

# GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- VII (New) EXAMINATION – WINTER 2019

Subject Code: 2172009

Date: 30/11/2019

Subject Name: Soft Computing Applications

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q.1 (a)** Do as directed. **03**

- (i) State the difference between soft computing and hard computing with reference to its problem solving capabilities.
- (ii) With the suitable example define & explain the supervised and unsupervised learning method.

**(b)** Identify the basic traits of soft computing as computational process and briefly explain how any one of these traits help us in problem solving of engineering sector. **04**

**(c)** Explain the basic membership functions of fuzzy sets with a suitable example. **07**

**Q.2 (a)** Consider two fuzzy sets  $\tilde{A}$  and  $\tilde{B}$  as shown **03**

$$\tilde{A} = \left\{ \frac{1}{2} + \frac{0.5}{3} + \frac{0.3}{4} + \frac{0.2}{5} \right\} \text{ and } \tilde{B} = \left\{ \frac{0.5}{2} + \frac{0.7}{3} + \frac{0.2}{4} + \frac{0.4}{5} \right\}$$

Calculate several operation on the fuzzy set (i)  $\tilde{A} \cup \tilde{B}$  (ii)  $\tilde{A} \cap \tilde{B}$  (iii)  $\bar{\tilde{A}}$  (iv)  $\bar{\tilde{B}}$  (v) cardinality and relative cardinality of fuzzy sets  $\tilde{A}$  and  $\tilde{B}$

**(b)** For the fuzzy sets given in Q.2(a) find out **04**

- (i) Algebraic product
- (ii) Bounded sum
- (iii) Bounded difference
- (iv) Algebraic sum

**(c)** Consider two fuzzy relations  $R_1$  and  $R_2$  on  $X \times Y$  and  $Y \times Z$  respectively, where  $X = \{a, b, c\}$ ,  $Y = \{1, 2, 3, 4\}$  and  $Z = \{\alpha, \beta\}$ . Assume  $R_1$  and  $R_2$  can be expressed as the following relation **07**

$$\tilde{R}_1 = \begin{bmatrix} 0.2 & 0.6 & 0.8 & 0.9 \\ 0.5 & 0.1 & 0.6 & 0.4 \\ 0.7 & 0.3 & 0.2 & 0.7 \end{bmatrix} \text{ and } R_2 = \begin{bmatrix} 0.6 & 0.2 \\ 0.3 & 0.7 \\ 0.4 & 0.9 \\ 0.8 & 0.5 \end{bmatrix}$$

Calculate the fuzzy *max-min*, and *max-prod* composition between two fuzzy relations.

**OR**

**(c)** Let  $F = \left\{ \frac{0.6}{a} + \frac{0.2}{b} + \frac{0.3}{c} + \frac{0.9}{d} \right\}$  be a fuzzy set. Find a set of  $\alpha$ -cut such that **07**

$F = \bigcup_{\alpha} \alpha F_{\alpha}$ . How many such sets of  $\alpha$ -cuts are there? Justify your answer.

Q.3 (a) With suitable diagram explain the law of Excluded Middle and the law of Contradiction. **03**  
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(b) Define defuzzification and compare first of maxima and last of maxima method. **04**

(c) For the logical union of the membership functions shown below Figure (a) and (b), find the defuzzified value  $x^*$  using centroid and weighted average method. **07**

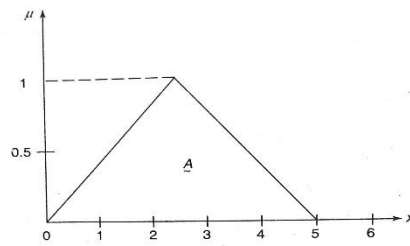


Figure (a)

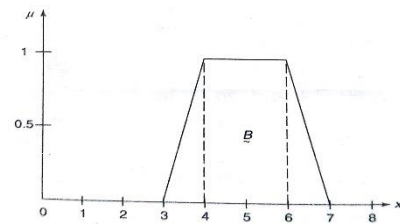


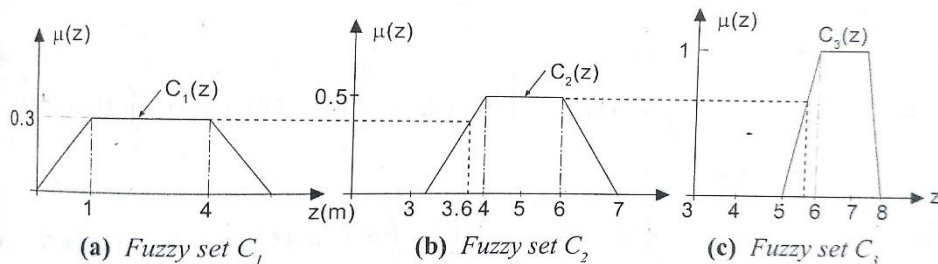
Figure (b)

OR

Q.3 (a) What is fuzzy equivalence relation? **03**

(b) Define: reflexive and irreflexive properties of fuzzy relation. **04**

(c) Figure shows three implication process results  $\tilde{C}_1$ ,  $\tilde{C}_2$  and  $\tilde{C}_3$ . Find the aggregated output and the defuzzified output using centroid method. **07**



Q.4 (a) What is activation function? Explain the different types of activation functions used in ANN's. **03**

(b) Sketch the Hebb network and show the steps of training algorithm for the same. **04**

(c) Realize the Mc-Culloch-Pitts neuron model for AND gate (take binary data). **07**

OR

Q.4 (a) Using McCulloch-Pitts neuron structure implement XOR function. (Consider binary data). **03**

(b) Explain the training algorithm of the Perceptron network. **04**

(c) Classify the two-dimensional input pattern shown in figure using Perceptron network. The symbol “\*” indicates the data representation to be +1 and “#” indicates data to be -1. For the pattern I, the target is +1 and for the pattern H, the target is -1. **07**

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| * | * | * | * | # | * |
| # | * | # | * | * | * |
| * | * | * | * | # | * |

Pattern – I      Pattern – H

Q.5 (a) With the help of ADALINE network architecture, draw the flow diagram for the step of learning in ADALINE network. **03**

- (b) Write a short note on Adaptive Resonance Theory. 04
- (c) With the help of block diagram and explain the application of neural network in machine vision. 07

**OR**

- Q.5** (a) State the merits and demerits of Kohonen Self-organizing feature maps. 03
- (b) Write a short note on Learning Vector Quantization network. 04
- (c) With the help of block diagram and flow chart, explain the application of fuzzy logic in water level control. 07

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