Nirma University

Institute of Technology

Semester End Examination (IR/RPR), December - 2023

B. Tech. in Computer Science and Engineering, Semester-V

2CS503-O Design and Analysis of Algorithms

Roll / Exam No: 21BCE032 | Supervisor's Initial with Date:

Time: 3 Hours | Max Marks: 100

Instructions:
1. Attempt all the questions.
2. Figures to right indicate full marks.
3. Draw neat sketches wherever necessary.
4. Assume suitable data wherever required.

Section I

Q-1 Do as directed **[16]**

A Solve the following recurrences: [8]

(a) $T(n)-8T(n-1) = 14n+5$

(b) $T(n) = 3T(n/4) + n^2$ (Using Recurrence Tree method)

B Find out the θ notation for the following: - [8]

1. $f(n) = 27n^2 + 16n$
2. $f(n) = 3 * 2^n + 4n^2 + 5n + 3$

Q-2 Do as directed **[18]**

A Sort the following elements in descending order using Heap Sort Algorithm. [6]

65, 77, 5, 23, 32, 45, 99, 83, 69, 81

OR

A Using greedy algorithm, find an optimal schedule for following jobs with $n=5$. [6]

Profits: (a, b, c, d, e) = (100,19,27,25,15)

Deadline: (d_1, d_2, d_3, d_4, d_5) = (2, 1, 2, 1, 3)

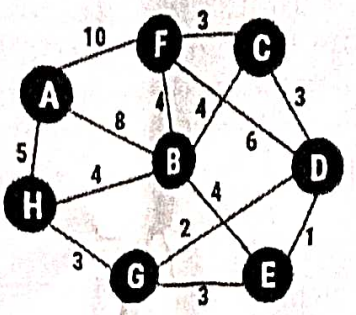
B Analyse the following code and find the time complexity of the following: [6]

(i)	*(ii)*
l=0 *for i=1 to n do* *for j=1 to n^2 do* *for k=1 to n^3 do* *l=l+1*	*x=0* *for i=1 to n do* *for j=1 to n^2 do* *for k=1 to $\sqrt{n}$ do* *x=x+1*

OR

B Discuss the general template of divide and conquer algorithm.

C Find out MST (Minimum Spanning Tree) for the following graph using Prims algorithm. [6]

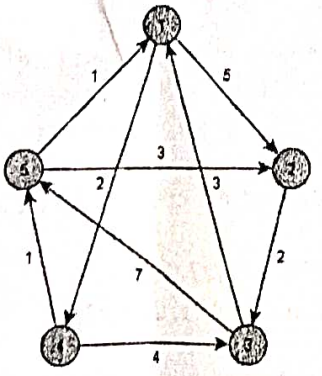


Q-3 Do as directed **[16]**

A Device Back tracking solution for finding Hamiltonian cycle for given graph. Trace it for the following adjacency matrix of a graph. [8]

	A	B	C	D	E
A	1	0	1	0	0
B	0	1	1	0	1
C	1	1	0	1	0
D	0	1	1	0	0
E	1	0	0	1	0

B Discuss the applicability of Bellman Ford algorithm for different kinds of graphs and Find all pair shortest path for the following graph using Bellman Ford algorithm. [8]



Section II

Q-4 Do as directed **[16]**

A What is the optimal way to compute A1*A2*A3*A4, where the dimensions of the matrices are: A1: 10 × 20, A2: 20 × 1, A3: 1 × 40, A4: 40 × 5 ? The optimal way is the one that involves the least number of scalar multiplications. Report the optimal parenthesising and minimum number of scalar multiplications. Show computation for each step. [8]

B Find an optimal Huffman code for the following set of frequency. [8]

Characters	A	B	C	D	E	F
Frequencies	24	12	10	8	8	5

Q-5 Do as Directed. **[18]**

A What is amortized analysis of an algorithm? Compare accounting method, potential method and aggregate analysis with a suitable example. [6]

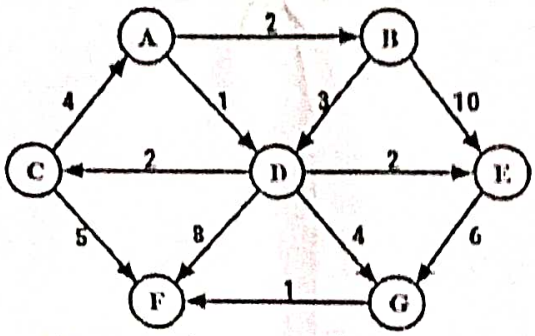
OR

A Explain the Algorithm for solving Knapsack problem for the following data using Greedy Algorithm. [6]

Assume maximum knapsack capacity W = 7

Items	Weight	Value
I_1	5	6
I_2	4	5
I_3	3	4

B Write Dijkstra shortest path algorithm. Also apply the algorithm on the following figure. Assume vertex "A" as the source vertex [6]



C Making change problem can be solved by Greedy Algorithm as well as Dynamic programming approach. True / false justify with suitable example. [6]

OR

C What do you understand by P, NP, NP complete and NP hard problems, explain with suitable examples? [6]

Q-6 **Do as directed** **[16]**

A Apply Hungarian algorithm to assign the four tasks to four operators. The assigning costs are given in Table. Evaluate Time complexity of the algorithm. [8]

		Operators			
		1	2	3	4
Tasks	A	20	28	19	13
	B	15	30	31	28
	C	40	21	20	17
	D	21	28	26	12

B The N Queen is the problem of placing N chess queens on an N×N chessboard so that no two queens attack each other. Design an algorithm for solving N-Queen Problem using backtracking and evaluate time complexity. [8]