TEST BANK

STATISTICS
for
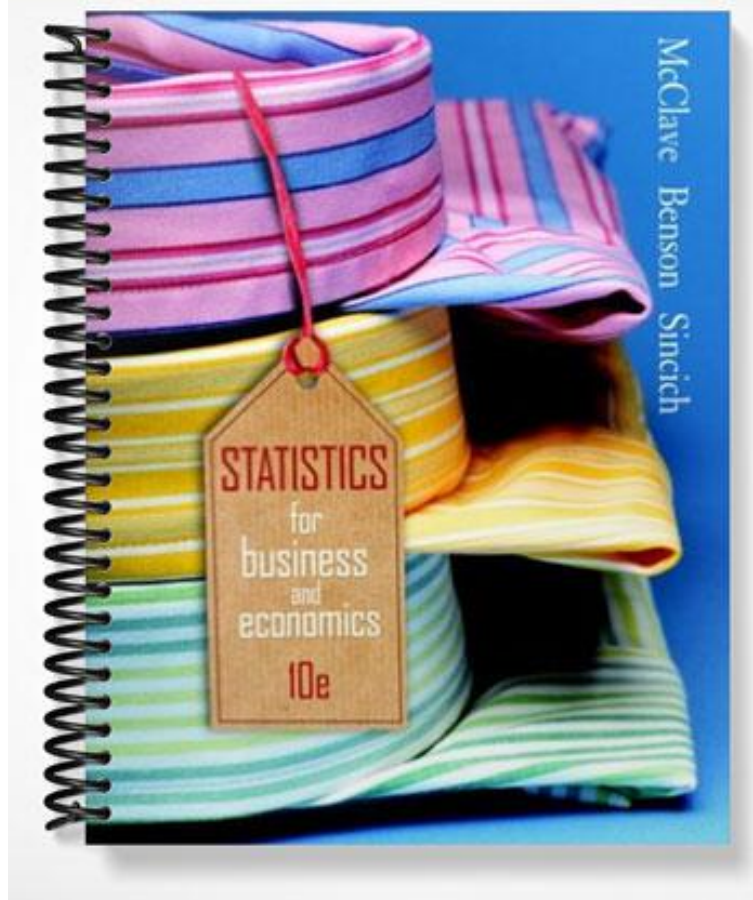business
and
economics
10e

McClave Benson Sincich

Ch. 2   Methods of Describing Data

2.1   Describing Qualitative Data

1   Construct Frequency/Relative Frequency Table

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) What number is missing from the table?

Grades on Test	Frequency	Relative Frequency
A	6	.24
B	7	
C	9	.36
D	2	.08
F	1	.04

A) .28   B) .07   C) .72   D) .70

2) What number is missing from the table?

Year in College	Frequency	Relative Frequency
Freshman	600	.30
Sophomore	560	.28
Junior		.22
Senior	400	.20

A) 440   B) 220   C) 480   D) 520

2 Construct, Interpret Bar Graph

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1)

The manager of a store conducted a customer survey to determine why customers shopped at the store. The results are shown in the figure. What proportion of customers responded that merchandise was the reason they shopped at the store?
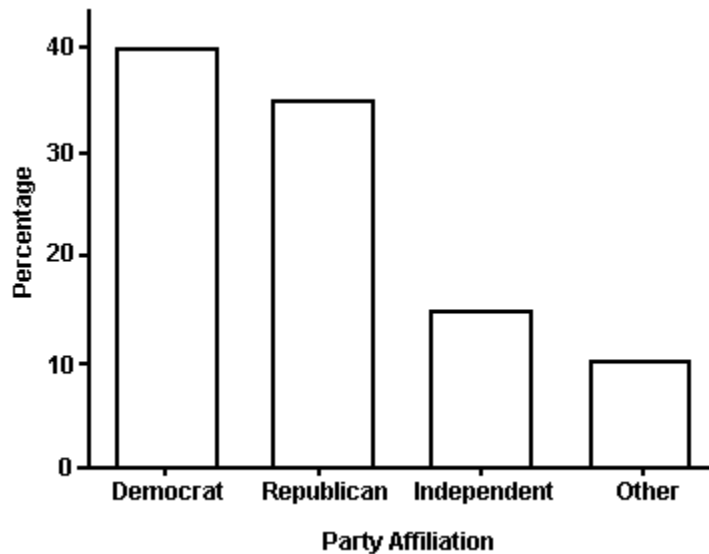
A) $\frac{3}{7}$
B) 30
C) $\frac{1}{2}$
D) $\frac{2}{7}$

2)

The bar graph shows the political affiliation of 1,000 registered U.S. voters. What percentage of the voters belonged to one of the traditional two parties (Democratic or Republican)?

A) 75%
B) 40%
C) 35%
D) 25%

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

3) The data below show the types of medals won by athletes representing the United States in the 2006 Winter Olympics.

| gold	gold	silver	gold	bronze	silver	silver
bronze	gold	silver	silver	bronze	silver	gold
gold	silver	silver	bronze	bronze	gold	silver
gold	gold	bronze	bronze			

   a.   Construct a frequency table for the data.
   b.   Construct a relative frequency table for the data.
   c.   Construct a frequency bar graph for the data.

3   Construct, Interpret Pie Chart

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1)
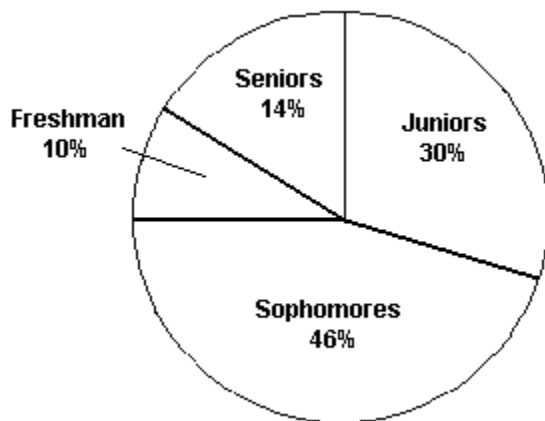
The pie chart shows the classifications of students in a statistics class.

What percentage of the class consists of freshman, sophomores, and juniors?

   A) 86%   B) 14%   C) 44%   D) 54%

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

2) The table shows the number of each type of book found at an online auction site during a recent search.

Type of Book	Number
Children's	51,033
Fiction	141,114
Nonfiction	253,074
Educational	67,252

   a.   Construct a relative frequency table for the book data.
   b.   Construct a pie chart for the book data.

4 Construct, Interpret Pietro Diagram

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

1) What characteristic of a Pareto diagram distinguishes it from other bar graphs?

2) The table shows the number of each Ford car sold in the United States in June 2006.

Car	Number
Crown Victoria	7,204
Five Hundred	9,089
Taurus	20,418
Fusion	13,691
Focus	15,837
Mustang/GT	15,350
Total	81,589

    a.   Construct a relative frequency table for the car sales.
    b.   Construct a Pareto diagram for the car sales using the class percentages as the heights of the bars.

5 Construct, Interpret Side–by–Side Bar Chart

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

1) An annual survey sent to retail store managers contained the question "Did your store suffer any losses due to employee theft?" The responses are summarized in the table for two years, 2000 and 2005. Compare the responses for the two years using side–by–side bar charts. What inferences can be made from the charts?

Employee Theft	Percentage in 2000	Percentage in 2005
Yes	34	23
No	51	68
Don't know	15	9
Totals	100	100

2.2 Graphical Methods for Describing Quantitative Data

1 Construct, Interpret Histogram

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

1) The data show the total number of medals (gold, silver, and bronze) won by each country winning at least one gold medal in the 2006 Winter Olympics.

1   2   3   3   4   9   9   11   11

11   14   14   19   22   23   24   25   29

a.   Complete the class frequency table for the data.

Total Medals	Frequency
1–5	
6–10	
11–15	
16–20	
21–25	
26–30	

b.   Using the classes from the frequency table, construct a histogram for the data.

