Solutions for Statistical Techniques in Business and Economics 19th Edition by Lind

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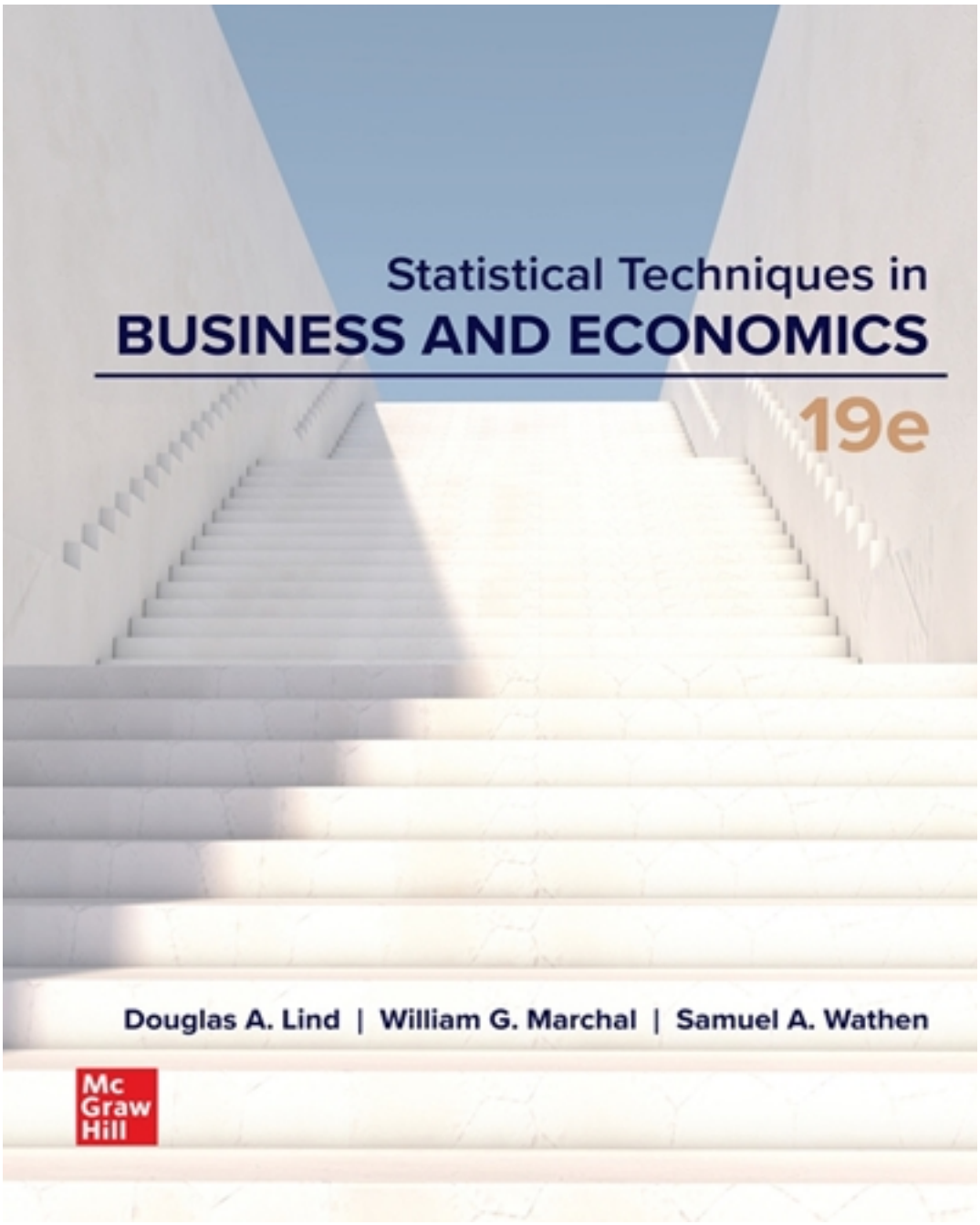


Solutions

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. Four classes are needed, one for each mattress type. **(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

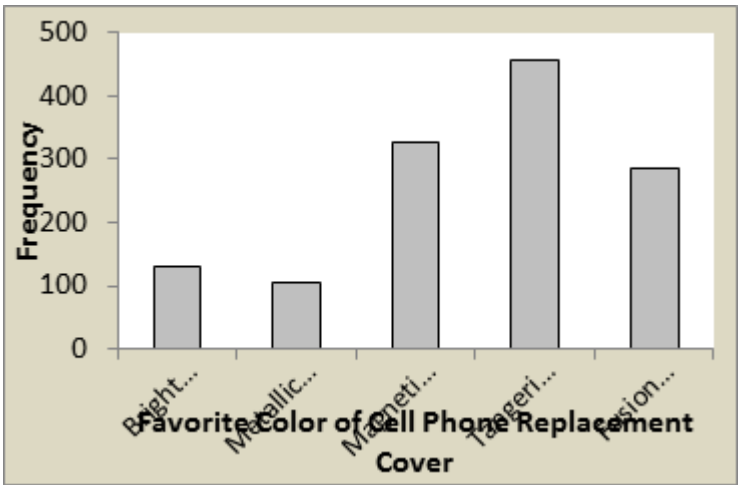
(LO2-1)

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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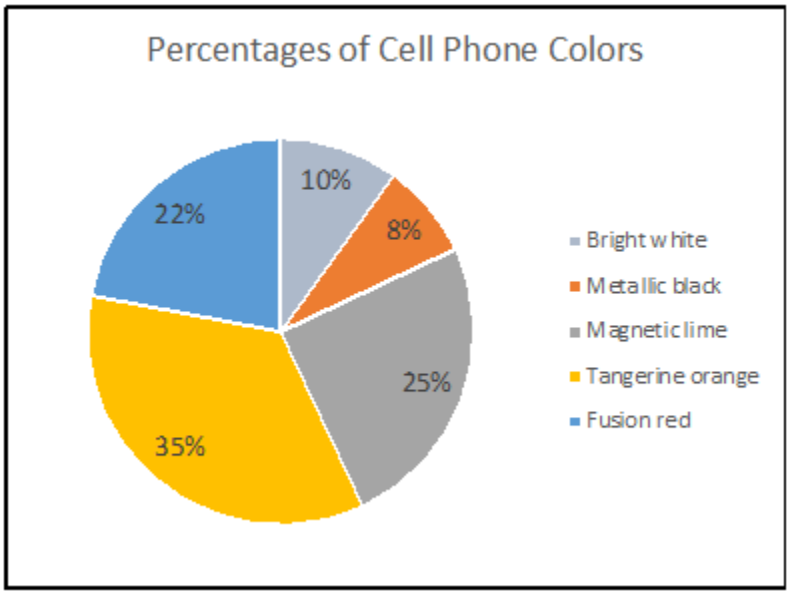
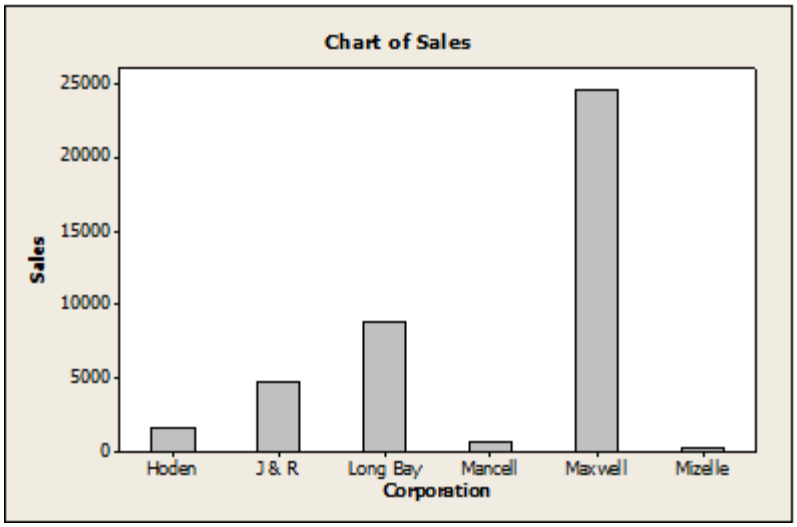


