MA206, Lesson 5 - Strength of Evidence

Review: What are the p-value guidelines for evaluating the **strength of evidence?**.

Weak Evidence against the null

Moderate Evidence against the null

Strong Evidence against the null

Very Strong Evidence against the null

Define and describe the **standardized statistic** for a proportion.

z =

What are the standardized test statistic guidelines for evaluating the **strength of evidence**?

What factors impact the **strength of evidence**?

1) Read "Inferences of Competence from Faces Predict Election Outcomes" by Todorov et al in Science (June 2008).

a) What is the author's research question? Why is it important?

b) Identify the observational units in this study

c) Identify the variable. Is the variable quantitative or categorical?

d) Describe the parameter of interest in words.

e) List the Null and Alternate hypotheses for this study.

f) For 2004 races only, list the observed statistic and sample size for both Senate and House races.

g) Which races have a higher proportion of candidates deemed more competent that won their respective elections, the Senate or House elections?

h) Conduct a simulation analysis using the 3S Strategy. Comment on the center, variability and shape of the null distributions generated for Senate and House races.

Senate

House

i) List the p-values based on your simulations for both Senate and House races. Comment on the strength of evidence in terms of the research question.

Senate

House:

j) Report the mean and standard deviation of the simulated proportions.

Senate:

House:

k) Calculate and interpret the standardized statistic.

Senate:

House:

l) Is the evidence stronger for the Senate 2004 races or the House 2004 races? Why?

m) What do our results prove?

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n) How broadly are you willing to generalize your conclusion?

2) An article published in *College Mathematics Journal* (Eyler, Shalla, Doumaux, and McDevitt, 2009) found that players tend to not prefer scissors when playing Rock-Paper-Scissors. You want to test if people really choose scissors less, and conduct a test. You played 120 games and your friend chose scissors 31 times.

a) List the null and alternate hypothesis in words and symbols.

b) Run a simulation using the WileyPlus applet and report the mean and standard deviation of your null distribution.

c) What is the standardized statistic (z) for your test? Comment on the strength of evidence.

d) If you repeated the test another 240 times and your friend chose scissors the same proportion of times ($\hat{p} = 0.258333$), would you expect your strength of evidence to increase, decrease, or stay the same?

e) If we repeated the experiment with a different friend and our sample size stayed the same (120), but the number of times he chose scissors was 38, would the strength of evidence increase, decrease, or stay the same?

f) What if we used our original experimental data ($\frac{31}{120}$ scissors), but instead we wanted to do a two-sided test instead of a one-sided test. Would our strength of evidence increase, decrease, or stay the same?

3) After Al Franken (D-MN) resigned from the U.S. Senate in 2018, one might wonder if Minnesota has had a larger number of congressional resignations than one would expect compared to other states. On Teams, download the resignations.csv file and upload it into R using the Tidyverse Tutorial or Course Guide as reference. This file[1] lists all of the congressional resignations from state senators back to 1905. As each state has exactly 2 senators, it is reasonable to assume that if a resigned senator is chosen at random, each state has an equal chance of being represented if state has nothing to do with resignation.

The following code follows the Halloween Candy example in the Course Guide (Significance: How Strong is the Evidence?) and can be used to find proportions of the dataset.

```
library(tidyverse)
library(janitor)

resign %>%
  count(State) %>%
  mutate(Proportion = n/sum(n)) %>%
  adorn_totals()
```

a) In your own words, explain what the research question is. What are our observational units and variable(s) of interest? Classify the variables as either categorical or quantitative.

b) List your null and alternate hypotheses, observed statistic, sample size, and the standard deviation of your null distribution.

c) List your simulated p-value. Comment on the strength of evidence.

d) Calculate your standardized statistic. Comment on the strength of evidence.

[1] From Kaggle, https://www.kaggle.com/yamqwe/congressional-resignationse