# Python for Physics
# Lab -1

# What is Python

Python is a widely used general-purpose high level programming language, designed by Guido van Rossum in 1991.

## Why Python

Python has several advantages over other programming languages. They are:

i. Code readability
ii. Easy syntax
iii. English like keywords
iv. Concise programs
v. Automatic Memory management
vi. Free and open source software

# Python comparing with C

C

```
#include "stdio.h"
int main() {
  printf("Hello\n");
}
```

Java

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

python

```
print("hello")
```

**Notice: no ;**

jupyter python NumPy

localhost:8888/notebooks/Python%20for%20Applied%20Physics%20.ipynb#

jupyter Python for Applied Physics Last Checkpoint: Last Tuesday at 3:14 PM (autosaved) Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

# Python for Applied Physics

## Mechanics

### Grivatational Force

This program calculates and displays the Gravitational Force between two masses:

$$F = \frac{Gm^1m^2}{r^2}$$

In [1]:

```
# define the input
mass_1 = float( input('Enter the value of mass 1 (in kilogram) '))
mass_2 = float (input('Enter the value of mass 1 (in kilogram) '))
distance = float (input('Enter the value of distance '))
G = 6.67*10**-11     #  Gravitational constant in the units of Nm^2/kg^2:

# Calculation
# computes the value of Gravitational Force
Grv_force = (G * mass_1*mass_2)/(distance**2)
print ('Force between the masses is = ',Grv_force,' Newtons.')
```

# Introduction to Jupiter Notebook

The Jupyter Notebook is an open-source web application that allows us 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.

A single document that combines explanations with executable code and its output — an ideal way to provide:

- reproducible research results
- documentation of processes
- instructions
- tutorials and training materials of all shapes and sizes

# Installation

The easiest way for a beginner to get started with Jupyter Notebook is by installing Anaconda.

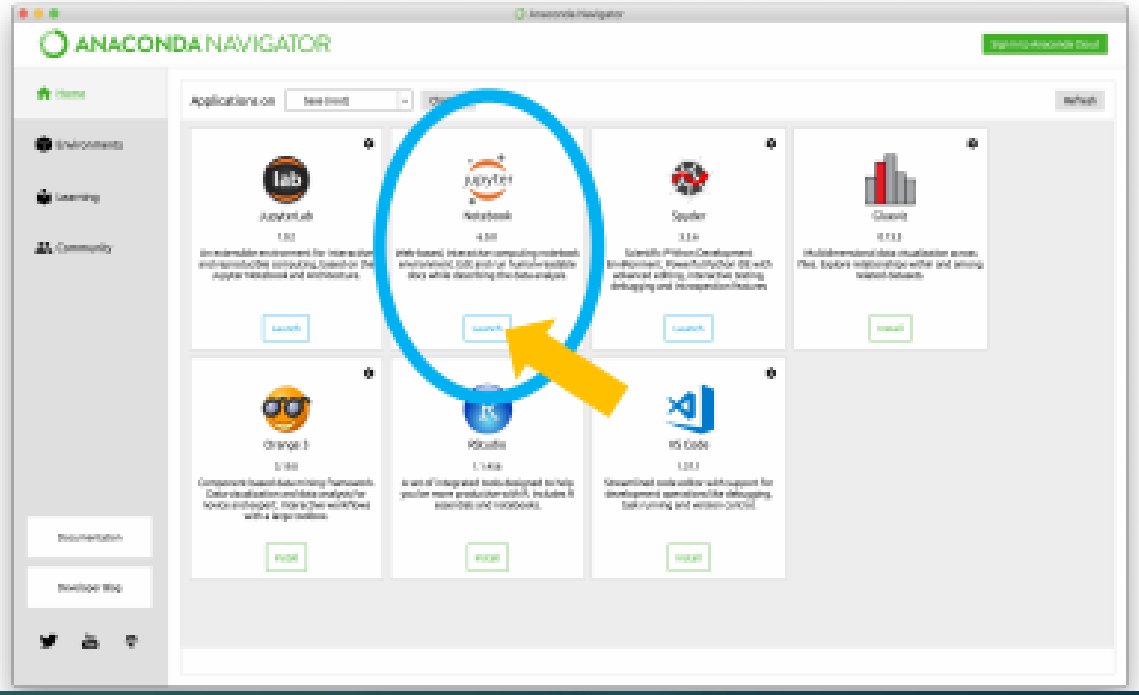
Link for installing Anaconda is:
https://www.anaconda.com/products/individual

Anaconda is the most widely used Python distribution for data science and comes pre-loaded with all the most popular libraries and tools.
Some of the biggest Python libraries included in Anaconda include NumPy, pandas, and Matplotlib, though the full 1000+ list is exhaustive.

