

7.1 Averages, Medians, and Modes

- OBJECTIVES**
- a Find the average of a set of numbers and solve applied problems involving averages.
 - b Find the median of a set of numbers and solve applied problems involving medians.
 - c Find the mode of a set of numbers and solve applied problems involving modes.
 - d Compare two sets of data using their means.

Average

To find the **average** of a set of numbers, add the numbers and then divide by the number of items of data.

In most colleges, students are assigned grade point values for grades awarded. The grade point average, is the average of the grade point values for each credit hour taken. At most colleges, grade values are assigned as follows:

A: 4.0 B: 3.0 C: 2.0 D: 1.0 F: 0.0

EXAMPLE B Grade Point Averages (GPAs)

Some classes carry more weight than others. His A in math could count as 4-A's. Rather than list them all out, we will multiply and then add before dividing.

Course	Grade	Number of Credit Hours
Mathematics	A	4
History	B	4
English	C	3
Spanish	B	3
Biology	C	4

a Find the average of a set of numbers and solve applied problems involving averages.

EXAMPLE A Bowling Average

Roberto bowled a 175, 210 and 162. Find his bowling average.



Solution

To find the mean we add the scores together and then divide by the number of scores, 3:

$$\frac{175 + 210 + 162}{3} = \frac{547}{3} = 182.33$$

Roberto's bowling average is 182.

EXAMPLE B Grade Point Averages (GPAs)

Cameron earned the following grades for one semester. What was his grade point average?

Course	Grade	Number of Credit Hours
Mathematics	A	4
History	B	4
English	C	3
Spanish	B	3
Biology	C	4

EXAMPLE B Grade Point Averages (GPAs)

- Mathematics $4.0 \cdot 4 = 16$
- History $3.0 \cdot 4 = 12$
- English $2.0 \cdot 3 = 6$
- Spanish $3.0 \cdot 3 = 9$
- Biology $2.0 \cdot 4 = 8$

Multiplying grade point values by the number of credits for each course

51 Total

EXAMPLE B Grade Point Averages (GPAs)

The total number of credit hours taken is:

$$4 + 4 + 3 + 3 + 4 = 18$$

We divide 51 by 18.

$$\text{GPA} = \frac{51}{18} = 2.833$$

Cameron's grade point average was 2.833.

EXAMPLE C Grading

To earn an A in math, Johanna must have a mean test score of at least 90. On the first four tests, her scores were 92, 88, 95, and 81. What is the lowest score Johanna can get on the last test and still get a A?

EXAMPLE C Grading

Solution

We can find the total of five scores needed as follows:

$$90 + 90 + 90 + 90 + 90 = 450.$$

The total of the scores on the first four tests is

$$92 + 88 + 95 + 81 = 357.$$

Thus Johanna needs to get at least $450 - 356$, or **94**, to get an A.

EXAMPLE C Grading

Check:

$$\frac{92 + 88 + 95 + 81 + 94}{5} = \frac{450}{5}, \text{ or } 90.$$

b Find the median of a set of numbers and solve applied problems involving medians.

Another type of center-point statistic is the *median*. Medians are useful when we wish to de-emphasize unusually extreme scores.

The middle number of a set of data is called the median.

EXAMPLE D Median

What is the median of this set of numbers?

89, 860, 81, 88, 116, 95, 103

Solution

Arrange the numbers in order from smallest to largest. Then locate the middle number.

81, 88, 89, 95, 103, 116, 860

↑
Middle number

The median is 95.

Median

Once a set of data is listed in order, from smallest to largest, the **median** is the middle number if there is an odd number of values. If there is an even number of values, the median is the number that is the average of the two middle numbers.

EXAMPLE E Median Salaries

The salaries of six administrators at a large company are as follows:

\$72,000, \$112,000, \$68,000, \$91,000, \$71,000, \$81,000

What is the median salary of the administrators?

EXAMPLE E Median Salaries

Median

$$\frac{\$72,000 + \$81,000}{2} = \frac{\$153,000}{2} = \$76,500$$

The median salary is \$76,500.

