STAT 216 Coursepack

Spring 2025
Montana State University

Melinda Yager
Jade Schmidt
Stacey Hancock

This resource was developed by Melinda Yager, Jade Schmidt, and Stacey Hancock in 2021 to accompany the online textbook: Hancock, S., Carnegie, N., Meyer, E., Schmidt, J., and Yager, M. (2021). *Montana State Introductory Statistics with R*. Montana State University. https://mtstateintrostats.github.io/IntroStatTextbook/.

Contents

Preface **1**

1 Unit 1 Review **2**

1.1 Module Review 2
1.2 Key Topics 2
1.3 Module 1 Review - Sampling Methods 3
1.4 Module 2 Review 6
1.5 Module 3 Review - Simulation Methods 8
1.6 Module 4 Review 11
1.7 Key Topics Exam 1 17

Preface

This coursepack accompanies the textbook for STAT 216: Montana State Introductory Statistics with R, which can be found at https://mtstateintrostats.github.io/IntroStatTextbook/. The syllabus for the course (including the course calendar), data sets, and links to D2L Brightspace, Gradescope, and the MSU RStudio server can be found on the course webpage: https://math.montana.edu/courses/s216/. Other notes and review materials are linked in D2L.

Each of the activities in this workbook is designed to target specific learning outcomes of the course, giving you practice with important statistical concepts in a group setting with instructor guidance. In addition to the in-class activities for the course, video notes are provided to aid in taking notes while you complete the required videos. Bring this workbook with you to class each class period, and take notes in the workbook as you would your own notes. A well-written completed workbook will provide an optimal study guide for exams!

All activities and labs in this coursepack will be completed during class time. Parts of each lab will be turned in on Gradescope. To aid in your understanding, read through the introduction for each activity before attending class each day.

STAT 216 is a 3-credit in-person course. In our experience, it takes six to nine hours per week outside of class to achieve a good grade in this class. By "good" we mean at least a C because a grade of D or below does not count toward fulfilling degree requirements. Many of you set your goals higher than just getting a C, and we fully support that. You need roughly nine hours per week to review past activities, read feedback on previous assignments, complete current assignments, and prepare for the next day's class. A typical week in the life of a STAT 216 student looks like:

- *Prior to class meeting*:
  - Read assigned sections of the textbook, using the provided reading guides to take notes on the material.
  - Watch the provided videos, taking notes in the coursepack.
  - Read through the introduction to the day's in-class activity.
  - Read through the week's homework assignment and note any questions you may have on the content.
- *During class meeting*:
  - Work through the guided activity, in-class activity or weekly lab with your classmates and instructor, taking detailed notes on your answers to each question in the activity.
- *After class meeting*:
  - Complete any parts of the activity you did not complete in class.
  - Review the activity solutions in the Math and Stat Center, and take notes on key points.
  - Complete any remaining assigned readings for the week.
  - Complete the week's homework assignment.

MODULE 1

Unit 1 Review

The following module contains both a list of key topics covered in Unit 1 as well as Module Review Worksheets that will be covered in Weekly Review Sessions.

1.1 Module Review

The following worksheets review each of the modules. These worksheets will be completed during Melinda's Study Sessions each week. Solutions will be posted on D2L in the Unit 1 Review folder after the study sessions.

1.2 Key Topics

Review the key topics for Unit 1 prior to the first exams. All of these topics will be covered in Modules 1–4.

1.3 Module 1 Review - Sampling Methods

1. Suppose that the proportion of all American adults that fit the medical definition of being obese is 0.23. A large medical clinic would like to determine if the proportion of their patients that are obese is higher than that of all American adults. The clinic takes a simple random sample of 30 of their patients and finds that 9 patients in the sample are obese.

a. What is the target population?

b. What are the observational units?

c. What variable is being studied?

d. Is the variable identified in part (c) categorical or quantitative?

2. Martha works in Macy's advertising department. She is interested in the shopping experience of all Macy's shoppers in the U.S. Every Saturday morning for a month she stands outside of the Bozeman Macy's asking people about their experience. One of the questions she uses is: "As a huge fan of Macy's, I believe Macy's has the best choices of clothing in Bozeman. Don't you agree?" Every person that was asked, responded.

a. Identify the target population.

b. Identify the sample.

c. Which of the three types of sampling bias (selection, non-response, response) may be present? Explain your choice(s).

