Dated: 31st March, 2020

Data Structures and Algorithms:

Session: 2019

Semester: Spring 2021

Teacher: Sahar Waqar

Rubrics:

Installation of Jupyter notebook on PCs	Solving Python notebooks and class exercises	Implementation of Insertion sort	File handling in Python	Merge both algorithms and create a new one. (HW)
5	5	5	5	10
5 – Complete installation	5 – Solved and understood all	5 – Implemented and executed on multiple inputs. Understanding complete	5 – File reading and writing complete. Understanding complete	10 – Created new algorithm by merging IS and MS. Performed cost analysis with different inputs for best, avg and worst cases. Plotting and graphs complete.
3 – Working online	3 – Solved multiplication notebook	3 – Implemented but weak understanding	3 – One of the task completed for file reading or writing i.e. either reading or writing is completed	6 – All done for 10 marks except for cost analysis and graph plotting
				2 – Tried but unable to propose any solution for merging both algorithms.
0 – Done nothing	0 – Done nothing	0 – Did not implement	0 – Done nothing	0 – Did not tried at all or plagiarised code.

Goals:

- Install Jupyter notebook on PCs
- Python notebook and class exercises
- Implementation of Insertion sort algorithm
- Time analysis of sort algorithm
- File Handling in Python

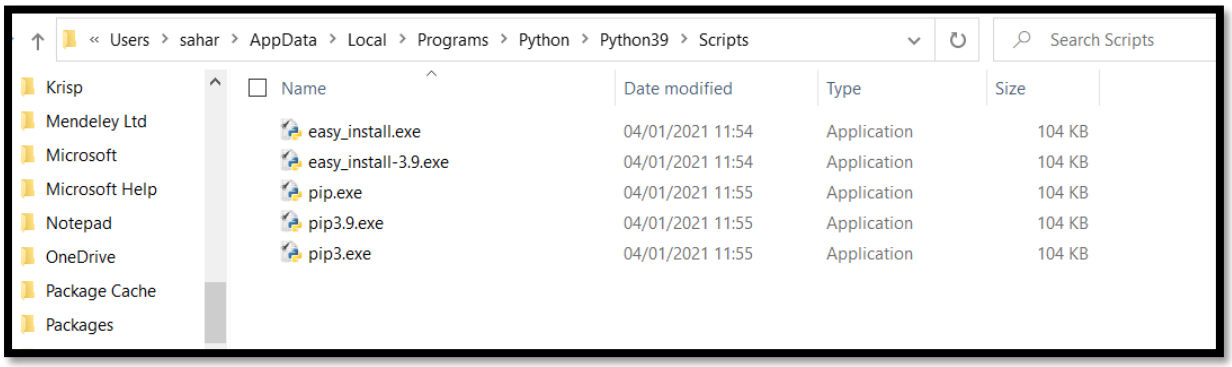
Installation of Jupyter:

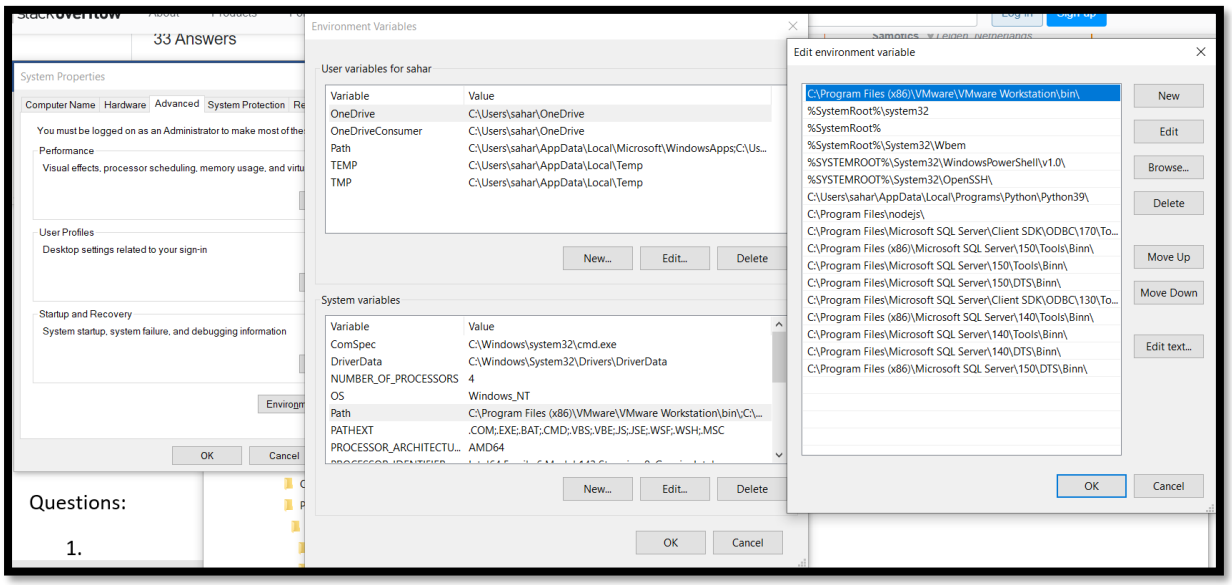
- https://jupyter.org/try
- Run this with Python in browser.
- Install this on your PC as well. (https://jupyter.org/install). It can be installed using pip package. If you have not installed Python and pip command in the given link does not work, follow this link for pip install (https://phoenixnap.com/kb/install-pip-windows) .

