

**M. SC. (MATHEMATICS WITH
APPLICATIONS IN COMPUTER
SCIENCE) (MSCMACS)**

Term-End Examination

June, 2026

**MMTE-002 : DESIGN AND ANALYSIS OF
ALGORITHMS**

Time : 2 Hours

Maximum Marks : 50

Note : (i) Attempt any **four** questions from question nos. 1 to 5. Question no. 6 is compulsory.

(ii) Use of calculator is not allowed.

1. (a) Sort the following numbers using Insertion sort algorithm showing all the steps : 5

40, 20, 70, 10, 15, 35

- (b) Draw a binary search tree for the following inputs : 5

13, 14, 3, 10, 5, 16, 12, 11, 26

Give the pre-order traversal output for the binary search tree you have constructed.

2. (a) Explain the terms average and worse case time complexities of a sorting algorithm. What are they for the Quick sort algorithm ? Give reasons for your response. 5

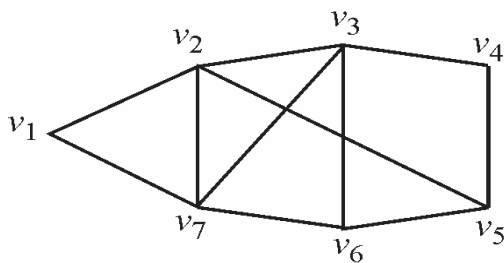
- (b) Compute the time complexity of Bellman-Ford algorithm. 5

3. (a) Find the maximal set of non-dominated points of $\{(1, 1), (2, 2), (5, 6), (1, 3), (6, 10)\}$ by using divide and conquer technique. 5

- (b) Find the optimal Huffman tree and the Huffman code for the following set of frequencies : 5

A : 14, B : 24, C : 4, D : 6, E : 9, F : 12,
G : 8

4. (a) Explain all the steps, create a minimum heap with the following values : 5
21, 54, 76, 3, 95, 12, 41, 29, 9, 87
- (b) Determine a Longest Common Subsequence (LCS) of $X = \langle 2, 1, 4, 2, 3 \rangle$ and $Y = \langle 2, 4, 2, 3 \rangle$ by using Dynamic Programming technique. 5
5. (a) Explaining the steps, find a spanning tree of the following graph by using Depth First Search (DFS) algorithm starting at v_1 : 5



- (b) Derive the recurrence relation for number of operations in Merge sort and solve it. 5

6. Which of the following statements are True and which are False ? Justify your answers. 5×2=10

- (a) Merge sort algorithm is a stable sorting algorithm.
- (b) Every NP-hard problem is also a NP-complete problem.
- (c) In the dynamic programming approach, the optimal solution is not always achievable.
- (d) An array in ascending order is a max-heap.
- (e) If the weights of the edges of a graph are distinct, the graph has a unique minimal spanning tree.

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