

# Math 58 / 58B - Introduction to (Bio)Statistics

*your name here*

*due Feb 13, 2020*

## Homework 3

### Assignment Summary (Goals)

- create CIs
- interpret CIs

#### 1. **Chronic illness, Part I** (Problem 2.37, ISRS).

In 2013, the Pew Research Foundation reported that “45% of U.S. adults report that they live with one or more chronic conditions”. However, this value was based on a sample, so it may not be a perfect estimate for the population parameter of interest on its own. The study reported a standard error of about 1.2%, and a normal model may reasonably be used in this setting. Create a 95% confidence interval for the proportion of U.S. adults who live with one or more chronic conditions. Also interpret the confidence interval in the context of the study.

#### 2. **Chronic illness, Part I** (Problem 2.39, ISRS).

In 2013, the Pew Research Foundation reported that “45% of U.S. adults report that they live with one or more chronic conditions”, and the standard error for this estimate is 1.2%. Identify each of the following statements as true or false. Provide an explanation to justify each of your answers.

- (a) We can say with certainty that the confidence interval from Exercise 2.37 contains the true percentage of U.S. adults who suffer from a chronic illness.
- (b) If we repeated this study 1,000 times and constructed a 95% confidence interval for each study, then approximately 950 of those confidence intervals would contain the true fraction of U.S. adults who suffer from chronic illnesses.
- (c) The poll provides statistically significant evidence (at the  $\alpha = 0.05$  level) that the percentage of U.S. adults who suffer from chronic illnesses is below 50%.
- (d) Since the standard error is 1.2%, only 1.2% of people in the study communicated uncertainty about their answer.

#### 3. **Competitive Advantage of Uniform Color?** (Chp 1 #10, ISCAM)

Does uniform color give athletes an advantage over their competitors? To investigate this question, Hill and Barton (Nature, 2005, <https://www.nature.com/articles/435293a>) examined the records in the 2004 Olympic Games for four combat sports: boxing, tae kwon do, Greco-Roman wrestling, and freestyle wrestling. Competitors in these sports were randomly assigned to wear either a red or a blue uniform. The researchers investigated whether competitors wearing one color won significantly more often than those wearing the other color. They analyzed results for a total of 457 matches. Of these, red won the match 248 times, while blue won 209 times.

- (a) Identify the observational units and variable of interest. Indicate which outcome you will consider “success.”
- (b) Explain how and why randomness was used in this study (that is, why does it matter to the results?).
- (c) Do the technical conditions given on page 124 (section 3.1.1) hold in this setting?
- (d) Compute a 95% confidence interval for the parameter. Write a sentence interpreting what this interval says, including how you are defining the parameter.

- (e) Now determine a 90% confidence interval for the parameter. Comment on how it differs from the 95% interval. [Hint: Refer to both the midpoints of the intervals and their widths.]
  - (f) Summarize your results as if to an athletic director at a university. Include discussion about how you are willing to “generalize” these results beyond these 457 matches.
4. Answer the following questions in one or two sentences.
- (a) If we can't know for sure whether the confidence interval contains the value of the population parameter, on what grounds can we be confident about this?
  - (b) Survey researchers typically select only one random sample from a population, and then they produce a confidence interval based on that sample. How do we know whether the resulting confidence interval is successful in capturing the unknown value of the population parameter?
  - (c) Why don't we always create 99.99% intervals?