Sairam INSTITUTIONS

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West Tambaram, Chennai - 44

YEAR	SEM
II	III

CS8391

DATA STRUCTURES (COMMON TO CSE & IT

UNIT No. 1 LINEAR DAT A STRUCTURES

QUESTION BANK

Version: 1.XX

UNIT I - LINEAR STRUCTURES

1. Define algorithm.(R)

An algorithm is a step-by-step recipe for solving an instance of a problem. It is a precise procedure for solving a problem in finite number of steps. An algorithm states the actions to be executed and the order in which these actions are to be executed. An algorithm is also defined as a well-ordered collection of clear and simple instructions of definite and effectively computable operations that, when executed, produces a result and stops executing at some point in a finite amount of time rather than just going on and on infinitely.

2. Illustrate the properties of an algorithm.(A)

The properties of an algorithm includes,

- An algorithm takes zero or more inputs.
- An algorithm results in one or more outputs.
- All operations can be carried out in a finite time.
- An algorithm should be efficient and flexible.
- It should use less memory space as much as possible.
- An algorithm must terminate after a finite number of steps.
- Each step in the algorithm after a finite number of steps.
- Each step in the algorithm must be easily understood for someone reading it.
- An algorithm should be concise and compact to facilitate verification of their correctness.

3. Define efficiency of an algorithm.(R)

Efficiency of an algorithm denotes the rate at which an algorithm solves a problem of size n. it is measured by the amount of resources it uses, the time and the space. The time refers to the number of steps the algorithm executes while the space refers to the number of unit memory storage it requires.

4. Discuss about run time. What is its impact in calculating time complexity? (U)

Run time is the time to execute the compiled program. The run time of an algorithm depends upon the number of instructions present in the algorithm. The run time is in the control of the programmer, as the compiler is going to compile only the same number of statements, irrespective of the type of compiler used.

5. What is mean by time complexity of an algorithm? (U)

Time complexity of an algorithm is the amount of time (or the number of steps) needed by a program to complete its task.

6. Define worst case of an algorithm. (R)

Worst case is the longest time that an algorithm will use over all instances of size n for a given problem to produce a desired result.

7. Define space complexity of an algorithm. (R)

Space complexity of a program is the amount of memory used at once by the algorithm until it completes its execution.

8. Classify the different memory spaces occupied by an algorithm. (A)

The following are the different spaces considered for determining the amount of memory used by the algorithm, instruction space, data space and environment space.

9. Discuss divide and conquer algorithm. (U)

Divide and conquer is based on dividing the problem into several, smaller sub instances, solving them independently and then combining the sub instance solutions so as to yield a solution for the original instance.

10. Point out some of the problems that implements divide and conquer algorithm. (A)

Problems that implements divide and conquer algorithm are quick sort, binary search, merge sort and strassen's matrix multiplication.

11. Define data structures. (R)

Data structure defines a way of organizing all data items that consider not only the elements stored but also stores the relationship between the elements.

12. What is mean by static data structures. (U)

A data structure formed when the number of data items are known in advance is referred as static data structure or fixed size data structure.

13. List some of the static data structures in C. (R)

Some of the static data structures in C refer to arrays, pointers, structures, etc.,

14. Define dynamic data structures. (R)

A data structure formed when the number of data items are not known in advance is known as dynamic data structure or variable size data structure.

15. Generalize some of the dynamic data structures in C. (C)

Some of the dynamic data structures in C refers to linked lists, stacks, queues, trees. Etc.,

16. What are the different types of data structure? (R)

- Linear data structure.
- Non-linear data structure

17. Define linear data structures. (R)

Linear data structures are data structures having a linear relationship between its adjacent elements. Linked lists are examples of linear data structures.

18. Define non-linear data structures. (R)

Non-linear data structures are data structures that don't have a linear relationship between its adjacent elements but have a hierarchical relationship between the elements. Trees and graphs are examples of non-linear data structures.

19. Classify the different types of linked lists. (A)

The different types of linked list include single linked list, double linked list and circular linked list.

20. Classify the different types of circular linked lists. (A)

The different types of circular linked list include circular singly linked list and circular doubly linked list.

21. Mention the basic operations carried out in a linked list. (U)

The basic operations carried out in a linked list includes,

- Searching an element in a list.
- Finding the successor element of a node.
- Finding the predecessor element of a node.
- Appending a linked list to another existing list.
- Splitting a linked list in to two lists.
- Arranging a linked list in ascending order.

22. List the advantages in using a linked list. (R)

The advantages in using a linked list are,

- It is not necessary to specify the number of elements in a linked list during its declaration.
- Linked list can grow and shrink in size depending upon the insertion and deletion that occurs in the list.
- Insertions and deletions at any place can be handled easily and efficiently.
- A linked list does not waste any memory space.

23. List out the disadvantages in using a linked list. (R)

The disadvantages in using a linked list are,

- Searching a particular element in a list is difficult and time consuming.
- A linked list will use more storage space than an array to store the same number of elements (therefore each element in a list needs additional memory space for storing the address of the next node).

