Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(CSE)/SEM-8/CS-801B/2010

2010

SOFT COMPUTING

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

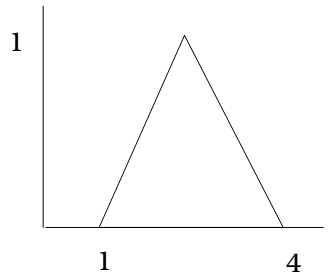
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) The fuzzy set shown in figure 1 is



a) only normal

b) only convex

c) both normal and convex

d) convex but not normal.

ii) The boundary of the fuzzy A set is defined by those elements x of the universe such that

a) $\mu A(x) = 1$ b) $\mu A(x) = 0$

c) $0 < \mu A(x) < 1$ d) $0 \leq \mu A(x) \leq 1$.

iii) Let A normal fuzzy set is one whose one membership function has

a) at least one element x in the universe whose membership value is 1.

b) all elements in the universe have membership value of 1.

c) none of the elements in the universe has membership value of 1.

d) at least one element x in the universe whose membership value is 0.

iv) A fuzzy number is a fuzzy set with the property of

a) only normal

b) only convex

c) both normal and convex

d) normal but not convex.

v) Which of the following is true ?

I. On average, neural networks have higher computational rates than conventional computers

II. Neural networks learn by example.

III. Neural networks mimic the way the human brain works.

of the statements

a) all of these are true

b) (II) and (III) are true

c) (I), (II) and (III) are true

d) none of these are.

vi) The Hebbian learning rule is ..... type of learning.

a) supervised b) competitive

c) Boltzmann d) reinforcement.

vii) Which of the following is/are found in Genetic Algorithms ?

I. Evolution

II. Selection

III. Reproduction

IV. Mutation.

of these

a) (I) & (II)

b) (I), (II) & (III)

c) (II), (III) & (IV)

d) all of these.

viii) Single layer perception is used for

a) linear separability b) error minimization

c) non-linear separability d) annealing.

ix) In ..... mode of training, all neurons in Hopfield networks fire at random.

a) Stable status b) Output

c) Synchronous d) Asynchronous.

x) If crossover between chromosomes in search space does not produce significantly different offsprings, what does it imply ? (if offspring consists of one half of each parent)

I. The crossover operation is not successful.

II. Solution is about to be reached.

III. Diversity is so poor that the parents involved in the crossover operation are similar.

IV. The search space of the problem is not ideal for GAs to operate.

of these

a) (II), (III) & (IV)

b) (II) & (III)

c) (I), (III) & (IV)

d) all of these.

xi) Fuzzy set theory was introduced by

a) Zadeh b) Rosenblatt

c) Minsky d) Glover.

xii) X-OR problem can be solved by

a) single layer perceptron

b) bayes theorem

c) multi-layer perceptron

d) both (a) and (b).

GROUP – B

(Short Answer Type Questions)

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

2. What is soft computing ? Indicate biological analogies of the basic techniques of soft computing.

3. Implement the AND function using McCulloh-Pitts neurons using binary data.

4. Discuss the different types of crossover method in Genetic algorithm.

5. Two fuzzy sets A and B are represented by the following two membership functions :

$$\mu_A(x) = \begin{cases} \max\left(0, \frac{x-3}{7}\right) : x \le 10 \\ \max\left(0, \frac{17-x}{7}\right) : x > 10 \end{cases}$$

$$\mu_B(x) = \begin{cases} \max\left(0, \frac{x-8}{2}\right) : x \le 10 \\ \max\left(0, \frac{12-x}{2}\right) : x > 10 \end{cases}$$

a) Sketch these membership functions.

b) What do *A* and *B* approximately represent ?

c) Which of the two sets is fuzzier ?

6. Define the *T*-norm and *T*-Co norm with example.

GROUP – C

(Long Answer Type Questions)

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

7. a) How is genetic algorithm different from traditional algorithm ?

b) State the schema theorem.

c) Discuss the different types of crossover method in Genetic algorithm.

d) Explain any one selection strategy used in GA.

4 + 3 + 4 + 4

8. a) Compare feed-forward and feedback networks.

b) With a neat flowchart, explain the training process of Perceptron network.

c) Find a Perceptron network for OR function with bipolar inputs and targets using Perceptron learning rule. [Take initial weights including bias and learning rate to be 0]. Find out the final weights and bias. 4 + 6 + 5

9. a) Outline the basic structure and components of a simple biological neuron.

   b) Describe how this is related to a McCulloch-Pitts neuron.

   c) Design network of McCulloch-Pitts neurons that implement logical NOT gate. Draw the network and label all the weight and threshold values. 5 + 5 + 5

10. a) Given the following fuzzy number and using Zadeh's extension principle, calculate K = I *J and explain why 6 is non-convex.

   I = approximately 3 = { 0.2/2 + 1/3 + 0.1/4 }

   J = approximately 2 = { 0.1/1 + 1/2 + 0.3/3 }

   b) In the field of computer networking there is an imprecise relationship between the level of use of a network communication bandwidth and the latency experienced in peer - to peer communications. Let X be a fuzzy set of use levels and Y be a fuzzy set of latencies with the following membership functions.

   X = { 0.2/10 + 0.5/20 + 0.8/40 + 1/60 + 0.6/80 + 0.1/100 }

   Y = { 0.3/0.5 + 0.6/1 + 0.9/1.5 + 1.0/4 + 0.6/8 + 0.3/20 }

   i) Find the Cartesian product represented by the relation $R = X + Y$

   Now suppose we have a second fuzzy set with bandwidth usage given by

   Z = { 0.3/10 + 0.6/20 + 0.7/40 + 0.9/60 + 1/80 + 0.5/100 }

   Find $S = Z * R$

   ii) using max-min composition

   iii) using max-product composition. 5 + 4 + 3 + 3

11. Write short notes on any *three* of the following : 5 + 5 + 5

a) Boltzmann Learning

b) Supervised Learning

c) Self organizing feature maps

d) Fuzzy averaging operators

e) Ant Colony Optimization.