Assignment 1

Question 1

Equation = $\bar{x}_1 x_2 x_3 + x_1 \bar{x}_2$

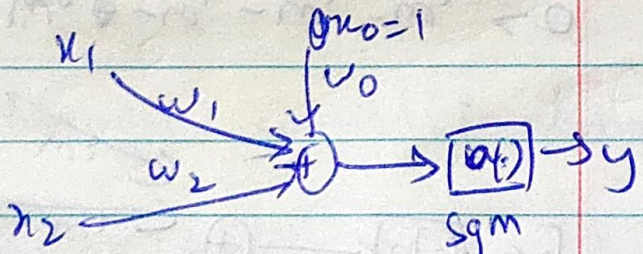
~~= OR(AND(NOT(x_1), AND(x_2, x_3)))~~

We need to implement AND, NOT and OR function

= OR(AND(NOT(x_1), AND(x_2, x_3)), AND(x_1, NOT(x_2)))

AND:

x_1	x_2	y
-1	-1	-1
-1	1	-1
1	-1	-1
1	1	1



$w_0 - w_1 - w_2 < 0$

$w_0 - w_1 + w_2 < 0$

$w_0 + w_1 - w_2 < 0$

$w_0 + w_1 + w_2 > 0$

$\Rightarrow w_0 < 0$, ~~$w_1 + w_2 < 0$~~

~~$w_0 < w_1 + w_2$~~

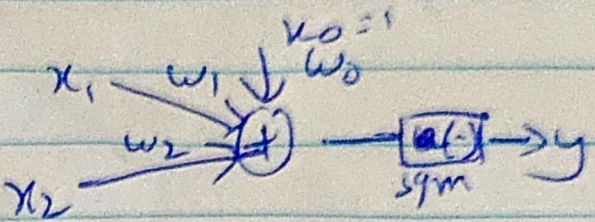
$\Rightarrow w_0 < w_1$, $w_2 > 0$, $w_1 > 0$

$w_1 + w_2 > 0$

$w_0 = -1, w_1 = 1, w_2 = 1$

OR

x_1	x_2	y
-1	-1	-1
1	-1	1
-1	1	1
1	1	1



$\Rightarrow w_0 > 0$

~~$w_0 + w_1 > 0$~~

$w_1 > 0$

$w_2 > 0$

$w_0 - w_1 - w_2 < 0$

$w_0 + w_1 - w_2 > 0$

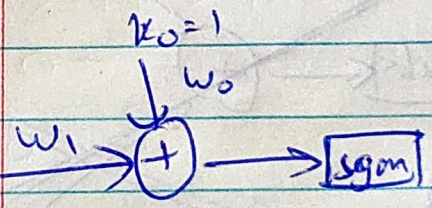
$w_0 - w_1 + w_2 > 0$

$w_0 + w_1 + w_2 > 0$

$w_0 = 1, w_2 = 1, w_3 = 1$

NOT:

x_1	y
1	-1
-1	1

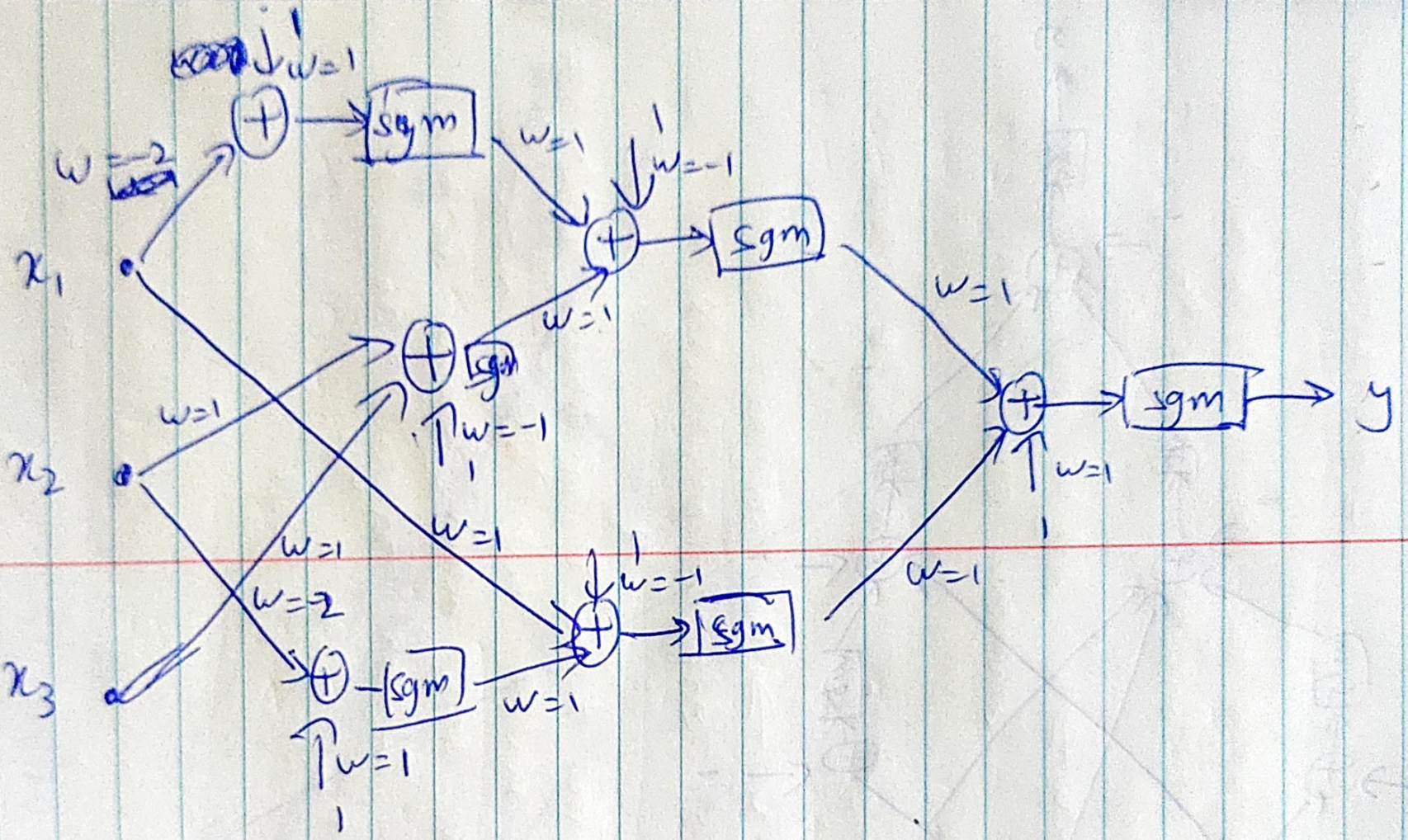


$w_0 + w_1 < 0$

$w_0 - w_1 > 0$

$w_1 < 0, w_0 > 0$

$w_1 = -2, w_0 = 1$


x1
x2
x3
w=-2
w=1
w=1
w=1
w=-2
w=1
w=1
w=-1
w=1
w=-1
w=1
w=-1
w=1
w=1
w=1
sgm
sgm
sgm
sgm
sgm
1
1
1
1
y

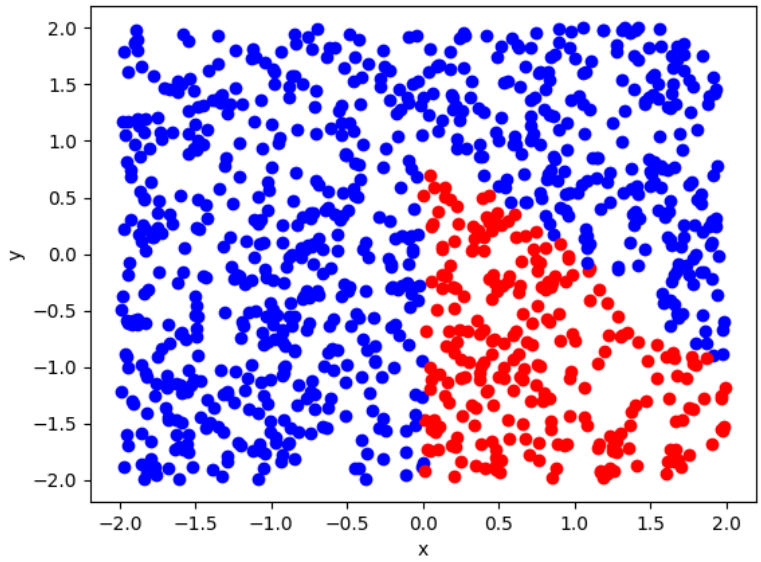
Question 2:

Code:

```
import matplotlib as m
import numpy as np
import random as rand
import time
import matplotlib.pyplot as plt

rand.seed(time.time())
coords = np.empty([2, 1000])

for i in range(1000):
  coords[0][i] = rand.uniform(2, -2)
  coords[1][i] = rand.uniform(2, -2)

def step(input):
  if input<0:
    return 0
  else:
    return 1

def network(x, y):
  return step(-1.5 + step(1 + x - y) + step(1 - x - y) - step(-x))

for i in range(1000):
  if network(coords[0][i], coords[1][i]) == 0:
    plt.plot(coords[0][i], coords[1][i], 'bo')
  else:
    plt.plot(coords[0][i], coords[1][i], 'ro')
plt.xlabel('x')
plt.ylabel('y')
```

plt.show()

Plot:



The region where the values are 1 are between the lines x = 0 and y = -x + 1