

**M.Sc. MATHEMATICS
THIRD SEMESTER
FUZZY SETS
MSM - 304E**

[USE OMR FOR OBJECTIVE PART]

**SET
A**

Duration: 1:30 hrs.

Full Marks: 35

Time: 15 mins.

Marks: 10

$$1 \times 10 = 10$$

(Objective)

Choose the correct answer from the following:

- Let $U = (a, b, c, d)$ and $I_2 = \{0,1\}$. A function $f: U \rightarrow I_2$ is defined as follows: $f(a) = 0, f(b) = 1, f(c) = 0, f(d) = 1$. Then f defines a crisp set A in U where

- a. $A = \{a, b\}$ b. $A = \{b, c\}$
c. $A = \{b, d\}$ d. $A = \{a, b, c\}$

2. A fuzzy set A on a domain $U = \{a, b, c, d, e\}$ is given by

U	a	b	c	d	e
$A(x)$	0.2	0.02	0.24	0.12	0.19

Height of A is

- a. 0.2 b. 0.02
c. 0.24 d. 0.19

3. A fuzzy set A is defined on a domain $U = \left\{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}\right\}$ is given by

U	1	1/2	1/3	1/4	1/5
$A(x)$	0.2	1	0.24	1	0.19

The core of A is

- a. $\left\{1, \frac{1}{2}\right\}$ b. $\left\{\frac{1}{2}, \frac{1}{3}\right\}$
c. $\left\{\frac{1}{3}, \frac{1}{4}\right\}$ d. $\left\{\frac{1}{2}, \frac{1}{4}\right\}$

4. A fuzzy set A on a domain U will be normed if the $\text{ht}(A)$ (height of A) is a number
- greater than 1
 - less than 1
 - equal to 1
 - satisfying any one of (a), (b) or (c)

5. Let $U = \{a, b, c, d\}$ be any domain of discourse. If A and B are fuzzy sets on U given by $A = \frac{0.0}{a} + \frac{0.7}{b} + \frac{0.4}{c} + \frac{1.0}{d}$ and $B = \frac{0.3}{a} + \frac{0.7}{b} + \frac{0.6}{c} + \frac{1.0}{d}$ then

(Here A', B' are the complements of A and B respectively)

- a. $A \subseteq B$
c. $A' \subseteq B$

6. Let A be a fuzzy set in a domain U and A' , the complement of A in U then
 - a. $A \cup A' = U$
 - b. $A \cap A' = \phi$
 - c. Both of (a) and (b) are true
 - d. Both of (a) and (b) are not necessarily true
7. Let $U = \{a, b, c, d\}$ and $A = (0.8, 1.0, 0.3, 0.1)$. Then $A_{0.3}$ the α -cut of A for $\alpha = 0.3$ is
 - a. $\{a\}$
 - b. $\{a, b\}$
 - c. $\{a, b, c\}$
 - d. U
8. Let $A = \frac{0.0}{a} + \frac{0.3}{b} + \frac{0.2}{c} + \frac{0.8}{d} + \frac{0.1}{e}$ be a fuzzy set on $U = \{a, b, c, d, e\}$. Then the scalar cardinality of $A_{0.2}$ i.e., $SC(A_{0.2})$ is
 - a. 2
 - b. 3
 - c. 4
 - d. 5
9. For any fuzzy set A on U the α th power of A i.e., A^α for $\alpha = 0.5$ is called
 - a. Concentration of A
 - b. Dilation of A
 - c. Contrast Intensification of A
 - d. None of these
10. For any fuzzy set A on a domain U and for any $\alpha \in (0, 1]$, the restricted scalar multiplication of A by α i.e., αA is again a fuzzy set on U such that
 - a. $\alpha A = A$
 - b. $\alpha A = A'$
 - c. $\alpha A \subseteq A$
 - d. $A \subseteq \alpha A'$

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(Descriptive)

Time : 1 hr. 15 mins.

Marks : 25

[Answer question no.1 & any two (2) from the rest]

1. Considering $U = \{a, b, c\}$, establish a one-one correspondence between the set of all characteristic function on U and the set of all subsets of U . 5

2. a. How do you define a fuzzy set A on a domain U ? If A and B are any fuzzy sets on U , then define $A \cup B$, $A \cap B$ and A' citing at least one example for each of them. 1+6+3
=10
 - b. For any fuzzy set A on a domain U , explain the concepts of
 - (i) Support of A
 - (ii) Core of A
 - (iii) Height of A

3. a. Define α -cut of a fuzzy set A on a domain U . If $\alpha, \beta \in (0, 1]$, $\alpha \leq \beta$ then show that $A_\beta \subseteq A_\alpha$. 1+4+5
=10
 - b. Considering a fuzzy set $A = (0.0, 1.0, 0.5, 0.8)$ on a domain $U = \{a, b, c, d\}$, show that

$$A = \bigcup \{ \alpha A_\alpha : \alpha \in L(A) \}$$
 where $L(A)$ is the level set of $A = \{0.5, 0.8, 1.0\}$

4. a. Define Fuzzy cardinality of a fuzzy set A on a domain U . 5+5=10

If $A = (0.0, 0.3, 0.2, 0.8, 0.1)$ then find $FC(A)$, the fuzzy cardinality of A .

 - b. For any domain U and for every $x \in U$ if $K(x)$ is a fuzzy set on U explain the concept of fuzzification of A i.e. $F(A)$ by $K(x)$.

If $U = \{a, b, c\}$, $A = \frac{0.3}{a} + \frac{0.6}{b}$ and

$$K(a) = \frac{0.7}{a} + \frac{0.4}{b}, K(b) = \frac{0.4}{a} + \frac{1.0}{b} + \frac{0.4}{c} \text{ and } K(c) = \frac{0.2}{b} + \frac{0.8}{c}$$
 then compute $F(A)$.

5. Let $U = \{a, b, c\}$, $V = \{x, y, z\}$, $W = \{p, q, r\}$ and $f: U \times V \rightarrow W$ be such that

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$$f(a, x) = f(a, y) = f(c, y) = p$$

$$f(a, z) = f(b, x) = f(b, z) = q$$

$$f(b, y) = f(c, x) = f(c, z) = r$$

If $A = \frac{0.2}{a} + \frac{0.7}{b} + \frac{0.5}{c}$ and $B = \frac{0.5}{x} + \frac{0.3}{y} + \frac{1.0}{z}$ then find C , the cartesian product of A and B under f .

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