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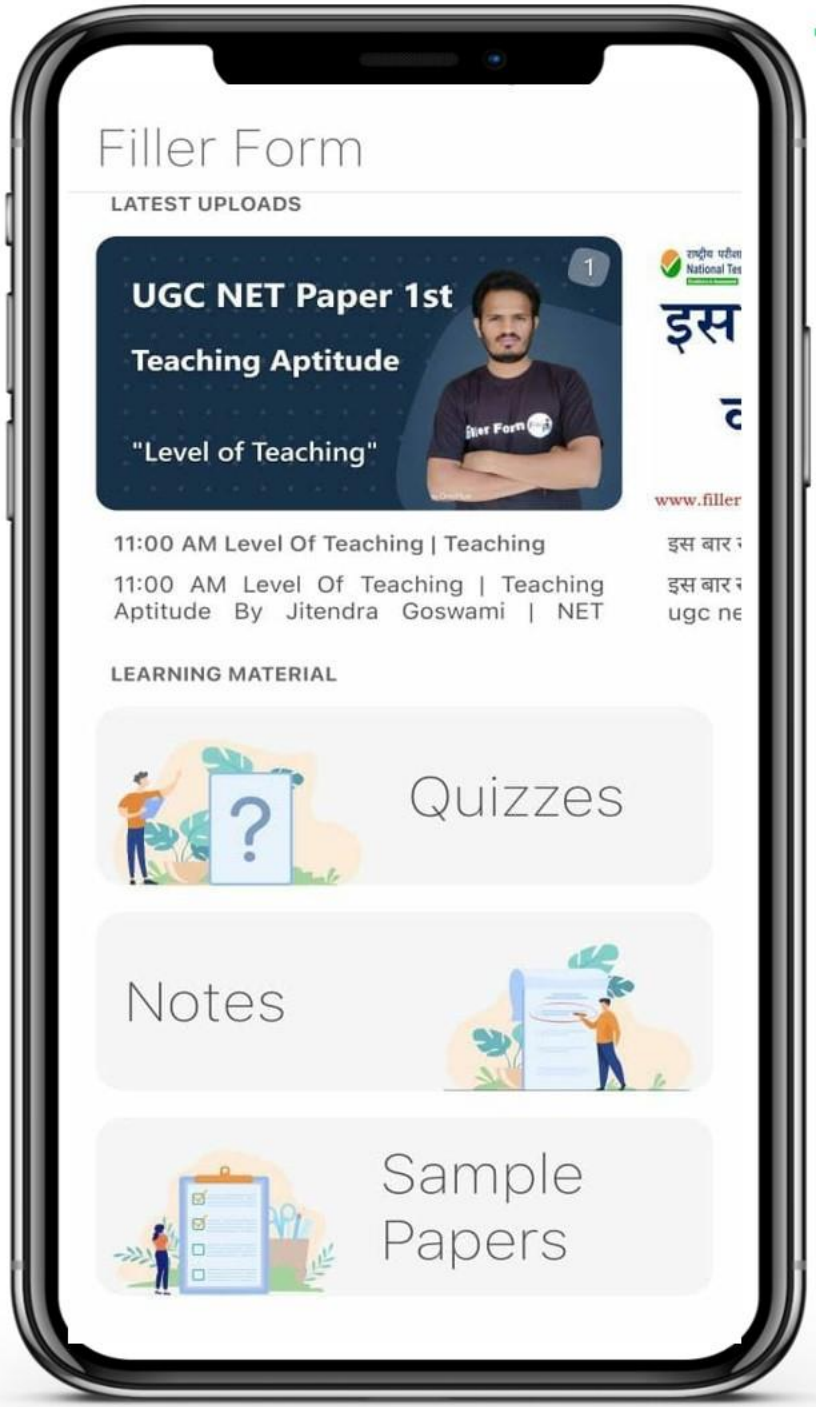


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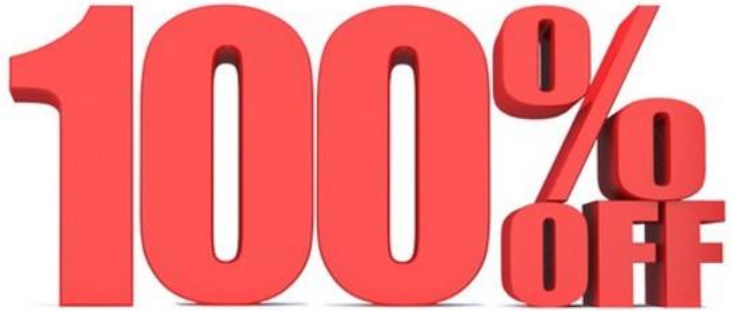


