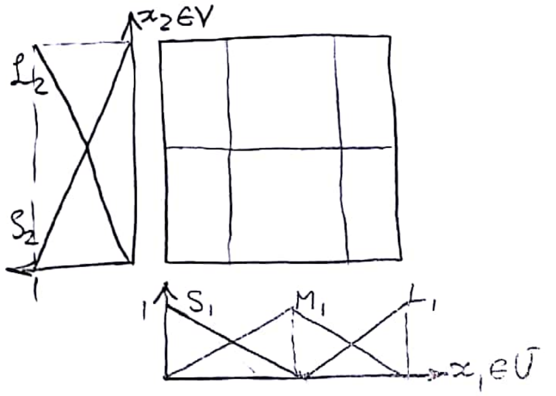
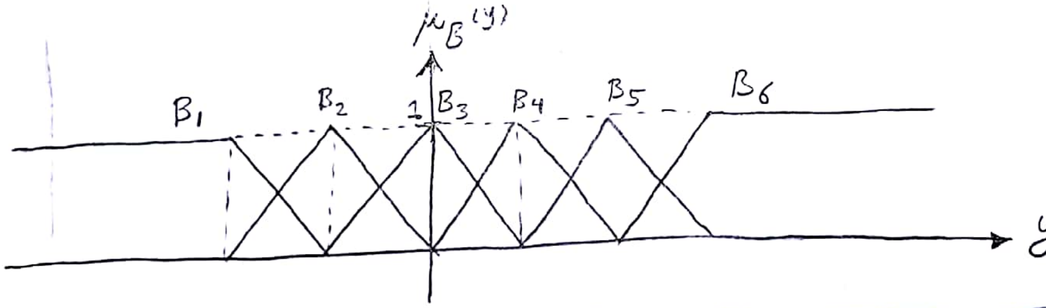
تمرین سری ۶ کنترل فازی — ایمان شریفی ۹۸۲۱۰۸۱۴

7.2) If x_1 is S_1 and x_2 is S_2, THEN y is B^1.
If x_1 is S_1 and x_2 is L_2 Then y is B^2.
If x_1 is M_1 and x_2 is S_2 Then y is B^3.
if x_1 is M_1 and x_2 is L_2 then y is B^4.
if x_1 is L_1 and x_2 is S_2 Then y is B^5.
if x_1 is L_1 and x_2 is L_2 Then y is B^6.



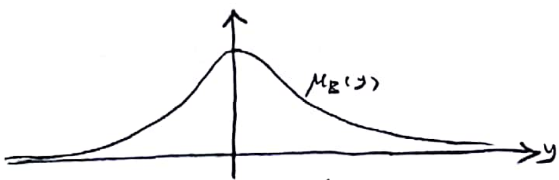
A set of fuzzy If-Then Rules is Continuous if there do not exist such neighboring rules whos Then part fuzzy sets have empty intersection

Ex. for Continous $\mu_B(y)$



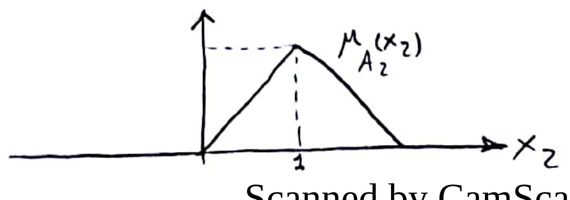
7.3) Rule: If x_1 is A_1 and x_2 is A_2 ... and x_n is A_n Then y is B.

$$\mu_B(y) = \exp(-y^2)$$



$$\mu_{A_1}(x_1) = \begin{cases} 1 - |x_1| & \text{if } -1 \le x_1 \le 1 \\ 0 & \text{otherwise.} \end{cases}$$

$$\mu_{A_2}(x_2) = \begin{cases} 1 - |x_2 - 1| & \text{if } 0 \le x_2 \le 2 \\ 0 & \text{otherwise.} \end{cases}$$



the input A' is a fuzzy singleton.

