26/12/22

Theory of Approximate Resoning :-

Rules :- 1) If ___ then ___
2) If ___ then ___ else ___

1) If ___ then ___ :-

if x is A then Y is B where x & Y are the universe and A & B are fuzzy sets on the given universes respectively.

Here if part is called as Anticident & then part is called as Consiquient.
The above rule is expressed in term of fuzzy logic as,

$$R = (A \times B) \cup (\bar{A} \times Y)$$ where Y is universe

eg:- If Temperature is high then speed is high.

2) If ___ then ___ else ___ :-

if $\underbrace{x \text{ is } A}_{\text{Anticident}}$ then $\underbrace{Y \text{ is } B}_{\text{consiquent}}$ else $\underbrace{Y \text{ is } C}_{\text{consiquient}}$

In the above rule

$$R = (A \times B) \cup (\bar{A} \times C).$$

The above consist of two anticident & two consiquients i.e (x is A) acts as Anticident for consiquent for (Y is B) is executed if Anticident (x is A) is not executed

eg:- If tomato are red then they are ripped or else they are not ripped.

(1)

* $A = \left\{ \frac{0.1}{x_1} + \frac{0.2}{x_2} + \frac{0.5}{x_3} \right\} \in X$

$B = \left\{ \frac{0.6}{y_1} + \frac{0.3}{y_2} + \frac{0.1}{y_3} \right\} \in Y$

find "If x is A then y is B"

Solⁿ:- $R = (A \times B) \cup (\bar{A} \times Y)$

$Y = \left\{ \frac{1}{y_1} + \frac{1}{y_2} + \frac{1}{y_3} \right\}$ ~~(max of union is)~~

~~A×B(=)~~ $\bar{A} = \left\{ \frac{0.9}{x_1} + \frac{0.8}{x_2} + \frac{0.5}{x_3} \right\}$

$$A \times B = \begin{array}{c|ccc} & y_1 & y_2 & y_3 \\ x_1 & 0.1 & 0.1 & 0.1 \\ x_2 & 0.2 & 0.2 & 0.1 \\ x_3 & 0.5 & 0.3 & 0.1 \end{array}$$

$$\bar{A} \times Y = \begin{array}{c|ccc} & y_1 & y_2 & y_3 \\ x_1 & 0.9 & 0.9 & 0.9 \\ x_2 & 0.8 & 0.8 & 0.8 \\ x_3 & 0.5 & 0.5 & 0.5 \end{array}$$

$$R = \begin{bmatrix} 0.9 & 0.9 & 0.9 \\ 0.8 & 0.8 & 0.8 \\ 0.5 & 0.5 & 0.5 \end{bmatrix}$$

* $C = \left\{ \frac{0.6}{y_1} + \frac{0.1}{y_2} + \frac{1}{y_3} \right\} \in Y$

find "if x is A then y is B else y is C"

$R = (A \times B) \cup (\bar{A} \times C)$

$$\bar{A} \times C = \begin{array}{c|ccc} & y_1 & y_2 & y_3 \\ x_1 & 0.6 & 0.1 & 0.9 \\ x_2 & 0.6 & 0.1 & 0.8 \\ x_3 & 0.5 & 0.1 & 0.5 \end{array}$$

$$R = \begin{bmatrix} 0.6 & 0.1 & 0.9 \\ 0.6 & 0.2 & 0.8 \\ 0.5 & 0.3 & 0.5 \end{bmatrix}$$

28/12/22

Suppose we are evaluating a new ~~inno~~ inovation to determine it's commercial protection we will use 2 matrix R. using uniquiness of innovention denoted by the universe novility skills $X = [1, 2, 3, 4]$ & the market ~~o~~ size of innovention commercial ~~mo~~ market denoted on the universe market size.
$Y = [1, 2, 3, 4, 5, 6]$ In both universe. lowest numbers are with highest uniquiness and highest market size in the group say compressable new innovention in the and liquid of very usefull temp in ~~the~~ and viscosity.
has just recieved score of medium uniquness denoted by A and medium market size B. we wish to determine implication that is if medium uniquness and "medium market size" following are the given fuzzy set also find if medium uniquness than medium market size else diffuse market size.

Suppose the fuzzy relation are developed using if than rule, discribe the ~~to~~ innovention potential. we wish to know what market size would be associated with a ~~l~~ uniquiness "almost high uniquiness with new anticipated a" find the consiquent B' using max min composition

$A' =$ almost high uniquiness $= \left\{ \frac{0.5}{1} + \frac{1}{2} + \frac{0.3}{3} + \frac{0}{4} \right\}$

$A =$ medium uniquness $= \left\{ \frac{0.6}{2} + \frac{1}{3} + \frac{0.2}{4} \right\}$

$B =$ medium market size $= \left\{ \frac{0.4}{1} + \frac{0.5}{2} + \frac{0.6}{3} + \frac{0.6}{4} + \right.$

$\left. \frac{0.6}{5} + \frac{0.3}{6} \right\}$

B = medium market size = $\left\{ \frac{0.4}{2} + \frac{1}{3} + \frac{0.8}{4} + \frac{0.3}{5} \right\}$

C = diffuse market size = $\left\{ \frac{0.3}{1} + \frac{0.5}{2} + \frac{0.6}{3} + \frac{0.6}{4} + \frac{0.6}{5} + \frac{0.3}{6} \right\}$.

$$y = \left\{ \frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} \right\}$$

$$A \times B \quad \begin{array}{c c} & \begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \end{array} \\ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \end{array} & \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.4 & 0.6 & 0.6 & 0.3 & 0 \\ 0 & 0.4 & 1 & 0.8 & 0.3 & 0 \\ 0 & 0.2 & 0.2 & 0.2 & 0.2 & 0 \end{bmatrix} \end{array}$$

$$\bar{A} = \left\{ \frac{1}{1} + \frac{0.4}{2} + \frac{0}{3} + \frac{0.8}{4} \right\}$$

$$\bar{A} \times y \quad \begin{array}{c c} & \begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \end{array} \\ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \end{array} & \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 0.4 & 0.4 & 0.4 & 0.4 & 0.4 & 0.4 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0.8 & 0.8 & 0.8 & 0.8 & 0.8 & 0.8 \end{bmatrix} \end{array}$$

$$R = (A \times B) \cup (\bar{A} \times y)$$

$$R = \begin{array}{c c} & \begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \end{array} \\ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \end{array} & \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 0.4 & 0.4 & 0.6 & 0.6 & 0.4 & 0.4 \\ 0 & 0.4 & 1 & 0.8 & 0.3 & 0 \\ 0.8 & 0.8 & 0.8 & 0.8 & 0.8 & 0.8 \end{bmatrix} \end{array}$$

