(1)

a) Show the fuzzification of good(x) for the following definition

Good: A student total mark greater than or equal to 80 is really good, but less than or equal to 60 is not considered as good.

b) Find the fuzzification of bad(x)

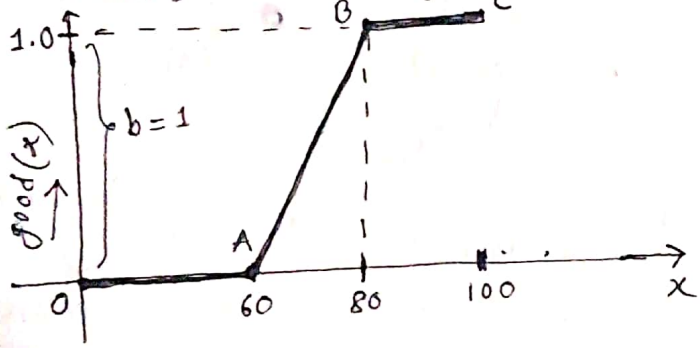
c) Find good(x) ∧ bad(x)

d) Find good(x) ∨ bad(x)

e) Find the value of ((good(75) AND NOT(bad(55))

a) Ans:

Fuzzification of good(x):



$$good(x) = \begin{cases} OA & \text{Where } 0 \leq x \leq 60 \\ AB & \text{Where } 60 < x < 80 \\ BC & \text{Where } 80 \leq x \leq 100 \end{cases}$$

For OA

A ≡ (0, 0)

A ≡ (60, 0)

OA is on x-axis.

equation of OA: (From HSC)

$Y = 0$

$\Rightarrow good(x) = 0$

For AB

A ≡ $(60, 0)$ → y_1

B ≡ $(80, 1)$ → x_2, y_2

equation of AB:

$$\frac{Y - Y_1}{Y_1 - Y_2} = \frac{x - x_1}{x_1 - x_2}$$

$$\Rightarrow \frac{Y - 0}{0 - 1} = \frac{x - 60}{60 - 80}$$

$$\Rightarrow \frac{Y}{-1} = \frac{x - 60}{-20}$$

$$\Rightarrow \frac{Y}{1} = \frac{x - 60}{20}$$

$$\therefore Y = \frac{x - 60}{20}$$

$$\therefore good(x) = \frac{x - 60}{20}$$

For BC

BC is parallel to x-axis.

equation of BC:

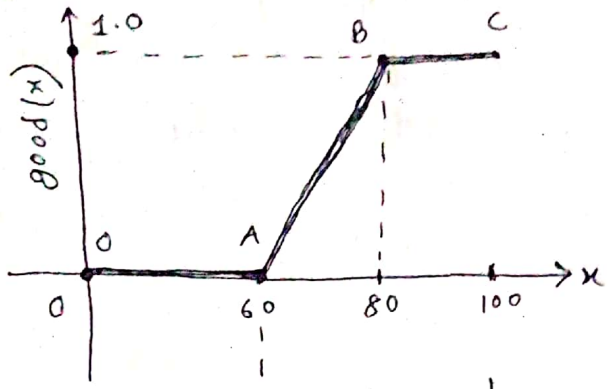
$Y = b$

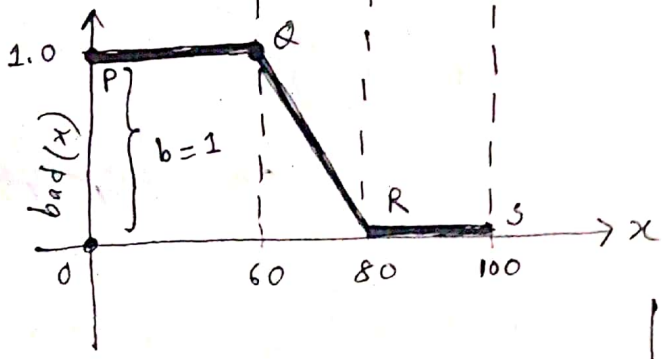
$\Rightarrow Y = 1$

$\therefore good(x) = 1$

$$good(x) = \begin{cases} 0 & 0 \leq x \leq 60 \\ \frac{x - 60}{20} & 60 < x < 80 \\ 1 & 80 \leq x \leq 100 \end{cases}$$

b) Ans: (2)





$$bad(x) = \begin{cases} PQ & \text{where } 0 \le x \le 60 \\ QR & \text{where } 60 < x < 80 \\ RS & \text{where } 80 \le x \le 100 \end{cases}$$

For PQ

PQ is parallel to x-axis.

equation of PQ:

$y = b$

$\Rightarrow bad(x) = 1$

OR

$bad(x) = 1 - OA$

$= 1 - 0$

$= 1$

For QR

$Q \equiv (60, 1)$ $\quad x_1, y_1$

$R \equiv (80, 0)$ $\quad x_2, y_2$

equation of QR:

$$\frac{y - y_1}{y_1 - y_2} = \frac{x - x_1}{x_1 - x_2}$$

$$\Rightarrow \frac{y-1}{1-0} = \frac{x-60}{60-80}$$

$$\Rightarrow \frac{y-1}{1} = \frac{x-60}{-20}$$

$$\Rightarrow y - 1 = -\frac{x-60}{20}$$

$$\Rightarrow y = 1 - \frac{x-60}{20}$$

$$\Rightarrow bad(x) = \frac{20 - x + 60}{20}$$

$$\therefore bad(x) = \frac{80 - x}{20}$$

OR

$bad(x) = 1 - AB$

$= 1 - \frac{x-60}{20}$

$= \frac{20 - x + 60}{20}$

$= \frac{80 - x}{20}$

For RS

RS is on x-axis

equation of RS:

$y = 0$

$\Rightarrow bad(x) = 0$

OR

$bad(x) = 1 - BC$

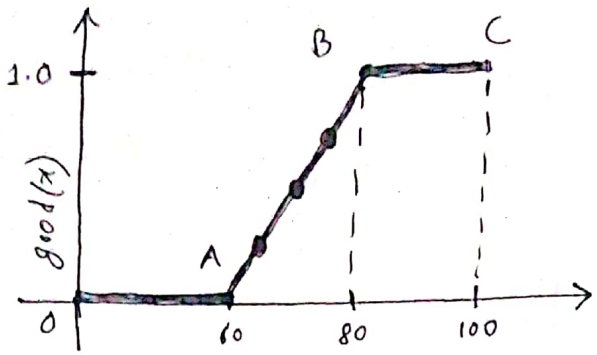
$= 1 - 1$

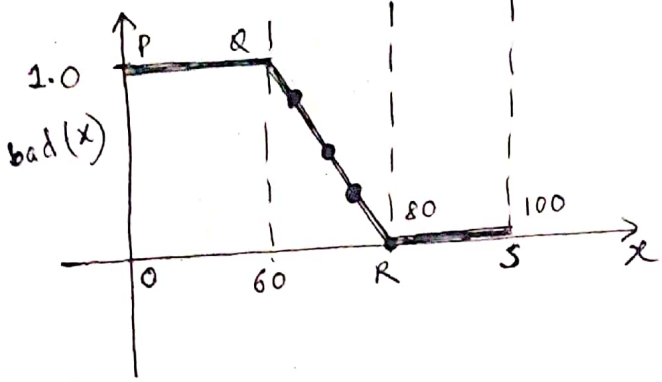
$= 0$

$$\therefore bad(x) = \begin{cases} 1 & 0 \le x \le 60 \\ \frac{80-x}{20} & 60 < x < 80 \\ 0 & 80 \le x \le 100 \end{cases}$$

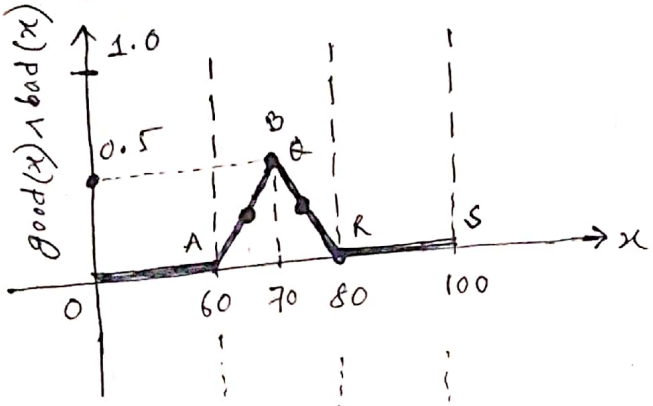
(3)

c) Ans:



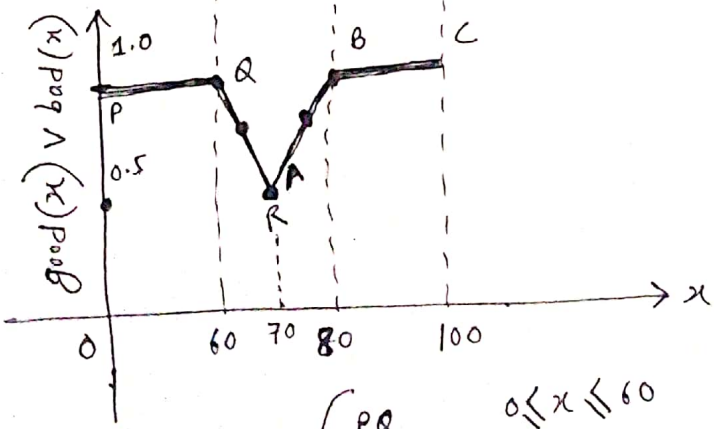


$$good(x) \wedge bad(x) = \begin{cases} OA & 0 \leq x \leq 60 \\ AB & 60 < x < 70 \\ QR & 70 \leq x < 80 \\ RS & 80 \leq x \leq 60 \end{cases}$$



$$= \begin{cases} 0 & 0 \leq x \leq 60 \\ \frac{x-60}{20} & 60 < x < 80 \\ \frac{80-x}{20} & 70 \leq x < 80 \\ 0 & 80 \leq x \leq 60 \end{cases}$$

d) Ans:



$$good(x) \vee bad(x) = \begin{cases} PQ & 0 \leq x \leq 60 \\ QR & 60 < x < 70 \\ AB & 70 \leq x < 80 \\ BC & 80 \leq x \leq 60 \end{cases} = \begin{cases} 1 & 0 \leq x \leq 60 \\ \frac{80-x}{20} & 60 < x < 70 \\ \frac{x-60}{20} & 70 \leq x < 80 \\ 1 & 80 \leq x \leq 60 \end{cases}$$

e) Ans:

good(75) = ?

bad(55) = ?

$x = 75$

$\therefore 60 < x < 80$ is applicable

$$good(x) = \frac{x - 60}{20}$$

$$= \frac{75 - 60}{20}$$

$$= 0.75$$

$x = 55$

$\therefore 0 \leq x \leq 60$ is applicable

$bad(x) = 1$

$\therefore ((good(75) \text{ AND } NOT(bad(55)))$

$= (0.75 \text{ AND } NOT(1))$

$= (0.75 \text{ AND } 0)$

$= 0$