Chapter 2

Describing Data: Frequency Tables, Frequency Distributions, and Graphic Presentation

1. Pepsi-Cola has a 25% market share, found by 90/360. (LO 3)

2. Three classes are needed, one for each player. (LO 1)

3. There are four classes: winter, spring, summer, and fall.
The relative frequencies are 0.1, 0.3, 0.4, and 0.2, respectively. (LO 1)

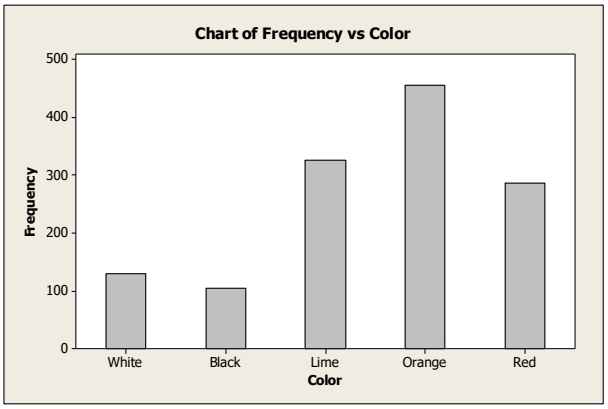
4. (LO 1)

City	Frequency	Relative Frequency
Indianapolis	100	0.05
St. Louis	450	0.225
Chicago	1300	0.65
Milwaukee	150	0.075

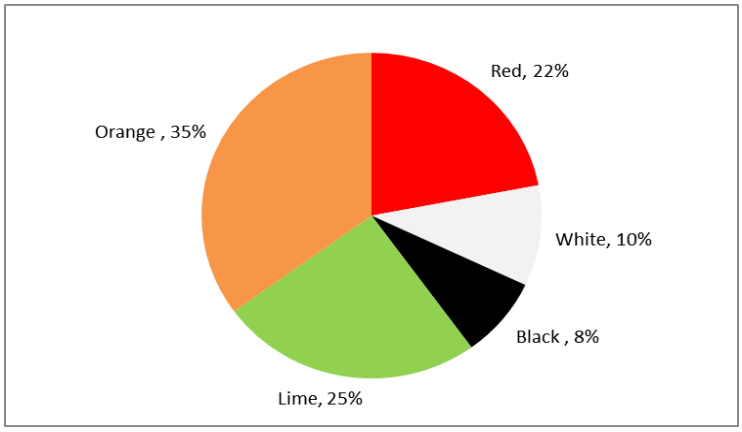
5. a. A frequency table.

Color	Frequency	Relative Frequency
Bright White	130	0.10
Metallic Black	104	0.08
Magnetic lime	325	0.25
Tangerine Orange	455	0.35
Fusion Red	286	0.22
Total	1300	1.00

b.



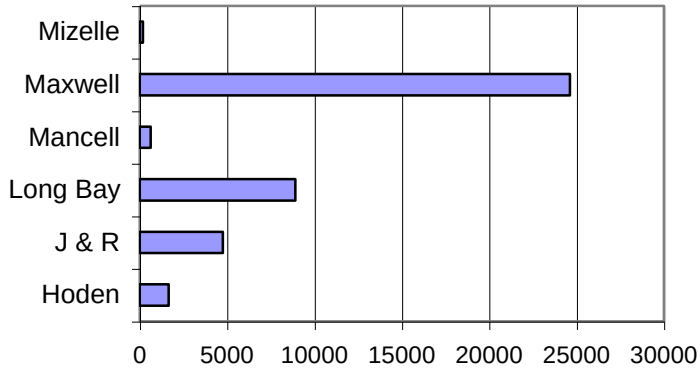
c.



d. 350,000 orange; 250,000 lime; 220,000 red; 100,000 white, and 80,000 black, found by multiplying relative frequency by 1,000,000 production. (LO 3)

6. Maxwell Heating & Air Conditioning far exceeds the other corporations in sales. Mancell electric & Plumbing and Mizelle Roofing & Sheet Metal are the two corporations with the least amount of fourth quarter sales. (LO 2)

7.



$2^5 = 32$, $2^6 = 64$ therefore 6 classes (LO 4)

8. $2^5 = 32$, $2^6 = 64$ suggests 6 classes. $i \geq \frac{\$29 - \$0}{6} = 4.47$ Use interval of 5. (LO 4)

9. $2^7 = 128$, $2^8 = 256$ suggests 8 classes $i \geq \frac{567 - 235}{8} = 41.5$ Use interval of 45. (LO 4)

10. a. $2^5 = 32$, $2^6 = 64$ suggests 6 classes.

b. $i \geq \frac{129 - 42}{6} = 14.5$ Use interval of 15 and start first class at 40. (LO 4)

11. a. $2^4 = 16$ suggests 5 classes

b. $i \geq \frac{31-25}{5} = 1.2$ Use interval of 1.5

c. 24

d.

	f	Relative frequency
24 up to 25.5	2	0.125
25.5 up to 27	4	0.250
27 up to 28.5	8	0.500
28.5 up to 30	0	0.000
30 up to 31.5	2	0.125
Total	16	1.000

e. The largest concentration is in the 27 up to 28.5 class (8). (LO 5)

12. a. $2^4 = 16$, $2^5 = 32$, suggest 5 classes

b. $i \geq \frac{98-51}{5} = 9.4$ Use interval of 10.

c. 50

d.

	f	Relative frequency
50 up to 60	4	0.20
60 up to 70	5	0.25
70 up to 80	6	0.30
80 up to 90	2	0.10
90 up to 100	3	0.15
Total	20	1.00

e. The fewest number is about 50, the highest about 100. The greatest concentration is in classes 60 up to 70 and 70 up to 80. (LO 5)

13. a.