2) The total points scored by a basketball team for each game during its last season have been summarized in the table below.

Score	Frequency
41–60	3
61–80	8
81–100	12
101–120	7

a.   Explain why you cannot use the information in the table to construct a stem–and–leaf display for the data.
b.   Construct a histogram for the scores.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Answer the question True or False.

3) All class intervals in a histogram have the same width.

A) True   B) False

4) A histogram can be constructed using either class frequencies or class relative frequencies as the heights of the bars.

A) True   B) False

2   Construct, Interpret Stem–and–Leaf Display

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) A survey was conducted to determine how people feel about the quality of programming available on television. Respondents were asked to rate the overall quality from 0 (no quality at all) to 100 (extremely good quality). The stem–and–leaf display of the data is shown below.

```
Stem Leaf
   3 0 7
   4 0 3 4 7 8 9 9 9
   5 0 1 1 2 3 4 5
   6 1 2 5 6 6
   7 1 7
   8
   9 9
```

What percentage of the respondents rated overall television quality as very good (regarded as ratings of 80 and above)?

    A) 4%   B) 1%   C) 36%   D) 9%

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

2) The scores for a statistics test are as follows:

87   76   91   77   92   96   88   85   66   89
79   98   58   99   83   88   82   59   15   69

Create a stem–and–leaf display for the data.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

**Answer the question True or False.**

3) For large data sets, a stem–and–leaf display is a better choice than a histogram.

    A) True   B) False

3   Construct, Interpret Dot–Plot

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) A dot plot of the speeds of a sample of 50 cars passing a policeman with a radar gun is shown below.
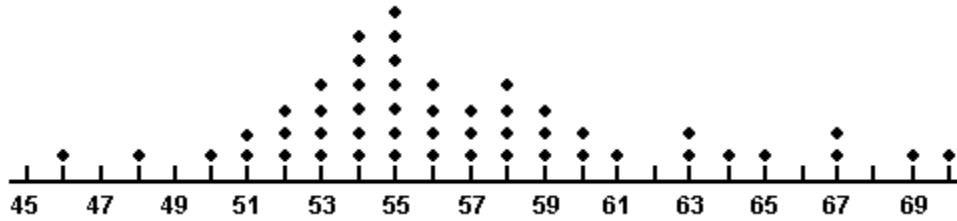
What proportion of the motorists were driving above the posted speed limit of 60 miles per hour?

A) 0.18   B) 0.22   C) 0.04   D) 2

2) Which of the graphical techniques below can be used to summarize qualitative data?

A) bar graph   B) dot plot

C) stem–and–leaf plot   D) box plot

3) Parking at a university has become a problem. University administrators are interested in determining the average time it takes a student to find a parking spot. An administrator inconspicuously followed 250 students and recorded how long it took each of them to find a parking spot. Which of the following types of graphs should not be used to display information concerning the students parking times?

A) pie chart   B) stem–and–leaf display

C) histogram   D) box plot

4) Fill in the blank. One advantage of the _____ is that the actual data values are retained in the graphical summarization of the data.

A) stem–and–leaf plot   B) histogram   C) pie chart

2.3   Summation Notation

1   Use Summation Notation

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) A data set contains the observations 4, 3, 1, 8, 2. Find $\sum x$.

A) 16   B) 18   C) 192   D) 6

2) A data set contains the observations 2, 3, 7, 6, 4. Find $\left(\sum x\right)^2$.

A) 114   B) 484   C) 44   D) 22

3) A data set contains the observations 6, 5, 8, 1, 2. Find $\sum x^2$.

A) 130   B) 484   C) 44   D) 22

4) A data set contains the observations 4, 7, 2, 3, 1. Find $\sum(x-5)$.

    A) –8   B) 42   C) 22   D) 12

5) A data set contains the observations 1, 6, 2, 4, 5. Find $\sum x^2 - \dfrac{\left(\sum x\right)^2}{5}$.

    A) 17.2   B) 259.2   C) 65.6   D) 146.8

6) Which expression represents the sum of the squares of the observations in a data set?

    A) $\sum x^2$ B) $\left(\sum x^2\right)^2$ C) $\sum \sqrt{x}$ D) $\sqrt{\sum x}$

2.4 Numerical Measures of Central Tendency

1 Find Mean, Median, Mode

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) A sociologist recently conducted a survey of senior citizens who have net worths too high to qualify for Medicaid but have no private health insurance. The ages of the 25 uninsured senior citizens were as follows:

    69 74 67 77 87 75
    62 90 66 91 70 93
    77 63 82 64 69 82
    71 74 61 88 76 65 83

Find the median of the observations.

    A) 74   B) 71   C) 75   D) 74.5

2) The scores for a statistics test are as follows:

    98 76 97 77 99 92 78 85 71 89
    79 84 50 60 85 70 85 87 18 75

Compute the mean score.

    A) 77.75   B) 80.95   C) 68.70   D) 75

3) A shoe retailer keeps track of all types of information about sales of newly released shoe styles. One newly released style was marketed to tall people. Listed below are the shoe sizes of 12 randomly selected customers who purchased the new style. Find the mode of the shoe sizes.

    $9\frac{1}{2}$ 11   12 $11\frac{1}{2}$

    $8\frac{1}{2}$ $10\frac{1}{2}$ 8   11

    10   11 $9\frac{1}{2}$ 10

    A) 11   B) $10\frac{1}{4}$ C) $10\frac{1}{2}$ D) $9\frac{1}{2}$

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

4) Each year advertisers spend billions of dollars purchasing commercial time on network television. In the first 6 months of one year, advertisers spent $1.1 billion. Who were the largest spenders? In a recent article, the top 10 leading spenders and how much each spent (in million of dollars) were listed:

    Company A $70.7   Company F $27
    Company B   63   Company G 24.3
    Company C 55.9   Company H 23.7
    Company D 54.8   Company I   23.9
    Company E 30.2   Company J   20.4

Calculate the mean and median for the data.

5) The data show the total number of medals (gold, silver, and bronze) won by each country winning at least one gold medal in the 2006 Winter Olympics. Find the mean, median, and mode of the numbers of medals won by these countries.

1   2   3   3   4   9   9   11   11

11   14   14   19   22   23   24   25   29

2 Interpret Measures of Central Tendency

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) At the U.S. Open Tennis Championship a statistician keeps track of every serve that a player hits during the tournament. The statistician reported that the mean serve speed of a particular player was 103 miles per hour. Suppose that the statistician indicated that the serve speed distribution was skewed to the left. Which of the following values is most likely the value of the median serve speed?

    A) 111 mph   B) 95 mph   C) 87 mph   D) 103 mph

2) During one recent year, U.S. consumers redeemed 6.12 billion manufacturers' coupons and saved themselves $2.32 billion. Calculate and interpret the mean savings per coupon.

    A) The average savings was $0.38 per coupon.

    B) The average savings was 263.8 cents per coupon.

    C) Half of all coupons were worth more than 263.8 cents in savings.

   D) Half of all coupons were worth more than $0.38 in savings.

3) The output below displays the mean and median for the state high school dropout rates in 1998 and 2002.

	Drop 1998	Drop 2002
N	51	51
MEAN	28.12	26.66
MEDIAN	27.18	25.51

Interpret the 2002 median dropout rate of 25.51.

   A) Half of the 51 states had a dropout rate below 25.51%.

   B) Most of the 51 states had a dropout rate close to 25.51%.

   C) The most frequently observed dropout rate of the 51 states was 25.51%.

   D) Half of the 51 states had a dropout rate of 25.51%.

