Chapter 2

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

1. Pepsi-Cola has a 25% market share, found by 90/360. **(LO2-2)**

2. Three classes are needed, one for each player. **(LO2-1)**

3.

Season	Frequency	Relative Frequency
Winter	100	0.1
Spring	300	0.3
Summer	400	0.4
Fall	200	0.2
Total	1000	1.0

(LO2-1)

4.

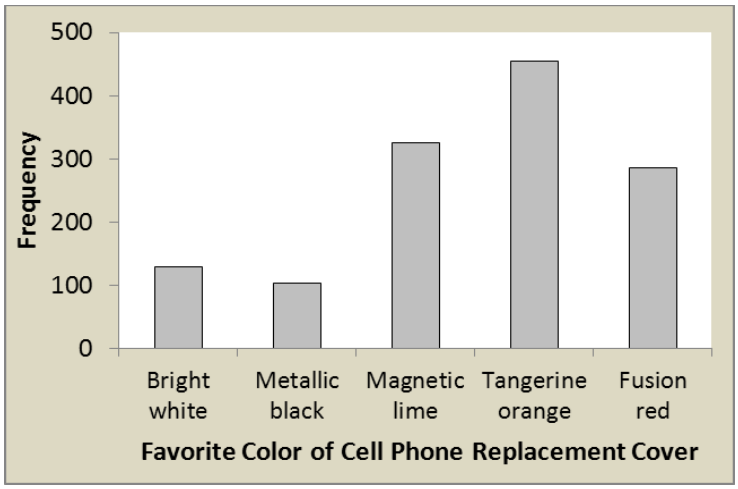
City	Frequency	Relative Frequency
Indianapolis	100	0.05
St. Louis	450	0.225
Chicago	1300	0.65
Milwaukee	150	0.075

(LO2-1)

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.



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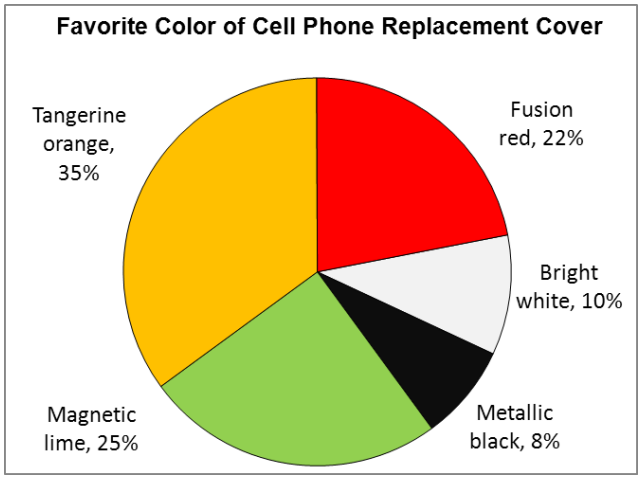
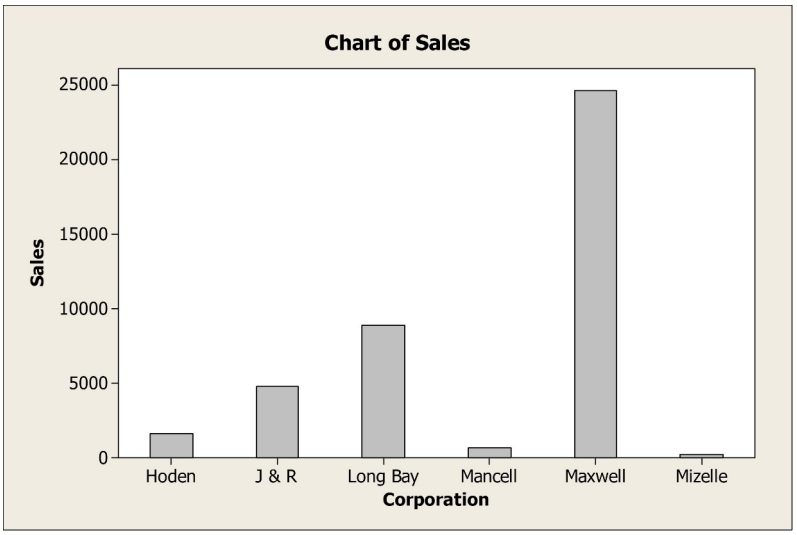


d. Wellstone Inc. should produce 350,000 orange; 250,000 lime; 220,000 red; 100,000 white, and 80,000 black. These numbers are found by multiplying the relative frequency of each color by the 1,000,000 production level. **(LO2-2)**

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. **(LO2-2)**



7. $2^5 = 32 < 38 < 64 = 2^6$ therefore 6 classes **(LO2-3)**

8. $2^5 = 32 < 45 < 64 = 2^6$ suggests 6 classes. $i \geq \frac{\$29 - \$0}{6} = 4.47$ Use interval of 5. **(LO2-3)**

9. $2^7 = 128 < 230 < 256 = 2^8$ suggests 8 classes $i \geq \frac{567 - 235}{8} = 41.5$ Use interval of 45. **(LO2-3)**

10. a. $2^5 = 32 < 53 < 64 = 2^6$ suggests 6 classes.

a. $i \geq \frac{129 - 42}{6} = 14.5$ Use interval of 15 and start first class at 40. **(LO2-3)**

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

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

b. 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 number of units produced in the past 16 days range between 24 and 31 units. The largest concentration is in the 27 up to 28.5 class (8). **(LO2-3)**

12. a. $2^4 = 16 < 20 < 32 = 2^5$ 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. **(LO2-3)**

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

a. 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

(LO2-3)

14. a. The 2^k rule would suggest 6 classes as $2^5 = 32 < 40 < 64 = 2^6$. With six classes the interval would be larger than (84 – 18) / 6 = 11, but as we are summarizing money observations a class interval of 10 is more convenient to work with.
The frequency 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

a. Data tends to cluster in classes 45 up to 55 and 55 up to 65.
b. 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 (actually 84 from the raw data). The largest concentration of ages is between 45 up to 65 years.
d.

