

2.11: Chapter Homework

2.2 Display Data

39.

Fifty part-time students were asked how many courses they were taking this term. The (incomplete) results are shown below:

| # of courses | Frequency | Relative frequency | Cumulative relative frequency |
|--------------|-----------|--------------------|-------------------------------|
| 1 | 30 | 0.6 | |
| 2 | 15 | | |
| 3 | | | |

Table1.13 Part-time Student Course Loads

- Fill in the blanks in Table 2.11.13
- What percent of students take exactly two courses?
- What percent of students take one or two courses?

40.

Sixty adults with gum disease were asked the number of times per week they used to floss before their diagnosis. The (incomplete) results are shown in **Table 2.11.14**.

| # flossing per week | Frequency | Relative frequency | Cumulative relative frequency |
|---------------------|-----------|--------------------|-------------------------------|
| 0 | 27 | 0.4500 | |
| 1 | 18 | | |
| 3 | | | 0.9333 |
| 6 | 3 | 0.0500 | |
| 7 | 1 | 0.0167 | |

Table1.14 Flossing Frequency for Adults with Gum Disease

- Fill in the blanks in Table 2.11.14
- What percent of adults flossed six times per week?
- What percent flossed at most three times per week?

41.

Nineteen immigrants to the U.S were asked how many years, to the nearest year, they have lived in the U.S. The data are as follows: 2;5; 7; 2; 2; 10; 20; 15; 0; 7; 0; 20; 5; 12; 15; 12; 4; 5; 10 .

Table 2.11.15was produced.

Table 2.11.15 Frequency of Immigrant Survey Responses

| Data | Frequency | Relative frequency | Cumulative relative frequency |
|------|-----------|--------------------|-------------------------------|
| 0 | 2 | 219219 | 0.1053 |
| 2 | 3 | 319319 | 0.2632 |
| 4 | 1 | 119119 | 0.3158 |
| 5 | 3 | 319319 | 0.4737 |
| 7 | 2 | 219219 | 0.5789 |

| Data | Frequency | Relative frequency | Cumulative relative frequency |
|------|-----------|--------------------|-------------------------------|
| 10 | 2 | 2/19 | 0.6842 |
| 12 | 2 | 2/19 | 0.7895 |
| 15 | 1 | 1/19 | 0.8421 |
| 20 | 1 | 1/19 | 1.0000 |

- Fix the errors in Table 2.11.15. Also, explain how someone might have arrived at the incorrect number(s).
- Explain what is wrong with this statement: "47 percent of the people surveyed have lived in the U.S. for 5 years."
- Fix the statement in **b** to make it correct.
- What fraction of the people surveyed have lived in the U.S. five or seven years?
- What fraction of the people surveyed have lived in the U.S. at most 12 years?
- What fraction of the people surveyed have lived in the U.S. fewer than 12 years?
- What fraction of the people surveyed have lived in the U.S. from five to 20 years, inclusive?

42.

How much time does it take to travel to work? **Table 2.11.16** shows the mean commute time by state for workers at least 16 years old who are not working at home. Find the mean travel time, and round off the answer properly.

Table 2.11.16

| | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| 24.0 | 24.3 | 25.9 | 18.9 | 27.5 | 17.9 | 21.8 | 20.9 | 16.7 | 27.3 |
| 18.2 | 24.7 | 20.0 | 22.6 | 23.9 | 18.0 | 31.4 | 22.3 | 24.0 | 25.5 |
| 24.7 | 24.6 | 28.1 | 24.9 | 22.6 | 23.6 | 23.4 | 25.7 | 24.8 | 25.5 |
| 21.2 | 25.7 | 23.1 | 23.0 | 23.9 | 26.0 | 16.3 | 23.1 | 21.4 | 21.5 |
| 27.0 | 27.0 | 18.6 | 31.7 | 23.3 | 30.1 | 22.9 | 23.3 | 21.7 | 18.6 |

43.

