

randomly selected each day for detailed inspection to confirm that they meet all required specifications.

- a. Do you think the quarters are randomly selected with replacement or without replacement?
- b. Give two reasons why statistical methods tend to be based on the assumption that sampling is conducted *with* replacement, instead of without replacement.

3. Unbiased Estimators Data Set 1 in Appendix B includes a sample of 40 pulse rates of women. If we compute the values of sample statistics from that sample, which of the following statistics are *unbiased* estimators of the corresponding population parameters: sample mean; sample median; sample range; sample variance; sample standard deviation; sample proportion?

4. Sampling Distribution Data Set 20 in Appendix B includes a sample of weights of 100 M&M candies. If we explore this sample of 100 weights by constructing a histogram and finding the mean and standard deviation, do those results describe the sampling distribution of the mean? Why or why not?

5. Good Sample? For the population of all college students currently taking a statistics course, you want to estimate the proportion who are women. You obtain a simple random sample of statistics students at Broward College in Florida. Is the resulting sample proportion a good estimator of the population proportion of all college statistics students? Why or why not?

6. Lottery Results Many states have a Pick 3 lottery in which three digits are randomly selected each day. Winning requires that you select the same three digits in the same order that they are drawn. Assume that you compute the mean of each set of three selected digits.

- a. What is the approximate shape of the distribution of the sample means (uniform, normal, skewed, other)?
- b. What value do the sample means target? That is, what is the mean of all such sample means?
- c. For each set of three digits that is selected, if you find the proportion of odd numbers, what is the mean of those proportions?

In Exercises 7–10, use the same population of {4, 5, 9} that was used in Examples 1 and 5. As in Examples 1 and 5, assume that samples of size $n = 2$ are randomly selected with replacement.

7. Sampling Distribution of the Sample Variance

- a. Find the value of the population variance σ^2 .
- b. Table 6-3 describes the sampling distribution of the sample mean. Construct a similar table representing the sampling distribution of the sample variance s^2 . Then combine values of s^2 that are the same, as in Table 6-4. (*Hint:* See Example 1 for Tables 6-3 and 6-4 that describe the sampling distribution of the sample mean.)
- c. Find the mean of the sampling distribution of the sample variance.
- d. Based on the preceding results, is the sample variance an unbiased estimator of the population variance? Why or why not?

8. Sampling Distribution of the Sample Standard Deviation For the following, round results to three decimal places.

- a. Find the value of the population standard deviation σ .