If – then – else $\quad R = (A \times B) \cup (\bar{A} \times C)$

~~B~~=

$$\bar{A} \times C = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array} \begin{array}{c} \begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \end{array} \\ \begin{bmatrix} 0.3 & 0.5 & 0.6 & 0.6 & 0.5 & 0.3 \\ 0.3 & 0.4 & 0.4 & 0.4 & 0.4 & 0.3 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0.3 & 0.5 & 0.6 & 0.6 & 0.5 & 0.3 \end{bmatrix} \end{array}$$

$R = (A \times B) \cup (\bar{A} \times C)$

$$\begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array} \begin{array}{c} \begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \end{array} \\ \begin{bmatrix} 0.3 & 0.5 & 0.6 & 0.6 & 0.5 & 0.3 \\ 0.3 & 0.4 & 0.6 & 0.6 & 0.4 & 0.3 \\ 0 & 0.4 & 1 & 0.8 & 0.3 & 0 \\ 0.3 & 0.5 & 0.6 & 0.6 & 0.5 & 0 \end{bmatrix} \end{array}$$

By using Principle of Cylindrical extension principle extending A on y domain.

$A' = \left\{ \frac{0.5}{1} + \frac{1}{2} + \frac{0.3}{3} + \frac{0}{4} \right\}$ → convert to matrix

$\boxed{B' = A' \circ R :-}$

$$\begin{bmatrix} 0.5 & 1 & 0.3 & 0 \end{bmatrix} \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array} \begin{array}{c} \begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \end{array} \\ \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 0.4 & 0.4 & 0.6 & 0.6 & 0.4 & 0.4 \\ 0 & 0.4 & 1 & .8 & 0.3 & 0 \\ 0.8 & 0.8 & 0.8 & .8 & .8 & .8 \end{bmatrix} \end{array}$$

$B' = [0.5, 0.5, 0.6, 0.6, 0.5, 0.5]$

29/12/22
①

W = weak stimulus $= \left\{ \frac{1}{0} + \frac{0.9}{50} + \frac{0.3}{100} + \frac{0}{150} + \frac{0}{200} \right\} \in X$

M = medium stimulus $= \left\{ \frac{0}{0} + \frac{0.4}{50} + \frac{1}{100} + \frac{0.4}{150} + \frac{}{200} \right\} \in X$

S = Severe response $= \left\{ \frac{0}{0} + \frac{0}{50} + \frac{0.5}{100} + \frac{0.9}{150} + \frac{1}{200} \right\} \in Y$

find if weak stimulus then not severe response.

not Severe $= \bar{S} = \left\{ \frac{1}{0} + \frac{1}{50} + \frac{0.5}{100} + \frac{0.1}{150} + \frac{0}{200} \right\} \in Y$

~~if then~~ if x is A then y is $\bar{B}$ $= (A \times \bar{B}) \cup (\bar{A} \times Y)$

$= (W \times \bar{S}) \cup (\bar{W} \times Y)$

$\bar{W} = \left\{ \frac{0}{0} + \frac{0.1}{50} + \frac{0.7}{100} + \frac{1}{150} + \frac{1}{200} \right\} \in X$

$Y = \left\{ \frac{1}{0} + \frac{1}{50} + \frac{1}{100} + \frac{1}{150} + \frac{1}{200} \right\}$

$$W \times \bar{S} = \begin{array}{c|ccccc} & 0 & 50 & 100 & 150 & 200 \\ \hline 0 & 1 & 1 & 0.5 & 0.1 & 0 \\ 50 & 0.9 & 0.9 & 0.5 & 0.1 & 0 \\ 100 & 0.3 & 0.3 & 0.3 & 0.1 & 0 \\ 150 & 0 & 0 & 0 & 0 & 0 \\ 200 & 0 & 0 & 0 & 0 & 0 \end{array}$$

$$\bar{W} \times Y = \begin{array}{c|ccccc} & 0 & 50 & 100 & 150 & 200 \\ \hline 0 & 0 & 0 & 0 & 0 & 0 \\ 50 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ 100 & 0.7 & 0.7 & 0.7 & 0.7 & 0.7 \\ 150 & 1 & 1 & 1 & 1 & 1 \\ 200 & 1 & 1 & 1 & 1 & 1 \end{array}$$

"

$$R = \begin{array}{c|ccccc} & 0 & 50 & 100 & 150 & 200 \\ \hline 0 & 1 & 1 & 0.5 & 0.1 & 0 \\ 50 & 0.9 & 0.9 & 0.5 & 0.1 & 0.1 \\ 100 & 0.7 & 0.7 & 0.7 & 0.7 & 0.7 \\ 150 & 1 & 1 & 1 & 1 & 1 \\ 200 & 1 & 1 & 1 & 1 & 1 \end{array}$$

Find the response B', if medium stimulus i.e.
find $B' = S \circ R$ usin max min comp

$$S = \left\{ \frac{0}{0} + \frac{0}{50} + \frac{.5}{100} + \frac{.9}{150} + \frac{1}{200} \right\}$$

$$\boxed{B' = A' \cdot R}$$

$$(1\times5) \begin{bmatrix} 0 & .4 & 1 & .4 & 0 \end{bmatrix} \begin{bmatrix} 1 & 1 & 0.5 & 0.1 & 0 \\ 0.9 & 0.9 & 0.5 & 0.1 & 0.1 \\ 0.7 & 0.7 & 0.7 & 0.7 & 0.7 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

max min com

$$B' = \begin{bmatrix} 0.7 & 0.7 & 0.7 & 0.7 & 0.7 \end{bmatrix}$$

(2)

weight of :