Visits	f
0 up to 3	9
3 up to 6	21
6 up to 9	13
9 up to 12	4
12 up to 15	3
15 up to 18	1
Total	51

b. The largest group of shoppers (21) shop at BiLo 3, 4 or 5 times during a month period. Some customers visit the store only 1 time during the month, but others shop as many as 15 times.

c.

Number of Visits	*Percent of Total*
0 up to 3	17.65
3 up to 6	41.18
6 up to 9	25.49
9 up to 12	7.84
12 up to 15	5.88
15 up to 18	1.96
Total	100.00

(LO 5)

14. a. An interval of 10 is more convenient to work with. The distribution using 10 is:

	f
15 up to 25	1
25 up to 35	2
35 up to 45	5
45 up to 55	10
55 up to 65	15
65 up to 75	4
75 up to 85	3
Total	40

b. Data tends to cluster in classes 45 up to 55 and 55 up to 65.

c. Based on the distribution, the youngest person taking the Caribbean cruise is 15 years (actually 18 from the raw data). The oldest person was less than 85 years. The largest concentration of ages is between 45 up to 65 years.

d.

Ages	*Percent of Total*
15 up to 25	2.5
25 up to 35	5.0
35 up to 45	12.5
45 up to 55	25.0
55 up to 65	37.5
65 up to 75	10.0
75 up to 85	7.5
Total	100.0

(LO 5)

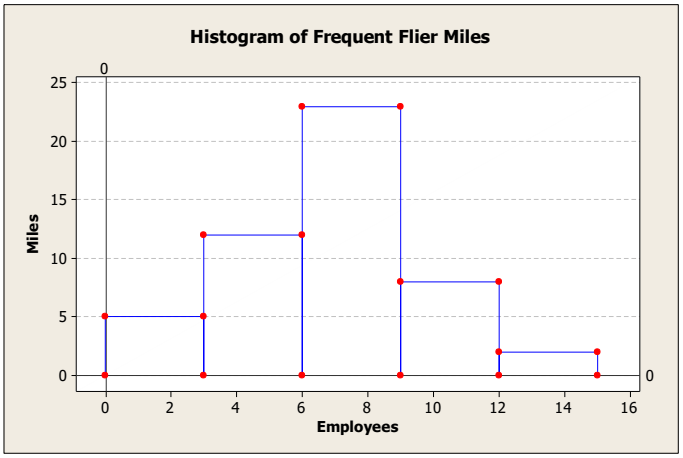
15. a. Histogram
b. 100
c. 5
d. 28
e. 0.28
f. 12.5
g. 13 (LO 6)

16. a. 3
b. about 26
c. 2
d. frequency polygon (LO 6)

17. a. 50

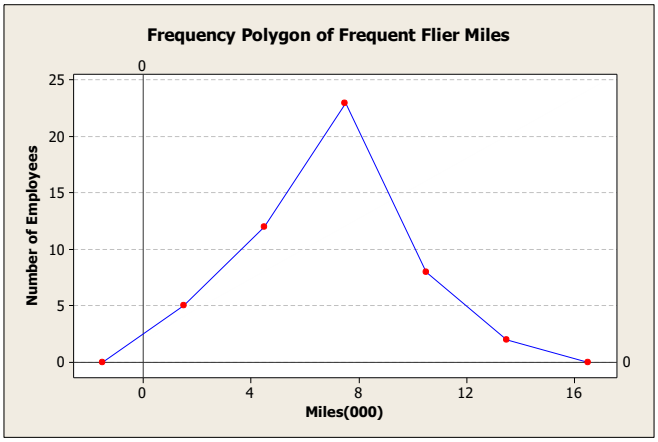
b. 1.5 thousands of miles

c.



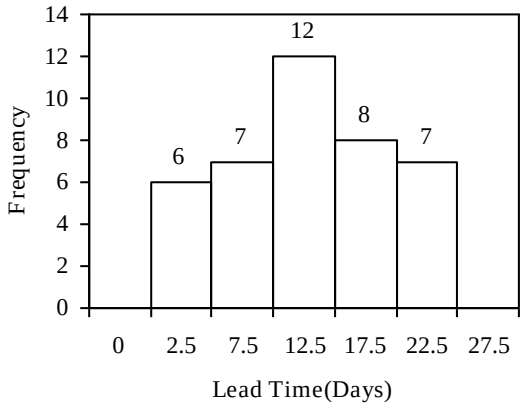
d. X = 1.5, Y = 5

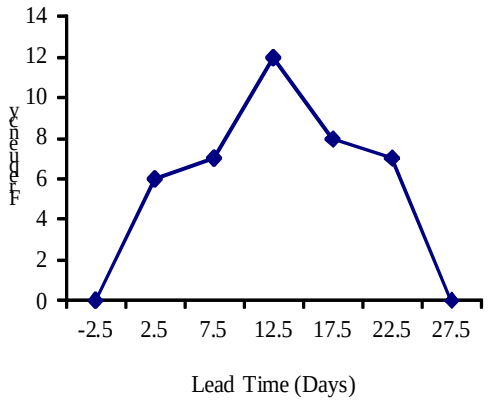
e.



f. For the 50 employees about half earn between 6 and 8 thousand frequent flier miles. Five earn less than 3 thousand frequent flier miles, and two earn more than 12 thousand frequent flier miles. (LO 6)

18. a. 40
    b. 2.5
    c. 2.5
    d.





    e. Based on the charts, the shortest lead time is 0 days, the longest 25 days. The concentration of lead times is 10-15 days. (LO 6)

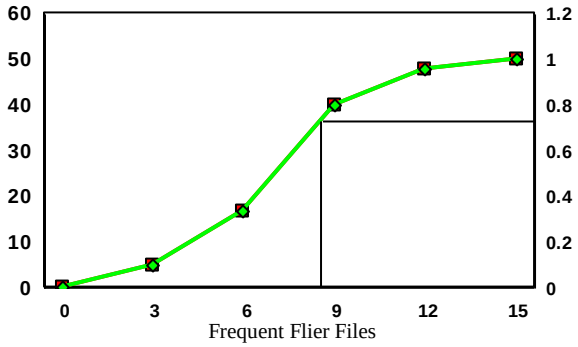
19. a. 40
    b. 5
    c. 11 or 12
    d. about $18 per hour
    e. about $9 per hour
    f. about 75% (LO 7)

20. a. 200
    b. about 50 or $50,000
    c. about $180,000
    d. about $240,000
    e. about 60 homes
    f. about 130 homes (LO 7)

21. a. 5
    b.

