Department of Computer Science & Engineering,
Motilal Nehru National Institute of Technology Allahabad.

(M.C.A 3rd semester: End-Sem Examination 2018-19)

Subject: Soft Computing (CS33103) Duration: 3.0 HRS Max. Marks: 60

Note: Be specific and to the point in your answers. Make assumptions wherever necessary and quote it. All questions are compulsory and carry equal marks. For numericals, maintain a precision up to 3 decimal places.

Q1. The fuzzy sets A, B, and C are all defined on the universe $X = [0, 5]$ with the following membership functions:

$$\mu_A(x) = \frac{1}{1+5(x-5)^2} \quad :: \quad \mu_B(x) = 2^{-x} \quad :: \quad \mu_C(x) = \frac{2x}{x+5}$$

(i) Sketch the membership functions

(ii) Define the intervals along the x axis corresponding to the λ-cut sets for each of the fuzzy sets A, B, C for the following values of λ: 0.2, 0.6 and 1.0

Q2. Determine the crisp λ-cut relations for $\lambda=0.1\,j$, for $j = 0, 1, \ldots, 10$ for the following fuzzy relation matrix **R:**

$$R = \begin{bmatrix} 0.2 & 0.7 & 0.4 & 1 \\ 1 & 0.9 & 0.5 & 0.1 \\ 0 & 0.8 & 1 & 0.6 \\ 0.2 & 0.5 & 1 & 0.3 \end{bmatrix}$$

Q3. Two fuzzy sets A and B, both defined on X, are as follows:

$\mu(x_i)$	x_1	x_2	x_3	x_4	x_5	x_6
P	0.1	0.7	0.8	1.0	0.7	0.1
Q	1.0	0.9	0.5	0.2	0.1	0

For the fuzzy sets: S1 and S2, find the following:

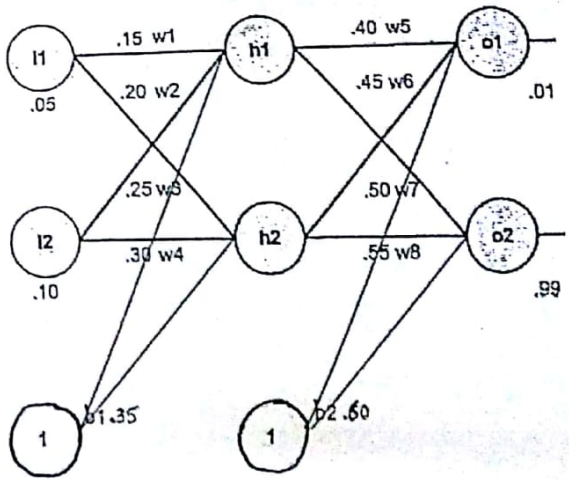
i) $P \cup Q$ *ii)* $P \cap Q$ *iii)* $P - Q$ *iv)* P^c *v)* $(Q^c - P)$ *vi)* $(P \cup Q)^c$ *vii)* $(P^c \cup Q)$ *viii)* $(Q \cap Q^c)$

Q4. As illustrated in figure in the right, input values i1, i2 are given as 0.05 and 0.10 respectively. And target values as 0.01 and 0.99 respectively. Using the back-propagation training algorithm, find:

i) the net output at the end of network.

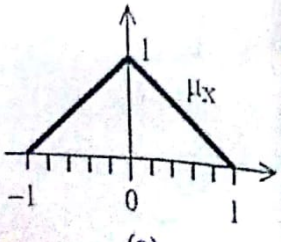
ii) updated weights.

Use learning rate $\alpha = 0.5$ with a binary sigmoidal activation function.

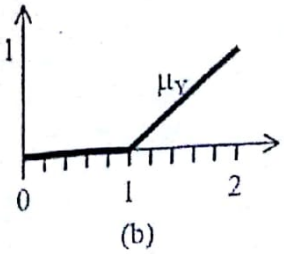


Q5. Using the genetic algorithm, minimize the objective function $f(x) = x^2+x+1$. Assume the necessary operators for the process on your own. Show the work space with *10* population members, each of size *5* bits. $x \in [0,5]$

Q6. Consider a fuzzy system of the form $z = -x - y$, where the fuzzy inputs x and y have membership functions as shown in figures (a) and (b), below. Find the interval *Z* and membership function μ_Z for the fuzzy output *z*.



(a)



(b)