Alexandria University
Faculty of Engineering
Specialized Scientific Programs
Spring 2025

CSE 227: Data Structures II
6th Term
Assignment 1
Deadline: Saturday 1st March 2025 1:30 pm

Assignment 1

Sorting Techniques

Sorting is one of the most fundamental algorithmic problems within computer science. It has been claimed that as many as 25% of all CPU cycles are spent sorting, which provides a lot of incentive for further study and optimization of sorting. In addition, there are many other tasks (searching, calculating the median, finding the mode, removing duplicates, etc.) that can be implemented much more efficiently once the data is sorted. The wide variety of algorithms gives us a lot of richness to explore, especially when considering the tradeoffs offered in terms of efficiency, operation mix, code complexity, best/worst case inputs, and so on.

1. Lab Goal
- You need to understand:
    - Different running times for each algorithm, best and worst-case running time.

2. Sorting Algorithms
You're required to implement:

- $O(n^2)$ sorting algorithms:
    - **Bubble Sort.**
    - **Selection Sort.**
    - **Insertion sort.**

To test your implementation and analyze the running time performance, you will have to implement a function that generates a random array for a given size, sort this array with the sort algorithms you implemented and print the time taken
Steps:

➔ Generate Array of size X (1000 - 25,000 - 50,000 - 100,000 - ..etc) *(Make sure you pass the same array to all algorithms with same numbers)*

➔ Sort it with your implementation of $O(n^2)$ algorithms
➔ Print:
  ◆ Running time for Bubble Sort is … ms[should be printed for each algorithm]

3. Graph
A graph is required between Time (milliseconds) vs Array Size for different sorting algorithms, generate random arrays of different sizes and calculate the time required to sort it using the algorithms you implemented above and plot the results to a graph as what is shown in the image, you can use Excel sheet to generate the graph.

(Example Graph)
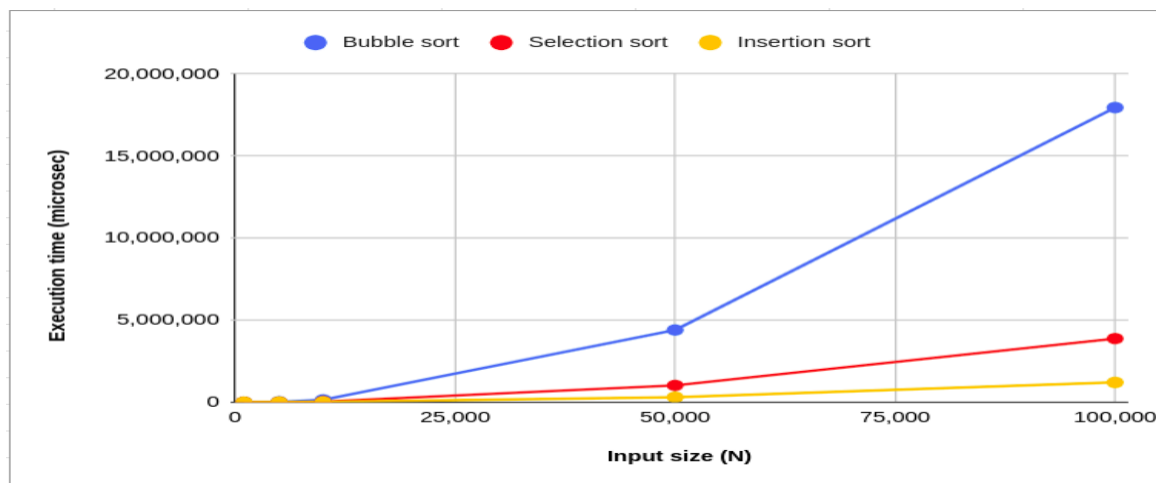
Summary of Deliverables:

- Bubble, Insertion and Selection sort Algorithms
- Time comparison Report

4. References
Some references that can help you understand sorting and its application.

- Link: Visualization for different sorting algorithms
- Link:
  - Measure the time taken by function in Python
  - Measure the time taken by function in C
  - Measure the time taken by function in Java

Prof Dr. Amr El Masry
Dr. Mohamed Kholeif

5. Notes

- Implement your algorithms using (Python, Java, or C/C++) Preferably Python
- You should work in groups **of 3 members.**
- Discussion will have higher weight than implementation, so you should understand your implementation well to get discussion marks.
- Your file name should be <id1 #>_<id2 #>_<id3 #>.zip .
- Late submissions are not allowed unless there is a valid documented excuse.

Prof Dr. Amr El Masry

Dr. Mohamed Kholeif