

**21. Effect of Vitamin Supplement on Birth Weight.** When birth weights were recorded for a simple random sample of 16 male babies born to mothers taking a special vitamin supplement, the sample had a mean of 3.675 kilograms and a standard deviation of 0.657 kilogram (based on data from the New York State Department of Health). Use a 0.05 significance level to test the claim that the mean birth weight for all male babies of mothers given vitamins is different from 3.39 kilograms, which is the mean for the population of all males. Based on these results, does the vitamin supplement appear to have an effect on birth weight?

**22. Pulse Rates.** One of the authors claimed that his pulse rate was lower than the mean pulse rate of statistics students. The author's pulse rate was measured and found to be 60 beats per minute, and the 20 students in his class measured their pulse rates. The 20 students had a mean pulse rate of 74.5 beats per minute, and their standard deviation was 10.0 beats per minute. Is there sufficient evidence to support the claim that the mean pulse rate of statistics students is greater than 60 beats per minute? Use a 0.05 significance level.

**23. Olympic Winners.** Listed below are the winning times (in seconds) of men in the 100-meter dash for consecutive summer Olympic games, listed in order by row.

12.0	11.0	11.0	11.2	10.8	10.8	10.8	10.6
10.8	10.3	10.3	10.3	10.4	10.5	10.2	10.0
9.95	10.14	10.06	10.25	9.99	9.92	9.96	

Assuming that these results are sample data randomly selected from the population of all past and future Olympic games, use a 0.05 significance level to test the claim that the mean time is less than 10.5 seconds. What

do you observe about the precision of the numbers? What extremely important characteristic of the data set is not considered in this hypothesis test?

**24. Nicotine in Cigarettes.** The Carolina Tobacco Company advertised that its best-selling nonfiltered cigarettes contain 40 milligrams of nicotine or less, but *Consumer Advocate* magazine ran tests of 10 randomly selected cigarettes and found the amounts (in milligrams) shown below.

47.3	39.3	40.3	38.3	46.3
43.3	42.3	49.3	40.3	46.3

Use a significance level of 0.05 to test the magazine's claim that the mean nicotine content is greater than 40 milligrams.



### Projects for the Internet and Beyond

For useful links, select "Links for Internet Projects" for Chapter 10 at [www.aw.com/bbt](http://www.aw.com/bbt).

**25. Noted Personalities.** The *World Almanac and Book of Facts* includes a section called "Noted Personalities," with subsections for architects, artists, business leaders, cartoonists, and several other categories. Select a sample from one group and find the mean and standard deviation of the life spans. Test the claim that the group has a mean life span that is different from 77 years, which is the current mean life span for the general population.

**26. Gosset.** The  $t$  distribution was originally developed by William Sealey Gosset. Use the Internet to search for "William Sealey Gosset" or "William S. Gosset." Write a paragraph describing important information about Gosset and his accomplishments.

## 10.2 Hypothesis Testing with Two-Way Tables

All the hypothesis tests we have considered so far have had null hypotheses in which a population mean ( $\mu$ ) or proportion ( $p$ ) is claimed to be *equal* to some value. But there are many situations in which the null hypothesis takes a different form. In this section, we examine hypothesis tests designed to look for a relationship between two variables. The basic process is the same as always: Identify the null and alternative hypotheses, test the null hypothesis with sample data, and then decide whether the evidence from the sample supports rejecting or not rejecting the null hypothesis. If we reject the null hypothesis, it means we accept the alternative hypothesis.

### Identifying the Hypotheses with Two Variables

Suppose that administrators at a college are concerned that there may be bias in the way degrees are awarded to men and women in different departments. They therefore collect data on the number of degrees awarded to men and women in different departments. These data concern two variables: *major* and *gender*. The variable *major* can take on many values,