

**MASTER OF COMPUTER  
APPLICATIONS**

**(MCA-NEW)**

**Term-End Examination**

**December, 2024**

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

*Time : 3 Hours*

*Maximum Marks : 100*

*Weightage : 70%*

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**Note :** (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **three** questions from the  
rest.*

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1. (a) Write Euclid's algorithm to find the GCD of  
two natural numbers  $m$  and  $n$ . 5

- (b) Arrange the following growth rates in increasing order : 5

$O(n^2)$ ,  $O(2^n)$ ,  $O(n \log n)$ ,  $O(2!)$ ,

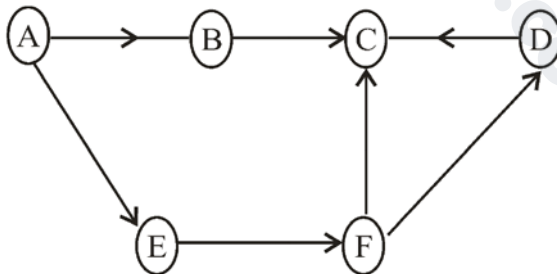
$O(1)$ ,  $O(\log n)$

- (c) Give a recursive function to find the height of a binary tree. What is the running time of this algorithm ? 5

- (d) Compute  $x^{283}$  by using left-to-right binary exponentiation. 5

- (e) Write binary search algorithm and evaluate its time complexity in the best and worst case. 5

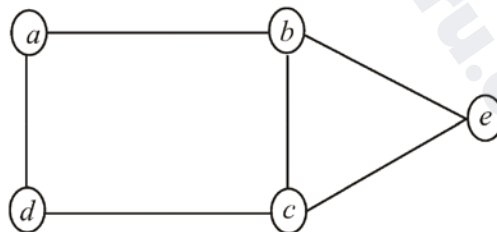
- (f) Find the topological ordering of the following graph : 5



- (g) For the following given letter and their frequencies, construct the Huffman tree : 5

$C_i$	$f_i$
$a$	65
$b$	3
$c$	4
$d$	10
$e$	3
$f$	6

- (h) What are the disadvantages of using Dijkstra's algorithm ? List out any *four*. 5
2. (a) Define a BFS tree. Give the breath first traversal for the undirected graph given below, starting from vertex ' $a$ ' : 10



Also give any *three* applications of DFS.

- (b) Write Bubble Sort Algorithm. Using bubble sort sort the following sequence :

20, 15, 25, 10, 8, 38, 27, 11

Find the total number of comparisons required by the bubble sort algorithm in sorting the list. 10

3. (a) Write Merge Sort Algorithm. Apply the same to sort the array of elements : 10

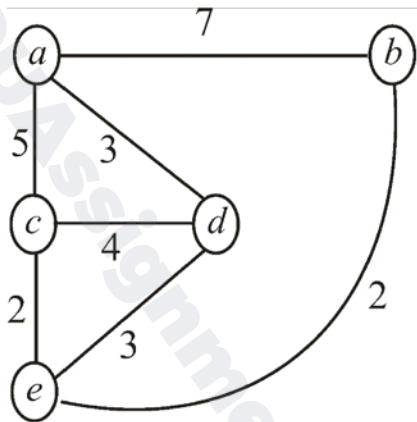
7, 15, 5, 9, 20, 18, 25, 17, 11

- (b) Explain how dynamic programming can be used to solve matrix chain multiplication. Apply the algorithm to multiply the following : 10

$(M_1, M_2, M_3, M_4)$  with dimensions

$(15 \times 6, 6 \times 50, 50 \times 9, 9 \times 12)$

4. (a) Write Dijkstra's algorithm. Using Dijkstra's algorithm, find the minimum distances of all the nodes from starting node 'a': 10



- (b) Solve the following fractional Knapsack problem using Greedy algorithm : 10

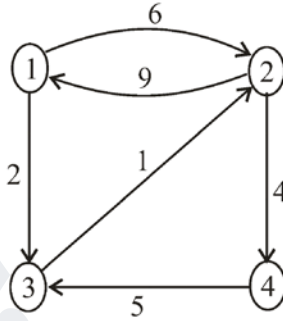
Number of objects = 7

Capacity of Knapsack = 5

Weight of objects,  $W_i = (2, 3, 5, 7, 1, 4, 1)$

Profit of objects  $P_i = (10, 5, 15, 7, 6, 18, 3)$

5. (a) Apply Floyd Warshall algorithm on the following graph : 10



Show the matrix  $D_2$  of the graph.

- (b) A binomial coefficient is defined by the following recurrence relation :

$$C(n, 0) = 1 \text{ and } C(n, n) = 1 \quad \text{for } n > 0$$

$$C(n, k) = C(n-1, k) + C(n-1, k-1) \quad \text{for } n > k > 0$$

- (i) Write a recursive function to generate  $C(n, k)$ . 4
- (ii) Give an algorithm based on dynamic programming to solve  $C(n, k)$ . 6

Compare the time requirements to solve algorithm.

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