Programming Assignment: Comparison Sorting

Course: CS212 Design and Analysis of Algorithms

August 16, 2024

Objective

The goal of this assignment is to deepen your understanding of sorting algorithms, lower bounds in sorting, and order statistics. You will implement, analyze, and compare different algorithms, applying the theoretical concepts learned in the course.

Problem Statement

Problem : Sorting Algorithms [40 Marks]

You are required to implement and compare three sorting algorithms: Insertion Sort, Merge Sort, and QuickSort. You will also analyze the performance of these algorithms on different types of input data (e.g., random, sorted, reverse-sorted).

Tasks:

1. **Implementation:**
   - Implement the following sorting algorithms:
     - Insertion Sort
     - Merge Sort
     - QuickSort (with and without randomization)
2. **Testing:**
   - Test the performance of your sorting algorithms on the following input cases:
     - Random data
     - Already sorted data
     - Reverse-sorted data
     - Data with many duplicate elements
   - Use arrays of size 100, 1000, and 10,000 for your tests.
3. **Analysis:**
   - For each sorting algorithm, measure and compare the execution time for the different input cases. Plot the graph showing the execution time of each case in different algorithms.
   - Provide a summary of your findings, including a comparison of when each algorithm performs best.

Submission Guidelines

- **Code:** Submit the source code files for each problem. Ensure your code is well-commented and follows good coding practices.
- **Testing:** Include the input/output for the test cases you used to validate your implementation.

Note

- You are expected to work individually on this assignment.
- Plagiarism will not be tolerated. Any suspected plagiarism will result in penalties as per the course policy.