SOLUTIONS MANUAL

Business Statistics

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note: see inside!

CHAPTER 2
Displaying Descriptive Statistics

2.1

a) $2^7 = 128 > 100$ therefore use 7 classes.

b) $2^9 = 512 > 300$ therefore use 9 classes.

c) $2^{10} = 1,024 > 1,000$ therefore use 10 classes.

d) $2^{11} = 2,048 > 2,000$ therefore use 11 classes.

2.2 $2^6 = 64 > 50$ therefore use 6 classes.

$$\text{Estimated Class Width} = \frac{74-16}{6} = 9.7 \approx 10$$

a) 16-25, 26-35, 36-45, 46-55, 56-65, 66-75

b) 16 to under 26, 26 to under 36, 36 to under 46, 46 to under 56, 56 to under 66, 66 to under 76

2.3

Number	**Frequency**	**Relative Frequency**	**Cumulative Relative Frequency**
1	6	0.250	0.250
2	6	0.250	0.500
3	5	0.208	0.708
4	4	0.167	0.875
5	3	0.125	1.00
Total	**24**	**1.00**	

2.4 $2^5 = 32 > 30$ therefore use 5 classes.

$$\text{Estimated Class Width} = \frac{42.8-13.9}{5} = 5.8 \approx 6$$

Class	Frequency	Relative Frequency	Cumulative Relative Frequency
13 to less than 19	6	0.200	0.200
19 to less than 25	11	0.367	0.567
25 to less than 31	4	0.133	0.700
31 to less than 37	7	0.233	0.933
37 to less than 43	2	0.067	1.0
Total	**30**	**1.00**	

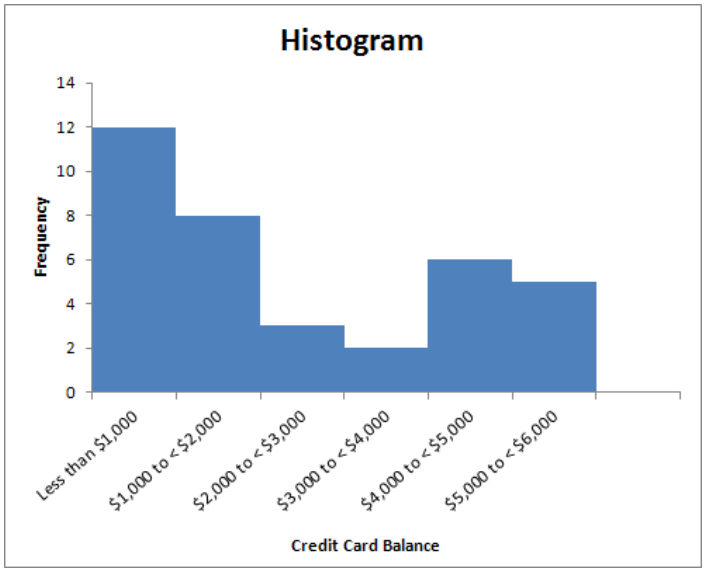
2.5 $2^6 = 64 > 36$ therefore use 6 classes.

$$\text{Estimated Class Width} = \frac{\$5,927 - \$162}{6} = \$960 \approx \$1,000$$

a, b, c)

Class	Frequency	Relative Frequency	Cumulative Relative Frequency
Less than $1,000	12	0.333	0.333
$1,000 to less than $2,000	8	0.222	0.555
$2,000 to less than $3,000	3	0.083	0.638
$3,000 to less than $4,000	2	0.056	0.694
$4,000 to less than $5,000	6	0.167	0.861
$5,000 to less than $6,000	5	0.139	1.000
Total	**36**	**1.000**	

d) The following histogram was constructed using bins $999, $1,999, $2,999, $3,999, $4,999, and $5,999.



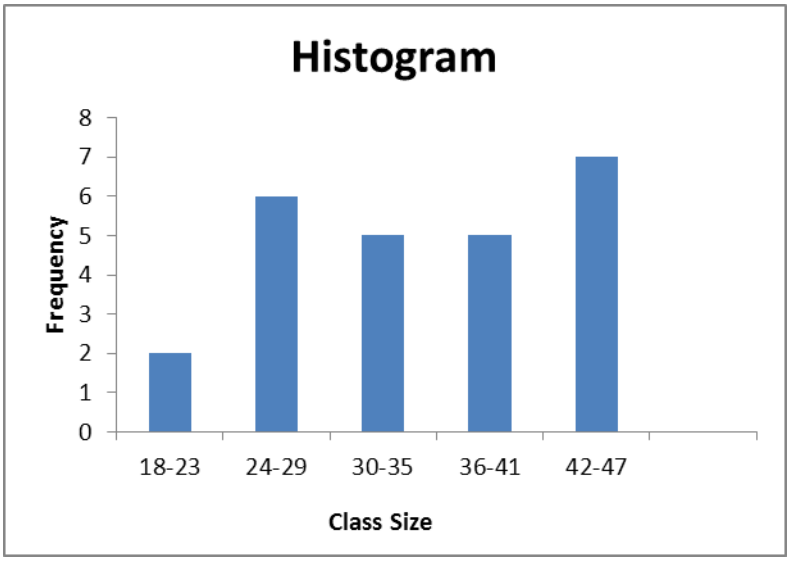
2.6 $2^5 = 32 > 25$ therefore use 5 classes.

$$\text{Estimated Class Width} = \frac{46-18}{5} = 5.6 \approx 6$$

a, b, c)

Class	Frequency	Relative Frequency	Cumulative Relative Frequency
18-23	2	0.08	0.08
24-29	6	0.24	0.32
30-35	5	0.20	0.52
36-41	5	0.20	0.72
42-47	7	0.28	1.00
Total	**25**	**1.00**	

d) The following histogram was constructed using bins 22.9, 28.9, 34.9, 40.9, and 46.9.

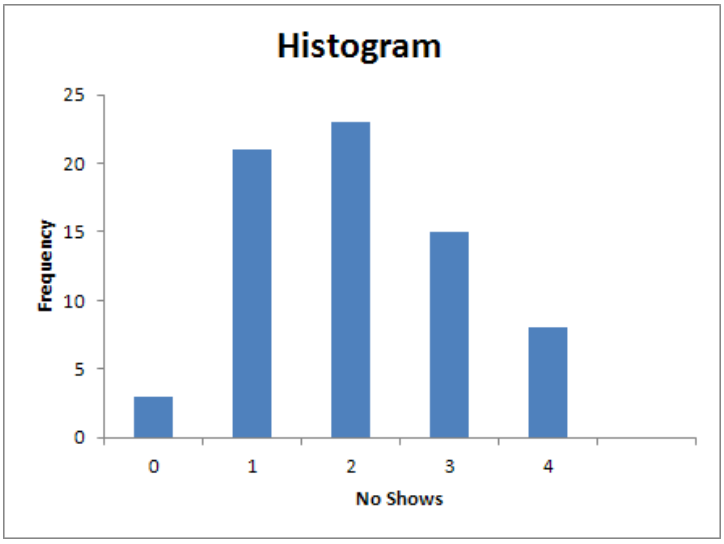


2.7

a, b, c)

Number	Frequency	Relative Frequency	Cumulative Relative Frequency
0	3	0.043	0.043
1	21	0.300	0.343
2	23	0.329	0.672
3	15	0.214	0.886
4	8	0.114	1.000
Total	**70**	**1.000**	

d) The following histogram was constructed using bins 0, 1, 2, 3, and 4.



2.8 $2^6 = 64 > 40$ therefore use 6 classes.

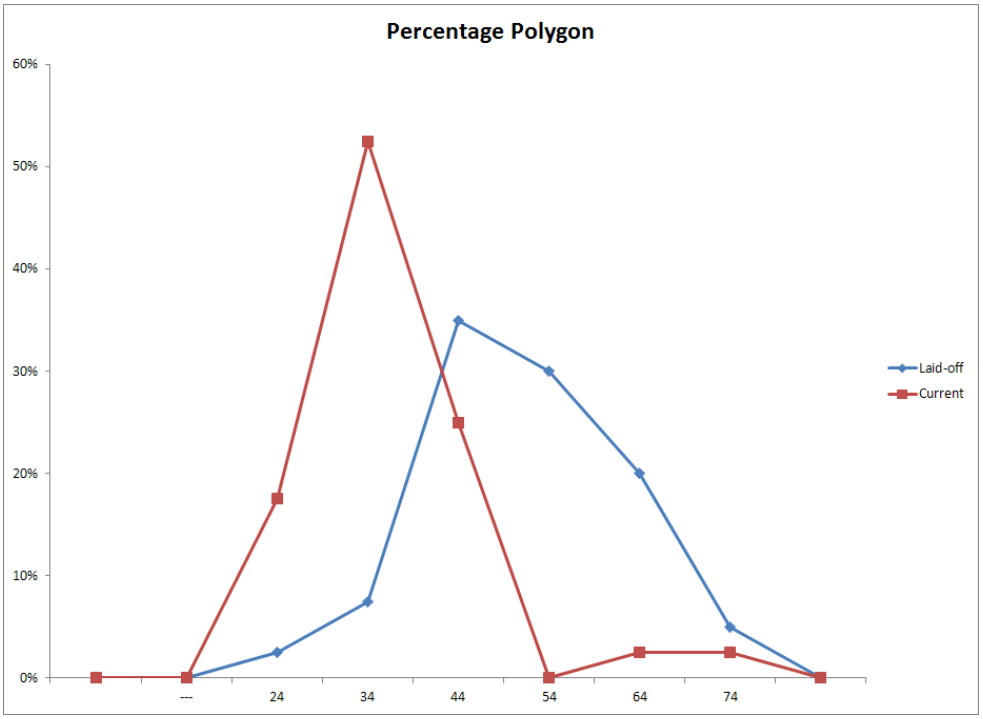
$$\text{Estimated Class Width (Current)} = \frac{76-19}{6} = 9.5 \approx 10$$

Results would be similar using the laid-off ages.

