

INT254 Sample Questions

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) $(A \cap B)$

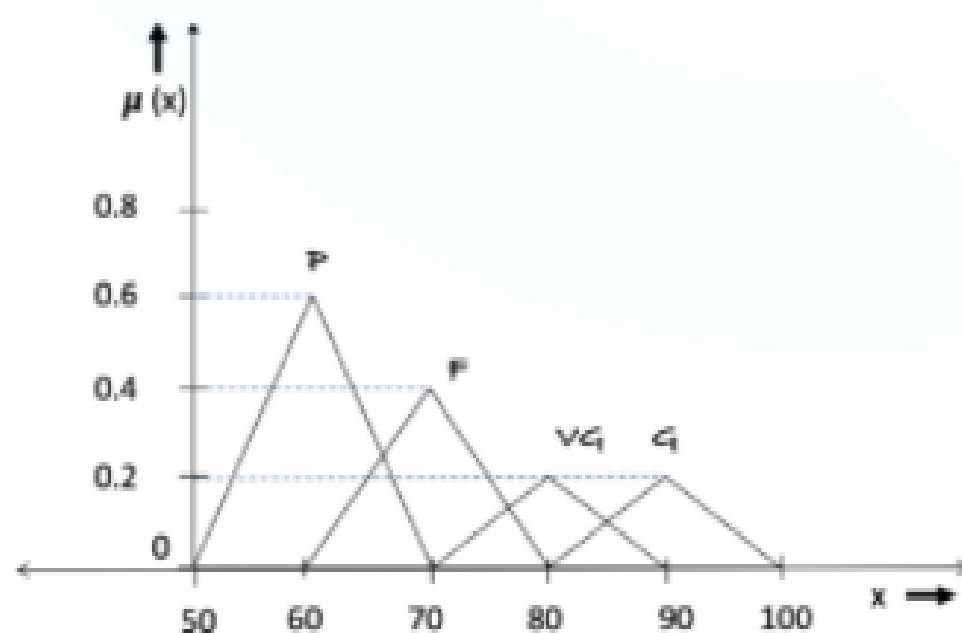
(iii) $\text{Sum}(A+B)$

(iv) $\text{Difference}(A-B)$

(v) $\text{Disjunctive Sum}(A \oplus B)$

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?

Q12: Define the initial population for the following problem:

Minimize $f(x) = x_1^2 + x_2^2$

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 R_1 and R_2

$$i) R_1 = \min \mu_{Ax}, \mu_{By} \quad R_2 = \max \{ \mu_{Cx}, \mu_{D(y)} \}$$

ii) Union ($R_1 \cup R_2$) and Intersection ($R_1 \cap R_2$)

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) $(P \cup \bar{P})_{0.8}$

(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?

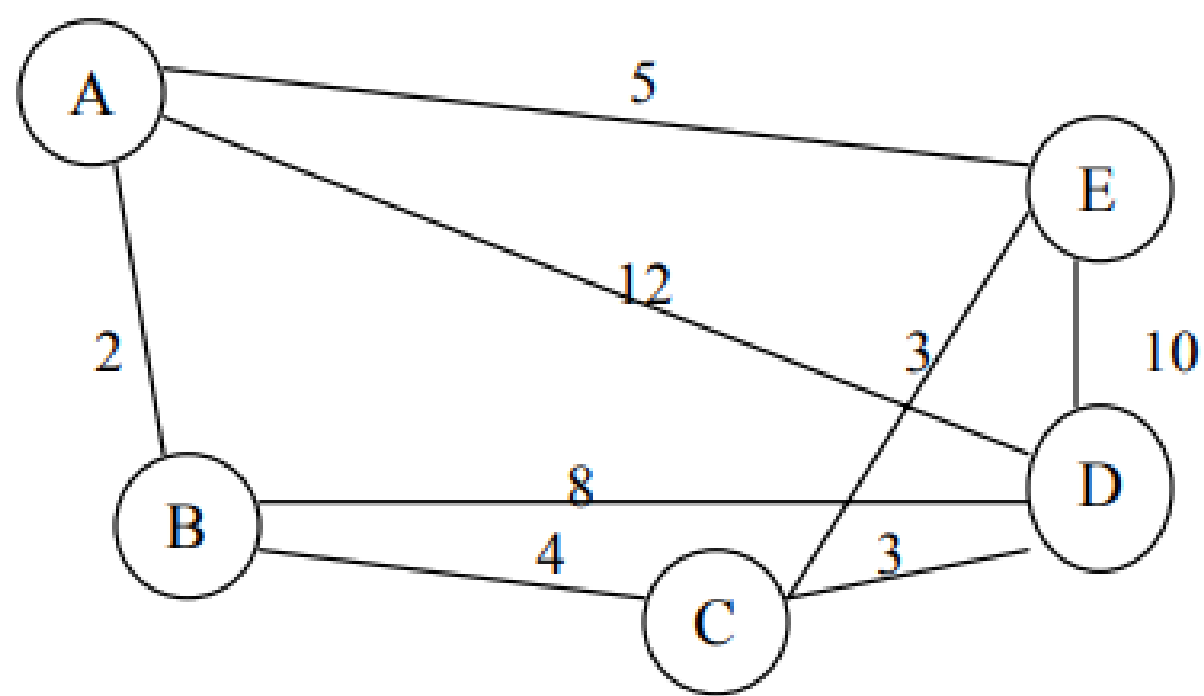
Q Explain Crow algorithm with suitable example?

