

## Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

USN

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### Fourth Semester B.E. Degree Examination Design and Analysis of Algorithms

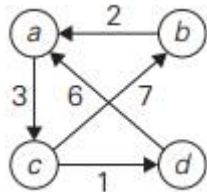
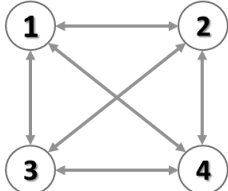
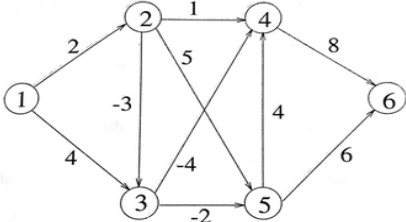
TIME: 03 Hours

Max. Marks: 100

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

Module -1			Bloom's Taxonomy Level	Marks
<b>Q.01</b>	<b>a</b>	Define an algorithm. Discuss the criteria of an algorithm with an example.	L1	6
	<b>b</b>	What are the various basic asymptotic efficiency classes? Explain Big O, Big Omega and Big Theta asymptotic notations.	L2	8
	<b>c</b>	Discuss about the important problem types and fundamental data structures.	L2	6
<b>OR</b>				
<b>Q.02</b>	<b>a</b>	Outline an algorithm to find maximum of n elements and obtain its time complexity.	L2	7
	<b>b</b>	Design an algorithm to search an element in an array using sequential search. Discuss the Best case worst case and average case efficiency of this algorithm	L3	7
	<b>c</b>	Discuss adjacency matrix and adjacency list representation of graph with an example	L2	6
<b>Module-2</b>				
<b>Q.03</b>	<b>a</b>	Explain the concept of Divide and Conquer. Write the recursive algorithm to perform binary search on list of elements	L2	7
	<b>b</b>	Develop a recursive algorithm to find the minimum and maximum element from the list. Illustrate with an example.	L3	7
	<b>c</b>	Apply Quick sort on the following set of elements: 60, 70, 75, 80, 85, 60, 55, 50, 45	L3	6
<b>OR</b>				
<b>Q.04</b>	<b>a</b>	Apply Source removal method to obtain Topological sort for the Given Graph: <div style="text-align: center;"> <pre> graph TD     C1((C1)) --&gt; C3((C3))     C2((C2)) --&gt; C3     C3 --&gt; C4((C4))     C3 --&gt; C5((C5))     C4 --&gt; C5           </pre> </div>	L3	6
	<b>b</b>	Write an algorithm to sort N numbers by applying Merge sort.	L3	7
	<b>c</b>	Apply Strassen's Matrix Multiplication method to multiply the given two matrices. Discuss how this method is better than general matrix multiplication method $\begin{bmatrix} 4 & 3 \\ 2 & 1 \end{bmatrix} \times \begin{bmatrix} 2 & 5 \\ 1 & 6 \end{bmatrix}$	L3	7