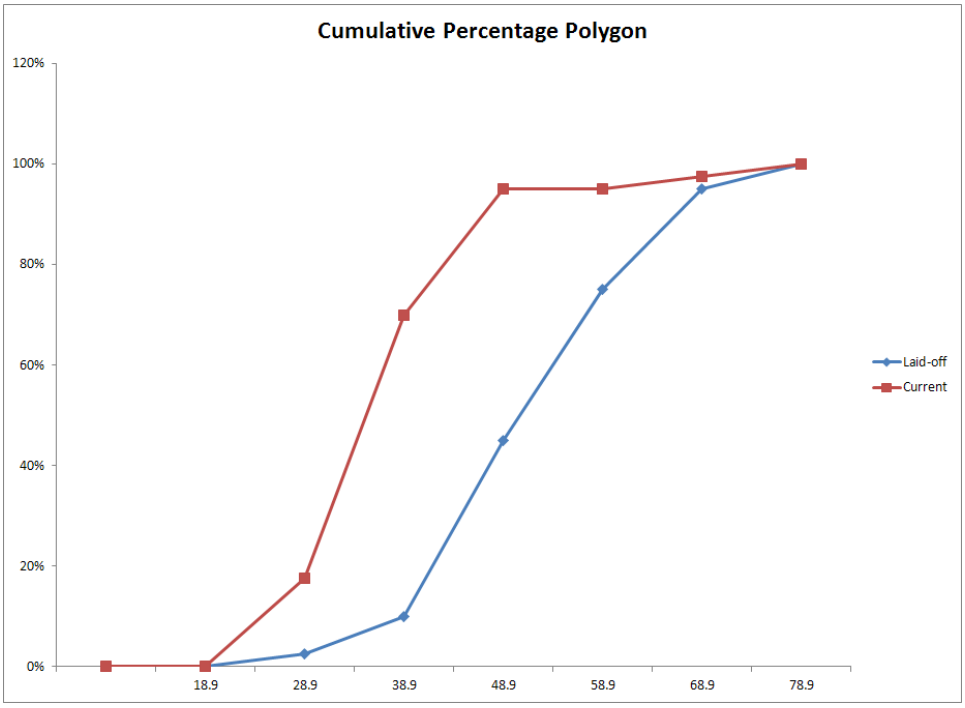
Class	Bins	Midpoint
19 to less than 29	28.9	24
29 to less than 39	38.9	34
39 to less than 49	48.9	44
49 to less than 59	58.9	54
59 to less than 69	68.9	64
69 to less than 79	78.9	74

An extra bin (18.9) was added to Excel to provide the open-ended class required by PHStat2.

a)



b)



c) According to these polygons, it appears that the current workforce is younger than the laid-off employees. It appears that the laid-off employees may have a case for age discrimination.

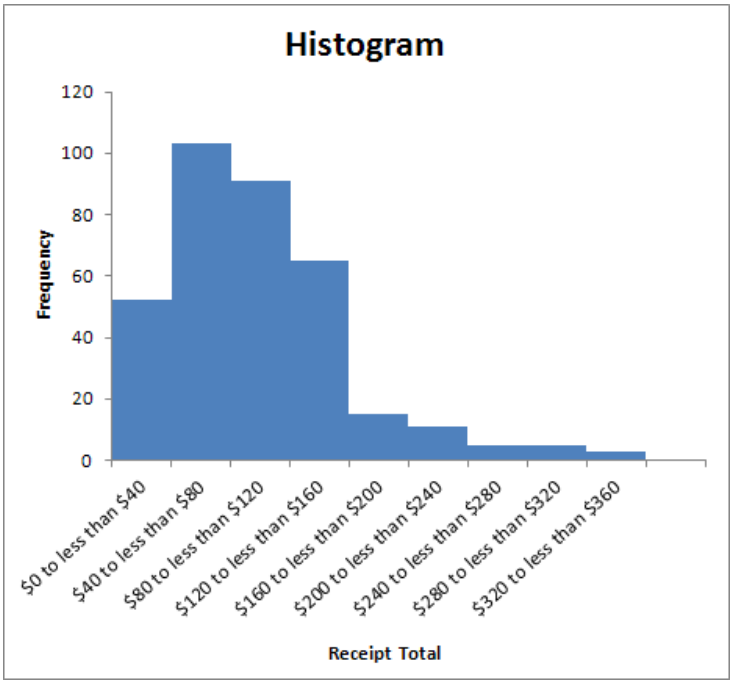
2.9 $2^9 = 512 > 350$ therefore use 9 classes.

$$\text{Estimated Class Width} = \frac{\$349.99 - \$2.19}{9} = \$38.64 \approx \$40$$

a, b, c)

Class	Frequency	Relative Frequency	Cumulative Relative Frequency
Less than $40	52	0.149	0.149
$40 to less than $80	103	0.294	0.443
$80 to less than $120	91	0.260	0.703
$120 to less than $160	65	0.186	0.889
$160 to less than $200	15	0.043	0.932
$200 to less than $240	11	0.031	0.963
$240 to less than $280	5	0.014	0.977
$280 to less than $320	5	0.014	0.991
$320 to less than $360	3	0.009	1.000
Total	**350**	**1.000**	

d) The following histogram was constructed using bins 39.999, 79.999, 119.999, 159.999, 199.999, 239.999, 279.999, 319.999, and 359.999.



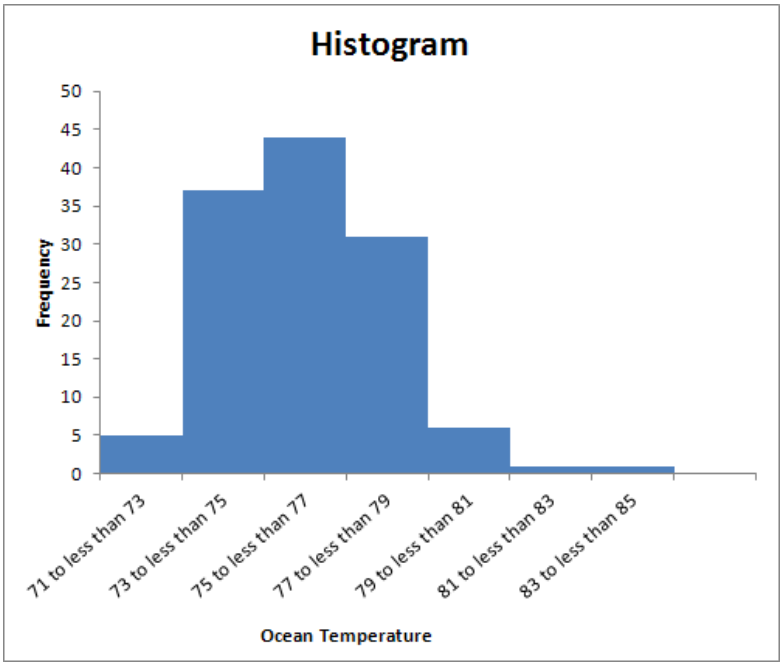
2.10 $2^7 = 128 > 125$ therefore use 7 classes.

$$\text{Estimated Class Width} = \frac{83.2 - 71.0}{7} = 1.7 \approx 2$$

a, b, c)

Class	Frequency	Relative Frequency	Cumulative Relative Frequency
71 to less than 73	5	0.040	0.040
73 to less than 75	37	0.296	0.336
75 to less than 77	44	0.352	0.688
77 to less than 79	31	0.248	0.936
79 to less than 81	6	0.048	0.984
81 to less than 83	1	0.008	0.992
83 to less than 85	1	0.008	1.000
Total	**125**	**1.000**	

d) The following histogram was constructed using bins 72.99, 74.99, 76.99, 78.99, 80.99, 82.99, and 84.99.



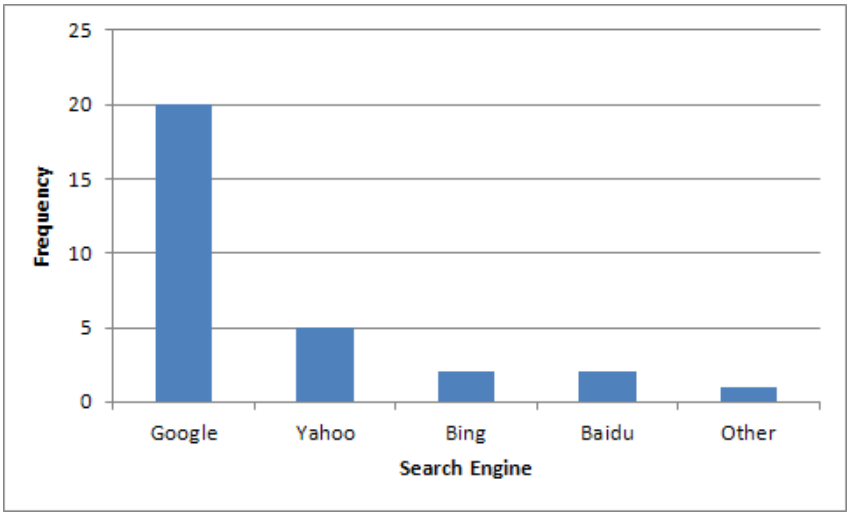
e) For 68.8% of the days, ocean temps were lower than 70 degrees.

2.11

a, b, c)

Category	Frequency	Relative Frequency	Cumulative Relative Frequency
Google	20	0.667	0.667
Yahoo	5	0.167	0.833
Bing	2	0.067	0.900
Baidu	2	0.067	0.967
Other	1	0.033	1.000
Total	**30**	**1.000**	

d)

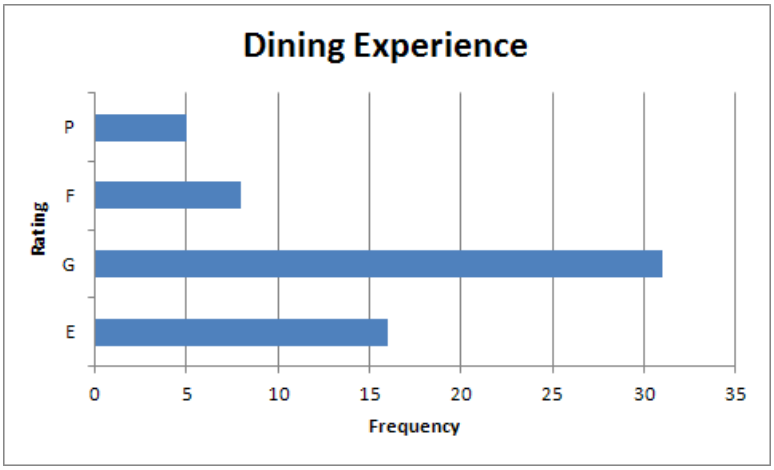


2.12

a, b, c)

