Indian Institute of Technology Mandi
February-June 2015 Semester

CS202: Advanced Data Structure and Algorithms

Programming Assignment 2

Last date of submission of code: 13th March, 2016
Last date of submission of report: 17th March, 2016

1. Implement the following sorting algorithms using C++ programing language and sort the input sequence in **ascending order**.
   a) Insertion sort
   b) Selection sort
   c) Rank sort
   d) Buble sort
   e) Merge sort
   f) Quick sort

   Program should take *n* inputs given from the user and display the sorted sequence.
2. Datasets with different input sizes are given. Implement the above mentioned sorting algorithms by reading the inputs from the file. Observe the running time for the above mentioned sorting algorithms for each of the data with different input sizes. Note down the running time for each dataset. and compare the running time for each of the algorithms by plotting the recorded running times for each dataset for each algorithms. Also plot the graph showing the asymptotic running time for the different algorithms as a functon of input size (use the different input sizes provided to you).
3. Datasets of different sizes in **ascending order** is given. Use the data files containing data points in ascending order as input to the programs of each of the above mentioned sorting algorithms for ascending order and observe the running time. This is the best case scenario. Compare the best case running time of each of the algorithms.
4. Datasets of different sizes in **descending order** is given. Use the data files containing data points in descending order as input to the programs of each of the above mentioned sorting algorithms for ascending order and observe the running time. This is the worst case scenario. Compare the worst case running time of each of the algorithms.
5. Write efficient algorithms for Rank sort and Buble sort. Analyse the running time of the new algorithms and give the actual and asymptotic running time as discussed in the class. Use the given datasets to sort the data points. Observe and compate the actual running time. **(Bonus)**
6. Repeat (2), (3) and (4) for the new algorithms. **(Bonus)**

Note:

1. The program should have both the options of reading the numbers to be sorted from user as well as reading them from file.
2. Each array is implemented using the vector data structure (vector.hpp) implemented in the Assignment 1.
3. Everyone should use the vector.hpp and sorter.hpp classes provided. Do not change the class names. It is expected to strictly use the interfaces provided in the classes to implement the tasks.

Submit the report in PDF form on the observations and resoning behind the obtained results on or before 17th March 2016.
The report should include the pseudo-code of each algorithms (both original and modified) and their running time analysis (including the acutal and asymptotic best base and worst case running time) as discussed in the class. The report should also contain the plots/graphs showing the asymptotic running time for the different algorithms as a functon of input size as well as the recorded running time as a uncton of input size. The report ahould also contain the comparision of different algorithms and the reasonings.

Note: The report should be neat and clear. Use the uniform fonts for the different sections and main body of the report. **Prepare the report using word document or equivalent. (No hand written report is accepted). Convert the report to PDF format before submitting. Reports not in PDF form will not be accepted/evaluated.**