Problem Solving Workshop #3 Tech Interviews and Competitive Programming Meetup

March 6, 2016 https://www.meetup.com/tech-interviews-and-competitive-programming/

Instructor: Eugene Yarovoi (can be contacted through the group Meetup page above under Organizers)

More practice questions: leetcode.com, glassdoor.com, geeksforgeeks.org
Books: Elements of Programming Interviews, Cracking the Coding Interview
Have questions you want answered? Contact the instructor, or ask on Quora. You can post questions and follow the instructor and other people who write about algorithms.

Try to find optimized solutions, and provide a time and space complexity analysis with every solution for the algorithms questions.

Easy Problem

You are given an array of integers. Out of all the sums of two elements, return the one closest to 0.

Example input: [15,18,30]
Output: 33
Explanation: 15+18 give 33, and no two elements give a sum closer than that to 0.

Example input: [-7,-10,6]
Output : -1
Explanation: -7+6 gives a sum of -1, no two elements give a sum closer to 0.

Follow-up: What if the array is given to you in sorted order, can you improve your algorithm based on that?

Medium Problem

You're given a height map for a mountain, represented as a 2D array (matrix). When skiing, a skier can only move to adjacent (vertically/horizontally) tiles and go from higher elevation to lower elevation. Determine the longest possible ski path based on this rule. (Ties may be broken in arbitrary ways.)

Example input:
3 5 3
2 3 4
1 0 1
Output: path: 5 -> 3 -> 2 -> 1 -> 0, length: 5
Explanation: the skier can take this path, and no other path is longer:
3 **5** 3

2 3 4

1 0 1

The path 4->3->2->1->0 would also have been valid.

Hard Problem

Snow White and the N dwarfs live in the forest. Each morning the dwarfs form a long line and go whistling away to the mine. Snow White runs around them and snaps pictures to upload onto her favorite social network. Each picture will contain some contiguous subarray of the dwarves. That is, if the dwarves are in a line and can be assigned numbers 1, 2, ..., N, each picture will contain dwarves A, A+1, ..., B-1, B for some A, B.

Each dwarf has a colored cap, and there are C different colors. Snow White considers a picture to be pretty if strictly more than half of the caps on it are of the same color. That is, if there are K dwarves in the picture, a picture will be pretty if strictly more than K/2 caps are of the same color.

Given the initial sequence of dwarves in terms of their cap colors, and a set of M pictures specified in terms of their A, B values (first and last dwarves in the picture), determine for each picture whether it is pretty, and what color is the majority color in each pretty picture (no need to determine majority color for non-pretty pictures).

First assume N and M may be large, but consider the case where C is small (say C=3). This is a lot easier. Then try to extend to cases where C may be large as well.

Example Input:
dwarfCaps = [red, blue, red, blue, red, blue, yellow, blue, yellow, yellow]
pictures = [(start=0, end=1), (start=0, end=2), (start=6, end=9)]
Output: [none, red, yellow]
Explanation: For the range [0, 1], there is no majority color (1/2 is not a majority). For the range [0, 2], red is the majority color (2/3 dwarves have a red cap). For the range [6, 9], yellow has 3/4 dwarves.