REG.NO.:

SLOT: D2+TD2

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

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

Programme Name & Branch : B.Tech(CSE)
Course Code and Course Name : BCSE306L and Artificial Intelligence
Faculty Name(s) : COMMON TO ALL
Class Number(s) : COMMON TO ALL
Date of Examination : 20-08-2025
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: (Type the CO statements covered in this question paper. Use the CO number as per the syllabus copy)
  CO1- Evaluate Artificial Intelligence (AI) methods and describe their foundations.
  CO2-Apply basic principles of AI in solutions that require problem-solving, inference, perception, knowledge representation and learning.
  CO4-Analyse and illustrate how search algorithms play a vital role in problem-solving

Q. No	Question
1.	List the PEAS description and the properties for the given tasks to their environment characteristics with suitable justification. a. AI-powered Surgical Robot b. Automatic speech translation system (e.g., real-time English to French translator) c. AI Fitness Trainer with Pose Detection (e.g., yoga posture correction). d. Face recognition-based entry system

Task	Performance Measure	Environment	Actuators	Sensors	Observability	Deterministic / Stochastic
a. AI-powered Surgical Robot	Precision, patient safety, recovery rate, success rate	Human body, operating room	Robotic arms, surgical tools	Cameras, imaging, force sensors, vital monitors	Fully observable (with sensors)	Mostly deterministic, some uncertainty (bleeding, organ shifts)
b. Automatic Speech Translation	Accuracy, speed, naturalness	Human conversation	Audio/text output	Microphone (speech input)	Partially observable (tone, intent may be missed)	Stochastic (noise, ambiguity)
c. AI Fitness Trainer (Pose Detection)	Accuracy of pose detection, correct feedback, injury prevention	User body posture, workout space	Audio/visual feedback	Camera, motion sensors, wearables	Fully observable (with good sensors), partial if occluded	Stochastic (lighting, clothing variations)
d. Face Recognition Entry System	Accuracy, speed, low false recognition	Entry point (door, lighting, users)	Lock/unlock mechanism, alarm, display	Camera, IR sensors	Partially observable (mask, poor light)	Stochastic (chance of errors)

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2. A modern smart city has deployed an advanced AI-based traffic management system to reduce congestion, improve road safety, and respond dynamically to traffic conditions. The system collects real-time data from thousands of sensors embedded in roads, traffic cameras, GPS data from vehicles, and weather stations.

Using this data, the AI controls traffic lights at intersections by adjusting their timing based on current and predicted traffic flow, emergency vehicle detection, and accident reports. It considers multiple factors, such as time of day, road conditions, weather, and special events (e.g., concerts, parades), to decide which lights should stay green longer or shorter. The system aims to maximize overall traffic flow, minimize average travel time, and reduce fuel consumption balancing different priorities based on city-defined goals.

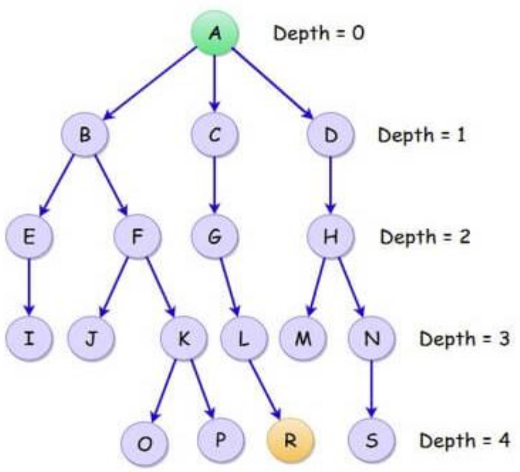
Over time, the AI adapts by analysing historical traffic patterns, driver behaviour, and the effectiveness of its previous decisions. For instance, if a strategy used during a previous festival worked well, the AI is more likely to use or adapt it during a similar future event. It continuously updates its models to improve future traffic control decisions.

Identify and explain which types of intelligent agents are involved in this system with suitable diagram.

ANSWER:

→ Utility based agent (5 m)
→Learners agent (5m)

3. a) Apply the Iterative Deepening Search (IDS) algorithms to find a path in the given graph:



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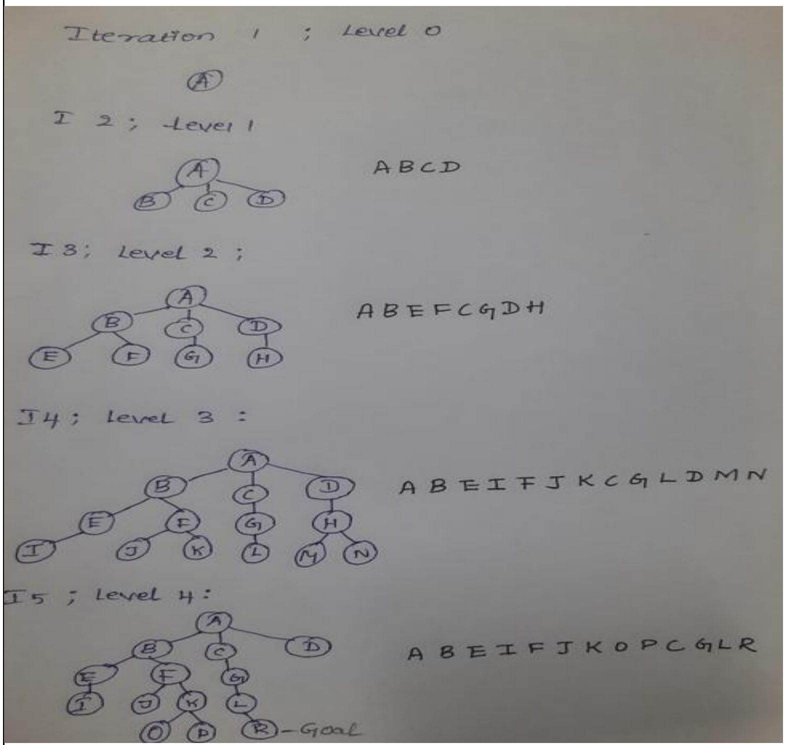
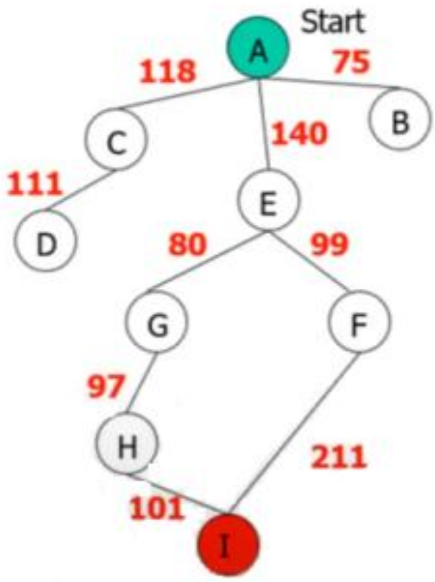


b) Apply Greedy Best First Search mechanism for following scenario.



State	Heuristic: h(n)
A	366
B	374
C	329
D	244
E	253
F	178
G	193
H	98
I	0

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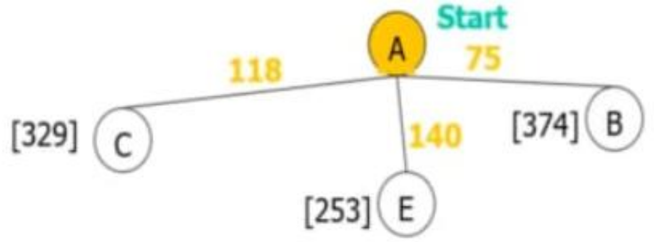

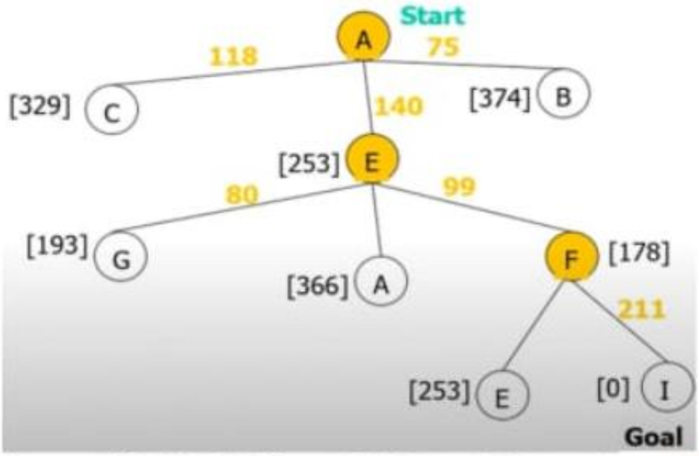

Path cost(A-E-F-I) = 253 + 178 + 0 = 431

dist(A-E-F-I)= 140 +99+211=450

4. Apply the A* search algorithm to solve the 15-puzzle problem, which consists of tiles numbered 1 to 15 placed in a square grid with one empty slot. The goal is to rearrange the tiles from the given initial state to the goal state by performing a series of legal moves (one tile at a time).

The initial state and goal state are shown below.

- Let g(n) represent the depth of the node.
- Let h(n) represent the number of misplaced tiles

Determine the optimal sequence of moves from the initial state to the goal state.

Initial State

1	2	4	15
2		5	12
7	6	11	14
8	9	10	13

Goal State

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	

	Step 1 – Given Initial State 1 2 4 15 1 3 4 15 3 b 5 12 0r 2 b 5 12 7 6 11 14 7 6 11 14 8 9 10 13 8 9 10 13 Goal State 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 b **Step 2 – Compute Manhattan Distance (h_2)** Each misplaced tile contributes its row+col difference from the goal. Total Manhattan distance ≈ 30+ (very high). ⇒ This means the optimal path length is likely 40+ moves. Too long for manual tracing. **Step 3 – Observation (Hot Question Insight)** Recognize that large heuristic values → long paths. For demonstration, we want a smaller h_2, so we choose a reshuffled state closer to the goal. **Step 4 – Choose a Near-Goal Initial State** Example (just 6 moves away): 1 2 3 4 5 6 7 8 9 10 b 12 13 14 11 15 **Step 5 – Solve with A*** Compute f(n) = g(n) + h(n). Expand nodes until goal. With Manhattan heuristic, this state requires ~6 moves, so can solve it in <15 iterations. **Note:** Even i*f the student has followed the flow of the A** search till the end to solve the tiles, then the marks can be awarded accordingly.
5.	Critically analyse the fundamental key components of a Genetic Algorithm (GA), elaborating on the functional significance towards optimal or near-optimal solutions with an example. ANSWER:

	1. Chromosome design 2. Initialization 3. Fitness calculation 4. Selection 5. Crossover 6. Mutation 7. Update 8. Repeat from step 3

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