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MIT WORLD PEACE UNIVERSITY | PUNE
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MIT-WPU
॥ विश्वशान्तिर्ध्रुवं ध्रुवा ॥

# ASSIGNMENT / TEST BOOKLET

Student's Name : Vishwa Singh

Class : OE2 Division : A Roll No.: PA10 Academic Year : 2020-2021

Subject : Soft Computing Assignment / Test No. : 2 Date : 1/8/2021

**PLEDGE**

I solemnly affirm that I have written this Assignment/Test based on my own preparation. I have neither copied it from others nor given it to others for coping. I know that this is to be submitted as a part of my submission at the end of the term.

Vishwa

Signature of the student

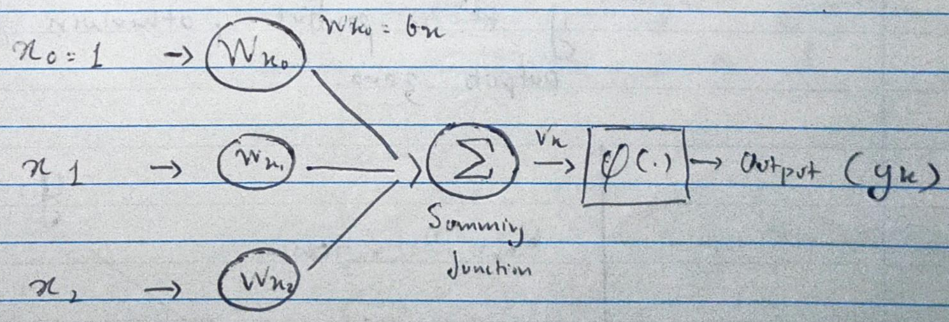
| Q. No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Marks/Grade | | | | | | | | | | | |

Name & sign of the faculty Member

(Please start writing assignment/ test from here)

## Question 1

The perceptron is the simplest form of a neural network used for the classification of patterns said to be linearly separable.

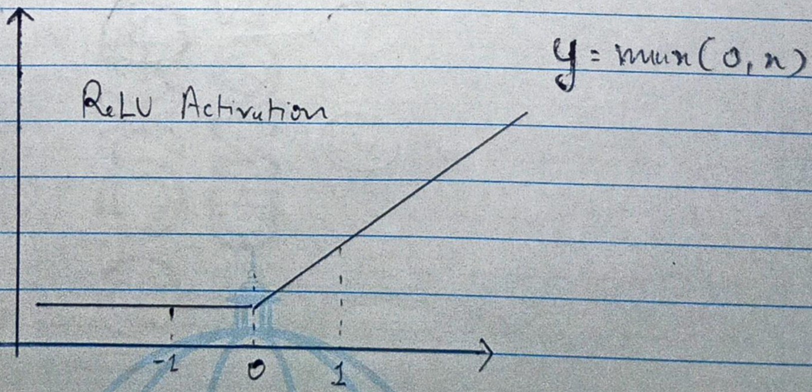


## Limitations :

- Output values can only be either 0 or 1 due to the hard limit transfer function.
- Can only classify linearly separable sets of vector
- Not effective until used in a DNN.

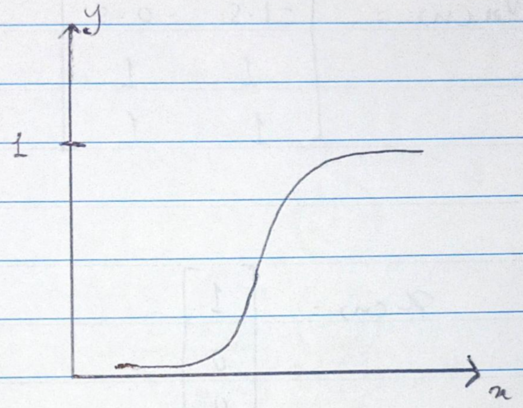
## Question 2

1) **ReLU activation** : The rectified Linear Unit or ReLU is a piecewise linear function that will output the input directly if it is positive, otherwise, it outputs zero.




The advantage of ReLU is that it doesn't activate all neurons at the same time.

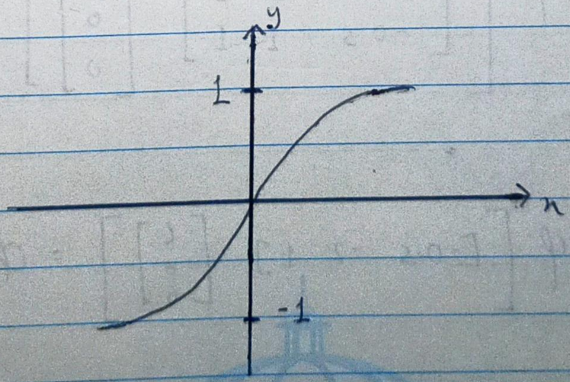
2) <u>Sigmoid</u> : This function gives a value between 0 to 1.



$$y = \frac{1}{1+e^{-x}}$$

This is mostly used ~~to~~ in the output nodes for probabilistic models.