4)
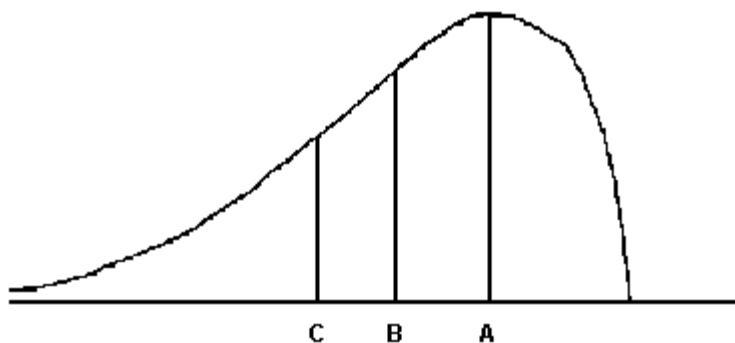
For the distribution drawn here, identify the mean, median, and mode.

   A) A = mode, B = median, C = mean   B) A = median, B = mode, C = mean

   C) A = mode, B = mean, C = median   D) A = mean, B = mode, C = median

5) In a distribution that is skewed to the right, what is the relationship of the mean, median, and mode?

   A) mean > median > mode   B) median > mean > mode

   C) mode > median > mode   D) mode > mean > median

6) Many firms use on–the–job training to teach their employees computer programming. Suppose you work in the personnel department of a firm that just finished training a group of its employees to program, and you have been requested to review the performance of one of the trainees on the final test that was given to all trainees. The mean of the test scores is 74. Additional information indicated that the median of the test scores was 79. What type of distribution most likely describes the shape of the test scores?

   A) skewed to the left   B) symmetric

   C) skewed to the right   D) unable to determine with the information given

7) A shoe company reports the mode for the shoe sizes of men's shoes is 12. Interpret this result.

    A) The most frequently occurring shoe size for men is size 12

    B) Most men have shoe sizes between 11 and 13.

    C) Half of the shoes sold to men are larger than a size 12

    D) Half of all men's shoe sizes are size 12

8) Which of the following is *not* a measure of central tendency?

    A) range   B) median   C) mode   D) mean

9) The distribution of salaries of professional basketball players is skewed to the right. Which measure of central tendency would be the best measure to determine the location of the center of the distribution?

    A) median   B) mode   C) mean   D) range

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

10) Parking at a university has become a problem. University administrators are interested in determining the average time it takes a student to find a parking spot. An administrator inconspicuously followed 240 students and recorded how long it took each of them to find a parking spot. The times had distribution that was skewed to the right. Based on this information, discuss the relationship between the mean and the median for the 240 times collected.

11) The output below displays the mean and median for the state high school dropout rates in 1998 and 2002.

	Drop 1998	Drop 2002
N	51	51
MEAN	28.55	26.17
MEDIAN	27.76	25.56

Use the information to determine the shape of the distributions of the high school dropout rates in 1998 and 2002.

12) The total points scored by a basketball team for each game during its last season have been summarized in the table below. Identify the modal class of the distribution of scores.

Score	Frequency
4160	3
6180	8
81100	12
101120	7

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Answer the question True or False.

13) In a symmetric and mound shaped distribution, we expect the values of the mean, median, and mode to differ greatly from one another.

    A) True   B) False

14) In symmetric distributions, the mean and the median will be approximately equal.

    A) True   B) False

15) In skewed distributions, the mean is the best measure of the center of the distribution since it is least affected by extreme observations.

    A) True   B) False

16) In practice, the population mean μ is used to estimate the sample mean $\bar{x}$.

    A) True   B) False

2.5 Numerical Measures of Variability

1 Calculate Range, Variance, Standard Deviation

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) Each year advertisers spend billions of dollars purchasing commercial time on network television. In the first 6 months of one year, advertisers spent $1.1 billion. Who were the largest spenders? In a recent article, the top 10 leading spenders and how much each spend (in million of dollars) were listed:

Company A	$72.2	Company F	$27.4
Company B	62.9	Company G	25.7
Company C	57.2	Company H	23.2
Company D	55.1	Company I	23.8
Company E	28	Company J	19.5

Calculate the sample variance.

    A) 394.976   B) 3862.198   C) 2132.976   D) 1911.339

2) Calculate the range of the following data set:

4, 6, 5, 3, 4, 12, 5, 6, 4

    A) 9   B) 12   C) 3   D) 15

3) The top speeds for a sample of five new automobiles are listed below. Calculate the standard deviation of the speeds.

180, 160, 155, 115, 150

    A) 23.6114   B) 241.4902   C) 171.4628   D) 134.45

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

4) The ages of five randomly chosen professors are 62, 59, 51, 60, and 41. Calculate the sample variance of these ages.

5) The data show the total number of medals (gold, silver, and bronze) won by each country winning at least one gold medal in the 2006 Winter Olympics. Find the range, sample variance, and sample standard deviation of the numbers of medals won by these countries.

| 1 | 2 | 3 | 3 | 4 | 9 | 9 | 11 | 11 |

| 11 | 14 | 14 | 19 | 22 | 23 | 24 | 25 | 29 |

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

6) Calculate the variance of a sample for which $n = 5$, $\sum x^2 = 1320$, $\sum x = 80$.

   A) 10.00   B) 8.00   C) 326.00   D) 3.16

7) Calculate the standard deviation of a sample for which $n = 6$, $\sum x^2 = 830$, $\sum x = 60$.

   A) 6.78   B) 46.00   C) 6.19   D) 164.00

2 Interpret Measures of Variability

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) What two data characteristics are usually measured using numerical descriptive measures?

   A) central tendency and variability   B) maximum and minimum

   C) variability and size of sample   D) sample size and spread

2) One year, batting averages in the National League averaged .252 with a high of .338 and a low of .228 (minimum 250 at-bats). Based on this information, which measure of variation could be calculated?

   A) range   B) variance

   C) standard deviation   D) percentile

3) Which of the following is a measure of the variability of a distribution?

   A) range   B) skewness   C) median   D) z-score

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

4) Various state and national automobile associations regularly survey gasoline stations to determine the current retail price of gasoline. Suppose one such national association contacts 200 stations in the United States to determine the price of regular unleaded gasoline at each station. In the context of this problem, define the following descriptive measures: $\mu, \sigma, \bar{x}, s$.

5) Given the sample variance of a distribution, explain how to find the standard deviation.

6) Which is expressed in the same units as the original data, the variance or the standard deviation?

7) Which measures variability about the mean, the range or the standard deviation?

8) For a given data set, which is typically greater, the range or the standard deviation?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

9) The total points scored by a basketball team for each game during its last season have been summarized in the table below. Which statement following the table must be true?

Score	Frequency
4160	3
6180	8
81100	12
101120	7

A) The range is at least 41 but at most 79.   B) The range is 79.

C) The range is at least 41 but at most 120.   D) The range is at least 81 but at most 100.

10) Which number on the screen below is the sample standard deviation of the data?

```
1-Var Stats
 x̄=5.8
 Σx=58
 Σx²=408
 Sx=2.82055944
 σx=2.675817632
↓n=10
■
```

A) 2.82   B) 408   C) 5.8   D) 2.67

2.6   Interpreting the Standard Deviation

1   Use Empirical Rule

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) At the U.S. Open Tennis Championship a statistician keeps track of every serve that a player hits during the tournament. The statistician reported that the mean serve speed of a particular player was 104 miles per hour (mph) and the standard deviation of the serve speeds was 8 mph. Assume that the statistician also gave us the information that the distribution of the serve speeds was mound–shaped and symmetric. What proportion of the player's serves was between 112 mph and 120 mph?

A) 0.1350   B) 0.270   C) 0.95   D) 120

2) The amount of television viewed by today's youth is of primary concern to Parents Against Watching Television (PAWT). 300 parents of elementary school–aged children were asked to estimate the number of hours per week that their child watches television. The mean and the standard deviation for their responses were 14 and 3, respectively. PAWT constructed a stem–and–leaf display for the data that showed that the distribution of times was a symmetric, mound–shaped distribution. Give an interval where you believe approximately 95% of the television viewing times fell in the distribution.