Forbes magazine published data on the best small firms in 2012. These were firms which had been publicly traded for at least a year, have a stock price of at least \$5 per share, and have reported annual revenue between \$5 million and \$1 billion. **Table 2.11.17** shows the ages of the chief executive officers for the first 60 ranked firms.

Table 2.11.17

| Age | Frequency | Relative frequency | Cumulative relative frequency |
|-------|-----------|--------------------|-------------------------------|
| 40–44 | 3 | | |
| 45–49 | 11 | | |
| 50–54 | 13 | | |
| 55–59 | 16 | | |
| 60–64 | 10 | | |
| 65–69 | 6 | | |
| 70–74 | 1 | | |

- What is the frequency for CEO ages between 54 and 65?
- What percentage of CEOs are 65 years or older?
- What is the relative frequency of ages under 50?
- What is the cumulative relative frequency for CEOs younger than 55?
- Which graph shows the relative frequency and which shows the cumulative relative frequency?

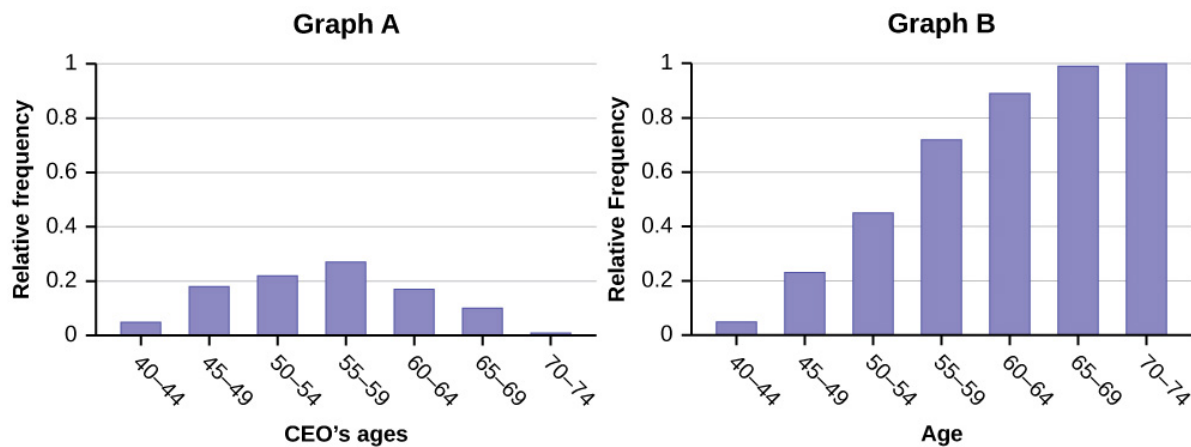


Figure 2.11.11

Use the following information to answer the next two exercises: Table 2.11.18 contains data on hurricanes that have made direct hits on the U.S. Between 1851 and 2004. A hurricane is given a strength category rating based on the minimum wind speed generated by the storm.

| Category | Number of direct hits | Relative frequency | Cumulative frequency |
|----------|-----------------------|--------------------|----------------------|
| 1 | 109 | 0.3993 | 0.3993 |
| 2 | 72 | 0.2637 | 0.6630 |
| 3 | 71 | 0.2601 | |
| 4 | 18 | | 0.9890 |
| 5 | 3 | 0.0110 | 1.0000 |
| | Total = 273 | | |

Table1.18 Frequency of Hurricane Direct Hits

44.

What is the relative frequency of direct hits that were category 4 hurricanes?

- a. 0.0768
- b. 0.0659
- c. 0.2601
- d. Not enough information to calculate

45.

What is the relative frequency of direct hits that were AT MOST a category 3 storm?

- a. 0.3480
- b. 0.9231
- c. 0.2601
- d. 0.3370

84.

Table 2.11.63 contains the 2010 obesity rates in U.S. states and Washington, DC.