3. This study aims to explore whether Swiss university students feeling academic study pressure (whether the student had experienced academic failure) tend to use psychotropic drugs (whether the student had used psychotropic drugs during the student's time at university) as a coping mechanism. An invitation email was sent to all bachelor's and master's students at the University of Lausanne, totaling 15,400 individuals, with a link to access the online questionnaire containing 49 questions and 107 items. No reminder was sent out, and no incentive was given to complete the questionnaire. A total of 1,690 students initially participated in the study, but 424 questionnaires were too incomplete to be used for analysis and were excluded. Additionally, 67 questionnaires were removed because of significant missing sociodemographic information, resulting in 1,199 completed responses included in the final analysis. Is there an association between study pressure and use of psychotropic drugs among Swiss University students?

a. Identify the target population.

b. Identify the sample.

c. Which of the three types of sampling bias (selection, non-response, response) may be present? Explain your choice(s).

d. Identify the type and roles of each variable in the study.

4. Researchers decided to investigate whether a cat's coat color is associated with aggressive cat behavior by creating a 20-minute survey. The survey was distributed by posting it to social media and through cat-related listservs (e.g., For the Love of Cats), inviting individuals to take the survey. A total of 1,365 surveys were completed by participants. The frequency of each of the following aggressive behavior categories was assessed: hiss, stalk/chase, bite, slap/scratch. Frequency of behaviors toward people were recorded on a 6-point scale: 0 = never, 1 = less than once every 6 months, 2 = once every 6 months, 3 = once per month, 4 = once per week, 5 = one or more times per day. Because there were four aggressive behavior categories, each with a frequency of 0 to 5 possible, each cat could score between 0 to 20 for human aggression. Is there an association between coat color and aggressive behavior among cats?

a. Identify the target population.

b. Identify the sample.

c. Which of the three types of sampling bias (selection, non-response, response) may be present? Explain your choice(s).

d. Identify the type and roles of each variable in the study.

1.4 Module 2 Review

1. Spelling errors in a text can either be non-word errors (teh instead of the) or word errors (lose instead of loose). It was found that non-word errors make up about 25% of all errors. A human proofreader will catch 92% of non-word errors and 75% of word errors.

Let N represent non-word errors and C represent that a human proofreader will catch the error.

a. Identify the following values with appropriate probability notation.

0.25

0.92

0.75

b. Fill in the table below to represent the situation:

	N	N^C	Total
C			
C^C			
Total			100000

c. Using your table calculate the probability that a randomly selected error caught by a human proofreader is a non-word error. Use appropriate probability notation.

d. Find the probability a selected error is a non-word error and was not caught by a human proofreader. Use appropriate probability notation.

e. Find the value of $P(N|C)$. What does this probability mean?

2. A private college report contains these statistics:

- 70% of incoming freshmen attended public schools
- 75% of public-school students who enroll as freshmen eventually graduate
- 90% of other freshmen eventually graduate

Let A represent the event that a freshman attended public school and B the event that a freshman eventually graduates.

a. Identify the following values with appropriate probability notation.

0.70

0.75

0.90

b. Fill in the table below to represent the situation:

	A	A^C	Total
B			
B^C			
Total			100000

c. Calculate the probability a selected freshman attended public school given they did not graduate. Use appropriate probability notation.

d. Calculate the probability a selected freshman does not graduate. Use appropriate probability notation.

e. Of the population of freshman that attended public school, what is the probability they do not graduate. Use appropriate probability notation.

f. Find the value of $P(A \text{ and } B^C)$. Write this probability in context of the problem.

1.5 Module 3 Review - Simulation Methods

```
hearing <- read.csv("data/hearing_loss.csv")
```

A recent study examined hearing loss data for 1753 U.S. teenagers. In this sample, 328 were found to have some level of hearing loss. News of this study spread quickly, with many news articles blaming the prevalence of hearing loss on the higher use of ear buds by teens. At MSNBC.com (8/17/2010), Carla Johnson summarized the study with the headline: "1 in 5 U.S. teens has hearing loss, study says." Is this an appropriate or a misleading headline?

