2. Using the state standards for mathematics for the content area of data analysis and probability for your state, identify the middle school objectives that are found in Chapter 1. The following website may be useful: www.doe.state.in.us. This website will allow you to access the web pages of the state departments of education for the 50 states. From the state web pages you should be able to find the state’s mathematical standards.

3. A teacher is interested in the television viewing habits of sixth graders. She chooses a day and has her sixth grade class of 25 students record the amount of time they spend watching television on that particular day. She finds that her class watched an average of 3.15 hours of television that day.

a. Describe or identify each of the following:
   i. the population
   ii. the sample
   iii. the variable
   iv. the raw data
   v. a sample statistic
   vi. a population parameter

b. What sampling method did the teacher use? What are the advantages and disadvantages of this method?

c. What data type is the variable you identified?

4. Classify each of the variables below as categorical or quantitative. If the variable is categorical, decide whether it is nominal or ordinal. If the variable is quantitative, decide whether it is interval or ratio.

   a. Type of television show (comedy, drama, sports, etc.)
   b. Length of time watching television in a given day
   c. Olympic medal types (gold, silver, bronze)
   d. Temperature in degrees Fahrenheit
   e. Number of children in a family
   f. Area codes for long-distance calls
   g. Number of minutes spent grading homework papers on a particular night
   h. How much children like broccoli (really like, like, it's okay, don't like, really don't like)

5. Classify each of the quantitative variables below as discrete or continuous.

   a. Number of points scored in a basketball game
   b. Average number of points per game for a basketball player
   c. Number of eggs in a bird’s nest
   d. Weight of eggs in a bird’s nest
   e. Length of eggs in a bird’s nest
   f. Number of hurricanes in a given three-month period
   g. Scores on your most recent statistics quiz
   h. Length of time spent by students riding the bus to and from school
6. The table of contents for a book gives the page number for the start of each chapter.
   a. Suppose that Chapter 3 starts on page 30 and Chapter 4 starts on page 42. The difference in the page numbers is 12. Is this difference meaningful in this situation? If so, what does it mean?
   b. Suppose that Chapter 3 starts on page 30 and Chapter 5 starts on page 50. The quotient of these page numbers is $60/30 = 2$. Is this quotient meaningful in this situation? If so, what does it mean?
   c. Based on your answers to (a) and (b), what type of data (nominal, ordinal, interval, or ratio) would you consider the pages numbers in a table of contents to be?

7. Give an example of each of the following data types, if possible. If it is not possible to give an example of the specified data type, explain why.
   a. discrete
   b. nominal
   c. continuous
   d. ordinal
   e. ratio
   f. ratio, discrete
   g. ratio, continuous
   h. interval, discrete
   i. interval, continuous
   j. nominal, continuous
   k. nominal, discrete
   l. ordinal, discrete
   m. categorical
   n. quantitative

8. Identify the sampling technique used in each of the following situations. Explain why you chose that particular technique for the situation and discuss the advantages/disadvantages of the technique in each situation.
   a. Ms. Kidder assigns a different number to each of her 23 students. She then uses her calculator to randomly select five of those students to put up a new bulletin board display.
   b. Every sixth student in the cafeteria line is given a carrot stick with their lunch instead of a celery stick.
   c. The State Department of Agriculture decides to check on the average number of bushels per acre of corn being harvested in the state of Iowa. There are 99 counties in Iowa. They randomly select 10 of those counties and survey all of the farmers in those counties regarding the corn harvest.
   d. The Internal Review Service decides to audit every 500th income return that they receive in their office.
   e. Mr. Marshall polls his sixth period science class to determine whether more students like football or more like basketball.
f. New Mexico has 33 counties. Suppose those counties are classified by high income, middle income, or low income based on the average annual income of the residents of those counties. From each of those three classifications, two counties are selected at random to be polled on the effects of a proposed tax hike.

g. Parents attending a basketball game at the local high school are asked to complete a survey on the types of snacks they would like to see sold at the concession stand.
newspapers, and other media sources has increased tremendously. Consequently, the study of misleading graphs and how to avoid making graphs that might lead people to the wrong conclusion has also increased.

The key terms and ideas from Chapter 2 are listed below:

- frequency table 21
- frequency 21
- relative frequency 22
- percentage 23
- bar graph 23
- circle graph 23
- stem-and-leaf plot 23
- histogram 23
- line plot 23
- line graph 23
- class width 27
- lower class limit 27
- upper class limit 27
- class marks 27
- class boundaries 27
- back-to-back stem-and-leaf plot 31
- dot plot 33
- class frequency graph 33
- misleading graph 36

Assessment is an integral part of every curriculum from the elementary school all the way through college. The question always arises—what is it that students should be able to do after completing this lesson/unit/chapter? We have included here our intended learning goals for Chapter 2. Students who have a good grasp of the concepts developed in Chapter 2 should be successful in responding to these items:

- Explain or describe what is meant by each of the terms in the vocabulary list.
- Construct and interpret frequency and relative frequency tables for both categorical and numerical data.
- Construct, interpret, and compare bar graphs and circle graphs for categorical data.
- Construct, interpret, and compare histograms, stem-and-leaf plots, line plots, and line graphs for numerical data.
- Choose an appropriate graph for a given data set.
- Identify potentially misleading features of given graphs.

