BE2-R4: ARTIFICIAL INTELLIGENCE & 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 is Chinese Room Test? Discuss how is it different from Turing test?
b)   Compare Breadth First and Depth First Search techniques on the basis of time, space and optimality and completeness.
c)   Criticize Hill Climbing algorithm with the help of an example.
d)   Differentiate between Semantic Nets and Frames?
e)   Why do we need fuzzy logic systems in the present scenario? What are its advantages and disadvantages?
f)   Discuss the role of Recursive Transitions Nets (RTN) and Augmented Transition Nets (ATN) in natural language processing
g)   Briefly explain the learning paradigms in artificial neural networks.

(7x4)

2.
a)   Consider a state space where the start state is number 1 and each state k has two successors: numbers 2k and 2k + 1.
    i)   Draw the portion of the state space for states 1 to 15.
    ii)   Suppose the goal state is 11. List the order in which nodes will be visited for breadth-first search and depth-first search.
b)   What are production systems? Describe the various categories of production systems.
c)   What is Simulated Annealing algorithm? How is it different from Local Beam Search?

(8+6+4)

3.
a)   Given the game board below where it is X's turn to play next, show the game tree with a cut-off depth of two ply (i.e., stop after each player makes one move). Use the following evaluation function on all leaf nodes:
Eval(s) = 10X3(s) + 3X2(s) + X1(s) – (10O3(s) + 3O2(s) + O1(s))
where we define Xn(*s*) as the number of rows, columns, or diagonals in state *s* with exactly *n* X's and no O's, and similarly define On(*s*) as the number of rows, columns, or diagonals in state *s* with exactly *n* O's and no X's. Use the minimax algorithm to determine X's best move.

b)   What are artificial neural networks (ANNs)? Discuss the basic structure of ANNs in detail.
c)   Draw the Parse tree for the given statement: "The bird pecks the grains"

(10+6+2)

4.

a) What is Fuzzy Logic system? Explain its various components with the help of an example.

b) Is it true to say that Dempster-Shafer theory is an alternative to traditional probability theory. Justify your answer with appropriate reasons. Also discuss the suitable applications of Dempster-Shafer theory and traditional probability theory.

c) Write a PROLOG program:
   i) To remove duplicates from the list
   ii) For merging two ordered lists using cut

(6+6+6)

5.

a) Consider a situation in which we want to reason about the relationship between smoking and lung cancer. We'll use 5 Boolean random variables representing "has lung cancer" (C), "smokes" (S), "has a reduced life expectancy" (RLE), "exposed to second- hand smoke" (SHS), and "at least one parent smokes" (PS). Intuitively, it is known that whether or not a person has cancer is directly influenced by whether she is exposed to second-hand smoke and whether she smokes. Both of these things are affected by whether her parents smoke. Cancer reduces a person's life expectancy.
   i) Draw the network (nodes and arcs only)
   ii) How many independent values are required to specify all the conditional probability tables (CPTs) for the network?
   iii) How many independent values are in the full joint probability distribution for this problem domain?

b) Self Organizing Networks and Recurrent Networks are alternatives to each other? Comment and Justify.

c) Define the term Knowledge Acquisition (KA)? Describe the techniques used for Knowledge Acquisition.

(6+6+6)

6.

a) Choose variable symbols, predicates etc and express the following sentences in FOL:
   i) Every parrot is an animal with wings.
   ii) Animals with wings fly.
   iii) Polly is a parrot.
   Show using Modus Ponens as well as resolution that Polly flies.

b) Construct semantic network representations for the information below:
   "Mary gave the green flowered vase to her cousin."

c) Discuss the role of consistency driven techniques in constraint satisfaction problems.

(6+4+8)

7.

a) Discuss various activation functions of Artificial Neural Network.

b) Explain Hebb's Learning Rule.

(9+9)