

Analysis of Algorithms
CS 376, Spring 2023

Problem Set 3

Due **AT THE BEGINNING OF CLASS** Wednesday, April 5

- From CLRS, please read Chapters 7.1 and 9 (Section 9.2 is skippable).
- *A general note for CS376:* When writing up your homework, please write neatly and **explain your answers clearly**, giving all details needed to make your answers easy to understand. Clear communication *is* the point, on every assignment.

In general in CS376, unless explicitly specified otherwise, answers should be accompanied by explanations; as part of this, in general, when you present an algorithm, give an accompanying correctness argument (i.e., proof). Answers without explanations may not receive full credit. Please feel free to ask me any questions about explanations that might come up!

Exercises

1. CLRS 4.2-7 (page 83).
2. Trace the *full operation* of Quicksort (as given in CLRS, Section 7.1) on array $A = \langle 13, 19, 9, 5, 12, 8, 7, 4, 21, 2, 6, 11 \rangle$. Show the array and the (*first*, *last*, *pivot*) values for every recursive call of Quicksort—that is, the p and r values for every recursive call, and the resulting pivot value—and show the results of every call of **Partition** performed during the procedure. That is, show the array orderings and resulting sub-arrays at every level in the recursion tree.

The purpose of this exercise is to give you experience with how Quicksort works in detail. Because of that, this exercise is not intended to be an especially small amount of work, or have an especially slick answer—it's intended to take you through the detailed process of Quicksort once in your Colby CS education! For this one exercise, you do not need to provide text explanations of your work; showing the recursive calls and results for every step in the recursion as described will suffice for this exercise.

NOTE: If you're not fully comfortable with how **Partition** works, please feel free to work through exercise CLRS 7.1-1 (page 174), and I'll be happy to go over it with you!

3. CLRS 9.3-9 (pages 223–224)
4. CLRS 9-1 (page 224)