Name: Krish Sukhani

UID: 2018140059

Batch: D ¶

Branch: IT

Multicategory Single Layered Classifiers

In [1]:

```
import numpy as np
import math
```

In [2]:

```
input = np.array([[1,0,0,1],[1,0,1,1],[0,1,0,1],[0,0,0,1],[1,1,0,1],[1,1,
1,1],[0,1,1,1],[0,0,1,1]])
```

In [3]:

```
output = np.array([[1,0,0,0],[0,1,0,0],[0,0,1,0],[0,0,0,1],[1,0,0,0],[0,1
,0,0],[0,0,1,0],[0,0,0,1]])
```

In [4]:

```
def unipolar_bin(imp):
    value = 0
    if imp >= 0:
        value = 1
    return value
```

In [5]:

```
def bipolar_con(inp):
    return (2/(1+math.exp(-inp))-1)
```

RDPTA

In [6]:

```
W=np.array([[0]*4]*4).astype(float)
lr=1
```

In [7]:

```
def RCPTA(X, Y):
    for i in range(100):
        print("\nIteration No. ", i+1)
        err_val = 0
        for j in range(X.shape[0]):
            print("Input ", j+1, " : " , str(X[j]))
            for k in range(X.shape[1]):
                print("\nCurrent Weight: " + str(W[k]))
                z = np.dot(X[j],W[k])
                y = unipolar_bin(z)
                actual = Y[j][k]
                print("\nActual: ",actual)
                print("\nPredicted: ",y)
                e = actual - y
                err_val += 0.5*e**2
                r = lr*e
                delW=np.dot(r,X[j])
                W[k] += delW
                print("\nUpdated Weight: "+str(W[k]))
        if err_val==0:
            break
    print("\nTotal Interations->",i+1)
    print("Final Weights ->")
    print(W)
```

