

**CHAPTER 2**  
**VISUAL DESCRIPTION OF DATA**

**SECTION EXERCISES**

**2.1** d/p/e A frequency distribution is a table that divides the data values into classes and shows the number of observed values that fall into each class. By summarizing and reporting data into a frequency distribution, the data can be readily understood and interpreted.

**2.2** d/p/m Selecting the number of classes is a subjective process. In general, about 5 to 15 classes will be suitable.

**2.3** c/p/m

- a. 40.88 million      b. lower limit is 35, upper limit is under 45      c. 10 years      d. 40 years

**2.4** c/p/m

- a. 34.02 million      b. lower limit is 25, upper limit is under 35      c. 10 years      d. 30 years

**2.5** c/p/m

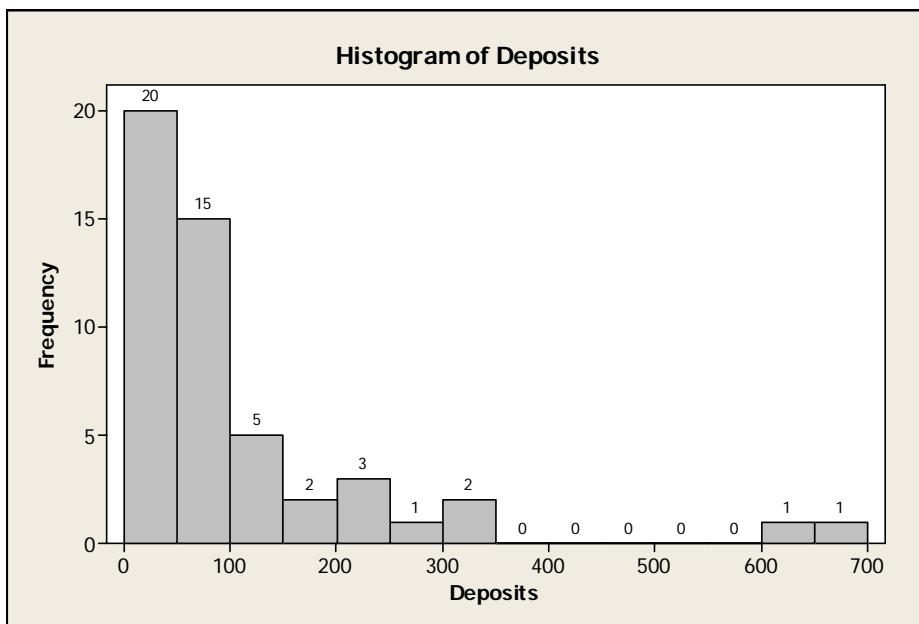
- a. 172.21 thousand      b. lower limit is 45, upper limit is under 55      c. 10 years      d. 50 years

**2.6** c/p/m

- a. 33.08 thousand      b. lower limit is 15, upper limit is under 25      c. 10 years      d. 20 years

**2.7** d/p/e Mutually exclusive means a given data value can fall into only one class. Exhaustive means that the set of classes includes all possible data values.

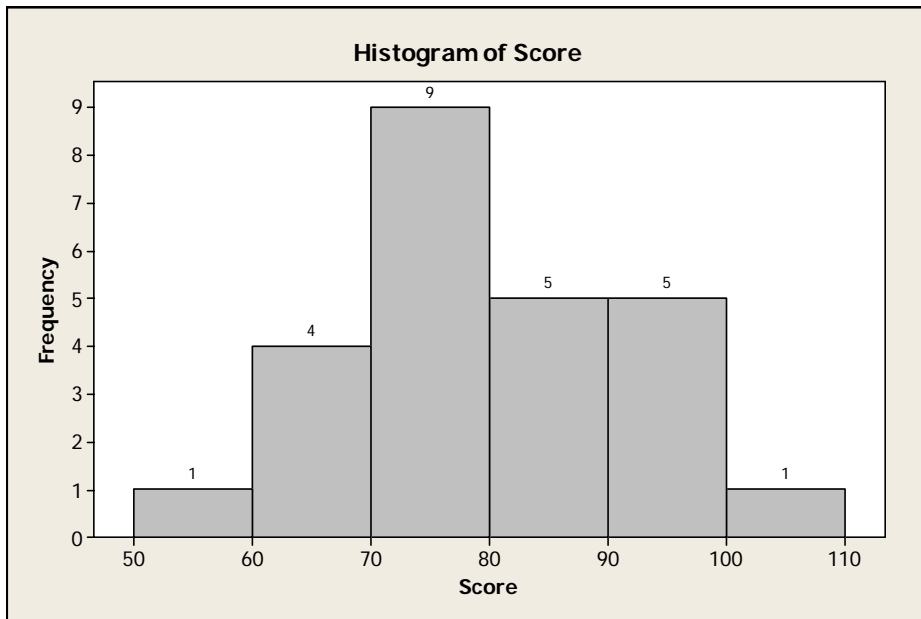
**2.8** c/p/m The number of states in each category is shown above the corresponding bar. For example, there are 15 states within the \$50 billion - under \$100 billion category.



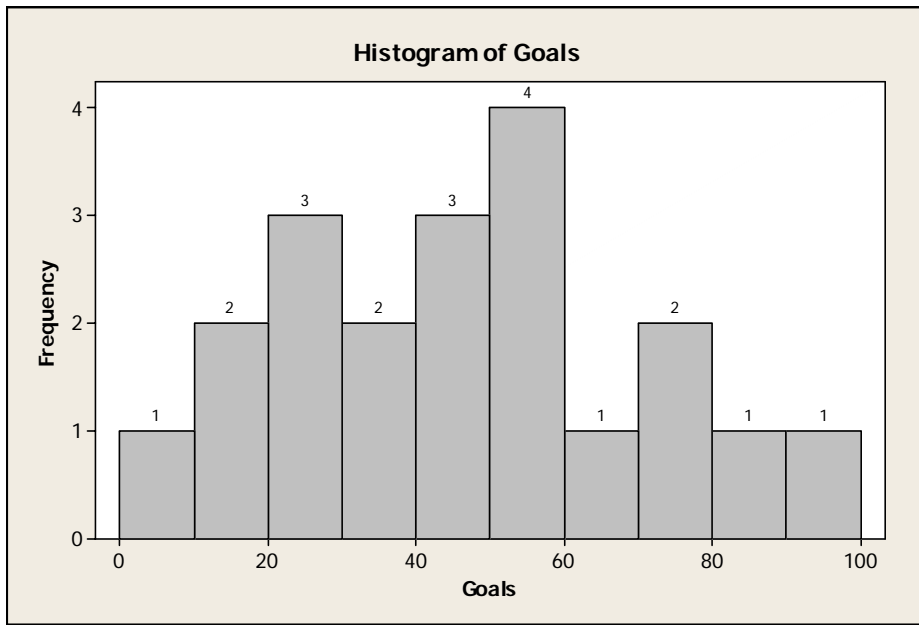
**2.9** c/p/m The number of employees in each category is shown above the corresponding bar. For example, there are 7 data values within the 20 - under 22 category.



**2.10** c/p/m The number of applicants in each category is shown above the corresponding bar. For example, there were 9 applicants within the 70 - under 80 category.



**2.11 c/p/m** The number of seasons in each goal category is shown above the bars. For example, there were 2 seasons during which Mr. Gretzky's goal total was in the 70 - under 80 category.



