# COMP5434 - Tutorial #1

Python and Jupyter

## Outlines

In this tutorial, we will discover a popular programming language, Python, and one of its editors, Jupyter. Moreover, we will also try to discover clustering by using Python.

The tutorial is based on Windows 11 (64-bit). The operations on different operating systems are similar.

## Table of Contents



## Python

### Introduction

Python is a popular programming language, which is easy to learn and use.

Python has various kinds of libraries which can undertake different types of tasks.

- Data Analysis:
  - NumPy: matrix calculation
  - Pandas: data manipulation and capabilities
  - Matplotlib: data visualization
- Machine Learning
  - Tensorflow
  - Pytorch
- Website Development
  - requests
  - django
  - beautifulsoup

Python is highly popular among programming languages. It ranks No.1 on the TIOBE index in January 2024, which measures the popularity of programming languages.

| Jan 2024 | Jan 2023 | Change | Programming Language | Ratings | Change |
|---|---|---|---|---|---|
| 1 | 1 | | Python | 13.97% | -2.39% |
| 2 | 2 | | C | 11.44% | -4.81% |
| 3 | 3 | | C++ | 9.96% | -2.95% |
| 4 | 4 | | Java | 7.87% | -4.34% |
| 5 | 5 | | C# | 7.16% | +1.43% |

## Python Installation

If you have already installed Python, please skip this section, and move to the next one. In this section, we will use Python 3.10.6 as an example.

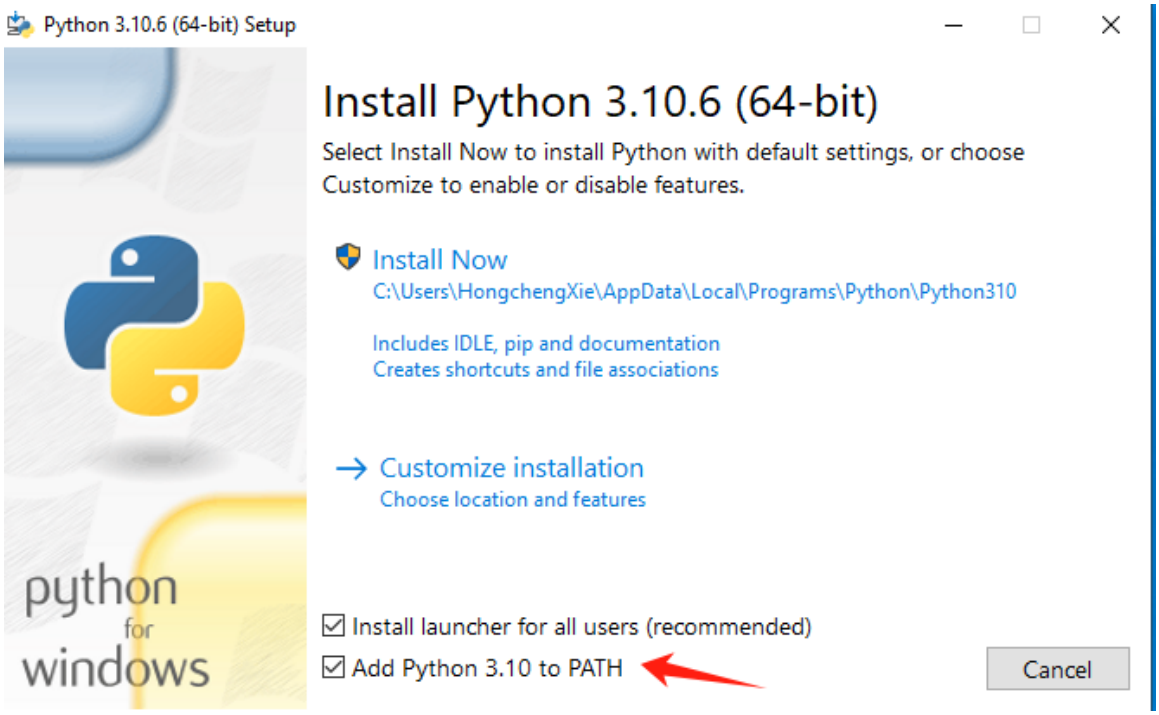
Note: In the remaining parts, the contents which are quoted from the computer and the commands we will input are in *Italics*.

