample dataframes using Pandas library

In [234]:
```
# import pandas library - we also import numpy for use in a couple examples
import pandas as pd
import numpy as np
```

Pandas is an open-source Python library used for data analysis. Here we will use it to create sample data to demostrate how it works.

More info here: https://pandas.pydata.org/

Firstly, check the version numbers of both:

In [235]:
```
pd.__version__
```

Out[235]: '0.25.1'

In [236]:
```
np.__version__
```

Out[236]: '1.17.2'

In [237]:
```
pd?
```

In [312]:
```
from IPython.display import Image
Image('Pandas_DataFrame.png')
```

USING SEABORN LIBRARY TO VISUALISE DATA

Seaborn is a Python data visualization library based on **matplotlib**. It provides a high-level interface for drawing attractive and informative statistical graphics. *(*https://seaborn.pydata.org/*)*.

Seaborn

Examples using Jupyter Notebook to run seaborn commands to Visualise data

Open the file **Visualisation.ipynb** by browsing for file in Jupyter Notebook

Matplotlib and Seaborn

Seaborn is a library for making statistical graphics in Python. It is built on top of matplotlib and closely integrated with pandas data structures.

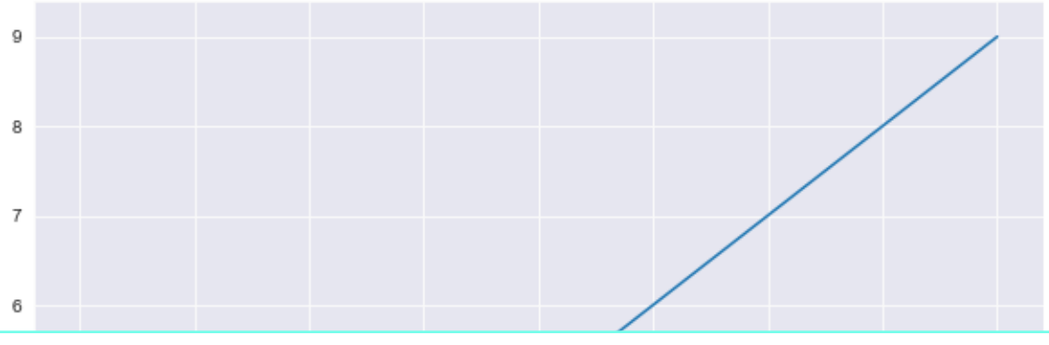
In [63]:
```
import matplotlib.pyplot as plt
```

In [64]:
```
import numpy as np
import seaborn as sb
sb.set_style('darkgrid')
import pandas as pd
from matplotlib import rcParams
```

In [65]:
```
x = range(1,10)
y = [1,2,3,4,5,6,7,8,9]

plt.plot(x,y)
```

Out[65]:
```
[<matplotlib.lines.Line2D at 0x1a2a189b10>]
```



Next Steps

Check out the **useful_links.md** file provided in the folder you downloaded at the beginning of the course.

For reference I have included some below:

Jupyter Notebook
https://realpython.com/jupyter-notebook-introduction/

Python
https://realpython.com/learning-paths/python3-introduction/

Pandas
https://realpython.com/pandas-python-explore-dataset/
https://realpython.com/python-data-cleaning-numpy-pandas/