A) between 8 and 20 hours per week   B) less than 11 and more than 17 hours per week

C) between 5 and 23 hours per week   D) less than 20

3) A sociologist recently conducted a survey of citizens over 60 years of age who have net worths too high to qualify for Medicaid but have no private health insurance. The ages of the 25 uninsured senior citizens were as follows:

68 73 66 76 86 74 61 89 65 90 69 92 76
62 81 63 68 81 70 73 60 87 75 64 82

Suppose the mean and standard deviation are 74.04 and 9.75, respectively. If we assume that the distribution of ages is mound–shaped and symmetric, what percentage of the respondents will be between 64.29 and 93.54 years old?

A) approximately 81.5%   B) approximately 68%

C) approximately 95%   D) approximately 84%

4) A small computing center has found that the number of jobs submitted per day to its computers has a distribution that is approximately mound–shaped and symmetric, with a mean of 72 jobs and a standard deviation of 6. Where do we expect approximately 95% of the distribution to fall?

A) between 60 and 84 jobs per day   B) between 66 and 78 jobs per day

C) between 54 and 90 jobs per day   D) between 84 and 90 jobs per day

5) A study was designed to investigate the effects of two variables — (1) a student's level of mathematical anxiety and (2) teaching method — on a student's achievement in a mathematics course. Students who had a low level of mathematical anxiety were taught using the traditional expository method. These students obtained a mean score of 470 with a standard deviation of 40 on a standardized test. Assuming a mound–shaped and symmetric distribution, what percentage of scores exceeded 390?

A) approximately 97.5%   B) approximately 95%

C) approximately 100%   D) approximately 84%

6) A study was designed to investigate the effects of two variables — (1) a student's level of mathematical anxiety and (2) teaching method — on a student's achievement in a mathematics course. Students who had a low level of mathematical anxiety were taught using the traditional expository method. These students obtained a mean score of 440 with a standard deviation of 50 on a standardized test. Assuming a mound–shaped and symmetric distribution, in what range would approximately 68% of the students score?

A) between 390 and 490   B) below 490

C) above 490   D) below 390 and above 490

7) A recent survey was conducted to compare the cost of solar energy to the cost of gas or electric energy. Results of the survey revealed that the distribution of the amount of the monthly utility bill of a 3–bedroom house using gas or electric energy had a mean of $97 and a standard deviation of $12. If the distribution can be considered mound–shaped and symmetric, what percentage of homes will have a monthly utility bill of more than $85?

A) approximately 84%   B) approximately 95%

C) approximately 16%   D) approximately 34%

8) Many firms use on–the–job training to teach their employees computer programming. Suppose you work in the personnel department of a firm that just finished training a group of its employees to program, and you have been requested to review the performance of one of the trainees on the final test that was given to all trainees. The mean and standard deviation of the test scores are 80 and 2, respectively, and the distribution of scores is mound–shaped and symmetric. What percentage of test–takers scored better than a trainee who scored 74?

A) approximately 100%   B) approximately 84%

C) approximately 95%   D) approximately 97.5%

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

9) At the U.S. Open Tennis Championship a statistician keeps track of every serve that a player hits during the tournament. The statistician reported that the mean serve speed of a particular player was 95 miles per hour (mph) and the standard deviation of the serve speeds was 13 mph. Assume that the statistician also gave us the information that the distribution of serve speeds was mound–shaped and symmetric. Find the percentage of serves that were hit faster than 69 mph.

10) A small computing center has found that the number of jobs submitted per day to its computers has a distribution that is approximately mound–shaped and symmetric, with a mean of 77 jobs and a standard deviation of 12. On what percentage of days do the number of jobs submitted exceed 89?

11) By law, a box of cereal labeled as containing 16 ounces must contain at least 16 ounces of cereal. The machine filling the boxes produces a distribution of fill weights that is mound–shaped and symmetric, with a mean equal to the setting on the machine and with a standard deviation equal to 0.02 ounce. To ensure that most of the boxes contain at least 16 ounces, the machine is set so that the mean fill per box is 16.06 ounces. What percentage of the boxes do, in fact, contain at least 16 ounces?

12) Many firms use on–the–job training to teach their employees computer programming. Suppose you work in the personnel department of a firm that just finished training a group of its employees to program, and you have been requested to review the performance of one of the trainees on the final test that was given to all trainees. The mean and standard deviation of the test scores are 81 and 2, respectively, and the distribution of scores is mound–shaped and symmetric. If a firm wanted to give the best 2.5% of the trainees a big promotion, what test score would be used to identify the trainees in question?

13) The following data represent the scores of 50 students on a statistics exam. The mean score is 80.02, and the standard deviation is 11.9.

39	51	59	63	66	68	68	69	70	71
71	71	73	74	76	76	76	77	78	79
79	79	79	80	80	82	83	83	83	85
85	86	86	88	88	88	88	89	89	89
90	90	91	91	92	95	96	97	97	98

What percentage of the scores lies within one standard deviation of the mean? two standard deviations of the mean? three standard deviations of the mean? Based on these percentages, do you believe that the distribution of scores is mound–shaped and symmetric? Explain.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

14) The distribution of scores on a test is mound–shaped and symmetric with a mean score of 78. If 68% of the scores fall between 72 and 84, which of the following is most likely to be the standard deviation of the distribution?

    A) 6   B) 2   C) 3   D) 12

2   Use Chebyshev's Rule

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) At the U.S. Open Tennis Championship a statistician keeps track of every serve that a player hits during the tournament. The statistician reported that the mean serve speed of a particular player was 97 miles per hour (mph) and the standard deviation of the serve speeds was 10 mph. If nothing is known about the shape of the distribution, give an interval that will contain the speeds of at least three–fourths of the player's serves.

    A) 77 mph to 117 mph   B) 87 mph to 107 mph

    C) 67 mph to 127 mph   D) 117 mph to 137 mph

2) By law, a box of cereal labeled as containing 32 ounces must contain at least 32 ounces of cereal. The machine filling the boxes produces a distribution of fill weights with a mean equal to the setting on the machine and with a standard deviation equal to 0.03 ounce. To ensure that most of the boxes contain at least 32 ounces, the machine is set so that the mean fill per box is 32.09 ounces. Assuming nothing is known about the shape of the distribution, what can be said about the proportion of cereal boxes that contain less than 32 ounces.

    A) The proportion is at most 11%.   B) The proportion is at least 89%.

    C) The proportion is at most 5.5%.   D) The proportion is less than 2.5%.

3) A study was designed to investigate the effects of two variables — (1) a student's level of mathematical anxiety and (2) teaching method — on a student's achievement in a mathematics course. Students who had a low level of mathematical anxiety were taught using the traditional expository method. These students obtained a mean score of 420 with a standard deviation of 40 on a standardized test. Assuming no information concerning the shape of the distribution is known, what percentage of the students scored between 340 and 500?

    A) at least 75%   B) approximately 95%

    C) at least 89%   D) approximately 68%

4) A study was designed to investigate the effects of two variables — (1) a student's level of mathematical anxiety and (2) teaching method — on a student's achievement in a mathematics course. Students who had a low level of mathematical anxiety were taught using the traditional expository method. These students obtained a mean score of 250 with a standard deviation of 50 on a standardized test. Assuming a non–mound–shaped distribution, what percentage of the students scored over 400?

    A) at most 11%   B) approximately 2.5%

    C) at least 89%   D) at most 5.5%

5) A recent survey was conducted to compare the cost of solar energy to the cost of gas or electric energy. Results of the survey revealed that the distribution of the amount of the monthly utility bill of a 3–bedroom house using gas or electric energy had a mean of $126 and a standard deviation of $14. If nothing is known about the shape of the distribution, what percentage of homes will have a monthly utility bill of less than $98?