Q Explain Bee algorithm with suitable example?

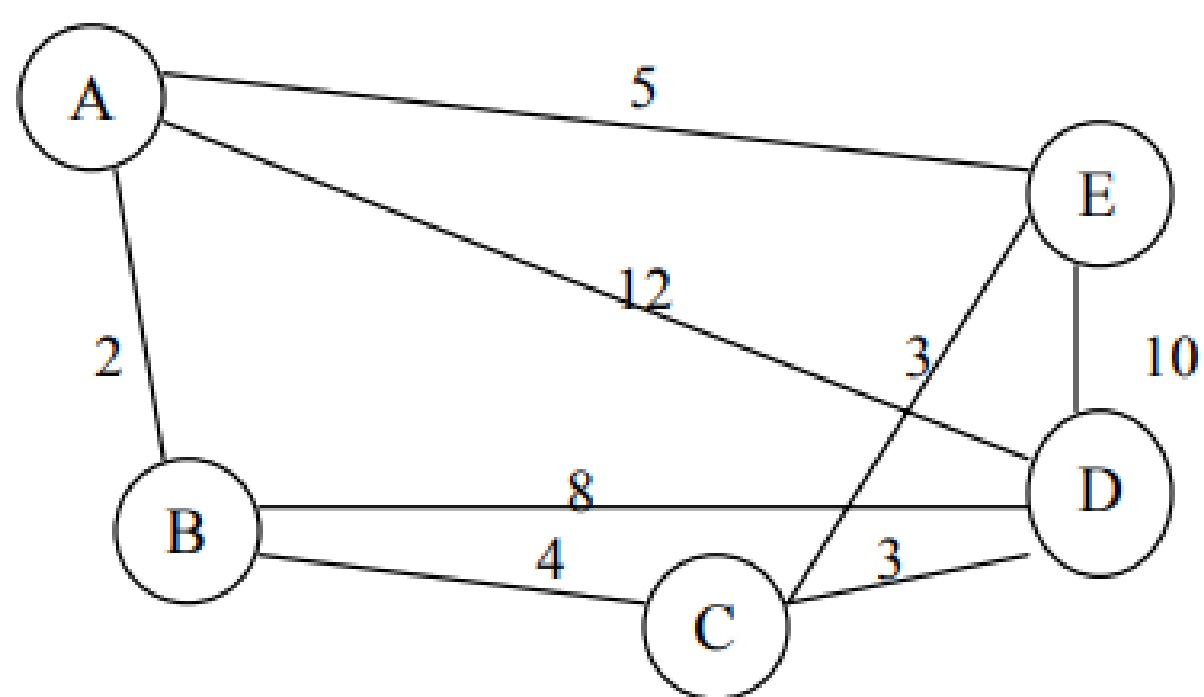
Q Explain whale algorithm with suitable example?

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 path i) $A \rightarrow E \rightarrow C \rightarrow D \rightarrow B \rightarrow A$ and path ii) $A \rightarrow B \rightarrow C \rightarrow D \rightarrow E \rightarrow A$?



Q Compute Pheromone update using with vaporization rate 0.25 technique for given Cost graph pheromone initial value is 1 for the tourpath i) A → D → E → C → B → A and path ii) A → B → C → D → E → A?



Q1. Define the Mamdani of a fuzzy set.

