

Topic 4 Data Structures and Algorithms

Interview Questions and Answers

Q1. What is the difference between linear data structure and non-linear data structure?

Linear data structure: If elements of the data structures are in a sequential manner or linear list then it is called a linear data structure. Arrays, Linked list, Stack, and Queue are examples of linear data structure

Non-linear data structure: In a non-linear data structure, elements are not arranged in order, and data elements are connected to several other data elements. Trees and Graphs are examples of non-linear data structure

Q2. What is a doubly-linked list? Give some examples

In a doubly-linked list, each node consists of three fields (Prev, Next, and Data). Data field stores the element whereas Next and Prev fields stores the information about the next node and previous node respectively. Hence each node has the link to its successor and predecessor. In a doubly-linked list, the list can be traversed in both directions from any node.

Some examples are:

- Undo and redo functionalities on any application
- Browser's back-forward options
- Next and back buttons in a music playlist

Q3. What is an algorithm?



An algorithm is a step-by-step process or set of instructions to be executed to solve a particular problem to get the desired output. It can either be written in simple languages like sentences or a flow chart.

Q4. What is the difference between Stack and Queue?

Stack: It is a data structure that follows the LIFO (Last In First Out) or FIFO (First In First Out) while performing any operation. Elements can be added and removed from only one end i.e., from the top.

Queue: It is a data structure that follows the FIFO (First In First Out) while performing any operation. It has two open ends i.e., rear and front. An element can be added from the rear end and removed from the front end

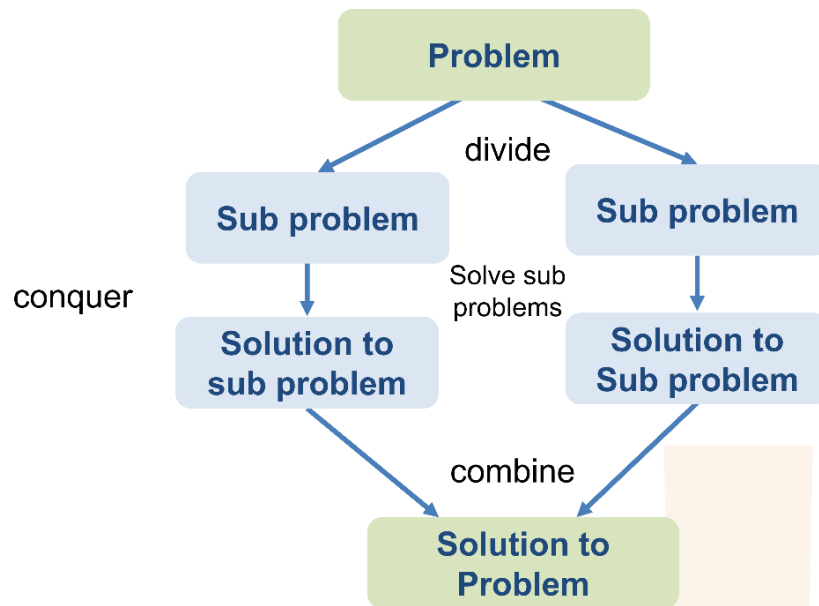
Q5. What are the operations performed on Stack? Explain

Following are the operations performed on the stack:

1. Peek: it returns the top of the stack without removing or inserting any element
2. Push: it adds an element at the top of the stack
3. Pop: it removes the element from the top of the stack
4. Search: Checks whether an element is present or not
5. isEmpty: Check whether the stack is empty or not

Q6. How divide and conquer algorithm work?

The divide and conquer algorithm divide a problem into smaller sub-problems. Once these problems are solved then the solution of those sub-problems are combined to get the solution.

**Q7. Explain how bubble sort works?**

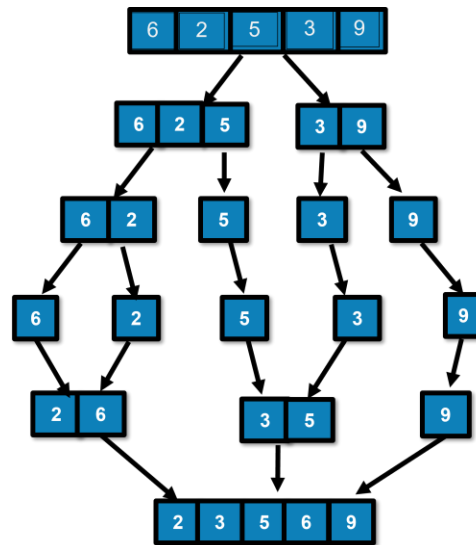
It is the simplest sorting algorithm that works by repeatedly swapping i th and $(i+1)$ th element if they are not correct in order.

It is also known as exchange sort.

Bubble sort is an algorithm in which we are comparing first two values and put the larger value at the larger index. Then we take next two values and compare these two values and place the larger value at the larger index. This process is repeated until the largest element reaches at the end. Then it starts again from 0 index to $n-1$ index. The algorithm follows same steps until the elements are sorted.

Q8. Explain how merge sort works?

Merge sort follows the divide and conquer algorithm. It sorts an array by repeatedly finding minimum/maximum. It maintains two subarrays in a given array. They are sorted sub-array and unsorted subarray.



Q9. How enqueue is different from the push operation?

Both enqueue and pop are used to insert an element. The difference is that pop operation is used on the stack to insert the element from the top whereas enqueue operation is used on the queue to insert an element at the rear end.

Q10. How circular linked list is different from the single linked list.

Both are non-linear data structures that store the data element in the forms of nodes where each node stores data and the address of the subsequent node. The only difference is that in a circular linked list, the last node is pointing to the head node whereas it does not point to the head node in a single linked list

Q11. Explain how the backtracking algorithm works?

This algorithm searches every possible combination for solving a computational problem and removes those sub solutions that do not satisfy the constraints of the problem.

Backtracking algorithm is applied to some specific types of problem:

- Decision problem used to find a feasible solution
- Optimization problem used to find the best solution
- Enumeration problem used to find the set of all feasible solution

Q12. Explain the working of binary search?

Binary search works only on a sorted array, but some exceptions exist. The array must be sorted before performing a binary search. Binary search repeatedly divides the search interval in half. It begins with an interval by considering the whole array and finds the middle element. If the search element is less than the middle element of the interval, it will narrow the interval to the lower half. If the search element is greater than the middle element of the interval, it will narrow the interval to the upper half. Otherwise, it repeatedly checks the interval until the value is found.

Q13. How sets are different from an array?

Both set and array are used to store the collection of heterogeneous elements. But the only difference is that the set stores unique values whereas the array can store duplicated values.

An array is an ordered list of objects whereas Set is an unordered list of objects.

An array has index and values can be accessed using index whereas set does not have any index values to access elements of Set.