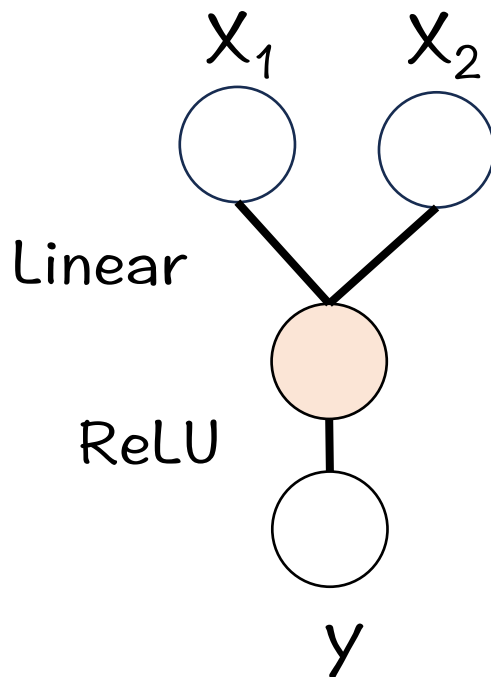
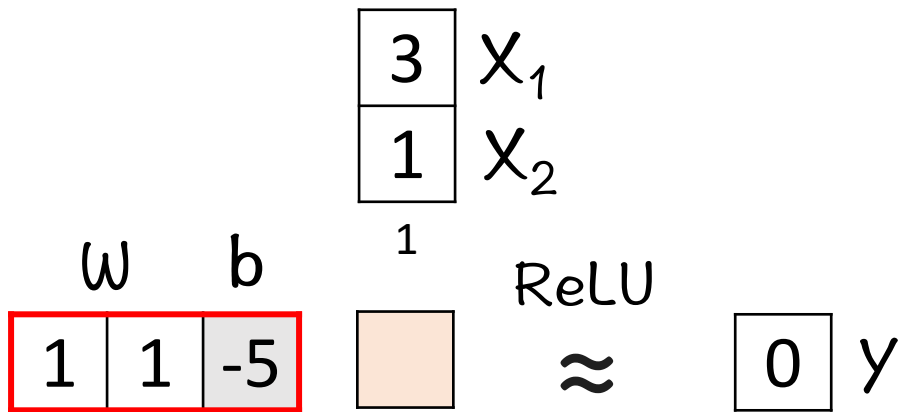


# Artificial Neuron

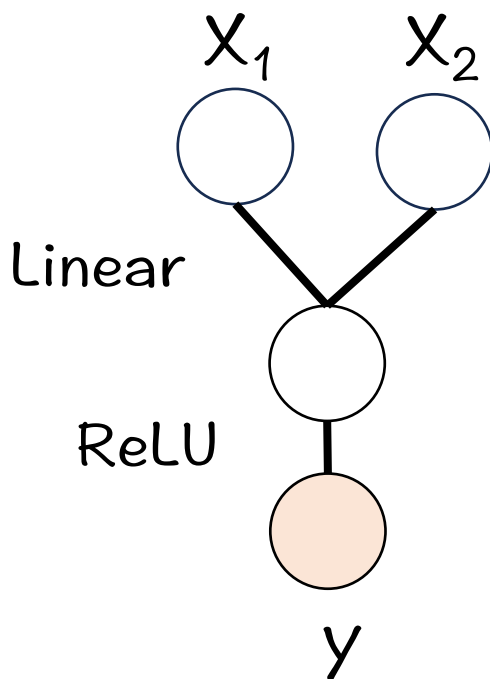
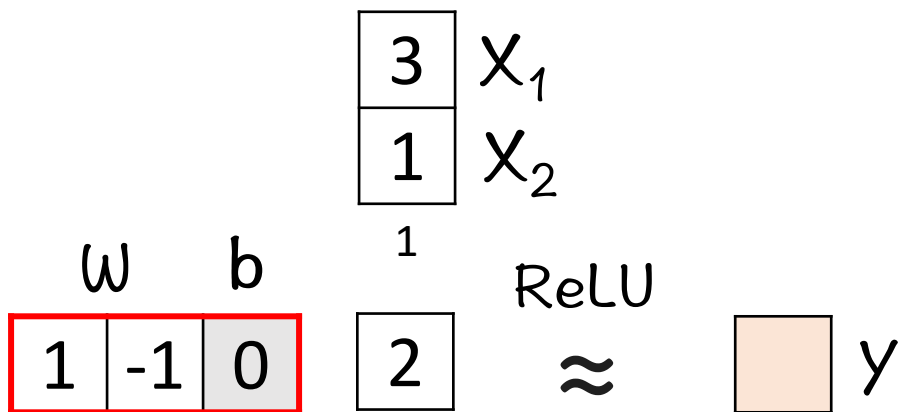
## Exercise 1



-1

# Artificial Neuron

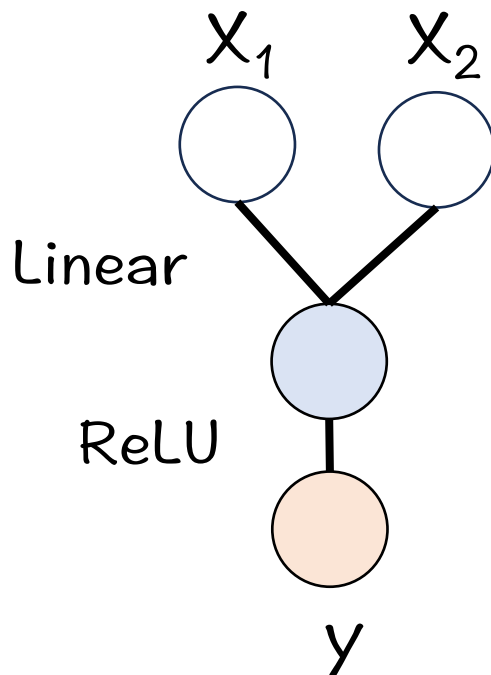
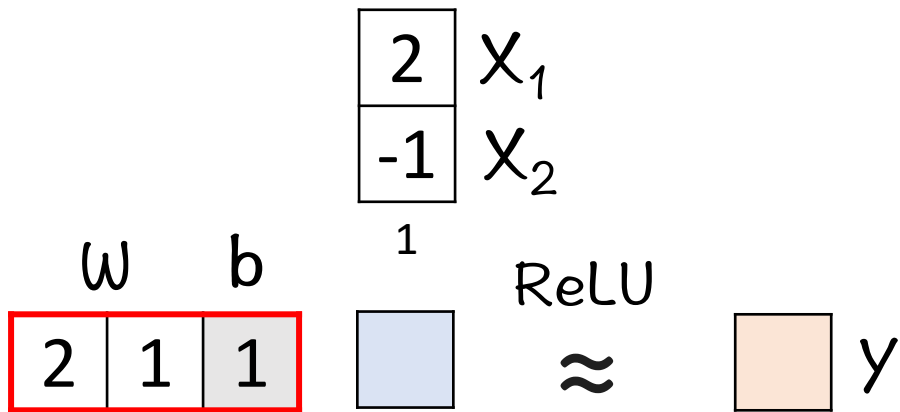
## Exercise 2



2

# Artificial Neuron

## Exercise 3

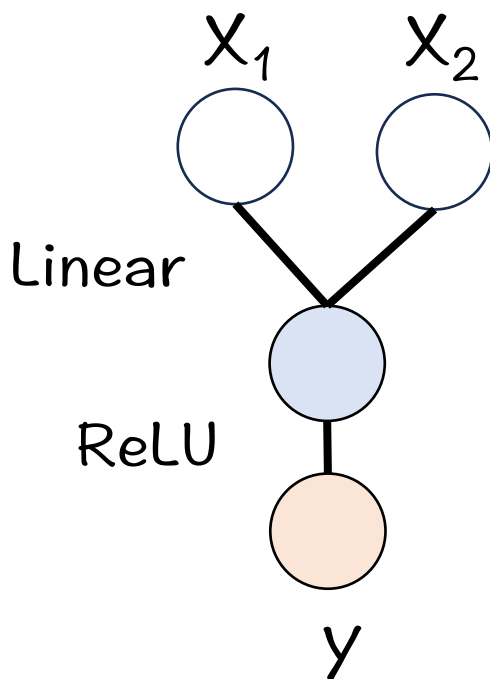
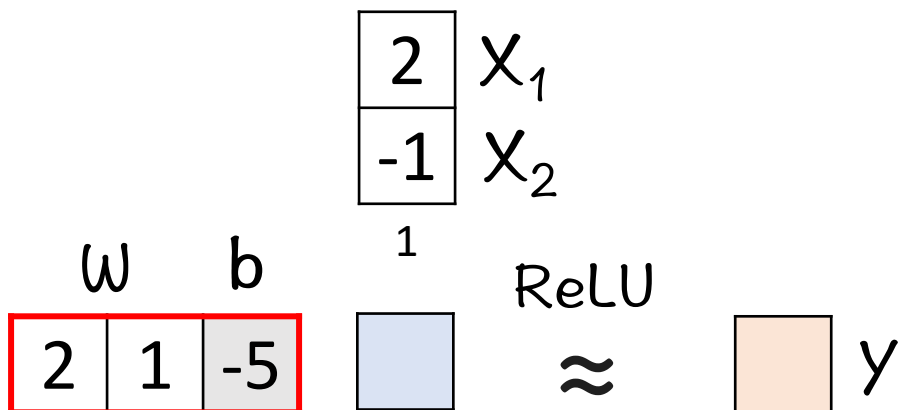