EXAMPLE E Median Salaries

Solution

Arrange the numbers in order smallest to largest

68,000 71,000 72,000 81,000 91,000 112,000

The two middle numbers are 72,000 and 81,000

Mode

The **mode** of a set of data is the number or numbers that occur most often. If each number occurs the same number of times, there is no mode.

EXAMPLE G Mode

Find the mode or modes of these data:

- 8, 12, 15, 27, 31, 42
- 44, 55, 55, 55, 62, 65, 67, 67, 67, 72, 73, 75

Solution

- 8, 12, 15, 27, 31, 42 There is no mode.
- 44, 55, 55, 55, 62, 65, 67, 67, 67, 72, 73, 75

The modes are 55 and 67.

44, 55, 55, 55, 62, 65, 67, 67, 67, 72, 73, 75

d Compare two sets of data using their means.

Sometimes there is a need to make comparisons between two sets of data. Most often the *mean* is used.

d Compare two sets of data using their means.

EXAMPLE H Poultry Weights

Catherine wishes to see which of two kinds of roasters (chickens) is better (the heavier the bird the better). She grows both kinds of birds under similar conditions and measures weights after 7 weeks. Which kind is better?

Cornish Rock Cross			Super Roasters		
6.4	6.5	6.8	6.5	6.6	6.9
6.8	6.4	6.5	7.2	7.5	7.8
6.7	7.1	7.2	6.8	7.2	7.1
6.2	6.3	6.8	6.3	6.4	6.9

EXAMPLE H Poultry Weights

Cornish Rock Cross			Super Roasters		
6.4	6.5	6.8	6.5	6.6	6.9
6.8	6.4	6.5	7.2	7.5	7.8
6.7	7.1	7.2	6.8	7.2	7.1
6.2	6.3	6.8	6.3	6.4	6.9

6.642

6.933

The mean weight of the Super Roasters is higher than that of the Cornish Cross. Based on weight, the Super Roasters are a better bird.

EXAMPLE F Mode

Find the mode of these data.

23, 24, 27, 27, 18, 29

Solution

The number that occurs most often is **27**.

A set of data has just one mean and just one median, but it can have more than one mode. It may also have no mode—when all the numbers are equally represented.

EXAMPLE H Poultry Weights

Compute the mean of each group.

Cornish Rock Cross			Super Roasters		
6.4	6.5	6.8	6.5	6.6	6.9
6.8	6.4	6.5	7.2	7.5	7.8
6.7	7.1	7.2	6.8	7.2	7.1
6.2	6.3	6.8	6.3	6.4	6.9

Cornish: Mean

$$= \frac{6.4 + 6.5 + 6.8 + 6.8 + 6.4 + 6.5 + 6.7 + 7.1 + 7.2 + 6.2 + 6.3 + 6.8}{12} = \frac{79.7}{12} = 6.642$$

Super: Mean

$$= \frac{6.5 + 6.6 + 6.9 + 7.2 + 7.5 + 7.8 + 6.8 + 7.2 + 7.1 + 6.3 + 6.4 + 6.9}{12} = \frac{83.2}{12} = 6.933$$

7.2

Tables and Pictographs

OBJECTIVES

- a Extract and interpret data from tables.
- b Extract and interpret data from pictographs.

a Extract and interpret data from tables.

A table is often used to present data in rows and columns.

EXAMPLE A Nutritional Data

The following table lists the nutrition information for five breakfast cereals.

Cereal	Fiber	Salt	Sugar	Saturated Fat
Golden Grahams	3g to 6 g	1.25 g	10 g	less than 5 g
Crispix	< 3g	1.25 g	10 g	less than 5 g
Shredded wheat	6 g or more	0.25 g	0.25 g	less than 5 g
Weetabix	6 g or more	< 1.25 g	< 10 g	less than 5g
Honey Nut Cheerios	3 g to 6 g	1.25 g	10 g	less than 5 g

EXAMPLE A Nutritional Data

Which cereal has the greatest amount of fiber?

