Chapter 2—Describing Data with Numerical Measures

MULTIPLE CHOICE

1. Which of the following is a meaningful measure of centre when the data are qualitative?
   a. the mean
   b. the median
   c. the mode
   d. the quartile

   ANS: C PTS: 1 REF: 56 | 59 TOP: 1–3
   BLM: Remember

2. Which of the following is a property of a symmetric distribution?
   a. The mean is greater than the median.
   b. The mean and median are equal.
   c. The mean is less than the median.
   d. The mean is less than the mode.

   ANS: B PTS: 1 REF: 59 TOP: 1–3
   BLM: Remember

3. In a histogram, what may be said of the proportion of the total area that must be to the right of the mean?
   a. It is less than 0.50 if the distribution is skewed to the left.
   b. It is always exactly 0.50.
   c. It is more than 0.50 if the distribution is skewed to the right.
   d. It is exactly 0.50 only if the distribution is symmetric.

   ANS: D PTS: 1 REF: 57-59 TOP: 1–3
   BLM: Higher Order - Understand

4. Which of the following statements applies to this set of data values: 17, 15, 16, 14, 17, 18, and 22?
   a. The mean, median, and mode are all equal.
   b. Only the mean and median are equal.
   c. Only the mean and mode are equal.
   d. Only the median and mode are equal.

   ANS: A PTS: 1 REF: 57-59 TOP: 1–3
   BLM: Higher Order - Apply

5. Which of the following *best* describes the relationship between the population mean and the sample mean?
   a. The population mean is always larger than the sample mean.
   b. The population mean is always smaller than the sample mean.
   c. The population mean is always larger than or equal to the sample mean.
   d. The population mean can be smaller than, larger than, or equal to the sample mean.

   ANS: D PTS: 1 REF: 57-58 TOP: 1–3

BLM: Higher Order - Understand

6. The average score for a class of 35 students was 70. The 20 male students in the class averaged 73. What was the average score for the 15 female students in the class?
   a. 60
   b. 66
   c. 70
   d. 73

   ANS: B PTS: 1 REF: 57-58 TOP: 1–3
   BLM: Higher Order - Apply

7. In a histogram, what may one conclude about the proportion of the total area that must be to the left of the median?
   a. It is exactly 0.50.
   b. It is less than 0.50 if the distribution is skewed to the left.
   c. It is more than 0.50 if the distribution is skewed to the right.
   d. It is between 0.25 and 0.75 if the distribution is symmetric.

   ANS: A PTS: 1 REF: 58-59 TOP: 1–3
   BLM: Higher Order - Understand

8. Which of the following statements about the mean is NOT always correct?
   a. The sum of the deviations from the mean is 0.
   b. Half the observations are on either side of the mean.
   c. The mean is a measure of the middle of a distribution.
   d. The value of the mean times the number of observations equals the sum of all of the observations.

   ANS: B PTS: 1 REF: 57-59 TOP: 1–3
   BLM: Higher Order - Understand

9. Which of the following can be used to summarize data about qualitative variables?
   a. measures of centre
   b. measures of variability
   c. proportions
   d. measures of relative standing

   ANS: C PTS: 1 REF: 14 TOP: 1–3
   BLM: Remember

10. Consider this data set: 5, 6, 7, 11, and 15. Which of the following values equals its mean?
    a. 7.0
    b. 7.1
    c. 8.1
    d. 8.8

    ANS: D PTS: 1 REF: 57-58 TOP: 1–3
    BLM: Higher Order - Apply

11. A random sample from an unknown population had a sample standard deviation of zero. From this piece of information, which one of the following is a reasonable conclusion?
    a. The sample range must be zero.
    b. An error was made in computing the sample standard deviation. It must always be greater than zero.
    c. The population standard deviation must be zero.
    d. The population standard deviation must be less than zero

    ANS: A PTS: 1 REF: 67 TOP: 1–3
    BLM: Higher Order - Understand

12. The following data represent a sample of 10 scores on a 20-point statistics quiz: 16, 16, 16, 16, 16, 18, 18, 20, 20, and 20. After the mean, median, range, and variance were calculated for the scores, it was discovered that one of the scores of 20 should have been an 18. Which of the following pairs of measures will change when the calculations are redone using the correct scores?
    a. mean and range
    b. median and range
    c. mean and variance
    d. median and variance

    ANS: C PTS: 1 REF: 57-58 | 63-64
    TOP: 1–3 BLM: Higher Order - Apply

13. Which of the following represents a disadvantage of using the sample range to measure dispersion?
    a. It produces spreads that are not meaningful for data analysis.
    b. The largest or smallest observation (or both) may be an outlier.
    c. The sample range is not measured in the same units as the data.
    d. The sample range is measured in the same units as the data.

    ANS: B PTS: 1 REF: 63 TOP: 1–3
    BLM: Higher Order - Understand

14. The following 10 scores were obtained on a 20-point quiz: 4, 5, 8, 9, 11, 13, 15, 18, 18, and 20. The teacher computed the usual descriptive measures of centre and variability for these data, and then discovered an error was made. One of the 18s should have been a 16. Which pair of the following measures, calculated on the corrected data, would change from the original computation?
    a. mean and standard deviation
    b. mean and median
    c. range and median
    d. mean and range

    ANS: A PTS: 1 REF: 57-58 | 63-65
    TOP: 1–3 BLM: Higher Order - Apply

15. Which of the following is NOT a measure of variability?
    a. the variance
    b. the standard deviation
    c. the mean

d. the range

ANS: C PTS: 1 REF: 57 | 62-63 TOP: 1–3
BLM: Remember

16. If two data sets have the same range, which of the following characteristics do these data sets also share?
    a. The distances from the smallest to the largest observations in both sets will be the same.
    b. The smallest and largest observations will be the same in both sets.
    c. They will have the same variance.
    d. They will have the same interquartile range.

ANS: A PTS: 1 REF: 63 TOP: 1–3
BLM: Higher Order - Understand

17. A sample of 26 observations has a standard deviation of 4. What is the sum of the squared deviations from the sample mean?
    a. 21
    b. 25
    c. 100
    d. 400

ANS: D PTS: 1 REF: 65 TOP: 1–3
BLM: Higher Order - Apply

18. Which of the following refers to numbers that indicate the spread or scatter of observations in a data set?
    a. measures of centre
    b. measures of location
    c. measures of variability
    d. measures of shape

ANS: C PTS: 1 REF: 62-63 TOP: 1–3
BLM: Remember

19. Which of the following statements describes the variance of a data set?
    a. The variance is a mean of absolute deviations.
    b. The variance is a mean of positive and negative deviations.
    c. The variance is a mean of squared deviations.
    d. The variance is a mean of only the positive deviations.

ANS: C PTS: 1 REF: 64 TOP: 1–3
BLM: Higher Order - Understand

20. If a store manager selected a sample of customers and computed the mean income for this sample, what has he computed?
    a. a parameter
    b. a statistic
    c. a qualitative value
    d. a categorical value

ANS: B PTS: 1 REF: 56 TOP: 1–3
BLM: Higher Order - Understand

21. Which of the following is a characteristic of a population mean?
    a. It will always be larger than the mean of a sample selected from that population.
    b. It will always be larger than the population median.
    c. It will usually differ in value from the mean of a sample selected from that population.
    d. It will always be smaller than the population median.

    ANS: C PTS: 1 REF: 57-58 TOP: 1–3
    BLM: Higher Order - Understand

22. A sample of students who have taken a calculus test has a mean score of 78.2, a mode of 67, and a median score of 67. Based on this information, what may one deduce about the distribution of the test scores?
    a. It is symmetric.
    b. It is right-skewed.
    c. It is left-skewed.
    d. It is bimodal.

    ANS: B PTS: 1 REF: 57-60 TOP: 1–3
    BLM: Higher Order - Understand

23. Which of the following is the most frequently used measure of variation?
    a. the mean
    b. the range
    c. the variance
    d. the standard deviation

    ANS: D PTS: 1 REF: 65 TOP: 1–3
    BLM: Remember

24. Which of the following measures is NOT affected by extreme values in the data?
    a. the mean
    b. the median
    c. the variance
    d. the range

    ANS: B PTS: 1 REF: 58 TOP: 1–3
    BLM: Higher Order - Understand

25. A university placement office conducted a survey of 100 engineers who had graduated from a local university. For these engineers, the mean salary was computed to be $72,000 with a standard deviation of $8,000. Which of the following best characterizes the percentage of these engineers who earn either more than $96,000 or less than $48,000?
    a. approximately 2.3%
    b. at least 5.6% (1/18 of the engineers)
    c. at most 5.6% (1/18 of the engineers)
    d. at most 11.1% (1/9 of the engineers)

ANS: D PTS: 1 REF: 68-69 | 71 TOP: 4–5
BLM: Higher Order - Analyze

26. According to Tchebysheff's Theorem, what is the percentage of measurements in a data set that will fall within three standard deviations of the mean?
    a. 16%
    b. at least 68%
    c. 75%
    d. at least 89%

    ANS: D PTS: 1 REF: 68-69 TOP: 4–5
    BLM: Higher Order - Apply

27. You are given a distribution of measurements that is approximately mound-shaped. According to the Empirical Rule, what would be the approximate percentage of measurements in a data set that will fall within two standard deviations of their mean?
    a. 99%
    b. 95%
    c. 90%
    d. 68%

    ANS: B PTS: 1 REF: 69-70 TOP: 4–5
    BLM: Remember

28. The expression $\bar{x} = \sum f_i x_i / n,$ where $n = \sum f_i,$ is recognizable as the formula for which of the following measures?
    a. the population mean, computed from ungrouped data
    b. the sample mean, computed from ungrouped data
    c. the population mean, computed from grouped data
    d. the sample mean, computed from grouped data

    ANS: D PTS: 1 REF: 76 TOP: 4–5
    BLM: Remember

29. The expression $s^2 = \left[\sum x_i^2 f_i - \left(\sum x_i f_i\right)^2 / n\right] / (n-1)$; $n = \sum f_i,$ is recognizable as the formula for which of the following measures?
    a. the sample variance, computed from ungrouped data
    b. the population variance, computed from ungrouped data
    c. the sample variance, computed from grouped data
    d. the population variance, computed from grouped data

    ANS: C PTS: 1 REF: 76 TOP: 4–5
    BLM: Remember

30. Suppose that a particular statistical population can be described, at least roughly, by the normal curve. Which of the following can we use to estimate the percentages of all population values that lie within specified numbers of standard deviations from the mean?
    a. Tchebysheff's Theorem
    b. the Empirical Rule

c. the interquartile range
d. a box plot

ANS: B PTS: 1 REF: 69-70 TOP: 4–5
BLM: Remember

31. The lengths of screws produced by a machine are normally distributed, with a mean of 3 cm and a standard deviation of 0.2 cm. What can we conclude from this?
a. Approximately 68% of all screws have lengths between 2.8 and 3.2 cm.
b. Approximately 95% of all screws have lengths between 2.8 and 3.2 cm.
c. Just about all screws have lengths between 2.8 and 3.2 cm.
d. Just about all screws have lengths between 2.9 and 3.1 cm.

