National University of Computer and Emerging Sciences

Assignment No. 3

Design and Analysis of Algorithms

Sorting Algorithms

CS2009

Spring 2024

Deadline: 20 March, 2024

Submission Instructions:

- All problems must be solved and submitted in hand-written format.
- Use A4 size papers with assignment front paper.
- This is an individual assignment.
- **Plagiarism is strictly prohibited.**
- **Please do not use any AI tool and do not copy from others.**
- **Just analyze the problem and then brainstorm the solution.**

Give the following in Question 1-6

- Best Sorting Algorithm you can Apply
- Justification to apply the algorithm
- Discuss the Limitations for applying the algorithm
- Dry-run the examples with the algorithm you choose

Question 01: (10 Marks)

In a classroom setting, the teacher wants to quickly identify the students who scored the highest in an exam. The teacher has a small list of exam scores for each student in the class. Since the class size is relatively small, efficiency is not a major concern, but simplicity and ease of implementation are preferred due to time constraints. Use such an algorithm where the teacher can easily understand and implement it without needing advanced programming knowledge. Once the scores are sorted, the teacher can quickly identify the students with the highest scores, allowing for recognition and further academic support if needed.

87	92	78	95	88	90	84	89	93	91

Question 02: (10 Marks)

In an e-commerce platform, incoming customer orders need to be processed efficiently to ensure timely delivery and customer satisfaction. Each order is assigned a unique order ID, and as orders come in, they need to be sorted based on these IDs to streamline the processing workflow.
Apply a sorting algorithm which have ability to efficiently sort integers within a specific range.

1023	**1018**	**1025**	**1020**	**1019**	**1022**	**1021**	**1017**	**1024**	**1016**

Question 03: (10 Marks)

In meteorological research projects, scientists often collect temperature data from multiple weather stations to analyze climate patterns and trends. To simplify the analysis process, temperature readings are typically grouped into temperature ranges or buckets, allowing researchers to study temperature distribution across different regions.
Which sorting algorithm is applicable in this scenario due to its efficiency when dealing with uniformly distributed data within a specific range.

22.5	24.3	23.1	21.9	25.7	24.8	26.2	22.0	23.5	25.0

Question 04: (10 Marks)

In schools and educational institutions, class rosters are often generated alphabetically to facilitate attendance tracking and organization. Sorting student names alphabetically ensures that class rosters are arranged in a systematic and easy-to-follow manner.
Which sorting algorithm is applicable in this scenario due to its efficiency and stability in sorting large lists of data. List of student names can be sorted alphabetically in a straightforward manner, ensuring that class rosters are generated accurately and efficiently.

Emma	Rushford	Franklin	Jack	Alice	Frank	Grace	Hannah	Charlie	David	Isaac	Bob

Question 05: (10 Marks)

In an online multiplayer game, maintaining a leaderboard is crucial for recognizing top-performing players and fostering healthy competition among players. The leaderboard should display players in descending order of their scores, with the highest scorer appearing at the top. As players achieve new high scores or submit their scores, the leaderboard needs to be updated efficiently to reflect the latest rankings.

Dataset 1: Player Scores:
Player A - Score: 1200
Player B - Score: 1050
Player C - Score: 1300
Player D - Score: 950
Player E - Score: 1100

Dataset 2: Player Scores:
Player X - Score: 2200
Player Y - Score: 2450
Player Z - Score: 2000
Player W - Score: 2100
Player V - Score: 2300

Question 06: (10 Marks)

In a mobile phone's contact application, organizing phone numbers is essential for easy navigation and quick access to contacts. Which sorting algorithm is applicable in this scenario due to its efficiency in sorting strings based on their characters (digits in this case).

123-456-7890	987-654-3210	555-123-4567	777-888-9999	111-222-333	323-423-7634

Question 07: (30 Marks)

Compare the Sorting Algorithms you had used in above question using the table given below:

Algorithm	No. of Comparisons	No. of Swaps	Best Case	Average Case	Worst Case	In-place	Stable
Bubble Sort	n*n/2	n^1/2	O(n)	O(n^2)	O(n^2)	YES	YES