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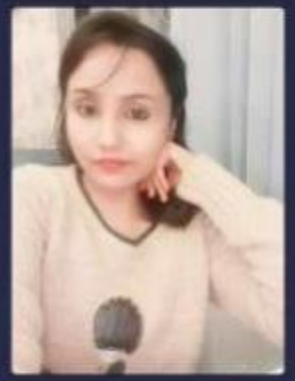

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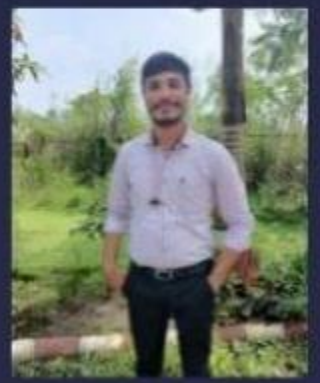

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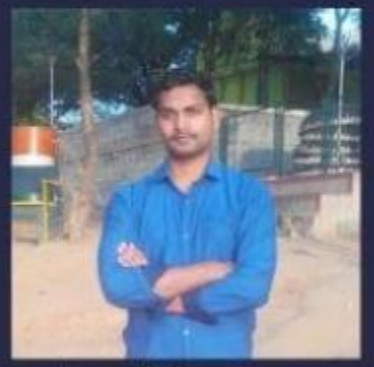

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# Home work



8. Support of a fuzzy set

$$A = \left\{ \frac{x_1}{0.2}, \frac{x_2}{0.15}, \frac{x_3}{0.9}, \frac{x_4}{0.95}, \frac{x_5}{0.15} \right\}$$