# How to Launch Jupyter Notebook

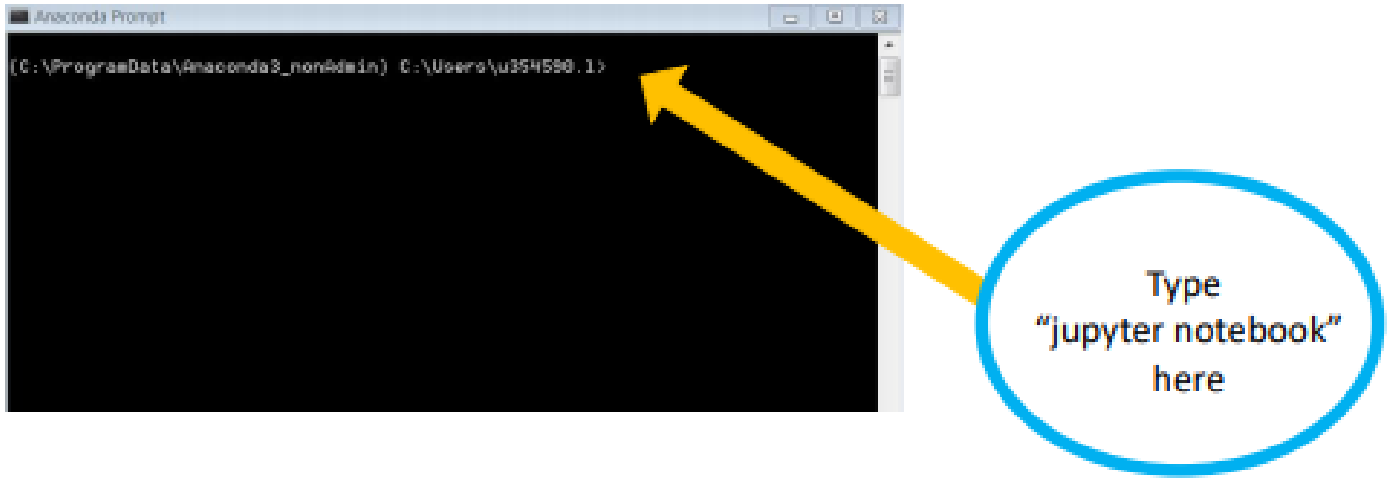
**There are 3 ways to launch Jupyter Notebook:**

1) Using Anaconda Navigator ANACONDA NAVIGATOR
   a) Open the application called Anaconda Navigator (this may take a couple of minutes)
   b) Click on "Launch" in the Jupyter Notebook box



# How to Launch Jupyter Notebook

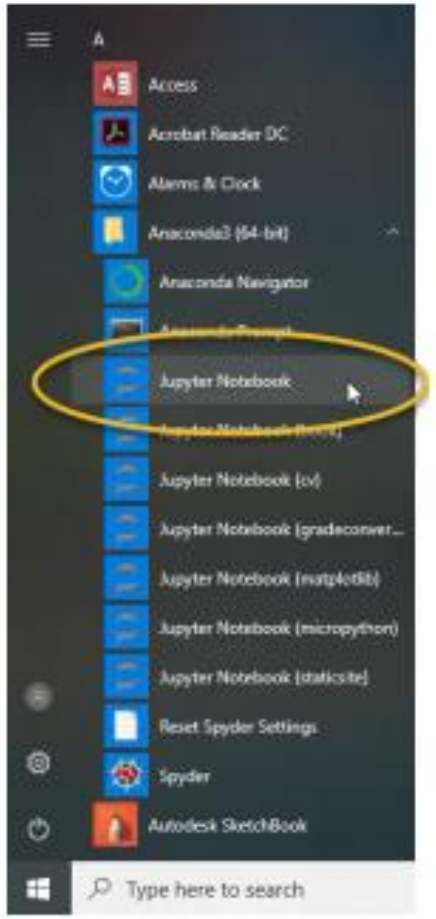
2) Using Anaconda Prompt
   a) Open the application called Anaconda Prompt
   b) Type “jupyter notebook” (without quotes) and hit the return key




Note: your Anaconda Prompt window will show a different pathname than in this image, but it will look similar!

