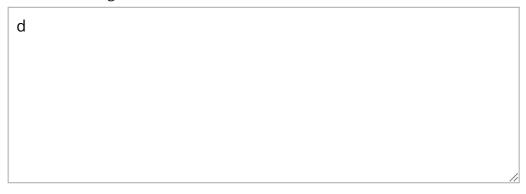


1/1 points

1.

**Dynamic median.** Design a data type that supports insert in logarithmic time, find-the-median in constant time, and remove-the-median in logarithmic time.

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*: maintain *two* binary heaps, one that is max-oriented and one that is min-oriented.



1/1 points

2.

Randomized priority queue. Describe how to add the methods sample() and delRandom() to our binary heap implementation. The two methods return a key that is chosen uniformly at random among the remaining keys, with the latter method also removing that key. The sample() method should take constant time; the delRandom() method should take logarithmic time. Do not worry about resizing the underlying array.



Your answer cannot be more than 10000 characters.

## Thank you for your response.



points

3.

**Taxicab numbers.** A *taxicab* number is an integer that can be expressed as the sum of two cubes of positive integers in two different ways:  $a^3+b^3=c^3+d^3$ . For example, 1729 is the smallest taxicab number:  $9^3+10^3=1^3+12^3$ . Design an algorithm to find all taxicab numbers less than n.

- Version 1: Use time proportional to  $n^2 \log n$  and space proportional to  $n^2$ .
- Version 2: Use time proportional to  $n^2 \log n$  and space proportional to n.

d			
			//

Your answer cannot be more than 10000 characters.

## Thank you for your response.

Hints:

- Version 1: Form the sums  $a^3 + b^3$  and sort.
- Version 2: Use a min-oriented priority queue with n items.