

## 2.11: Chapter 2 Homework

### 2.2 Display Data

For the next three exercises, use the data to construct an appropriate graph.

1. In a survey, 40 people were asked how many times they visited a store before making a major purchase. The results are shown below.

Number of times in store	Frequency
1	4
2	10
3	16
4	6
5	4

Table 2.11.1

2. In a survey, several people were asked how many years it has been since they purchased a mattress. The results are shown below.

Years since last purchase	Frequency
0	2
1	8
2	13
3	22
4	16
5	9

Table 2.11.2

3. Several children were asked how many TV shows they watch each day. The results of the survey are shown below.

Number of TV shows	Frequency
0	12
1	18
2	36
3	7
4	2

Table 2.11.3

4. The students in Ms. Ramirez's math class have birthdays in each of the four seasons. Table 2.11.4 shows the four seasons, the number of students who have birthdays in each season, and the percentage (%) of students in each group. Construct a bar graph showing the number of students.

Seasons	Number of students	Proportion of population
Spring	8	24%

Seasons	Number of students	Proportion of population
Summer	9	26%
Autumn	11	32%
Winter	6	18%

Table 2.11.4

5. Using the data from Mrs. Ramirez's math class supplied in the previous question, construct a bar graph showing the percentages.

6. David County has six high schools. Each school sent students to participate in a county-wide science competition. Table 2.11.5 shows the percentage breakdown of competitors from each school, and the percentage of the entire student population of the county that goes to each school. Construct a bar graph that shows the population percentage of competitors from each school.

High school	Science competition population	Overall student population
Alabaster	28.9%	8.6%
Concordia	7.6%	23.2%
Genoa	12.1%	15.0%
Mocksville	18.5%	14.3%
Tynneson	24.2%	10.1%
West End	8.7%	28.8%

Table 2.11.5

7. Use the data from the David County science competition supplied in Table 2.11.5. Construct a bar graph that shows the county-wide population percentage of students at each school.

8. Sixty-five randomly selected car salespersons were asked the number of cars they generally sell in one week. Fourteen people answered that they generally sell three cars; nineteen generally sell four cars; twelve generally sell five cars; nine generally sell six cars; eleven generally sell seven cars. Complete Table 2.11.6.

Data value (# cars)	Frequency	Relative frequency	Cumulative relative frequency

Table 2.11.6

9. What does the frequency column in Table 2.11.6 sum to? Why?

10. What does the relative frequency column in Table 2.11.6 sum to? Why?

11. What is the difference between relative frequency and frequency for each data value in Table 2.11.6?

12. What is the difference between cumulative relative frequency and relative frequency for each data value?

13. To construct the histogram for the data in Table 2.11.6, determine appropriate minimum and maximum  $x$  and  $y$  values and the scaling. Sketch the histogram. Label the horizontal and vertical axes with words. Include numerical scaling.



Figure 2.11.1

14. Construct a frequency polygon for the following:

Table 2.11.7

a.	Pulse rates for women	Frequency
	60–69	12
	70–79	14
	80–89	11
	90–99	1
	100–109	1
	110–119	0
	120–129	1

Table 2.11.8

b.	Actual speed in a 30 MPH zone	Frequency
	42–45	25
	46–49	14
	50–53	7
	54–57	3
	58–61	1

Table 2.11.9

c.	Tar (mg) in nonfiltered cigarettes	Frequency
	10–13	1
	14–17	0
	18–21	15
	22–25	7
	26–29	2

15. Construct a frequency polygon from the frequency distribution for the 50 highest ranked countries for depth of hunger.

Table 2.11.10

Depth of hunger	Frequency
230–259	21
260–289	13

Depth of hunger	Frequency
290–319	5
320–349	7
350–379	1
380–409	1
410–439	1

16. Use the two frequency tables to compare the life expectancy of men and women from 20 randomly selected countries. Include an overlaid frequency polygon and discuss the shapes of the distributions, the center, the spread, and any outliers. What can we conclude about the life expectancy of women compared to men?

Table 2.11.11

Life expectancy at birth – women	Frequency
49–55	3
56–62	3
63–69	1
70–76	3
77–83	8
84–90	2

Table 2.11.12

Life expectancy at birth – men	Frequency
49–55	3
56–62	3
63–69	1
70–76	1
77–83	7
84–90	5

17. Construct a times series graph for (a) the number of male births, (b) the number of female births, and (c) the total number of births.

