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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST 1

Winter Semester: 2021 - 22

Course Code: CSE3007

Course Name: Introduction to Fuzzy Logic

Program & Sem: B.Tech CAI & IV Sem

Date: 27/04/2022

Time: 11.30 am to 12.30 pm

Max Marks: 30

Weightage: 15%

Instructions:

- (i) Read the all questions carefully and answer accordingly.
(ii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries two marks.

(5Qx 2M= 10M)

1. Define Crisp and Fuzzy Sets. [C.O.NO 1] [KNOWLEDGE]
2. State whether a fuzzy membership be true and false at the same time? [C.O.NO 1] [KNOWLEDGE]
3. What is a membership function of a fuzzy set? [C.O.NO 1] [KNOWLEDGE]
4. What is support in a fuzzy set? [C.O.NO 2] [KNOWLEDGE]
5. Describe α -cut and strong α -cut method. [C.O.NO 2] [KNOWLEDGE]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries five marks.

(2Qx5M=10M)

6. Consider the following real variables from everyday life: (C.O.NO 1) [COMPREHENSION]
 - a) Income measured in Indian Rupees.
 - b) Speed measured in meters per second.
 - c) A TV show measured in how much you are interested watching it.
 - d) A meal measured in how much you like to eat it.

In each case, infer fuzzy membership functions (Linguistic Hedges).

7. Using intuition and your own definition of the universe of discourse, discuss and plot fuzzy membership functions for the following variables: (C.O.NO 2) [COMPREHENSION]

Liquid level in the tank

- a) Very small
- b) Small
- c) Empty
- d) Full
- e) Very full

Part C [Problem Solving Questions]

Answer the Questions. The question carries ten marks.

(1Qx10M=10M)

8. Two fuzzy sets A and B defined on X are follows

(C.O.NO 1) [APPLICATION]

$$\mu_A(x) = \{(x_1, 0), (x_2, 0.1), (x_3, 0.2), (x_4, 0.3), (x_5, 0.4), (x_6, 0.5), (x_7, 0.6)\}$$

$$\mu_B(x) = \{(x_1, 1), (x_2, 0.9), (x_3, 0.8), (x_4, 0.7), (x_5, 0.6), (x_6, 0.5), (x_7, 0.4)\}$$

Solve the following α -cut sets.

a) $(\bar{A})_{0.2}$

c) $(A \cup B)_0$

e) $(A \cap \bar{A})_{0.7}$

b) $(\bar{B})_{0.6}$

d) $(A \cap B)_{0.5}$



Roll No

**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST 2

Winter Semester: 2021 - 22

Course Code: CSE 3007

Course Name: Introduction to Fuzzy Logic

Program & Sem: B.Tech CAI & IV Sem

Date: 2nd June 2022

Time: 11.30 AM to 12.30 PM

Max Marks: 30

Weightage: 15%

Instructions:

(iii) Read the all questions carefully and answer accordingly.

(iv) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TWO marks.

(5Qx2M=10M)

8. Given a crisp set $A = \{1, 2, 3, 4\}$. Define the relation matrix for the relation

$$R: \{(a, b) \mid b = a+1, a, b \in A\}$$

[C.O.NO 2] [KNOWLEDGE]

9. Given that "x is Sweet" with $T(x) = 0.8$ and "y is Sweet" with $T(y) = 0.6$. State the fuzzy truth value of "If x is Sweet then y is Sweet".

[C.O.NO 2] [KNOWLEDGE]

10. Define is Generalized Modus Tollens?

[C.O.NO 3] [KNOWLEDGE]

11. A fuzzy set Young is defined as follows: $Young: \{(15, 0.5), (20, 0.8), (25, 0.8), (30, 0.5), (35, 0.3)\}$. Identify the crisp value of Young using *MoF* method.

[C.O.NO 3] [KNOWLEDGE]

12. Identify the value range of λ in Lambda Cut Method?

[C.O.NO 3] [KNOWLEDGE]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries FIVE marks.

