PG Even Semester Examination, September, 2023

COMPUTER SCIENCE

(10th Semester)

Course No.: MCSCC-1002 / MS-402

(Fuzy Set Theory and Applications)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

The figures in the margin indicate full marks for the questions.

Answer any five questions, taking one from each unit.

UNIT-I

1. (a) Explain why we need Fuzzy set theory. Explain type 2 Fuzzy set with a relevant example. 3+2=5

   (b) Consider the universe of discourse

   $x \in [0,10]$ & A = triangle (x: 2, 5,7)

   Verify the law of contradiction & the law of excluded middle on the above fuzzy set. 5

   (c) (i) What is a subnormal fuzzy set? 1

   (ii) A subnormal fuzzy set A is given for a universe of discourse X. Find out the normalized fuzzy set A'. 4

A= {(5, 0.1), (6, 0.4), (7, 0.5), (8, 0.8), (9, 0.7), (10, 0.3) (11, 0.5), (12, 0.7), (13, 0.6), (14, 0.5), (15, 0.5)}

2. (a) Consider the fuzzy sets A, B, C for universe of discourse X∈ [0,10] as follows :- 4

$\mu_A(x)$ = traingle (x; 2, 5, 7)

$\mu_B(x)$ = gaussian (x; 3, 0.8)

$\mu_C(x)$ = trapezoidal (x; 4, 6, 8, 9)

Show that (AUB) C = A (B C)

(b) Show, with an example, what are support, cove and crossover points of a fuzzy set. 3

(c) Show that A⊆B if A B=A and A B= B. 3

(d) Compute the scalar cardinalities for each of the following fuzzy sets

(i) A= .4/V + .2/w + .5/x + .4/y + 1/z 1

(ii) B= 1/x + 1/y + 1/z 1

(iii) D(x)= 1–x/10 for x∈ {0,1,2, ... 10} = X 2

UNIT-II

3. (a) What are α–cut and strong α cut of a fuzzy set? 2

(b) Prove that A⊆B if $A \subseteq \alpha_B$ α. 3

(c) Prove that A=B if $\alpha_A = \alpha_B$ α 4

(d) Determine whether the following fuzzy sets given by the membership functions is a fuzzy number or not. 5

(b) What are the fuzzy propositions? How are they work, give example? 3

(c) What is the fuzzy inference? Draw the diagram of inference system. 2

(d) What is fuzzy concept in linguistics? Explain the advantages of linguistic hedge with appropriate justifications. 4

UNIT-V

9. (a) Define hard partition and soft partition in fuzzy clustering. 4

(b) Explain fuzzy C-means algorithm. 5

(c) Explain deterministic fuzzy automata. 5

10. Write short notes on : 4+5+5

(a) Fuzzy Pattern Recognition

(b) Fuzzy Expert System

(c) Fuzzy Controllers.

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(i) $\mu_C(x) = \begin{cases} 1, & \text{for } 0<x<10 \\ 0, & \text{otherwise} \end{cases}$

(ii) $\mu_D(x) = \begin{cases} \min(1,x) & \text{for } x>0 \\ 0, & \text{for } x<0 \end{cases}$

4. (a) With examples from real life justify why the support of fuzzy number is bounded. 3

(b) Prove that A=B iff $\alpha_A^+ \subseteq \alpha_B^+$ 3

(c) Show that a fuzzy set A defined on is convex iff.

$\mu_A(\lambda x_1+(1-\lambda)x_2) > \min(\mu_A(x_1), \mu_A(x_2))$

where $x_1, x_2 \in$ support of A & $\lambda \in [0,1)$

(d) Let A and B be two fuzzy numbers whose membership functions are given by

$\mu_A(x) =$ $= (x+2)/2, \ -2<x<0$
$= (2-x)/2, \ 0<x<2$
$= 0,$ otherwise

$\mu_B(x) =$ $= (x-2)/2,$ for $2<x<4$
$= (6-x)/2$ for $0<x<6$
$= 0,$ otherwise

Calculate the fuzzy numbers A+B, A–B. 3

UNIT-III

5. (a) What is a fuzzy relation? How can binary fuzzy relations be represented? 1+2=3

(b) Explain domain and range of a fuzzy relation by taking a suitable example. 3

(c) Explain inverse and composition of a fuzzy relation by taking a suitable example. 3

(d) Explain reflexive, symmetric, antisymmetric, transitive and non-transitive properties of a fuzzy repation. 5

6. (a) Check if the given relation is anti-similarity relation or not. 5

$$\bar{R} = \begin{bmatrix} 1 & 0.1 & 0.7 \\ 0.1 & 1 & 0.7 \\ 0.7 & 0.7 & 1 \end{bmatrix}$$

(b) What is fuzzy morphism? Explain the details of fuzzy morphisms with example. 5

(c) Why is max-min approximation method very useful to forecasting any factor? Explain the method by taking an example of any commodity from a local market. 4

UNIT-IV

7. (a) What are the primitives of Lukasiewicz multi-valued logic? 3

(b) Compare Kleene and Preist Logics. What is indeterminate value in n-valued logic? 4

(c) What is fuzzy quantifier? Explain various types of fuzzy quantifiers? 4

(d) Write the properties of fuzzy measures. 3

8. (a) Comprare possibility theory with probability theory with examples. 5