Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (CSE)/SEM-2/CSEM-205A/2013

2013
SOFT COMPUTING

Time Allotted : 3 Hours *Full Marks* : 70

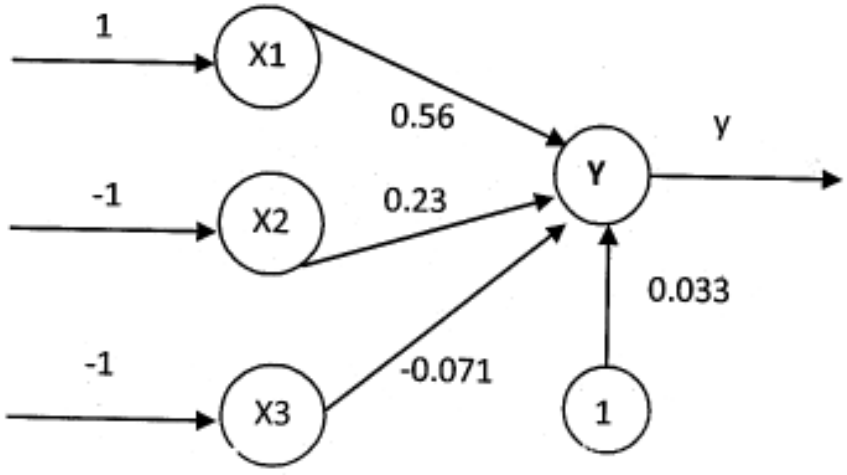
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Short Answer Type Questions)

Answer *all* questions. 5 × 2 = 10

1. Calculate the net input for the following network :



2. For aircraft simulator data the determination of certain changes in its operating conditions is made on the basis of hard break points in the match region. We define two fuzzy sets *A* and *B* representing to condition of "near" a mach number of 0·65 and "in the region" of a mach number of 0·65, respectively, as follows :

$$A = \text{near mach } 0{\cdot}65 = \left\{\frac{0}{0{\cdot}64} + \frac{0{\cdot}75}{0{\cdot}645} + \frac{1}{0{\cdot}65} + \frac{0{\cdot}5}{0{\cdot}655} + \frac{0}{0{\cdot}66}\right\}$$

$$B = \text{in the region of mach } 0{\cdot}65 = \left\{\frac{0}{0{\cdot}64} + \frac{0{\cdot}25}{0{\cdot}645} + \frac{0{\cdot}75}{0{\cdot}65} + \frac{1}{0{\cdot}655} + \frac{0{\cdot}5}{0{\cdot}66}\right\}$$

For these two sets find the following :

a) $\overline{A \cup B}$

b) $\overline{A \cap B}$

3. For the fuzzy relation *R*,

$$R = \begin{bmatrix} 1{\cdot}0 & 0{\cdot}1 & 0{\cdot}0 & 0{\cdot}5 & 0{\cdot}3 \\ 0{\cdot}02 & 0{\cdot}1 & 0{\cdot}55 & 1{\cdot}0 & 0{\cdot}6 \\ 0{\cdot}2 & 1{\cdot}0 & 0{\cdot}6 & 1{\cdot}0 & 0{\cdot}0 \\ 0{\cdot}03 & 0{\cdot}5 & 1{\cdot}0 & 0{\cdot}3 & 0{\cdot}0 \end{bmatrix}$$

Find the λ-cut relation for $\lambda = 0^+$, 0·1, 0·4 and 0·8.

4. The two fuzzy vectors of length 4 are defined as :

   a = (0·5, 0·2, 1·0, 0·8)

   b = (0·8, 0·1, 0·9, 0·3)

   Find the inner product and outer product for these two fuzzy vectors.

5. Consider the two fuzzy sets

$$A = \left\{\frac{0\cdot2}{1} + \frac{0\cdot3}{2} + \frac{0\cdot4}{3} + \frac{0\cdot5}{4}\right\}$$

$$B = \left\{\frac{0\cdot1}{1} + \frac{0\cdot2}{2} + \frac{0\cdot2}{3} + \frac{1}{4}\right\}$$

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

GROUP – B

(Long Answer Type Questions)

Question no. 6 is compulsory and answer any *four* from the rest.