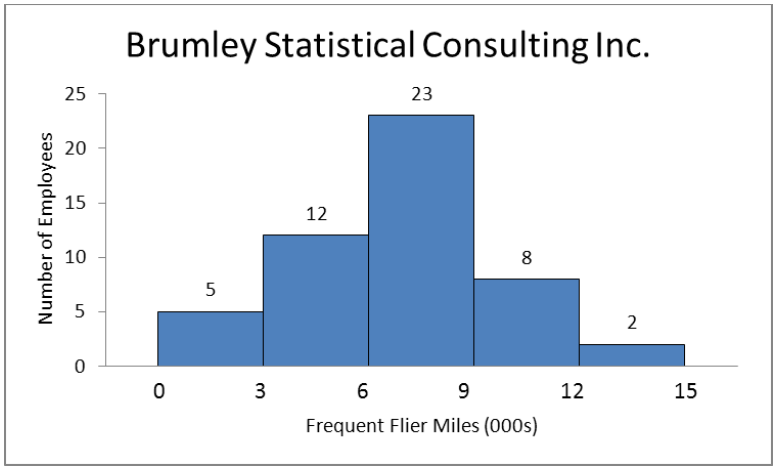
Ages	*Percent of Total*
15 up to 25	2.5
25 up to 35	5.0
35 up to 45	12.5
45 up to 55	25.0
55 up to 65	37.5
65 up to 75	10.0
75 up to 85	7.5
Total	100.0

(LO2-3)

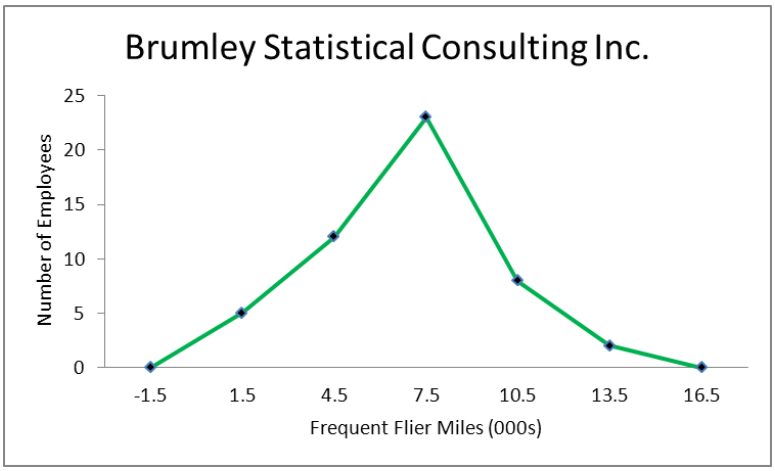
15. a. Histogram
b. 100
c. 5
d. 28
e. 0.28
f. 12.5
g. 13 **(LO2-4)**

16. a. 3
b. about 26
c. 2
d. frequency polygon **(LO2-4)**

17. a. 50
b. 1.5 thousand frequent flier miles
c.

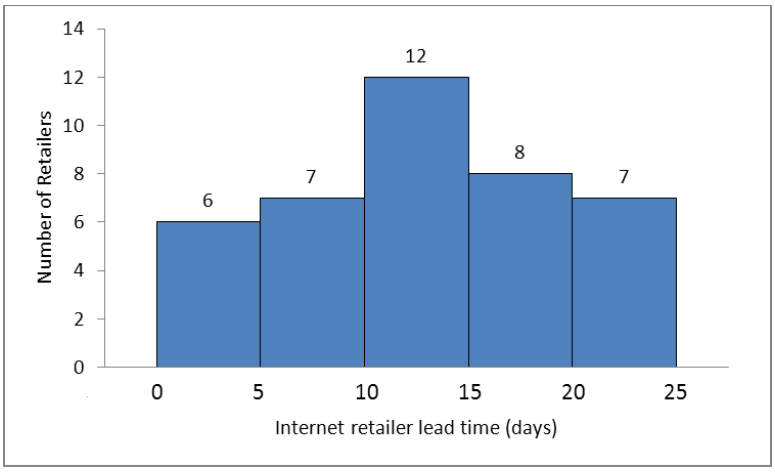


d. X = 1.5, Y = 5
e.



f. For the 50 employees about half earn between 6 and 9 thousand frequent flier miles. Five earn less than 3 thousand frequent flier miles, and two earn more than 12 thousand frequent flier miles. **(LO2-4)**

18. a. 40
b. 2.5 days
c. 2.5,6
d.



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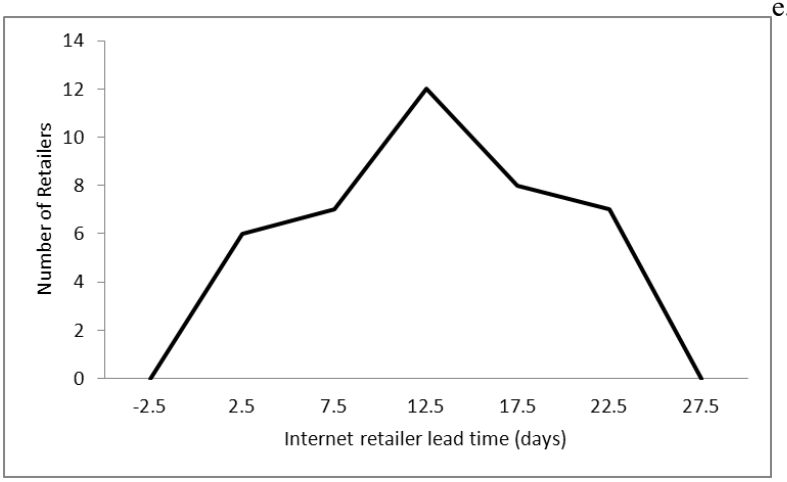


f. Based on the charts, the shortest lead time is 0 days, the longest 25 days. The concentration of lead times is 10-15 days. **(LO2-4)**