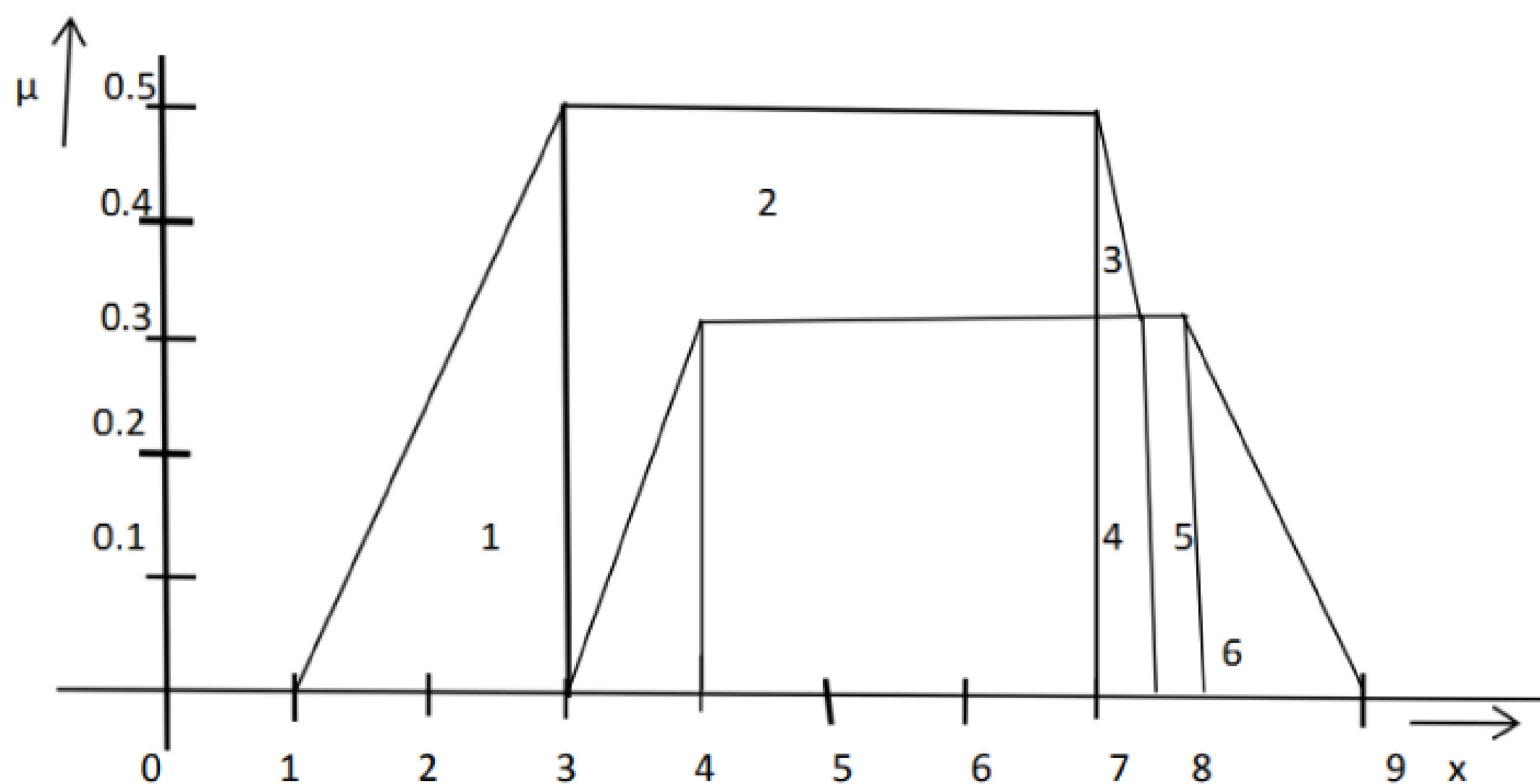
Q2. Let assume X and Y are two fuzzy sets where $X = \{(1,1), (3,0.5), (2,1)\}$ and $Y = \{(1,2), (4,2), (1,1)\}$. Find $A-B$

