Ques. 1) **What do you mean by data structure?**

Ans.) A data structure is a way of organizing data in a computer so it can be used more efficiently. Basically there are two types of data structure linear and non-linear. Linear data structure include array, stack, queue and linked list and non- linear data structure are like trees.

Ques. 2) **What are some of the applications of DS?**

Ans.) Different data structure have different applications. For example in case of arrays.

2d Arrays are specially used for image processing, it is also used in speech processing in which each speech is an array.
Applications of **linked list** data structure includes web pages can be linked so the user can go back and forth with the help of a doubly linked list. Images are also linked with each other, so that any image viewer software uses a linked list to view the previous and the next images using the previous and next buttons.
Stack data structure can be used in the following ways:
converting infix to postfix, undo operation is also carried through stacks, it is used in many virtual machines like JVM.
Queue data structure are used in operating system for the purpose of job scheduling, to handle congestion in network we use queue.

Ques.3) **What are the advantages of linked list over arrays?**
Ans.) the principal benefit of linked list over arrays is that the list elements can be easily inserted and removed without reallocation or reorganizing of the entire structure because the data items need to be stored contiguously in memory.

Ques.4) **Write a syntax in C to create a node in singly linked list?**
Ans.)

```
struct Node{
        int data;
        Node *next;
            }
// creating a node of the list
    struct  Node* head=NULL;
      head=(struct Node*)malloc(sizeof(struct Node));
```

Ques.5) **What is the use of doubly linked list when compared to that of singly linked list?**

Ans.) the speed of traversing in case of doubly linked list is faster as compared to singly linked list. The insertion and deletion is much faster because of two pointer in doubly linked list. We can quickly insert and delete a node before a given node.

Ques.6) **What is difference between array and stack?**

Ans.) an array consists of item each identify with a fixed index, while stack is an abstract data type that serves as a collection of elements with two principal operations push and pop. Array contains elements of same type and stack contains elements of different types. Stack follow LIFO principle. Any element in array can be accessed using index. In stack only the top most element can be removed.

Ques.7) **What are the minimum number of queues used to implement the priority queue?**

Ans.) 2 queues are required one is for storing the elements and another for priorities.

Ques. 8) **What are the different types of traversal techniques in a tree?**

Ans.) there are basically 4 types of technique:

1. Preorder
2. Inorder
3. Postorder
4. Level Order

Ques. 9) **Why it is said that searching a node in a binary search tree is efficient than that of a simple binary tree?**

Ans.) It is true as in case of binary tree all the elements which are greater than the root node stores in the right part of the tree, while all the elements less than the root node stores in the left subtree. So in every search we are comparing the value to be searched with the root node, if it is greater than we move to the right part of the subtree otherwise we move to the left part of the subtree. So in each search iteration we are neglecting half the tree thus reducing the work and searching in much more efficient way.

Ques. 10) **What are applications of graph DS?**

Ans.) in computer science graph is used to represent network of communication, data organization, computational devices.

Facebook: Each user is represented as a vertex and two people are friends when there is an edge between two vertices. Similarly friend suggestion also uses graph theory concept

Google Maps: Various locations are represented as vertices and the roads are represented as edges and graph theory is used to find shortest path between two nodes.

Recommendations on e-commerce websites: The "Recommendations for you" section on various e-commerce websites uses graph theory to recommend items of similar type to user's choice.

Ques. 11) **Can we apply binary search algorithm to a sorted linked list?**

Ans.) Yes, we can apply binary search.
here is the approach.

- Here, start node(set to Head of list), and the last node(set to NULL initially) are given.
- Middle is calculated using two pointers approach.
- If middle's data matches the required value of search, return it.
- Else if middle's data < value, move to upper half(setting start to middle's next).
- Else go to lower half(setting last to middle).
- The condition to come out is, either element found or entire list is traversed. When entire list is traversed, last points to start i.e. last -> next == start

Ques. 12) **When can you tell a memory leak will occur?**

Ans.) Memory leak occurs when programmers create a memory in heap and forget to delete it. Memory leaks are particularly serious issues for programs like daemons and servers which by definition never terminate.

To avoid memory leaks, memory allocated on heap should always be freed when no longer needed.

Ques. 13) **how will you check if a given binary tree is a BST or not?**

Ans.) the idea is to use inorder traversal and keep track of the previously visited node value. since the inorder traversal of a BST generates a sorted array as output. So the previous element should always be less than or equal to the current element.
while doing In-Order traversal we can keep track of previously visited Node value by passing an integer variable using reference to the recursive calls. If the value of the

currently visited node is less than the previous value, then the tree is not the BST.

Ques. 14) **Which data structure is ideal to perform recursion operation and why?**
Ans.) Stack is most suitable data structure that we need for recursion. It is because of the principle that java uses that is Last In and First Out. So we need the latest call which is made to the compiler should be executed that is in simple terms we want function calls to be executed in the same manner in which they are called, and stack is the most suitable data structure for such tasks.

Ques. 15) **What are some of the most important applications of stack?**
Ans.) Expression conversion.
Parenthesis checker.
Backtracking.

Ques. 16) **Convert the below given expression to its equivalent Prefix and Postfix**
Ans.) From INFIX TO POSTIX:

1. Scan the infix expression from left to right.
2. If the scanned character is an operand, output it.
3. Else,
…..**3.1** If the precedence of the scanned operator is greater than the precedence of the operator in the stack(or the stack is empty or the stack contains a '('), push it.
…..**3.2** Else, Pop all the operators from the stack which are greater than or equal to in precedence than that of the scanned operator. After doing that Push the scanned operator to the stack. (If you encounter parenthesis while popping then stop there and push the scanned operator in the stack.)
4. If the scanned character is an '(', push it to the stack.
5. If the scanned character is an ')', pop the stack and and output it until a '(' is encountered, and discard both the parenthesis.
6. Repeat steps 2-6 until infix expression is scanned.
7. Print the output
8. Pop and output from the stack until it is not empty

Ques. 17) **Sorting a stack using a temporary stack?**
Ans.) we can sort the stack using the following stack:

Create a temporary stack say **tmpStack**.

1. While input stack is NOT empty do this:
   - Pop an element from input stack call it **temp**
   - while temporary stack is NOT empty and top of temporary stack is greater than temp,
     pop from temporary stack and push it to the input stack
   - push **temp** in temporary stack
2. The sorted numbers are in tmpStack

// 18 to 23 are coded.

Ques. 24) **Kth smallest in unsorted array.**
Ans.) the best approach is to create a min_heap and then pick the k the element in the min heap. In case of max element create a max heap and get the kth element.

Ques. 25) **Shortest path between two vertices.**
Ans.)

Algorithm:

- Input the graph.
- Input the source and destination nodes.
- Find the paths between the source and the destination nodes.
- Find the number of edges in all the paths and return the path having the minimum number of edges.