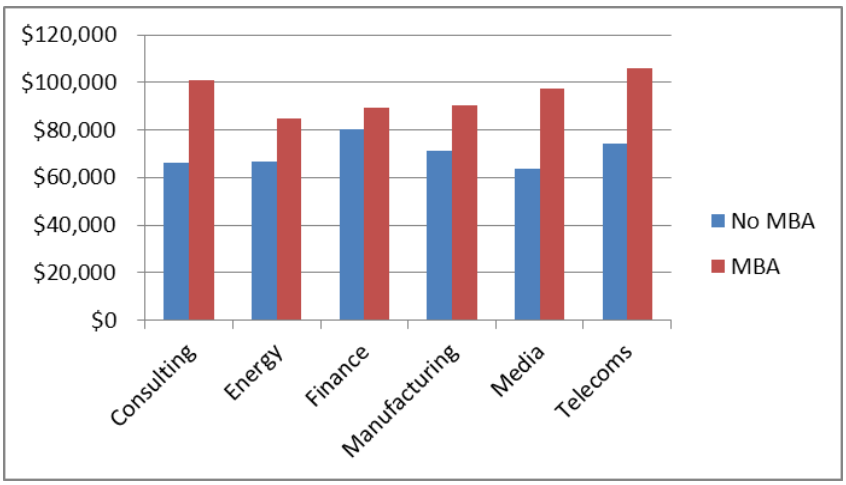
Category	Frequency	Relative Frequency	Cumulative Relative Frequency
Excellent	16	0.267	0.267
Good	31	0.517	0.783
Fair	8	0.133	0.917
Poor	5	0.083	1.000
Total	**60**	**1.000**	

d)

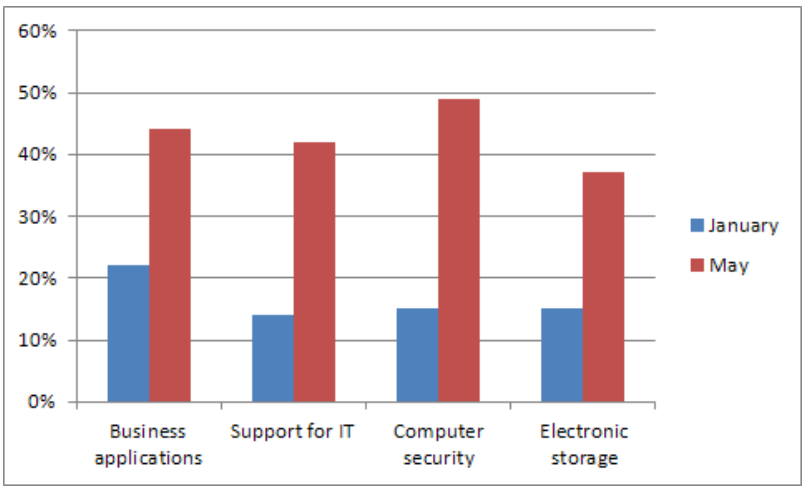


e) 78.3% rated their dining experience as either Excellent or Good.

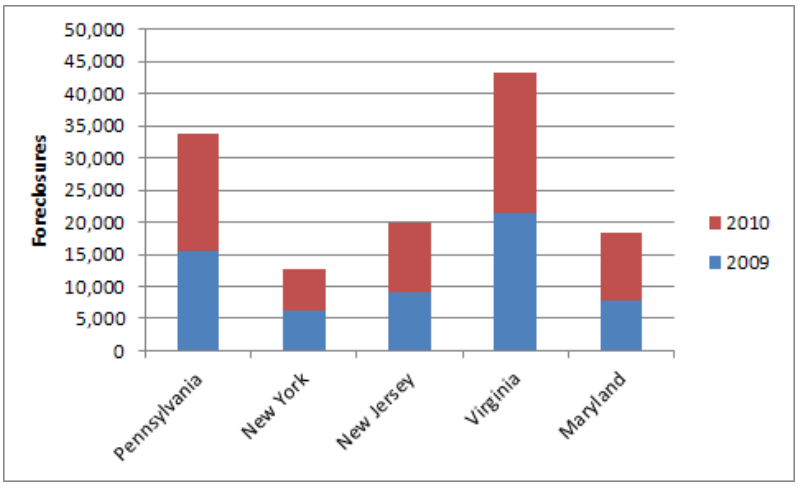
2.13



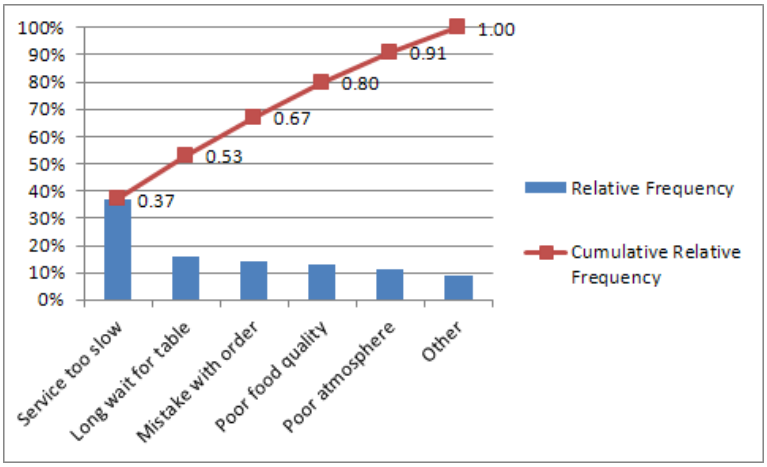
2.14



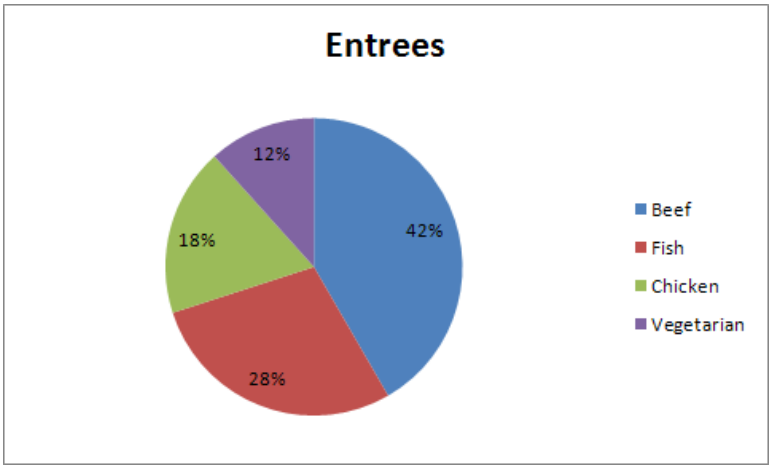
2.15



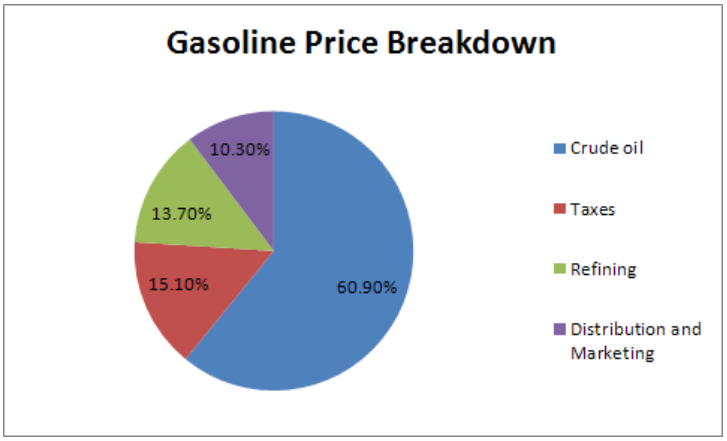
2.16



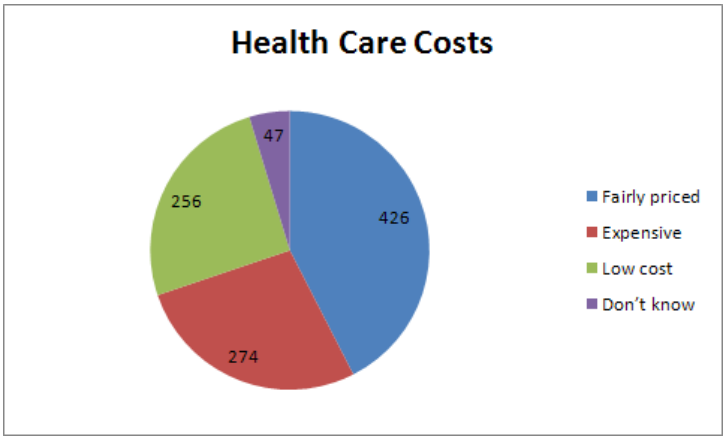
2.17



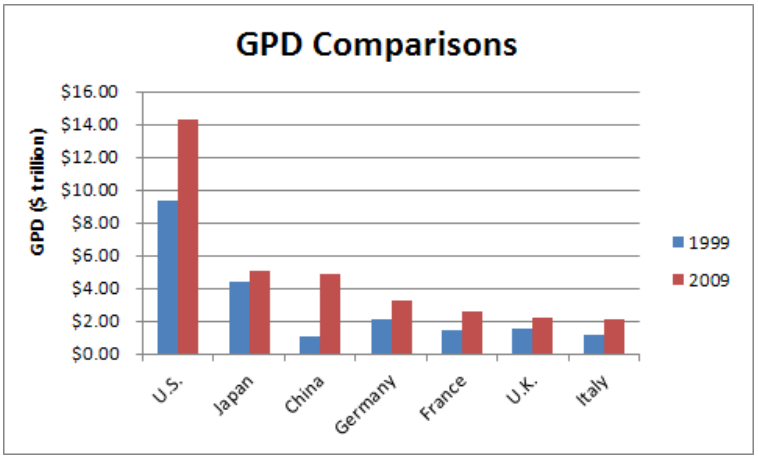
2.18



2.19 Because all the possible categories appear to be included in the data, a pie chart would be a good choice to display this data.



2.20 Because we are comparing data from a sample of countries over different time periods, a clustered bar chart would be a good choice to display this data. A stacked bar chart would not be the best choice because adding the GDPs for 2 time periods that are 10 years apart is not very meaningful.



2.21

Grade	Female	Male	Total
A	5	2	7
B	5	7	12
C	2	3	5
Total	**12**	**12**	**24**

71% (5/7) of the As were earned by females even though they comprise of 50% (12/24) of the students in the class. The females appear to have done better grade-wise than the males.

2.22

Rating	Darby	Exton	Media	Total
1	0	2	3	5
2	2	3	8	13
3	6	7	7	20
4	7	3	2	12
Total	**15**	**15**	**20**	**50**

Darby received 58% (7/12) of the 4-star ratings even though they were only 30% (15/50) of the surveyed customers. Darby appears to have higher customer satisfaction when compared to the other two locations.