Q3. Write the genetic algorithms work in pseudocode

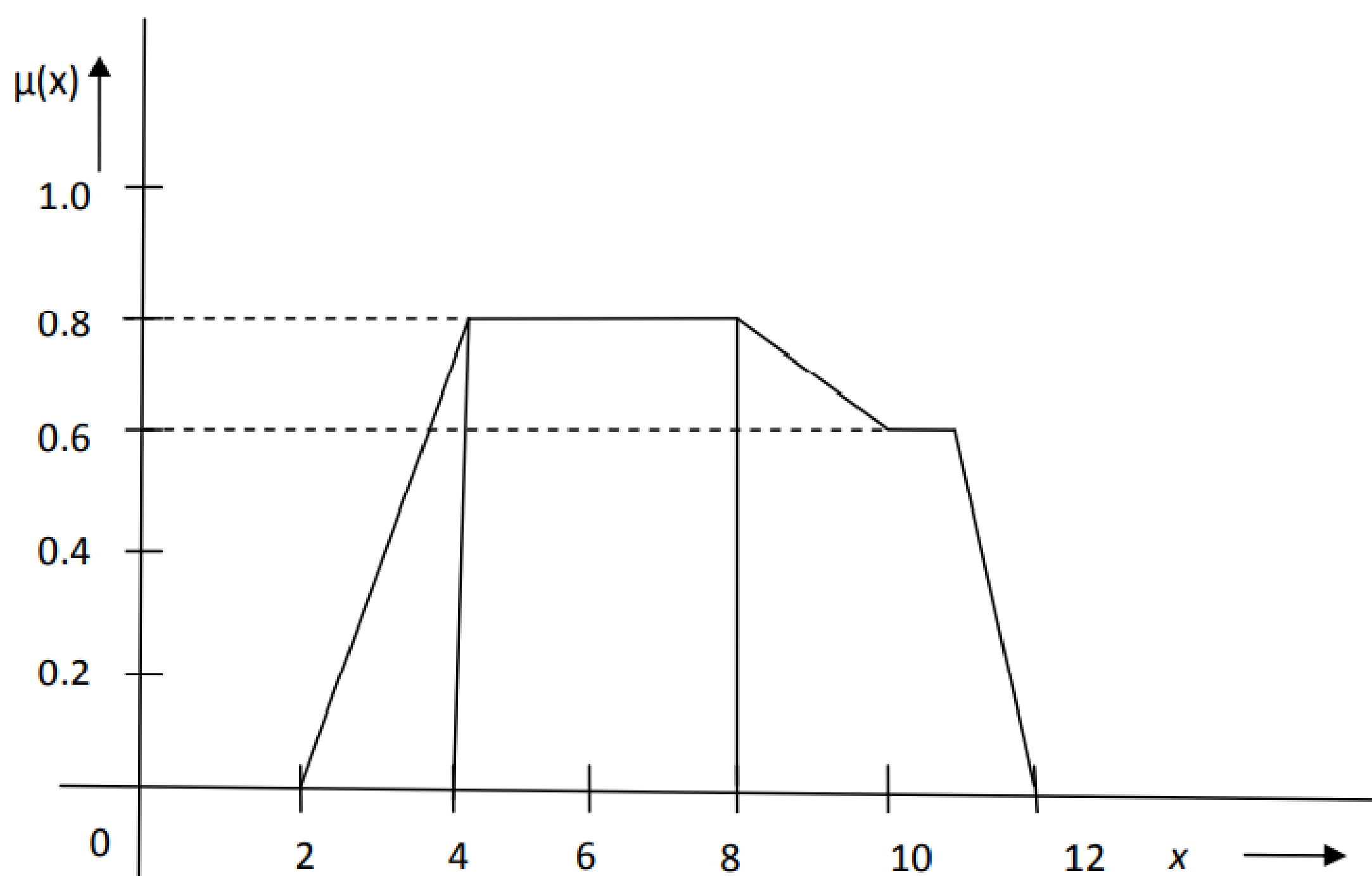
Q4. Name any method can be used to locate the whales. Explain it in detail

Q5. What is hybridization and explain the auxiliary hybrid system.

1. Find the defuzzification value using Center of gravity (COG) / Centroid of Area (COA) Method.



Find the defuzzification value using First of Maxima Method (FOM), Last of Maxima Method (LOM), Mean of Maxima Method (MOM).



What is membership function? Explain with graphical representation.

What is Fuzzification? Explain Fuzzification with example.

Find the fuzzy Union, Intersection and Compliment of A&B of given sets.

$$A = \{(x_1, 0.5), (x_2, 0.1), (x_3, 0.4)\} \text{ and } B = \{(x_1, 0.2), (x_2, 0.3), (x_3, 0.5)\};$$

Write the steps of Genetic Algorithms with proper explanation

What is Crossover. Explain Crossover (Single Point) n Points and Uniform Crossover with examples.

What is Search Space in Genetic Algorithms?

Comparison of Natural and Genetic Algorithms Terminology?

What is Mutation in Genetic Algorithms?

Find the value for 2-Iterations using PSO. Initially all velocity is 0, $C_1=C_2=1$, random value for first iteration $r_1=0.213$ and $r_2=0.876$ and for second iteration $r_1=0.113$ and $r_2=0.706$.

Problem: Find the maximum of the function

$$f(x) = -x^2 + 5x + 20 \text{ with } -10 \leq x \leq 10$$

using the PSO algorithm. Use 9 particles with the initial positions $x_1 = -9.6$, $x_2 = -6$, $x_3 = -2.6$, $x_4 = -1.1$, $x_5 = 0.6$, $x_6 = 2.3$, $x_7 = 2.8$, $x_8 = 8.3$, and $x_9 = 10$. Show the detailed computations for iterations 1, 2 and 3.

What is the Ant Colony Optimization? Why do we need ACO. Explain with example.

Explain Crow search and Crow Search behaviour.

Explain about Bat Algorithm.

How Firefly Algorithm does work for the optimization?

What is Swarm optimization techniques?