

**15. Births: Sampling Distribution of Sample Proportion** When two births are randomly selected, the sample space for genders is bb, bg, gb, and gg. Assume that those four outcomes are equally likely. Construct a table that describes the sampling distribution of the sample proportion of girls from two births. Does the mean of the sample proportions equal the proportion of girls in two births? Does the result suggest that a sample proportion is an unbiased estimator of a population proportion?

**16. Births: Sampling Distribution of Sample Proportion** When three births are randomly selected, the sample space for genders is bbb, bbg, bgb, bgg, gbb, gbg, ggb, and ggg. Assume that those eight outcomes are equally likely. Construct a table that describes the sampling distribution of the sample proportion of girls from three births. Does the mean of the sample proportions equal the proportion of girls in three births?

**17. SAT and ACT Tests** Because they enable efficient procedures for evaluating answers, multiple-choice questions are commonly used on standardized tests, such as the SAT or ACT. Such questions typically have five choices, one of which is correct. Assume that you must make random guesses for two such questions. Assume that both questions have correct answers of "a."

a. After listing the 25 different possible samples, find the proportion of correct answers in each sample, then construct a table that describes the sampling distribution of the sample proportions of correct responses.

b. Find the mean of the sampling distribution of the sample proportion.

c. Is the mean of the sampling distribution (from part (b)) equal to the population proportion of correct responses? Does the mean of the sampling distribution of proportions *always* equal the population proportion?

**18. Quality Control** After constructing a new manufacturing machine, five prototype integrated circuit chips are produced and it is found that two are defective (D) and three are acceptable (A). Assume that two of the chips are randomly selected *with replacement* from this population.

a. After identifying the 25 different possible samples, find the proportion of defects in each of them, then use a table to describe the sampling distribution of the proportions of defects.

b. Find the mean of the sampling distribution.

c. Is the mean of the sampling distribution (from part (b)) equal to the population proportion of defects? Does the mean of the sampling distribution of proportions *always* equal the population proportion?

## 6-4 Beyond the Basics

**19. Using a Formula to Describe a Sampling Distribution** Exercise 15 requires the construction of a table that describes the sampling distribution of the proportions of girls from two births. Consider the formula shown here, and evaluate that formula using sample proportions  $x$  of 0, 0.5, and 1. Based on the results, does the formula describe the sampling distribution? Why or why not?

$$P(x) = \frac{1}{2(2 - 2x)!(2x)!} \quad \text{where } x = 0, 0.5, 1$$

**20. Mean Absolute Deviation** Is the mean absolute deviation of a sample a good statistic for estimating the mean absolute deviation of the population? Why or why not? (Hint: See Example 5.)