COSC 3320 Practice Problems Set 2

October 9, 2023

Problem 1

Given an array of *distinct* integers A, describe an algorithm to print out all permutations of the array.

Problem 2

Given an array of *possibly non-distinct* integers A, describe an algorithm to print out all *unique* permutations of the array.

Problem 3

You are given a sorted array consisting of numbers, each of which appears twice in the array, except for one number which appears only once. Describe an $\mathcal{O}(\log n)$ algorithm to find the value of the number which appears only once.

Problem 4

Let's play a game. You have a $n \times n$ square grid. Initially you must place a token on a square in the first row. In each turn, you move your token to one square to the right, or one square down. The game ends when you move your token out of the board. Each square on the grid has a numerical value, which could be positive, zero, or negative. You start with 0 score. Whenever the token lands on a square, you add its value to your score. You try to score as many points as possible.

For example, given the grid below, and placing initial token on 1st row 2nd column, and moving down, down, right, down, down, the game ends and you have score -9 (which is not the maximum possible):

−1	7	-8	10	−5
−4	−9	8	−6	0
5	−2	−6	−6	7
−7	4	7	−3	−3
7	1	−6	4	−9

Describe an algorithm to compute the maximum score, given a board A[1 . . .][1 . . . n], and analyze its time complexity.

This problem can be solved using backtracking or dynamic programming. For additional challenge, try both!