Table 2.11.13

Sex/Year	1855	1856	1857	1858	1859	1860	1861
Female	45,545	49,582	50,257	50,324	51,915	51,220	52,403
Male	47,804	52,239	53,158	53,694	54,628	54,409	54,606
Total	93,349	101,821	103,415	104,018	106,543	105,629	107,009

Table 2.11.14

Sex/Year	1862	1863	1864	1865	1866	1867	1868	1869
Female	51,812	53,115	54,959	54,850	55,307	55,527	56,292	55,033

Male	55,257	56,226	57,374	58,220	58,360	58,517	59,222	58,321
Total	107,069	109,341	112,333	113,070	113,667	114,044	115,514	113,354

Table 2.11.15

Sex/Year	1870	1871	1872	1873	1874	1875
Female	56,431	56,099	57,472	58,233	60,109	60,146
Male	58,959	60,029	61,293	61,467	63,602	63,432
Total	115,390	116,128	118,765	119,700	123,711	123,578

18. The following data sets list full time police per 100,000 citizens along with homicides per 100,000 citizens for the city of Detroit, Michigan during the period from 1961 to 1973.

Table 2.11.16

Year	1961	1962	1963	1964	1965	1966	1967
Police	260.35	269.8	272.04	272.96	272.51	261.34	268.89
Homicides	8.6	8.9	8.52	8.89	13.07	14.57	21.36

Table 2.11.17

Year	1968	1969	1970	1971	1972	1973
Police	295.99	319.87	341.43	356.59	376.69	390.19
Homicides	28.03	31.49	37.39	46.26	47.24	52.33

- Construct a double time series graph using a common x-axis for both sets of data.
- Which variable increased the fastest? Explain.
- Did Detroit's increase in police officers have an impact on the murder rate? Explain.

## 2.3 Measures of the Location of the Data

19. Listed are 29 ages for Academy Award winning best actors *in order from smallest to largest*.

18; 21; 22; 25; 26; 27; 29; 30; 31; 33; 36; 37; 41; 42; 47; 52; 55; 57; 58; 62; 64; 67; 69; 71; 72; 73; 74; 76; 77

- Find the 40<sup>th</sup> percentile.
- Find the 78<sup>th</sup> percentile.

20. Listed are 32 ages for Academy Award winning best actors *in order from smallest to largest*.

18; 18; 21; 22; 25; 26; 27; 29; 30; 31; 31; 33; 36; 37; 37; 41; 42; 47; 52; 55; 57; 58; 62; 64; 67; 69; 71; 72; 73; 74; 76; 77

- Find the percentile of 37.
- Find the percentile of 72.

21. Jesse was ranked 37<sup>th</sup> in his graduating class of 180 students. At what percentile is Jesse's ranking?

22.

- For runners in a race, a low time means a faster run. The winners in a race have the shortest running times. Is it more desirable to have a finish time with a high or a low percentile when running a race?
- The 20<sup>th</sup> percentile of run times in a particular race is 5.2 minutes. Write a sentence interpreting the 20<sup>th</sup> percentile in the context of the situation.
- A bicyclist in the 90<sup>th</sup> percentile of a bicycle race completed the race in 1 hour and 12 minutes. Is he among the fastest or slowest cyclists in the race? Write a sentence interpreting the 90<sup>th</sup> percentile in the context of the situation.

23.

