We plan to build a fuzzy irrigation controller.

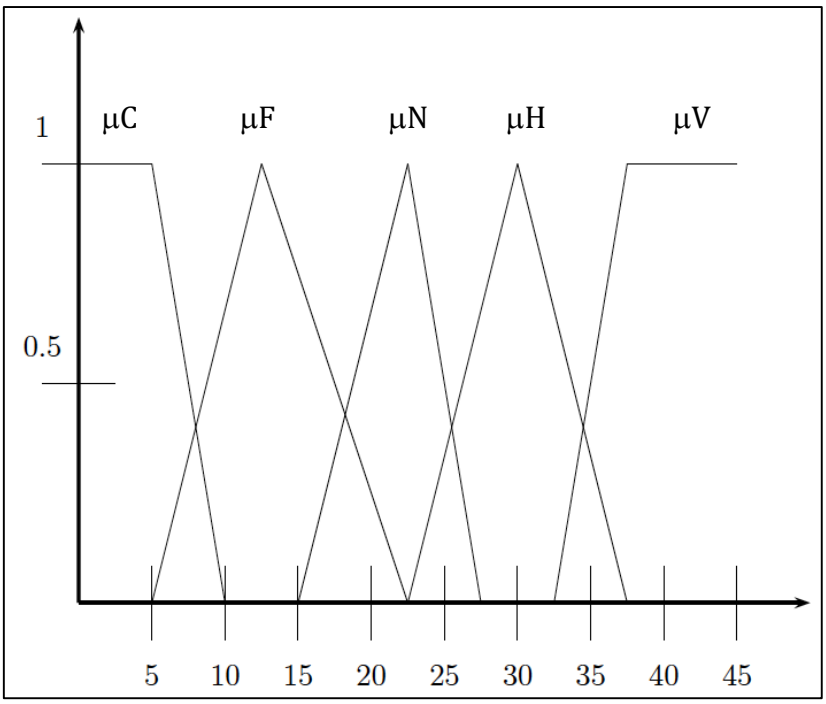
The truth variables of this system, regarding the inputs are temperature and humidity while the output can be reduced to the watering duration.

The membership functions of input (temperature and humidity) and output (duration) are respectively given by the figures below.

Temperature $\in [0, 45^{\circ}]$

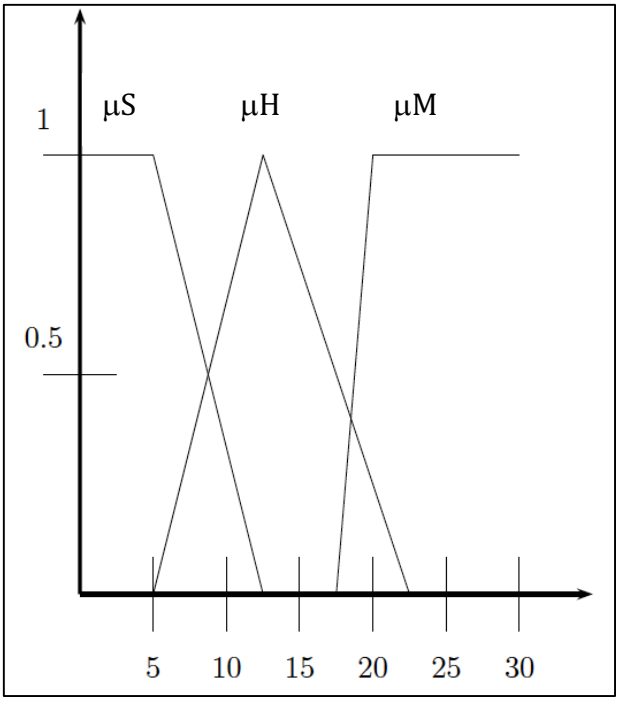
Humidity $\in$ [0, 30%]

Duration $\in$ [0, 70 min]



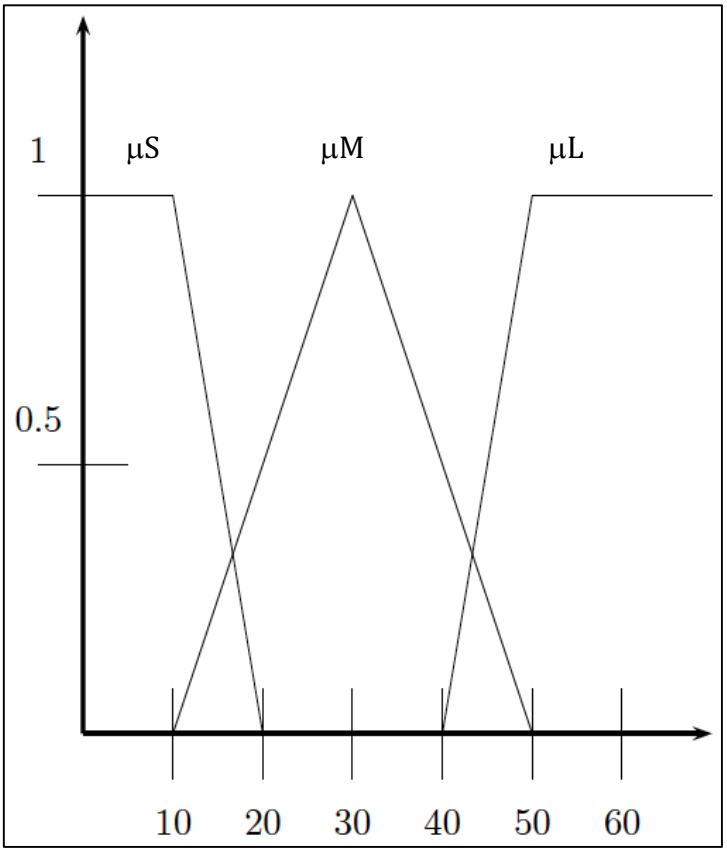
Temperature membership function

C : Cold
F : Frech
N : Normal
H : Hot
V : Very Hot



Humidity membership function

D : Dry
H : Humid
W : Wet



Duration membership function

S : Short
M : Medium
L : Long

The inference rules are as follows:

R1 → If the temperature is very hot AND the soil is dry THEN the duration is long.
R2 → If the temperature is hot AND the soil is dry THEN the duration is long.
R3 → If the temperature is fresh AND the soil is dry THEN the duration is long.
R4 → If the temperature is normal AND the soil is dry THEN the duration is long.
R5 → If the temperature is cold AND the soil is dry THEN the duration is medium.
R6 → If the temperature is very hot AND the soil is humid THEN the duration is medium.
R7 → If the temperature is hot AND the soil is humid THEN the duration is medium.
R8 → If the temperature is fresh AND the soil is humid THEN the duration is medium.
R9 → If the temperature is normal AND the soil is humid THEN the duration is medium.
R10 → If the temperature is cold AND the soil is humid THEN the duration is short.
R11 → If the temperature is very hot AND the soil is wet THEN the duration is medium.
R12 → If the temperature is hot AND the soil is wet THEN the duration is medium.
R13 → If the temperature is fresh AND the soil is wet THEN the duration is short.
R14 → If the temperature is normal AND the soil is wet THEN the duration is short.
R15 → If the temperature is cold AND the soil is wet THEN the duration is short.

The recorded temperature is 35° and the humidity is 10%. Determine using the fuzzy logic steps the watering time for the soil. Use the weighted average in defuzzification. To do this, we perform an average between the average values of each class, weighted by the value of the membership functions.