    A) at most 25%   B) at least 75%   C) at most 11.1%   D) at least 88.9%

6) Many firms use on–the–job training to teach their employees computer programming. Suppose you work in the personnel department of a firm that just finished training a group of its employees to program, and you have been requested to review the performance of one of the trainees on the final test that was given to all trainees. The mean and standard deviation of the test scores are 82 and 4, respectively. Assuming nothing is known about the distribution, what percentage of test–takers scored above 90?

    A) at most 25%   B) at least 75%

    C) approximately 2.5%   D) approximately 97.5%

7) If nothing is known about the shape of a distribution, what percentage of the observations fall within 2 standard deviations of the mean?

    A) at least 75%   B) at most 25%

    C) approximately 95%   D) approximately 5%

8) Fill in the blank. _____ gives us a method of interpreting the standard deviation of any data set, regardless of the shape of the distribution.

    A) Chebyshev's Rule   B) The Empirical Rule

    C) both A and B   D) neither A nor B

9) Fill in the blank. _____ is a method of interpreting the standard deviation of data that have a mound–shaped, symmetric distribution.

    A) The Empirical Rule   B) Chebyshev's Rule

    C) both A and B   D) neither A nor B

10) Given a data set, which of the following is most likely to be the percentage of data within three standard deviations of the mean?

    A) 95%   B) 65%   C) 70%   D) 85%

2.7 Numerical Measures of Relative Standing

1 Compute, Interpret z–Score

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) Many firms use on–the–job training to teach their employees computer programming. Suppose you work in the personnel department of a firm that just finished training a group of its employees to program, and you have been requested to review the performance of one of the trainees on the final test that was given to all trainees. The mean and standard deviation of the test scores are 75 and 3, respectively, and the distribution of scores is mound–shaped and symmetric. Suppose the trainee in question received a score of 71. Compute the trainee's z–score.

    A) $z = -1.33$ B) $z = -4$ C) $z = -12$ D) $z = 0.91$

2) A recent survey was conducted to compare the cost of solar energy to the cost of gas or electric energy. Results of the survey revealed that the distribution of the amount of the monthly utility bill of a 3–bedroom house using gas or electric energy had a mean of $93 and a standard deviation of $11. Three solar homes reported monthly utility bills of $56, $54, and $51. Which of the following statements is true?

   A) Homes using solar power may have lower utility bills than homes using only gas and electricity.

   B) The utility bills for homes using solar power are about the same as those for homes using only gas and electricity.

   C) Homes using solar power may actually have higher utility bills than homes using only gas and electricity.

   D) Homes using solar power always have lower utility bills than homes using only gas and electricity.

3) A radio station claims that the amount of advertising each hour has a mean of 13 minutes and a standard deviation of 1.4 minutes. You listen to the radio station for 1 hour and observe that the amount of advertising time is 9 minutes. Calculate the z–score for this amount of advertising time.

   A) $z = -2.86$ B) $z = 2.86$ C) $z = -5.6$ D) $z = 0.58$

4) On a given day, gasoline prices in the state of Colorado had a mean price of $2.26/gallon with a standard deviation of $0.03. A particular Colorado gas station had gasoline for $2.23/gallon. Interpret the z–score for this gas station.

   A) The gas price of this station falls 1 standard deviation below the mean gas price of all Colorado stations.

   B) The gas price of this station falls 1 standard deviation above the mean gas price of all Colorado stations.

   C) The gas price of this Colorado station falls 3 standard deviations below the mean gas price of all Colorado stations.

   D) The gas price of this Colorado station falls 3 standard deviations above the mean gas price of all Colorado stations.

5) Which of the following is a measure of relative standing?

   A) z–score   B) mean   C) variance   D) pie chart

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

6) A study was designed to investigate the effects of two variables — (1) a student's level of mathematical anxiety and (2) teaching method — on a student's achievement in a mathematics course. Students who had a low level of mathematical anxiety were taught using the traditional expository method. These students obtained a mean score of 450 and a standard deviation of 20 on a standardized test. Find and interpret the z–score of a student who scored 580 on the standardized test.

7) A recent survey was conducted to compare the cost of solar energy to the cost of gas or electric energy. Results of the survey revealed that the distribution of the amount of the monthly utility bill of a 3–bedroom house using gas or electric energy had a mean of $104.00 and a standard deviation of $10.00. Assuming the distribution is mound–shaped and symmetric, would you expect to see a 3–bedroom house using gas or electric energy with a monthly utility bill of $159.00? Explain.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

8) Find the z–score for the value 98, when the mean is 73 and the standard deviation is 9.

   A) $z = 2.78$ B) $z = 2.67$ C) $z = -1.22$ D) $z = 1.22$

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

9) Test scores for a history class had a mean of 79 with a standard deviation of 4.5. Test scores for a physics class had a mean of 69 with a standard deviation of 3.7. One student earned a 60 on the history test and a 67 on the physics test. Calculate the z–score for each test. On which test did the student perform better?

10) The following data represent the scores of 50 students on a statistics exam. The mean score is 80.02, and the standard deviation is 11.9.

39 51 59 63 66 68 68 69 70 71
71 71 73 74 76 76 76 77 78 79
79 79 79 80 80 82 83 83 83 85
85 86 86 88 88 88 88 89 89 89
90 90 91 91 92 95 96 97 97 98

Find the z–scores for the highest and lowest exam scores.

2 Find, Interpret Percentile

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) When Scholastic Achievement Test scores (SATs) are sent to test–takers, the percentiles associated with scores are also given. Suppose a test–taker scored at the 66th percentile on the verbal part of the test and at the 15th percentile on the quantitative part. Interpret these results.

A) This student performed better than 66% of the other test–takers on the verbal part and better than 15% on the quantitative part.

B) This student performed better than 66% of the other test–takers on the verbal part and better than 85% on the quantitative part.

C) This student performed better than 34% of the other test–takers on the verbal part and better than 85% on the quantitative part.

D) This student performed better than 34% of the other test–takers on the verbal part and better than 15% on the quantitative part.

2) Summary information is given for the weights (in pounds) of 1000 randomly sampled tractor trailers.

MIN: 4006   25%:   5606
MAX: 10,606   75%:   8606
AVE: 7006   Std. Dev.:   1400

Find the percentage of tractor trailers with weights between 5606 and 8606 pounds.

A) 50%   B) 75%   C) 25%   D) 100%

3) The test scores of 30 students are listed below. Which number could be the 30th percentile?

31 41 45 48 52 55 56 56 63 65
67 67 69 70 70 74 75 78 79 79
80 81 83 85 85 87 90 92 95 99

A) 64   B) 56   C) 67   D) 90

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

   4) A retail store's customer satisfaction rating is at the 88th percentile. What percentage of retail stores has higher customer satisfaction ratings than this store?

   5) In a summary of recent real estate sales, the median home price is given as $325,000. What percentile corresponds to a home price of $325,000?

2.8   Methods for Detecting Outliers (Optional)

1   Determine if Datum is an Outlier

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

   1) At the U.S. Open Tennis Championship a statistician keeps track of every serve that a player hits during the tournament. The statistician reported that the mean serve speed of a particular player was 100 miles per hour (mph) and the standard deviation of the serve speeds was 15 mph. Using the z–score approach for detecting outliers, which of the following serve speeds would represent outliers in the distribution of the player's serve speeds?

   Speeds: 48 mph, 115 mph, and 130 mph

   A) 48 is the only outlier.   B) 48 and 115 are both outliers, but 130 is not.

   C) 48, 115, and 130 are all outliers.   D) None of the three speeds is an outlier.

   2) The speeds of the fastballs thrown by major league baseball pitchers were measured by radar gun. The mean speed was 84 miles per hour. The standard deviation of the speeds was 5 mph. Which of the following speeds would be classified as an outlier?

   A) 100 mph   B) 74 mph   C) 92 mph   D) 79 mph

   3) Which of the following statements concerning the box plot and z–score methods for detecting outliers is false?