d. Wellstone Inc. should produce 350,000 orange; 250,000 lime; 220,000 red; 100,000 white, and 80,000 black. These numbers are found by multiplying the relative frequency of each color by the 1,000,000-production level. (**LO2-2)**

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. $i \geq \frac{\$29 - \$0}{6} = 4.83$. Round up and use an interval of 5. **(LO2-3)**

9. $2^7 = 128 < 230 < 256 = 2^8$ suggests 8 classes $i \geq \frac{567 - 235}{8} = 41.5$ Round up and use an interval of 5 **(LO2-3)**

10.

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

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

11.

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

b. $i \geq \frac{31 - 25}{5} = 1.2$. Round up and use an 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 number of units produced in the past 16 days range between 24 and 31 units. The class with the highest frequency or relative frequency is the mode. The highest frequency is in the 27 up to 28.5 class. On 50% of the 16 days, the company produced between 27 and 28.5 units. **(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

b. The mode or largest group of shoppers (21) shop at BiLo 3, 4 or 5 times per month. Most shoppers make less than 9 visits. A small number of visitors make 9 or more visits.

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

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 (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.

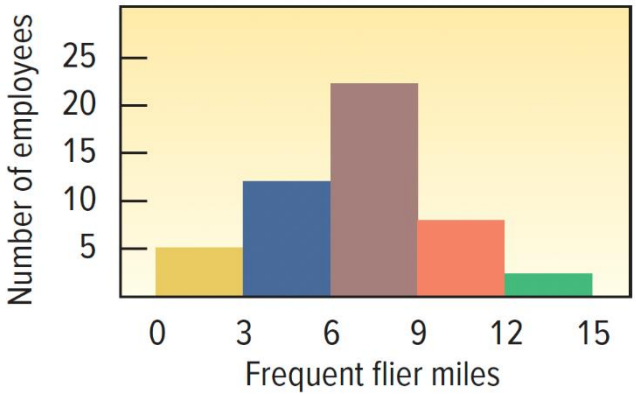
a. Histogram
b. 100
c. 5
d. 28
e. 0.28
f. 12.5
g. 13 **(LO2-4)**

16.

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

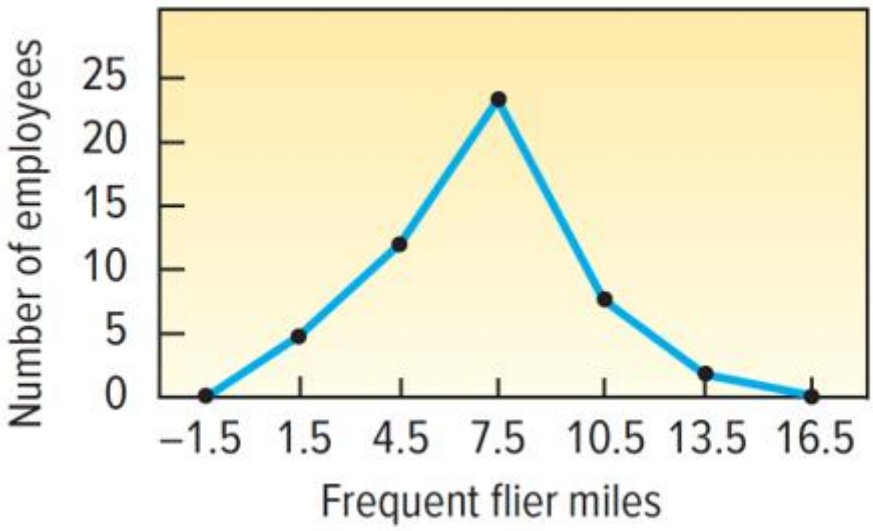
17.

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



d. X = 1.5, Y = 5

e.

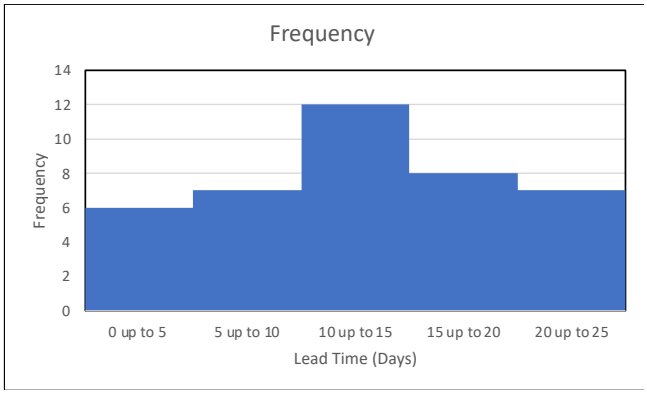


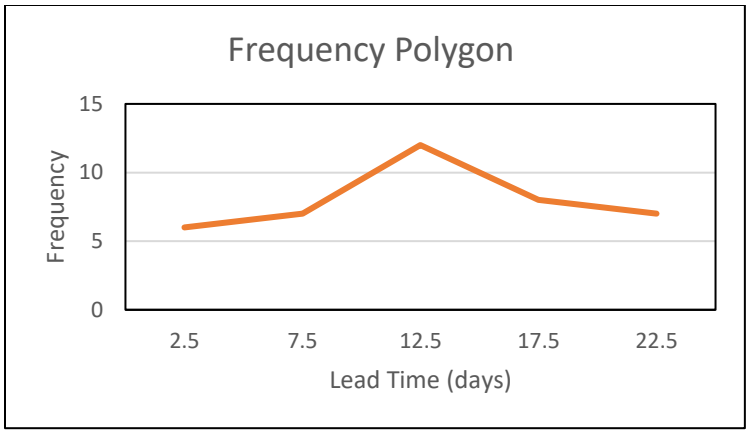
f. For the 50 employees about half earn between 6 and 9 thousand frequent flier miles. Five earn less than 3 thousand frequent flier miles, and two earn more than 12 thousand frequent flier miles. (LO2-4)

18.