<b>Module-3</b>																												
<b>Q. 05</b>	<b>a</b>	Apply Greedy method to obtain an optimal solution to the Knapsack problem where Knapsack capacity m=15.																										
		<table border="1" style="margin: auto;"> <tr><td>Object</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>Weight</td><td>10</td><td>5</td><td>15</td><td>7</td><td>6</td><td>8</td><td>3</td></tr> <tr><td>Profit</td><td>2</td><td>3</td><td>5</td><td>7</td><td>1</td><td>4</td><td>1</td></tr> </table>	Object	1	2	3	4	5	6	7	Weight	10	5	15	7	6	8	3	Profit	2	3	5	7	1	4	1	L3	7
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Weight	10	5	15	7	6	8	3																					
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<b>b</b>	What is Job sequencing with deadlines problem? For the given data, find the optimal job sequence and maximum profit using Greedy approach.																											
		<table border="1" style="margin: auto;"> <tr><td>Jobs</td><td>J1</td><td>J2</td><td>J3</td><td>J4</td><td>J5</td></tr> <tr><td>Profits</td><td>60</td><td>100</td><td>20</td><td>40</td><td>20</td></tr> <tr><td>Deadlines</td><td>2</td><td>2</td><td>3</td><td>1</td><td>1</td></tr> </table>	Jobs	J1	J2	J3	J4	J5	Profits	60	100	20	40	20	Deadlines	2	2	3	1	1	L2	6						
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Deadlines	2	2	3	1	1																							
<b>c</b>	Apply Prim's algorithm to obtain the minimum cost spanning tree for the given weighted graph.																											
			L3	7																								
<b>OR</b>																												
<b>Q. 06</b>	<b>a</b>	Design Dijkstra's algorithm and apply the same to find single source shortest path for the given graph by considering 'S' as the source vertex																										
			L3	8																								
	<b>b</b>	Construct the Huffman tree for the following data																										
		<table border="1" style="margin: auto;"> <tr><td>Character</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>-</td></tr> <tr><td>Probability</td><td>0.5</td><td>0.35</td><td>0.5</td><td>0.1</td><td>0.4</td><td>0.2</td></tr> </table>	Character	A	B	C	D	E	-	Probability	0.5	0.35	0.5	0.1	0.4	0.2	L3	5										
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		Encode: a) BED    b) AB_CD																										
<b>c</b>	Define Heap. Sort the given list of Elements using heap sort: 2, 9, 7, 6, 5, 8																											
			L3	8																								
<b>Module-4</b>																												
<b>Q. 07</b>	<b>a</b>	Explain Multistage graphs with example. Write multistage graph algorithm using forward approach.																										
			L2	6																								
	<b>b</b>	Write Warshall's algorithm to compute transitive closure of a directed graph. Apply the same on the graph defined by the following adjacency matrix:																										
		$A = \begin{matrix} & \begin{matrix} a & b & c & d \end{matrix} \\ \begin{matrix} a \\ b \\ c \\ d \end{matrix} & \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix} \end{matrix}$	L3	8																								
<b>c</b>	Construct an optimal binary search tree for the following four-key set																											
		<table border="1" style="margin: auto;"> <tr><td>Key</td><td>A</td><td>B</td><td>C</td><td>D</td></tr> <tr><td>Probability</td><td>0.1</td><td>0.2</td><td>0.4</td><td>0.3</td></tr> </table>	Key	A	B	C	D	Probability	0.1	0.2	0.4	0.3	L3	6														
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Q. 08	a	Apply Floyd's algorithm to find all pair shortest path for the given graph		L3	7																									
	b	Find the optimal tour for sales person using dynamic programming technique for the given graph and its corresponding edge length matrix	 $\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$	L3	7																									
	c	Find the shortest path from node 1 to every other node in the given graph using Bellman-Ford algorithm		L3	6																									
		<b>Module-5</b>																												
Q. 09	a	What is the central principle of backtracking? Apply backtracking to solve the below instance of sum of subset problem $S = \{5, 10, 12, 13, 15, 18\}$ $d = 30$ .		L3	7																									
	b	Solve the below instance of assignment problem using branch and bound algorithm	<table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Job1</th> <th>Job2</th> <th>Job3</th> <th>Job4</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>9</td> <td>2</td> <td>7</td> <td>8</td> </tr> <tr> <td>b</td> <td>6</td> <td>4</td> <td>3</td> <td>7</td> </tr> <tr> <td>c</td> <td>5</td> <td>8</td> <td>1</td> <td>8</td> </tr> <tr> <td>d</td> <td>7</td> <td>6</td> <td>9</td> <td>4</td> </tr> </tbody> </table>		Job1	Job2	Job3	Job4	a	9	2	7	8	b	6	4	3	7	c	5	8	1	8	d	7	6	9	4	L3	7
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c	What is Hamiltonian circuit problem? What is the procedure to find Hamiltonian circuit of a graph?			L2	6																									
		OR																												
Q. 10	a	Illustrate N Queen's Problem using Back tracking to solve 4 Queen's problem		L3	8																									
	b	Explain the following: a] LC Branch and bound b] FIFO Branch and bound		L2	6																									
	c	Explain the classes of NP-Hard and NP-Complete problems		L2	6																									