2.23

7 | 1 2 3 4 5 8 8 9
8 | 0 3 6 6 7 7
9 | 0 0 4 7 9
10 | 0 1 7 7
11 | 0 1 1 2 5 6 8
12 | 0 0 2 5 6
13 | 0 4 4 7 9

2.24

10 | 0 2 5 8 8 9
11 | 0 1 2 3 3 4 4 5
12 | 1 1 1 2 3 3 5 6 7 7 9
13 | 0 2 2 6 7 7 7 9
14 | 0 0 2 5 6
15 | 0

2.25 a)

1 | 3 6
2 | 1 2 3 4 7 9
3 | 5 7 7 7 8
4 | 0 0 1 2 3 3 4 4 5 5 7 8 8 9
5 | 0 0 1 1 2 2 4 5 8 9
6 | 4 7

b)

1 (0) | 3
1 (5) | 6
2 (0) | 1 2 3 4
2 (5) | 7 9
3 (0) |
3 (5) | 5 7 7 7 8
4 (0) | 0 0 1 2 3 3 4 4
4 (5) | 5 5 7 8 8 9
5 (0) | 0 0 1 1 2 2 4
5 (5) | 5 8 9
6 (0) | 4
6 (5) | 7

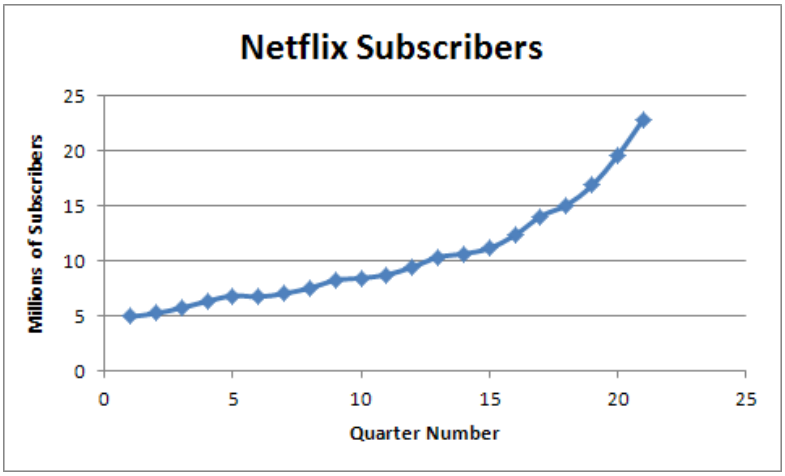
2.26 a)

1 | 6
2 | 1 6 6 7 7 8 8 8 9
3 | 1 1 2 3 5 5 5 6 6 7 9
4 | 0 0 5
5 | 9

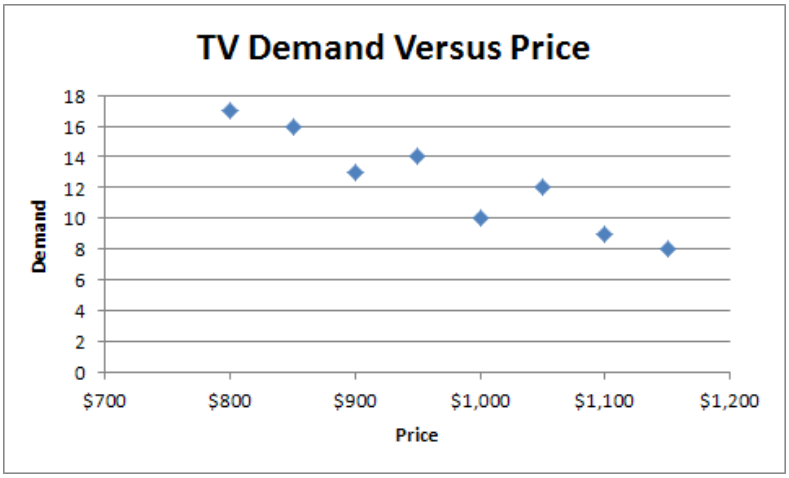
b)

1 (0) |
1 (5) | 6
2 (0) | 1
2 (5) | 6 6 7 7 8 8 8 9
3 (0) | 1 1 2 3
3 (5) | 5 5 5 6 6 7 9
4 (0) | 0 0
4 (5) | 5
5 (0) |
5 (5) | 9

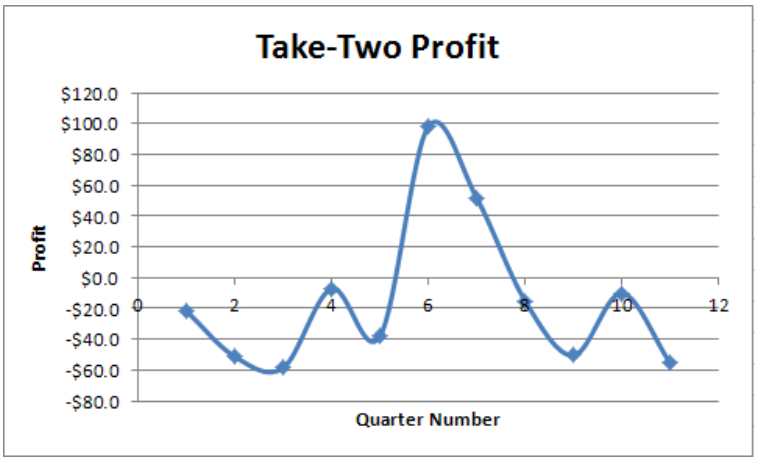
2.27 It appears that the number of Netflix subscribers is increasing significantly during this time period.



2.28 It appears that the demand for TVs decreases as price increases.



2.29



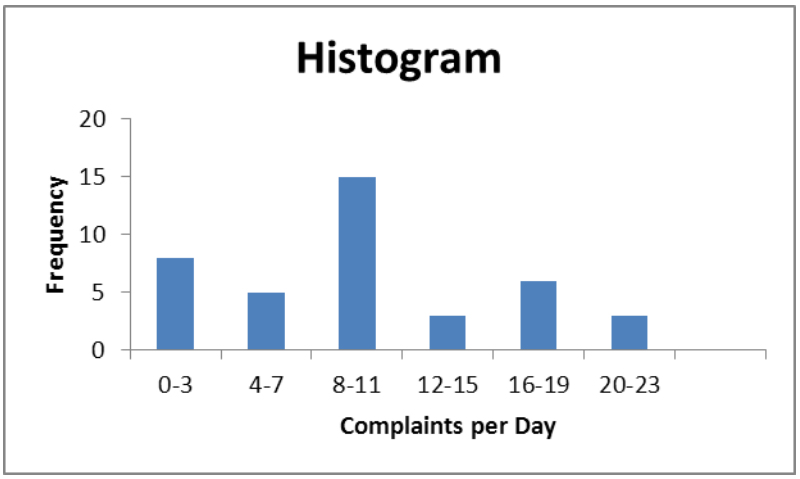
2.30 $2^6 = 64 > 40$ therefore use 6 classes.

$$\text{Estimated Class Width} = \frac{23-0}{6} = 3.8 \approx 4$$

a, b, c)

Class	Frequency	Relative Frequency	Cumulative Relative Frequency
0-3	8	0.200	0.200
4-7	5	0.125	0.325
8-11	15	0.375	0.700
12-15	3	0.075	0.775
16-19	6	0.150	0.925
20-23	3	0.075	1.000
Total	**40**	**1.000**	

d) The following histogram was constructed using bins 2.9, 6.9, 10.9, 14.9, 18.9, and 22.9.

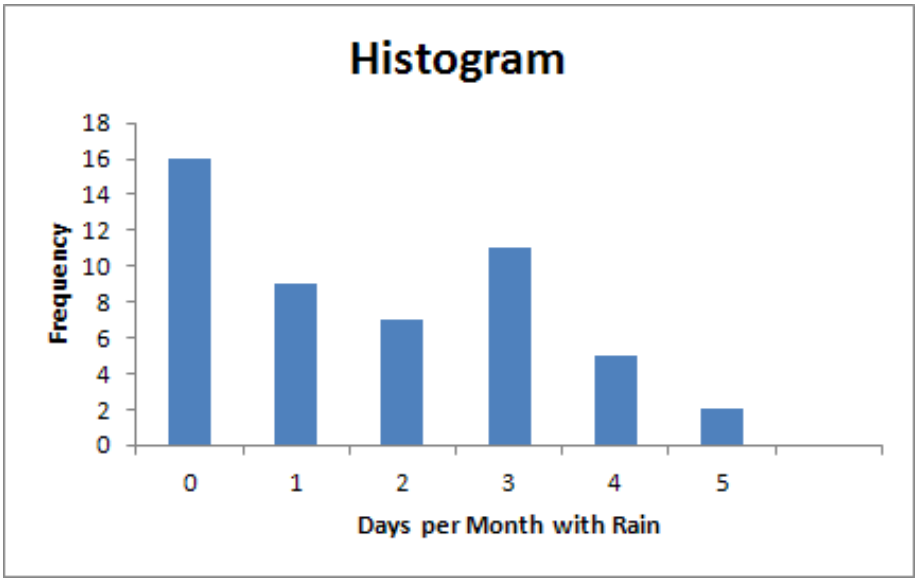


2.31

a, b, c)

Number	Frequency	Relative Frequency	Cumulative Relative Frequency
0	16	0.32	0.32
1	9	0.18	0.50
2	7	0.14	0.64
3	11	0.22	0.86
4	5	0.10	0.96
5	2	0.04	1.00
Total	**50**	**1.00**	

d) The following histogram was constructed using bins 0, 1, 2, 3, 4, and 5.



e) 50%

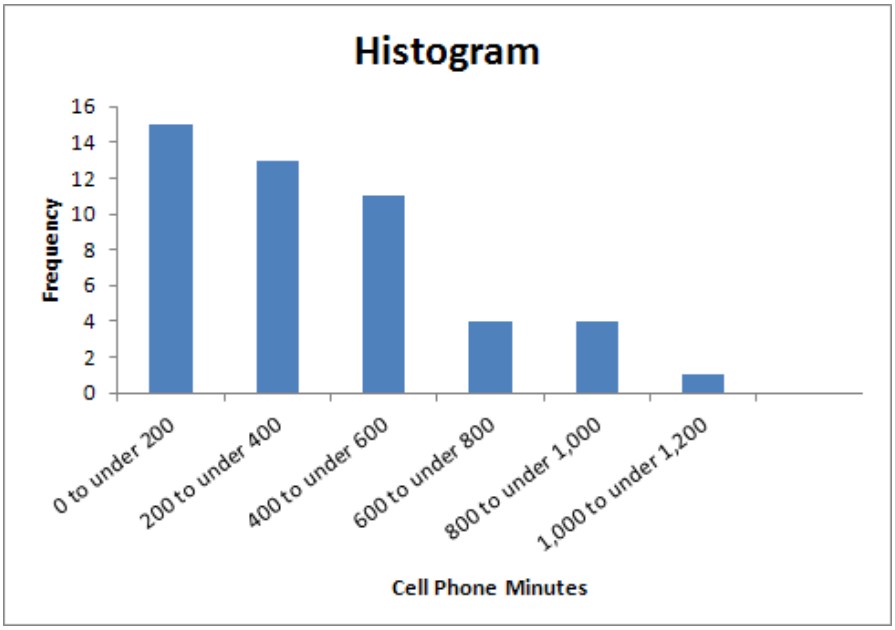
2.32 $2^6 = 64 > 48$ therefore use 6 classes.

$$\text{Estimated Class Width} = \frac{1{,}187 - 43}{6} = 190.7 \approx 200$$

a, b, c)

Class	Frequency	Relative Frequency	Cumulative Relative Frequency
0 to under 200	15	0.313	0.313
200 to under 400	13	0.271	0.584
400 to under 600	11	0.229	0.813
600 to under 800	4	0.083	0.896
800 to under 1,000	4	0.083	0.979
1,000 to under 1,200	1	0.021	1.000
Total	**48**	**1.000**	

d) The following histogram was constructed using bins 199.9, 399.9, 599.9, 799.9, 999.9, and 1,199.9.