In [8]:

```
RCPTA(input,output)
```

```
Iteration No.  1
Input  1  :  [1 0 0 1]

Current Weight: [0. 0. 0. 0.]

Actual:  1

Predicted:  1

Updated Weight: [0. 0. 0. 0.]

Current Weight: [0. 0. 0. 0.]

Actual:  0

Predicted:  1

Updated Weight: [-1.  0.  0. -1.]

Current Weight: [0. 0. 0. 0.]

Actual:  0

Predicted:  1

Updated Weight: [-1.  0.  0. -1.]

Current Weight: [0. 0. 0. 0.]

Actual:  0

Predicted:  1

Updated Weight: [-1.  0.  0. -1.]
Input  2  :  [1 0 1 1]

Current Weight: [0. 0. 0. 0.]

Actual:  0

Predicted:  1

Updated Weight: [-1.  0. -1. -1.]

Current Weight: [-1.  0.  0. -1.]

Actual:  1

Predicted:  0

Updated Weight: [0. 0. 1. 0.]
```

```
Current Weight: [-1.  0.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  0.  0. -1.]

Current Weight: [-1.  0.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  0.  0. -1.]
Input  3  :  [0 1 0 1]

Current Weight: [-1.  0. -1. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  0. -1. -1.]

Current Weight: [0. 0. 1. 0.]

Actual:  0

Predicted:  1

Updated Weight: [ 0. -1.  1. -1.]

Current Weight: [-1.  0.  0. -1.]

Actual:  1

Predicted:  0

Updated Weight: [-1.  1.  0.  0.]

Current Weight: [-1.  0.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  0.  0. -1.]
Input  4  :  [0 0 0 1]

Current Weight: [-1.  0. -1. -1.]
```

```
Actual:  0

Predicted:  0

Updated Weight: [-1.  0. -1. -1.]

Current Weight: [ 0. -1.  1. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 0. -1.  1. -1.]

Current Weight: [-1.  1.  0.  0.]

Actual:  0

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1.  0.  0. -1.]

Actual:  1

Predicted:  0

Updated Weight: [-1.  0.  0.  0.]
Input  5  :  [1 1 0 1]

Current Weight: [-1.  0. -1. -1.]

Actual:  1

Predicted:  0

Updated Weight: [ 0.  1. -1.  0.]

Current Weight: [ 0. -1.  1. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 0. -1.  1. -1.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0
```

```
Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1.  0.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  0.  0.  0.]
Input  6  :  [1 1 1 1]

Current Weight: [ 0.  1. -1.  0.]

Actual:  0

Predicted:  1

Updated Weight: [-1.  0. -2. -1.]

Current Weight: [ 0. -1.  1. -1.]

Actual:  1

Predicted:  0

Updated Weight: [1. 0. 2. 0.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1.  0.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  0.  0.  0.]
Input  7  :  [0 1 1 1]

Current Weight: [-1.  0. -2. -1.]

Actual:  0

Predicted:  0
```

```
Updated Weight: [-1.  0. -2. -1.]

Current Weight: [1. 0. 2. 0.]

Actual:  0

Predicted:  1

Updated Weight: [ 1. -1.  1. -1.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1.  0.  0.  0.]

Actual:  0

Predicted:  1

Updated Weight: [-1. -1. -1. -1.]
Input  8  :  [0 0 1 1]

Current Weight: [-1.  0. -2. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  0. -2. -1.]

Current Weight: [ 1. -1.  1. -1.]

Actual:  0

Predicted:  1

Updated Weight: [ 1. -1.  0. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1. -1. -1.]
```

```
Actual:  1

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]

Iteration No.  2
Input  1  :  [1 0 0 1]

Current Weight: [-1.  0. -2. -1.]

Actual:  1

Predicted:  0

Updated Weight: [ 0.  0. -2.  0.]

Current Weight: [ 1. -1.  0. -2.]

Actual:  0

Predicted:  0

Updated Weight: [ 1. -1.  0. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  2  :  [1 0 1 1]

Current Weight: [ 0.  0. -2.  0.]

Actual:  0

Predicted:  0

Updated Weight: [ 0.  0. -2.  0.]

Current Weight: [ 1. -1.  0. -2.]
```

```
Actual:  1

Predicted:  0

Updated Weight: [ 2. -1.  1. -1.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  3  :  [0 1 0 1]

Current Weight: [ 0.  0. -2.  0.]

Actual:  0

Predicted:  1

Updated Weight: [ 0. -1. -2. -1.]

Current Weight: [ 2. -1.  1. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1.  1. -1.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0
```

```
Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  4  :  [0 0 0 1]

Current Weight: [ 0. -1. -2. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 0. -1. -2. -1.]

Current Weight: [ 2. -1.  1. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1.  1. -1.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]
Input  5  :  [1 1 0 1]

Current Weight: [ 0. -1. -2. -1.]

Actual:  1

Predicted:  0

Updated Weight: [ 1.  0. -2.  0.]

Current Weight: [ 2. -1.  1. -1.]

Actual:  0

Predicted:  1
```

```
Updated Weight: [ 1. -2.  1. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  6  :  [1 1 1 1]

Current Weight: [ 1.  0. -2.  0.]

Actual:  0

Predicted:  0

Updated Weight: [ 1.  0. -2.  0.]

Current Weight: [ 1. -2.  1. -2.]

Actual:  1

Predicted:  0

Updated Weight: [ 2. -1.  2. -1.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  7  :  [0 1 1 1]
```

```
Current Weight: [ 1.  0. -2.  0.]

Actual:  0

Predicted:  0

Updated Weight: [ 1.  0. -2.  0.]

Current Weight: [ 2. -1.  2. -1.]

Actual:  0

Predicted:  1

Updated Weight: [ 2. -2.  1. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  8  :  [0 0 1 1]

Current Weight: [ 1.  0. -2.  0.]

