Exam.Code:0916
Sub. Code: 33428

2056

B.E. (Computer Science and Engineering)

Fourth Semester

CS-401: Analysis and Design of Algorithms

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Section.

x-x-x

1. a) How does the Master's Theorem help in solving recurrences, and what are its limitations? 10

   b) Draw a 4-Queen's solution on a 4 X 4 chessboard that satisfies the backtracking constraints.

   c) Name any two problems that can be solved using greedy algorithms.

   d) Why is the Matrix-chain Multiplication problem solved using Dynamic Programming instead of a Greedy approach?

   e) How do approximation algorithms provide value when dealing with NP-hard optimization problems?

Section - A

2. a) Arrange the following functions in increasing order of asymptotic growth rate: nlogn, n^2, 2^n, log n, n!. 4

   b) A university maintains a sorted database of 500,000 student records based on roll numbers. A system must quickly find the details of a particular student. Explain how Binary Search can be used to locate the required record. Illustrate the search process and analyze its time complex 6

3. a) Given a network of five servers represented as a weighted graph, assume or draw a suitable graph on your own, and explain how Prim's Algorithm constructs the Minimum Spanning Tree (MST) starting from any arbitrary vertex. 5

   b) Why is Dijkstra's algorithm considered a Greedy algorithm, while the Bellman-Ford algorithm is categorized as Dynamic Programming? 5

4. a) An array A=[12,5,7,3,8,15] is given. Perform Merge Sort on the array. Show all splitting and merging steps. Determine the final sorted array. 5

   b) Why does the Greedy strategy work perfectly for the Fractional Knapsack problem but fail for the 0/1 Knapsack problem? Justify your answer. 5

P.T.O.

Section - B

5. a) A smart city has multiple intersections connected by roads with different travel times. The system needs to compute the shortest travel time between every pair of intersections to optimize traffic signals. Explain how an All-Pairs Shortest Path algorithm can be used to solve this problem. 5

   b) How does Dynamic Programming help in solving the Longest Common Subsequence problem efficiently? Explain the steps involved. 5

6. a) Why is Backtracking considered more efficient than brute force search for solving constraint satisfaction problems? 4

   b) Define a Hamiltonian Cycle. Why does checking all possible paths take a long time in Hamiltonian Cycle problems? 6

7. a) Write short note on Approximation algorithms. 6

   b) What is the difference between Polynomial Time and Polynomial Time Verification? How do approximation algorithms provide a practical solution for NP-hard optimization problems? 4

x-x-x