VIT®

Vellore Institute of Technology

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

Reg. No. : 1138

Final Assessment Test(FAT) - Nov/Dec 2024

Programme	**B.Tech.**	Semester	**Fall Semester 2024-25**
Course Code	**BCSE306L**	Faculty Name	**Prof. Radhika Selvamani**
Course Title	**Artificial Intelligence**	Slot	**E2+TE2**
		Class Nbr	**CH2024250101164**
Time	**3 hours**	Max. Marks	**100**

General Instructions

- Write only Register Number in the Question Paper where space is provided (right-side at the top) & do not write any other details.

Course Outcomes

On completion of this course, students should be able to:

1. Evaluate Artificial Intelligence (AI) methods and describe their foundations.
2. Apply basic principles of AI in solutions that require problem-solving, inference, perception, knowledge representation, and learning.
3. Demonstrate knowledge of reasoning, uncertainty, and knowledge representation for solving real-world problems
4. Analyse and illustrate how search algorithms play a vital role in problem-solving

Section - I
Answer all Questions (6 × 10 Marks)

*M - Marks

Q.No	Question	*M	CO	BL
01.	Answer the following questions by analyzing the recent applications of Artificial Intelligence such as ChatGPT, Tesla's self-driving system, and DeepMind's AlphaFold: a. Core functionalities and goals of these applications (4 Marks) b. Industries impacted by ChatGPT, Tesla's self-driving system, and AlphaFold and the changes they have introduced in these fields (3 Marks) c. Two key limitations associated with these technologies (3 Marks)	10	1	2
02.	You are evaluating two search algorithms for a robotics application where a robot needs to find the shortest path in a grid-based environment with obstacles. The grid is a 5x5 matrix, where cells are either free space or obstacles. The robot must navigate from the starting position to the goal position. The grid representation is given below, where S denotes the starting position, T denotes the target position, 0 denotes an empty cell, and 1 denotes an obstacle. Given that the robot can move upward, downward, right, and left direction.	10	2	3

S	0	1	0	0
0	0	1	0	1
0	0	0	0	0
1	1	1	1	0
0	0	0	1	T

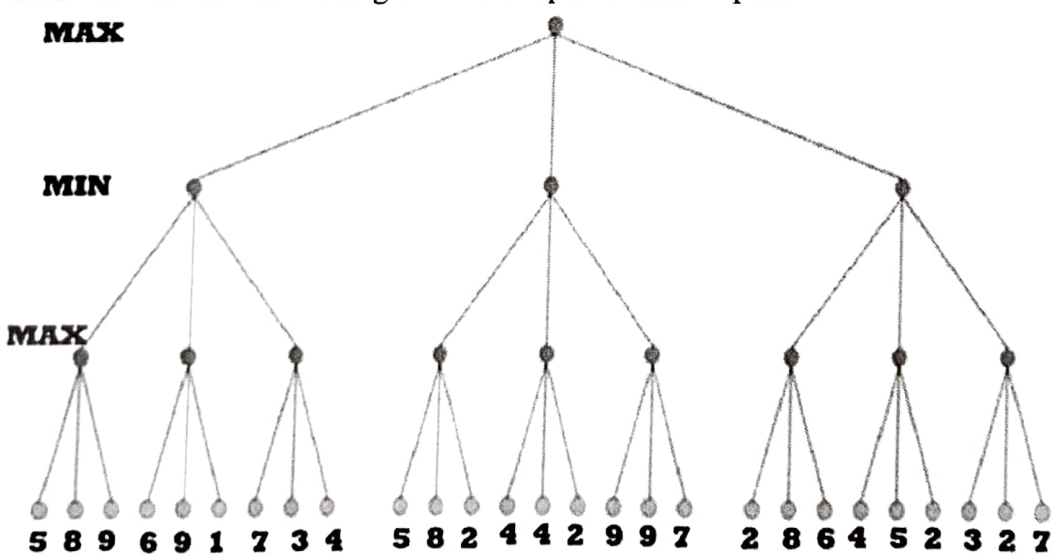
For the above-given problem:
a. Define how you would represent the state space for this navigation problem by using Breadth First Search (BFS) and Depth First Search (DFS). (5 Marks)
b. For each search strategy, evaluate (i) whether it always finds a path when one exists and (ii) whether it guarantees the shortest possible path, assuming uniform movement costs between grid cells. (5 Marks)

03. Assume that you are a logistics planner for a delivery company. The company has several delivery points across a city, and your task is to determine the shortest route that allows the driver to visit each delivery point once and return to the starting location. The **Delivery Points**: Start, A, B, C, D, with distances between points as given as follows (in arbitrary units): 10 2 3

From/To	Start	A	B	C	D
Start	0	4	6	8	2
A	4	0	7	3	5
B	6	7	0	4	2
C	8	3	4	0	6
D	3	5	2	6	0

To address this, you decide to use simulated annealing to find an optimized route.
a. Describe how you would set up the problem for simulated annealing, including the representation of states and cost function. (2 Marks)
b. Explain how the Simulated Annealing algorithm would proceed to optimize the delivery route and why it's suitable for this problem. Explain your solution upto 4 iterations with initial temperature = 100 and cooling rate = 0.9 (8 Marks)