Miles	*f*	*CF*
0 up to 3	5	5
3 up to 6	12	17
6 up to 9	23	40
9 up to 12	8	48
12 up to 15	2	50

    c.



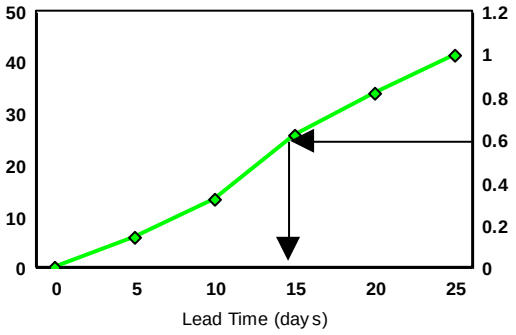
    d. about 8.7 thousands of miles (LO 7)

22. a. 13, 25

b.

Lead Time	*f*	*CF*
0 up to 5	6	6
5 up to 10	7	13
10 up to 15	12	25
15 up to 20	8	33
20 up to 25	7	40

c.

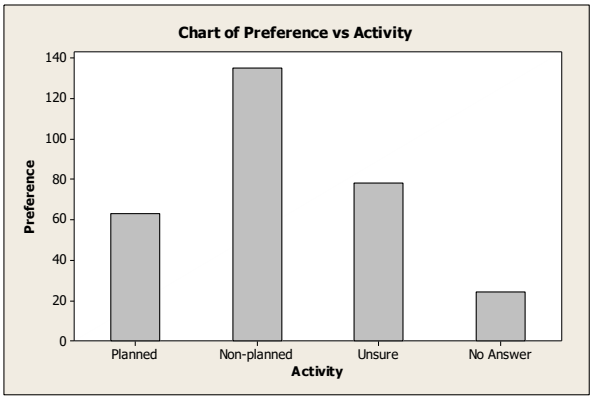


d. 14 (LO 7)

23. a. Qualitative variables are ordinarily nominal level of measurement, but some are ordinal. Quantitative variables are commonly of interval or ratio level of measurement.
b. Yes, both types depict samples and populations. (LO 1)

24. A frequency table calls for qualitative data. On the other hand, a frequency distribution involves quantitative data. (LO 1)

25. a. A frequency table.
b.



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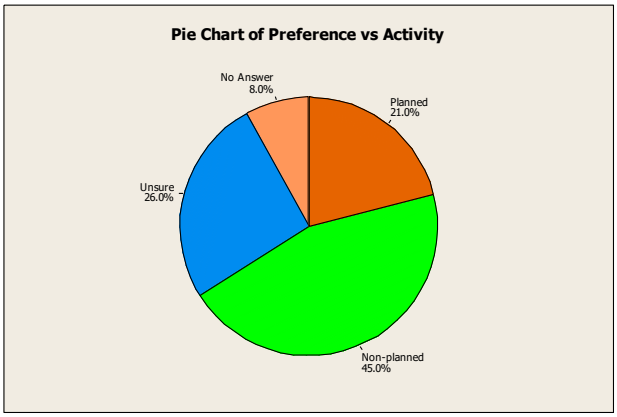


d. The pie chart may be easier to comprehend. (LO 3)

26. a. The scale is ordinal and the variable is qualitative.

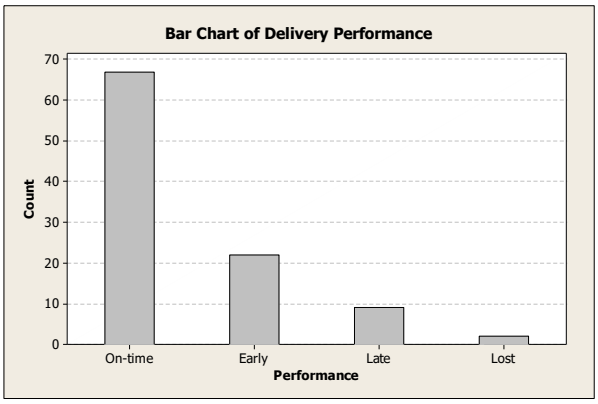
b.

Performance	Frequency
Early	22
On-time	67
Late	9
Lost	2

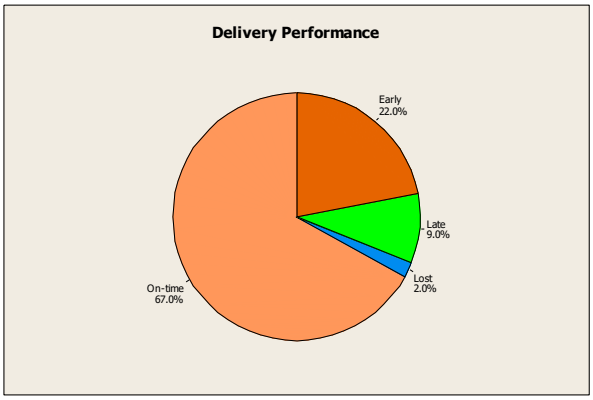
c.