- a. For runners in a race, a higher speed means a faster run. Is it more desirable to have a speed with a high or a low percentile when running a race?
  - b. The 40<sup>th</sup> percentile of speeds in a particular race is 7.5 miles per hour. Write a sentence interpreting the 40<sup>th</sup> percentile in the context of the situation.
24. On an exam, would it be more desirable to earn a grade with a high or low percentile? Explain.
25. Mina is waiting in line at the Department of Motor Vehicles (DMV). Her wait time of 32 minutes is the 85<sup>th</sup> percentile of wait times. Is that good or bad? Write a sentence interpreting the 85<sup>th</sup> percentile in the context of this situation.
26. In a survey collecting data about the salaries earned by recent college graduates, Li found that her salary was in the 78<sup>th</sup> percentile. Should Li be pleased or upset by this result? Explain.
27. In a study collecting data about the repair costs of damage to automobiles in a certain type of crash tests, a certain model of car had \$1,700 in damage and was in the 90<sup>th</sup> percentile. Should the manufacturer and the consumer be pleased or upset by this result? Explain and write a sentence that interprets the 90<sup>th</sup> percentile in the context of this problem.
28. The University of California has two criteria used to set admission standards for freshman to be admitted to a college in the UC system:
- a. Students' GPAs and scores on standardized tests (SATs and ACTs) are entered into a formula that calculates an "admissions index" score. The admissions index score is used to set eligibility standards intended to meet the goal of admitting the top 12% of high school students in the state. In this context, what percentile does the top 12% represent?
  - b. Students whose GPAs are at or above the 96<sup>th</sup> percentile of all students at their high school are eligible (called eligible in the local context), even if they are not in the top 12% of all students in the state. What percentage of students from each high school are "eligible in the local context"?
29. Suppose that you are buying a house. You and your realtor have determined that the most expensive house you can afford is the 34<sup>th</sup> percentile. The 34<sup>th</sup> percentile of housing prices is \$240,000 in the town you want to move to. In this town, can you afford 34% of the houses or 66% of the houses?
- Use the following information to answer the next six exercises.* Sixty-five randomly selected car salespersons were asked the number of cars they generally sell in one week. Fourteen people answered that they generally sell three cars; nineteen generally sell four cars; twelve generally sell five cars; nine generally sell six cars; eleven generally sell seven cars.
30. First quartile = \_\_\_\_\_
  31. Second quartile = median = 50<sup>th</sup> percentile = \_\_\_\_\_
  32. Third quartile = \_\_\_\_\_
  33. Interquartile range (*IQR*) = \_\_\_\_\_ - \_\_\_\_\_ = \_\_\_\_\_
  34. 10<sup>th</sup> percentile = \_\_\_\_\_
  35. 70<sup>th</sup> percentile = \_\_\_\_\_

## 2.4 Measures of the Center of the Data

36. Find the approximate mean for the following frequency tables.

a.	Grade	Frequency
	49.5–59.5	2
	59.5–69.5	3
	69.5–79.5	8
	79.5–89.5	12
	89.5–99.5	5

Table 2.11.18

b.	Daily low temperature	Frequency
	49.5–59.5	53
	59.5–69.5	32
	69.5–79.5	15
	79.5–89.5	1
	89.5–99.5	0

Table 2.11.19

c.	Points per game	Frequency
	49.5–59.5	14
	59.5–69.5	32
	69.5–79.5	15
	79.5–89.5	23
	89.5–99.5	2

Table 2.11.20

Use the following information to answer the next three exercises: The following data show the lengths of boats moored in a marina. The data are ordered from smallest to largest: 16; 17; 19; 20; 20; 21; 23; 24; 25; 25; 25; 26; 26; 27; 27; 27; 28; 29; 30; 32; 33; 33; 34; 35; 37; 39; 40

37. Calculate the mean.

38. Identify the median.

39. Identify the mode.

Use the following information to answer the next three exercises: Sixty-five randomly selected car salespersons were asked the number of cars they generally sell in one week. Fourteen people answered that they generally sell three cars; nineteen generally sell four cars; twelve generally sell five cars; nine generally sell six cars; eleven generally sell seven cars.

Calculate the following:

40. sample mean = \_\_\_\_\_

41. median = \_\_\_\_\_

42. mode = \_\_\_\_\_

## 2.5 Sigma Notation and Calculating the Arithmetic Mean

43. A group of 10 children are on a scavenger hunt to find different color rocks. The results are shown in the Table 2.11.21 below. The column on the right shows the number of colors of rocks each child has. What is the mean number of rocks?

Child	Rock colors
1	5
2	5
3	6
4	2
5	4

6	3
7	7
8	2
9	1
10	10

Table 2.11.21

44. A group of children are measured to determine the average height of the group. The results are in Table 2.11.22 below. What is the mean height of the group to the nearest hundredth of an inch?

Child	Height in inches
Adam	45.21
Betty	39.45
Charlie	43.78
Donna	48.76
Earl	37.39
Fran	39.90
George	45.56
Heather	46.24

Table 2.11.22

45. A person compares prices for five automobiles. The results are in Table 2.11.23. What is the mean price of the cars the person has considered?

Price
\$20,987
\$22,008
\$19,998
\$23,433
\$21,444

Table 2.11.23

46. A customer protection service has obtained 8 bags of candy that are supposed to contain 16 ounces of candy each. The candy is weighed to determine if the average weight is at least the claimed 16 ounces. The results are in given in Table 2.11.24. What is the mean weight of a bag of candy in the sample?