**2.12 c/a/m**

Annual Sales	Percent	Cumulative Frequency
Under \$10,000	59.30	1262
\$ 10,000 - under \$ 25,000	12.03	1518
\$ 25,000 - under \$ 50,000	7.42	1676
\$ 50,000 - under \$ 100,000	6.58	1816
\$ 100,000 - under \$ 250,000	7.47	1975
\$ 250,000 - under \$500,000	3.85	2057
\$500,000 - under \$1,000,000	1.97	2099
\$1,000,000 or more	1.36	2128

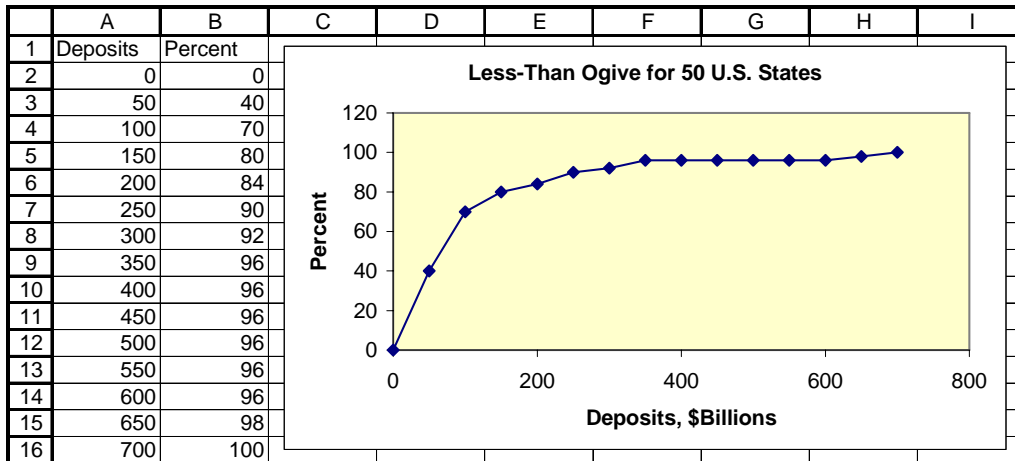
**2.13 c/a/m**

Driver Age	Percent	Cumulative Frequency
Under 18	4.83	9.50
18 - under 25	8.39	26.00
25 - under 35	17.29	60.02
35 - under 45	20.78	100.90
45 - under 55	20.71	141.64
55 - under 65	13.30	167.81
65 or older	14.69	196.71

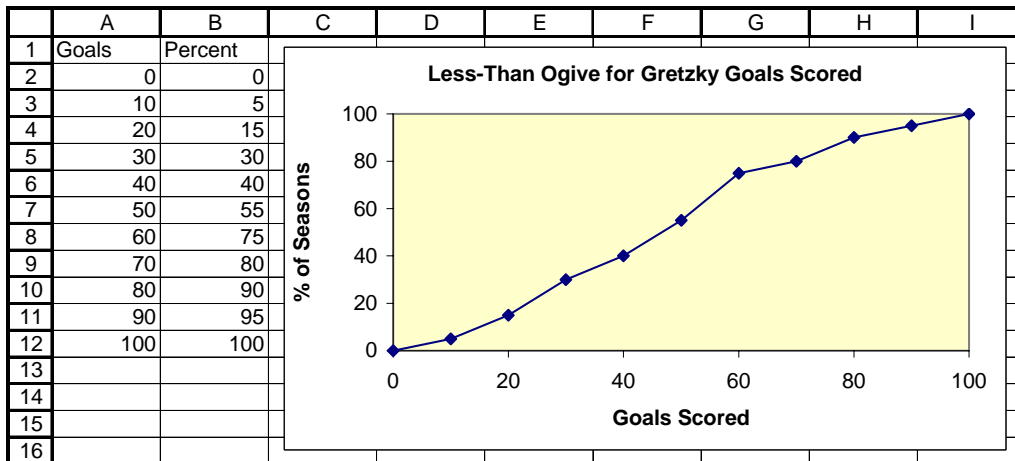
2.14 c/a/m

Total Deposits, \$ Billions	Relative Frequency, %	Greater-Than or Within, %
0 - under 100	70.0	70.0
100 - under 200	14.0	30.0
200 - under 300	8.0	16.0
300 - under 400	4.0	8.0
400 - under 500	0.0	4.0
500- under 600	0.0	4.0
600 - under 700	4.0	4.0

2.15 c/a/m Less-than Ogive for 50 U.S. States:

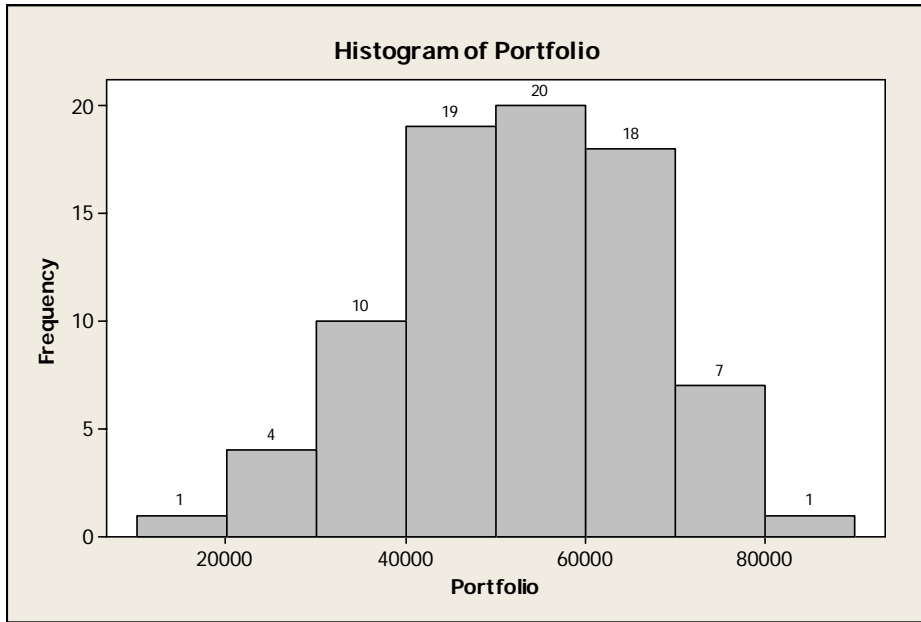


2.16 c/p/m

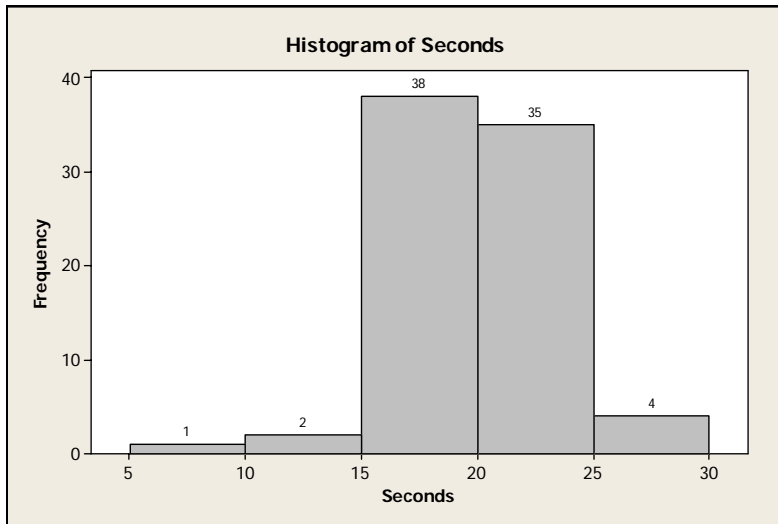


**2.17** c/c/m

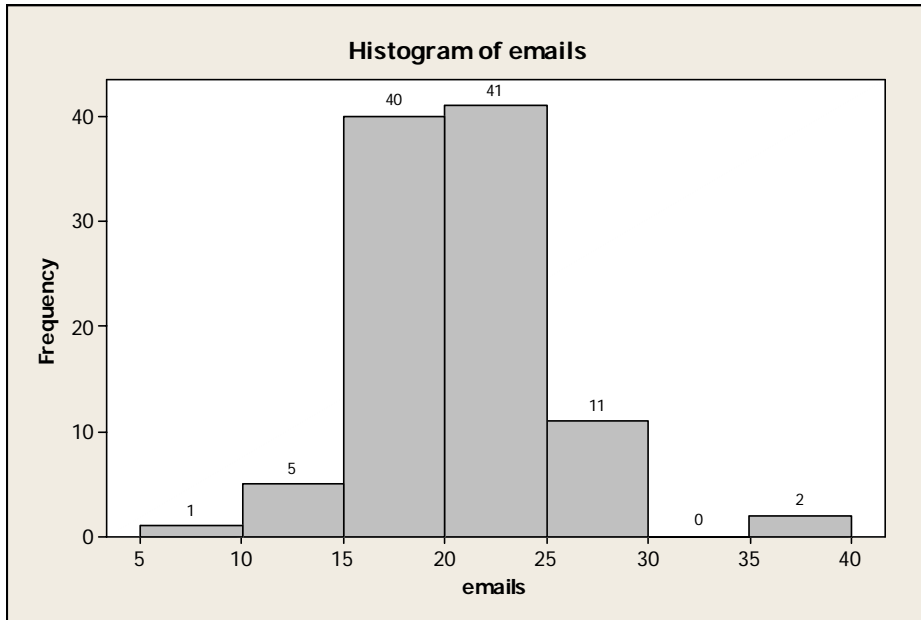
The number of data values in each category is shown above the bar. For example, there are 10 data values in the \$30,000 - under \$40,000 category. There are two portfolio values at the extremes that seem especially low or high compared to the others.



**2.18** c/c/m The number of data values in each category is shown above the bar. For example, there was only one data value in the 5 seconds - under 10 seconds category, and this seems to be an especially low time compared to the others.



**2.19 c/c/m** The number of data values in each category is shown above the bar. For example, there are 41 data values in the 20 - under 25 e-mails category. The single value in the 5 - under 10 category and the two values in the 35 - under 40 category would appear to be especially low and high, respectively.



**2.20 c/p/m**

Stem (Tens)	Leaf (Units)
1	559
2	014567
3	458
4	12688
5	17
6	24479
7	1257
8	13

**2.21 c/p/m**

Stem (Tens)	Leaf (Units)
1	13799
2	24446889
3	0023379
4	1123366689
5	22334677799
6	0113

**2.22 c/p/m**

20 20 22 22 27 28 30 31 31 33 35 39 41 43 44 44 54 57

**2.23 c/p/d** It is not possible to determine the exact values because there is not enough detail to determine the units digit. One possible set of data is shown below:

613	695	770	899	955
630	702	864	900	962
633	708	866	903	981
652	721	884	909	
677	755	897	936	

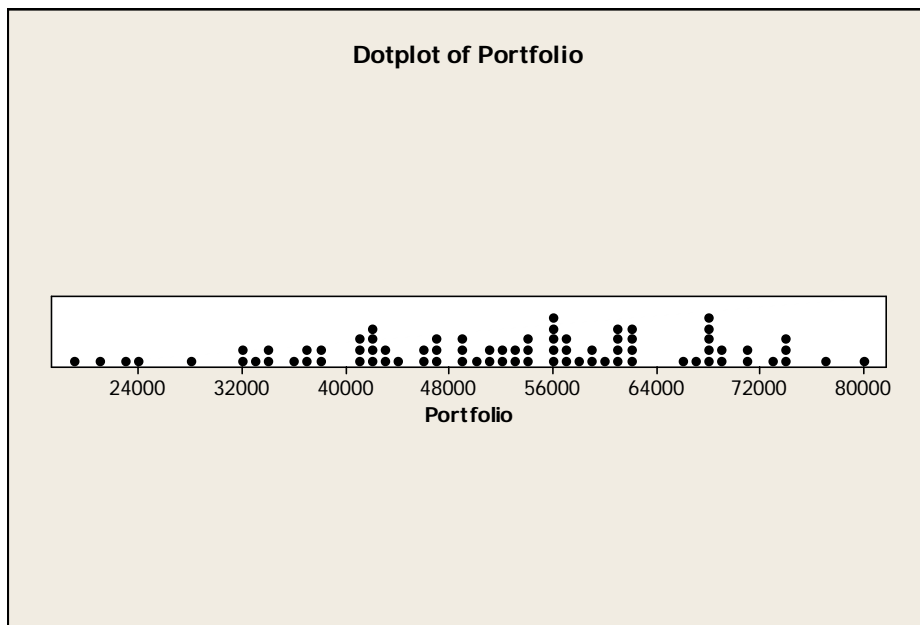
## 2.24 c/c/m

### Stem-and-Leaf Display: Portfolio

Stem-and-leaf of Portfolio N = 80

Leaf Unit = 1000

```
1 1 9
4 2 033
5 2 7
10 3 12234
15 3 66788
25 4 0111222233
34 4 566668899
(9) 5 001133334
37 5 55566777899
26 6 001111222
17 6 677778889
8 7 003334
2 7 6
1 8 0
```



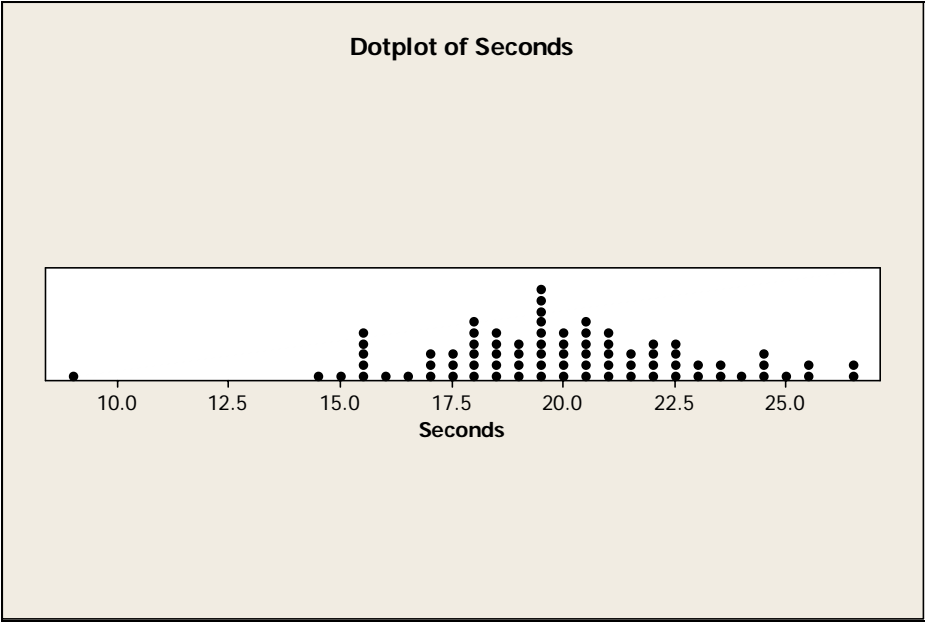
## 2.25 c/c/m

### Stem-and-Leaf Display: Seconds

Stem-and-leaf of Seconds N = 80

Leaf Unit = 0.10

```
1 9 1
1 10
1 11
1 12
1 13
3 14 79
8 15 45557
12 16 0589
21 17 145677999
29 18 04556689
(12) 19 122344457778
39 20 0112333456789
26 21 00357778
18 22 033359
12 23 135
9 24 22249
4 25 66
2 26 56
```