4

4

# Artificial Neuron

## Exercise 4

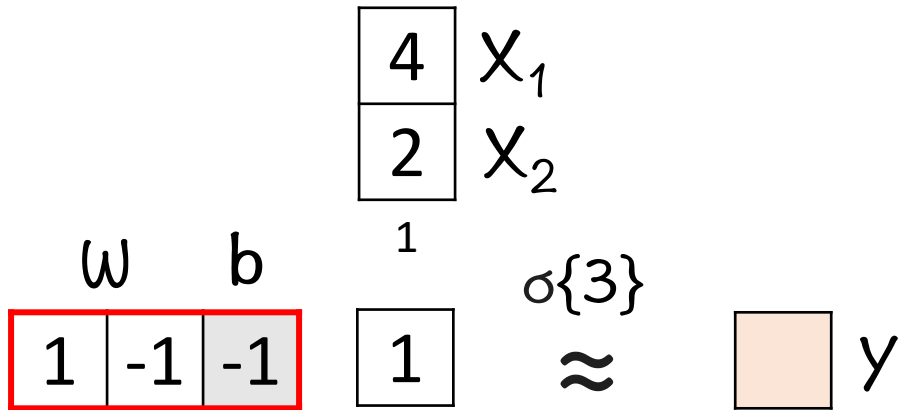


-2

0

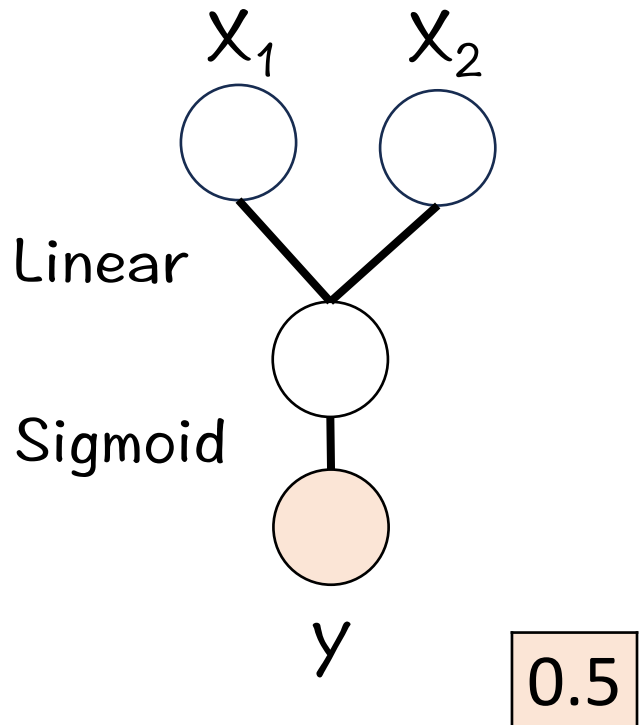
# Artificial Neuron

## Exercise 5



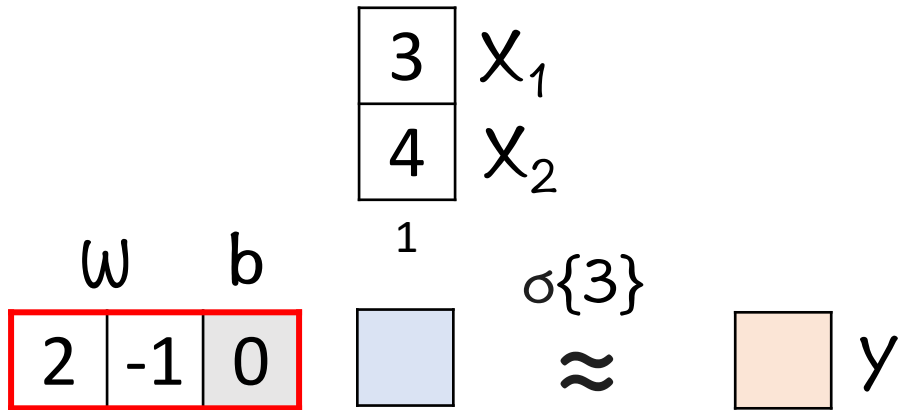
3 Level Quantization  
for hand calculation 🍌

Integer	Sigmoid $\sigma$
$\geq 2$	1
-1, 0, 1	0.5
$\leq -2$	0



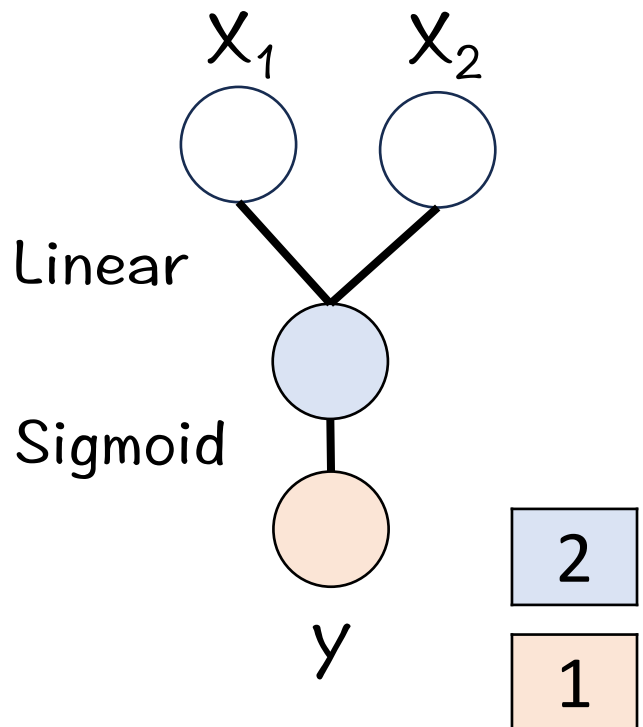
# Artificial Neuron

## Exercise 6



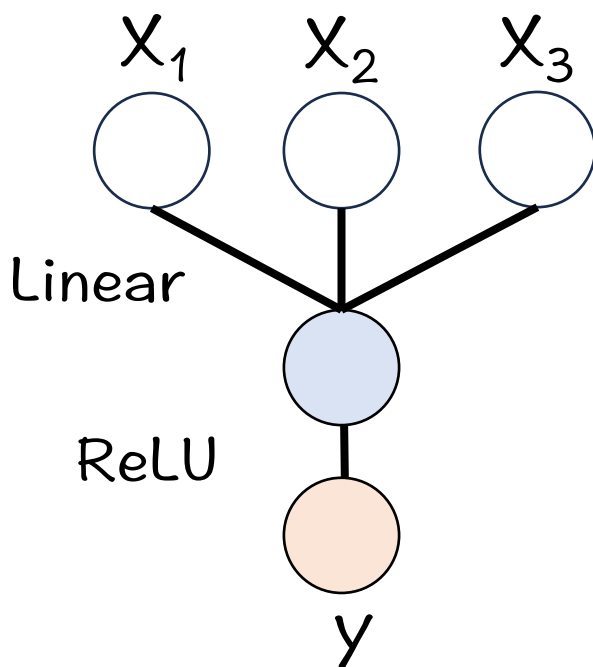
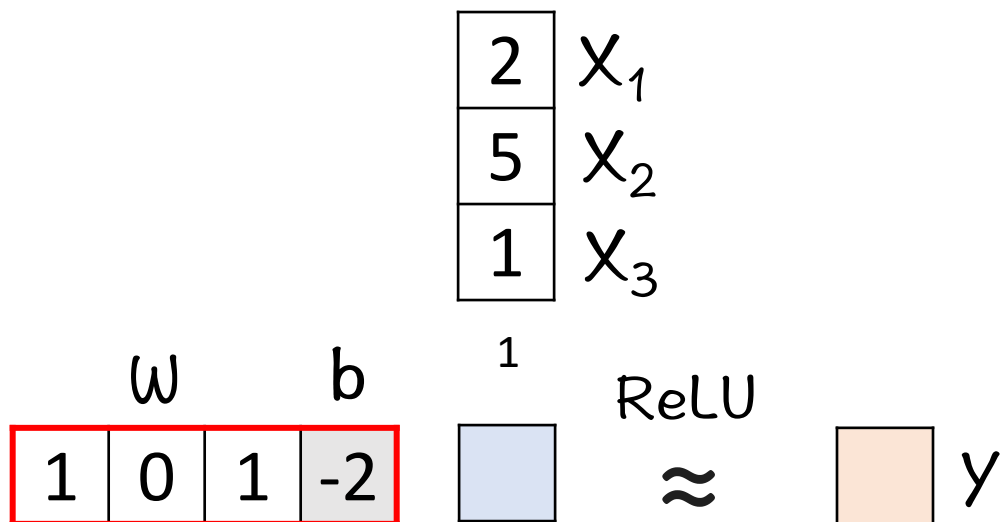
3 Level Quantization  
for hand calculation 🍌

