CSE 151A - Discussion 04

Problem 1.

Suppose you have a set of labeled data points and have solved for the linear prediction rule $H(\vec{x}) = w_0 + w_1 x_1 + w_2 x_2$ by minimizing the MSE.

a) Describe at a high level what it means when $w_0 = 0$.

b) You now realize that you accidentally skipped a data point during your calculation; is it 100% necessary for you to recompute $\vec{w}$? If not, explain why.

Problem 2.

Here is a data set of sales figures from different stores (this is a small sample taken directly from the data used in class, so the final answer will be slightly different).

store #	sales	sq. ft	# competitors
1	398	4.3	4
2	347	3.6	6
3	161	2.6	13
4	464	4.7	3

a) Let's try to predict net sales from two variables: the square footage of the store and the number of competing stores in the area. Our model will be:

$$\text{net sales} \approx w_0 + w_1 \times \text{sq. ft} + w_2 \times \#\text{ competitors}$$

Solve for w_0, w_1, and w_2 and rewrite the above equation using these values.

HINTS:
You will need the design matrix, X, and the vector $\vec{y}$.
Then, you can solve $\vec{w} = (X^T X)^{-1} X^T \vec{y}$.

b) Suppose your friend wants to open a store, but can only afford to do so if they can make more than \$300 in sales. If there are 5 competitors in the area, how large (in sq. ft) must the store be in order for your friend to make ends meet?

Problem 3.

Suppose we have 50 labeled data points and we wish to fit a linear regression model to them. We plan on running several experiments to decide on model complexity and determine a reasonable λ value for regularization. For each experiment, we will use Leave-One-Out Cross Validation to compute the overall error for that model.
It takes 5 seconds to compute the validation error for a single fold, and we want to evaluate 1-degree, 3-degree, 5-degree, 10-degree, and 20-degree polynomial models over 4 different values for λ. How many total seconds will it take for all of the experiments to finish?