

the final exam and still earn a grade of B in the course? (Assume that to get a B your mean score must be between 80 and 89.)

### Solution

Solve the problem by first finding the total number of points needed to obtain a mean of 80 on 5 exams. Then calculate the number of points accumulated on the first four exams. Finally, subtract the number of points accumulated from the total needed. This will give the number of points needed on the final exam.

- a. Find the total number of points needed for a B. Since the 5 exams are to have a mean score of 80 (or more), then the total number of points must be at least the following product.

$$\begin{array}{r} 80 \\ \times 5 \\ \hline \end{array} \quad \text{Minimum total points needed for a B}$$

- b. Calculate the number of points you have accumulated on the first 4 exams.

$$\begin{array}{r} 85 \\ 78 \\ 82 \\ +70 \\ \hline \end{array} \quad \text{Points accumulated}$$

- c. To obtain a mean of 80 (or more) on your 5 exams, you need the following score on the final exam.

$$\begin{array}{r} 400 \quad \text{Total points needed} \\ - \quad \text{Points accumulated} \\ \hline \end{array} \quad \text{Points needed on the final exam}$$

Thus, you need at least a score of      on your final exam to earn a grade of B for the course. (Note: We will see an algebraic approach to solving problems of this type in Chapter 7.)

### Now work margin exercise 4.

#### Completion Example Answers

4. a.  $800 \times 5 = 400$  b.  $85 + 78 + 82 + 70 = 315$  c.  $400 - 315 = 85$ ; 85

#### Margin Exercise Answers

1. 102 minutes 2. 87 3. a. Mode: 35 b. Range: 37 4. 97

### Note

Of the four statistics mentioned in this section, the mean and median are most commonly used. Many people feel that the mean (or arithmetic average) is relied on too much in reporting central tendencies. A few very large (or very small) data items can distort the mean as a picture of a central tendency. As you can see in the Group A data, the median of \$27,500 is probably more representative of the data than the mean of \$35,250. Note how the one income of \$80,000 raises the mean considerably.

When you read an article in a magazine or newspaper that reports means or medians, you should now have a better understanding of the implications.

## 4.5 Exercises

### Concept Check

**Fill-in-the-Blank.** Complete each sentence using information found in this section.

- The study of how to gather, organize, analyze, and interpret numerical information is called \_\_\_\_\_.
- A particular measure or characteristic of a sample is called a/an \_\_\_\_\_.

3. The value(s) measuring some characteristic of interest is considered \_\_\_\_\_.
4. The sum of all the numerical data divided by the number of data items is known as the \_\_\_\_\_ of the data.
5. The median is the middle term if there is a/an \_\_\_\_\_ number of items.
6. The median is the average of the two middle terms if there is a/an \_\_\_\_\_ number of items.

**True/False.** Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

7. Data is the value(s) of a particular characteristic of interest such as number of people, weight, temperatures, or innings pitched.
8. The range is the difference between the first number listed in the data and the last number listed.
9. The number that appears the greatest number of times in a set of data is the sample.
10. The mean and median are never the same number.

## Practice

For each set of data, find **a.** the mean, **b.** the median, **c.** the mode (if any), and **d.** the range. See Examples 1 through 3.

1. The ages of the first five US presidents on the date of their inaugurations were as follows. (The presidents were Washington, Adams, Jefferson, Madison, and Monroe.)

57,    61,    57,    57,    58

2. Dr. Wright recorded the following nine test scores for students in his statistics course.

95, 82, 85, 71, 65, 85, 62, 77, 98

3. Family incomes in a survey of eight students are as follows.

\$35,000,    \$28,000,    \$42,000,    \$71,000,  
\$63,000,    \$36,000,    \$51,000,    \$63,000

4. Stacey went to six different auto repair shops to get the following estimates to repair her car.

\$425,    \$525,    \$325,    \$300,    \$500,    \$325

5. Mike kept track of his golf scores for twelve rounds of eighteen holes each. His scores were as follows. Round to the nearest tenth, if necessary.

85,    90,    82,    85,    87,    80,  
78,    82,    88,    82,    86,    81

6. The city planning department issued the following numbers of building permits over a three-week period (15 business days).

17, 19, 18, 35, 30, 29, 23, 14,  
18, 16, 20, 18, 18, 25, 30

7. On a one-day fishing trip, Mr. and Mrs. Milster recorded the following lengths of the ten fish they caught (measured in inches).