Integer	Sigmoid $\sigma$
$\geq 2$	1
-1, 0, 1	0.5
$\leq -2$	0



# Artificial Neuron

## Exercise 7

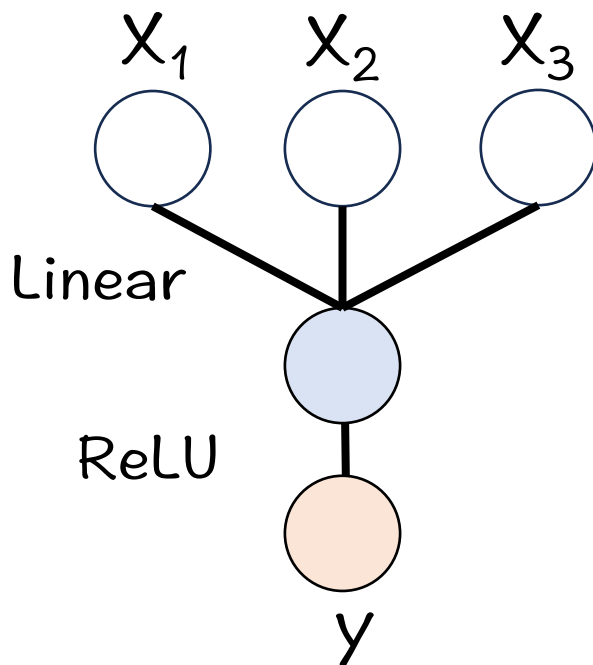
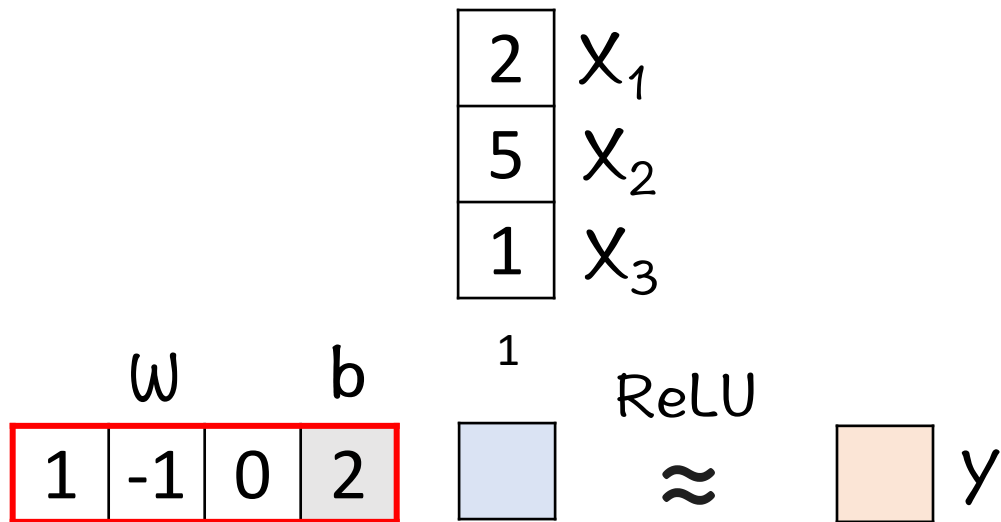