Cereal	Fiber	Salt	Sugar	Saturated Fat
Golden Grahams	3g to 6 g	1.25 g	10 g	less than 5 g
Crispix	< 3g	1.25 g	10 g	less than 5 g
Shredded wheat	6 g or more	0.25 g	0.25 g	less than 5 g
Weetabix	6 g or more	< 1.25 g	< 10 g	less than 5g
Honey Nut Cheerios	3 g to 6 g	1.25 g	10 g	less than 5 g

EXAMPLE A Nutritional Data

Which cereal has the least amount of salt?

Cereal	Fiber	Salt	Sugar	Saturated Fat
Golden Grahams	3g to 6 g	1.25 g	10 g	less than 5 g
Crispix	< 3g	1.25 g	10 g	less than 5 g
Shredded wheat	6 g or more	0.25 g	0.25 g	less than 5 g
Weetabix	6 g or more	< 1.25 g	< 10 g	less than 5g
Honey Nut Cheerios	3 g to 6 g	1.25 g	10 g	less than 5 g

b Extract and interpret data from pictographs.

A pictograph uses symbols to represent amounts. In addition, a key is given telling what each symbol represents.

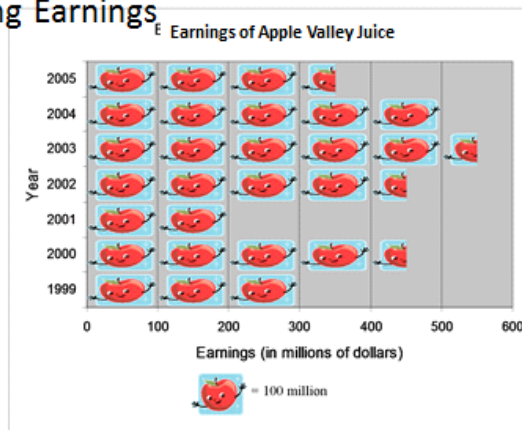
EXAMPLE B Estimating Earnings

Determine the approximate earnings of Apple Valley in 1999.

3 symbols

3 · 100 million

\$300 million



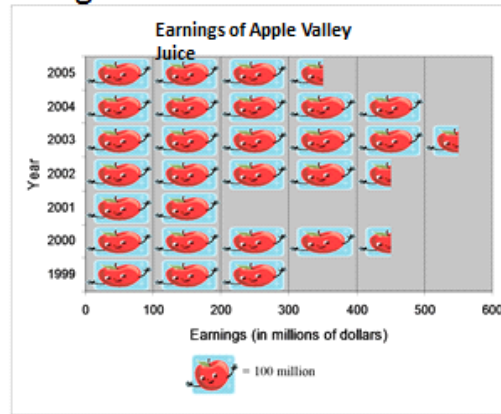
EXAMPLE B Estimating Earnings

In what year did earnings first go above \$400 million?

$$400 \div 100$$

4 symbols

Look for the first year in which there are more than 4 symbols. **2000**



7.3

Bar Charts and Line Graphs

OBJECTIVES

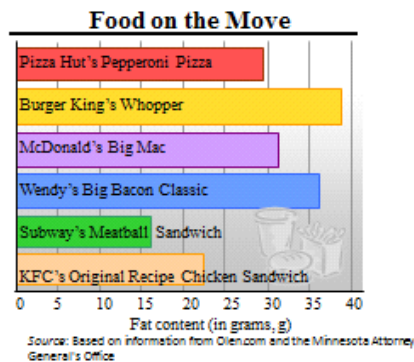
- a Extract and interpret data from bar graphs.
- b Draw bar graphs.
- c Extract and interpret data from line graphs.
- d Draw line graphs.

a Extract and interpret data from bar graphs.

EXAMPLE A Nutrition Facts

Which item contains the most fat?