1. Write the parameter of interest in context of the study.

2. Write the null hypothesis in words and notation in context of the problem.

3. Based on the research questions, choose the direction for the alternative hypothesis.

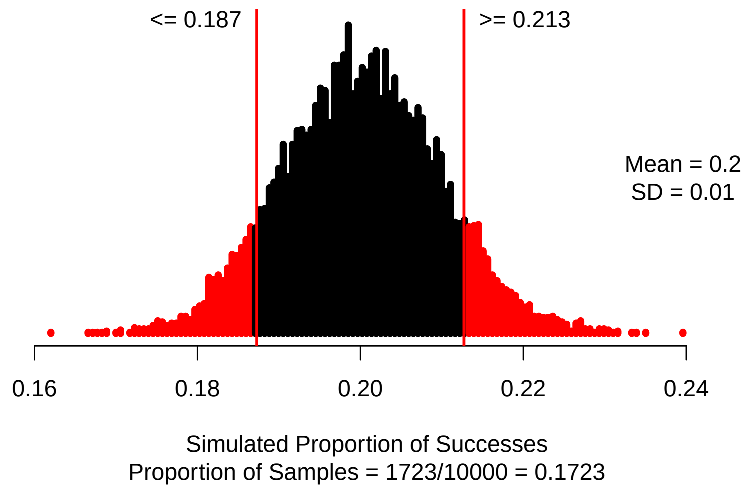
4. Write the alternative hypothesis in words and notation in context of the problem.

5. Calculate the summary statistic. Use proper notation.

6. What values should be entered for each of the following into the one proportion test to create 10000 simulations?

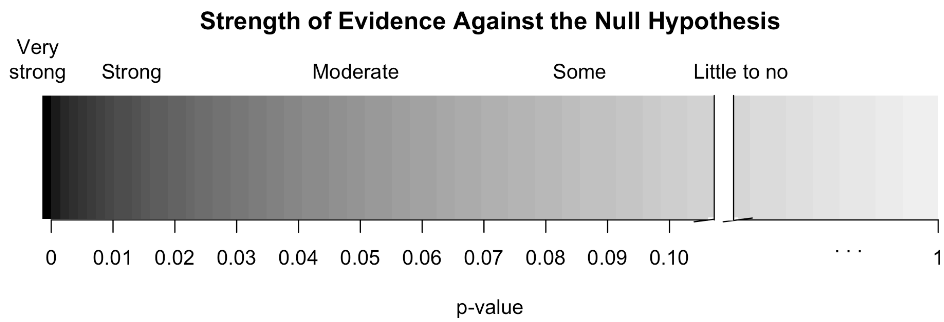
- Probability of success:
- Sample size:
- Number of repetitions:
- As extreme as:
- Direction ("greater", "less", or "two-sided"):

```r
one_proportion_test(probability_success = 0.2, #Null hypothesis value
                    sample_size = 1753, #Enter sample size
                    number_repetitions = 10000, #Enter number of simulations
                    as_extreme_as = 0.187, #observed statistic
                    direction = "two-sided", #specify direction of alternative hypothesis
                    summary_measure = "proportion") #Reporting proportion or number of successes?
```



7. Interpret the p-value in context of the problem.

8. How much evidence does the data provide against the null hypothesis?



9. Write a conclusion to the study in context of the problem.

10. Would a 95% confidence interval contain the null value of 0.2? Explain.

11. What values should be entered for each of the following into the simulation to create the bootstrap distribution of sample proportions to find a 95% confidence interval?

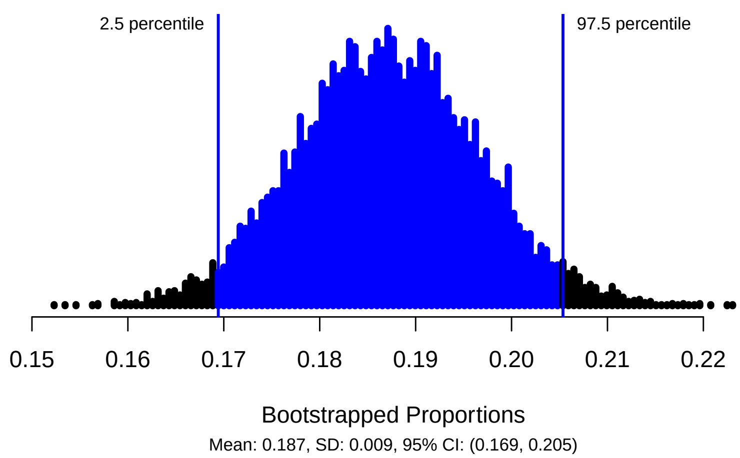
- Sample size:

- Number of successes:

- Number of repetitions:

- Confidence level (as a decimal):

```
set.seed(216)
one_proportion_bootstrap_CI(sample_size = 1753, # Sample size
                            number_successes = 328, # Observed number of successes
                            number_repetitions = 10000, # Number of bootstrap samples to use
                            confidence_level = 0.95) # Confidence level as a decimal
```



12. Explain how to use cards to create one bootstrap sample.

13. Report the 95% confidence interval in interval notation.

14. Interpret the 95% confidence interval in context of the problem.

1.6 Module 4 Review

Statistician Jessica Utts has conducted an extensive analysis of Ganzfeld studies that have investigated psychic functioning. Ganzfeld studies involve a "sender" and a "receiver." Two people are placed in separate rooms. The sender looks at a "target" image on a television screen and attempts to transmit information about the target to the receiver. The receiver is then shown four possible choices or targets, one of which is the correct target and the other three are "decoys." The receiver must choose the one he or she thinks best matches the description transmitted by the sender. If the correct target is chosen by the receiver, the session is a "hit." Otherwise, it is a miss. Utts reported that her analysis considered a total of 2,124 sessions and found a total of 709 "hits" (Utts, 2010). Is there evidence of psychic ability?

1. Write the parameter of interest in context of the study.

2. Calculate the point estimate. Use proper notation.

3. Write the null hypothesis in words.

4. Write the alternative hypothesis in notation.

A single proportion can be mathematically modeled using the normal distribution if certain conditions are met.

Conditions for the sampling distribution of $\hat{p}$ to follow an approximate normal distribution.

- Independence: The sample's observations are independent, e.g., are from a simple random sample
- Large enough sample size:
  - Success-Failure Condition: There are at least 10 successes and 10 failures in the sample

$$n \times \hat{p} \geq 10$$

and

$$n \times (1 - \hat{p}) \geq 10$$

5. Are the conditions met to model the data with the Normal distribution?

Standardized sample proportion.

The standardized statistic for theory-based methods for one proportion is:

$$Z = \frac{\hat{p} - \pi_0}{SE_0(\hat{p})}$$

Where

$$SE_0(\hat{p}) = \sqrt{\frac{\pi_0 \times (1 - \pi_0)}{n}}$$

6. Calculate the null standard error of the sample proportion

7. Calculate the standardized statistic for the sample proportion.

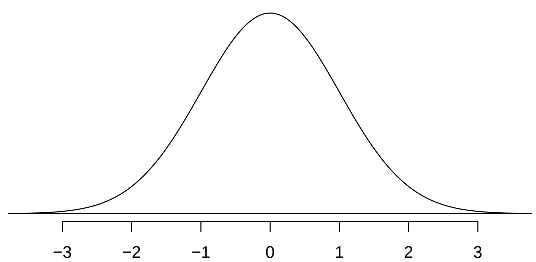
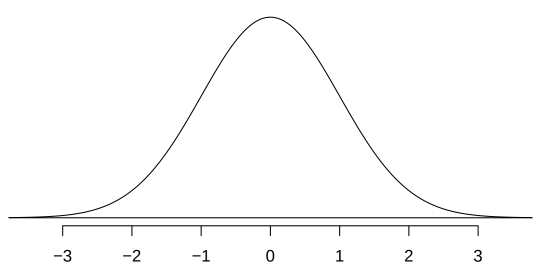


Figure 1.1: A standard normal curve.



8. Interpret the standardized statistic in context of the problem.

We will use the `pnorm()` function in `R` to find the p-value. The value of the standardized statistic calculated in question 8 is entered into the `R` code. We used `lower.tail = FALSE` to find the p-value so that `R` will calculate the p-value *greater* than the value of the standardized statistic.