**2.26 c/c/m**

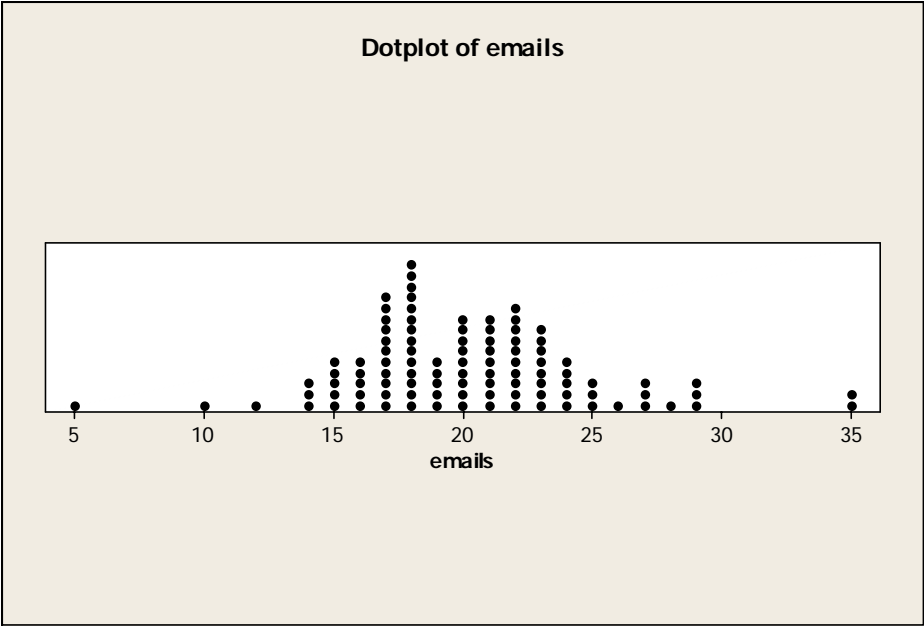
**Stem-and-Leaf Display: emails**

Stem-and-leaf of emails    N = 100  
 Leaf Unit = 1.0

```

1   0 5
1   0
1   0
2   1 0
3   1 2
11  1 44455555
27  1 6666677777777777
46  1 8888888888888899999
(18) 2 000000001111111111
36  2 222222222233333333
18  2 44444555
10  2 6777
6   2 8999
2   3
2   3
2   3 55
```

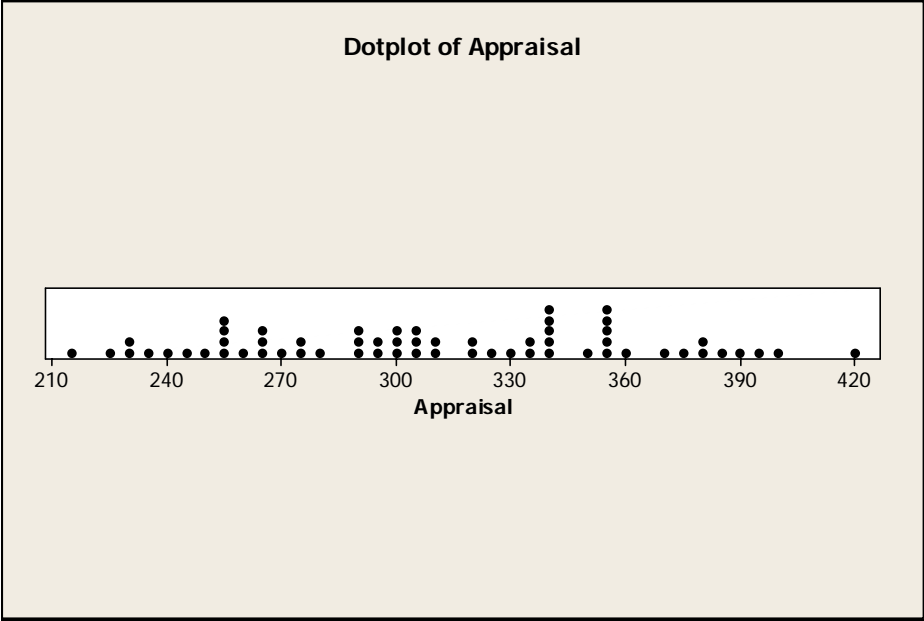




**2.27 c/c/m**  
**Stem-and-Leaf Display: Appraisal**

Stem-and-leaf of Appraisal N = 60  
 Leaf Unit = 10

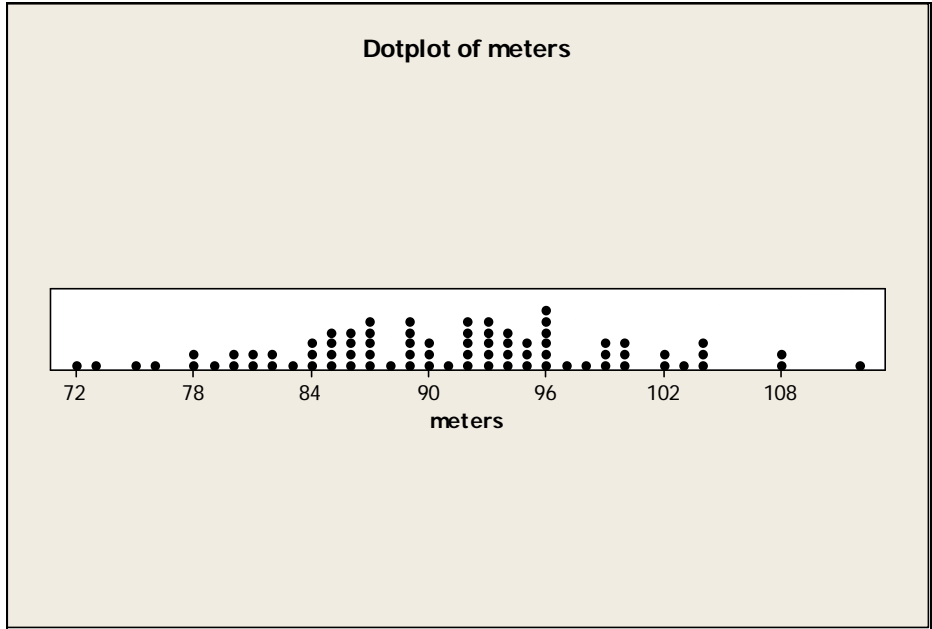
1	2	1
5	2	2233
12	2	4445555
20	2	66666777
25	2	99999
(8)	3	00000001
27	3	22233333
19	3	444455555
10	3	677
7	3	888999
1	4	1



