# Section 1.3 Exercises

79. **Quiz grades** Joey's first 14 quiz grades in a marking period were

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| | | | | | | |
|---|---|---|---|---|---|---|
| 86 | 84 | 91 | 75 | 78 | 80 | 74 |
| 87 | 76 | 96 | 82 | 90 | 98 | 93 |

Calculate the mean. Show your work.

80. **Cowboys** The 2011 roster of the Dallas Cowboys professional football team included 7 defensive linemen. Their weights (in pounds) were 321, 285, 300, 285, 286, 293, and 298. Calculate the mean. Show your work.

81. **Quiz grades** Refer to Exercise 79.

(a) Find the median by hand. Show your work.

(b) Suppose Joey has an unexcused absence for the 15th quiz, and he receives a score of zero. Recalculate the mean and the median. What property of measures of center does this illustrate?

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82. **Cowboys** Refer to Exercise 80.

(a) Find the median by hand. Show your work.

(b) Suppose the heaviest lineman had weighed 341 pounds instead of 321 pounds. How would this change affect the mean and the median? What property of measures of center does this illustrate?

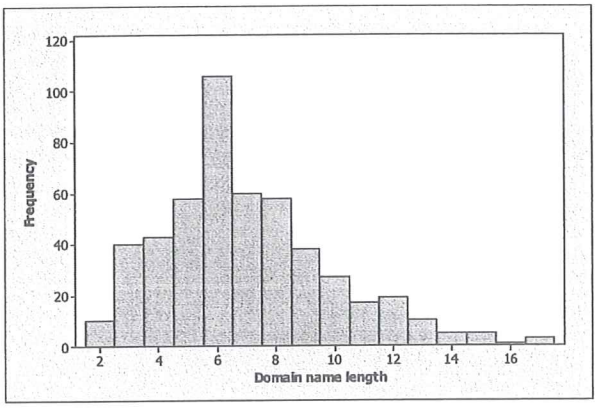
83. **Incomes of college grads** According to the Census Bureau, the mean and median income in a recent year of people at least 25 years old who had a bachelor's degree but no higher degree were $48,097 and $60,954. Which of these numbers is the mean and which is the median? Explain your reasoning.

84. **House prices** The mean and median selling prices of existing single-family homes sold in July 2012 were $263,200 and $224,200.[41] Which of these numbers is the mean and which is the median? Explain how you know.

85. **Baseball salaries** Suppose that a Major League Baseball team's mean yearly salary for its players is $1.2 million and that the team has 25 players on its active roster. What is the team's total annual payroll? If you knew only the median salary, would you be able to answer this question? Why or why not?

86. **Mean salary?** Last year a small accounting firm paid each of its five clerks $22,000, two junior accountants $50,000 each, and the firm's owner $270,000. What is the mean salary paid at this firm? How many of the employees earn less than the mean? What is the median salary? Write a sentence to describe how an unethical recruiter could use statistics to mislead prospective employees.

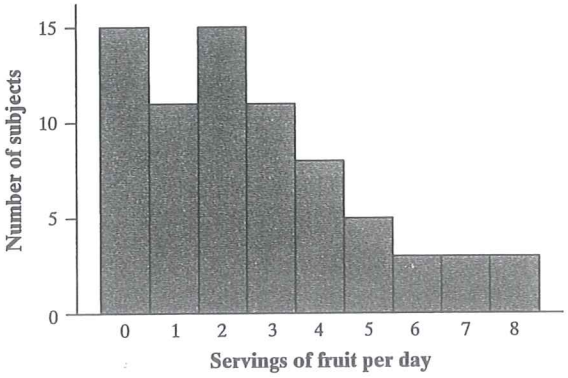
87. **Domain names** When it comes to Internet domain names, is shorter better? According to one ranking of Web sites in 2012, the top 8 sites (by number of "hits") were google.com, youtube.com, wikipedia.org, yahoo.com, amazon.com, ebay.com, craigslist.org, and facebook.com. These familiar sites certainly have short domain names. The histogram below shows the domain name lengths (in number of letters in the name, not including the extensions .com and .org) for the 500 most popular Web sites.