Notes:

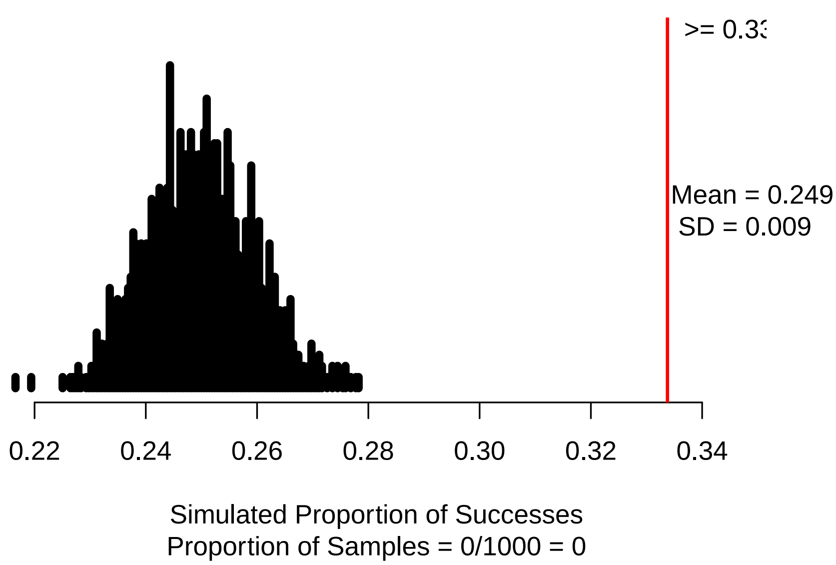
- Use `lower.tail = TRUE` when doing a left-sided test.
- Use `lower.tail = FALSE` when doing a right-sided test.
- To find a two-sided p-value, use a left-sided test for negative Z or a right-sided test for positive Z, then multiply the value found by 2 to get the p-value.

```
pnorm(9.333, # Enter value of standardized statistic
      m=0, s=1, # Using the standard normal mean = 0, sd = 1
      lower.tail=FALSE) # Gives a p-value greater than the standardized statistic
#> [1] 5.145792e-21
```

9. Report the value of the p-value.

Simulation Method:

```
set.seed(216)
one_proportion_test(probability_success = 0.25, #Null hypothesis value
                    sample_size = 2124, #Enter sample size
                    number_repetitions = 1000, #Enter number of simulations
                    as_extreme_as = 0.334, #observed statistic
                    direction = "greater", #specify direction of alternative hypothesis
                    summary_measure = "proportion") #Reporting proportion or number of successes?
```



10. Interpret the p-value in context of the study.

Next we will use theory-based methods to estimate the parameter of interest.

To calculate a theory-based 95% confidence interval for π, we will first find the **standard error** of $\hat{p}$ by plugging in the value of $\hat{p}$ for π in $SD(\hat{p})$:

$$SE(\hat{p}) = \sqrt{\frac{\hat{p} \times (1-\hat{p})}{n}}.$$

Note that we do not include a "0" subscript, since we are not assuming a null hypothesis.

11. Calculate the standard error of the sample proportion to find a 95% confidence interval.

To find the confidence interval, we will add and subtract the **margin of error** to the point estimate:

$$\text{point estimate} \pm \text{margin of error}$$
$$\hat{p} \pm z^* SE(\hat{p})$$

The z^* multiplier is the percentile of a standard normal distribution that corresponds to our confidence level. If our confidence level is 95%, we find the Z values that encompass the middle 95% of the standard normal distribution. If 95% of the standard normal distribution should be in the middle, that leaves 5% in the tails, or 2.5% in each tail. The `qnorm()` function in `R` will tell us the z^* value for the desired percentile (in this case, 95% + 2.5% = 97.5% percentile).

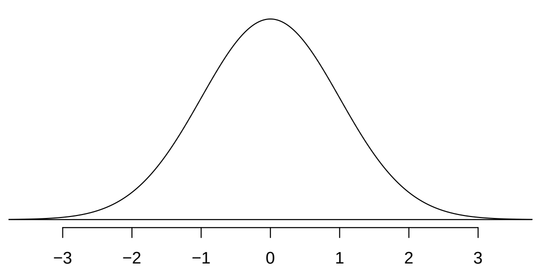


Figure 1.2: A standard normal curve.

```
qnorm(0.975) # Multiplier for 95% confidence interval
```