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

e.





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.

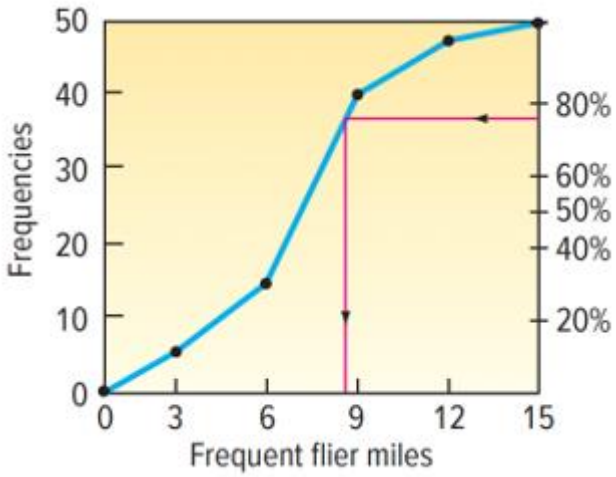
a. 200
b. 50 or $50,000
c. about $180,000
d. about $240,000
e. about 60 homes
f. about 145 homes **(LO2-4)**

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)**

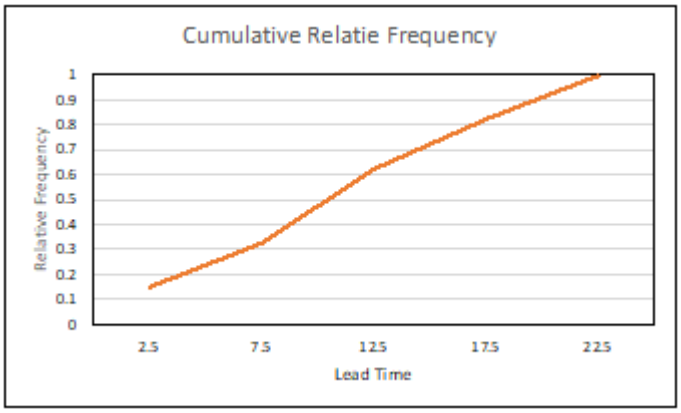
22.

a. 13, 25

b.

Lead Time	*Cum. Freq*	*Cumulative Relative Frequency*
0 up to 5	6	.15 or 15%
5 up to 10	13	.325 or 32.5%
10 up to 15	25	.625 or 62.5%
15 up to 20	33	.825 or 82.5%
20 up to 25	40	1.0 r 100%

c.



d. 12.5 **(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)**

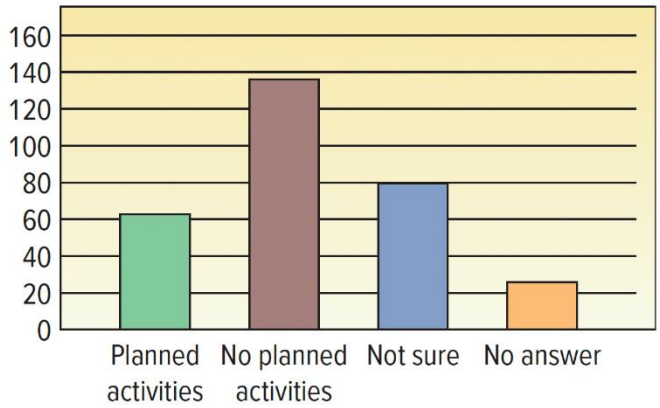
b. Yes, both types depict samples and populations. **(LO1-3)**

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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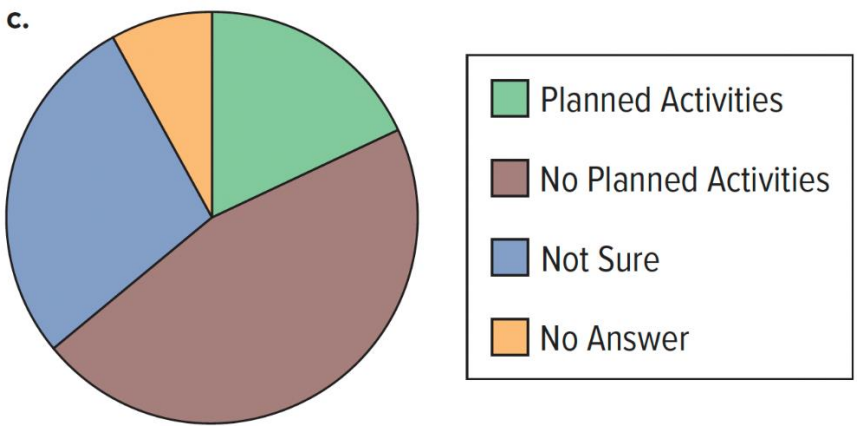


d. The pie chart may be easier to comprehend as the percentages of potential customers are likely more important than the number of potential customers. **(LO2-2)**

26.

a. For the variable, on-time-delivery, the scale is ordinal and the variable is qualitative.

b.

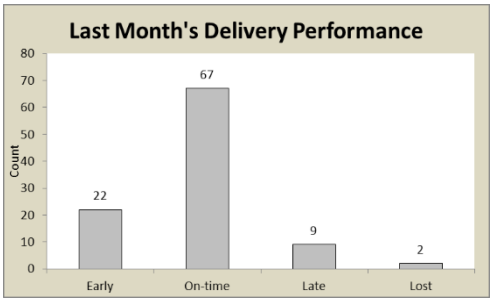
Performance	Frequency
Early	22
On-time	67
Late	9
Lost	2

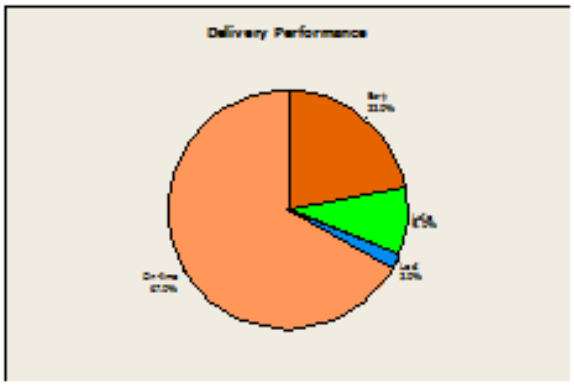
c.