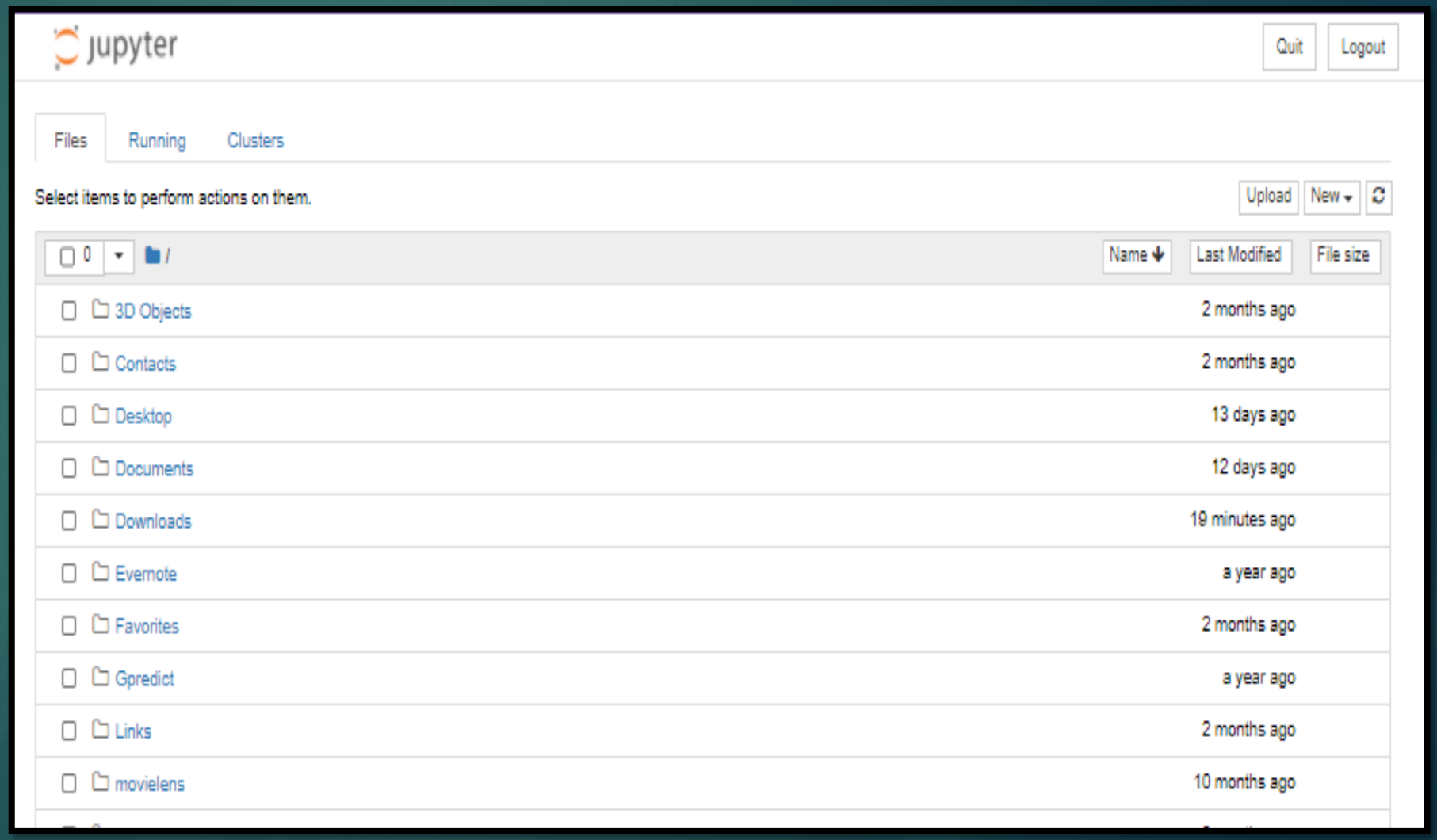
# How to Launch Jupyter Notebook

3) Clicking on the Jupyter Notebook App in the Start Menu (I just learned about this method, and it will probably be the fastest!)



