UPES
UNIVERSITY OF TOMORROW

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Knowledge Engineering and Expert System   Semester: 2
Program: MCA   Time : 03 hrs.
Course Code: CSAI 7014   Max. Marks: 100

Instructions: Attempt all the questions.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Discuss how a production system is different from an expert system.	4	CO1
Q 2	Write a prolog program to determine the last and n^{th} element of a list.	4	CO2
Q 3	Establish the validity of the following arguments: (i) {A v C, ~B v ~C} → (A v ~B) (ii) {A v C, ~C → B, ~B, A → S, ~U} → (~U ^ S)	4	CO2
Q 4	Differentiate between Non-monotonic and monotonic reasoning with suitable examples.	4	CO3
Q 5	List down the various errors which might contribute to uncertainty in the expert system.	4	CO4

SECTION B
(4Qx10M= 40 Marks)

Q 1	Draw a semantic network representing the following knowledge: "Every living things need oxygen to live. Every human is a living thing. Ram is human. Answer the query Ram is living thing and Ram needs oxygen to live using inheritance."	10	CO1

Q 2	Draw an AND-OR tree for arriving at UPES from your home. Explore all the possibilities for your journey to the university while considering all the necessary requirements.	10	CO1
Q 3	Discuss the characteristics of an inference engine? Describe backward and forward chaining mechanism used by an inference engine. **OR** Describe the following with appropriate examples: (a) Tree (b) Graph (c) Hasse Diagram (d) Lattice	10	CO2
Q 4	Consider the following set of statements: *(A) Either taxes are increased or if expenditures rise then the debt ceiling is raised.* *(B) If taxes are increased, then the cost of collecting taxes rises.* *(C) If a rise in expenditures implies that the government borrows more money, then if the debt ceiling is raised, then interest rates increase.* *(D) If taxes are not increased and the cost of collecting taxes does not increase then if the debt ceiling is raised, then the government borrows more money.* *(E) The cost of collecting taxes does not increase.* *(F) Either interest rates do not increase or the government does not borrow more money.* Apply the rules of inference/resolution-refutation method to prove either the debt ceiling isn't raised or expenditures don't rise.	10	CO3

SECTION-C
(2Qx20M=40 Marks)

| Q 1 | Consider the following axioms:

● Every investor bought [something that is] stocks or bonds.
● If the Reliance crashes, then all stocks that are not gold stocks fall.
● If the T-Bill interest rate rises, then all bonds fall.
● Every investor who bought something that falls is not happy. | 20 | CO3 |

Prove that "**If the Reliance crashes and the T-Bill interest rate rises, then any investor who is happy bought some gold stock**" using resolution-refutation method.

OR

(A) Let T (x, y) mean that student x likes cuisine y, where the domain for x consists of all students at your school and the domain for y consists of all cuisines. Express each of these statements by a simple English sentence. Assume ¥ refers to the universal quantifier and Ξ refers to the existential quantifier. **(12 Marks)**

a) ¬T (Arpit, Japanese).

b) ΞxT (x, Korean)   ¥x T (x, Mexican).

c) ΞyT (Devanshi, y)   T (Isha, y)

d) ¥x ¥z Ξy((x != z) → ¬(T (x, y)   T (z, y)))

e) Ξx Ξz ¥y(T (x, y) ↔ T (z, y))

f) ¥x ¥zΞy(T (x, y) ↔ T (z, y))

(B) Explain Skolemization using a suitable example of your choice.

(5 Marks)

(C) Describe the terms- modus ponens, modus tollens, and universal instatiation. **(3 Marks)**

Q 2	Write short notes on any four of the following: (A) Markov Chain Process (B) Temporal Reasoning (C) Inference Net (D) Bayes' Theorem (E) Propagation of Probabilities	20	CO4