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

d.

e.





f. Speedy Swift's objectives are 99% of packages should be early or on-time. Further 0% should be lost. The data show that 89% of the packages are either early or on-time. 9% of the packages are late. 2% of the packages are lost. The company is not meeting 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 the minutes to commute range between 15 and 50 minutes. The distribution shows that most common commute times are from 22 minutes up to 26 minutes. Commute times greater than 43 minutes are very infrequent. **(LO2-3)**

30.

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

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

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
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 $i \geq (10 - 1)/6$. 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. Most students attended 4 up to 8 movies during a semester. **(LO2-3)**

32.

a. 6 because $2^5 = 32 < 36 < 64 = 2^6$.

b. The interval width should be at least 2 as $i \geq (15-3)/6$. Use 2.

c. 3 because it is the minimum number of years.

d. Please note that the solution does not perfectly follow the number of classes, 6. If 6 classes are used, then the value of 15 is outside the last class. There are two choices. The first choice is to include 15 in the last class and change the class label to "13 to 15". The second choice is to use 7 classes with the addition of "15 up to 17" class. The two correct solutions follow.

Class	Frequency	Class	Frequency
3 up to 4	2	3 up to 4	2
5 up to 6	7	5 up to 6	7
7 up to 8	11	7 up to 8	11
9 up to 10	7	9 up to 10	7
11 up to 12	7	11 up to 12	7
13 to 15	2	13 up to 15	1
Total	36	15 up to 17	1
		Total	36

e. The mode of the distribution is the 7 up to 8-year class. Most stocks are held from 5 up to 12 years. It is very infrequent that stocks are held less than 4 years or more than 13 years. **(LO2-3)**

33.

a. There are four classes 4 because $2^3 = 12 < 15 < 16 = 2^4$. The interval width should be at least 11.75 as $i \geq (51-4)/4 = 11.75$. Round up and use 12 as the class interval. Start the first interval at 4 because it is the minimum number of years.

Number of Calls	Frequency
4 up to 15	5
16 up to 27	3
28 up to 39	6
40 up to 51	1
Grand Total	**15**

b. The mode is the 28-39 class. There appears to be one outlier in the 40 up to 51 class. **(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 $i \geq (7829 - 312)/6$. 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 "startup" phase of this publication. The mode of the distribution is in the 6000 up to 7500 class which contains the highest frequency, 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. 6 classes are recommended because $2^5 = 32 < 33 < 64 = 2^6$. The minimum class interval size would be $30.50 as $i \geq (265 - 82)/6$ thus an interval of 35 would work. Start the first class at 80 as 82 is the minimum value.

b.

Class	Frequency
$80 up to $115	6
115 up to 150	20
150 up to 185	10
185 up to 220	3
220 up to 255	4
255 up to 290	1
Total	44

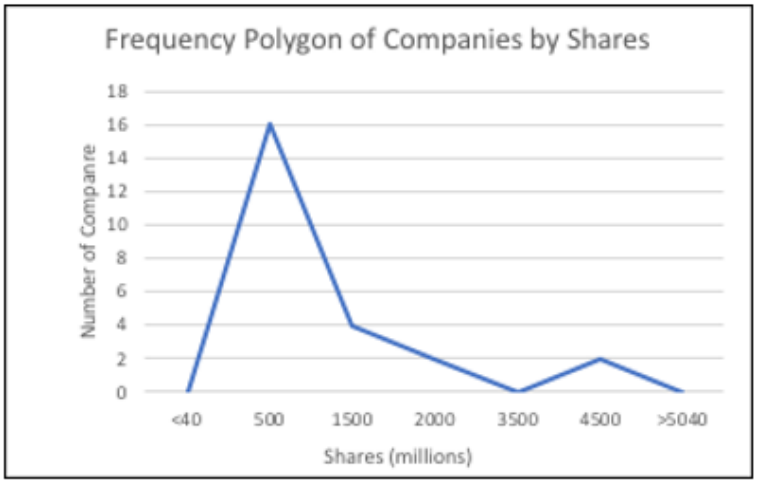
c. Based on the frequency distribution the purchases ranged from a low of about $80 to a high of about $290. The highest frequency is in the $115 up to $150 class. **(LO2-3)**

38.

a. 24 = 16 < 24 < 32 = 25. Thus 5 classes are recommended. Class interval is at least 958 (rounded 957.47) as $i \geq (4830 - 42.67)/5$. A suggested interval width would be 1000.

Shares (millions)	Number of Companies
40-1040	16
1040-2040	4
2040-3040	2
3040-4040	0
4040-5040	2
Grand Total	**24**

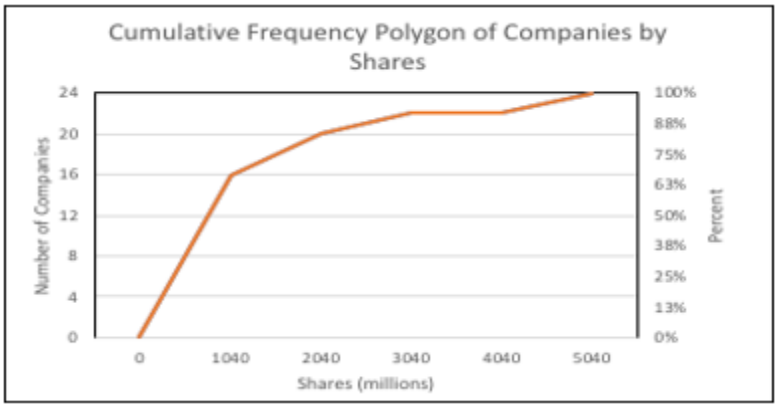
b.



c.

Shares (millions)	Number of Companies
up to 1040	16
up to 2040	20
up to 3040	22
up to 4040	22
up to 5050	24
Grand Total	

d.

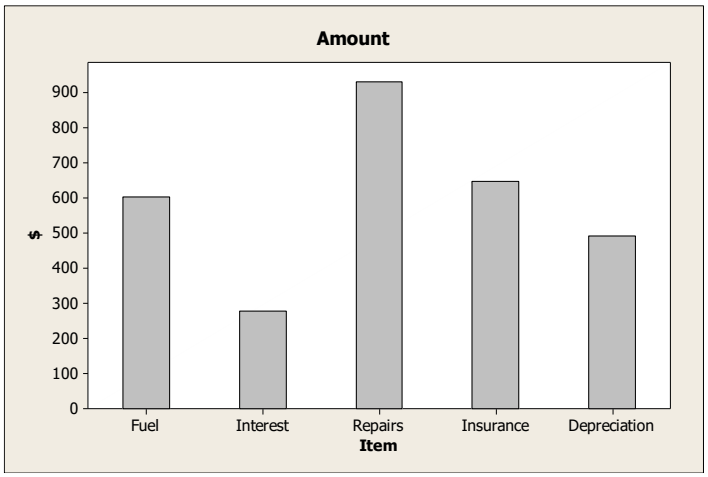


e. About 2 billion shares are outstanding for the lowest 75% of the companies. This is found by drawing a line to the curve from 75% and reading off the value on the X-axis.

f. The number of outstanding shares range from 500 million to over 4 billion, with the largest number of companies (16 of 24) having less than 500 million outstanding shares. Only 2 companies have more than 3.500 billion shares outstanding. **(LO2-4)**

39.

a.



b. 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.

c. Of the five classes, car owners spend the most on repairs, followed by insurance, fuel, depreciation, and loan interest.

