Short Assignment 4

Problem 1 (3 points)

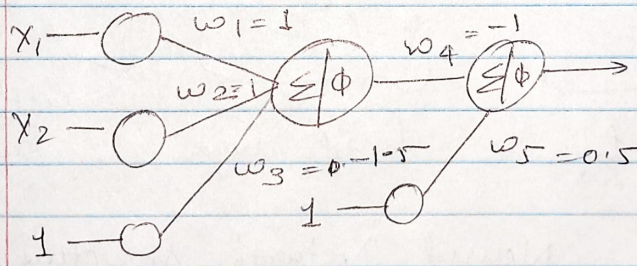
Draw a Perceptron to implement the NAND gate $\overline{A \cap B} = \overline{A} \cup \overline{B}$ using the threshold activation function $\phi(x) = \begin{cases} 1, & x > 0 \\ 0, & x \leq 0 \end{cases}$.

Solve this problem by hand and show your work.

Ans.01 for NAND gate

x_1	x_2	y
0	0	1
0	1	1
1	0	1
1	1	0

Thu from here we can infer NAND gate to be NOT(AND) gate.
Thus, we can create a perceptron as follows. Let us consider $w_1, w_2 = 1$
$w_4 = 1$



∴ for the perceptron to be NAND gate

$w_3 = -1.5$
$w_5 = 0.5$

In [ ]:

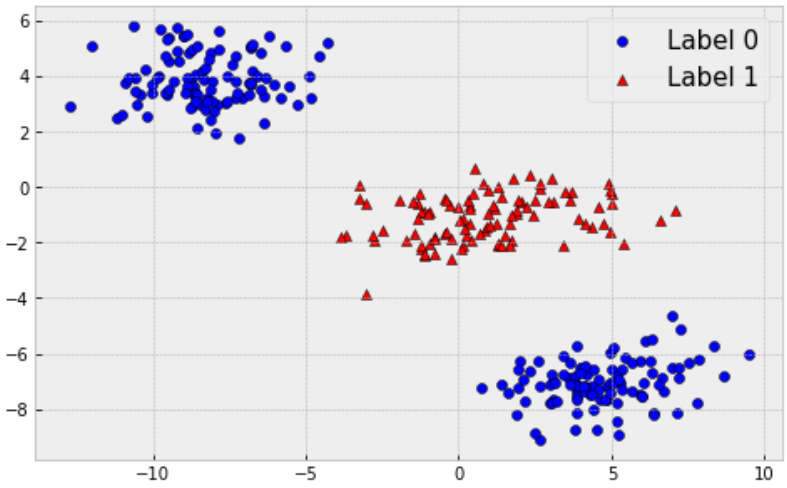
In [ ]:

Problem 2 (6 points)

Consider the following two-dimensional data set and desired values for a two-class classification problem:

In [2]:
```
from IPython.display import Image
Image('figures/classification.png', width=400)
```

Out[2]:

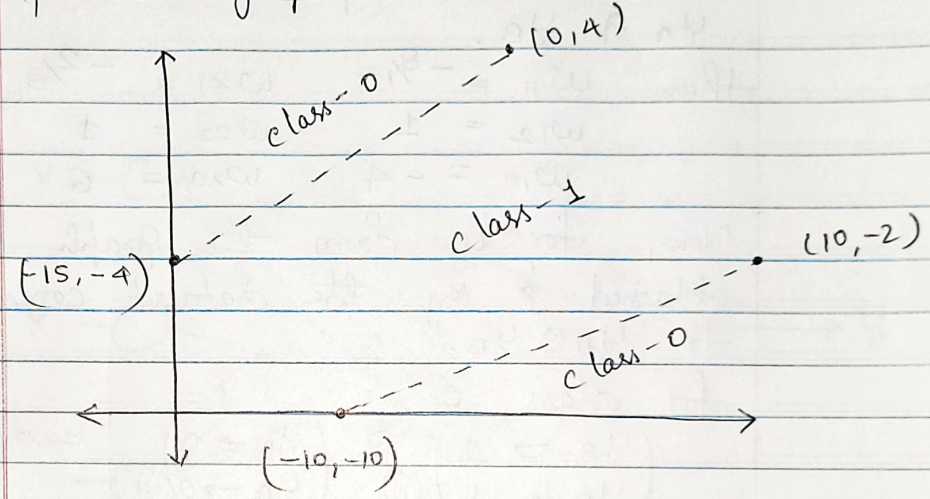


For the hard-limit activation function $\phi(x) = \begin{cases} 1, & x > 0 \\ 0, & x \leq 0 \end{cases}$, define a neural network structure and the associated parameter values that can solve this classification problem with zero error on this dataset.

Solve this problem by hand and show your work.

Ans 02 $\phi(x) = \begin{cases} 1, & x > 0 \\ 0, & x \leq 0 \end{cases}$

from the Graph in the dataset.



Thus, from this graph.

$V_{A1} = (-15,-4)$ & $(0,4) = V_{A2}$

$V_{B1} = (-10,-10)$ & $(10,-2) = V_{B2}$

$\therefore \quad m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$\therefore \quad m_1 = \dfrac{8}{15}$ & $m_2 = \dfrac{2}{5}$

$$\therefore \begin{cases} V_A \Rightarrow & x_2 - \frac{8}{15}x_1 - 4 = 0 \\ V_B \Rightarrow & x_2 - \frac{2}{5}x_1 + 6 = 0 \end{cases}$$

Thus:- $y_A = \phi\left(x_2 - \frac{8}{15}x_1 - 4\right)$

$y_B = \phi\left(x_2 - \frac{2}{5}x_1 + 6\right)$.