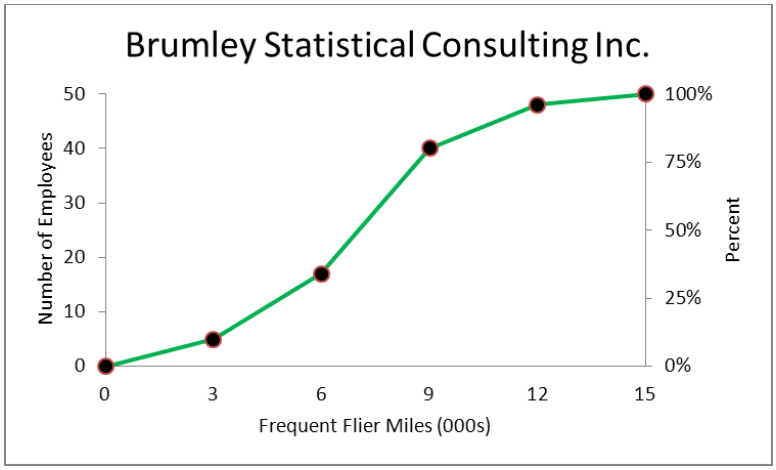
19. a. 40
b. 5
c. 11 or 12
d. about $18 per hour
e. about $9 per hour
f. about 78% **(LO2-4)**

20. a. 200
b. 50 or $50,000
c. about $180,000
d. about $240,000
d. about 60 homes
e. about 145 homes **(LO2-4)**

21. a. 5
b. *Miles* *CF*

Less than 3	5
Less than 6	17
Less than 9	40
Less than 12	48
Less than 15	50

c.



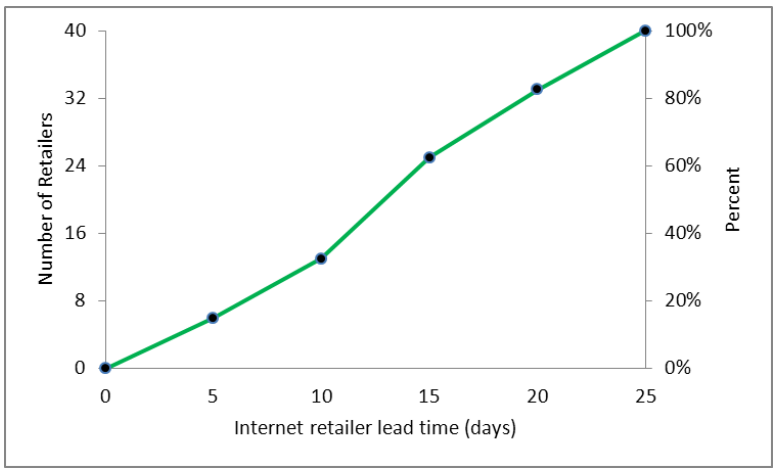
d. about 8.7 thousand frequent flier miles **(LO2-4)**

22. a. 13, 25

b.

Lead Time	*CF*
Less than 5	6
Less than 10	13
Less than 15	25
Less than 20	33
Less than 25	40

c.

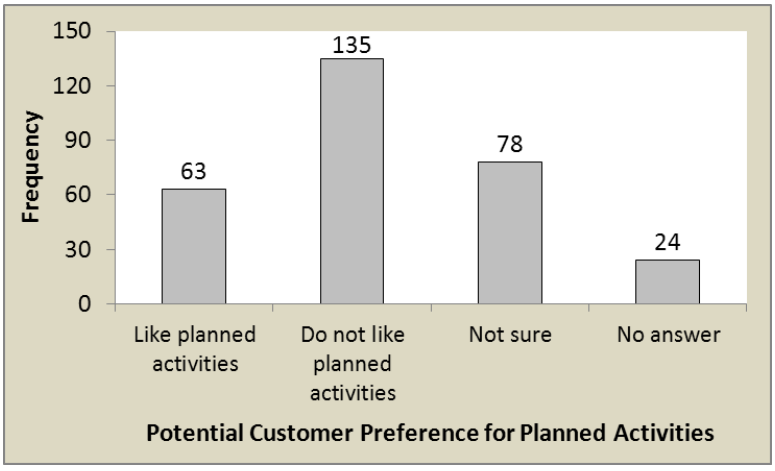


d. 14 **(LO2-4)**

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. **(LO1-5)**
b. Yes, both types depict samples and populations. **(LO1-3)**

24. A frequency table calls for qualitative data. On the other hand, a frequency distribution involves quantitative data. **(LO2-1 and 2-3)**

25. a. A frequency table.
b.



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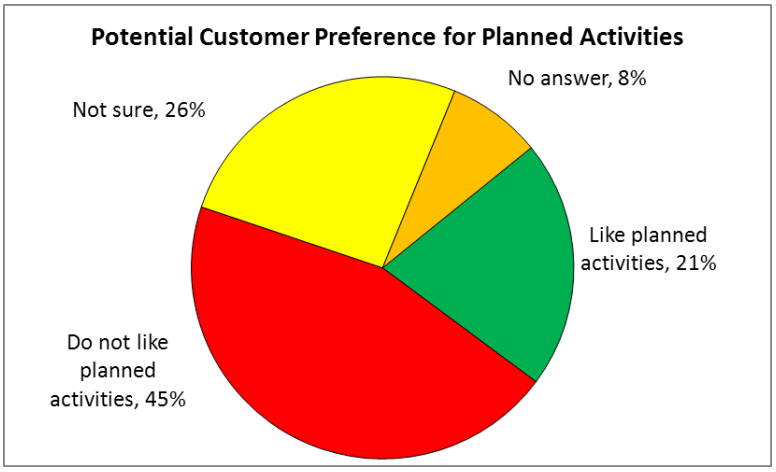


d. The pie chart may be easier to comprehend as the percentages of potential customers are likely more important than the number of potential customers. **(LO2-2)**

