



Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025

## Analysis and Design of Algorithms

Time: 3 hrs.

Max. Marks: 100

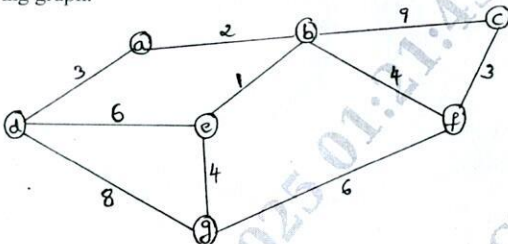
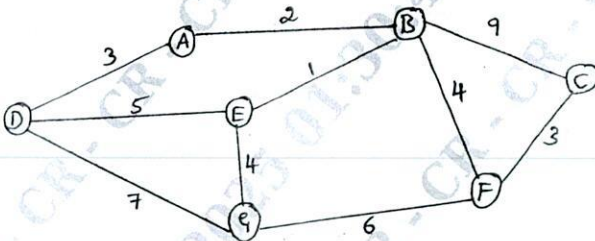
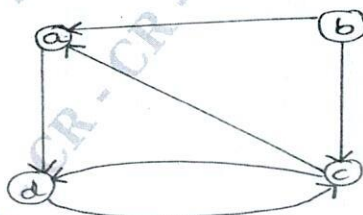
Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M: Marks, L: Bloom's level, C: Course outcomes.

Module – 1				M	L	C
Q.1	a.	Define algorithm Explain asymptotic notations Big oh, Big omega and Big theta notations.	08	L2	CO1	
	b.	Explain the general plan for analyzing the efficiency of a recursive algorithm. Suggest a recursive algorithm to find factorial of number. Derive its efficiency.	08	L3	CO1	
	c.	If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then show that $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$	04	L2	CO1	
OR						
Q.2	a.	With a neat diagram explain different steps in designing and analyzing algorithm.	08	L2	CO1	
	b.	Write an algorithm to find the max element in an array of n elements. Give the mathematical analysis of this non- recursive algorithm.	08	L3	CO1	
	c.	With the algorithm derive the worst case efficiency for selection sort.	04	L3	CO1	
Module – 2						
Q.3	a.	Explain the concept of divide and conquer. Design an algorithm for merge sort and derive its time complexity.	10	L3	CO2	
	b.	Design an algorithm for insertion algorithm and obtain its time complexity. Apply insertion sort on these elements. 89, 45, 68, 90, 29, 34, 17	10	L3	CO2	
OR						
Q.4	a.	Design an algorithm for Quick sort. Apply quick sort on these elements. 5, 3, 1, 9, 8, 2, 4, 7.	10	L3	CO2	
	b.	Explain Strassen's Matrix multiplication and derive its time complexity.	10	L2	CO2	
Module – 3						
Q.5	a.	Define AVL trees. Explain its four rotation types.	10	L2	CO3	
	b.	Design an algorithm for Heap sort. Construct bottom – up heap for the list 15, 19, 10, 7, 17, 16.	10	L3	CO4	
OR						
Q.6	a.	Design Horspool's Algorithm for string matching Apply Horspool algorithm to find pattern BARBER in the test: JIM_SAW_ME_IN_A_BARBERSHOP.	10	L3	CO4	
	b.	Define heap. Explain the properties of heap along with its representation.	10	L2	CO3	

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Module – 4																		
Q.7	a.	Construct minimum cost spanning tree using Kruskal's algorithm for the following graph.	10	L3	CO4													
																		
Fig. 7(a)																		
	b.	What are Huffman trees? Construct the Huffman tree for the following data	10	L3	CO4													
<table border="1" data-bbox="1324 561 1934 622"><tr><th>Character</th><th>A</th><th>B</th><th>C</th><th>D</th><th>-</th></tr><tr><td>Probability</td><td>0.4</td><td>0.1</td><td>0.2</td><td>0.15</td><td>0.15</td></tr></table> <p>i) Encode the text ABAC ABAD ii) Decode the code 100010111001010</p>			Character	A	B	C	D	-	Probability	0.4	0.1	0.2	0.15	0.15				
Character	A	B	C	D	-													
Probability	0.4	0.1	0.2	0.15	0.15													
OR																		
Q.8	a.	Apply Dijkstra's algorithm to find single source shortest path for the given graph by considering A as the source vertex.	10	L3	CO4													
																		
Fig. 8 (a)																		
	b.	Define transitive closure of a graph. Apply Warshall's algorithm to compute transitive closure of a directed graph.	10	L3	CO4													
																		
Fig. 8 (b)																		

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Module – 5																					
Q.9	a.	Explain the following with examples. i) P problem ii) NP problem ii) NP-Complete problem iv) NP – Hard problem	10	L2	CO5																
	b.	What is backtracking? Apply backtracking to solve the below instance of sum of subset problem. S = { 1, 2, 5, 6, 8} and d = 9.	10	L3	CO6																
OR																					
Q.10	a.	Illustrate N Queen's problem using backtracking to solve 4 – Queens problem.	10	L2	CO6																
	b.	Using Branch and Bound method solve the below instance of Knapsack Problem. <table border="1"><thead><tr><th>Item</th><th>Weight</th><th>Value</th></tr></thead><tbody><tr><td>1</td><td>4</td><td>40</td></tr><tr><td>2</td><td>7</td><td>42</td></tr><tr><td>3</td><td>5</td><td>25</td></tr><tr><td>4</td><td>3</td><td>12</td></tr></tbody></table> Capacity = 10	Item	Weight	Value	1	4	40	2	7	42	3	5	25	4	3	12	10	L3	CO6	
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