

## 422 Quiz 5 Solutions.

epoch 1

$$1. \quad w = (0, 0) \\ b = 0$$

$$a_1 = -1 \times 0 + -1 \times 0 + 0 = 0$$

$$a_1 y_1 = 0 \times -1 = 0 \leq 0 \quad \text{update!}$$

$$w = w + xy = (0, 0) + (-1, -1) \times -1$$

$$w = (1, 1)$$

$$b = b + y = -1$$

$$w = (1, 1) \\ b = -1$$

$$a_2 = -1 \times 1 + 1 \times 1 - 1 = -1$$

$$-1 \times -1 = 1 \geq 0 \quad \text{no update}$$

$$a_3 = 1 \times 1 + -1 \times 1 - 1 = -1$$

$$-1 \times -1 = 1 > 0 \quad \text{no update}$$

$$a_4 = 1 \times 1 + 1 \times 1 - 1 = 1$$

$$1 \times 1 = 1 > 0 \quad \text{no update}$$

epoch 2

$$a_1 = -1 \times 1 + -1 \times 1 - 1 = -3$$

$$-3 \times -1 = 3 > 0 \quad \text{no update.}$$

we have already checked samples 2-4 with these weights so we know we will go through epoch 2 without any updates. So we're done and our result is:  $w = (1, 1) \quad b = -1$

2. We know a point lies on the decision boundary when its activation is  $\emptyset$ .

$$1) (-5, 0, 2) \cdot (1, -2, 3) - 1 = -5 + 0 + 6 - 1 = 0$$

yes!

$$2) (3, 2, -1) \cdot (1, -2, 3) - 1 = 3 - 4 - 3 - 1 \neq 0$$

no!

$$3) (-1, 2, 2) \cdot (1, -2, 3) - 1 = -1 - 4 + 6 - 1 = 0$$

yes!

$$4) (1, 1, 1) \cdot (1, -2, 3) - 1 = 1 - 2 + 3 - 1 \neq 0$$

no!

$$5) (3, -5, 2) \cdot (1, -2, 3) - 1 = 3 + 10 + 6 - 1 \neq 0$$

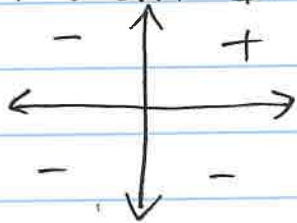
no!

1, 3, 3 are on the decision boundary.

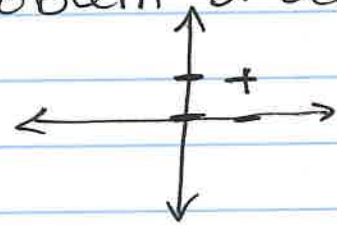
## 622 Quiz 5 solutions

1. Same as 422 problem 1
2. I will likely accept several answers for this question, but this is what I was looking for.

Problem 1 data



Problem 2 data



the perceptron draws a line that separates the data in such a way that none of the points lie on the line.

There is more space between points in the problem 1 data so it is easier to find a line.

3. Same as 422 problem 2. 1) 3, 2)