

VOCABULARY

arithmetic mean (p. 897)

back-to-back bar graph
(p. 889)

bar graph (p. 889)

bimodal (p. 899)

box-and-whisker plot (p. 909)

class interval (p. 890)

class limits (p. 890)

class mark (p. 890)

cumulative frequency
distribution (p. 902)

frequency distribution
(p. 890)

frequency polygon (p. 892)

hinge (p. 909)

histogram (p. 890)

inferential statistics (p. 927)

interquartile range (p. 909)

leaf (p. 899)

level of confidence (p. 929)

line plot (p. 889)

mean (p. 897)

mean deviation (p. 910)

measure of central tendency
(p. 897)

measure of variability
(p. 908)

median (p. 897)

median class (p. 902)

mode (p. 897)

normal curve (p. 918)

normal distribution (p. 918)

outlier (p. 909)

percentile (p. 922)

population (p. 927)

quartile (p. 909)

random sample (p. 927)

range (p. 890)

semi-interquartile range
(p. 909)

standard deviation (p. 911)

standard error of the mean
(p. 927)

stem (p. 899)

stem-and-leaf plot (p. 899)

three-dimensional bar graph
(p. 890)

variance (p. 912)

whisker (p. 909)

UNDERSTANDING AND USING THE VOCABULARY

Choose the term from the list above that best completes each statement.

1. A _____ is a display that visually shows the quartile points and the extreme values of a set of data.
2. The _____ of a set of data is the middle value if there are an odd number of values.
3. The standard deviation of the distribution of the sample means is known as the _____.
4. The _____ of a set of data is the difference between the greatest and the least values in the set.
5. A statistic that describes the center of a set of data is called an average or _____.
6. A _____ is the entire set of items or individuals in the group being considered.
7. Data with two modes are _____.
8. The major purpose of _____ is to use the information gathered in a sample to make predictions about a population.
9. A _____ is the most common way of displaying a frequency distribution.
10. A measure of variability often associated with the arithmetic mean is the _____.

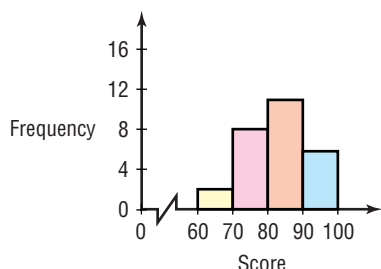
SKILLS AND CONCEPTS

OBJECTIVES AND EXAMPLES

Lesson 14-1 Draw, analyze, and use bar graphs and histograms.

Draw a histogram of the data below.

Scores	Frequency
60–70	2
70–80	8
80–90	11
90–100	6



REVIEW EXERCISES

The table below gives the weight in ounces of the popular women's tennis shoes.

Weight (ounces)	Number of Shoes
9.0–10.0	2
10.0–11.0	18
11.0–12.0	5
12.0–13.0	2
13.0–14.0	3

- What is the range of the data?
- What are the class marks?
- Draw a histogram of the data.

Lesson 14-2 Find the mean, median, and mode of a set of data.

Find the mean, median, and mode of the set {46, 47, 59, 49, 50, 48, 58, 56, 58, 54, 53}.

$$\frac{1}{11} \sum_{i=1}^{11} X_i = \frac{46 + 47 + \dots + 54 + 53}{11} \text{ or } 53$$

The mean is 53.

To find the median, order the data.

46, 47, 48, 49, 50, 53, 54, 56, 58, 58, 64

Since there are an odd number of data, the median is the middle value. The median is 53.

The most frequent value in this set of data is 58. So, the mode is 58.

Find the mean, median, and mode of each set of data.

