CBCS SCHEME

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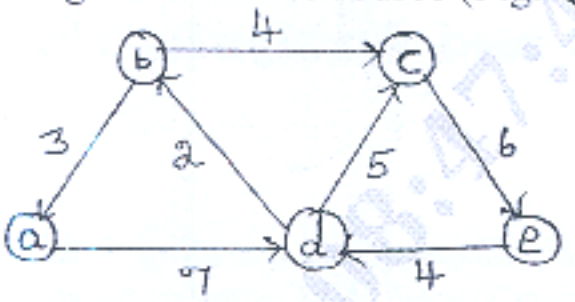
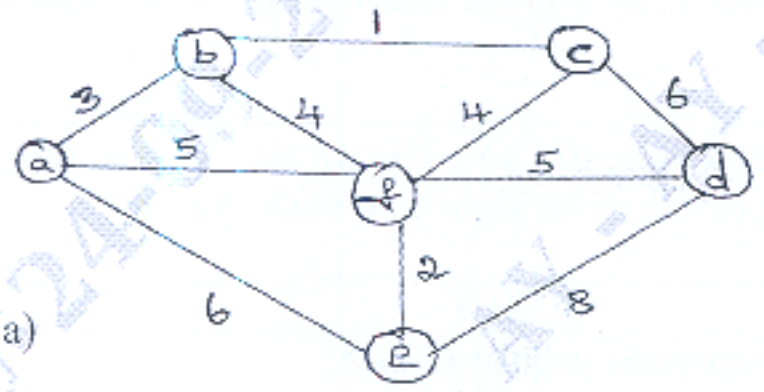
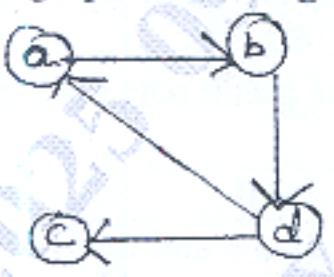
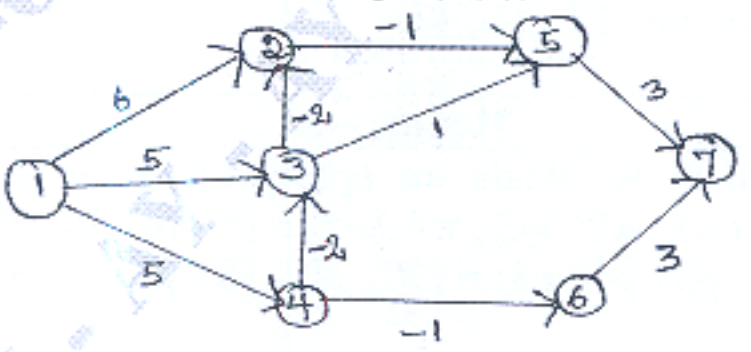
22MCA15

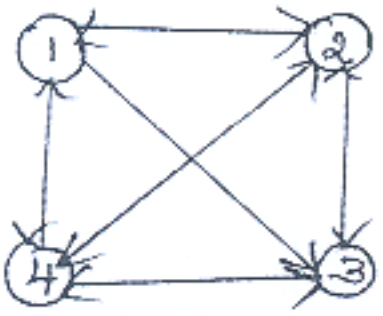
First Semester MCA Degree Examination, June/July 2025
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Design an Algorithm to search an element in an array using sequential search. Discuss the best case , worst and average case efficiency of this algorithm.	8	L2	CO1
	b.	Explain asymptotic notations Big O , Big Ω and Big θ that are used to compare the order of growth of an algorithm with example.	12	L2	CO1
		OR			
Q.2	a.	Explain in detail the important problem types.	8	L2	CO1
	b.	Give general plan of mathematical analysis of recursive algorithms. Describe Towers of Hanoi Problem and illustrate mathematical analysis of the Towers of Hanoi Problem.	12	L2	CO1
		Module – 2			
Q.3	a.	Write a recursive algorithm for binary search and also bring out its efficiency.	8	L2	CO1
	b.	Discuss quick – sort approach to sort an array and trace for the following data set. 5 , 3 , 1 , 9 , 8 , 2 , 4 , 7 Derive the best case complexity of quick sort algorithm.	12	L2	CO1
		OR			
Q.4	a.	Design an algorithm for merge and sort and derive its time efficiency.	8	L2	CO1
	b.	Write a recursive algorithm for finding maximum and minimum and also bring out its efficiency. Apply the MaxMin algorithm for the list 23 , 13 , - 5 , - 8 , 15 , 60 , 17 , 31 , 47	12	L2	CO2
		Module – 3			
Q.5	a.	Apply greedy method to obtain an optimal solution to the knapsack problem , M = 60 , (w1 , w2 , w3 , w4 , w5) = (5 , 10 , 20 , 30 , 40) and profit (p1 , p2 , p3 , p4 , p5) = (30 , 20 , 100 , 90 , 160). Find the total profit earned.	8	L2	CO1

	b.	Design Dijkstra's algorithm and apply the same to find the single source shortest path for graph taking vertex 'a' as source (Fig. Q5(b)).  Fig. Q5(b)	12	L2	CO1
		OR			
Q.6	a.	Find the minimum cost spanning tree using Kruskal's Algorithm , for the graph Fig. Q6(a).  Fig. Q6(a)	8	L2	CO1
	b.	Construct a Huffman code for the following data : Character: A, B, C, D, - Probability: 0.4, 0.1, 0.2, 0.15, 0.15 Encode the text ABACABAD and decode the text 100010111001010.	12	L2	CO1
		Module – 4			
Q.7	a.	Write Warshall's algorithm to compute transitive closure. Generate transitive closure of the given graph below Fig. Q7(a).  Fig. Q7(a)	12	L2	CO2
	b.	Apply Bellman ford algorithm to the graph given below, to find shortest path to all the vertices from vertex 1. (Fig. Q7(b)).  Fig. Q7(b)	8	L2	CO1
		OR			
Q.8	a.	Define Optimal Binary search tree. Find the optimal binary search tree for the keys given below : Key: A, B, C, D Probability: 0.1, 0.2, 0.4, 0.3	12	L2	CO1

	b.	Solve the following Travelling Sales Person (TSP) using dynamic programming.  $\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$ Fig. Q8(b)	**8**	**L2**	**CO1**
		Module – 5			
Q.9	**a.**	Explain the general procedure of backtracking and also give the solution for 4 – queens problem using state space tree.	**12**	**L2**	**CO3**
	b.	Apply backtracking to solve the following instance of the subset – sum problem : S = {5 , 10 , 12 , 13 , 15 , 18} and d = 30. Give all possible solutions.	**8**	**L2**	**CO3**
		OR			
Q.10	**a.**	What is branch and bound method? How it is different from backtracking. Apply branch and bound method for the following instance of assignment problem to find optimal solution. (Fig. Q10 (a)). $C = \begin{array}{c} \begin{matrix} J1 & J2 & J3 & J4 \end{matrix} \\ \begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix} \end{array} \begin{matrix} \text{person a} \\ \text{person b} \\ \text{person c} \\ \text{person d} \end{matrix}$ Fig. Q10(a)	**12**	**L2**	**CO3**
	b.	Explain the following with example : i) Class P problems ii) Class NP problems iii) NP complete problem iv) NP Hard problem	**8**	**L2**	**CO3**

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