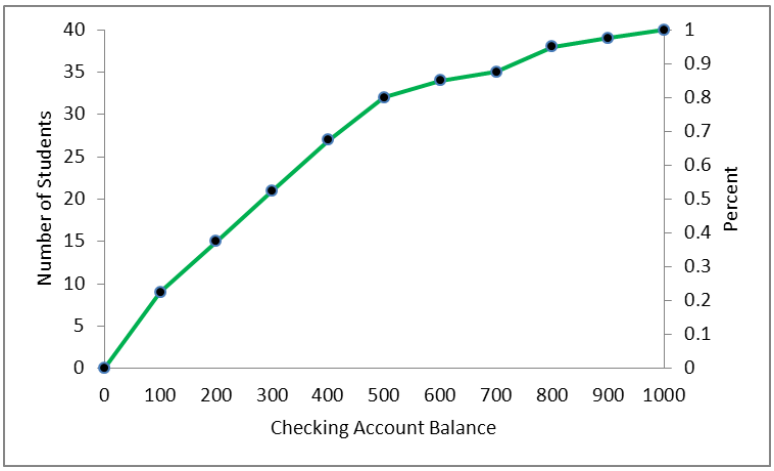
40.

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

Class	Frequency	Cumulative Frequency
0-199	15	15
200-399	12	27
400-599	7	34
600-799	4	38
800-999	2	40
Grand Total	**40**	

Probably a class interval of $200 would be better.

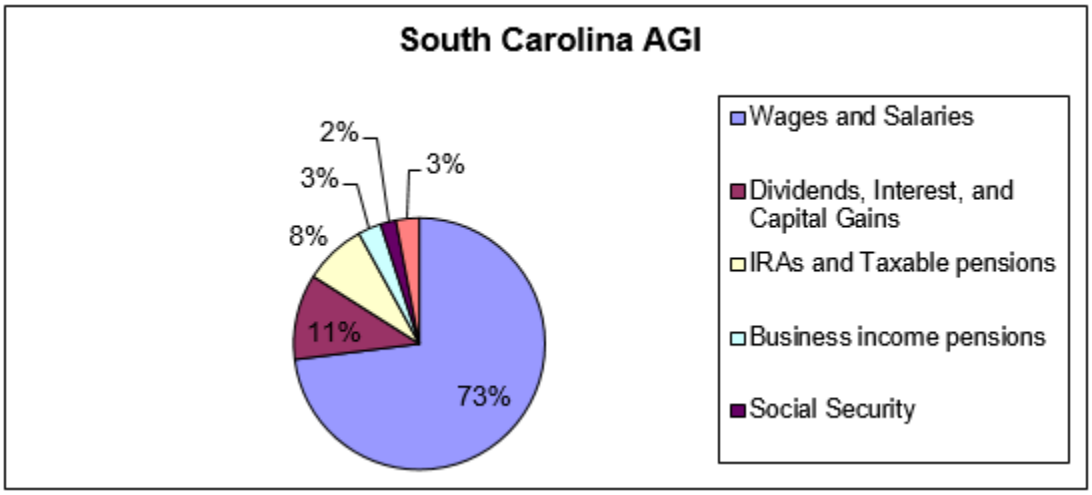
b.



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.



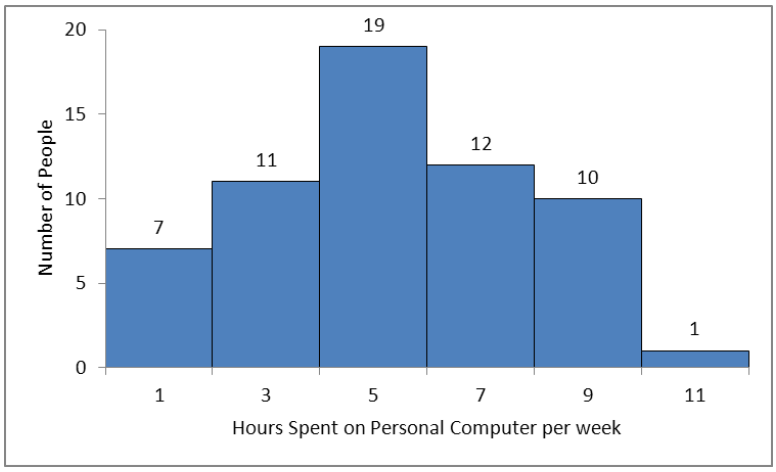
By far the largest part, nearly three-fourths of adjustable gross income in South Carolina is from wages and salaries. Dividends and IRAs each contribute roughly ten percent more to AGI with eight percent coming from business income pensions, social security, and other sources. **(LO2-2)**

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.



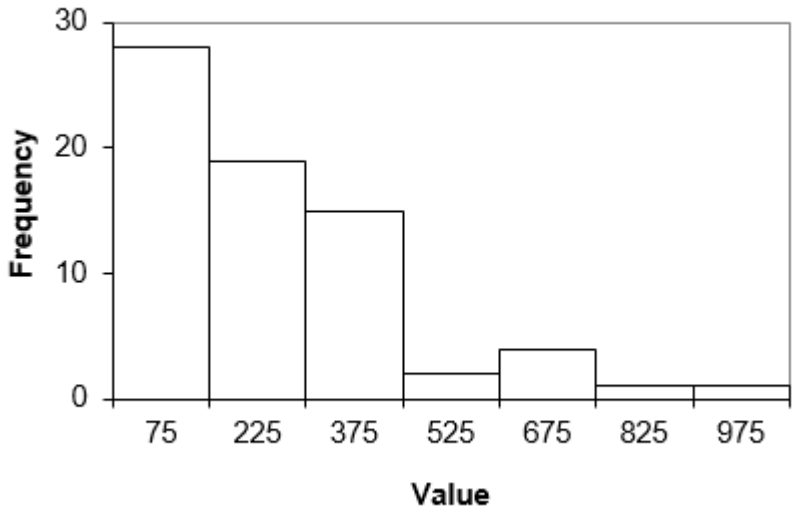
The "typical" person used the computer about 5 hours per week and everyone is within about five hours of that amount. **(LO2-4)**

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)**

Class	Frequency
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 900	1
900 up to 1050	1
Grand Total	70

b.



c. Based on the histogram, the majority of people has less than $500,000 in their investment portfolio and may not have enough money for retirement. Merrill Lynch financial advisors need to promote the importance of investing for retirement in this age group.