1. Open your web browser and visit https://www.python.org/downloads/release/python-3106/.
2. Scroll down and find the installer which is for your operating system. For Windows 11 (64-bit), click *Windows installer (64-bit)* to download the installer.

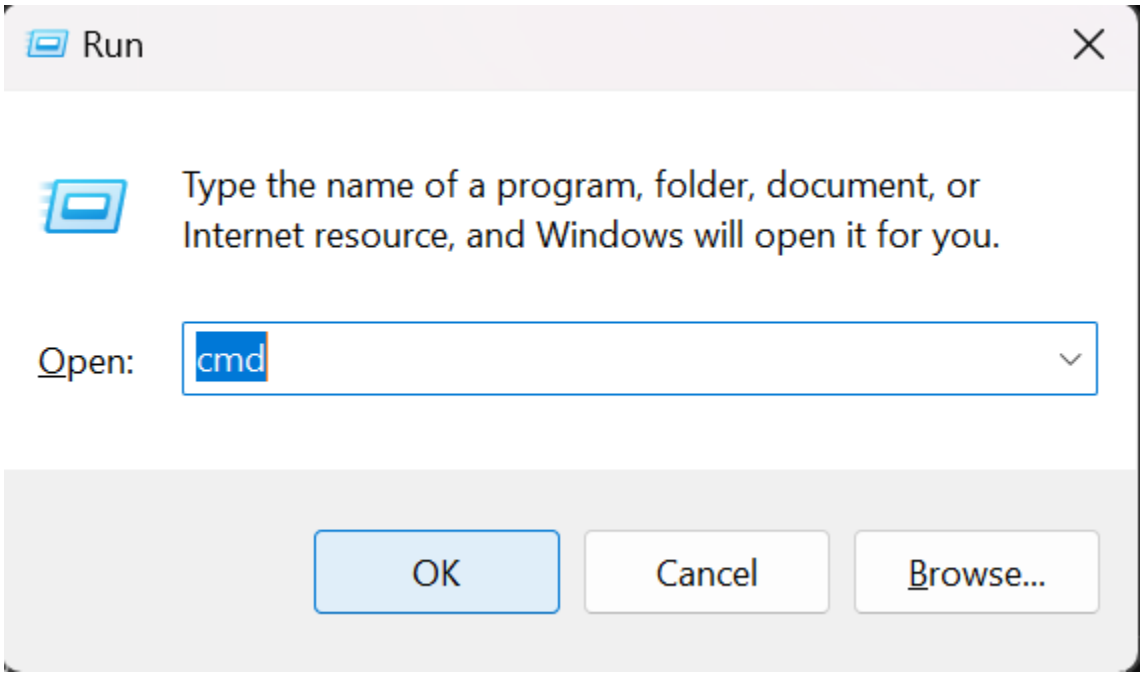
**Files**

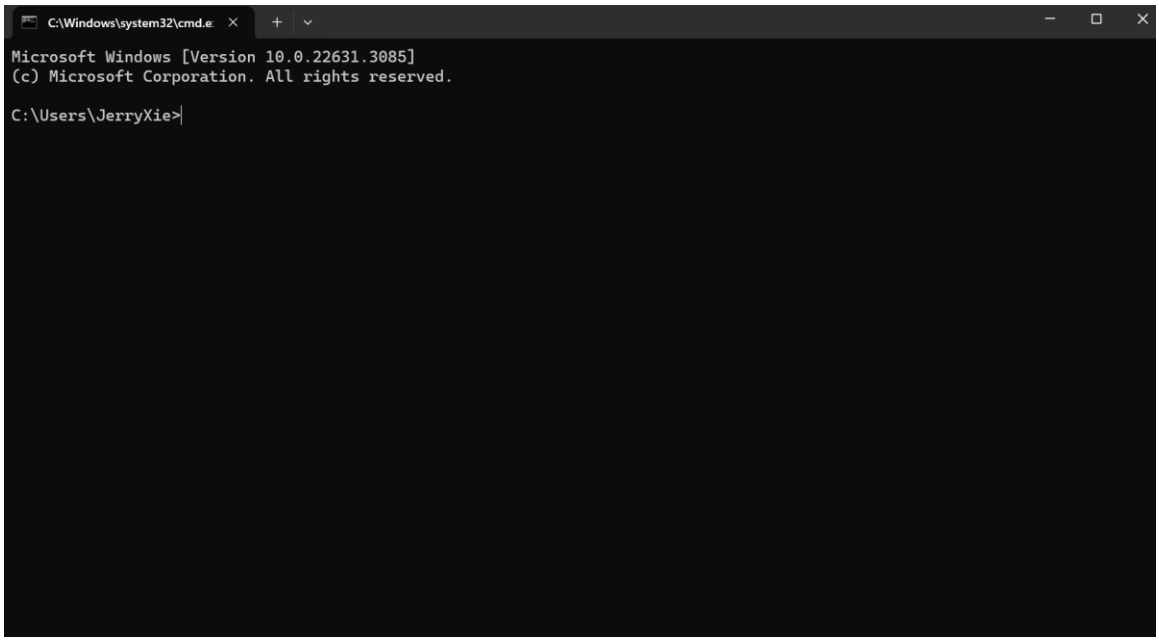
| Version | Operating System | Description | MD5 Sum | File Size | GPG |
|---|---|---|---|---|---|
| Gzipped source tarball | Source release | | d76638ca8bf57e44ef0841d2cde557a0 | 25986768 | SIG |
| XZ compressed source tarball | Source release | | afc7e14f7118d10d1ba95ae8e2134bf0 | 19600672 | SIG |
| macOS 64-bit universal2 installer | macOS | for macOS 10.9 and later | 2ce68dc6cb870ed3beea8a20b0de71fc | 40826114 | SIG |
| Windows embeddable package (32-bit) | Windows | | a62cca7ea561a037e54b4c0d120c2b0a | 7608928 | SIG |
| Windows embeddable package (64-bit) | Windows | | 37303f03e19563fa87722d9df11d0fa0 | 8585728 | SIG |
| Windows help file | Windows | | 0aee63c8fb87dc71bf2bcc1f62231389 | 9329034 | SIG |
| Windows installer (32-bit) | Windows | | c4aa2cd7d62304c804e45a51696f2a88 | 27750096 | SIG |
| Windows installer (64-bit) | Windows | Recommended | 8f46453e68ef38e5544a76d84df3994c | 28916488 | SIG |