**2.28 c/c/m**

**Stem-and-Leaf Display: meters**

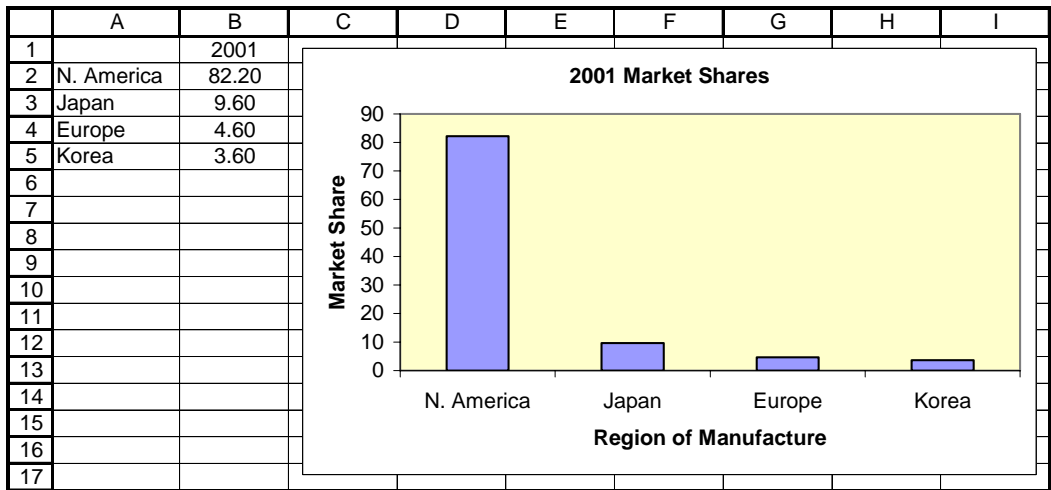
```
Stem-and-leaf of meters      N = 80
Leaf Unit = 1.0
 2   7 12
 7   7 56789
19   8 001111233444
37   8 55555666667778899999
(19)  9 0011111222333333344
24   9 5566666678999
11  10 00112344
 3  10 78
 1  11 2
```



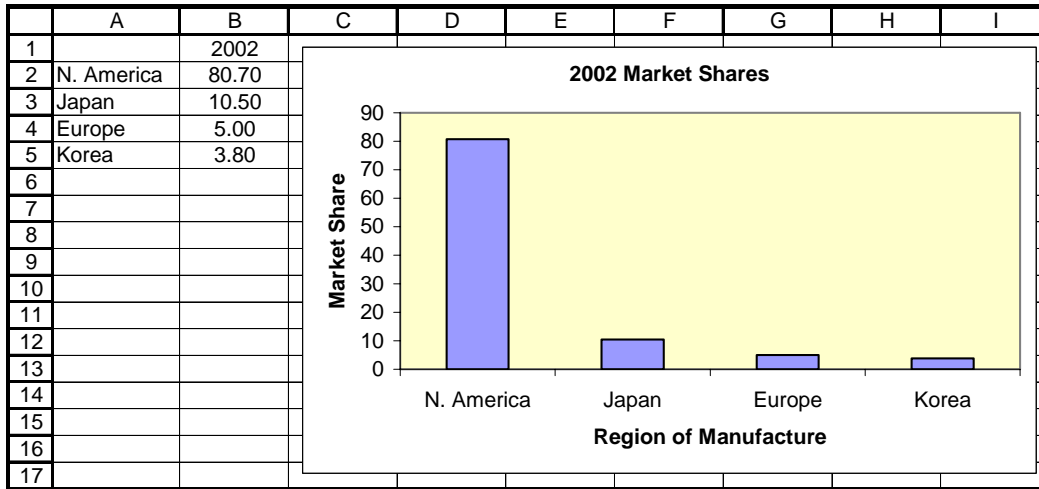
**2.29 d/p/m** A histogram graphically displays class intervals as well as class frequencies. A bar chart displays the frequencies for a set of categories or classes. Histograms are appropriate for quantitative data, while bar charts are better for qualitative data.

**2.30 c/a/m**

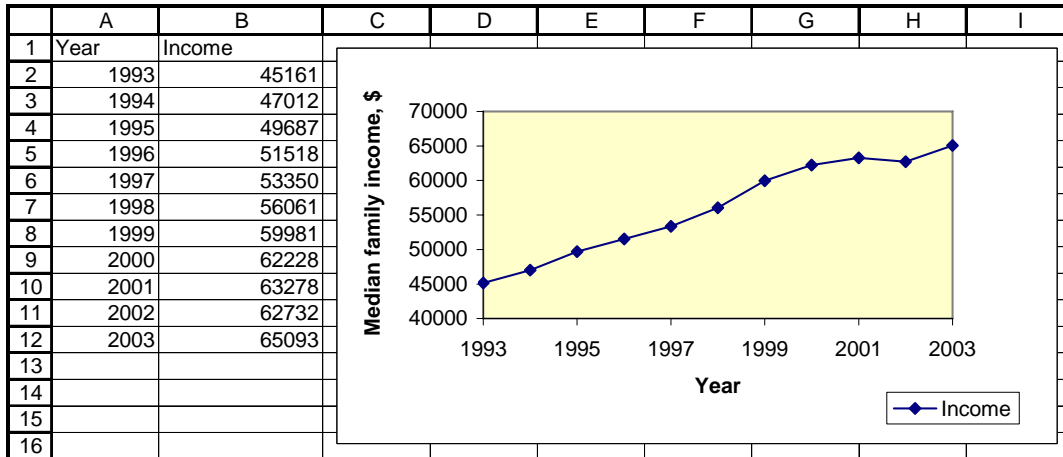
a. Bar Chart of market shares in 2001:



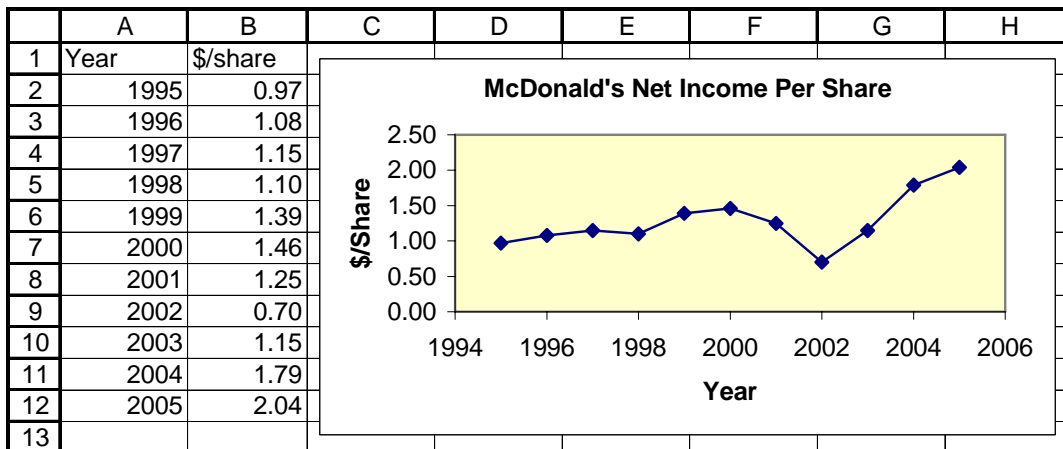
b. Bar Chart of market shares in 2002:



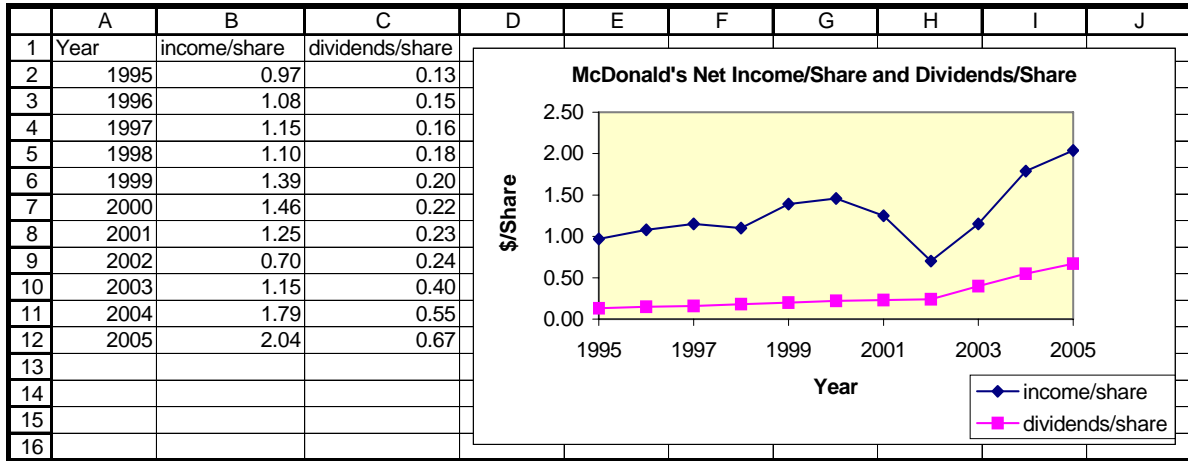
2.31 c/p/m



2.32 c/p/m

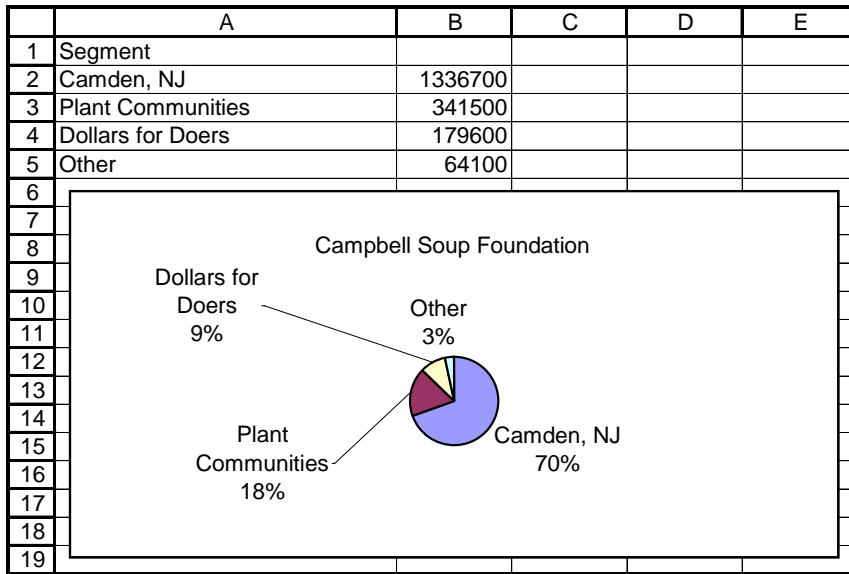


2.33 c/p/m

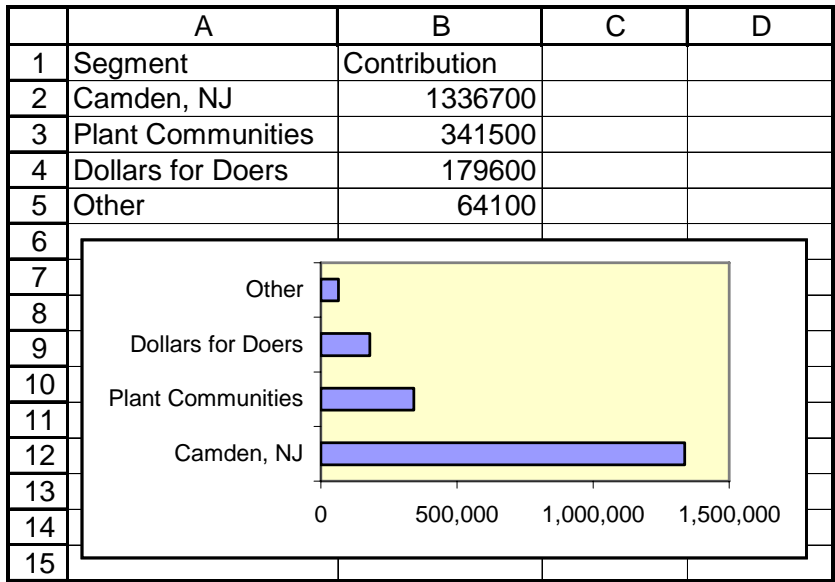


2.34 c/p/m

a. Pie chart summarizing Campbell Soup Foundation contributions:



b. Bar chart summarizing Campbell Soup Foundation contributions:

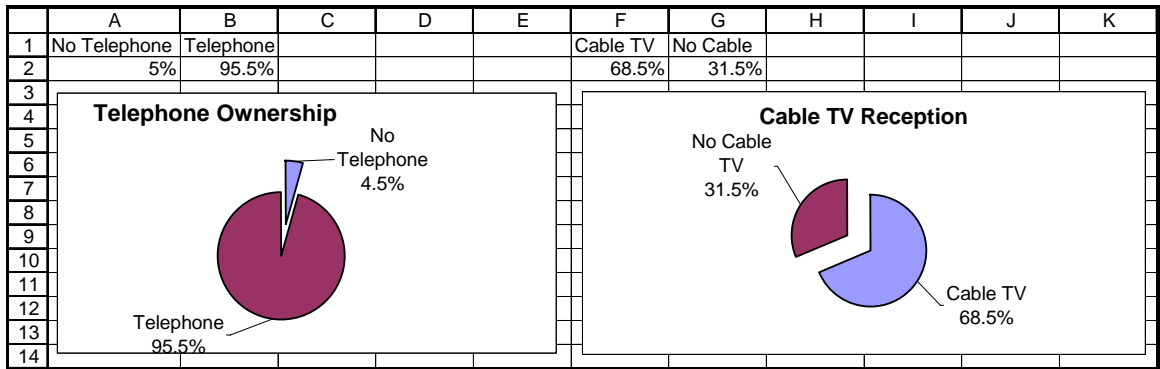


c. A bar chart is appropriate because the data are qualitative.

**2.35 c/p/d**

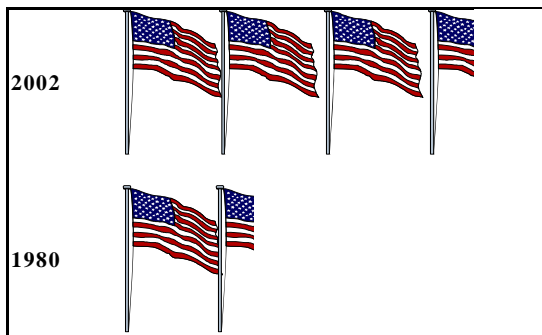
a. Ownership of a telephone and subscription to cable TV are two different variables, not mutually exclusive categories.

b. Pie Charts.

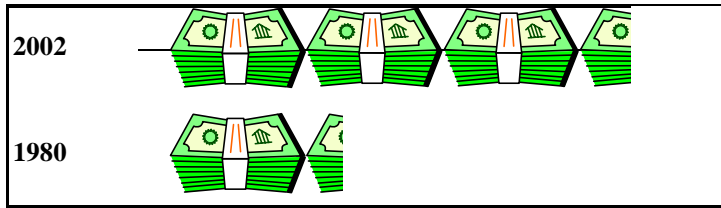


**2.36 c/p/m**

a. Pictogram using flags; each flag represents approximately \$100 billion in defense expenditures:



b. Pictogram with stacks of money; each stack representing about \$100 billion in defense expenditures.



2.37 c/a/m The ship representing 2002 is approximately 2.6 (i.e., 348/134) times as high, 2.6 times as wide, and will have about 6.7 times the area of the ship representing 1980.