Performance	Relative Frequency
Early	.22
On-time	.67
Late	.09
Lost	.02

d.



e.



f. 89% of the packages are either early or on-time and 2% of the packages are lost. So they are missing both of their objectives. They must eliminate all lost packages and reduce the late percentage to below 1%. (LO 3)

27. $2^6 = 64$ and $2^7 = 128$ suggest 7 classes (LO 4)

28. $2^7 = 128$, $2^8 = 256$ suggests 8 classes. $i \geq \dfrac{490 - 56}{8} = 54.25$ Use interval of 60. (LO 4)

29. a. 5 because $2^4 = 16 < 25$ and $2^5 = 32 > 25$

b. $i \geq \dfrac{48 - 16}{5} = 6.4$ use interval of 7.

c. 15

d.

Class	Frequency
15 up to 22	3
22 up to 29	8
29 up to 36	7
36 up to 43	5
43 up to 50	2
	25

e. It is fairly symmetric with most of the values between 22 and 36. (LO 4)

30. a. 6 because $2^5 = 32 < 45$ and $2^6 = 64 > 45$

b. 100, found by $\dfrac{570 - 41}{6} = 88.17$

c. 0

d.

Class	*Frequency*
0 up to 100	3
100 up to 200	12
200 up to 300	16
300 up to 400	10
400 up to 500	3
500 up to 600	1
	45

(LO 4)

31. a. 2^5 = 32 <45 < 64 = 2^6. Thus 6 classes are recommended.
b. The interval width should be at least 1.5, found by (10-1) /6. Use 2 for convenience.
c. 0
d.

Class	Frequency
0 up to 2	1
2 up to 4	5
4 up to 6	12
6 up to 8	17
8 up to 10	8
10 up to 12	2

e. The distribution is fairly symmetric or "bell-shaped" with a large peak in the middle two classes of 4 up to 8. (LO 4)

32. a. 2^5 = 32 <36 < 64 = 2^6. Thus 6 classes are recommended.
b. The interval width should be at least 2, found by (15-3) /6. Use 2.2 for convenience and to ensure there are only 6 classes
c. 2.2
d.

Class	Frequency
2.2 up to 4.6	2
4.6 up to 6.8	7
6.8 up to 9	11
9 up to 11.2	12
11.2 up to 13.4	2
13.4 up to 15.6	2

e. The distribution is fairly symmetric or "bell-shaped" with a large peak in the middle two classes of 6.8 up to 11.2. (LO 4)

33.

Class	Frequency
0 up to 200	19
200 up to 400	1
400 up to 600	4
600 up to 800	1
800 up to 1000	2

This distribution is positively skewed with a large "tail" to the right or positive values. Notice that the top 7 tunes account for 4342 plays out of a total of 5968 or about 73 percent of all plays. (LO 5)

34. a. $2^5 = 32 < 33 < 64 = 2^6$. Thus 6 classes are recommended.
b. The interval width should be at least 1253, found by (7829-312) /6. Use 1500 for convenience.
c. 0
d.

Class	Frequency
0 up to 1500	1
1500 up to 3000	2
3000 up to 4500	0
4500 up to 6000	7
6000 up to 7500	20
7500 up to 9000	3

e. This distribution is negatively skewed with a few very small values which likely correspond to the "start up" phase of this publication. The crest of the distribution is in the 6000 up to 7500 class which contains the greater part or 20 of the 33 months. (LO 4)

35. a. 56
b. 10 (found by 60 – 50)
c. 55
d. 17 (LO 7)

36. a. Cumulative frequency polygon
b. 250
c. 50 (found by 100 – 50)
d. $240,000
e. $230,000 (LO 4)

37. a. $30.50, (found by 265 – 82)/6
b. $35
c.

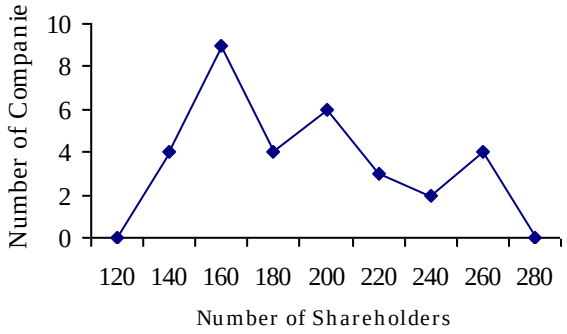
$70 up to $105	4
105 up to 140	17
140 up to 175	14
175 up to 210	2
210 up to 245	6
245 up to 280	1
Total	44

d. The purchases ranged from a low of about $70 to a high of about $280. The concentration is in the $105 up to $175 class. (LO 4)

38. a. Class interval is 19, found by (266 – 133)/7. We selected 20.

Stockholders (000)	*Number of companies*	*Less than CF*
130 up to 150	4	4
150 up to 170	9	13
170 up to 190	4	17
190 up to 210	6	23
210 up to 230	3	26
230 up to 250	2	28
250 up to 270	4	32
Total	32	

b.



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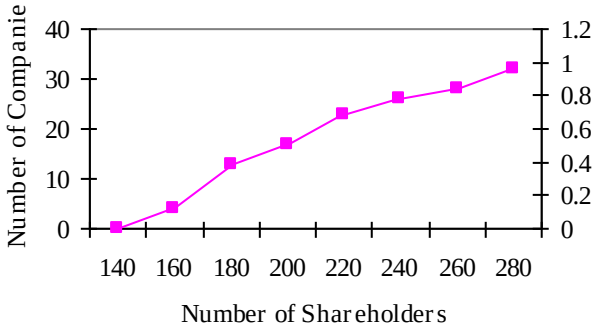
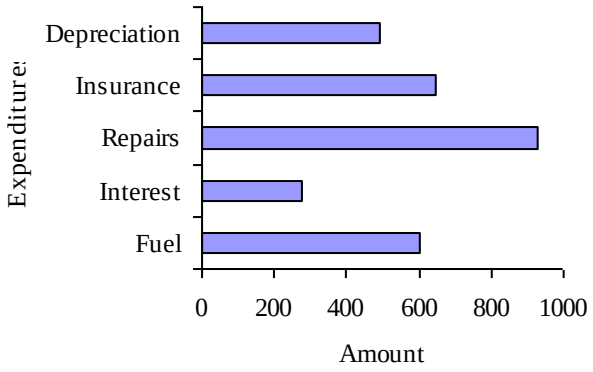


d. About 220 thousand, found by ¾ of 32 = 24. The 24th company has about 220 thousand shareholders found by drawing a line to the curve from 24 and down to the X-axis.

