

DATA STRUCTURES

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Assignment 1

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Question:

Plot graphs for at least five different sorting algorithms and submit a pdf with explanation (Y-Axis: Time X-Axis: number of elements). Use rand() to generate these numbers and for each N(number of elements), run your algorithm at least five times and take the average time as the time for that N.

Explanation:

The time-complexities of the five algorithms for sorting are as follows:

Bubble Sort: $O(n^2)$

Insertion Sort: $O(n^2)$

Selection Sort: $O(n^2)$

Quick Sort: $O(n\log(n))$

Merge Sort: $O(n\log(n))$

From the graph, it is easy to conclude the order of sorting algorithms considered for the assignment (slowest to fastest) as:

1. Bubble Sort
2. Selection Sort
3. Insertion Sort
4. Merge Sort
5. Quick Sort

However, merge sort and quick sort algorithms are almost equal in all cases. Although the worst case scenario of quick

sort is $O(n^2)$, but its average running time is $O(n\log(n))$ only, which is the worst case scenario for merge sort.

The data table for the graph plotted is as under:

No. of elements	1000	10000	50000	100000	200000
Bubble Sort	0.03075	0.317	8.425	34.2233	137.562
Insertion Sort	0.007	0.0955	1.952	7.754	31.3675
Merge Sort	0.00675	0.0175	0.02525	0.0455	0.0885
Quick Sort	0.004	0.0126	0.02502	0.0445	0.0775
Selection Sort	0.00675	0.15025	3.37025	13.391	54.368

The rate of growth of n^2 is more than $n\log(n)$, therefore, the difference in time, keeps on increasing as the value of n keeps on increasing.

Method:

The generate.c file takes the no. of elements as an input and generates an output file which serves as an input file to the sorting programs.

To measure running time of the sorting programs, time command of bash has been used.

