Algorithms

Homework 1: due 9 April 2019

You are to write a program that implements randomized and deterministic selection algorithms. Given n elements and an integer i ($1 \leq i \leq n$), your program finds the i-th smallest element in the n elements by the following two algorithms.

- Randomized-select: `Randomized-Select` in CLRS
- Deterministic-select: the worst-case linear-time algorithm in CLRS

Your program should proceed as follows.

(1) Read all input data into memory.

(2) Run the randomized-select algorithm for the given input, and measure the time. Print the i-th smallest number and the time.

(3) Check the correctness of your randomized-select implementation by a checker program. Print the result of checking. The checker program gets the input (n elements and i) and the output (the i-th smallest number your program returns) as its input and checks whether the output is correct or not. The checker program for selection should run in linear time.

(4) Run the deterministic-select algorithm for the given input, and measure the time. Print the i-th smallest number and the time.

(5) Check the correctness of your deterministic-select implementation. Print the result of checking.

- Measure the actual time usage of the two algorithms on inputs of various sizes and compute the ratio of the constants hidden in the asymptotic time complexities of the two algorithms.
- Explain how your checker program works in your report.
- Hand in your report, programs, and an example running (with at least two input files) by email to `yychoi@theory.snu.ac.kr`.
- Write down the environment you run your program and how to run it.
- Write comments appropriately in your program.