Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER–IV EXAMINATION – SUMMER 2015

Subject Code:2640009 **Date:20/05/2015**

Subject Name: Soft Computing (SC)

Time: 10:30 am to 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Answer the following questions to the point: (Each carry one mark) **07**

i. How Soft Computing differs from Hard Computing?

ii. Draw a schematic diagram of both a Biological Neuron and an Artificial Neural Network to show the similarities among them.

iii. What do you understand by Linear Seperability?

iv. State the identity property for crisp sets.

v. Suggest a method for initializing the weight vector and bias in Hamming Network.

vi. What is Plasticity-Stability Dilemma?

vii. Define Generalization. Why is it expected from the networks?

(b) Answer the following briefly:

i. Name the three sets used in Neural Network training. **03**

ii. Give an example of Fuzzy Cartesian Product. **02**

iii. Define: Simulated Annealing **02**

Q.2 **(a)** Distinguish between: **07**

i. Supervised Learning and Unsupervised Learning

ii. Crisp Set and Fuzzy Set

(b) Do as directed:

i. Perform the process of Parallel Relaxation on the network of your choice with minimum 5 nodes to reach 1 stable state. **03**

ii. What are Hybrid Systems? In which categories hybrid systems can be further classified? **02**

iii. Write the mathematical formulation for defining a Triangular Membership Function. **02**

OR

(b) Answer the following questions:

i. Discuss any one real-time application of Neural Networks. **03**

ii. What are Activation Functions? Explain any two. **02**

iii. Explain the basic characteristics of Hopfield Networks. **02**

Q.3 **(a)** What is Multilayer Perceptron? Write the algorithm for training a Back Propagation Network. **07**

(b) Construct a Maxnet with 4 neurons and inhibitory weight $\varepsilon = 0.2$ and train the network with given initial input signals as follows: **07**

$$a_1(0) = 0.3 \qquad a_2(0) = 0.5 \qquad a_3(0) = 0.7 \qquad a_4(0) = 0.9$$

OR

Q.3 **(a)** Discuss the architecture of Adaptive Resonance Theory Networks with its working. **07**

(b) Train a Hetero-associative Network to store the given bipolar input vectors **07**

$s = (s_1\ s_2\ s_3\ s_4)$ to give the output vector $t = (t_1\ t_2)$. The bipolar vector pairs are as given below:

Vectors	s_1	s_2	s_3	s_4	t_1	t_2
1st	1	-1	-1	-1	-1	1
2nd	1	1	-1	-1	-1	1
3rd	-1	-1	-1	1	1	-1
4th	-1	-1	1	1	1	-1

Now, test the network for test vector $x = [0\ 1\ 0\ -1]$ with changes in two values in 2nd input vector $[1\ 1\ -1\ -1]$.

Q.4 (a) Design a computer software to perform image processing to locate objects within a scenery. The two fuzzy sets representing images of a flower $\underset{\sim}{A}$ and a leaf $\underset{\sim}{B}$ are as follows: **07**

$$\underset{\sim}{A} = \left\{\frac{0.1}{0} + \frac{0.2}{1} + \frac{0.4}{2} + \frac{0.6}{3} + \frac{1}{4}\right\} \text{ and } \underset{\sim}{B} = \left\{\frac{1}{0} + \frac{0.5}{1} + \frac{0.7}{2} + \frac{0.3}{3} + \frac{0}{4}\right\}$$

For these two sets, find the following:

a) $(\underset{\sim}{B})_{0.2}$ b) $(\overline{\underset{\sim}{A}})_{0.7}$ c) $\underset{\sim}{A} \cup \overline{\underset{\sim}{B}}$ d) $\underset{\sim}{B} \cap \overline{\underset{\sim}{A}}$

e) $\overline{\underset{\sim}{A} \cup \underset{\sim}{B}}$ f) $\overline{\underset{\sim}{A}} \cap \overline{\underset{\sim}{B}}$ g) $\underset{\sim}{A} \mid \underset{\sim}{B}$

(b) Draw a suitable block diagram and explain the operation of a Fuzzy Logic Controller with the help of an example. **07**

OR

Q.4 (a) Explain the idea behind Fuzzy Rule Based System giving an appropriate example. **07**

(b) i. Explain different methods of Defuzzification. **04**

ii. Consider a fuzzy relation $\tilde{R}$ on $X \times Y$ and $\tilde{S}$ on $Y \times Z$ as follows: **03**

$$R = \begin{array}{c} \\ x \end{array}\begin{array}{c} y \\ \begin{bmatrix} 0.5 & 0.1 \\ 0.2 & 0.9 \\ 0.8 & 0.6 \end{bmatrix} \end{array} \text{ and } R = \begin{array}{c} \\ y \end{array}\begin{array}{c} z \\ \begin{bmatrix} 0.6 & 0.4 & 0.5 \\ 0.5 & 0.8 & 0.9 \end{bmatrix} \end{array}$$

Obtain the min-max composition on $\tilde{R}$ and $\tilde{S}$.

Q.5 (a) What do you understand by Reproduction? Discuss in detail Roulette-Wheel Selection and Tournament Selection. **07**

(b) Discuss various ways of encoding or representing individual genes for carrying out optimization using Genetic Algorithm. Give one example for each. **07**

OR

Q.5 (a) Explain the idea behind Genetic Algorithms throwing light on its Mutation and Crossover operators. **07**

(b) Write short notes on the following: **07**

i. Elitism

ii. Fitness Function

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