Practice 10

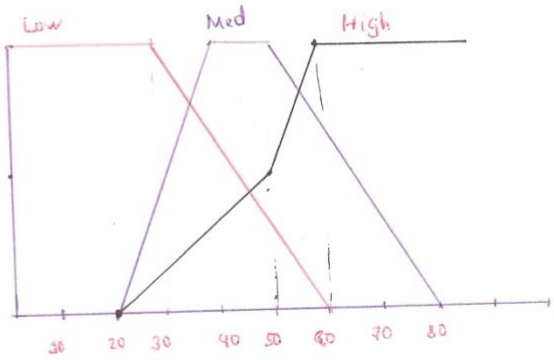
Pasteurization plant

a)

Milk Temp — Low $\begin{cases} 0 & x \geq 60 \\ \frac{60-x}{30} & x \in (30,60) \\ 1 & x \leq 30 \end{cases}$

Med $\begin{cases} 0 & x \leq 20 \\ \frac{x-20}{20} & x \in (20,40) \\ \frac{80-x}{30} & x \in (40,50) \\ 1 & x \in (40,50) \end{cases}$

High $\begin{cases} 0 & \leq 20 \\ \frac{x-20}{30} & x \in (20,50) \\ 1 & x \geq 60 \\ 0,5 + \frac{x-50}{10} \times 0,5 & x \in (50,60) \end{cases}$



Bactery Concentration

$$\text{Few} = \begin{cases} 0 & x \geq 160 \\ 1 & x \leq 80 \\ \dfrac{160 - x}{80} & x \in (80, 160) \end{cases}$$

$$\Delta \text{ lot} = \begin{cases} 0 & x \leq 100 \\ \dfrac{x - 100}{50} & x \in (100, 150) \\ 0{,}5 + \dfrac{x - 150}{20} \cdot 0{,}5 & x \in (150, 170) \\ 1 & x \geq 170 \end{cases}$$

Burner power

- Few

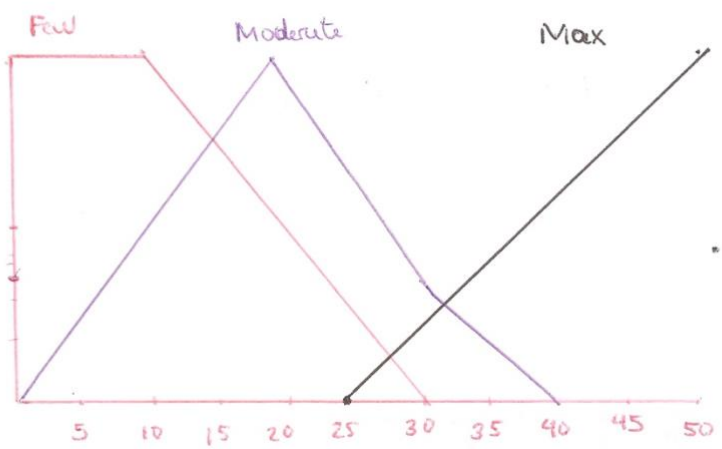
$$\begin{cases} 0 & x \geq 30 \\ \frac{30 - x}{20} & x \in (10, 30 \\ 1 & x \leq 10 \end{cases}$$

- Medium

$$\begin{cases} 0 & x \leq 10 \\ \frac{x - 10}{10} & x \in (10, 20) \\ 0,3 + \frac{x - 20}{10} \times 0,7 & x \in (20, 30) \\ 1 & x = 20 \\ 0,3 \times \frac{x - 30}{10} & x \in (30, 40) \end{cases}$$

- Max

$$\begin{cases} 0 & x \leq 25 \\ 1 & x \geq 50 \\ \frac{x - 25}{25} & x \in (25, 50) \end{cases}$$



Chemicals quantity — Null

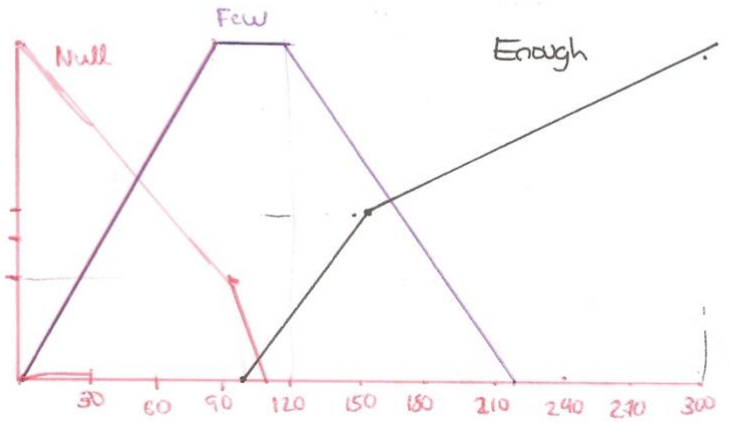
$$\begin{cases} 0 & x \geq 110 \\ 1 & x = 0 \\ \dfrac{110 - x}{110} & x \in (0, 110) \end{cases}$$

