CSCI 602 Algorithm Design & Analysis Assignment 1 10 pts

You have learned insertion sort and selection sort algorithms. In this assignment, you will implement these algorithms and study the impact of the pattern of input data on time cost of the algorithms. You can choose your preferred programming language. You are required to write a report that records running time of your program under different conditions. You need to submit your source file to Blackboard, and your report on the due day in class. See requirements below.

1. Your program runs on the Linux server (hopper/turing) at the Computer Science Department unless otherwise noted. If the department server does not support your programming language, you can use your own computer. But you need to specify it in your report.

2. Implementation of the sorting algorithms: You cannot use sorting library routines (e.g. qsort of C programming, sort and stable_sort of C++ programming … etc.) Use an array to store your collection of data when possible.

3. About the program:
   1) The driver program takes up to three command line arguments in form of "[N=n] [S=R/A/D] G=I/S". The first argument specifies the size of the sorting task, i.e., the number of integers. You will use sizes of 100, 1000, 10000, 100000, 1000000, … etc. to test your program. The second argument specifies the pattern of data to be sorted: 'A' indicates ascending order; 'D' indicates descending order; 'R' indicates random data. The third argument specifies the algorithm invoked when the program executes. "[ ]" indicates an argument is optional. By default, N is 1000, S is 'R'. For example, invoking the following command

      ```
      ./your-program N=10000 S=A G=I
      ```

      will generate 10000 ascending sorted integers to be initial data and use insertion sort algorithm to sort the data. And the command

      ```
      ./your-program G=S
      ```

      will generate 1000 random integers and use selection sort algorithm to sort the data. I assumed a C++ program in above examples. If yours is Java, Python, or other programming languages, you need to use proper command.

   2) Preparation of your initial data: Generate the specified number of random integers if the second command line argument is "S=R" or there is no argument on this. You can use library routine(s) for this step. If the argument is "S=A", use a simple approach to produce the specified number of integers in ascending order, e.g., in sequence of "1, 2, 3, 4, 5, 6, …" Do similarly for the argument "S=D'.

   3) Implement the two sorting algorithms as separate routines. Invoke one of them based on the command line argument "G=I/S".

4) When running your program, use the `time` command to record time spent on running the program. E.g.

```
/usr/bin/time ./your-program N=100000 G=I
```

Again, this example assumes a C++ program. When N is small, your program will finish in a very short time. You can gradually increase your input size (increment of 10x) to test your program. If your program has run for over a few seconds, kill the program and stop increasing the size. You need to run multiple times of your program with different command line arguments to finish the report.

5) Documentation: The documentation standards are largely consistent with CSCI 241. Refer to this site for details: http://faculty.cs.niu.edu/~mcmahon/CS241/241DocStandards.html. In the documentation box on top of your program, indicate how to compile and/or run your program from the command line.

4. About the written report: Summarize your discovery about the algorithms you have implemented in respect to the relationship between time cost and problem size and influence of the special pattern in input data on the algorithm. Your report needs to be typewritten. The next page has a suggested form you can use.

CSCI 602/490 Algorithm Design & Analysis Assignment 1 Report

Name: ______________________________ Zid: _______________ Programming Language: _______

Command to compile your program (if applicable): ___________________________________

Command to run your program (Give an example): ____________________________________

N	Data pattern (R/A/D)	User time	N	Data pattern (R/A/D)	User time

Summary of your observation: ____

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