(a) Estimate the mean and median of the distribution. Explain your method clearly.

(b) If you wanted to argue that shorter domain names were more popular, which measure of center would you choose—the mean or the median? Justify your answer.

88. **Do adolescent girls eat fruit?** We all know that fruit is good for us. Below is a histogram of the number of servings of fruit per day claimed by 74 seventeen-year-old girls in a study in Pennsylvania.[42]




(a) With a little care, you can find the median and the quartiles from the histogram. What are these numbers? How did you find them?

(b) Estimate the mean of the distribution. Explain your method clearly.

89. **Quiz grades** Refer to Exercise 79.

pg 55 (a) Find and interpret the interquartile range (*IQR*).

pg 56 (b) Determine whether there are any outliers. Show your work.

90. **Cowboys** Refer to Exercise 80.

(a) Find and interpret the interquartile range (*IQR*).

(b) Determine whether there are any outliers. Show your work.

91. **Don't call me** In a September 28, 2008, article titled pg 57 "Letting Our Fingers Do the Talking," the *New York Times* reported that Americans now send more text messages than they make phone calls. According to a study by Nielsen Mobile, "Teenagers ages 13 to 17 are by far the most prolific texters, sending or receiving 1742 messages a month." Mr. Williams, a high school statistics teacher, was skeptical about the claims in the article. So he collected data from his first-period statistics class on the number of text messages and calls they had sent or received in the past 24 hours. Here are the texting data:

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 7 | 1 | 29 | 25 | 8 | 5 | 1 | 25 | 98 | 9 | 0 | 26 |
| 8 | 118 | 72 | 0 | 92 | 52 | 14 | 3 | 3 | 44 | 5 | 42 | |

(a) Make a boxplot of these data by hand. Be sure to check for outliers.

(b) Explain how these data seem to contradict the claim in the article.

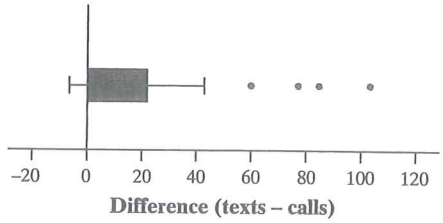
92. **Acing the first test** Here are the scores of Mrs. Liao's students on their first statistics test:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 93 | 93 | 87.5 | 91 | 94.5 | 72 | 96 | 95 | 93.5 | 93.5 | 73 |
| 82 | 45 | 88 | 80 | 86 | 85.5 | 87.5 | 81 | 78 | 86 | 89 |
| 92 | 91 | 98 | 85 | 82.5 | 88 | 94.5 | 43 | | | |

(a) Make a boxplot of the test score data by hand. Be sure to check for outliers.

(b) How did the students do on Mrs. Liao's first test? Justify your answer.

93. **Texts or calls?** Refer to Exercise 91. A boxplot of the difference (texts – calls) in the number of texts and calls for each student is shown below.




(a) Do these data support the claim in the article about texting versus calling? Justify your answer with appropriate evidence.

(b) Can we draw any conclusion about the preferences of all students in the school based on the data from Mr. Williams's statistics class? Why or why not?

94. **Electoral votes** To become president of the United States, a candidate does not have to receive a majority of the popular vote. The candidate does have to win a majority of the 538 electoral votes that are cast in the Electoral College. Here is a stemplot of the number of electoral votes for each of the 50 states and the District of Columbia.

| | |
|---|---|
| 0 | 3333333344444 |
| 0 | 55555666777788999 |
| 1 | 0000111123 |
| 1 | 5557 |
| 2 | 011 |
| 2 | 7 |
| 3 | 14 |
| 3 | |
| 4 | |
| 4 | |
| 5 | |
| 5 | 5 |

