

2.12: Practice

1. In a survey, 40 people were asked how many times they visited a store before making a major purchase. The results are shown in Table 2.38.

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

Table 2.38

2. In a survey, several people were asked how many years it has been since they purchased a mattress. The results are shown in Table 2.39.

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

Table 2.39

3. Several children were asked how many TV shows they watch each day. The results of the survey are shown in Table 2.40.

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

Table 2.40

4. The students in Ms. Ramirez's math class have birthdays in each of the four seasons. Table 2.41 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%
Summer	9	26%
Autumn	11	32%
Winter	6	18%

Table 2.41

5. Using the data from Ms. Ramirez's math class supplied in Table 2.41, 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 2.42 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 2.42

7. Use the data from the David County science competition supplied in Table 2.42. 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 the table.

Data Value (# cars)	Frequency	Relative Frequency	Cumulative Relative Frequency

Table 2.43

- 9.
- What does the frequency column in Table 2.43 sum to? Why?
- 10.
- What does the relative frequency column in Table 2.43 sum to? Why?
- 11.
- What is the difference between relative frequency and frequency for each data value in Table 2.43?
- 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 2.43, 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.

 An empty graph template for use with this question.

Figure 2.31

- 14.
- Construct a frequency polygon for the following:

a.	Pulse Rates for Females	Frequency
	60–69	12
	70–79	14
	80–89	11

Pulse Rates for Females	Frequency
90–99	1
100–109	1
110–119	0
120–129	1

Table 2.44

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 2.45

c.

Tar (mg) in Nonfiltered Cigarettes	Frequency
10–13	1
14–17	0
18–21	15
22–25	7
26–29	2

Table 2.46

15.

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

Depth of Hunger	Frequency
230–259	21
260–289	13
290–319	5
320–349	7
350–379	1
380–409	1
410–439	1

Table 2.47

16.

Use the two frequency tables to compare the life expectancy of males and females 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 females compared to males?

Life Expectancy at Birth – Females	Frequency
49–55	3
56–62	3
63–69	1
70–76	3
77–83	8
84–90	2

Table 2.48

Life Expectancy at Birth – Males	Frequency
49–55	3
56–62	3
63–69	1
70–76	1
77–83	7
84–90	5

Table 2.49

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.

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 2.50

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 2.51

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

Table 2.52

18.

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

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 2.53

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

Table 2.54

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

2.2 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 40th percentile.
- Find the 78th 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 37th 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 20th percentile of run times in a particular race is 5.2 minutes. Write a sentence interpreting the 20th percentile in the context of the situation.
- A bicyclist in the 90th 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 90th percentile in the context of the situation.

23. 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?

- The 40th percentile of speeds in a particular race is 7.5 miles per hour. Write a sentence interpreting the 40th 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 85th percentile of wait times. Is that good or bad? Write a sentence interpreting the 85th 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 78th 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 90th percentile. Should the manufacturer and the consumer be pleased or upset by this result? Explain and write a sentence that interprets the 90th percentile in the context of this problem.

28. The University of Wisconsin has two criteria used to set admission standards for students to be admitted to a college in the UW 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 96th 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 34th percentile. The 34th 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 = 50th percentile = _____
32. Third quartile = _____
33. Interquartile range (*IQR*) = _____ - _____ = _____
34. 10th percentile = _____
35. 70th percentile = _____

Use the following information to answer the next two 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.

2.3 Measures of the Center of the Data

36. Find the 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 2.55

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 2.56

c.	Points per Game	Frequency
	49.5–59.5	14
	59.5–69.5	32
	69.5–79.5	15

Points per Game	Frequency
79.5–89.5	23
89.5–99.5	2

Table 2.57

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 = $\bar{x} =$ _____
41. median = _____
42. mode = _____

2.4 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 2.57 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 2.57

44. A group of children are measured to determine the average height of the group. The results are in Table 2.58 below. What is the mean height of the group to the nearest hundredth of an inch?

Child	Height in inches
Adam	45.21
Betina	39.45
Chen	43.78
Donna	48.76

Edhas	37.39
Fran	39.90
George	45.56
Heather	46.24

Table 2.58

45. A person compares prices for five automobiles. The results are in [Table 2.59](#). What is the mean price of the cars the person has considered?

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

Table 2.59

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 2.60. 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 2.60

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 2.61.

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 2.61

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?

2.5 Geometric Mean

- 51.** What is the geometric mean of the data set given? 5, 10, 20
52. What is the geometric mean of the data set given? 9.000, 15.00, 21.00
53. What is the geometric mean of the data set given? 7.0, 10.0, 39.2
54. What is the geometric mean of the data set given? 17.00, 10.00, 19.00
55. What is the average rate of return for the values that follow? 1.0, 2.0, 1.5
56. What is the average rate of return for the values that follow? 0.80, 2.0, 5.0
57. What is the average rate of return for the values that follow? 0.90, 1.1, 1.2
58. What is the average rate of return for the values that follow? 4.2, 4.3, 4.5

2.6 Skewness and the Mean, Median, and Mode

Use the following information 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 this distribution.

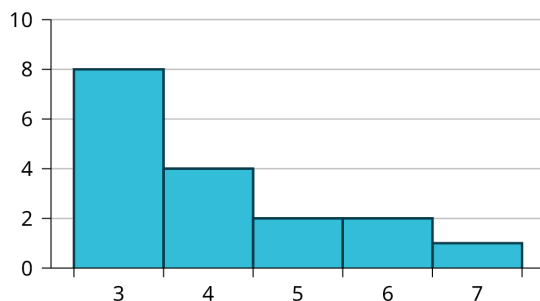


Figure 2.15

- 66.** Describe the relationship between the mode and the median of this distribution.