04. A cybersecurity organization defending its network against a potential cyber attack. The attacker aims to compromise the network by exploiting various vulnerabilities, while the defender's goal is to prevent the attack by setting up protective measures at strategic points. This interaction can be modeled as an adversarial search tree, where each node represents a possible network state, and each move by the attacker or defender alters the state of the network. The root node represents the current network state, and each subsequent level alternates between the attacker (trying to maximize damage) and the defender (trying to minimize it). Apply the alpha-beta pruning algorithm to determine which attack and defense strategies will be pruned from the decision tree without affecting the overall optimal defense plan. 10 2 3



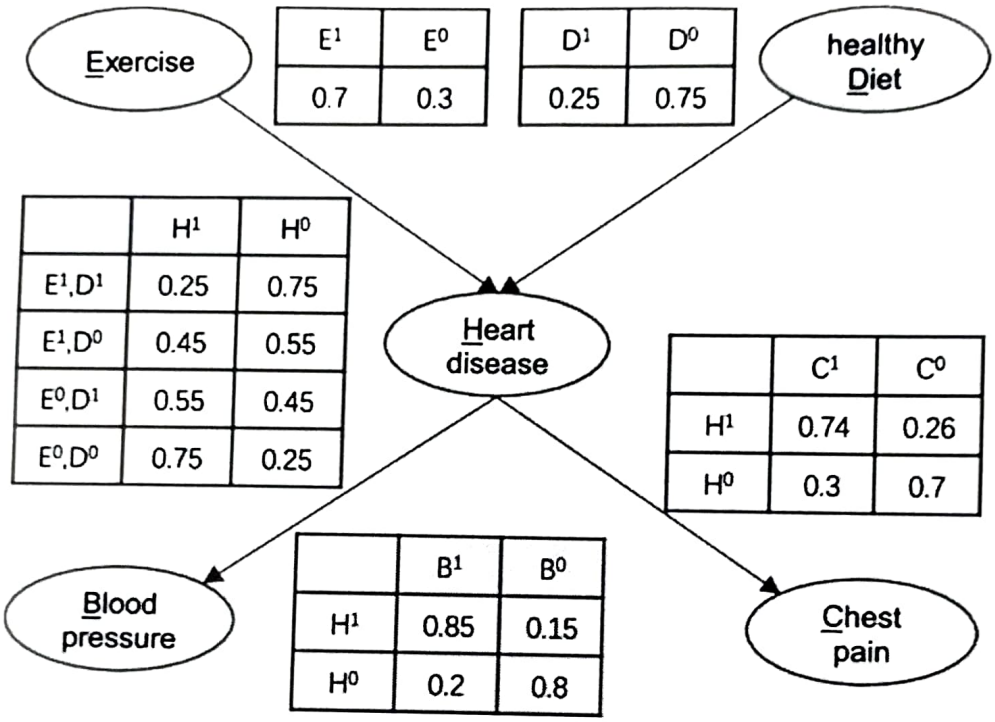
06.	An international e-commerce company, GlobalGoods, sells products in over 20 countries and receives customer support inquiries in multiple languages. To manage the multilingual communication needs efficiently, GlobalGoods integrates an AI-powered communication system that includes a multilingual chatbot and real-time translation for customer service. The AI solution uses Natural Language Processing (NLP), Machine Translation (MT), and Sentiment Analysis. a. Analyze how each component of the AI system (NLP, MT, Sentiment Analysis) contributes to handle high volumes of multilingual inquiries and assess their effectiveness in various scenarios, such as urgent customer complaints or detailed product inquiries. (5 Marks) b. Identify the primary advantages that this AI-powered communication solution brings to GlobalGoods. (5 Marks)	10	4	4

Section - II

Answer all Questions (2 × 20 Marks)

*M - Marks

Q.No	Question	*M	CO	BL
07.	Consider the following set of statements: • All cricket players are athletes. • Kapil is a cricket player. • If a player is a captain, then they have leadership skills. • Kapil is the captain of the team. • Some captains are not good at strategy. • If a player has leadership skills, then they can motivate the team. • All players with leadership skills are respected by their teammates. • Kapil can motivate the team. a. Convert all these statements into First-order logic (FOL). (4 Marks) b. Convert each of the FOL statements to the Conjunctive Normal Form. (4 Marks) c. Apply refutation by resolution to determine if the conclusion "Kapil is respected by his teammates" can be inferred from these statements. (8 Marks) d. Discuss how first-order logic struggles to adequately represent certain intuitive concepts such as vagueness, context, or the notion of "most" in statements. (4 Marks)	20	3	4
08.	A health clinic is analyzing patient data to predict the likelihood of heart disease in its patients. They have created a Bayesian network model with the following relationships:. a. Find the exact prior probability of having chest pain given a person is having a healthy diet and follows proper exercise. (5 Marks) b. Find the approximate probability for the same by generating the random samples using the random numbers [0.76, 0.26, 0.92, 0.52, 0.34, 0.95, 0.03, 0.64, 0.18, 0.92, 0.52, 0.22, 0.46, 0.99, 0.96, 0.59, 0.82, 0.29, 0.77, 0.11, 0.68, 0.01, 0.15, 0.90, 039]. (5 Marks) c. Find the approximate probability using rejection sampling for the same and explain how this affects the accuracy of the conditional probability estimate compared to random sampling. (5 Marks) d. Discuss the strengths and limitations of each approach in terms of computational efficiency, sample size dependency, and potential sources of error. (5 Marks)	20	3	3



BL-Bloom's Taxonomy Levels - (1.Remembering, 2.Understanding, 3.Applying, 4.Analysing, 5.Evaluating, 6.Creating)

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