there is not a linear correlation between x and y. But if we use the methods of this section, we get $r_s = 1$ and critical values of ± 0.648, suggesting that there is a correlation between x and y. *With rank correlation, we can sometimes detect relationships that are not linear.*

using TECHNOLOGY

STATDISK Enter the sample data in columns of the data window. Select **Analysis** from the main menu bar, then select **Rank Correlation.** Select the two columns of data to be included, then click **Evaluate.** The STATDISK results include the exact value of the test statistic r_s and the critical value.

MINITAB Enter the paired data in columns C1 and C2. If the data are not already ranks, select **Data** and **Rank** to convert the data to ranks, then select **Stat,** followed by **Basic Statistics,** followed by **Correlation.** Minitab will display the exact value of the test statistic r_s. Although Minitab identifies it as the Pearson correlation coefficient described in Section 10-2, it is actually the Spearman correlation coefficient described in this section (because it is based on ranks). *Caution:* Ignore the P-value, because it is calculated using the methods of Chapter 10, not the methods of this section.

EXCEL Excel does not have a function that calculates the rank correlation coefficient from original sample values, but the exact value of the test statistic r_s can be found as follows. First replace each of the original sample values by its corresponding rank. Enter those ranks in columns A and B. Click on the ***fx*** function key located on the main menu bar. Select the function category **Statistical** and the function name **CORREL,** then click **OK.** In the dialog box, enter the cell range of values for x, such as A1:A10. Also enter the cell range of values for y, such as B1:B10. Excel will display the exact value of the rank correlation coefficient r_s.

XLSTAT XLSTATcan be used by selecting **Correlation/Association tests.** For the type of test, select **Spearman**. The value of r_s will be listed in the table identified as "Correlation matrix (Spearman)," and if the value is displayed in a bold font, we can reject the claim of no correlation.

TI-83/84 PLUS If using a TI-83/84 Plus calculator or any other calculator with 2-variable statistics, you can find the exact value of r_s as follows: (1) Replace each sample value by its corresponding rank, then (2) calculate the value of the linear correlation coefficient r with the same procedures used in Section 10-2. Enter the paired ranks in lists L1 and L2, then press STAT and select **TESTS.** Using the option **LinRegTTest** will result in several displayed values, including the exact value of the rank correlation coefficient r_s. *Caution:* Ignore the P-value, because it is calculated using the methods of Chapter 10, not the methods of this section.

STATCRUNCH Replace each sample value by its corresponding rank, then use the same StatCrunch procedure described in Section 10-2. *Caution:* Ignore the P-value, because it is calculated using the methods of Chapter 10, not the methods of this section.

13-6 Basic Skills and Concepts

Statistical Literacy and Critical Thinking

1. Regression If the methods of this section are used with paired sample data, and the conclusion is that there is sufficient evidence to support the claim of a correlation between the two variables, can we use the methods of Section 10-3 to find the regression equation that can be used for predictions? Why or why not?

2. Level of Measurement Which of the levels of measurement (nominal, ordinal, interval, ratio) describe data that cannot be used with the methods of rank correlation? Explain.

3. Notation What do r, r_s, ρ, and ρ_s denote? Why is the subscript s used? Does the subscript s represent the same standard deviation s introduced in Section 3-3?

4. Efficiency Refer to Table 13-2 in Section 13-1 and identify the efficiency of the rank correlation test. What does that value tell us about the test?