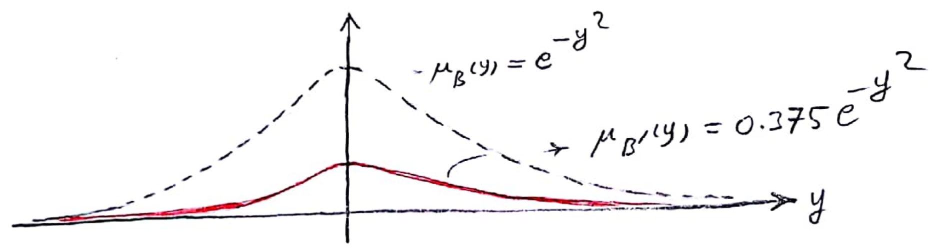
$$\mu_{A'}(x_1,x_2) = \begin{cases} 1 & \text{if } x_1 = 0.5 \text{ and } x_2 = 1{,}25 \\ 0 & \text{otherwise} \end{cases} \rightarrow \begin{cases} x_1^* = 0.5 \\ x_2^* = 1{,}25 \end{cases}$$

(a) $$\mu_{B'}(y) = \max_{Ru(1)} \left\{ \sup_{X\in U} \left(\mu_{A'}(x_1,x_2) \prod_{i=1}^{2} \mu_{A_i}(x_i)\, \mu_B(y) \right) \right\}$$

Product Inference Engine (PIE)

$$= \max \left\{ \sup_{X\in U} \left(\mu_{A_1}(0.5)\, \mu_{A_2}(1{,}25)\, \mu_B(y) \right) \right\}$$

$$= \max \left\{ \sup \left(0.5 * 0.75\ \mu_B(y) \right) \right\} = 0.375\ \mu_B(y) = \boxed{0.375 e^{-y^2}}$$

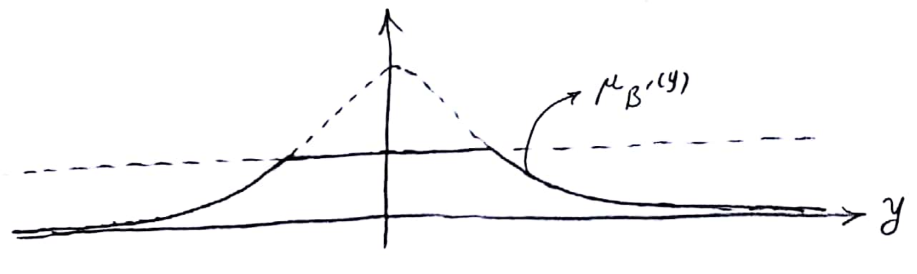


(b) $$\mu_{B'}(y) = \max_{Ru(1)} \left\{ \sup_{X\in U} \min \left(\mu_{A'}(x_1,x_2), \mu_{A_1}(x_1), \mu_{A_2}(x_2), \mu_B(y) \right) \right\}$$

Minimum Inference Engine (MIE)

$$= \max \left\{ \sup_{X\in U} \min \left(\mu_{A_1}(0.5), \mu_{A_2}(1{,}25), \mu_B(y) \right) \right\}$$

$$= \min \left(0.5, \mu_B(y) \right)$$



(C) $$\mu_{B'}(y) = \min \left\{ \sup_{X\in U} \min \left(\mu_{A'}(x), \mu_{Ru(1)}(x,y) \right) \right\}$$

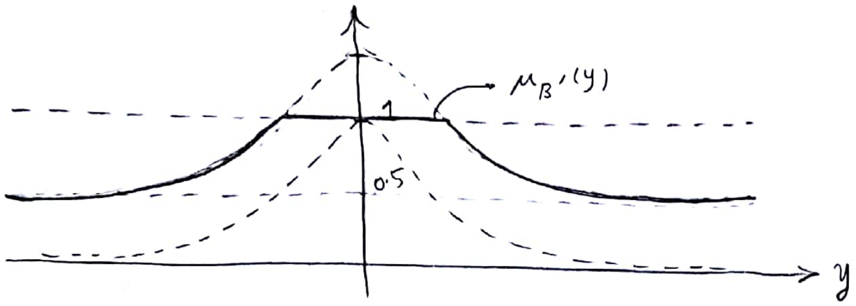
Lukasiewicz Inference Engine. (LIE)

$$= \min \left\{ \sup_{X\in U} \min \left(\mu_{A'}(x), \min \left(1, 1 - \min \left(\mu_{A_i}(x_i) \right) + \mu_B(y) \right) \right\} \right.$$