# How to Launch Jupyter Notebook

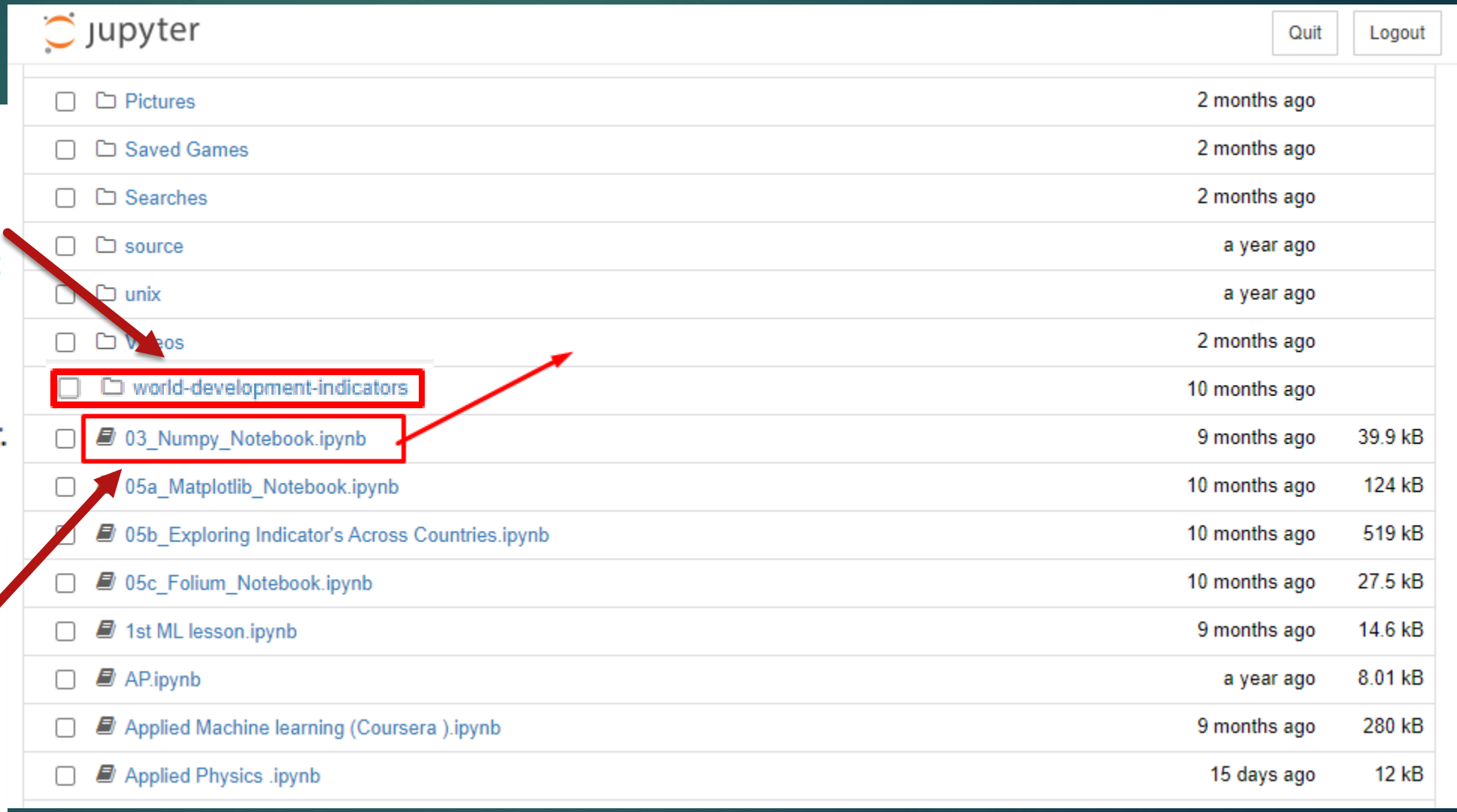
You will know that Jupyter Notebook opened correctly if you see a page similar to this one open in your browser!



