Feedback — Interview Questions: Analysis of Algorithms

Help Center

You submitted this homework on **Thu 10 Sep 2015 10:23 PM EDT**. You will be able to view your score after the deadline passes.

These interview questions are for your own enrichment and are not assessed. If you click the *Submit Answers* button, you will get a hint.

Question 1

3-SUM in quadratic time. Design an algorithm for the 3-SUM problem that takes time proportional to N^2 in the worst case. You may assume that you can sort the N integers in time proportional to N^2 or better.

Your Answer	Score	Explanation
Total	0.00 / 0.00	

Question Explanation

Hint: given an integer `x` and a sorted array `a[]` of N distinct integers, design a linear-time algorithm to determine if there exists two distinct indices `i` and `j` such that `a[i] + a[j] == x`.

Question 2

Search in a bitonic array. An array is *bitonic* if it is comprised of an increasing sequence of integers followed immediately by a decreasing sequence of integers. Write a program that, given a bitonic array of N distinct integer values, determines whether a given integer is in the array.

- Standard version: Use $\sim 3 \lg N$ compares in the worst case.
- Signing bonus: Use $\sim 2 \lg N$ compares in the worst case (and prove that no algorithm can

guarantee to perform fewer than $\sim 2 \lg N$ compares in the worst case).

Your Answer	Score	Explanation
Total	0.00 / 0.00	

Question Explanation

Hints:

- Standard version. First, find the maximum integer using $\sim 1 \lg N$ compares—this divides the array into the increasing and decreasing pieces.
- Signing bonus. Do it without finding the maximum integer.

Question 3

Egg drop. Suppose that you have an N-story building (with floors 1 through N) and plenty of eggs. An egg breaks if it is dropped from floor T or higher and does not break otherwise. Your goal is to devise a strategy to determine the value of T given the following limitations on the number of eggs and tosses:

- Version 0: 1 egg, $\leq T$ tosses.
- Version 1: $\sim 1 \lg N$ eggs and $\sim 1 \lg N$ tosses.
- Version 2: $\sim \lg T$ eggs and $\sim 2 \lg T$ tosses.
- Version 3: 2 eggs and $\sim 2\sqrt{N}$ tosses.
- Version 4: 2 eggs and $\leq c\sqrt{T}$ tosses for some fixed constant c.

Your Answer	Score	Explanation
Total	0.00 / 0.00	

Question Explanation

Hints:

- Version 0: sequential search.
- Version 1: binary search.
- Version 2: find an interval containing T of size $\leq 2T$, then do binary search.

- Version 3: find an interval of size $\sqrt{N}$, then do sequential search. Note: can be improved to $\sim \sqrt{2N}$ tosses.
- Version 4: $1 + 2 + 3 + \ldots + t \sim \frac{1}{2} t^2$. Aim for $c = 2\sqrt{2}$.