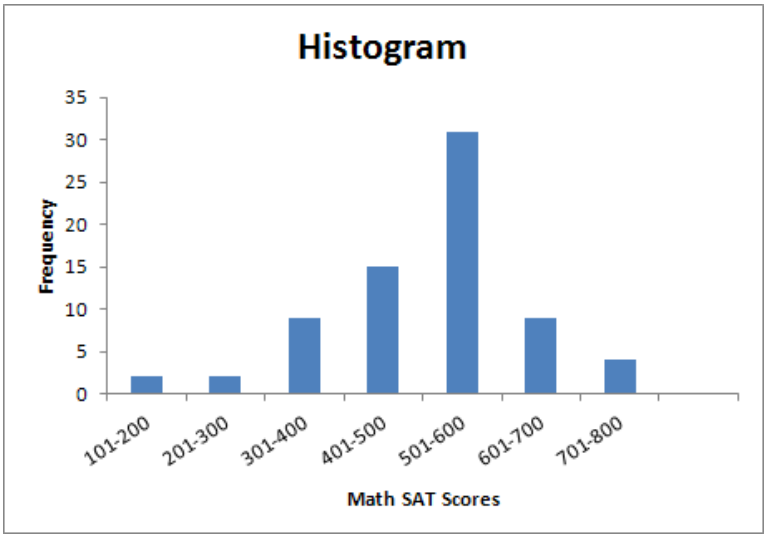
2.33 $2^7 = 128 > 72$ therefore use 7 classes.

$$\text{Estimated Class Width} = \frac{795 - 190}{7} = 86.4 \approx 100$$

a, b, c)

Class	Frequency	Relative Frequency	Cumulative Relative Frequency
101-200	2	0.028	0.028
201-300	2	0.028	0.056
301-400	9	0.125	0.181
401-500	15	0.208	0.389
501-600	31	0.431	0.820
601-700	9	0.125	0.945
701-800	4	0.056	1.001
Total	**72**	**1.001**	

d) The following histogram was constructed using bins 200, 300, 400, 500, 600, 700, and 800.



2.34 $2^5 = 32 > 30$ therefore use 5 classes.

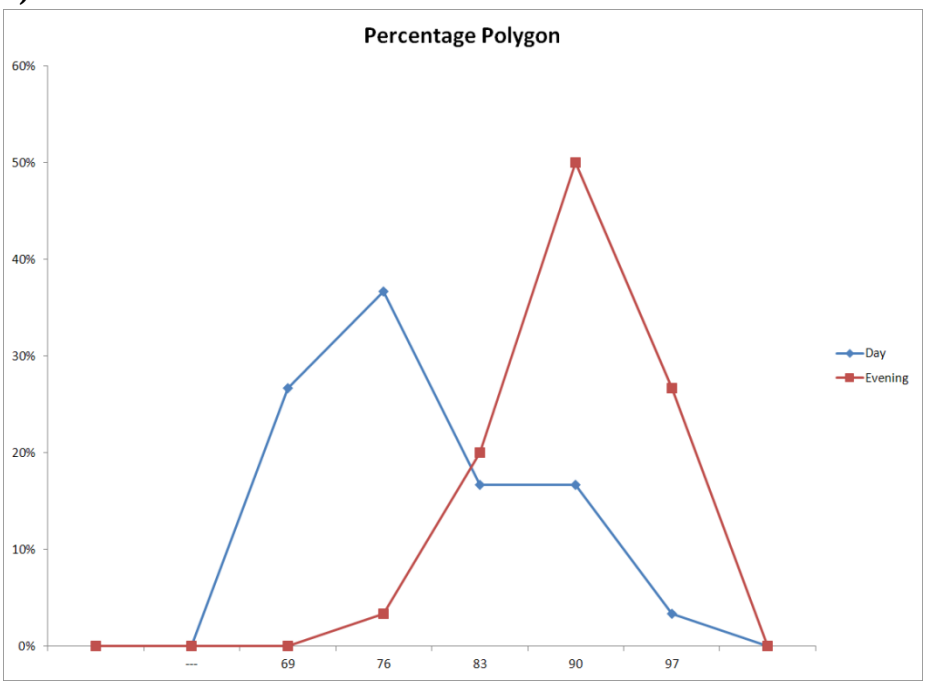
$$\text{Estimated Class Width (Day)} = \frac{100-66}{5} = 6.8 \approx 7$$

Results would be similar using the evening grades.

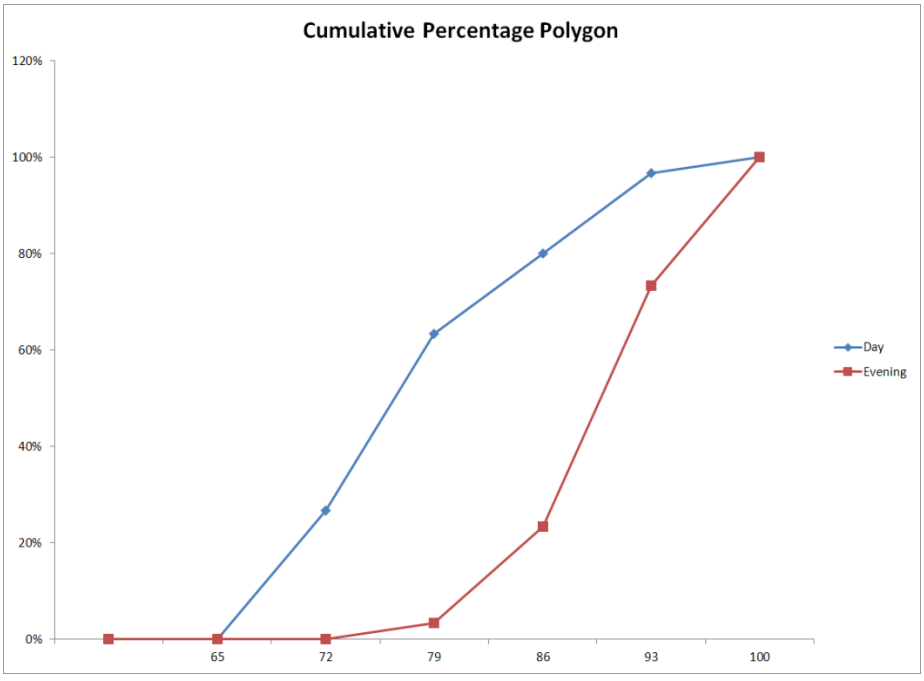
Class	**Bins**	**Midpoint**
66-72	72	69
73-79	79	76
80-86	86	83
87-93	93	90
94-100	100	97

An extra bin (65) was added to Excel to provide the open-ended class required by PHStat2.

a)



b)



c) The evening class grades appear to be noticeably higher than the day class grades.

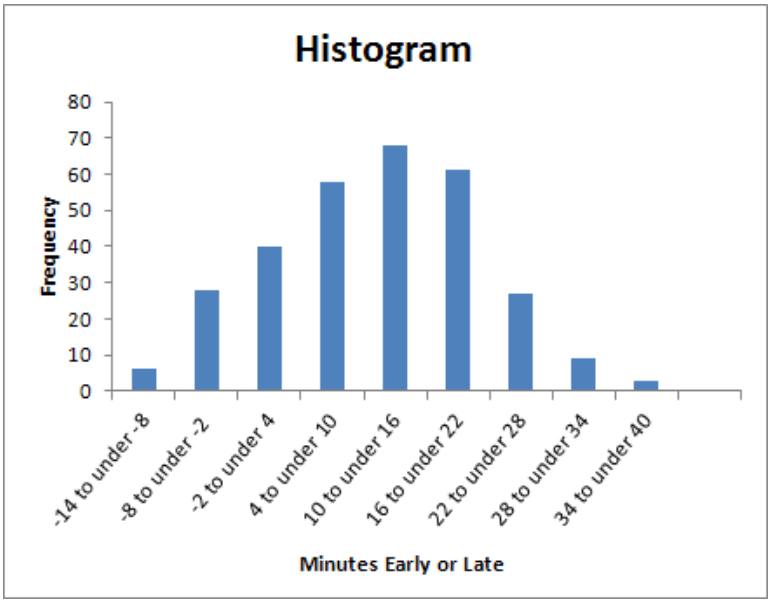
2.35 $2^9 = 512 > 300$ therefore use 9 classes.

$$\text{Estimated Class Width} = \frac{39-(-14)}{9} = 5.9 \approx 6$$

a, b, c)

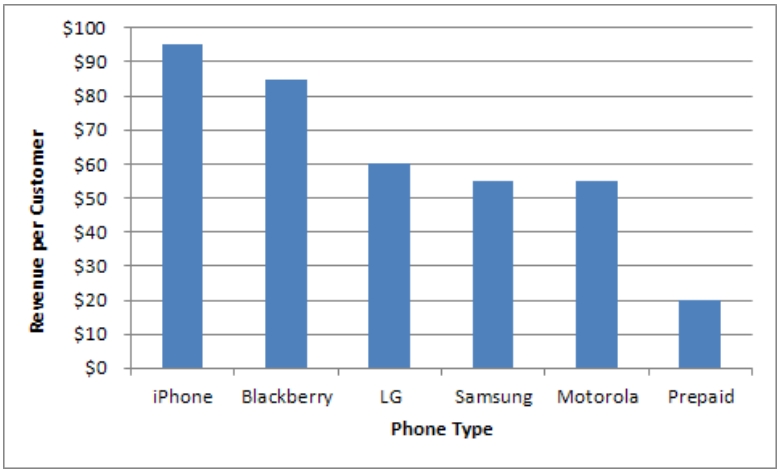
Class	Frequency	Relative Frequency	Relative Cumulative Frequency
-14 to under -8.1	6	0.020	0.020
-8 to under -2.1	28	0.093	0.113
-2 to under 4	40	0.133	0.246
4 to under 10	58	0.193	0.439
10 to under 16	68	0.227	0.666
16 to under 22	61	0.203	0.869
22 to under 28	27	0.090	0.959
28 to under 34	9	0.030	0.989
34 to under 40	3	0.010	0.999
Total	**300**	**0.999**	

d) The following histogram was constructed using bins -8.1, -2.1, 3.9, 9.9, 15.9, 21.9, 27.9, 33.9, and 39.9.