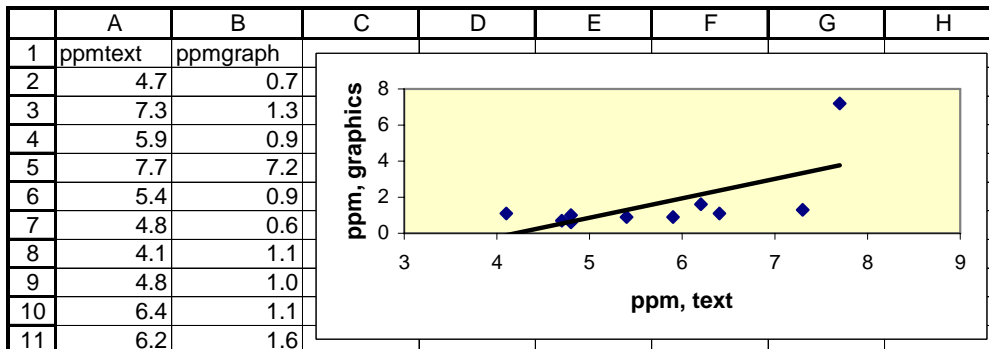


2.38 d/p/e A scatterplot is a plot in which each point represents a pair of known or observed values of x and y. The variables are represented on the horizontal (x) and vertical (y) axes. The scatterplot is useful in examining whether the variables might be related to each other in some way.

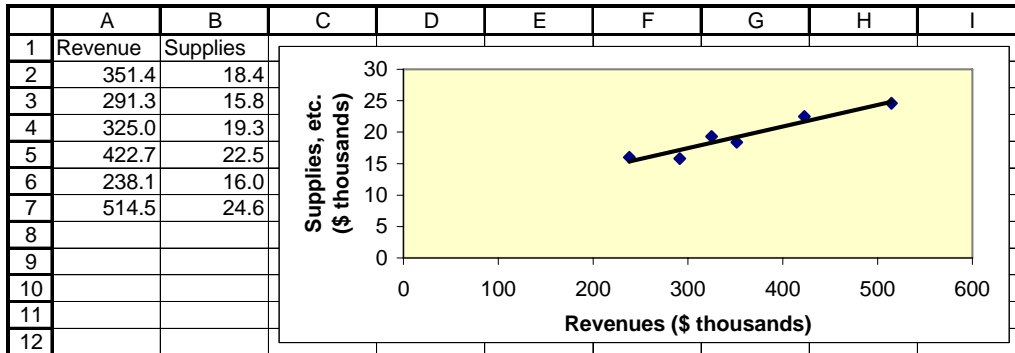
2.39 d/p/e In a positive linear relationship, y tends to increase linearly with increases in x. In a negative linear relationship, y tends to decrease linearly as x increases.

2.40 d/p/e When there is no relationship between two variables, the slope of the best-fit straight line will tend to be zero.

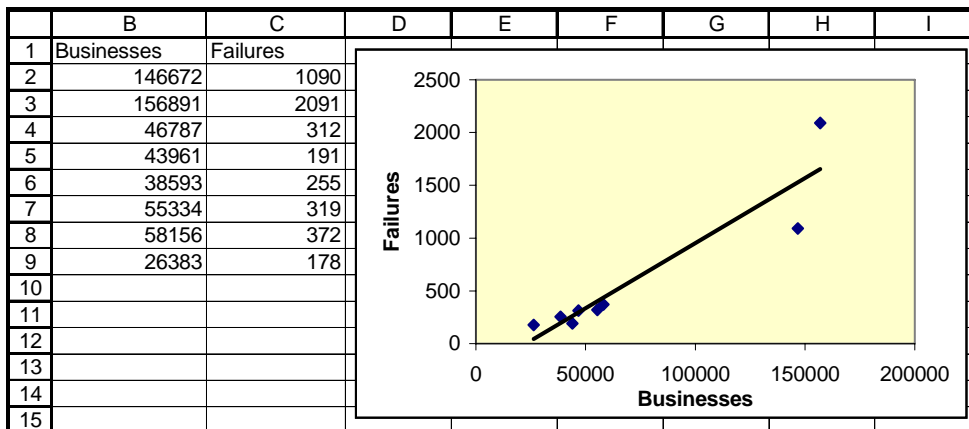
2.41 p/p/m We can use Excel to plot the data for us. As we can see from the graph, there does appear to be a slight direct relationship between the variables -- printers with a higher speed for printing text also tend to have a higher speed for printing graphics. Note: The line in the graph below was actually fitted by Excel. Lines "eyeballed" by humans may vary.



2.42 p/p/m We can use Excel to plot the data for us. As we can see from the graph, there does appear to be a strong linear relationship between service revenues and expenses for supplies. The relationship appears to be a direct relationship; that is, as revenues increase, supply expenses increase. Note: The line in the graph below was actually fitted by Excel. Lines "eyeballed" by humans may vary.

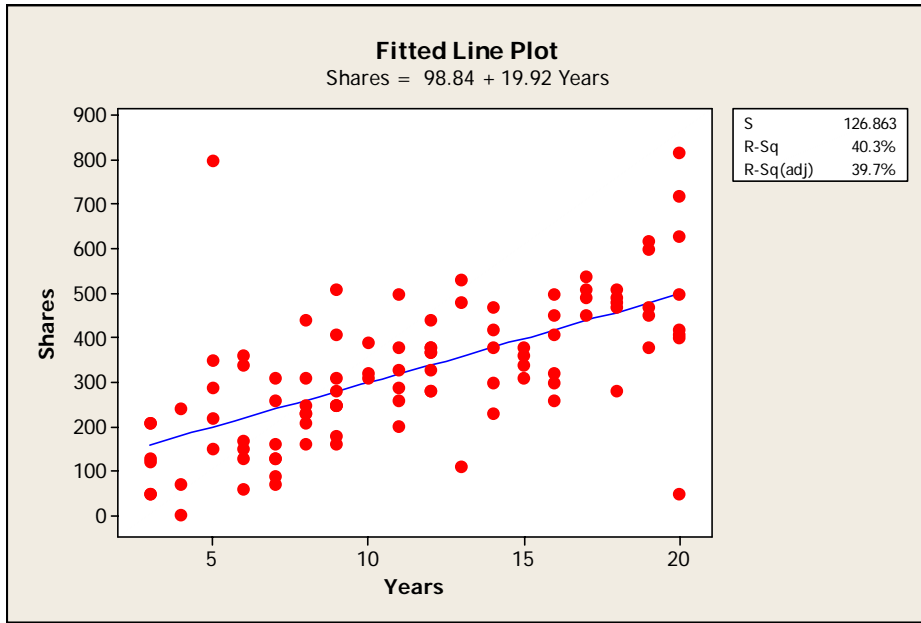


2.43 p/p/m We can use Excel to plot the data for us. As can be seen from the graph, there does appear to be a relationship between the number of businesses in a state and the number of business failures in the state, and the relationship appears to be a direct relationship; that is, as the number of businesses increases, the number of business failures increases. However, there are two rather distinct "clusters", with a group of smaller values quite distant from the two points with larger data values. Thus, it is difficult to determine if the relationship might be linear. Note: The line in the graph below was actually fitted by Excel. Lines "eyeballed" by humans may vary.



