DATA STRUCTURE

UNIT – I

1. **What is Data Structure?**

A data structure is a mathematical or logical way of organizing data in the memory that consider not only the items stored but also the relationship to each other and also it is characterized by accessing functions.

2. **List down any four applications of data structures?**
   a. Compiler design
   b. Operating System
   c. Database Management system
   d. Network analysis

3. **What is Linear data structure?**

A collection of data set stored in a sequence order into memory is known as linier data structure.

- A sequence of zero or more elementsA1, A2, A3, … AN
- N: length of the list
- A1: first element
- AN: last element
- Ai: position i
- If N=0, then empty list
- Linearly ordered
  - Ai precedes Ai+1
  - Ai follows Ai-1

4. **Give examples of linear and non-linear data structure?**

Linier data structure:

Lists, Stacks , Queues

Non-linier data structure

Trees , Graphs , Sets , Tables

5. **What is ADT?**

An ADT is a set of operation. A useful tool for specifying the logical properties of a data type is the abstract data type.ADT refers to the basic mathematical concept that defines the data type. Eg.Objects such as list, set and graph along their operations can be viewed as ADT's.

Union, Intersection, size, complement and find are the various operations of ADT.

6. **Define Algorithm.**

Algorithm is a solution to a problem independent of programming language. It consist of set of finite steps which, when carried out for a given set of inputs, produce the corresponding output and terminate in a finite time.

7. What are the features of an efficient algorithm?

a. Free of ambiguity
b. Efficient in execution time
c. Concise and compact
d. Completeness
e. Definiteness
f. Finiteness

8. What is List ADT?

List ADT is a sequential storage structure. General list of the form a1, a2, a3….., an and the size of the list is 'n'. Any element in the list at the position I is defined to be ai, ai+1 the successor of a_i and $a_{i-1}$is the predecessor of a_i.

9. What are the different ways to implement list?

a. Simple array implementation of list
b. Linked list implementation of list

10. What are the advantages in the array implementation of list?

a. Print list operation can be carried out at the linear time
b. Find Kth operation takes a constant time

11. What are the various operations done under list ADT?

a. Print list
b. Insert
c. Make empty
d. Remove
e. Next
f. Previous
g. Find k_{th} element

12. What is Linked List?

Linked list is a kind of series of data structures, which are not necessarily adjacent in memory. Each structure contains the element and a pointer to a record containing its successor.

13. Name the two fields of Linked list?

a. Info field(Data part)
b. Next field(address part)

14. What is Doubly Linked List?

In a simple linked list, there will be one pointer named as 'NEXT POINTER' to point the next element, where as in a doubly linked list, there will be two pointers one to point the next element and the other to point the previous element location.

15. Name the three fields of Doubly Linked list?

Info field
Left field
Right field

16. What is Circular Linked List?

When the last node or pointer of a list, point to the first element of the list, then it is a circularly linked list.

17. What is Sentinel / Dummy node / Header Node?

The first node of the list may be created with no information to indicate the starting place of the list, which is known as dummy or sentinel or header node.

18. Define Structure?

A Structure is a group of items in which each item is identified by its own identifier ,each of which is known as a member of the structure.

19. What are the applications of linked list?

1. Polynomial Addition
2. Radix Sort
3. Multi list
4. Buddy system
5. Dynamic memory allocation
6. Garbage Collection

20. What is Radix Sort?

Radix sort is one of the linear sorting algorithms for integers. It functions by sorting the input numbers on each digit, for each of the digits in the numbers. However, the process adopted by this sort method is somewhat counterintuitive, in the sense that the numbers are sorted on the least-significant digit first, followed by the second-least significant digit and so on till the most significant digit.

21. What is garbage collection?

In computer science, garbage collection (GC) is a form of automatic memory management. The garbage collector, or just collector, attempts to reclaim garbage, or memory used by objects that are no longer in use by the application.

22. What is Stack ADT?

A Stack is an ordered collection of items into which new items may be inserted and from which items may be deleted at one end, called the top of the stack. The other name of stack is Last-in -First-out list.

ADT operations of Stack:

1. PUSH
2. POP

23. What are the applications of Stack ADT?

1. Conversion of infix to postfix
2. Evaluation of expression
3. Function calls / recursive calls
4. Balancing symbols
5. Conversion of numbers

24. What is Queue ADT?

Queue is another data structure which has two ends, front and rear, where data is added only at the rear and is removed only at the front. Thus the first item to be inserted is always the first to be removed (FIFO)

Applications of Queue ADT:,

Access to network resources such as printing,
mail-server,
web-server, etc are mostly based on FCFS.

ADT operations:

CreateQueue,
ClearQueue,
FullQueue,
EmptyQueue,
AppendQueue (enqueue) and
Serve (dequeue or remove).

Way of Implementation:

It can also be implemented using both array (static approach)and linked list (Dynamic approach).

25. What is Circular Queue?

The queue, which wraps around upon reaching the end of the array is called as circular queue.

26. Explain the usage of stack in recursive algorithm implementation?

In recursive algorithms, stack data structures is used to store the return address when a recursive call is encountered and also to store the values of all the parameters essential to the current state of the procedure. Priority queue is a data structure in which the intrinsic ordering of the elements does determine the results of its basic operations. Ascending and Descending priority queue are the two types of Priority queue.

27. What is LIFO? Name the ADT which one uses LIFO operation.

LIFO - Last In First Out. Stack ADT uses LIFO operation.

28. What is FIFO? Name the ADT which one uses FIFO operation.

FIFO – First In First Out. Queue uses the FIFO operation.

29. Write algorithm for inserting a node at the beginning of the list ADT.

```
If(start == NULL)
{
    Start = newnode();
}
Else
{
    Newnode->next = start;
    Start = newnode;
}
```

30. Define Recursion?

Recursion is a function calling itself again and again.

31. Write postfix from of the expression –A+B-C+D?

A-B+C-D+

32. What are the postfix and prefix forms of the expression?

A+B*(C-D)/(P-R)

Postfix form: ABCD-*PR-/+
Prefix form : +A/*B-CD-PR

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34. How do you test for an empty queue?

To test for an empty queue, we have to check whether READ=HEAD where REAR is a pointer pointing to the last node in a queue and HEAD is a pointer that pointer to the dummy header. In the case of array implementation of queue, the condition to be checked for an empty queue is READ<FRONT.