AE Additional Exercises

1. Joe is always between 5 and 35 minutes late for work. Assuming that X, the number of minutes that Joe is late for work, has a continuous uniform distribution, answer the following questions.

- **a.** Find the mean of X.
- **b.** Find the standard deviation of X.
- **c.** Find the probability that on any randomly selected day, Joe is at least a half hour late for work.
- **d.** What percent of the time will X fall within one standard deviation of its mean?
- **e.** Compare this percent to that given by the Empirical Rule of Chapter 4. Why the large discrepancy?

2. Using the standard normal tables, determine the following probabilities. Sketch the associated areas.

- **a.** $P(0 \le z \le 0.85)$
- **b.** $P(-1.25 \le z \le 2.25)$
- **c.** $P(z \ge 1.75)$
- **d.** $P(z \le -2.75)$

3. Using the standard normal tables, determine the following probabilities. Sketch the associated areas.

- **a.** $P(0 \le z \le 1.00)$
- **b.** $P(-2.50 \le z \le 3.01)$
- **c.** $P(z \ge 3.25)$
- **d.** $P(z \le -2.50)$

4. Find the value of z such that 0.99 of the area under the curve lies between $-z$ and z.

5. Find the value of z such that 0.80 of the area under the curve lies between $-z$ and z.

6. The weights of newborn baby boys born at a local hospital are believed to have a normal distribution with an average weight of 7.25 lb and a standard deviation of 1 lb. If a newborn baby boy, born at the local hospital, is randomly selected, answer the following questions.

- **a.** Find the probability that the weight of the newborn baby boy will be more than 8 lb.
- **b.** Find the probability that the weight of the newborn baby boy will be less than 6 lb.
- **c.** Find the probability that the weight of the newborn baby boy will be between 6.5 lb and 8.5 lb.
- **d.** Find the weight that separates the lowest 10% of the weights from the highest 90% of the weights.
- **e.** If babies in the lowest 10 percent of weights are kept for observation, would a baby that weighed 5 lb be kept for observation?

7. Medication errors in a hospital can be dangerous and expensive. Medication errors are defined as giving a patient a non-prescribed medication in any quantity or the improper dosage of a prescribed medication. Suppose the national average for medication errors is one out of every 1000 patients. A hospital believes that their medication error rate is comparable to the national average. If the hospital randomly selects 5000 patients, answer the following questions.

- **a.** Find the expected number of patients in the sample that will have had a medication error.
- **b.** What is the standard deviation of the number of patients in the sample that will have had a medication error?
- **c.** What is the probability of observing one or more patients who have had medication errors in the sample?
- **d.** What is the probability of observing two or more patients who have had medication errors in the sample?
- **e.** Do you have any concerns about the accuracy of the probabilities you determined in parts **c.** and **d.**?

8. The number of violent crimes committed in a large city follows a Poisson distribution with an average rate of 10 per month.

- **a.** Find the expected number of violent crimes committed in a 3-month period.
- **b.** Find the standard deviation of the number of violent crimes committed in a 3-month period.
- **c.** Find the probability that at least 45 violent crimes will be committed in a 3-month period.
- **d.** Find the probability that between 25 and 40 (inclusive) violent crimes will be committed in a 3-month period.
- **e.** Find the probability that less than 20 violent crimes will be committed in a 3-month period.

9. According to the 2011 Statistical Abstract of the United States, 20.5% of the scores on the critical reading portion of the SAT Reasoning Test exceeded 600. Approximately 17.4% of the scores were less than 400, according to the same reference. Assuming that scores on the critical reading portion of the SAT are approximately normally distributed, what are the mean and the standard deviation of the scores on the verbal portion of the SAT Reasoning Test?

Source: U.S. Census Bureau

10. The annual average per capita consumption of red meat in the United States in 2008 was 108.3 pounds, according to the 2011 Statistical Abstract of the United States. This figure was down from a per capita average of 126.4 pounds in 1980. Assume that both in 2008 and 1980 the per capita amount of red meat consumed was a normal random variable with a standard deviation of 15 pounds.

Source: U.S. Census Bureau

- **a.** In 1980, what percent of the population consumed at least 100 pounds of red meat?
- **b.** In 2008, what percent of the population consumed at least 100 pounds of red meat?
- **c.** In 1980, what percent of the population consumed at most 130 pounds of red meat?
- **d.** In 2008, what percent of the population consumed at most 130 pounds of red meat?
- **e.** Do you feel that it is reasonable to assume that the per capita amount of red meat consumed has a normal distribution? Why or why not?

11. A cell phone manufacturer has developed a new type of battery for its phones. Extensive testing indicates that the population battery life (in days) obtained by all batteries of this new type is normally distributed with a mean of 700 days and a standard deviation of 100 days. The manufacturer wishes to offer a guarantee providing a discount on batteries if the original battery purchased does not exceed the days stated in the guarantee. What should the guaranteed battery life be (in days) if the manufacturer desires that no more than 5% of the batteries will fail to meet the guaranteed number of days?

12. The manager of a retail store wants to determine the best method of staffing employees without being wasteful. The problem that is often encountered is having too many employees and too few customers, and vice versa. The manager realized that during the holiday season they attract, on average, 90 customers per hour. On some days, the number is higher, on others, the number is lower. The manager would like to determine the probability of at least 2 customers arriving in a given minute during holiday season. Use the normal approximation to find the probability.

13. A machine used to regulate the amount of dye dispensed for mixing shades of paint can be set so that it discharges an average of μ milliliters of dye per can of paint. The amount of dye discharged is known to have a normal distribution with a variance equal to 0.0160. If more than 6 milliliters of dye are discharged when making a particular shade of blue paint, the shade is unacceptable. Determine the setting of μ so that no more than 1% of the cans of paint will be unacceptable.

14. The length of time required to complete a college achievement test is found to be normally distributed with a mean of 75 minutes and a standard deviation of 15 minutes. When should the test be terminated if we wish to allow sufficient time for 95% of the students to complete the test?

15. A manufacturing plant utilizes 3000 electric light bulbs that have a length of life that is normally distributed with a mean of 500 hours and a standard deviation of 50 hours. To minimize the number of bulbs that burn out during operation hours, all the bulbs are replaced after a given period of operation. How often should the bulbs be replaced if we want not more than 2% of the bulbs to burn out between replacement periods?

16. Howe's Finance Corporation provides financing for customers at an automotive dealership. The average loan amount is $24,000 with a standard deviation of $8000. Assuming that the loan amount is normally distributed, what is the probability that a randomly selected consumer buying a car will want to finance at least $20,000?

17. Suppose that the income of families in a large community follows a normal distribution. Two families are randomly selected and their incomes are $55,000 and $85,000, respectively. The two incomes correspond to z-scores of –0.5 and 2.0 respectively. Calculate the mean and standard deviation of the income of families in the neighborhood.

18. Suppose that the 30^{th} percentile of a normal distribution is equal to 756 and that the 90^{th} percentile of this normal distribution is 996. Find the mean and standard deviation of the normal distribution.