Faculty of Engineering

Smgrc Group

Fall 2023

Dr. Bevrani
Dr. Baigzadeh

Intelligent Control

Assignment

Concept and Mathematics of Fuzzy Logic Systems

Deadline: 10 Nov.

University of Kurdistan

1- Let *U* be the interval *[0,100]* representing the age of ordinary humans and the fuzzy sets "young" and "old" define as follows:

$$\begin{cases} Young = \int_0^{25} 1/x + \int_{25}^{100} [1+(\frac{x-25}{5})^2]^{-1}/x \\ Old = \int_{50}^{100} [1+(\frac{x-50}{5})^{-2}]^{-1}/x \end{cases}$$

a) By employing the Matlab software, plot these fuzzy sets.
b) Define your own “young”, “middle-aged” and “old” fuzzy sets and plot them by the Matlab software.

2- Let x_1 be the speed of a car, x_2 be the acceleration, and y be the force applied to the accelerator. Consider the following fuzzy IF-THEN rule:

$$If\ x_1 \text{ is slow and } x_2 \text{ is small } Then\ y \text{ is large}$$

where the domains of x_1, x_2 and y are $U_1 = [0, 100]$, $U_2 = [0, 30]$ and $V = [0, 6]$, respectively. In addition, the membership function for x_1, x_2 and y are assumed as follows:

$$\mu_{slow}(x_1) = \begin{cases} 1 & x_1 \le 35 \\ \frac{45-x_1}{10} & 35 < x_1 \le 45 \\ 0 & x_1 > 45 \end{cases}, \quad \mu_{small}(x_2) = \begin{cases} \frac{4-x_2}{4} & 0 < x_2 \le 4 \\ 0 & x_2 > 4 \end{cases}$$

$$\mu_{large}(y) = \begin{cases} 0 & y \le 2 \\ y-2 & 2 < y \le 4 \\ 1 & y > 4 \end{cases}$$

Consider the minimum t-norm, then interpret the fuzzy IF-THEN rule by using Dienes-Rescher implication, Lukasiewicz Implication and Zadeh Implication.