ANS: A PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Analyze

32. According to Tchebysheff's Theorem, which of the following bounds will delimit the fraction of observations falling within *k* (where $k \geq 1$) standard deviations of the mean?
a. at most, $1 - (1/k)^2$
b. at least $(1 - 1/k)^2$
c. at most, $1 - (1/k^2)$
d. at least $1 - (1/k^2)$

ANS: D PTS: 1 REF: 68-69 TOP: 4–5
BLM: Remember

33. The distribution of actual volumes of tomato soup in 450 mL cans is thought to be bell-shaped, with a mean of 450 mL and a standard deviation equal to 8 mL. Based on this information, between what two values could we expect 95% of all cans to contain?
a. 430 and 470 mL
b. 432 and 468 mL
c. 434 and 466 mL
d. 440 and 460 mL

ANS: C PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Analyze

34. Incomes of workers in an automobile company in Ontario are known to be right-skewed, with a mean equal to $36,200. Applying Tchebysheff's Theorem, at least 8/9 of all incomes are in the range of $29,600 to $42,800. What is the standard deviation of those incomes from that mean?
a. $2,200
b. $4,755
c. $6,500
d. $6,700

ANS: A PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Apply

35. Which of the following randomly selected measurements, x, might be considered a potential outlier if it were to be selected from the given population?
    a. $x = 0$ from a population with $\mu = 0$ and $\sigma = 2$
    b. $x = -5$ from a population with $\mu = 1$ and $\sigma = 4$
    c. $x = 7$ from a population with $\mu = 3$ and $\sigma = 2$
    d. $x = 4$ from a population with $\mu = 0$ and $\sigma = 1$

    ANS: D PTS: 1 REF: 59 | 77-78 TOP: 6–7
    BLM: Higher Order - Apply

36. Which of these values represents a lower quartile for the data set 23, 24, 21, and 20?
    a. 20.25
    b. 22.0
    c. 22.5
    d. 23.5

    ANS: A PTS: 1 REF: 79-81 TOP: 6–7
    BLM: Higher Order - Apply

37. Which one of these values represents the upper quartile of the data set 10, 12, 16, 7, 9, 7, 41, and 14?
    a. 7
    b. 8
    c. 15.5
    d. 24

    ANS: C PTS: 1 REF: 79-81 TOP: 6–7
    BLM: Higher Order - Apply

38. Expressed in percentiles, how is the interquartile range defined?
    a. It is the difference between the 20% and 70% values.
    b. It is the difference between the 20% and 80% values.
    c. It is the difference between the 25% and 75% values.
    d. It is the difference between the 45% and 95% values.

    ANS: C PTS: 1 REF: 80 TOP: 6–7
    BLM: Remember

39. Scores on a chemistry exam were mound-shaped with a mean score of 90 and a standard deviation of 64. Scores on a statistics exam were also mound-shaped, with a mean score of 70 and a standard deviation of 16. A student who took both exams achieved a grade of 102 on the chemistry exam and a grade of 77 on the statistics exam. Which of these may be inferred from the information given?
    a. The student did relatively better on the chemistry exam than on the statistics exam, compared to the other students in each class.
    b. The student did relatively better on the statistics exam than on the chemistry exam, compared to the other students in the two classes.
    c. The student's scores on both exams are similar when accounting for the scores of the other students in the two classes.

d. Without more information it is impossible to say which of the student's exam scores indicates the better performance.

ANS: B PTS: 1 REF: 77-78 TOP: 6–7
BLM: Higher Order - Analyze

40. Which of the following summary measures is most affected by outliers?
a. the first quartile
b. the second quartile
c. the third quartile
d. the variance

ANS: D PTS: 1 REF: 64-65 | 79-80
TOP: 6–7 BLM: Remember

41. What percentage of all observations in a data set lie between the 30th percentile and the third quartile?
a. 30%
b. 45%
c. 75%
d. 79%

ANS: B PTS: 1 REF: 78-81 TOP: 6–7
BLM: Higher Order - Apply

42. Which of the following describes a graphical device that displays the highest and lowest values in a data set, as well as the upper quartile, the middle value, and the lower quartile?
a. a box plot
b. a five-number summary
c. a dotplot
d. a stem-and-leaf plot

ANS: A PTS: 1 REF: 81-84 TOP: 6–7
BLM: Remember

43. Lily's score on her biochemistry text placed her at the 97th percentile. What does this mean?
a. Lily's score has a *z*-score of 0.97.
b. Lily was in the bottom 3% of the students who took the test.
c. Lily scored as high as or higher than 97% of the students who took the test.
d. Lily's score has a *z*-score of –0.97.

ANS: C PTS: 1 REF: 78 TOP: 6–7
BLM: Higher Order - Understand

44. A sample of 50 values produced the following summary statistics: $Q_1 = 10$, $Q_2 = 14.6$, $Q_3 = 16.7$, and $\bar{x} = 15.3$. Based on this information, what are the left and right ends, respectively, of the box plot using whiskers?
a. 5.3 and 32.0
b. 10 and 14.6
c. 10 and 16.7

d. 14.6 and 16.7

ANS: C PTS: 1 REF: 81-84 TOP: 6–7
BLM: Higher Order - Apply

45. A sample of 600 values produced the following summary statistics: $Q_1 = 35.6$, $Q_2 = 54.2$, $Q_3 = 62.4$, and $\overline{x} = 56.8$. Given this information, which of the following values constitutes the lower fence on a box plot**?**
a. –4.60
b. 26.80
c. 75.80
d. 102.60

ANS: A PTS: 1 REF: 81-84 TOP: 6–7
BLM: Higher Order - Apply

46. A sample of 600 values produced the following summary statistics: $Q_1 = 35.6$, $Q_2 = 54.2$, $Q_3 = 62.4$, and $\overline{x} = 56.8$. Given this information, which of the following values is the upper fence on a box plot of this data set?
a. –4.60
b. 26.80
c. 75.80
d. 102.60

ANS: D PTS: 1 REF: 81-84 TOP: 6–7
BLM: Higher Order - Apply

47. If a data set has 15 values that have been sorted in ascending order, which value in the data set will be at the 25th percentile?
a. the fourth value
b. the third value
c. the second value
d. the first value

ANS: A PTS: 1 REF: 78 TOP: 6–7
BLM: Higher Order - Understand

48. If the distribution of sales is thought to be symmetric with very little variation, then what may one conclude about the box plot that represents the data set?
a. The whiskers on a box plot the box should be about half as long as the box is wide.
b. The width of the box will be very wide but the whiskers will be very short.
c. The left and right edges will be approximately at equal distance from the second quartile.
d. The width of the box will be very short, but the whiskers will be very long.

ANS: C PTS: 1 REF: 81-84 TOP: 6–7
BLM: Higher Order - Understand

49. The following summary statistics were computed from a sample of size 250: $Q_1 = 9$, $Q_2 = 13$, $Q_3 = 15$, and $\bar{x} = 10$. Given this information, which of the following statements is correct?
    a. The distribution of the data is slightly right-skewed.
    b. The distribution of the data is symmetric.
    c. A data value of 1 is an outlier.
    d. A data value of 25 is an outlier.

    ANS: D PTS: 1 REF: 82 TOP: 6–7
    BLM: Higher Order - Analyze

TRUE/FALSE

1. Numerical descriptive measures computed from population measurements are called parameters.

    ANS: T PTS: 1 REF: 56 TOP: 1–3
    BLM: Remember

2. Numerical descriptive measures computed from sample measurements are called statistics.

    ANS: T PTS: 1 REF: 56 TOP: 1–3
    BLM: Remember

3. Two classes, one with 15 students and the other with 25 students, took the same test and averaged 85 points and 75 points, respectively. If the two classes were combined, the overall average score of the 40 students would be 80 points.

    ANS: F PTS: 1 REF: 57 TOP: 1–3
    BLM: Higher Order - Apply

4. If, from a set of data, the sample mean $\bar{x}$ was found to be 15 but the sample median was only 9, then the data set would be said to be skewed to the right.

    ANS: T PTS: 1 REF: 59 TOP: 1–3
    BLM: Higher Order - Understand

5. When data have been grouped (as in a frequency table, a relative frequency histogram, etc.), the class with the highest frequency is called the modal class, and the midpoint of that class is taken to be the mode.

    ANS: T PTS: 1 REF: 59-60 TOP: 1–3
    BLM: Remember

6. The mode is generally used to describe large data sets.

    ANS: T PTS: 1 REF: 59-60 TOP: 1–3
    BLM: Remember

7. The mode of a data set or a distribution of measurements, if it exists, is unique.

   ANS: F PTS: 1 REF: 59-60 TOP: 1–3
   BLM: Remember

8. Jessica has been keeping track of what she spends to eat out. Last week's expenditures for meals eaten out were $15.69, $15.95, $16.19, $20.91, $17.49, $24.53, and $17.66. The mean amount Jessica spends on meals is $18.35.

   ANS: T PTS: 1 REF: 57 TOP: 1–3
   BLM: Higher Order - Apply

9. A data sample has a mean of 87 and a median of 117. The distribution of the data is positively skewed.

   ANS: F PTS: 1 REF: 59 TOP: 1–3
   BLM: Higher Order - Understand

10. A student scores 89, 75, 94, and 88 on four exams during the semester and 97 on the final exam. If the final is weighted double and the four others weighted equally, the student's final average would be 90.

    ANS: T PTS: 1 REF: 57 TOP: 1–3
    BLM: Higher Order - Apply

11. In a mound-shaped distribution, there is no difference in the values of the mean and the median.

    ANS: T PTS: 1 REF: 59 TOP: 1–3
    BLM: Remember

12. Measures of centre are values around which observations tend to cluster and which describe the location of what, in some sense, might be called the "centre" of a data set.

    ANS: T PTS: 1 REF: 56 TOP: 1–3
    BLM: Remember

13. The median is a measure of centre that divides an ordered array of data into two halves. If the data are arranged in ascending order from smallest to largest, all the observations below the median are smaller than or equal to it, while all the observations above the median are larger than or equal to it.

