IN 5400 Solution hints week2

Exercise 1 Linear regression

a) What is the loss function for linear regression?

The squared error

$$J(w,b) = \frac{1}{2m}\sum_{i=1}^{m}(\hat{y}^{(i)} - y(i))^2$$

b) How does gradient descent update the estimate? Give the general formulae.

$$w = w - \lambda\frac{\partial}{\partial w}J(w,b)$$

Exercise 2

c) Given

$$x = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

$$y = \begin{bmatrix} 1.5 \\ 2 \\ 2.5 \end{bmatrix}$$

Plot x,y as points in a plot

d) If we start with $w = 0$ and $b = 0$, compute the value of the initial loss function.

J= 1/6(1.5*1.5+2*2+2.5*2.5)=12.5/6 = 2.08

e) If we start with $w = 0$ and $b = 0$, compute the estimates after one iteration if the learning rate is 1.

$$\frac{\partial}{\partial w}J(w,b) = \frac{\partial}{\partial w}\frac{1}{2m}\sum_i(wx^{(i)} + b - y^{(i)})^2 = \frac{2}{2m}\sum_i(wx^{(i)} + b - y^{(i)})x^{(i)}$$

$$= 1/3(-1 * 1.5 - 2 * 2 - 2.5 * 3) = -13/3 = -4.33$$

$$\frac{\partial}{\partial b}J(w,b) = \frac{\partial}{\partial b}\frac{1}{2m}\sum_i(wx^{(i)} + b - y^{(i)})^2 = \frac{2}{2m}\sum_i(wx^{(i)} + b - y^{(i)})$$

$$= 1/3(-1.5 - 2 - 2.5) = -2$$

The estimates are then:

$$w = 0 - (-4.33) = 4.33, b = 0 - (-2) = 2$$