14.3, 13.6, 10.5, 15.5, 20.1,  
10.9, 12.4, 25.0, 30.2, 23.5

8. Fifteen college students reported the following hours of sleep the night before an exam.

4, 6, 6, 7, 6.5, 6.5, 7.5, 8.5,  
5, 6, 4.5, 5.5, 9, 3, 8

9. The volume (in thousands of cubic meters) of the world's 5 largest dams are as follows.

Atatürk Dam:	84,500
Fort Peck Dam:	96,000
Hourtribijk:	78,000
Oahe Dam:	70,300
Tarbela Dam:	153,000

10. The Big City fire department reported the following mileage for tires used on their nine fire trucks.

14,000, 14,000, 11,000, 15,000, 9000,  
14,000, 12,000, 10,000, 9000

11. Resident tuition charged by 10 colleges are as follows. Round to the nearest tenth, if necessary.

\$4088, \$5175, \$5076, \$3639, \$3756,  
\$6529, \$4479, \$5922, \$5138, \$5124

12. Nonresident tuition charged by 10 colleges are as follows.

\$19,934, \$19,000, \$19,948, \$18,236, \$17,890,  
\$18,950, \$17,764, \$20,920, \$17,860, \$18,513

13. The following list contains the ages of 20 students surveyed in a college chemistry class.

18, 23, 23, 23, 22, 18, 21, 20, 18, 20,  
19, 20, 21, 19, 23, 36, 35, 26, 17, 24



### Super Bowl History

The first Super Bowl was held on January 15, 1967, and Roman numerals are used to refer to this annual event instead of the year. Two teams are tied with the most wins, with 6 wins each—the Pittsburgh Steelers (IX, X, XIII, XIV, XL, and XLIII) and New England Patriots (XXXVI, XXXVIII, XXXIX, XLIX, LI, and LIII). The New England Patriots also have the most appearances in the big game (11 total). There are four teams that have never appeared: the Cleveland Browns, the Detroit Lions, the Jacksonville Jaguars, and the Houston Texans.

14. The local high school basketball team scored the following points per game during their 20-game season.

85, 60, 62, 70, 75, 52, 88, 50, 80, 72,  
90, 85, 85, 93, 70, 75, 68, 73, 65, 82

15. The winning margin for each of the first 40 Super Bowls are as follows.

25, 19, 9, 16, 3, 21, 7, 17,  
10, 4, 18, 17, 4, 12, 17, 5,  
10, 29, 22, 36, 19, 32, 4, 45,  
1, 13, 35, 17, 23, 10, 14, 7,  
15, 7, 27, 3, 27, 3, 3, 11

16. The local weather station recorded the following daily high temperatures (in degrees Fahrenheit) for one month.

75°, 76°, 76°, 78°, 85°, 82°,  
85°, 88°, 90°, 90°, 88°, 95°,  
96°, 92°, 88°, 88°, 80°, 80°,  
78°, 80°, 78°, 76°, 77°, 75°,  
75°, 74°, 70°, 70°, 72°, 73°

17. The distances from Chicago to selected cities are as follows.

Boston:	980 miles
Cleveland:	345 miles
Dallas:	930 miles
Denver:	1050 miles
Detroit:	280 miles
Indianapolis:	190 miles
Los Angeles:	2110 miles
Miami:	1390 miles
New Orleans:	950 miles
San Francisco:	2210 miles
Seattle:	2050 miles



18. The numbers of passengers (to the nearest thousand) at 10 airports are as follows.

ATL (Atlanta):	101,489,000
PEK (Beijing):	89,938,000
DXB (Dubai):	78,010,000
ORD (Chicago):	76,942,000
HND (Tokyo):	75,316,000
LHR (London):	74,989,000
LAX (Los Angeles):	74,704,000
HKG (Hong Kong):	68,342,000
CDG (Charles de Gualle):	65,771,000
DFW (Dallas Fort Worth)	64,072,000

Source: "World Top 30 Airports",  
[www.world-airport-codes.com](http://www.world-airport-codes.com)

19. The number of volumes (to the nearest thousand) in top college libraries in the United States is as follows.

Harvard University Library:	16,832,000
Yale University Library:	15,200,000
University of Michigan Library:	13,829,000
University of Illinois at Urbana-Champaign:	13,158,000
Columbia University:	12,200,000
University of California, Berkeley Libraries:	11,545,000
Kings College Libraries:	11,189,000
University of Texas Libraries:	9,990,000
Indiana University Library:	9,934,000
University of Chicago Library:	9,837,000

Source: "List of the largest libraries in the United States,"  
[www.wikipedia.org](http://www.wikipedia.org)

20. The Medal of Honor is the nation's highest military awarded for uncommon valor by men and women in battle. The numbers of medals awarded by war are as follows.

War	Medals	War	Medals
Civil War:	1523	World War I:	126
Korean Expedition (1871):	15	Occupation of Nicaragua:	2
Indian Wars:	426	World War II:	417
Spanish-American War:	110	Korean War:	145
Second Samoan Civil War:	4	Vietnam War:	258
Philippine-American War:	86	USS <i>Liberty</i> Incident:	1
Boxer Rebellion:	59	Battle of Mogadishu:	2
Occupation of Veracruz:	56	Iraq War:	4
United States Occupation of Haiti:	8	War in Afghanistan:	14
Dominican Republic Occupation:	3		

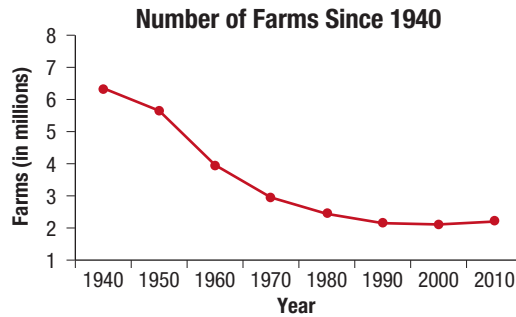
Source: Congressional Medal of Honor Society

## Applications

Solve.

