a. Using an alternative hypothesis of $p < 0.4$, a sample size of $n = 50$, and assuming that the true value of p is 0.25, find the power of the test. See Exercise 36 in Section 8-2. (*Hint:* Use the values $p = 0.25$ and $pq/n = (0.25)(0.75)/50$.)

b. Find the value of β, the probability of making a type II error.

c. Given the conditions cited in part (a), what do the results indicate about the effectiveness of the hypothesis test?

8-4 Testing a Claim About a Mean

Key Concept Because this section presents methods for testing a claim about a population mean, it is one of the most important sections in this book. Part 1 of this section deals with the very realistic and commonly used case in which the population standard deviation σ is not known. Part 2 includes a brief discussion of the procedure used when σ is known, which is very rare.

Part 1: Testing a Claim About a Population Mean When σ Is Not Known

In reality, it is very rare that we test a claim about an unknown value of a population mean but we somehow know the value of the population standard deviation σ. The realistic situation is that we test a claim about a population mean and the value of the population standard deviation σ is not known. When σ is not known, we use a "t test" that incorporates the Student t distribution. The requirements, test statistic, P-value, and critical values are summarized as follows.

Testing Claims About a Population Mean (with σ Not Known)

Use the formal method of hypothesis testing to test a claim about a population mean.

Notation

n = sample size

$\bar{x}$ = *sample* mean

$\mu_{\bar{x}}$ = *population* mean (this value is taken from the claim and is used in the statement of the null hypothesis)

Requirements

1. The sample is a simple random sample.

2. Either or both of these conditions is satisfied: The population is normally distributed or $n > 30$.

Test Statistic for Testing a Claim About a Mean

$$t = \frac{\bar{x} - \mu_{\bar{x}}}{\frac{s}{\sqrt{n}}}$$ (Round t to three decimal places, as in Table A-3.)

***P*-values:** Use technology or use the Student t distribution (Table A-3) with degrees of freedom given by df $= n - 1$. (Figure 8-4 in Section 8-2 summarizes the procedure for finding P-values.)

Critical values: Use the Student t distribution (Table A-3) with degrees of freedom given by df $= n - 1$. (If using Table A-3 to find a critical value of t, but the table does not include the number of degrees of freedom, you could be conservative by using the next lower number of degrees of freedom found in the table, or you could use the closest number of degrees of freedom in the table, or you could interpolate.)