(2) T = Hot temp $\left\{ \frac{0.1}{10} + \frac{.2}{20} + \frac{.5}{30} + \frac{.8}{40} + \frac{.9}{50} \right\}$ CX

H_M = moderate Humidity $= \left\{ \frac{0.4}{5} + \frac{0.6}{10} + \frac{.8}{15} \; \frac{.9}{20} \; \frac{1}{25} \right\}$ (Y

Fan
N_H = high speed = $\left\{ \frac{.1}{1000} + \frac{.3}{1500} + \frac{.6}{2000} \; \frac{.8}{2500} \; \frac{.9}{3000} \right\}$ (X

" if Temp is Hot & humidity then speed is high"

$$y = \left\{ \frac{1}{1000} + \frac{1}{1500} + \frac{1}{2000} + \frac{1}{2500} + \frac{1}{3000} \right\}$$

~~AND operation ($T_H \cap H_M$) =~~

AND Operation ($T_H \cap H_M$)

(i) $T_H = \left\{ \frac{0.1}{(10,5)} + \frac{0.2}{(20,10)} + \frac{0.5}{(30,15)} + \frac{0.8}{(40,20)} + \frac{0.9}{(50,25)} \right\}$

$$T_H \times N_H = \begin{array}{c|ccccc} & 1000 & 1500 & 2000 & 2500 & 3000 \\ x_1 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ x_2 & 0.1 & 0.2 & 0.2 & 0.2 & 0.2 \\ x_3 & 0.1 & 0.3 & 0.5 & 0.5 & 0.5 \\ x_4 & 0.1 & 0.3 & 0.6 & 0.8 & 0.8 \\ x_5 & 0.1 & 0.3 & 0.6 & 0.8 & 0.9 \end{array}$$

$\overline{T_H} = \left\{ \frac{0.9}{x_1} + \frac{0.8}{x_2} + \frac{0.5}{x_3} + \frac{0.2}{x_4} + \frac{0.1}{x_5} \right\}$

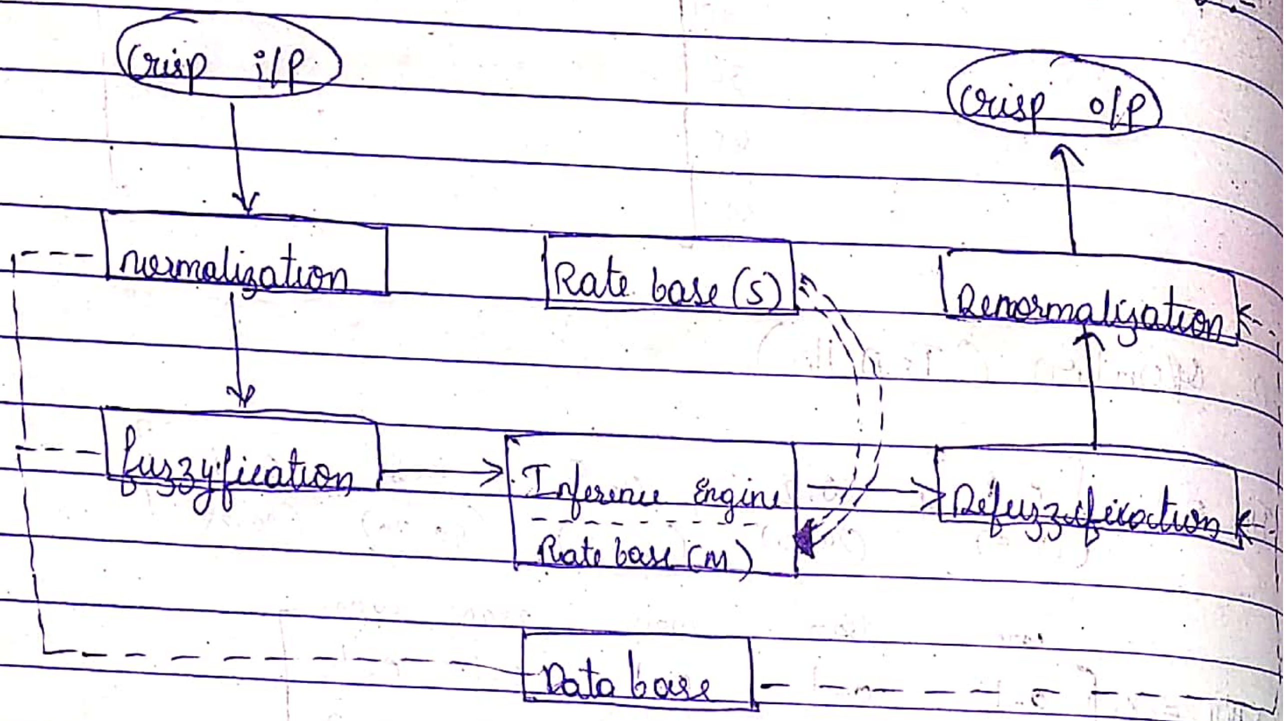
$$\overline{T_H} \times Y = \begin{array}{c|ccccc} & 1000 & 15000 & 2000 & 2500 & 3000 \\ x_1 & 0.9 & 0.9 & 0.9 & 0.9 & 0.9 \\ x_2 & 0.8 & 0.8 & 0.8 & 0.8 & 0.8 \\ x_3 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 \\ x_4 & 0.2 & 0.2 & 0.2 & 0.2 & 0.2 \\ x_5 & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \end{array}$$

ii) $(T_H \times N_H) \cup (\overline{T_H} \times Y)$

$$\begin{array}{c|ccccc} & 1000 & 1500 & 1000 & 2500 & 3000 \\ x_1 & 0.9 & 0.9 & 0.9 & 0.9 & 0.9 \\ x_2 & 0.8 & 0.8 & 0.8 & 0.8 & 0.8 \\ x_3 & 0.5 & 0.5 & 0.5 & 0.5 & 0.5 \\ x_4 & 0.2 & 0.3 & 0.6 & 0.8 & 0.8 \\ x_5 & 0.1 & 0.3 & 0.6 & 0.8 & 0.9 \end{array}$$

