1. We are training a neuron using the perceptron algorithm. We have one feature, x_1 . For some sample, s, with label y=1, we get a<0. Using the update rules for the perceptron, show that we will do better on sample s after we update w and b. (3 points)

Winew = World + Y.X. = World + X. brew = bold + y = bold + 1

aold = Wiold X, + bold

Arew = Winew X₁ + bnew = (Wiold + X₁) X₁ + bold = Wold X₁ + bold 2. Given a neuron with parameters w = [0, 1, 1] and b = 1, which of the following points are on the $+X_1^2+1$

decision boundary for the neuron? How do you know? (3 points) W.P1 = 0+2+3=5 @ +b= 6 X

 $p_1 = (1, 2, 3)$

 $p_2 = (1, 2, -3)$

 $p_3 = (8, -1, 0)$

 $p_4 = (2, 6, -8)$ $p_5 = (3, -2, 1)$

W.P2 = 0+2-3+b= 0V W.P3+6=0-1+0+1=0~

W. P4+b=0+6-8+1=-1 X

3. Using the training data below, train a neuron using the perceptron algorithm for two epochs.

and

initial w = [0,0] and b = 0. Give the final w and b. Iterate through the points in the order presented above. What are the w and b after two epochs? (4 points)

Sample	x_1	x_2	Label
s_1	0	0	-1
s_2	1	1	1
s_3	0	1	-1
s_4	2	2	1
s_5	1	0	-1
Se	1	2	1

@ a=0+0+0=0=0 update W=0+0.-1=0 b=0-1=-1 W2 = 0+0 -1 = 0

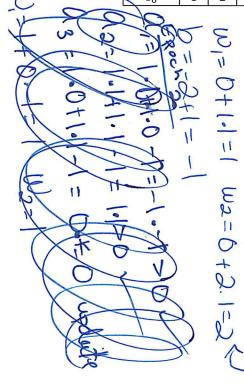
a=0.1+0.1-1=-1.1=0 update W1= 0+1.1=1 W2=0+1.1=1 b=1-1=0.

a3=1.0+1.1+0=1.-140 update W1=1+0=1 W2=1+10-1=0 6=0-1=-1

Q4=1.2+0.2-1=1.1 >0

as=1.1+0.0-1=0=0 update

W= 11-1=0 W2=0+0=0 b=-2. 1.- M.1+M.2-2 =-2.1 < 1 update



1. A model trained with the perceptron algorithm is guaranteed to give you 100% accuracy on the training data. True or false. Circle one and explain (2 points)

Only on linearly separable data.

2. Given D features, how many parameters does our neuron have? Explain. (2 points)

one parameter per féature (one Wi for each x:) plus the bias term.

3. We have trained a neuron using the perceptron algorithm until convergence. Our resulting weights are w = [10, 5, -4, 3, 2, 0] and b = 0. Which feature, $x_1, x_2, x_3, x_4, x_5, x_6$ would you say is the most important? Why? (2 points)

X, because it has the highest after training.

4. Using the training data below, train a neuron using the perceptron algorithm for two epochs. Use initial w = [0,0] and b = 0. Give the final w and b. Iterate through the points in the order presented above. Give the w and b after two epochs. (4 points) Epoch 2 $W_1 = 1$ $W_2 = 2$ b = 1

Sample	x_1	x_2	Label
s_1	0	0	-1
s_2	1	1	1
s_3	0	1	-1
s_4	2	2	1
s_5	1	0	-1

Q=0.1+0.2-1=-10-1=(>0) 1 O2= | o|+2.1 = 2.1 = 0

a3=1.0+2.1-1=1.-120 update

W1=1+0.1=1 W2=2+10-1=1 0 6=1-1=-2.

Qu=1.2+1.2-2=2.120

as=(.1+1.0-2=-1.-1>0

Qu=(0/+1020-2=10/>0

W=11,11 h=-2.