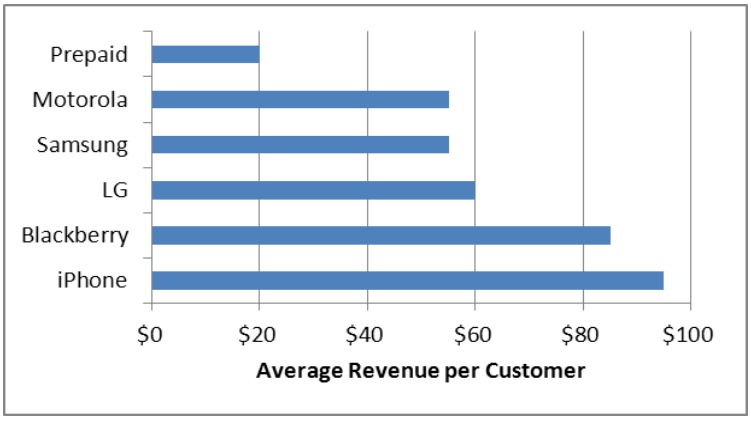


e) Approximately 74 out of 300 flights were not late (24.7%).

2.36 a)



b)



2.37 $2^7 = 128 > 100$ therefore use 7 classes.

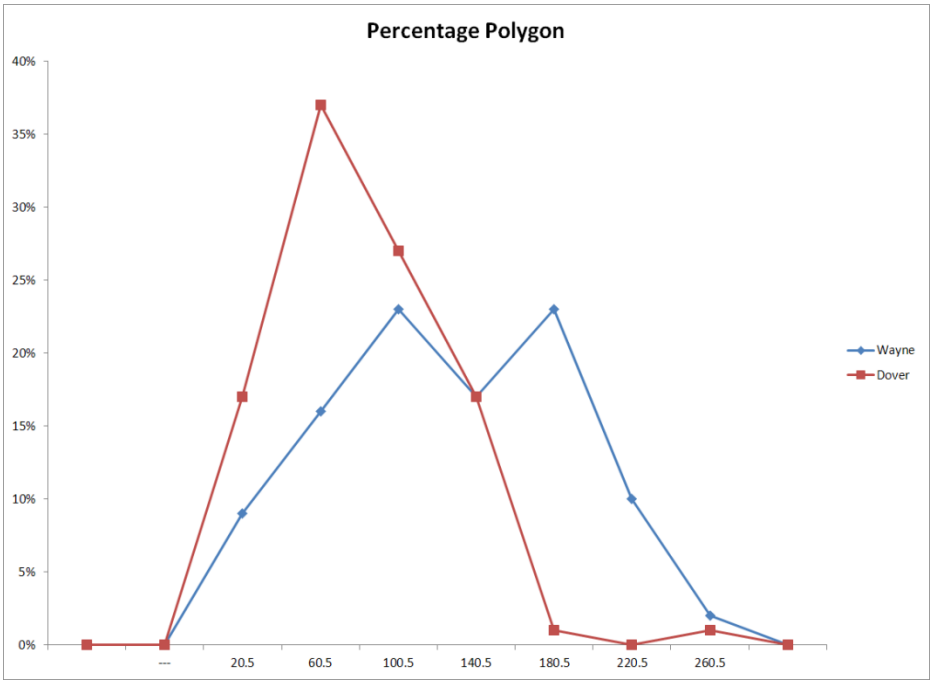
$$\text{Estimated Class Width (Wayne)} = \frac{259-12}{7} = 35.3 \approx 40$$

Results would be similar using the Dover data.

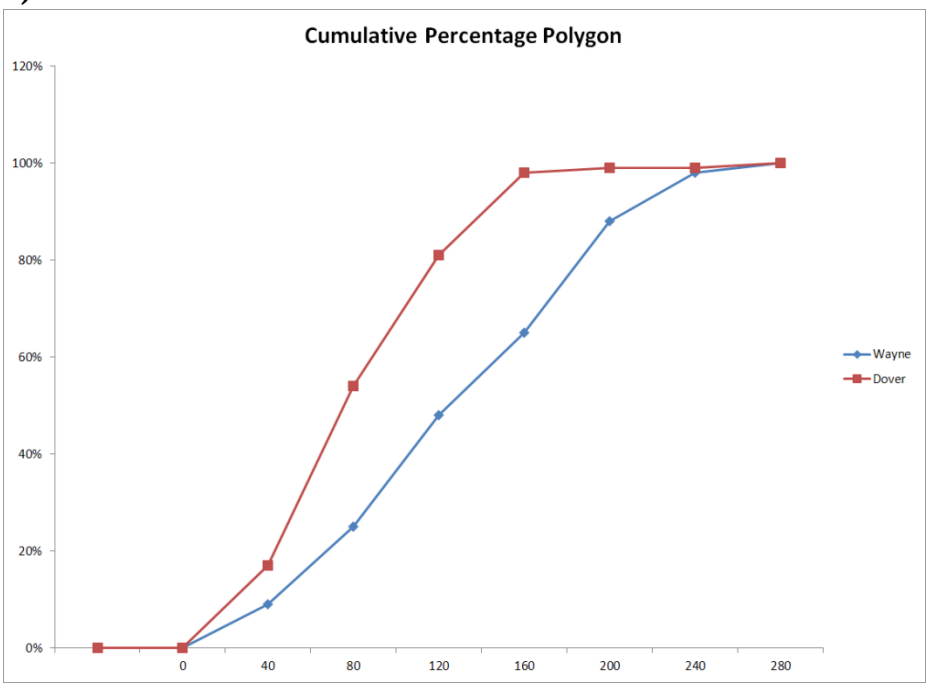
Class	**Bins**	**Midpoint**
1-40	40	20.5
41-80	80	60.5
81-120	120	100.5
121-160	160	140.5
161-200	200	180.5
201-240	240	220.5
241-280	280	260.5

An extra bin (0) was added to Excel to provide the open-ended class required by PHStat2.

a)

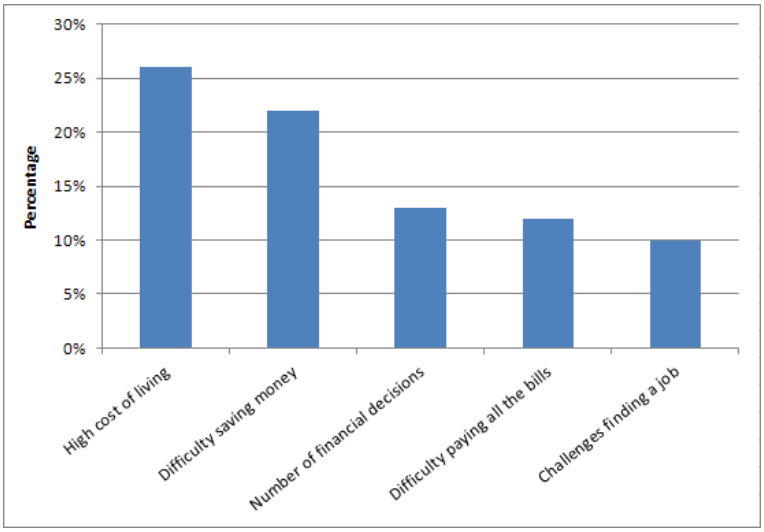


b)

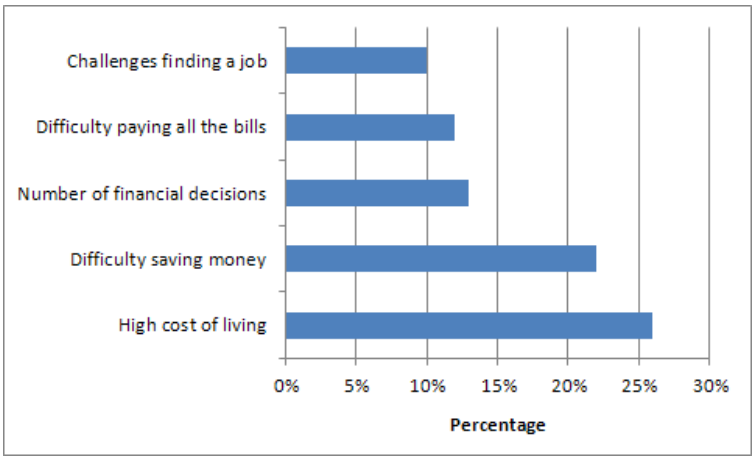


c) It appears that the days on the market for homes sold in Wayne are longer than for homes sold in Dover.

