CS/B.Tech/(CSE-New)/SEM-7/CS-703B/2013-14

b) Consider the following fuzzy set defined on the universe :

$X = \{a, b, c, d, e\}$ as

$$A = \left\{ \frac{1}{a} + \frac{0.9}{b} + \frac{0.6}{c} + \frac{0.3}{d} + \frac{0}{e} \right\}$$

Using Zadeh's notation find the λ-cut set for $\lambda = 1, 0.9, 0.6, 0.3$.   9 + 6

11. a) What happens if the following parameters allowed to change in case of a simple GA ?   3 × 3

   i) Population size

   ii) Probability of crossover

   iii) Probability of mutation.

   b) Explain elitism with suitable example.   3

   c) Justify the importance of encoding in a GA.   3

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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

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :   10 × 1 = 10

   i) Which of the following phenomena is modelled by fuzzy set theory ?

   a) Randomness   b) Vagueness

   c) Uncertainty   d) All of these.

   ii) Let $U = \{ a, b, c \}$, and $P = \frac{0.5}{a} + \frac{0.5}{c}$ be a fuzzy set on U. Then which of the following is true ?

   a) P is normal   b) P is sub-normal

   c) Both (a) and (b)   d) None of these.

iii) Which of the following is true regarding variation of the size C of a fuzzy set a increases from 0 to 1 ?

   a) Size of a-cut increases

   b) Size of a-cut decreases

   c) They are not related

   d) None of these.

iv) The effect of the synaptic gap in a biological neuron is modelled in artificial neuron model as

   a) the weights of the interconnections

   b) the activation function

   c) the net input to the processing element

   d) none of these.

v) Parallel relaxation is a process related to the functionality of

   a) Perceptron

   b) McCulloch-Pitts Neuron

   c) Hopfield networks

   d) none of these.

vi) Which of the following operations can be realized by a network of McCulloch-Pitts Neurons, but not a network of perceptions ?

   a) Logical AND   b) Logical OR

   c) Logical XOR   d) None of these.

vii) Which of the following ANN learning methods uses Euclidian distance between the weight vector and the input vector to compute the output ?

   a) Perceptron Learning

   b) Widrow-Hoff Learning

   c) Winner-takes-all learning

   d) None of these.

viii) In order to apply GA, an optimization problem should be formulated as

   a) maximization problem

   b) minimization problem

   c) decision problem

   d) none of these.

ix) Which of the following properties is not guaranteed by a GA ?

    a) Admissibility   b) Convergence

    c) Both (a) and (b)   d) None of these.

x) In Simulated Annealing (SA), the probability of accepting a solution worse than the current one

    a) increases as the temperature decreases

    b) decreases as the temperature decreases

    c) remains constant throughout

    d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. a) What is the necessity of activation function ?

    b) List the commonly used activation functions.   2 + 3

3. Design a Hebb net to implement logical AND function with bipolar inputs and targets.

4. Consider a Kohonen net with two clusters unit and five input units. The weight vectors for the cluster units are

$$W_1 = (0{\cdot}1 \quad 0{\cdot}9 \quad 0{\cdot}7 \quad 0{\cdot}3 \quad 0{\cdot}2)$$

$$W_2 = (0{\cdot}6 \quad 0{\cdot}7 \quad 0{\cdot}5 \quad 0{\cdot}4 \quad 1{\cdot}0)$$

Use the square of Euclidian distance to find the winning cluster unit for the input pattern

$X = (0{\cdot}0 \quad 0{\cdot}2 \quad 0{\cdot}1 \quad 0{\cdot}2 \quad 0{\cdot}0)$. Using a learning rate of 0·2, find the new weights for the winning unit.