Within a universal set X is given as

A. $\left\{ \frac{x_1}{0.15}, \frac{x_2}{0.15}, \frac{x_3}{0.15}, \frac{x_4}{0.15}, \frac{x_5}{0.15} \right\}$

B. $\left\{ \frac{x_1}{0.95}, \frac{x_2}{0.95}, \frac{x_3}{0.95}, \frac{x_4}{0.95}, \frac{x_5}{0.95} \right\}$

C. $\{x_3, x_4\}$

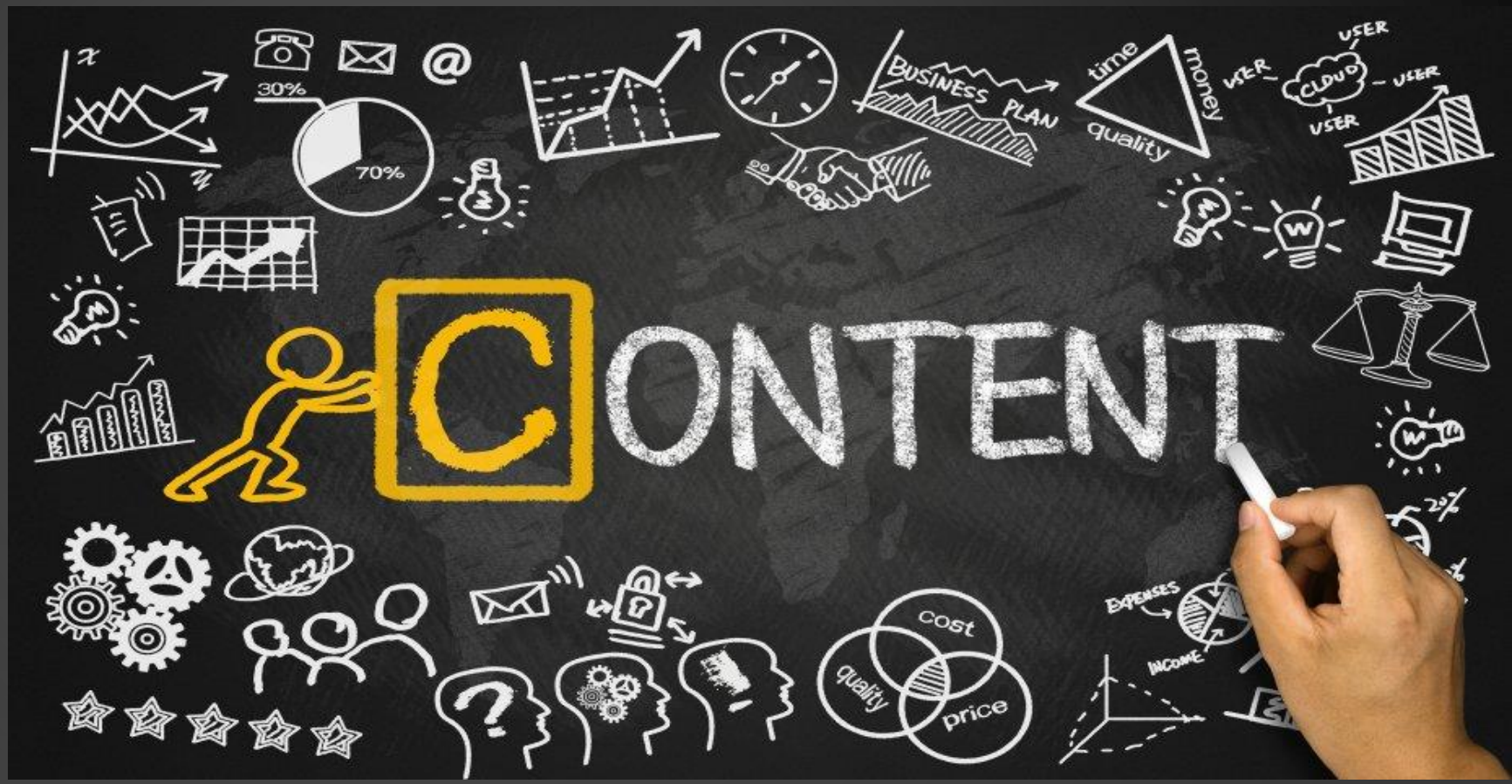
D. $\{x_1, x_2. x_3. x_4. x_5\}$

# ❑ Approaches to AI

Content:

1. Basic Operation On Fuzzy Sets:

2. Algebric Sum, Product.



# BASIC OPERATION ON FUZZY SETS

1)Equal Sets : Two fuzzy sets A and B are equal if

$$\mu A(x) = \mu B(x) \quad \text{for all } x \in X$$

and is written as A=B . If for atleast one $x \in X$ ,then A and B are said to be unequal and written $A \neq B$

2) complement : The complement of fuzzy set A is denoted by Ac (or A') and is defined by its membership as

$\mu c\ A(x) = 1 - \mu B(x)$ for all x.

$1 - \mu c$

Example: If A = {(x1,0) , (x2,0.3), (x3,0.5)}

Then Ac = {(x1,1) , (x2,0.7), (x3,0.5)}

Since $\mu c\ A(x1) = 1 - \mu\ A(x) = 1 - 0 = 1$

$\mu c\ A(x2) = 1 - \mu c\ A(x2) = 1 - 0.3 = 0.7$

and $\mu c\ A(x3) = 1 - \mu\ A(x3) = 1 - 0.5 = 0.5$

**Que.** **Given U = {1,2,3,4,5,6,7}**

**A = {(3, 0.7), (5, 1), (6, 0.8)}**

**then A will be: (where ~ ⟶ complement)**

**a.** {(4, 0.7), (2,1), (1,0.8)}

**b.** {(4, 0.3.): (5, 0), (6. 0.2) }

**c.** {(l, 1), (2, 1), (3, 0.3), (4, 1), (6,0.2), (7, 1)}

**d.** {(3, 0.3), (6.0.2)}

Que. Given U = {1,2,3,4,5,6,7}

A = {(3, 0.7), (5, 1), (6, 0.8)}

then A will be: (where ~ → complement)

a. {(4, 0.7), (2,1), (1,0.8)}

b. {(4, 0.3.): (5, 0), (6. 0.2) }

c. {(l, 1), (2, 1), (3, 0.3), (4, 1), (6,0.2), (7, 1)}

d. {(3, 0.3), (6.0.2)}

**Answer: (c). {(l, 1), (2, 1), (3, 0.3), (4, 1), (6,0.2), (7, 1)}**

# 3)UNION: The union of two fuzzy sets A and B is a fuzzy set C given by C = AUB

$$\mu A(x) = \max [\mu A(x) , \mu B(x)] ; x \in X$$

Example: If A = { (4,0.1),(6,0.5),(8,0.6),(10,0.7) }

B = { (4,0.2),(6,1),(8,0.4),(10,0.5) }

Then C = AUB = { (4,0.2),(6,1),(8,0.6),(10,0.7) }

Since $\mu C(x1) = \max [\mu A(x1) , \mu B(x1)] = \max[0.1,0.2] = 0.2$

$\mu C(x2) = \max [\mu A(x2) , \mu B(x2)] = \max[0.5,1] = 1$

$\mu C(x3) = \max [\mu A(x3) , \mu B(x3)] = \max[0.4,0.6] = 0.6$

$\mu C(x4) = \max [\mu A(x4) , \mu B(x4)] = \max[0.7 ,0.5] = 0.7$

4)Intersection: The intersection of two fuzzy sets A and B is a fuzzy . set C given by : $C = A \cap B$

