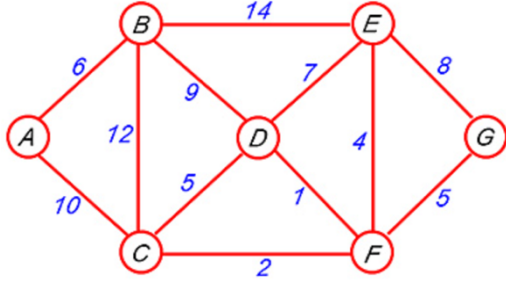
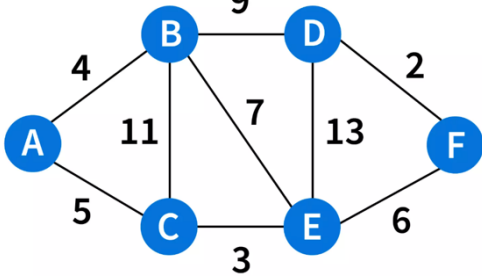
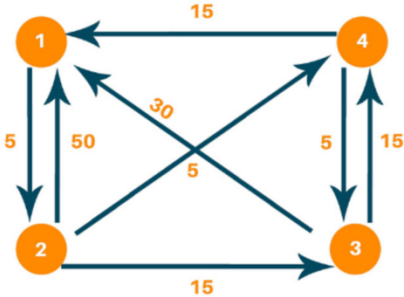


Name: Enrolment No:																	
UPES End Semester Examination, December 2025 Course: Design and Analysis of Algorithms Program: B.Sc. Course Code: CSEG2021 Semester: III Time : 03 hrs. Max. Marks: 100 Instructions:																	
SECTION A (5Qx4M=20Marks)																	
S. No.		Marks	CO														
Q1	Define time complexity. Explain the difference between worst-case and average-case analysis with suitable examples.	4	CO1														
Q2	State and explain asymptotic notation. Illustrate the difference between Big-O and Omega.	4	CO1														
Q3	Write the steps of Quick Sort using the divide-and-conquer approach.	4	CO2														
Q4	Explain the principle behind the Greedy method with a suitable real-life example.	4	CO2														
Q5	What are P, NP, and NP-Complete classes? Provide one example for each	4	CO4														
SECTION B (4Qx10M= 40 Marks)																	
Q6	Use Iteration Method to solve the recurrence: $T(n) = T\left(\frac{n}{4}\right) + n$ Show all steps and derive the asymptotic time complexity.	10	CO1														
Q7 (a)	Apply Merge Sort on the array [20, 7, 1, 54, 10, 3, 11]. Show recursive splitting, merging steps, and final sorted output. Also derive the complexity.	10	CO2														
OR																	
Q7 (b)	Given the following items and their frequencies: <table border="1" style="margin: 10px auto; width: 60%;"> <tr> <th>Item</th> <th>P</th> <th>Q</th> <th>R</th> <th>S</th> <th>T</th> <th>U</th> </tr> <tr> <td>Freq</td> <td>5</td> <td>7</td> <td>10</td> <td>15</td> <td>20</td> <td>45</td> </tr> </table> Construct the Huffman Tree, derive all codewords, and compute total weighted cost.	Item	P	Q	R	S	T	U	Freq	5	7	10	15	20	45	10	CO2
Item	P	Q	R	S	T	U											
Freq	5	7	10	15	20	45											

Q8	What is Minimum Spanning Tree (MST)? Apply Prim's and Kruskal's algorithm on the given graph to obtain the MST using both methods. 	10	CO2
Q9	Solve the 0/1 Knapsack problem using Dynamic Programming for: Weights: $W = \{1, 4, 5, 7\}$ Values: $V = \{1, 3, 4, 5\}$ Capacity: $C = 7$ Draw the complete DP table and compute the optimal value.	10	CO3
SECTION-C (2Qx20M=40 Marks)			
Q10	Using the given weighted graph, apply Dijkstra's algorithm to compute shortest path from source A to all nodes.  Draw the graph, show table updates, and final shortest path tree	20	CO3
Q11 (a)	Apply Floyd-Warshall algorithm to compute All-Pairs Shortest Path for the given weighted graph.  Show matrix updates at each step.	20	CO4
OR			
Q11 (b)	Using the backtracking technique, solve the 4-Queens problem. Draw the complete state-space tree, clearly show the backtracking steps, and indicate all dead-end configurations	20	CO4