Actual:  0

Predicted:  0

Updated Weight: [ 1.  0. -2.  0.]

Current Weight: [ 2. -2.  1. -2.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -2.  1. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0
```

```
Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]

Iteration No.  3
Input  1  :  [1 0 0 1]

Current Weight: [ 1.  0. -2.  0.]

Actual:  1

Predicted:  1

Updated Weight: [ 1.  0. -2.  0.]

Current Weight: [ 2. -2.  1. -2.]

Actual:  0

Predicted:  1

Updated Weight: [ 1. -2.  1. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  2  :  [1 0 1 1]

Current Weight: [ 1.  0. -2.  0.]

Actual:  0
```

```
Predicted:  0

Updated Weight: [ 1.  0. -2.  0.]

Current Weight: [ 1. -2.  1. -3.]

Actual:  1

Predicted:  0

Updated Weight: [ 2. -2.  2. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  3  :  [0 1 0 1]

Current Weight: [ 1.  0. -2.  0.]

Actual:  0

Predicted:  1

Updated Weight: [ 1. -1. -2. -1.]

Current Weight: [ 2. -2.  2. -2.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -2.  2. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1
```

```
Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  4  :  [0 0 0 1]

Current Weight: [ 1. -1. -2. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 1. -1. -2. -1.]

Current Weight: [ 2. -2.  2. -2.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -2.  2. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]
Input  5  :  [1 1 0 1]

Current Weight: [ 1. -1. -2. -1.]

Actual:  1

Predicted:  0

Updated Weight: [ 2.  0. -2.  0.]
```

```
Current Weight: [ 2. -2.  2. -2.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -2.  2. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  6  :  [1 1 1 1]

Current Weight: [ 2.  0. -2.  0.]

Actual:  0

Predicted:  1

Updated Weight: [ 1. -1. -3. -1.]

Current Weight: [ 2. -2.  2. -2.]

Actual:  1

Predicted:  1

Updated Weight: [ 2. -2.  2. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0
```

```
Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  7  :  [0 1 1 1]

Current Weight: [ 1. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 1. -1. -3. -1.]

Current Weight: [ 2. -2.  2. -2.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -2.  2. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  8  :  [0 0 1 1]

Current Weight: [ 1. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 1. -1. -3. -1.]

Current Weight: [ 2. -2.  2. -2.]

Actual:  0

Predicted:  1
```

```
Updated Weight: [ 2. -2.  1. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]

Iteration No.  4
Input  1  :  [1 0 0 1]

Current Weight: [ 1. -1. -3. -1.]

Actual:  1

Predicted:  1

Updated Weight: [ 1. -1. -3. -1.]

Current Weight: [ 2. -2.  1. -3.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -2.  1. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0
```

```
Updated Weight: [-1. -1.  0.  0.]
Input  2  :  [1 0 1 1]

Current Weight: [ 1. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 1. -1. -3. -1.]

Current Weight: [ 2. -2.  1. -3.]

Actual:  1

Predicted:  1

Updated Weight: [ 2. -2.  1. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  3  :  [0 1 0 1]

Current Weight: [ 1. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 1. -1. -3. -1.]

Current Weight: [ 2. -2.  1. -3.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -2.  1. -3.]
```

```
Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  4  :  [0 0 0 1]

Current Weight: [ 1. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 1. -1. -3. -1.]

Current Weight: [ 2. -2.  1. -3.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -2.  1. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]
Input  5  :  [1 1 0 1]

Current Weight: [ 1. -1. -3. -1.]
```

```
Actual:  1

Predicted:  0

Updated Weight: [ 2.  0. -3.  0.]

Current Weight: [ 2. -2.  1. -3.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -2.  1. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  6  :  [1 1 1 1]

Current Weight: [ 2.  0. -3.  0.]

Actual:  0

Predicted:  0

Updated Weight: [ 2.  0. -3.  0.]

Current Weight: [ 2. -2.  1. -3.]

Actual:  1

Predicted:  0

Updated Weight: [ 3. -1.  2. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0
```

```
Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  7  :  [0 1 1 1]

Current Weight: [ 2.  0. -3.  0.]

Actual:  0

Predicted:  0

Updated Weight: [ 2.  0. -3.  0.]

Current Weight: [ 3. -1.  2. -2.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -2.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  8  :  [0 0 1 1]

Current Weight: [ 2.  0. -3.  0.]

Actual:  0

Predicted:  0

Updated Weight: [ 2.  0. -3.  0.]
```

```
Current Weight: [ 3. -1.  2. -2.]

Actual:  0

Predicted:  1

Updated Weight: [ 3. -1.  1. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]

Iteration No.  5
Input  1  :  [1 0 0 1]

Current Weight: [ 2.  0. -3.  0.]

Actual:  1

Predicted:  1

Updated Weight: [ 2.  0. -3.  0.]

Current Weight: [ 3. -1.  1. -3.]

Actual:  0

Predicted:  1

Updated Weight: [ 2. -1.  1. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]
```

```
Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  2  :  [1 0 1 1]

Current Weight: [ 2.  0. -3.  0.]

Actual:  0

Predicted:  0

Updated Weight: [ 2.  0. -3.  0.]

Current Weight: [ 2. -1.  1. -4.]

Actual:  1

Predicted:  0

Updated Weight: [ 3. -1.  2. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  3  :  [0 1 0 1]

Current Weight: [ 2.  0. -3.  0.]

Actual:  0

Predicted:  1

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -3.]
```

```
Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  4  :  [0 0 0 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -3.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1
```

```
Updated Weight: [-1. -1.  0.  0.]
Input  5  :  [1 1 0 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  1

Predicted:  1

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -3.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  6  :  [1 1 1 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -3.]

Actual:  1

Predicted:  1

Updated Weight: [ 3. -1.  2. -3.]
```

```
Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  7  :  [0 1 1 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -3.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  8  :  [0 0 1 1]

Current Weight: [ 2. -1. -3. -1.]
```

```
Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -3.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]

Iteration No.  6
Input  1  :  [1 0 0 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  1

Predicted:  1

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -3.]

Actual:  0

Predicted:  1

Updated Weight: [ 2. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]
```

```
Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  2  :  [1 0 1 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 2. -1.  2. -4.]

Actual:  1

Predicted:  1

Updated Weight: [ 2. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  3  :  [0 1 0 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0
```

```
Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 2. -1.  2. -4.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  4  :  [0 0 0 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 2. -1.  2. -4.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]
```

```
Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]
Input  5  :  [1 1 0 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  1

Predicted:  1

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 2. -1.  2. -4.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  6  :  [1 1 1 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 2. -1.  2. -4.]
```

```
Actual:  1

Predicted:  0

Updated Weight: [ 3.  0.  3. -3.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  7  :  [0 1 1 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3.  0.  3. -3.]

Actual:  0

Predicted:  1

Updated Weight: [ 3. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0
```

```
Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  8  :  [0 0 1 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -4.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]

Iteration No.  7
Input  1  :  [1 0 0 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  1

Predicted:  1

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -4.]

Actual:  0
```

```
Predicted:  0

Updated Weight: [ 3. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  2  :  [1 0 1 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -4.]

Actual:  1

Predicted:  1

Updated Weight: [ 3. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
```

```
Input  3  :  [0 1 0 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -4.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  4  :  [0 0 0 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -4.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]
```

```
Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]
Input  5  :  [1 1 0 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  1

Predicted:  1

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -4.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  6  :  [1 1 1 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0
```

```
Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -4.]

Actual:  1

Predicted:  1

Updated Weight: [ 3. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  7  :  [0 1 1 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -4.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  1

Predicted:  1
```

```
Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  0

Predicted:  0

Updated Weight: [-1. -1.  0.  0.]
Input  8  :  [0 0 1 1]

Current Weight: [ 2. -1. -3. -1.]

Actual:  0

Predicted:  0

Updated Weight: [ 2. -1. -3. -1.]

Current Weight: [ 3. -1.  2. -4.]

Actual:  0

Predicted:  0

Updated Weight: [ 3. -1.  2. -4.]

Current Weight: [-1.  1.  0. -1.]

Actual:  0

Predicted:  0

Updated Weight: [-1.  1.  0. -1.]

Current Weight: [-1. -1.  0.  0.]

Actual:  1

Predicted:  1

Updated Weight: [-1. -1.  0.  0.]

Total Interations-> 7
Final Weights ->
[[ 2. -1. -3. -1.]
 [ 3. -1.  2. -4.]
 [-1.  1.  0. -1.]
 [-1. -1.  0.  0.]]
```

