

Fuzzy Set

$$A = [(1, 0.2) (3, 0.7) (5, 0.4) (7, 1)]$$

$$B = [(2, 0.4) (4, 0.6)]$$

$$R = A \times B = [(1,2), 0.2]$$

$$[(1,4), 0.2]$$

$$[(3,2), 0.4]$$

$$[(3,4), 0.4]$$

$$[(5,2), 0.4]$$

$$[(5,4), 0.4]$$

$$[(7,2), 0.4]$$

$$[(7,4), 0.4]$$

$$\begin{matrix} 1 \\ 3 \\ 5 \\ 7 \end{matrix} \begin{bmatrix} 0.2 & 0.2 \\ 0.4 & 0.4 \\ 0.4 & 0.4 \\ 0.4 & 0.6 \end{bmatrix}$$

$$R' = \begin{matrix} & x & y \\ 2 & [0.1 & 0.4] \\ 1 & [0.2 & 0.7] \end{matrix}$$

$\circ = \text{Max (min)}$

$$R \circ R' = \begin{bmatrix} \text{Max} (0.1, 0.2) & \text{max} (0.1, 0.2) \\ \text{Max} (0.1, 0.2) & \text{max} (0.1, 0.4) \\ \text{Max} (0.4, 0.2) & \text{max} (0.4, 0.4) \\ \text{Max} & 0.2 & 0.6 \end{bmatrix}$$

Consp Set.

$$[A]_{m \times n} \times [B]_{n \times p} = [C]_{m \times p}$$

Relations

$$A = \{1, 3, 5, 7\}$$

$$B = \{2, 4\}$$

$$A \times B = \{ (1,2), (1,4), (3,2), (3,4), (5,2), (5,4), (7,2), (7,4) \}$$

	2	4
1	1	1
3	1	1
5	1	1
7	1	1

	1	3	5	7
2	1	1	1	1
4	1	1	1	1

$$R = \{ (A, B) \mid B = A + 1 \}$$

$$R = \{ (1,2), (3,4) \}$$

	2	4
1	1	0
3	0	1
5	0	0
7	0	0

	1	3	5	7
2	1	0	0	0
4	0	1	0	0

$$R' = \{ (A, B) \mid B \geq A \}$$

$$= \{ (1,2), (1,4), (3,4), (4,4) \}$$

0.2	0.2
0.2	0.6
0.2	0.4
0.2	0.6

Compute the OP of the statement.

① Temperature is high
Rotation is high
High x High R.

② temp is high, Rotation is high
else rotation is slow,
High^c x Rotation

Ex: Temp = { 20, 30, 40, 50 }
Rotation = { 100, 200, 300, 400 } Overwrite

High = { (40, 0.9), (50, 1) }
(20, 1), (30, 1)

High^c = { (40, 0.1), (50, 0) }

Medium = { (30, 0.8), (40, 0.1) }

Cold = { (20, 1), (30, 0.2) }

Slow R = { (100, 1), (300, 0.5),
(400, 1) }

	100	200	300	400
20	0	0	0	0
30	0	0	0	0
40	0	0.2	0.5	0.9
50	0	0.2	0.5	1

= High x High R

①

High^c x Rotation

②

1	1	1	1
1	1	1	1
0.1	0.1	0.1	0.1
0	0	0	0

① V ②

1	1	1	1
1	1	1	1
0.1	0.2	0.5	0.9
0	0.2	0.5	1

② High^c x Slow R.

Slow R = { (100, 1), (200, 0.2), (300, 0.5), (400, 0) }

High^c = { (20, 1), (30, 0.1), (40, 0.1), (50, 0) }

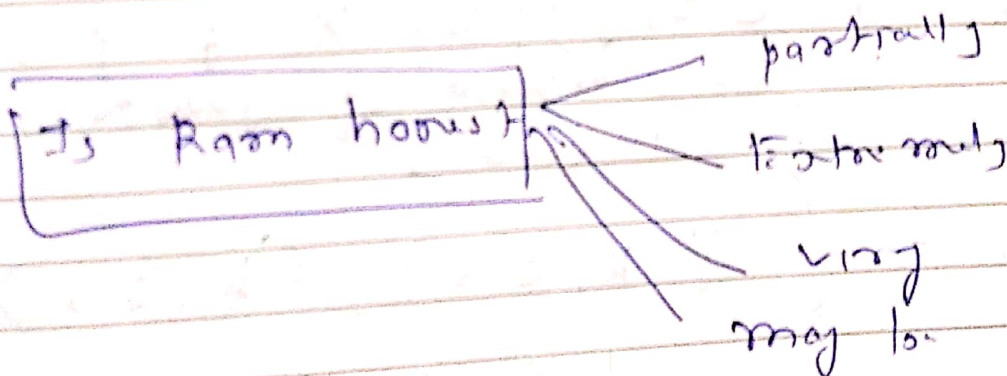
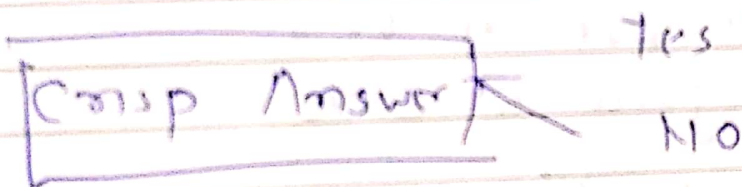
	100	200	300	400
20	1	0.2	0.5	0
30	0.1	0.2	0.5	0
40	0.1	0.1	0.1	0
50	0	0	0	0

