U.S.N.										

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

Autonomous Institute Affiliated to VTU

February 2025 Semester End Main Examinations

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

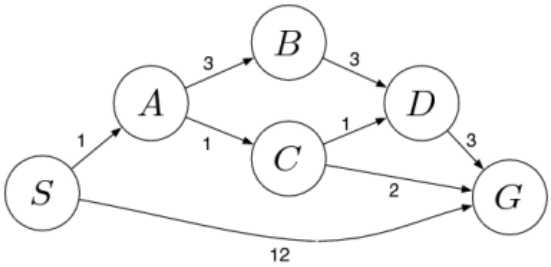
Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**

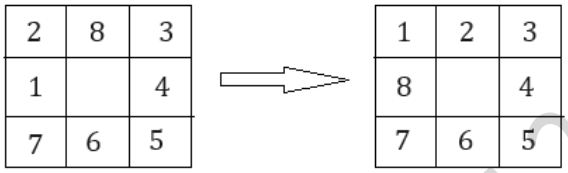
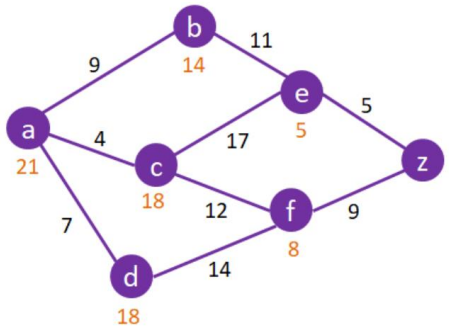
Course Code: 22AM4PCIAI **Max Marks: 100**

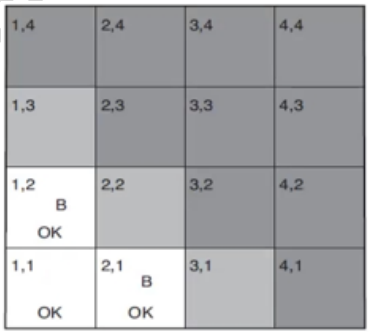
Course: Introduction to Artificial Intelligence

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)		Define Artificial Intelligence (AI) and explain four distinct approaches to AI, highlighting their respective methodologies.	*CO1*	*PO1*	**06**
	b)		i. Write Uniform Cost Search Algorithm. ii. Find the optimal path to reach the delivery goal (G) from the starting point (S) for the graph shown in Figure 1b.  Figure 1b	*CO1*	*PO2*	**06**
	c)		Provide a diagram that illustrates how Iterative Deepening Search (IDS) explores nodes by progressively increasing the depth limit. Also explain the benefits of IDS.	*CO1*	*PO2*	**08**
			OR			
2	a)		Give the PEAS (Performance, Environment, Activator, Sensor) description for i. Ketchup producing industry ii. Subject tutoring	*CO1*	*PO1*	**06**
	b)		Write pseudocode agent programs for the model-based reflex agent and utility-based agents with appropriate block diagrams.	*CO1*	*PO2*	**08**
	c)		Differentiate the following dimensions to analyze several tasks environment with examples i. Fully observable vs partially observable ii. Deterministic vs Stochastic iii. Episodic vs sequential	*CO1*	*PO1*	**06**

			UNIT - II			
	3	a)	Anand is tasked with designing a simple algorithm to solve a Sudoku puzzle using the Generate and Test approach. Describe the process to generate possible solutions for the puzzle and test them to determine if they are valid.	*CO2*	*PO2*	**06**
		b)	Highlight the drawbacks of the Hill Climbing algorithm in an optimization problem.	*CO2*	*PO1*	**06**
		c)	Apply the Constraint Satisfaction problem to obtain the solution for: CROSS+ROADS=TRAIL	*CO2*	*PO2*	**08**
			OR			
	4	a)	Illustrate 8 square problem using the Hill Climbing Search Algorithm for the given initial state and goal state.  Initial State Goal State	*CO1*	*PO2*	**08**
		b)	How can you ensure that the A* search algorithm is both admissible and capable of finding the optimal solution?	*CO1*	*PO1*	**04**
		c)	i. Write A* Search Algorithm ii. Find the most cost-effective path to reach from start state A to final state Z for the graph shown in Figure 3c using A* Search Algorithm.  Figure 3c	*CO1*	*PO2*	**08**
			UNIT - III			
	5	a)	Differentiate between Propositional Logic and First Order Logic.	*CO2*	*PO1*	**05**
		b)	Prove the equivalence for the given propositions using Standard Logical Equations. **$(p \rightarrow q) \wedge [(\sim q \wedge (r \vee \sim q))] \Leftrightarrow \sim (q \vee p)$**	*CO2*	*PO2*	**08**
		c)	Consider the following knowledge base: The humidity is high or the sky is cloudy. If the sky is cloudy, then it will rain. If the humidity is high, then it is hot. It is not hot. Goal: It will rain	*CO2*	*PO2*	**07**

