Lab Assignment 6: Sorting Algorithms

Instructions:

1. This assignment contains both programming as well as theory questions. Prepare and submit a .zip file which contains all the program files, graphs, and scanned copy of answers of theory questions.
2. To plot the graphs tools such as gnuplot or MS excel can be used.
3. Submit your assignment on **Google Classroom** only.
4. Name of the zip file should be written as yourfullname_enrollmentnumber.pdf
5. Unless stated explicitly, sorting has to be done always in ascending order.

Deadline: 5th May 2020

Total Marks: 10

Late Evaluation: 20% penalty if delayed by one week. 50% penalty if delayed by two week.

1. Calculate the time and space complexities of the Quick Sort for following input. Also, discuss the method of calculating the complexity. **(2 Marks)**
(a) When input array is already sorted.
(b) When input array is reverse sorted.
(c) When all the elements in the input array is same.
(d) When pivot element is always the median of the elements of the array on which Partition algorithm is applied.

2. Discuss in place and stable property of following sorting algorithms. Justify your answer.
(a) Insertion Sort (b) Selection Sort (c) Merge Sort (d) Quick Sort **(1 Marks)**

3. Do the following operation on Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, and Quick Sort: **(5 Marks)**
(a) Write C program for all.
(b) Plot three graphs for best case, average case and worst case, respectively to compare the execution time of these five sorting algorithms. The Y-axis in the graph represents the execution time of the program and X-axis represents the size of the input array. Different sizes of the input array will be 30, 60, 90, and 120. In the best case, the input array is already sorted. In the worst case, input array is reverse sorted. Any input sequence other than best case and worst case can be considered as average case. To generate the input sequence for average case, rand() function can be used. You can take help from Internet on how to use rand() function to generate input sequence for average case. In order to estimate the execution time of a particular C program, u will have to add a piece of code to your program. U can search that code from Internet. Analyse and conclude the observations in the graphs.
(c) Repeat (b) by taking number of swaps or jumps or exchanges on Y-axis in place of execution time.
(d) Repeat (b) by taking number of comparisons on Y-axis in place of execution time.

4. Modify the Bubble Sort so that it shows O(n) time complexity in best case. (**0.5 Marks)**
5. What are the applications of Merge and Quick sorts. Also, discuss the cases on which Merge sort is more suitable over Quick sort. U can take help of Internet. **(0.5 Marks)**
6. What is External Merge Sort. Write its algorithm. U can take help of Internet. **(0.5 Marks)**
7. Write in words about any sorting algorithm apart from above five sorting algorithms. U can take help of Internet. There are more than 50 sorting algorithms. I hope it will be minimally repeated. **(0.5 Marks)**