

(Time: 3 Hours)

Total Marks: 80

- N.B. (1) Question No 1 is compulsory  
 (2) Attempt any 3 Questions out of the remaining six questions

- Q1** (a) For following dataset, Class 'X' data points are P1(1,2), P2(1,1) and class 'O' data points are Q1(2,3), Q2(-1,1), Q3(3,2). Plot the points and determine that the given dataset is linearly separable or not. **5**  
 (b) State activation functions used in Neural network? Plot each of them with its equation. **5**  
 (c) State the differences between derivative based and derivative free optimization **5**  
 (d) Derive identity for unipolar continuous function :  $f(\text{net}) = O(1-O)$  **5**

- Q2** (a) What is Multi-Layer Perceptron? With the Block Diagram explain the algorithm used to adjust weights at each layer. Show it for two layers. **10**  
 (b) Use perceptron learning rule for computing weights after one iteration for the data given below: ( use Binary Bipolar function. **10**  
 $X_1 = [1 \ -2 \ 0 \ -1]^T$ ;  $X_2 = [0 \ 1.5 \ -0.5 \ -1]^T$ ;  $X_3 = [-1 \ 1 \ 0.5 \ -1]^T$ . Initial weight  $W^1 = [1 \ -1 \ 0 \ 0.5]$ . The learning constant is given by  $c = 0.1$ . Desired output for  $X_1, X_2, X_3$  are  $[-1, -1, 1]$  respectively.

- Q3** (a) Design a Fuzzy system to predict price of the Resale cars. Assume Total Mileage and year of Manufacturing as input variables (attributes) and Sale price as an output variable. Assume 3 descriptors (values of variables) for each input attributes and 5 descriptors for output attributes.  
 1. Show clearly the units used for & universe of discourse of each attribute. **02**  
 2. Create Fuzzy Rulebase for Price prediction Problem. **03**  
 3. Define fuzzy membership functions for all Input and Output attributes **05**  
 (b) Explain Kohanan's Self Organizing Map w.r.t its architecture, Layers, How to determine no. of neurons in the layers (may give example), Neighborhood, Stopping conditions and applications. **10**

- Q4** (a) For the given Fuzzy sets M (Medium) & H (High), Find fuzzy set 1. Very High **10**  
 2. Medium and High 3. Medium or High 4.  $M_{\alpha=0.5}$  (Alpha level) 5. NOT High.  
 $M = \{0.2/a + 0.4/b + 1/c + 0.8/d + 0/e\}$   
 $H = \{0.1/a + 0.4/b + 0.3/c + 0.6/d + 0.8/e\}$

- (b) Design Mc- Culloch-Pitt's Neuron model to solve following functions **10**  
 1.

X1	X2	D
0	0	0
0	1	0
1	0	1
1	1	1

2.

X1	X2	D
0	0	0
0	1	0
1	0	0
1	1	1

- Q5** (a) Explain Centre of Sums defuzzification techniques with suitable example. **04**  
(b) Determine the weights after two iterations for Hebbian learning of a single neuron network using Bipolar Binary activation function starting with initial weights  $w = [-1, -1]$  and input patterns are  $X1 = [1.3, -1]$ ,  $X2 = [2.1, 3.2]$ ,  $X3 = [-1.2, -1.8]$  and  $c = 1$  **08**  
(c) Describe Roulette wheel and Tournament selection methods in Genetic Algorithms. **08**
- Q6** (a) Differentiate Winner Take All and Learning Vector Quantization in terms of weight updation, Learning type, topological neighborhood, applications. **04**  
(b) Why we need Hybrid systems? Draw and explain architecture of ANFIS. **10**  
(c) State the differences between derivative based and derivative free optimization **06**

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