Table 2.11.63

| State | Percent (%) | State | Percent (%) | State | Percent (%) |
|---------|-------------|----------|-------------|--------------|-------------|
| Alabama | 32.2 | Kentucky | 31.3 | North Dakota | 27.2 |

| State | Percent (%) | State | Percent (%) | State | Percent (%) |
|----------------|-------------|----------------|-------------|----------------|-------------|
| Alaska | 24.5 | Louisiana | 31.0 | Ohio | 29.2 |
| Arizona | 24.3 | Maine | 26.8 | Oklahoma | 30.4 |
| Arkansas | 30.1 | Maryland | 27.1 | Oregon | 26.8 |
| California | 24.0 | Massachusetts | 23.0 | Pennsylvania | 28.6 |
| Colorado | 21.0 | Michigan | 30.9 | Rhode Island | 25.5 |
| Connecticut | 22.5 | Minnesota | 24.8 | South Carolina | 31.5 |
| Delaware | 28.0 | Mississippi | 34.0 | South Dakota | 27.3 |
| Washington, DC | 22.2 | Missouri | 30.5 | Tennessee | 30.8 |
| Florida | 26.6 | Montana | 23.0 | Texas | 31.0 |
| Georgia | 29.6 | Nebraska | 26.9 | Utah | 22.5 |
| Hawaii | 22.7 | Nevada | 22.4 | Vermont | 23.2 |
| Idaho | 26.5 | New Hampshire | 25.0 | Virginia | 26.0 |
| Illinois | 28.2 | New Jersey | 23.8 | Washington | 25.5 |
| Indiana | 29.6 | New Mexico | 25.1 | West Virginia | 32.5 |
| Iowa | 28.4 | New York | 23.9 | Wisconsin | 26.3 |
| Kansas | 29.4 | North Carolina | 27.8 | Wyoming | 25.1 |

- Use a random number generator to randomly pick eight states. Construct a bar graph of the obesity rates of those eight states.
- Construct a bar graph for all the states beginning with the letter "A."
- Construct a bar graph for all the states beginning with the letter "M."

85.

Suppose that three book publishers were interested in the number of fiction paperbacks adult consumers purchase per month. Each publisher conducted a survey. In the survey, adult consumers were asked the number of fiction paperbacks they had purchased the previous month. The results are as follows:

Table 2.11.64 Publisher A

| # of books | Freq. | Rel. freq. |
|------------|-------|------------|
| 0 | 10 | |
| 1 | 12 | |
| 2 | 16 | |
| 3 | 12 | |
| 4 | 8 | |
| 5 | 6 | |
| 6 | 2 | |
| 8 | 2 | |

Table 2.11.65 Publisher B

| # of books | Freq. | Rel. freq. |
|------------|-------|------------|
| | | |

| # of books | Freq. | Rel. freq. |
|------------|-------|------------|
| 0 | 18 | |
| 1 | 24 | |
| 2 | 24 | |
| 3 | 22 | |
| 4 | 15 | |
| 5 | 10 | |
| 7 | 5 | |
| 9 | 1 | |

Table 2.11.66 Publisher C

| # of books | Freq. | Rel. freq. |
|------------|-------|------------|
| 0–1 | 20 | |
| 2–3 | 35 | |
| 4–5 | 12 | |
| 6–7 | 2 | |
| 8–9 | 1 | |

- Find the relative frequencies for each survey. Write them in the charts.
- Use the frequency column to construct a histogram for each publisher's survey. For Publishers A and B, make bar widths of one. For Publisher C, make bar widths of two.
- In complete sentences, give two reasons why the graphs for Publishers A and B are not identical.
- Would you have expected the graph for Publisher C to look like the other two graphs? Why or why not?
- Make new histograms for Publisher A and Publisher B. This time, make bar widths of two.
- Now, compare the graph for Publisher C to the new graphs for Publishers A and B. Are the graphs more similar or more different? Explain your answer.

86.

