

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 Separability?
 - 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**
- $$a_1(0) = 0.3 \quad a_2(0) = 0.5 \quad a_3(0) = 0.7 \quad a_4(0) = 0.9$$

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
1 st	1	-1	-1	-1	-1	1
2 nd	1	1	-1	-1	-1	1
3 rd	-1	-1	-1	1	1	-1
4 th	-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 $\underline{A}$ and a leaf $\underline{B}$ are as follows: **07**

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

For these two sets, find the following:

- a) $(\underline{B})_{0.2}$ b) $(\overline{\underline{A}})_{0.7}$ c) $\underline{A} \cup \overline{\underline{B}}$ d) $\underline{B} \cap \overline{\underline{A}}$
 e) $\overline{\underline{A} \cup \underline{B}}$ f) $\overline{\underline{A}} \cap \overline{\underline{B}}$ g) $\underline{A} | \underline{B}$
- (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**

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

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
