

8. You have a list of the average gasoline price for each month during the past year. Which type of display would be most appropriate for these data?
- a. a bar graph b. a pie chart c. a line chart
9. A histogram is
- a. a graph that shows how some quantity has changed through history.
- b. a graph that shows cumulative frequencies.
- c. a bar chart for quantitative data.
10. You have a histogram and you want to convert it into a line chart. A good first step would be to
- a. make a list of all the categories in alphabetical order.
- b. place a dot at the top of each bar, in the center of the bar.
- c. calculate all the relative frequencies that you can read from the histogram.

Exercises 5C

REVIEW QUESTIONS

- What is a frequency table? Explain what we mean by the categories and frequencies. What do we mean by relative frequency? What do we mean by cumulative frequency?
- What is the distinction between qualitative data and quantitative data? Give a few examples of each.
- What is the purpose of binning? Give an example in which binning is useful.
- What two types of graphs are most common when the categories are qualitative data? Describe the construction of each.
- Describe the importance of labeling on a graph, and briefly discuss the kinds of labels that should be included on graphs.
- What two types of graphs are most common when the categories are quantitative data? Describe the construction of each.

DOES IT MAKE SENSE?

Decide whether each of the following statements makes sense (or is clearly true) or does not make sense (or is clearly false). Explain your reasoning.

- I made a frequency table with two columns, one labeled *State* and one labeled *State Capitol*.
- The relative frequency of B grades in our class was 0.3.
- Your bar graph must be wrong, because your bars are wider than the ones shown on the teacher's answer key.
- Your bar graph must be wrong, because it shows different frequencies than the ones shown on the teacher's answer key.
- Your pie chart must be wrong, because you have the 45% frequency wedge near the upper left and the answer key shows it near the lower right.
- Your pie chart must be wrong, because when I added the percentages on your wedges, they totaled 124%.
- I was unable to make a bar chart, because the data categories were qualitative rather than quantitative.
- I rearranged the bars on my histogram so that the tallest bar would come first.

BASIC SKILLS & CONCEPTS

15–16: **Frequency Tables.** Make frequency tables for the following data sets. Include columns for relative frequency and cumulative frequency.

15. Final grades of 20 students in a math class:

A A B B B B B C C C C C C C C D D D F F

16. A Web site that reviews recent movies lists 5 five-star films (the highest rating), 10 four-star films, 20 three-star films, 15 two-star films, and 5 one-star films.

17–24: **Qualitative vs. Quantitative.** Determine whether the following variables are qualitative or quantitative.

- The birth months of individuals
- The responses on a questionnaire: 0 = strongly disagree, . . . , 5 = strongly agree
- The yes/no responses on a ballot initiative to the question "Do you support an increase in the sales tax?"
- The amount of rainfall in each month of a year in Chattanooga, Tennessee
- The flavors of ice cream sold in a shop
- The breeds of 120 purebred dogs
- The annual salaries of major league baseball players
- The gold medal count of each team in the 2010 Olympics

25–26: **Binned Frequency Tables.** Use the given bin sizes to make a frequency table for the following data set:

89 67 78 75 64 70 83 95 69 84
77 88 98 90 92 68 86 79 60 96

Include columns for relative frequency and cumulative frequency.

- Use 5-point bins (95 to 99, 90 to 94, etc.).
- Use 10-point bins (90 to 99, 80 to 89, etc.).
- Largest States.** Make a bar graph of the populations of the five most populous states (shown on the next page for 2008), with the bars in descending order.

State	Population
California	36.6 million
Texas	23.9 million
New York	19.3 million
Florida	18.3 million
Illinois	12.9 million

28. **Meat Producers.** Make a bar graph of beef production of the five largest beef-producing nations in the world (data below), with the bars in descending order.

Country	Amount of Beef (millions of metric tons)
U.S.	12.0
Brazil	7.9
China	7.6
Argentina	2.8
India	2.8

29–30: **Pie Charts.** Construct pie charts for the following data sets. The first step is to compute a percentage for each category in the data set.

29. The annual sales (in millions of dollars) of the leading chocolate brands are shown in the table.

Company	Sales (\$ millions)
M&Ms	253
Hershey's	186
Hershey's Kisses	114
Dove	112
All others	1377

30. The five leading tourist destinations (in millions of visitors) are shown in the table.

Country	Visitors (millions)
France	81.9
Spain	59.2
U.S.	56.0
China	54.7
Italy	43.7

31. **Government Income.** The pie chart in Figure 4.12 on p. 284 shows the makeup of federal government receipts. Make a bar graph for these data.

32. **Government Spending.** The pie chart in Figure 4.13 on p. 284 shows the makeup of federal government spending. Make a bar graph for these data.

33. **Oscar-Winning Actors.** The following data show ages of Academy Award-winning actors from 1985 to 2008. Make a frequency table for these data using bins of 20–29, 30–39, and so on. Then draw a histogram to display the binned data.

