Step 4: Fuzzification

Using fuzzy set generated from 1st tutorial, we can get the fuzzy value by putting the crisp value to our membership functions.

Eg:

Temp = 27

$$Freezing(x) = \begin{cases} 1, 0 \leq x \leq 20 \\ \dfrac{30 - x}{30 - 20}, 20 \leq x \leq 30 \end{cases}$$

In this function the value 27 is in Freezing and in the second statement where $20 \leq x \leq 30$ not on the first statement.

Then we going to use the second formula and input the value.

Eg:

$$\frac{30 - 27}{30 - 20} = \frac{3}{10} = 0.3$$

Then for Temp = 27, the fuzzy value is Freezing = 0.3

For our problem you have to produce the fuzzy value for:

Temp = 81 and **Cover = 23**

Step 5: Rules Evaluation

In rules evaluation we select the rules which the linguistic terms exist in our fuzzification process.

Eg:

Freezing (example above) and we compared to our 4 rules and it does have any Freezing terms then we does not meet any rules. Then the value Temp 27 does not meet any rules.

Check example in slide and select appropriate rules that meet your fuzzy values.

Step 6: Rules Inference (& aggregation of output)

In rules inference we put the value in the rules we selected above and get the output aggregation

Eg:

We have Hot = 0.55 and Sunny = 0.85

If the rules

- ▶ If it's Sunny **and** Hot, drive Fast

    Sunny(Cover)∧Hot(Temp)⇒Fast(Speed)

    0.85 ∧ 0.55 = 0.55 ⇒ Fast = 0.55 (minimum value between the two attributes)

- ▶ If it's Sunny **or** Hot, drive Fast

    Sunny(Cover) ∨ Hot(Temp)⇒Fast(Speed)
    0.85 ∨ 0.55 = 0.55 ⇒ Fast = 0.85 (maximum value between the two attributes)

And lastly we combine each output for next step

Eg:

2 rules evaluation with Fast = 0.55, and Fast=0.25

Step 7: Defuzzification

We now refer to the fuzzy output sets and determine the defuzzification value

Eg:

We calculate using COG in slide Module 3 Fuzzy Logic ES.pdf at KALAM slide page 15-17