MCPTA

In [9]:

```
W=np.array(np.random.rand(4,4)).astype(float)
lr=1
```

In [10]:

```
def MCPTA(X, Y):
    for i in range(100):
        print("Iteration No. ", i+1)
        for j in range(X.shape[0]):
            error = 0
            print("Input ", j+1, " : " , str(X[j]))
            for k in range(X.shape[1]):
                print("\nCurrent Weight: " + str(W[k]))
                z = np.dot(X[j],W[k])
                y = bipolar_con(z)
                actual = Y[j][k]
                print("\nActual: ",actual)
                print("\nPredicted: ",y)
                r=lr*0.5*(actual-y)*(1-y*y)
                delW=np.dot(r,X[j])
                W[k] += delW
                e = actual - y
                error += 0.5*e**2
                print("\nUpdated Weight: "+ str(W[k]))
        print("Final Error:", error, "\n")
        if error<0.4:
            break
    print("\nTotal Iterations ",i+1)
    print("Final Weights ")
    print(W)
```

In [11]:

```
MCPTA(input,output)
```

```
Iteration No.  1
Input  1  :  [1 0 0 1]

Current Weight: [0.39007198 0.83649959 0.82589872 0.8019288
2]

Actual:  1

Predicted:  0.5341974307646227

Updated Weight: [0.55651095 0.83649959 0.82589872 0.9683677
9]

Current Weight: [0.90638042 0.87749823 0.9149361  0.0732816
4]

Actual:  0

Predicted:  0.4540823132896017

Updated Weight: [ 0.72615305  0.87749823  0.9149361  -0.1069
4573]

Current Weight: [0.96357298 0.87805741 0.71978125 0.4650465
1]

Actual:  0

Predicted:  0.6133722489525115

Updated Weight: [0.77227    0.87805741 0.71978125 0.2737435
3]

Current Weight: [0.01066381 0.3366967  0.45523487 0.9584266
6]

Actual:  0

Predicted:  0.44987634533150334

Updated Weight: [-0.16874941  0.3366967   0.45523487  0.7790
1344]
Input  2  :  [1 0 1 1]

Current Weight: [0.55651095 0.83649959 0.82589872 0.9683677
9]

Actual:  0

Predicted:  0.8259920092243924
```

```
Updated Weight: [0.42528676 0.83649959 0.69467453 0.8371435
9]

Current Weight: [ 0.72615305  0.87749823  0.9149361  -0.1069
4573]

Actual:  1

Predicted:  0.6452234752235377

Updated Weight: [ 0.82969222  0.87749823  1.01847527 -0.0034
0657]

Current Weight: [0.77227    0.87805741 0.71978125 0.2737435
3]

Actual:  0

Predicted:  0.7078678612599811

Updated Weight: [0.59568419 0.87805741 0.54319544 0.0971577
2]

Current Weight: [-0.16874941  0.3366967   0.45523487  0.7790
1344]

Actual:  0

Predicted:  0.4874799780770682

Updated Weight: [-0.35456783  0.3366967   0.26941646  0.5931
9503]
Input  3  :  [0 1 0 1]

Current Weight: [0.42528676 0.83649959 0.69467453 0.8371435
9]

Actual:  0

Predicted:  0.6841218953714083

Updated Weight: [0.42528676 0.65453095 0.69467453 0.6551749
6]

Current Weight: [ 0.82969222  0.87749823  1.01847527 -0.0034
0657]

Actual:  0

Predicted:  0.4111927455269486

Updated Weight: [ 0.82969222  0.70666398  1.01847527 -0.1742
```

```
4082]

Current Weight: [0.59568419 0.87805741 0.54319544 0.0971577
2]

Actual:  1

Predicted:  0.45231552350183835

Updated Weight: [0.59568419 1.09587444 0.54319544 0.3149747
6]

Current Weight: [-0.35456783  0.3366967   0.26941646  0.5931
9503]

Actual:  0

Predicted:  0.43410663906956737

Updated Weight: [-0.35456783  0.16054677  0.26941646  0.4170
451 ]
Input  4  :  [0 0 0 1]

Current Weight: [0.42528676 0.65453095 0.69467453 0.6551749