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

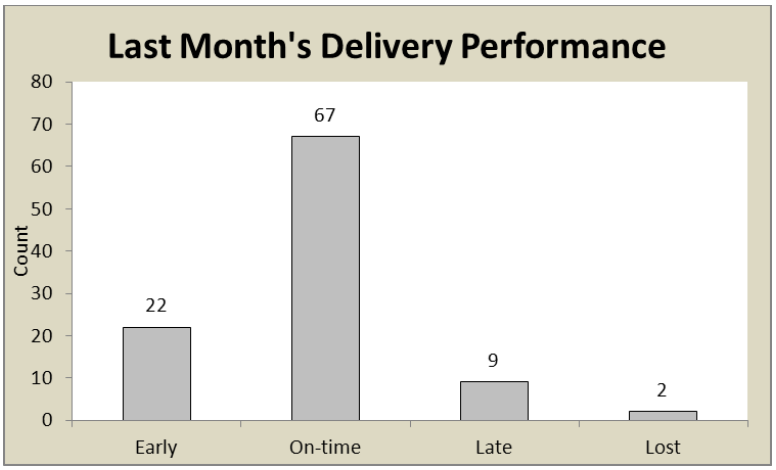
b.

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

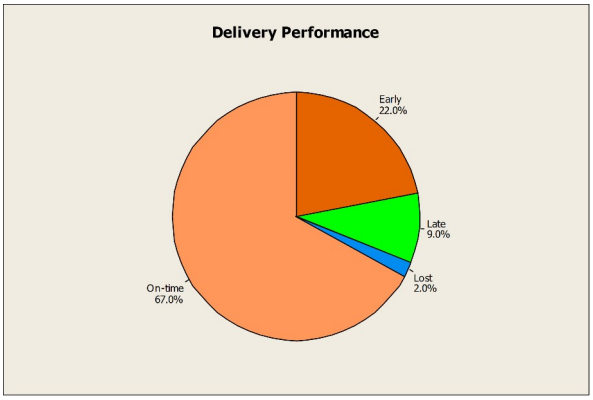
c.

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%. **(LO2-2)**

27. The 2^k rule would suggest using 7 classes as $2^6 = 64 < 83 < 128 = 2^7$. **(LO2-3)**

28. $2^7 = 128 < 145 < 256 = 2^8$ suggests 8 classes. $i \geq \frac{490 - 56}{8} = 54.25$ Use interval of 60. **(LO2-3)**

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

b. $i \geq \frac{48 - 16}{5} = 6.4$ suggests an 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
Total	25

e. Based on the frequency distribution we see the data are fairly symmetric with most of the values between 22 and 36 and a minimum of 15 and a maximum of 50. **(LO2-3)**

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

a. 100, suggested as the interval must be larger than $i \geq \frac{570 - 41}{6} = 88.17$

b. 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
Total	45

(LO2-3)

31. a. 6 because $2^5 = 32 < 45 < 64 = 2^6$.
    b. The interval width should be at least 1.5 as $i \geq (10\text{-}1)/6$. 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
Total	45

    e. The distribution is fairly symmetric or "bell-shaped" with most of the observations occurring in the middle two classes of 4 up to 8. **(LO2-3)**

32. a. 6 because $2^5 = 32 < 36 < 64 = 2^6$.
    b. The interval width should be at least 2 as $i \geq (15\text{-}3)/6$. Use 2.2 for convenience and to ensure there are only 6 classes
    c. 2.2
    d.

Class	Frequency
2.2 up to 4.4	2
4.4 up to 6.6	7
6.6 up to 8.8	11
8.8 up to 11.0	7
11.0 up to 13.2	7
13.2 up to 15.4	2
Total	36

    e. The distribution is fairly symmetric or "bell-shaped" with a peak in the middle class of 6.6 up to 8.8. **(LO2-3)**

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
Total	27

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. **(LO2-3)**

34. a. $2^5 = 32 < 33 < 64 = 2^6$. Thus 6 classes are recommended.
b. The interval width should be at least 1253 as $i \geq (7829\text{-}312)/6$. 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
Total	33

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. **(LO2-3)**

35. a. 56
b. 10 (found by 60 – 50)
c. 55
d. 17 **(LO2-4)**

36. a. Cumulative frequency polygon
b. 250
c. 50 (found by 100 – 50)
d. $240,000
e. $230,000 **(LO2-4)**

37. a. $2^5 = 32 < 33 < 64 = 2^6$. Thus 6 classes are recommended.
The minimum class interval size would be $30.50 as $i \geq (265 - 82)/6$ thus an interval of 35 would work.
b.

Class	Frequency
$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

c. Based on the frequency distribution the purchases ranged from a low of about $70 to a high of about $280. The concentration is in the $105 up to $175 classes. **(LO2-3)**

38. a. $2^4 = 16 < 24 < 32 = 2^5$. Thus 5 classes are recommended. Class interval is at least 387 as $i \geq (1957 - 22)/5$. A suggest interval size would be 400.