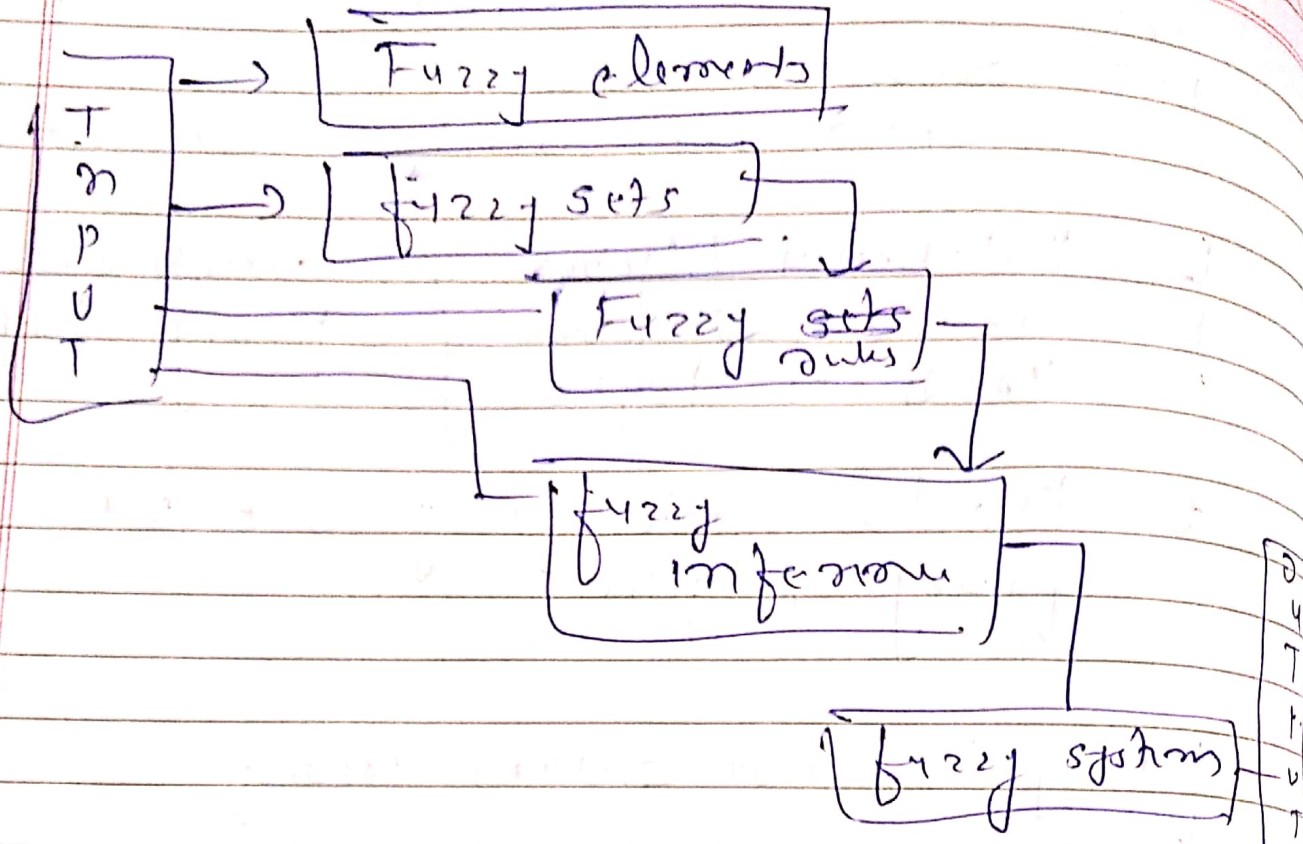
Fuzzy logic is a mathematical language to express something.
grammar, syntax, semantic

- ↳ Relational Algebra
 - ↳ Boolean Algebra
 - ↳ Predicate logic
- } combined in fuzzy logic
- ↳ Deals with fuzzy set or fuzzy Algebra

fuzzy :- not clear, noisy

Antonym fuzzy - Crisp





example

$X =$ all student in 617

$S =$ All good students.

