Assignment 8: Algorithm Design
CS 758/858, Fall 2023
Due **11:30pm on Sun Oct 29**

Written Problems

Don't forget to prove that your solutions meet the relevant time and/or space bounds!

1. Exercise 20.2–7 in CLRS.
2. You find yourself standing in a huge maze with high featureless walls. You have a large number of brightly colored coins. Give an algorithm for escaping that uses time and coins linear in the size of the maze. (My understanding is that this is one of the oldest algorithms known, over 2,500 years old.)
3. Numbers arrive over time. Every now and then, you are asked for the median of all the numbers that have arrived so far. Show how to handle both kinds of events faster than $O(n)$, where n is the number of numbers that have arrived so far.
4. Given a sequence of n values $x_1, x_2, \ldots, x_n$, you will need to answer queries of the form: given i, j (with $i \leq j$), what is the smallest value in the subsequence $x_i, \ldots, x_j$? Show how to answer queries in $O(\lg n)$ time per query using at most $O(n \lg n)$ space.
5. Give an $O(|V| + |E|)$ time algorithm that, given a graph, determines whether or not it is a forest.
6. You observe the price of a stock for the last n days and wonder wistfully how much money you could have made by trading in it. Give an algorithm that finds the best day i to buy and day $j > i$ to sell to maximize your profit. For 2/3 credit, your algorithm can run in $O(n \lg n)$ time; for full credit, it must be $O(n)$ (so that you can afford to run it for all the stocks on the NASDAQ).
7. (Those in 858 only) Problem 14–11 in CLRS.
8. What suggestions do you have for improving this assignment in the future?

Submission

Submit your work electronically as usual.