

- 9.19 Calculate the standard error for t for the sample used in Exercise 9.17 using symbolic notation: 93, 97, 91, 88, 103, 94, 97.
- 9.20 Calculate the standard error for t for the sample used in Exercise 9.18 using symbolic notation: 1.01, 0.99, 1.12, 1.27, 0.82, 1.04.
- 9.21 Calculate the t statistic for the data presented in Exercise 9.17, assuming $\mu = 96$. Again, the data are 93, 97, 91, 88, 103, 94, 97.
- 9.22 Calculate the t statistic for the data presented in Exercise 9.18, assuming $\mu = 0.96$. Again, the data are 1.01, 0.99, 1.12, 1.27, 0.82, 1.04.
- 9.23 Identify the critical t value in each of the following circumstances:
- A one-tailed test with 73 degrees of freedom at a p level of 0.10
 - A two-tailed test with 108 degrees of freedom at a p level of 0.05
 - A one-tailed test with 38 degrees of freedom at a p level of 0.01
- 9.24 Calculate degrees of freedom and identify the critical t value in each of the following circumstances:
- A two-tailed test based on 8 observations at a p level of 0.10
 - A one-tailed test based on 42 observations at a p level of 0.05
 - A two-tailed test based on 89 observations at a p level of 0.01
- 9.25 Identify t critical values for each of the following tests:
- A single-sample t test examining scores for 26 participants to see if there is any difference compared to the population, using a p level of 0.05
 - A one-tailed, paired-samples t test performed on scores on the Marital Satisfaction Inventory for 18 couples who went through marriage counseling, using a p level of 0.01
 - A two-tailed, single-sample t test, using a p level of 0.05, with 34 degrees of freedom
- 9.26 Assume we know the following for a two-tailed, single-sample t test, at a p level of 0.05: $\mu = 44.3$, $N = 114$, $M = 43$, $s = 5.9$.
- Calculate the t statistic.
 - Calculate a 95% confidence interval.
 - Calculate effect size using Cohen's d .
- 9.27 Assume we know the following for a two-tailed, single-sample t test: $\mu = 7$, $N = 41$, $M = 8.5$, $s = 2.1$.
- Calculate the t statistic.
 - Calculate a 99% confidence interval.
 - Calculate effect size using Cohen's d .
- 9.28 Assume we know the following for a paired-samples t test: $N = 32$, $M_{\text{difference}} = 1.75$, $s = 4.0$.
- Calculate the t statistic.
 - Calculate a 95% confidence interval for a two-tailed test.
 - Calculate effect size using Cohen's d .
- 9.29 Assume we know the following for a paired-samples t test: $N = 13$, $M_{\text{difference}} = -0.77$, $s = 1.42$.
- Calculate the t statistic.
 - Calculate a 95% confidence interval for a two-tailed test.
 - Calculate effect size using Cohen's d .
- 9.30 Each of the following is a p value for a specific t statistic. For each, use Excel to determine p_{rep} .
- 0.022
 - 0.37
 - 0.004

Applying the Concepts

- 9.31 For each of the problems described below, which are the same as those described in Exercise 9.25, identify what the z critical value would have been if there had been just one sample and we knew the mean and standard deviation of the population:
- A single-sample t test examining scores for 26 participants to see if there is any difference compared to the population, using a p level of 0.05
 - A one-tailed, single-sample t test performed on scores on the Marital Satisfaction Inventory for 18 people who went through marriage counseling, using a p level of 0.01
 - A two-tailed, single-sample t test, using a p level of 0.05, with 34 degrees of freedom
 - Comparing the t critical values with the z critical values, explain how and why these are different.
- 9.32 On its Web site, the *Princeton Review* claims that students who have taken its course improve their GRE scores, on average, by 210 points. (No other information is provided about this statistic.) Treating this average gain as a population mean, a researcher wonders whether the far cheaper technique of practicing for the GRE on one's own using books and CD-ROMs would lead to a different average gain. She randomly selects five students from the pool of students at her university who plan to take the GRE. The students take a practice test before and after two months of self-study. They reported (fictional) gains of 160, 240, 340, 70, and 250 points. (Note that many experts suggest that the results from self-study are similar to those from a structured course if you have the self-discipline to go solo. Regardless of the format, preparation has been convincingly demonstrated to lead to increased scores.)

