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 2025-2026

Slot: D2

Programme Name & Branch : B.Tech & CSE(BS)
Course Code and Course Nam :CBS3003 & Design and Analysis of Algorithms
Faculty Name(s) :Prof. Manas Gautam, Prof. Gopinath M
Class Number(s) : VL2025260502417, VL2025260502386
Date of Examination : 18.03.2026
Exam Duration : 90 minutes **Maximum Marks: 50**

General instruction(s):

- Answer All Questions – Based on the Marks, Answer the 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: (Type the CO statements covered in this question paper. Use the CO number as per the syllabus copy)
  CO1: Analyse worst-case running times of algorithms using asymptotic analysis
  CO2: Identify suitable algorithmic paradigm for solving the given problem
  CO3: Understand and apply various graph-based algorithms
  CO4: Understand the classes of complexity
  CO5: Introduction to approximation, randomized and quantum algorithms
  CO6: Describe various algorithmic strategies, analysis and their implementation

<table>
<tr><th>Q. No</th><th>Question</th><th>M</th><th>CO</th><th>BL</th></tr>
<tr><td>1.</td><td>a) A software company is developing a version comparison tool to detect similarities between two versions of a program code.
The tool analyzes two sequences of characters and identifies the longest sequence that appears in both versions while maintaining the same order.

The two code sequences are:

Sequence A: A C G T C G A
Sequence B: C G T G A C

Based on the above sequences, answer the following:

a) Construct the dynamic programming table used to compute the similarity between the two sequences. (3 Marks)

b) Using the completed table, determine the longest common subsequence between the two sequences. (2 Marks)</td><td>5</td><td>CO2</td><td>BL3</td></tr>
<tr><td></td><td>b)A manufacturing company produces metal rods of length n meters. Each rod can be sold as a whole or cut into smaller pieces. The company has a price list showing the selling price for rods of different lengths. For example:-
<table>
<tr><td>Length(m)</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Price($)</td><td>2</td><td>5</td><td>7</td><td>8</td></tr>
</table>
The company wants to determine the best way to cut a rod of length 4 meters in order to maximize total revenue.

i) List all possible ways to cut the rod. (2 Marks)

ii) Determine which cutting strategy provides the maximum revenue. (1.5 Marks)</td><td>5</td><td>CO2</td><td>BL3</td></tr>
</table>

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 2025-2026

Slot: D2

iii) Write a pseudocode to compute the maximum revenue obtainable for a rod of length n. (1.5 Marks)

2. A machine learning system processes data through a sequence of four transformation stages. Each stage converts data from one dimensional format to another.

The size of data handled by each stage is given below:-

Stage	Input Dimension	Output Dimension
S1	30	5
S2	5	60
S3	60	10
S4	10	20

Combining two consecutive stages with dimensions (a×b) and (b×c) requires a×b×c processing operations.

Different ways of grouping the stages lead to different computational costs because intermediate results have different sizes.

a) List all possible ways to group the stages during processing. (2 Marks)

b) Compute the number of operations required for each grouping. (4 Marks)

c) Determine the grouping that results in the minimum number of operations. (2 Marks)

d) Write the recurrence relation used to compute the optimal grouping strategy.(2 Marks)

10 | CO2 | BL3

3. a) i)Apply Dijkstra's Algorithm to Graph-1 to compute shortest paths from A. (5 Marks)

Edge	W	Edge	W	Edge	W
A→B	6	A→C	4	A→D	5
C→B	2	D→C	1	B→E	7
C→E	3	D→F	6	E→F	3

ii) Apply Bellman–Ford Algorithm to Graph-2 to compute shortest paths from A. (4 Marks)

Edge	W	Edge	W	Edge	W
A→B	6	A→C	4	A→D	5
C→B	-2	D→C	-1	B→E	3
C→E	3	D→F	-2	E→F	3

iii) State why Dijkstra cannot be used when negative edges exist? (1 Mark)

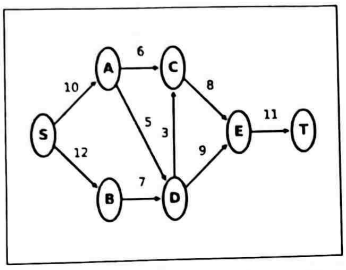
10 | CO3 | BL4

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 2025-2026

Slot: D2

4.	A cloud service provider needs to transfer data from a central server s to a destination server t through several intermediate processing nodes. Each connection between servers has a maximum bandwidth capacity (in GB/s) as shown in the network diagram. Network Capacities  Based on the above network, answer the following questions: a) Examine the network and identify the possible data transmission routes that allow data to travel from the source server s to the destination server t. (2 Marks) b) Analyze how data can be progressively transmitted through the network while respecting the capacity limits of each communication link. Determine the maximum amount of data that can be transferred from s to t using an appropriate maximum flow approach. Clearly show the sequence of augmenting paths and the flow sent in each step. (6 Marks) c) During the computation of network flow, the capacity of an edge changes after sending data through it. State the rule used to update the remaining capacity of an edge in the residual network. (2 Marks)	10	CO3	BL3
5.	A software development company is designing an intelligent system to solve complex decision problems. During testing, the engineers observe that the system can quickly check whether a proposed solution is correct. However, when the system attempts to generate the correct solution by itself, the computation time increases rapidly as the input size grows. The development team begins to investigate whether the problem belongs to a category of problems that are efficiently solvable or computationally difficult. Based on the above scenario, answer the following questions- a) Analyze the situation described in the case study where a solution can be verified efficiently but is difficult to compute. Identify the computational complexity class that best represents such problems and justify your reasoning. (5 Marks) b) Compare the characteristics of P, NP, and NP-Complete problems and explain how understanding these classes helps algorithm designers evaluate the feasibility of solving complex problems. (5 Marks)	10	CO4	BL4

****