

11.4 Exercises

Basic Concepts

1. How can a confidence interval be used to test a hypothesis?
2. Can a confidence interval be used to test a one-sided hypothesis?
3. Describe the difference between statistical significance and practical significance.
4. Give an example of a situation in which results could be statistically significant but not practically significant.

Exercises

5. Historically, the average number of points scored by a team during an NFL football game is known to be 19.551. Use the Super Bowl data set and a confidence interval approach to test whether the number of points scored by a team during the Super Bowl is different than 19.551 at $\alpha = 0.05$.
6. AAA Controls makes a switch that is advertised to activate a warning light if the power supplied to a machine reaches 100 volts. A random sample of 250 switches is tested and the mean voltage at which the warning light occurs is 98 volts. The population standard deviation is known to be 3 volts. Using the confidence interval approach, test the hypothesis that the mean voltage activation is different from AAA Controls' claim at the 0.05 level.
7. 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 selected 12 vegetarian children that were six years old. The average height of the children is 42.5 inches. The average height for all six-year-old children is 45.75 inches with a standard deviation of 3.8 inches.
 - a. Using confidence intervals, 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.
 - b. What assumption did you make in performing the test?
8. High-power experimental engines are being developed by the Stevens Motor Company for use in its 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 of 50 HP.
 - a. Use the confidence interval approach 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 $\alpha = 0.01$.
 - b. What assumption did you make in performing the test?

Data

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

9. The nutrition label for Oriental Spice Sauce states that one package of 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. Calculate a 99% confidence interval for the mean sodium content in Oriental Spice Sauce.
 - b. Using the confidence interval approach, is there evidence that the sodium content is different than the nutrition label states?
10. 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. Data from matches which have been played over the two-year period were collected and a random sample of 50 moves was analyzed. The sample mean is 3.5 minutes with a standard deviation of 1.5 minutes. Using the confidence interval approach, test the hypothesis that the average time per move is different from 5 minutes at a 0.01 significance level.
11. For adults, a cholesterol value under 200 mg/dl is preferred. High cholesterol values over a period of time can result in a stroke or heart attack. A random sample of 10 cholesterol readings for a patient has an average of 204 mg/dl. The population standard deviation of the test is 6 mg/dl. Is there overwhelming evidence to conclude that the patient's cholesterol level is above 200 mg/dl at a 0.05 significance level? Discuss the statistical and practical significance for this problem.
12. A horticulturist working for a large plant nursery is conducting experiments on the growth rate of a new shrub. Based on previous research, the horticulturist feels the average weekly growth rate of the new shrub is 1 cm per week. A random sample of 45 shrubs has an average growth of 0.90 cm per week with a standard deviation of 0.30 cm. Will a test of hypothesis at the 0.05 significance level support the claim that the growth rate is less than 1 cm per week? Discuss the statistical and practical significance for this problem.
13. 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 which 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. Are the complaints substantiated by the data at $\alpha = 0.10$? Discuss the statistical and practical significance for this problem.
14. In 2022, 3.96 billion people used social media, which is more than half the population of the world.¹³ The average time spent on social media around the world is 147 minutes. Jennifer's daily average time spent on social media for the last ten days was 132 minutes. Perform a hypothesis test to determine if Jennifer's time spent on social media is significantly less than the average. Use $\alpha = 0.01$. Assume the population standard deviation is 35 minutes. Discuss the statistical and practical significance for this problem.