VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

REG.NO.:

SLOT: D2

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
WINTER SEMESTER 2025-2026

Programme Name & Branch	**: B.Tech Computer Science & Engineering and Business Systems(BBS)**
Course Code and Course Name	**: CBS3003 & Design and Analysis of Algorithms**
Faculty Name(s)	**:Mr. Manas Gautam, Dr. Gopinath M**
Class Number(s)	**: VL2025260502417, VL2025260502386**
Date of Examination	**: 30.01.2026**
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 (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
  CO6: Describe various algorithmic strategies, analysis and their implementation

Q. No	Question	Module	Marks	CO	BL
1.	a) Using asymptotic notations, determine whether the following statements are TRUE or FALSE. Justify each answer using proper reasoning. (2*3=6 Marks) i)$n\log n = O(n^2)$ ii)$5n^2+3n=\Theta(n^2)$ iii)$n^3=\Omega(n^2)$	1	6	CO1	BL4
	b) Solve the following recurrence relation using an appropriate method and determine its time complexity: $T(n)=3T(n/2)+n$	1	4	CO1	BL4
2.	a) An algorithm performs the following operations for an input of size n: i. A loop that executes n times ii. Inside the loop, a constant-time operation is performed iii. Additionally, a nested loop executes n/2 times independently (i) Write the time complexity expression (2*3=6 Marks) (ii) Determine the asymptotic time complexity using Big-O (iii) Comment on efficiency for large inputs	1	6	CO1	BL4
	b) Differentiate between Big-O and Big-Ω notations with suitable examples.	1	4	CO1	BL4
3.	A salesman has to visit four cities A, B, C, and D exactly once and return to the starting city. The distance matrix representing the cost of travel between the cities is given below: | | A | B | C | D | | A | 0 | 10 | 15 | 20 |	2	10	CO2	BL4

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		B	10	0	35	25				
		C	15	35	0	30				
		D	20	25	30	0				
	Using the Branch and Bound technique: (4+3+3=10 Marks) i) Construct the state space tree, clearly indicating the branching at each level. ii) Compute the lower bound for each node, showing all intermediate calculations used for bounding. iii) Apply pruning to eliminate non-promising partial tours and hence determine the optimal tour and the minimum total travel cost.									
4.	a) Solve the Subset Sum Problem using the Backtracking approach. Given the set (3+3=6 Marks) S={3,5,6,7} and target sum 12: i) Write the backtracking algorithm for the Subset Problem. ii) ii) Draw the state space tree and identify the feasible solution(s).						2	6	CO2	BL4
	b) Solve the 4-Queens problem using the Backtracking technique. Explain how backtracking is used to place the queens such that no two queens attack each other. (4 Marks)						2	4	CO2	BL4
5.	a) A knapsack of capacity 50 units has the following items: (5 Marks)						3	5	CO6	BL4

Item	Weight	Value
1	5	30
2	10	40
3	8	35
4	12	50
5	7	28
6	11	55

Apply the Fractional Knapsack algorithm and analyze the greedy choice made at each step.

b) Given the characters with frequencies {a:5, b:9, c:12, d:13, e:16, f:45}. Construct the Huffman tree and analyze how the greedy strategy minimizes the total cost. (3+2=5 Marks)	3	5	CO6	BL4

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