36 62 43 51 32 42 54 52 37 38 32 45
60 46 40 36 47 29 43 37 38 45 50 48

34. **Oscar Winners.** In words, contrast the graphs in Example 7 (for actresses) with the one you drew in Exercise 33. Do actors appear to be more likely to win Oscars when they are younger, older, or neither? Do you think these graphs indicate any difference in how movie makers treat male and female performers? Defend your opinion.

35. **Homicide Rates.** Study Figure 5.10. Write one to two paragraphs summarizing how the homicide rate has changed with time since 1960.

36. **Death Rates.** Figure 5.13 shows overall death rates in the United States during the 20th century. Note that the spike in 1919 was due to a worldwide epidemic of influenza. Write a few sentences summarizing the overall trend, describing how much the death rate changed during the century, and putting the 1919 spike into context in terms of its impact on the population.

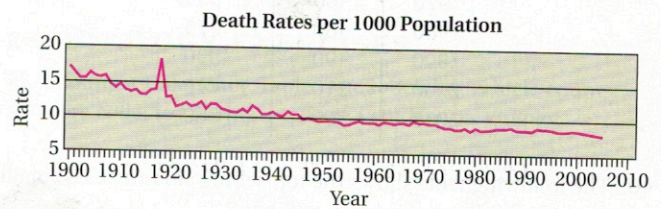


FIGURE 5.13 Source: National Center for Health Statistics.

FURTHER APPLICATIONS

37–45: **Statistical Graphs.** Consider the following data sets.

a. State whether the variables are qualitative or quantitative.

b. Draw a bar graph or a pie chart if the data are qualitative. Draw a histogram or a line chart if the data are quantitative.

c. Write a paragraph discussing interesting features of the data revealed by your display.

37. The following frequency table categorizes Nobel Prize winners in literature from 1990 through 2005 by their age at the time they received the award.

Age	Number of Winners
<58	1
58–59	2
60–61	1
62–63	3
64–65	0
66–67	1
68–69	3
70–71	1
72–73	2
74–75	2
76–77	2
>77	1

38. The following table shows the amount spent, in billions of dollars, by the leading U.S. advertisers in 2007.

Advertiser	Spending (\$ billions)
Procter and Gamble	5.2
AT&T	3.2
Verizon	3.0
General Motors	3.0
Time Warner	3.0
Ford Motor Company	2.5

39. The following table shows the number of bachelor's degrees (in thousands) conferred on men and women in U.S. colleges and universities over the past 50 years.

Year	Men	Women
1960	260	140
1970	460	335
1980	480	475
1990	490	530
2000	510	710
2010	590	860

40. The following table shows the top-selling albums (CDs) of all time, with estimated sales in millions.

Title, Artist	Sales (millions)
Greatest Hits, Eagles	29.0
Thriller, Michael Jackson	27.0
Led Zeppelin IV, Led Zeppelin	23.0
The Wall, Pink Floyd	23.0
Back in Black, AC/DC	22.0
Greatest Hits, Billy Joel	21.0
Double Live, Garth Brooks	21.0

41. The following table shows the number of daily newspapers (morning and evening) in the United States between 1950 and 2007.

Year	Number of Newspapers
1950	1772
1960	1763
1970	1748
1980	1745
1990	1611
2000	1480
2007	1422

42. The following table gives the percentages of total energy produced in the United States from various sources.

Energy Source	Percentage of Total Energy
Coal	32.2%
Natural gas	31.0%
Crude oil	16.4%
Nuclear power	11.7%
Renewable	8.7%

Source: U.S. Department of Energy.

43. The following table gives the stated religions of first-year college students. (Note: The "other religions" category consists of religions that were stated by less than 1% of the students in the sample.)

Religion	Percent of Sample
Baptist	11.6
Catholic	30.5
Episcopal	1.7
Jewish	2.8
Lutheran	5.8
Methodist	6.4
Mormon	1.5
Presbyterian	4.0
United Church of Christ	1.5
Other religions	19.3
No religion	14.9

Source: UCLA Higher Education Research Institute.

44. The following table gives the rates of violent crimes (rape, robbery, assault, theft) by age of victim. Rates have units of crimes per 1000 people aged 12 or older.

Age Group	Crime Rate
12-15	51.6
16-19	53.0
20-24	43.3
25-34	26.4
35-49	18.5
50-64	10.3
>65	2.0

Source: Bureau of Justice Statistics.

45. The following table gives average family size in the United States since 1940.

Year	Family Size	Year	Family Size
1940	3.76	1980	3.29
1950	3.54	1985	3.23
1960	3.67	1990	3.17
1965	3.70	1995	3.19
1970	3.58	2000	3.17
1975	3.42	2007	3.19

Source: U.S. Bureau of Census.

46. **Alcohol-Related Motor Vehicle Fatalities.** Figure 5.14 shows the number of motor vehicle fatalities in the United States in which alcohol was involved for each year from 1982 to 2007.

