1. (12 points) In the perceptron below, what will be the output when the input is (0, 0)? What about inputs (0, 1), (1, 1), and (1, 0)? What if we change the bias weight to -0.5?

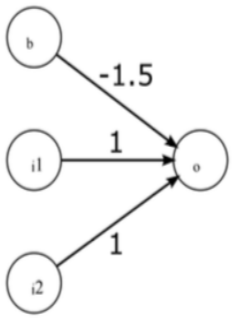
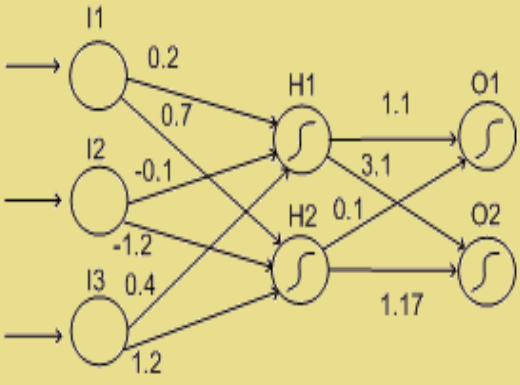


Figure 1: Single Layer Perceptron. b = 1

	Bias = -1.5		Bias = -0.5	
Input	Weighted Sum	Output	Weighted Sum	Output
(0, 0)	-1.5	0	-0.5	0
(0, 1)	-0.5	0	0.5	1
(1, 1)	0.5	1	1.5	1
(1, 0)	-0.5	0	0.5	1

2. (15 points) Consider the below feed-forward network.



Suppose we input the values 10, 30, 20 into the three input units, from top to bottom. Use the sigmoid function as the activation function in all hidden units and output units. Report the likelihood associated to each of the labels.

$$
\begin{aligned}
h_1 &= 0.2(10) - 0.1(30) + 0.4(20) = 7 \\
H_1 &= \frac{1}{1+e^{-7}} = 0.999 \\
h_2 &= 0.7(10) - 1.2(30) + 1.2(20) = -5 \\
H_2 &= \frac{1}{1+e^{5}} = 0.00669 \\
o_1 &= 1.1(0.999) + 0.1(0.00669) = 1.0996 \\
O_1 &= \frac{1}{1+e^{-1.0996}} = 0.75 \\
o_2 &= 3.1(0.999) + 1.17(0.00669) = 3.104 \\
O_2 &= \frac{1}{1+e^{-3.104}} = 0.957
\end{aligned}
$$

Then

$$
P_{O_1} = \frac{0.75}{0.75 + 0.957} = 0.44 \quad \text{and } P_{O_2} = \frac{0.957}{0.75 + 0.957} = 0.56
$$

The End.