

Spirit Week Participation

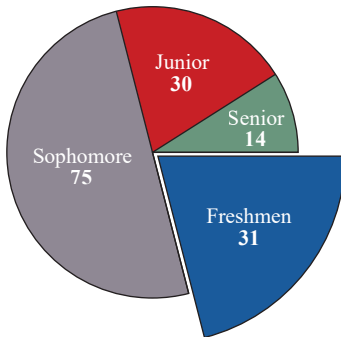


FIGURE 10

## Misleading Graphs

As we said at the beginning of the section, it's important to display data so that it is organized clearly and it effectively conveys the intended message. Ideally, graphs should be able to stand alone without the need for additional information in order to be understood. However, sometimes graphs either intentionally or unintentionally convey the wrong message about data or are not quite clear enough to get their message across. It's important to be aware that there are visually misleading and/or ambiguous graphs out there. For example, making the bars different widths on a bar chart might imply that one category is somehow larger than another. Similarly, a distorted piece of a pie graph might inaccurately lead the reader to assume that one section of data is larger than another. An example of this is the graph in Figure 10.

In their graph, the freshmen wanted to emphasize the fact that they came in second place for spirit week—although they just grabbed second place by a tiny margin. If the exact numbers were not on the graph, the emphasis on the freshmen piece of pie might visually imply that the freshman wedge is considerably larger than the junior wedge. Watch out for these visual manipulations when interpreting graphs.

### Skill Check Answers

- 0 pets
- 6,488,203 people

## 9.2 EXERCISES

### ✓ CONCEPT CHECK

Fill in each blank with the correct term.

- A \_\_\_\_\_ is a graph that represents a frequency distribution.
- When comparing parts of data to the whole, a \_\_\_\_\_ visually shows this using sections of a circle.
- A \_\_\_\_\_ graph is best to use when showing data over a time period.
- When comparing multiple categories from different populations, a \_\_\_\_\_ graph or a \_\_\_\_\_ graph can be used.
- A \_\_\_\_\_ is a literal count of each member of a data set and how often it occurs.

 APPLICATIONS

6. The grades on the first statistics test for Ms. Seago's class are listed in the following table. Construct a frequency distribution for the grades.

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

7. The following table gives the grouped frequency distribution of weights of 194 babies in kilograms. Answer the questions that follow based on the distribution.

Birth Weight (kg)	0.00–0.99	1.00–1.99	2.00–2.99	3.00–3.99	4.00–4.99	5.00–5.99
Frequency	2	17	39	89	46	1

- How many classes are in the grouped frequency distribution?
  - What is the class width?
  - What is the value of the lower class limit of the 3<sup>rd</sup> class?
  - What is the value of the upper class limit of the 5<sup>th</sup> class?
  - What is the relative frequency of the 4<sup>th</sup> class? Give your answer as a percentage rounded to the nearest tenth.
8. The following table represents a grouped frequency distribution of the number of hours spent on the computer per week for 55 students.

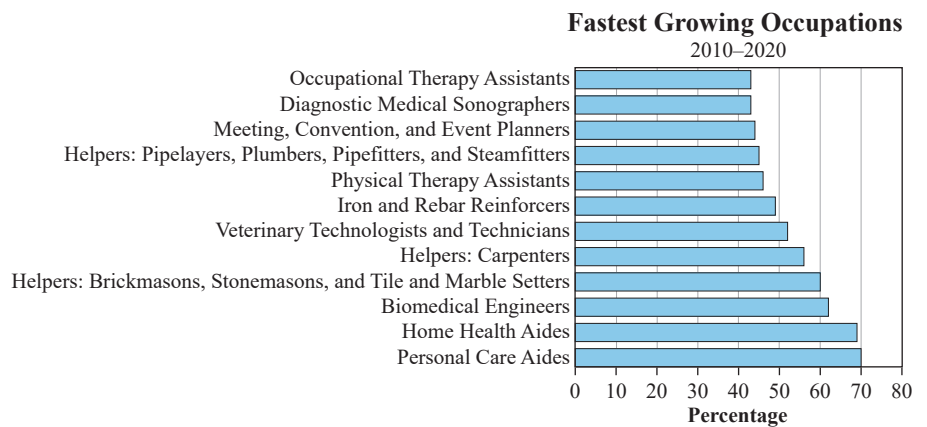
Hours	Number of Students
0.0–4.4	9
4.5–8.9	14
9.0–13.4	21
13.5–17.9	11

- Calculate the relative frequencies (as percentages rounded to the nearest tenth) for each class.
- What percentage of the students used the computer between 9 and 13.4 hours per week?
- What percentage of the students used the computer less than 9 hours per week?

