ST.FRANCIS INSTITUTE OF TECHNOLOGY

Mount Poinsur, S.V.P. Road, Borivli (West), Mumbai - 400103

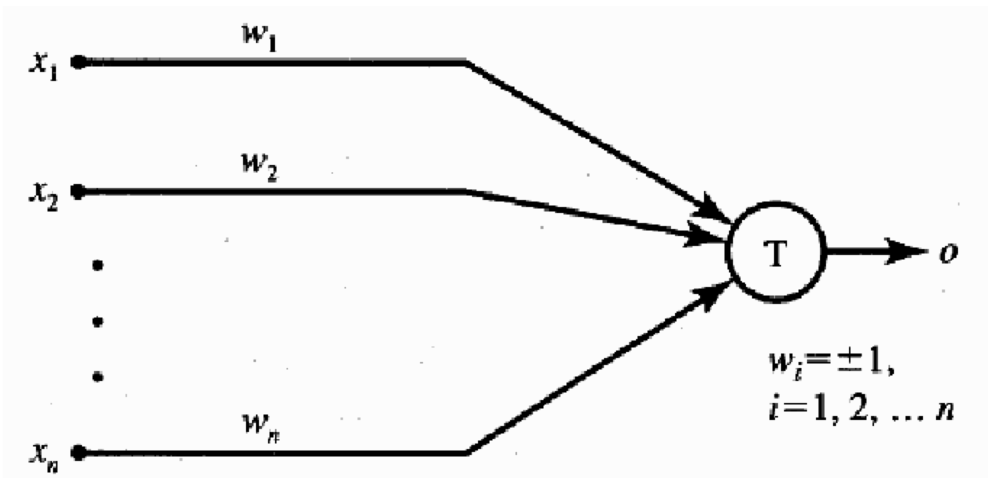
Computer Engineering Department
Experiment No. 05

Aim:

To implement McCulloch-Pitts Neuron Model

Theory:

The first formal definition of a synthetic neuron model based on the highly simplified considerations of the biological model was formulated by McCulloch and Pitts (1943). The McCulloch-Pitts model of the neuron is as shown below:



The inputs x_i, for i = 1, 2, . . . , n, are 0 or 1, depending on the absence or presence of the input impulse at instant k. The neuron's output signal is denoted as o. The firing rule for this model is defined as follows:

$$o^{k+1} = \begin{cases} 1 & \text{if } \sum_{i=1}^{n} w_i x_i^k \geq T \\ 0 & \text{if } \sum_{i=1}^{n} w_i x_i^k < T \end{cases}$$

where superscript k = 0, 1, 2, . . . denotes the discrete-time 'instant, and w_i is the multiplicative weight connecting the i'th input with the neuron's membrane. We will assume that a unity delay elapses between the instants k and k + 1. Note that w_i = + 1 for excitatory synapses, w_i = - 1 for inhibitory synapses for this model, and T is the neuron's threshold value, which needs to be exceeded by the weighted sum of signals for the neuron to fire.

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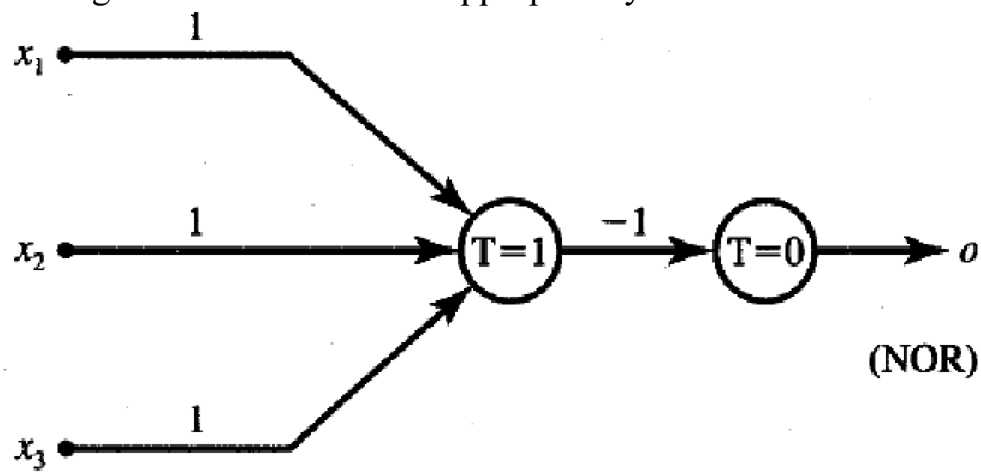
Although this neuron model is very simplistic, it has substantial computing potential. It can perform the basic logic operations NOT, OR, and AND, provided its weights and thresholds are appropriately selected.



Experiment:

Design Mc. Culloc Pitts Model for the following logic functions.

1. AND
2. OR
3. AND NOT
4. NAND
5. NOR

Conclusion: The implementation of Mc Culloch Pitts Model was done.