Assignment #2

Date Due: October 31, 2019

Total: 100 marks

The C program provided will generate to the standard output any number of pairs in 7 possible ways. Your program should be able to take the output of the C/C++/Java program as standard input and produce the sorted array. You can also modify the source code to allow a different format for the standard output to match the format accepted by your program. You are not allowed to modify the generation pattern.

1. Write a program (in a language at your choice) that performs the following tasks:
   (a) (10 marks) sorts an array of pairs of integers using Merge-Sort;
   (b) (10 marks) sorts an array of pairs of integers using Insertion-Sort;
   (c) (10 marks) sorts an array of pairs of integers using Selection-Sort;
   (d) (10 marks) sorts an array of pairs of integers using Quick-Sort(dumb version: the pivot is always the first element);
   (e) (10 marks) sorts an array of pairs of integers using Heap-Sort;
   (f) (10 marks) sorts an array of pairs of integers using the improved version of Bubble-Sort;
   (g) (10 marks) for each sorting algorithms above we have a counter for counting steps;
   (h) the main algorithm has as input an arbitrary array and as output the sorted array, using each of the 6(six) algorithms above, together with the corresponding running time (number of steps).

2. (50 marks)
   - Analyze the behaviour of the sorting programs for various inputs (test all 8 possible generation patterns).
   - Summarize your results and present your conclusion about your experiment and the theoretical bounds.[1].
   - For each of the 8 patterns show which algorithm performs best and explain why.
   - In case there is another algorithm that performs better than the ones listed for some of the input data, implement it, test it and show why it is better than the algorithms listed at 1.

[1] This part can be submitted on paper

The program) should be archived and compressed in a file, then uploaded to moodle before the due date. Please include the running screens (a demonstration of your program), preferably in text format.

Note: $(x_1, y_1) \leq (x_2, y_2)$ iff $x_1 \leq x_2$, or $x_1 = x_2$ and $y_1 \leq y_2$.