7. (a) Using your own intuition and definition of universe of discourse, plot Membership functions for liquid level in the tank. (empty, very less, less, full, very full). 4

(b) Cluster the following eight points (with (x, y) representing locations) into three clusters:

A1(2, 10), A2(2, 5), A3(8, 4), A4(5, 8), A5(7, 5), A6(6, 4), A7(1, 2), A8(4, 9)

Initial cluster centers are: A1(2, 10), A4(5, 8) and A7(1, 2).

The distance function between two points a = (x1, y1) and b = (x2, y2) is defined as-

$P(a, b) = |x2 - x1| + |y2 - y1|$

Use K-Means Algorithm to find the three cluster centers after the second iteration. 6

8. Write short notes on any two : 5x2=10

(a) Fuzzy set theory and Probability theory.

(b) Exploration and Exploitation.

(c) Convex and non-convex optimization problems.

****





# B. Tech Odd Semester Examination, February, 2023

## Computer Science & Engineering

(7th Semester)

Course No.: CSE-702(4)

**(Soft Computing)**

*Full Marks: 50*

*Pass Marks: 25*

*Time: 2 hours*

**Note:**
1. Attempt any five questions.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the right margin indicate full marks for the question.
6. All the mathematical symbols and abbreviations have their usual meanings.

1. (a) How is XOR problem nonlinear? Discuss. 6

(b) Crossover or Mutation? Which one of the two is more powerful? 4

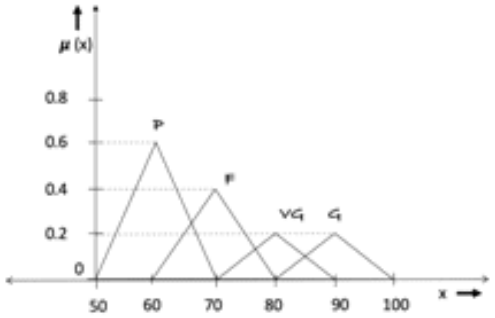
2. (a) Consider the discrete fuzzy set defined on the universe X= {a, b, c, d, e} asA== {1/a + 0.9/b + 0.6/c + 0.3/d + 0/e}

Using Zadhe's notation, find the λ -cut sets for λ=0.6, 0.3, 0+. 2 x 3=6

(b) Compute CD for the following solutions: 4

| Solution | $F_1^{min}$ | $F_2^{min}$ |
|---|---|---|
| 1 | 8 | 1 |
| 2 | 1 | 1 |
| 3 | 2 | 2 |
| 4 | 3 | 2 |
| 5 | 9 | 3 |

3. (a) 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 center of sums method. 4




(b) Let the fuzzy sets A, B and C be the sub sets of the universe {1, 2, 3, 199, 200}.

Let,

A={1/0.1, 2/0.3,3/0.3, 4/0.4, 5/0.5, 6/0.7, 7/0.8, 8/0.9, 9/1, 10/1}, and

B={1/0.1, 2/0.3, 3/0.5, 4/0.7, 5/0.9, 6/1,7/0.8, 8/0.5, 9/0.2, 10/0}

Find out the following fuzzy sets: C= A*(A+B);

C= A2;

C= 1/B. 2x3=6

4. (a) Write the differences between SOO and MOO Problems. 5

(b) Determine Cartesian product of the following two fuzzy sets:

A(x)= {(x1,0.1), (x2, 0.25), (x3, 0.34)}

B(y)= {(y1, 0.8), (y2,0.75)} 5

5. (a) Two fuzzy relations A and B are given below:

$$A = [a_{ij}] = \begin{matrix} 0.3 & 0.4 \\ 0.1 & 0.1 \end{matrix}$$

$$B = [b_{jk}] = \begin{matrix} 0.2 & 0.6 & 0.75 \\ 0.9 & 0.8 & 0.1 \end{matrix}$$

Determine the composition of these two fuzzy relations. 6

(b) How is ReLU better than Sigmoid function? 4

6. (a) To solve an optimization problem using real coded GA, let us assume that a mating pair is found to be as follows:

Pr1=16.85, Pr2= 19.51

Determine the children solutions using linear crossover technique. 5

(b) Consider the following objective space for a Min-Min optimization problem:


Compute Front_1 and front_2 solutions using non-dominated soring. Draw required diagrams. Show all necessary steps. 5