1
---

1
---

# Artificial Neuron

## Exercise 8



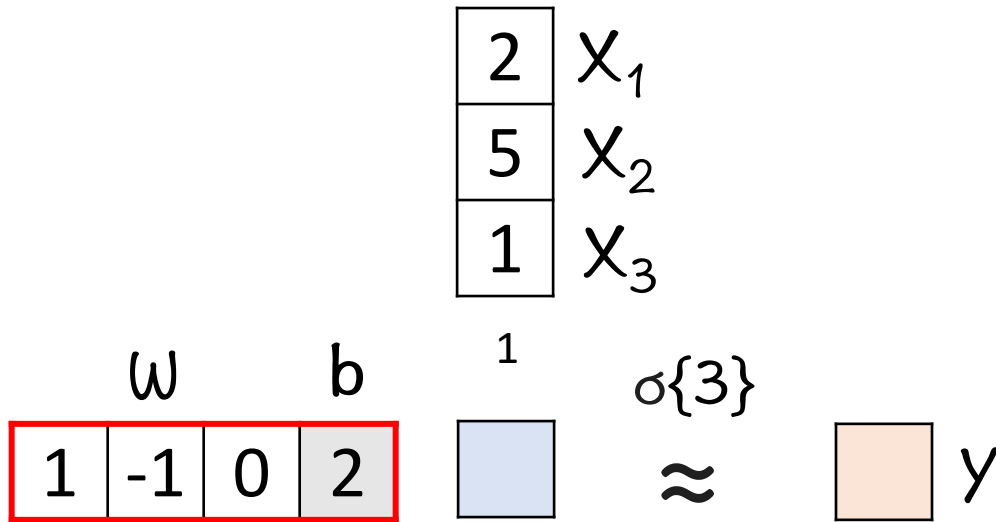
-1

0



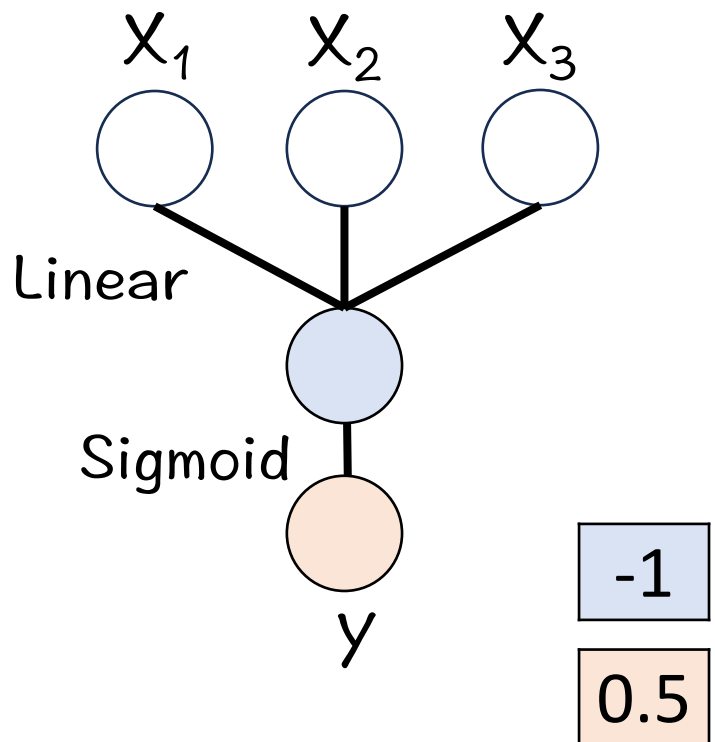
# Artificial Neuron

## Exercise 9



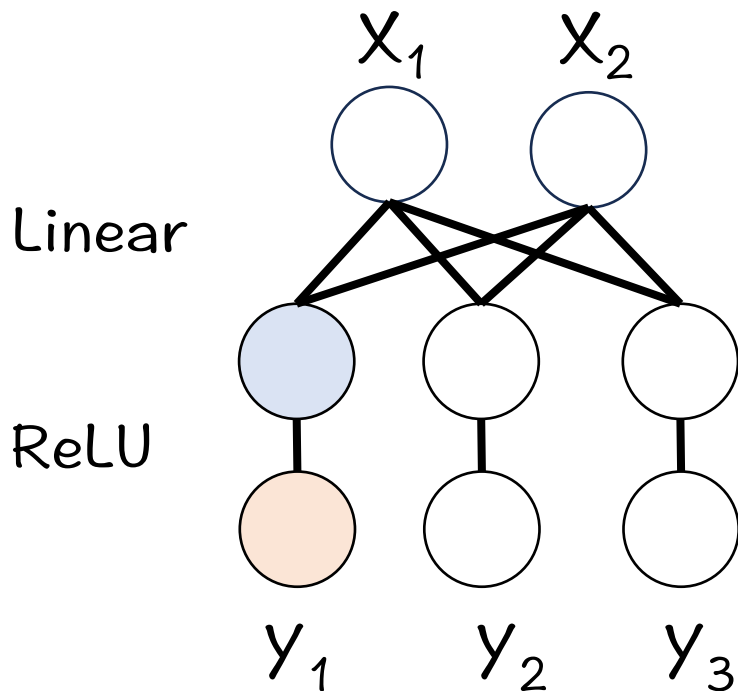
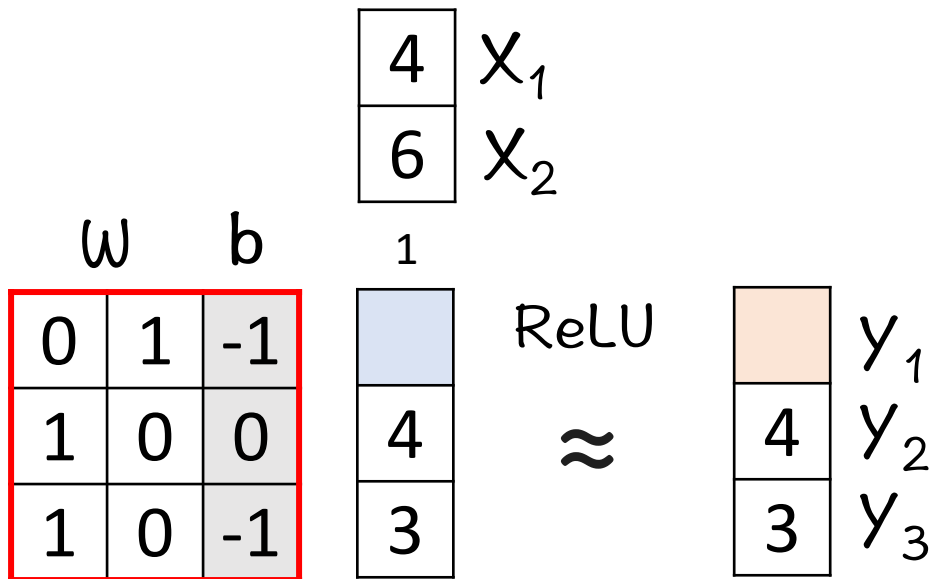
3 Level Quantization  
for hand calculation 🖋️

Integer	Sigmoid $\sigma$
$\geq 2$	1
-1, 0, 1	0.5
$\leq -2$	0



# Artificial Neuron

## Exercise 10

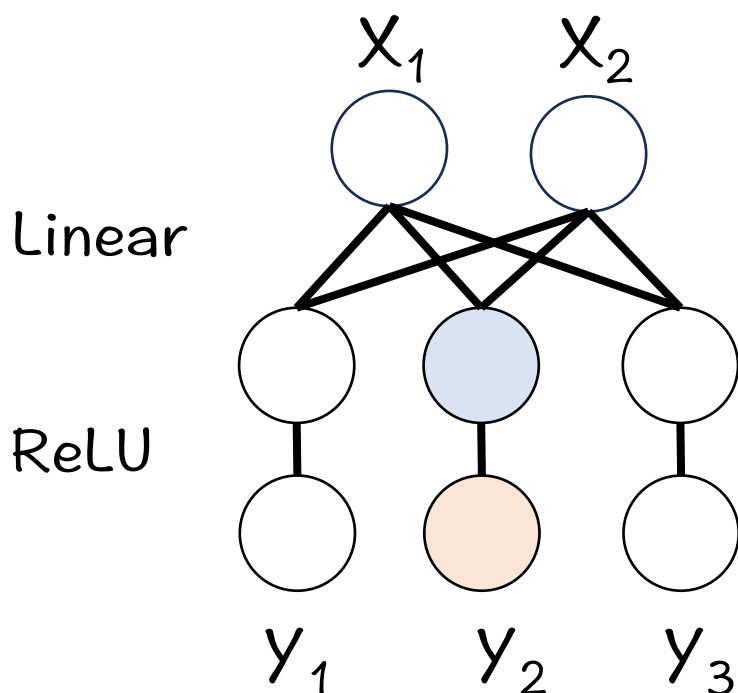
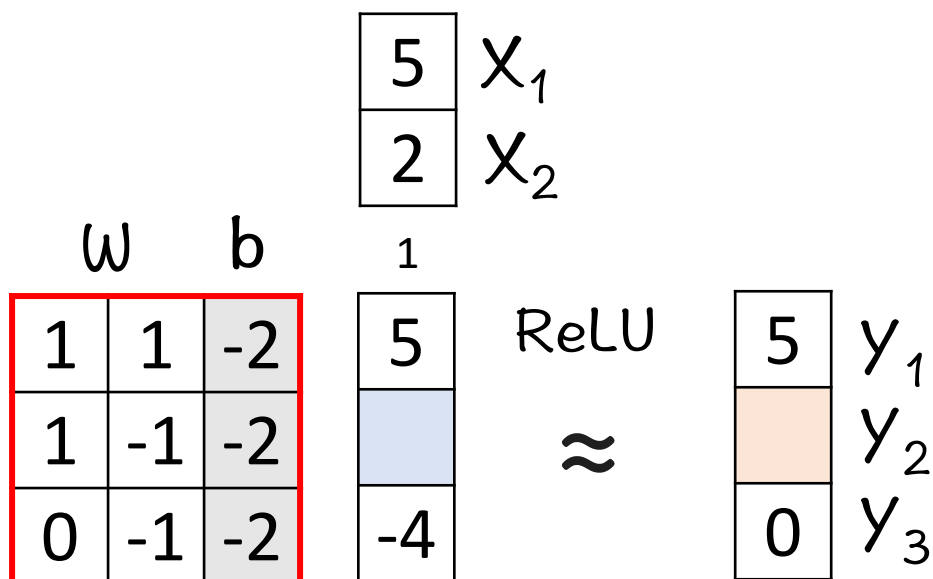


5

5

# Artificial Neuron

## Exercise 11

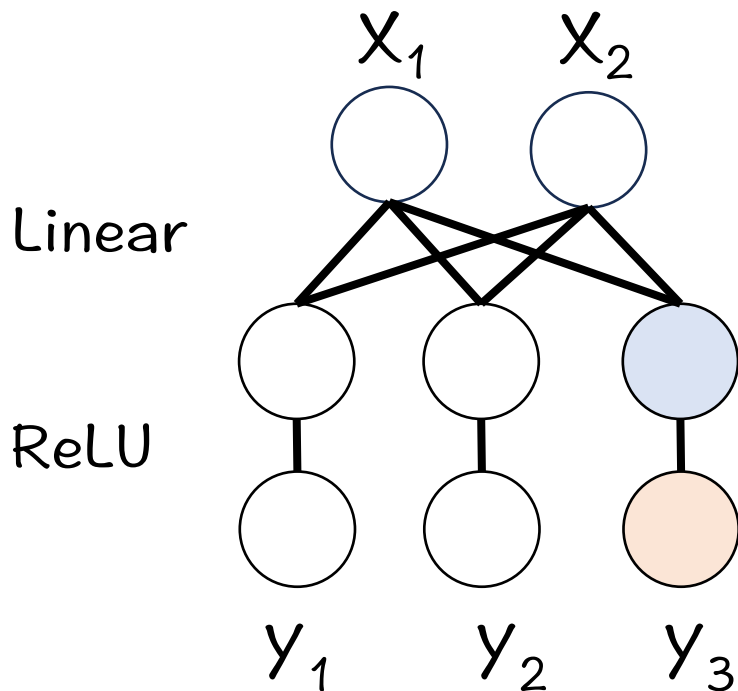
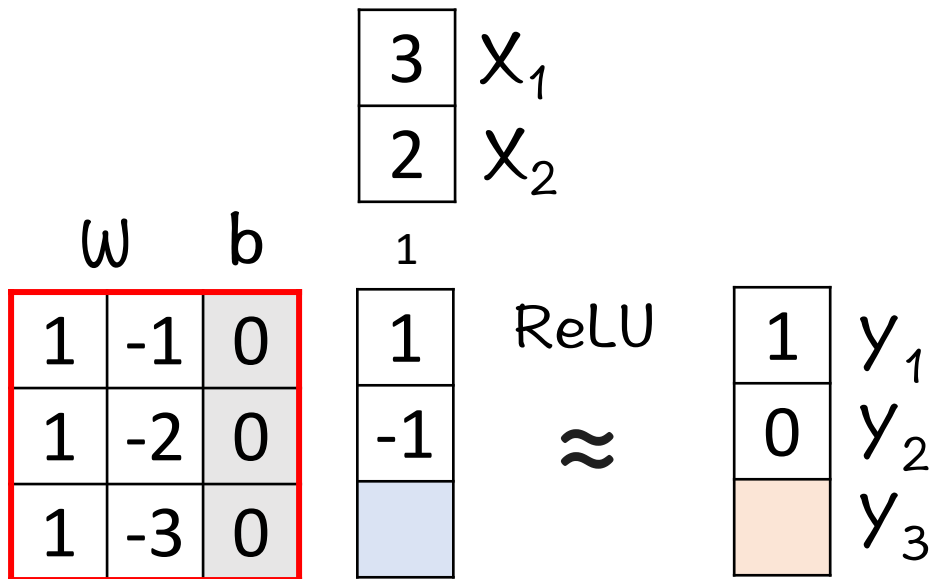