6]

Actual:  0

Predicted:  0.3163513560519471

Updated Weight: [0.42528676 0.65453095 0.69467453 0.5128292
1]

Current Weight: [ 0.82969222  0.70666398  1.01847527 -0.1742
4082]

Actual:  0

Predicted:  -0.08690066200708824

Updated Weight: [ 0.82969222  0.70666398  1.01847527 -0.1311
1861]

Current Weight: [0.59568419 1.09587444 0.54319544 0.3149747
6]

Actual:  0

Predicted:  0.15619815223319478

Updated Weight: [0.59568419 1.09587444 0.54319544 0.2387811
3]
```

```
Current Weight: [-0.35456783  0.16054677  0.26941646  0.4170
451 ]

Actual:  1

Predicted:  0.20555190309942128

Updated Weight: [-0.35456783  0.16054677  0.26941646  0.7974
858 ]
Input  5  :  [1 1 0 1]

Current Weight: [0.42528676 0.65453095 0.69467453 0.5128292
1]

Actual:  1

Predicted:  0.6619763617839898

Updated Weight: [0.52023545 0.74947965 0.69467453 0.6077779
1]

Current Weight: [ 0.82969222  0.70666398  1.01847527 -0.1311
1861]

Actual:  0

Predicted:  0.6060273985607594

Updated Weight: [ 0.63796612  0.51493788  1.01847527 -0.3228
4471]

Current Weight: [0.59568419 1.09587444 0.54319544 0.2387811
3]

Actual:  0

Predicted:  0.7465740431930399

Updated Weight: [0.4304572  0.93064746 0.54319544 0.0735541
4]

Current Weight: [-0.35456783  0.16054677  0.26941646  0.7974
858 ]

Actual:  0

Predicted:  0.292897168096073

Updated Weight: [-0.48845277  0.02666183  0.26941646  0.6636
0086]
Input  6  :  [1 1 1 1]
```

```
Current Weight: [0.52023545 0.74947965 0.69467453 0.6077779
1]

Actual:  0

Predicted:  0.8580974129151473

Updated Weight: [0.40710868 0.63635288 0.58154776 0.4946511
4]

Current Weight: [ 0.63796612  0.51493788  1.01847527 -0.3228
4471]

Actual:  1

Predicted:  0.7279099033238887

Updated Weight: [ 0.70192731  0.57889908  1.08243646 -0.2588
8351]

Current Weight: [0.4304572  0.93064746 0.54319544 0.0735541
4]

Actual:  0

Predicted:  0.7569044728819039

Updated Weight: [ 0.26882191  0.76901216  0.38156015 -0.0880
8115]

Current Weight: [-0.48845277  0.02666183  0.26941646  0.6636
0086]

Actual:  0

Predicted:  0.23134796118751333

Updated Weight: [-0.59793566 -0.08282106  0.15993356  0.5541
1796]
Input  7  :  [0 1 1 1]

Current Weight: [0.40710868 0.63635288 0.58154776 0.4946511
4]

Actual:  0

Predicted:  0.6943339350521873

Updated Weight: [0.40710868 0.45655497 0.40174985 0.3148532
3]
```

```
Current Weight: [ 0.70192731  0.57889908  1.08243646 -0.2588
8351]

Actual:  0

Predicted:  0.6051453992081086

Updated Weight: [ 0.70192731  0.38712879  0.89066617 -0.4506
538 ]

Current Weight: [ 0.26882191  0.76901216  0.38156015 -0.0880
8115]

Actual:  1

Predicted:  0.4863326430624466

Updated Weight: [0.26882191 0.96509968 0.57764767 0.1080063
7]

Current Weight: [-0.59793566 -0.08282106  0.15993356  0.5541
1796]

Actual:  0

Predicted:  0.3055368289422229

Updated Weight: [-0.59793566 -0.22132812  0.0214265   0.4156
109 ]
Input  8  :  [0 0 1 1]

Current Weight: [0.40710868 0.45655497 0.40174985 0.3148532
3]

Actual:  0

Predicted:  0.34371710800783895

Updated Weight: [0.40710868 0.45655497 0.25019492 0.1632982
9]

Current Weight: [ 0.70192731  0.38712879  0.89066617 -0.4506
538 ]

Actual:  0

Predicted:  0.21652395674629554

Updated Weight: [ 0.70192731  0.38712879  0.7874798  -0.5538
4018]

Current Weight: [0.26882191 0.96509968 0.57764767 0.1080063
