# Stat 346 Homework 1

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## 1 Problem 1

### 1.1 Part a

$\hat{y} = 10 + 0.56 \times 7 = 13.92$

### 1.2 Part b

$17 - (10 + 0.56 \times 7) = 3.08$

### 1.3 Part c

It increases by $0.56 * 3 = 1.68$ points.

### 1.4 Part d

No. Simple linear regression does not require that each data point be fittable on a function; that is, not every $X$ value must have a corresponding unique $Y$ value.

### 1.5 Part e

$\sigma^2 = \frac{SSE}{n-2} = \frac{11}{18-2} = 0.6875$

### 1.6 Part f

In this case, there are 60 minutes in an hour. We can assign units to the linear regression as shown:

$$\hat{y} \text{ points} = 10 \text{ points} + 0.56 \text{ points / hour} \times x \text{ hours} \quad (1)$$

If $x$ is to be converted to minutes, we simply perform dimensional analysis and arrive at the following equation:

$$\hat{y} = 10 + 9.33 \times 10^{-3} \times x \quad (2)$$

## 2 Problem 2

The first equation describes a fitted line to a dataset where $b_0$ and $b_1$ are estimated parameters. The second describes an ideal regression distribution where $\beta_0$ and $\beta_1$ are optimal intercept and slope, and $\epsilon$ is the error between the optimal line and the response variable.

## 3 Problem 3, KNN Problem #1.13

### 3.1 Part a

Observational: the group of people from whom the data was recorded was predetermined by a nonrandom factor (employment by the company).

### 3.2 Part b

The conclusions are probably relevant for the company's employees, but there is no guarantee that the conclusions hold for people outside of the company.

### 3.3 Part c

1. Employees know that their managers are looking for improvement, so they begin to perform better

2. Employees that prepare more for seminar are smarter and thus more likely to improve

### 3.4 Part d

1. Conduct a random sampling across many companies

2. Compare change in productivity level before and after the seminar, not just productivity after

# 4 Problem 4, KNN Problem #1.16

The closer the distribution of the values of the response variable follow a normal distribution, the more accurate the predictions of the least squares method are.

# 5 Problem 5, KNN Problem #2.1

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# 6 Problem 6

A sampling distribution is a statistical distribution of a value based on the assumption that that value can be modeled as a random variable. Sampling distributions give us an idea of how much variance a test statistic has, thus allowing us to make conclusions concerning its precision and accuracy.

# 7 Problem 7, KNN Problem #1.27

# 8 Problem 8

1. How many spoken languages do you know?
2. How many programming languages do you know?
3. What is your major?
4. How many years have you been in college, counting both undergrad and graduate work?

I'd like to learn more about regression analysis as it applies to financial data.