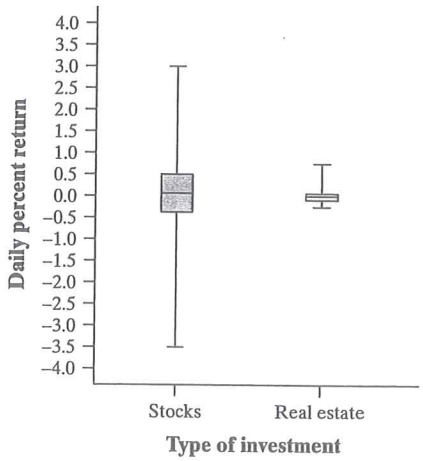
Key: 1|5 is a state with 15 electoral votes.

(a) Make a boxplot of these data by hand. Be sure to check for outliers.

(b) Which measure of center and spread would you use to summarize the distribution—the mean and standard deviation or the median and *IQR*? Justify your answer.

Part 2

95. **Comparing investments** Should you put your money into a fund that buys stocks or a fund that invests in real estate? The boxplots compare the daily returns (in percent) on a "total stock market" fund and a real estate fund over a one-year period.[43]

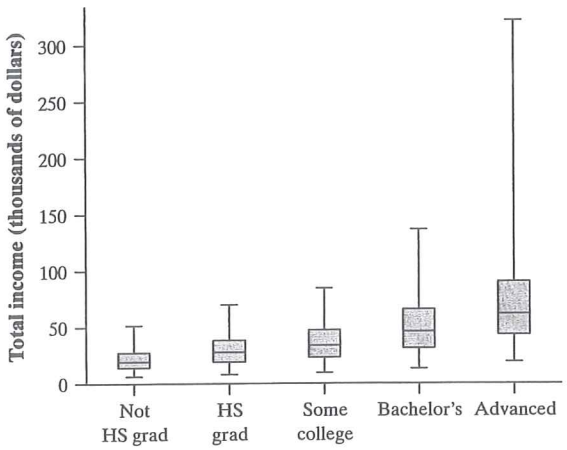



(a) Read the graph: about what were the highest and lowest daily returns on the stock fund?

(b) Read the graph: the median return was about the same on both investments. About what was the median return?

(c) What is the most important difference between the two distributions?

96. **Income and education level** Each March, the Bureau of Labor Statistics compiles an Annual Demographic Supplement to its monthly Current Population Survey.[44] Data on about 71,067 individuals between the ages of 25 and 64 who were employed full-time were collected in one of these surveys. The boxplots below compare the distributions of income for people with five levels of education. This figure is a variation of the boxplot idea: because large data sets often contain very extreme observations, we omitted the individuals in each category with the top 5% and bottom 5% of incomes. Write a brief description of how the distribution of income changes with the highest level of education reached. Give specifics from the graphs to support your statements.




97. **Phosphate levels** The level of various substances in the blood influences our health. Here are measurements of the level of phosphate in the blood of a patient, in milligrams of phosphate per deciliter of blood, made on 6 consecutive visits to a clinic: 5.6, 5.2, 4.6, 4.9, 5.7, 6.4. A graph of only 6 observations gives little information, so we proceed to compute the mean and standard deviation.

(a) Find the standard deviation from its definition. That is, find the deviations of each observation from the mean, square the deviations, then obtain the variance and the standard deviation.

(b) Interpret the value of $s_x$ you obtained in part (a).

98. **Feeling sleepy?** The first four students to arrive for a first-period statistics class were asked how much sleep (to the nearest hour) they got last night. Their responses were 7, 7, 9, and 9.

(a) Find the standard deviation from its definition. That is, find the deviations of each observation from the mean, square the deviations, then obtain the variance and the standard deviation.

(b) Interpret the value of $s_x$ you obtained in part (a).

(c) Do you think it's safe to conclude that the mean amount of sleep for all 30 students in this class is close to 8 hours? Why or why not?

99. **Shopping spree** The figure displays computer output for data on the amount spent by 50 grocery shoppers.