(2Qx5M=10M)

13. Given $X = \{a, b, c, d\}$ and $Y = \{1, 2, 3, 4\}$.

(C.O.NO3) [COMPREHENSION]

Let $A = \{(a, 0.0), (b, 0.8), (c, 0.6), (d, 1.0)\}$ and $B = \{(1, 0.2), (2, 1.0), (3, 0.8), (4, 0.0)\}$.

Infer the implication relation: *If x is A then y is B.*

14. Let $P = \begin{bmatrix} 0.3 & 0.5 & 0.8 \\ 0 & 0.7 & 1 \\ 0.4 & 0.6 & 0.5 \end{bmatrix}$ and $Q = \begin{bmatrix} 0.9 & 0.5 & 0.7 & 0.7 \\ 0.3 & 0.2 & 0 & 0.9 \\ 1 & 0 & 0.5 & 0.5 \end{bmatrix}$.

(C.O.NO 2) [COMPREHENSION]

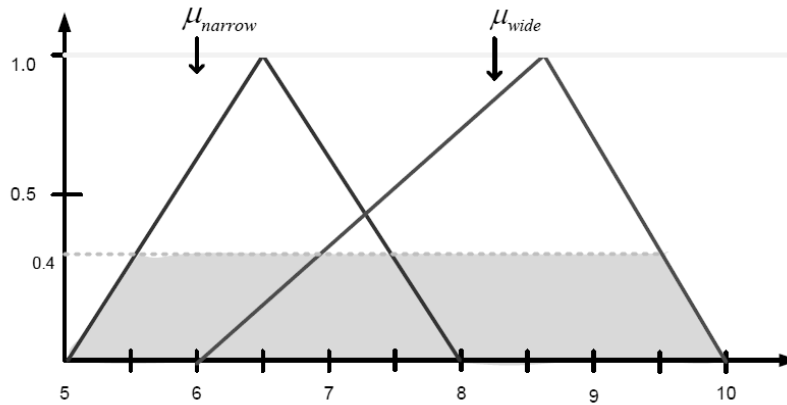
Infer R where $R = P \circ Q$ using max-min composition.

Part C [Problem Solving Questions]

Answer the Question. The question carries TEN marks.

(1Qx10M=10M)

9. The width of a road as narrow and wide is defined by two fuzzy sets, whose membership functions are plotted as shown in the figure below. (C.O.NO 3) [APPLICATION]



If a road with degree of membership value of 0.4 then what will be its width (in crisp) measure. Compute the crisp values using CoG defuzzification method.



**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

END TERM EXAMINATION

Winter Semester: 2021 - 22

Course Code: CSE 3007

Course Name: Introduction to Fuzzy Logic

Program & Sem: B.Tech AI/ML & IV Sem

Date: 30th June 2022

Time: 09:30 AM to 12:30 PM

Max Marks: 100

Weightage: 50%

Instructions:

(v) Read the all questions carefully and answer accordingly.

(vi) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries FIVE marks.

(6Qx 5M= 30M)

1. Define Sigmoidal Membership function with an example. [C.O.NO 1] [KNOWLEDGE]
2. List out the any five properties of Fuzzy Set. [C.O.NO 1] [KNOWLEDGE]
3. State why defuzzification is essential part of Fuzzy Logic Controller?
[C.O.NO 3] [KNOWLEDGE]
4. List the operation that can be performed in Fuzzy Relations. [C.O.NO 2] [KNOWLEDGE]
5. Define fuzzy Cartesian product with example. [C.O.NO 2] [KNOWLEDGE]
6. State fuzzy connectives for three valued logic with suitable example.
[C.O.NO 3] [KNOWLEDGE]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries FIFTEEN marks.

(2Qx15M=30M)

7. Consider the following two sets P and D, which represent a set of paddy plants and a set of plant diseases. More precisely $P = \{P_1, P_2, P_3, P_4\}$ a set of four varieties of paddy plants, $D = \{D_1, D_2, D_3, D_4\}$ of the four various diseases affecting the plants.

