CBCS SCHEME

USN 1 M E 2 2 C S 0 1 6 **BCS401**

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2024

Analysis and 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.

			M	L	C
		Module – 1			
Q.1	a.	What is an algorithm? Explain the fundamentals of algorithmic problem solving.	10	L2	CO1
	b.	Develop an algorithm to search an element in an array using sequential search. Calculate the best case, worst case and average case efficiency of this algorithm.	10	L3	CO1
		OR			
Q.2	a.	Explain asymptotic notations with example.	10	L2	CO1
	b.	Give the general plan for analyzing the efficiency of the recursive algorithm. Develop recursive algorithm for computing factorial of a positive number. Calculate the efficiency in terms of order of growth.	10	L3	CO1
		Module – 2			
Q.3	a.	Explain Strassen's matrix multiplication approach with example and derive its time complexity.	10	L3	CO2
	b.	What is divide and conquer? Develop the quick sort algorithm and write its best case. Make use of this algorithm to sort the list of characters: E, X, A, M, P, L, E.	10	L2	CO2
		OR			
Q.4	a.	Distinguish between decrease & conquer and divide & conquer algorithm design techniques with block diagram. Develop insertion sort algorithm to sort a list of integers and estimate the efficiency.	10	L3	CO2
	b.	Define topological sorting. List the two approaches of topological sorting and illustrate with examples.	10	L2	CO2
		Module – 3			
Q.5	a.	Define AVL tree with an example. Give worst case efficiency of operations on AVL tree. 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. Explain the bottom-up heap construction algorithm. 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			
Q.6	a.	Define 2-3 tree. Give the worst case efficiency of operations on 2-3 tree. Build 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 Horspool 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			
Q.7	a.	Apply Dijkstra's algorithm to find the single source shortest path for given graph [Fig.Q7(a)] by considering 's' as source vertex. Illustrate each step.	10	L3	CO4

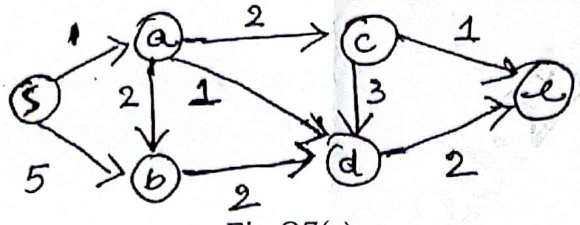

Fig.Q7(a)

b. Define transitive closure. Write Warshall's algorithm to compute transitive closure. Illustrate using the following directed graph. — 10 | L3 | CO4

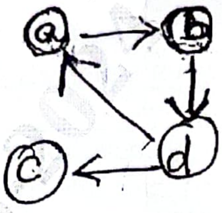

Fig.Q7(b)

OR

Q.8 a. Define minimum spanning tree. Write Kruskal's algorithm to find minimum spanning tree. Illustrate with the following undirected graph. — 10 | L3 | CO4

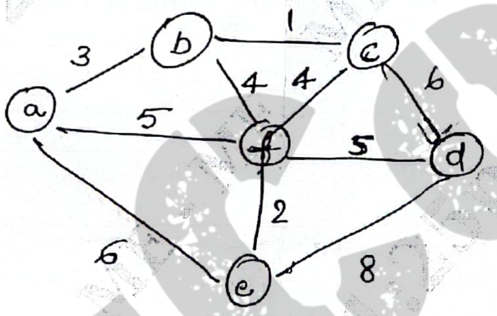

Fig.Q8(a)

b. Construct Huffman Tree and resulting code for the following: — 10 | L3 | CO4

Character	A	B	C	D	-
Probability	0.4	0.1	0.2	0.15	0.15

(i) Encode the text : ABACABAD

(ii) Decode the text : 100010111001010

Module – 5

Q.9 a. Explain n-Queen's problem with example using backtracking approach. — 10 | L2 | CO5

b. Solve the following instance of the knapsack problem by the branch-and-bound algorithm. Construct state-space tree. — 10 | L3 | CO5

Item	Weight	Value
1	4	\$ 40
2	7	\$ 42
3	5	\$ 25
4	3	\$ 12

The knapsack's capacity W is 10.

OR

Q.10 a. Differentiate between Branch and Bound technique and Backtracking. Apply backtracking to solve the following instance of subset-sum problem S = {3, 5, 6, 7} and d = 15. Construct a state space tree. — 10 | L3 | CO5

b. Explain greedy approximation algorithm to solve discrete knapsack problem. — 10 | L2 | CO5

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