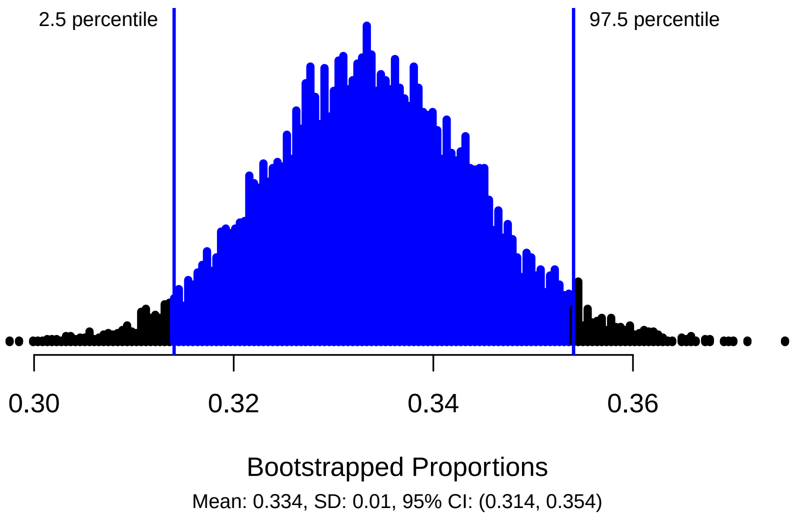
```
#> [1] 1.959964
```

12. Calculate the margin of error for a 95% confidence interval for the true proportion of sessions that will result in a hit.

13. Calculate the 95% confidence interval for the true proportion of sessions that will result in a hit.

Simulation Methods:

```
set.seed(216)
one_proportion_bootstrap_CI(sample_size = 2124, # Sample size
                            number_successes = 709, # Observed number of successes
                            number_repetitions = 10000, # Number of bootstrap samples to use
                            confidence_level = 0.95) # Confidence level as a decimal
```



14. Interpret the 95% confidence interval in context of the problem.

15. Write a conclusion based on the p-value and the 95% confidence interval.

1.7 Key Topics Exam 1

Descriptive statistics and study design

1. Identify the observational units.
2. Identify the types of variables (categorical or quantitative).
3. Identify the explanatory variable (if present) and the response variable (roles of variables).
4. Identify the appropriate type of graph and summary measure.
5. Identify if a given value is a statistic or a parameter. Identify the appropriate notation.
6. Identify the study design (observational study or randomized experiment).
7. Identify the sampling method and potential types of sampling bias (non-response, response, selection).
8. Identify and interpret the summary statistic
9. Identify the target population
10. Identify the types of sampling bias (response, non-response, selection, none)
11. Identify the type(s) of graph(s) that could be used to plot the given variable(s).

Hypothesis testing

12. Write the parameter of interest in context of the problem.
13. State the null and alternative hypotheses in both words and notation
14. Verify the validity condition is met to use simulation-based methods to find a p-value.
15. Verify the validity conditions are met to use theory-based methods to find a p-value from the theoretical distribution.
16. In a simulation-based hypothesis test, describe how to create one dot on a dotplot of the null distribution using coins, cards, or spinners.
17. Explain where the null distribution is centered and why.
18. Describe and illustrate how R calculates the p-value for a simulation-based test.
19. Describe and illustrate how R calculates the p-value for a theory-based test.
20. Type of theoretical distribution (standard normal distribution or t-distribution with appropriate degrees of freedom) used to model the standardized statistic in a theory-based hypothesis test.
21. Calculate and interpret the standard error of the statistic under the null using the correct formula on the Golden ticket.
22. Calculate and interpret the appropriate standardized statistic using the correct formula on the Golden ticket.
23. Interpret the p-value in context of the study: it is the probability of ______, assuming ______.
24. Evaluate the p-value for strength of evidence against the null: how much evidence does the p-value provide against the null?
25. Write a conclusion about the research question based on the p-value.
26. Describe which features of the study impact the p-value and how.

1.7.1 Confidence intervals

27. Describe how to simulate one bootstrapped sample using cards.
28. Explain where the bootstrap distribution is centered and why.
29. Find an appropriate percentile confidence interval using a bootstrap distribution from R output.
30. Verify the validity condition is met to use simulation-based methods to find the confidence interval.
31. Verify the validity conditions are met to use theory-based methods to calculate a confidence interval.
32. Describe and illustrate how the bootstrap distribution is used to find the confidence interval for a given confidence level.
33. Describe and illustrate how the standard normal distribution or t-distribution is used to find the multiplier for a given confidence level.
34. Calculate and interpret the standard error of the statistic (not assuming the null hypothesis) using the correct formula on the Golden ticket
35. Calculate the appropriate margin of error and confidence interval using theory-based methods.
36. Interpret the confidence interval in context of the study.
37. Based on the interval, what decision can you make about the null hypothesis? Does the confidence interval agree with the results of the hypothesis test? Justify your answer.
38. Interpret the confidence level in context of the study. What does "confidence" mean?
39. Describe which features of the study have an effect on the width of the confidence interval and how.

