Instead, we can use the 5% guideline for cumbersome calculations. The sample size of 5 is less than 5% of the population of 10,000, so we can treat the events as independent, even though they are actually dependent. We get this much easier (although not quite as accurate) calculation:

$$\frac{1259}{10{,}000}\cdot\frac{1259}{10{,}000}\cdot\frac{1259}{10{,}000}\cdot\frac{1259}{10{,}000}\cdot\frac{1259}{10{,}000} = \left(\frac{1259}{10{,}000}\right)^5 = 0.0000316$$

For Example 2, the following comments are important:

- In part (b) we adjust the second probability to take into account the selection of a defective scale in the first outcome.
- In part (c) we applied the 5% guideline for cumbersome calculations.
- While parts (a) and (b) apply to two events, part (c) illustrates that the multiplication rule extends quite easily to more than two events.

If you're thinking that the exact calculation in part (c) of Example 2 is not all that bad, consider a pollster who randomly selects 1000 survey subjects from the 230,118,473 adults in the United States. Pollsters sample without replacement, so the selections are dependent. Instead of doing exact calculations with some *really* messy numbers, they typically treat the selections as being independent, even though they are actually dependent. The world then becomes a much better place in which to live. Apart from trying to avoid messy calculations, in statistics we have a special interest in sampling with replacement, and this will be discussed in Section 6-4.

CAUTION In any probability calculation, it is extremely important to carefully identify the event being considered. See Example 3 where parts (a) and (b) might seem quite similar, but their solutions are very different.

Example 3 Birthdays

When two different people are randomly selected from those in your class, find the indicated probability by assuming that birthdays occur on the days of the week with equal frequencies.

a. Find the probability that the two people are born on the *same day of the week*.

b. Find the probability that the two people are both born on *Monday*.

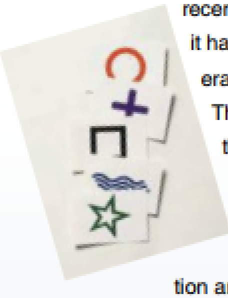
Solution

a. Because no particular day of the week is specified, the first person can be born on any one of the seven weekdays. The probability that the second person is born on the same day as the first person is 1/7. The probability that two people are born on the same day of the week is therefore 1/7.

b. The probability that the first person is born on Monday is 1/7 and the probability that the second person is also born on Monday is 1/7. Because the two events are independent, the probability that both people are born on Monday is

$$\frac{1}{7}\cdot\frac{1}{7} = \frac{1}{49}$$

Princeton Closes Its ESP Lab



The Princeton Engineering Anomalies Research (PEAR) laboratory recently closed, after it had been in operation since 1975. The purpose of the lab was to conduct studies on extrasensory perception and telekinesis. In one of the lab's experiments, test subjects were asked to think high or think low, then a device would display a random number either above 100 or below 100. The researchers then used statistical methods to determine whether the results differed significantly from what would be expected by chance. The objective was to determine whether the test subjects could use their minds to somehow influence the behavior of the random-generating device.

Because the PEAR lab had been an embarrassment to many members of Princeton's community, they welcomed its closing. After being used for research for 28 years, and after using more than $10 million in funding, the PEAR lab failed to provide results compelling enough to convince anyone that ESP or telekinesis are real phenomena.