such as the population of adult incomes in the United States. Now imagine pollsters, each randomly selecting 50 people. Each pollster computes the mean of the 50 incomes, so we get a collection of sample means, which we denote as $\bar{x}_1$, $\bar{x}_2$, $\bar{x}_3$, and so on. These sample means are shown in the green box near the top of Table 6-2. What do we know about this collection of sample means? As we move farther to the right in Table 6-2, we see that the sample means tend to have a *normal* distribution (even if the original population is not normally distributed). We might write an ending to this story by saying that "the sampling distribution of the sample mean is a normal distribution." Now there's a happy ending. Let's now formally define a general definition of a sampling distribution of a statistic.

DEFINITION The **sampling distribution of a statistic** (such as a sample mean or sample proportion) is the distribution of all values of the statistic when all possible samples of the same size n are taken from the same population. (The sampling distribution of a statistic is typically represented as a probability distribution in the format of a table, probability histogram, or formula.)

Sampling Distribution of the Sample Mean

The preceding definition is general, so let's consider the specific sampling distribution of the sample mean.

DEFINITION The **sampling distribution of the sample mean** is the distribution of all possible sample means (or the distribution of the variable $\bar{x}$), with all samples having the same sample size n taken from the same population. (The sampling distribution of the sample mean is typically represented as a probability distribution in the format of a table, probability histogram, or formula.)

These concepts are very abstract, so let's deal with a concrete application so that we can gain better understanding.

Example 1 Sampling Distribution of the Sample Mean

A friend of the author has three children with ages of 4, 5, and 9. Let's consider the population consisting of {4, 5, 9}. (We don't usually know all values in a population, and we don't usually work with such a small population, but it works well for the purposes of this example.) If two ages are randomly selected with replacement from the population {4, 5, 9}, identify the sampling distribution of the sample mean by creating a table representing the probability distribution of the sample mean. Do the values of the sample mean target the value of the population mean?

Solution

If two values are randomly selected with replacement from the population {4, 5, 9}, the leftmost column of Table 6-3 lists the nine different possible samples. Because we want to identify the sampling distribution of the sample mean, we compute the mean of each of the nine samples, and those sample means are listed in the second column of Table 6-3. The nine samples are equally likely with a probability of 1/9 (as shown in the third column of Table 6-3). We saw in Section 5-2 that a probability distribution is a description that gives the probability for each value of a random variable, as in the second and third columns of Table 6-3. The second and

Push Polling

In a recent campaign for mayor of New York City, Anthony Weiner was considering a run against incumbent Michael Bloomberg. In one survey, people were asked questions such as these: "Are you registered to vote? Do you plan to vote in the mayoral election? Would you vote for Anthony Weiner if you knew that he has an association with European models?" Some survey questions were routine, but some questions were clearly designed to discredit candidate Weiner. This is an example of *push polling*, which is the practice of political campaigning under the guise of a poll. Its name is derived from its objective of pushing voters away from opposition candidates by asking loaded questions designed to discredit them. This survey question was used in another campaign: "Please tell me if you would be more likely or less likely to vote for Roy Romer if you knew that Gov. Romer appoints a parole board which has granted early release to an average of four convicted felons per day every day since Romer took office." The National Council on Public Polls says that push polls are unethical, and reputable pollsters do not approve of push polling.