

Answer the following questions:

Q1: [8 Marks]

Find the *eigenvalues* and *eigenvectors* of the matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 5 & 0 \\ 1 & 2 & 3 \end{bmatrix}$.

Q2: [8 Marks]

For the tables Ca and Cb, Find:

- $\Pi_{\text{Class, Sub.}} (\sigma_{\text{Students} > 50} (Ca \cup Cb))$
- $Ca \cap Cb$
- $Cb - Ca$

Ca			
School	Class	Students	Sub.
AB1	5	66	9
CD2	4	75	7
KB3	9	50	13
AB2		50	
MF2		45	
CD2		100	

Cb			
School	Class	Students	Sub.
AB2	5	50	9
MF2	8	45	12
KB3	9	50	13
CD2	7	100	11

Q3: [8 Marks]

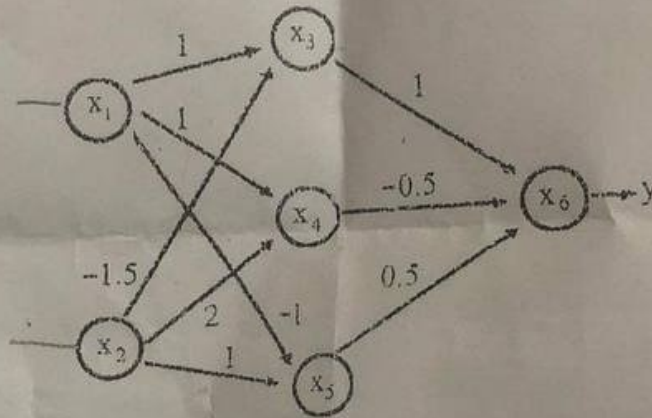
For the following table, find the *equation* between *b* and *a* using *least squares*. Then, *predict* the output *b* if *a* = 4.

Input <i>a</i>	5	3	2	1
Output <i>b</i>	2	4	7	9

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				



$R_3 = R_3 - 4R_2$

0	1	1	2	0
0	1	1	1	0
0	0	0	0	0

$R_3 = R_3 + 2R_1$

-2	2	0	0	0
0	2	0	0	0
0	0	0	0	0

$X_3 =$

Q5:

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

$x_1 + 2x_2 - x_3 = 6$
 $3x_1 + 8x_2 + 9x_3 = 10$
 $2x_1 - x_2 + 2x_3 = -2$

0	1	1	2	0
0	1	1	1	0
0	0	0	0	0

[4 Marks]

$\begin{matrix} 1 & 2 & 0 \\ 0 & 1 & 0 \end{matrix}$

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

[4 Marks]