

AP Code	1191AM-1A	Reg.No	
KPR Institute of Engineering and Technology (Autonomous) Avinashi Road, Arsur, Coimbatore - 641 407			
Course Code & Title	U21AM401 Machine Learning 1	Dept.:	CSE(AIML)
Year	II	Semester: 04	Ac.Yr.: 2024 - 2025
CIAT	II	Duration: 90 Minutes	Date: 16.05.2025 - AN Maximum Marks: 60

Section - A (10X1=10 Marks)				
Q. No	Answer All Questions	Marks	BT	CO
1	Which of the following is a true statement about uninformed search? a It always uses a heuristic to find the goal. b It does not guarantee finding the goal in finite time. c It explores all possible states in the search space. d It requires domain-specific knowledge to work.	1	R	CO1
2	Which of the following search algorithms is complete and guarantees optimality if all step costs are equal? a A* Search b Uniform Cost Search c Greedy Best-First Search d Depth-First Search	1	R	CO1
3	Which of the following statements is true about informed search strategies? a They guarantee an optimal solution if the goal is reachable. b They can only work in deterministic environments. c They use a heuristic to guide the search. d They are faster than uninformed search strategies in all cases.	1	R	CO2
4	Which of the following search strategies is guaranteed to find a solution if one exists within a finite search space? a Depth-First Search b Uniform Cost Search c Breadth-First Search d All of the above	1	R	CO2
5	Which of the following is a limitation of propositional logic? a It cannot express relationships between variables. b It is too complex to use in practical applications. c It cannot handle quantifiers. d It only represents facts and not beliefs.	1	R	CO2
6	In propositional logic, which of the following is a valid formula? a $(P \wedge Q) \rightarrow R$ b $(P \vee (Q \wedge R))$ c $(P \rightarrow Q) \vee (\neg Q \rightarrow R)$ d All of the above	1	U	CO2
7	Backward chaining works by: a Working forwards from known facts to derive the goal. b Using random search to find the goal. c Starting from the goal and working backwards to find the facts. d Generating all possible solutions and filtering them.	1	U	CO3
8	In machine learning, the goal of concept learning is to: a Identify the features that best learn from labeled data to generalize. b Minimize the error between predicted and actual values. c Maximize the separation between different classes. d Maximize the accuracy of the model.	1	U	CO3
9	What is a key limitation of the Find-S algorithm?	1	U	CO3

10	a It requires a large number of training examples. b It does not handle noisy data well. c It is too computationally expensive. d It can only handle binary classification.			
	The Candidate Elimination algorithm maintains: a A hypothesis space representing all possible concepts. b A decision tree representing all possible features. c A set of rules to classify data. d A single concept representing the best.	1	U	CO3

Section - B (10X2=20 Marks)				
Q.No	Answer All Questions	Marks	BT	CO
11	Difference Breadth-First Search (BFS) and Depth-First Search (DFS).	2	U	CO1
12	Define a heuristic function. Explain admissibility and consistency properties.	2	R	CO1
13	What is a Constraint Satisfaction Problem (CSP)?	2	R	CO2
14	Solve the following cryptarithmic problem by assigning digits (0-9) to each letter such that the sum is correct and no two letters have the same digit: A + A + A = BA.	2	Ap	CO2
15	What is forward chaining?	2	R	CO2
16	Prove whether the following expression is a tautology, contradiction, or contingent using a truth table: $(P \vee Q) \rightarrow (P \wedge Q)$.	2	Ap	CO2
17	Translate the following into First-Order Logic (FOL) and infer the conclusion: "All students are intelligent." "Alice is a student." Task: Translate into FOL. Infer: "Alice is intelligent."	2	Ap	CO3
18	Define Candidate Elimination Algorithm in machine learning.	2	R	CO3
19	Define concept learning.	2	R	CO3
20	How does a decision tree work as a learning algorithm?	2	U	CO3

Section - C (1X6=6 Marks & 2X12=24 Marks)				
Q.No	Answer All Questions	Marks	BT	CO
	Given the following graph with nodes A, B, C, D, E and their heuristic values (h): (A,10) (B,6) (C,4) (D,0) (E,3)			
	Edges: <ul style="list-style-type: none"> A → B (Cost = 2) A → C (Cost = 4) B → D (Cost = 3) C → D (Cost = 1) C → E (Cost = 2) E → D (Cost = 2) 	6	Ap	CO1
	Using the A* algorithm, find the shortest path from A to D, and show the steps including $f(n) = g(n) + h(n)$ for each node			
	(Or)			
21 b)	Explain the concept of a Constraint Satisfaction Problem (CSP) and how it applies to solving Cryptarithmic problems. Solve the following cryptarithmic puzzle using the CSP framework: SEND + MORE = MONEY	6	Ap	CO1

22 a)	<p>Given the following facts and rules:</p> <ul style="list-style-type: none"> • If a person is guilty and has a motive, then they are a criminal. • West has a motive. • West is guilty. <p>Represent these statements in First-Order Logic (FOL). Using the Backward Chaining algorithm, determine whether West is a criminal. Draw the corresponding backward chaining tree and show the steps of reasoning.</p>	6	Ap	CO2
ii)	<p>Given the following knowledge base in First-Order Logic (FOL):</p> <ul style="list-style-type: none"> • $\forall x (\text{Human}(x) \rightarrow \text{Mortal}(x))$ • $\forall x (\text{King}(x) \wedge \text{Greedy}(x) \rightarrow \text{Evil}(x))$ • $\text{Human}(\text{John})$ • $\text{King}(\text{John})$ • $\text{Greedy}(\text{John})$ <p>Using the Forward Chaining algorithm, determine whether the following conclusions can be inferred:</p> <ol style="list-style-type: none"> 1. $\text{Mortal}(\text{John})$ 2. $\text{Evil}(\text{John})$ <p>Clearly show the sequence of inferences made.</p>	6	Ap	CO2;
(Or)				
22 b)	<p>Represent the following scenario in Propositional Logic:</p> <ul style="list-style-type: none"> • "If it rains, the ground will be wet. If the ground is wet, the grass will grow." • Use logical connectives and evaluate the truth of the conclusion "The grass will grow" based on the truth values of the premises. 	6	Ap	CO2
ii)	<p>Given the following facts:</p> <ul style="list-style-type: none"> • West is an American. • Nono is a hostile nation. • Missiles are weapons. • Nono has missiles. • West sold missiles to Nono. • All Americans who sell weapons to hostile nations are criminals. <p>Using backward chaining, prove whether West is a criminal, and show the logical steps involved.</p>	6	Ap	CO2

23 a)	12	Ap	CO3
<p>i) List and explain the components of a learning system in machine learning. Discuss the role of each component in the learning process and how they contribute to building an effective machine learning model.</p> <p>ii) Explain the Candidate Elimination algorithm and describe how it maintains the version space of hypotheses. How does this process help in refining the hypothesis to best fit the training data? Provide an example to demonstrate the concept.</p> <p>(Or)</p> <p>i) Define inductive bias in Decision Tree learning. How does it affect the tree's ability to generalize from training data to unseen examples? Discuss its impact on model accuracy and performance.</p> <p>ii) Define concept learning and explain the Find-S algorithm used to generalize concepts from training data. Provide a simple example to illustrate how the algorithm works in practice.</p>			
23 b)	12	Ap	CO3