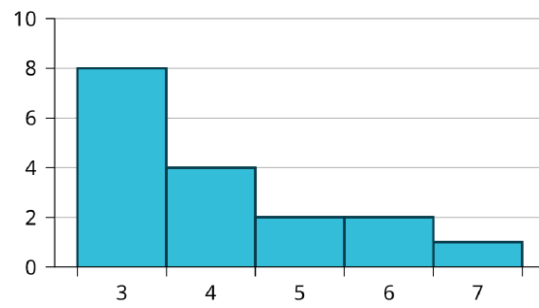


Figure 2.16

67. Describe the relationship between the mean and the median of this distribution.

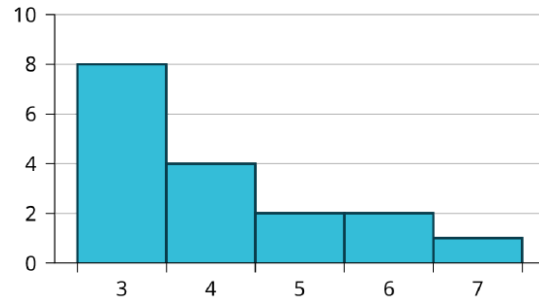


Figure 2.17

68. Describe the shape of this distribution.

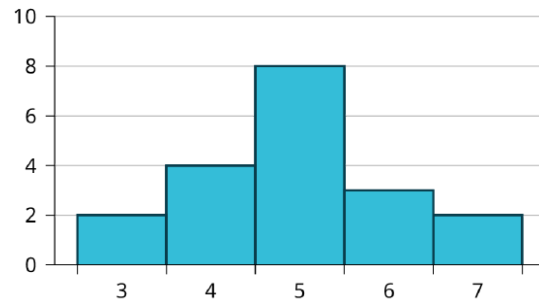


Figure 2.18

69. Describe the relationship between the mode and the median of this distribution.

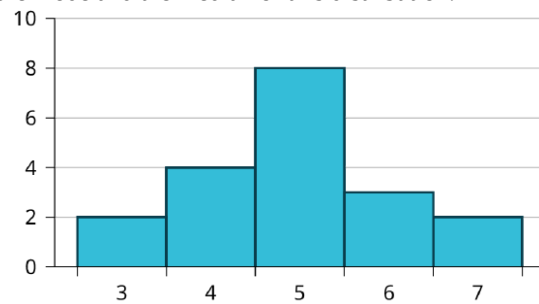


Figure 2.19

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

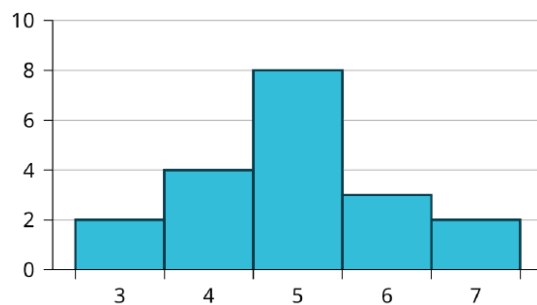


Figure 2.20

71. Describe the shape of this distribution.

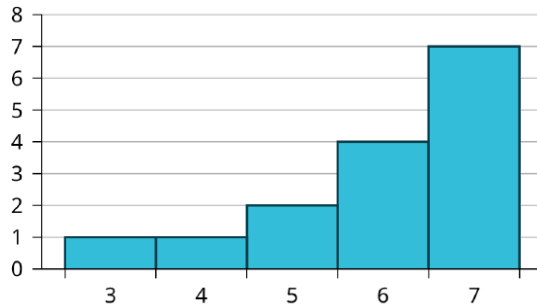


Figure 2.21

72. Describe the relationship between the mode and the median of this distribution.

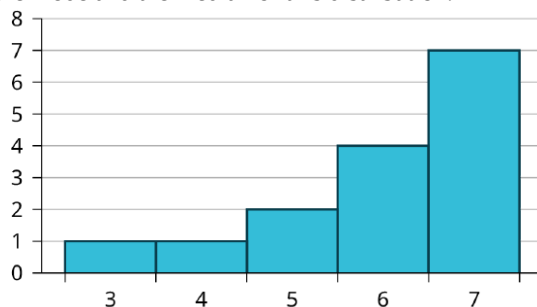


Figure 2.22

73. Describe the relationship between the mean and the median of this distribution.

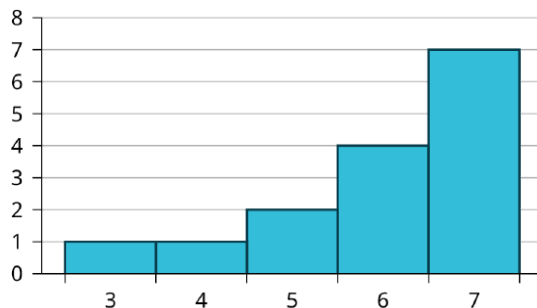


Figure 2.23

74. The mean and median for the data are the same.

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

Is the data perfectly symmetrical? Why or why not?

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

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

76. Which is the least, the mean, the mode, and the median of the 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. Use a graphing calculator or computer to 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?

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

Table 2.62

82. Use Table 2.62 to find the value that is three standard deviations:

- above the mean
- below the mean

Find the standard deviation for the following frequency tables using the formula. Check the calculations with the TI 83/84.

83. Find the standard deviation for the following frequency tables using the formula. Check the calculations with the TI 83/84.

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 2.63

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 2.64

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 2.65

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