Z/K/TY

Reg. No: 23BLE0447

Final Assessment Test – November 2025

VIT
Vellore Institute of Technology

Course: BCSE306L - Artificial Intelligence

Class NBR(s): 2215/2217/2219/2230/2240/2241/2250/ 2265/2269/2276/2285/2311/2313/2315/2316/2319/ 2320/2321/2323/2522

Slot: D2+TD2

Time: Three Hours

Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

COs	CO Statements
CO1	Evaluate Artificial Intelligence (AI) methods and describe their foundations.
CO2	Analyse and illustrate how search algorithms play a vital role in problem-solving.
CO3	Demonstrate knowledge of reasoning, uncertainty, and knowledge representation for solving real-world problems.
CO4	Apply basic principles of AI in solutions that require problem-solving, inference, perception, knowledge representation and learning.
CO5	Illustrate the construction of learning and expert systems.
CO6	Discuss current scope and limitations of AI and social implications.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions
(10 X 10 = 100 Marks)

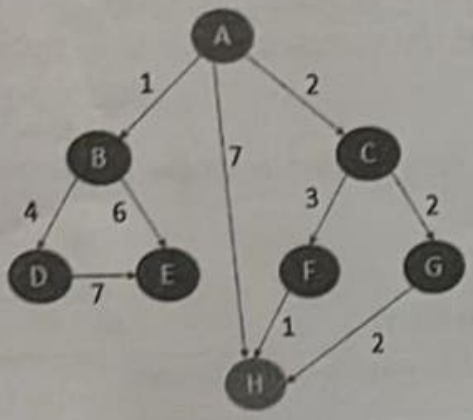
1. Consider an intelligent virtual assistant designed to operate within a military environment. Develop the **PEAS (Performance Measure, Environment, Actuators, Sensors)** description for this agent. Additionally, describe the corresponding **task environment** and analyze its key characteristics. **CO1 BL5**

2. a) Given the following graph with edge costs, illustrate the step-by-step execution of the Uniform-Cost Search (UCS) algorithm to find the optimal path from the start node S to the goal node G. Clearly show the contents of the frontier at each iteration and the total cost of the path found. **CO2 BL3**

   - S to A (cost 4), S to B (cost 1)
   - A to C (cost 3), A to D (cost 8)
   - B to A (cost 2), B to E (cost 10)
   - C to G (cost 4)
   - D to G (cost 2)
   - E to G (cost 5)

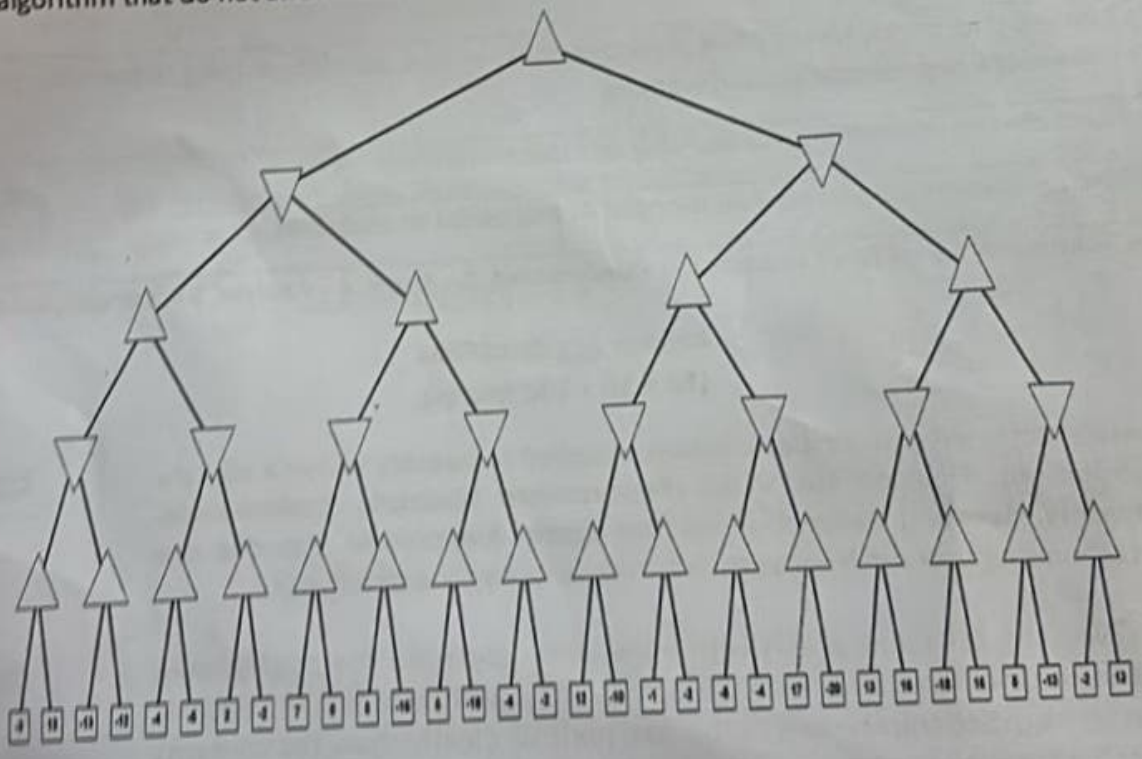
   b) Analyse the uninformed search algorithms regarding completeness, optimality, time complexity, and space complexity.