```

```
7]

Actual:  0

Predicted:  0.32999889962909856

Updated Weight: [ 0.26882191  0.96509968  0.43061654 -0.0390
2476]

Current Weight: [-0.59793566 -0.22132812  0.0214265   0.4156
109 ]

Actual:  1

Predicted:  0.21510575502141682

Updated Weight: [-0.59793566 -0.22132812  0.39571491  0.7898
9931]
Final Error: 0.44499116186963006

Iteration No.  2
Input  1  :  [1 0 0 1]

Current Weight: [0.40710868 0.45655497 0.25019492 0.1632982
9]

Actual:  1

Predicted:  0.2777141540170798

Updated Weight: [0.7403984  0.45655497 0.25019492 0.4965880
1]

Current Weight: [ 0.70192731  0.38712879  0.7874798  -0.5538
4018]

Actual:  0

Predicted:  0.07390855199165225

Updated Weight: [ 0.6651749   0.38712879  0.7874798  -0.5905
9259]

Current Weight: [ 0.26882191  0.96509968  0.43061654 -0.0390
2476]

Actual:  0

Predicted:  0.11439561153676459

Updated Weight: [ 0.21237261  0.96509968  0.43061654 -0.0954
7405]
```

```
Current Weight: [-0.59793566 -0.22132812  0.39571491  0.7898
9931]

Actual:  0

Predicted:  0.09568815820833398

Updated Weight: [-0.64534167 -0.22132812  0.39571491  0.7424
933 ]
Input  2  :  [1 0 1 1]

Current Weight: [0.7403984  0.45655497 0.25019492 0.4965880
1]

Actual:  0

Predicted:  0.6313096576610961

Updated Weight: [0.5505484  0.45655497 0.06034491 0.3067380
1]

Current Weight: [ 0.6651749   0.38712879  0.7874798  -0.5905
9259]

Actual:  1

Predicted:  0.4061826163136393

Updated Weight: [ 0.91309831  0.38712879  1.03540321 -0.3426
6918]

Current Weight: [ 0.21237261  0.96509968  0.43061654 -0.0954
7405]

Actual:  0

Predicted:  0.2671177646836522

Updated Weight: [ 0.08834341  0.96509968  0.30658734 -0.2195
0326]

Current Weight: [-0.64534167 -0.22132812  0.39571491  0.7424
933 ]

Actual:  0

Predicted:  0.24156296178133396

Updated Weight: [-0.75907523 -0.22132812  0.28198135  0.6287
5974]
Input  3  :  [0 1 0 1]
```

```
Current Weight: [0.5505484  0.45655497 0.06034491 0.3067380
1]

Actual:  0

Predicted:  0.3641364963043501

Updated Weight: [0.5505484  0.29862813 0.06034491 0.1488111
7]

Current Weight: [ 0.91309831  0.38712879  1.03540321 -0.3426
6918]

Actual:  0

Predicted:  0.02222614603915596

Updated Weight: [ 0.91309831  0.37602121  1.03540321 -0.3537
7676]

Current Weight: [ 0.08834341  0.96509968  0.30658734 -0.2195
0326]

Actual:  1

Predicted:  0.35643685392704727

Updated Weight: [0.08834341 1.2459998  0.30658734 0.0613968
6]

Current Weight: [-0.75907523 -0.22132812  0.28198135  0.6287
5974]

Actual:  0

Predicted:  0.20094373678581423

Updated Weight: [-0.75907523 -0.3177431   0.28198135  0.5323
4476]
Input  4  :  [0 0 0 1]

Current Weight: [0.5505484  0.29862813 0.06034491 0.1488111
7]

Actual:  0

Predicted:  0.07426858235685141

Updated Weight: [0.5505484  0.29862813 0.06034491 0.1118817
1]
```

```
Current Weight: [ 0.91309831  0.37602121  1.03540321 -0.3537
7676]

Actual:  0

Predicted:  -0.175066264937064

Updated Weight: [ 0.91309831  0.37602121  1.03540321 -0.2689
2636]

Current Weight: [0.08834341 1.2459998  0.30658734 0.0613968
6]

Actual:  0

Predicted:  0.03068879032298577

Updated Weight: [0.08834341 1.2459998  0.30658734 0.0460669
2]

Current Weight: [-0.75907523 -0.3177431   0.28198135  0.5323
4476]

Actual:  1

Predicted:  0.26005964810242777

Updated Weight: [-0.75907523 -0.3177431   0.28198135  0.8772