Weight in ounces
15.65
16.09
16.01
15.99
16.02



16.00
15.98
16.08

Table 2.11.24

47. A teacher records grades for a class of 70, 72, 79, 81, 82, 82, 83, 90, and 95. What is the mean of these grades?
48. A family is polled to see the mean of the number of hours per day the television set is on. The results, starting with Sunday, are 6, 3, 2, 3, 1, 3, and 7 hours. What is the average number of hours the family had the television set on to the nearest whole number?
49. A city received the following rainfall for a recent year. What is the mean number of inches of rainfall the city received monthly, to the nearest hundredth of an inch? Use Table 2.11.25

Month	Rainfall in inches
January	2.21
February	3.12
March	4.11
April	2.09
May	0.99
June	1.08
July	2.99
August	0.08
September	0.52
October	1.89
November	2.00
December	3.06

Table 2.11.25

50. A football team scored the following points in its first 8 games of the new season. Starting at game 1 and in order the scores are 14, 14, 24, 21, 7, 0, 38, and 28. What is the mean number of points the team scored in these eight games?
51. What is the mean and standard deviation of the data set given? 5, 10, 20
52. What is the mean and standard deviation of the data set given? 9.000, 15.00, 21.00
53. What is the mean of the data set given? 7.0, 10.0, 39.2
54. What is the mean and standard deviation of the data set given? 17.00, 10.00, 19.00
55. What is the average and standard deviation for the values that follow? 1.0, 2.0, 1.5
56. What is the average and standard deviation for the values that follow? 0.80, 2.0, 5.0
57. What is the average and standard deviation for the values that follow? 0.90, 1.1, 1.2
58. What is the average and standard deviation for the values that follow? 4.2, 4.3, 4.5

## 2.6 Skewness and the Mean, Median, and Mode

Use the following instructions to answer the next three exercises. State whether the data are symmetrical, skewed to the left, or skewed to the right.