- a. Using symbolic notation and formulas (where appropriate), determine the appropriate mean and standard error for the distribution to which we will compare this sample. Show all steps of your calculations.
 - b. Using symbolic notation and the formula, calculate the t statistic for this sample.
 - c. As an interested consumer, what critical questions would you want to ask about the statistic reported by the *Princeton Review*? List at least three questions.
- 9.33 The Florida Department of Corrections publishes an online death row fact sheet. It reports the average time on death row prior to execution as 11.72 years but provides no standard deviation. This mean is a parameter, as it is calculated from the entire population of executed prisoners in Florida. Has the time spent on death row changed in recent years? According to the execution list linked to the same Web site, the six prisoners executed in Florida during the years 2003, 2004, and 2005 spent 25.62, 13.09, 8.74, 17.63, 2.80, and 4.42 years on death row, respectively. (All were men, although Aileen Wuornos, the serial killer portrayed by Charlize Theron in the 2003 film *Monster*, was among the three prisoners executed by the state of Florida in 2002; Wuornos spent 10.69 years on death row.)
- a. Using symbolic notation and formulas (where appropriate), determine the appropriate mean and standard error for the distribution of means. Show all steps of your calculations.
 - b. Using symbolic notation and the formula, calculate the t statistic for time spent on death row for the sample of recently executed prisoners.
 - c. The specific p value for the t statistic you just calculated is 0.929. Use Excel to determine p_{rep} . What does p_{rep} tell you about this study?
 - d. The execution list provides data on all prisoners executed since the death penalty was reinstated in Florida in 1976. Included for each prisoner are the name, race, gender, date of birth, date of offense, date sentenced, date arrived on death row, data of execution, number of warrants, and years on death row. State at least one hypothesis, other than year of execution, that could be examined using a t distribution and the comparison mean of 11.72 years on death row. Be specific about your hypothesis (and if you are truly interested, you can search for the data online).
 - e. What additional information would you need to calculate a z score for the length of time Aileen Wuornos spent on death row?
- 9.34 Refer to the information provided in Exercise 9.33 when answering the following:
- a. Write hypotheses to address the question “Has the time spent on death row changed in recent years?”
 - b. Using these data as “recent years” and the mean of 11.72 years as the comparison, answer the question based on your t statistic, using alpha of 0.05.
- 9.35 Refer to the information provided in Exercise 9.33 when answering the following:
- a. Calculate the confidence interval for this statistic based on the data presented.
 - b. What conclusion would you make about your hypotheses based on this confidence interval? What can you say about the size of this confidence interval?
- 9.36 Refer to the information provided in Exercise 9.33 and the work you have done through Exercise 9.35 when answering the following:
- a. Calculate the effect size using Cohen’s d .
 - b. Evaluate the size of this effect.
- 9.37 Many communities worldwide are lamenting the effects of so-called big box retailers (e.g., Wal-Mart) on their local economies, particularly on small, independently owned shops. Do these large stores affect the bottom lines of locally owned retailers? Imagine that you decide to test this premise. You assess earnings at 20 local stores for the month of October, a few months before a big box store opens. You then assess earnings the following October, correcting for inflation.
- a. What are the two populations?
 - b. What would the comparison distribution be? Explain.
 - c. What hypothesis test would you use? Explain.
 - d. Check the assumptions for this hypothesis test.
 - e. What is one flaw in drawing conclusions from this comparison over time?
- 9.38 For the scenario described in Exercise 9.37 (big box stores and their effect on local retailers), state the null and research hypotheses in both words and symbols.
- 9.39 Bardwell, Ensign, and Mills (2005) assessed the moods of 60 male U.S. Marines following a month-long training exercise conducted in cold temperatures and at high altitudes. Negative moods, including fatigue and anger, increased substantially during the training and lasted up to three months after the training ended. Mean mood scores were compared to population norms for three groups: college men, adult men, and male psychiatric outpatients. Let’s examine anger scores for six men at the end of training; these scores are fictional, but their mean and standard deviation are very close to the actual descriptive statistics for the sample: 14, 12, 13, 12, 14, 15.
- a. The population mean anger score for college men is 8.90. Conduct all six steps of a single-sample t test. Be sure to label all six steps. Report the statistics as you would in a journal article.