Few

$$\begin{cases} 0 & x = 0 \\ 1 & x \in (90, 120) \\ \dfrac{x - 120}{100} & x \in (120, 220) \\ \dfrac{90 - x}{90} & x \in 0, 90 \end{cases}$$

Many

$$\begin{cases} 0 & x \leq 100 \\ 1 & x \geq 300 \\ \dfrac{x - 100}{50} \times 0,2 & x \in (100, 150) \\ 0,5 + \dfrac{x - 150}{150} \times 0,2 & x \in (150, 300) \end{cases}$$



b) Rules IF - Then

R1 -

Milk temp. Low = $\frac{60-35}{30}$ = 25/30 = 0,83

Concentration high = $\frac{140-100}{50}$ = $\frac{40}{50}$ = 0,8

max(0,83 , 0,8) = 0,83

⇒

Burner max : $0,83 = \frac{x-25}{25}$ ⇒ x = 45,75

R2 -

Concentration high = 0,8 ⇒ Many Chemicals : x = 240

R3 -

Milk Temp Avg = $\frac{35-20}{20}$ = $\frac{15}{20}$ = 3/4 = 0,75

Concentration Low = $\frac{160-140}{80}$ = $\frac{1}{4}$ = 0,25

max( ) = 0,75

⇒

Few chemicals : $0,75 = \frac{x-120}{100}$ ⇒ x = 195

Burner mod : $0,75 = 0,3 + \frac{x-20}{10} * 0,7$ ⇒ x = 26,4

R4 -

Milk Temp High = $\frac{35-20}{30}$ = $\frac{15}{30}$ = 1/2 = 0,5

Concentration Low = $\frac{160-140}{80}$ = 20/80 = $\frac{1}{4}$ = 0,25

max(,) = 0,25

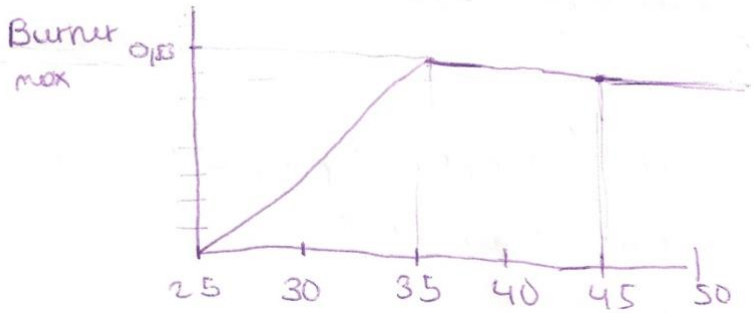
⇒

Burner Low : $0,25 = \frac{30-x}{20}$ ⇒ x = 25

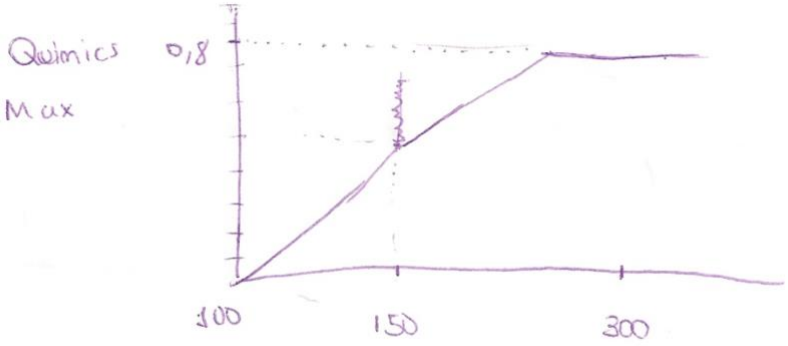
Chemicals Null : $0,25 = \frac{110-x}{110}$ ⇒ x = 82,5