**Descriptive Statistics: Amount spent**

| Variable | Total Count | Mean | StDev | Minimum | Q1 | Median | Q3 | Maximum |
|---|---|---|---|---|---|---|---|---|
| Amount spent | 50 | 34.70 | 21.70 | 3.11 | 19.06 | 27.85 | 45.72 | 93.34 |

(a) What would you guess is the shape of the distribution based only on the computer output? Explain.

(b) Interpret the value of the standard deviation.

(c) Are there any outliers? Justify your answer.

100. **C-sections** Do male doctors perform more cesarean sections (C-sections) than female doctors? A study in Switzerland examined the number of cesarean sections (surgical deliveries of babies) performed in a year by samples of male and female doctors. Here are summary statistics for the two distributions:

| | $\bar{x}$ | $s_x$ | Min | $Q_1$ | Med | $Q_3$ | Max | *IQR* |
|---|---|---|---|---|---|---|---|---|
| **Male doctors** | 41.333 | 20.607 | 20 | 27 | 34 | 50 | 86 | 23 |
| **Female doctors** | 19.1 | 10.126 | 5 | 10 | 18.5 | 29 | 33 | 19 |

(a) Based on the computer output, which distribution would you guess has a more symmetrical shape? Explain.

(b) Explain how the *IQR*s of these two distributions can be so similar even though the standard deviations are quite different.

(c) Does it appear that male doctors perform more C-sections? Justify your answer.

101. **The *IQR*** Is the interquartile range a resistant measure of spread? Give an example of a small data set that supports your answer.

102. **What do they measure?** For each of the following summary statistics, decide (i) whether it could be used to measure center or spread and (ii) whether it is resistant.

(a) $\dfrac{Q_1 + Q_3}{2}$ (b) $\dfrac{\text{Max} - \text{Min}}{2}$

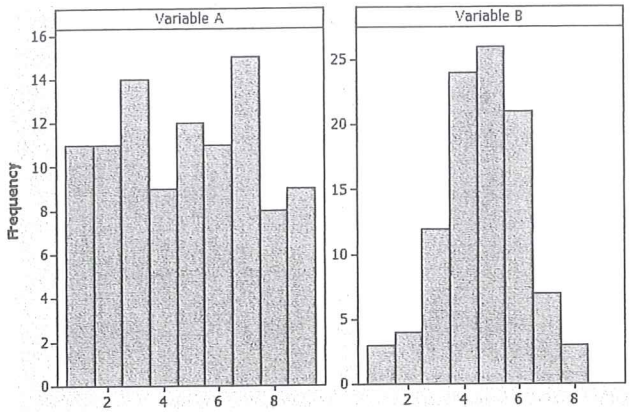
103. **SD contest** This is a standard deviation contest. You must choose four numbers from the whole numbers 0 to 10, with repeats allowed.

(a) Choose four numbers that have the smallest possible standard deviation.

(b) Choose four numbers that have the largest possible standard deviation.

(c) Is more than one choice possible in either part (a) or (b)? Explain.

104. **Measuring spread** Which of the distributions shown has a larger standard deviation? Justify your answer.




105. **SSHA scores** Here are the scores on the Survey of Study Habits and Attitudes (SSHA) for 18 first-year college women:

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STEP 4

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 154 | 109 | 137 | 115 | 152 | 140 | 154 | 178 | 101 |
| 103 | 126 | 126 | 137 | 165 | 165 | 129 | 200 | 148 |

and for 20 first-year college men:

| | | | | | | |
|---|---|---|---|---|---|---|
| 108 | 140 | 114 | 91 | 180 | 115 | 126 |
| 92 | 169 | 146 | 109 | 132 | 75 | 88 |
| 113 | 151 | 70 | 115 | 187 | 104 | |

Do these data support the belief that men and women differ in their study habits and attitudes toward learning? (Note that high scores indicate good study habits and attitudes toward learning.) Follow the four-step process.

