

**MT 5103: Mathematics for Robotics**

**Assignment 4**

**Due Date: 26<sup>th</sup> November, 2023**

**Fuzzy Logic**

- 1) Two discrete fuzzy sets are given as

$$A = \{(2, 1), (3, 0.5), (4, 0.3), (5, 0.2)\}$$

$$B = \{(2, 0.5), (3, 0.7), (4, 0.2), (5, 0.4)\}$$

Find: (a)  $A^c$  or  $\bar{A}$  (b)  $A \cup B$  (c)  $A \cap B$  (d)  $A - B$  (e)  $B - A$

(f)  $\overline{A \cup B}$  (g)  $\overline{A \cap B}$

- 2) The elements in two fuzzy sets A and B are given as

$$A = \{(D1, 0.9), (D2, 0.5), (D3, 0.4), (D4, 0.2)\}$$

$$B = \{(S1, 0.1), (S2, 0.3), (S3, 0.8)\}$$

Find:  $A \times B$  and  $A \circ B$  (vector Product)

- 3) Suppose I have two fuzzy sets defining temperature data.

$$\text{Low Temperature} = \{(40, 1), (50, 0.7), (60, 0.5), (70, 0.3), (80, 0)\}$$

$$\text{High Temperature} = \{(40, 0), (50, 0.2), (60, 0.4), (70, 0.7), (80, 1)\}$$

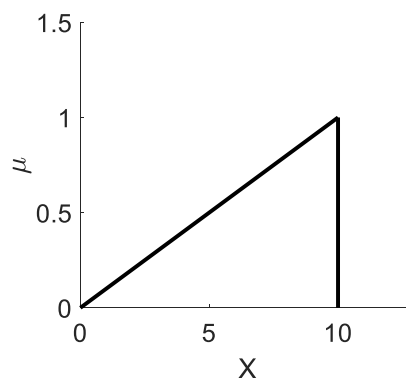
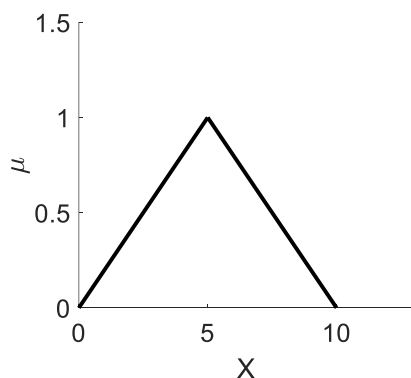
Find the following membership functions:

a) Temperature not very low

b) Temperature not very high

c) Temperature not very low and not very high

- 4) Suppose an engineer is addressing a problem in the power control of a mobile cellular telephone transmitting to its base station. Let MP be the medium-power fuzzy set and HP be the high-power set. Let the universe of discourse is spanned as  $X = \{0, 2, 4, 6, 8, 10\}$ . The membership functions of the two fuzzy sets are shown in figure below. For these two fuzzy sets demonstrate union, intersection, complement, and the difference.



- 5) Many products, such as tar, petroleum jelly, and petroleum, are extracted from crude oil. In a newly drilled oil well, three sets of oil samples are taken and tested for their viscosity. The results are given in the form of the three fuzzy sets  $B_1$ ,  $B_2$ , and  $B_3$ , all defined on a universe of normalized viscosity as shown in figure below. We have to find the most nearly representative viscosity value for all three oil samples. Hence find  $z^*$  for the three fuzzy sets using Centre of Gravity Method (CoG), Centre of Sum Method (CoS), Centre of Largest Area.

