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) Write notes on Mundane Tasks, formal Tasks and Expert Tasks in knowledge based systems.
b) Distinguish between Breadth First search and Depth First Search.
c) What is a heuristic search technique? Discuss the various types of heuristic search techniques in brief.
d) Differentiate between Semantic Web and Semantic Nets.
e) Compare and contrast supervised learning and unsupervised learning techniques.
f) What is Fuzzy Logic? Explain with the help of examples, how is it different from the crisp logic?
g) Define NLP? Discuss the various components of NLP?

(7x4)

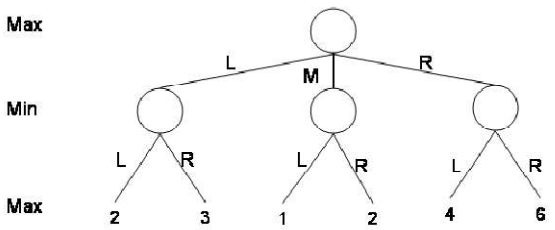
2.

a) The missionaries and cannibals is an important AI problem. Three missionaries and three cannibals are on one side of a river, along with a boat that can hold one or two people. Find a way to get everyone to the other side, without ever leaving a group of rnissionaries in one place outnumbered by the cannibals in that place.
   i) Formulate the problem precisely, making only those distinctions necessary to ensure a valid solution.
   ii) Write steps to generate an appropriate solution to the problem.
b) Translate the following first-order logic sentences into Prolog.
   i) Knows(Sylvester,Tweetie)
   ii) $\forall$x,y Friend(x,y) ⇒Knows(x,y)
   iii) $\forall$x,y (Cat(x) /\Bird(y)) ⇒LikesToEat(x,y)
   iv) x(Parakeet(x) \/Penguin(x)) ⇒ Bird(x)
   v) $\forall$x Parakeet(x) ⇒(Files(x) /\ Chirps
c) Write a PROLOG programs to append two lists.

(10+5+3)

3.

a) Consider the game tree shown below. The top node is a max node. The labels on the arcs are the moves. The numbers in the bottom layer are the values of the different outcomes of the game to the max player.
   i) Using alpha-beta pruning, consider the nodes from right to left, which nodes are cut off? Show all steps to identify the nodes that are not examined. Support your answer with appropriate reasons.



b) Discuss the various methods for solving constraint satisfaction problems.

c) In a class of 10 students (the universal set), 3 students speaks German to some degree, namely Ana to degree 0.7, Bobby to degree 1.0, Catrina to degree 0.4. What is the size of the subset A of German speaking students in the class?

(8+8+2)

4.

a) Convert the following English statements to statements in first order logic.
   i) Every boy or girl is a child.
   ii) Every child gets a doll or a train or a lump of coal.
   iii) No boy gets any doll.
   iv) No child who is good gets any lump of coal e. Jack is a boy.

b) Explain the architecture of knowledge based systems with the help of diagram.

c) What are recurrent networks? Discuss the various components of simplest fully recurrent neural network.

(6+6+6)

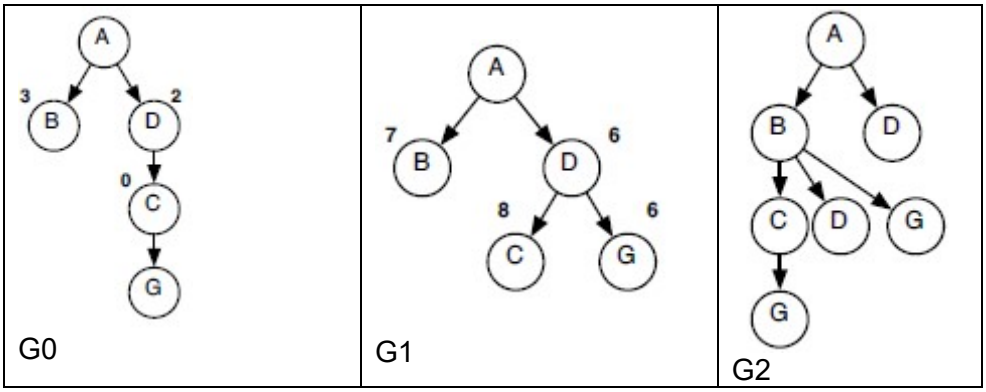
5.

a) Compare and contrast Perceptron learning rule with Delta learning rule.

b) Discuss how definition of rational approach to artificial intelligence is different from human approach.

c) Consider the trees given below (labeled G0, G1 and G2). Assume that children of a node are visited in alphabetical order. Each tree shows all the nodes that have been visited. Numbers next to nodes indicate the relevant "score" used by the algorithm for those nodes. For each tree, indicate the algorithm that was used to generate it. If you choose an algorithm that uses a heuristic function, indicate which of the given heuristics was used. Also, for each algorithm mention whether the result was an optimal path and if not, why not. Be precise.

H1:heuristic 1 = {h(A)=3,h(B)=6,h(C)=4,h(D)=3} H2:heuristic 2 = {h(A)=3,h(B)=3,h(C)=0,h(D)=2}



(4+5+9)

6.

a) Design the syntax structure for the following sentences:
   i) Children ate the cake with the spoon.
   ii) The dog saw a man in the park.
   iii) The angry bear chased the frightened little squirrel.

b) Construct semantic network representations for the information below:
Richard Nixon is a Quaker and a Republican. Quakers and Republicans are Persons. Every Quaker every quaker follows the doctrine of pacifism.

c) Prove that that A* is admissible if it uses a monotone heuristic.

(6+6+6)

7.

a) What is Hill Climbing algorithm? Under what conditions this algorithm gets stuck in local optima?

b) A multilayer feed forward neural network has neurons one, two and three as input layer neurons, neuron four and five in the hidden layer and neuron six in the output layer. Assume learning rate be 0.9. The initial weights and the bias values of the network are given below, along with the first input training sample X= (1, 0, and 1), whose class label is 1. Using the back propagation algorithm, show the weight values obtained after one iteration.

Weight and bias values

X1	X2	X3	W14	W15	W24	W25	W34	W35	W46	W56	B4	B5	B6
1	0	1	.2	-0.3	0.4	0.1	-0.5	0.2	-0.3	-0.2	-0.4	0.2	0.1

(8+10)