

CHAPTER REVIEW PROBLEMS

CHECKING YOUR UNDERSTANDING

- 6.38** Why is it that only one normal distribution table such as Table E.2 is needed to find any probability under the normal curve?
- 6.39** How do you find the area between two values under the normal curve?
- 6.40** How do you find the X value that corresponds to a given percentile of the normal distribution?
- 6.41** What are some of the distinguishing properties of a normal distribution?
- 6.42** How does the shape of the normal distribution differ from the shapes of the uniform and exponential distributions?
- 6.43** How can you use the normal probability plot to evaluate whether a set of data is normally distributed?
- 6.44** Under what circumstances can you use the exponential distribution?

APPLYING THE CONCEPTS

- 6.45** An industrial sewing machine uses ball bearings that are targeted to have a diameter of 0.75 inch. The lower and upper specification limits under which the ball bearings can operate are 0.74 inch and 0.76 inch, respectively. Past experience has indicated that the actual diameter of the ball bearings is approximately normally distributed, with a mean of 0.753 inch and a standard deviation of 0.004 inch. What is the probability that a ball bearing is
- between the target and the actual mean?
 - between the lower specification limit and the target?
 - above the upper specification limit?
 - below the lower specification limit?
 - Of all the ball bearings, 93% of the diameters are greater than what value?
- 6.46** The fill amount in soft drink bottles is normally distributed, with a mean of 2.0 liters and a standard deviation of 0.05 liter. If bottles contain less than 95% of the listed net content (1.90 liters, in this case), the manufacturer may be subject to penalty by the state office of consumer affairs. Bottles that have a net content above 2.10 liters may cause excess spillage upon opening. What proportion of the bottles will contain
- between 1.90 and 2.0 liters?
 - between 1.90 and 2.10 liters?
 - below 1.90 liters or above 2.10 liters?
 - At least how much soft drink is contained in 99% of the bottles?
 - 99% of the bottles contain an amount that is between which two values (symmetrically distributed) around the mean?
- 6.47** In an effort to reduce the number of bottles that contain less than 1.90 liters, the bottler in Problem 6.46 sets the filling machine so that the mean is 2.02 liters. Under these circumstances, what are your answers in Problem 6.46 (a) through (e)?
- 6.48** An orange juice producer buys all his oranges from a large orange grove. The amount of juice squeezed from each of these oranges is approximately normally distributed, with a mean of 4.70 ounces and a standard deviation of 0.40 ounce.
- What is the probability that a randomly selected orange will contain between 4.70 and 5.00 ounces of juice?
 - What is the probability that a randomly selected orange will contain between 5.00 and 5.50 ounces of juice?
 - At least how many ounces of juice will 77% of the oranges contain?
 - 80% of the oranges contain between what two values (in ounces of juice), symmetrically distributed around the population mean?
- 6.49** The file **DomesticBeer** contains the percentage alcohol, number of calories per 12 ounces, and number of carbohydrates (in grams) per 12 ounces for 128 of the best-selling domestic beers in the United States. For each of the three variables, decide whether the data appear to be approximately normally distributed. Support your decision through the use of appropriate statistics and graphs.
- Source: Data extracted from www.Beer100.com, June 15, 2009.
- 6.50** The evening manager of a restaurant was very concerned about the length of time some customers were waiting in line to be seated. She also had some concern about the seating times—that is, the length of time between when a customer is seated and the time he or she leaves the restaurant. Over the course of one week, 100 customers (no more than 1 per party) were randomly selected, and their waiting and seating times (in minutes) were recorded in **Wait**.
- Think about your favorite restaurant. Do you think waiting times more closely resemble a uniform, an exponential, or a normal distribution?
 - Again, think about your favorite restaurant. Do you think seating times more closely resemble a uniform, an exponential, or a normal distribution?
 - Construct a histogram and a normal probability plot of the waiting times. Do you think these waiting times more closely resemble a uniform, an exponential, or a normal distribution?
 - Construct a histogram and a normal probability plot of the seating times. Do you think these seating times more closely resemble a uniform, an exponential, or a normal distribution?
- 6.51** All the major stock market indexes posted heavy losses in 2008. The mean one-year return for stocks in the S&P 500, a group of 500 very large companies, was -38.5% . The mean one-year return for the NASDAQ, a group of 3,200 small and medium-sized companies, was -40.5% . Historically, the one-year returns are approximately normal, the standard deviation

in the S&P 500 is approximately 20%, and the standard deviation in the NASDAQ is approximately 30%.

