Most statistical technologies have programs that automatically perform a one-sample z-test for a population mean. In this subsection, we present output and step-by-step instructions to implement such programs.

**Example 9.15 Using Technology to Conduct a z-Test**

**Poverty and Calcium** Table 9.10 on page 439 displays the calcium intakes for a sample of 18 people with incomes below the poverty level. Use Minitab, Excel, or the TI-83/84 Plus to perform the hypothesis test in Example 9.14 on page 438.

**Solution** Let \( \mu \) denote the mean calcium intake (per day) of all people with incomes below the poverty level. You are to perform the hypothesis test

\[
H_0: \mu = 800 \text{ mg (mean calcium intake is not less than the RDA)}
\]

\[
H_a: \mu < 800 \text{ mg (mean calcium intake is less than the RDA)}
\]

at the 5% significance level (\( \alpha = 0.05 \)). Note that the hypothesis test is left tailed because a less-than sign (<) appears in the alternative hypothesis. Also, recall that \( \sigma = 188 \text{ mg} \).

Printout 9.1 shows the output obtained by applying the one-sample z-test programs to the calcium intake data in Table 9.10.
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The three outputs in Printout 9.1 show that the $P$-value for the hypothesis test is 0.118. Because the $P$-value exceeds the specified significance level of 0.05, we do not reject $H_0$. The test results are not statistically significant at the 5% level; that is, at the 5% significance level, the data do not provide sufficient evidence to conclude that the mean calcium intake of all people with incomes below the poverty level is less than the RDA of 800 mg.

Obtaining the Output (Optional)

Printout 9.1 provides output from Minitab, Excel, and the TI-83/84 Plus for a one-sample $z$-test based on the sample of calcium intakes in Table 9.10. The following are detailed instructions for obtaining that output. First, we store the calcium intake data in a column (Minitab), range (Excel), or list (TI-83/84 Plus) named CALCI. Then, we proceed as follows.

**MINITAB**
1. Choose Stat $\rightarrow$ Basic Statistics $\rightarrow$ 1-Sample Z...
2. Select the Samples in columns option button
3. Click in the Samples in columns text box and specify CALCI
4. Click in the Standard deviation text box and type 188
5. Click in the Test mean text box and type 800
6. Click the Options… button
7. Click the arrow button at the right of the Alternative drop-down list box and select less than
8. Click OK
9. Click OK

**EXCEL**
1. Choose DDXL $\rightarrow$ Hypothesis Tests
2. Select 1 Var z Test from the Function type drop-down box
3. Specify CALCI in the Quantitative Variable text box
4. Click OK
5. Click the Set $\mu_0$ and sd button
6. Click in the Hypothesized $\mu_0$ text box and type 800
7. Click in the Population std dev text box and type 188
8. Click OK
9. Click the 0.05 button
10. Click the $\mu < \mu_0$ button
11. Click the Compute button

**TI-83/84 PLUS**
1. Press STAT, arrow over to TESTS, and press 1
2. Highlight Data and press ENTER
3. Press the down-arrow key, type 800 for $\mu_0$, and press ENTER
4. Type 188 for $\sigma$ and press ENTER
5. Press 2nd $\rightarrow$ LIST
6. Arrow down to CALCI and press ENTER three times
7. Highlight $\mu < \mu_0$ and press ENTER
8. Press the down-arrow key, highlight Calculate or Draw, and press ENTER