    ANS: T PTS: 1 REF: 58 TOP: 1–3
    BLM: Higher Order - Understand

14. The mode is the sum of a data set's minimum and maximum values, divided by 2.

    ANS: F PTS: 1 REF: 59 TOP: 1–3

BLM: Remember

15. If the variability of a set of data is very small, then the sample variance may be negative.

ANS: F PTS: 1 REF: 64-65 TOP: 1–3
BLM: Higher Order - Understand

16. When all the numbers in the data set are the same, the standard deviation, *s*, must be zero.

ANS: T PTS: 1 REF: 67 TOP: 1–3
BLM: Higher Order - Understand

17. In all cases, the sum of the deviations of the measurements from their mean is 0.

ANS: T PTS: 1 REF: 64 TOP: 1–3
BLM: Higher Order - Understand

18. The sample variance is approximately the average of the squared deviations of the measurements from their mean.

ANS: T PTS: 1 REF: 65 TOP: 1–3
BLM: Higher Order - Understand

19. The sample variance calculated with a divisor of n gives a better estimate of the population variance, σ^2, than does the sample variance, s^2, with a divisor of $n - 1$.

ANS: F PTS: 1 REF: 66 TOP: 1–3
BLM: Remember

20. The larger the values of the sample variance, s^2, and the sample standard deviation, *s*, the greater the variability in the data.

ANS: T PTS: 1 REF: 67 TOP: 1–3
BLM: Higher Order - Understand

21. In order to measure the variability in the same units as the original observations, we compute the sample variance.

ANS: F PTS: 1 REF: 67 TOP: 1–3
BLM: Higher Order - Understand

22. Measures of variability describe typical values in the data.

ANS: F PTS: 1 REF: 62-63 TOP: 1–3
BLM: Remember

23. The mean is one of the most frequently used measures of variability.

ANS: F PTS: 1 REF: 57 | 62-63 TOP: 1–3

BLM: Remember

24. The range is considered the weakest measure of variability.

ANS: T PTS: 1 REF: 63 TOP: 1–3
BLM: Remember

25. The value of the standard deviation will always exceed that of the variance.

ANS: F PTS: 1 REF: 65 TOP: 1–3
BLM: Higher Order - Understand

26. The standard deviation is expressed in terms of the original units of measurement, but the variance is not.

ANS: T PTS: 1 REF: 67 TOP: 1–3
BLM: Higher Order - Understand

27. The value of the standard deviation may be either positive or negative, while the value of the variance will always be positive or zero.

ANS: F PTS: 1 REF: 67 TOP: 1–3
BLM: Higher Order - Understand

28. The standard deviation is the positive square root of the variance.

ANS: T PTS: 1 REF: 65 TOP: 1–3
BLM: Remember

29. A sample of 20 observations has a standard deviation of 4. The sum of the squared deviations from the sample mean is 320.

ANS: F PTS: 1 REF: 65 TOP: 1–3
BLM: Higher Order - Apply

30. The value of the mean times the number of observations equals the sum of all of the observations.

ANS: T PTS: 1 REF: 57 TOP: 1–3
BLM: Higher Order - Understand

31. In a histogram, the proportion of the total area that must be to the left of the median is less than 0.50 if the distribution is skewed to the left.

ANS: F PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Understand

32. In a histogram, if the distribution is skewed to the right, the proportion of the total area that must be to the left of the median is more than 0.50.

ANS: F PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Understand

33. If two data sets have the same range, the variances in both sets will be the same.

ANS: F PTS: 1 REF: 63-65 TOP: 1–3
BLM: Higher Order - Understand

34. The sum of the deviations squared from the mean is always zero.

ANS: F PTS: 1 REF: 64 TOP: 1–3
BLM: Higher Order - Understand

35. Measures of variability are numbers that indicate the spread or scatter of observations; they show the extent to which individual values in a data set differ from one another and, hence, differ from their central location.

ANS: T PTS: 1 REF: 62-63 TOP: 1–3
BLM: Remember

36. A parameter and a statistic can be used interchangeably.

ANS: F PTS: 1 REF: 56 TOP: 1–3
BLM: Remember

37. The median is one of the most commonly used measures of variability.

ANS: F PTS: 1 REF: 58 | 62-63 TOP: 1–3
BLM: Remember

38. For distributions of data that are skewed to the left or right, the median would likely be the best measure of centre.

ANS: T PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Understand

39. You are given the data values 5, 10, 15, 20, and 25. If these data were considered to be a population, and you calculated its mean, you would get the same value as if these data were considered to be a sample from another larger population.

ANS: T PTS: 1 REF: 56-57 TOP: 1–3
BLM: Higher Order - Understand

40. The value $(n + 1)/2$ indicates the value of the median in an ordered data set, where n is the number of data values.

ANS: F PTS: 1 REF: 58 TOP: 1–3
BLM: Remember

41. For any distribution, if the mean is equal to the standard deviation, you can conclude that the distribution is symmetric.

ANS: F PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Understand

42. A distribution is said to be skewed to the right if the population mean is larger than the sample mean.

ANS: F PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Understand

43. One advantage of using the median as a measure of centre is that its value is NOT affected by extreme values.

ANS: T PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Understand

44. A data set in which the mean and median are equal is said to be bimodal data.

ANS: F PTS: 1 REF: 59-60 TOP: 1–3
BLM: Remember

45. If the mean value of a distribution is 85 and the median is 67, the distribution must be skewed to the right.

ANS: T PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Understand

46. One of the advantages of the standard deviation over the variance as a measure of variability is that the standard deviation is measured in the original units.

ANS: T PTS: 1 REF: 67 TOP: 1–3
BLM: Remember

47. For any distribution, the standard deviation is a measure of the variability of the data around the median.

ANS: F PTS: 1 REF: 65 TOP: 1–3
BLM: Remember

48. Suppose the standard deviation for a given sample is known to be 12. If each data value in the sample is multiplied by 3, the standard deviation will be 36.

ANS: T PTS: 1 REF: 65 TOP: 1–3
BLM: Higher Order - Apply

49. When the distribution is skewed to the left, then the mean > the median.

ANS: F PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Understand

50. When the distribution is skewed to the right, the mean < the median.

ANS: F PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Understand

51. When the distribution is symmetric and unimodal, the mean = the median.

ANS: T PTS: 1 REF: 57-59 TOP: 1–3
BLM: Higher Order - Understand

52. If a distribution is strongly skewed by one or more extreme values, you should use the mean rather than the median as a measure of centre.

ANS: F PTS: 1 REF: 59 TOP: 1–3
BLM: Remember

53. Half of the observations in a data set are on either side of the mean.

ANS: F PTS: 1 REF: 58 TOP: 1–3
BLM: Higher Order - Understand

54. The mean is a measure of the ~~middle~~ centre of a distribution.

ANS: T PTS: 1 REF: 56-57 TOP: 1–3
BLM: Remember

55. The sum of the squared deviations from the mean is always zero.

ANS: F PTS: 1 REF: 65 TOP: 1–3
BLM: Higher Order - Understand

56. The standard deviation is always smaller than the variance.

ANS: F PTS: 1 REF: 65 TOP: 1–3
BLM: Higher Order - Understand

57. Tchebysheff's Theorem states the following: Given a number *k* greater than or equal to 1, and a set of measurements, at least ($1 - 1/k^2$) of the measurements in the data set will lie within *k* standard deviations of their mean.

ANS: T PTS: 1 REF: 68-69 TOP: 4–5
BLM: Remember

58. The Empirical Rule states the following: Given a distribution of measurements that is approximately bell-shaped (mound-shaped), then the interval $\mu \pm \sigma$ contains approximately 68% of the measurements; the interval $\mu \pm 2\sigma$ contains approximately 95% of the measurements; and the interval $\mu \pm 3\sigma$ contains all or almost all of the measurements.

ANS: T PTS: 1 REF: 69-70 TOP: 4–5
BLM: Remember

59. The Empirical Rule and Tchebysheff's Theorem can be used to describe data sets.

ANS: T PTS: 1 REF: 68-70 TOP: 4–5
BLM: Higher Order - Understand

60. The Empirical Rule can be applied to any numerical data set.

ANS: F PTS: 1 REF: 69-70 TOP: 4–5
BLM: Remember

61. For larger sample sizes, a rough approximation for the sample standard deviation *s* is that *s* $\approx$ *R*/4, where *R* is the range.

ANS: T PTS: 1 REF: 63 | 69 TOP: 4–5
BLM: Remember

62. Since Tchebysheff's Theorem applies to any distribution, it provides a very conservative estimate of the fraction of measurements that fall into a particular interval.

ANS: T PTS: 1 REF: 69 TOP: 4–5
BLM: Higher Order - Understand

63. Tchebysheff's Theorem gives a lower bound to the fraction of measurements to be found in an interval constructed as $\bar{x} \pm ks$.

ANS: T PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Understand

64. Tchebysheff's Theorem applies only to data sets which have a mound-shaped distribution.

ANS: F PTS: 1 REF: 69 TOP: 4–5
BLM: Remember

65. While Tchebysheff's Theorem applies to any distribution, regardless of shape, the Empirical Rule applies only to distributions that are mound-shaped.

ANS: T PTS: 1 REF: 69 TOP: 4–5
BLM: Remember

66. The mean of 40 sales receipts is $69.75 and the standard deviation is $10.25. Using Tchebysheff's Theorem, at least 75% of the sales receipts were between $49.25 and $90.25.

ANS: T PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Apply

67. According to Tchebysheff's Theorem, at least 96% of observations should fall within five standard deviations of the mean.

ANS: T PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Apply

68. Tchebysheff's Theorem provides us with a measure of the shape of a set of data that focuses on the difference between the mode and the mean, and then relates it to the standard deviation.

ANS: F PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Understand

69. The distribution of chequing account balances for customers at Independent Bank is known to be bell-shaped with a mean of $1800 and a standard deviation of $300. Given this information, the percentage of accounts with balances between $1500 and $2100 is approximately 95%.

ANS: F PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Analyze

70. The distribution of dollars paid for home insurance by home owners in Windsor is bell-shaped with a mean equal to $800 every six months, and a standard deviation equal to $120. Based on this information, we can use Tchebysheff's Theorem to determine the percentage of home owners who will pay between $560 and $1040 for home insurance.

ANS: F PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Apply

71. The distribution of credit card balances for customers is highly skewed to the right, with a mean of $1200 and a standard deviation of $150. Based on this information, approximately 68% of the customers will have credit card balances between $1050 and $1350.

ANS: F PTS: 1 REF: 68-69 | 71 TOP: 4–5
BLM: Higher Order - Analyze

72. The sample *z*-score is a measure of relative standing defined by $z = (x - \bar{x})/s$. It measures the distance between an observation and the mean in units of the standard deviation.