44.

a. For every company, divide Sales by Units to get the average annual sales per unit for each company.

b. Since $2^6 = 64 < 70 < 128 = 2^7$, 7 classes are recommended. Rounding to millions of dollars, the interval should be at least $(13526 - 19)/7 = 1{,}932$. Rounding up, use $2,000 a convenient value for the class interval. Set the lower limit of the first class to be zero.

Sales ($millions)	Frequency
0 up to 2000	96
2000 up to 4000	1
4000 up to 6000	1
6000 up to 8000	0
8000 up to 10000	0
10000 up to 12000	0
12000-14000	2
Grand Total	**100**

c. Since $2^6 = 64 < 100 < 128 = 2^7$, 7 classes are recommended. The interval should be at least $(3.571 - 0.037)/7 = 0.505$. Use 0.5 ($500,000) as a convenient value. Set the lower limit of the first class to be zero.

Unit sales ($millions)	Frequency
0 up to 0.5	10
0.5 up to 1	40
1 up to 1.5	24
1.5 up to 2	12
2 up to 2.5	8
2.5 up to 3	3
3 up to 3.5	2
3.5 up to 4	1
Grand Total	100

d. Based on total sales, the pizza market is dominated by Pizza Hut and Dominoes. Both companies exceed $12 billion in annual sales. Most stores (96%) have annual sales of less than $2 million. Pizza Hut and Dominoes also have the most units, i.e., number of stores. So, another way to look at sales is by average sales per store or unit. Note that this distribution is quite different. Most stores (76) show per unit sales between $0.5 and $2 million per unit. Pizza Hut and Dominos are in this group with between 0.5 and 1.0 million dollars in per unit sales. It is interesting to note that Buddy's pizza shows the highest sales per unit, more than $3.5 million, with only 14 stores. (**LO2-3**)

45.

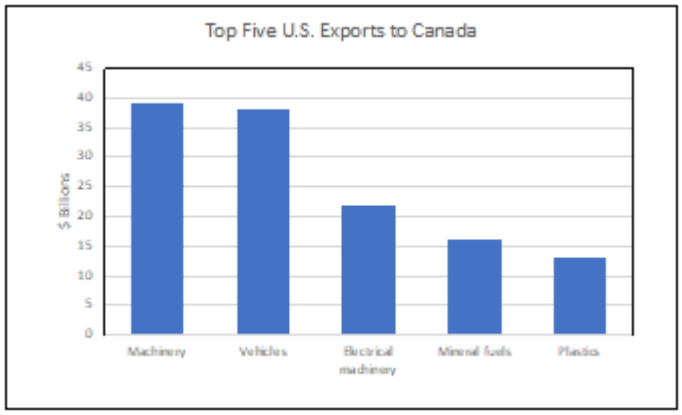
a. pie chart
b. 700, found by 0.70(1000)
c. Yes, ninety percent are either through networking and connections (70%) or job posting websites (20%). **(LO2-2)**

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
d. 2.73 billion, found by (0.4334)(6.3), in individual taxes **(LO2-2)**

47.

a.

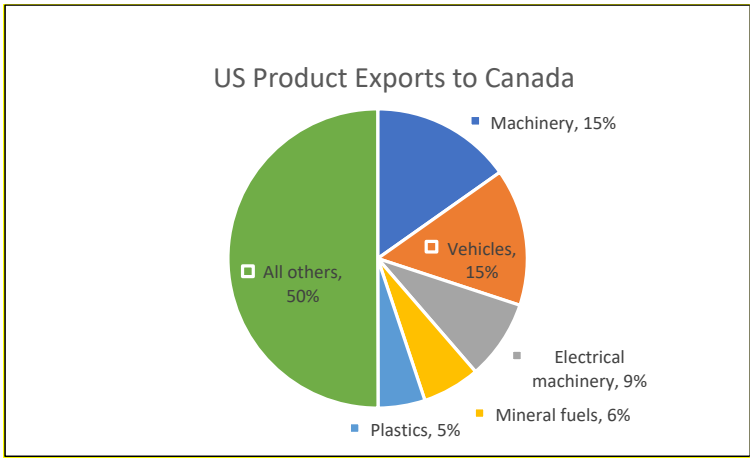


b.

Export	Percent of Total Exports
Machinery	15%
Vehicles	15%
Electrical machinery	9%
Mineral fuels	6%
Plastics	5%

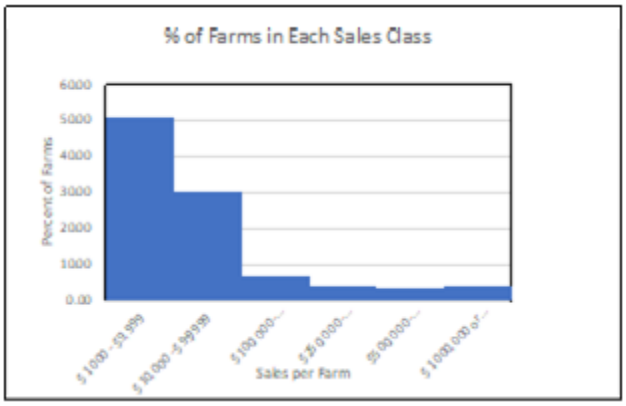
c. Subtracting (15% + 15% + 9% + 6% + 5%) from 100%, all other exports account for 50% of the total exports to Canada.

d. For the total of $256.2 billion of exports, a pie chart shows the percentages for each class. **(LO2-2)**

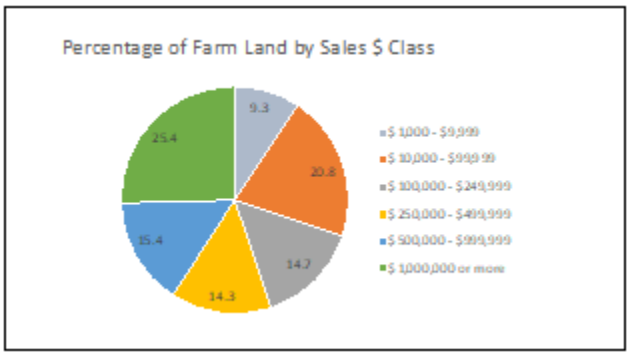


48.

a.