5. Three fuzzy sets are defined as follows :

$$A = \left\{ \frac{0{\cdot}1}{30} + \frac{0{\cdot}2}{60} + \frac{0{\cdot}3}{90} + \frac{0{\cdot}4}{120} \right\}$$

$$B = \left\{ \frac{1}{1} + \frac{0{\cdot}2}{2} + \frac{0{\cdot}5}{3} + \frac{0{\cdot}7}{4} + \frac{0{\cdot}3}{5} + \frac{0}{6} \right\}$$

$$C = \left\{ \frac{0{\cdot}33}{100} + \frac{0{\cdot}65}{200} + \frac{0{\cdot}92}{300} + \frac{0{\cdot}21}{400} \right\}$$

Find the following :

a) $R = A \times B$

b) $S = B \times C$

Explain in brief the principle of simulated annealing.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

a) List the stages involved in training of Back Propagation network.

b) What are activations used in Back Propagation Network Algorithm ?

c) Using Back Propagation Network, find the new weights for the network shown in the following figure. The network is presented with the input pattern (1,0) and

target output 1. Use learning rate $a = 0.3$ and binary sigmoid activation function.
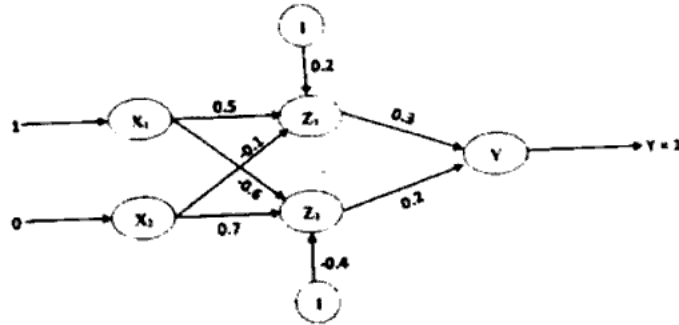
$$3 + 2 + 10$$

8. a) Draw the architecture of an auto-associative network.

    b) Train a hetero-associative memory network using Hebb rule to store input row vector $S = (S_1, S_2, S_3, S_4)$ to the output row vector $t = (t_1, t_2)$.

    The vector pairs are given as below :

    $S(1) = (1\,0\,0\,1)$ $t(1) = (1\;0)$

    $S(2) = (1\,1\,1\,1)$ $t(2) = (1\;0)$

    $S(3) = (1\,1\,0\,0)$ $t(3) = (0\;1)$

    $S(4) = (0\,0\,1\,1)$ $t(4) = (0\;1)$

    c) Find the weight matrix required to store the vectors $[\,1\;1\;-1\;1\;-1\,]$, $[\,1\;1\;1\;1\;-1\,]$, $[\,-1\;-1\;1\;1\;-1\,]$ and $[\,1\;1\;-1\;-1\;1\,]$ in w_1, w_2, w_3, w_4 respectively. Calculate the total weight matrix to store all the vectors and check whether it is capable of recognizing the same vectors represented. Perform the association for weight matrix with no self-connection.

    $$3 + 6 + 6$$

9. Let X be the Universe of satellites of interest, as defined below :

    $$X = \{\,A_{12}, X_{15}, B_{16}, F_4, F_{900}, V_{111}\,\}$$

    Let A be the fuzzy set of INSAT-V satellite :

    $$A = \left\{ \frac{0.2}{A12} + \frac{0.3}{X15} + \frac{1}{B16} + \frac{0.1}{F4} + \frac{0.5}{V111} \right\}$$

    Let B be the fuzzy set of INSAT-B satellite :

    $$B = \left\{ \frac{0.1}{A12} + \frac{0.25}{X15} + \frac{0.9}{B16} + \frac{0.7}{F4} + \frac{0.3}{F900} + \frac{0.2}{V111} \right\}$$

    Find the following sets of combinations for these two sets :

    $$15 \times 1$$

    i) $A \cup B$ ii) $A \cap B$ iii) $\bar{A}$

    iv) $\bar{B}$ v) $\overline{A \cup B}$ vi) $\overline{A \cap B}$

    vii) $\overline{A} \cup \overline{B}$ viii) $\overline{A} \cap \overline{B}$ ix) $A \mid B$

    x) $B \mid A$ xi) $A \cup \bar{A}$ xii) $A \cap \bar{A}$

    xiii) $B \cup \bar{B}$ xiv) $B \cap \bar{B}$ xv) $B \cap \bar{A}$

10. a) Using inference method find the membership values of the triangular shapes for each of the following triangles :

    i) $30°, 60°, 90°$

    ii) $45°, 65°, 70°$

    The triangular shapes are : Isosceles (I), Right angled (R), Equilateral (E), Other triangles (T).