2/1/2023

★ Fuzzy knowledge based controller (FKBC) :-



⟶ Information

---> Data flow

===> meaning to symbol flow

★ Fuzzification :- Convert crisp value into fuzzy value (both i/p & o/p).

i/p	o/p
cut of clothes	Time for washing
(0 to 7 kg)	(0 - 60 min)
(0-3) (3-5) (5-7)	(0-20) (20-40) (40-60)
L M H	L M H

5/1/23

★

~~Select randomly the Set~~

★ There are two methods of choosing the Scaling function :

① Heuristic method

② Analytical method

① Heuristic method :- This is a trial & error base method

Choice :-

i) Select randomly the Scaling function

ii) check for the performance of the controller

iii) if not ~~Satif~~ Satisfactory go to Step 1

iv) if Satisfactory select the Scaling function.

② Analytical Method :- Here mathematical models are used to evaluate the Scaling function.

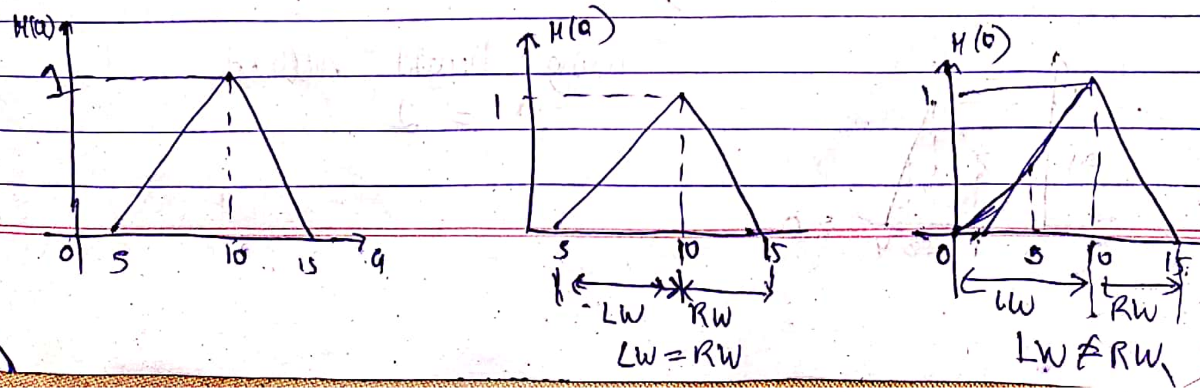
★ Choice of membership function :-

1. higher computation efficiency.
2. efficient use of memory.
3. uniform representation

   usefull choices are Δ^{le} funct^n, Trapezoidal, Increment, decrement.

4. The best Choice is triangular funct^n.

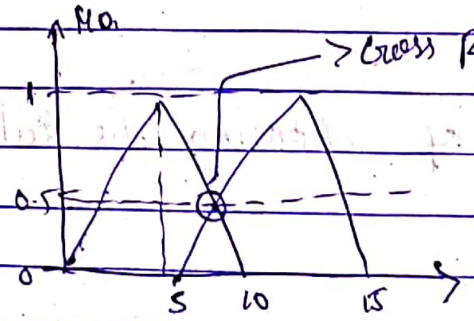
★ 1) The Peak funct^n :- 2) Left & Right width



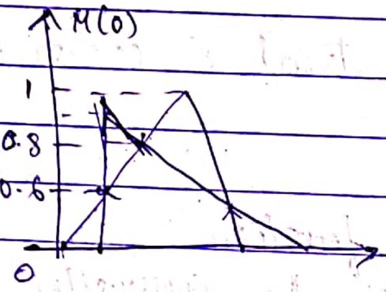
2)

Select a funct which has max cross pt.

3. No. of Cross point



① Cross pt.



3 Cross pt.

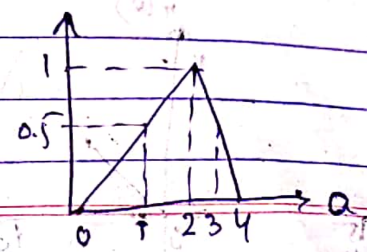
The most optimal choice of Δ^{le} functⁿ is one which as peak value = 1, & LW = RW as no. of Cross point = 1 & Cross point = 0.5.

* Defuzzification :—

① height method
2). weighted average method
3) Middle of maximum (MOM)
4) First of maximum (FOM)
5) last of maximum (LOM)
6.) centre of gravity (COG)

① height method :-

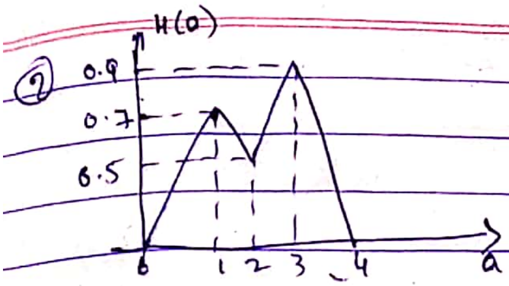
① find the Defuzzified value (z*)



using height method
∴ $z^* = 2$.

(for 1st problem)

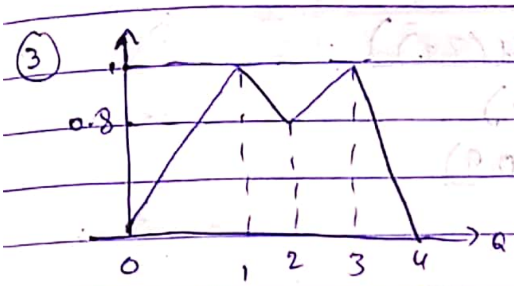
(2)



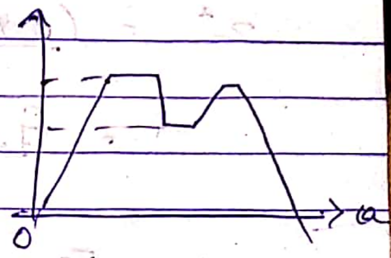
A funct^n which have crisp value of max^m no. of ~~memerb~~ membership.