b) Titrating

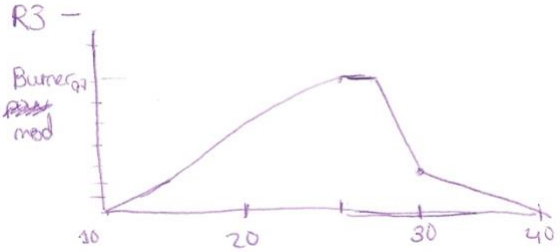
R1 –

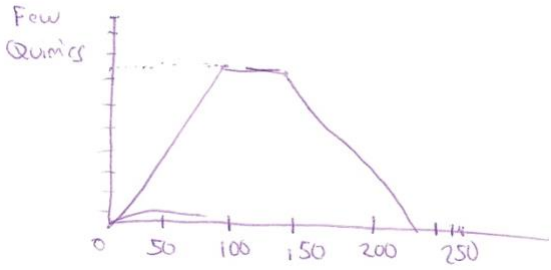


R2 –

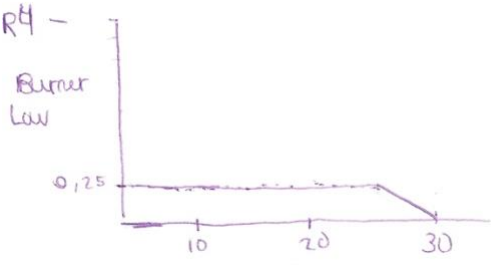


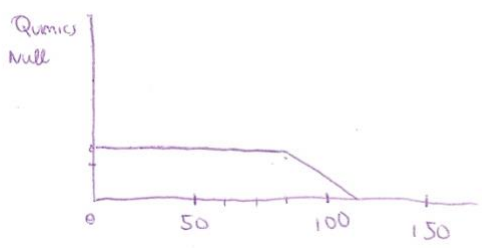
R3 –



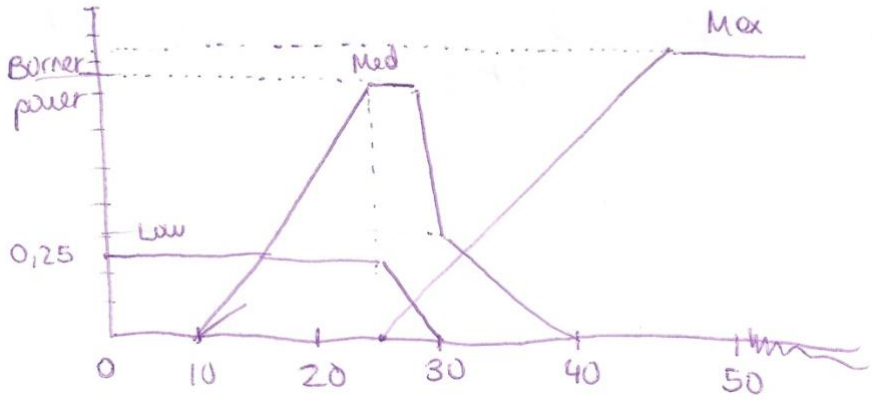


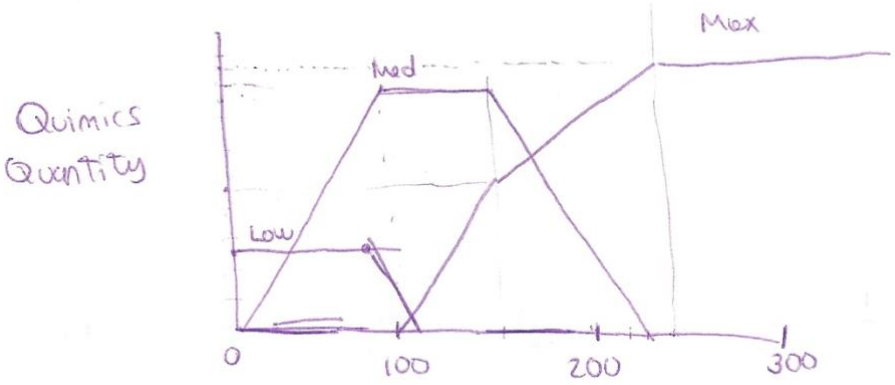
R4 –



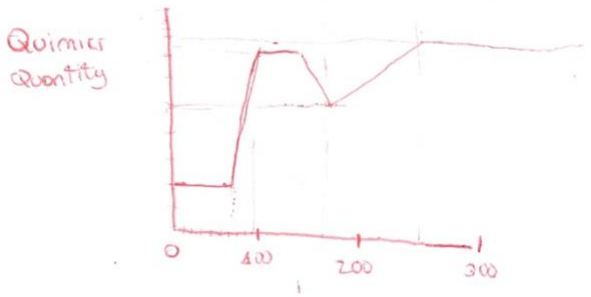


Agregation





Deffuzification



Cross points :

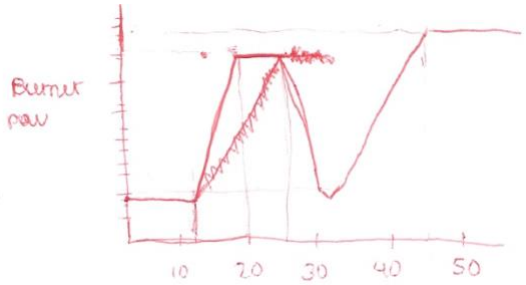
$0,25 = \frac{90-x}{40} \Rightarrow$

$x = 67,5$

$0,5 + \frac{x-150}{150} * 0,2 = \frac{x-120}{160}$

$\Rightarrow x = 173,076$

$C = 162,5278$



Cross points :

$0,25 = \frac{x - 10}{40} \Rightarrow$

$x = 12,5$

$0,3 * \frac{40 - x}{10} = \frac{x - 25}{25}$

$\Rightarrow$

$x = 31,4285$

$C = (0,25 \cdot 12,5) + (0,75 * 20) + (26,4285 \cdot 0,75) + (0,3 * 30) + (31,4285 * 0,25) + (45,75 * 0,83) \;/\; 0,25 + 0,75 + 0,75 + 0,3 + 0,25 + 0,83 = 92,776 / 2,3175 = 40$