9. Sisscon is a phone answering service. The following data are the numbers of calls per day reported by the company for the last month.

10	72	64	32	78	62	11
37	45	32	52	38	70	66
13	21	14	13	39	73	62
41	63	44	23	27	22	21
55	24	53	43	20	16	22

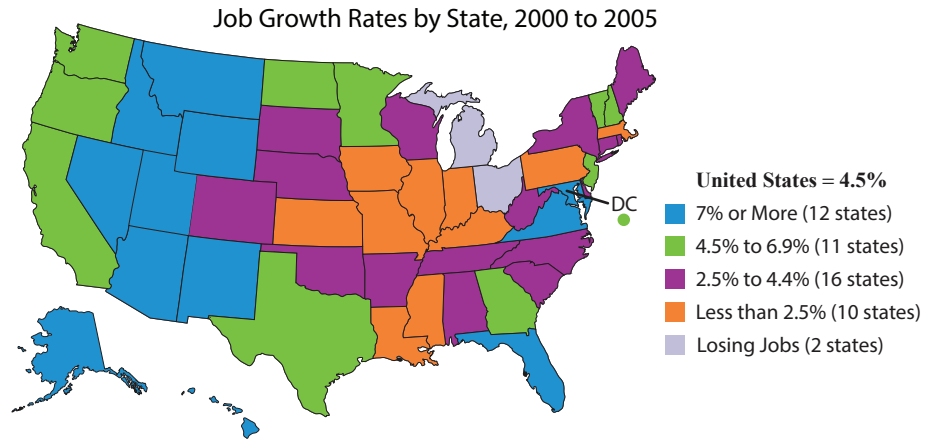
- Create a grouped frequency distribution for the data using 8 classes and then use it to answer the following questions. Let the first lower class limit be 0 and the class width equal 10.
  - Calculate the relative frequencies for each class. Give your answers as percentages.
  - For what percentage of the days is the number of calls between 40 and 49?
  - For what percentage of the days is the number of calls in the single digits?
  - What is the most common range for the number of calls per day?
10. Consider the bar graph, constructed from a 2012 study, of the predicted fastest growing occupations between 2010 and 2020.<sup>1</sup>



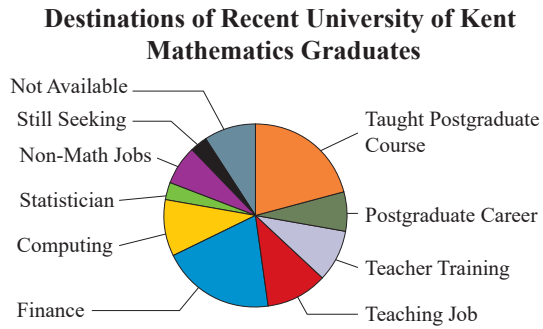
- At a quick glance, which occupation was predicted to grow the most between 2010 and 2020? What was the predicted amount of growth?
- How many new jobs were predicted to be available in the fastest-growing occupation in 2020?