e. The largest number of companies (9) have 150 up to 170 thousand shareholders. The smallest number is about 130 thousand, the largest number is about 270 thousand. (LO 7)

39. (LO 3)

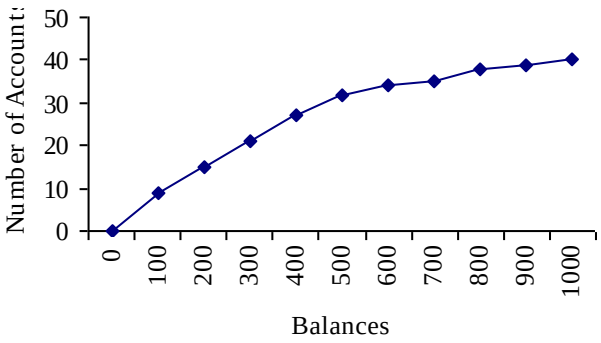


40. a.

Balance	*f*	*CF*
0 up to 100	9	9
100 up to 200	6	15
200 up to 300	6	21
300 up to 400	6	27
400 up to 500	5	32
500 up to 600	2	34
600 up to 700	1	35
700 up to 800	3	38
800 up to 900	1	39
900 up to 1000	1	40
Total	40	

Probably a class interval of $200 would be better.

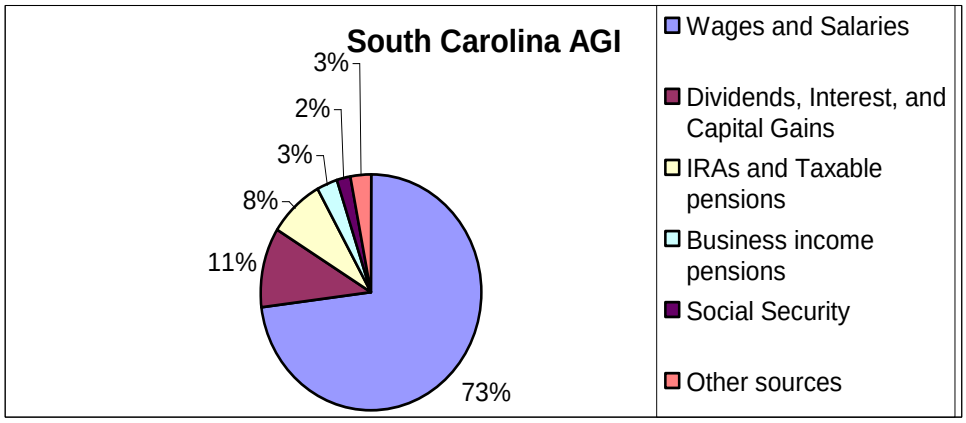
b.



c. About 67% have less than a $400 balance. Therefore, about 33% would be considered "preferred."

d. Less than $50 would be a convenient cutoff point. (LO 7)

41.

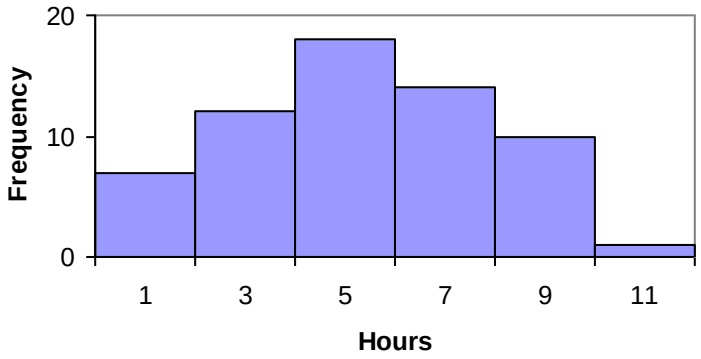


By far the largest part of income in South Carolina is earned income. Almost three-fourths of adjusted gross income comes from wages and salaries. Dividends and IRAs each contribute roughly another ten percent. (LO 3)

42. a. Since $2^5 = 32 < 60 < 64 = 2^6$, 6 classes are recommended. The interval should be at least (10.1 – 0.4)/6 = 1.6. So we will use two as a convenient value.

Hours	*f*
0 up to 2	7
2 up to 4	11
4 up to 6	19
6 up to 8	12
8 up to 10	10
10 up to 12	1
Total	60

b.

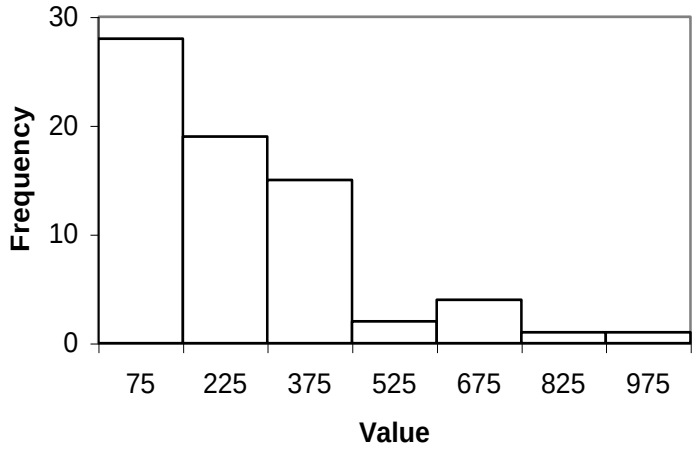


The "typical" person used the computer about 5 hours per week and everyone is within about five hours of that amount. (LO 6)

