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Fifth Semester B.Tech. Degree Examination, November 2014
(2008 Scheme)
08.516 : FUZZY SYSTEMS AND APPLICATIONS (TA)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions.

1. The fuzzy set $A = \left\{\frac{0.1}{50} + \frac{0.3}{60} + \frac{0.5}{70} + \frac{0.8}{80} + \frac{1}{90} + \frac{1}{100}\right\}$. Represent A in resolution form.

2. Given fuzzy sets $A = \frac{0.2}{1} + \frac{0.9}{2} + \frac{0.7}{3} + \frac{0.6}{4} + \frac{1}{5}$

   $B = \frac{0.3}{1} + \frac{1}{2} + \frac{0.5}{3} + \frac{0.4}{4} + \frac{0.1}{5}$ Check the subsethood $A \subseteq B$, $B \subseteq A$.

   Compute the subsethood values. S(A, B), S(B, A).

3. Fuzzy sets $A = \left\{\frac{1}{1.0} + \frac{0.7}{1.5} + \frac{0.3}{2.0} + \frac{0.15}{2.5} + \frac{0}{3.0}\right\}$

   $B = \left\{\frac{1}{1.0} + \frac{0.6}{1.5} + \frac{0.2}{2.0} + \frac{0.1}{2.5} + \frac{0}{3.0}\right\}$ Find $A \cup \overline{A}$, $A \cap \overline{B}$.

4. $T = \left\{\frac{0}{0} + \frac{0.3}{1} + \frac{0.7}{2} + \frac{0.8}{3} + \frac{0.9}{4} + \frac{1}{5}\right\}$ Check excluded middle law, contradiction law.

5. a) State extension principle related to fuzzy logic.

   b) Sets A, B defined on the universe of discourse X

   $A = \frac{0.5}{6} + \frac{0.7}{7} + \frac{0.8}{8} + \frac{0.9}{9} + \frac{1}{10}$.

   Let A function $f : X_x X \rightarrow X$ defined as $f(x) = x^2$. Calculate $B = f(A)$.

P.T.O.

6. Define linguistic variables and linguistic hedges. Give examples.

7. Let the Fuzzy Relation $R(x, y) = \begin{bmatrix} 0.2 & 0.5 & 1 & 0 \\ 0.1 & 0 & 0.7 & 0.4 \\ 0.9 & 0.2 & 0 & 0.2 \end{bmatrix}$ find the projection $[R \downarrow X]$ and $[R \downarrow Y]$.

8. Consider the fuzzy relation $R(x, y) = \begin{bmatrix} 0.3 & 0 & 0.7 \\ 0 & 1 & 0.9 \\ 0.2 & 0 & 0.5 \\ 0 & 0.3 & 0 \end{bmatrix}$ find the range, domain, height and inverse of R(x, y).

9. Explain about fuzzy rule base system.

10. Under what conditions FLC performs better than conventional controllers ?

PART – B

Answer **any two** from **each** Module.

Module – I

11. a) Consider fuzzy sets A and B denoted by respective membership functions $L_A(x) = \frac{x}{x+1}$ and $L_B(x) = 1 - \frac{x}{10}$ for all x Σ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. Find the scalar and fuzzy cardinalities.

    b) Let A and B be two fuzzy sets defined on universal discourse X. Prove the modular equality of fuzzy count. $|A| + |B| = |A \cap B| + |A \cup B|$.

12. Let fuzzy set A and B are

    $A = \frac{0.5}{3} + \frac{1}{5} + \frac{0.6}{7} + \frac{0.8}{8}$ and $B = \frac{1}{3} + \frac{0.5}{5} + \frac{0.1}{7} + \frac{1}{8}$. Obtain the following :

    a) A × B the Cartesian Product

    b) A . B the algebraic product

    c) A $\odot$ B the bounded product

    d) A $\vee$ B drastic product

13. Show that Yager intersection becomes
    a) drastic product as w $\rightarrow$ 0
    b) bounded product as w $\rightarrow$ 1
    c) as w $\rightarrow$ α t w (a, b) = Min (a, b)

Module – II

14. a) Check whether the relational matrix given below is that of fuzzy similarity

$$\text{relation } R = \begin{bmatrix} 1 & 0.7 & 0 \\ 0.7 & 1 & 0.5 \\ 0 & 0.5 & 1 \end{bmatrix}$$

    b) Obtain the transitive closure of R.

15. Define the inputs X = {0, 50, 100, 150, 200} Y = {0, 50, 100, 150, 200} : linguistic variables

$$W = \text{Weak stimulus} = \left\{\frac{1}{0} + \frac{0.9}{50} + \frac{0.3}{100} + \frac{0}{150} + \frac{0}{200}\right\} \subset X,$$

$$M = \text{Medium stimulus} = \left\{\frac{0}{0} + \frac{0.4}{50} + \frac{0.1}{100} + \frac{0.4}{150} + \frac{0}{200} \subset X\right.$$

$$S = \text{Severe response} = \left\{\frac{0}{0} + \frac{0}{50} + \frac{0.5}{100} + \frac{0.9}{150} + \frac{1}{200} \subset Y\right.$$

Given proposition : If weak stimulus then not severe response.

Find the response for a new antecedent M – Medium stimulus.

16. State and explain the defuzzification methods.

Module – III

17. a) Discuss about different types of fuzzy logic controllers.
    b) Explain different types of fuzzy rule formats.

18. Discuss the application of fuzzy logic control is controlling an air conditioner.

19. Explain fuzzy logic controlling in inverted pendulum.