$$\mu A(x) = \min [\mu A(x) , \mu B(x)] ; x \in X$$

Example: if A ={(3,0.1), (5,0.7), (7,0.7)}

B = {(3,0.4), (5,0.8), (7,0.3)}

Then $C = A \cap B$ = {(3,0.1), (5,0.7), (7,0.3)}

Since $\mu C(x1) = \min [\mu A(x1) , \mu B(x1)] = \min[0.1 , 0.4] = 0.1$

$\mu C(x2) = \min [\mu A(x2) , \mu B(x2)] = \min[0.7 , 0.8] = 0.7$

$\mu C(x3) = \min [\mu A(x3) , \mu B(x3)] = \min[0.7 , 0.3] = 0.3$

2. If A and B are two fuzzy sets with membership functions:

$\mu a(\chi) = \{0.2, 0.5., 0.6, 0.1, 0.9\}$

$\mu b(\chi) = \{0.1, 0.5, 0.2, 0.7, 0.8\}$

then the value of $\mu a \cap \mu b$ will be

a. {0.2,0.5,0.6,0.7,0.9}

TAKE MAX $A \cup B = \{0.2, 0.5, 0.6, 0.7, 0.9\}$

b. {0.2, 0.5,0.2, 0.1,0.8}

TAKE MIN $A \cap B = \{0.1, 0.5, 0.2, 0.1, 0.8\}$

c. {0.1, 0.5, 0.6, 0.1,0.8}

d. {0.1, 0.5, 0.2, 0.1,0.8}

**5) DIFFERENCE :** The difference of two fuzzy sets A and B is defined by $A-B = A \cap B^c$

Example : If A = {(x1,0.3) , (x2,0.4), (x3,0.5)}

B = {(x1,0.2) , (x2,0.6), (x3,0.7)}

Then Bc = {(x1,0.8) , (x2,0.4), (x3,0.3) }

Note that , except in particular cases $A - B \neq B - A$

**6)Algebraic Sum:** The algebraic sum of two fuzzy set A and B is defined by the membership function as

$\mu A+B(x) = \mu A(x) + \mu B(x) - \mu A(x)\, \mu B(x)$ for all $x \in X$
and written as A +B

**Consider two fuzzy sets.**

$$A = \{ \frac{0.2}{1} + \frac{0.3}{2} + \frac{0.4}{3} + \frac{0.5}{4} \}$$

$$B = \{ \frac{0.1}{1} + \frac{0.2}{2} + \frac{0.2}{3} + \frac{0}{4} \}$$

Find the algebraic sum, algebraic product, sets.

**Solution:**

**[A] Algebraic sum:**

$$MA + B\ (x) = MA\ (x) + r\ B\ (x) - MA\ (x)\ .\ MB\ (x)$$

$$= \{ \frac{0.3}{1} + \frac{0.5}{2} + \frac{0.6}{3} + \frac{0.5}{4} \}$$

$$- \{ \frac{0.02}{1} + \frac{0.06}{2} + \frac{0.08}{3} \}$$

$$= \{ \frac{0.28}{1} + \frac{0.44}{2} + \frac{0.52}{3} + \frac{0.5}{4} \}$$

**7) Algebraic Product** : The algebraic product of two fuzzy sets A and B is defined by two membership functions as

$$\mu A.B\ (x) = \mu A\ (x)\ .\ \mu B(x) \text{ for all } x \in X$$

and written as A.B

in particular $\mu A.A(x) = \mu A\ 2\ (x) = [\mu A(x)]2$ for all $x \in X$

Example. If A = {(1,0.5), (2, 1), (3, 0.6)}

B = {(1.1) , (2, 0.6)}

Then A + B = {(1,1), (2,1), (3, 0.6)}

and A.B = {(1, 0.5),(2, 0.6), (3,0)}

Consider two fuzzy sets.

$$A = \{ \frac{0.2}{1} + \frac{0.3}{2} + \frac{0.4}{3} + \frac{0.5}{4} \}$$

$$B = \{ \frac{0.1}{1} + \frac{0.2}{2} + \frac{0.2}{3} + \frac{0}{4} \}$$

[B] Algebraic product:

$$MAB(x) = MA(x)\ MB(x)$$

$$= \{ \frac{0.02}{1} + \frac{0.06}{2} + \frac{0.08}{3} + \frac{0}{4} \}$$

# HOME WORK

1. If two fuzzy sets A and B are given with membership functions

$\mu_A(x) = \{0.2, 0.4, 0.8, 0.5, 0.1\}$

$\mu_B(x) = \{0.1, 0.3, 0.6, 0.3, 0.2\}$

Then the value of $\mu\ \overline{A \cap B}$ will be

A. {0.9, 0.7, 0.4, 0.7, 0.9}

B. {0.2, 0.4, 0.8, 0.5, 0.2}

C. {0.1, 0.3, 0.6, 0.3, 0.1}

D. {0.7, 0.3, 0.4, 0.2, 0.7}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