CBCS SCHEME

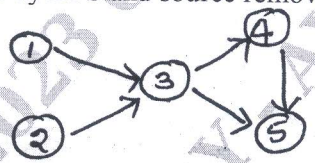
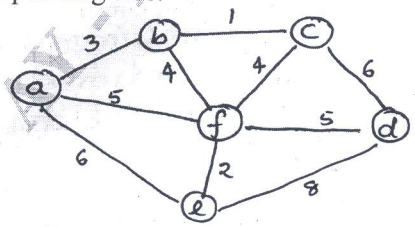
USN | | | | | | | | | | |

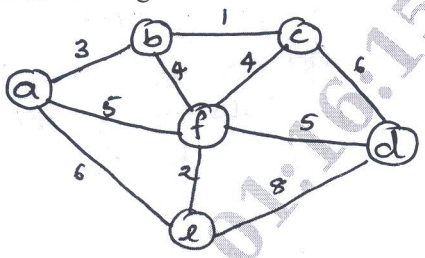
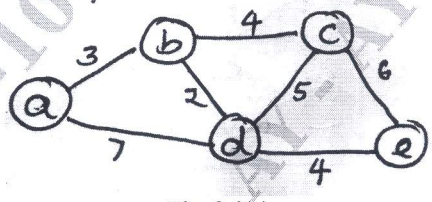
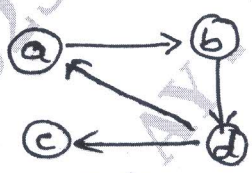
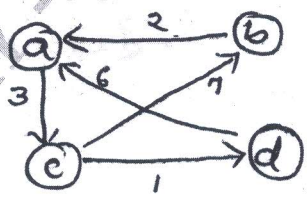
22MCA15

First Semester MCA Degree Examination, June/July 2023
Design and Analysis of Algorithm

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.	List out important problem types. Explain any three of them.	10	L1	CO1
	b.	What is asymptotic notation? List and explain the asymptotic notation	10	L1	CO1
		OR			
Q.2	a.	List out the fundamental data structures. Explain any two of them.	10	L1	CO1
	b.	What is an algorithms? List the algorithm specifications and explain.	5	L1	CO1
	c.	Prove the following theorem. If $t_1(n) \in 0\ (g_1(n))$ and $t_2(n) \in 0(g_2(n))$ then $t_1(n) + t_2(n) \in 0\ (\max\{g_1(n), g_2(n)\}$	5	L2	CO2
		Module – 2			
Q.3	a.	Discuss Strassen's matrix multiplications and analyze. Also find the product of $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ $B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ Using Strassen's matrix multiplication.	12	L2	CO2
	b.	Write an algorithm for quick sort and analyze its efficiency.	8	L3	CO3
		OR			
Q.4	a.	Write algorithm for merge sort find the time complexity. Sort the following using merge sort. 8, 3, 2, 9, 7, 1, 5, 4.	10	L3	CO3
	b.	What do you mean by topological order of a graph? Find the topological order of the given graph by DFS and source removal method  Fig Q4(b)	10	L2	CO2
		Module – 3			
Q.5	a.	Write the Prims algorithm to find minimal spanning tree. And apply the Prims algorithm to find the minimal spanning tree for a given graph and find the cost of the spanning tree.  Fig Q5(a)	10	L3	CO3

	b.	Write the Kruskal's algorithm. Find the minimum spanning tree for the given graph using Kruskal's algorithm.  Fig Q5(b)	10	L3	CO3
		OR			
Q.6	a.	Write the Dijkstra's algorithm to find single source shortest path problem. Apply Dijkstr's algorithm considering 'a' as the source vertex to find single source shortest path  Fig Q6(a)	10	L3	CO3
	b.	Define Huffman tree. Consider the five character alphabet with following probability. Character: A, B, C, D, - Probability: 0.35, 0.1, 0.2, 0.2, 0.15 i) Construct Huffman tree ii) Construct the Huffman code for all characters iii) Encode DAD iv) Decode 1001101101110111	10	L3	CO3
		Module – 4			
Q.7	a.	Write the Warshalls's algorithm and find the transitive closure for the given graph.  Fig Q7(a)	10	L2	CO2
	b.	Write the Floyd's algorithm and apply this algorithm to find all pair shortest path for the given diagraph.  Fig Q7(b)	10	L2	CO2

<table>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>Discuss the knapsack problem by dynamic programming with respect to the following example.
<table>
<tr><th>Items</th><th>Weight</th><th>Value</th></tr>
<tr><td>1</td><td>2</td><td>12</td></tr>
<tr><td>2</td><td>1</td><td>10</td></tr>
<tr><td>3</td><td>3</td><td>20</td></tr>
<tr><td>4</td><td>2</td><td>15</td></tr>
</table>
Capacity W = 5</td><td>12</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>Discuss optional Binary search trees and write its algorithm.</td><td>8</td><td>L1</td><td>CO1</td></tr>
<tr><td colspan="6" align="center">Module – 5</td></tr>
<tr><td>Q.9</td><td>a.</td><td>Explain Backtracking. Describe the 4-Queen problem and discuss the possible solution.</td><td>10</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Explain P, NP and NP complete problem with example</td><td>10</td><td>L2</td><td>CO2</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.10</td><td>a.</td><td>Explain Brand and Bound technique solve the assignment problem using branch and bound technique.
job → 1 2 3 4 ↓ person
$$\begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix} \begin{matrix} a \\ b \\ c \\ d \end{matrix}$$</td><td>10</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>What is state space tree? Draw the state space tree of the Back tracking algorithm applied to the instance S = {3, 5, 6, 7} and d = 15 of the sub set sum problem.</td><td>10</td><td>L2</td><td>CO2</td></tr>
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