# How to open a Notebook file

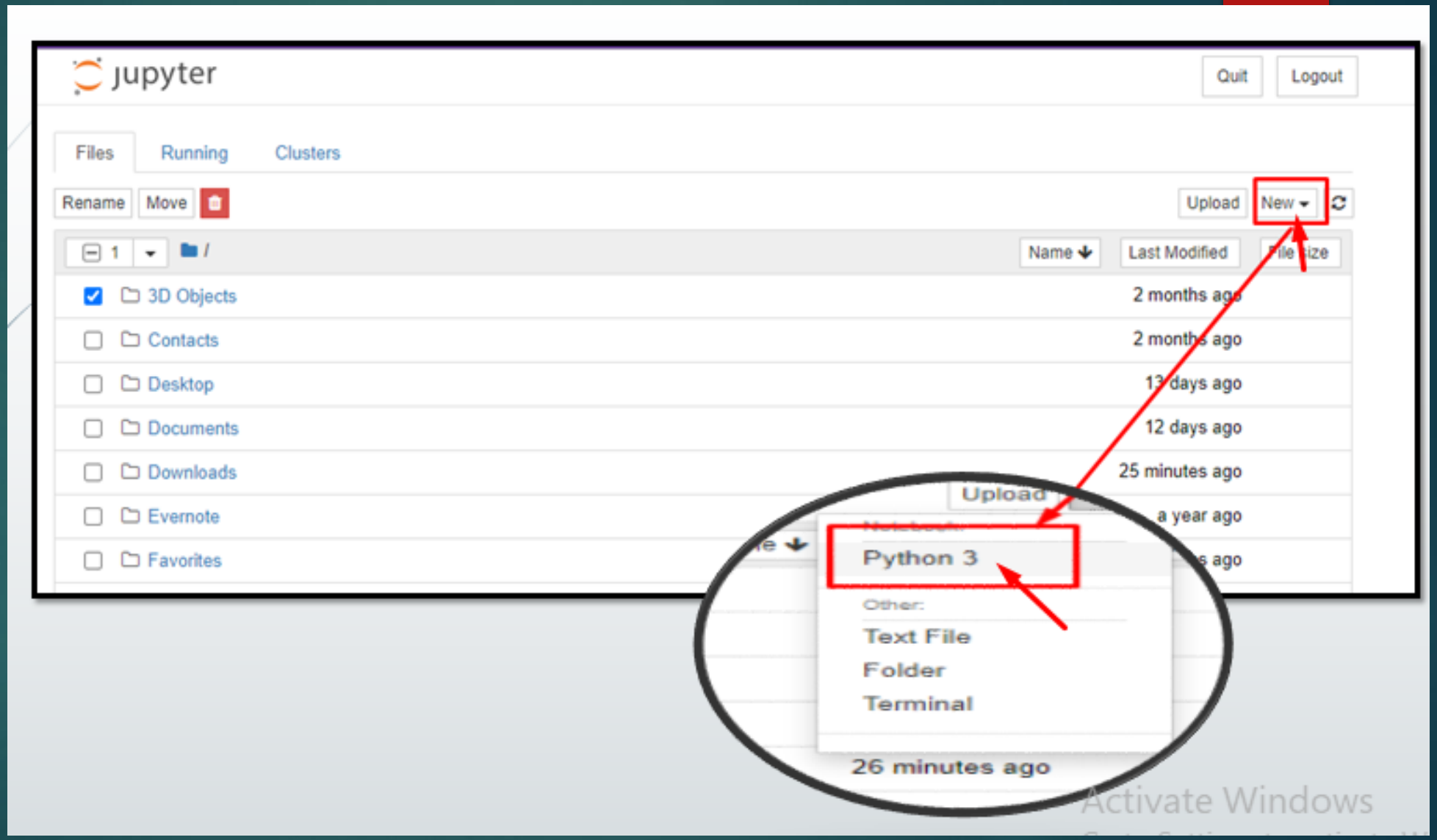
Navigate through your folders until you get to the directory you want to save your scripts in. You can navigate through by clicking on the name of the Folder.