ANS: T PTS: 1 REF: 77-78 TOP: 6–7
BLM: Remember

73. *z*-scores exceeding 3 in absolute value are likely to occur.

ANS: F PTS: 1 REF: 77-78 TOP: 6–7
BLM: Higher Order - Understand

74. Any unusually large observation (as measured by a *z*-score greater than 3), or any unusually small observation (as measured by a *z*-score smaller than –3) is considered to be an outlier.

ANS: T PTS: 1 REF: 77-78 TOP: 6–7
BLM: Higher Order - Understand

75. The 10th percentile of a set of measurements is the value that exceeds 90% of the measurements and is less than the remaining 10% of the measurements.

ANS: F PTS: 1 REF: 78 TOP: 6–7
BLM: Higher Order - Understand

76. The difference between the largest and smallest values in an ordered array is called the interquartile range.

ANS: F PTS: 1 REF: 63 | 80 TOP: 6–7
BLM: Remember

77. Quartiles divide the values in a data set into four parts of equal size.

ANS: T PTS: 1 REF: 79-81 TOP: 6–7
BLM: Remember

78. The interquartile range is the difference between the lower and upper quartiles.

ANS: T PTS: 1 REF: 80 TOP: 6–7
BLM: Remember

79. Expressed in percentiles, the upper quartile is the 75th percentile.

ANS: T PTS: 1 REF: 79-81 TOP: 6–7
BLM: Remember

80. Measures of relative standing indicate the position of one observation relative to other observations in a set of data.

ANS: T PTS: 1 REF: 77-78 TOP: 6–7
BLM: Higher Order - Understand

81. The median equals the second quartile.

ANS: T PTS: 1 REF: 79-81 TOP: 6–7
BLM: Higher Order - Understand

82. The standard deviation is a measure of relative standing.

ANS: F PTS: 1 REF: 77-78 TOP: 6–7
BLM: Higher Order - Understand

83. If a set of data has 120 values, the value of the 30th percentile will be calculated using the 36th and 37th values in the data, when the data values have been arranged in ascending order.

ANS: T PTS: 1 REF: 78 TOP: 6–7
BLM: Higher Order - Apply

84. The distribution of a set of data is considered to be symmetric if the first quartile and the 25th percentile are equal.

ANS: F PTS: 1 REF: 78-79 TOP: 6–7
BLM: Higher Order - Understand

85. If the mean value of a set of data is 83.5 and the median is 72.8, then the third quartile will be at least 83.5.

ANS: F PTS: 1 REF: 79-81 TOP: 6–7
BLM: Higher Order - Understand

86. Assume that 75% of the households in Saskatchewan have incomes of $24,375 or below. Given this information, it is certain that the mean household income is less than $24,375.

ANS: F PTS: 1 REF: 79-81 TOP: 6–7
BLM: Higher Order - Understand

87. The left and right ends of the box in a box plot represent the 25th and 75th percentiles, respectively.

ANS: T PTS: 1 REF: 81-84 TOP: 6–7
BLM: Remember

88. The following five-number summary for a sample of size 500 was obtained: Minimum = 250, $Q_1 = 1,200$, $Q_2 = 3,600$, $Q_3 = 4,800$, and Maximum = 4,950. Based on this information, the distribution of the data seems to be symmetric.

ANS: F PTS: 1 REF: 79 TOP: 6–7
BLM: Higher Order - Analyze

89. The following five-number summary for a sample of size 500 was obtained: Minimum = 250, $Q_1 = 1,200$, $Q_2 = 3,600$, $Q_3 = 4,800$, and Maximum = 4,950. Based on this information, if you were to construct a box plot, the value 215 would be considered an outlier.

ANS: F PTS: 1 REF: 81-84 TOP: 6–7
BLM: Higher Order - Apply

90. The following five-number summary for a sample of size 500 was obtained: Minimum = 250, $Q_1 = 1,200,$ $Q_2 = 3,600,$ $Q_3 = 4,800,$ and Maximum = 4,950. Based on this information, if you were to construct a box plot, the value corresponding to the right-hand edge of the box would be 4,800.

ANS: T PTS: 1 REF: 118-120 TOP: 6–7
BLM: Higher Order - Apply

91. The following five-number summary for a sample of size 500 was obtained: Minimum = 250, $Q_1 = 1,200,$ $Q_2 = 3,600,$ $Q_3 = 4,800,$ and Maximum = 4,950. Based on this information, if you were to construct a box plot, the value corresponding to the upper fence is 10,200.

ANS: T PTS: 1 REF: 118-120 TOP: 6–7
BLM: Higher Order - Apply

92. A sample of 2500 vehicles in Minnesota showed the following statistics related to the number of accidents per month: $Q_1 = 15,$ $Q_2 = 48,$ and $Q_3 = 62.$ Based on these data, we can conclude that the distribution of accidents is skewed.

ANS: T PTS: 1 REF: 59 | 79-81 TOP: 6–7
BLM: Higher Order - Understand

PROBLEM

Motor Skills of Children
The times required for 10 children to learn a particular motor skill were recorded as 9, 15, 23, 20, 16, 15, 24, 18, 10, and 20 minutes.

1. Refer to Motor Skills of Children statement. Find the mean time to learn this task.

ANS:
$\bar{x} = 17$ minutes

PTS: 1 REF: 57-58 TOP: 1–3
BLM: Higher Order - Apply

2. Refer to Motor Skills of Children statement. Find the median time to learn this task.

ANS:
$m = 17$

PTS: 1 REF: 58 TOP: 1–3
BLM: Higher Order - Apply

3. Refer to Motor Skills of Children statement. Based on the values of the mean and median in the previous two questions, are the measurements symmetric or skewed? Give a reason for your answer.

   ANS:
   Since the mean and median values are the same, we conclude that the measurements are symmetric.

   PTS: 1 REF: 59 TOP: 1–3
   BLM: Higher Order - Understand

4. Suppose someone told you that each value of a data set of 5 measurements had been multiplied by 100 and the sample mean was calculated to be 17.20. What was the sample mean of the original data?

   ANS:
   $\bar{x}_{orig.} = 0.172$

   PTS: 1 REF: 57 TOP: 1–3
   BLM: Higher Order - Apply

   Flu Shot
   Eight doctors were asked how many flu shots they had given to patients this fall. The numbers of flu shots were 6, 3, 5, 24, 2, 6, 0, and 8.

5. Refer to Flu Shot statement. Find the sample mean.

   ANS:
   $\bar{x} = 6.75$

   PTS: 1 REF: 57-58 TOP: 1–3
   BLM: Higher Order - Apply

6. Refer to Flu Shot statement. Find the median number of flu shots given.

   ANS:
   $m = 5.5$

   PTS: 1 REF: 58 TOP: 1–3
   BLM: Higher Order - Apply

7. Refer to Flu Shot statement. Based on the values of the mean and median in the previous two questions, are the measurements symmetric or skewed? Why?

   ANS:
   Since the mean is larger than the median, we conclude that the measurements are skewed to the right.

   PTS: 1 REF: 59 TOP: 1–3

BLM: Higher Order - Understand

8. In assembling a home appliance, workers generally finish the process within 30 minutes to 1 hour. Occasionally, due to system failures, the assembly process takes a long time, possibly as long as 4 to 5 hours. What is the most appropriate measure of central tendency to use in this case if you want the measure to be representative of most of the observed times? Why is it the most appropriate measure?

   ANS:
   Median is the most appropriate measure because it is not influenced by extreme values.

   PTS: 1 REF: 59 TOP: 1–3
   BLM: Higher Order - Analyze

9. The following data represent scores on a 15-point aptitude test: 8, 10, 15, 12, 14, and 13. Subtract 5 from every observation and compute the sample mean for both the original data and the new data. What effect, if any, does subtracting 5 from every observation have on the sample mean?

   ANS:
   $\bar{x}_{org.} = 12$, and $\bar{x}_{new} = 7$. The sample mean $\bar{x}$ is shifted to the left (decreased) by 5.

   PTS: 1 REF: 57 TOP: 1–3
   BLM: Higher Order - Apply

   Student Ratings
   Thirty-three students were asked to rate themselves on whether they were outgoing or not, using this five-point scale: 1 = extremely extroverted, 2 = extroverted, 3 = neither extroverted nor introverted, 4 = introverted, or 5 = extremely introverted. The results are shown in the table below:

Rating x_i	1	2	3	4	5
Frequency f_i	1	7	20	5	0

10. Refer to Student Ratings table. Calculate the sample mean.

    ANS:
    $\bar{x} = 2.88$

    PTS: 1 REF: 57-58 TOP: 1–3
    BLM: Higher Order - Apply

11. Refer to Student Ratings table. Calculate the median.

    ANS:
    $m = 3$

PTS: 1 REF: 58 TOP: 1–3
BLM: Higher Order - Apply

Cracks in Bar

The following data represent the number of small cracks per bar for a sample of eight steel bars: 4, 6, 10, 1, 3, 1, 25, and 8.

12. Refer to Cracks in Bar statement. What is the average number of small cracks per bar?

ANS:
$\bar{x}$ = 7.25

PTS: 1 REF: 57-58 TOP: 1–3
BLM: Higher Order - Apply

13. Refer to Cracks in Bar statement. Which, if any, of the observations appear to be outliers? Justify your answer.

ANS:
The value 25 has a *z*-score of 2.26 making it a suspect outlier.

PTS: 1 REF: 59 TOP: 6–7
BLM: Higher Order - Apply

14. Refer to Cracks in Bar statement. Find the standard deviation for the number of small cracks per bar.

ANS:
$s = \sqrt{\frac{852 - (58)^2 / 8}{7}} = 7.85$

PTS: 1 REF: 66 TOP: 1–3
BLM: Higher Order - Apply

Aptitude Tests
Twenty-eight applicants interested in working in community services took an examination designed to measure their aptitude for social work. A stem-and-leaf plot of the 28 scores appears below, in which the first column is the count per "branch," the second column is the stem value, and the remaining digits are the leaves.

Count	Stems	Leaves
1	4	6
1	5	9
4	6	3688
6	7	026799
9	8	145667788
7	9	1234788

15. Refer to Aptitude Tests table. What is the median score?

ANS:
$m = 84.5$

PTS: 1 REF: 58 TOP: 1–3
BLM: Higher Order - Apply

16. Refer to Aptitude Tests table. What is the sample mean for this data set?

ANS:
$\bar{x} = 80.64$

PTS: 1 REF: 57-58 TOP: 1–3
BLM: Higher Order - Apply

17. Refer to Aptitude Tests table. Should the Empirical Rule be applied to this data set?

ANS:
No. The data do not appear to be mound-shaped.

PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Analyze

18. Refer to Aptitude Tests table. Use the range approximation to determine an approximate value for the standard deviation. Is this a good approximation?

ANS:
$s \approx R/4 = 13$. This approximation is very close to the actual value of $s = 12.85$.

PTS: 1 REF: 72-73 TOP: 4–5
BLM: Higher Order - Apply

19. Refer to Aptitude Tests table. What is the value of the sample standard deviation?

ANS:
$s = 12.85$

PTS: 1 REF: 66 TOP: 1–3
BLM: Higher Order - Apply

20. Refer to Aptitude Tests table. What is the range of these data?

ANS:
$R = 52$

PTS: 1 REF: 63 | 72-73 TOP: 1–3
BLM: Higher Order - Apply

21. Refer to Aptitude Tests table. What is the value of the first and third quartiles?

ANS:
Position of first quartile = 0.25(29) = 7.25, then $Q_1 = 70 + 0.25(2) = 70.5$
Position of third quartile = 0.75(29) = 21.75, then $Q_3 = 88 + 0.75(3) = 90.25$

PTS: 1 REF: 79-81 TOP: 6–7
BLM: Higher Order - Apply

22. Refer to Aptitude Tests table. What is the interquartile range?

ANS:
IQR = $Q_3 - Q_1 = 19.75$

PTS: 1 REF: 80 TOP: 6–7
BLM: Higher Order - Apply

23. Refer to Aptitude Tests table. Find the inner fences.

ANS:
$Q_1 - 1.5(\text{IQR}) = 70.5 - 1.5(19.75) = 40.875$, and
$Q_3 + 1.5(\text{IQR}) = 90.25 + 1.5(19.75) = 119.875$

PTS: 1 REF: 81-84 TOP: 6–7
BLM: Higher Order - Apply

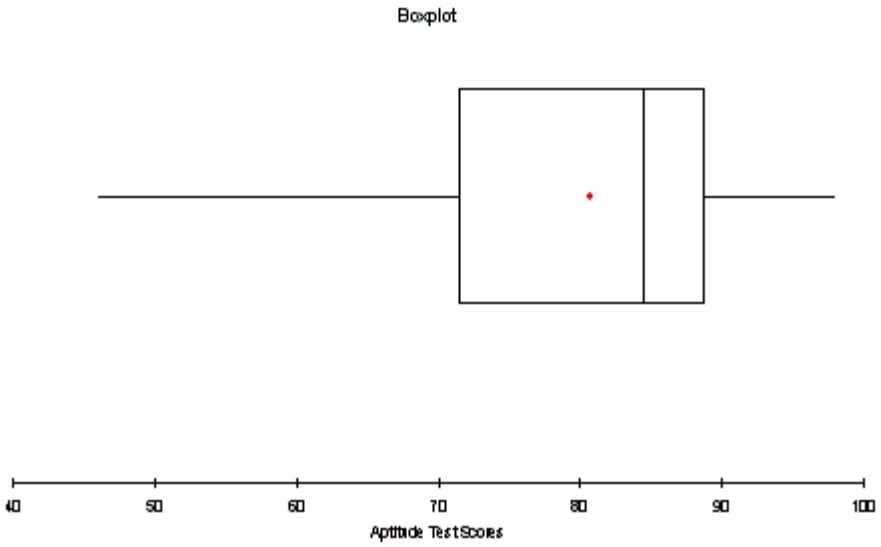
24. Refer to Aptitude Tests table. Find the outer fences.

ANS:
$Q_1 - 3(\text{IQR}) = 70.5 - 3(19.75) = 11.25$, and
$Q_3 + 3(\text{IQR}) = 90.25 + 3(19.75) = 149.50$

PTS: 1 REF: 81-84 TOP: 6–7
BLM: Higher Order - Apply

25. Refer to Aptitude Tests table. Construct a box plot for these data.

ANS:



PTS: 1 REF: 81-84 TOP: 6–7
BLM: Higher Order - Apply

26. Refer to Aptitude Tests table. Does the box plot indicate the presence of any outliers?

ANS:
There do not appear to be any outliers present since there are no observations between the inner and outer fences or outside the outer fences.

PTS: 1 REF: 82 TOP: 6–7
BLM: Higher Order - Understand

27. Suppose you are given the following set of sample measurements: –1, 0, 2, 6, 5, and 6.
a. Calculate the sample mean.
b. Find the median.
c. Find the mode.
d. Are these data symmetric, skewed to the right or skewed to the left? Justify your answer.

ANS:
a. $\bar{x} = 3$
b. m = (2 + 5)/2 = 3.5
c. 6
d. The data are skewed to the left since the mean is less than the median.

PTS: 1 REF: 57-59 TOP: 1–3
BLM: Higher Order - Apply

Ice Cream Cone Sales

A neighbourhood ice cream vendor reports the following sales of single-scoop ice cream cones (measured in hundreds of cones) for five randomly selected weeks: 5, 4, 6, 5, and 3.

28. Refer to the Ice Cream Cone Sales statement. Find the average number of weekly sales of single-scoop ice cream cones.

ANS:
$\bar{x} = 4.6$

PTS: 1 REF: 57-58 TOP: 1–3
BLM: Higher Order - Apply

29. Refer to the Ice Cream Cone Sales statement. Find the median number of weekly sales of single-scoop ice cream cones.

ANS:
$m = 5$

PTS: 1 REF: 58 TOP: 1–3
BLM: Higher Order - Apply

30. Refer to the Ice Cream Cone Sales statement. Find the variance for the weekly sales of single scoop ice cream cones.

ANS:
$s^2 = 1.3$

PTS: 1 REF: 65-66 TOP: 1–3
BLM: Higher Order - Apply

31. The following data represent the sales (measured in $10,000s) of seven real estate salespersons employed by a local agency: 23, 34, 56, 47, 45, 60, and 249. Which measure of centre, the mean or the median, would provide a better measure of the average sales of the company? Give a reason for your answer.

ANS:
The median would seem to provide a better measure of the average sales since it will not be adversely affected by the extreme value of 249. (The mean will be pulled strongly to the right by the extreme value of 249.)

PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Analyze

Athletic Training Time

The following data represent the numbers of minutes an athlete spends training per day: 73, 74, 76, 77, 79, 79, 83, 84, 88, 84, 84, 85, 86, 86, 87, 87, 88, 91, 92, 92, 93, 97, 98, 98, 81, and 82. The mean and standard deviation were computed to be 85.54 and 6.97, respectively.

32. Refer to the Athletic Training Time statement. Create a stem-and-leaf plot for the distribution of training times.

ANS:

Stems	Leaves
7	34
7	6799
8	123444
8	5667788
9	1223
9	788

PTS: 1 REF: 52 TOP: 1–3
BLM: Higher Order - Apply

33. Refer to the Athletic Training Time statement. Is the distribution relatively mound-shaped?

ANS:
Yes, the distribution of training times appears to be relatively mound-shaped.

PTS: 1 REF: 53 TOP: 1–3
BLM: Higher Order - Understand

34. Refer to the Athletic Training Time statement. What percentage of measurements would you expect to be between 71.60 and 99.48?

ANS:
Since the distribution appears to be relatively mound-shaped, the Empirical Rule applies. The interval (71.60, 99.48) represents two standard deviations from the mean, so we would expect approximately 95% of the measurements to lie in this interval.

PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Analyze

35. Refer to the Athletic Training Time statement. What percentage of the measurements lies in the interval (71.60, 99.48)?

ANS:
26 of the 26 measurements or 100% of the measurements lie in the given interval.

PTS: 1 REF: 69-70 TOP: 4–5
BLM: Higher Order - Apply

Calories in Soft Drinks

The following data represent the number of calories in 340 mL cans of a sample of 8 popular soft drinks: 124, 144, 147, 146, 148, 154, 150, and 234.

36. Refer to the Calories in Soft Drinks statement. Find the median and the sample mean.

ANS:
$m = (147 + 148)/2 = 147.5$, $\bar{x} = 155.875$

PTS: 1 REF: 57-58 TOP: 1–3
BLM: Higher Order - Apply

37. Refer to the Calories in Soft Drinks statement. Are these measurements of numbers of calories symmetric or skewed? Justify your conclusion.

ANS:
Since the mean $\bar{x}$ is larger than the median, we conclude that the measurements are skewed to the right.

PTS: 1 REF: 59 TOP: 1–3
BLM: Higher Order - Understand

Psychological Experiments
In a psychological experiment, the time on task was recorded for ten subjects having a five-minute time constraint. These measurements (in seconds) were 182, 197, 207, 272, 192, 257, 247, 197, 232, and 237.

38. Refer to the Psychological Experiments statement. Find the average time on task.

ANS:
$\bar{x} = 222$

PTS: 1 REF: 57-58 TOP: 1–3
BLM: Higher Order - Apply

39. Refer to the Psychological Experiments statement. Find the median time on task.

ANS:
$m = (207 + 232)/2 = 219.5$

PTS: 1 REF: 58 TOP: 1–3
BLM: Higher Order - Apply

40. Refer to the Psychological Experiments statement. If you were writing a report to describe these data, which measure of central tendency would you use? Explain.

ANS:
Since there are no unusually large or small observations to affect the value of the mean, we would probably report the mean or average time on task.

PTS: 1 REF: 57-59 TOP: 1–3
BLM: Higher Order - Analyze

41. You are given a sample of 8 measurements: 13, 11, 15, 16, 14, 14, 13, and 15. Calculate the sample mean.

ANS:

$\bar{x}$ = 13.875

PTS: 1 REF: 57-58 TOP: 1–3
BLM: Higher Order - Apply

42. A sample of $n = 10$ measurements consists of the following values: 15, 12, 13, 16, 11, 12, 14, 15, 11, and 13. Calculate the sample mean and the median of this data set. Are the data mound-shaped?

ANS:
$\bar{x}$ = 13.2, and $m = 13$. No; the data is slightly skewed to the right since the mean is slightly larger than the median.

PTS: 1 REF: 57-59 TOP: 1–3
BLM: Higher Order - Apply

43. The following data represent the scores for a sample of 10 students on a 20-point chemistry quiz: 16, 14, 2, 8, 12, 12, 9, 10, 15, and 13. Find the median and the sample mean.

ANS:
Median $m = (12 + 12)/2 = 12$, and $\bar{x}$ = 11.1

PTS: 1 REF: 57-58 TOP: 1–3
BLM: Higher Order - Apply

Community College Raises
Assume that all employees of a community college received a monthly raise.

44. Refer to the Community College Raises statement. How would a $150 raise affect the mean of salaries? How would a $150 raise affect the standard deviation of salaries?

