

CS 624: Notes 13

Ryan Culpepper

October 31, 2022

1 Administrative

- Expect Homework 03 soon.
- Expect Midterm Exam 1 grades by Wednesday night.

2 Results of Midterm Exam 1

Problem 1 (O)

- must show factor $(c_1 c_2)$ and starting point $(\max(n_1, n_2))$
- working with inequalities, not equations

Problem 2, 3 (master theorem)

- some used a different version of the master theorem and didn't explain it
- must state that $n \log n = O(n^{2-\epsilon})$
- result is Θ -bound, not O -bound

Problem 4 (heaps)

- circle *pairs of nodes* violating heap property

2.1 Problem 5 (lower-half sum)

Correct solution (20 points)

1. Use RANDOMIZED-SELECT algorithm (based on quicksort's RANDOM-PARTITION subroutine) to select the median (the $\text{floor}(n/2)$ order statistic).
2. Afterwards, as a side effect, the elements of the array from 1 to $\text{floor}(n/2)$ are the $\text{floor}(n/2)$ smallest elements.
3. Calculate the sum of $A[1..\text{floor}(n/2)]$.

Average-case run time: $O(n)$

Almost as good (19 points)

1. Find the median (using RANDOMIZED-SELECT or the non-random algorithm).
2. Calculate the sum of all elements in the array that are \leq the median.

This algorithm can be *incorrect* if the median occurs multiple times.

Average-case run time: $O(n)$

Correct but slower than necessary (15 points)

1. Sort the array.
2. Calculate the sum of $A[1..\text{floor}(n/2)]$.

Average-case run time: $O(n \log n)$

Other issues

- incorrect analysis (“sorting takes time $O(n)$ ”)
- complexity presented in unreduced form, like “ $O(n + n \log n)$ ”

3 Greedy Algorithms

(ended on slide 16)