# Homework 4

Yuan Li, N19728558, NetID: yl6606

## Part I: Written Exercises

1. (a) Answer:

$$\begin{aligned}\frac{\partial}{\partial w}E_{in} &= \frac{\partial}{\partial w}||y - Xw||^2 + \lambda||w||^2 \\ &= 2wX^TX - 2X^Ty + 2\lambda w \\ &= 2w(X^TX + \lambda I) - 2X^Ty\end{aligned}$$

1. (b) Answer:

Set above equation equals 0, then:

$$\begin{aligned}2w(X^TX + \lambda I) - 2X^Ty &= 0 \\ w(X^TX + \lambda I) &= X^Ty \\ w &= (X^TX + \lambda I)^{-1}X^Ty\end{aligned}$$

So the closed form solution should be: $w = (X^TX + \lambda I)^{-1}X^Ty$