SCOA Assignment no-01

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Q1] Explain classical set vs fuzzy set

→ a) Classical set :-

i) It is a collection of distinct objects for example, a set of students passing grades

ii) Each individual entity in a set is called a member or an element of the set

iii) The classical set is defined in such a way that the universe of discourse is splitted into two groups members & non-members, Hence in classical sets No partial membership exists

iv) Let A is given set, The membership function can be used to define a set A is given by

$$\mu A(x) = \begin{cases} 1 & \text{if } x \in A \\ 0 & \text{if } x \notin A \end{cases}$$

↓ Operations on classical set :- Union
Intersection
Compliment
Difference

b) Fuzzy Set :-

i) It is a set having degree of membership between 1 & 0.

ii) Fuzzy set are represented with tilde character (~) for example :- Number of cars following traffic signals at a particular time out of all cars represent will have membership value between [0, 1]

iii) Partial membership exists when number of one fuzzy set can also be a part of other fuzzy sets in the same universe

iv) The degree of membership or truth is not same as

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probability, fuzzy truth represents membership in vaguely defined sets

↳ A fuzzy set $\tilde{A}$ in the universe discourse, U, can be defined as a set of ordered pairs of at if it given by

$$\tilde{A} = \{(x, \mu \tilde{A}(x)) \mid x \in X\}$$

Q2) Difference between fuzzification & defuzzification

fuzzification	Defuzzification
i) It is process of transforming a crisp set to a fuzzy set or fuzzyset to fuzzier set	i) It is the process of reducing a fuzzy set into a step (crisp) or a converting fuzzy member into a crisp member
ii) It converts precise data into impreise data	ii) It converts an imprecise data set into precise dataset
iii) It uses method like, inference rank ordering, angular fuzzy sets, neural n/w	iii) It uses methods like, maximum membership, centroid method, weighted average method
iv) It is easy to implement	iv) It is complex to implement
v) It uses if-then rules to fuzzify the crisp value	v) It uses center of gravity methods to get centroid of sets
vi) Example: Voltmeter	vi) Example - Stepper motor

Q3] Consider two sets

$B_1 = \{1/1.0 + 0.75/1.5 + 0.3/2.0 + 0.15/2.5 + 0/3.0\}$

$B_2 = \{1/1.0 + 0.6/1.5 + 0.2/2.0 + 0.1/2.5 + 0/3.0\}$

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→ ① $\underset{\sim}{B_1} \cup \underset{\sim}{B_2} = \max [\mu_{B_1}(x), \mu_{B_2}(x)]$

$= \{1/1.0 + 0.75/1.5 + 0.3/2.0 + 0.15/2.5 + 0/3.0\}$

② $\underset{\sim}{B_1} \cap \underset{\sim}{B_2} = \min [\mu_{B_1}(x), \mu_{B_2}(x)]$

$= \{1/1.0 + 0.6/1.5 + 0.2/2.0 + 0.1/2.5 + 0/3.0\}$

③ $\overline{\underset{\sim}{B_1}} = 1 - \mu_B(x)$

$= \{0/1.0 + 0.25/1.5 + 0.7/2.0 + 0.85/2.5 + 1/3.0\}$

④ $\overline{\underset{\sim}{B_2}} = 1 - \mu_B(x)$

$= \{0/1.0 + 0.4/1.5 + 0.8/2.0 + 0.9/2.5 + 1/3.0\}$

⑤ $\underset{\sim}{B_1}/\underset{\sim}{B_2} = \underset{\sim}{B_1} \cap \underset{\sim}{B_2}$

$= \{1/1.0 + 0.4/1.5 + 0.3/2.0 + 0.15/2.5 + 0/3.0\}$

⑥ $\overline{\underset{\sim}{B_1} \cup \underset{\sim}{B_2}} = \overline{\underset{\sim}{B_1}} \cap \overline{\underset{\sim}{B_2}}$

$= \{0/1.0 + 0.25/1.5 + 0.7/2.0 + 0.85/2.5 + 1/3.0\}$