   A) The z–score method is less affected by an extreme observation in the data set.

   B) The box plot method uses the quartiles as a basis for detecting outliers.

   C) The z–score method uses the mean and standard deviation as a basis for detecting outliers.

   D) The box plot method is less affected by an extreme observation in the data set.

   4) Which of the following statements could be an explanation for the presence of an outlier in the data?

   A) The measurement may be correct and from the same population as the rest but represents a rare event. Generally, we accept this explanation only after carefully ruling out all others.

   B) The measurement is incorrect. It may have been observed, recorded, or entered into the computer incorrectly.

   C) The measurement belongs to a population different from that from which the rest of the sample was drawn.

   D) All of the above are explanations for outliers.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

5) A radio station claims that the amount of advertising each hour has an a mean of 17 minutes and a standard deviation of 2.3 minutes. You listen to the radio station for 1 hour and observe that the amount of advertising time is 22.52 minutes. Based on your observation, what would you infer about the radio station's claim?

6) The following data represent the scores of 50 students on a statistics exam. The mean score is 80.02, and the standard deviation is 11.9.

39	51	59	63	66	68	68	69	70	71
71	71	73	74	76	76	76	77	78	79
79	79	79	80	80	82	83	83	83	85
85	86	86	88	88	88	88	89	89	89
90	90	91	91	92	95	96	97	97	98

Use the z-score method to identify potential outliers among the scores.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Answer the question True or False.

7) The z-score uses the quartiles to identify outliers in a data set.

A) True   B) False

8) An outlier is defined as any observation that falls within the outer fences of a box plot.

A) True   B) False

2   Calculate Quartiles and IQR

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) At the U.S. Open Tennis Championship a statistician keeps track of every serve that a player hits during the tournament. The lower quartile of a particular player's serve speeds was reported to be 88 mph. Which of the following interpretations of this information is correct?

A) 75% of the player's serves were hit at speeds greater than 88 mph.

 B) 25% of the player's serves were hit at 88 mph.

C) 75% of the player's serves were hit at speeds less than 88 mph.

D) 88 serves traveled faster than the lower quartile.

2) A sociologist recently conducted a survey of citizens over 60 years of age who have net worths too high to qualify for Medicaid but have no private health insurance. The ages of the 25 uninsured senior citizens were as follows:

68 73 66 76 86 74 61 89 65 90 69 92 76
62 81 63 68 81 70 73 60 87 75 64 82

Find the upper quartile of the data.

A) 81.5   B) 65.5   C) 73   D) 92

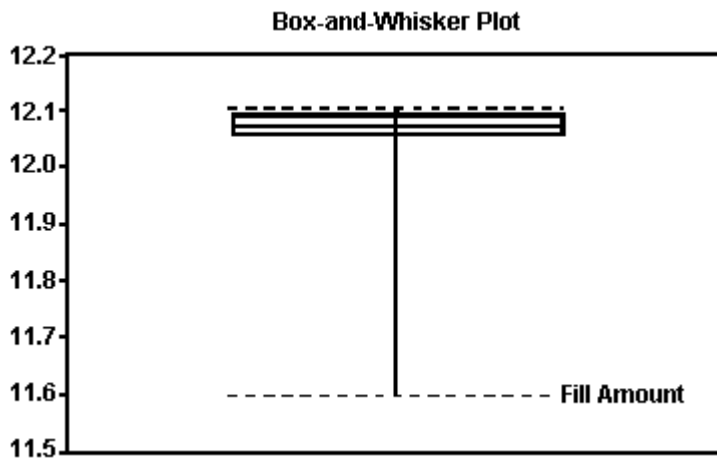SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

3) The amount of television viewed by today's youth is of primary concern to Parents Against Watching Television (PAWT). Three hundred parents of elementary school–aged children were asked to estimate the number of hours per week that their child watches television. The upper quartile for the distribution was given as 15 hours. Interpret this value.

4) For a given data set, the lower quartile is 45, the median is 50, and the upper quartile is 57. The minimum value in the data set is 32, and the maximum is 81.

a.   Find the interquartile range.
b.   Find the inner fences.
c.   Find the outer fences.
d.   Is either of the minimum or maximum values considered an outlier? Explain.

3   Construct, Interpret Boxplot

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) The box plot shown below displays the amount of soda that was poured by a filling machine into 12 –ounce soda cans at a local bottling company.

Box-and-Whisker Plot

Based on the box plot, what shape do you believe the distribution of the data to have?

A) skewed to the left   B) approximately symmetric

C) skewed to the right   D) skewed to the center

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

2) The following data represent the scores of 50 students on a statistics exam.

39	51	59	63	66	68	68	69	70	71
71	71	73	74	76	76	76	77	78	79
79	79	79	80	80	82	83	83	83	85
85	86	86	88	88	88	88	89	89	89
90	90	91	91	92	95	96	97	97	98

   a.   Find the lower quartile, the upper quartile, and the median of the scores.
   b.   Find the interquartile range of the data and use it to identify potential outliers.
   c.   In a box plot for the data, which scores, if any, would be outside the outer fences? Which scores, if any, would be outside the inner fences but inside the outer fences?

2.9 Graphing Bivariate Relationships (Optional)

1 Construct, Interpret Scatterplot

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

1) The data below represent the numbers of absences and the final grades of 15 randomly selected students from a statistics class. Construct a scattergram for the data. Do you detect a trend?

Student	Number of Absences	Final Grade as a Percent
1	5	79
2	6	78
3	2	86
4	12	56
5	9	75
6	5	90
7	8	78
8	15	48
9	0	92
10	1	78
11	9	81
12	3	86
13	10	75
14	3	89
15	11	65

2) The scores of nine members of a women's golf team in two rounds of tournament play are listed below.

Player	1	2	3	4	5	6	7	8	9
Round 1	85	90	87	78	92	85	79	93	86
Round 2	90	87	85	84	86	78	77	91	82

Construct a scattergram for the data.

2.10   The Time Series Plot (Optional)

1   Define Time Series Plot

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

1) What is a time series plot?

2) What is the primary advantage of a time series plot?

2.11   Distorting the Truth with Descriptive Techniques

1   Understand Misleading Statistics

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

1) Explain how stretching the vertical axis of a histogram can be misleading.

2) Explain how using a scale break on the vertical axis of a histogram can be misleading.

3) Explain how it can be misleading to draw the bars in a histogram so that the width of each bar is proportional to its height rather than have all bars the same height.

4) Explain how it can be misleading to report only the mean of a distribution without any measure of the variability.

Ch. 2   Methods of Describing Data
Answer Key

2.1   Describing Qualitative Data
1   Construct Frequency/Relative Frequency Table
    1) A
    2) A

2   Construct, Interpret Bar Graph
    1) A
    2) A
    3) a.

Medal	Frequency
Gold	9
Silver	9
Bronze	7

    b.

Medal	Relative Frequency
Gold	.36
Silver	.36
Bronze	.28

    c.
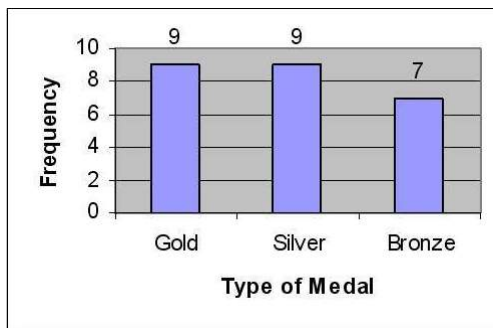
3   Construct, Interpret Pie Chart
    1) A

2) a.