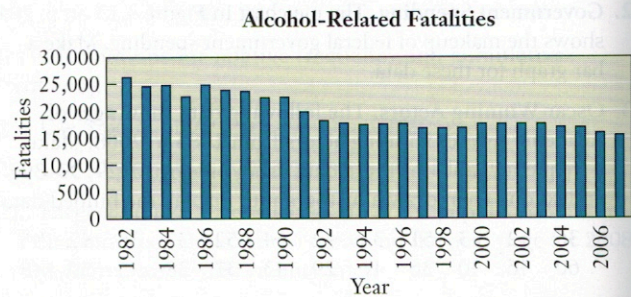


FIGURE 5.14 Source: National Highway Traffic Safety Administration.

- a. How many alcohol-related fatalities were there in 1982? in 2007? Comment on the overall trend over this period.
- b. What is the percent change in alcohol-related fatalities over this period?
- c. The total numbers of automobile fatalities in 1982 and 2007 were 43,945 and 41,059, respectively. What percentage of all fatalities in these two years involved alcohol?
- d. In view of your answer to part c, can you offer explanations for the trend in these data? Explain.
47. **Ages of Presidents.** The following table gives the order of the presidents of the United States and the ages at which they first took office.
- Find a creative way to display these data.
 - Which presidents could have said that they were the *youngest* president (or the same age in years as the youngest) at the time they took office?
 - Which presidents could have said that they were the *oldest* president (or the same age in years as the oldest) at the time they took office?
 - Write a paragraph describing significant features of the data.

Order	1	2	3	4	5	6	7	8	9	10	11
Age	57	61	57	57	58	57	61	54	68	51	49
Order	12	13	14	15	16	17	18	19	20	21	22
Age	64	50	48	65	52	56	46	54	49	50	47
Order	23	24	25	26	27	28	29	30	31	32	33
Age	55	55	54	42	51	56	55	51	54	51	60
Order	34	35	36	37	38	39	40	41	42	43	44
Age	62	43	55	56	61	52	69	64	46	54	47

WEB PROJECTS

48. **CO₂ Emissions.** Look for updated data on international carbon dioxide emissions at the Web site for the *International Energy Annual*, published by the U.S. Energy Information Administration (EIA). Create an updated or expanded version of Figure 5.5. Discuss any new features of your updated graphs.
49. **Energy Table.** Explore some of the many energy tables at the U.S. Energy Information Administration (EIA) Web site. Choose a table that you find interesting, and make a graph of its data. You may choose any of the graph types discussed in this section. Explain how you made your graph, and briefly discuss what can be learned from it.
50. **Statistical Abstract.** Go to the Web site for the *Statistical Abstract of the United States*. Explore the selection of “frequently requested tables.” Choose one table of interest to you, and make a graph of its data. You may choose any of the graph types discussed in this section. Explain how you made your graph, and briefly discuss what can be learned from it.

IN YOUR WORLD

51. **Frequency Tables.** Find a recent news article that includes some type of frequency table. Briefly describe the table and how it adds to the news report. Do you think the table was constructed in the best possible way for the article? If so, why? If not, what would you have done differently?

52. **Bar Graph.** Find a recent news article that includes a bar graph with qualitative data categories. Briefly explain what the graph shows, and discuss whether it helps make the point of the news article.
53. **Pie Chart.** Find a recent news article that includes a pie chart. Briefly discuss the effectiveness of the pie chart. For example, would it be better if the data were displayed in a bar graph rather than a pie chart? Could the pie chart be improved in other ways?
54. **Histogram.** Find a recent news article that includes a histogram. Briefly explain what the histogram shows, and discuss whether it helps make the point of the news article. Are the labels clear? Is the histogram a time-series diagram? Explain.
55. **Line Chart.** Find a recent news article that includes a line chart. Briefly explain what the line chart shows, and discuss whether it helps make the point of the news article. Are the labels clear? Is the line chart a time-series diagram? Explain.

TECHNOLOGY EXERCISES

56. **Making a Frequency Table.** The following vehicle counts were collected during a tour of a student parking lot.

Category of Car	Frequency
American cars	30
Japanese cars	25
English cars	5
Other European cars	12
Motorcycles	8

- Use Excel to make a frequency table for these data that includes both the relative frequencies and the cumulative frequencies.
 - What is the sum of the frequencies?
 - What is the sum of the relative frequencies?
 - What is the sum of the cumulative frequencies?
57. **Making a Bar Graph.** Use Excel to make a bar graph of the data in Exercise 56.
58. **Making a Pie Chart.** Use Excel to make a pie chart of the data in Exercise 56.
59. **Making a Line Chart.** Consider the following data on the production of tobacco in the United States between 2000 and 2007.

Year	Tobacco Produced (million lb)
2000	1053
2001	991
2002	871
2003	803
2004	882
2005	645
2006	727
2007	779

Make a line chart that displays these data.

60. **Making a Histogram.** Make a histogram for the data in Exercise 59.