- {4, 8, 2, 4, 5, 5, 6, 7, 4}
- {250, 200, 160, 240, 200}
- {19, 11, 13, 15, 16}
- {6.6, 6.3, 6.8, 6.6, 6.7, 5.9, 6.4, 6.3}

stem	leaf
12	2 8
13	0 1 3 5
14	1 6
12	2 = 122



OBJECTIVES AND EXAMPLES

Lesson 14-3 Find the interquartile range, the semi-interquartile range, mean deviation, and standard deviation of data.

interquartile range: $Q_3 - Q_1$

semi-interquartile range: $Q_R = \frac{Q_3 - Q_1}{2}$

mean deviation: $MD = \frac{1}{n} \sum_{i=1}^n |X_i - \bar{X}|$

standard deviation: $\sigma = \sqrt{\frac{1}{n} \sum_{i=1}^n (X_i - \bar{X})^2}$

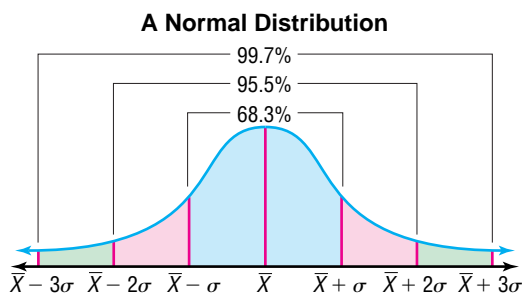
REVIEW EXERCISES

A number cube is tossed 10 times with the following results.

5 1 5 4 2 3 6 2 5 1

19. Find the interquartile range.
20. Find the semi-interquartile range.
21. Find the mean deviation.
22. Find the standard deviation.

Lesson 14-4 Use the normal distribution curve.



A set of data is normally distributed with a mean of 75 and a standard deviation of 6. What percent of the data is between 69 and 81?

The values within one standard deviation of the mean are between $75 - 6$, or 69, and $75 + 6$, or 81. So, 68.3% of the data is between 69 and 81.

The mean of a set of normally distributed data is 88 and the standard deviation is 5.

23. What percent of the data is in the interval 78–98?
24. Find the probability that a value selected at random from the data lies in the interval 86–90.
25. Find the interval about the mean that includes 90% of the data.

Suppose 150 values in a data set are normally distributed.

26. How many values are within one standard deviation of the mean?
27. How many values are within two standard deviations of the mean?
28. How many values fall in the interval between the mean and one standard deviation above the mean?

OBJECTIVES AND EXAMPLES

Lesson 14-5 Find the standard error of the mean to predict the true mean of a population with a certain level of confidence.

Find the standard error of the mean for $\sigma = 12$ and $N = 100$. If $\bar{X} = 75$, find the range for a 1% level of confidence.

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{N}}$$

$$\sigma_{\bar{X}} = \frac{12}{\sqrt{100}} \text{ or } 1.2$$

The standard error of the mean is 1.2.

A 1% level of confidence is given when $P = 99\%$.

When $P = 0.99$, $t = 2.58$.

Use $\sigma_{\bar{X}} = 1.2$ to find the range.

$$\begin{aligned} \bar{X} \pm t\sigma_{\bar{X}} &= 75 \pm (2.58)(1.2) \\ &= 71.90 \text{ to } 78.10 \end{aligned}$$

Thus, the interval about the mean is 71.90 to 78.10.

REVIEW EXERCISES

Find the standard error of the mean for each sample.

29. $\sigma = 1.5, N = 90$

30. $\sigma = 4.9, N = 120$

31. $\sigma = 25, N = 400$

32. $\sigma = 18, N = 25$

For each sample, find the interval about the sample mean that has a 1% level of confidence.

33. $\sigma = 15, N = 50, \bar{X} = 100$

34. $\sigma = 30, N = 15, \bar{X} = 90$

35. $\sigma = 24, N = 200, \bar{X} = 40$

In a random sample of 200 adults, it was found that the average number of hours per week spent cleaning their home was 1.8, with a standard deviation of 0.5.

36. Find the standard error of the mean.

37. Find the range about the mean such that the probability is 0.90 that the true mean lies within the range.

38. Find the range about the sample mean that has a 5% level of confidence.

39. Find the range about the sample mean that has a 1% level of confidence.

40. **Entertainment** In a random sample of 100 families, the children watched television an average of 4.6 hours a day. The standard deviation is 1.4 hours. Find the range about the sample mean so that a probability of 0.90 exists that the true mean will lie within the range.