$S = \{ (s, g) \mid s \in X \ \& \ g \in S \}$
is measurement of goodness of students

$S = \{ (R, 0.8), (K, 0.7), (S, 0.2), (A, 0.9) \}$

Genetic Algorithms

classmate

Date _____
Page _____

(ACO)

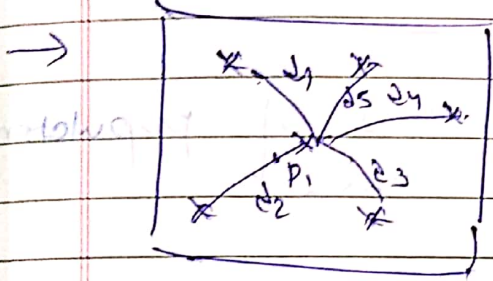
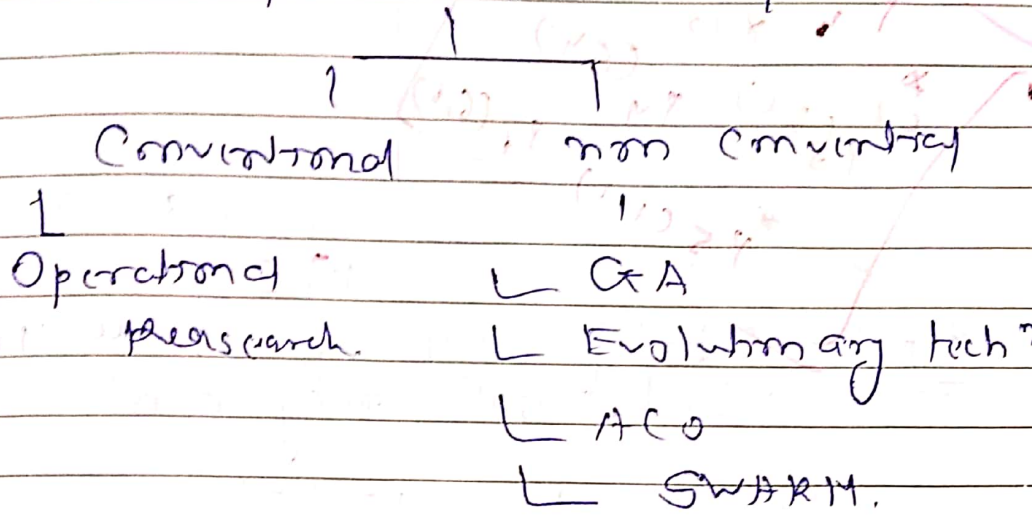
non conventional