59. 1; 1; 1; 2; 2; 2; 3; 3; 3; 3; 3; 3; 3; 3; 4; 4; 4; 5; 5

60. 16; 17; 19; 22; 22; 22; 22; 22; 23

61. 87; 87; 87; 87; 87; 88; 89; 89; 90; 91

62. When the data are skewed left, what is the typical relationship between the mean and median?

63. When the data are symmetrical, what is the typical relationship between the mean and median?

64. What word describes a distribution that has two modes?

65. Describe the shape of the distribution in Figure 2.11.2

66. Describe the relationship between the mode and the median of the distribution in Figure 2.11.2

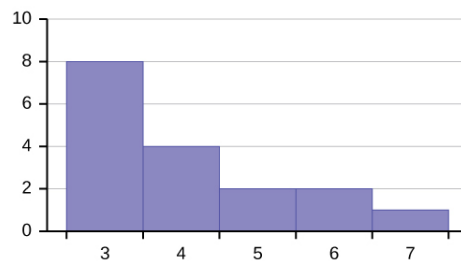


Figure 2.11.2

67. Describe the relationship between the mean and the median of the distribution in Figure 2.11.3

68. Describe the shape of the distribution in Figure 2.11.3

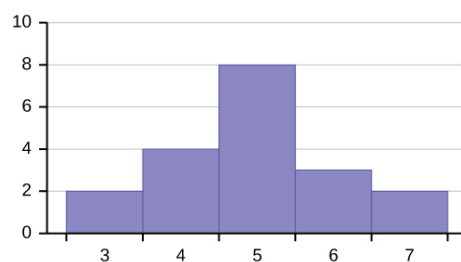


Figure 2.11.3

69. Describe the relationship between the mode and the median of the distribution in Figure 2.11.3

70. Are the mean and the median the exact same in the distribution in Figure 2.11.3? Why or why not?

71. Describe the shape of the distribution in Figure 2.11.4

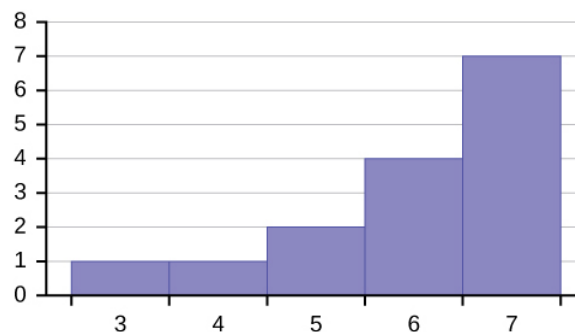


Figure 2.11.4

72. Describe the relationship between the mode and the median of the distribution in Figure 2.11.4

73. Describe the relationship between the mean and the median of the distribution in Figure 2.11.4

74. The mean and median for the following data are the same. Is the data perfectly symmetrical? Why or why not?

3; 4; 5; 5; 6; 6; 6; 6; 7; 7; 7; 7; 7; 7

75. Which is the greatest, the mean, the mode, or the median of the following data set?

11; 11; 12; 12; 12; 12; 13; 15; 17; 22; 22; 22

76. Which is the least, the mean, the mode, and the median of the following data set?

56; 56; 56; 58; 59; 60; 62; 64; 64; 65; 67

77. Of the three measures, which tends to reflect skewing the most, the mean, the mode, or the median? Why?

78. In a perfectly symmetrical distribution, when would the mode be different from the mean and median?

## 2.7 Measures of the Spread of the Data

Use the following information to answer the next two exercises: The following data are the distances between 20 retail stores and a large distribution center. The distances are in miles.

29; 37; 38; 40; 58; 67; 68; 69; 76; 86; 87; 95; 96; 96; 99; 106; 112; 127; 145; 150

79. Find the standard deviation and round to the nearest tenth.

80. Find the value that is one standard deviation below the mean.

81. Two baseball players, Fredo and Karl, on different teams wanted to find out who had the higher batting average when compared to his team. Which baseball player had the higher batting average when compared to his team?

Table 2.11.26

Baseball player	Batting average	Team batting average	Team standard deviation
Fredo	0.158	0.166	0.012
Karl	0.177	0.189	0.015

82. Use Table 2.11.26 to find the value that is three standard deviations:

- above the mean
- below the mean

83. Find the approximate mean for the following frequency tables using the formula.

Table 2.11.27

a.

Grade	Frequency
49.5–59.5	2
59.5–69.5	3
69.5–79.5	8
79.5–89.5	12
89.5–99.5	5

Table 2.11.28

b.

Daily low temperature	Frequency
49.5–59.5	53
59.5–69.5	32
69.5–79.5	15
79.5–89.5	1
89.5–99.5	0

Table 2.11.29

c.	Points per game	Frequency
	49.5–59.5	14
	59.5–69.5	32
	69.5–79.5	15
	79.5–89.5	23
	89.5–99.5	2

## 2.2 Display Data

84. Table 2.11.30 contains the 2019 poverty rates in U.S. states and Washington, DC.

Table 2.11.30

State	Percent (%)	State	Percent (%)	State	Percent (%)
Alabama	15.6	Kentucky	16.0	North Dakota	10.5
Alaska	10.2	Louisiana	18.8	Ohio	13.0
Arizona	13.5	Maine	10.9	Oklahoma	15.1
Arkansas	16.0	Maryland	9.1	Oregon	11.5
California	11.8	Massachusetts	9.5	Pennsylvania	12
Colorado	9.4	Michigan	12.9	Rhode Island	11.6
Connecticut	9.9	Minnesota	8.9	South Carolina	13.9
Delaware	11.2	Mississippi	19.5	South Dakota	11.9
Washington, DC	14.1	Missouri	12.9	Tennessee	13.8
Florida	12.7	Montana	12.6	Texas	13.6
Georgia	13.5	Nebraska	9.9	Utah	8.8
Hawaii	9.0	Nevada	12.7	Vermont	10.1
Idaho	11.0	New Hampshire	7.5	Virginia	9.9
Illinois	11.4	New Jersey	9.1	Washington	9.8
Indiana	11.9	New Mexico	17.5	West Virginia	16.2
Iowa	11.0	New York	13.1	Wisconsin	10.4
Kansas	11.3	North Carolina	13.6	Wyoming	9.9

- Use a random number generator to randomly pick eight states. Construct a bar graph of the poverty 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 2.11.31 Publisher A

# of books	Freq.	Rel. freq.

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

Table 2.11.32 Publisher B

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

Table 2.11.33 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 2.11.34 Singles

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

Table 2.11.35 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.

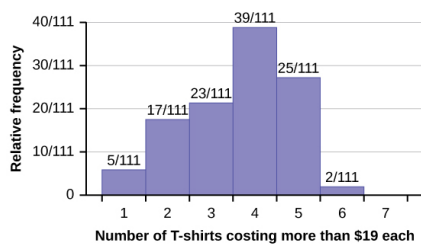
Table 2.11.36

# of movies	Frequency	Relative frequency	Cumulative relative frequency

# 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.
- Find the median, and interpret it.
- Find the mode, and interpret it.

