Sorting – Homework 11

- This is an individual assignment.
- Before you start on the homework, please read the rules on collaboration and submission in the syllabus.

The goal of this assignment is to compare the running time of three different sorting algorithms - Selection Sort, Merge Sort, and Quick Sort - and visualize the results using Python.

1. Create a new file **hw11.py**.
2. Add a docstring with your name and surname on top.
3. Copy all sorting functions from the lecture code (lines 6 - 77) file `Sorting.py`.
4. Install Matplotlib:
   - To install Matplotlib, you can use the following command in your terminal or command prompt, depending on your Python environment. Open your terminal or command prompt and type:

     ```
     pip install matplotlib
     ```

     This command uses the Python package manager pip to download and install the Matplotlib library. Make sure you have a working internet connection, and the installation should proceed without any issues.
   - The following code gives an EXAMPLE how to plot data using Matplotlib library.

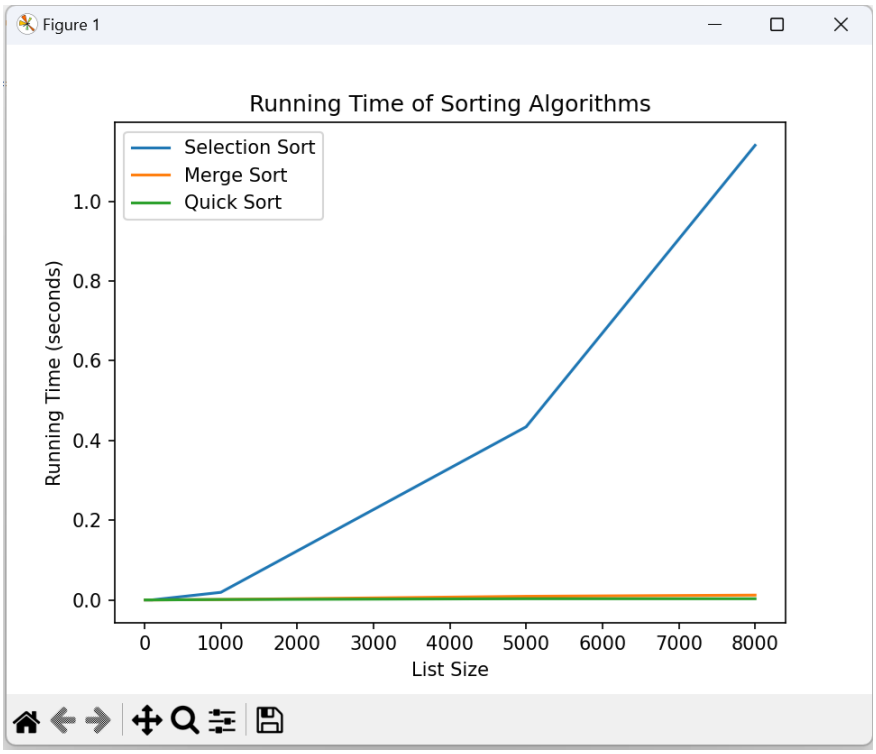
     ```
     import matplotlib.pyplot as plt

     # Sample data
     x = [1, 2, 3, 4, 5]
     y = [2, 4, 6, 8, 10]
     z = [3, 5, 7, 9, 11]
     # Create a simple line plot
     plt.plot(x, y,  label='y')
     plt.plot(x, z,  label='z')
     # Add labels to the plot
     plt.xlabel('X-axis')
     plt.ylabel('Y-axis')
     # Add legend to the plot
     plt.legend()
     # Add a title to the plot
     plt.title('Simple Plot in Python')
     # Display the plot
     plt.show()
     ```

5. In the `main` function:
   - Generate and save random lists of integers between 0 and 1000 to be sorted (import random). Ensure that the lists are of varying sizes to capture the algorithms' performance under different input conditions: 10, 100, 1000, 5000, 8000. You have to generate new lists for each sorting algorithms because lists are mutable (once you sort it with the first algorithm the next would sort already sorted list).

- Measure and record the running time of each sorting algorithm for each list size. Use the `time` module in Python for this purpose (import `time`).
- Create a plot to visualize the running time of each algorithm with respect to the size of the input list. Your plot should also include: title (as in the example), x-label, y-label, legend.

6. Example plot for reference:



This assignment will not only test your understanding of sorting algorithms but also your ability to analyze and present experimental data effectively. Good luck!

Submission Requirements

The title for this lab is hw11. Your submitted file is required to be named `hw11.py`.

Grading

The rubric for this assignment is available through Gradescope.