(6 pages) Reg. No. : ....

Code No. : 20300 E **Sub. Code : AEMA 62**

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2023.

Sixth Semester

Mathematics

Major Elective — FUZZY MATHEMATICS

(For those who joined in July 2020 only).

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. The range of membership function is ————

(a) R (b) A

(c) X (d) [0, 1]

2. A fuzzy set A is said to be normal if $h(A) =$ ————.

(a) 0 (b) $\frac{1}{2}$

(c) 1 (d) 3

3. If $A \subseteq B$ then ${}^{\alpha}A$ ————.

(a) $={}^{\alpha}B$ (b) $\subseteq{}^{\alpha}B$

(c) $\supseteq{}^{\alpha}B$ (d) $\subseteq A \cup B$

4. If $A_1 \subseteq A_2$, then $f(A_1)$ ————.

(a) $\subseteq f(A_2)$ (b) $\subseteq A_2$

(c) $\supseteq f(A_2)$ (d) $= f(A_2)$

5. If c is a fuzzy complement then $a \le b \Rightarrow$

(a) $c(a) \le c(b)$ (b) $c(a) \ge c(b)$

(c) $c(a) = a$ (d) $c(a) = c(b)$

6. If i is a fuzzy intersection then $i(a, 1) =$ ————.

(a) 1 (b) 0

(c) a (d) $a+1$

7. If A is a fuzzy number, then ${}^{0+}A$ is ————.

(a) not bounded (b) bounded

(c) connected (d) not connected

8. [4, 10]/[1, 2] = ————.

(a) [2, 10] (b) [1, 10]

(c) [2, 4] (d) [2, 7]

9. Multi persion decision making was introduced in ————.

(a) 1970 (b) 1974

(c) 1980 (d) 1982

10. In Multipersion decision making, $S(x_i, x_j)$ ————.

(a) $N(x_i, x_j)$ (b) $\frac{N(x_i, x_j)}{n}$

(c) $N(x_i, x_j)-1$ (d) $\frac{N(x_i, x_j)}{n}+1$

PART B — (5 × 5 = 25 marks)

Answer ALL the questions, choosing either (a) or (b).

11. (a) Define α-cut. Also if

$$A = 0/x_1 + 0.2/x_2 + 0.7/x_3 + 0.41/x_4 + 0.5/x_5 + 0.3/x_6 + 0.9/x_7 + 0.81/x_8 + 0.6/x_9 + 0.11/x_{10}.$$

Or

(b) Define : Strong α-cut. Also if $A = 0.3/x_1 + 0.1/x_2 + 0.8/x_3 + 0.65/x_4 + 0.4/x_5 + 0/x_6 +$ then find strong α-cut $(\alpha = 0.2, 0.3, 0.4)$.

12. (a) Prove that ${}^{\alpha}(A \cap B) = {}^{\alpha}A \cap {}^{\alpha}B$.

Or

(b) Prove that ${}^{\alpha}(\overline{A}) = {}^{(1-\alpha)+}\overline{A}$.

13. (a) If c is a continuous fuzzy complement, then prove that c has a unique equilibrium.

Or

(b) The standard fuzzy intersection is the only idempotent t-norm.

14. (a) Prove that $MIN[MIN(A, B), C] = MIN[A, MIN(B, C)]$ and $MAX[MAX(A, B), C] = MAX[A, MAX(B, C)]$

Or

(b) If A, B are two fuzzy numbers with

$$A(x) = \begin{cases} \frac{x+2}{2}, & -2 < x < 0 \\ \frac{2-x}{2}, & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$$ and

$$B(x) = \begin{cases} \frac{x-2}{2}, & 0 < x \le 4 \\ \frac{6-x}{2}, & 4 < x \le 6 \\ 0 & \text{otherwise} \end{cases}$$ then find $A+B$.

15. (a) Define fuzzy linear programming with an example.

Or

(b) Solve by graphical method :

Min $z = x_1 - 2x_2$,

$3x_1 - x_2 \geq 1$, $2x_1 + x_2 \leq 6$, $0 \leq x_1 \leq 2$, $x_1 \geq 0$.

PART C — (5 × 8 = 40 marks)

Answer ALL the questions, choosing either (a) or (b).

16. (a) Prove that a fuzzy set A on R is convex iff $A(\lambda(x_1) + (1-\lambda)x_2) \geq Min\{A(x_1), A(x_2)\}$.

Or

(b) Explain the following :

(i) Height of a fuzzy set

(ii) Level set of a fuzzy set

(iii) Standard fuzzy complement.

17. (a) State and prove Second Decomposition Theorem.

Or

(b) Explain about Extension principle for fuzzy sets.

18. (a) State and prove First Characterization theorem of fuzzy complements.

Or

(b) Prove that $i_{min}(a, b) \leq Min(a,b)$. i_{min} denotes the drastic intersection.

19. (a) Explain about Arithmetic operation on intervals.

Or

(b) Explain about Lattice of fuzzy numbers.

20. (a) Explain : Multi persion decision making.

Or

(b) Solve : Max $z = 5x_1 + 4x_2$,

$\langle 4, 2, 1\rangle x_1 + \langle 5, 3, 1\rangle x_2 \leq \langle 24, 5, 8\rangle$

$\langle 4, 1, 2\rangle x_1 + \langle 5, 3, 1\rangle x_2 \leq \langle 12, 6, 3\rangle$.