APPLICATIONS AND PROBLEM SOLVING

41. **Safety** The numbers of job-related injuries at a construction site for each month of 1999 are listed below. (*Lesson 14-2*)

10	13	15	39	21	24
19	16	39	17	23	25

- Make a stem-and-leaf plot of the numbers of injuries.
- What is the mean number of the data?
- Find the median of the data.
- Find the mode of the data.

42. The height of members of the boys basketball team are normally distributed. The mean height is 75 inches, and the standard deviation is 2 inches. Randall is 80 inches tall. What percent of the boys on the basketball team are taller than Randall? (*Lesson 14-4*)



ALTERNATIVE ASSESSMENT

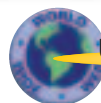
OPEN-ENDED ASSESSMENT

- The mean of a set of five pieces of data is 15, and the median is 10. When one certain value is added to the set, the mean stays the same but the median changes.
 - Find a set of data for which this is true.
 - What value can be added to your set so that the mean stays the same but the median changes?
- Find some data in a newspaper or magazine. Use what you have learned in this chapter to analyze the data.


PORTFOLIO

Choose one of the types of data displays you studied in this chapter. Describe a situation in which this type of display would be used. Explain why the type of display you chose is the best one to use in this situation.

Additional Assessment See p. A69 for a practice Chapter 14 test.


 Unit 4 *inter*NET Project

 THE UNITED STATES
CENSUS BUREAU

More and more models!

- Use the data you collected for the project in Chapter 12. Display the data in a table or use software to prepare a spreadsheet of the data.
- Use computer software or a graphing calculator to find at least three models for the population data. Draw a graph of each function.
- Compare your function models for the population data. Use your models to predict the U.S. population for the year 2050. Determine which one you think best fits the data.
- Write a one-page paper comparing the arithmetic and geometric sequences you wrote for Chapter 12 with the function models. Discuss which one model you think best fits the population data and give your estimate for the population in 2050.





Statistics and Data Analysis Problems

On the SAT and ACT exams, you will calculate the mean (average), median, and mode of a data set.

The SAT and ACT exams may include a one or two questions on interpreting graphs. The most common graphs are bar graphs, circle graphs, line graphs, stem-and-leaf plots, histograms, and frequency tables.

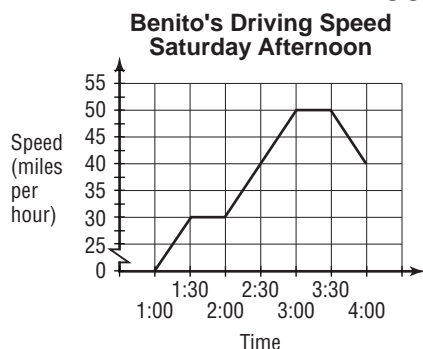
TEST-TAKING TIP

If a problem includes a graph, look carefully at the graph including its labels and units. Then read the question.

Two or three questions may refer to the same graph.

ACT EXAMPLES

Questions 1 and 2 refer to the following graph.



1. For what percent of the time was Benito driving 40 miles per hour or faster?
- A 20 B 25 C $33\frac{1}{3}$ D 40 E 50

HINT Watch for different units of measure.

Solution Benito drove a total of 3 hours. He drove 40 miles per hour or faster for 1 hour and 30 minutes or $1\frac{1}{2}$ hours. The fraction of the time he drove 40 mph or more is $\frac{3}{2}$ or $\frac{1}{2}$, which equals 50%. The answer is choice E.

2. How far, in miles, did Benito drive between 1:30 and 2:00?
- A 0 B 15 C 20 D 30
E It cannot be determined from the information given.

Solution rate \times time = distance
 $(30 \text{ mph})\left(\frac{1}{2} \text{ hour}\right) = 15 \text{ miles}$

The answer is choice B.

SAT EXAMPLE

3. For $x = 0$, $x = 1$, and $x = 2$, Set $A = \{x, x + 3, 3x, x^2\}$. What is the mode of Set A ?

A 0 B 1 C 2 D 2.5 E 3

HINT Look carefully at the given information and at the form of the answer choices (numbers, variables, and so on.)

