BENNETT UNIVERSITY
THE TIMES GROUP

Enrolment No: E22CSEU0827 Name of Student: MADHAV GUPTA

Department/ School: SCSET

END TERM EXAMINATION, EVEN SEMESTER 2024

COURSE CODE: CSET206 **MAX. DURATION: 2 HRS**

COURSE NAME: Design and Analysis of Algorithms

PROGRAM: BTECH **TOTAL MARKS: 35**

Mapping of Questions to Course and Program Outcomes						
	Section A	**Section B**				
Q.No.	A1	B1	B2	B3	B4	B5
CO	1	2	3	1	3	2
PO	1-5,9-12	1-5,9-12	1-2,4-5,9-12	1-5,9-12	1-2,4-5,9-12	1-5,9-12
BTL	3	3	4	3	3	3

GENERAL INSTRUCTIONS: -

1. Do not write anything on the question paper except **name, enrolment number** and **department/school.**
2. Carrying mobile phone, smart watch and any other non-permissible materials in the examination hall is an act of **UFM.**

COURSE INSTRUCTIONS: -

1. Attempt **ALL** the questions, **ALL** questions are mandatory.
2. **Section A** carries **10** marks and **Section B** carries **25** marks.
3. **Any data you feel missing suitably be assumed and stated clearly.**

SECTION A **(10Qx1M =10 Marks)**

A1) Answer **ALL** the questions

I. What is the minimum number of comparisons required to find maximum and minimum elements from an array having 1024 elements?

II. Define the algorithm and its various characteristics in detail.

BENNETT UNIVERSITY
THE TIMES GROUP

III. Solve the following recurrence relation using the Backward Substitution method:

$$T(n) = T\left(\frac{n}{2}\right) + \frac{1}{\log_2 n} \quad \text{with } n = 2^k \text{ and } T(2) = 1$$

IV. Identify the recurrence relation for the number of ways to climb n stairs, if you can climb either 1 or 2 steps at a time.

V. Explain amortized analysis with an example.

VI. Define flow and its three properties with examples.

VII. Explain the Longest Common Subsequence (LCS) problem with an example.

VIII. Define Live Node, E-Node, and Dead Node in the context of backtracking.

IX. Define the articulation point and biconnected graph with an example.

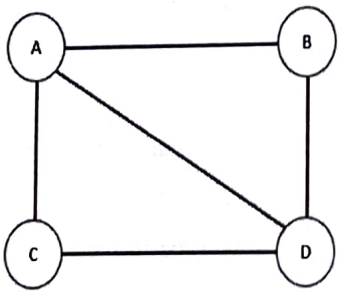
X. Explain a scenario where Dijkstra's algorithm fails to produce the shortest path.

SECTION B (5Qx5M = 25 Marks)

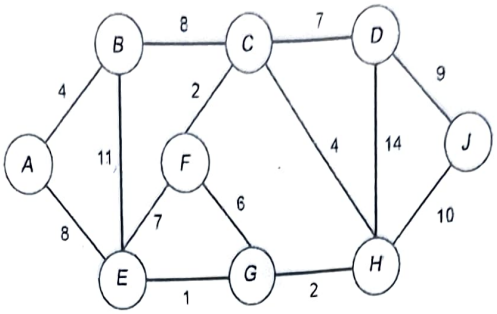
B1) Apply Huffman encoding to create a Huffman Tree for the following given file, consisting of symbols and their respective frequencies, and evaluate the resulting memory savings achieved through this encoding process. **(3+2 = 5 Marks)**

Symbol	a	e	i	o	u	s	t
Frequency	10	15	12	3	4	13	1

B2) I. Demonstrate backtracking with an example, apply the backtracking approach to find one Hamiltonian cycle in the following graph starting from A. **(1+2=3 Marks)**



II. Analyse the following graph, depicting cities as vertices and roads as edges with associated repair costs. Determine the minimum cost required to repair the roads, ensuring that all cities stay connected without forming cycles, and provide a comprehensive list of the roads that need to repair. **(2 Marks)**



B3) I. Explain the Divide and Conquer Karatsuba algorithm to multiply 2 large integer numbers with an example. **(2 Marks)**

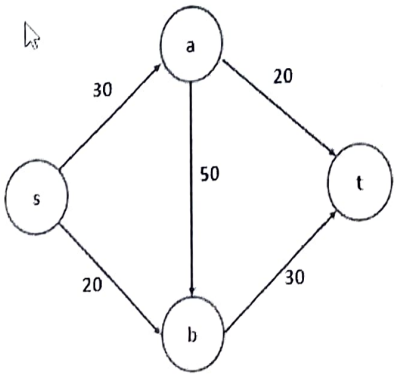
II. Solve the following recurrence relation using the recursion tree approach **(3 Marks)**

$$T(n) = T\left(\frac{n}{3}\right) + T\left(\frac{2n}{3}\right) + n$$

B4) Utilize dynamic programming to find the minimum number of multiplication operations and determine the optimal order for multiplying all matrices in the given chain, consisting of matrices A_1, A_2, A_3, and A_4 with dimensions specified as p_0=7, p_1=8, p_2=4, p_3=5, and p_4=3. **(5 Marks)**

B5) I. Explain P, NP, NP-Hard, and NP-Complete class with one example each. **(2 Marks)**

II. Apply Ford Fulkerson algorithm to compute maximum flow in the following flow network. **(3 Marks)**



-ALL THE BEST-