Terna Engineering College
Computer Engineering Department

Program: Sem VII

Course: Artificial Intelligence & Soft Computing (AI&SC)

Experiment No. 08

PART B

(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per the following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Blackboard access available)

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Class: BE-COMPS-50	Batch: B3
Date of Experiment: 05-10-2021	Date of Submission: 05-10-2021
Grade :	

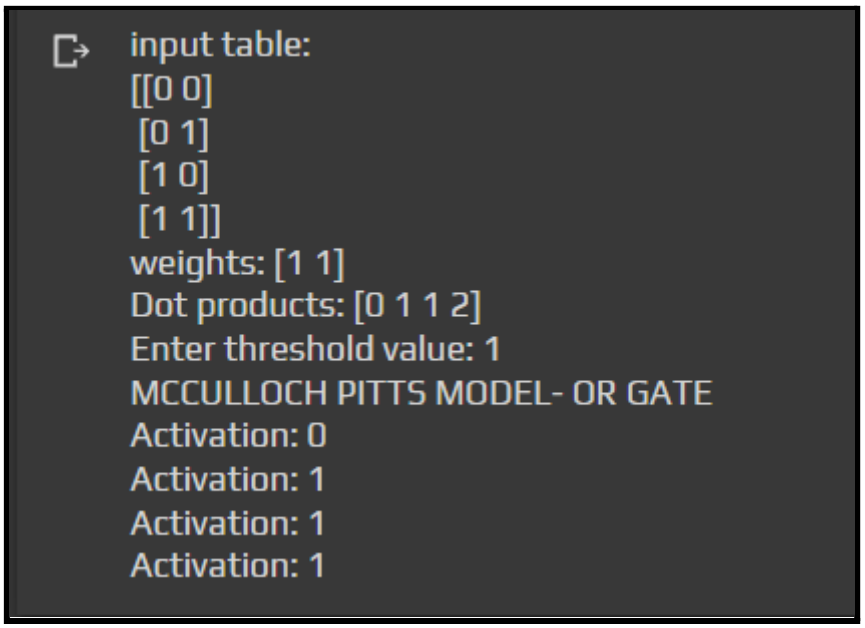
Aim: To implement McCulloch Pitts Neuron Model for AND/OR functions.

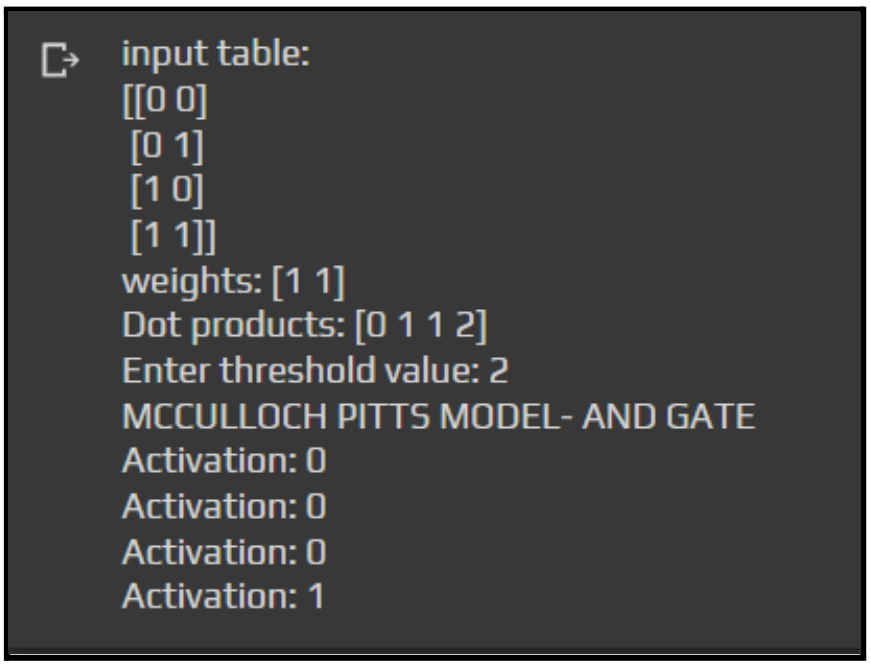
B.1 Software Code written by a student:

```
import numpy as np

def linear_threshold_gate(dot: int, T: float) -> int:
  '''Returns the binary threshold output'''
  if (dot >= T):
    return 1
  else:
    return 0

# matrix of inputs
input_table = np.array([
[0,0], # both no
[0,1], # one no, one yes
[1,0], # one yes, one no
[1,1] # bot yes
])
print(f'input table:\n{input_table}')
# array of weights
weights = np.array([1,1])
print(f'weights: {weights}')
# dot product matrix of inputs and weights
```