<sup>1</sup> BLS Occupational Outlook Handbook, <http://www.bls.gov/ooh>

11. Answer the following questions about the Job Growth graph.<sup>2</sup>



- a. How many states lost jobs between 2000 and 2005?
  - b. In what part of the country were jobs growing the most in this time period?
12. The following pie chart shows destinations of recent University of Kent mathematics graduates, including business, financial math, and statistics.<sup>3</sup>



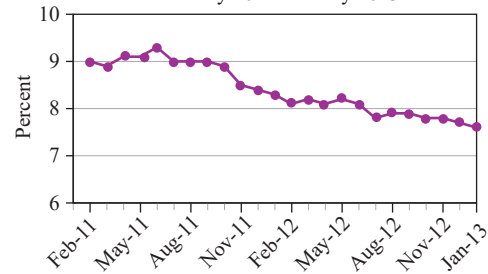
- a. Does it appear that any destination category accounts for more than 25% of the graduates?
- b. Which pairs of destinations appear to have similar percentages of graduates?
- c. How many mathematics graduates from the University of Kent were surveyed?
- d. Is the graph misleading in any way?

<sup>2</sup> InContext, <http://www.incontext.indiana.edu>

<sup>3</sup> University of Kent, <http://www.kent.ac.uk>

13. The following graph shows the US unemployment rate from February 2011 to January 2013.<sup>4</sup>

**US Unemployment Rate, Seasonally Adjusted**  
February 2011–January 2013



- Describe the trend of the unemployment percentage from February 2011 to January 2013.
  - Approximate the month and rate of the highest unemployment during this time period.
  - Approximate the month and rate of the lowest unemployment during this time period.
  - Is the graph misleading in any way?
14. The following is a portion of a table about state health facts. It lists 8 of the 50 states along with the percentage of women age 50 and older who report having had a mammogram between 2008 and 2010.

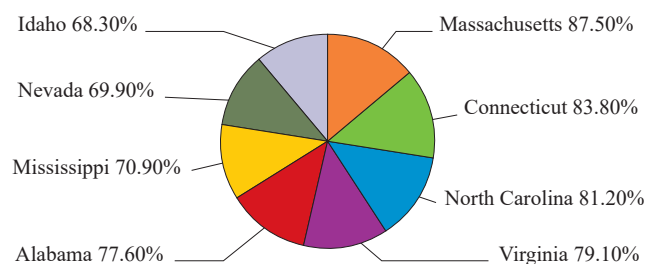
**Percentage of Women Age 50 and Older Who Had a Mammogram between 2008 and 2010**

Massachusetts	87.50%
Connecticut	83.80%
North Carolina	81.20%
Virginia	79.10%
Alabama	77.60%
Mississippi	70.90%
Nevada	69.90%
Idaho	68.30%

**Source:** Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2010, available at <http://apps.nccd.cdc.gov/brfss/list.asp?cat=WH&yr=2010&qkey=4427&state=All>

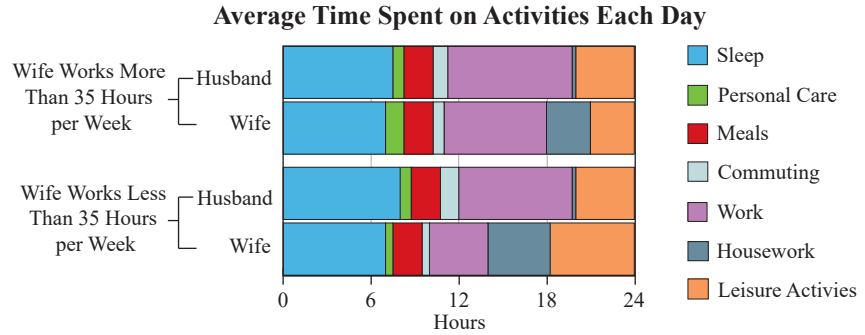
Is the following pie chart a good way to display this data? Explain why or why not.

**Percentage of Women Age 50 and Older Who Had a Mammogram between 2008 and 2010**



<sup>4</sup> Bureau of Labor Statistics, <http://www.bls.gov>  
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15. The stacked bar graph shows the average number of hours that married people in Japan spend each day doing various activities.<sup>5</sup>



- a. For wives who spend less than 35 hours per week working, how many hours on average are spent each day for leisure activities?
- b. For husbands whose wives work more than 35 hours per week, approximately how many hours on average are spent on sleep?
- c. Compare the number of hours spent sleeping for wives in each category.
- d. What type of graph could be used to represent these data in a clearer fashion?

<sup>5</sup> Statistics Bureau (Japan), <http://www.stat.go.jp>