Q1. Given fuzzy two sets A and B compute following:

A = $\{(x_1, 0.6), (x_2, 0.2), (x_3, 0.3)\}$

B= $\{(x_1, 0.7), (x_2, 0.3), (x_3, 0.4)\}$

(i) $(A \cup B)$

(ii) $(A \cap B)$

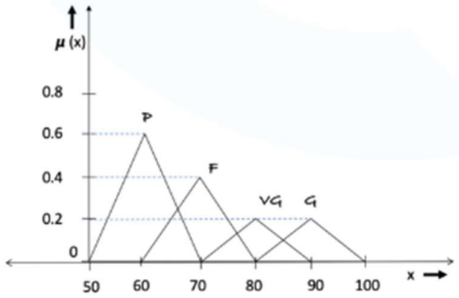
(iii) Sum(A+B)

(iv) Difference(A-B)

(v) Disjunctive Sum($A \oplus B$)

Q2:

Let A be a fuzzy set that tells about a student as shown in figure below. Here, the linguistic variable P represents a Pass student, F stands for a Fair student, G represents a Good student and VG represents a Very Good student. Calculate the defuzzified value for the fuzzy set A with weighted average method and center of sums.



Q 3:

Consider the fuzzy relation

$$R = \begin{bmatrix} 1 & 0.8 & 0 & 0.1 & 0.2 \\ 0.8 & 1 & 0.4 & 0 & 0.9 \\ 0 & 0.4 & 1 & 0 & 0 \\ 0.1 & 0 & 0 & 1 & 0.5 \\ 0.2 & 0.9 & 0 & 0.5 & 1 \end{bmatrix}$$

Perform λ-cut operations for the values of $\lambda = 0.9, 0^+$

Q4: List the five functional blocks FIS is constructed on with a block diagram.

Q5: Explain the methods used for decomposition of compound linguistic rules into simple canonical rules.

Q6: Explain the Roulette wheel technique for traditional GA selection.

Q7: Describe the various stopping conditions for genetic algorithm flow.

Q8: Differentiate between Mamdani FIS and Sugeno FIS.

Q9: What is Fuzzy Inference System (FIS)? Illustrate Mamdani FIS and Sugeno FIS with examples?

Q10: What are Genetic Algorithms (GA)? Explain the operators in GA?

Q11. a) Explain four mutation methods?

b) List the stopping condition for Genetic Algorithm Flow?

Q 12: Define the initial population for the following problem:

Minimize f(x)=$\frac{x2}{2} + \frac{x2}{2}$

Where 0<x<15

- Population Size 5 and Initial Population 13, 5, 8, 14, 11
- Encoding technique: Binary encoding
- Selection operator: roulette wheel selection
- Single point crossover at 2

Compute for 1 iteration

Q13: Proof the following properties of fuzzy set:

- Commutativity
- Associativity
- Distributivity
- Absorption
- Idempotency / Tautology

Q2. Given fuzzy four sets A, B, C, D compute following:

A = {(x_1, 0.6), (x_2, 0.2), (x_3, 0.3)}

B= {(y_1, 0.7), (y_2, 0.3), (y_3, 0.4)}

C= {(x_1, 0.6), (x_2, 0.2), (x_3, 0.3)}

D= {(y_1, 0.7), (y_2, 0.3), (y_3, 0.4)}

Compute R1 and R2

$i) R1 = \min\{\mu_{A(x)}, \mu_{B(y)}\}\ R2 = \max\{\mu_{C(x)}, \mu_{D(y)}\}$

ii) Union (R1 ∪ R2) and Intersection (R1 ∩ R2)

Q3.

The Lambda-cut method for a fuzzy set can also be extended to fuzzy relation also.

Example: For a fuzzy relation R

$$R = \begin{bmatrix} 1 & 0.2 & 0.3 \\ 0.5 & 0.9 & 0.6 \\ 0.4 & 0.8 & 0.7 \end{bmatrix}$$

We are to find λ-cut relations for the following values of $\lambda = 0, 0.2, 0.9, 0.5$

$$R_0 = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} \text{ and } R_{0.2} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} \text{ and}$$

$$R_{0.9} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \text{ and } R_{0.5} = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

Lambda-cut sets : Example

Two fuzzy sets P and Q are defined on x as follows.

$\mu(x)$	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

Find the following :

(a) $P_{0.2}$, $Q_{0.3}$

(b) $(P \cup Q)_{0.6}$

(c) $(P \cup \overline{P})_{0.8}$

(d) $(P \cap Q)_{0.4}$

Q Explain PSO algorithm with suitable example?

Q Explain ACO algorithm with suitable example?

Q Explain BAT algorithm with suitable example?

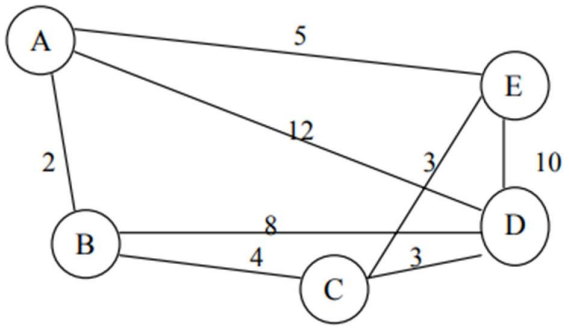
Q Explain Crow algorithm with suitable example?

Q Explain Bee algorithm with suitable example?

Q Explain whale algorithm with suitable example?

Q Explain cuckoo algorithm with suitable example?

Q Compute Pheromone update using without vaporization technique for given Cost graph pheromone initial value is 1 for the tour A→E→C→D→B→A?



Q Compute Pheromone update using with vaporization technique for given Cost graph pheromone initial value is 1 for the tour A→D→E→C→B→A?