Outstanding Shares(millions)	Number of Companies
0 up to 400	10
400 up to 800	8
800 up to 1200	4
1200 up to 1600	1
1600 up to 2000	1
Total	24

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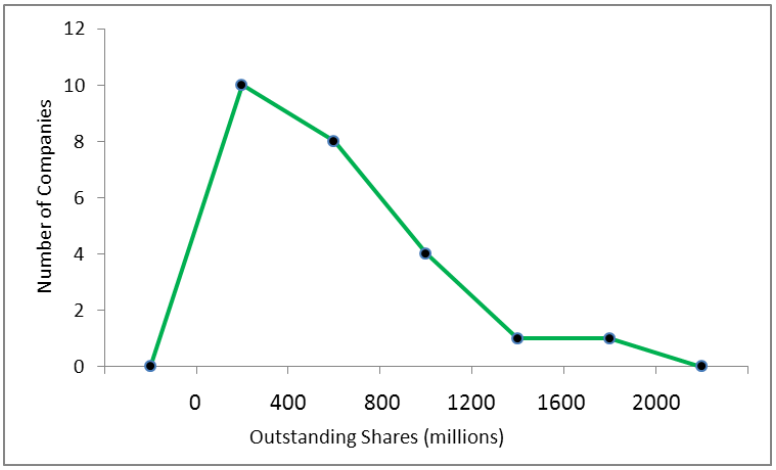
b.



c.

Outstanding Shares(millions)	Number of Companies
Less than 400	10
Less than 800	18
Less than 1200	22
Less than 1600	23
Less than 2000	24

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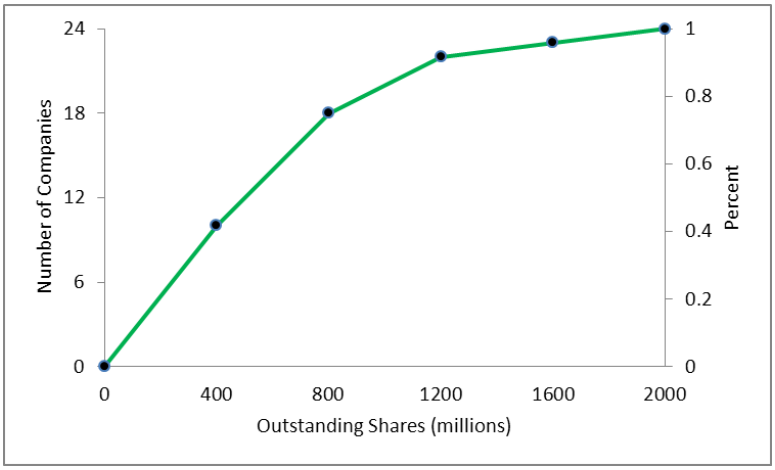
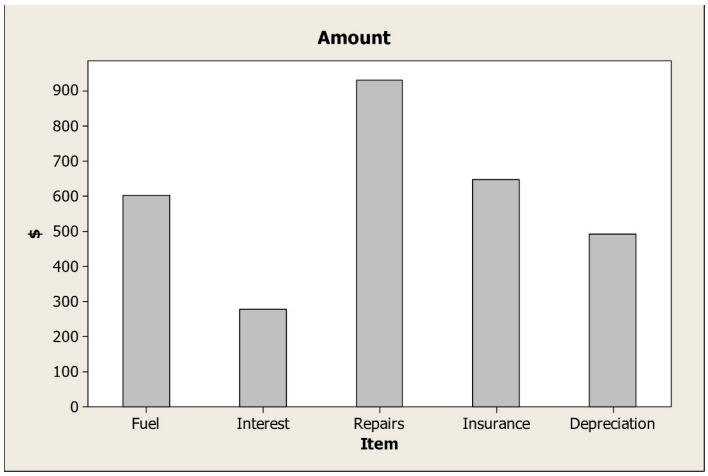


e. About 800 million shares are outstanding for the lowest 75% of the companies. This is found by drawing a line to the curve from 75% and reading off the value on the X-axis.

f. The number of outstanding shares range from 0 to 2 billion, with the largest number of companies (10 of 24) having less than 400 million outstanding shares. Only 2 companies have more than 1200 million shares. **(LO2-4)**

39. This data is qualitative and can be represented with either a bar chart or a pie chart. Bar charts are preferred when the goal is to compare the actual amount in each category. **(LO2-2)**



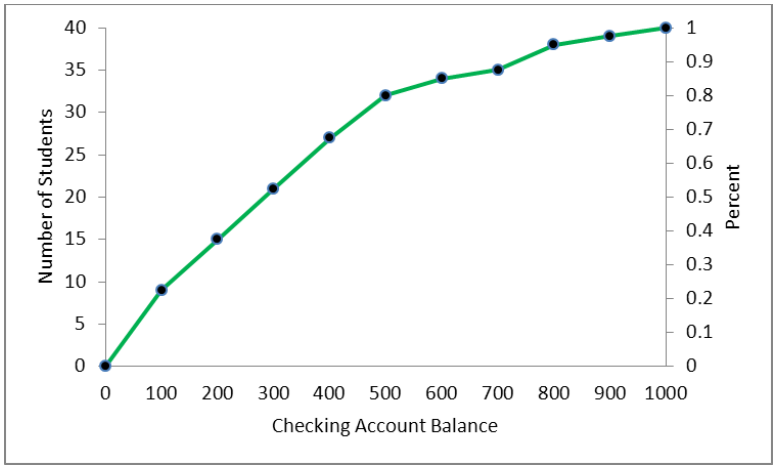
40. a.

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.

