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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Institutional Elective **Duration: 3 hrs.**
Course Code: 24AM6OEAIG **Max Marks: 100**
Course: Introduction to Artificial Intelligence

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			CO	*PO*	Marks
		UNIT - I			
1	a)	Apply the concept of Intelligent Agents by designing a simple agent-based model for a smart home environment. Explain how the agent would perceive, decide, and act.	*CO1*	*PO3*	**10**
	b)	Apply Depth Limited Search to a maze-solving problem with a maximum depth of 3. Explain the outcomes and what happens if the goal is beyond this depth?	*CO1*	*PO3*	**10**
		OR			
2	a)	Construct a Production System to automate customer support responses. Specify the condition-action rules and show how it would resolve queries?	*CO1*	*PO3*	**10**
	b)	Compare and contrast Breadth First Search, Depth First Search, and Uniform Cost Search in terms of completeness, optimality, time, and space complexity.	*CO1*	*PO2*	**10**
		UNIT - II			
3	a)	Apply the Hill Climbing strategy to solve the 8-Queens problem. Show how the algorithm attempts to optimize the placement of queens on the board?	*CO2*	*PO2*	**10**
	b)	Use Generate-and-Test to find a solution to a number puzzle problem (e.g., finding a number whose square is less than 100 and is divisible by 3). Explain the process.	*CO2*	*PO2*	**10**
		OR			
4	a)	Construct a Best-First Search for a robot navigation problem where the heuristic is the straight-line distance to the goal. Explain the path selected.	*CO2*	*PO3*	**10**
	b)	Apply Constraint Satisfaction to solve a Sudoku puzzle. Describe how constraints help prune the search space?	*CO2*	*PO3*	**10**
		UNIT - III			
5	a)	Explain the syntax and semantics of First-Order Logic. How does it differ from Propositional Logic in terms of expressiveness?	*CO3*	*PO3*	**8**

		b)	You are working with a knowledge base of facts and rules about a simple diagnostic system for a car's engine: Facts: • The car's engine won't start if the battery is dead. (denoted BatteryDead → ¬EngineStarts) • The car's engine starts if the battery is charged and the starter motor is working. (denoted BatteryCharged ∧ StarterWorks → EngineStarts) Rules: • If the engine doesn't start, the battery might be dead or the starter motor might be faulty. Tasks: i. Using forward chaining, explain the process of inferring if the engine will start given the fact that the starter motor works, but the battery is dead. ii. Using backward chaining, infer the conditions required to get the engine started if we know the engine is not starting.	*CO3*	*PO3*	**12**
			OR			
	6	a)	Explain Backward Chaining as an inference technique. How does it differ from Forward Chaining in approach and use cases? Illustrate with an example.	*CO3*	*PO3*	**8**
		b)	Consider the following knowledge base: Propositional Logic: P: The coffee machine is plugged in. Q: The coffee machine is turned on. R: Coffee is brewed. The relationship is: P ∧Q → R (If the coffee machine is plugged in and turned on, then coffee is brewed.) First-Order Logic: • ∀x (Person(x) → ∃y (Room(y) ∧ HasRoom(x,y))) (Every person has a room.) Given the above facts: • John is a person and has a room. • The coffee machine is plugged in but not turned on. Perform the following tasks: i. Using propositional logic, determine if coffee is brewed. ii. Using First-Order Logic, infer if John has a room based on the knowledge provided.	*CO3*	*PO3*	**12**
			UNIT - IV			
	7	a)	Consider the following rules in a medical diagnosis system for detecting a disease: • If the patient has a fever and a cough, the patient may have the flu. • If the patient has a fever, chills, and body aches, the patient may have the flu. Given that the patient exhibits a fever and a cough: i. Apply forward reasoning to deduce if the patient has the flu. ii. Now, apply backward reasoning to check if the patient must have a fever and cough to confirm they have the flu.	*CO3*	*PO4*	**10**

		b)	You are designing an intelligent system to manage a home automation system. The system uses declarative rules to control the lights and heating in the house. • The light is on if the person is in the room and it is dark. • The heating is on if the person is in the room and the temperature is below 18°C. Tasks: i. Represent the above two facts using declarative rules in logic form. ii. Imagine the system uses procedural knowledge to manage lights and heating. Describe how this might differ in implementation and what kind of rules the system would use in procedural knowledge?	*CO3*	*PO4*	**10**
			OR			
	8	a)	In the WUMPUS World environment, the goal is for an agent to navigate a grid-based world filled with pitfalls (P) and a dangerous Wumpus (W). The agent must use sensors to avoid danger and eventually capture the Wumpus. Facts: • Stench is felt in the squares adjacent to the Wumpus. • Breeze is felt in the squares adjacent to a pit. • The agent can smell the stench or feel the breeze but cannot directly see the Wumpus or the pits. i. Write the rules of the WUMPUS world using propositional logic. For example, express that if there is a stench in an adjacent square, then the Wumpus must be nearby. ii. Describe how the agent can use forward reasoning to navigate the grid and avoid the Wumpus and pits, based on the sensory inputs (stench, breeze).	*CO3*	*PO4*	**10**
		b)	Referring to WUMPUS problem given in Q8a, i. Use backward reasoning to infer the possible locations of the Wumpus and pits, given the stench and breeze information. ii. Consider the case where the agent does not have perfect sensory data. How might uncertainty affect the agent's decision-making, and how could probabilistic reasoning be used to improve the agent's actions in such a scenario?	*CO3*	*PO4*	**10**
			UNIT - V			
	9	a)	List and explain the various roles that expert systems can play in real-world applications. Provide examples of expert systems that perform each role.	*CO3*	*PO3*	**10**
		b)	Analyze the key differences between rule-based expert systems and model-based expert systems in terms of their architecture. What advantages and limitations do each approach have in terms of efficiency and scalability?	*CO3*	*PO4*	**10**
			OR			
	10	a)	Describe the MYCIN expert system. What type of problems was it designed to solve, and how does it make use of rules and inference to provide solutions?	*CO3*	*PO3*	**10**

		b)	Compare the DART and XOON expert systems in terms of their application domains and design principles. How do these systems differ in their approach to problem-solving and their effectiveness in handling real-world complexity?	*CO3*	*PO3*	**10**

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