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:

- 21
- 59
- 41
- 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:

- cluster
- simple random
- stratified
- convenience

90. Following are the 2019 poverty rates by U.S. states and Washington, DC.

Table 2.11.37

State	Percent (%)	State	Percent (%)	State	Percent (%)
Alabama	15.6	Kentucky	16.0	North Dakota	10.5
Alaska	10.2	Louisiana	18.8	Ohio	13.0
Arizona	13.5	Maine	10.9	Oklahoma	15.1
Arkansas	16.0	Maryland	9.1	Oregon	11.5
California	11.8	Massachusetts	9.5	Pennsylvania	12
Colorado	9.4	Michigan	12.9	Rhode Island	11.6
Connecticut	9.9	Minnesota	8.9	South Carolina	13.9
Delaware	11.2	Mississippi	19.5	South Dakota	11.9

State	Percent (%)	State	Percent (%)	State	Percent (%)
Washington, DC	14.1	Missouri	12.9	Tennessee	13.8
Florida	12.7	Montana	12.6	Texas	13.6
Georgia	13.5	Nebraska	9.9	Utah	8.8
Hawaii	9.0	Nevada	12.7	Vermont	10.1
Idaho	11.0	New Hampshire	7.5	Virginia	9.9
Illinois	11.4	New Jersey	9.1	Washington	9.8
Indiana	11.9	New Mexico	17.5	West Virginia	16.2
Iowa	11.0	New York	13.1	Wisconsin	10.4
Kansas	11.3	North Carolina	13.6	Wyoming	9.9

Construct a bar graph of poverty 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 African Americans in the U.S. currently is 34 years; for Caucasians in the U.S., it is 43 years. How might it be possible for African Americans and Caucasians to die at approximately the same age, but for the median ages to differ?

**92.** Six hundred adult Americans were asked by telephone poll, "What do you think constitutes a middle-class income?" The results are in Table 2.11.38. Also, include left endpoint, but not the right endpoint.

Table 2.11.38

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 40<sup>th</sup> and 80<sup>th</sup> percentiles
- Construct a bar graph of the data

### 2.4 Measures of the Center of the Data

**93.** The hottest temperatures on record by country range from 86.2°F (Greenland) to 134.0°F (the United States). This data is summarized in the following table.

Table 2.11.39

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Hottest temperature on record (°F)	Number of countries
79.5–89.5	2
89.5–99.5	13
99.5–109.5	39
109.5–119.5	41
119.5–129.5	28
129.5–139.5	2

- What is the best estimate of the average hottest temperature for all countries?
- The United States has a hottest temperature recording of 134.0°F. Is this temperature above average or below? How does the United States compare to other countries?

94. Table 2.11.40 gives the percent of children under five earning various score ranges on a motor skills assessment. What is the best estimate for the mean score of all these children on the assessment?

Table 2.11.40

Score range on assessment	Number of children
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

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 2.11.41 and Table 2.11.42 respectively.

- Is the mean of the sample within \$1 of the population mean?
- What is the difference in the sample and population means?
- Interpret the sample mean.
- Interpret the population mean.
- Calculate and interpret the standard deviation of the sample.
- Calculate and interpret the standard deviation of the population.

Table 2.11.41

Prices of the sample
\$21
\$23
\$21
\$24
\$22
\$22
\$25
\$21

\$20

\$24

Table 2.11.42

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 2.11.43 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 2.11.43

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?
- Interpret the mean in words.
- Find the median, and interpret it.
- Find the mode, and interpret it.

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 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?

## 2.7 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 2.11.44

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, but we will assume that each school's GPAs follow a normal distribution.

- Which student had the best GPA when compared to other students at his school? Explain how you determined your answer.
- Interpret the mean and standard deviation of GPAs at Thuy's school.
- If we assume that Thuy's school has a maximum GPA of 4.0, what shape is the distribution of GPAs at Thuy's school likely to be?

Table 2.11.45

Student	GPA	School Mean GPA	School SD GPA
Thuy	2.7	3.2	0.8
Vichet	87	75	20

Student	GPA	School Mean GPA	School SD GPA
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 hottest temperatures on record by country range from 86.2°F (Greenland) to 134.0°F (the United States). This data is summarized in Table 2.11.46

Hottest temperature on record (°F)	Number of countries
79.5–89.5	2
89.5–99.5	13
99.5–109.5	39
109.5–119.5	41
119.5–129.5	28
129.5–139.5	2

Table 2.11.46

What is the best estimate of the average hottest recorded temperature for these countries? How “unusual” is the United States’ hottest temperature of 134.0 °F compared to the average here? Explain.