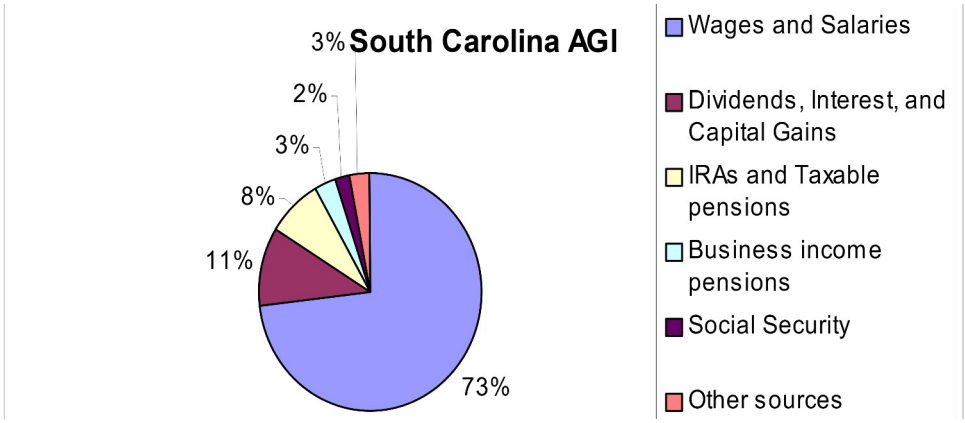
b.



c. Based on the cumulative frequency polygon it appears that about 67% have less than a $400 balance. Therefore, about 33% would be considered "preferred."

d. Less than $100 would be a convenient cutoff point. **(LO2-3)**

41.



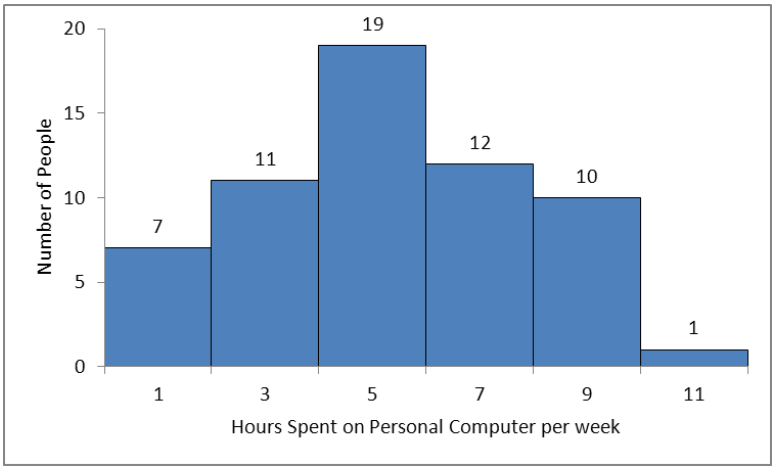
By far the largest part, nearly three-fourths of adjustable gross income in South Carolina is from wages and salaries. Dividends and IRAs each contribute roughly another ten percent to AGI with eight percent coming from business income pensions, social security, and other sources. **(LO2-2)**

42. a. Since $2^5 = 32 < 60 < 64 = 2^6$, 6 classes are recommended. The interval should be at least as $i \geq (10.1 - 0.4)/6 = 1.6$, with 2 being a convenient value.

Hours Spent on Personal Computer (*per week*)	Number of Individuals
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

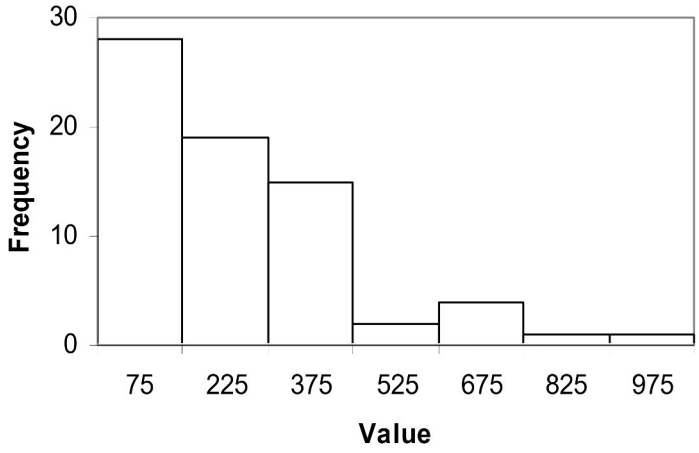
b.



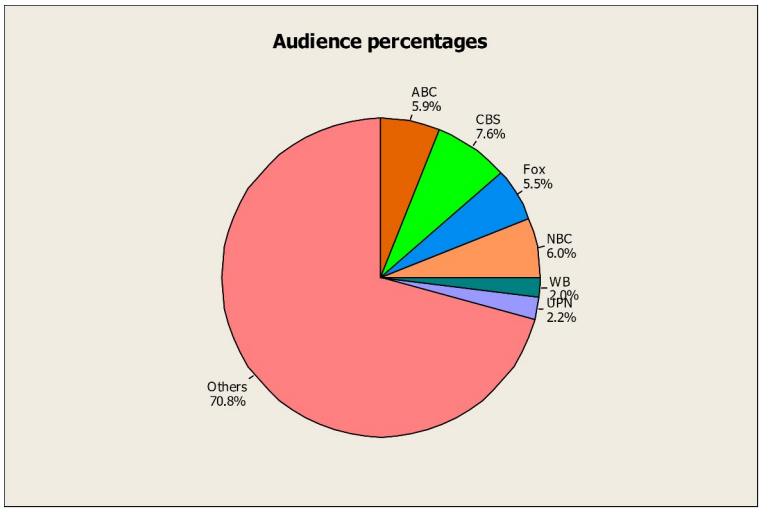
The "typical" person used the computer about 5 hours per week and everyone is within about five hours of that amount. **(LO2-4)**

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. **(LO2-4)**

b.