Often, cruise ships conduct all on-board transactions, with the exception of gambling, on a cashless basis. At the end of the cruise, guests pay one bill that covers all onboard transactions. Suppose that 60 single travelers and 70 couples were surveyed as to their on-board bills for a seven-day cruise from Los Angeles to the Mexican Riviera. Following is a summary of the bills for each group.

Table 2.11.67 Singles

| Amount(\$) | Frequency | Rel. frequency |
|------------|-----------|----------------|
| 51–100 | 5 | |
| 101–150 | 10 | |
| 151–200 | 15 | |
| 201–250 | 15 | |
| 251–300 | 10 | |
| 301–350 | 5 | |

Table 2.11.68 Couples

| |
|--|
| |
|--|

| Amount(\$) | Frequency | Rel. frequency |
|------------|-----------|----------------|
| 100–150 | 5 | |
| 201–250 | 5 | |
| 251–300 | 5 | |
| 301–350 | 5 | |
| 351–400 | 10 | |
| 401–450 | 10 | |
| 451–500 | 10 | |
| 501–550 | 10 | |
| 551–600 | 5 | |
| 601–650 | 5 | |

- Fill in the relative frequency for each group.
- Construct a histogram for the singles group. Scale the x -axis by \$50 widths. Use relative frequency on the y -axis.
- Construct a histogram for the couples group. Scale the x -axis by \$50 widths. Use relative frequency on the y -axis.
- Compare the two graphs:
 - List two similarities between the graphs.
 - List two differences between the graphs.
 - Overall, are the graphs more similar or different?
- Construct a new graph for the couples by hand. Since each couple is paying for two individuals, instead of scaling the x -axis by \$50, scale it by \$100. Use relative frequency on the y -axis.
- Compare the graph for the singles with the new graph for the couples:
 - List two similarities between the graphs.
 - Overall, are the graphs more similar or different?
- How did scaling the couples graph differently change the way you compared it to the singles graph?
- Based on the graphs, do you think that individuals spend the same amount, more or less, as singles as they do person by person as a couple? Explain why in one or two complete sentences.

87.

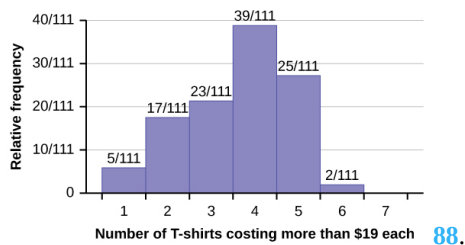
Twenty-five randomly selected students were asked the number of movies they watched the previous week. The results are as follows.

Table 2.11.69

| # of movies | Frequency | Relative frequency | Cumulative relative frequency |
|-------------|-----------|--------------------|-------------------------------|
| 0 | 5 | | |
| 1 | 9 | | |
| 2 | 6 | | |
| 3 | 4 | | |
| 4 | 1 | | |

- Construct a histogram of the data.
- Complete the columns of the chart.

Use the following information to answer the next two exercises: Suppose one hundred eleven people who shopped in a special t-shirt store were asked the number of t-shirts they own costing more than \$19 each.



88.

The percentage of people who own at most three t-shirts costing more than \$19 each is approximately:

- a. 21
- b. 59
- c. 41
- d. Cannot be determined

89.

If the data were collected by asking the first 111 people who entered the store, then the type of sampling is:

- a. cluster
- b. simple random
- c. stratified
- d. convenience

90.

Following are the 2010 obesity rates by U.S. states and Washington, DC.