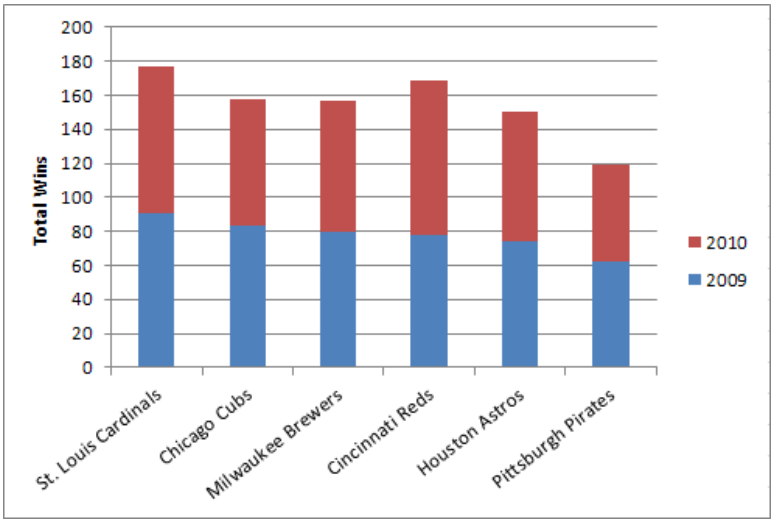
2.38 a)



b)

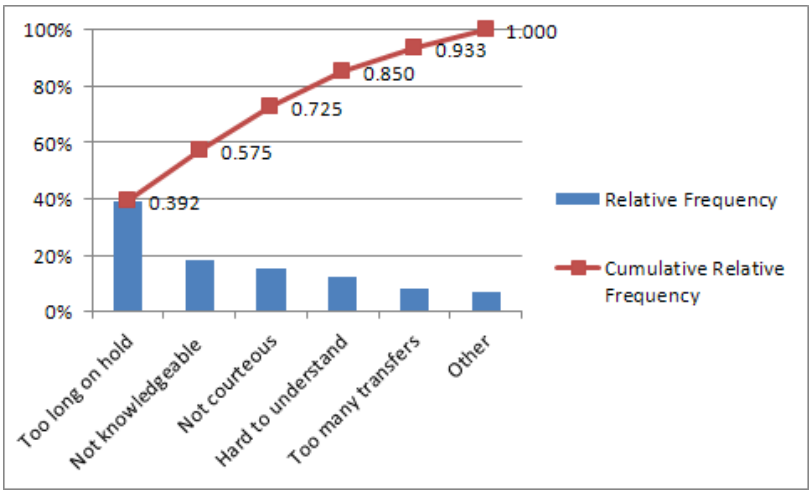


2.39



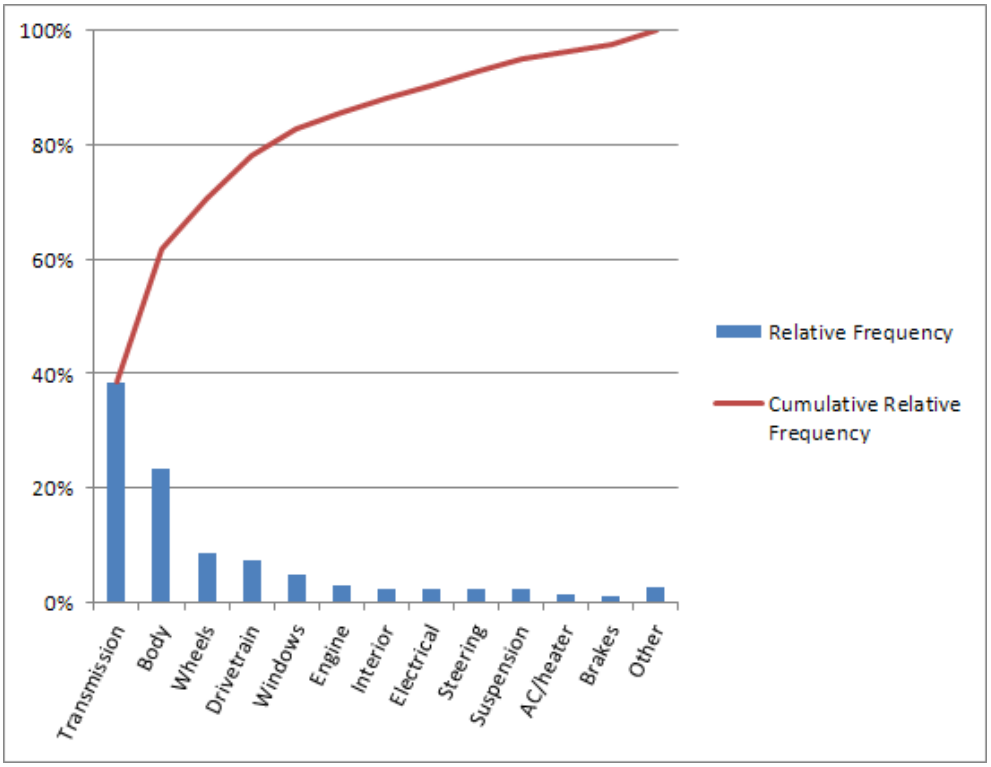
2.40

Reason	Frequency	Relative Frequency	Cumulative Relative Frequency
Too long on hold	47	0.392	0.392
Not knowledgeable	22	0.183	0.575
Not courteous	18	0.150	0.725
Hard to understand	15	0.125	0.850
Too many transfers	10	0.083	0.933
Other	8	0.067	1.000
Total	120		

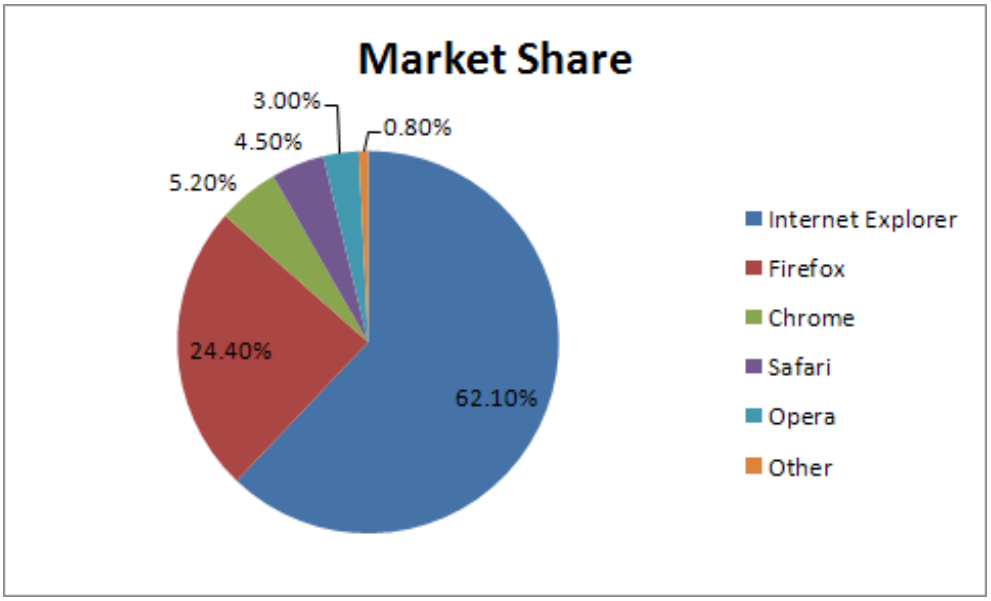


2.41

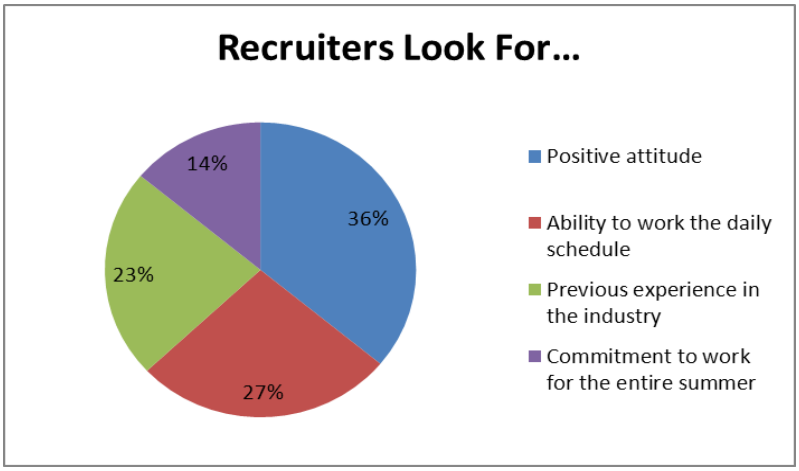
Reason	Frequency	Relative Frequency	Cumulative Relative Frequency
Transmission	721	0.385	0.385
Body	437	0.233	0.619
Wheels	164	0.088	0.706
Drivetrain	139	0.074	0.780
Windows	89	0.048	0.828
Engine	55	0.029	0.857
Interior	45	0.024	0.881
Electrical	44	0.024	0.905
Steering	42	0.022	0.927
Suspension	41	0.022	0.949
AC/heater	26	0.014	0.963
Brakes	22	0.012	0.975
Other	47	0.025	1.000
Total	1872		



