CBCS SCHEME

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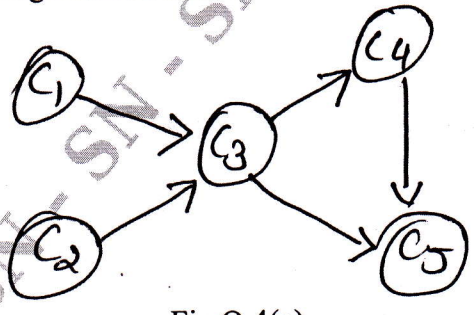
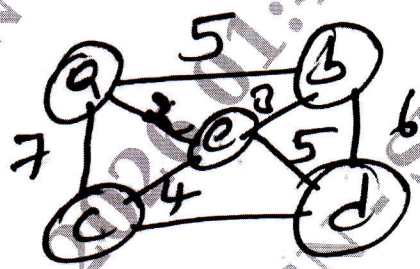
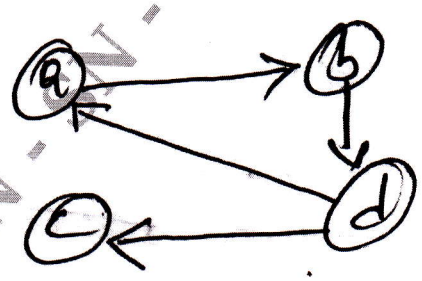
BCS401

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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.

		Module – 1	M	L	C
Q.1	a.	Define algorithm with the help of flow chart, explain the various stages of algorithm's design and analysis process.	10	L2	CO1
	b.	Compare the order of $1/2 .n (n-1)$ and n^2.	4	L3	CO1
	c.	List and explain asymptotic notations used to compare the orders of growth of an algorithm, with an example each.	6	L3	CO1
		OR			
Q.2	a.	Give the general plan for analyzing the time efficiency of recursive algorithm show that efficiency of tower of Hanoi is exponential.	10	L2	CO1
	b.	Prove that if $t_1(n) \in 0(g_1(n))$ and $t_2(n) \in 0(g_2(n))$, then $t_1(n) + t_2(n) \in 0\{\max g_1(n), g_2(n)\}$.	4	L3	CO1
	c.	Solve the following recurrence $x(n) = x(n-1) + 5$ for $n > 1$, $x(1) = 0$	6	L3	CO1
		Module – 2			
Q.3	a.	Define Divide and Conquer. Design an algorithm for merge sort and sort the list "EXAMPLE" in alphabetical order using merge sort.	10	L3	CO2
	b.	Design an algorithm for quick sort. Sort the list 65, 70, 75, 80, 85, 60, 55, 50, 45. Also derive the worst case complexity of quick sort.	10	L3	CO2
		OR			
Q.4	a.	Define decrease and conquer technique. What are the three major variations of decrease and conquer technique? Obtain the topological ordering for the following graph. Using source removal method.  Fig.Q.4(a)	10	L3	CO2

	b.	Design an algorithm to sort N number of elements using insertion sort. Illustrate the tracing of insertion sort algorithm for the following set of numbers 25, 10, 72, 18, 40, 11, 64, 58, 32, 9.	10	L3	CO2
		Module – 3			
Q.5	a.	What is heap? Design an algorithm to construct a heap for the elements of the given array by bottom up approach. Show heap construction of the given list 2, 9, 7, 6, 5, 8 by successive insertion using bottom up procedure.	10	L2	CO3
	b.	What is AVL tree? Explain the four types of rotations used to construct the AVL tree. Construct AVL tree for the set 5, 6, 8, 3, 2, 4, 7 by successive insertion.	10	L3	CO3
		OR			
Q.6	a.	Apply Horse Pool's algorithm to search for the pattern DEMOCRATIC from the text INDIA_IS_A_DEMOCRATIC_COUNTRY. Explain its working along with a neat shift table and algorithm to find the pattern string.	10	L3	CO3
	b.	Design an algorithm for comparision counting sort. Apply the same to sort the list 62, 31, 84, 96, 19, 47.	10	L3	CO3
		Module – 4			
Q.7	a.	Apply Kruskal's algorithm to find minimum cost spanning tree to the graph shown below source = a ;  Fig.Q.7(a)	10	L3	CO4
	b.	Explain the Warshall's algorithm to find the transitive closure of a directed graph. Apply it to the following graph.  Fig.Q.7(b)	10	L3	CO4

OR

Q.8 a. Construct a minimum cost spanning tree using prims algorithm for the following graph source = 'a'. (10 Marks, L3, CO4)

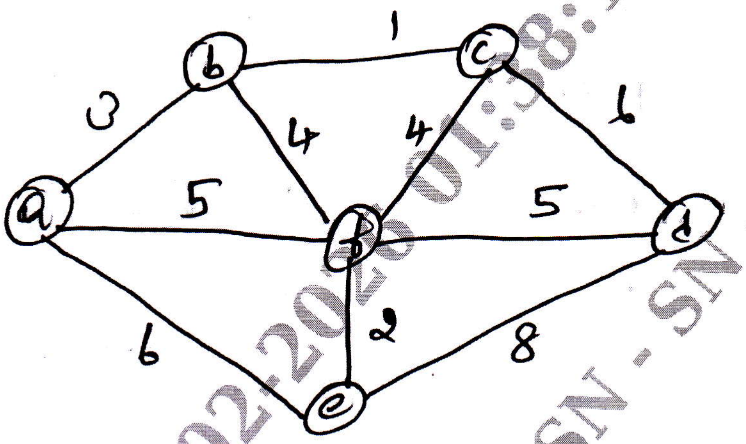


Fig.Q.8(a)

b. What is Huffman Tree? Explain the algorithm to construct the Huffman tree. Construct the Huffman tree for the following data: (10 Marks, L3, CO4)

Character	A	B	C	D	-
Probability	0.35	0.1	0.2	0.2	0.15

Module – 5

Q.9 a. Using Branch and Bound technique solve the below instance of knapsack problem. (10 Marks, L3, CO6)

Item	Weight	Value
1	2	12
2	1	10
3	3	20
4	2	5

Capacity = 5

b. Define Backtracking. Apply backtracking to solve the instance of the sum of subset problem s = {3, 5, 6, 7} and d = 15. (10 Marks, L3, CO6)

OR

Q.10 a. Explain the concept of P, NP, NP – complete and NP-Hard problem. (10 Marks, L2, CO5)

b. What are Decision Trees? Explain with example, how decision trees are used in sorting algorithms. (10 Marks, L2, CO6)

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