

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

**Term-End Examination**

**December, 2021**

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

*Time : 3 hours*

*Maximum Marks : 100*

*(Weightage : 70%)*

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**Note :** Question no. 1 is **compulsory**. Attempt any **three** questions from the rest.

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1. (a) Write a mathematical definition of  $O$  (big oh). Assume that the function  $f(n) = 2n^2 + 3n + 1$ . Show that  $f(n) = O(n^2)$ . 5
- (b) Define a recurrence relation of QuickSort algorithm and solve it using a recurrence tree. 10
- (c) What are the key features of combinatorial problems ? Describe and formulate three combinatorial problems. 10

- (d) Describe a task scheduling problem as an optimization problem. Apply the scheduling algorithm with deadlines to maximize the total profit to the following problem :

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Jobs	Deadlines	Profits
1	2	60
2	3	50
3	4	70
4	5	80
5	4	75
6	3	55
7	2	40

- (e) List all the different orders in which we can multiply five matrices M1, M2, M3, M4, M5.

5

2. (a) Explain the naïve string matching algorithm and derive its worst case complexity. What is its drawback ? What will be the maximum valid shifts of a pattern in the text in the following example ?

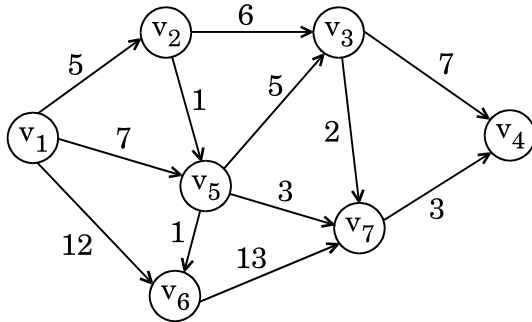
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Text : a b c x y z d e f g h

Pattern : f g h

- (b) What is the similarity between Dijkstra's single source shortest path and Prim's minimum cost spanning tree algorithms ? Apply Dijkstra's algorithm to find the shortest path from  $v_1$  to all other vertices of the following graph :

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3. (a) Apply Horner's method for evaluating a polynomial expression

$$p(x) = 6x^6 + 5x^5 + 4x^4 - 3x^3 + 8x - 7$$

at  $x = 3$ .

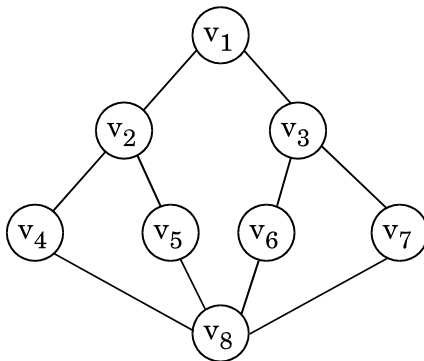
Calculate :

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- (i) How many times will the loop execute ?
- (ii) What will be the total number of multiplication and addition operations ?
- (b) Define a fractional knapsack problem as an optimization problem. Write a greedy method to find an optimal solution to the problem. Show the complexity of the algorithm.

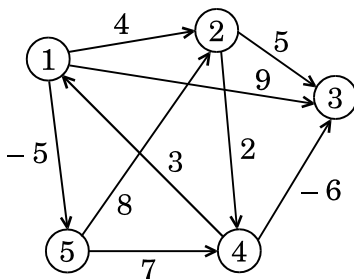
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4. (a) Apply the DFS algorithm to the following graph with the starting vertex  $v_1$ . List the order in which vertices will be visited.



Show the complexity analysis if a graph is represented through

- (i) Adjacency list, and  
 (ii) Adjacency matrix. 10
- (b) Explain P, NP and NP-complete class of problems with appropriate examples of each class. 10
5. (a) Apply Floyd Warshall's algorithm and show the matrix  $D^2$  of the following graph : 10



- (b) Explain the use of master method. Write and interpret all the three cases of the master method to solve recurrence relation problem.

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