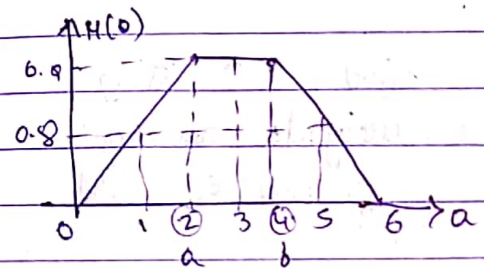
$\therefore z^* = 3$

(3)

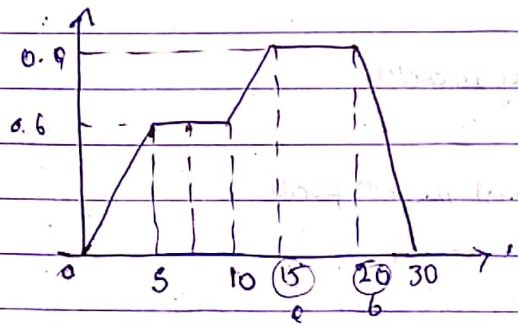


height method: NA



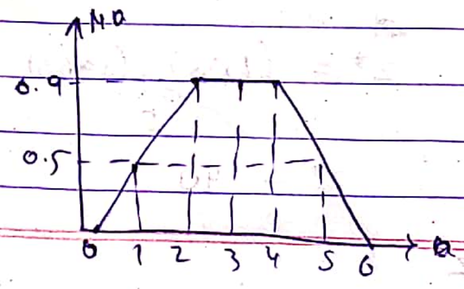


$$z^* = \frac{a+b}{2} = \frac{2+4}{2} = \frac{6}{2} = 3$$



$$z^* = \frac{a+b}{2} = \frac{15+20}{2} = \frac{35}{2} = 17.5$$

(2) Weighted average value :- Crisp value associated with a.

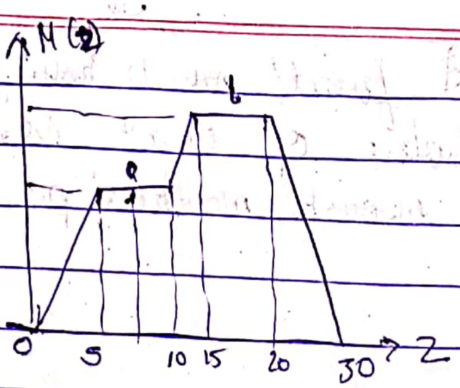


$$z^* = \frac{\sum_{a=1}^{n} (a \times \mu(a))}{\sum_{a=1}^{n} \mu(a)}$$

$$z^* = \frac{3 \times 0.9}{0.9} = 3$$

Scanned with CamScanner

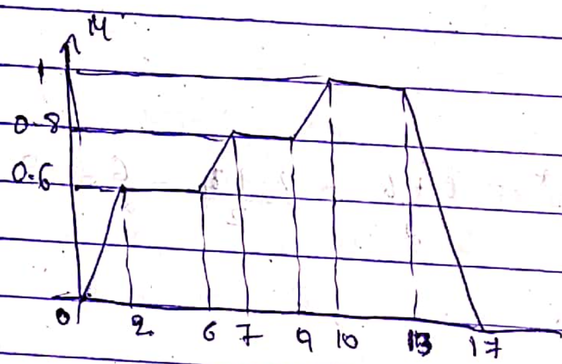
2



$$z^* = \frac{(a \times M(z_1)) + (b \times M(z_2))}{M(z_1) + M(z_2)}$$

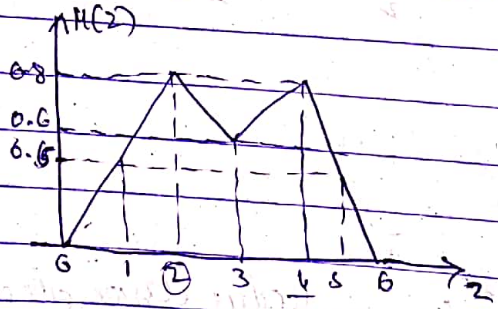
$$= \frac{(7.5 \times 0.6) + (17.5 \times 0.9)}{0.9 \times 0.6}$$

$=$



find z^* using weighted average method & MOM

(4,5) First of max^m & Last of max^m

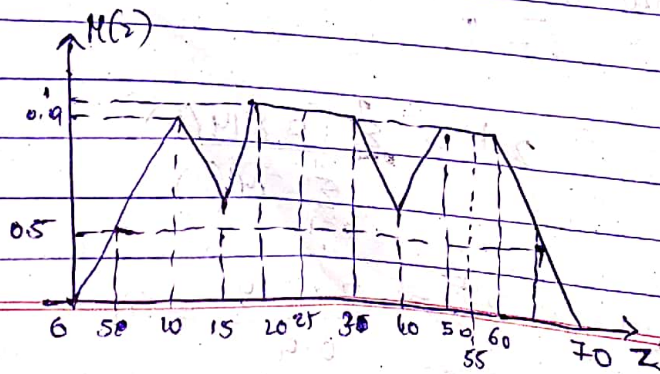


First max^m peak

$z^* = 2.$

Last max^m peak

$z^* = 4$



MOM

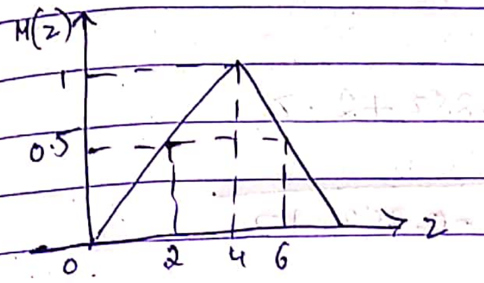
$$z^* = \frac{(1 \times 25) + (1 * 55)}{2}$$

$z^* = 40$

Sush.

FOM = 20 , LOM = 60.

6) Center of gravity (COG) :-



Find z^* using applicable method.

