

1. (Haykin 3/e problem 1.3)
 - a. The perceptron may be used to perform numerous logic function. Demonstrate the implementation of the binary logic function AND, OR, and COMPLEMENT. (Assume the input to AND and OR is two numbers drawn from $\{-1,1\}$ representing false and true (respectively) and the input to COMPLEMENT is one number drawn from $\{-1,1\}$).
 - b. A basic limitation of the perceptron is that it cannot implement the EXCLUSIVE-OR function. Explain the reason for this limitation.
2. Suppose the inputs to an SLP are three numbers $x, y,$ and z having values drawn from $\{1,-1\}$. Find a weight vector w of length four (i.e., including a bias) that will yield the following output function: if $x=1$ and $y=-1$, or if $x=-1$ and $y=1$, or if $x=1$ and $y=1$, then the output is z . Otherwise, the output is -1 . Describe how you found this weight vector.
3. (Haykin 3/e problem 1.5)
Equations (1.37) and (1.38) define the weight vector and bias of the Bayes classifier for a Gaussian environment. Determine the composition of this classifier for the case when the covariance matrix \mathbf{C} is defined by

$$\mathbf{C} = \sigma^2 \mathbf{I}$$

where σ^2 is a constant and \mathbf{I} is the identity matrix.