3. Using the given graph, apply the **Greedy Best-First Search** and **A*** search algorithms to determine the optimal path from node **A** to node **H**. Show all steps involved in the search process and compare the results obtained by both techniques. **CO2** **BL4**



NODES	HEURISTICS
A	5
B	3
C	4
D	2
E	6
F	3
G	1
H	0

4. Apply minmax algorithm to the given tree. Prune the nodes using alpha-beta pruning algorithm that do not affect the outcome of the game. **CO4** **BL3**



5. Explain the fundamental mechanics of a Genetic Algorithm (GA). Detail the role and implementation of the four key processes: Initial Population Generation, Fitness Function, Selection, Crossover, and Mutation. Give an example of a problem where a GA would outperform both Hill Climbing and Simulated Annealing. **CO4** **BL3**

6. a) Formalize the following natural language statements into First-Order Logic (FOL). [4] CO4 BL3

i. All dogs are friendly, unless they live near a mountain.
ii. Only one CEO reports directly to the Board of Directors.
iii. Every person who owns a dog is a friend of someone who owns a cat.
iv. Mary is a student.

b) The following statements describe the relationship between weather and the picnic: [6]

- If it is raining, then the ground will be wet.
- If the ground is wet, then the picnic will be cancelled.
- If it is sunny, then it cannot be raining.
- It is either raining or sunny.

Using the above information, prove **by the resolution method with contradiction** that the picnic will be cancelled.

CO4 BL3

7. a) Given the following rules and facts:

i. $Bird(x) \wedge Flies(x) \rightarrow Happy(x)$
ii. $Sparrow(Tweety) \rightarrow Bird(Tweety)$
iii. $Sparrow(Tweety)$
iv. $Flies(Tweety)$

Use **forward chaining** and **backward chaining** to determine whether $Happy(Tweety)$ can be inferred.

b) **Given:** Whoever can read is literate
Dolphins are not literate
Some dolphins are intelligent

Prove by unification:
Some who are intelligent cannot read.

CO3 BL

8. Consider the following medical diagnosis scenario:

- P(M) = 0.005 (Probability of having a rare Migraine)
- P(H) = 0.995 (Probability of having a Headache)
- P(S | M) = 0.98 (Probability of seeing a Scintillation Scotoma given Migraine)
- P(S | ⌐M ^ H) = 0.05 (Probability of seeing Scintillation Scotoma given no Migraine but a regular Headache)
- P(S | ⌐M ^ ⌐H) = 0.01 (Probability of seeing Scintillation Scotoma given no Migraine and no Headache)

Calculate P(M | S) (the probability of having a Migraine given that a Scintillation Scotoma is observed). Clearly state the assumptions and show the application of Bayes' Rule and the Law of Total Probability.

9.a)	Design a planning system for an intelligent agent that utilizes both forward search and backward search strategies to achieve specified goals within a dynamic environment. Explain how your system integrates these methods with reference to classical planning paradigms, and analyze the potential advantages your hybrid approach has over conventional single-mode planning techniques in terms of efficiency, scalability, and adaptability.	CO5	BL6
	OR		
9.b)	A domestic service robot is assigned to prepare a meal in the kitchen. Describe how the **STRIPS representation** can be used to define the initial state, goal state, and operators for this task. Explain how the robot can use this information to generate a valid **plan** for completing the meal preparation efficiently.	CO5	BL6
10.a)	Analyze how probabilistic language models handle ambiguity in natural language communication. Illustrate your answer with various probabilistic approaches in AI-based text interpretation.	CO6	BL6
	OR		
10.b)	Explain the difference between information retrieval and information extraction with suitable examples. Elaborate how these techniques are used in AI Chabot applications?	CO6	BL6

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