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) Explain the means-end-analysis approach to problem solving.
b) Justify the following with respect to control strategies:
   i) Breadth first Search is complete even if zero step-costs are allowed.
   ii) Depth-first iterative deepening always returns the same solution as breadth-first search if b is finite and the successor ordering is fixed.
c) Represent the following English sentence in first order logic sentence.
   "John social security number is same as Mary's."
d) Give the condition under which A* provides an optimal solution.
e) Differentiate between supervised and unsupervised learning.
f) What do you understand by the term "Expert Systems"? How is it different from knowledge-based system?
g) Describe the use of alpha-beta cutoffs in minimax search.

(7x4)

2.
a) A farmer has to cross a river with his fox, goose and grain. His boat can only carry him along with one of his possessions. An unguarded fox will eat the goose and an unguarded goose will eat the grain. Give a good representation of this problem. Write down the search tree and perform breadth first search.
b) Consider the Water Jug Problem defined as follows:
   "You are given two jugs of capacity 4 litres and 3 litres respectively. Neither has any measuring marker on it. How can you get exactly 2 litres of water into the 4 litre jug assuming unlimited supply of water?"
   Give the representation and state space for this problem along with the operators to be used to solve the problem.
c) Justify the use of Fuzzy Logic in AI? What are the criticisms for fuzzy logic?

(8+6+4)

3.
a) Convert the following sentences into *predicate logic* and Prove by *Proof of Resolution* "Buckeyes are not food".
   i)   John eats all kinds of food.
   ii) Apples are Food.
   iii) Chicken is Food.
   iv) Anything anyone eats and isn't killed by is food.
   v)   Bill eats peanuts and is still alive.
   vi) Sue eats everything Bill eats.
b) When can predicate logic and resolution/unification be used as a form of automated reasoning? What are the strengths and weaknesses of this form?

(10+8)

4.
a) Why is it required to update knowledge in Expert System? Which facility is there in Expert System for the same?
b) What is Natural Language Processing (NLP)? Why is NLP good for? Explain briefly applications of NLP.
c) What is McCullock and Pitts model for an artificial neuron?
d) What do you mean by *sensitivity of initial conditions* and *generalization* in the context of Neural Networks?

(5+4+4+5)

5.
a) Compare the working of Neural Networks with the working of human Brain. List the advantages and disadvantages of Neural Networks?
b) Compare Perceptron learning v/s Backpropagation leaning in Neural Networks.
c) Can Hopfield Networks solve a variety of optimization problems? Can it find an optimum solution for all optimization problems? How?

(8+5+5)

6.
a) Write a PROLOG program for generating the sub lists of the given list.
b) Write a PROLOG program to implement Tower of Hanoi.
c) How cut and fail change the execution of a PROLOG program? Explain with the help of examples.

(6+6+6)

7.
a) What are the various ways in which uncertainty can be handled in rule-based system? Explain each with the help of an example.
b) What kind of knowledge is needed to understand and produce the Natural language? Explain in brief.
c) Find a plan for the following Blocks World Problem. Use backward chaining the breadth first search. Show the resulting "before" relation and make sure that there are no loops.

Initial state:	Final state:
on(A, Table)	on(A, Table)
on(B, Table)	on(B, A)
on(C, Table)	on(C, B)
on(D, Table)	on(D, C)

(6+6+6)