**118.** Table 2.11.47 gives the percent of children under five earning various score ranges on a motor skills assessment. What is the best estimate for the most common score of all these children on the assessment? How did you determine this?

Table 2.11.47

Score range on assessment	Number of children
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

**119.** Javier and Ercilia are supervisors at a shopping mall. Each was given the task of estimating the mean distance that shoppers live from the mall. They each randomly surveyed 100 shoppers. The samples yielded the following information.

Table 2.11.47

--

	Javier	Ercilia
$\bar{x}$	6.0 miles	6.0 miles
$s$	4.0 miles	7.0 miles

- How can you determine which survey was correct ?
- Explain what the difference in the results of the surveys implies about the data.
- If the two histograms depict the distribution of values for each supervisor, which one depicts Ercilia's sample? How do you know?

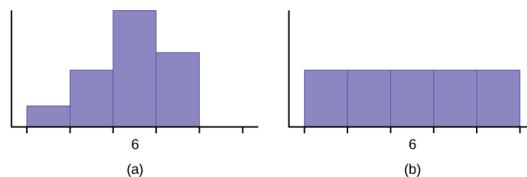


Figure 2.11.5

Use the following information to answer the next three exercises: We are interested in the number of years students in a particular elementary statistics class have lived in California. The information in the following table is from the entire section.

Table 2.11.48

Number of years	Frequency	Number of years	Frequency
7	1	22	1
14	3	23	1
15	1	26	1
18	1	40	2
19	4	42	2
20	3		
			Total = 20

120. What is the *IQR*?

- 8
- 11
- 15
- 35

121. What is the mode?

- 19
- 19.5
- 14 and 20
- 22.65

122. Is this a sample or the entire population?

- sample
- entire population
- neither

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

Table 2.11.49

# of movies	Frequency
0	5
1	9
2	6
3	4
4	1

- Find the sample mean  $\bar{x}$ .
- Find the approximate sample standard deviation,  $s$ .

**124.** Forty randomly selected students were asked the number of pairs of sneakers they owned. Let  $X$  = the number of pairs of sneakers owned. The results are as follows:

Table 2.11.50

$X$	Frequency
1	2
2	5
3	8
4	12
5	12
6	0
7	1

- Find the sample mean  $\bar{x}$ , rounded to one decimal place.
- Find the sample standard deviation,  $s$ .
- Construct a histogram of the data.
- Add relative frequency and cumulative relative frequency columns to the chart.
- Find the first quartile.
- Find the median.
- Find the IQR.
- Find the mode.
- Interpret the sample mean, standard deviation, Q1, median, Q3, IQR, and mode.
- What percent of the students owned at least five pairs?
- Find the 40<sup>th</sup> percentile.
- Find the 90<sup>th</sup> percentile.
- Construct a line graph of the data.
- Construct a stemplot of the data.

**125.** Following are the published weights (in pounds) of all of the team members of the San Francisco 49ers from a previous year.

177; 205; 210; 210; 232; 205; 185; 185; 178; 210; 206; 212; 184; 174; 185; 242; 188; 212; 215; 247; 241; 223; 220; 260; 245; 259; 278; 270; 280; 295; 275; 285; 290; 272; 273; 280; 285; 286; 200; 215; 185; 230; 250; 241; 190; 260; 250; 302; 265; 290; 276; 228; 265

- Organize the data from smallest to largest value.
- Find the median.
- Find the first quartile.
- Find the third quartile.
- The middle 50% of the weights are from \_\_\_\_\_ to \_\_\_\_\_.

- f. If our population were all professional football players, would the above data be a sample of weights or the population of weights? Why?
- g. If our population included every team member who ever played for the San Francisco 49ers, would the above data be a sample of weights or the population of weights? Why?
- h. Assume the population was the San Francisco 49ers. Find:
  - i. the population mean,  $\mu$ .
  - ii. the population standard deviation,  $\sigma$ .
  - iii. the weight that is two standard deviations below the mean.
  - iv. When Steve Young, quarterback, played football, he weighed 205 pounds. How many standard deviations above or below the mean was he?
- i. That same year, the mean weight for the Dallas Cowboys was 240.08 pounds with a standard deviation of 44.38 pounds. Emmitt Smith weighed in at 209 pounds. With respect to his team, who was lighter, Smith or Young? How did you determine your answer?