1

1

# Artificial Neuron

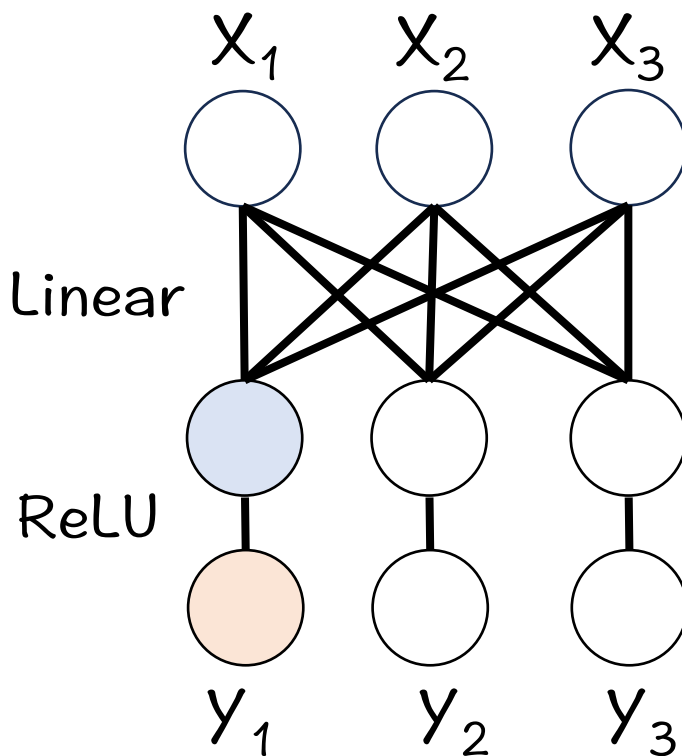
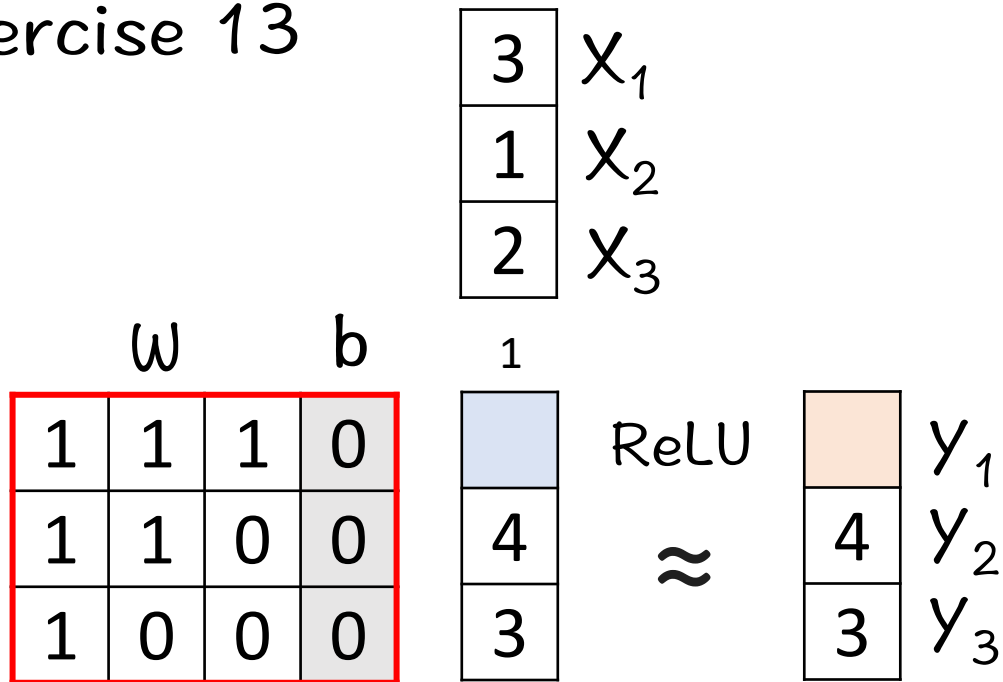
## Exercise 12