ANS:
a. The mean of salaries will increase by $150.
b. The standard deviation of salaries will remain unchanged.

PTS: 1 REF: 57 | 65-66 TOP: 1–3
BLM: Higher Order - Apply

45. Refer to the Community College Raises statement. What would happen to the mean of salaries if all salaries were raised by 5%? What would happen to the standard deviation of salaries if all salaries were raised by 4%?

ANS:
a. The mean of salaries will increase by 5%.
b. The standard deviation of salaries will increase by 4%.

PTS: 1 REF: 57 | 65-66 TOP: 1–3
BLM: Higher Order - Apply

Optometrist Customers
The following values denote the number of customers handled by an optometrist during a random sample of four periods of one hour each: 4, 6, 2, and 5.

46. Refer to the Optometrist Customers statement. Find the standard deviation of these values.

ANS:
$s = 1.708$ customers

PTS: 1 REF: 65-66 TOP: 1–3
BLM: Higher Order - Apply

47. Refer to the Optometrist Customers statement. Find the range *R*.

ANS:
$R = 6 - 2 = 4$

PTS: 1 REF: 63 TOP: 1–3
BLM: Higher Order - Apply

48. The following data represent scores on a 15-point aptitude test: 8, 10, 15, 12, 14, and 13. Subtract 5 from every observation and compute the sample variance for the original data and the new data. What effect, if any, does subtracting 5 from every observation have on the sample variance?

ANS:
$s^2_{orig.} = 6.80$, and $s^2_{new} = 6.80$. The sample variance remains unchanged.

PTS: 1 REF: 64-65 TOP: 1–3
BLM: Higher Order - Analyze

Student Extroversion
Thirty-three students were asked to rate themselves on whether they were outgoing or not using this five-point scale: 1 = extremely extroverted, 2 = extroverted, 3 = neither extroverted nor introverted, 4 = introverted, or 5 = extremely introverted. The results are shown in the table below:

Rating x_i	1	2	3	4	5
Frequency f_i	1	7	20	5	0

49. Refer to the Student Extroversion statement and table. Calculate the sample standard deviation.

ANS:
$s = 0.696$

PTS: 1 REF: 65-66 TOP: 1–3

BLM: Higher Order - Apply

50. Refer to the Student Extroversion statement and table. Find the percentage of measurements in the intervals $\bar{x} \pm s$ and $\bar{x} \pm 2s$. Compare these results with the Empirical Rule percentages, and comment on the shape of the distribution.

ANS:
Sixty-one percent of the observations are in the interval $\bar{x} \pm s$ = (2.19, 3.57). The Empirical Rule says if the data set is mound-shaped, we should expect to see approximately 68% of the data within one standard deviation of the mean.

Ninety-seven percent of the observations are in the interval $\bar{x} \pm 2s$ = (1.50, 4.26). The Empirical Rule says that if the data set is mound-shaped, we should expect to see approximately 95% of the observations within two standard deviations of the mean.

Since both percentages are relatively close to those predicted by the Empirical Rule, the data must be approximately mound-shaped.

PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Analyze

51. Suppose you are given the following set of sample measurements: –1, 0, 2, 6, and 6.
    a. Calculate the sample variance.
    b. Calculate the sample standard deviation.
    c. Calculate the range.

ANS:
a. $s^2 = 10.8$
b. $s = \sqrt{s^2} = 3.286$
c. $R = 7$

PTS: 1 REF: 63 | 64-66 TOP: 1–3
BLM: Higher Order - Apply

52. You are given a sample of 8 measurements: 13, 11, 15, 16, 14, 14, 13, and 15.
    a. Calculate the range.
    b. Calculate the sample variance and standard deviation.
    c. Compare the range and the standard deviation. Approximately how many standard deviations equal the value of the range?

ANS:
a. $R = 5$
b. $s^2 = 2.4107$, and $s = 1.5526$
c. The range $R = 5$, is 5/1.5526 = 3.22 standard deviations.

PTS: 1 REF: 63 | 64-66 TOP: 1–3
BLM: Higher Order - Apply

53. A sample of $n = 10$ measurements consists of the following values: 15, 12, 13, 16, 11, 12, 14, 15, 11, and 13. Calculate the value of the standard deviation (s) and the range (R), and use R to approximate s. Is this a good approximation?

ANS:
$s = 1.75$, $R = 5$, $s \approx R/4 = 1.25$. Yes, this is a good approximation.

PTS: 1 REF: 63 | 65-66 | 72-73 TOP: 1–3
BLM: Higher Order - Apply

54. The following data represent the scores for a sample of 10 students on a 20-point chemistry quiz: 16, 14, 2, 8, 12, 12, 9, 10, 15, and 13. Calculate the sample variance, the lower and upper quartiles, and the IQR for these data.

ANS:
$s^2 = 16.767$, position of lower quartile = 0.25(11) = 2.75; $Q_1 = 8 + 0.75(1) = 8.75$; position of upper quartile = 0.75(11) = 8.25; $Q_3 = 14 + 0.25(1) = 14.25$, and IQR = $Q_3 - Q_1 = 5.5$.

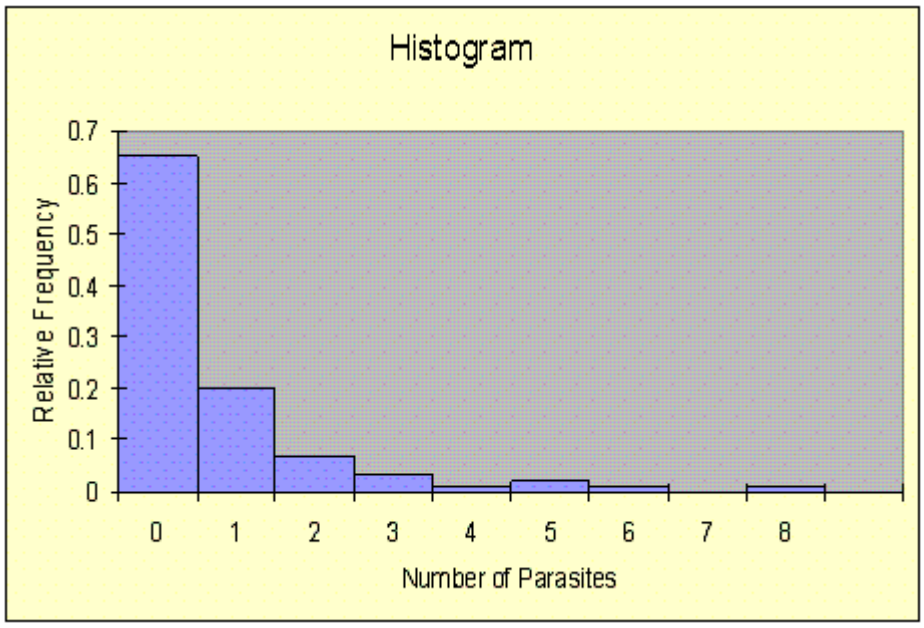
PTS: 1 REF: 64-65 | 79-81 TOP: 1–3
BLM: Higher Order - Apply

Parasites in Foxes
A random sample of 100 foxes was examined by a team of veterinarians to determine the prevalence of a particular type of parasite. Counting the number of parasites per fox, the veterinarians found that 65 foxes had no parasites, 20 had one parasite, and so on. A frequency tabulation of the data is given here:

Number of Parasites, x	0	1	2	3	4	5	6	7	8
Number of Foxes, f	65	20	7	3	1	2	1	0	1

55. Refer to the Parasites in Foxes statement and table. Construct a relative frequency histogram for x, the number of parasites per fox.

ANS:



PTS: 1 REF: 56-58 TOP: 1–3
BLM: Higher Order - Apply

56. Refer to the Parasites in Foxes statement and table. Calculate the sample mean $\bar{x}$ and the sample standard deviation s for the sample.

ANS:
$\bar{x}$ = 0.71, and s = 1.387

PTS: 1 REF: 76 TOP: 1–3
BLM: Higher Order - Apply

57. Refer to the Parasites in Foxes statement and table. What fraction of the parasite counts fall within two standard deviations of the mean? Do they fall within three standard deviations or the mean? Do these results agree with Tchebysheff's Theorem? Do they agree with the Empirical Rule?

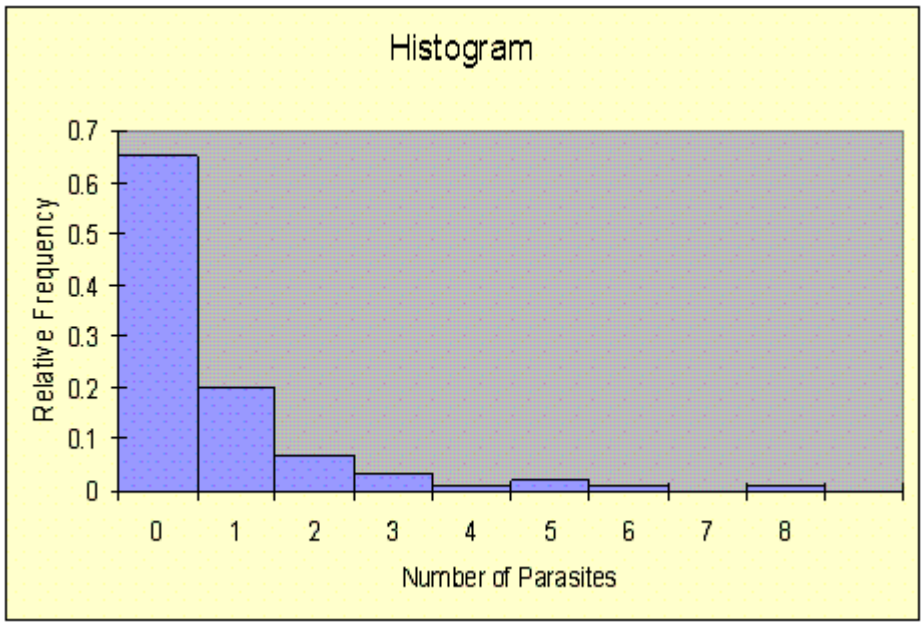
ANS:
The two intervals $\bar{x} \pm ks$ for k = 2, 3 are calculated in the table below along with the actual proportion of measurements falling in the intervals. Tchebysheff's Theorem is satisfied and the approximations given by the Empirical Rule are fairly close for k = 2 and k = 3.

k	$\bar{x} \pm ks$ Interval	Fraction in Interval	Tchebysheff's Theorem	Empirical Rule
2	0.71 ± 2.774	–2.064 to 3.484	95/100 = 0.95 At least 0.75	$\approx$ .95
3	0.71 ± 4.161	–3.451 to 4.871	96/100 = 0.96 At least 0.89	$\approx$ 1.00

PTS: 1 REF: 68-71 TOP: 4–5
BLM: Higher Order - Analyze

58. Refer to the Parasites in Foxes statement and table. Construct a relative frequency histogram for *x*, the number of parasites per fox.