- **Open a previously saved Notebook file** by clicking on the name of the file
- The extension for a Jupyter Notebook file is ".ipynb", which is short for "interactive python notebook"



# How to open a Notebook file

**Open a new Notebook file** by clicking on the "New" menu on the upper right



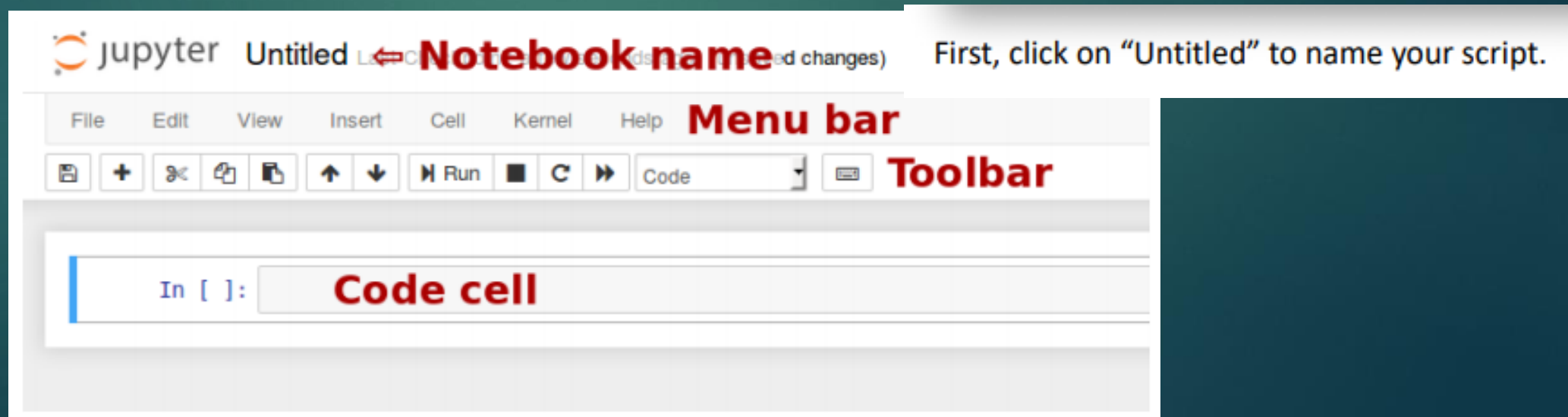
# How to start writing a Jupyter Notebook

**Notebook name:** The name displayed at the top of the page, next to the Jupyter logo, reflects the name of the .ipynb file. Clicking on the notebook name brings up a dialog which allows you to rename it. Thus, renaming a notebook from “Untitled0” to “My first notebook” in the browser, renames the Untitled0.ipynb file to My first notebook.ipynb.

**Menu bar:** The menu bar presents different options that may be used to manipulate the way the notebook functions.

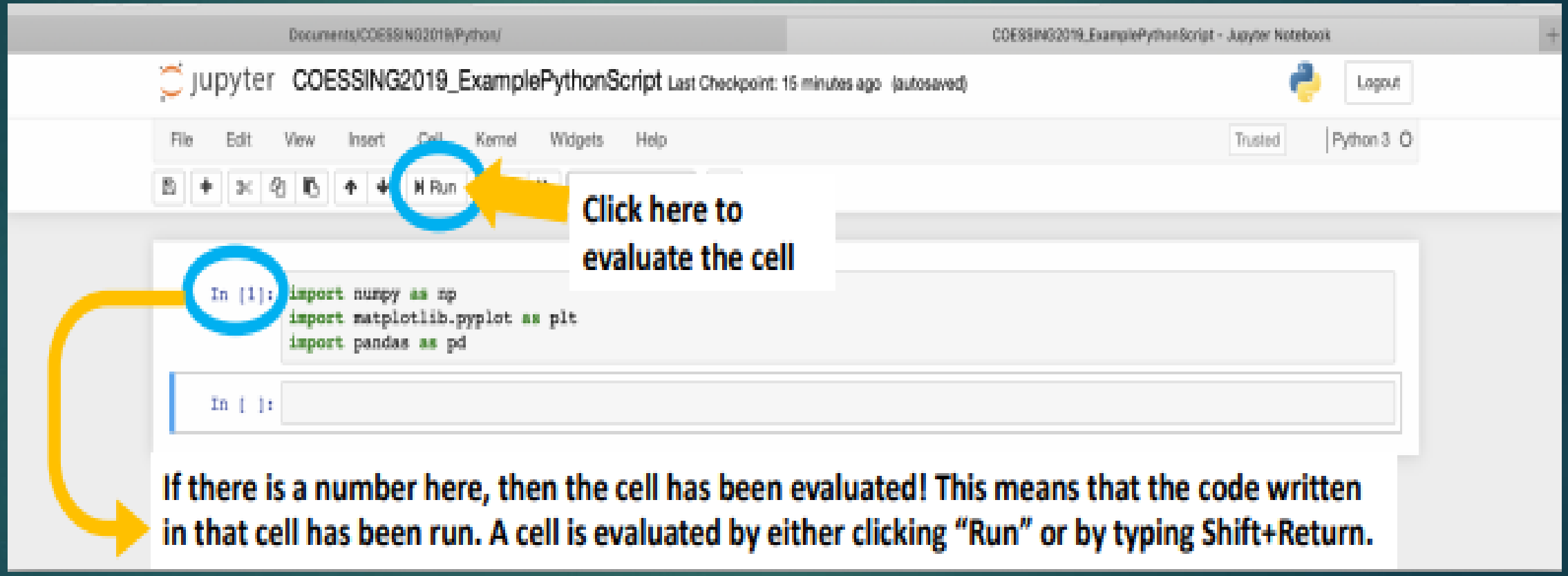
**Toolbar:** The tool bar gives a quick way of performing the most-used operations within the notebook, by clicking on an icon.