- What is the probability that a stock in the S&P 500 gained value in 2008?
- What is the probability that a stock in the S&P 500 gained 10% or more?
- What is the probability that a stock in the S&P 500 lost 50% or more in 2008?
- What is the probability that a stock in the S&P 500 lost 60% or more?
- Repeat (a) through (d) for a stock in the NASDAQ.
- Write a short summary on your findings. Be sure to include a discussion of the risks associated with a large standard deviation.

6.52 An article reported (L. J. Flynn, “Tax Surfing,” *The New York Times*, March 25, 2002, p. C10) that the mean time to download the home page for the Internal Revenue Service, www.irs.gov, is 0.8 second. Suppose that the download time is normally distributed, with a standard deviation of 0.2 second. What is the probability that a download time is

- less than 1 second?
- between 0.5 and 1.5 seconds?
- above 0.5 second?
- Above how many seconds are 99% of the download times?
- 95% of the download times are between what two values, symmetrically distributed around the mean?

6.53 The same article mentioned in Problem 6.52 also reported that the mean download time for the H&R Block Web site, www.hrblock.com, is 2.5 seconds. Suppose that the download time is normally distributed, with a standard deviation of 0.5 second. What is the probability that a download time is

- less than 1 second?
- between 0.5 and 1.5 seconds?
- above 0.5 second?
- Above how many seconds are 99% of the download times?
- Compare the results for the IRS site computed in Problem 6.52 to those of the H&R Block site.

6.54 (Class Project) According to Burton G. Malkiel, the daily changes in the closing price of stock follow a *random walk*—that is, these daily events are independent of each other and move upward or downward in a random manner—and can be approximated by a normal distribution. To test this theory, use either a newspaper or the Internet to select one company traded on the NYSE, one company traded on the American Stock Exchange, and one company traded on the NASDAQ and then do the following:

- Record the daily closing stock price of each of these companies for six consecutive weeks (so that you have 30 values per company).
- Record the daily changes in the closing stock price of each of these companies for six consecutive weeks (so that you have 30 values per company).

For each of your six data sets, decide whether the data are approximately normally distributed by

- constructing the stem-and-leaf display, histogram or polygon, and boxplot.
- comparing data characteristics to theoretical properties.
- constructing a normal probability plot.
- Discuss the results of (a) through (c). What can you say about your three stocks with respect to daily closing prices and daily changes in closing prices? Which, if any, of the data sets are approximately normally distributed?

Note: The random-walk theory pertains to the daily changes in the closing stock price, not the daily closing stock price.

TEAM PROJECTS

The file **Bond Funds** contains information regarding eight variables from a sample of 180 mutual funds:

- Type—Type of bonds comprising the bond fund (intermediate government or short-term corporate)
- Assets—In millions of dollars
- Fees—Sales charges (no or yes)
- Expense ratio—Ratio of expenses to net assets in percentage
- Return 2008—Twelve-month return in 2008
- Three-year return—Annualized return, 2006–2008
- Five-year return—Annualized return, 2004–2008
- Risk—Risk-of-loss factor of the mutual fund (below average, average, or above average)

6.55 For the expense ratio, three-year return, and five-year return, decide whether the data are approximately normally distributed by

- comparing data characteristics to theoretical properties.
- constructing a normal probability plot.

STUDENT SURVEY DATABASE

6.56 Problem 2.117 on page 65 describes a survey of 50 undergraduate students (stored in **UndergradSurvey**). For these data, for each numerical variable, decide whether the data are approximately normally distributed by

- comparing data characteristics to theoretical properties.
- constructing a normal probability plot.

6.57 Problem 2.117 on page 65 describes a survey of 50 undergraduate students (stored in **UndergradSurvey**).

- Select a sample of 50 undergraduate students and conduct a similar survey for those students.
- For the data collected in (a), repeat (a) and (b) of Problem 6.56.
- Compare the results of (b) to those of Problem 6.56.

6.58 Problem 2.119 on page 65 describes a survey of 40 MBA students (stored in **GradSurvey**). For these data, for each numerical variable, decide whether the data are approximately normally distributed by

- comparing data characteristics to theoretical properties.
- constructing a normal probability plot.