C14-R3: AI AND NEURAL NETWORKS

NOTE:

1. **Answer question 1 and any FOUR from questions 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 do you mean by an expert system? What are the applications of an expert system?

b) Contrast between on-line learning and batch-mode learning for multilayer perceptron network.

c) State with justification whether the following statements are true or false.
   i) Hill Climbing algorithm is admissible.
   ii) We always get performance improvement using alpha-beta cutoffs in MiniMax algorithm.

d) What do you mean by defuzzification? Explain with an example.

e) According to some people, cut and fail should not have been in Prolog. Can you explain why?

f) Distinguish between supervised learning and unsupervised learning in the context of artificial neural networks.

g) For $f(net_j)$ as given by

$$f(net_j) = \frac{1}{1+e^{-(net_j-\Theta_j)/\Theta_o}}$$

Computer and plot $f'(net_j)$ for $\Theta_j = 0; \Theta_o = 1$.

(7x4)

2.

a) Write A* algorithm and show how A* algorithm can be used to find minimal cost overall path or simply any path as quickly as possible.

b) What do you mean by proof by Resolution? Give pros and cons of Resolution proof method.

c) Consider an artificial neural unit with the following input/output characteristic

$O_i = \max\{i_1, i_2, \ldots, i_d\}$

Is this unit linear? Show how the unit of equation could be used to implement AND.

(6+6+6)

3.

a) Trace the execution of the constraint satisfaction procedure in solving the crypt arithmetic problem:

```
  BASE
+
  BALL
 _____
GAMES
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b) List various ways in which knowledge can be represented. Give the Semantic Network representation for the sentence "John gave Marry the book".

c) Compare Perceptron learning v/s Backpropagation learning in Neural Networks.

(6+6+6)

4.

a) Bayes network and fuzzy logic are concerned for modeling uncertainty of the world. Bring out the differences between these two.

b) Which kind of knowledge is needed to understand and produce a language? Discuss five-stage model along with the internal processing involved at each stage in a typical NLP based system.

c) Compare MLP (Multi Layer Perceptron) network with RBF (Radial Basis Function) network.

(6+6+6)

5.

a) Rules and chaining provide more flexibility and thus result in more usefulness over logic. Is it a correct statement? Justify.

b) Write significance of an expert system shell. What are the components of an expert system shell? Give names of two well known expert systems.

c) Convert these sentences to propositional logic. Using the logical rules, proof by resolution that "it is good to walk" is a logical consequence of the given information.

i) It is raining, it is snowing or it is dry.
ii) It is warm.
iii) It is not raining.
iv) It is not snowing.
v) If the weather is nice, then it is good to walk.
vi) If the weather is dry and warm, the weather is nice.

(6+6+6)

6.

a) Write a Prolog program to determine whether the list is palindrome or not.

b) Write a Prolog program to split a list into two lists such that one list contains negative numbers and one contains positive numbers.

c) Write a prolog program to join two lists of integer excluding common elements.

(6+6+6)

7.

a) What are the components of a planning system? Describe planning with forward state space search.

b) How the frames are organized? What are the advantages and disadvantages of frames and semantic nets? Why the scripts are required? Can it be considered as a variant of frames?

c) Briefly describe Bayesian belief nets and how are they used to classify items for a given problem.

(6+6+6)