**Code cell:** the default type of cell; read on for an explanation of cells



# How to start writing a Jupyter Notebook

It's good practice to start your script by importing libraries you will need. Below are three libraries that are often used, but you may need different ones.



# Creating a Variable

- To create a variable in Python, all you need to do is specify the variable name, and then assign a value to it.

- **<variable** name**>** = **<value>**

- Python uses = to assign values to variables. There's no need to declare a variable in advance (or to assign a data type to it), assigning a value to a variable itself declares and initializes the variable with that value. There's no way to declare a variable without assigning it an initial value.

# Examples of different variables of different data types

```
a = 4
b= 3.5
c = 'Physics'
list = [1,2,3,4]
print (a,' ,', b , ',', c , ',' ,list)
```

```
4  , 3.5 , Physics , [1, 2, 3, 4]
```

```
print (type(a), type(b), type(c), type(list))
```

```
<class 'int'> <class 'float'> <class 'str'> <class 'list'>
```

```
print ("Hello World")
print(a)
print(" The course name:  ", c)
```

```
Hello World
4
 The course name:   Physics
```

# Point to remember for variable assignment

- Variable assignment works from left to right. So the following will give you an syntax error.

```
0=x
    File "<ipython-input-83-e50bc5b3cdd5>", line 1
      0=x
         ^
SyntaxError: can't assign to literal
```

# Rules for variable naming

1. Variables names must start with a letter or an underscore

```
x = True # valid
_y = True # valid
9x = False # starts with numeral
```

```
  File "<ipython-input-85-798efde345de>", line 3
    9x = False # starts with numeral
     ^
SyntaxError: invalid syntax
```

```
$y = False # starts with symbol
```

```
  File "<ipython-input-86-50101988d602>", line 1
    $y = False # starts with symbol
    ^
SyntaxError: invalid syntax
```

2. The remainder of your variable name may consist of letters, numbers and underscores.

3. Names are case sensitive.

```
x = 9
y = X*5
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-90-2c3b2d56c6c5> in <module>()
      1 x = 9
----> 2 y = X*5

NameError: name 'X' is not defined
```

4. You cannot use python's keywords as a valid variable name. You can see the list of keyword by:

```
import keyword
print(keyword.kwlist)
```

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

# Python as calculator(1/2)

```
In [1]: 2+5
Out[1]: 7

In [2]: 5-3
Out[2]: 2

In [3]: 7*6
Out[3]: 42

In [4]: 90/4
Out[4]: 22.5
```

# Python as Calculator(2/2)

```
In [1]: 5//2     # rounds down the answer to the nearest whole number
Out[1]: 2

In [2]: 9%2     # Modulus : gives the remainder when 9 is divided by 2
Out[2]: 1

In [3]: 10%2    # Modulus: gives the remainder when 10 is divided by 2
Out[3]: 0

In [6]: 6**2    # Exponent: 6 to the power of 2
Out[6]: 36
```