U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**

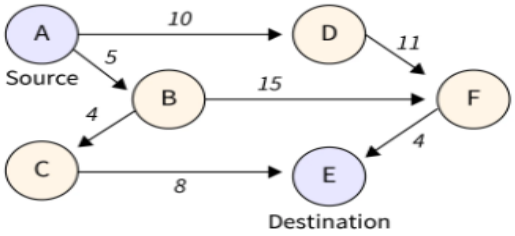
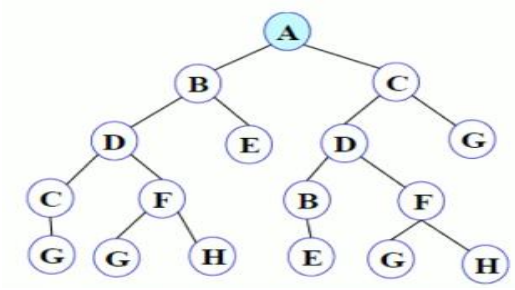
Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**

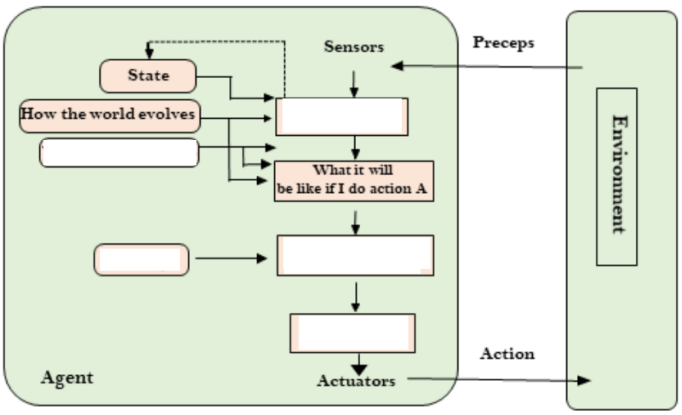
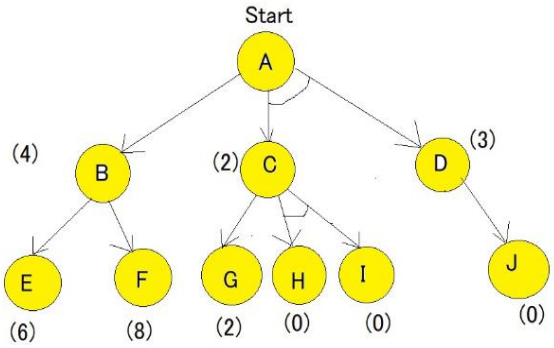
Course Code: 22AM4PCIAI **Max Marks: 100**

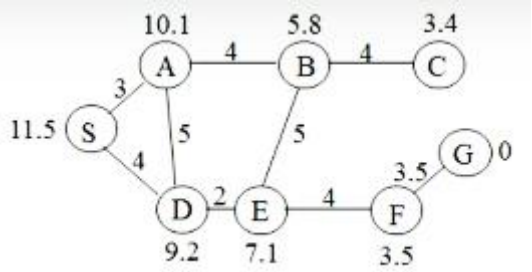
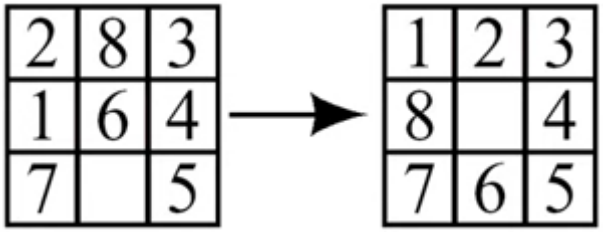
Course: Introduction to Artificial Intelligence

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.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Describe the PEAS (Performance measure, Environment, Actuators, Sensors) framework for the following task environment: i. Robot Navigation. ii. Interactive English Tutoring. iii. Playing Tennis Match.	*CO1*	*PO2*	**06**
	b)		Use the Uniform Cost Search (UCS) algorithm for the graph shown in Figure 1b to find the least-cost path from source node A to destination node E. Also provide the steps involved in the UCS algorithm.  Figure 1b	*CO1*	*PO2*	**07**
	c)		i. Write Depth First Search (DFS) algorithm. ii. Apply Depth-First Search (DFS) to find the shortest path from node A to node G with diagrammatic representation shown in Figure 1c.  Figure 1c	*CO1*	*PO2*	**07**
			OR			

	2	a)	Define Artificial Intelligence (AI) and explain four distinct approaches to AI, highlighting their respective methodologies.	*CO1*	*PO2*	**05**
		b)	Complete the architecture diagram shown in Figure 2b for a utility-based agent by filling in the blanks with appropriate components.  Figure 2b	*CO1*	*PO2*	**05**
		c)	Visualize a large-scale manufacturing facility that produces complex machinery components. To improve production efficiency and reduce defects, the facility decides to implement an intelligent agent. This agent is tasked with analyzing data from various sensors to identify patterns, anomalies, and potential areas for optimization. Over time, the agent learns to predict equipment failures before they occur, optimize machine settings for maximum output, to minimize waste, and downtime. Choose a suitable intelligent agent for implementation and describe its architecture in detail.	*CO1*	*PO2*	**10**
			UNIT - II			
	3	a)	Apply the AO* search algorithm to solve the following graph depicted in the Figure 2a.  Figure 2a	*CO2*	*PO2*	**08**
		b)	Solve the following Cryptarithmetic problem. DONALD + GERALD = ROBERT.	*CO2*	*PO2*	**08**
		c)	Highlight the drawbacks of the Hill Climbing algorithm in optimization problem.	*CO2*	*PO1*	**04**
			OR			