Table 2.11.70

| State | Percent (%) | State | Percent (%) | State | Percent (%) |
|----------------|-------------|----------------|-------------|----------------|-------------|
| Alabama | 32.2 | Kentucky | 31.3 | North Dakota | 27.2 |
| Alaska | 24.5 | Louisiana | 31.0 | Ohio | 29.2 |
| Arizona | 24.3 | Maine | 26.8 | Oklahoma | 30.4 |
| Arkansas | 30.1 | Maryland | 27.1 | Oregon | 26.8 |
| California | 24.0 | Massachusetts | 23.0 | Pennsylvania | 28.6 |
| Colorado | 21.0 | Michigan | 30.9 | Rhode Island | 25.5 |
| Connecticut | 22.5 | Minnesota | 24.8 | South Carolina | 31.5 |
| Delaware | 28.0 | Mississippi | 34.0 | South Dakota | 27.3 |
| Washington, DC | 22.2 | Missouri | 30.5 | Tennessee | 30.8 |
| Florida | 26.6 | Montana | 23.0 | Texas | 31.0 |
| Georgia | 29.6 | Nebraska | 26.9 | Utah | 22.5 |
| Hawaii | 22.7 | Nevada | 22.4 | Vermont | 23.2 |
| Idaho | 26.5 | New Hampshire | 25.0 | Virginia | 26.0 |
| Illinois | 28.2 | New Jersey | 23.8 | Washington | 25.5 |
| Indiana | 29.6 | New Mexico | 25.1 | West Virginia | 32.5 |
| Iowa | 28.4 | New York | 23.9 | Wisconsin | 26.3 |
| Kansas | 29.4 | North Carolina | 27.8 | Wyoming | 25.1 |

Construct a bar graph of obesity rates of your state and the four states closest to your state. Hint: Label the x-axis with the states.

2.3 Measures of the Location of the Data

91.

The median age for U.S. blacks currently is 30.9 years; for U.S. whites it is 42.3 years.

- Based upon this information, give two reasons why the black median age could be lower than the white median age.
- Does the lower median age for blacks necessarily mean that blacks die younger than whites? Why or why not?
- How might it be possible for blacks and whites to die at approximately the same age, but for the median age for whites to be higher?

92.

Six hundred adult Americans were asked by telephone poll, "What do you think constitutes a middle-class income?" The results are in [Table 2.71](#). Also, include left endpoint, but not the right endpoint.

Table 2.11.71

| Salary (\$) | Relative frequency |
|---------------|--------------------|
| < 20,000 | 0.02 |
| 20,000–25,000 | 0.09 |
| 25,000–30,000 | 0.19 |
| 30,000–40,000 | 0.26 |
| 40,000–50,000 | 0.18 |
| 50,000–75,000 | 0.17 |
| 75,000–99,999 | 0.02 |
| 100,000+ | 0.01 |

- What percentage of the survey answered "not sure"?
- What percentage think that middle-class is from \$25,000 to \$50,000?
- Construct a histogram of the data.
 - Should all bars have the same width, based on the data? Why or why not?
 - How should the <20,000 and the 100,000+ intervals be handled? Why?
- Find the 40th and 80th percentiles
- Construct a bar graph of the data

2.4 Measures of the Center of the Data

93.

The most obese countries in the world have obesity rates that range from 11.4% to 74.6%. This data is summarized in the following table.

Table 2.11.72

| Percent of population obese | Number of countries |
|-----------------------------|---------------------|
| 11.4–20.45 | 29 |
| 20.45–29.45 | 13 |
| 29.45–38.45 | 4 |
| 38.45–47.45 | 0 |
| 47.45–56.45 | 2 |

| Percent of population obese | Number of countries |
|-----------------------------|---------------------|
| 56.45–65.45 | 1 |
| 65.45–74.45 | 0 |
| 74.45–83.45 | 1 |

- What is the best estimate of the average obesity percentage for these countries?
- The United States has an average obesity rate of 33.9%. Is this rate above average or below?
- How does the United States compare to other countries?

94.

Table 2.11.73 gives the percent of children under five considered to be underweight. What is the best estimate for the mean percentage of underweight children?

