In [5]:

```
import numpy as np
import matplotlib.pyplot as  plt
import random
```

In [6]:

```
'''
data = [[x1 ,x2] , T]
'''
data = [[0.05,0.1],0.01]
X = data[0]
Y = data[1]
l_rate = 0.5
epochs = 10
# weights = np.random.rand(6) w1,w2,w3,w4,w5,w6
weights = [0.15,0.20,0.25,0.30,0.40,0.45]
bias = [0.35,0.35 ,0.60 ]
```

In [7]:

```


def Sigmoid(a):
    return 1/(1+np.exp(-a))

def MSE(T,O):
    return 0.5*(T-O)**2

def forward_propagation(X,Y,weights,bias =  None):
    h = []
    for i in range(len(X)):
        h.append(Sigmoid(weights[i]*X[0] + weights[i+2]*X[1] + bias[i])) #activation(w1x1 +
        #  k = activation ( h1w5 + h2w6 + bias3)
    k = Sigmoid(h[0]*weights[i+3] + h[1]*weights[i+4] + bias[i+1])
    return h,k,MSE(Y,k)



print('>>Hidden_layer_weights..K value..Error>>',forward_propagation(X,Y,weights,bias))
```

```
>>Hidden_layer_weights..K value..Error>> ([0.5944759307482401, 0.59628269929
67878], 0.7514046013526043, 0.27484039145340705)
```

