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22MCA15

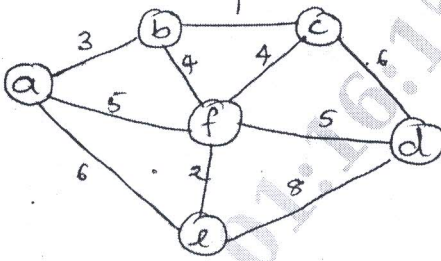**First Semester MCA Degree Examination, June/July 2023**
Design and Analysis of Algorithm

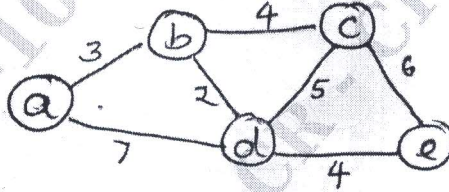Time: 3 hrs.   Max. Marks: 100

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	10	L2	CO2

Fig Q4(b)

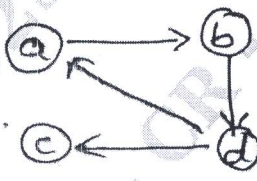|		Module – 3			
Q.5	a.	Write the Prims algorithm to find minimal spanning tree. And apply the Prims algorithm to find the minimal spanning tree for a given graph and find the cost of the spanning tree.	10	L3	CO3

Fig Q5(a)

	b.	Write the Kruskal's algorithm. Find the minimum spanning tree for the given graph using Kruskal's algorithm.	10	L3	CO3

Fig Q5(b)

OR

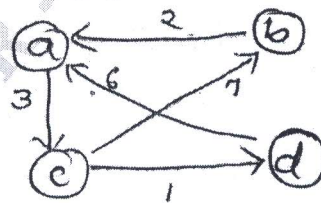|					
Q.6	a.	Write the Dijkstra's algorithm to find single source shortest path problem. Apply Dijkstr's algorithm considering 'a' as the source vertex to find single source shortest path	10	L3	CO3

Fig Q6(a)

	b.	Define Huffman tree. Consider the five character alphabet with following probability.	10	L3	CO3

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

Module – 4

Q.7	a.	Write the Warshalls's algorithm and find the transitive closure for the given graph.	10	L2	CO2

Fig Q7(a)

	b.	Write the Floyd's algorithm and apply this algorithm to find all pair shortest path for the given diagraph.	10	L2	CO2

Fig Q7(b)

		OR			
Q.8	a.	Discuss the knapsack problem by dynamic programming with respect to the following example.	12	L3	CO3

Items	Weight	Value	
1	2	12	Capacity W = 5
2	1	10	
3	3	20	
4	2	15	

	b.	Discuss optional Binary search trees and write its algorithm.	8	L1	CO1
		Module – 5			
Q.9	a.	Explain Backtracking. Describe the 4-Queen problem and discuss the possible solution.	10	L2	CO2
	b.	Explain P, NP and NP complete problem with example	10	L2	CO2
		OR			
Q.10	a.	Explain Brand and Bound technique solve the assignment problem using branch and bound technique. job → 1 2 3 4 ↓person $\begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix}$ a b c d	10	L3	CO3
	b.	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.	10	L2	CO2

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