Height method = 4
FOM = 4
MOM = 4

centre of gravity :-

For AB = $y = mx + c$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1-0}{4-0} = 0.25$

$\therefore y = 1, x = 4$

$1 = (0.25 \times 4) + c$

$\boxed{c = 0}$

$M(z_1) = mz + c = 0.25z + 0$

$\boxed{M(z_1) = 0.25z}$ — (1)

For BC = $y = mx + c$ $\quad m = \frac{0-1}{8-4} = \frac{-1}{4} = -0.25$

here $y = 0, x = 8$

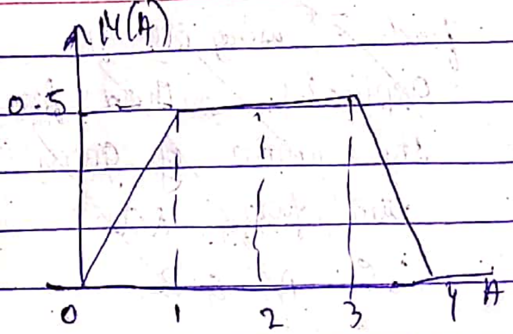
$0 = -0.25 \times 8 + c$

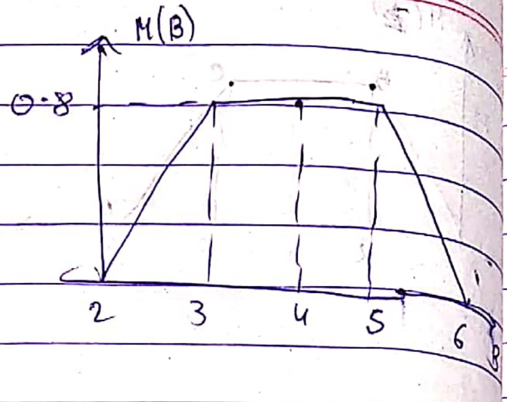
$\boxed{c = 2}$

$M(z_2) = mz + c = \boxed{-0.25z + 2}$ — (2)

$$z^* = \frac{\int M(z) \cdot z \, dz}{\int M(z) \, dz}$$

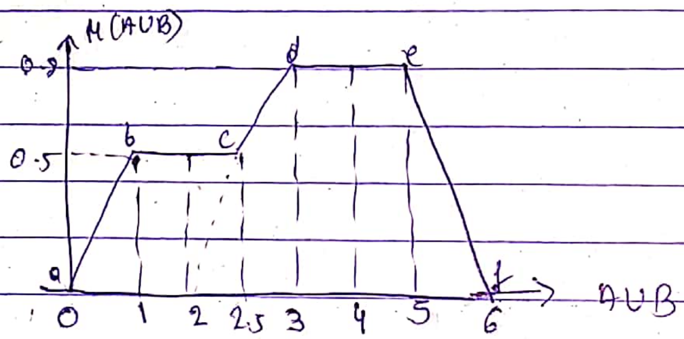
Scanned with CamScanner





find z^* using all the applicable method for the union of given fuzzy sets i.e. A & A

Soln:-



Weight avg = $z^* = \dfrac{\Sigma M(z) \cdot z}{\Sigma M(z)}$

$= \dfrac{(0.5 \times 1.75) + (0.8 \times 4)}{(0.5 + 0.8)} = 3.134$

MOM $= 4$

LOM $= z^* = 5$

FOM $= z^* = 3$

Centre of Gravity :

for ab = $y = mx + c$ $\quad m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{0.5 - 0}{1 - 0} = 0.5$

here $y = 0.5$, $x = 1$

$\therefore 0.5 = (0.5 \times 1) + c$

$c = 0$

$M(z_1) = mz + c$

$\boxed{M(z_1) = 0.5z}$ —①

for bc : $\boxed{M(z_2) = 0.5}$ —②

for cd : $y = mx + c$ $m = \frac{0.8 - 0.5}{3 - 2.5} = \cancel{0.266} \; 0.6$

here $y = 0.8$, $x = 3$

$\cancel{0.8 = (0.266 \times 3) + c}$

$\cancel{0.8 = 0.798 + c}$

$c =$

$y = mx + c$

$0.8 = (0.6 \times 3) + c$

$0.8 = 1.8 + c$

$c = -1$

$M(z_3) = mz + c$

$\boxed{M(z_3) = 0.6z - 1}$ —③

for de = $\boxed{M(z_4) = 0.8}$ —④

for ef = $y = mx + c$ $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 0.8}{6 - 5} = \frac{-0.8}{1} = -0.8$

$y = 0$, $x = 6$

$0 = (-0.8 \times 6) + c$

$c = 4.8$

$M(z) = mz + c$ $\boxed{M(z_5 = -0.8 + 4.8}$ —⑤

$$\therefore \frac{\int_0^1 M(z_1) z\, dz + \int_1^{2.5} M(z_2) z\, dz + \int_{2.5}^{3} M(z_3) z\, dz + \int_3^5 M(z_4) z\, dz + \int_5^6 M(z_5) z\, dz}{\int_0^1 M(z_1)\, dz + \int_1^{2.5} M(z_2)\, dz + \int_{2.5}^{3} M(z_3)\, dz + \int_3^5 M(z_4)\, dz + \int_5^6 M(z_5)\, dz}$$

Scanned with CamScanner

16/1/23

Unit 4

★ Design a Fuzzy for a fully automatic washing m/c :-

1) Selection of input & o/p Parameters.

i/p	o/p
1) weight of cloths (W)	1) Time of washing (T)
2) Type of cloths (Tc)	2) qty of detergent (WD)
3) Dirt level (D)	3) " " water (WW)

② Range selection :-

i/p	o/p :
W = (0 to 9kg)	T (0 to 60min)
Tc = (s, c, w, n)	WD = (0 to 300gms)
D = (0 to 100%)	WW = (0 to 100 ltr)

For simplicity of calculation we will select only 2 i/p & one o/p for ~~over~~ our further calculation :

Soln. Term Sets

i/p W = (0 to 9kg) => [0 - 4.5] [2.25 - 6.75] [4.5 - 9]
Low (L) medium (M) High (H)

