

MA-225

May-2025

Integrated M.Sc. (CA&IT), Sem.-II

Data Structure and Algorithm

Time : 2:00 Hours]

[Max. Marks : 50

1. Answer the following Questions : 10
- (A) Define following terms : (Any five)
- (1) Weighted Graph
 - (2) Priority Queue
 - (3) Data Structure
 - (4) Sparse Matrix
 - (5) Stack
 - (6) Cycle
- (B) Write true or false (Any five) :
- (1) Non-primitive data types are usually implemented using primitive data types as building blocks.
 - (2) A queue follows the Last In First Out (LIFO) principle.
 - (3) In a Binary Tree, each node can have at least two children.
 - (4) An AVL tree is a self-balancing binary search tree, where the height difference between the left and right subtree is at most 1.
 - (5) A doubly linked list can traverse in both directions but requires more memory.
 - (6) BFS can be used for level-order traversal in trees.
2. Answer the following questions : 10
- (A) Explain the classification of data structures.
- (B) Write an algorithm to insert a node at a specific position in a singly linked list.
- OR**
- (A) Explain the difference between static and dynamic memory allocation. Mention the purpose of `malloc()` and `calloc()` in C.
- (B) Explain 1D and 2D array with example.
3. Answer the following questions : 10
- (A) Convert the following infix expression into postfix expression :
 $A * (B + C * (D - E))$
- (B) Write algorithms for enqueue and dequeue in circular queue.
- OR**
- (A) Convert the following infix expression into postfix expression :
 $((A + B) * C - (D - E)) ^ (F + G)$
- (B) Write an algorithm to insert a node at specific position in doubly linked list.

4. Answer the following questions : (Any two)

10

(A) Construct an AVL tree from the given sequence :

14, 17, 11, 7, 53, 4, 13, 12, 8, 60, 19

Clearly indicate the balance factor and required rotations at each step.

(B) Create a binary search tree for the given following elements :

M, N, O, L, Q, K, P, H, I, B, A, Z

(C) A government wants to lay **fiber-optic cables** between 6 major cities to provide high speed internet connectivity. The goal is to **minimize the total cost** while ensuring that **all cities are connected**.

The estimated costs (in crores of rupees) for laying cable between pairs of cities are shown in the table below :

Cities :

A : Ahmedabad B : Baroda C : Surat D : Rajkot E : Bhavnagar F : Jamnagar

From (Vertex)	To(vertex)	Cost(crores) (weight of Edges)
A	B	4
A	C	3
A	D	7
B	C	6
B	E	5
C	E	11
D	F	8
E	F	9
C	D	10

(1) Draw or describe the weighted undirected graph of the cities and cable costs.

(2) Find minimum spanning tree using Kruskal's algorithm.

5. Answer the following questions :

10

(A) Write the **Linear Search** algorithm with an example.

(B) Explain the **Bubble Sort** algorithm with each step of example given below :

15, 16, 6, 8, 5, 9

OR

(A) Write the **Binary Search** algorithm with example.

(B) Explain the **Quick Sort** algorithm with each step of example given below :

7, 6, 10, 5, 9, 2