

Interview Questions: Priority Queues

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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.

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Question 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.

Question 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.

Question 3

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

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