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.

d

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.

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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.

d

Your answer cannot be more than 10000 characters.

Thank you for your response.

1 / 1 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.