Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (CSE)/SEM-3/CST-631/2009-10

2009
SOFT COMPUTING

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 and any *four* from the rest.

1. a) Consider a universe of aircraft speed near the speed of sound as χ = { 0·72, 0·725, 0·75, 0·775, 0·78 } and a fuzzy set on this universe for the speed "near mach 0·75" = $\underset{\sim}{M}$ where

$$\underset{\sim}{M}=\{0/0{\cdot}72 + 0{\cdot}8/0{\cdot}725 + 1/0{\cdot}75 + 0{\cdot}8/0{\cdot}775 + 0/0{\cdot}78\}$$

Define a universe of altitudes as Y = { 21, 22, 23, 24, 25, 26, 27 } in k-feet and a fuzzy set on this universe for the altitude fuzzy set "approximately 24000 feet" = N, where

$$\underset{\sim}{N} = \{ 0/21\ k + 0{\cdot}2/22\ k + 0{\cdot}7/23\ k + 1/24\ k + 0{\cdot}7/25\ k + 0{\cdot}2/26\ k + 0/27\ k \}$$

i) Construct a relation $\underset{\sim}{R} = \underset{\sim}{M} \times \underset{\sim}{N}$

ii) For another aircraft speed, say $\underset{\sim}{M}_1$, in the region of mach 0·75, where

$$\underset{\sim}{M}_1 = \{ 0/0{\cdot}72 + 0{\cdot}8/0{\cdot}725 + 1/0{\cdot}75 + 0{\cdot}6/0{\cdot}775 + 0/0{\cdot}78 \}$$

Find the relation $\underset{\sim}{S} = \underset{\sim}{M}_1 \circ \underset{\sim}{R}$ using max-min composition. 5

b) Train a hetero-associative network to store the input vectors $s=(s_1\ s_2\ s_3\ s_4)$ to the output vector $t=(t_1\ t_2)$. The vector pairs are given in the following table :

	s_1	s_2	s_3	s_4	t_1	t_2
1st	1	0	0	0	0	0
2nd	1	1	0	0	0	0
3rd	0	0	0	1	1	0
4th	0	0	1	1	1	0

5

2. a) State Perceptron training algorithm for single output classes. 5

b) Find the weights required to perform the following classification using Perceptron network. The vectors (1, 1, 1, 1) and (– 1, 1, – 1, – 1) are belonging to the class (so have target value 1). Vectors (1, 1, 1, – 1) and (1, – 1, – 1, 1) not belonging to the class (so have the target value – 1). Assume learning rate as 1 and initial weights are zero (Perform only 1st epoch). 10

3. a) Consider two fuzzy sets :

$\underset{\sim}{A}$ = { 0·2/1 + 0·3/2 + 0·4/3 + 0·5/4 } and

$\underset{\sim}{B}$ = { 0·1/1 + 0·2/2 + 0·2/3 + 1/4 }

Find the algebraic sum, algebraic product and bounded sum of the given fuzzy sets. 3

b) Describe the importance of fuzzy sets. 1

c) Using Madaline network, implement XOR function with bipolar inputs and targets. Assume the required parameters for training of the network. Take bipolar data [Calculate only 1st epoch]. 11

4. a) Two fuzzy relations are given by

$$\underset{\sim}{R} = \begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{array}{c} \begin{array}{cc} y_1 & y_2 \end{array} \\ \begin{bmatrix} 0{\cdot}6 & 0{\cdot}3 \\ 0{\cdot}2 & 0{\cdot}9 \end{bmatrix} \end{array} \text{ and } \underset{\sim}{S} = \begin{array}{c} \\ y_1 \\ y_2 \end{array} \begin{array}{c} \begin{array}{ccc} z_1 & z_2 & z_3 \end{array} \\ \begin{bmatrix} 1 & 0{\cdot}5 & 0{\cdot}3 \\ 0{\cdot}8 & 0{\cdot}4 & 0{\cdot}7 \end{bmatrix} \end{array}$$

Obtain fuzzy relation $\underset{\sim}{T}$ as a composition between the fuzzy relations. 5

b) What are tolerance and equivalence relations ? 5

c) Compare between supervised learning and unsupervised learning with proper diagrams. 5

5. a) Describe the training algorithm for 'Back-Propagation' network. 6

b) Construct and test a 'BAM' network to associate letters '*E*' and '*F*' with simple bipolar input-output vectors. The target output for '*E*' is (–1, 1) and for '*F*' is (1, 1). The display matrix size is 5 × 3. The input patterns are :

✳	✳	✳	✳	✳	✳
✳	■	■	✳	✳	✳
✳	✳	✳	✳	■	■
✳	■	■	✳	■	■
✳	✳	✳	✳	■	■

[✳ = + 1 & ■ = – 1]. 9

6. a) What do you mean by 'Topological preserving' maps ? 1

b) Define 'Euclidean distance'. 1

c) For a given Kohonen self-organizing feature map with weights shown in figure.

Use the square of the Euclidean distance to find the cluster unit Y_J closest to the input vector (0·2, 0·4). Using a learning rate of 0·2, find the new weights for unit Y_J. 7

d) Briefly discuss about Hamming net. Also describe the algorithm. 6