

**MASTER OF COMPUTER
APPLICATIONS
(MCA-NEW)**

Term-End Examination

June, 2023

**MCS-211 : DESIGN AND ANALYSIS OF
ALGORITHMS**

Time : 3 Hours

Maximum Marks : 100

(Weightage : 70%)

Note : *Question No. 1 is compulsory and carries 40 marks. Attempt any **three** questions from the rest.*

1. (a) What is an algorithm ? What are its desirable characteristics ? 5
- (b) What are asymptotic notations ? Explain any *two* asymptotic notations with suitable example for each. 5
- (c) Solve the following recurrence relation using substitution method : 5

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

- (d) Write and explain binary search algorithm with an suitable example. 5
- (e) Explain Depth First Search (DFS) algorithm with an suitable example. 5
- (f) What is Dynamic Programming approach of problem solving ? Write the steps involved in dynamic programming. 6
- (g) What are Optimization and Decision problems ? Give an example of each. 5
- (h) Design a state space tree for the given subset sum problem. $S = \{4, 6, 7, 8\}$, $W = 8$. 4
2. (a) Explain all the three cases of Master's Theorem. Apply Master's theorem to solve the given recurrence relation : 8

$$T(n) = 9T\left(\frac{n}{3}\right)$$

- (b) Evaluate :

$$p(x) = 3x^4 + 2x^3 - 5x + 7 \text{ at } x = 2$$

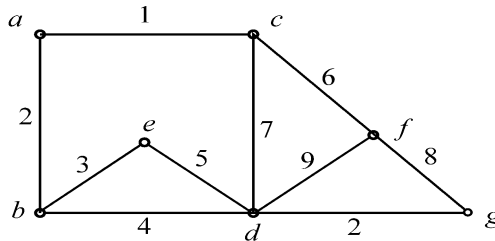
using Horner's rule. Show stepwise iterations. 6

- (c) Prove that for all non-negative integers 'n' : 6

$$2^0 + 2^1 + 2^2 + \dots + 2^n = 2^{n+1} - 1.$$

3. (a) What is Huffman coding ? Write the steps for building the Huffman tree with an example. 6
- (b) Explain Quick sort algorithm using divide and conquer approach. 6
- (c) What are strongly connected components ? Explain how adjacency matrix and adjacency list are created for a connected graph with the help of a suitable diagram. 2+3+3

4. (a) Show the step by step execution of Kruskal's algorithm for the following graph : 6



- (b) What is Matrix chain multiplication problem ? Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions are as follows : 2+6

Matrix	Dimension
A ₁	30 × 35
A ₂	35 × 15
A ₃	15 × 5

- (c) Explain Rabin Karp Algorithm for string matching with suitable example. 6
5. Write short notes on any *four* of the following :
4×5=20
- (i) Deterministic *vs.* Non-deterministic algorithms
 - (ii) CLIQUE and vertex cover problem
 - (iii) Backtracking problem with example
 - (iv) Bellman-Ford algorithm
 - (v) Fractional Knapsack problem