Table 2:73

| Percent of underweight children | Number of countries |
|---------------------------------|---------------------|
| 16–21.45 | 23 |
| 21.45–26.9 | 4 |
| 26.9–32.35 | 9 |
| 32.35–37.8 | 7 |
| 37.8–43.25 | 6 |
| 43.25–48.7 | 1 |

2.5 Sigma Notation and Calculating the Arithmetic Mean

95.

A sample of 10 prices is chosen from a population of 100 similar items. The values obtained from the sample, and the values for the population, are given in Table 2.11.74 and Table 2.11.75 respectively.

- Is the mean of the sample within \$1 of the population mean?
- What is the difference in the sample and population means?

Table 2.11.74

| Prices of the sample |
|----------------------|
| \$21 |
| \$23 |
| \$21 |
| \$24 |
| \$22 |
| \$22 |
| \$25 |
| \$21 |
| \$20 |
| \$24 |

Table 2.11.75

| |
|--|
| |
|--|

| Prices of the population | Frequency |
|--------------------------|-----------|
| \$20 | 20 |
| \$21 | 35 |
| \$22 | 15 |
| \$23 | 10 |
| \$24 | 18 |
| \$25 | 2 |

96.

A standardized test is given to ten people at the beginning of the school year with the results given in Table 2.11.76 below. At the end of the year the same people were again tested.

- What is the average improvement?
- Does it matter if the means are subtracted, or if the individual values are subtracted?

Table 2.11.76

| Student | Beginning score | Ending score |
|---------|-----------------|--------------|
| 1 | 1100 | 1120 |
| 2 | 980 | 1030 |
| 3 | 1200 | 1208 |
| 4 | 998 | 1000 |
| 5 | 893 | 948 |
| 6 | 1015 | 1030 |
| 7 | 1217 | 1224 |
| 8 | 1232 | 1245 |
| 9 | 967 | 988 |
| 10 | 988 | 997 |

97.

A small class of 7 students has a mean grade of 82 on a test. If six of the grades are 80, 82, 86, 90, 90, and 95, what is the other grade?

98.

A class of 20 students has a mean grade of 80 on a test. Nineteen of the students has a mean grade between 79 and 82, inclusive.

- What is the lowest possible grade of the other student?
- What is the highest possible grade of the other student?

99.

If the mean of 20 prices is \$10.39, and 5 of the items with a mean of \$10.99 are sampled, what is the mean of the other 15 prices?

2.6 Geometric Mean

100.

An investment grows from \$10,000 to \$22,000 in five years. What is the average rate of return?

101.

An initial investment of \$20,000 grows at a rate of 9% for five years. What is its final value?

102.

A culture contains 1,300 bacteria. The bacteria grow to 2,000 in 10 hours. What is the rate at which the bacteria grow per hour to the nearest tenth of a percent?

103.

An investment of \$3,000 grows at a rate of 5% for one year, then at a rate of 8% for three years. What is the average rate of return to the nearest hundredth of a percent?

104.

An investment of \$10,000 goes down to \$9,500 in four years. What is the average return per year to the nearest hundredth of a percent?

2.7 Skewness and the Mean, Median, and Mode

105.

The median age of the U.S. population in 1980 was 30.0 years. In 1991, the median age was 33.1 years.

- What does it mean for the median age to rise?
- Give two reasons why the median age could rise.
- For the median age to rise, is the actual number of children less in 1991 than it was in 1980? Why or why not?

2.8 Measures of the Spread of the Data

Use the following information to answer the next nine exercises: The population parameters below describe the full-time equivalent number of students (FTES) each year at Lake Tahoe Community College from 1976–1977 through 2004–2005.

- $\mu = 1000$ FTES
- median = 1,014 FTES
- $\sigma = 474$ FTES
- first quartile = 528.5 FTES
- third quartile = 1,447.5 FTES
- $n = 29$ years

106.

A sample of 11 years is taken. About how many are expected to have a FTES of 1014 or above? Explain how you determined your answer.

107.

75% of all years have an FTES:

- at or below: _____
- at or above: _____

108.