**126.** One hundred teachers attended a seminar on mathematical problem solving. The attitudes of a representative sample of 12 of the teachers were measured before and after the seminar. A positive number for change in attitude indicates that a teacher's attitude toward math became more positive. The 12 change scores are as follows:

3; 8; -1; 2; 0; 5; -3; 1; -1; 6; 5; -2

- a. What is the mean change score?
- b. What is the standard deviation for this population?
- c. What is the median change score?
- d. Find the change score that is 2.2 standard deviations below the mean.

**127.** Refer to Figure 2.11.6 determine which of the following are true and which are false. Explain your solution to each part in complete sentences.

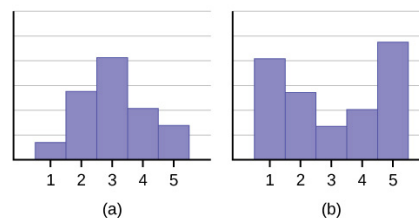


Figure 2.11.6

- a. The medians for both graphs are the same.
- b. We cannot determine if any of the means for both graphs is different.
- c. The standard deviation for graph b is larger than the standard deviation for graph a.
- d. We cannot determine if any of the third quartiles for both graphs is different.

**128.** In a recent issue of the *IEEE Spectrum*, 84 engineering conferences were announced. Four conferences lasted two days. Thirty-six lasted three days. Eighteen lasted four days. Nineteen lasted five days. Four lasted six days. One lasted seven days. One lasted eight days. One lasted nine days. Let  $X$  = the length (in days) of an engineering conference.

- a. Organize the data in a chart.
- b. Find the median, the first quartile, and the third quartile.
- c. Find the 65<sup>th</sup> percentile.
- d. Find the 10<sup>th</sup> percentile.
- e. The middle 50% of the conferences last from \_\_\_\_\_ days to \_\_\_\_\_ days.
- f. Calculate the sample mean of days of engineering conferences.
- g. Calculate the sample standard deviation of days of engineering conferences.
- h. Find the mode.
- i. If you were planning an engineering conference, which would you choose as the length of the conference: mean; median; or mode? Explain why you made that choice.
- j. Give two reasons why you think that three to five days seem to be popular lengths of engineering conferences.

129. A survey of enrollment at 35 community colleges across the United States yielded the following figures:

6414; 1550; 2109; 9350; 21828; 4300; 5944; 5722; 2825; 2044; 5481; 5200; 5853; 2750; 10012; 6357; 27000; 9414; 7681; 3200; 17500; 9200; 7380; 18314; 6557; 13713; 17768; 7493; 2771; 2861; 1263; 7285; 28165; 5080; 11622

- Organize the data into a chart with five intervals of equal width. Label the two columns "Enrollment" and "Frequency."
- Construct a histogram of the data.
- If you were to build a new community college, which piece of information would be more valuable: the mode or the mean?
- Calculate the sample mean.
- Calculate the sample standard deviation.
- A school with an enrollment of 8000 would be how many standard deviations away from the mean?

Use the following information to answer the next two exercises.  $X$  = the number of days per week that 100 clients use a particular exercise facility.

Table 2.11.51

$x$	Frequency
0	3
1	12
2	33
3	28
4	11
5	9
6	4

130. The 80<sup>th</sup> percentile is \_\_\_\_\_

- 5
- 80
- 3
- 4

131. The number that is 1.5 standard deviations BELOW the mean is approximately \_\_\_\_\_

- 0.7
- 4.8
- 2.8
- Cannot be determined

132. Suppose that a publisher conducted a survey asking adult consumers the number of fiction paperback books they had purchased in the previous month. The results are summarized in the Table 2.11.52

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



# of books	Freq.	Rel. Freq.
9	1	

Table 2.11.52

- Are there any outliers in the data? Use an appropriate numerical test involving the *IQR* to identify outliers, if any, and clearly state your conclusion.
- If a data value is identified as an outlier, what should be done about it?
- Are any data values further than two standard deviations away from the mean? In some situations, statisticians may use this criteria to identify data values that are unusual, compared to the other data values. (Note that this criteria is most appropriate to use for data that is mound-shaped and symmetric, rather than for skewed data.)
- Do parts a and c of this problem give the same answer?
- Examine the shape of the data. Which part, a or c, of this question gives a more appropriate result for this data?
- Based on the shape of the data which is the most appropriate measure of center for this data: mean, median or mode?

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