In [8]:

```
def Backward_propagation(X,Y,weights,bias,epochs ,l_rate = 0.1):
    for epoch in range(epochs):
        # second layer w5 = w5 (old) - l_rate * (MSE(O,T) * sigmoid(O)*(1-sigmoid(O)) * h1)
        H , O_in_K , Error  = forward_propagation(X,Y,weights,bias)
        #last layer
        del_w = []
        for i in range(len(weights)-1,len(H)+1,-1):
            del_w.append(l_rate * (MSE(O_in_K,Y) * Sigmoid(O_in_K) *(1-Sigmoid(O_in_K))* H[
            weights[i] = weights[i] - l_rate * (MSE(O_in_K,Y) * Sigmoid(O_in_K)  *(1-Sigmoi

        #hidden Layer w1 = w1 - l_rate * (X[0] * del_w[0])
        for k in range(len(X)):
            weights[k]= weights[k] - l_rate * (X[0] * del_w[1]) #0,1
            weights[k+2] = weights[k+2] - l_rate * (X[1] * del_w[0]) #2,3


        # print(epoch)
        result = Sigmoid(del_w[1]*H[0] + del_w[0]*H[1] + bias[2])
        print(f'>>> {epoch+1}/{epochs} ====>> Loss : {Error}')


Backward_propagation(X,Y,weights,bias,epochs=100,l_rate = l_rate )
```

```
>>> 1/100 ====>> Loss : 0.27484039145340705
>>> 2/100 ====>> Loss : 0.2718911786870838
>>> 3/100 ====>> Loss : 0.2689550493493747
>>> 4/100 ====>> Loss : 0.26603303706929116
>>> 5/100 ====>> Loss : 0.26312613924141814
>>> 6/100 ====>> Loss : 0.26023531609111866
>>> 7/100 ====>> Loss : 0.2573614898837244
>>> 8/100 ====>> Loss : 0.254505544275348
>>> 9/100 ====>> Loss : 0.25166832380223175
>>> 10/100 ====>> Loss : 0.2488506335048939
>>> 11/100 ====>> Loss : 0.24605323868273574
>>> 12/100 ====>> Loss : 0.24327686477424743
>>> 13/100 ====>> Loss : 0.24052219735748867
>>> 14/100 ====>> Loss : 0.23778988226512618
>>> 15/100 ====>> Loss : 0.23508052580798053
>>> 16/100 ====>> Loss : 0.2323946951007719
>>> 17/100 ====>> Loss : 0.22973291848355049
>>> 18/100 ====>> Loss : 0.22709568603215768
>>> 19/100 ====>> Loss : 0.22448345015097526
>>> 20/100 ====>> Loss : 0.22189662624119028
>>> 21/100 ====>> Loss : 0.21933559343781933
>>> 22/100 ====>> Loss : 0.2168006954087972
>>> 23/100 ====>> Loss : 0.2142922412095411
>>> 24/100 ====>> Loss : 0.21181050618654118
>>> 25/100 ====>> Loss : 0.2093557329237026
>>> 26/100 ====>> Loss : 0.2069281322253676
>>> 27/100 ====>> Loss : 0.20452788413017353
>>> 28/100 ====>> Loss : 0.20215513895015075
>>> 29/100 ====>> Loss : 0.19981001832973072
>>> 30/100 ====>> Loss : 0.1974926163196123
>>> 31/100 ====>> Loss : 0.19520300046072242
>>> 32/100 ====>> Loss : 0.19294121287380447
>>> 33/100 ====>> Loss : 0.19070727135046395
>>> 34/100 ====>> Loss : 0.18850117044180364
>>> 35/100 ====>> Loss : 0.18632288254107868
```

```
>>> 36/100 ====>> Loss : 0.1841723589570946
>>> 37/100 ====>> Loss : 0.18204953097536708
>>> 38/100 ====>> Loss : 0.17995431090433822
>>> 39/100 ====>> Loss : 0.1778865931042243
>>> 40/100 ====>> Loss : 0.17584625499633175
>>> 41/100 ====>> Loss : 0.17383315805093164
>>> 42/100 ====>> Loss : 0.17184714875202833
>>> 43/100 ====>> Loss : 0.16988805953758596
>>> 44/100 ====>> Loss : 0.16795570971399457
>>> 45/100 ====>> Loss : 0.16604990634376526
>>> 46/100 ====>> Loss : 0.16417044510563256
>>> 47/100 ====>> Loss : 0.16231711112642458
>>> 48/100 ====>> Loss : 0.1604896797842266
>>> 49/100 ====>> Loss : 0.15868791748251668
>>> 50/100 ====>> Loss : 0.15691158239509562
>>> 51/100 ====>> Loss : 0.15516042518176124
>>> 52/100 ====>> Loss : 0.15343418967479414
>>> 53/100 ====>> Loss : 0.15173261353643086
>>> 54/100 ====>> Loss : 0.15005542888759346
>>> 55/100 ====>> Loss : 0.14840236290823208
>>> 56/100 ====>> Loss : 0.14677313840971168
>>> 57/100 ====>> Loss : 0.14516747437974026
>>> 58/100 ====>> Loss : 0.14358508650039672
>>> 59/100 ====>> Loss : 0.14202568763986276
>>> 60/100 ====>> Loss : 0.1404889883185074
>>> 61/100 ====>> Loss : 0.1389746971500099
>>> 62/100 ====>> Loss : 0.13748252125823274
>>> 63/100 ====>> Loss : 0.13601216667058091
>>> 64/100 ====>> Loss : 0.13456333868860232
>>> 65/100 ====>> Loss : 0.13313574223659533
>>> 66/100 ====>> Loss : 0.13172908218899795
>>> 67/100 ====>> Loss : 0.1303430636773381
>>> 68/100 ====>> Loss : 0.1289773923775236
>>> 69/100 ====>> Loss : 0.12763177477824852
>>> 70/100 ====>> Loss : 0.12630591843128652
>>> 71/100 ====>> Loss : 0.1249995321844321
>>> 72/100 ====>> Loss : 0.12371232639784281
>>> 73/100 ====>> Loss : 0.12244401314451961
>>> 74/100 ====>> Loss : 0.12119430639565004
>>> 75/100 ====>> Loss : 0.1199629221915229
>>> 76/100 ====>> Loss : 0.11874957879870474
>>> 77/100 ====>> Loss : 0.11755399685415215
>>> 78/100 ====>> Loss : 0.11637589949691411
>>> 79/100 ====>> Loss : 0.11521501248805746
>>> 80/100 ====>> Loss : 0.11407106431943183
>>> 81/100 ====>> Loss : 0.11294378631186731
>>> 82/100 ====>> Loss : 0.11183291270337763
>>> 83/100 ====>> Loss : 0.11073818072792264
>>> 84/100 ====>> Loss : 0.10965933068526139
>>> 85/100 ====>> Loss : 0.10859610600240692
>>> 86/100 ====>> Loss : 0.10754825328717461
>>> 87/100 ====>> Loss : 0.10651552237429275
>>> 88/100 ====>> Loss : 0.10549766636452836
>>> 89/100 ====>> Loss : 0.10449444165725762
>>> 90/100 ====>> Loss : 0.10350560797689316
>>> 91/100 ====>> Loss : 0.10253092839356281
>>> 92/100 ====>> Loss : 0.10157016933841229
>>> 93/100 ====>> Loss : 0.10062310061389186
>>> 94/100 ====>> Loss : 0.09968949539936438
>>> 95/100 ====>> Loss : 0.09876913025236063
>>> 96/100 ====>> Loss : 0.09786178510578637
```

```
>>> 97/100 ====>> Loss : 0.09696724326137503
>>> 98/100 ====>> Loss : 0.09608529137966099
>>> 99/100 ====>> Loss : 0.09521571946673595
>>> 100/100 ====>> Loss : 0.09435832085803664
```