

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.

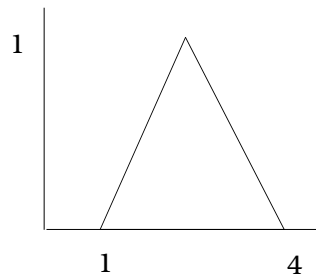
GROUP A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

10 × 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.

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[Turn over

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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 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.

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- 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.

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- 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.

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- 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. $3 \times 5 = 15$

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 :

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

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

- a) Sketch these membership functions.

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- 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. $3 \times 15 = 45$

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. $4 + 6 + 5$

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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.

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

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

- 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. $5 + 4 + 3 + 3$

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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.
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