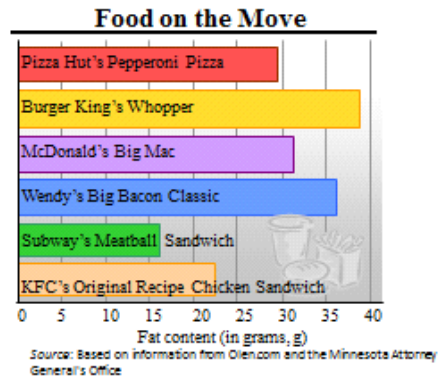
Burger King's Whopper



EXAMPLE A Nutrition Facts

Which item contains about 23 grams of fat?

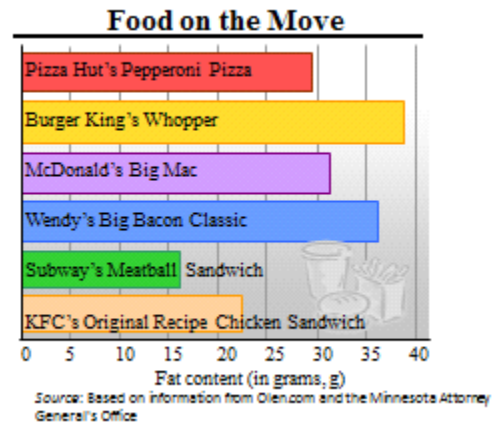
KFC's Chicken Sandwich



EXAMPLE A Nutrition Facts

How much fat does a Subway Meatball Sandwich have?

About 16 grams



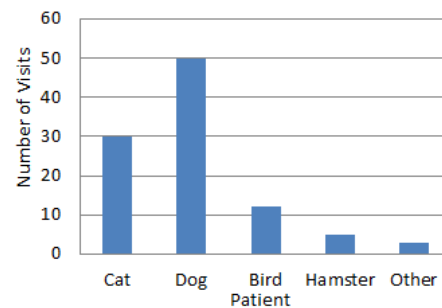
b Draw bar graphs.

EXAMPLE B Veterinary Visits

Make a bar graph to show the number of patients in the past week of a veterinary clinic.

Patients	Visits
Cats	30
Dogs	50
Birds	12
Hamsters	5
Other	3

EXAMPLE B Veterinary Visits



Cats	30
Dogs	50
Birds	12
Hamsters	5
Other	3

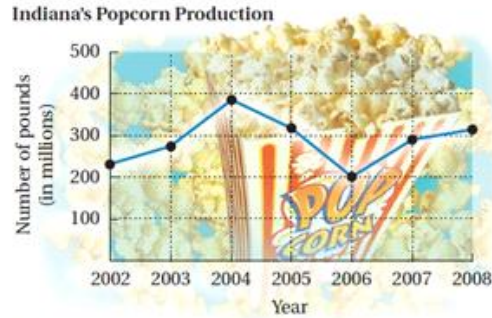
c Extract and interpret data from line graphs.

Line graphs are often used to show a change over time as well as to indicate patterns or trends.

EXAMPLE C Popcorn Production

In what year was the popcorn production the highest?

2004

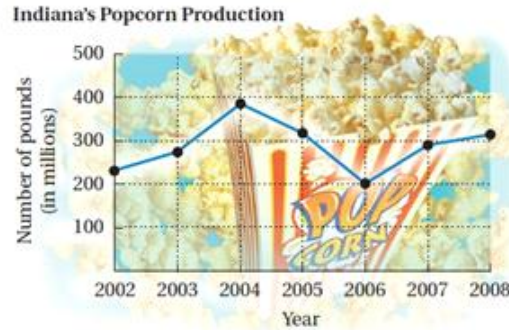


SOURCE: *The Hoosier Farmer*, Spring 2008; Indiana Corn Growers Association

EXAMPLE C Popcorn Production

What was the production in 2006?

200 million pounds



SOURCE: *The Hoosier Farmer*, Spring 2008; Indiana Corn Growers Association

d Draw line graphs.

EXAMPLE D Draw a Line Graph

Listed to the right is the year end closing stock price for Microsoft. Make a line graph of the data.

