

**December 2022**  
**MCA I Semester**  
**Data Structures (MCA-20-101)**

Time : 3 Hours]

[Max. Marks : 75

*Instructions :*

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

**PART-A**

1. (a) Explain how right choice of data structure decides the performance of an algorithm? (1.5)
- (b) Explain in which condition Quick sort do perform worst and why? (1.5)
- (c) What are characteristics of an algorithm? (1.5)
- (d) What initial, overflow and underflow conditions of a circular queue implemented using array in C? (1.5)
- (e) What are benefits of Quick sort on Merge sort? (1.5)
- (f) Give no. of total node and total number of leaf node of a complete binary tree. (1.5)
- (g) How do we represent a tree using array? (1.5)

- (h) Give the formula to calculate the address of element at index (i, j) in an 2D of size  $R \times C$ . (1.5)
- (i) Explain how search is performed for Skip lists? (1.5)
- (j) What is a Red-Black tree? (1.5)

### PART-B

2. (a) Find out the average time complexity of  
 (i) an algorithm of insertion sort.  
 (ii) an algorithm for Merge sort. (4,4)
- (b) Explain and give the algorithm for binary search. Also give its complexity. (7)
3. (a) What do mean by static and dynamic allocation of memory for a give structure? (6)
- (b) Construct, step wise, a binary search tree for following data sequence.  
 25 15 40 20 18 24 10 30 45  
 Now delete 15 from this tree. (7,2)
4. (a) Give the step wise conversion of following expression into postfix expression.  $((a + b)*c)*(d/f\$g)$   
**Note:** The precedence of \$ is highest in all operators used. (7)
- (b) Explain and give the algorithm to insert left and right child in a threaded binary search tree. (8)
5. (a) Give recursive inorder, postorder and preorder traversal algorithm of a binary tree. (8)

- (b) Give the algorithms for insertion and deletion after a given element in a linked list. (7)
6. (a) Create Huffman code for the following object whose frequency of occurrence in the message are also given. (6)

Object	Frequency
A	60%
B	25%
C	10%
D	3%
E	2%

- (b) Find all possible path matrix PK for following given adjacency matrix. (9)

$$A = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

7. (a) What is Hashing? Explain various hashing functions with examples. (7)
- (b) What an AVL tree? How are elements inserted and removed from it. (8)