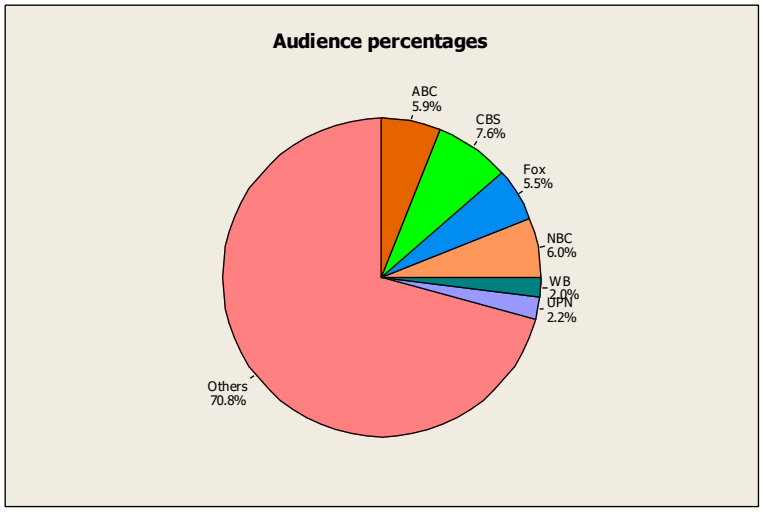
43. a. Since $2^6 = 64 < 70 < 128 = 2^7$, 7 classes are recommended. The interval should be at least (1002.2 – 3.3)/7 = 142.7 use 150 as a convenient value. (LO 4)

Values	*f*
0 up to 150	28
150 up to 300	19
300 up to 450	15
450 up to 600	2
600 up to 750	4
750 up to 1050	1
Total	70

b.



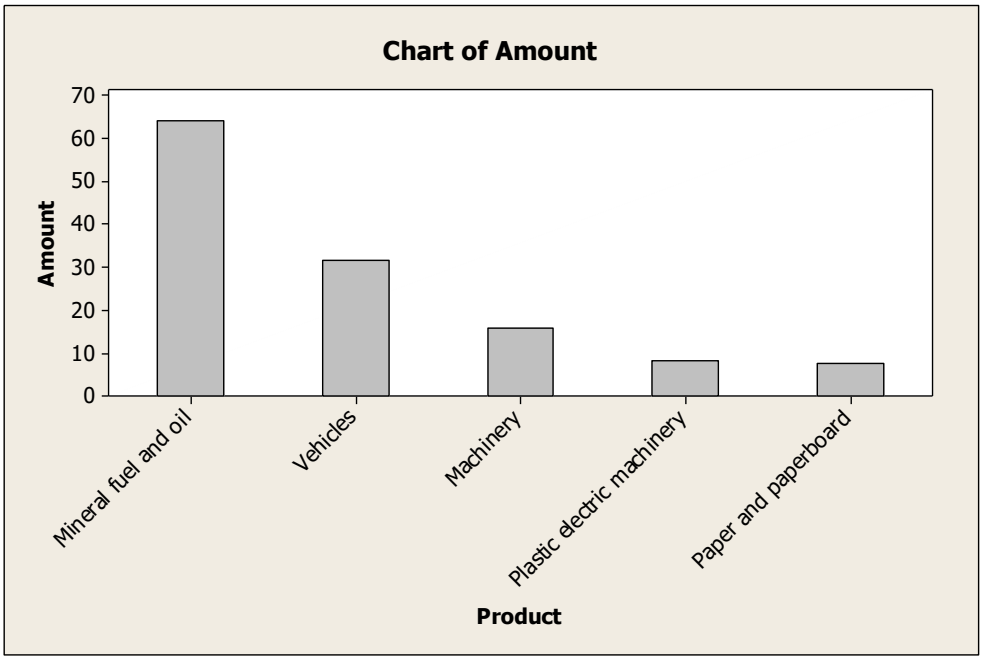
44. (LO 3)



45. a. pie chart
b. 215, found by 0.43(500)
c. Seventy-eight percent are in either a house of worship (43%) or outdoors (35%). (LO 3)

46. a. 87.88%, found by 44.54% + 43.34%
b. Corporate taxes (8.31%) are more than license fees (2.9%)
c. 2.81 billion, found by (0.4454)(6.3), in sales taxes and
2.73 billion, found by (0.4334)(6.3), in individual taxes (LO 3)

47. a.



b. Mineral fuel and oil are 28.4%, found by 63.9/224.9, of total exports to the U.S. Vehicles are 14.1%, found by 31.6/224.9. The two categories together represent 42.5% of Canada's total exports to the United States.

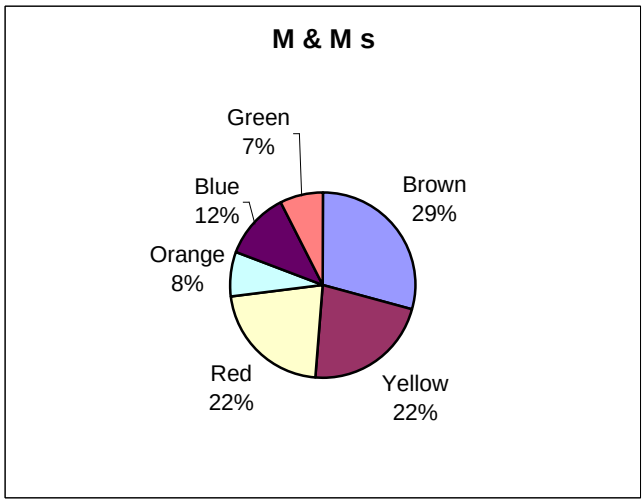
c. Mineral fuel and oil are 50.3%, found by 63.9/127, of the top five exported products to the U.S. Vehicles are 24.9%, found by 31.6/127. The two categories together represent 75.2% of Canada's top five exports to the United States.

