

Data structure questions

Eeny, meeny, miny, heap

Which data structure to keep?

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These have been collected from books, other courses, and actual interview questions.

1. Describe a stack based data structure that supports push, pop, and find-min in $O(1)$ operations.
2. Given the pre-order traversal of a binary search tree, reconstruct the tree.
3. Design a queue using only stacks. It must support the enqueue and dequeue operations. If you start with an empty queue, end up enqueueing and dequeuing k elements, what is the total running time using your data structure?
4. Given login/logout time of all users for a particular website in the form: (userId, login time, logout time). Store this data, to query the total number of users who logged in and logged out in a given time range.
5. I am designing a media player that should store songs and play them in random order. I need to be able to insert, delete, and play a random song. What data structure would you use?
6. Given two pointers to nodes x and y in a binary search tree, find the unique path between them. What is the time complexity of your algorithm?
7. You have a stream on words. Design a data structure that at any point, tells you the 10 most repeated words.
8. You have a stream of integers. Maintain the value of the median. What about the k th smallest element?
9. A pair of nodes x, y in a (supposed) binary search tree violate the BST property if x is an ancestor of y , and the corresponding values are “out of order”. Given a BST, find the number of pairs that violate the BST property.

10. Given a string of parentheses/brackets, check if it is valid (meaning that every opening can be matched to a closing). Thus, $((\{()\}))()$ is valid, but $()(\{\})$ is not.
11. An array is k -sorted, if all elements are misplaced by at most k positions (with respect to the true sorted order). Sort a k sorted array in time $O(n \log k)$.
12. Convert a max heap to a min heap.
13. Consider an input of k sorted arrays of integers, each of size n . A range $[a, b]$ intersects an array, if it contains an element of the array. The size of this range is $|b - a|$. Find the smallest range intersecting all arrays.
14. Augment a BST, so that it keeps track of the height of every node. Figure out how to update these values on any insert or delete.
15. Consider a BST. We want an extra operation “less-than delete”: given x , this operation should delete all keys at most x . Design an efficient algorithm for this problem. You are allowed to augment your tree with extra $O(1)$ information per node.