3. Open the installer you downloaded, tick *Add Python 3.10 to PATH*, and Click *Install Now* to install.

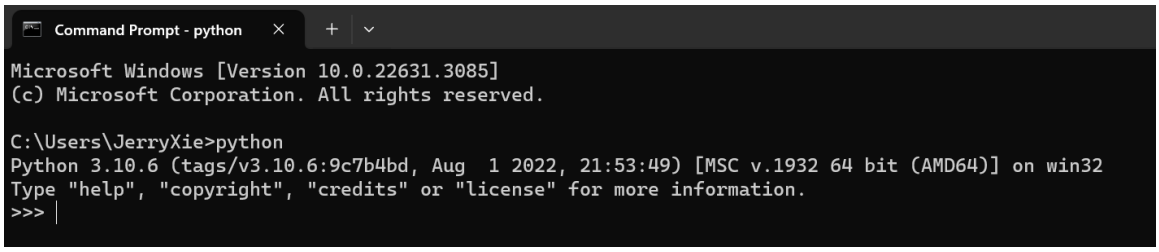



4. Press Win+R on your keyboard, type *cmd* and click *OK*, to open Command Prompt.

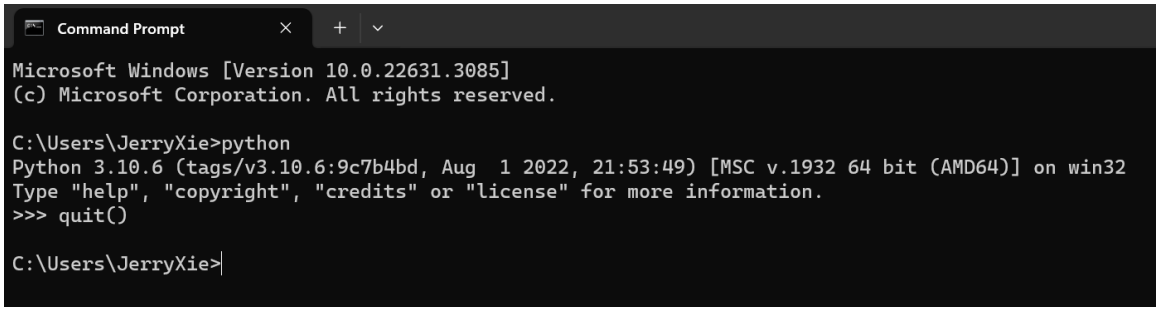




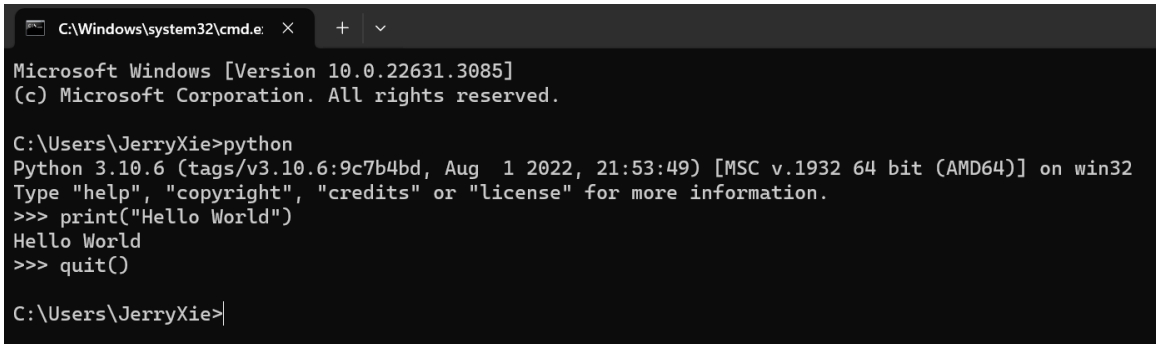

5. Type *python* and press Enter on your keyboard. Your installation will be successful if your python program is running.




6. You can type *quit()* and press Enter to exit Python program.




Unlike C/C++ programs that are compiled into binary code, Python programs must be executed by Python's interpreter.