Year	Closing Price
1995	\$5.48
1996	\$10.33
1997	\$17.16
1998	\$34.67
199	\$58.35
2000	\$21.69
2001	\$33.13
2002	\$25.85
2003	\$27.37
2004	\$27.72

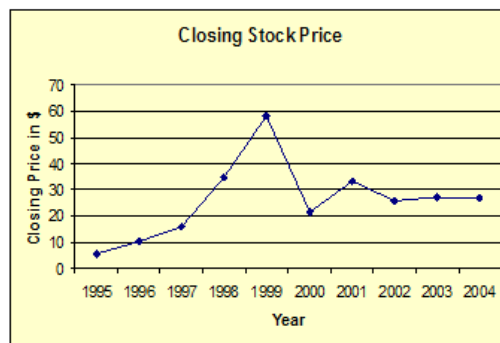
EXAMPLE D Draw a Line Graph

First, we indicate the different years on the horizontal scale and give the horizontal scale the title "Year."

Next, we scale the vertical axis by 10's to show the year end closing price.

Mark the closing price at the appropriate level above each year. Then draw the line segments connecting the points.

EXAMPLE D Draw a Line Graph



7.4

Circle Graphs

OBJECTIVES

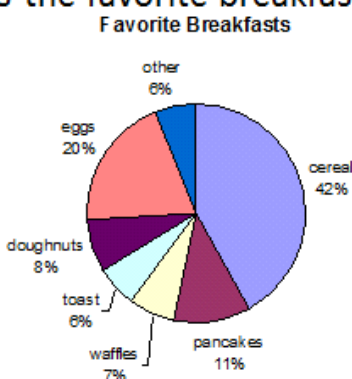
- a Extract and interpret data from circle graphs.
- b Draw circle graphs.

a Extract and interpret data from circle graphs.

EXAMPLE A Breakfast Food Preferences

The following circle graph shows the favorite breakfast foods for students.

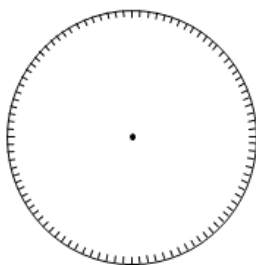
- a. What is the most popular item? **cereal**
- b. What percent of the students favorite breakfast food is eggs and pancakes? $20 + 11 = 31\%$



b Draw circle graphs.

To draw a circle graph, or pie chart, think of a pie cut into 100 equally sized pieces. We would shade the appropriate size wedge for each item.

Start with a circle marked in 100 equally spaced tick marks.



EXAMPLE B Vacation Preferences

The results of a survey showing the percents of where people would most like to visit are given in the list to the right.

Use this information to draw a circle graph.

Yellowstone	12%
Hawaii	58%
Grand Canyon	15%
Golden Gate Bridge	8%
Boston	4%
Disney World	3%

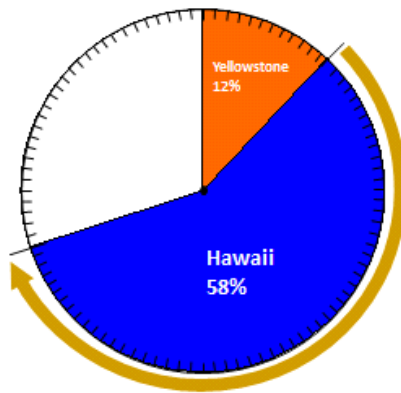
EXAMPLE B Vacation Preferences

We start with the 12% given for Yellowstone. We draw a line from the center to any tick mark. Then we count off 12 ticks and draw another line. We shade the wedge with the color and label the wedge as shown.



EXAMPLE B Vacation Preferences

To shade a wedge for Hawaii, at 58%, we start at one side of the Yellowstone wedge, count off 58 ticks, and draw another line. We shade the wedge with a different color and label the wedge.



EXAMPLE B Vacation Preferences

We continue in this manner and choosing different colors, we obtain the graph shown here. Finally, we give the graph the overall title "Vacation Destinations"

