AE Additional Exercises

1. A statistics professor has determined the following probability distribution for X, the grade which a student will earn in a business statistics class.

Grade Distribution

Grade	x	$P(X = x)$
A	4.0	0.15
B	3.0	0.35
C	2.0	0.25
D	1.0	0.15
F	0.0	0.10

a. What is the average grade that a student will earn in a business statistics class?

b. Find the variance of the grades that students will earn in a business statistics class.

c. Find the standard deviation of the grades which students will earn in a business statistics class.

d. What is the probability that a student will earn a grade of 4.0?

e. Find the probability that a student will earn a grade of at least 2.0.

f. Find the probability that a student will earn a grade of at most 1.0.

g. Find the probability that a student will earn a grade of more than 3.0.

2. The U.S. Department of Labor has issued a new set of guidelines governing certain work practices for employees. It estimates that only 20% of all firms will be subject to the new guidelines. To validate the estimate of the number of firms that will be affected by the new guidelines, the department randomly selects a sample of twenty firms for a study. Assuming their initial estimate of 20% is correct, answer the following questions.

a. What is the probability that 1 or fewer of the sampled firms will be subject to the new rules?

b. What is the probability that between 15 and 25 percent of the sampled firms will be subject to the rules?

c. One of the directors in the department remarked he thought that ten firms out of the sample would be subject to the rules. If the initial estimate is correct, what is the chance of this occurring?

3. Historically, the probability that a library book will be returned in one week is $p = 0.50$. The head librarian for the University Staff Hospital library is monitoring a random sample of 10 books to determine if the historical proportion of the books returned within one week, 0.50, has changed. Assuming the historical return rate is still the same, answer the following questions.

a. What is the probability that between four and six books will be returned in one week?

b. What is the chance that eight or more books will be returned in one week?

c. What is the probability that only one book will be returned in one week?

4. The number of fatalities resulting from automobile accidents for a 10-mile stretch of an interstate highway averages 1 per 100,000 automobiles. During a particular holiday weekend, 500,000 automobiles traveled over the 10-mile segment. Using a Poisson distribution, find the probability of each of the following.

- **a.** No fatalities
- **b.** 3 fatalities
- **c.** At least one fatality

5. Compute the mean and variance for the following random variables.

- **a.** The number of sixes obtained in 10 rolls of a single die.
- **b.** The number of hearts in a 13 card bridge hand. (Draw 13 cards from a standard deck without replacement.)
- **c.** The number of free throws made by a professional basketball player in his next 10 attempts. (Assume the player makes 88% of his free throws in the long run.)
- **d.** The number of cracked eggs selected when randomly selecting 5 eggs from a 12-egg carton containing 2 cracked eggs.
- **e.** The number of dots on the upper face when a single die is thrown.

6. A manufacturer of digital cameras knows that a shipment of 30 cameras sent to a large discount store contains eight defective cameras. The manufacturer also knows that the store will choose two of the cameras at random, test them, and accept the shipment if neither one is defective.

- **a.** Find the probability that at least one is defective.
- **b.** What is the probability that the shipment is accepted?

7. In a certain shipment of sixteen radios, four are defective. Eight of the radios are selected at random without replacement. What is the probability that at least one of the eight radios is defective?

8. According to the American Hotel and Lodging Association (AH&LA), women accounted for 31% of business travelers in the year 2009. Suppose that to attract these women business travelers, the AH&LA found that 80% of hotels offer hair dryers in the bathrooms. Consider a random and independent sample of 15 hotels.

Source: American Hotel & Lodging Association

- **a.** Based on the information given, how many of the 15 hotels are expected to offer hair dryers in the bathrooms?
- **b.** Find the probability that all of the hotels in the sample offer hair dryers in the bathrooms.
- **c.** Find the probability that more than 5 but less than 9 of the hotels in the sample offer hair dryers in the bathrooms.

9. A carnival has a game of chance: a fair coin is tossed. If it lands heads, you win $1, and if it lands tails, you lose $0.50. How much should a ticket cost to play this game if the carnival wants to break even?

10. You are working on a multiple choice test which consists of 15 problems. Each of the problems has five answers, only one of which is correct. If you are totally unprepared for the test and are guessing, what is the probability that your first correct answer is within the first fifteen problems?

11. An automobile manufacturer is always trying to improve the quality of its vehicles. Assume that the number of defects per vehicle follows a Poisson distribution. If these defects occur randomly at an average rate of five per vehicle, what is the probability that a randomly selected vehicle will have at least one defect?

12. When proofreading a statistics textbook, one can expect to find a number of errors, whether they are typographical, symbolic, or even incorrect mathematical calculations. On average, a statistics textbook will contain 30 errors. What is the probability that when proofreading a text, one finds at least three errors? Assume that the number of errors found follows a Poisson distribution.

13. While on a shopping spree, you randomly select five portable music players from an electronics store that sells 20 portable music players. Of these 20 music players, 12 will last beyond the 1-year limited warranty and will not need to be replaced or repaired. What is the probability that at least three of the five portable music players selected will not last beyond the limited warranty period without needing to be replaced or repaired?

14. A jeweler was given a collection of twelve diamonds, of which three were synthetic (fake). If the jeweler selected two of these diamonds at random (without replacement), what is the probability that neither jewel is found to be synthetic?

15. L-Mart Inspections is a building inspection company. There were ten new commercial construction buildings completed in the last month and the sites are now available for inspection. L-Mart plans to inspect some of the new constructions for code violations and believes that half of the buildings will have violations.

a. What probability model would be appropriate for describing the number of buildings in the sample that have code violations? Explain your answer.

b. If L-Mart randomly selects four buildings to inspect, what is the probability that three of the buildings will have violations?