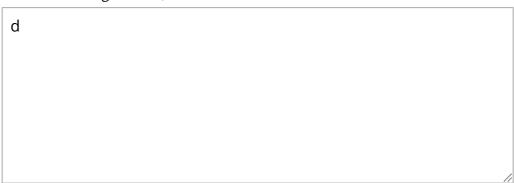


1/1 points

1.

**Nuts and bolts.** A disorganized carpenter has a mixed pile of n nuts and n bolts. The goal is to find the corresponding pairs of nuts and bolts. Each nut fits exactly one bolt and each bolt fits exactly one nut. By fitting a nut and a bolt together, the carpenter can see which one is bigger (but the carpenter cannot compare two nuts or two bolts directly). Design an algorithm for the problem that uses  $n\log n$  compares (probabilistically).

Note: these interview questions are ungraded and purely for your own enrichment. To get a hint, submit a solution.



Your answer cannot be more than 10000 characters.

## Thank you for your response.

Hint: modify the quicksort partitioning part of quicksort.

Remark: This research paper gives an algorithm that runs in  $n\log^4 n$  time in the worst case.



1/1 points

2.

**Selection in two sorted arrays.** Given two sorted arrays  $a[\ ]$  and  $b[\ ]$ , of sizes  $n_1$  and  $n_2$ , respectively, design an algorithm to find the  $k^{th}$  largest key. The order of growth of the worst case running time of your algorithm should be  $\log n$ , where  $n=n_1+n_2$ .

- ullet Version 1:  $n_1=n_2$  and k=n/2
- Version 2: k=n/2
- Version 3: no restrictions

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Your answer cannot be more than 10000 characters.

## Thank you for your response.

Hint: there are two basic approaches.

- Approach A: Compute the median in  $a[\ ]$  and the median in  $b[\ ]$ . Recur in a subproblem of roughly half the size.
- Approach B: Design a constant-time algorithm to determine whether a[i] is the  $k^{th}$  largest key. Use this subroutine and binary search.

Dealing with corner cases can be tricky.



1 / 1 points

3.

**Decimal dominants.** Given an array with n keys, design an algorithm to find all values that occur more than n/10 times. The expected running time of your algorithm should be linear.

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Your answer cannot be more than 10000 characters.

## Thank you for your response.

*Hint:* determine the  $(n/10)^{th}$  largest key using quickselect and check if it occurs more than n/10 times.

Alternate solution hint: use 9 counters.