0

# Artificial Neuron

## Exercise 13



6

6

# Artificial Neuron

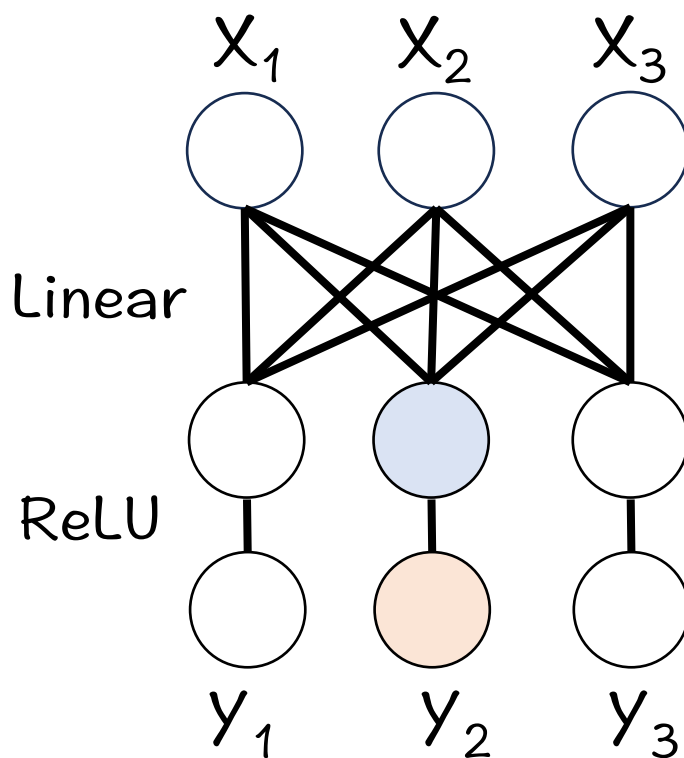
## Exercise 14

Exercise 14

$w$		$b$	
1	1	0	0
1	0	-1	0
1	-1	0	0

2	$x_1$
3	$x_2$
4	$x_3$

5	ReLU	3	$y_1$
	$\approx$		$y_2$
-1		0	$y_3$



# Artificial Neuron

## Exercise 15

Exercise 15

5	$x_1$
2	$x_2$
-3	$x_3$

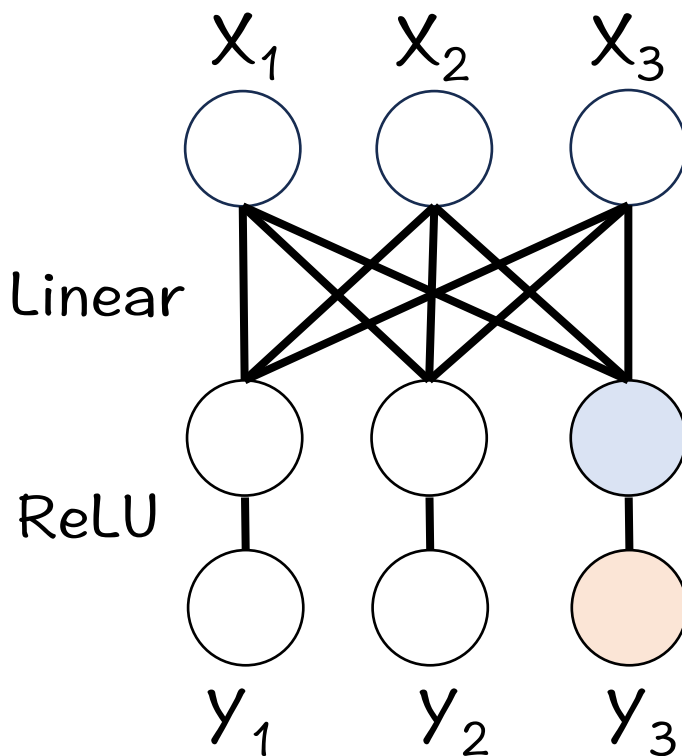
$w$	$b$		
0	1	0	-3
1	0	-1	0
1	-1	0	0

1	-1
8	

ReLU

0	$y_1$
8	$y_2$
	$y_3$

$\approx$

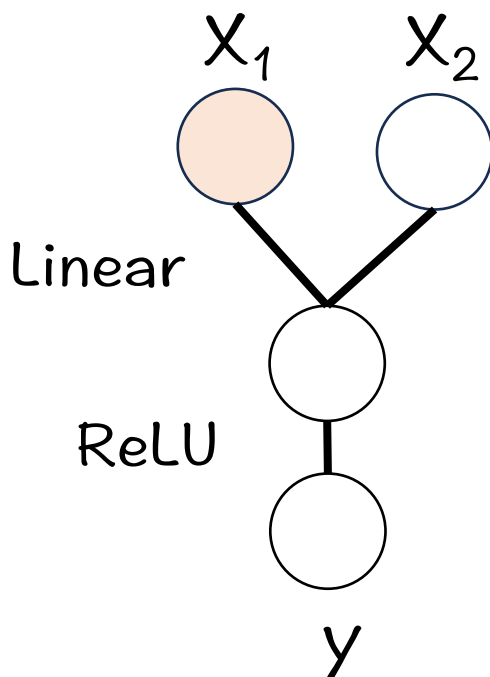
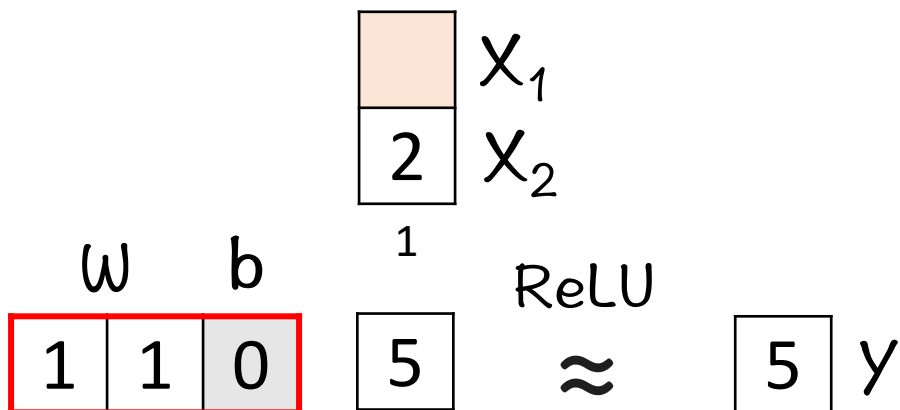


3

3

# Artificial Neuron

## Exercise 16

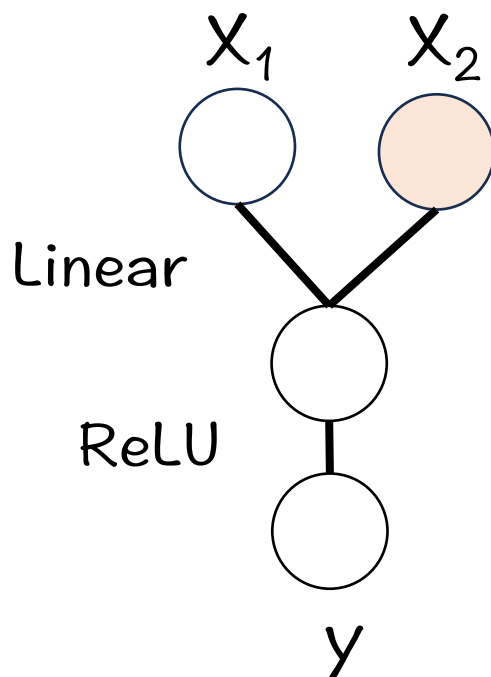




# Artificial Neuron

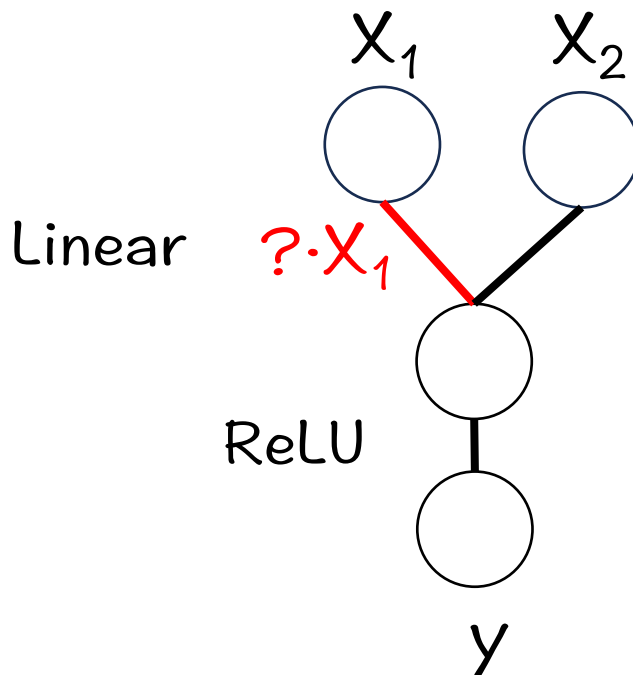
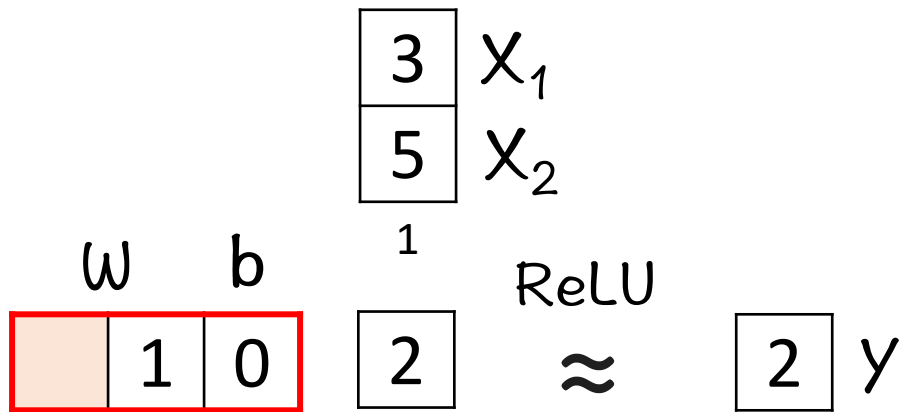
## Exercise 17

$$\begin{array}{ccc} & & \begin{array}{|c|} \hline 4 \\ \hline \end{array} X_1 \\ & & \begin{array}{|c|} \hline \text{ } \\ \hline \end{array} X_2 \\ & & 1 \\ w & b & \\ \begin{array}{|c|c|c|} \hline 1 & -1 & 0 \\ \hline \end{array} & \begin{array}{|c|} \hline -1 \\ \hline \end{array} & \text{ReLU} \\ & \approx & \begin{array}{|c|} \hline 0 \\ \hline \end{array} y \end{array}$$