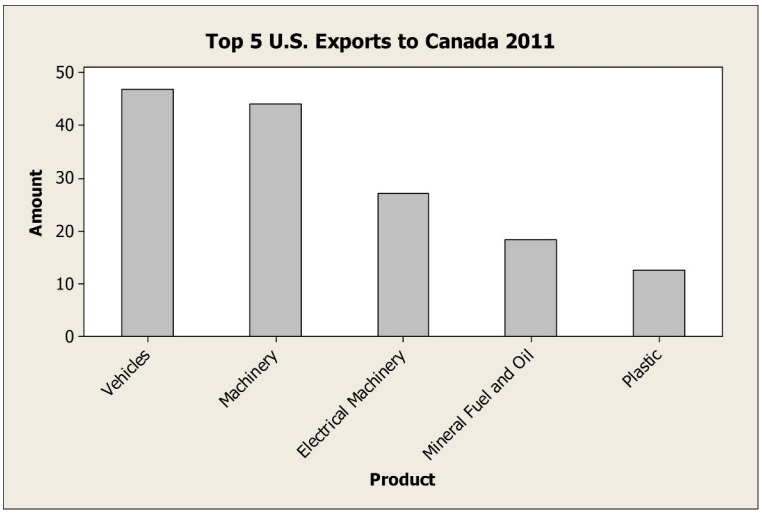
44. **(LO2-2)**



45. a. pie chart
    b. 700, found by 0.70(1000)
    c. Yes, ninety percent are either through networking and connections (70%) or job posting websites (20%). **(LO2-2)**

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 **(LO2-2)**

47. a.



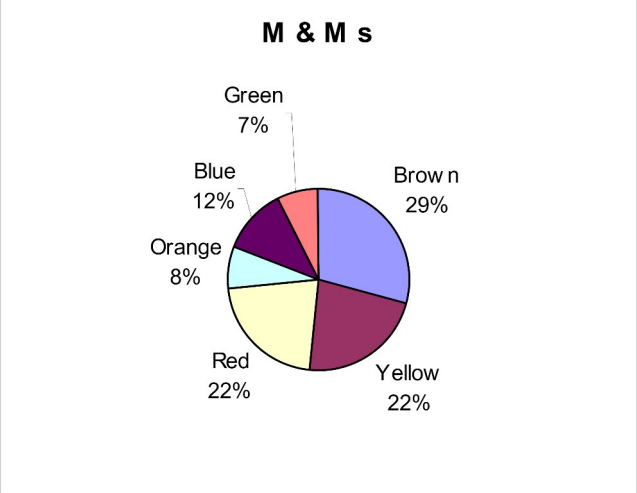
    b. 23.2%, found by (18.4 + 46.9)/281
    c. 43.8 %, found by (18.4 + 46.9)/ (46.9 + 44.2 + 27.1 + 18.4 + 12.6) **(LO2-2)**

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	15
20 up to 40	11
40 up to 60	10
60 up to 80	7
80 up to 100	5
100 or more	2
Total	50

Twenty-six of the 50 states, or 52 percent, have fewer than 40,000 farms. There are two states that have more than 100,000 farms. **(LO2-3)**

49.

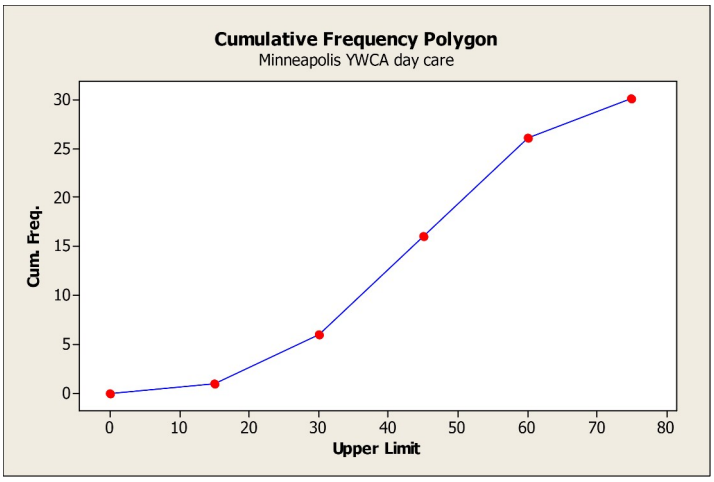


Brown, yellow, and red make up almost 75 percent of the candies. The other 25 percent is composed of blue, orange, and green. **(LO2-2)**

50. a.

Class	Cumulative Frequency
Less than 15	1
Less than 30	6
Less than 45	15
Less than 60	26
Less than 75	30

b.



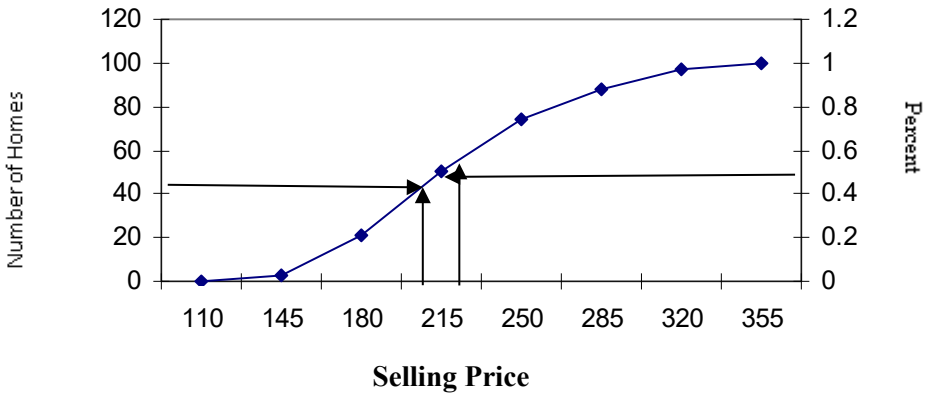
c. 6 days saw fewer than 30.

d. The highest 80 percent of the days had at least 30 families. **(LO2-3)**

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

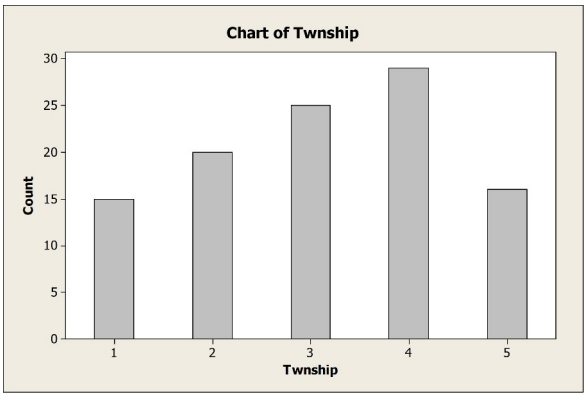
Selling Price	*F*	*CF*
110 up to 145	3	3
145 up to 180	19	22
180 up to 215	31	53
215 up to 250	25	78
250 up to 285	14	92
285 up to 320	10	102
320 up to 355	3	105