$$= \min\left\{ \sup_{X\in U} \min\left(1, \min\left(1, 1-(0.5)+\mu_B(y)\right)\right)\right\}$$

$$= \min\left\{ \sup_{X\in U} \min\left(1, 0.5+\mu_B(y)\right)\right\}$$

$$= \min\left\{1, 0.5+\mu_B(y)\right\}$$

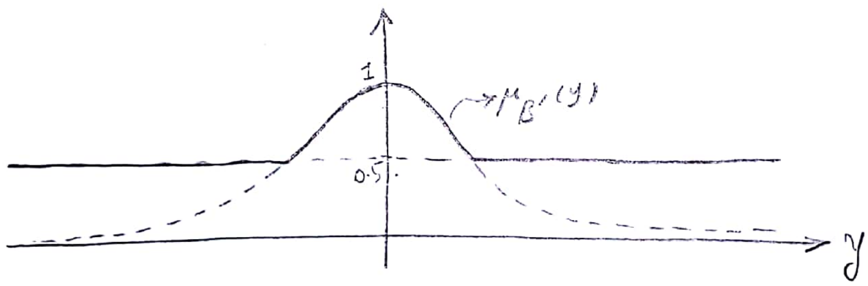


(d) $$\mu_{B'}(y) = \min\left\{ \sup_{X\in U} \min\left(\mu_{A'}(x), \max\left(\min\left(\mu_{A_1}(x_1), \mu_{A_2}(x_2), \mu_B(y)\right), 1-\min\left(\mu_{A_1}(x_1), \mu_{A_2}(x_2)\right)\right)\right)\right\}$$

Zadeh Inference Engine(ZIE)

$$= \min\left\{ \sup_{X\in U} \min\left(1, \max\left(\min\left(0.5, \mu_B(y)\right), 0.5\right)\right)\right\}$$

$$= \max\left(0.5, \mu_B(y)\right)$$

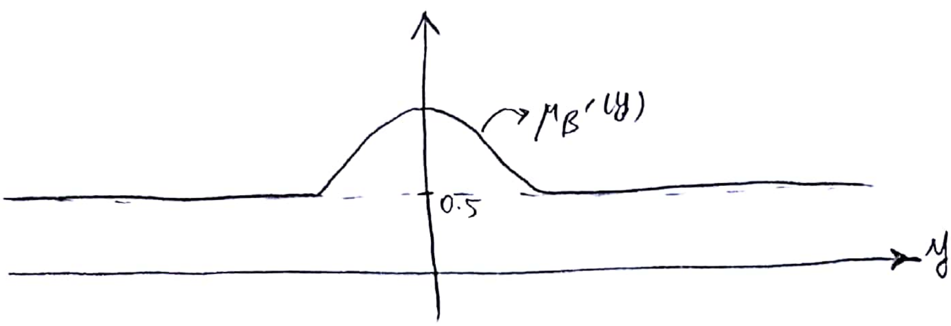


(e) $$\mu_{B'}(y) = \min\left\{ \sup_{X\in U} \min\left(\mu_{A'}(x), \max\left(1-\min\left(\mu_{A_i}(x_i)\right), \mu_B(y)\right)\right)\right\}$$

Dienes-Rescher Inference Engine(DIE)

$$= \min\left\{ \sup_{X\in U} \min\left(1, \max\left(0.5, \mu_B(y)\right)\right)\right\}$$

$$= \max\left(0.5, \mu_B(y)\right)$$



7.5) Godel combination. $\mu_{B'}(y) = \sup_{x \in U} t[\mu_{A'}(x), \mu_{Q_G}(x,y)]$

$$\mu_{B'}(y) = \min \begin{cases} \mu_{A'}(x) & , \text{ if } \min(\mu_{A_i}(x_i)) > \mu_B(y) \\ \sup \min(\mu_{A'}(x), \mu_{B'}(y)) & , \text{ otherwise} \end{cases}$$

if $\mu_{A'}(x)$ be a fuzzy Singleton. So $\mu_{B'}(y)$ is easier.

$$\mu_{B'}(y) = \min \begin{cases} 1 & \text{if } \min(\mu_{A_i^1}(x_i)) > \mu_{B^l}(y) \\ \mu_{B'}(y) & \text{otherwise.} \end{cases}$$