"Average Driving Distance and Fairway Accuracy." 2008. https://www.pga.com/ and https://www.lpga.com/.
Banton, et al, S. 2022. "Jog with Your Dog: Dog Owner Exercise Routines Predict Dog Exercise Routines and Perception of Ideal Body Weight." *PLoS ONE* 17(8).
Bhavsar, et al, A. 2022. "Increased Risk of Herpes Zoster in Adults ≥50 Years Old Diagnosed with COVID-19 in the United States." *Open Forum Infectious Diseases* 9(5).
Bulmer, M. n.d. "Islands in Schools Project." https://sites.google.com/site/islandsinschoolsprojectwebsite/home.
"Bureau of Transportation Statistics." 2019. https://www.bts.gov/.
"Child Health and Development Studies." n.d. https://www.chdstudies.org/.
Darley, J. M., and C. D. Batson. 1973. ""From Jerusalem to Jericho": A Study of Situational and Dispositional Variables in Helping Behavior." *Journal of Personality and Social Psychology* 27: 100–108.
Davis, Smith, A. K. 2020. "A Poor Substitute for the Real Thing: Captive-Reared Monarch Butterflies Are Weaker, Paler and Have Less Elongated Wings Than Wild Migrants." *Biology Letters* 16.
Du Toit, et al, G. 2015. "Randomized Trial of Peanut Consumption in Infants at Risk for Peanut Allergy." *New England Journal of Medicine* 372.
Edmunds, et al, D. 2016. "Chronic Wasting Disease Drives Population Decline of White-Tailed Deer." *PLoS ONE* 11(8).
Education Statistics, National Center for. 2018. "IPEDS." https://nces.ed.gov/ipeds/.
"Great Britain Married Couples: Great Britain Office of Population Census and Surveys." n.d. https://discovery.nationalarchives.gov.uk/details/r/C13351.
Group, TODAY Study. 2012. "A Clinical Trial to Maintain Glycemic Control in Youth with Type 2 Diabetes." *New England Journal of Medicine* 366: 2247–56.
Hamblin, J. K., K. Wynn, and P. Bloom. 2007. "Social Evaluation by Preverbal Infants." *Nature* 450 (6288): 557–59.
Hirschfelder, A., and P. F. Molin. 2018. "I Is for Ignoble: Stereotyping Native Americans." Retrieved from https://www.ferris.edu/HTMLS/news/jimcrow/native/homepage.htm.
Hutchison, R. L., and M. A. Hirthler. 2013. "Upper Extremity Injuies in Homer's Iliad." *Journal of Hand Surgery (American Volume)* 38: 1790–93.
"IMDb Movies Extensive Dataset." 2016. https://kaggle.com/stefanoleone992/imdb-extensive-dataset.
Kalra, et al., Dl. 2022. "Trustworthiness of Indian Youtubers." Kaggle. https://doi.org/10.34740/KAGGLE/DSV/4426566.
Keating, D., N. Ahmed, F. Nirappil, Stanley-Becker I., and L. Bernstein. 2021. "Coronavirus Infections Dropping Where People Are Vaccinated, Rising Where They Are Not, Post Analysis Finds." *Washington Post*. https://www.washingtonpost.com/health/2021/06/14/covid-cases-vaccination-rates/.
Laeng, Mathisen, B. 2007. "Why Do Blue-Eyed Men Prefer Women with the Same Eye Color?" *Behavioral Ecology and Sociobiology* 61(3).
Levin, D. T. 2000. "Race as a Visual Feature: Using Visual Search and Perceptual Discrimination Tasks to Understand Face Categories and the Cross-Race Recognition Deficit." *Journal of Experimental Psychology* 129(4).
LUETKEMEIER, et al., M. 2017. "Skin Tattoos Alter Sweat Rate and Na+ Concentration." *Medicine and Science in Sports and Exercise* 49(7).
Madden, et al, J. 2020. "Ready Student One: Exploring the Predictors of Student Learning in Virtual Reality." *PLoS ONE* 15(3).
Miller, G. A. 1956. "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information." *Psychological Review* 63(2).
Moquin, W., and C. Van Doren. 1973. "Great Documents in American Indian History." Praeger.
"More Americans Are Joining the 'Cashless' Economy." 2022. https://www.pewresearch.org/short-reads/2022/10/05/more-americans-are-joining-the-cashless-economy/.
National Weather Service Corporate Image Web Team. n.d. "National Weather Service – NWS Billings." https://w2.weather.gov/climate/xmacis.php?wfo=byz.
O'Brien, Lynch, H. D. 2019. "Crocodylian Head Width Allometry and Phylogenetic Prediction of Body Size in Extinct Crocodyliforms." *Integrative Organismal Biology* 1.
"Ocean Temperature and Salinity Study." n.d. https://calcofi.org/.

