

# Stat/Math 415 Homework 5

Due Friday Oct 25; Joseph Sepich (jps6444)

## 1 Problem 7.4-3

Problem information:

- $\bar{x} = 6.09$
- $s = 0.02$

### 1.1 Part a

Sample size calculation: sample size needed for  $\epsilon = 0.001$  with confidence of  $\alpha = 0.1$

Assuming standard deviation is the same for the population we can use the Z value of 1.645 for alpha of 0.1 and plug the numbers into our equation based off a confidence interval:

$$n \geq \frac{z_{\alpha/2} S^2}{\epsilon^2} = \frac{1.645^2 * 0.02^2}{0.001^2} = 1082.41$$

Remember we must round up, so we need the sample size to be at least **1,083** samples.

### 1.2 Part b

With the following numbers we have a decent sample size, and we don't know the distribution, so we use central limit theorem and approximate with a normal distribution:

- $n = 1219$
- $\bar{x} = 6.048$
- $s = 0.022$

Since we looking at the confidence level from the last problem, we are still using the same Z value of 1.645. We plug this into our confidence interval formula:

$$\bar{x} \pm Z_{\alpha/2} \frac{s}{\sqrt{n}} = 6.048 \pm 1.645 * \frac{0.022}{\sqrt{1219}}$$

This gives us a confidence interval for mu of **[6.0470, 6.0490]**

### 1.3 Part c

The problem states that for every 0.01 pounds less the company would save \$14,000 per year. the original sample mean was 6.09 and the new one is around 6.048. This would be a savings of roughly  $4.2 * 14,000 = \$58,800$ .

## 1.4 Part d

To estimate the proportion of boxes that will weight less than 6 pounds, we want to know  $P(X < 6)$ . We can use our estimated normal distribution from CLT to come up with a z score of  $\frac{6-6.048}{0.022} \approx -2.18$ .

$$P(X < 6) = P(Z < -2.18) = 1 - P(Z < 2.18) = 1 - 0.9854 = 0.0146$$

The proportion of boxes measured to be under 6 pounds is now **0.0146**.

## 2 Problem 7.4-7

## 3 Problem 7.4-8

## 4 Problem 6.5-3

## 5 Problem 6.5-5