Topic 4 Data Structures

Interview Questions and Answers

Q1. What are Graphs?

A graph may be a picturing of a group of objects where some pairs of objects are connected by links. The interconnected objects are represented by points termed as vertices, and therefore the links that connect the vertices are called edges.

Formally, a graph may be a pair of sets (V, E), where V is the set of vertices and E is that the set of edges, connecting the pairs of vertices.

Q2. What is a Hash Map?

Hash map is a widely used efficient data structure that is used to store data that can be searched in constant time O(1). It is also referred to as a hash table, unordered map, dictionary, hash set, and others. This arrangement of data structure is implemented over an array that maps keys to values. Hence, the hash map can be seen as a set of key-value pairs. Each key is a number in the range of 0 to the array size – 1, generated by a hash function.

Q3. What is a tree data structure?

A tree can be defined as a non-linear and hierarchical data structure that is a collection of entities(nodes) connected by edges. It always contains N-1 edges. A tree has a unique node called the root node. In a tree, there will not be any cycle or loop. Tree data structure plays an important role due to the non-linear arrangement. It is used to make decisions for searching, deleting, and inserting any element in the tree.

Q4. What is a Binary tree?

A binary tree is a finite set of data items that is either empty or consists of a single item called root and two disjoint binary trees called the left subtree and right subtree. In a binary tree, every node can have a maximum of 2 children which are known as the left child and right child.

Q5. What is the use of a Greedy Algorithm?

A greedy algorithm is used as a simple and easy-to-implement solution to complex, multi-step problems by deciding what next step will provide the most evident benefit. The algorithms work by repeatedly constructing a group of objects from the smallest possible constituent parts. Greedy algorithms are often utilized in ad hoc mobile networking to efficiently route packets with the fewest number of hops and therefore the shortest delay possible. They are also utilized in machine learning, business intelligence (BI), AI, and programming.

Q6. What is Traversal?

Traversal is an operation on the data structure. It is the process used to access each element present in the data structure like an array or linked list, tree, or graph.

Accessing means visiting every element at least once, just to display them to user or perform an operation on all the elements. Traversing is the basic operation that can be performed on any data structure

Q7. What are DFS and BFS?

DFS means depth-first search and it uses a stack to find the shortest path. It can be used better when the target is far from the source. DFS is more suitable for decision trees and is faster than BFS. The time complexity of DFS is O(V+E) where v is vertices and E is edges.

BFS means breadth-first search and it uses a queue to find the shortest path. It can be used better when the target is closer to the source. BFS is more suitable for decision trees as it considers all neighbors and is slower than DFS. The time complexity of BFS is O(V+E) where v is vertices and E is edges.

Q8. What is a Heap?

Heap is a binary tree data structure where the root node is compared with its children. It consists of two types:

1) max heap: a max heap is a complete binary tree in which value of each is greater than or equal to its child nodes

2) min heap: a max heap is a complete binary tree in which value of each is less than or equal to its child nodes

Q9. What is the difference between Binary Heap and Binomial Heap?

A binomial heap is a set of binomial trees whereas a binary heap is a binary tree with the following points:

It's a complete binary tree where all levels are completely filled except the last level and therefore the last level has all keys as left as possible. This point of Binary Heap makes them suitable to be stored in an array.

A Binary Heap is one of the two Min Heap or Max Heap. In a Min Binary Heap, the key at the root must be minimum among all keys present in Binary Heap. The same property should be recursively true for all nodes in Binary Tree.

Q10. What is the difference between multi-level inheritance and hierarchical inheritance?

Multi-level inheritance: in multi-level, the derived class inherits the base class as well as the derived class (it also acts as a base class to other class). For example, A, B, and C are three classes, B is derived from A, and C is derived from B. Now C can use the properties of both A and B

Hierarchical inheritance: in hierarchal inheritance, two or more classes are getting inherited from one single class, so it has a single parent class and multiple derived classes. For example, A, B, and C are three classes, if both classes B and C gets derived from class A then it is called hierarchical inheritance

Q11. What is the use of Dynamic Programming?

a. Dynamic programming helps to solve optimization problems.
b. It helps in breaking down the complex problems into simple sub-problems. It finds the optimal solution to these sub-problems.
c. It stores the result of sub-problems.
d. It reuses them so that the same sub-problem is not calculated more than once. Finally calculates the result of a complex problem.

Q12. What are the advantages of Heap over a stack?

Stack means linear data structure whereas Heap means hierarchical data structure.

Stack memory will not at all become fragmented whereas Heap memory can be fragmented as blocks of memory are first allocated then freed.

The stack can access local variables only while Heap allows you to access variables globally. Stack variables cannot be resized whereas Heap variables can be resized.

Stack memory is allocated in a contiguous block whereas Heap memory is allocated in any random order.

Stack doesn't require de-allocate variables whereas in Heap de-allocation is required.

Stack allocation and deallocation are done by compiler instructions whereas Heap allocation and deallocation is done by the programmer.