Q41 Truth table for 'OR' pair of boolean variables

x_1	x_2	t
1	1	1
1	-1	1
-1	1	1
-1	-1	-1

perceptron network:

$$y = F(y_{in}) = \begin{cases} 1 & y_{in} > 0 \\ 0 & y_{in} >= 0 \\ -1 & y_{in} < = 0 \end{cases}$$
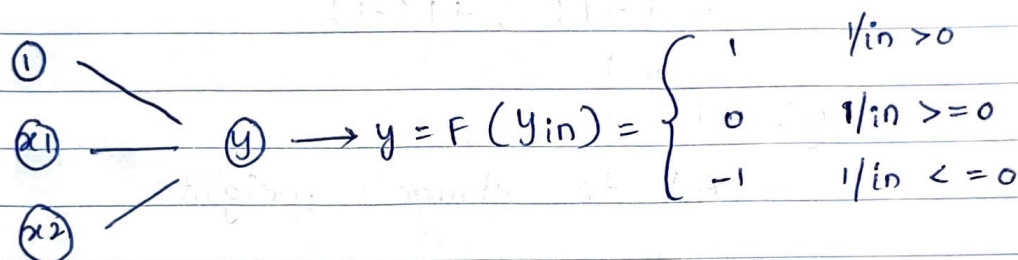
let initial weights and constant $b = 0$
i.e $w_1 = w_2 = b = 0$

first input perception $\rightarrow \begin{bmatrix} x_1 & x_2 & t \\ 1 & 1 & 1 \end{bmatrix}$

$\therefore y_{in} = b + w_1 x_1 + w_2 x_2$
$= 0 + 0(1) + 0(1) = 0$
$y = f(y_{in}) = 0$
since $y \neq t$
we need to update weights
$w_i(new) = w_i(old) + \alpha t x_i$
where α is learning rate here $\alpha = 1$

$\therefore w_i(new) = 0 + (1)(1)(1)$
$= 1$

$w_2(new) = 0 + (1)(1)(1)$
$$= 1$$

$b(new) = b(old) + \alpha t$
$$= 1$$

$w_1 = w_2 = b = 1$

$$\qquad x_1 \qquad x_2 \qquad t$$
second input $\rightarrow [1 , -1 , 1]$

$y_{in} = b + w_1(x_1) + w_2(x_2)$
$$= 1 + 1(1) + 1(-1)$$
$$= 1$$

$y_{in} = t$

No need to change weights

So, $w_1 = w_2 = b = 1$

Third input $\rightarrow [-1, 1, +1]$
$$\qquad x_1 \qquad x_2 \quad t$$

$y_{in} = b + w_1(x_1) + w_2(x_2)$
$$= 1 + w_1(-1) + w_2(1)$$
$$= 1 + 1(-1) + 1(1)$$
$$= 1$$

$y_{in} = t$

No need to change weights

$$\qquad\qquad x_1 \qquad x_2 \qquad t$$
fourth input $= [-1 , -1, -1]$

$y_{in} = b + w_1(x_1) + w_2(x_2)$
$$= 1 + 1(-1) + 1(-1)$$
$$= -1$$

$$y_{in} = t$$

we don't need to update weights

The final weights,

$$w_1 = 1, \quad w_2 = 1, \quad b = 1$$

$b = 1$ The perceptron network becomes

$$① \underset{b=1}{} $$

$$②_{x_1} \underset{w_1=1}{\underline{\quad\quad}} ⓨ \longrightarrow y = f(y_{in}) = \begin{cases} 1 & 1/in > 0 \\ 0 & 1/in = 0 \\ -1 & 1/in < 0 \end{cases}$$

$$③_{x_2} \underset{w_2=1}{} $$