3) <u>Tanh</u> : It is a hyperbolic tangent function that returns a value -1 to 1.



$$y = \tanh(x)$$

With this, negative inputs will be mapped strongly negative, and positive to strongly positive.

## Question 3

### CASE 1 :

$$W_H(n) = \begin{bmatrix} -1.5 & -0.5 \\ 1 & 1 \\ 1 & 1 \end{bmatrix}$$

1) [0,0]

$$x(n) = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

$$y^H(n) = \varphi\left[\begin{bmatrix} -1.5 & -0.5 \\ 1 & 1 \\ 1 & 1 \end{bmatrix}^T \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}\right]$$

$$= \varphi\left[\begin{bmatrix} -1.5 & 1 & 1 \\ -0.5 & 1 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}\right] = \varphi\begin{bmatrix} -1.5 \\ -0.5 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$y^o(n) = \varphi\left[\begin{bmatrix} -0.5 & -2 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}\right] = \varphi\left[-0.5\right] = 0$$

2) $[0, 1]$

$$x_n = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

$$y^{H}(n) = \varphi\left[\begin{bmatrix} -1.5 & 1 & 1 \\ -0.5 & 1 & 1 \end{bmatrix}\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}\right] = \varphi\begin{bmatrix} -0.5 \\ 0.5 \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$y^{o}(n) = \varphi\left[\begin{bmatrix} -0.5 & -2 & 1 \end{bmatrix}\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}\right] = \varphi(0.5)$$

$$= 1$$

3) $[1, 0]$

$$x_n = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$$

$$y^{H}(n) = \varphi\left[\begin{bmatrix} -1.5 & 1 & 1 \\ -0.5 & 1 & 1 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}\right] = \varphi\begin{bmatrix} -0.5 \\ 0.5 \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$y^{o}(n) = \varphi\left[\begin{bmatrix} -0.5 & -2 & 1 \end{bmatrix}\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}\right] = \varphi[0.5] = 1$$

4) [1, 1]

$$x_n = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$y^{x}(n) = \varphi \left[ \begin{bmatrix} -1.5 & 1 & 1 \\ -0.5 & 1 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \right] = \varphi \begin{bmatrix} 0.5 \\ 1.5 \end{bmatrix}$$

$$= \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$y^{o}(n) = \varphi \left[ \begin{bmatrix} -0.5 & -2 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \right] = \varphi [-1.5]$$

$$= 0$$

CASE 2

1) $$W_n(n) = \begin{bmatrix} 1.5 & 0.5 \\ -1 & -1 \\ -1 & -1 \end{bmatrix}$$

1 $\underline{[0,0]}$

$$x_n = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

$$y^H(n) = \varphi\left[\begin{bmatrix} 1.5 & -1 & -1 \\ 0.5 & -1 & -1 \end{bmatrix}\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}\right] = \varphi\begin{bmatrix} 1.5 \\ 0.5 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$y^o(n) = \varphi\left[\begin{bmatrix} -0.5 & 1 & -1 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}\right] = \varphi[-0.5]$$

$$= 0$$

2 $\underline{[0,1]}$

$$x_n = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

$$y^H(n) = \varphi\left[\begin{bmatrix} 1.5 & -1 & -1 \\ 0.5 & -1 & -1 \end{bmatrix}\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}\right] = \varphi\begin{bmatrix} 0.5 \\ -0.5 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$y^o(n) = \varphi\left[\begin{bmatrix} -0.5 & 1 & -1 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}\right] = \varphi[0.5] =$$

$$1$$

3 [1, 0]

$$x_n = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$$

$$y^{H}(n) = \varphi\left[\begin{bmatrix} 1.5 & -1 & -1 \\ 0.5 & -1 & -1 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}\right] = \varphi\begin{bmatrix} 0.5 \\ -0.5 \end{bmatrix}$$

$$= \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

$$y^{o}(n) = \varphi\left[\begin{bmatrix} -0.5 & 1 & -1 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}\right] = \varphi[0.5] = 1$$

4 [1, 1]

$$x_n = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$y^{H}(n) = \varphi\left[\begin{bmatrix} 1.5 & -1 & -1 \\ 0.5 & -1 & -1 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}\right] = \varphi\begin{bmatrix} -0.5 \\ -1.5 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$y^{o}(n) = \varphi\left[\begin{bmatrix} -0.5 & 1 & -1 \end{bmatrix}\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}\right] = \varphi[-0.5]$$

$$= 0$$