Misleading Statistics

You made conclusions based on graphs of data. You’ll recognize how statistics can be misleading. So you can interpret a graph of storms, as in Exs. 7–9.

Activity

You can use graphs to influence the way people interpret data.

The table at the right shows the results of a survey asking 100 students their favorite drink.

<table>
<thead>
<tr>
<th>Drink</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>25</td>
</tr>
<tr>
<td>Juice</td>
<td>21</td>
</tr>
<tr>
<td>Soda</td>
<td>31</td>
</tr>
<tr>
<td>Water</td>
<td>23</td>
</tr>
</tbody>
</table>

1. Draw a bar graph of the data with a scale from 0 to 35 in increments of 5.
2. Draw a bar graph of the data with a scale from 0 to 50 in increments of 10.
3. Which graph is more likely to persuade someone that students drink too much soda? Explain your choice.

Misleading Graphs

How someone draws a graph can affect how the information is interpreted. Bar and line graphs could be misleading if the scale appears to distort the data in some way.

Example 1: Potentially Misleading Graphs

Movies

The bar graph shows the number of admissions to movie theaters in the United States in 3 different years. Without using the scale, compare admissions in 1990 and 2000. Then compare the admissions using the scale.

Solution

Admissions in 1990 appear to have been about half the number in 2000, because the 1990 bar is half as high as the 2000 bar.

Admissions in 1990 were actually about 86% of admissions in 2000, because \(1.2 \div 1.4 = 86\%\). The break in the scale distorts the relative heights of the bars.
EXAMPLE 2 Misleading Averages

Cameras A store owner says that the average price of a digital camera at the store is $65. The prices of the 10 digital cameras sold at the store are:

$65, $65, $80, $90, $95, $100, $112, $120, $168, and $215.

Does $65 describe the prices well? Why might a store owner use this number?

Solution

The mode, $65, does not describe the data well because it is less than most of the prices. A store owner might use $65 as the average price to convince people that the store sells very inexpensive digital cameras.

Misleading Averages An average can be represented by the mean, the median, or the mode. You may get a misleading impression of a data set if the average that is used does not represent the data well.

Your turn now

Solve the problem below.

1. Tell which line graph makes the average price of a movie ticket in the United States appear to increase more dramatically. Explain.

Your turn now

The numbers of monthly book donations to a library are listed below. Use these data in Exercises 2 and 3.

23, 28, 36, 45, 25, 31, 39, 47, 28, 32, 40, 226

2. Does 50 describe the numbers of donations well? Why or why not?

3. Why might a library use 50 as the average number of donated books?
Getting Ready to Practice

1. **Vocabulary** Describe how the scale affects a graph’s appearance.

**Jumping** The bar graph shows various long jump records.

2. Without looking at the scale, about how many times greater does the record for kangaroos appear to be than the record for humans? for frogs?

3. Using the scale, is the record for kangaroos less than or greater than two times the record for humans? for frogs?

4. **Guided Problem Solving** Jill says that her average score on a game is 500. Do the scores below support this? Why would Jill say this?

   350, 305, 300, 200, 500, 325, 375, 225, 275, 500

   1. Find the mean, median, and mode(s) of the scores.
   2. Does 500 describe Jill’s scores well? Why or why not?
   3. Why would Jill use 500 as her average score?

Practice and Problem Solving

5. **Dogs** Which line graph would a dog walker use to persuade you to get your dog walked for 60 minutes? Explain.

   A.

   ![Cost of Walking Dogs Graph](image1)

   B.

   ![Cost of Walking Dogs Graph](image2)

6. **Skateboarding** A reporter says that the average age of the athletes in a skateboarding competition is 18 years. All the ages are listed below. Why do you think this average was used? Is there a better one?

   15, 17, 29, 17, 15, 16, 15, 20
Storms  The bar graph shows how many hurricanes and tropical storms started in various months from 1995 to 2001 in the Eastern Pacific.

7. Without looking at the scale or the data values, about how many times more storms appeared to start from July to September than from April to June?

8. Using the data values, about how many times more storms actually started from July to September than from April to June?

9. Would a travel agent use the data values or the bars on the graph to convince someone not to travel to the Eastern Pacific in the summer?

Baseball  The numbers of games won by a baseball team in 10 seasons are listed below.

82, 94, 97, 88, 88, 71, 69, 55, 59, 72

10. A sports report states that the average number of wins by the team is 88. Does 88 describe the numbers of wins well? Why or why not?

11. Why might a report use 88 as the average number of wins?

Electives  The circle graph shows the results of a survey asking students their favorite elective.

12. Without looking at the percents, which elective appears to have the most responses? Explain.

13. Draw a circle graph that more accurately shows the actual percent for each elective.

Houses  The list below shows the prices of several houses in a region.

$115,000, $115,000, $130,000, $140,000, $145,000, $150,000, $152,000, $190,000, $198,000, $215,000

14. A real estate agent says that the average cost of a home in the region is $115,000. Does $115,000 describe the prices well? Why or why not?

15. Why might a real estate agent use $115,000 as the average price?

16. Which average provides you with the information you would most want to know when buying a house? Why?
17. Bears  The table shows the number of grizzly bears that were born in Yellowstone from 1992 to 1998. Draw a bar graph that makes the number of newborns in 1998 appear to be twice the number in 1992.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborns</td>
<td>60</td>
<td>41</td>
<td>47</td>
<td>37</td>
<td>72</td>
<td>62</td>
<td>70</td>
</tr>
</tbody>
</table>

**Challenge**  The graph below shows the numbers, in millions, of CD shipments in the United States in 1998 and 1999.

18. About how many times greater in area is the picture for 1999 than the picture for 1998? Explain how this may distort the data.

19. Was the actual number of shipments in 1999 less than or greater than twice the number of shipments in 1998?

**Mixed Review**

20. Write 6 more than a number as a variable expression. (Lesson 12.1)

21. You toss a coin twice. Find the probability that you get heads at least one time. (Lesson 13.3)

**Basic Skills**  Find the range of the data.

22. 14, 16, 11, 10, 13, 15, 21, 18

23. 532, 416, 501, 543, 580, 499

**Test-Taking Practice**

24. Short Response  The bar graph shows the heights of two buildings. Without looking at the scale, tell how many times taller Building B appears than Building A. Does your answer represent the actual relationship? Explain.

25. Multiple Choice  The list below shows the number of cars at a car wash each day last week. You want it to seem as successful as possible. Which value would you use as the average number of cars washed per day?

73, 80, 106, 73, 73, 85, 98

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