1. In some classification problems, the cost of misclassification is not symmetric, i.e., one wishes to penalize misclassification of positive examples differently from misclassification of negative examples. For instance, in cancer classification, misclassifying a patient who has cancer as not having cancer is far more serious a mistake than the opposite situation. Suppose we have a binary classification problem and define a cost function \( C(y_i, \hat{y}_i) \) as the cost of predicting \( \hat{y}_i \) when the true label is \( y_i \).

\[
C(y_i, \hat{y}_i) = \begin{cases} 
0 & \text{if } y_i = \hat{y}_i \\
p & \text{if } y_i = 1 \text{ and } \hat{y}_i = -1 \\
n & \text{if } y_i = -1 \text{ and } \hat{y}_i = 1 
\end{cases}
\]

where \( p \) and \( n \) are some positive constants. Your goal is to design a perceptron algorithm for this asymmetric binary classification problem. (Please write down the pseudocode.) Hint: Start your derivation from the following loss function:

\[
L(w) = \frac{1}{T} \sum_{i \in M} C(y_i, \hat{y}_i)|y_i - w'x_i|
\]

where \( M \) is the set of misclassified examples and \( T \) is the number of training examples. The perceptron is parameterized by vector \( w \) and \( \hat{y} = sign(w'x) \).