

Assignment 4

csci2200, Algorithms

Instructions:

- HONOR CODE: WORK ON THIS ASSIGNMENT ALONE, OR WITH ONE PARTNER. BETWEEN DIFFERENT TEAMS, COLLABORATION IS AT LEVEL 1 [VERBAL COLLABORATION ONLY]
 - Check out the Homework guidelines on class website.
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1. **Select the \sqrt{n} -closest:** Given an unordered sequence S of n elements (for simplicity, assume items are integers or real numbers), describe an efficient method for finding the $\lceil \sqrt{n} \rceil$ elements whose values are closest to (the value of) the median of S . What is the running time of your method? Aim for linear time.

What we expect: The rationale of the algorithm, pseudocode, analysis

2. **Merging sorted lists:** Assume you have k sorted arrays containing a total of n elements, and you want to merge them together in a single (sorted) array containing all n elements. For simplicity you may assume that the k arrays contain the same number of elements, namely n/k elements each.

- (a) Approach 1: merge array 1 with array 2, then merge the result with array 3, then merge the result with array 4, and so on. What is the worst-case running time ?

What we expect: Detailed analysis of this approach

- (b) Approach 2: split the set of k arrays into two sets of $k/2$ arrays, merge each one recursively, then use the standard 2-way merge procedure (from mergesort) to combine the two resulting arrays. What is the worst-case running time ?

What we expect: A recurrence , the recurrence depth, and the solution.

- (c) Approach 3: Give another approach (to merge the k arrays) that uses a heap, and runs in $O(n \lg k)$ -time.

What we expect: The idea of the algorithm, pseudo-code, analysis