

# Interview Questions: Priority Queues (ungraded)

Practice Quiz, 3 questions

✓ **Congratulations! You passed!**

Next Item



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point

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. If the number of keys in the data type is even, find/remove the *lower median*.

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

Dynamic median

Specification:

1. insert in logarithmic time
2. find-the-median in constant time
3. remove-the-median in logarithmic time

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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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.

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Specification:  
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Add two methods to binary heap implementation:

1. sample() method, choose uniformly at random among the remaining keys. (constant time)
2. delRandom() also removing that key. (logarithmic time)

Your answer cannot be more than 10000 characters.

**Thank you for your response.**

*Hint:* use `sink()` and `swim()`.



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point

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 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  $n$ .

Taxicab numbers:

Design an algorithm to find all taxicab numbers with  $a$ ,  $b$ ,  $c$ , and  $d$  less than  $n$ .

V1: Use time proportional to  $n^2 \log n$  and space proportional to  $n^2$ .

V2: Use time proportional to  $n^2 \log n$  and space proportional to  $n$ .

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.

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