24. Define Abstract Data Type(ADT). (R)

An abstract data type is a set of operations for which the implementation of the data structure is not specified anywhere in the program

25. Distinguish between arrays and linked list. (A)

Arrays	linked list
Size of any array is fixed.	Size of a list is variable.
It is necessary to specify the number array number of, elements during declaration	It is not necessary to specify the in an Number of elements in during declaration.
Insertion and deletions are somewhat difficult out easily	Insertions and deletions are carried in an Array.
It occupies less memory than a linked list memory.	It occupies more for the same number of elements.

26. What are the applications of Arrays? (R)

- Parallel Arrays to store records
- Sparse Matrices
- Matrix operations

27. Mention some of the application of linked list. (U)

Some of the applications of linked lists are,

- Polynomial Manipulation
- Stacks
- Queues

28. Give examples of Linear and Non-Linear Data Structures. (R)

Linear Data Structures

1. Linked Lists(Singly & Doubly Linked Lists)
2. Circular Linked Lists (Circular-singly & Circular-doubly Linked Lists).

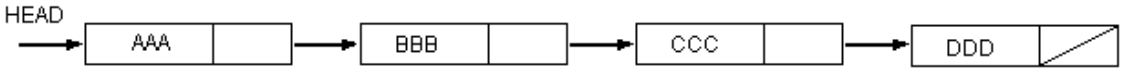
Non-Linear Data Structures, Trees, Graphs.

29. What are the advantages and disadvantages of linked list? (R)

- **Advantages:**
  - Memory location for a linked list is dynamic, that is memory allocation is done during run time. So memory will not be wasted.
  - Data movements during insertion and deletion will be eliminated. So time will not be wasted.
  - Memory allocation for each node of a linked list need not be continuous.
- **Disadvantages:**
  - Nodes of a linked list cannot be accessed directly. To access a particular node accessing should start only from the beginning.
  - To store a single data, along with data, memory must be allocated for a pointer also, which wastes memory.

30. Define Singly Linked List. (R)

A singly linked list is a list structure in which each node contains a single pointer field that points to the next node in the list, along with a data field.

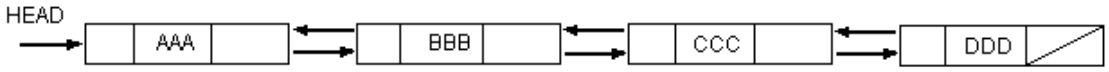


31. Define Doubly Linked List. (R)

A doubly linked list is a list structure in which each node contains two pointer fields along with a data field namely,

BLINK – Points to the previous node in the list

FLINK – Points to the successive node in the list



32. Define Circular linked list. (R)

Circular linked list is a more complicated linked data structure. Nodes in a linked list are linked together using a next field, which stores the address of the next node in the next field of the previous node i.e. each node of the list refers to its successor and the last node points back to the first node unlike singly linked list.

33. Define double circularly linked list? (R)

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

34. What is the need for the header? (U)

Header of the linked list is the first element in the list and it stores the number of elements in the list. It points to the first data element of the list.

35. What is meant by dummy header? (U)

It is a head node in the linked list before the actual data nodes.

PART – B

1. Write an ADT to perform the following in a Singly Linked List. **(A)**
   - To inert an element in the beginning, middle , end of the list
   - To delete an element from anywhere in the list
2. Write an ADT to perform the following in a Doubly Linked List. **(A)**
   - To inert an element in the beginning, middle , end of the list
   - To delete an element from anywhere in the list
3. Write a program for polynomial multiplication using Linked List. **(A)**
4. What is linked list? Explain with suitable program segments of any four operations of a linked list. **(A)**
5. Write a program to concatenate two linked list. L1 U L2. **(A)**
6. Explain polynomial manipulation using linked list with an example. **(A)**
7. What are the various functions used to access a text File. Explain with an example. **(E)**
8. Discuss the different forms of macro substitution in preprocessor directives with example. **(R)**
9. What is a doubly linked list? Write an algorithm for inserting, deleting and searching an element from doubly linked list. **(R)**
10. What is a singly linked list? Write an algorithm for inserting, deleting and searching an element from singly linked list. **(R)**
11. Given two sorted lists L1 and L2, write the procedure to compute L1 U L2 using only basic list operations. **(R)**
12. Explain the following operations in a doubly linked list. **(R)**
    a. Insert an element
    b. Delete an element
    c. Reverse the list.
13. Explain the following operations in a singly linked list. **(R)**

a. Insert an element

b. Delete an element

c. Reverse the list.

14. Explain and Write a routine to implement addition, subtraction and differentiation of two polynomials **(R)**

15. List out the operations of circular linked list and design an algorithm to insert an element using Circular Linked List. **(R)**

16. Write an algorithm to insert and delete a key in a circular queue. **(A)**

17. Write an ADT to implement stack of size N using an Linked List. The elements in the stack are to be integers. The operations to be supported are push, pop and display. Take into account the exception of stack underflow and overflow. **(A)**

18. Write explain the Routine to perform enqueue and dequeue operations in a linked list implementation of queue **(A)**

19. Discuss applications of linked list in detail. **(U)**