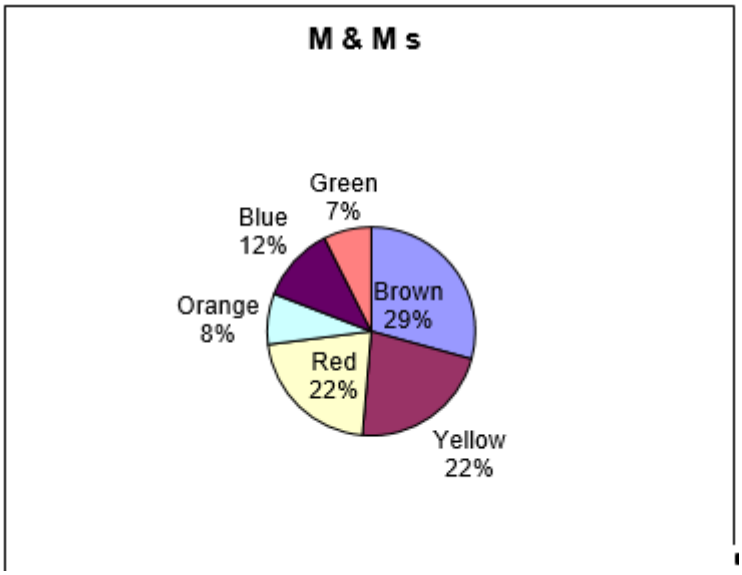


b.



d. The relative frequency distribution and pie charts show some interesting information. 51.1% of the 2.019 million farms, or about 1.032 million farms generated less than $10,000. In contrast, 3.9% of the 2.019 million farms, or about 79 thousand farms generated more than $1,000,000. The data shows that farms with sales of less than $10,000 accounted for the smallest percentage of total acreage; about 83,384 thousand acres. or 9.3% of the total of 896,600 thousand acres. Using the data, these farms average about 81 acres in size. In contrast, the data shows that farms with sales of more than $1,000,000 accounted for most total acreage, 896,600 thousand acres, or 25.4% of the total of or 227,736 thousand acres. Using the data, the average size of these farms average about 2883. **(LO2-3)**

49.



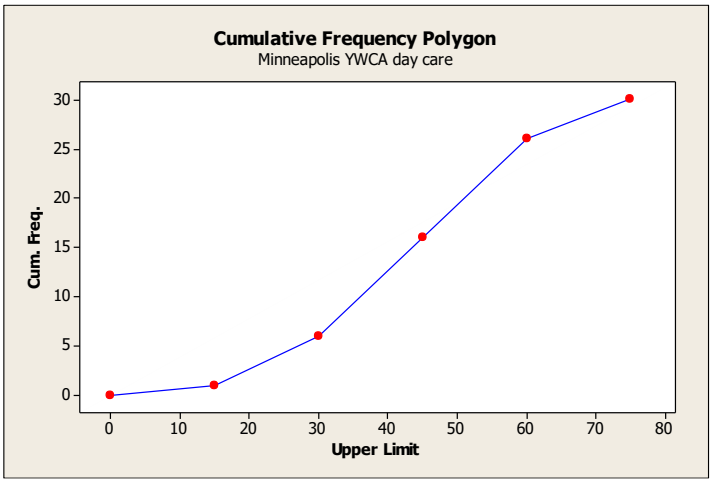
Brown, yellow, and red make up almost 75 percent of the candies. The other 25 percent is composed of blue, orange, and green. **(LO2-2)**

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. There are many choices and possibilities here. For example you could choose to start the first class at 160,000 rather than 120,000. The choice is yours!

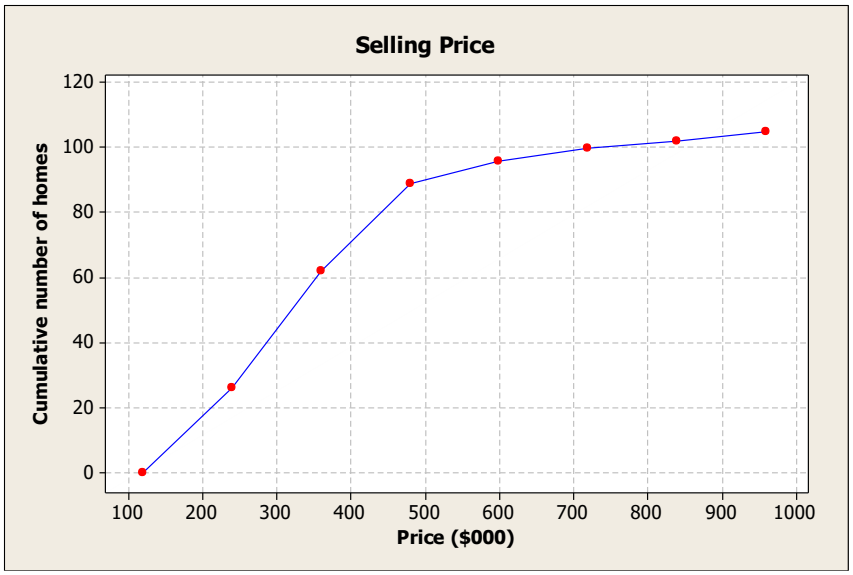
$i >= (919,480 - 167,962)/7 = 107,360$. Use intervals of 120,000

Selling Price (000)	Frequency	Cumulative Frequency
120 up to 240	26	26
240 up to 360	36	62
360 up to 480	27	89
480 up to 600	7	96
600 up to 720	4	100
720 up to 840	2	102
840 up to 960	1	105

a. Most homes (60%) sell between $240,000 and $480,000.

b. The typical price in the first class is $180,000 and in the last class it is $900,000

c.



Fifty percent (about 52) of the homes sold for about $320,000 or less. The top ten percent (about 90) of homes sold for at least $520,000 About 41 (about 41) percent of the homes sold for less than $300,000.

d.

2,3 and 4 bedroom houses are most common with about 25 houses each. 7 and 8 bedroom houses are rather rare. **(LO2-3)**

52.