- If you have already installed python and you are getting following error

```
C:\Users\sahar>pip install jupyterlab
'pip' is not recognized as an internal or external command,
operable program or batch file.
```

Then go to following path and add this path to environment variables.





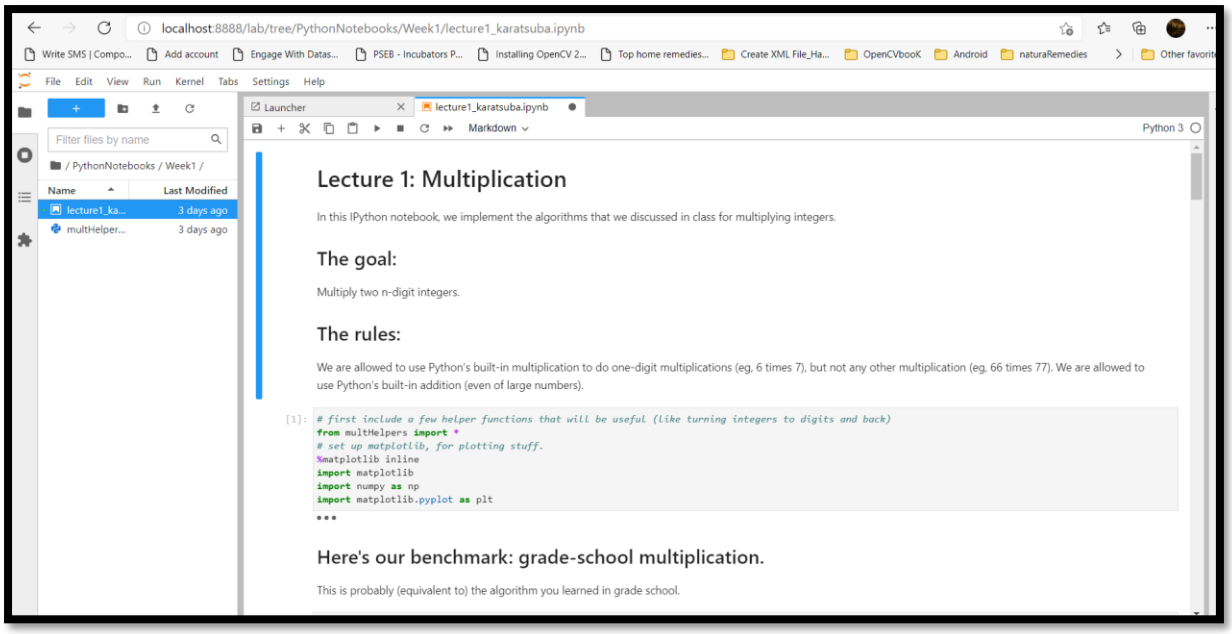
Add new environment variable and paste the path there. After this, try following command again and it should work now.

```
C:\Users\sahar>pip install jupyterlab
Collecting jupyterlab
  Downloading jupyterlab-3.0.12-py3-none-any.whl (8.3 MB)
     |                                | 3.5 MB 939 kB/s eta 0:00:06
```

