1030 – 1230
VI 301, 401

MAL 717 Fuzzy Sets Major Test
04 May 2007

Max Marks
50

1. Prove the following:
Suppose $\{p_i \mid i \in I\}$ are fuzzy sets in (X, ξ) and $\{q_i \mid i \in I\}$ are fuzzy sets in (Y, η). Then $r_x^y := \inf_{i \in I} \{p_i(x) \xrightarrow{\&} q_i(y)\}$ and $m_x^y := \sup_{i \in I} \{p_i(x) \,\&\, q_i(y)\}$ are fuzzy relations from (X, ξ) to (Y, η).
Apply this to the following situation:
R_i is the rule: <u>If</u> x is in the fuzzy singleton σ_i in (X, ξ)
<u>then</u> y is in the fuzzy singleton τ_i in (Y, η)
Interpreting the '<u>if</u> .... <u>then</u>' connective as $\xrightarrow{\&}$ as well as $\&$ in two different ways, justify these two interpretations and assuming that a fuzzy control map from (X, ξ) to (Y, η) is to be a fuzzy partial function so that $\varphi^{\#}(\sigma_i)$ is a singleton in (Y, η) if σ_i is a fuzzy singleton in (X, ξ) show that $M_x^y := \sup_{i \in I} [\sigma_i(x) \,\&\, \tau_i(y)]$ $\leq \inf_{i \in I} [\sigma_i(x) \xrightarrow{\&} \tau_i(y)] \wedge =: R_x^y$ can be deduced.

$\longrightarrow \boxed{19}$

2. Explain the compositional rule of inference and deduce the Generalized Modus Ponens from it. Provide one instance of the use of generalized modus ponens.

$\longrightarrow \boxed{08}$

3. Explain the Zadeh Extension Principle and use it to define addition and division of 'fuzzy quantities', i.e. functions $\mathbb{R} \longrightarrow [0, 1]$. Prove that every real number can be regarded as a fuzzy quantity and explain the correct meaning of the statement "division by zero is possible in the arithmetic of fuzzy quantities".

$\longrightarrow \boxed{10}$