

terms of the problem, to find a 95% confidence interval for the standard deviation, we take the square root of the endpoints of the confidence interval for the variance, yielding

$$0.0275 < \sigma < 0.0730.$$

The 95% confidence interval for the standard deviation of fill for the bottles is between 0.0275 ounce and 0.0730 ounce, indicating that the process meets the specifications of being less than 0.1 ounce.

10.5 Exercises

Basic Concepts

1. What is the sampling distribution for $\frac{(n-1)s^2}{\sigma^2}$?
2. What assumption must hold to use the chi-square distribution to make inferences about the population variance?
3. True or False: The chi-square distribution is skewed to the right.
4. What is the symbol for a critical value for the chi-square distribution? Describe the meaning of this critical value.
5. Give an example where we would want to calculate a confidence interval for σ^2 .

Exercises

6. Determine the critical value(s) for each of the following tests for a population variance where the assumption of normality is satisfied.
 - a. Right-tailed test, $\alpha = 0.01$, $n = 20$
 - b. Right-tailed test, $\alpha = 0.005$, $n = 5$
7. Determine the critical value(s) for each of the following tests for a population variance where the assumption of normality is satisfied.
 - a. Right-tailed test, $\alpha = 0.025$, $n = 18$
 - b. Right-tailed test, $\alpha = 0.05$, $n = 41$
8. A bolt manufacturer is very concerned about the consistency with which his machines produce bolts that are $\frac{3}{4}$ inches in diameter. When the manufacturing process is working normally the standard deviation of the bolt diameter is 0.05 inches. A random sample of 30 bolts has an average diameter of 0.25 inches with a standard deviation of 0.07 inches.
 - a. Construct a 95% confidence interval for the standard deviation of the bolt diameter. Interpret the interval.
 - b. What assumption did you make about the diameter of the bolts in constructing the confidence interval in part a.?

9. A drug that is used for treating cancer has potentially dangerous side effects if it is taken in doses that are larger than the required dosage for the treatment. The pharmaceutical company that manufactures the drug must be certain that the standard deviation of the drug content in the tablet is not more than 0.1 mg. Twenty-five tablets are randomly selected and the amount of drug in each tablet is measured. The sample has a mean of 20 mg and a variance of 0.015 mg.
- Construct a 99% confidence interval for the variance of the amount of drug in each tablet. Interpret the interval.
 - What assumption did you make about the amount of drug contained in the tablets in constructing the confidence interval in part a.?
10. A conservative investor would like to invest some money in a bond fund. The investor is concerned about the safety of her principal (the original money invested). Colonial Funds claims to have a bond fund which has maintained a consistent share price of \$7. They claim that this share price has not varied by more than \$0.25 on average since its inception. To test this claim, the investor randomly selects 25 days during the last year and determines the share price for the bond fund. The average share price of the sample is \$7 with a standard deviation of \$0.35.
- Construct a 90% confidence interval for the standard deviation of the share price of the bond fund. Interpret the interval.
 - What assumption did you make about the share prices of the bond fund in constructing the confidence interval in part a.?
11. A manufacturer of automobile batteries is concerned about the life of the batteries that are produced. The manufacturer is comfortable with the average life of the batteries but more concerned about the standard deviation. Research has shown that the average life of the automobile batteries is 60 months. However, the manufacturer would like the standard deviation of the life of the automobile batteries to be relatively small, say, approximately six months. To determine a reliable range of the standard deviation of the batteries currently being produced, the manufacturer took a random sample of 15 batteries and found that the average life was 58 months with a standard deviation of seven months.
- Construct a 98% confidence interval for the standard deviation of the life of their automobile batteries. Interpret this interval.
 - What assumptions did you make about the life of a battery being produced by the manufacturer?
12. Almost all smart devices (phones, tablets, and computers) are made with touch screens. A concern of many consumers is the shelf life of the “touch” component of the screens. A consumer advocacy group wanted to inform its members of a range that they can expect their touch screens to last. The group took a sample of 29 screens and measured the life of the “touch” function of the screens. That is, they used digital devices to simulate billions of touches to determine the life of the screens. Of the 29 screens sampled, the average “touch” life was 90 months with a standard deviation of six months. Construct an 80% confidence interval for the standard deviation of the life of the touch screens. Interpret this interval.