6. a) Construct and Test a BAM network to associate letters E and F with simple bipolar input-output vector. 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 :

*	*	*	*	*	*
*	∘	∘	*	∘	∘
*	*	*	*	*	*
*	∘	∘	*	∘	∘
*	*	*	*	∘	∘

Target output (–1, 1) (1,1)

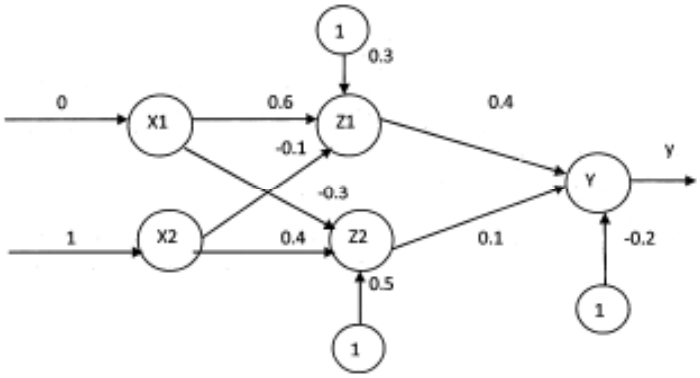
b) Let *X* be the universal set and let *A*, *B*, and *C* be the subsets of *X*. The basic assignments for the corresponding focal elements are mentioned in the following table. Determine the corresponding belief measure.

Focal Elements	**m (.)**
P	0·04
B	0·04
E	0·04
PUB	0·12
PUE	0·08
BUE	0·04
PUBUE	0·64

10 + 10

7. a) Write down the training algorithm for Back-Propagation network.

b) Apply Back-Propagation algorithm and find the final weights and bias value for the following network. It is presented with the input pattern [0, 1] and the target output is 1. Use a learning rate α = 0·25 and the binary sigmoidal activation function.



8. Consider a universe of aircraft speed near the speed of sound as X = { 0·72, 0·725, 0·75, 0·775, 0·78} and a fuzzy set on this universe for the speed "near mach 0·75" = M where

$$M = \left\{ \frac{0}{0\cdot72} + \frac{0\cdot8}{0\cdot725} + \frac{1}{0\cdot75} + \frac{0\cdot8}{0\cdot775} + \frac{0}{0\cdot78} \right\}$$

Define a universe of altitude 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 24·000 feet" = N where

$$N = \left\{ \frac{0}{21k} + \frac{0\cdot2}{22k} + \frac{0\cdot7}{23k} + \frac{1}{24k} + \frac{0\cdot7}{25k} + \frac{0\cdot2}{26k} + \frac{0}{27k} \right\}$$

a) Construct a relation $R = M \times N$

b) For another aircraft speed, say M_1, in the region of mach 0·75 where

$$M_1 = \left\{ \frac{0}{0\cdot72} + \frac{0\cdot8}{0\cdot725} + \frac{1\cdot0}{0\cdot75} + \frac{0\cdot6}{0\cdot775} + \frac{0}{0\cdot78} \right\}$$

Find relation S = M_1 o R using max-min composition. 10

9. Find the weight required to perform the following classification using perception network. The vectors (1,1,1,1,) and (–1,1,–1,–1) are belonging to the class (so have target value +1); vector (1,1,1,–1) and (1,–1,–1,1) are not belonging to the class (so have target value–1); Assume learning rate as 1 and initial weights as 0. (upto 2 epoch) 10

10. Implement OR function with bipolar inputs and targets using ADALINE network. Give appropriate network diagram and table for error calculation. (upto 2 epoch). 10

11. Construct a MAXNET with four neurons and inhibitory weight ε = 0·2, given the initial activations (input signals) as follows :

$a_1(0) = 0 \cdot 3$ $a_2(0) = 0 \cdot 5$

$a_3(0) = 0 \cdot 7$ $a_4(0) = 0 \cdot 9$

Draw the network structure. Perform upto five iterations. 10

12. Construct a Kohonen Self Organizing Feature Map to cluster the four given vectors, [0011]; [1000]; [0110] and [0001]. The number of clusters to be formed is two. Assume an initial learning rate of 0·5. Draw the network and perform only one epoch. 10

13. Maximize the following function using genetic algorithm

$f(x)=x^2+2$; where x is permitted to vary between 0 and 31.

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