TMC–501

M. C. A. (FIFTH SEMESTER)
END SEMESTER EXAMINATION, 2021-22
DESIGN AND ANALYSIS OF ALGORITHMS

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any *two* sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are **twenty**.

(iv) Each question carries 10 marks.

1. (a) Explain the various criteria used for analyzing algorithms. List the properties of various asymptotic notations. (CO1)

(b) Design an algorithm for merge sort and analyze its time complexity. (CO1)
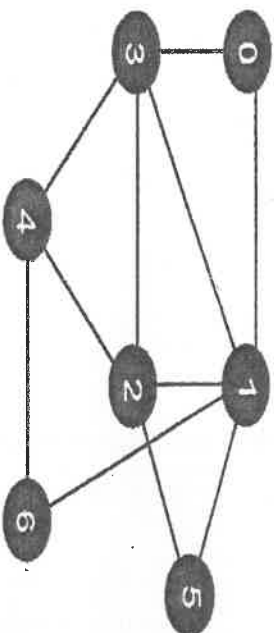

(c) Design an algorithm for DFS and analyze its time complexity. Find the d.f.s. of the given graph : (CO4)

5. (a) You are given the sequence {4, 10, 3, 12, 20 and 7}. The 5 matrices have size 4 × 10, 10 × 3, 3 × 12, 12 × 20, 20 × 7. Use chain matrix multiplication to find the maximum multiplications required. (CO3)

(b) Discuss the relationship between the class P, NP, NP-complex and NP-hard problems with suitable example of each class. (CO5)

(c) Write Rabin-Karp algorithm and analyze its time complexity. (CO5)

(c) Solve the following recurrence relation using Master's theorem : (CO1)

 (i) $T(n) = 2T(n/2) + n \log n$

 (ii) $T(n) = 3T(n/2) + n^2$

2. (a) What do you understand by Binomial Heap ? How to merge two binomial heap ? (CO2)

 (b) What is Binary Search Tree ? Discuss the search, insert and delete operation on BST with example. (CO2)

 (c) Write an algorithm to find the minimum element in a max. heap. Also find the time and space complexity. (CO2)

3. (a) Discuss dynamic programming with a simple example. Find shortest path tree for the given graph : (CO4)
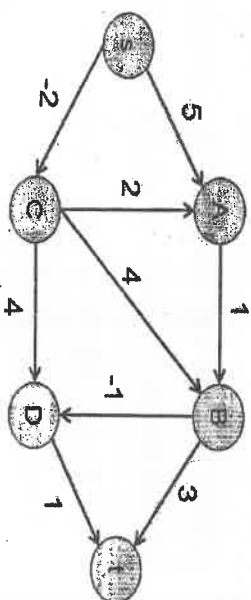
 (b) What is a Minimum Cost Spanning tree ? Explain Kruskal's minimum cost spanning tree algorithm with a suitable example. (CO4)

 (c) Write an algorithm to find negative cycle in a weighted graph. Analyze its time complexity. (CO4)

4. (a) What is meant by Divide and Conquer technique ? Write a sorting algorithm which uses divide and conquer technique. (CO1)

 (b) Describe the Dynamic 0/1 Knapsack Problem. Find an optimal solution for the dynamic programming 0/1 knapsack instance for $n = 3$, $m = 6$, profits are $(p_1, p_2, p_3) = (1, 2, 5)$, weights are $(w_2, w_2, w_3) = (2, 3, 4)$. (CO3)