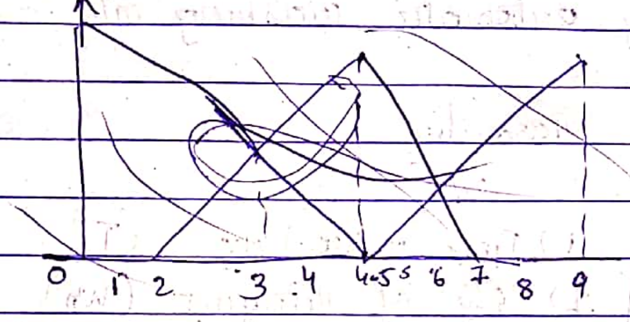
D = [0 to 100%) => [0 - 50] [25 - 75] [50 - 100]
L M H

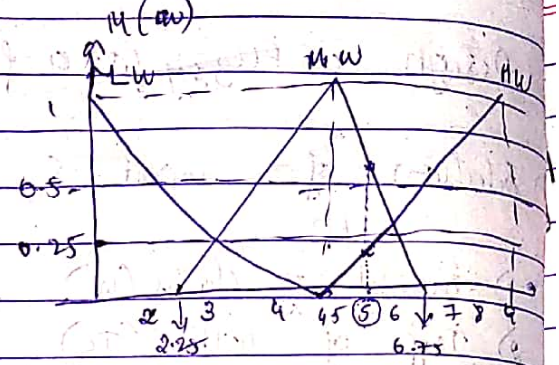
o/P (Time for washing):
T = [0 to 60min) => [0 - 30] [15 - 45] [30 - 60]
L M H

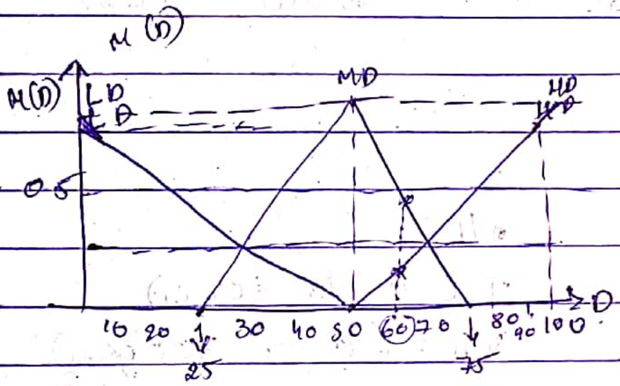
* Normalization :- as the values are small, Normalisation not reqd for i/p & o/p variables.

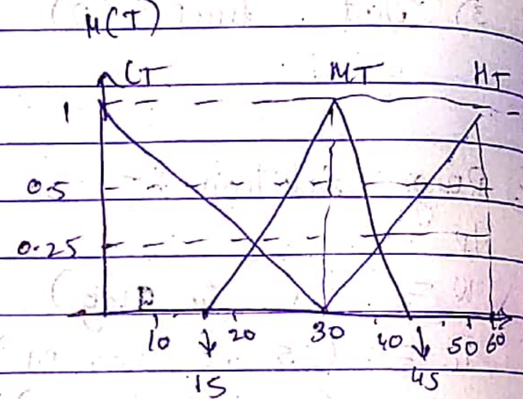
*

Fuzzyfication :-









★ Rule box :-

W \ D	L	M	H
L	L	L	M
M	L	M	M
H	M	H	H

Eg :- if D is L & W is L the T is L"

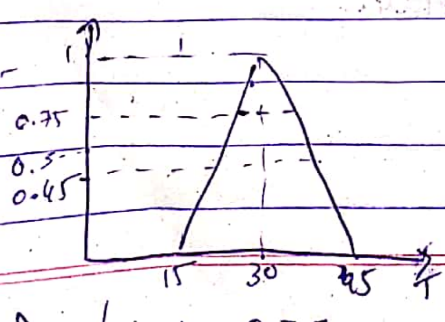
eg : Assume W = 5 kg , D = 60% find Time for washing

if W is M & D is M then T is M.

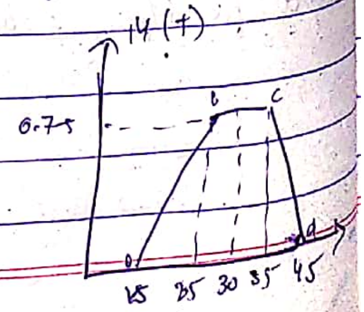
★ Inferrence Engine :- ~~The~~

the above problem can be solved by mamdani clipped Inferrence engine.

Defuzzyfication :-



=>



$\lambda_{cut} / \alpha_{cut} = 0.75$

Scanned with CamScanner

1) Height = NA

2) weight avag = $\frac{0.75 \times 30}{0.75}$ = 30

3) MOM = 30

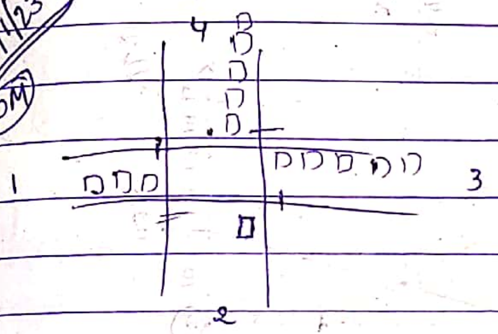
4) FOM = 25

5) LOM = 35

6) COG

17/1/23

Traffic Signal



* Selection of i/p & o/p parameter -

i/p	o/p
Vehical in Lane 1	Time of green signal for L1
V in L2	TG for L2
V in L3	TG for L3
V in L4	TG for L4

* Terms Sets in Range :

			L	M	H
i/p	VL1 = [0 to 15]	=>	[0 - ~~7~~.5]	[3.75 - 11.25]	[7.5 - 10]
	VL3 = [0 to 15]		[0 - 7.5]	(3.75 - 11.25]	[7.5 - 15]