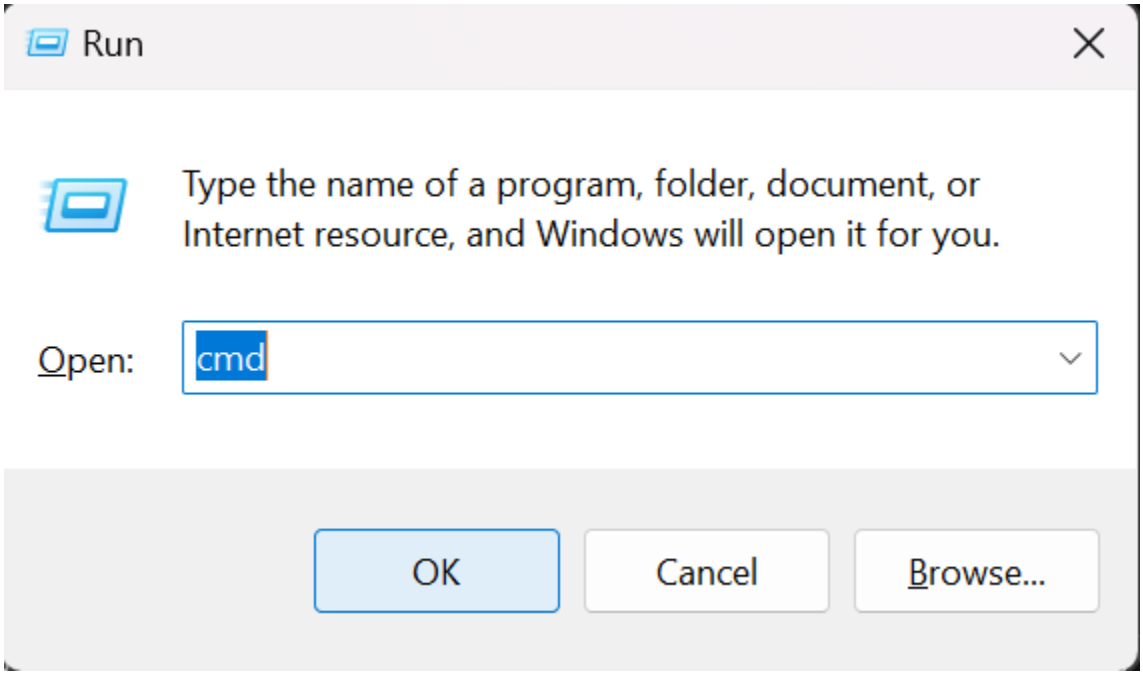


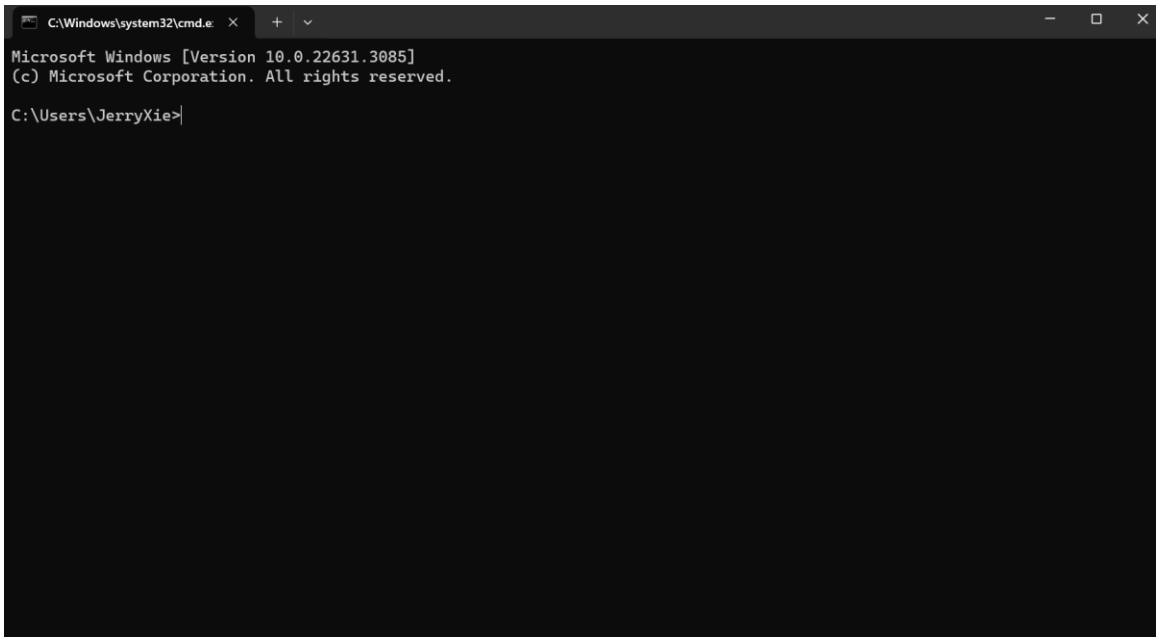

Remarks: Python can also be installed in other ways, such as Anaconda. You can visit https://www.anaconda.com/ for more information.

## Library Installation

Python uses a package management system, pip, to manage the Python libraries in your computer. By using pip, you do not have to download libraries from the Internet manually. It can help you address the issues automatically.

1. Press Win+R on your keyboard, type *cmd* and click *OK*, to open Command Prompt.





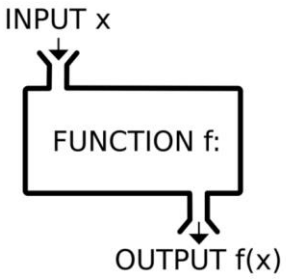

2. To install a library, please type *pip install <library's name>* and press Enter. (Please use the name of the library you want to install to replace the brackets).
3. To uninstall a library, please type *pip uninstall <library's name>* and press Enter.

We will use pip to install the libraries in the following sections.