Type of Book	Relative Frequency
Children's	.10
Fiction	.28
Nonfiction	.49
Educational	.13

b.
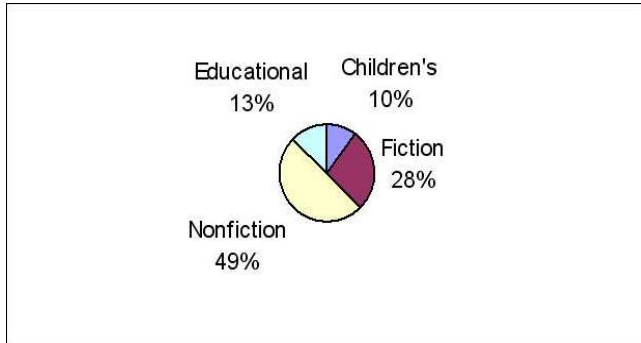
4   Construct, Interpret Pietro Diagram

1) In a Pareto diagram, the bars are arranged by height in a descending order from left to right.

2) a.

Car	Relative Frequency
Crown Victoria	.09
Five Hundred	.11
Taurus	.25
Fusion	.17
Focus	.19
Mustang/GT	.19

b.
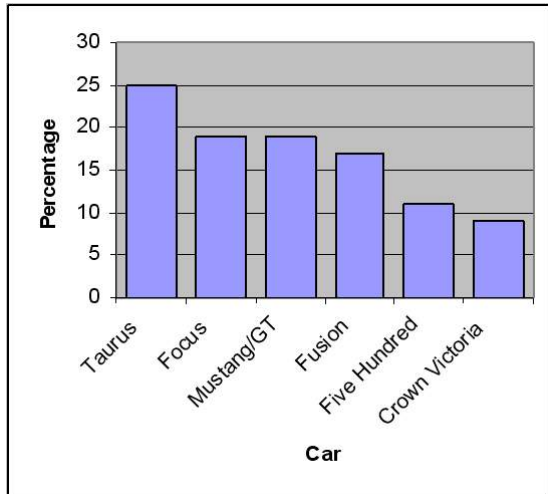
5 Construct, Interpret Side–by–Side Bar Chart

1)
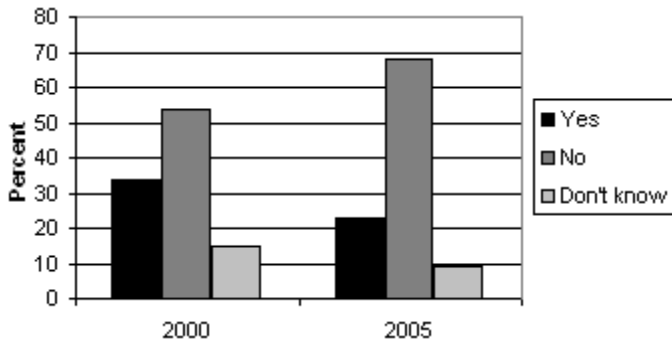
Losses due to employee theft have decreased from 2000 to 2005.

2.2   Graphical Methods for Describing Quantitative Data

1 Construct, Interpret Histogram

1) a.

Total Medals	Frequency
15	5
610	2
1115	5
1620	1
2125	4
2630	1

b.
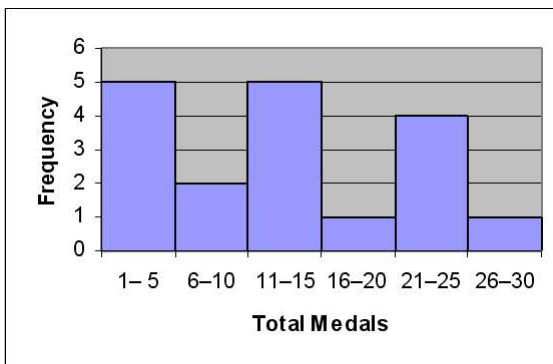
2) a.   The exact scores would be needed to construct a stem–and–leaf display but the exact scores are not available in the table given.

b.
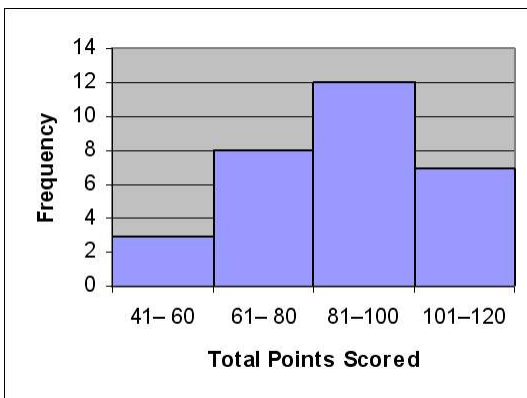
3) A

4) A

2 Construct, Interpret Stem–and–Leaf Display

   1) A

   2)

Stem	Leaf
1	5
2	
3	
4	
5	8 9
6	6 9
7	6 7 9
8	2 3 5 7 8 8 9
9	1 2 6 8 9

   3) B

3 Construct, Interpret Dot–Plot

   1) A

   2) A

   3) A

   4) A

2.3   Summation Notation

1 Use Summation Notation

   1) A

   2) A

   3) B

   4) A

   5) B

   6) A

2.4   Numerical Measures of Central Tendency

1 Find Mean, Median, Mode

   1) A

   2) A

   3) A

   4) The mean of the data is $x = \dfrac{\sum x}{n}$

$$\frac{70.7 + 63 + 55.9 + 54.8 + 30.2 + 27 + 24.3 + 23.7 + 23.9 + 20.4}{10}$$

$$= \frac{393.9}{10}$$

$$= 39.39 \Rightarrow \$39.39 \text{ million}$$

The median is the average of the middle two observations.

$$M = \frac{30.2 + 27}{2} = 28.60 \Rightarrow \$28.60 \text{ million}$$

5) The mean is the sum of the numbers divided by 18:

$$\frac{1 + 2 + 3 + 3 + 4 + 9 + 9 + 11 + 11 + 11 + 14 + 14 + 19 + 22 + 23 + 24 + 25 + 29}{18}$$

$$= \frac{234}{18} = 13 \text{ medals.}$$

The median is the mean of the two middle numbers: $\frac{11 + 11}{2} = 11$ medals.

The mode is the most frequent number of medals: 11 medals.

2   Interpret Measures of Central Tendency

1) A

2) A

3) A

4) A

5) A

6) A

7) A

8) A

9) A

10) Since the distribution is skewed to the right, we know that the mean time will exceed the median time.

11) In both 1998 and 2002, the mean dropout rates exceed the median dropout rates. This indicates that both the 1998 and 2002 high school dropout rates have distributions that are skewed to the right.

12) The modal class is the class with the greatest frequency: 81100 points.

13) B

14) A

15) B

16) B

2.5   Numerical Measures of Variability

1   Calculate Range, Variance, Standard Deviation

1) A

2) A

3) A

4) $s^2 = \dfrac{\sum(x - \bar{x})^2}{n - 1}$

$$\bar{x} = \frac{\sum x}{n} = \frac{62 + 59 + 51 + 60 + 41}{5} = 54.6$$

$$s^2 = \frac{(62 - 54.6)^2 + (59 - 54.6)^2 + (51 - 54.6)^2 + (60 - 54.6)^2 + (41 - 54.6)^2}{5 - 1}$$

$$= 75.30$$

5) The range is 29 – 1 = 28 medals.

The variance is $s^2 = \dfrac{\sum x^2 - \dfrac{\left(\sum x\right)^2}{n}}{n - 1} = \dfrac{4372 - \dfrac{(234)^2}{18}}{17} = \dfrac{1330}{17} \approx 78.24$

The standard deviation is $s = \sqrt{s^2} = \sqrt{\dfrac{1330}{17}} \approx 8.85$

6) A

7) A

2   Interpret Measures of Variability
   1) A
   2) A
   3) A
   4) μ is the mean price of the regular unleaded gasoline prices of all retail gas stations in the United States.

   σ is the standard deviation of the regular unleaded gasoline prices of all retail gas stations in the United States.

