

# Feedback — Interview Questions: Analysis of Algorithms

You submitted this homework on **Sun 24 Mar 2013 2:20 PM PDT -0700**. 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 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:  $1 + 2 + 3 + \dots + t \sim \frac{1}{2} t^2$ . Aim for  $c = 2\sqrt{2}$ .