MA206, Lesson 6 - Strength of Evidence

Review: How is the standardized statistic of a single proportion calculated?

z =

When can we use a theory-based approach to calculate a p-value?

Using the theoretical approach, what is the expected standard deviation of a null distribution for one proportion?

Using the theoretical approach, how do we calculate our standardized statistic for one proportion?

z =

How do we convert our theoretical z-score into a p-value?

1) Two firsties miss recall formation because they partied hard over the weekend, but blamed their lateness on a flat tire. The TAC team brings them both into separate offices and asks them both one question which will determine if they get hours or not. Which tire went flat? This question works if we assume that each tire is equally likely to be chosen, but it has been proposed that people tend to answer "right front" more often.

To test this, we asked 28 cadets, if they were in this situation, which tire would they say had gone flat. Our results are shown below.

Left Front	Left Rear	Right Front	Right Rear
6	4	14	4

a) What is the research question?

b) Identify the observational units in this study.

c) Describe the parameter of interest (in words).

d) State the appropriate null and alternate hypotheses to be tested, both in words and symbols.

e) What is our observed statistic? What is our sample size?

f) Using the one-proportion applet, list the simulated p-value, standardized statistic, and interpret the strength of evidence.

g) Does our sample meet the validity conditions to use a theory-based test?

h) Assume that validity conditions are met. What is the theory-based standardized statistic and p-value?

i) Summarize the conclusion that you draw from this study and your analysis. Explain your reasoning.

Suppose this study were repeated with only 14 cadets and 7 of them answered "front right." Use this reduced sample scenario to answer parts *j* through *l*.

j) What would you expect to happen to the strength of evidence against the null hypothesis in this case?

k) Does our reduced sample meet the validity conditions to use a theory-based test?

l) Using our reduced sample, calculate the new p-value and standardized statistic. Specify if you simulated or used theoretical methods.

2) A taste test was run on 4 sections of MA206 cadets between three types of chewy chocolate chip cookies - MAJ McD's homemade cookies, Chips Ahoy, and Keebler. The results are consolidated in the Cookies.csv file found on Teams. You may use the course guide as a reference. Here, we wish to assess if homemade cookies are preferred among cadets, as has been implied by various internet surveys. As a reference, we will assume that there is no difference between preferences for cookie maker.

```
library(tidyverse)
library(janitor)

Results <- read_csv("Cookies.csv")
```

a) List the null and alternate hypothesis, as given in this scenario.

b) List the number of successes, number of failures, sample size, and observed statistic as a proportion.

c) Do we meet the validity conditions to use theoretical methods?

d) Calculate the p-value and standardized statistic. Justify why you used simulation or theoretical methods.

e) Interpret your results.

3) A survey was run on 4 sections of MA206 cadets asking which of two senatorial candidates appeared more competent. The results are consolidated in the Faces.csv file found on Teams. You may use the course guide as a reference. Here, we wish to assess if cadets agree, given one second to look at side-by-side black and white photographs, which candidate appears more competent. We assume that if there is no difference and cadets choose randomly, then either candidate has an equal chance of being selected.

```
library(tidyverse)
library(janitor)

FacesResults <- read_csv("Faces.csv")
```

a) List the null and alternate hypothesis, as given in this scenario.

b) List the number of successes, number of failures, observed statistic as a proportion, and the sample size.

c) Do we meet the validity conditions to use theoretical methods?

d) Calculate the p-value and standardized statistic. Justify why you used simulation or theoretical methods.

e) Interpret your results.

f) Have we proven that cadets chose the candidate on the left because he appeared more competent and did not randomly select him?

4) On the television show *Mythbusters*, the hosts Jamie and Adam wanted to investigate which side buttered toast prefers to land on when it falls through the air. To replicate a piece of toast falling through the air, they set up a specially designed rig on the roof shot buttered toast into the air. Their results are replicated in the Toast.csv file.

a) Write your null and alternate hypotheses, using symbols and words.

b) List your p-value, standardized statistic, and if you used theoretical methods.

c) Write your conclusions, ensuring you reference your strength of evidence and what parameter you are inferring about.