- b. Now calculate the test statistic to compare this sample mean to the population mean anger score for adult men ($M = 9.20$). You do not have to repeat all the steps from part (a), but conduct step 6 of hypothesis testing and report the statistics as you would in a journal article.
- c. Now calculate the test statistic to compare this sample mean to the population mean anger score for male psychiatric outpatients ($M = 13.5$). Do not repeat all the steps from part (a), but conduct step 6 of hypothesis testing and report the statistics as you would in a journal article.
- d. What can we conclude overall about Marines' moods following high-altitude, cold-weather training? Remember, if we fail to reject the null hypothesis, we can only conclude that there is no evidence from this study to support the research hypothesis. We cannot conclude that we have supported the null hypothesis.

9.40 The number of paid days off (i.e., vacation, sick leave) taken by eight employees at a local small business is compared to the national average. You are hired by the business owner, who has been in business for just 18 months, to help her determine what to expect for paid days off. In general, she wants to set some standard for her employees and for herself. Let's assume your search on the Internet for data on paid days off leaves you with the impression that the national average is 15 days. The data for the eight local employees during the last fiscal year are: 10, 11, 8, 14, 13, 12, 12, and 27 days.

- Write hypotheses for your research.
- Which type of test would be appropriate to analyze these data in order to answer your question?
- Before doing any computations, do you have any concerns about this research? Are there any questions you might like to ask about the data you have been given?

9.41 Use the data presented in Exercise 9.40 to help this business owner understand her employees' experience with paid days off in greater detail.

- Calculate the appropriate t statistic. Show all of your work in detail.
- Draw a statistical conclusion for this business owner.
- The p level for the test statistic you calculated in part (a) is 0.454. Using Excel, determine p_{rep} .
- Calculate the confidence interval.
- Calculate and interpret the effect size.

9.42 Consider all the results you calculated in Exercise 9.41. How would you summarize the situation for this business owner? Identify the limitations of your analyses, and discuss the difficulties of making comparisons between populations and samples. Make reference to the assumptions of the statistical test in your answer.

9.43 After further investigation, you discover that one of the data points, 27 days, was actually the owner's number of paid days off. Redo some of the work for Exercise 9.41 adapting for this new information by deleting that value.

- Calculate the appropriate t statistic. Show all of your work in detail.
- Draw a statistical conclusion for this business owner.
- The p level for the test statistic you calculated in part (a) is now 0.003. Using Excel, determine p_{rep} .
- Calculate and interpret the effect size.
- Explain what changed in these analyses.

9.44 Is it harder to get into graduate programs in psychology or history? We randomly selected five institutions from among all U.S. institutions with graduate programs. The first number for each is the minimum GPA for applicants to the psychology doctoral program, and the second is for applicants to the history doctoral program. These GPAs were posted on the Web site of the well-known college guide company Peterson's.

Wayne State University: 3.0, 2.75

University of Iowa: 3.0, 3.0

University of Nevada—Reno: 3.0, 2.75

George Washington University: 3.0, 3.0

University of Wyoming: 3.0, 3.0

- The participants are not people; explain why it is appropriate to use a paired-samples t test for this situation.
- Conduct all six steps of a paired-samples t test. Be sure to label all six steps.
- Report the statistics as you would in a journal article.

9.45 Using the data provided in Exercise 9.44, calculate the effect size and explain what this adds to your analysis.

9.46 In Chapter 1, you were given an opportunity to complete the Stroop task in which color words are printed in the wrong color; for example, the word *red* might be printed in the color blue. The conflict that arises when we try to read the words, but are distracted by the colors, increases our reaction time and decreases our accuracy. Several researchers have suggested that the Stroop effect can be decreased by hypnosis. Raz (2005) used brain-imaging techniques [i.e., functional magnetic resonance imaging (fMRI)] to demonstrate that posthypnotic suggestion led highly hypnotizable individuals to see Stroop words as nonsense words. Imagine that you are working with Raz and your assignment is to determine if reaction times decrease (remember, a decrease is a good thing; it indicates that participants are faster) when highly hypnotizable individuals receive a posthypnotic suggestion to view the