STEP 4

106. **Hummingbirds and tropical flower** Researchers from Amherst College studied the relationship between varieties of the tropical flower *Heliconia* on the island of Dominica and the different species of hummingbirds that fertilize the flowers.[45] Over time, the researchers believe, the lengths of the flowers and the forms of the hummingbirds' beaks have evolved to match each other. If that is true, flower varieties fertilized by different hummingbird species should have distinct distributions of length.

The table below gives length measurements (in millimeters) for samples of three varieties of *Heliconia*, each fertilized by a different species of hummingbird. Do these data support the researchers' belief? Follow the four-step process.

***H. bihai***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 47.12 | 46.75 | 46.80 | 47.12 | 46.67 | 47.43 | 46.44 | 46.64 |
| 48.07 | 48.34 | 48.15 | 50.26 | 50.12 | 46.34 | 46.94 | 48.36 |

***H. caribaea* red**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 41.90 | 42.01 | 41.93 | 43.09 | 41.47 | 41.69 | 39.78 | 40.57 |
| 39.63 | 42.18 | 40.66 | 37.87 | 39.16 | 37.40 | 38.20 | 38.07 |
| 38.10 | 37.97 | 38.79 | 38.23 | 38.87 | 37.78 | 38.01 | |

***H. caribaea* yellow**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 36.78 | 37.02 | 36.52 | 36.11 | 36.03 | 35.45 | 38.13 | 37.10 |
| 35.17 | 36.82 | 36.66 | 35.68 | 36.03 | 34.57 | 34.63 | |

*Multiple choice: Select the best answer for Exercises 107 to 110.*

107. If a distribution is skewed to the right with no outliers,

(a) mean < median.
(b) mean ≈ median.
(c) mean = median.
(d) mean > median.
(e) We can't tell without examining the data.

108. The scores on a statistics test had a mean of 81 and a standard deviation of 9. One student was absent on the test day, and his score wasn't included in the calculation. If his score of 84 was added to the distribution of scores, what would happen to the mean and standard deviation?

(a) Mean will increase, and standard deviation will increase.
(b) Mean will increase, and standard deviation will decrease.
(c) Mean will increase, and standard deviation will stay the same.
(d) Mean will decrease, and standard deviation will increase.
(e) Mean will decrease, and standard deviation will decrease.

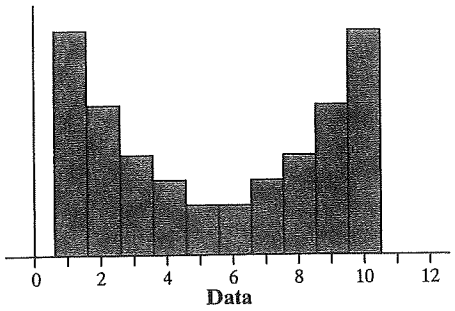
109. The stemplot shows the number of home runs hit by each of the 30 Major League Baseball teams in 2011. Home run totals above what value should be considered outliers?

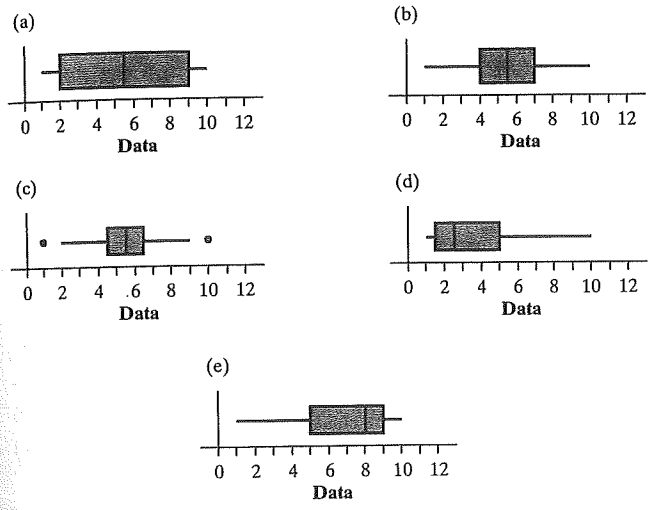
```
09|15
10|3789
11|47
12|19
13|
14|89
15|34445
16|239
17|223
18|356
19|1
20|3
21|0
22|2
```

Key: 14|8 is a team with 148 home runs.