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. **(LO2-3)**

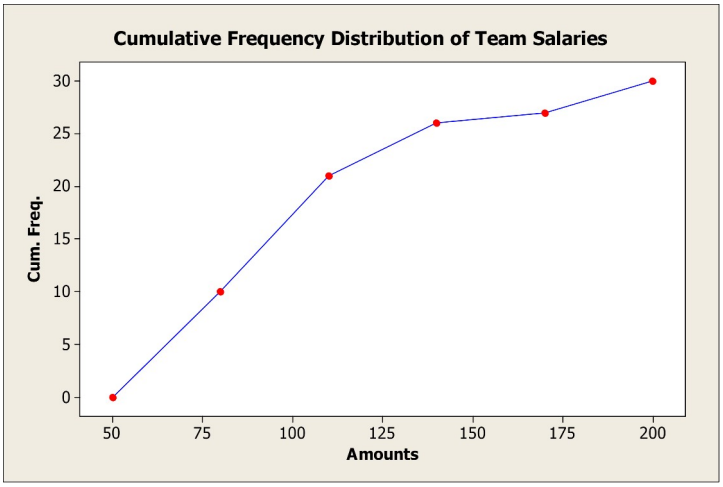
52. Since $2^4 = 16 < 30 < 32 = 2^5$, use 5 classes. The interval should be at least (198 – 55.2)/5 = 28.56 (in millions of dollars). Use 30. The resulting frequency distribution is:

Class	*f*
50 up to 80	10
80 up to 110	11
110 up to 140	5
140 up to 170	1
170 up to 200	3

a. The typical team salary is $90 million. It ranges from about $50 to 200 (in millions).

b. The distribution is positively skewed. The higher salary teams are further from the center than the lower salary teams. The Yankees appear to be quite unusual!

c



Forty-percent of the teams have salaries less than $85,000,000.
Ten teams pay less than $80,000,000. **(LO2-3)**

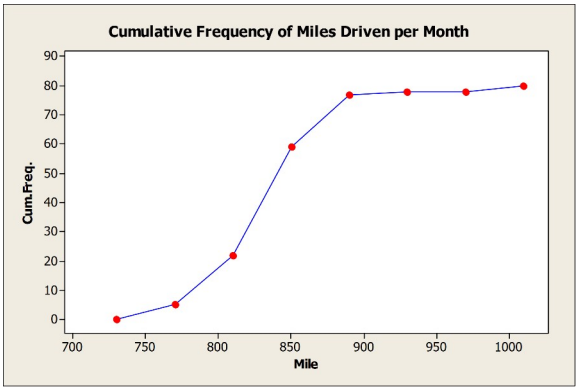
53. Since $2^6 = 64 < 80 < 128 = 2^7$, use 7 classes. The interval should be at least (1008 – 741)/7 = 38.14 miles. Use 40. The resulting frequency distribution is:

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. **(LO2-3)**

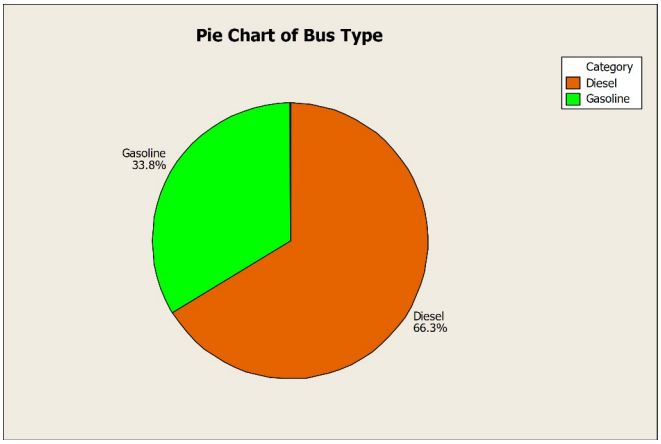
b. The distribution is "bell shaped" around 830. However, there are two outliers up around 1000 miles. **(LO2-3)**

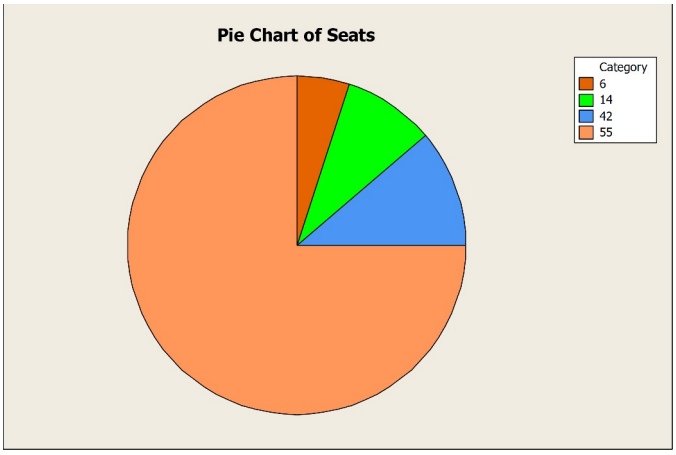
c.



Forty percent of the buses were driven fewer than 820 miles. Fifty-nine busses were driven less than 850 miles. **(LO2-3)**

d.





The first chart shows that the majority (66%) are diesel. The second diagram shows that nearly three fourths of the buses have 55 seats. **(LO2-2)**