Using this information, answer these questions.

1. What hypotheses would you use?
2. Is the sample considered small or large?
3. What assumption must be met before the hypothesis test can be conducted?
4. Which probability distribution would you use?
5. Would you select a one- or two-tailed test? Why?
6. What critical value(s) would you use?
7. Conduct a hypothesis test. Use $\sigma = 30.3$.
8. What is your decision?
9. What is your conclusion?
10. Write a brief statement summarizing your conclusion.
11. If you lived in a city whose population was about 50,000, how many automobile thefts per year would you expect to occur?

See page 469 for the answers.

Exercises 8–2

For Exercises 1 through 13, perform each of the following steps.

a. State the hypotheses and identify the claim.
b. Find the critical value(s).
c. Compute the test value.
d. Make the decision.
e. Summarize the results.

Use diagrams to show the critical region (or regions), and use the traditional method of hypothesis testing unless otherwise specified.

1. **Warming and Ice Melt** The average depth of the Hudson Bay is 305 feet. Climatologists were interested in seeing if the effects of warming and ice melt were affecting the water level. Fifty-five measurements over a period of weeks yielded a sample mean of 306.2 feet. The population variance is known to be 3.57. Can it be concluded at the 0.05 level of significance that the average depth has increased? Is there evidence of what caused this to happen?

   Source: *World Almanac and Book of Facts 2010.*

2. **Credit Card Debt** It has been reported that the average credit card debt for college seniors at the college book store for a specific college is $3262. The student senate at a large university feels that their seniors have a debt much less than this, so it conducts a study of 50 randomly selected seniors and finds that the average debt is $2995, and the population standard deviation is $1100. With $\alpha = 0.05$, is the student senate correct?

3. **Revenue of Large Businesses** A researcher estimates that the average revenue of the largest businesses in the United States is greater than $24 billion. A sample of 50 companies is selected, and the revenues (in billions of dollars) are shown. At $\alpha = 0.05$, is there enough evidence to support the researcher's claim? Assume $\sigma = 28.7$.

178	122	91	44	35
61	56	46	20	32
30	28	28	20	27
29	16	16	19	15
41	38	36	15	25
31	30	19	19	19
24	16	15	15	19
25	25	18	14	15
24	23	17	17	22
22	21	20	17	20

Source: *New York Times Almanac.*

4. **Moviegoers** The average "moviegoer" sees 8.5 movies a year. A *moviegoer* is defined as a person who sees at least one movie in a theater in a 12-month period. A random sample of 40 moviegoers from a large university revealed that the average number of movies seen per person was 9.6. The population standard deviation is 3.2 movies. At the 0.05 level of significance, can it be concluded that this represents a difference from the national average?

   Source: *MPAA Study.*

5. **Nonparental Care** According to the *Digest of Educational Statistics,* a certain group of preschool children under the age of one year each spends an average of 30.9 hours per week in nonparental care. A study of state university center-based programs indicated that a random sample of 32 infants spent an average of 32.1 hours per week in their care. The standard deviation of the population is 3.6 hours. At $\alpha = 0.01$ is there sufficient evidence to conclude that the sample mean differs from the national mean?

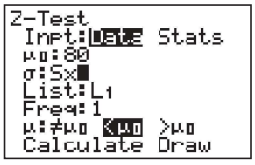
   Source: *www.nces.ed.gov*

TI-83 Plus or TI-84 Plus

Step by Step

Hypothesis Test for the Mean and the *z* Distribution (Data)

1. Enter the data values into L_1.
2. Press **STAT** and move the cursor to TESTS.
3. Press **1** for ZTest.
4. Move the cursor to Data and press **ENTER.**
5. Type in the appropriate values.
6. Move the cursor to the appropriate alternative hypothesis and press **ENTER.**
7. Move the cursor to Calculate and press **ENTER.**

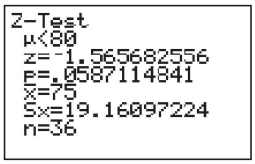


Example TI8–1

This relates to Example 8–4 from the text. At the 10% significance level, test the claim that $\mu < 80$ given the data values.

60	70	75	55	80	55	50	40	80	70	50	95
120	90	75	85	80	60	110	65	80	85	85	45
75	60	90	90	60	95	110	85	45	90	70	70

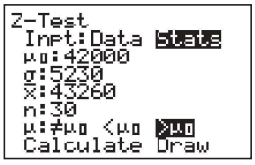
The population standard deviation σ is unknown. Since the sample size $n = 36 \geq 30$, you can use the sample standard deviation s as an approximation for σ. After the data values are entered in L_1 (step 1), press **STAT,** move the cursor to CALC, press **1** for 1-Var Stats, then press **ENTER.** The sample standard deviation of 19.16097224 will be one of the statistics listed. Then continue with step 2. At step 5 on the line for σ press **VARS** for variables, press **5** for Statistics, press **3** for S_x.



The test statistic is $z = -1.565682556$, and the P-value is 0.0587114841.

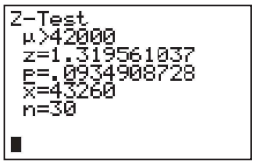
Hypothesis Test for the Mean and the *z* Distribution (Statistics)

1. Press **STAT** and move the cursor to TESTS.
2. Press **1** for ZTest.
3. Move the cursor to Stats and press **ENTER.**
4. Type in the appropriate values.
5. Move the cursor to the appropriate alternative hypothesis and press **ENTER.**
6. Move the cursor to Calculate and press **ENTER.**



Example TI8–2

At the 5% significance level, test the claim that $\mu > 42{,}000$ given $\sigma = 5230$, $\bar{X} = 43{,}260$, and $n = 30$.



The test statistic is $z = 1.319561037$, and the P-value is 0.0934908728.

Excel

Step by Step

Hypothesis Test for the Mean: *z* Test

Excel does not have a procedure to conduct a hypothesis test for the mean. However, you may conduct the test of the mean by using the MegaStat Add-in available on your CD. If you have not installed this add-in, do so, following the instructions from the Chapter 1 Excel Step by Step.

Example XL8–1

This example relates to Example 8–4 from the text. At the 10% significance level, test the claim that $\mu < 80$. The MegaStat z test uses the P-value method. Therefore, it is not necessary to enter a significance level.

1. Enter the data into column A of a new worksheet.
2. From the toolbar, select Add-Ins, **MegaStat>Hypothesis Tests>Mean vs. Hypothesized Value.** *Note:* You may need to open MegaStat from the MegaStat.xls file on your computer's hard drive.