21. Suppose that you are to take four hourly exams and a final exam in your chemistry class. Each exam has a maximum of 100 points and you must average between 75 and 82 points to receive a passing grade of C. If you have scores of 83, 65, 70, and 78 on the hourly exams, what is the minimum score you can make on the final exam and receive a grade of C? (First, explain your strategy in solving this problem. Then, solve the problem.)
22. Suppose that the instructor in the class in Exercise 21 has informed the class that the lowest of your hourly exam scores will be replaced by your score on the final exam, provided that your final exam score is higher. (That is, the final exam score may be counted twice.) Now, what is the minimum score that you can make on the final exam and still receive a grade of C? (First, explain your strategy in solving this problem. Then, solve the problem.)

23. The number of farms in the United States is decreasing. The following graph shows the number of farms (in millions) for each decade since 1940. As you can tell from the graph, the number of farms seems to be leveling off somewhat.



<b>1940:</b> 6.35	<b>1950:</b> 5.65
<b>1960:</b> 3.96	<b>1970:</b> 2.95
<b>1980:</b> 2.44	<b>1990:</b> 2.15
<b>2000:</b> 2.11	<b>2010:</b> 2.2

- a. Find the mean number of farms from 1940 to 2010.
- b. Find the mean number of farms from 1980 to 2010.
24. Financial institutions sometimes fail, as they did during the Great Recession in the US (which lasted from December 2007 through June 2009). The effects of this recession were felt for several years, as indicated by the number of bank failures from 2007 through 2016 (as reported by the Federal Deposit Insurance Company). Find the **a.** mean, **b.** median, **c.** mode, and **d.** range over these ten years.

<b>2007:</b> 3	<b>2008:</b> 25	<b>2009:</b> 140	<b>2010:</b> 157
<b>2011:</b> 92	<b>2012:</b> 51	<b>2013:</b> 24	<b>2014:</b> 18
<b>2015:</b> 8	<b>2016:</b> 5		

25. The armed forces of countries are measured in several ways: active troops, reserve troops, tanks, navy (carriers, cruisers, frigates, destroyers, submarines), and combat aircraft. In 2017, the following countries had active troops in the following numbers according to the International Institute for Strategic Studies.

Afghanistan:	171,200
Egypt:	438,500
China:	2,183,000
France:	202,950
United States:	1,347,300
Chile:	64,750

- a. What was the mean number of active troops for these countries? Round your answer to the nearest tenth.
- b. What was the median number of active troops for these countries?

26. Each state pays its governor a salary. During 2020, the governors' salaries from ten states were as follows. Find **a.** the mean, **b.** median, **c.** mode, and **d.** range for these ten salaries.

Pennsylvania	\$201,729
Georgia	\$175,000
Vermont	\$184,100
New York	\$225,000
California	\$209,747
Illinois	\$181,670
Tennessee	\$198,780
Massachusetts	\$185,000
New Jersey	\$175,000
Washington	\$182,179

## Writing & Thinking

27. State how to determine the median of a set of data.
28. Determine whether or not the mean and median represent the same number. Give examples to justify your answer.
29. Give three different and specific examples where some statistical measure is used (outside of a class).
30. Your grade point average (GPA) is a form of a **weighted average**. That is, 4 units of A counts more than 4 units of B. The most common weight for grades is A, 4 points; B, 3 points; C, 2 points; D, 1 point; and F, 0 points. To find a GPA,
1. Multiply the points for each grade by the number of units for the course.
  2. Find the sum of these products.
  3. Divide this sum by the total number of units taken.

Find the GPA (to the nearest tenth) for each of the following situations:

- a. 3 units of A in astronomy, 4 units of B in geometry, 3 units of C in sociology, and 4 units of A in biology.
- b. 5 units of B in history, 4 units of C in calculus, 3 units of A in computer science, and 4 units of D in geology.
- c. Your own GPA for the last semester (or your anticipated GPA for this semester).

## Collaborative Learning

31. With the class separated into teams of 2 to 4 students, each team is to go on campus and survey 50 students and ask each student how many minutes it takes him or her to drive to school from home.
- a. Each team is to find the mean, median, mode, and range for the 50 responses.
  - b. Each team is to bring all the data to class, and the class is to pool the information and find the mean, median, mode, and range for the pooled data.
  - c. The class is to discuss the results of the individual teams and the pooled data and what use such information might have for the administration of the college.