Inspired by biological phenomena

SWARM

Intelligence

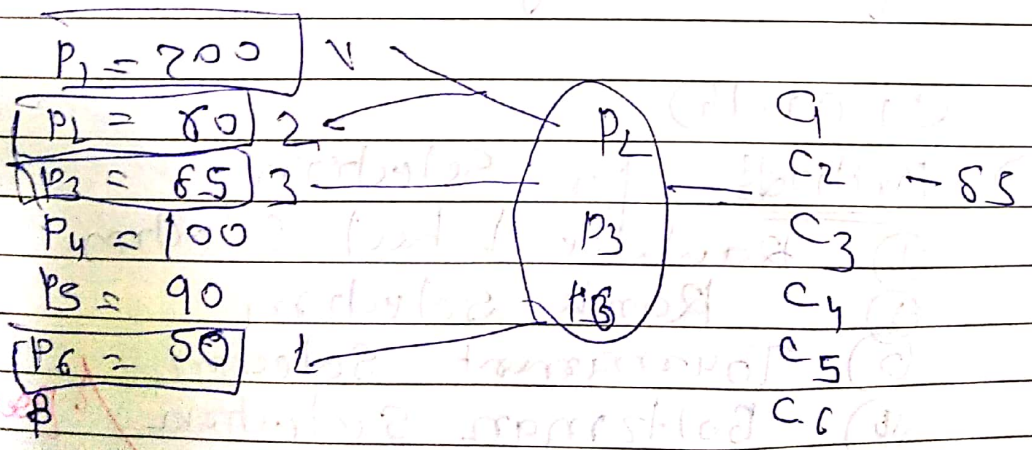
Optimization Techniques



Euclidian Distance

$$P_1 = d_1 + d_2 + d_3 + d_4 + d_5$$

If $P_1 < P_2$ then P_1 is over



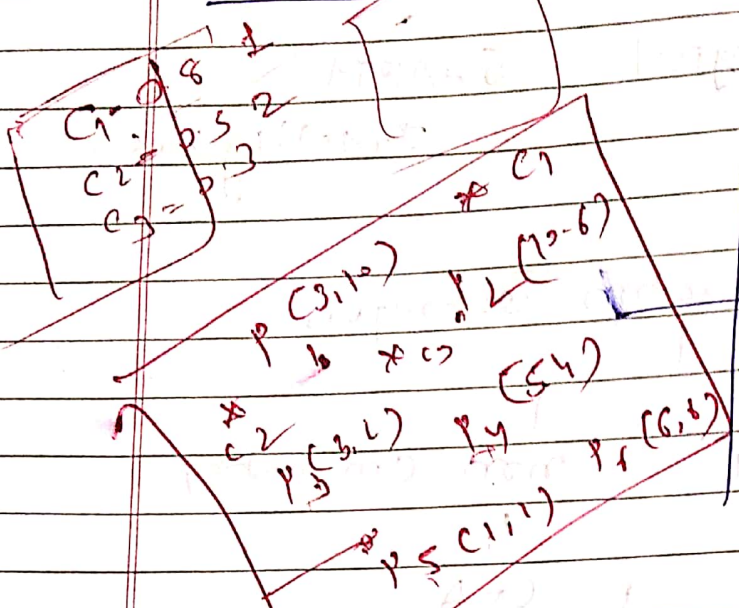
12
4

0 1 1 0
0 0 1 0 0
GA

2 5
15

5 bit
0 0 0 0 1
0 0 0 1 0
(7, 12)

Problem 1



~~c1~~ ~~p4~~ (15, 15)
~~(3, 10)~~ x c2 x c5
 p1 x c3
 (2, 2) p2 x c6
 p5 x c7 (6, 4) x c4 x c8

Step-1 Identification of space in which soln may exist

→ (0,0) to (15,15)

Step-2 Select random no of population in the identified space

Let's say soln are
c1 to c8

Step-3 Selection of chromosomes from the given population.

c1 (1, 14)

→ Methods for Selection

- ① Roulette Wheel Selection
- ② Rank Selection
- ③ Tournament Selection
- ④ Boltzman Selection

Random

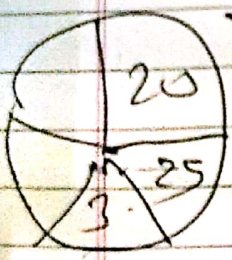
$2 + 9 + 4$

4 bits for x co-ordinate
4 bit. for y co-ordinate

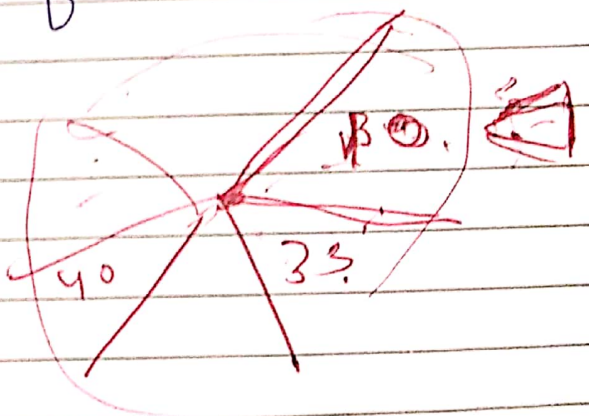
- $C_1 (1, 14) = 0001 \ 1100$
- $C_2 (4, 2) = 0100 \ 0111$
- $C_3 (15, 15) = 1111 \ 1111$
- $C_4 (10, 10) = 1010 \ 1010$
- $C_5 (11, 7) = 1011 \ 0111$
- $C_6 (8, 12) = 1000 \ 1100$

$C_1 P_1 \neq C_1 P_2 + C_1 P_3 + C_1 P_4 + C_1 P_5 + C_1 P_6$
 assume 30 (total distance)
 For ↑

⇒ Total $C_1 = 30$ (fitness function)
 $C_2 = 25$
 $C_3 = 40$
 $C_4 = 30$
 $C_5 = 35$
 $C_6 = 20$

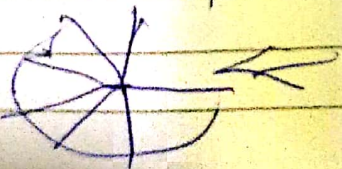
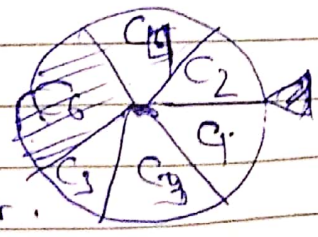


- ③
- ②
- ①
- ②
- ①



① Roulette Selection

Selection of C_6 is high because area occupied is wider.



⇒ (x) Rank Selection
give rank to chromosomes
according to fitness value

⇒ Take lower rank to most genes

⇒ (3) Tournament Selection

Take two random C
take tournament which is
fitter take to next gen.

⇒ (x) Maximize $f = 2a_1 + a_2$

$$a_1, a_2 \geq 0$$

$$a_1 + 2a_2 \leq 10$$

0
-2

