

# Interview Questions: Analysis of Algorithms

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**Warning:** The hard deadline has passed. You can attempt it, but **you will not get credit for it**. You are welcome to try it as a learning exercise.

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

☐ In accordance with the Coursera Honor Code, I (David Resnick) certify that the answers here are my own work.

## 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.

## 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).

## 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  $c$ .

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Submit Answers

Save Answers

You cannot submit your work until you agree to the Honor Code. Thanks!