

**School of Information Technology
IIT Kharagpur**

Course Id: IT60108 Soft Computing Applications

Class Test 1

Date: January 30, 2008

Total Time: 1 Hour

Max. Marks: 35

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 Yager's class of fuzzy complements satisfies the involution property.
(b) Show that Algebraic Product and Algebraic Sum as T-norm and T-conorm operators support the generalization of DeMorgan's Law. You need to show only $S(a,b) = N(T(N(a), N(b)))$ and assume $N(a) = 1 - a$.
(c) Show whether it holds or does not hold if we consider Yager's class of complements, using the same definitions of T-norm and S-norm. You have to give detailed steps to prove your point. **[3+5+7=15]**
2. If a fuzzy set A has membership function: Trapezoid(x; 2, 5, 10, 20) and another fuzzy set B has membership function: Trapezoid(x; 4, 6, 8, 25), plot $A \cup B$ for values of x between 0 and 30 using drastic sum as the S-norm operator. **[10]**
3. Define a Contrast Diminisher operator (DIM) such that $DIM(INT(A)) = A$. **[5]**
4. Let the binary fuzzy relations $R1 = \text{"x is relevant to y"}$ and $R2 = \text{"y is relevant to z"}$ on finite universes $X = \{1, 2, 3\}$, $Y = \{\alpha, \beta, \gamma, \delta\}$ and $Z = \{a, b\}$ be defined as follows:

$$R1 = \begin{bmatrix} 0.1 & 0.3 & 0.6 & 0.7 \\ 0.4 & 0.3 & 0.4 & 0.9 \\ 0.6 & 0.2 & 0.1 & 0.2 \end{bmatrix} \qquad R2 = \begin{bmatrix} 0.5 & 0.1 \\ 0.3 & 0.1 \\ 0.5 & 0.1 \\ 0.5 & 0.1 \end{bmatrix}$$

Derive the value of the fuzzy relation "x is relevant to z" for $x=1$ and $z=b$ using max-product composition. **[5]**