- *Is my result practically significant?* With very large samples, it's easy to get a small *P*-value (large test statistic) even though the sample value may not be practically different than the hypothesized value.
- *Are the assumptions I made to perform the test justifiable?*
- *Can I reproduce my results?*

11.3 Exercises

Basic Concepts

1. What are the two key questions to be asked in the hypothesis testing procedure in order to determine which test statistic is appropriate?

2. If the variance for a population is not known, how is the test statistic affected?

3. Suppose a null hypothesis was rejected at $\alpha = 0.05$. Would it be rejected at 0.01? Explain.

4. Discuss how *P*-values are used in the test of a hypothesis.

Exercises

5. Researchers studying the effects of diet on growth would like to know if a vegetarian diet affects the height of a child. The researchers randomly select 12 vegetarian children that are six years old. The average height of the children is 42.5 inches with a standard deviation of 3.8 inches. The average height for all six year old children is 45.75 inches.

a. What is the population being studied?

b. Conduct an hypothesis test to determine whether there is overwhelming evidence at $\alpha = 0.05$ that six year old vegetarian children are not the same height as other six year old children?

c. What assumption did you make in performing the test in part **b.**?

6. Consider the following σ unknown hypothesis tests for the population mean. Compute the *P*-value for each test and decide whether you would reject or fail to reject the null hypothesis at $\alpha = 0.01$.

a. $H_0: \mu = 25, H_a: \mu > 25, t = 2.7, n = 15$

b. $H_0: \mu = 0.85, H_a: \mu < 0.85, t = -2.5, n = 7$

c. $H_0: \mu = 1000, H_a: \mu \neq 1000, t = 2.0, n = 15$

7. Consider the following σ unknown hypothesis tests for the population mean. Compute the *P*-value for each test and decide whether you would reject or fail to reject the null hypothesis at $\alpha = 0.05$.

a. $H_0: \mu = 120, H_a: \mu > 120, t = 1.5, n = 20$

b. $H_0: \mu = 0.2, H_a: \mu < 0.2, t = -2.75, n = 18$

c. $H_0: \mu = 50, H_a: \mu \neq 50, t = 2.4, n = 5$

8. The average number of points scored by a team during an NFL football game is known to be 19.55. Use the Super Bowl data set to test whether the number of points scored by a team during the Super Bowl is different than 19.55 at $\alpha = 0.05$.

Data
stat.hawkeslearning.com
Discovering Statistics and Data, Fourth Edition > Data Sets > Super Bowl

9. The American IPA style of beer has on average 6.47% alcohol by volume (ABV). Use the Beers and Breweries data set , which is a sample of American canned beers brewed in the U.S., to determine if the American IPAs brewed in California have more ABV than average at $\alpha = 0.05$. Calculate the *P*-value for this hypothesis test.

Data
stat.hawkeslearning.com
Discovering Statistics and Data, Fourth Edition > Data Sets > Beers and Breweries

10. According to Trulia[12], the average price per square foot for Mount Pleasant homes sold in 2017 was $210. Using the Mount Pleasant Real Estate data set, which is a sample of homes for sale in three neighborhoods on the north side of Mount Pleasant, perform a hypothesis test to test the claim that the average price per square foot is lower in the Park West neighborhood than the city's average at $\alpha = 0.10$. Calculate the *P*-value for this hypothesis test.

Data
stat.hawkeslearning.com
Discovering Statistics and Data, Fourth Edition > Data Sets > Mount Pleasant Real Estate Data

11. Del Valley Foods requires that corn supplied for canning must weigh more than 5 ounces per ear. South Valley Farms claims that the corn they supply meets the required specifications. A sample of 200 ears of corn are selected at random from a delivery. The sample has a mean of 5.01 ounces and a standard deviation of 0.30 ounces. Will a test of hypothesis at $\alpha = 0.10$ support South Valley Farms' claim?

12. The director of the IRS has been flooded with complaints that people must wait more than 45 minutes before seeing an IRS representative. To determine the validity of these complaints, the IRS randomly selects 400 people entering IRS offices across the country and records the times that they must wait before seeing an IRS representative. The average waiting time for the sample is 55 minutes with a standard deviation of 15 minutes.

a. What is the population being studied?

b. Are the complaints substantiated by the data at $\alpha = 0.10$?

13. NarStor, a computer disk drive manufacturer, claims that the average time to failure for its hard drives is 14,400 hours. You work for a consumer group that has decided to examine this claim. Technicians ran 16 drives continuously for three years. Recently the last drive failed. The time to failure (in hours) are given below.

Time Until Failure (Hours)							
330	620	1870	2410	4620	6396	7822	8102
8309	12,882	14,419	16,092	18,384	20,916	23,812	25,814

a. What is the population being studied?

b. What is the variable being measured?

c. What level of measurement does the variable possess?

d. Conduct a hypothesis test to determine whether there is overwhelming evidence that the average time to failure is less than the manufacturer's claim. Use $\alpha = 0.01$.

e. What assumption did you make in performing the test in part **d.**?

14. Officials in charge of televising an international chess competition in South America want to determine if the average time per move for the top players has remained under five minutes over the last two years. Videos of matches which have been played over the two-year period are reviewed and a random sample of 50 moves are timed. The sample mean is 3.5 minutes with a standard deviation of 1.5 minutes.

a. What is the population under study?

b. Can the officials conclude at $\alpha = 0.05$ that the time per move is still under five minutes?

15. High power experimental engines are being developed by the Stevens Motor Company for use in their new sports coupe. The engineers have calculated the maximum horsepower for the engine to be 600 HP. Sixteen engines are randomly selected for horsepower testing. The sample has an average maximum HP of 620 with a standard deviation 50 HP.

a. Perform an hypothesis test to determine whether the data suggests that the average maximum HP for the experimental engine is significantly different than the maximum horsepower calculated by the engineers? Use a significance level of $\alpha = 0.10$.

b. What assumption did you make in performing the test in part **a.**?

16. The nutrition label for Oriental Spice Sauce states that one package of the sauce has 1190 milligrams of sodium. To determine if the label is accurate the FDA randomly selects two hundred packages of Oriental Spice Sauce and determines the sodium content. The sample has an average of 1167.34 milligrams of sodium per package with a sample standard deviation of 252.94 milligrams.

a. Find the *P*-value for the test of hypothesis that the sodium content is different than the nutrition label states.

b. Is there sufficient evidence to reject the null hypothesis at a significance level of 0.01?