C14-R3: AI AND NEURAL NETWORKS

NOTE:

1. **Answer question 1 and any FOUR questions from 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.

a) What is the most general unifier (mgu) and explain how it is useful in unification algorithm?

b) Differentiate between A^* and AO^* algorithm. In which type of AI problems they are used.

c) Explain frame based knowledge representation with the help of an example.

d) What is reinforced learning? How is it different from supervised learning?

e) Elaborate Alpha-Beta cutoffs in Minimax Search.

f) Differentiate between forward state propagation and backward state propagation w.r.t. plan generation algorithm.

g) What are the problems with hill climbing technique? Suggest a solution to remove such problems.

(7x4)

2.

a) Explain how does cut (!), fail and !, fail affect the execution of a prolog program with the help of suitable examples.

b) When would be best first search be worse than breadth first search? Justify your answer with the help of an example.

c) Solve following cryptoarithmatic problem using constraint satisfaction method.

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   T W O
 + T W O
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 F O U R
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(6+4+8)

3.

a) What are the advantages of conjunctive normal form? Convert the following fact into conjuctive normal form.

All Romans who know Marcus either hate Caesar or think that anyone who hates anyone is crazy.

b) Draw a semantic network for the following sentence:

Mohan is elder than Ram and Ram's age is 40 years.

c) What are three most fundamental components of a production system? What is the purpose of keeping a conflict resolution rule in the production system?

(6+6+6)

4.

a) What is the architecture of an expert system? Explain different components of an Expert System.

b) Give structure of
   i) Single Layer Feed-forward Network
   ii) Multilayer Feed-forward Network, and
   iii) Recurrent Network

c) Given the following information in a database
   A1: If x is on top of y, y supports x.
   A2: If x is above y and they are touching each other, x is on top of y.
   A3: A cup is above a book.
   A4: A cup is touching a book.
   i) Translate statements A1 through A4 into clausal form.
   ii) Show that the predicate support (book, cup) is true using resolution.

(6+6+6)

5.

a) Describe how patterns are stored and recalled in ART1 networks?

b) Illustrate ART1 learning algorithm.

c) Distinguish between parsing technique RTN and ATN for natural language understanding.

(5+8+5)

6.

a) What is the significance of planning in AI system? Explain the main components of a planning system.

b) How reasoning is performed under uncertain conditions? Use the concept of certainty factor to compute the values of CF, MB, MD for the hypothesis *h* given following three observations:
   CF(h1, 01) = 0.5
   CF(h2, 02) = 0.3
   CF(h3, 03) = -0.2

c) Explain the terms modus ponen modes tollen unification and resolution related to the reasoning systems. Give example of each.

(6+6+6)

7.

a) Draw Hamming network and explain how competitive learning is achieved in Hamming network?

b) Consider a fully simply connected neural network containing three input nodes and a single output node. The inputs to the network are eight possible binary patterns 000, 001, 0010 ….. 111. Find weight w_i for which the network can differentiate between the inputs by producing the outputs.

(9+9)