9348]
Input  5  :  [1 1 0 1]

Current Weight: [0.5505484  0.29862813 0.06034491 0.1118817
1]

Actual:  1

Predicted:  0.44666726394668976

Updated Weight: [0.7720166  0.52009634 0.06034491 0.3333499
1]

Current Weight: [ 0.91309831  0.37602121  1.03540321 -0.2689
2636]

Actual:  0

Predicted:  0.4700204463717954

Updated Weight: [ 0.73000637  0.19292926  1.03540321 -0.4520
1831]

Current Weight: [0.08834341 1.2459998  0.30658734 0.0460669
```

```
2]

Actual:  0

Predicted:  0.5981137198307767

Updated Weight: [-0.10372884  1.05392755  0.30658734 -0.1460
0534]

Current Weight: [-0.75907523 -0.3177431   0.28198135  0.8772
9348]

Actual:  0

Predicted:  -0.0994327770328225

Updated Weight: [-0.70985038 -0.26851825  0.28198135  0.9265
1833]
Input  6  :  [1 1 1 1]

Current Weight: [0.7720166  0.52009634 0.06034491 0.3333499
1]

Actual:  0

Predicted:  0.6873440897690444

Updated Weight: [ 0.59070963  0.33878936 -0.12096206  0.1520
4294]

Current Weight: [ 0.73000637  0.19292926  1.03540321 -0.4520
1831]

Actual:  1

Predicted:  0.6370305388998543

Updated Weight: [ 0.83784316  0.30076605  1.14324001 -0.3441
8152]

Current Weight: [-0.10372884  1.05392755  0.30658734 -0.1460
0534]

Actual:  0

Predicted:  0.5045492599035719

Updated Weight: [-0.29178193  0.86587446  0.11853425 -0.3340
5842]

Current Weight: [-0.70985038 -0.26851825  0.28198135  0.9265
1833]
```

```
Actual:  0

Predicted:  0.11456036788277979

Updated Weight: [-0.76637882 -0.32504669  0.22545291  0.8699
8989]
Input  7  :  [0 1 1 1]

Current Weight: [ 0.59070963  0.33878936 -0.12096206  0.1520
4294]

Actual:  0

Predicted:  0.1828552515665116

Updated Weight: [ 0.59070963  0.25041872 -0.20933271  0.0636
7229]

Current Weight: [ 0.83784316  0.30076605  1.14324001 -0.3441
8152]

Actual:  0

Predicted:  0.500454456843529

Updated Weight: [ 0.83784316  0.1132094   0.95568335 -0.5317
3817]

Current Weight: [-0.29178193  0.86587446  0.11853425 -0.3340
5842]

Actual:  1

Predicted:  0.31417878670232957

Updated Weight: [-0.29178193  1.17493694  0.42759673 -0.0249
9594]

Current Weight: [-0.76637882 -0.32504669  0.22545291  0.8699
8989]

Actual:  0

Predicted:  0.36721315083774897

Updated Weight: [-0.76637882 -0.48389474  0.06660486  0.7111
4184]
Input  8  :  [0 0 1 1]

Current Weight: [ 0.59070963  0.25041872 -0.20933271  0.0636
7229]
```

```
Actual:  0

Predicted:  -0.07270170832754408

Updated Weight: [ 0.59070963  0.25041872 -0.17317399  0.0998
3102]

Current Weight: [ 0.83784316  0.1132094   0.95568335 -0.5317
3817]

Actual:  0

Predicted:  0.20885382365722083

Updated Weight: [ 0.83784316  0.1132094   0.85581154 -0.6316
0999]

Current Weight: [-0.29178193  1.17493694  0.42759673 -0.0249
9594]

Actual:  0

Predicted:  0.19862473088983368

Updated Weight: [-0.29178193  1.17493694  0.33220241 -0.1203
9026]

Current Weight: [-0.76637882 -0.48389474  0.06660486  0.7111
4184]

Actual:  1

Predicted:  0.3703885428224276

Updated Weight: [-0.76637882 -0.48389474  0.33822312  0.9827
601 ]
Final Error: 0.24238391439015486


Total Iterations  2
Final Weights
[[ 0.59070963  0.25041872 -0.17317399  0.09983102]
 [ 0.83784316  0.1132094   0.85581154 -0.63160999]
 [-0.29178193  1.17493694  0.33220241 -0.12039026]
 [-0.76637882 -0.48389474  0.33822312  0.9827601 ]]
```

In [11]: