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DHANALAKSHMI SRINIVASAN COLLEGE OF ARTS & SCIENCE FOR WOMEN (AUTONOMOUS)

(For Candidates admitted from 2019-2020 onwards)

PG DEGREE EXAMINATIONS APRIL – 2021

M.SC – MATHEMATICS

FUZZY MATHEMATICS

Time: 3 Hrs **Max.Marks: 75**

PART – A

CHOOSE THE CORRECT ANSWER. **(10*1 = 10)**

1. Let two fuzzy sets,A and B, their standard intersection, (A∩B)(x) = …………∀ x ∈ X

   a) $\min[A(x), B(y)]$ b) $\max[A(x), B(y)]$

   c) $\sup_{z=x*y} \min[A(x), B(y)]$ d) $\inf_{z=x*y} \min[A(x), B(y)]$

2. The standard fuzzy intersection is the only ………

   a) $\sum_{x \in X} A(x)$ b) $\sum_{x \in X} |A(x) - B(x)|$ c) $\sum_{x \in X} |1 - A(x)|$ d) $\sum_{x \in X} |A(x).B(x)|$

3. If c is a continuous fuzzy complement, then c has a …………..equilibrium .

   a) 0 b) unique c) ∞ d) 2

4. A fuzzy union/t-co norm and u is a binary operation on the unit interval of boundary condition u(a,0)=……… for all a,b,d ∈ [0,1]

   a) 0 b) ∞ c) a d) 1

5. If A is a fuzzy number, α_A is a closed interval for every $\alpha \in (0,1]$.for α =1, 1_A is a nonempty closed interval because A is ………

   a) normal b) continuous c) bounded d) 0

6. The interval valued subtraction [2,5] – [1,3] = ………..

   a) [1,4] b) [2,3] c) [1,2] d) [-1,4]

7. A crisp binary relation R(X,X) that is reflexive, anti symmetric, and transitive is called a………

   a) Fuzzy relation b) fuzzy morphisms c) partial ordering d) tolerance relation.

8. A crisp binary relation R(X,X) is a reflexive and symmetric fuzzy relation, it is sometimes called a …

   a) Fuzzy morphisms b) proximity relation c) partial ordering d) tolerance relation

9. The three relations constrain each other in such a way that P∘Q = R, where ∘ denotes………………… compositions.

   a) Minimum b) maximum c) min-max d) max-min

10. The solution set S (Q,r) is not empty, it always contains a ………solution,$\hat{p}$, and it may contain………Solutions.

    a) Unique maximum, several minimum b) several maximum, Unique minimum

    c) Unique ,maximum d) several, maximum.

PART - B

ANSWER ALL THE QUESTIONS **(5*7 = 35)**

11. a) Let f: X→ Y be an arbitrary crisp function. Then for any A ∈ □ (X), prove f fuzzified by the extension principle satisfies the equation $f(A) = \cup_{\alpha\in[0,1]} f(\alpha +_A)$.

(OR)

b) Let f: X→ Y be an arbitrary crisp function. Then for any A ∈ □ (X) and for all $\alpha \in [0,1]$, prove the following Properties of f fuzzified by the extension principle holds.

(i) $\left(\alpha +_{[f(A)]}\right) = f(\alpha +_A)$; (ii) $\left(\alpha_{[f(A)]}\right)$ □ $f(\alpha_A)$;

12. a) Let i_w denote the class of yager t-norms, then prove that $I_{min}(a,b) \leq i_w(a,b) \leq \min(a,b)$

(OR)

b) Prove that the standard fuzzy intersection is the only idempotent t-norm.

13. a) Explain four arithmetic operations on intervals.

(OR)

b) Explain arithmetic operations on fuzzy numbers.

14. a) (i) Define Partial ordering. (ii) Write properties of partial ordering.

(OR)

b) Explain fuzzy equivalence relations.

15. a) If S (P,R) ≠ ∅, then prove that $\hat{P} = R \overset{\omega i}{o} Q^{-1}$ is the greatest member of S(P,R).

(OR)

b) Let i be a t-norm in the equation $Q = \begin{bmatrix} .1 & .6 \\ .8 & .9 \end{bmatrix}$ and $R = \begin{bmatrix} .2 & 1 \\ .25 & 1 \end{bmatrix}$ Determine if the above equation has a solution for i = max, product, and bounded difference, respectively.

PART - C

ANSWER ANY THREE QUESTIONS **(3*10 = 30)**

16. Explain extension principle for fuzzy sets.

17. If f be a decreasing generator. Then a function g(a) = f(0) – f(a) for any a ∈ [0,1] is an increasing generator with g(1) = f(0), then prove that $g^{(-1)}(a) = f^{(-1)}(f(0)-a)$.

18. Let A ∈ □ (X), then prove that A is a fuzzy number if and only if there exists a closed interval [a,b] ≠ ∅ such that

$$A(x) = \begin{cases} 1, & \text{for } x \in [a,b] \\ l(x), & \text{for } x \in (-\infty, a) \\ r(x), & \text{for } x \in (b,\infty) \end{cases}$$ where l is a function from $(-\infty, a)$ to [0,1] that is monotonic

increasing, continuous from the right, and such that l(x) =0 for $x \in (-\infty, \omega_1)$; r is a function from (b,∞) to [0,1] that is monotonic decreasing, continuous from the left, and such that r(x) =0 for $x \in (\omega_2, \infty)$.

19. Explain binary relation on a single set.

20. Explain solution method of fuzzy relation equations.