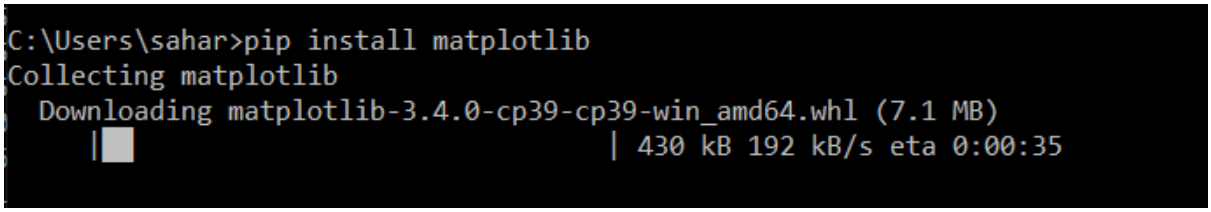
After installation, run jupyter using following command in cmd.

- jupyter-lab

Open your Week1 multiplication notebook – Karatsuba.

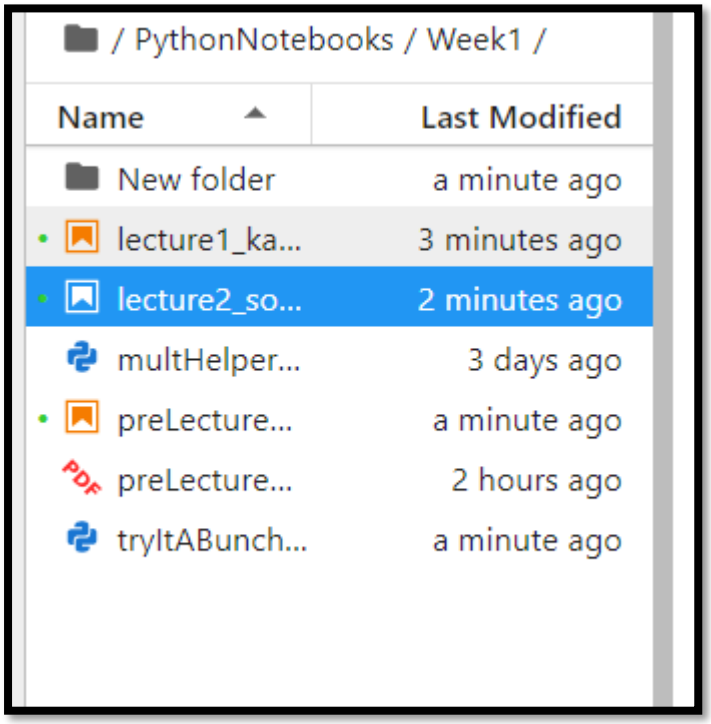


If you are getting any error while running the file, check error. If error is of matplotlib library run following command in cmd.



Questions:

1. Run and understand all of the following notebooks and code shared in lab folder.



2. Implement Insertion sort algorithm.
3. Apply Insertion sort and merge sort algorithm:
    a. Create arrays/list of following sizes 10, 100, 10000, 100000, 1000000000, 1000000000000. Add random values in these arrays or list. Save these lists in different files. For file handling in Python, see following link: https://www.programiz.com/python-programming/file-operation
    b. Load these values into lists from file and pass it to insertion sort and merge sort algorithm. Save the result in file.
    c. Note time at start of algorithm
    d. Note time at end of algorithm
    e. Calculate the time difference and fill the table shared in the end.

n/sorting algoritm	Merge sort	Insertion sort
10		
100		
1000		
10000		
100000		
1000000		
10000000		
10000000000		

Homework:

- Write algorithm which uses good points from both algorithms i.e. insertion sort and merge sort. You also need to complete the cost analysis for both algorithms. Execute on several inputs with best, average and worst cases and plot graphs which shows comparison of your algorithm with actual insertion and merge sort algorithm.
- Also, find out at what values of n, merge sort works better than insertion sort or vice versa. Similarly, do this for your own algorithm as well.