# Artificial Neuron

## Exercise 18



-1

# Artificial Neuron

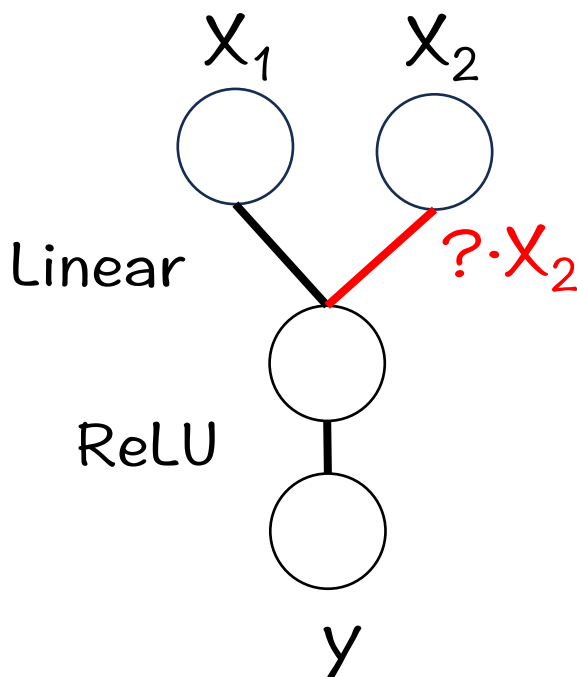
## Exercise 19

$w$	$b$
1	0

$x_1$	$x_2$
3	2

  
$$\begin{matrix} & & 1 \\ & & -1 \\ & \text{ReLU} & \\ & \approx & \end{matrix} \begin{matrix} & & 0 \\ & & y \end{matrix}$$

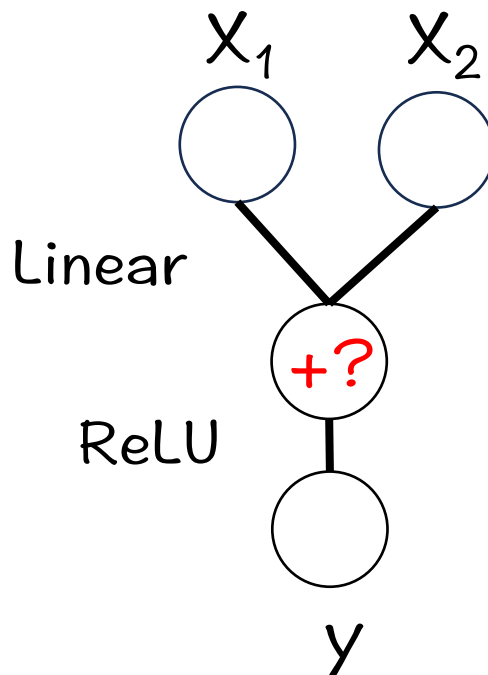


-2

# Artificial Neuron

## Exercise 20

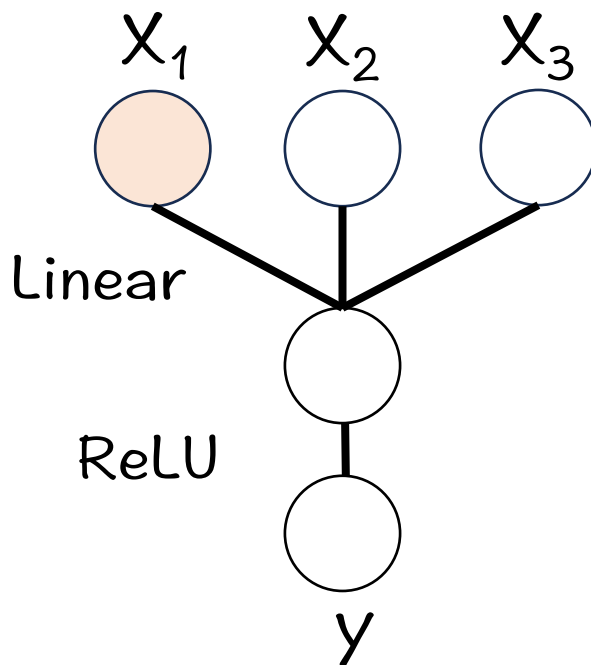
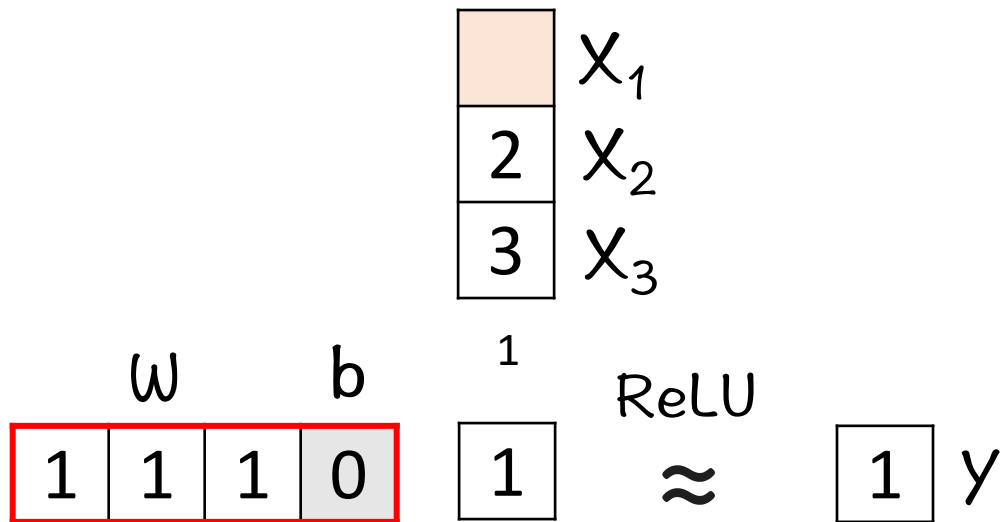
$$\begin{array}{ccc} & \begin{array}{|c|} \hline 3 \\ \hline \end{array} X_1 & \\ & \begin{array}{|c|} \hline 2 \\ \hline \end{array} X_2 & \\ & 1 & \\ w & b & \\ \begin{array}{|c|c|c|} \hline 1 & -1 & \text{ } \\ \hline \end{array} & \begin{array}{|c|} \hline -1 \\ \hline \end{array} & \text{ReLU} \\ & \approx & \begin{array}{|c|} \hline 0 \\ \hline \end{array} y \end{array}$$



-2

# Artificial Neuron

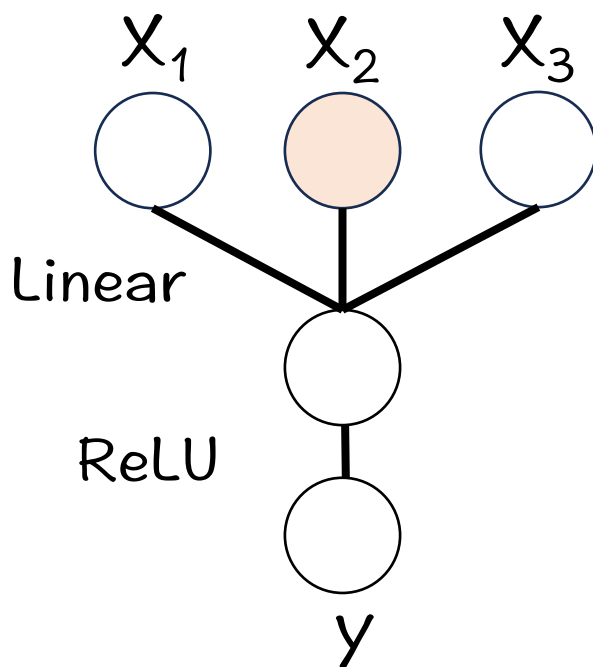
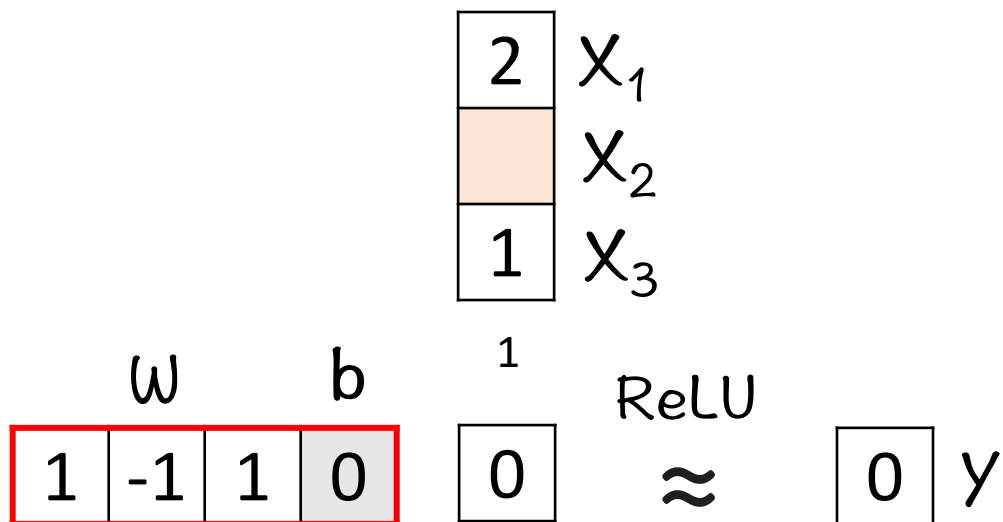
## Exercise 21