	4	a)	Find the most cost-effective path to reach from start state S to final state G for the graph shown in Figure 3a using A* Search Algorithm.  Figure 3a	*CO2*	*PO2*	**07**
		b)	Explain Mean End Analysis approach with a suitable example.	*CO2*	*PO1*	**05**
		c)	Illustrate 8 puzzle problem using Hill Climbing algorithm for the given initial state and goal state.  Initial State Goal State	*CO2*	*PO2*	**08**
			UNIT - III			
	5	a)	Consider the knowledge base where: A =“Angelo comes to the party” B =“Bruno comes to the party” C =“Carlo comes to the party” D =“Davide comes to the party”. Convert the following sentences into propositional logic: i. “If Davide comes to the party, then Bruno and Carlo come too” ii. “Carlo comes to the party only if Angelo and Bruno do not come” iii. “Davide comes to the party if and only if Carlo comes and Angelo doesn’t come” iv. “If Davide comes to the party, then, if Carlo doesn’t come then Angelo comes” v. “Carlo comes to the party provided that Davide doesn’t come, but, if Davide comes, then Bruno doesn’t come”	*CO2*	*PO3*	**10**
		b)	Formalize the following sentences using First Order Predicate Logic: i. Marcus was a man. ii. Marcus was a Pompeian. iii. All Pompeians were Romans. iv. Caesar was a ruler. v. All Pompeians were either loyal to Caesar or hated him.	*CO2*	*PO2*	**05**
		c)	Distinguish Procedural and Declarative Knowledge.	*CO2*	*PO1*	**05**

			OR			
	6	a)	The rule base contains the following rule set: • Rule 1: If A∧C, then F • Rule 2: If A∧E, then G • Rule 3: If B, then E • Rule 4: If G, then D Prove using Forward Chaining that A ∧ B→D	*CO2*	*PO2*	**08**
		b)	Transform the given complex proposition into Conjunctive Normal Form (CNF). i. $\neg((A \vee B) \implies (C \wedge D))$ ii. A ⇔ (B ∨ E)	*CO2*	*PO2*	**08**
		c)	Comprehend the types of quantifiers in First-Order Logic.	*CO2*	*PO1*	**04**
			UNIT - IV			
	7	a)	Given the full joint distribution compute the following with respect to the table shown below: i) P (toothache) ii) P (Cavity) iii) P (Toothache | cavity) iv) P (Cavity | toothache v catch)	*CO3*	*PO2*	**10**
		b)	In Orange County, 51% of the adults are males. One adult is randomly selected for a survey involving credit card usage. i. Find the prior probability that the selected person is a male. ii. It is later learned that the selected survey subject was smoking a cigar. On a whole 9.5% of male's smoke cigars and 1.7% of female's smoke cigars. Find the probability that the selected subject is a male.	*CO3*	*PO3*	**10**
			OR			
	8	a)	Explain Bayes' Theorem and discuss its applications in real-world scenarios.	*CO3*	*PO1*	**05**
		b)	Describe uncertain knowledge in Artificial Intelligence with examples.	*CO3*	*PO1*	**05**
		c)	Suppose 40% of all emails received are classified as spam. A spam detection software identifies spam emails with 98% accuracy, meaning it correctly classifies 98% of spam emails as spam and 95% of non-spam emails as not spam. If an email is marked as spam, what is the probability that it is actually a spam email?	*CO3*	*PO3*	**10**
			UNIT - V			
	9	a)	Explain the components of expert system with a neat diagram.	*CO3*	*PO1*	**05**
		b)	Outline the benefits and drawbacks of an expert system.	*CO3*	*PO1*	**05**

	toothache		**~ toothache**	
	catch	**~catch**	**catch**	**~catch**
cavity	0.108	0.012	0.072	0.008
~cavity	0.016	0.064	0.144	0.576

		c)	A financial consulting firm wants to develop an expert system to help financial analysts predict stock market trends and forecast future financial outcomes based on historical data, market conditions, and economic indicators. The expert system aims to provide insights into potential risks and opportunities for investment. i. Outline the steps involved in building such a system. ii. Explain the challenges associated with knowledge acquisition in this domain. iii. Provide an example of how financial analysts would use the expert system in practice to make informed investment decisions.	*CO3*	*PO3*	**10**
			OR			
	10	a)	With a neat sketch, explain the various components of EMYCIN expert system.	*CO3*	*PO1*	**05**
		b)	Differentiate between Conventional system and Expert system.	*CO3*	*PO1*	**05**
		c)	Rahul is a healthcare IT specialist tasked with implementing an expert system for diagnosing bacterial infections. i. Identify a suitable Expert System and discuss its architecture. ii. Outline the strengths and limitations of the Expert System for the given scenario.	*CO3*	*PO3*	**10**

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