ANS:



PTS: 1 REF: 56-58 | 76 TOP: 6–7
BLM: Higher Order - Apply

59. Refer to the Parasites in Foxes statement and table. Calculate the sample mean $\bar{x}$ and sample standard deviation s for the sample.

ANS:
$\bar{x}$ = 0.71, and s = 1.387

PTS: 1 REF: 76 TOP: 6–7
BLM: Higher Order - Apply

60. Refer to the Parasites in Foxes statement and table. What fraction of the parasite counts fall within two standard deviations of the mean? Within three standard deviations? Do these results agree with Tchebysheff's Theorem? Do they agree with the Empirical Rule?

ANS:
The two intervals $\bar{x} \pm ks$ for k = 2, 3 are calculated in the table below along with the actual proportion of measurements falling in the intervals. Tchebysheff's Theorem is satisfied and the approximations given by the Empirical Rule are fairly close for k = 2 and k = 3.

k	$\bar{x} \pm ks$	Interval	Fraction in Interval	Tchebysheff's Theorem	Empirical Rule
2	0.71 ± 2.774	–2.064 to 3.484	95/100 = 0.95	At least 0.75	$\approx$ .95
3	0.71 ± 4.161	–3.451 to	96/100 =	At least 0.89	$\approx$ 1.00

		4.871	0.96		

PTS: 1 REF: 68-71 TOP: 6–7
BLM: Higher Order - Analyze

61. The times required to service customers' cars at a repair shop are skewed to the right, with a mean of 2.5 hours and a standard deviation of 0.75 hours. What can be said about the percentage of cars whose service time is either less than 1 hour or more than 4 hours?

ANS:
Applying Tchebysheff's Theorem, we can say that at most 25% of the cars take less than one hour or more than four hours to service.

PTS: 1 REF: 68-69 | 71 TOP: 4–5
BLM: Higher Order - Analyze

Cola Bottling
When a machine dispensing cola at a bottling plant is working correctly, it dispenses a mean of 340 mL of cola per bottle, with a standard deviation of 6 mL.

62. Refer to the Cola Bottling statement. When the machine is working correctly, what percentage of the bottles will be filled with between 328 and 352 mL of cola?

ANS:
At least 75% of the bottles will be filled with between 328 and 352 mL of cola.

PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Apply

63. Refer to the Cola Bottling statement. On a particular day, the bottling plant supervisor randomly selects two bottles from among those filled by the machine. One bottle contains 336 mL of cola, and the other contains 344 mL of cola. Based on the contents of these two bottles, what can the supervisor conclude about the machine's performance?

ANS:
The machine seems to be working correctly.

PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Evaluate

Job Applicant Test Scores
A new manufacturing plant has 20 job openings. To select the best 20 applicants from among the 1000 job seekers, the plant's personnel office administers a written aptitude test to all applicants. The average score on the aptitude test is 150 points, with a standard deviation of 10 points. Assume the distribution of test scores is approximately mound-shaped.

64. Refer to the Job Applicant Test Scores statement. What percentage of the test scores will fall between 130 and 160 points?

ANS:
Approximately 81.5% of the test scores will fall between 130 and 160 points.

PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Analyze

65. Refer to the Job Applicant Test Scores statement. How many applicants will score between 130 and 160 points?

ANS:
Approximately 815 applicants will score between 130 and 160 points.

PTS: 1 REF: 69-70 TOP: 4–5
BLM: Higher Order - Apply

66. Refer to the Job Applicant Test Scores statement. One of the applicants scored 192 points on the test. What might you conclude about this test score?

ANS:
The score should be regarded as an outlier; the score should be double-checked to see if it was recorded correctly.

PTS: 1 REF: 59 | 69-70 TOP: 4–5
BLM: Higher Order - Analyze

Frequency Table
Suppose you are given the following frequency table of ratings from 0 to 8:

Rating x_i	0	1	2	3	4	5	6	7	8
Frequency f_i	69	17	6	3	1	2	1	0	1

Assume that the sample mean and the sample standard deviation are 0.66 and 1.387, respectively.

67. Refer to the Frequency Table. What fraction of the *x*-values fall within two standard deviations of the mean? Within three standard deviations of the mean?

ANS:
0.95 of the *x* values fall within two standard deviations of the mean.
0.96 of the *x* values fall within three standard deviations of the mean.

PTS: 1 REF: 68-69 | 71 TOP: 4–5
BLM: Higher Order - Analyze

68. Refer to the Frequency Table. Do the results of the previous question agree with Tchebysheff's Theorem?

ANS:
Yes. According to Tchebysheff's Theorem, at least 3/4 or 0.75 of the measurements fall within two standard deviations of the mean, and at least 8/9 or 0.89 of the measurements fall within three standard deviations of the mean.

PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Analyze

69. Refer to the Frequency Table Do the results of the previous question agree with the Empirical Rule?

ANS:
Yes. According to the Empirical Rule, approximately 95% of the measurements fall within two standard deviations of the mean, and all or almost all of the measurements fall within three standard deviations of the mean.

PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Analyze

Amount of Food Sold
Suppose the hourly dollar amount of food sold by a local restaurant follows an approximately mound-shaped distribution, with a mean sales level of $400 per hour and a standard deviation of $60 per hour.

70. Refer to the Amount of Food Sold statement. During what percentage of working hours does this restaurant sell between $280 and $520 worth of food per hour?

ANS:
95% of working hours

PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Analyze

71. Refer to the Amount of Food Sold statement. During a one-hour period, this restaurant had sales at the 84th percentile. What dollar sales figure does this represent?

ANS:
$460

PTS: 1 REF: 78 TOP: 4–5
BLM: Higher Order - Apply

72. For Labrador Retrievers, the average weight at 12 months of age is 23 kg, with a standard deviation of 1.2 kg. What can be said about the proportion of 12-month-old Labrador Retrievers that will weigh between 21.2 kg and 24.8 kg?

ANS:

Since it is not known whether the distribution of weights is mound-shaped, the Empirical Rule doesn't necessarily apply. Using Tchebysheff's Theorem, since the given interval represents 1.5 standard deviations on each side of the mean, at least $1 - 1/(1.5)^2 = 0.56$ of the weights will lie in the interval.

PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Analyze

73. The mean and variance of a sample of $n = 25$ measurements are 80 and 100, respectively. Explain in detail how to use Tchebysheff's Theorem to describe the distribution of the measurements.

ANS:

You are given $\bar{x} = 80$, and $s^2 = 100$. The standard deviation is $s = 10$. The distribution of measurements is centred about $\bar{x} = 80$, and Tchebysheff's Theorem states that

- At least 3/4 of the 25 measurements lie in the interval $\bar{x} \pm 2s = 80 \pm 20$; that is, 60 to 100.
- At least 8/9 of the measurements lie in the interval $\bar{x} \pm 3s = 80 \pm 30$; that is, 50 to 110.

PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Apply

Manufacturing Operation Time
In a time study conducted at a manufacturing plant, the length of time to complete a specified operation is measured for each one of $n = 40$ workers. The mean and standard deviation are found to be 15.2 and 1.40, respectively.

74. Refer to the Manufacturing Operation Time statement. Describe the sample data using the Empirical Rule.

ANS:
To describe the data using the Empirical Rule, calculate these intervals:
$(\bar{x} \pm s) = 15.2 \pm 1.40$, or 13.8 to 16.6
$(\bar{x} \pm 2s) = 15.2 \pm 2.80$, or 12.4 to 18.0
$(\bar{x} \pm 3s) = 15.2 \pm 4.20$, or 11.0 to 19.4
If the distribution of measurements is mound-shaped, you can apply the Empirical Rule and expect approximately 68% of the measurements to fall into the interval from 13.8 to 16.6, approximately 95% to fall into the interval from 12.4 to 18.0, and all or almost all to fall into the interval from 11.0 to 19.4.

PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Apply

75. Refer to the Manufacturing Operation Time statement. Describe the sample data using Tchebysheff's Theorem.

ANS:

If you doubt that the distribution of measurements is mound-shaped, or if you wish for some other reason to be conservative, you can apply Tchebysheff's Theorem and be absolutely certain of your statements. Tchebysheff's Theorem tells you that at least 3/4 of the measurements fall into the interval from 12.4 to 18.0, and at least 8/9 into the interval from 11.0 to 19.4

PTS: 1 REF: 68-69 | 71 TOP: 4–5
BLM: Higher Order - Apply

76. A sample of $n = 10$ measurements consists of the following values: 15, 12, 13, 16, 11, 12, 14, 15, 11, and 13.
a. Can you use Tchebysheff's Theorem to describe this data set? Why or why not?
b. Can you use the Empirical Rule to describe this data set? Why or why not?

ANS:
a. Yes, since the data set is not mound-shaped.
b. No, since the data set is not mound-shaped.

PTS: 1 REF: 71 TOP: 4–5
BLM: Higher Order - Analyze

77. A distribution of measurements is relatively mound-shaped, with mean 70 and standard deviation 10.
a. What percentage of the measurements will fall between 60 and 80?
b. What percentage of the measurements will fall between 50 and 90?
c. What percentage of the measurements will fall between 50 and 80?
d. If a measurement is chosen at random from this distribution, what is the probability that it will be greater than 80?

ANS:
a. The interval from 60 to 80 represents $\mu \pm \sigma = 70 \pm 10$. Since the distribution is relatively mound-shaped, the percentage of measurements between 60 and 80 is approximately 68% according to the Empirical Rule.
b. Again, using the Empirical Rule, the interval $\mu \pm 2\sigma = 70 \pm 20$ or between 50 and 90 contains approximately 95% of the measurements.
c. Since approximately 68% of the measurements are between 60 and 80, the symmetry of the distribution implies that approximately 34% of the measurements are between 70 and 80. Similarly, since approximately 95% of the measurements are between 50 and 90, approximately 47.5% of the measurements are between 50 and 70. Thus, the percentage of measurements between 50 and 80 is 34% + 47.5% = 81.5%.
d. Since the proportion of the measurements between 70 and 80 is 0.34, and the proportion of the measurements that is greater than 70 is 0.50, the proportion that is greater than 80 must be 0.50 – 0.34 = 0.16.

PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Analyze

78. A sample of $n = 10$ measurements consists of the following values: 15, 12, 13, 16, 11, 12, 14, 15, 11, and 13.
    a. Can you use Tchebysheff's Theorem to describe this data set? Why or why not?
    b. Can you use the Empirical Rule to describe this data set? Why or why not?

