C9-R4 : SOFT COMPUTING

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 perceptron ? List the limitations of perceptron. What is the importance of threshold in perceptron network ?

   (b) What is Soft Computing ? How is it differing from Hard Computing ? Which are application areas of Soft Computing ?

   (c) What is association of Biological Neural Network with Artificial Neural Network ? How Artificial Neural Network is processing data ? What is significance of Bias and Weight during this processing ?

   (d) What is a layer property in ANN ? Explain function of all types of layer in ANN. Explain types of ANN based on that.

   (e) Define linear separability. Justify XOR function is non-linearly separable by a single decision boundary line. How can the equation of a straight line be formed using linear separability ?

   (f) Define terms Neural Network, Fuzzy Logic and Genetic Algorithm with their significance in Soft Computing. Why we should do Hybridization of these techniques ?

   (g) Compare feed-forward and feedback network. **(7x4)**

2. (a) Explain Hill climbing Heuristic search technique. Differentiate between Blind and Heuristic search techniques.

   (b) Why crossover and mutation are required in GA ? How Crossover Rate and Mutation Rate for GA are calculated ? Give suitable example.

   (c) What is Membership Function in Fuzzy Logic ? Define Support, Core and Boundary in Fuzzy Membership Graph. Explain with example diagram. **(6+6+6)**

3. (a) Let X = {a, b, c, d}; Y = {1, 2, 3, 4} be two universe of discourse. A = {(a, 0), (b, 0.8), (c, 0.6), (d, 1)}, B = {(1, 0.2), (2, 1), (3, 0.8), (4, 0)} and C = {(1, 0), (2, 0.4), (3, 1), (4, 0.8)}. Prove any one De-Morgan's Law and Determine the implication relations : If X is A THEN Y is B ELSE Y is C.

   (b) Apply the fuzzy modus Ponens rules to deduce Rotation is quite slow.
   Given that :
   (i) If the temperature is high then the rotation is slow.
   (ii) The temperature is very high.
   Let H(High), VH(Very High), S(Slow) and QS(Quite Slow) indicate the associated fuzzy sets.

   Let the set of temperatures be X = {30, 40, 50, 60, 70, 80, 90, 100} and Let the set of rotations per minutes be Y = {10, 20, 30, 40, 50, 60} and H = {(70, 1) (80, 1)(90, 0.3)}, VH = {(90, 0.9) (100, 1)}, QS = {(10, 1)(20, 0.8)}, S = {(30, 0.8)(40, 1)(50, 0.6)} **(9+9)**

4. (a) Define and briefly explain terms : Bias, Threshold, Learning rate, Activation Function.

(b) What is Defuzzification ? Explain any three methods with its equation, take suitable example for same.

(c) What is Fuzzy Inference ? Explain two procedures to do Fuzzy Inference with example.
(6+6+6)

5. (a) Explain steps and techniques for developing Neuro-Fuzzy hybrid system. List 5 Layers of ANFIS architecture.

(b) What is significance of Hybrid system in soft computing ? Explain merits and demerits of various possible hybrid systems in soft computing using GA, NN and FS.

(c) How bias play important role in classification ? Write the importance of inductive bias in classification.

(d) What is Hopfield network ? What are the two types of Hopfield net ? What is the energy function of a discrete Hopfield network ? **(4+6+4+4)**

6. (a) How NNs are used to classify patterns for a given problem ? Which are the factors influencing the Back-Propagation training ? Mention the heuristics which will significantly improve the performance of Back propagation algorithm. How genetic algorithm can be controlled by Fuzzy Logic ?

(b) What is Recurrent Neural Network ? Explain structure of Recurrent Neural Network.

(c) Define and explain any one application of soft computing tools like Fuzzy-Genetic OR Neuro-Fuzzy Algorithm Hybrid system. **(6+6+6)**

7. (a) Define and explain any one application of soft computing tools Genetic Algorithm and Neural Network Hybrid system with proper description of problem, solution methods using these soft computing tools.

(b) Define term : Fuzzy set. How it is differing from Crisp set ? Explain various operations and properties of Fuzzy set, Operations on Fuzzy Relations with example.

(c) What is Associative Memory ? What are iterative auto associative memory networks ? Explain in detail on linear auto associative memory State the conditions of linearity.
(6+6+6)

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