48. There are 50 observations so the recommended number of classes is 6. However, there are several states that have many more farms than the others, so it may be useful to have an open ended class.
One possible frequency distribution is.

Farms in USA	*Frequency*
0 up to 20	16
20 up to 40	13
40 up to 60	8
60 up to 80	6
80 up to 100	4
100 or more	3
Total	50

Twenty-nine of the 50 states, or 58 percent, have fewer than 40,000 farms. There are three states that have more than 100,000 farms. (LO 4)

49.

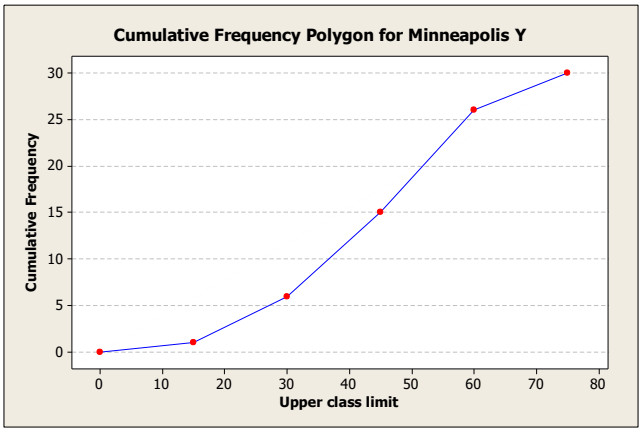


Brown, yellow, and red make up almost 75 percent of the candies. The other 25 percent is composed of blue, orange, and green. (LO 2)

50. a.

Class	Cumulative Frequency
0 up to 15	1
15 up to 30	6
30 up to 45	16
45 up to 60	26
60 up to 75	30

b.



c. 6 days saw fewer than 30.

d. The highest 80 percent of the days had at least 30 families. (LO 7)

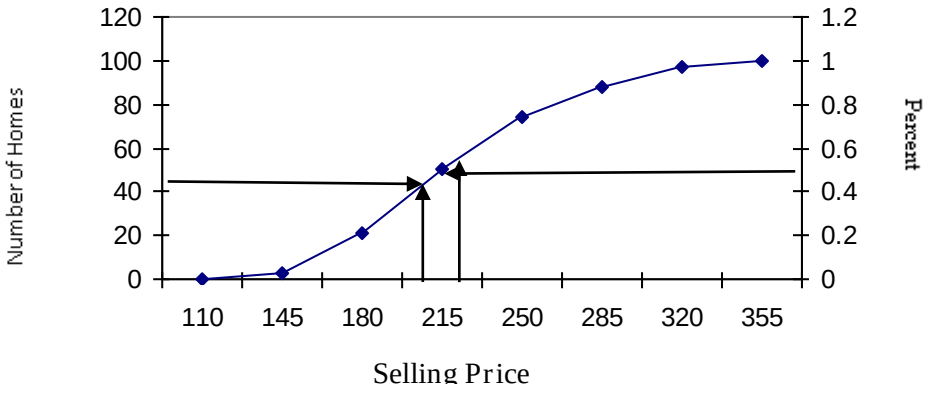
51. $i \geq \dfrac{345.3 - 125.0}{7} = 31.47$ Use interval of 35.

Selling Price	*F*	*CF*
110 up to 145	3	3
145 up to 180	19	22
180 up to 215	31	53
215 up to 250	25	78
250 up to 285	14	92
285 up to 320	10	102
320 up to 355	3	105

a. Most homes (53%) are in the 180 up to 250 range.

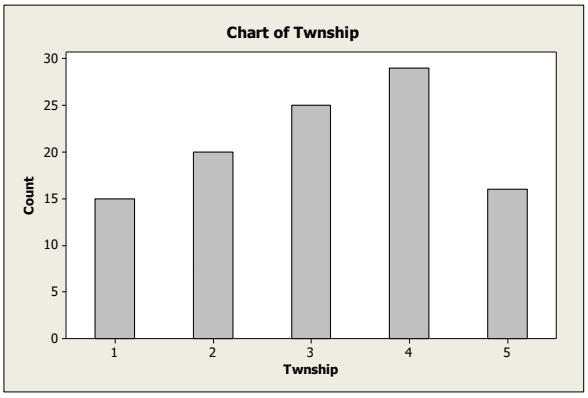
b. The largest value is near 355; the smallest, near 110.

c.



About 42 homes sold for less than 200.
About 55% of the homes sold for less than 220. So 45% sold for more.
Less than 1% of the homes sold for less than 125.

d.



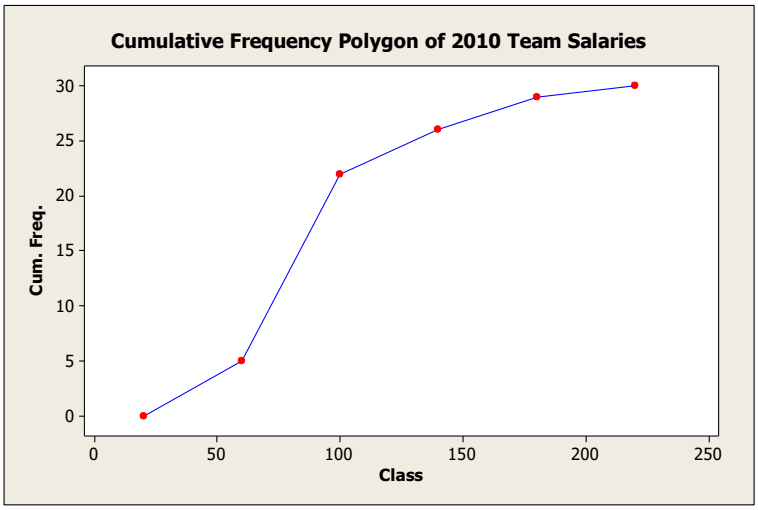
Townships 3 and 4 have more sales than average and Townships 1 and 5 have somewhat less than the average. (LO 7)

