

1 Assignment 2

Submit source code and running instructions to EAS¹. Do it in Java. Do not use java's search methods! Do not use Java's Collections or Subclasses, code your own. Place textual responses for 2, 3 and 4 in block comments in your code.

Posted: Thursday, May 18th

Due: Monday, May 29th

Grade: 5%

1. Quicksort

- (a) Implement a generic Quicksort algorithm that takes an array as input, it should use trivial pivot selection.
 - i. This file should be called QSNormal.java
 - ii. This class should have a sort method:
void sort(int[] input)
- (b) Implement a Quicksort algorithm that uses a Median of Three pivot selection.
 - i. This file should be called QSMedian.java
 - ii. The class should have a sort method:
void sort(int[] input)
- (c) Write classes that generate test inputs of size 10, 100, 10000, 1000000.
 - i. One file should be RandomGen.java
 - ii. One file should be FixedGen.java
 - iii. RandomGen should generate uniformly random integers.
 - iv. FixedGen should always generate a fixed input.
- (d) Make a driver that sorts values from your input
 - i. This file should be called QSDriver.java
 - ii. This file should output the run-time in either *ns* or *μs*
 - iii. it should accept command-line as follows:
java QSDriver <sort> <gen> <length> <seed>
 - A. <sort> is either QSNormal or QSMedian
 - B. <gen> is either RandomGen or FixedGen
 - C. <length> is the number of ints to be sorted in the input array
 - D. <seed> is an optional argument that lets you repeat the random seed for RandomGen (but is ignored by FixedGen)

¹<https://fis.encs.concordia.ca/eas/>

- (e) Record performance times of runs for each input size specified in 1c for Quicksorts implemented in 1a and 1b using RandomGen.
- 2. In clear, natural language, describe the performance differences between the two sorts. Try to correlate this with the underlying mechanism.
 - (a) This textual response should be no more than 8 lines / 80 words.
- 3. In clear, natural language, describe a pathological input (one that yields a worst-case) for your trivial Quicksort defined in 1a. The FixedGen.java file should produce this pathological input.
 - (a) This textual response should be no more than 8 lines / 80 words.
- 4. In clear, natural language, describe how the pathological case performs given the Median of Three Quicksort. Reference performance tests that you run and your understanding of what makes that input a pathological case. 1a.
 - (a) This textual response should be no more than 10 lines / 100 words.