Sample Answers to Chapter 4

4.1

Suppose the decision surface function is $w_0*1+w_1*x_1+w_2*x_2=0$. And the surface crosses two points (-1, 0), (0, 2). So we have,

$w_0+w_1*(-1)+w_2*0=0$, and

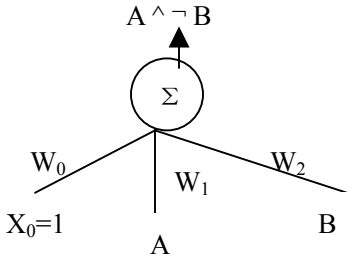
$w_0+w_1*0+w_2*2=0$.

Therefore, $w_0 = -2$, $w_1 = -2$, $w_2 = 1$.

4.2

(a)

A	B	A ^ ¬ B
0	0	0
0	1	0
1	0	1
1	1	0



Therefore,

$w_0 < 0$,

$w_0+w_2 < 0$,

$w_0+w_1 > 0$,

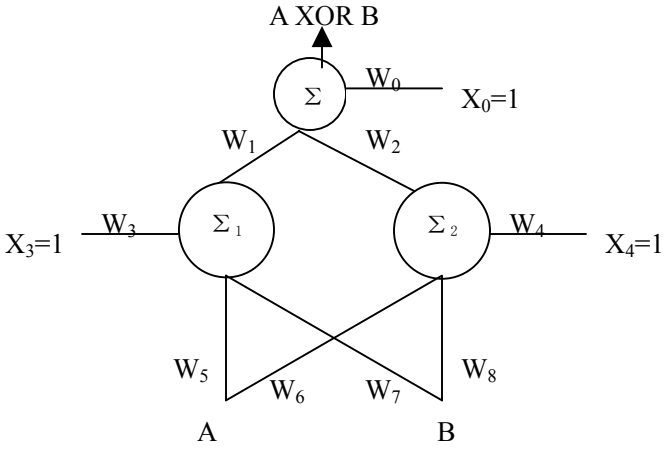
$w_0+w_1+w_2 < 0$.

Let $w_0 = -1$, $w_1 = 2$, $w_2 = -2$.

(b)

One possible two-layer network of perceptrons is as follows, but it's not unique.

A	B	A XOR B
0	0	0
0	1	1
1	0	1
1	1	0



Let $W_0 = -0.5$, $W_1 = 1$, $W_2 = -1$, $W_3 = -0.25$, $W_4 = -0.75$, $W_5 = W_6 = W_7 = W_8 = 0.5$.

4.5

$$\frac{\partial E}{\partial w_i} = \frac{\partial}{\partial w_i}\frac{1}{2}\sum_{d\in D}(t_d - o_d)^2$$

$$= \frac{1}{2}\sum_{d\in D}\frac{\partial}{\partial w_i}(t_d - o_d)^2$$

$$= \frac{1}{2}\sum_{d\in D}2(t_d - o_d)\frac{\partial}{\partial w_i}(t_d - o_d)$$

$$= \sum_{d\in D}(t_d - o_d)\frac{\partial}{\partial w_i}(t_d - o_d)$$

$$= \sum_{d\in D}(t_d - o_d)(-x_{id} - {x_{id}}^2)$$

Therefore,

$$\Delta w_i = \eta\sum_{d\in D}(t_d - o_d)(x_{id} + {x_{id}}^2)$$

4.9 Yes.

4.11 Refer to solution done by Mark Sharp and Lu Liu. Thanks!