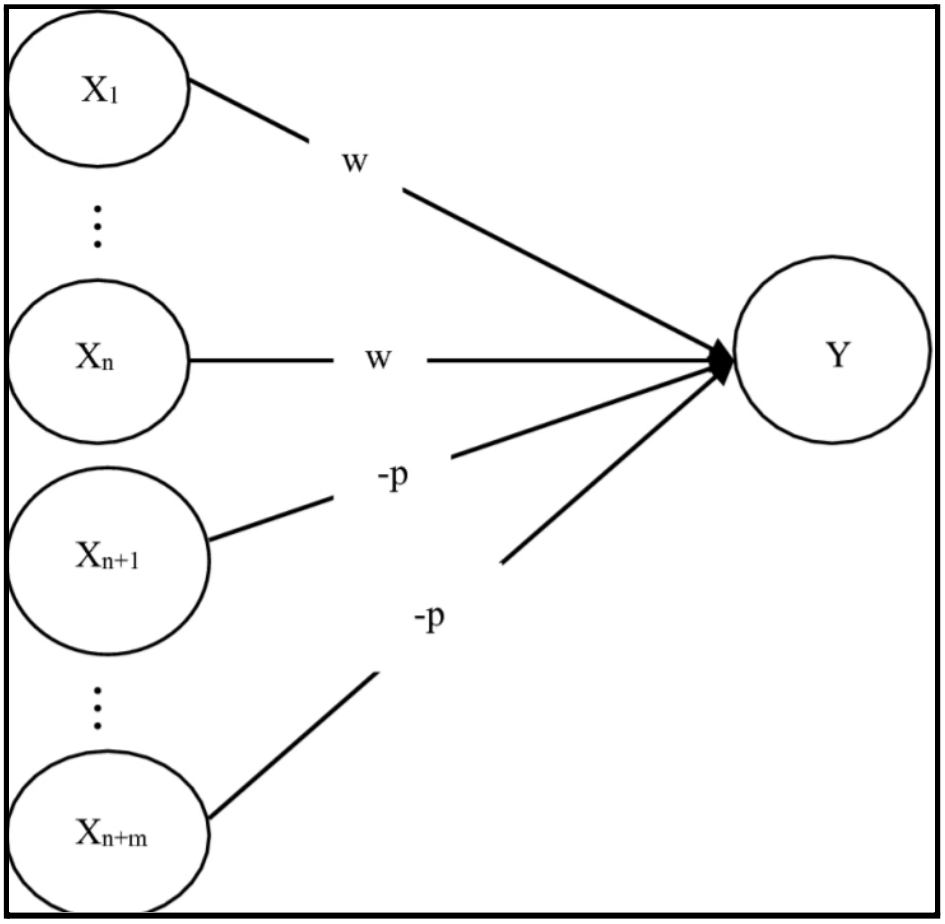
```
dot_products = input_table @ weights
print(f'Dot products: {dot_products}')
T = int(input("Enter threshold value: "))
if(T==1):
  print("MCCULLOCH PITTS MODEL- OR GATE")
if(T==2):
  print("MCCULLOCH PITTS MODEL- AND GATE")
for i in range(0,4):
  activation = linear_threshold_gate(dot_products[i], T)
  print(f'Activation: {activation}')
```

B.2 Input and Output:





B.3 Observations and learning:



Excitatory have positive weight and which denoted by "w" and inhibitory have negative weight and which is denoted by "p".

- ➔ The neuron fires if the net input to the neuron is greater than the threshold.
- ➔ The threshold is set so that the inhibition is absolute because nonzero inhibitory input will prevent the neuron from firing.
- ➔ It takes only one step for a signal to pass over one connection link. In this "y" is taken as output and X1, X2.....Xn (excitatory) & Xn+1, Xn+2....., Xn+m (inhibitory) are taken as input signals. The McCulloch Pitts neuron Y has the activation function:

$$F(y_{in}) = \begin{cases} 1 & \text{if } y\text{-}_{in} \geq \Theta \\ 0 & \text{if } y\text{-}_{in} < \Theta \end{cases}$$

Where Θ=threshold Y=net output

B.4 Conclusion:

We have successfully implemented a program to learn McCulloch Pitts Neuron Model for AND/OR functions.

B.5 Question of Curiosity

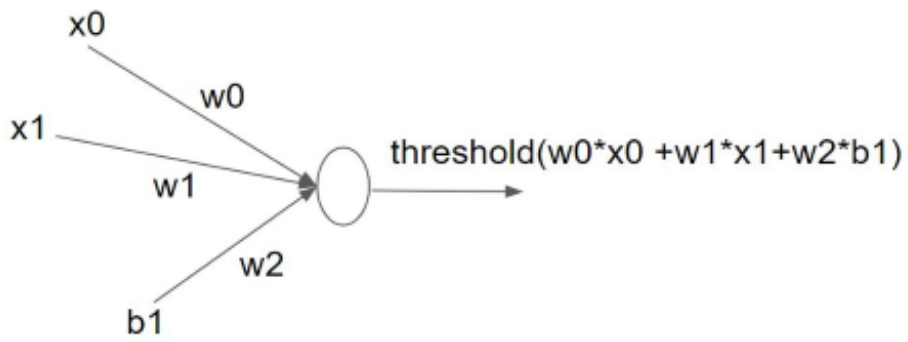
(To be answered by student based on the practical performed and learning/observations)

Q1)

Consider the neural network below. Find the appropriate weights for w0, w1 and w2 to represent the AND function.

Threshold function={1, if output >0; 0 otherwise}.

x0 and x1 are the inputs and b1=1 is the bias.



a. w0=1, w1=1, w2=1
b. w0=1, w1=1, w2=-1
c. w0=-1, w1=-1, w2=-1
d. w0=2, w1=-2, w3=-1

Ans: b. w0 =1, w1 = 1, w2 = -1

Q2)

Which of the combination of weights make the network represent OR function:

a. w0=1,w1=1,w2=0
b. w0=1, w2=1, w3=1
c. w0=1, w1=1, w2=-1
d. w0=-1, w1=-1, w2=-1

Ans: a. w0 =1, w1 = 1, w2 = 0