## How to learn Python

Some basic concepts:

1. Variable: a place to store data
2. Function: the basic unit to do something. Given some inputs, the function will return something as the output.




```
def find_square(num):
  # code
  return result

Square = find_square(3)
# code
```

3. Hierarchical functions: A library includes different functions. Python uses a dot to indicate the affiliations. For example, we want to call a function *add* in a library called *math*, we can use *math.add()* to locate it.

For more information, please refer to some reference websites:

- https://www.learnpython.org/en/Welcome
- https://www.youtube.com/watch?v=_uQrJ0TkZlc

## How to edit Python code

You can use different text editors or Integrated Development Environments (IDE) to write the Python code, such as Visual Code (https://code.visualstudio.com/) and PyCharm (https://www.jetbrains.com/pycharm/).

To run a file including Python code, you can open Command Prompt, and type *python <filename>* to let Python interpreter execute the codes.

# Jupyter – A visualized Python notebook

Jupyter is a web platform which can be used to write code snippets, add documentation, and test programs all within a webpage.

## Install Jupyter

Jupyter can be installed by pip.

1. Open Command Prompt
2. Type *pip install jupyter* and press Enter.

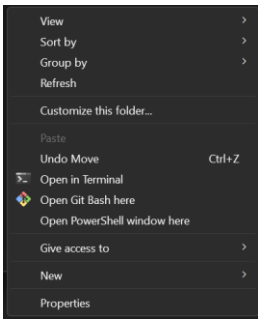
```
C:\Users\JerryXie>pip install jupyter
Collecting jupyter
  Using cached jupyter-1.0.0-py2.py3-none-any.whl (2.7 kB)
Requirement already satisfied: ipywidgets in c:\users\jerryxie\appdata\local\programs\python\python310\lib\site-packages
 (from jupyter) (8.1.1)
Requirement already satisfied: jupyter-console in c:\users\jerryxie\appdata\local\programs\python\python310\lib\site-pac
kages (from jupyter) (6.6.3)
Requirement already satisfied: qtconsole in c:\users\jerryxie\appdata\local\programs\python\python310\lib\site-packages
(from jupyter) (5.5.1)
Requirement already satisfied: notebook in c:\users\jerryxie\appdata\local\programs\python\python310\lib\site-packages (
from jupyter) (7.0.7)
Requirement already satisfied: nbconvert in c:\users\jerryxie\appdata\local\programs\python\python310\lib\site-packages
(from jupyter) (7.14.2)
Requirement already satisfied: ipykernel in c:\users\jerryxie\appdata\local\programs\python\python310\lib\site-packages
(from jupyter) (6.29.0)
Requirement already satisfied: matplotlib-inline>=0.1 in c:\users\jerryxie\appdata\local\programs\python\python310\lib\s
ite-packages (from ipykernel->jupyter) (0.1.6)
```

3. To install the libraries that we will use in the following parts, type *pip install matplotlib scikit-learn numpy ipython* and press Enter. (A pip command can install multiple libraries by using spaces).

```
(venv) C:\Users\JerryXie\Desktop\jupyter\venv\Scripts>pip install matplotlib scikit-learn numpy ipython
Collecting matplotlib
  Using cached matplotlib-3.8.2-cp310-cp310-win_amd64.whl (7.6 MB)
Collecting scikit-learn
  Downloading scikit_learn-1.4.0-1-cp310-cp310-win_amd64.whl (10.6 MB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 10.6/10.6 MB 1.7 MB/s eta 0:00:00
Collecting numpy
  Downloading numpy-1.26.3-cp310-cp310-win_amd64.whl (15.8 MB)
     ━━━━━━━━━━╸━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 4.7/15.8 MB 679.3 kB/s eta 0:00:17
```

## Launch Jupyter Notebook

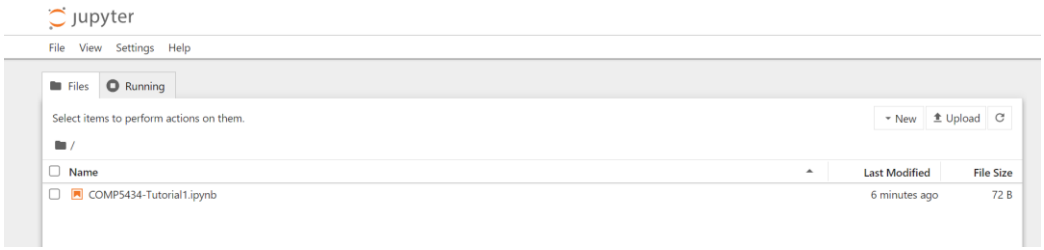
1. Open the tutorial folder, hold down Shift on your keyboard and right-click in a blank space. Choose *Open in Terminal* to open Command Prompt in this folder.



