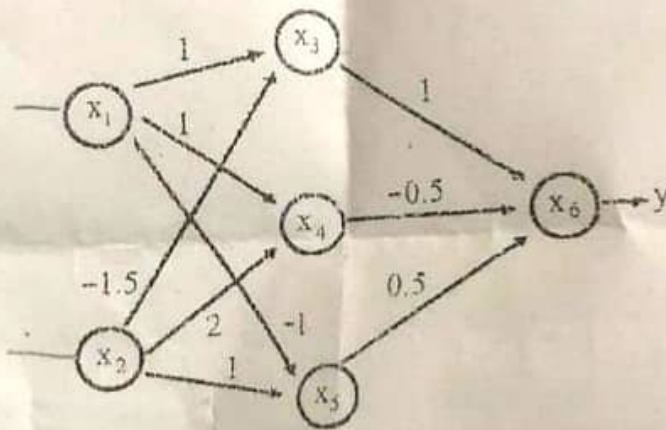


Q4: [8 Marks]

Complete the shown table, for the following Neural Network, where the *threshold* value $\theta = 0$.

X_1	X_2	X_3	X_4	X_5	$X_6 = y$
0	0				
0	1				
1	0				
1	1				



$R_3 = R_3 - 4R_2$

1	2	0
0	1	0
0	4	0

$R_3 = R_3 + 2R_1$
 $R_3 = R_3 - 4R_2$
 $R_3 = R_3 - 4R_2$
 $R_3 = R_3 - 4R_2$

Q5:

1- Solve the following equations by achieving a reduced Echelon form.

$$\begin{aligned}
 x_1 + 2x_2 - x_3 &= 6 \\
 3x_1 + 8x_2 + 9x_3 &= 10 \\
 2x_1 - x_2 + 2x_3 &= -2
 \end{aligned}$$

$$\begin{pmatrix}
 1 & 2 & -1 & 6 \\
 3 & 8 & 9 & 10 \\
 2 & -1 & 2 & -2
 \end{pmatrix}$$

[4 Marks]

1- Check if the vectors $a = [1 \ 1]^T$ and $b = [1 \ -1]^T$ are basis. If they are a basis, expand the vector $c = [5 \ -1]^T$ in this basis. [4 Marks]

c

① $a = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$, $b = \begin{bmatrix} 6 \\ 5 \\ 4 \end{bmatrix}$, $C = \begin{bmatrix} -1 \\ 1 \\ 4 \end{bmatrix}$

2

nearest v to C

$$C - a = \begin{bmatrix} -4 \\ -1 \\ 0 \end{bmatrix} \quad \|C - a\| = \begin{bmatrix} -4 \\ -1 \\ 0 \end{bmatrix} \cdot \begin{bmatrix} -4 \\ -1 \\ 0 \end{bmatrix} = \sqrt{16+1} = \sqrt{17} = 3.87$$

$$C - b = \begin{bmatrix} -7 \\ -4 \\ -3 \end{bmatrix} \quad \|C - b\| = \begin{bmatrix} -7 \\ -4 \\ -3 \end{bmatrix} \cdot \begin{bmatrix} -7 \\ -4 \\ -3 \end{bmatrix} = \sqrt{49+16+9} = 8.60$$

Vector a is nearest vector to C

$$a = \begin{bmatrix} 2 \\ 4 \\ 0 \end{bmatrix}$$

$$b = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$$

angle $\langle a, b \rangle = \cos \left(\frac{a^T b}{\|a\| \|b\|} \right)$

$$a^T b = [2 \ 4 \ 0] \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix} = 2 + 8 = 10$$

2

$$\|a\| = \begin{bmatrix} 2 \\ 4 \\ 0 \end{bmatrix} \cdot \begin{bmatrix} 2 \\ 4 \\ 0 \end{bmatrix} = \sqrt{4+16} = \sqrt{20}$$

$$\text{angle} = \cos^{-1} \left[\frac{10}{10.95} \right]$$

$$\|b\| = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix} = \sqrt{1+4+1} = \sqrt{6}$$

$$\rightarrow \cos^{-1} \rightarrow 24.04$$