   $\bar{x}$ is the mean price of the regular unleaded gasoline prices collected from the 200 stations sampled.

   s is the standard deviation of the regular unleaded gasoline prices collected from the 200 stations sampled.
   5) Take the square root of the sample variance to find the sample standard deviation.
   6) standard deviation
   7) standard deviation
   8) range
   9) A
   10) A

2.6   Interpreting the Standard Deviation

1   Use Empirical Rule
   1) A
   2) A
   3) A
   4) A
   5) A
   6) A
   7) A
   8) A
   9) We use the Empirical Rule to determine the percentage of serves with speeds faster than 69 mph. We do this by first finding the percentage of serves with speeds between 69 and 95 mph. The Empirical Rule states that approximately 34.0% (68%/2) fall between 69 and 95 mph. Because the distribution is symmetric about the mean speed of 95 mph, we know 50% of the serve speeds were faster than 95 mph. We add these findings together to determine that 34.0% + 50% = 84.0% of the serves were hit faster than 69 mph.
   10) The value 89 falls one standard deviation above the mean in the distribution. Using the Empirical Rule, 68% of the days will have between 65 and 89 jobs submitted. Of the remaining 32% of the days, half, or 32%/2 = 16%, of the days will have more than 89 jobs submitted.
   11) The value of 16 ounces falls three standard deviations below the mean. The Empirical Rule states that approximately all of the boxes will contain cereal amounts between 16.00 ounces and 16.12 ounces. Therefore, approximately 100% of the boxes contain at least 16 ounces.
   12) The Empirical Rule states that 95% of the data will fall between 77 and 85. Because the distribution is symmetric, half of the remaining 5%, or 2.5%, will have test scores above 85. Thus, 85 is the cutoff point that will identify the trainees who will receive the promotion.
   13) 74% of the scores lie within one standard deviation of the mean, 96% within two standard deviations, and 98% within three standard deviations. These percentages are close to those given in the Empirical Rule, so the distribution is roughly mound–shaped and symmetric, though obviously skewed slightly to the left.
   14) A

2   Use Chebyshev's Rule
   1) A
   2) A
   3) A
   4) A
   5) A
   6) A
   7) A
   8) A

9) A
10) A

2.7 Numerical Measures of Relative Standing

1 Compute, Interpret z–Score

1) A
2) A
3) A
4) A
5) A

6) The z–score is $z = \dfrac{x - \mu}{\sigma}$.

For a score of 58, $z = \dfrac{580 - 450}{20} = 6.50.$

This student's score falls 6.50 standard deviations above the mean score of 450.

7) The z–score for the value \$159.00 is:

$z = \dfrac{x - \bar{x}}{s} = \dfrac{159 - 104}{10} = 5.5$

An observation that falls 5.5 standard deviations above the mean is very unlikely. We would not expect to see a monthly utility bill of \$159.00 for this home.

8) A

9) history z–score = –4.22; physics z–score = –0.54; The student performed better on the physics test.

10) highest: $z = 1.51$; lowest: $z = -3.45$

2 Find, Interpret Percentile

1) A
2) A
3) A
4) 12%
5) 50th percentile

2.8 Methods for Detecting Outliers (Optional)

1 Determine if Datum is an Outlier

1) A
2) A
3) A
4) D
5) The z–score for the value 22.52 is 2.4

Since the z–score would not indicate that 22.52 minutes represents an outlier, there is no evidence that the station's claim is incorrect.

6) The z–score of 39 is –3.46. Since this z–score is less than –3, the score of 39 is an outlier. All other scores have z–scores between –3 and 3, so there are no other outliers.

7) B
8) B

2 Calculate Quartiles and IQR

1) A
2) A
3) 75% of the TV viewing times are less than 15 hours per week. 25% of the times exceed 15 hours per week.
4) a. The interquartile range is 57 – 45 = 12.
   b. The inner fences are 45 – 1.5(12) = 27 and 57 + 1.5(12) = 75.
   c. The outer fences are 45 – 3(12) = 0 and 57 + 3(12) = 93.
   d. The maximum of 81 is a potential outlier since it lies outside the inner fences. The minimum is within the inner fence and is not considered to be an outlier.

3 Construct, Interpret Boxplot

   1) A

   2) a.   The lower quartile is 73, the upper quartile is 89, and the median is 81.

       b.   The interquartile range is 89 – 73 = 16. The score of 39 is a potential outlier since it is less than 73 – 1.5(16) = 49.

       c.   No scores fall outside the outer fences, 25 and 137. Only the score of 39 lies between the inner and outer fences.

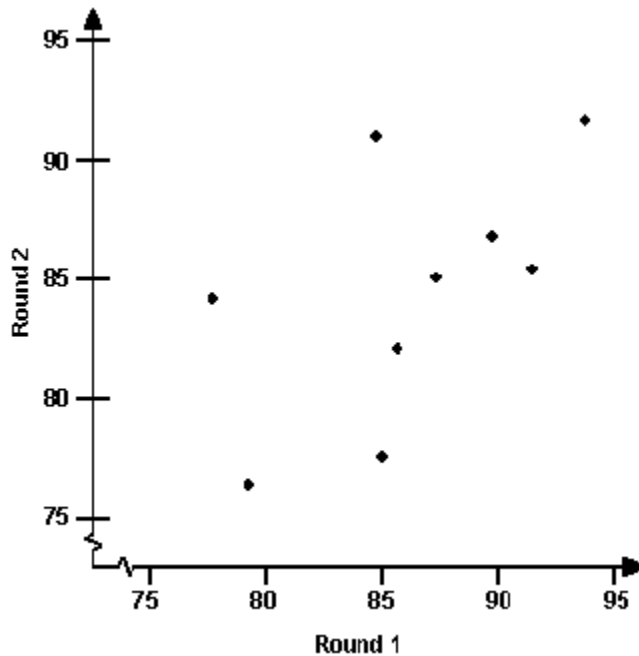## 2.9 Graphing Bivariate Relationships (Optional)

1 Construct, Interpret Scatterplot

   1)
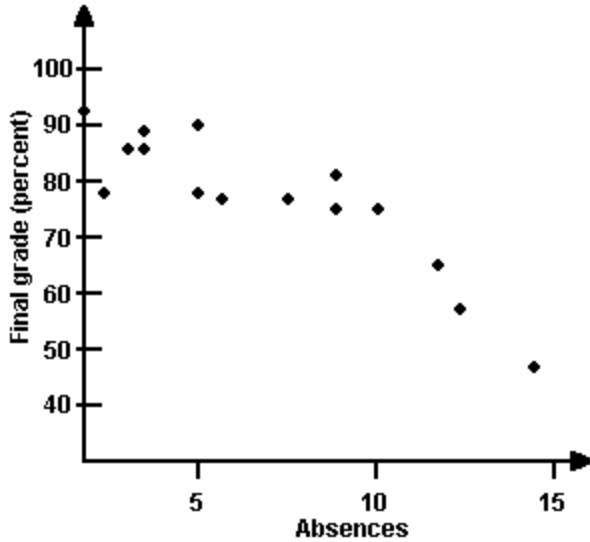
There appears to be a trend in the data. As the number of absences increases, the final grade decreases.

   2)

2.10 The Time Series Plot (Optional)

1 Define Time Series Plot

   1) A scatterplot with the measurements on the vertical axis and time (or the order in which the measurements were made) on the horizontal axis.

   2) A time series plot describes behavior over time and reveals movement (trend) and changes (variation) in the variable being monitored.

2.11 Distorting the Truth with Descriptive Techniques

1 Understand Misleading Statistics

1) Stretching the vertical axis may overemphasize the differences in the heights of the bars making the taller bars look much taller than the shorter bars.
2) Using a scale break on the vertical axis may make the shorter bars look disproportionately shorter than the taller bars.
3) The reader may think that the area of the bar represents the quantity rather than the height of the bar, giving a disproportionate emphasis on the taller bars.
4) When comparing means from two different distributions, the difference between them may be insignificant if the variability in one or both of the distributions is large.