From the last equation we know have the value for parameter related to y_A & y_B.

Thus. $w_{11} = -8/5$ $\quad w_{21} = -2/5$

$w_{12} = 1$ $\quad w_{22} = 1$

$w_{10} = -4$ $\quad w_{20} = 6$

Now, for y. from the graph drawn obtained by the dataset corresponding to y_A & y_B.

for class 0

$\begin{pmatrix} y_A \Rightarrow 1 \\ y_B \Rightarrow 1 \end{pmatrix}$ (i) & $\begin{pmatrix} y_A \Rightarrow 0 \\ y_B \Rightarrow 0 \end{pmatrix}$ (ii)

for class 1

$\begin{pmatrix} y_A \Rightarrow 0 \\ y_B \Rightarrow 1 \end{pmatrix}$ (iii)

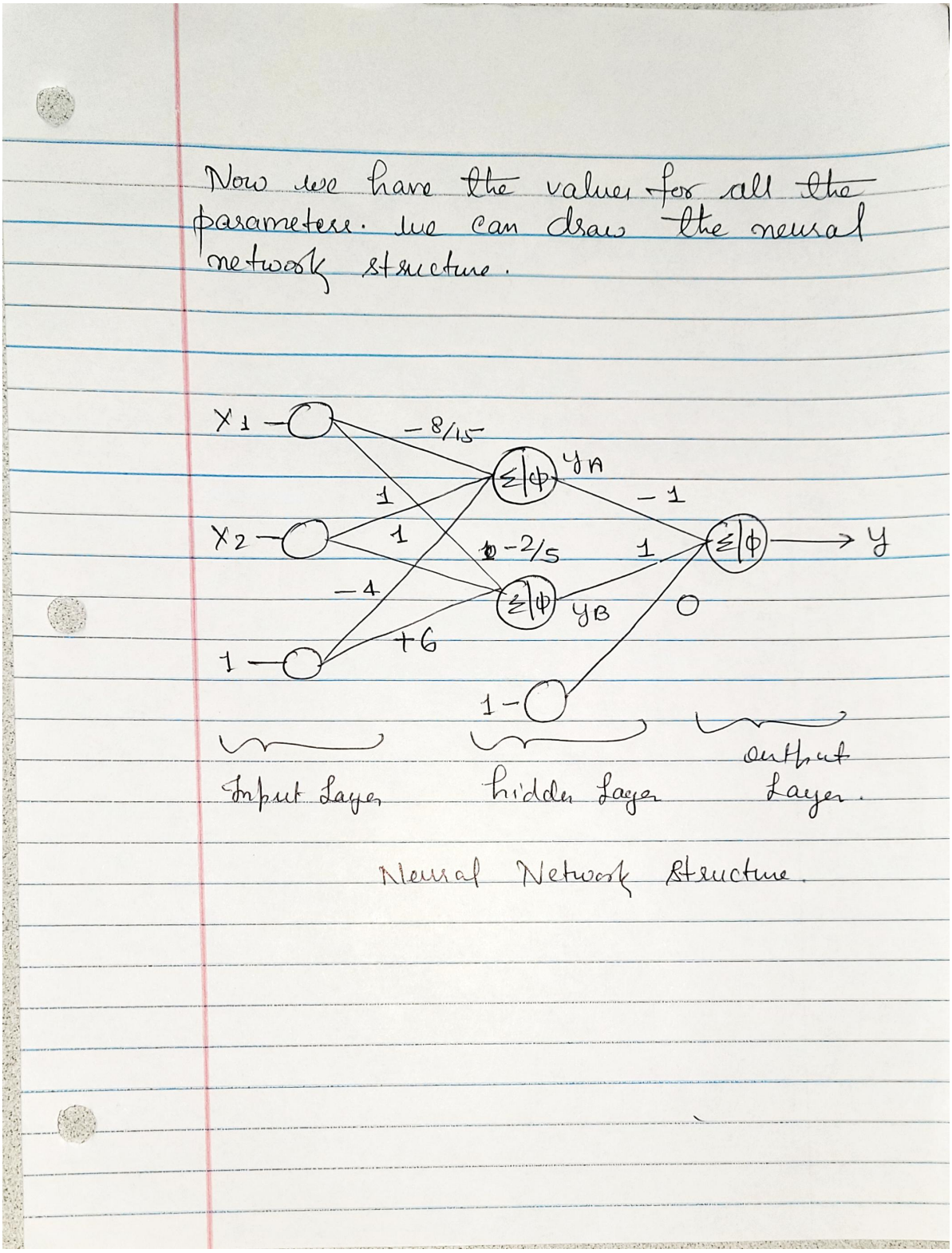
The equation of $y = w_A y_A + w_B y_B + w_C$ from (i), (ii) & (iii)

$w_A \cdot 1 + w_B \cdot 1 + w_C = 0$

$w_A \cdot 0 + w_B \cdot 0 + w_C = 0$

$w_A \cdot 0 + w_B \cdot 1 + w_C = 1$

Thus: $w_A = -1$, $w_B = 1$, $w_C = 0$



Submit Your Solution

Confirm that you've successfully completed the assignment.

Along with the Notebook, include a PDF of the notebook with your solutions.

`add` and `commit` the final version of your work, and `push` your code to your GitHub repository.

Submit the URL of your GitHub Repository as your assignment submission on Canvas.