    ANS:
    a. Yes, since the data set is not mound-shaped.
    b. No, since the data set is not mound-shaped.

    PTS: 1 REF: 71 TOP: 4–5
    BLM: Higher Order - Analyze

Height of Basketball Players
A sample of basketball players has a mean height of 190 cm, with a standard deviation of 12 cm. You know nothing else about the size of the data set or the shape of the data distribution.

79. Refer to the Height of Basketball Players statement. Can you use Tchebysheff's Theorem and/or the Empirical Rule to describe the data? Explain.

    ANS:
    Since nothing is known about the shape of the data distribution, you must use Tchebysheff's Theorem to describe the data.

    PTS: 1 REF: 71 TOP: 4–5
    BLM: Higher Order - Analyze

80. Refer to the Height of Basketball Players statement. What can you say about the fraction of measurements that fall between 154 and 226 cm?

    ANS:
    The interval from 154 to 226 represents $\mu \pm 3\sigma = 190 \pm 36$, which will contain at least 8/9 of the measurements.

    PTS: 1 REF: 68-69 TOP: 4–5
    BLM: Higher Order - Apply

81. Refer to the Height of Basketball Players statement. What can you say about the fraction of measurements that fall between 166 and 214?

    ANS:
    The interval from 166 to 214 represents $\mu \pm 2\sigma = 190 \pm 24$, which will contain at least 3/4 of the measurements.

    PTS: 1 REF: 68-69 TOP: 4–5
    BLM: Higher Order - Apply

82. Refer to the Height of Basketball Players statement. What can you say about the fraction of measurements that are less than 166?

ANS:
The value $x = 166$ lies two standard deviations below the mean. Since at least 3/4 of the measurements are within the two standard deviations range, at most 1/4 can lie outside that range, which means that at most 1/4 can be less than 166.

PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Apply

Solution Volumes
An analytical chemist wanted to use electrolysis to determine the number of moles of cupric ions in a given volume of solution. The solution was partitioned into $n = 30$ portions of 0.2 mL each. Each of the $n = 30$ portions was tested. The average number of moles of cupric ions for the $n = 30$ portions was found to be 0.185 mole; the standard deviation was 0.015 mole.

83. Refer to the Solution Volumes statement. Calculate the intervals ($\bar{x} \pm s$), ($\bar{x} \pm 2s$), and ($\bar{x} \pm 3s$).

ANS:
($\bar{x} \pm s$) = 0.185 $\pm$ 0.015 or 0.170 to 0.200
($\bar{x} \pm 2s$) = 0.185 $\pm$ 0.030 or 0.155 to 0.215
($\bar{x} \pm 3s$) = 0.185 $\pm$ 0.045 or 0.140 to 0.230

PTS: 1 REF: 57-58 | 65-66 | 68-69 TOP: 4–5
BLM: Higher Order - Analyze

84. Refer to the Solution Volumes statement. Describe the distribution of the measurements for the $n = 30$ portions of the solution using Tchebysheff's Theorem.

ANS:
If we doubt that the distribution of measurements is mound-shaped, or if no prior information as to the shape of the distribution is available, we use Tchebysheff's Theorem. We would expect none of the measurements to fall in the interval 0.17 to 0.20, at least 3/4 of the measurements to fall in the interval 0.155 to 0.215, and at least 8/9 of the measurements to fall in the interval from 0.14 to 0.23.

PTS: 1 REF: 68-69 TOP: 4–5
BLM: Higher Order - Apply

85. Refer to the Solution Volumes statement. Suppose the chemist had used only $n = 5$ portions of the solution for the experiment and obtained the readings 0.18, 0.21, 0.20, 0.22, and 0.18. Would the Empirical Rule be suitable for describing the $n = 5$ measurements? Why?

ANS:

If the chemist had used only a sample of size $n = 5$ for this experiment, the distribution would not be mound-shaped. Therefore, the Empirical Rule would not be suitable for describing $n = 5$ measurements.

PTS: 1 REF: 69-71 TOP: 4–5
BLM: Higher Order - Evaluate

86. Attendance at London Symphony concerts for the past two years showed an average of 3000 people per performance, with a standard deviation of 100 people per performance. Attendance at a randomly selected concert was found to be 3290. If attendance data is mound-shaped, does the attendance at the selected concert appear to be unusual? Justify your conclusion.

ANS:
The *z*-score associated with 3290 is 2.90, indicating that 3290 is 2.90 standard deviations above the mean. Although the *z*-score does not exceed 3, it is close enough for one to suspect that 3290 is an outlier.

PTS: 1 REF: 77-78 TOP: 6–7
BLM: Higher Order - Evaluate

87. Consider the following set of measurements: 5.4, 5.9, 3.5, 4.1, 4.6, 2.5, 4.7, 6.0, 5.4, 4.6, 4.9, 4.6, 4.1, 3.4, and 2.2.
    a. Find the 25th, 50th, and 75th percentiles.
    b. What is the value of the interquartile range?

ANS:

a. 25th percentile = Q_1 = 3.5; 50th percentile = Q_2 = 4.6; 75th percentile = Q_3 = 5.4
b. IQR = $Q_3 - Q_1$ = 5.4 – 3.5 =1.9

PTS: 1 REF: 78-80 TOP: 6–7
BLM: Higher Order - Apply

Number of Calories in Soft Drinks
The following data represent the number of calories in 340 mL cans of a sample of 8 popular soft drinks: 124, 144, 147, 146, 148, 154, 150, and 234.

88. Refer to the Number of Calories in Soft Drinks statement. Find the inner fences.

ANS:
$Q_1 - 1.5(\text{IQR}) = 144.5 - 1.5(8.5) = 131.75$, and
$Q_3 + 1.5(\text{IQR}) = 153 + 1.5(8.5) = 166.75$

PTS: 1 REF: 81-84 TOP: 6–7
BLM: Higher Order - Apply

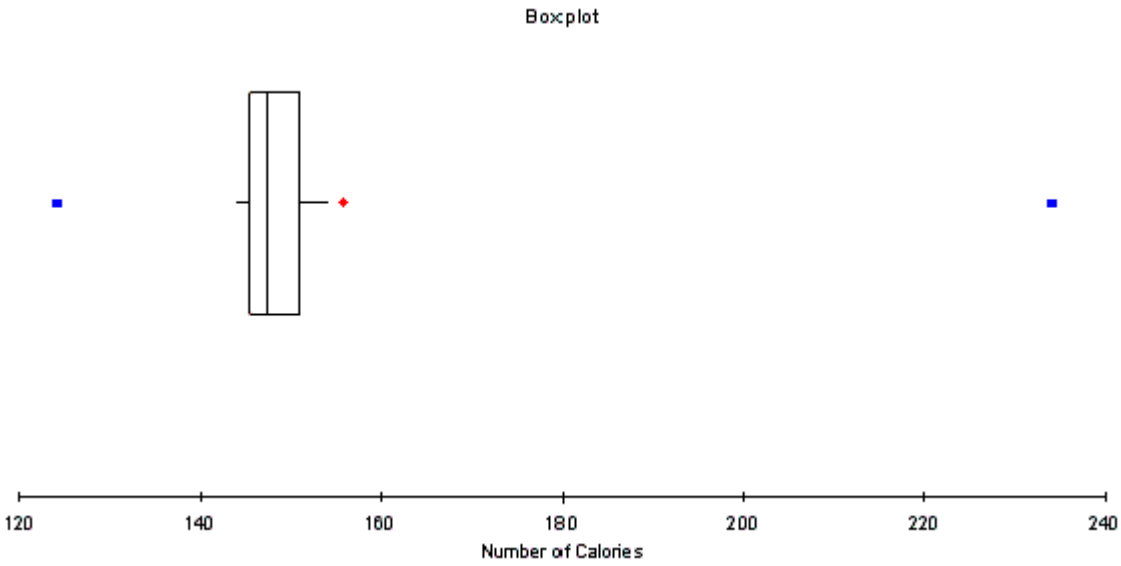
89. Refer to the Number of Calories in Soft Drinks statement. Find the outer fences.

ANS:
$Q_1 - 3(\text{IQR}) = 144.5 - 3(8.5) = 119$, and
$Q_3 + 3(\text{IQR}) = 153 + 3(8.5) = 178.5$

PTS: 1 REF: 81-84 TOP: 6–7
BLM: Higher Order - Apply

90. Refer to the Number of Calories in Soft Drinks statement. Construct a box plot for these data. Does the box plot indicate the presence of any outliers?

ANS:



Yes, the observation 124 is a suspect outlier since it lies between the lower outer fence and the lower inner fence. Also, the observation 234 is an extreme outlier since it lies above the upper outer fence.

PTS: 1 REF: 82 TOP: 6–7
BLM: Higher Order - Apply

91. The following data represent the scores for a sample of 10 students on a 20-point chemistry quiz: 16, 14, 2, 8, 12, 12, 9, 10, 15, and 13. Calculate the *z*-score for the smallest and largest observations. Is either of these observations unusually large or unusually small?

ANS:
For $x = 2$, z-score $= (2 - 11.1)/4.095 = -2.22$. For $x = 16$, z-score $= (16 - 11.1)/4.095 = 1.197$. Since the z-score for the smallest observation exceeds 2 in absolute value, the smallest observation is unusually small. However, the largest observation is not unusually large.

PTS: 1 REF: 77-78 TOP: 6–7
BLM: Higher Order - Apply

92. Two students are enrolled in different sections of an introductory statistics class at a local university. The first student, enrolled in the morning section, earns a score of 76 on a midterm exam where the class mean was 64 with a standard deviation of 8. The second student, enrolled in the afternoon section, earns a score of 72 on a midterm exam where the class mean was 60 with a standard deviation of 7.5. If the scores on the midterm exams are normally distributed, which student scored better relative to his or her classmates?

    ANS:

    z_1 = (76 – 64)/8 = 1.5; z_2 = (72 – 60)/7.5 = 1.6; the student in the afternoon section scored better relative to her classmates since her *z*-score is larger.

    PTS: 1 REF: 77-78 TOP: 6–7
    BLM: Higher Order - Evaluate

93. If the 90th and 91st observations in a set of 100 data values are 158 and 167, respectively, what is the 90th percentile value?

    ANS:
    166.1

    PTS: 1 REF: 78 TOP: 6–7
    BLM: Higher Order - Apply

94. If the 18th and 19th observations in a set of 25 data values are 42.6 and 43.8, what is the 70th percentile value?

    ANS:
    42.84

    PTS: 1 REF: 78 TOP: 6–7
    BLM: Higher Order - Apply