The population standard deviation = _____

109.

What percent of the FTES were from 528.5 to 1447.5? How do you know?

110.

What is the *IQR*? What does the *IQR* represent?

111.

How many standard deviations away from the mean is the median?

Additional Information: The population FTES for 2005–2006 through 2010–2011 was given in an updated report. The data are reported here.

Table 2.11.77

| Year | 2005–06 | 2006–07 | 2007–08 | 2008–09 | 2009–10 | 2010–11 |
|------------|---------|---------|---------|---------|---------|---------|
| Total FTES | 1,585 | 1,690 | 1,735 | 1,935 | 2,021 | 1,890 |

112.

Calculate the mean, median, standard deviation, the first quartile, the third quartile and the *IQR*. Round to one decimal place.

113.

Compare the *IQR* for the FTES for 1976–77 through 2004–2005 with the *IQR* for the FTES for 2005–2006 through 2010–2011. Why do you suppose the *IQRs* are so different?

114.

Three students were applying to the same graduate school. They came from schools with different grading systems. Which student had the best GPA when compared to other students at his school? Explain how you determined your answer.

Table 2.11.78

| Student | GPA | School Average GPA | School Standard Deviation |
|---------|-----|--------------------|---------------------------|
| Thuy | 2.7 | 3.2 | 0.8 |
| Vichet | 87 | 75 | 20 |
| Kamala | 8.6 | 8 | 0.4 |

115.

A music school has budgeted to purchase three musical instruments. They plan to purchase a piano costing \$3,000, a guitar costing \$550, and a drum set costing \$600. The mean cost for a piano is \$4,000 with a standard deviation of \$2,500. The mean cost for a guitar is \$500 with a standard deviation of \$200. The mean cost for drums is \$700 with a standard deviation of \$100. Which cost is the lowest, when compared to other instruments of the same type? Which cost is the highest when compared to other instruments of the same type. Justify your answer.

116.

An elementary school class ran one mile with a mean of 11 minutes and a standard deviation of three minutes. Rachel, a student in the class, ran one mile in eight minutes. A junior high school class ran one mile with a mean of nine minutes and a standard deviation of two minutes. Kenji, a student in the class, ran 1 mile in 8.5 minutes. A high school class ran one mile with a mean of seven minutes and a standard deviation of four minutes. Nedda, a student in the class, ran one mile in eight minutes.

- Why is Kenji considered a better runner than Nedda, even though Nedda ran faster than he?
- Who is the fastest runner with respect to his or her class? Explain why.

117.

The most obese countries in the world have obesity rates that range from 11.4% to 74.6%. This data is summarized in Table 2.11.79

Table 2.11.79

| Percent of population obese | Number of countries |
|-----------------------------|---------------------|
| 11.4–20.45 | 29 |
| 20.45–29.45 | 13 |
| 29.45–38.45 | 4 |
| 38.45–47.45 | 0 |

| Percent of population obese | Number of countries |
|-----------------------------|---------------------|
| 47.45–56.45 | 2 |
| 56.45–65.45 | 1 |
| 65.45–74.45 | 0 |
| 74.45–83.45 | 1 |

What is the best estimate of the average obesity percentage for these countries? What is the standard deviation for the listed obesity rates? The United States has an average obesity rate of 33.9%. Is this rate above average or below? How “unusual” is the United States’ obesity rate compared to the average rate? Explain.

118.

Table 2.11.80 gives the percent of children under five considered to be underweight.

Table 2.11.80

| Percent of underweight children | Number of countries |
|---------------------------------|---------------------|
| 16–21.45 | 23 |
| 21.45–26.9 | 4 |
| 26.9–32.35 | 9 |
| 32.35–37.8 | 7 |
| 37.8–43.25 | 6 |
| 43.25–48.7 | 1 |

What is the best estimate for the mean percentage of underweight children? What is the standard deviation? Which interval(s) could be considered unusual? Explain.

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