Exercise 2

1. Consider the linguistic variable “Old”. If the variable is defined by:

\[ \mu_{\text{Old}}(x) = \begin{cases} 
0 & 0 \leq x \leq 50 \\
[1+(x-50/5)^2]^{-1} & 50 \leq x < 100
\end{cases} \]

Determine the membership function of the terms NOT SO Old, MORE OR LESS Old, VERY Old

2. Consider two linguistic truth values of two propositions, True and False, which are defined as follows:

\[ v(\text{True}) = 0.6/0.6 + 0.7/0.7 + 0.8/0.8 + 0.9/0.9 + 1/1 \]
\[ v(\text{False}) = 0.4/0.6 + 0.3/0.7 + 0.2/0.8 + 0.1/0.9 \]

Determine the linguistic truth values of “VERY True” and “VERY False” and “MORE OR LESS True” U “ALMOST True”

3. Let the universe be \( U = \{1, 2, 3, 4\} \). Given a linguistic variable “Small” = 1/1 + 0.7/2 + 0.3/3 + 0.1/4 and a fuzzy relation \( R = \text{“ALMOST equal”} \) be defined as:

\[
\begin{array}{cccc}
1 & 2 & 3 & 4 \\
1 & 1 & 0.6 & 0.1 & 0 \\
2 & 0.6 & 1 & 0.6 & 0.1 \\
3 & 0.1 & 0.6 & 1 & 0.6 \\
4 & 0 & 0.1 & 0.6 & 1
\end{array}
\]

Use the max-min composition to compute \( R(y) = X \text{ is small o ALMOST equal} \)

4. Given the three input linguistic variables “work flow”, “safety” and “user’s preference” and the output linguistic variable “closeness value” shown in the figure below. The following data were collected from site or experienced personnel; deduct fuzzy rules based on these data.

If work flow = 60 and safety concern = 3.5 and user’s preference = 7 then closeness = 700
If work flow = 80 and safety concern = 1 and user’s preference = 10 then closeness = 1200
If work flow = 20 and safety concern = 6 and user’s preference = 3 then closeness = 90
If work flow = 130 and safety concern = 2 and user’s preference = 1 then closeness = 2800