National Institute of Technology, Tiruchirappalli - 15
Department of Computer Science and Engineering

Cycle Test 2

CSPC54 – Introduction to Artificial Intelligence and Machine learning

Course/Department : B.Tech./CSE
Batch : 2022-2026
Semester/Section : V A
Session : July/2024
Date and Time : 14-10-2024 & 03.30 PM – 04.30 PM
Marks : 15

Answer ALL Questions with proper steps and justification.
Draw diagrams wherever necessary.

1. Consider the following dataset. (3) CO4

Road Condition	Suspension Type	Speed (mph)	Temperature (°F)	Performance
Wet	Independent	50	70	Good
Dry	Dependent	70	80	Good
Wet	Independent	30	60	Poor
Dry	Dependent	60	90	Good
Wet	Independent	40	75	Poor
Dry	Dependent	80	85	Good
Wet	Independent	20	50	Poor
Dry	Dependent	50	70	Poor
Wet	Independent	60	80	Good
Dry	Dependent	40	65	Poor

In order to create a decision tree that accurately predicts the suspension system's performance, Calculate the information gain of attributes 'Road Condition' and 'Suspension Type'. Compare them and discuss on which one of these two can be selected as the root of the decision tree.

2. With the help of a suitable example discuss on exhaustive decomposition in categories. (1) CO2

3. You have the following propositional rules in your knowledge base: (2) CO3

Rule 1: If it is sunny, then the park is open. ($S \rightarrow P$)

Rule 2: If the park is open, then the picnic can happen. ($P \rightarrow C$)

Rule 3: If the picnic can happen and it is Saturday, then we will have the picnic.

($(C \wedge T) \rightarrow H$)

Fact 1: It is Saturday. (T)

Fact 2: It is not sunny. ($\neg S$)

Where S = "It is sunny", P = "The park is open", C = "The picnic can happen", T = "It is Saturday" and H = "We will have the picnic".

Determine using backward chaining that you will have picnic or not.

4. Formalize the following sentence in First-order logic. CO3

a) Some people with no jobs are restless. (1)
b) No leather bag is allowed. (1)

5. Consider the following knowledge base (KB) in First-Order Logic: **(3)** CO3

Rule 1: $\forall x(\text{Person}(x) \rightarrow \exists y(\text{Loves}(x,y) \wedge \text{Person}(y)))$

Rule 2: $\forall x \forall y(\text{Loves}(x,y) \rightarrow \text{Happy}(x))$

Rule 3: $\forall x(\text{Person}(x) \wedge \neg\text{Happy}(x) \rightarrow \exists y(\text{Loves}(y,x)))$

Fact 1: Person(Alice)

Fact 2: $\neg$Happy(Alice)

Using resolution refutation, prove whether there exists some person who loves Alice. Convert the sentences in the knowledge base to clausal form. Provide all intermediate steps, including unification, Skolemization, and clause resolution. Indicate any assumptions made during the proof process.

6. Write down the pseudo-code for DPLL algorithm. **(2)** CO2, 3

7. Consider an image classifier that distinguishes between 'CAT' and 'Dog', where CAT is the positive Class and DOG is the negative Class. There are 1750 Cat images and 1250 Dog images in the dataset. The classifier identified 1678 Cat images and 1126 Dog images correctly. Compute the accuracy, precision and recall of the classifier. **(2)** CO4