In addition to these, also consider another set $S = \{S_1, S_2, S_3, S_4\}$ be the common symptoms of the diseases. Let, R be a relation on $P \times D$, representing which plant is susceptible to which diseases, then R can be states as

$$R = \begin{matrix} & \begin{matrix} D_1 & D_2 & D_3 & D_4 \end{matrix} \\ \begin{matrix} P_1 \\ P_2 \\ P_3 \\ P_4 \end{matrix} & \left[\begin{array}{cccc} 0.6 & 0.6 & 0.9 & 0.8 \\ 0.1 & 0.2 & 0.9 & 0.8 \\ 0.9 & 0.3 & 0.4 & 0.8 \\ 0.9 & 0.8 & 0.4 & 0.2 \end{array} \right] \end{matrix}$$

Also consider T be the another relation on $D \times S$, which is given by

$$T = \begin{matrix} & S_1 & S_2 & S_3 & S_4 \\ D_1 & \begin{bmatrix} 0.1 & 0.2 & 0.7 & 0.9 \end{bmatrix} \\ D_2 & \begin{bmatrix} 1.0 & 1.0 & 0.4 & 0.6 \end{bmatrix} \\ D_3 & \begin{bmatrix} 0.0 & 0.0 & 0.5 & 0.9 \end{bmatrix} \\ D_4 & \begin{bmatrix} 0.9 & 1.0 & 0.8 & 0.2 \end{bmatrix} \end{matrix}$$

Identify the association of plants with the different symptoms of the disease using max-min composition. [C.O.NO 3] [COMPREHENSION]

8. Two fuzzy sets P and Q are defined on x as follows. [C.O.NO 2] [COMPREHENSION]

$\mu(X)$	x_1	x_2	x_3	x_4	x_5
P	0.1	0.2	0.7	0.5	0.4
Q	0.9	0.6	0.3	0.2	0.8

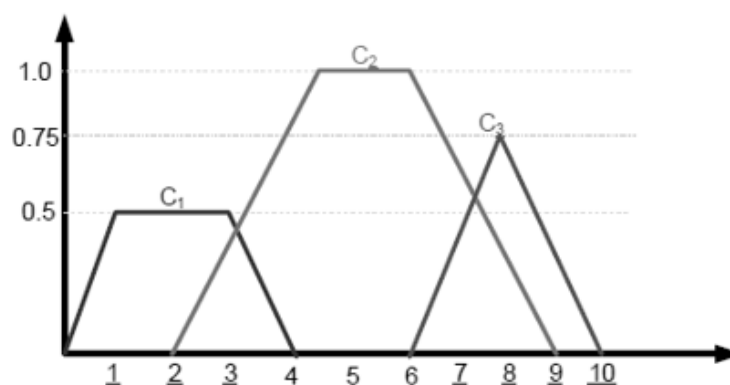
Infer the below expressions:

- a) $P_{0.2}, Q_{0.3}$
- b) $(P \cup Q)_{0.6}$
- c) $(P \cup \bar{P})_{0.8}$
- d) $(P \cap Q)_{0.4}$
- e) $\overline{(P \cap Q)}_{0.4}$

Part C [Problem Solving Questions]

Answer both the Questions. Each question carries TWENTY marks. (2Qx20M=40M)

9. Consider the output fuzzy sets as shown in the following plot:



Compute the crisp value using CoG, CoS and CoA methods. [C.O.NO 3] [APPLICATION]

10. A group of friends who are foodies frequently visits different restaurants to try new dishes. To avoid the confusion in tipping the server, they need an application to decide tip amount and contacted you to develop an application for tipping problem. Based on the quality of food and service provided, the application has to decide the percentage of tip on the bill. Illustrate a FLC for tipping problem based on the above problem statement. [C.O.NO 4] [APPLICATION]