-4

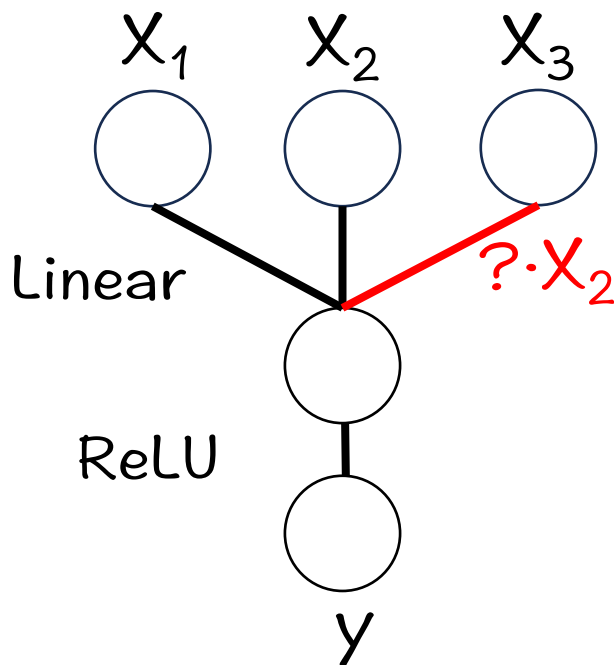
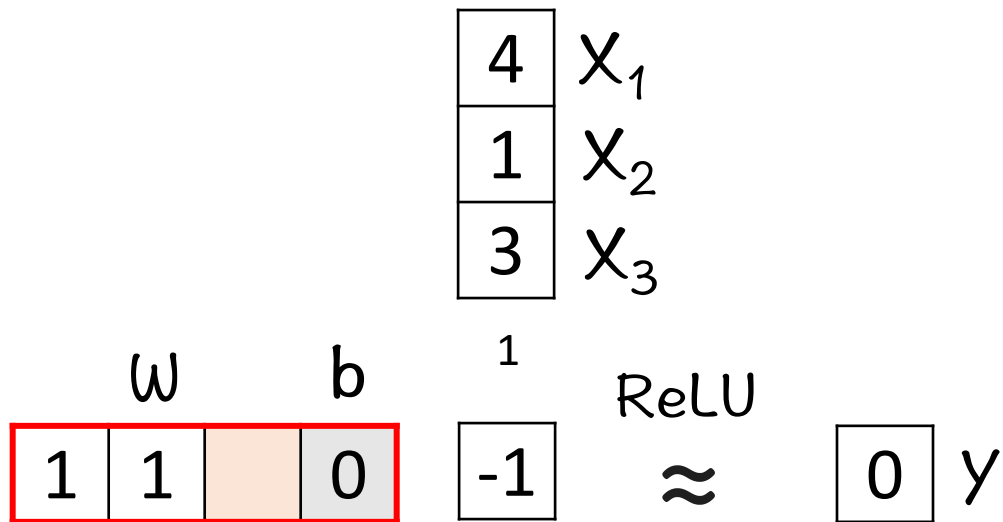
# Artificial Neuron

## Exercise 22



# Artificial Neuron

## Exercise 23



-2

# Artificial Neuron

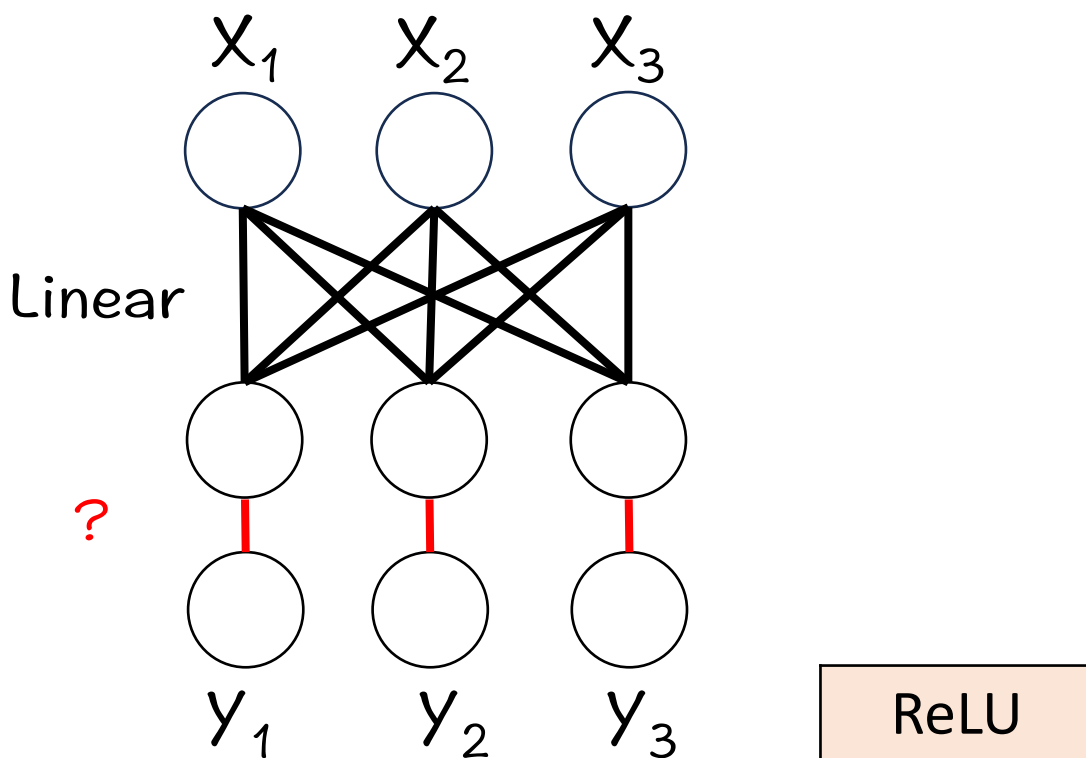
## Exercise 24

Exercise 24

2	$x_1$
4	$x_2$
3	$x_3$

$w$	$b$
1	1
-1	-2
0	-1
0	2

0	$y_1$
0	$y_2$
2	$y_3$

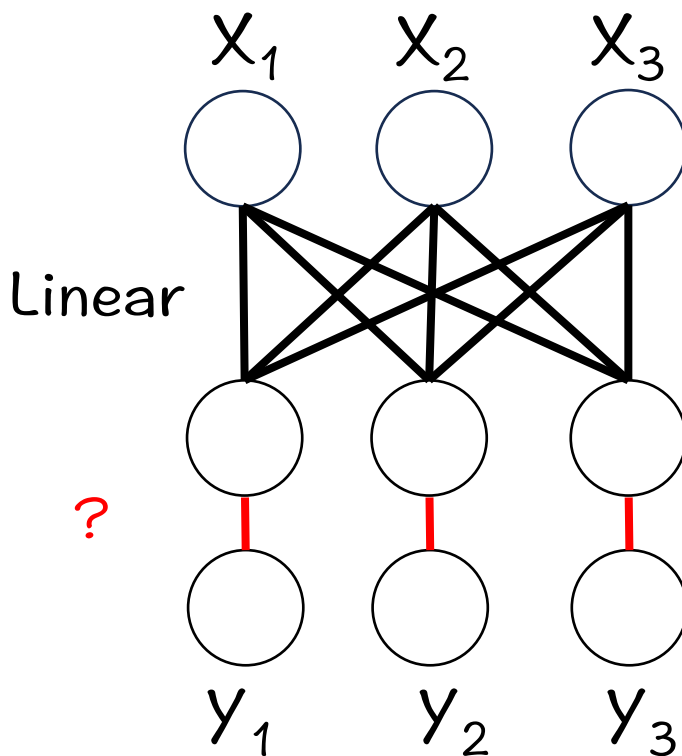




# Artificial Neuron

## Exercise 25

				2	$x_1$		
				4	$x_2$		
				3	$x_3$		
	$w$	$b$	1				
1	-1	0	0	-2	?	0	$y_1$
1	0	-1	0	-1	$\approx$	0.5	$y_2$
1	0	0	0	2		1	$y_3$



Sigmoid