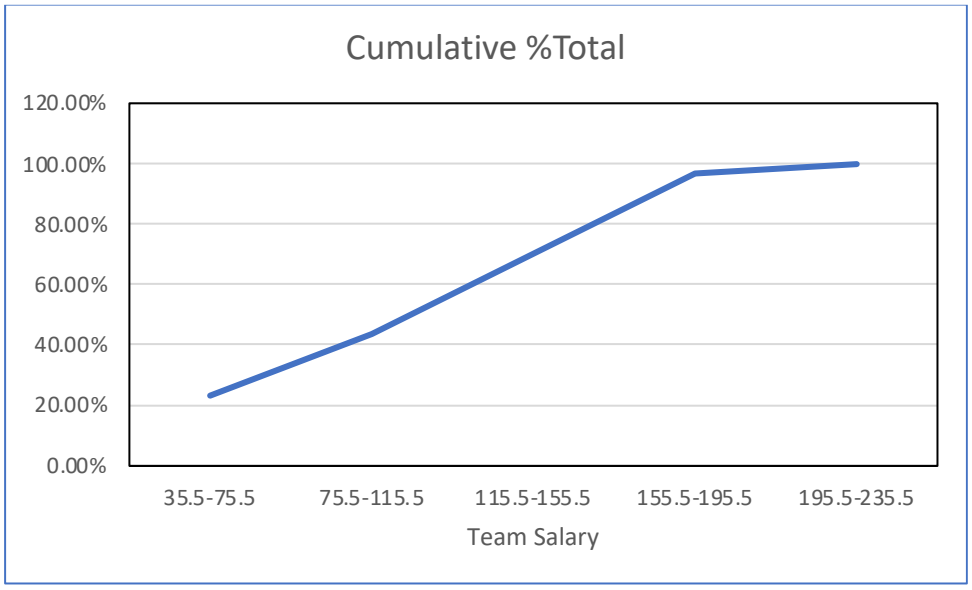
Team Salary	Frequency (# teams)
35.5-75.5	7
75.5-115.5	6
115.5-155.5	8
155.5-195.5	8
195.5-235.5	1
Grand Total	**30**

a. The frequency distribution is fairly even over the first four classes. So, the typical team salary is between $35.5 and $195.5 million. The overall range of salaries is based on the minimum of $35.5 million and a maximum of $235.5. The range of salaries would be $200.0 million.

b. The distribution of salaries is fairly even or uniform. There is one team, the Los Angeles Dodgers that is much higher than the 29 teams that make up most of the distribution of salary.

c.

Team Salary	Cumulative %
35.5-75.5	23.33%
75.5-115.5	43.33%
115.5-155.5	70.00%
155.5-195.5	96.67%
195.5-235.5	100.00%

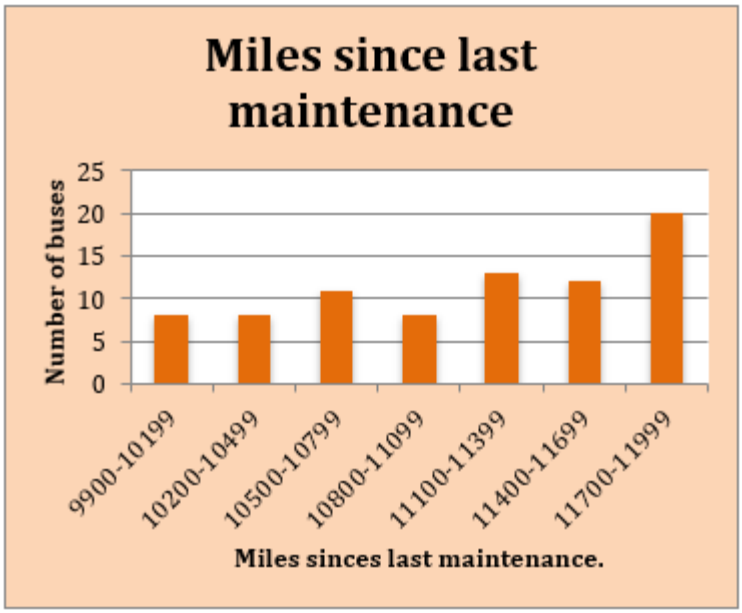


Based on the cumulative frequency distribution, we can estimate that 40% of the teams have a salary of about $95.5 (the class midpoint) million or less. Using the table and the distribution, about 3.33% of the 30 teams have a salary of $195.5 million or more. 3.33% of 30 teams rounds to 1 teams. **(LO2-3)**

53. Since $2^6 = 64 < 100 < 128 = 2^7$, use 7 classes. The interval should be at least $(11973 - 10000)/7 = 281$ *miles*. Use 300. The resulting frequency distribution is:

Class	*f*
9900 up to 10200	8
10200 up to 10500	8
10500 up to 10800	11
10800 up to 11100	8
11110 up to 11400	13
11400 up to 11700	12
11700 up to 12000	20

a. The typical amount driven, or the middle of the distribution is about 11100 miles. Based on the frequency distribution, the range is from 9900 up to 12000 miles. **(LO2-3)**

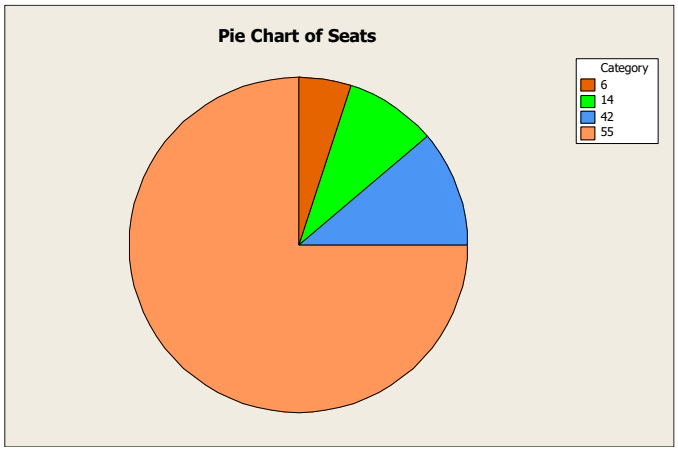


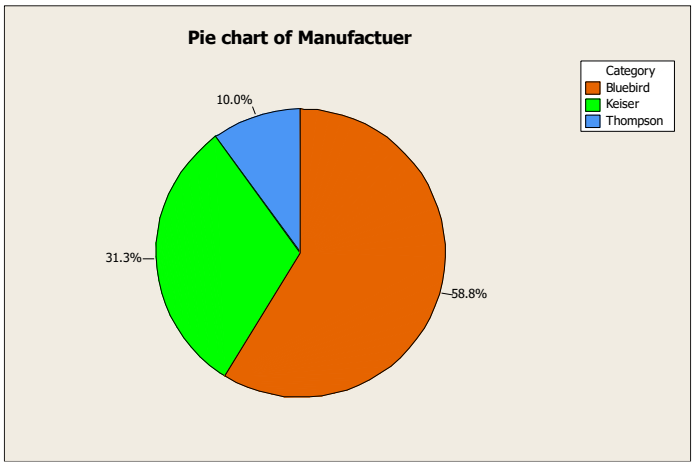
b. The distribution is somewhat "skewed" with a longer "tail" to the left and no outliers. **(LO2-3)**

c.

Forty percent of the buses were driven fewer than 11000 miles. Sixteen (16) busses were driven less than 10500 miles. **(LO2-3)**

d.





The first diagram shows that nearly three fourths of the buses have 55 seats. The second chart shows that Bluebird makes about 60 percent of the busses and Thompson only about 10 percent. **(LO2-2)**