Procedure for Constructing a Confidence Interval for σ or σ^2

1. Verify that the two requirements in the preceding box are satisfied.
2. Using $n - 1$ degrees of freedom, use technology or refer to Table A-4 to find the critical values χ^2_R and χ^2_L that correspond to the desired confidence level (as in Example 1).
3. Evaluate the upper and lower confidence interval limits using this format of the confidence interval:

$$\frac{(n-1)s^2}{\chi^2_R} < \sigma^2 < \frac{(n-1)s^2}{\chi^2_L}$$

4. If a confidence interval estimate of σ is desired, take the square root of the upper and lower confidence interval limits and change σ^2 to σ.
5. Round the resulting confidence interval limits using the round-off rule given in the preceding box.

CAUTION Confidence intervals can be used *informally* to compare the variation in different data sets, but *the overlapping of confidence intervals should not be used for making formal and final conclusions about equality of variances or standard deviations.*

Using Confidence Intervals for Hypothesis Tests

A confidence interval can be used to *test some claim* made about σ or σ^2. Formal methods of hypothesis testing are introduced in Chapter 8, and those methods might require adjustments to confidence intervals that are not described in this chapter. (We might need to construct a one-sided confidence interval or adjust the confidence level by using 90% instead of 95%.)

CAUTION Know that in this chapter, when we use a confidence interval to address a claim about σ or σ^2, we are making an *informal judgment* (that may or may not be consistent with formal methods of hypothesis testing introduced in Chapter 8).

Example 2 Confidence Interval for Estimating σ of IQ Scores

Data Set 5 in Appendix B lists IQ scores for subjects in three different lead exposure groups. The 22 full IQ scores for the group with medium exposure to lead (Group 2) have a standard deviation of 14.3. Consider the sample to be a simple random sample and construct a 95% confidence interval estimate of σ, the standard deviation of the population from which the sample was obtained.

Solution

Requirement check

Step 1: We first verify that the requirements are satisfied. (1) The sample can be treated as a simple random sample. (2) The following display shows a Minitab-generated histogram. Except for one low score, the shape of the histogram is very close to the bell shape of a normal distribution, so the requirement of normality is