“Older People Who Get Covid Are at Increased Risk of Getting Shingles.” 2022. https://www.washingtonpost.com/health/2022/04/19/shingles-and-covid-over-50/.

“Physician’s Health Study.” n.d. https://phs.bwh.harvard.edu/.

Porath, Erez, C. 2017. “Does Rudeness Really Matter? The Effects of Rudeness on Task Performance and Helpfulness.” *Academy of Management Journal* 50.

Quinn, G. E., C. H. Shin, M. G. Maguire, and R. A. Stone. 1999. “Myopia and Ambient Lighting at Night.” *Nature* 399 (6732): 113–14. https://doi.org/10.1038/20094.

Ramachandran, V. 2007. “3 Clues to Understanding Your Brain.” https://www.ted.com/talks/vs_ramachandran_3_clues_to_understanding_your_brain.

“Rates of Laboratory-Confimed COVID-19 Hospitalizations by Vaccination Status.” 2021. CDC. https://covid.cdc.gov/covid-data-tracker/#covidnet-hospitalizations-vaccination.

Richardson, T., and R. T. Gilman. 2019. “Left-Handedness Is Associated with Greater Fighting Success in Humans.” *Scientific Reports* 9 (1): 15402. https://doi.org/10.1038/s41598-019-51975-3.

Stephens, R., and O. Robertson. 2020. “Swearing as a Response to Pain: Assessing Hypoalgesic Effects of Novel ”Swear” Words.” *Frontiers in Psychology* 11: 643–62.

Stewart, E. H., B. Davis, B. L. Clemans-Taylor, B. Littenberg, C. A. Estrada, and R. M. Centor. 2014. “Rapid Antigen Group a Streptococcus Test to Diagnose Pharyngitis: A Systematic Review and Meta-Analysis” 9 (11). https://doi.org/10.1371/journal.pone.0111727.

Stroop, J. R. 1935. “Studies of Interference in Serial Verbal Reactions.” *Journal of Experimental Psychology* 18: 643–62.

Subach, et al, A. 2022. “Foraging Behaviour, Habitat Use and Population Size of the Desert Horned Viper in the Negev Desert.” *Soc.Open Sci* 9.

Sulheim, S., A. Ekeland, I. Holme, and R. Bahr. 2017. “Helmet Use and Risk of Head Injuries in Alpine Skiers and Snowboarders: Changes After an Interval of One Decade” 51 (1): 44–50. https://doi.org/10.1136/bjsports-2015-095798.

“Titanic.” n.d. http://www.encyclopedia-titanica.org.

“US COVID-19 Vaccine Tracker: See Your State’s Progress.” 2021. Mayo Clinic. https://www.mayoclinic.org/coronavirus-covid-19/vaccine-tracker.

US Environmental Protection Agency. n.d. “Air Data – Daily Air Quality Tracker.” https://www.epa.gov/outdoor-air-quality-data/air-data-daily-air-quality-tracker.

Wahlstrom, et al, K. 2014. “Examining the Impact of Later School Start Times on the Health and Academic Performance of High School Students: A Multi-Site Study.” *Center for Applied Research and Educational Improvement.*

Watson, et al., N. 2015. “Recommended Amount of Sleep for a Heathy Adult: A Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society.” *Sleep* 38(6).

Weiss, R. D. 1988. “Relapse to Cocaine Abuse After Initiating Desipramine Treatment.” *JAMA* 260(17).

“Welcome to the Navajo Nation Government: Official Site of the Navajo Nation.” 2011.Retrieved from https://www.navajo-nsn.gov/.

Wilson, Woodruff, J. P. 2016. “Vertebral Adaptations to Large Body Size in Theropod Dinosaurs.” *PLoS ONE* 11(7).