			Use propositional logic and apply the resolution method to prove that the goal is satisfiable.			
			OR			
	6	a)	Differentiate Forward chaining and Backward chaining.	*CO2*	*PO1*	**04**
		b)	Summaries the various types of quantifiers in First-Order Logic with suitable examples.	*CO2*	*PO1*	**04**
		c)	Convert the following First Order Logic to English statements: i. ∀x bird(x) →fly(x). ii. (∀x) student(x) → smart(x) iii. ∀x man(x) → respects (x, parent). iv. ∃x boys(x) → play (x, cricket). v. ¬∀ (x) [student(x) → like (x, Mathematics) ∧ like (x, Science)].	*CO2*	*PO2*	**06**
		d)	Convert the following proposition to Conjunctive Normal Form (CNF) with detailed steps: i. ¬((A∨B) ⟹ (C∧D)) ii. A ⇔ (B ∨ E)	*CO2*	*PO2*	**06**
			UNIT - IV			
	7	a)	Describe uncertainty in knowledge representation. Outline the various strategies to reduce uncertainty.	*CO2*	*PO1*	**04**
		b)	Suppose 40% of all emails received are classified as spam. A spam detection software identifies spam emails with 98% accuracy, and 95% of emails as not spam. If an email is marked as spam, what is the probability that it is a spam email?	*CO2*	*PO2*	**06**
		c)	In Wumpus World problem, an agent is exploring a 4x4 grid cave. The agent starts at position [1,1] as shown in the Figure 6c. Calculate the probability that each of the three grids [1,3], [2,2], [3,1] contains a pit in the Wumpus world problem.  Figure 6c	*CO2*	*PO3*	**10**
			OR			
	8	a)	i. Explain Bayes' Rule ii. Discuss its significance in probability theory. iii. Comprehend how Bayes' Rule is used to update the probability of an event based on new evidence. iv. Provide at least two real-world applications of Bayes' Rule.	*CO2*	*PO3*	**10**
		b)	A security company wants to develop a belief network for detecting fraudulent transactions in a financial system. The	*CO2*	*PO3*	**10**

			network will help in identifying suspicious activities based on various factors such as transaction amount, location, frequency of transactions, and customer behavior. The company intends to build a system that can assess the likelihood of fraud given these factors. i. Construct a belief network for fraud detection in a financial system. ii. Develop a belief network that represents the relationships between transaction amount, location, customer behavior, transaction frequency, and the likelihood of fraud. iii. How would the system use these factors to update the belief about a transaction being fraudulent?			
			UNIT - V			
	9	a)	Illustrate the architecture of an expert system along with its key components.	*CO3*	*PO2*	**06**
		b)	Distinguish expert system and conventional systems.	*CO3*	*PO1*	**04**
		c)	Peter is tasked with evaluating a case involving a patient presenting with symptoms of a severe bacterial infection. The patient shows symptoms such as fever, chills, and a localized infection, but their medical history includes several underlying conditions that might affect the diagnosis. i. Identify and describe the expert system which can be used for the diagnosis. ii. What are the strengths and limitations of the expert system?	*CO3*	*PO2*	**10**
			OR			
	10	a)	i. Outline the importance of knowledge representation in expert systems. ii. Explain how knowledge representation influences the system's ability to reason and make decisions. iii. Discuss the different types of knowledge representation techniques used in expert systems.	*CO3*	*PO1*	**10**
		b)	A retail company wants to develop an expert system to optimize inventory management. The system would help the company predict demand for different products based on historical sales data, seasonal trends, and customer behaviour. It aims to assist store managers in making decisions about stock levels, reordering products, and planning promotions to avoid stockouts or overstocking. i. Discuss the process of designing an expert system for inventory management in a retail company. ii. Explain the essential steps involved in building the system. iii. Identify the challenges of knowledge acquisition due to the variability in customer behaviour and market conditions.	*CO3*	*PO3*	**10**

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