

**MCA 1st Semester Examination, 2024**

**MCA**

*( Data Structure and Algorithm )*

PAPER – MCA-103

*Full Marks : 100*

*Time : 3 hours*

**Answer all questions**

*The figures in the right hand margin indicate marks*

*Candidates are required to give their answers in their own words as far as practicable*

**GROUP – A**

**1. Answer any five questions : 2 × 5**

**(a) Write the differences between structure and union in C language.**

*( Turn Over )*

- (b) What is the difference between regular recursion and tail recursion ? Provide an example.
- (c) What are the different storage classes in C language ?
- (d) How is the divide-and-conquer approach applied in Merge Sort ?
- (e) What do you mean by branch and bound technique ?
- (f) How backtracking approach is used in solving a problem ?
- (g) How any tree is represented as the binary tree ? Give one example.
- (h) What is threaded binary tree ?

GROUP – B

Answer any four questions : 15 × 4

2. (a) How does counting sort work ?
- (b) What is the complexity of counting sort ?
- (c) Which sorting technique is dependent on counting sort ?
- (d) Considering the following data, use that sorting algorithm which is dependent on counting sort  
14, 173; 9, 92, 64, 80, 4, 1, 44, 110  
3 + 1 + 1 + 10
3. (a) Explain the BFS and DFS algorithms in detail, including their applications.
- (b) Given two strings “AGGTAB” and “GXTXAYB”. Construct the Longest Common Subsequence (LCS) table using the dynamic programming approach to

find the length of the LCS. Also trace back through the table to identify the LCS itself. 5 + 10

4. Write an algorithm to implement a doubly linked list. You can use abstract data type. Perform the following operations. 3 × 5

(a) Insert a node at the beginning

(b) Insert a node at the end

(c) Delete a node from the end

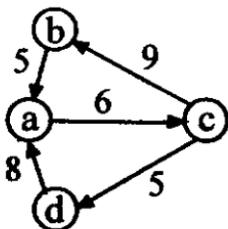
(d) Display the entire list

(e) Display the entire list in reverse order.

5. (a) Differentiate between Dijkstra's algorithm and Floyd-Warshall algorithm.

(b) Derive the shortest paths between all pair of vertices of the following graph by Floyd-Warshall algorithm. 5 + 10

( 5 )



6. (a) Write an algorithm to implement stack using linked list.
- (b) What are the advantages of linked list over array ?
- (c) What is sparse matrix ?
- (d) Why do we use sparse matrix instead of normal matrix ?  $7 + 3 + 2 + 3$
7. (a) Write down the algorithm of Quicksort.
- (b) Derive the recurrence relation for Quick Sort and find out the time complexity in best case and worst-case scenarios.  $8 + 7$

8. (a) Briefly explain the Kruskal's algorithm for minimum spanning tree.
- (b) State the Circuit Satisfiability problem.
- (c) What is the necessity of approximation schemes ?
- (d) Discuss UNION-FIND algorithm for set manipulation. 6 + 2 + 2 + 5
9. Write short notes on (any *three*) : 5 × 3
- (a) Column major and row major representation of multidimensional array
- (b) Insertion sort
- (c) Polynomial representation using array
- (d) Insertion in binary search tree
- (e) Infix to postfix conversion.

**[ Internal Assessment – 30 Marks ]**

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