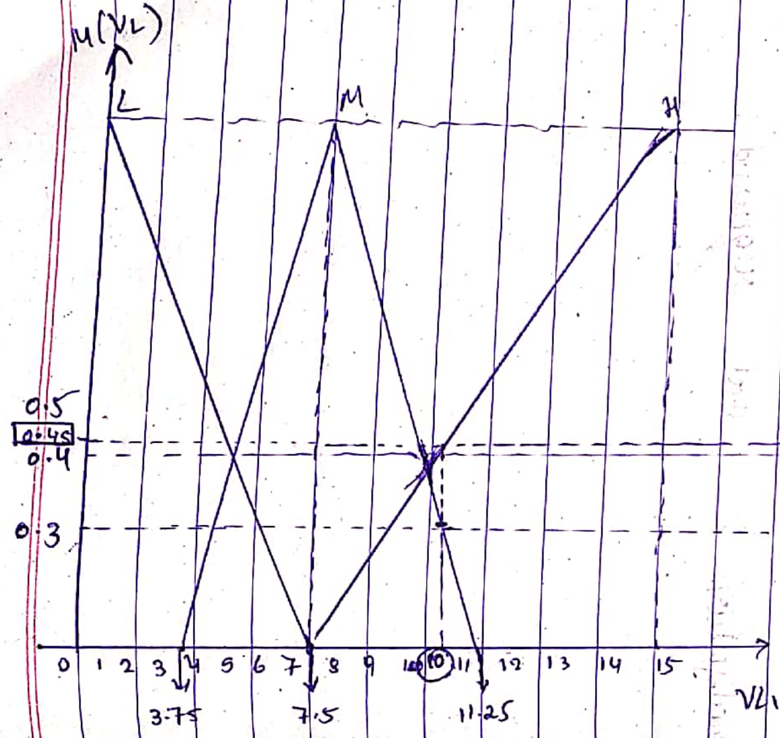
o/p TG1 = [0 to 60 sec]

* Normalization :- Not required.

Fuzzification :-

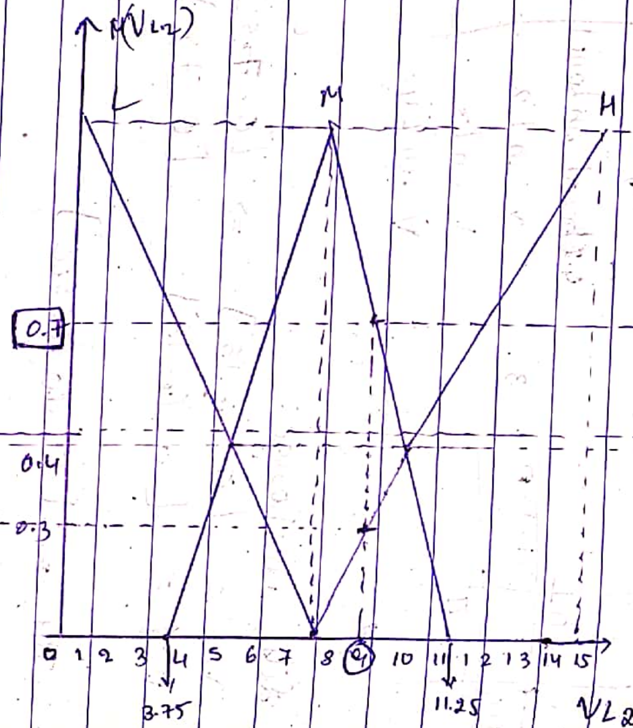
i/p ① V_{L1} = [0 to 15]

[0 - 7.5] [0.75 - 11.25] [7.5 - 15]



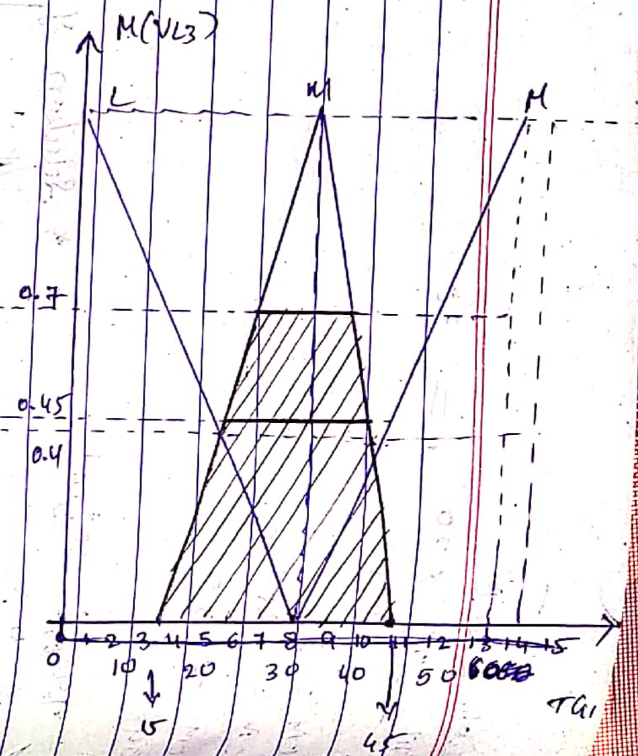
i/p ② V_{L2} (0 to 15)

[0 - 7.5] [0.75 - 11.25] [7.5 - 15]



o/p ① T_{G1} = (0 - 60s)

[0 - 30] [15 - 45] [30 - 60]



Scanned with CamScanner

Rule base:

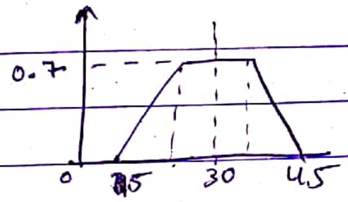
V_{L1} \ V_{L2}	L	M	H
L	L	L	L
M	M	M	M
H	H	M	M

eg:-
Assume
$V_{L1} = 10$
$V_{L2} = 9$

If V_{L1} is H & V_{L2} is M then T_{C1} is M

The above problem can be solved by mamdani clipped Inference engine.

Deffuzzification



1) Height M = NA
2) weighted avg $= \frac{0.7 \times 30}{0.7}$
$= 30$
3) MOM =
4) FOM =
5) LOM = 8