

## CS151 - Written Problem 8

### Solutions

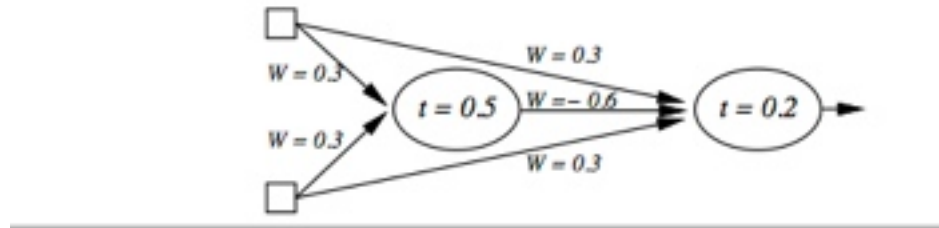
1. In class, I put up the following truth table:

$x_1$	$x_2$	$x_3$	$f(x_1, x_2, x_3)$
0	0	0	1
0	1	0	0
1	0	0	1
1	1	0	0
0	0	1	1
0	1	1	1
1	0	1	1
1	1	1	0

Could we model this function perfectly with a perceptron? If not, change the label of one of the cases to make it possible. If so, change the label of one of the cases to make it impossible.

The question here is whether the data is linearly separable since the perceptron can model/separate any linearly separable data. If you plot the data you'll see that the three 0 labeled examples are all on the plane with  $x_2 = 1$  and we can therefore separate them. Changing the example  $(0, 0, 01)$  to be labeled with a 1, would no longer make the data linearly separable.

2. We looked at one way of doing the XOR with a multi-layer feedforward network in class involving three neurons. Design a neural network that calculate the XOR of two inputs using only two neurons (*Hint*: you may have to pass the inputs to both neurons.).



3. Exercise 8.9 [a–b] (a little FOL never hurt anyone...)

- (a) (i) not syntactically correct – can't nest an and in a relation, (ii) correct, (iii) not valid, says one or the other is true
- (b) (i) correct, (ii) not valid (iii) not syntactically correct – brackets try and state the  $c$  only pertains to first clause, (iv) not syntactically correct – again, can't nest an and in a relation