SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

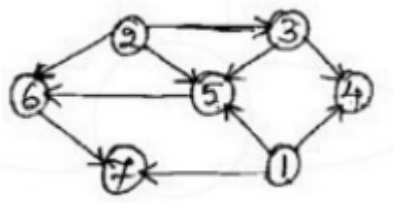
USN | | | | | | | | | | |

21CS44

Third Semester B.E. Degree Examination, Apr/May 2023
DESIGN AND ANALYSIS OF ALGORITHMS

Time: 3 hrs. **Max. Marks: 100**

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

Q. No.		Questions	Marks	BL/CO
		Module I		
1	a.	Define Space complexity and time complexity of an algorithm and compute the time complexity of Fibonacci number algorithm.	06	CL2/CO1
	b.	What are the various basic asymptotic efficiency classes? Illustrate Big O, Big Omega and Big Theta asymptotic notations with example.	07	CL3/CO1
	c.	Write and apply bubble sort to sort the list E, X, A, M, P, L, E in alphabetical order.	07	CL3/CO1
		OR		
2	a.	Explain the general plan for analyzing time efficiency of non-recursive algorithms.	06	CL2/CO1
	b.	Write a function to perform the addition of two matrix. Apply program step counter method and tabular method to estimate the time complexity.	07	CL3/CO1
	c.	Derive an algorithm using recursive analysis to find the number of binary digits in the binary representation of a positive decimal number and obtain its time complexity.	07	CL3/CO1
		Module II		
3	a.	Give the recursive algorithm to find maximum and minimum element from the list and apply the algorithm to find maximum and minimum to the list. [31, 76, 25, 12, -7, 8, 22, 70, -2, 4, -9]	10	CL3/CO2
	b.	Obtain topological sort for the graph using i) Source Removal Method ii) DFS Method 	10	CL3/CO2
		OR		
4	a.	Explain the three major variations of decrease and conquer technique with example for each. Apply insertion sort algorithm for the given data: 34, 21, 45, 89, 22, 67, 87, 11, 9.	10	CL3/CO2
	b.	Apply both Merge sort and Quick sort algorithm to sort the characters VIBGYOR.	10	CL3/CO2

Module III

5

a. Apply Greedy method to obtain an optimal solution to the Knapsack problem where Knapsack capacity m=15.

Object	1	2	3	4	5	6	7
Weight	10	5	15	7	6	8	3
Profit	2	3	5	7	1	4	1

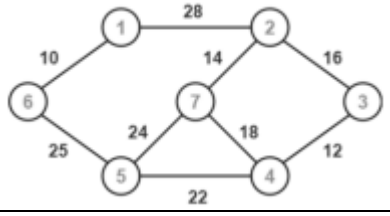
07 CL3/CO3

b. What is Job sequencing with deadlines problem? For the given data, find the optimal job sequence and maximum profit using Greedy approach.

Jobs	J1	J2	J3	J4	J5
Profits	60	100	20	40	20
Deadlines	2	2	3	1	1

06 CL2/CO3

c. Apply Prim's algorithm to obtain the minimum cost spanning tree for the given weighted graph.

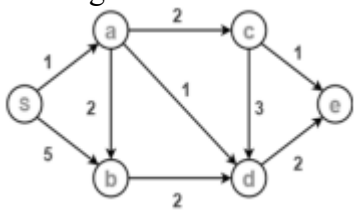


07 CL3/CO3

OR

6

a. 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.



07 CL3/CO3

b. Construct the Huffman tree for the following data:

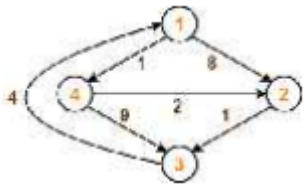
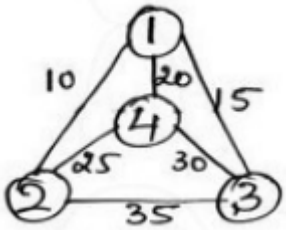
Character	A	B	C	D	E	-
Probability	0.5	0.35	0.5	0.1	0.4	0.2

i. Encode: a] BED b] AB_CD
ii. Decode: 0110110

06 CL2/CO3

c. Define Heap. Sort the given list of Elements using heap sort: 3, 2, 9, 7, 6, 5, 8, 1

07 CL3/CO3

<table>
<tr><td colspan="5">Module IV</td></tr>
<tr><td rowspan="3">7</td><td>a.</td><td>Apply Floyd's algorithm to find all pair shortest path for the graph given below.
 
</td><td>08</td><td>CL3/CO4</td></tr>
<tr><td>b.</td><td>Explain Multistage graphs with example. Write multistage graph algorithm using forward approach.</td><td>06</td><td>CL2/CO4</td></tr>
<tr><td>c.</td><td>Construct an optimal binary search tree for the following four–key set.
<table><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></td><td>06</td><td>CL3/CO4</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td rowspan="3">8</td><td>a.</td><td>Find the optimal tour for sales person using dynamic programming technique for the given graph and its corresponding edge length matrix
 
</td><td>08</td><td>CL3/CO4</td></tr>
<tr><td>b.</td><td>Write Warshall’s algorithm to compute transitive closure of a directed graph. Apply the same on the graph defined by the following adjacency matrix:
$A = \begin{array}{c} \\ a \\ b \\ c \\ d \end{array} \begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$</td><td>06</td><td>CL3/CO4</td></tr>
<tr><td>c.</td><td>Match the pattern BOABAB in the text BESS_KNEW_ABOUT_BOABAB using Horspool’s algorithm</td><td>06</td><td>CL2/CO4</td></tr>
<tr><td colspan="5">Module V</td></tr>
<tr><td rowspan="3">9</td><td>a.</td><td>Draw the state space tree to generate solutions to 4-Queens problem</td><td>4</td><td>CL2/CO5</td></tr>
<tr><td>b.</td><td>Apply backtracking method to solve subset sum problem for the instance n=6, d=30, S= {5, 10, 12, 13, 15, 18}.</td><td>8</td><td>CL3/CO5</td></tr>
<tr><td>c.</td><td>What are different computational models? Discuss in detail.</td><td>8</td><td>CL3/CO5</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td rowspan="2">10</td><td>a.</td><td>What is Hamiltonian circuit problem? What is the procedure to find Hamiltonian circuit of a graph?</td><td>4</td><td>CL2/CO5</td></tr>
<tr><td>b.</td><td>Solve the below instance of assignment problem using branch and bound algorithm.</td><td>8</td><td>CL3/CO5</td></tr>
</table>

		Person / Job1 Job2 Job3 Job4 a 9 2 7 8 b 6 4 3 7 c 5 8 1 8 d 7 6 9 4		
	c.	Apply Branch and Bound approach to solve the instance of 0/1 Knapsack problem. Knapsack Capacity W=10. Item 1 2 3 4 Weight 4 7 5 3 Value 40 42 25 12	8	CL3/CO5

Cognitive Levels of Bloom's Taxonomy

No.	CL1	CL2	CL3	CL4	CL5	CL6
Level	Remember	Understand	Apply	Analyze	Evaluate	Create

Course Outcomes

CO1	Solve the time complexity of recursive, non-recursive and brute force algorithm using asymptotic notations.	CL3
CO2	Solve the recurrence relation to obtain the performance of divide-and-conquer, decrease-and conquer approach.	CL3
CO3	Apply greedy technique, transform and conquer strategy to solve the problem for optimal solution.	CL3
CO4	Determine the time complexity for Dynamic-Programming paradigm and String-matching techniques.	CL3
CO5	Apply backtracking and branch-and-bound approach on combinatorial problems and categorize algorithms as P, NP, NP-complete and NP-hard classes.	CL3