Solution Notice that the answer choices are numbers. But Set A is defined using variable expressions. First determine the actual data of set A . Consider each value of x , one at a time. Substitute the value for x into each element of Set A .

For $x = 0$: $x = 0$, $x + 3 = 3$, $3x = 0$, and $x^2 = 0$.

When $x = 0$, $A = \{0, 3, 0, 0\}$.

When $x = 1$, $A = \{1, 4, 3, 1\}$.

When $x = 2$, $A = \{2, 5, 6, 4\}$.

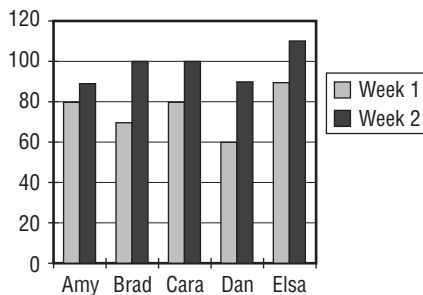
Thus, $A = \{0, 0, 0, 1, 1, 2, 3, 3, 4, 4, 5, 6\}$. The element 0 occurs three times and no other element occurs as many times. So the mode of Set A is 0. The answer is choice A.

You might notice that choice D, 2.5, is the value of the median set A .

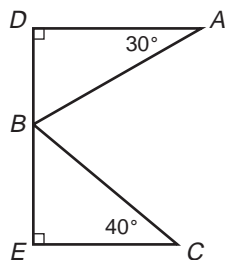
After you work each problem, record your answer on the answer sheet provided or on a piece of paper.

Multiple Choice

1. Based on the graph below, which worker had the greatest percent increase in income from week 1 to week 2?



- A Amy B Brad C Cara
 D Dan E Elsa
2. If $a = b + bc$, then in terms of c , what does $\frac{b}{a}$ equal?
 A $\frac{1}{c+2}$ B $\frac{1}{c+1}$ C $\frac{1}{c}$
 D c E $c+1$
3. If 0.1% of m is equal to 10% of n , then m is what percent of $10n$?
 A 1/1000% B 10% C 100%
 D 1000% E 10,000%
4. S is the set of all positive numbers n such that $n < 100$ and \sqrt{n} is an integer. What is the median value of the members of set S ?
 A 5 B 5.5 C 25
 D 50 E 99
5. In the figure, D , B , and E are collinear. What is the measure of $\angle ABC$?

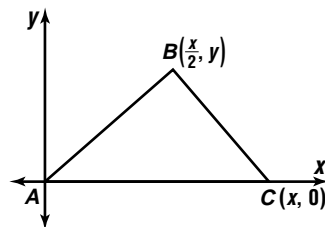


- A 20° B 35° C 50° D 60° E 70°

6. How many of the scores 10, 20, 30, 35, 35, and 50 are greater than the arithmetic mean of the scores?

- A 0 B 1 C 2
 D 3 E 4

7. In $\triangle ABC$, what is the ratio $\frac{\tan A}{\text{area } \triangle ABC}$?



- A $\frac{1}{2y^2}$ B $\frac{1}{y^2}$ C $\frac{2}{x^2}$ D $\frac{4}{x^2}$ E $\frac{x^2}{4}$

8. Based on the data in the table below, how many employees can this company expect to have by 2003?

Year	1997	1998	1999	2000	2001
Number of Employees	1900	2200	2500	2800	3100

- A 3100 B 3400 C 3550
 D 3700 E 4000

9. What is the difference between the median of Set A and the mean of Set B ?

Set A : {2, -1, 7, -4, 11, 3}
 Set B : {10, 5, -3, 4, 7, -8}

- A 2
 B 1.5
 C 0
 D -0.5
 E -2

10. **Grid-In** What is the arithmetic mean of the ten numbers below?

-820, -65, -32, 0, 1, 2, 3, 32, 65, 820

interNET CONNECTION SAT/ACT Practice For additional test practice questions, visit: www.amc.glencoe.com