Homework 5
Due by Midnight on 12/02/2015

Instructions:

(1) You must show work to receive credit

(2) Homework must be handed in on **Canvas**

(3) Disclaimer: This is the last graded homework, but remember that the homework is not comprehensive, this homework especially covers several chapters...thus, please review the suggested problems, the notes and the practice final in order to practice for the term exam

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Question 1: Bias and Efficiency (25pts)

(a) Given an example of an unbiased estimator that we have covered in class. Show that it is unbiased.

(b) Consider the following point estimators, Y, and Z of μ:

$$Y = \frac{(x_1 + 3x_2)}{4};\ Z = \frac{(2x_1 + 3x_2)}{5}$$

What is the relative efficiency of the estimators?

(c) Draw a diagram/graph illustrating both bias and efficiency. Explain why each matters.

Question 2: Confidence Intervals (25pts)

Suppose that the waiting times for patients at a local hospital are normally distributed with known population standard deviation of 30 minutes. A random sample of 75 patients in the local hospital had a mean time of 90 minutes. Assume a 95% confidence interval for the population mean μ.

(a) Write down all important pieces of the confidence interval discussed in class (UCL, LCL, W, ME).

(b) Calculate each piece, and explain what the confidence interval tells us.

Question 3: Hypothesis Testing (25pts)

The supervisor of a production line believes that the average time to assemble an electronic component is 14 minutes. Assume that assembly time is normally distributed with a standard deviation of 3.4 minutes. The supervisor times the assembly of 14 components, and finds that the average time for completion is 11.6 minutes.

(a) Test this claim with $\alpha = 0.05$, making sure to write down the appropriate hypothesis statement, and draw a diagram.

(b) If we were computing a one sided test, what would be the p-value of the test statistic?

Question 4: Confidence Intervals (25pts)

Assume that you are a financially constrained undergraduate who would like to know what the average student spends on textbooks. You find data on a random sample of 50 students, with a mean \$175 spent on books, and a population standard deviation of \$25.

(a) Find a 95% confidence interval for the population mean. Make sure to highlight the three important parts of this process.

(b) Now assume that you discover the above was not actually a random sample, so you hand collect a random sample with the amount spend on textbooks as:

$$174, 190, 210, 160, 140$$

Calculate a 90% confidence interval for the population mean with this new sample.

(c) What is different between a and b?

This question is only applicable if we cover this material on 12/30, I will announce in class, if this is the case, all will be reweighted

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Question 5: Tests of the Population Proportion (25pts)

The manufacturer of a new chewing gum claims that at least eight out of ten dentists surveyed prefer their type of gum and recommend it for their patients who chew gum. An independent consumer research firm decides to test their claim. The findings in a sample of 400 doctors indicate that 76% do actually prefer their gum. Is this evidence sufficient to doubt the manufacturer's claim? Use $= 0.05$.

(a) Test this claim with $\alpha = 0.05$, making sure to write down the appropriate hypothesis statement.

(b) Instead of testing the claim, form a confidence interval around the population proportion. How is this different?