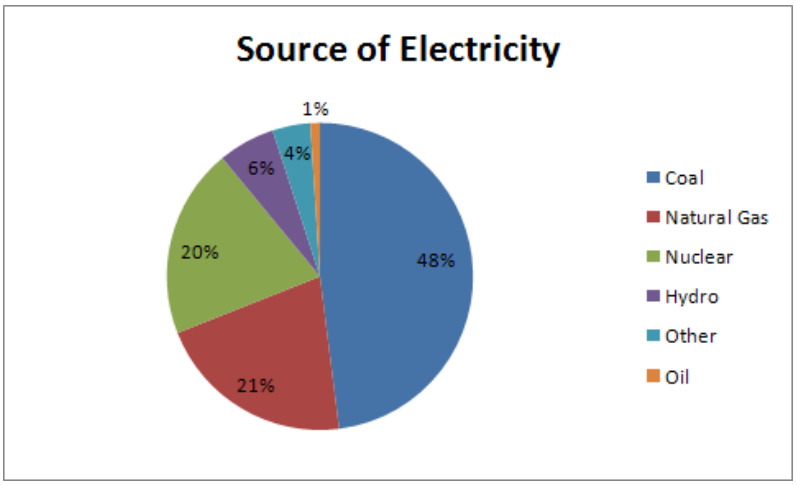
2.42



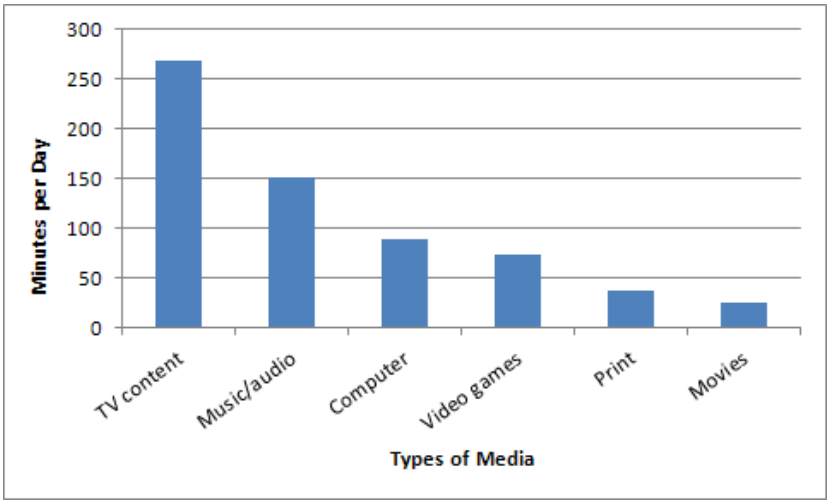
2.43



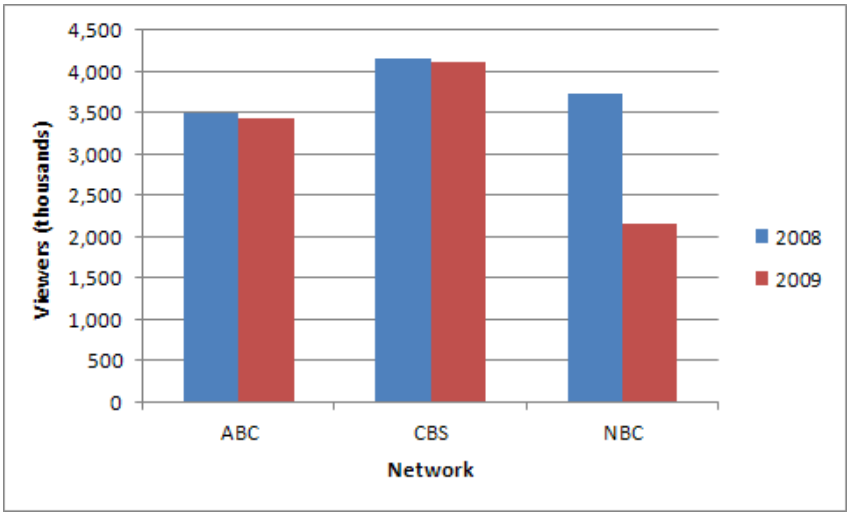
2.44



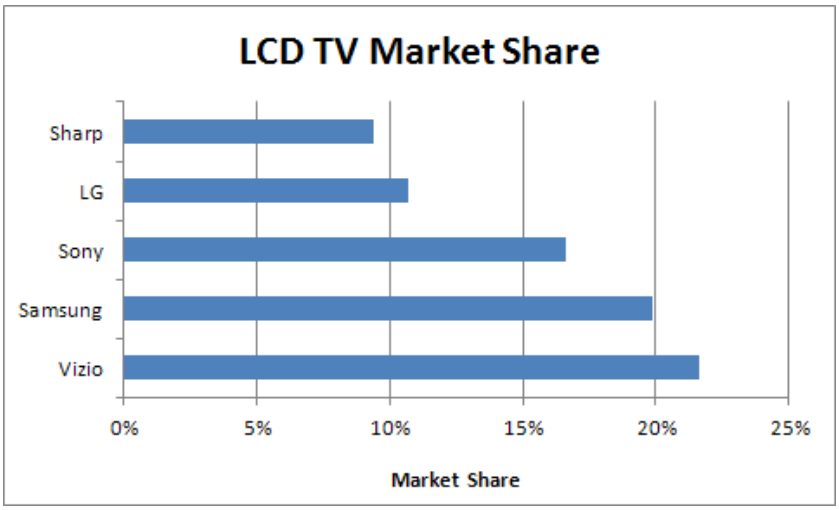
2.45 A bar chart would be appropriate for categorical data. The time data needs to be converted to common units (minutes).



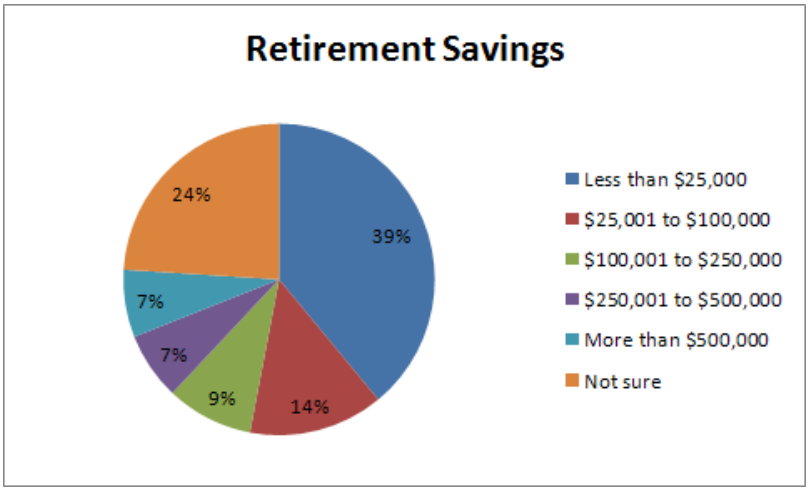
2.46 A clustered bar chart would be appropriate for this data. A stacked bar chart would also be an option.



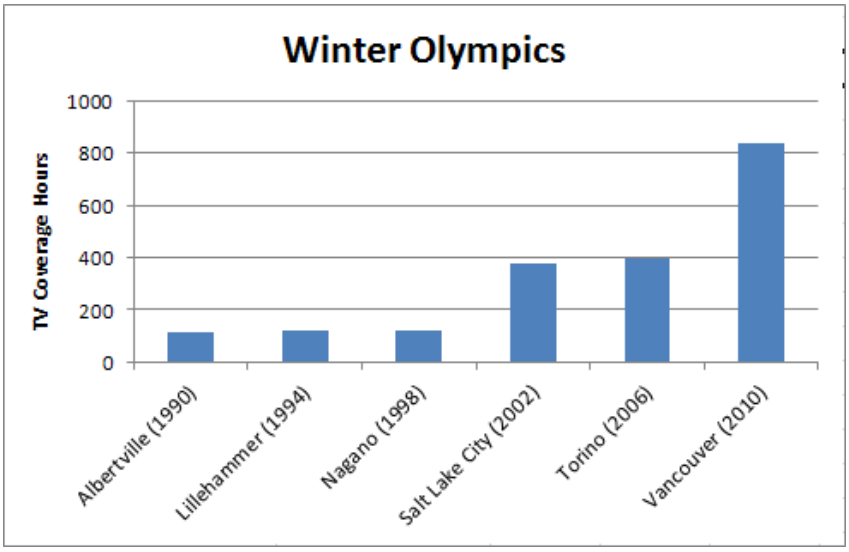
2.47 A bar chart, either horizontal or vertical, is the best choice for this data. A pie chart would not be appropriate because all brands are not included. The total percentage does not equal 100%.



2.48 A pie chart is the best choice because all categories are included and the percentage sums to 100%.



2.49 A bar chart, either horizontal or vertical, is the best choice for this data.



2.50

Brand	**Diet**	**Regular**	**Total**
Coke	6	6	12
Mt. Dew	2	8	10
Pepsi	4	7	11
Total	**12**	**21**	**33**

50% (6/12) of the Coke customers preferred Diet even though only 36% (12/33) of all the customers prefer Diet soda. Coke customers appear to have a higher percentage of customers who prefer diet soda than other brands.

2.51

Age	**Callaway**	**Nike**	**Taylor Made**	**Total**
20-29	4	2	19	25
30-39	9	15	10	34
40-49	16	6	8	30
50-59	3	3	5	11
Total	**32**	**26**	**42**	**100**

Younger golfers seem to prefer Taylor Made clubs while older golfers seem to refer Callaway.

2.52 a)

1 | 8 9 9
2 | 0 0 0 2 2 3 3 5 5 5 6 8 8 8 8 9
3 | 0 1 1 1 1 2 2 3 5 5 5 6 6 9 9
4 | 1 3 3 5 6
5 | 1

b)

1 (5) | 8 9 9
2 (0) | 0 0 0 2 2 3 3
2 (5) | 5 5 5 6 8 8 8 8 9
3 (0) | 0 1 1 1 1 2 2 3
3 (5) | 5 5 5 6 6 9 9
4 (0) | 1 3 3
4 (5) | 5 6
5 (0) | 1

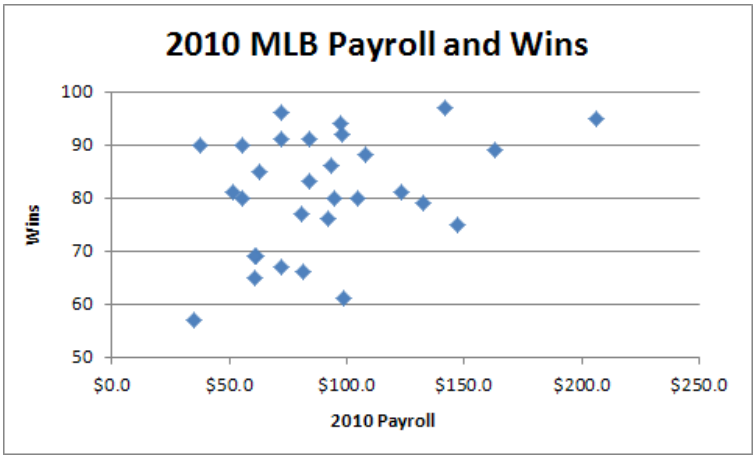
2.53 a)

7 | 0 0 2 2 4 5 6 7 7 7
8 | 1 2 5 8
9 | 0 1 2 2 3 3 3 4 5 7 7 9 9
10 | 0 1 2 4 5
11 | 2 8 9
12 | 5
13 | 0 0 1 8

b)

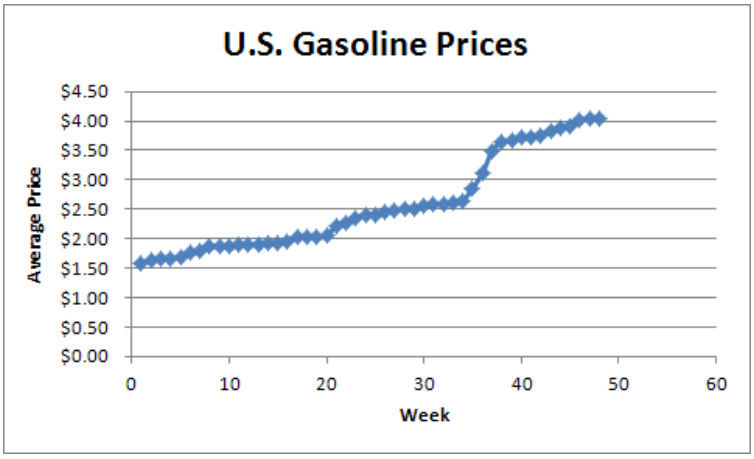
```
 7 (0) | 0 0 2 2 4
 7 (5) | 5 6 7 7 7
 8 (0) | 1 2
 8 (5) | 5 8
 9 (0) | 0 1 2 2 3 3 3 4
 9 (5) | 5 7 7 9 9
10 (0) | 0 1 2 4
10 (5) | 5
11 (0) | 2
11 (5) | 8 9
12 (0) |
12 (5) | 5
13 (0) | 0 0 1
13 (5) | 8
```

2.54



There does not appear to be a consistent relationship between payroll and wins during the 2010 season.

2.55



The trend in gasoline prices appear to rise consistently during this time period.