

**School of Information Technology
IIT Kharagpur**

Course Id: IT60108 Soft Computing Applications

Class Test 1

Date: January 31, 2007

Total Time: 1 Hour

Max. Marks: 40

Instructions: Answer all questions. You may answer the questions in any order. However, all parts of the same question must be answered together. Clearly state any reasonable assumption you make.

1. (a) Show that Sugeno's class of fuzzy complements satisfies the involution property.
(b) Prove that in order for them to satisfy the requirement: $\mu_A(x_1) - \mu_A(x_2) = \mu_{Abar}(x_2) - \mu_{Abar}(x_1)$, for all x_1 and x_2 , the parameter s should be zero. (It is NOT enough simply to put $s = 0$, and show that the property is satisfied.) **[3+7=10]**
2. Show that Bounded Product and Bounded Sum as T-norm and T-conorm operators are dual of each other in the sense of the generalized DeMorgan's Law. **[5]**
3. If a fuzzy set A has membership function: Bell(x ; 2, 6.50, 20) and another fuzzy set B has membership function: Bell(x ; 8, 5.75, 30), determine the value of $A \cap B$ for $x=22$ using drastic product as the T-norm operator. **[10]**
4. Define the membership functions of an orthogonal term set {young, middle-aged, old} of the linguistic variable age on the universe of discourse $X = [0, 90]$. The membership functions should be non trivial and meaningful. What is the value of $INT(old)$ for age = 70 considering your definition of membership functions? **[8+2=10]**
5. Let the binary fuzzy relations $R1 = "x \text{ is relevant to } y"$ and $R2 = "y \text{ is relevant to } z"$ on finite universes $X = \{1, 2, 3\}$, $Y = \{\alpha, \beta, \gamma, \delta\}$ and $Z = \{a, b\}$ be defined as follows:

$$R1 = \begin{bmatrix} 0.1 & 0.3 & 0.5 & 0.7 \\ 0.4 & 0.2 & 0.8 & 0.9 \\ 0.6 & 0.8 & 0.3 & 0.2 \end{bmatrix}$$

$$R2 = \begin{bmatrix} 0.9 & 0.1 \\ 0.2 & 0.3 \\ 0.5 & 0.6 \\ 0.7 & 0.2 \end{bmatrix}$$

Derive the value of the fuzzy relation "x is relevant to z" for $x=2$ and $z=a$ using max-min composition. **[5]**