52. a. Since $2^4 = 16 < 30 < 32 = 2^5$, use 5 classes. The interval should be at least (206.33 – 34.94)/5 = 34.3 (in millions of dollars). Use 40. The resulting frequency distribution is:

Class	*f*
20 up to 60	5
60 up to 100	17
100 up to 140	4
140 up to 180	3
180 up to 220	1

1. The typical team payroll is 90. It ranges from 20 to 220 (in millions).
2. The distribution is positively skewed. The higher payroll teams are further from the center than the lower payroll teams. The Yankees appear to be quite unusual!

b.



1. Forty-percent of the teams have payrolls less than $75,000,000.
2. Twenty-two teams pay less than $100,000,000.
3. The lowest five teams pay less than $60,000,000.

c. Use 5 classes here also. The interval should be at least (56,000 – 34,077)/5 = 4384.6. Use 5000 for convenience. The resulting frequency distribution is:

Class	*f*
33,000 up to 38,000	3
38,000 up to 43,000	13
43,000 up to 48,000	5
48,000 up to 53,000	8
53,000 up to 58,000	1

1. A typical stadium seats 42,000. The sizes cluster between 38,000 and 48,000.
2. The distribution is fairly balanced with a slight positive skew. No stadium is out of line with the others.

d. Use 5 classes here also. The interval should be at least (2010 – 1912)/5 = 19.6. Use 20 for convenience and to include extreme values. The resulting frequency distribution is below.

Class	*f*
1910 up to 1930	2
1930 up to 1950	0
1950 up to 1970	3
1970 up to 1990	3
1990 up to 2010	22

1. The typical stadium was built around 1997. The majority cluster in the years between 1990 and 2010.
2. The distribution is negatively skewed because 2 “old” stadiums are at least 80 years older than the rest.

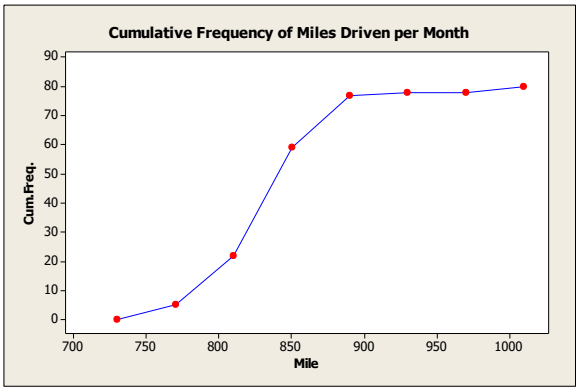
53. Since $2^6 = 64 < 80 < 128 = 2^7$, use 7 classes. The interval should be at least (1008 – 741)/7 = 38.14 miles. Use 40. The resulting frequency distribution is:

Class	*f*
730 up to 770	5
770 up to 810	17
810 up to 850	37
850 up to 890	18
890 up to 930	1
930 up to 970	0
970 up to 1010	2

a. The typical amount driven is 830 miles. The range is from 740 up to 1010 miles.

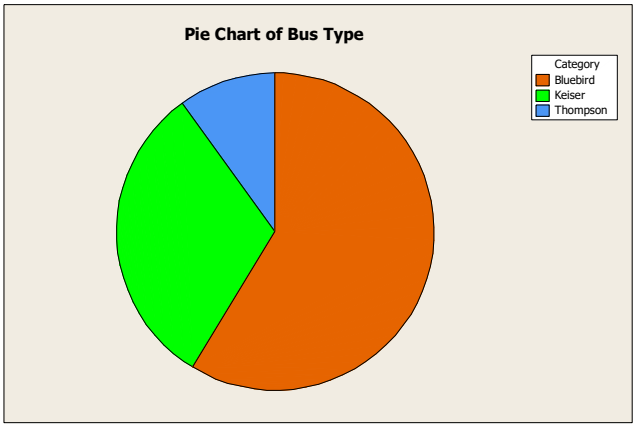
b. The distribution is “bell shaped” around 830. However, there are two outliers up around 1000 miles.

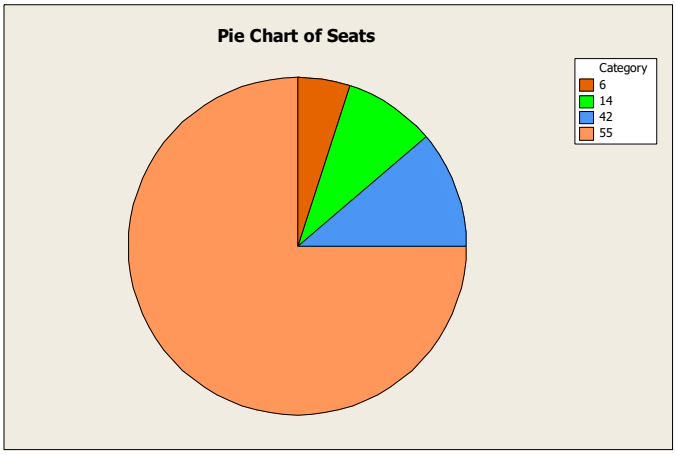
c.



Forty percent of the buses were driven fewer than 820 miles.
Fifty-nine busses were driven less than 850 miles.

d.





The first chart shows that Bluebird makes most of the buses. The second diagram shows that nearly three fourths of the buses have 55 seats. (LO 7)