In-Class Worksheet

STAT011 with Prof Suzy

Week 10: Experiments with Confidence Intervals

Name: _____

Instructions:

There are five questions in this worksheet. You will work with your group members to answer each question. Before getting started, take a moment and reflect on ways in which you can show your assigned group members respect. You may also view this initial list of examples that we will add to over the semester.

Briefly, in the space below, specify one way in which you will work to show your group members respect during today's lesson:

Part 1: Graduation

It's believed that as many as 25% of adults over 50 never graduated from high school. We wish to see if this percentage is the same among the 25 to 30 age group.

1. How many of this younger age group must we survey in order to estimate the proportion of non-grads to within 6% with 90% confidence?

2. Suppose we want to cut the margin of error to 4%. What's the necessary sample size?

3. What sample size would allow us to increase our confidence level to 95% while reducing the margin of error to only 2%?

Part 2: Speed of light

In 1882, Michelson measured the speed of light (usually denoted c as in Einstein's famous equation $E = mc^2$). His values are in km/sec and have $299,000$ subtracted from them. He reported the results of 23 trials with a mean of 756.22 and a standard deviation of 107.12.

4. Find a 95% confidence interval for the true speed of light from these statistics and state in words what this interval means. Keep in mind that the speed of light is a physical constant that, as far as we know, has a value that is true throughout the universe.

5. After his first attempt to determine the speed of light, Michelson conducted an "improved" experiment. In 1897, he reported results of 100 trials with a mean of 852.4 and a standard deviation of 79.0. First, find the standard error of the mean for these data. Then, without computing it, determine how you would you expect a 95% confidence interval for the second experiment to differ from the confidence interval for the first. Note at least three specific reasons why they might differ, and indicate the ways in which these differences would change the interval.

Bonus question: According to Stephen M. Stigler (The Annals of Statistics 5:4, 1075 [1977]), the true speed of light is $299,710.5$ km/sec, corresponding to a value of 710.5 for Michelson's 1897 measurements. What does this indicate about Michelson's two experiments? Find a new confidence interval and explain using your confidence interval.