Your course instructor may have additional or different assessable outcomes for your class. As teachers (or future teachers) you should think about the assessment outcomes and learning goals for each chapter as you work through them.

EXERCISES FOR CHAPTER 2

1. Using the Data Analysis and Probability Standards for Grades 6–8 from the NCTM’s Principles and Standards for School Mathematics found at www.nctm.org, identify the middle school objectives that are found in Chapter 2.

2. Using the state standards for mathematics for the content area of data analysis and probability for your state, identify the middle school objectives that are found in Chapter 2. The following website may be useful: www.doe.state.in.us. This website will allow you to access the web pages of the state departments of education for the 50 states. From the state web pages you should be able to find the state’s mathematical standards.
3. The 20 students in Ms. Little’s sixth grade class were asked to identify their favorite color. Their responses are shown below:
blue blue yellow green red blue green blue red blue
green red red blue blue green blue yellow blue green
a. Construct a relative frequency table for the data.
b. Construct a bar graph for the data.
c. Construct a circle graph for the data.

4. A regular six-sided number cube is rolled 50 times. The number of dots showing on each roll is recorded below:
2 2 5 3 4 1 5 3 3 4 2 4 3
2 6 3 6 5 6 2 2 2 5 5 3 3
6 6 4 3 1 6 1 1 2 2 3 3 5
4 5 4 4 2 4 6 1 6 1 3
a. Construct a relative frequency table for the data.
b. Construct a bar graph for the data.
c. Construct a circle graph for the data.

5. The weights in pounds (to the nearest pound) of 25 dogs are shown below:
15 12 45 60 78 35 62 67 84 91
6 18 22 36 48 43 44 57 92 72
8 26 45 61 65
a. Construct a relative frequency table for the data using the classes 1−10, 11−20, 21−30, 31−40, and so on.
b. Find the class width.
c. Find the class marks for each class.
d. Determine the class boundaries.
e. Construct a histogram for the data.
f. Construct a stem-and-leaf plot for the data.
g. Would a line plot be a good choice to represent this data? Why or why not?

6. The number of cups of coffee consumed per day by a college professor over a 30-day period are shown below:
5 5 8 3 9 2 3 6 5 4
4 5 5 6 10 3 6 6 7 8
6 5 6 4 2 5 6 6 5 4
a. Construct a frequency distribution for the data.
b. Construct a line plot for the data.
c. Would a stem-and-leaf plot be a good choice to represent this data? Why or why not?
d. Construct a histogram for this data set.

7. Using the frequency table you completed in Figure 2.2.5, answer the following questions:
a. Construct a histogram for Option 1.
b. Construct a histogram for Option 2.
c. Construct a histogram for Option 3.
d. Compare the shapes of the histograms you constructed for (a), (b), and (c).
   How are they the same? How are they different?
e. Which histogram gives more information?

f. Is it possible to recover the original raw data values from any of these histograms? Why or why not?

8. The data presented in the table below is taken from the website of the Statistical Abstract of the United States. The data show the number of total households (as defined by the Census Bureau) in 1,000's from 1900 to 2000 (www.census.gov/statab/www).

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Number of Households (in 1,000's)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>15,964</td>
</tr>
<tr>
<td>1910</td>
<td>20,256</td>
</tr>
<tr>
<td>1920</td>
<td>24,352</td>
</tr>
<tr>
<td>1930</td>
<td>29,905</td>
</tr>
<tr>
<td>1940</td>
<td>34,949</td>
</tr>
<tr>
<td>1950</td>
<td>42,251</td>
</tr>
<tr>
<td>1960</td>
<td>53,024</td>
</tr>
<tr>
<td>1970</td>
<td>63,450</td>
</tr>
<tr>
<td>1980</td>
<td>80,390</td>
</tr>
<tr>
<td>1990</td>
<td>91,947</td>
</tr>
<tr>
<td>2000</td>
<td>105,480</td>
</tr>
</tbody>
</table>

Construct a line graph to display the data. Be sure to label your axes! Remember to avoid the pitfalls of misleading graphs that you studied in Section 2.3.

9. When asked to create a graphic which would inform the student body about the number of and type of crimes committed on a college campus, a student journalist constructed the following graphic for use in the student paper. The caption read "Crime on Campus Sky Rockets!"

![Graph showing crime rates over time]

a. The editor of the student paper is not happy with this graph and feels that it is misleading. Do you agree or disagree? Why?

b. What type of graph would be a better choice to display this type of data? Why?

10. Suppose the following visual display is used to compare the amount of snow from two consecutive years. Does this graph give an accurate impression of the data? Why or why not?