(a) 173 (b) 210 (c) 222 (d) 229 (e) 257

110. Which of the following boxplots best matches the distribution shown in the histogram?




*Exercises 111 and 112 refer to the following setting.*

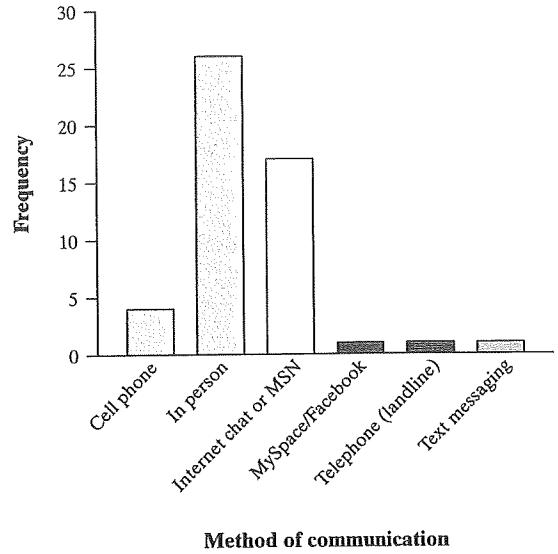
We used CensusAtSchool's "Random Data Selector" to choose a sample of 50 Canadian students who completed a survey in a recent year.

111. **How tall are you?** (1.2) Here are the students' heights (in centimeters).

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 166.5 | 170 | 178 | 163 | 150.5 | 169 | 173 | 169 | 171 | 166 |
| 190 | 183 | 178 | 161 | 171 | 170 | 191 | 168.5 | 178.5 | 173 |
| 175 | 160.5 | 166 | 164 | 163 | 174 | 160 | 174 | 182 | 167 |
| 166 | 170 | 170 | 181 | 171.5 | 160 | 178 | 157 | 165 | 187 |
| 168 | 157.5 | 145.5 | 156 | 182 | 168.5 | 177 | 162.5 | 160.5 | 185.5 |

Make an appropriate graph to display these data. Describe the shape, center, and spread of the distribution. Are there any outliers?

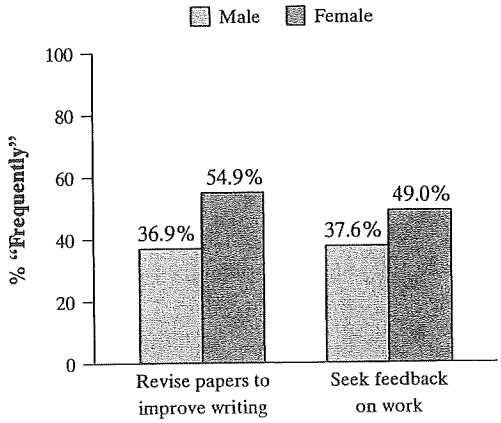
112. **Let's chat** (1.1) The bar graph displays data on students' responses to the question "Which of these methods do you most often use to communicate with your friends?"




(a) Would it be appropriate to make a pie chart for these data? Why or why not?

(b) Jerry says that he would describe this bar graph as skewed to the right. Explain why Jerry is wrong.

113. **Success in college** (1.1) The 2007 Freshman Survey asked first-year college students about their "habits of mind"—specific behaviors that college faculty have identified as being important for student success. One question asked students, "How often in the past year did you revise your papers to improve your writing?" Another asked, "How often in the past year did you seek feedback on your academic work?" The figure is a bar graph comparing male and female responses to these two questions.[46]




What does the graph tell us about the habits of mind of male and female college freshmen?