

**VIT**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

REG.NO.:

**SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2024-2025**

SLOT: E1

Programme Name & Branch : B. Tech CSE and Business Systems
Course Code and Course Name : CBS3003, Design and Analysis of Algorithms
Faculty Name(s) : Dr. Mukku Nisanth Kartheek
Class Number(s) : VL2024250505157
Date of Examination : 20-03-2025
Exam Duration : 90 minutes

Maximum Marks: 50**General instruction(s):**

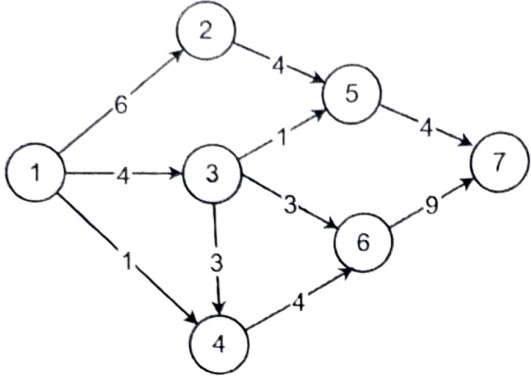
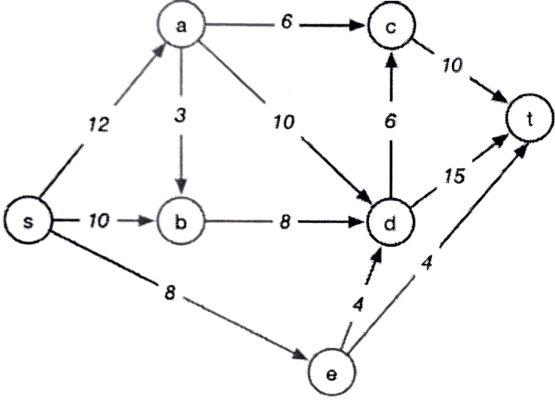
- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes
 2. Identify suitable algorithmic paradigm for solving the given problem.
 3. Understand and apply various graph-based algorithms
 4. Understand the classes of complexity

Q. No	Question	M	CO	BL
1.	a) Consider applying the Matrix Chain Multiplication Algorithm on the following five matrices (A, B, C, D, E): A: 7 x 4, B: 4 x 6, C: 6 x 9, D: 9 x 3, E: 3 x 5. Find the minimum number of scalar multiplications needed to multiply the five matrices, using dynamic programming. Show all your calculations. Find the optimal parenthesizing corresponding to the optimal value found.	8	2	3
	b) Identify two main points that why dynamic programming is efficient when compared to recursion.	2		
2.	a) Given two strings: String P: ABCYDEG String Q: MABZCDNE Compute the length of the longest common subsequence (LCS) of P and Q using dynamic programming.	7	2	4
	b) Suppose there are three assembly lines (each having n stations) instead of two lines. How would you modify the recurrence relations for $f_i[j]$ where, $f_i[j]$ refers to the fastest time a chasis can come out from j^{th} station of assembly line i.	3		
3.	a) Prim's algorithm and Kruskal's algorithm are two well-known algorithms for finding the Minimum Spanning Tree (MST) of a connected, weighted, and undirected graph. Compare these two algorithms in a tabular form by discussing their differences/similarities in terms of their approach in selection criteria, handling cycles, time complexity and connected components.	4	3	4
	b) Use the Dijkstra's algorithm to determine the shortest path between node 1 and node 7 in the following network.	6		



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4.	Find the maximum flow from source (s) to sink (t) using Ford-Fulkerson's algorithm, where the numbers on the edges represent the capacities. 	10	3	3
5.	a) Consider a problem X that is already known to be NP-complete. If we can solve X in polynomial time, what are the implications?	2	4	4
	b) The 3-SAT problem is NP-complete. Convert the following Boolean formula into 3-Conjunctive Normal Form (CNF) SAT. You can start constructing truth-assignment table for each clause and continue to obtain 3-CNF SAT formula. Here, Y_i ($i = 1, 3, 6$) are Boolean variables which will take values 0 or 1. $\Phi = Y_6 \wedge (Y_6 \leftrightarrow (\neg Y_1 \leftrightarrow Y_3))$	8		
