The results of Example 2 allow us to observe the following two important properties of the sampling distribution of the sample mean.

Behavior of Sample Means

1. The sample means *target* the value of the population mean. (That is, the mean of the sample means is the population mean. The expected value of the sample mean is equal to the population mean.)
2. The distribution of sample means tends to be a normal distribution. (This will be discussed further in the following section, but the distribution tends to become closer to a normal distribution as the sample size increases.)

Sampling Distribution of the Sample Variance

Let's now consider the sampling distribution of sample variances.

DEFINITION The **sampling distribution of the sample variance** is the distribution of sample variances, with all samples having the same sample size n taken from the same population. (The sampling distribution of the sample variance is typically represented as a probability distribution in the format of a table, probability histogram, or formula.)

CAUTION When working with population standard deviations or variances, be sure to evaluate them correctly. In Section 3-3 we saw that the computations for *population* standard deviations or variances involve division by the population size N (not the value of $n - 1$), as shown here.

Population standard deviation: $$\sigma = \sqrt{\frac{\Sigma(x-\mu)^2}{N}}$$

Population variance: $$\sigma^2 = \frac{\Sigma(x-\mu)^2}{N}$$

Because the calculations are typically performed with computer software or calculators, be careful to correctly distinguish between the standard deviation of a sample and the standard deviation of a population. Also be careful to distinguish between the variance of a sample and the variance of a population.

Example 3 Sampling Distribution of the Sample Variance

Consider repeating this process: Roll a die 5 times and find the variance s^2 of the results. What do we know about the behavior of all sample variances that are generated as this process continues indefinitely?

Solution

The middle portion of Table 6-5 illustrates a process of rolling a die 5 times and finding the variance of the results. Table 6-5 shows results from repeating this process 10,000 times, but the true sampling distribution of the sample variance involves repeating the process indefinitely. Because the values of 1, 2, 3, 4, 5, 6 are all equally likely, the population has a variance of $\sigma^2 = 2.9$, and Table 6-5 shows that the 10,000 sample variances have a mean of 2.88. If the process is continued