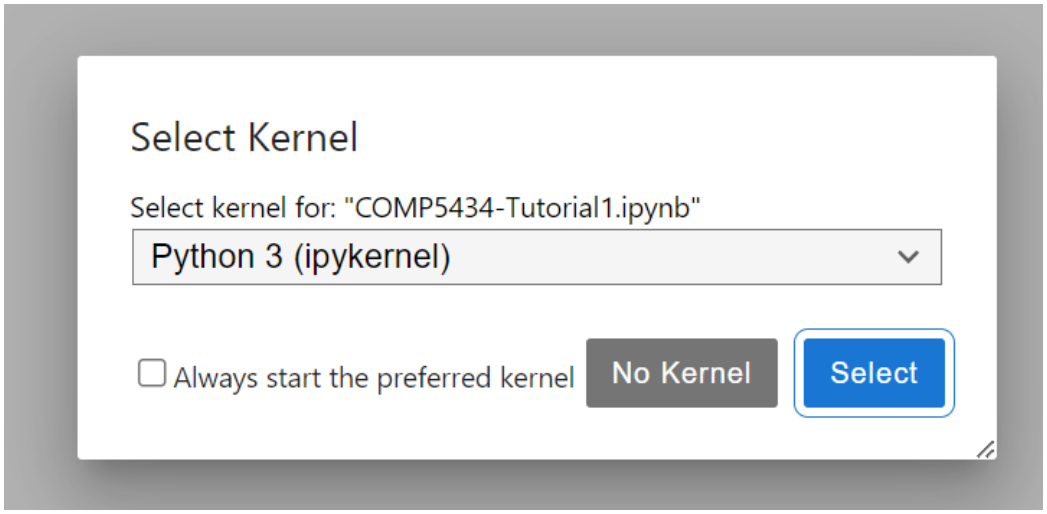

2. Type *jupyter notebook* and press Enter to launch Jupyter.

```
(venv) C:\Users\JerryXie\Desktop\jupyter>jupyter notebook
```

3. This is Jupyter's user interface. You can find the notebooks under *Files* tab.




4. Click *COMP5434-Tutorial1.ipynb* to open the tutorial notebook. If such window appears, click *Select* button.




A notebook consists of some cells.

# COMP5434 - Tutorial 1: Python and Jupyter

## Jupyter Demo

markdown cell

The next cell will print a message "Hello World".

```
[1]: print("Hello World")
```

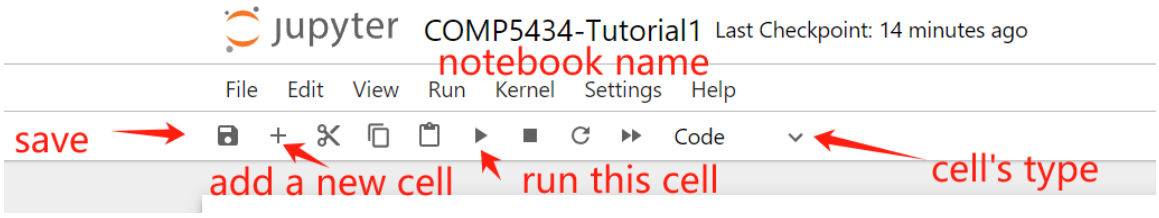
python code

```
Hello World
```

running result

- Markdown cells can be used to write documentation and texts by using Markdown language.
    - Markdown: Please refer to https://www.markdownguide.org/basic-syntax/
- Python cells can be used to write code in Python. The running result will be shown under this cell.

The toolbar looks like this. Running on a Markdown cell will let this cell show the content in the specific format defined in Markdown.



# Example: Data Clustering

Please follow the instructions in the Jupyter notebook of our tutorial.