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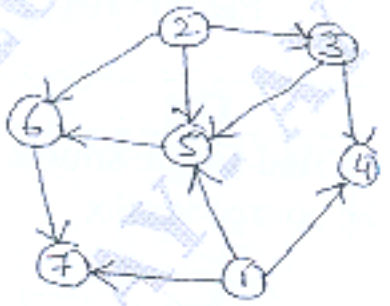
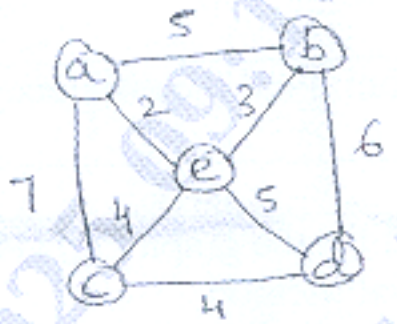
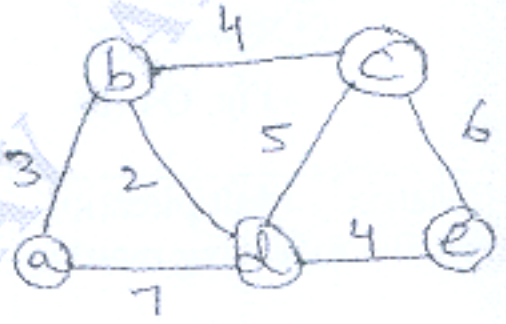
BCS401

Fourth Semester B.E/B.Tech. Degree Examination, June/July 2025
Analysis & Design 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
1	a.	Explain the algorithm design and analysis process in detail.	10	L2	CO1
	b.	Define Algorithm. Explain the asymptotic notations with example.	10	L2	CO1
		OR			
2	a.	Design an algorithm to search an element in an array using sequential search. Discuss the best-case, worst-case and average-case efficiency of this algorithm.	10	L3	CO1
	b.	Give the general plan for analyzing time efficiency of recursive algorithms and also analyze the tower of Hanoi recursive algorithm.	10	L3	CO1
		Module – 2			
3	a.	Apply quick sort algorithm to sort the list : 5, 3, 1, 9, 8, 2, 4, 7. Draw the tree of recursive calls made while tracing.	10	L3	CO2
	b.	Write Merge Sort Algorithm. Find the efficiency of the algorithm.	10	L2	CO2
		OR			
4	a.	Obtain the topological sort for the graph Fig. Q4 (a) using (i) Source Removal Method. (ii) Depth first Search Method.  Fig. Q4 (a)	10	L3	CO2
	b.	Explain Strassen's Matrix Multiplication. Apply Strassen's matrix multiplication to multiply the following matrices: $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \times \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.	10	L3	CO2

		Module – 3			
5	a.	Define AVL tree with an example. Construct an AVL tree of the list of keys : 5, 6, 8, 3, 2, 4, 7 indicating each step of key insertion and rotation.	**10**	**L3**	**CO3**
	b.	Define Heap. Apply heap sort to sort the list of numbers : 2, 9, 7, 6, 5, 8 in ascending order using array representation.	**10**	**L3**	**CO3**
		OR			
6	a.	Define 2-3 Tree. Construct 2-3 tree for the list of keys : 9, 5, 8, 3, 2, 4, 7 by indicating each step of key insertion and node splits.	**10**	**L3**	**CO3**
	b.	Design Har'spool algorithm for string matching. Apply this algorithm to find the pattern BARBER in the text : JIM_SAW_ME_IN_A_BARBERSHOP	**10**	**L3**	**CO3**
		Module – 4			
7	a.	Apply Floyd's algorithm to find the all pair shortest path for the given adjacency matrix. Fig. Q7 (a). $W = \begin{bmatrix} 0 & 1 & \infty & 1 & 5 \\ 9 & 0 & 3 & 2 & \infty \\ \infty & \infty & 0 & 4 & \infty \\ \infty & \infty & 2 & 0 & 3 \\ 3 & \infty & \infty & \infty & 0 \end{bmatrix}$ Fig. Q7 (a)	**10**	**L3**	**CO4**
	b.	Write Kruskal's algorithm to find minimum spanning tree. Illustrate with the following graph Fig. Q7 (b).  Fig. Q7 (b)	**10**	**L3**	**CO4**
		OR			
8	a.	Write Dijkstra's algorithm to find single source shortest path. Apply same for the given Fig. Q8 (a), a as the source vertex.  Fig. Q8 (a)	**10**	**L3**	**CO4**

	b.	Construct a Huffman tree and resulting code word for the following : Symbol | A | B | C | D | - Frequency | 0.35 | 0.1 | 0.2 | 0.2 | 0.15 Encode the text DAD. Decode the text 10011011011101.	10	L3	CO4
		Module – 5			
9	a.	Construct a state space tree to solve force queen's problem using backtracking.	10	L3	CO5
	b.	Solve the following instance of the knapsack problem by using branch and bound method. Item | 1 | 2 | 3 | 4 Weight | 4 | 7 | 5 | 3 Value | $40 | $42 | $25 | $12 Capacity W = 10	10	L3	CO5
		OR			
10	a.	Construct a state space tree for subset sum problem using branch and bound for the set S = {3, 5, 6, 7} and d = 15	10	L3	CO5
	b.	Explain the following terms : (i) P – Problems (ii) NP – Problems (iii) NP – Complete Problems (iv) NP – Hard Problems.	10	L2	CO5

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