2.44 p/c/m

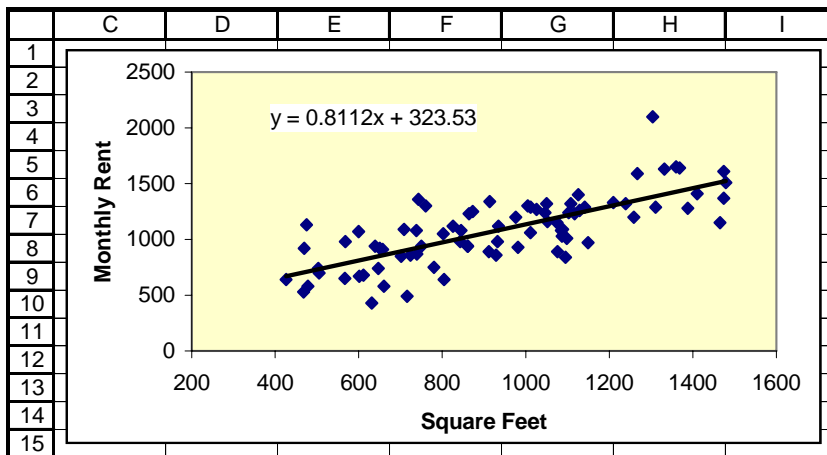
a. Scatter diagram with best-fit linear equation:



- b. There appears to be a direct relationship between the variables. Employees who have been with the company for more years tend to own more shares of stock.
- c. The slope of the equation is +19.92. Each additional year with the company tends to be accompanied by an additional 19.92 shares of stock.
- d. One person who has been with the company for only five years owns an unusually large amount of stock (800 shares) for a person with his relatively short tenure with the company. Two other individuals, one with 13 years of service and the other with 20 years of service, own unusually small amounts of stock considering how long they have been with the company.

2.45 p/c/m

a. Scatter diagram with best-fit linear equation:



- b. There appears to be a direct relationship between the variables. Apartments with more square feet of living area tend to have a higher monthly rental fee.



- c. The slope of the equation is +0.8112. Each additional square foot of living area tends to be accompanied by an additional \$0.8112 in monthly rental fee.
- d. One of the apartments appears to have about 1300 square feet of living space, but the rent is relatively high (over \$2000) for an apartment of this size. The location may be very attractive.

**2.46 d/p/e** The classificatory variables that represent the rows and columns of the contingency table will be in the nominal scale of measurement. The variables described within the table can be nominal (categories) when counts are being expressed. They can be interval or ratio when measures such as the median or mean are being expressed.

**2.47 d/p/e** Simple tabulation involves just one variable – e.g., we may express a count of how many persons in a sample are males and how many are females. In cross tabulation, we express a count of how many people are in combinations of categories – e.g., how many males are in the under-21 age group, how many females are in the 21-40 age group, and so on.

**2.48 c/p/e**

- a. Simple tabulation. There are 17 vehicles with a Diesel engine, 13 with a gasoline engine.

**Tabulated Statistics: Engine**

Rows: Engine	
	Count
1	17
2	13
All	30

- b. Cross tabulation – e.g., there are 9 vehicles that have a Diesel engine and manual transmission.

**Tabulated Statistics: Engine, Trans**

Rows: Engine		Columns: Trans	
	1	2	All
1	9	8	17
2	6	7	13
All	15	15	30

Cell Contents --  
Count

- c. Average mpg according to type of engine and type of transmission – e.g., the average fuel economy for the 9 vehicles having a Diesel engine and manual transmission is 36.789 miles per gallon. Diesel engines get a higher mpg than gasoline engines (33.918 versus 22.085) and manual transmissions get a higher mpg than automatics (31.633 versus 25.947). The most efficient combination is the Diesel engine with manual transmission.

**Tabulated Statistics: Engine, Trans**

Rows: Engine		Columns: Trans	
	1	2	All
1	9 36.789	8 30.688	17 33.918
2	6 23.900	7 20.529	13 22.085
All	15 31.633	15 25.947	30 28.790

Cell Contents --  
Count  
mpg:Mean

## 2.49 c/p/e

a. Simple tabulation. There are 17 vehicles with a Diesel engine, 13 with a gasoline engine.

### Tabulated Statistics: Engine

```
Rows: Engine
      Count
1      17
2      13
All     30
```

b. Cross tabulation – e.g., there are 9 vehicles that have a Diesel engine and air conditioning.

### Tabulated Statistics: Engine, AC

```
Rows: Engine      Columns: AC
      1      2      All
1      8      9      17
2      5      8      13
All    13     17     30
```

Cell Contents --  
Count

c. Average mpg according to type of engine and whether the vehicle has air conditioning – e.g., average fuel economy for the 9 vehicles having a Diesel engine and air conditioning is 32.089 miles per gallon. Diesel engines get a higher mpg than gasoline engines (33.918 versus 22.085) and cars without air conditioning get a higher mpg than cars with air conditioning (31.731 versus 26.541). The most efficient combination is the Diesel engine without air conditioning.

### Tabulated Statistics: Engine, AC

```
Rows: Engine      Columns: AC
      1      2      All
1      8      9      17
   35.975  32.089  33.918
2      5      8      13
   24.940  20.300  22.085
All    13     17     30
   31.731  26.541  28.790
```

Cell Contents --  
Count  
mpg:Mean

## 2.50 c/p/e

a. Simple tabulation. There are 15 vehicles with a manual transmission, 15 with an automatic.

### Tabulated Statistics: Trans

```
Rows: Trans
      Count
1      15
2      15
All     30
```

b. Cross tabulation – e.g., there are 7 vehicles that have a manual transmission and air conditioning.

**Tabulated Statistics: Trans, AC**

	Rows: Trans		Columns: AC
	1	2	All
1	8	7	15
2	5	10	15
All	13	17	30

Cell Contents --  
Count

- c. Average mpg according to type of transmission and whether the vehicle has air conditioning – e.g., average fuel economy for the 8 vehicles having a manual transmission and no air conditioning is 33.538 miles per gallon. Cars with manual transmissions get a higher mpg than cars with automatic transmissions (31.633 versus 25.947) and cars without air conditioning get a higher mpg than cars with air conditioning (31.731 versus 26.541). The most efficient combination is the manual transmission without air conditioning.

**Tabulated Statistics: Trans, AC**

	Rows: Trans		Columns: AC
	1	2	All
1	8 33.538	7 29.457	15 31.633
2	5 28.840	10 24.500	15 25.947
All	13 31.731	17 26.541	30 28.790

Cell Contents --  
Count  
mpg:Mean

**2.51 c/c/m**

- a. Simple tabulation. Among the 60 schools, 25 offer the bachelors as the highest degree, 24 offer the masters degree as their highest degree, and 11 offer doctorate degrees.

	F	G	H	I	J
1	Count of HighDegr	HighDegr			
2		1	2	3	Grand Total
3	Total	25	24	11	60

- b. Cross tabulation – e.g., 13 of the 60 schools are privately supported and offer the bachelors degree as their highest degree.

	F	G	H	I
6	Count	Pub/Priv		
7	HighDegr	1	2	Grand Total
8		1	12	13
9		2	12	12
10		3	6	5
11	Grand Total	30	30	60

- c. Average tuition and fees according to highest degree offered and public versus private support – e.g., for publicly supported schools that offer the bachelors as the highest degree, the average for tuition and fees is \$5323. Private schools that offer a doctorate degree average \$16,092 in tuition and fees. There seems to be a strong relationship between the categorization variables and the amount for tuition and fees.

	F	G	H	I
14	Average of TuitFees	Pub/Priv		
15	HighDegr	1	2	Grand Total
16	1	5323	9516	7503
17	2	8167	11965	10066
18	3	13133	16092	14478
19	Grand Total	8023	11592	9807

**2.52 c/c/m**

- a. Simple tabulation. Among the 60 schools, 19 are in an urban setting, 26 are in a suburban setting, and 15 are in a rural setting.

	F	G	H	I	J
22	Count	Setting			
23		1	2	3	Grand Total
24	Total	19	26	15	60

- b. Cross tabulation – e.g., 15 of the 60 schools are publicly supported and located in a suburban setting.

	F	G	H	I
27	Count	Pub/Priv		
28	Setting	1	2	Grand Total
29	1	8	11	19
30	2	15	11	26
31	3	7	8	15
32	Grand Total	30	30	60

- c. Average tuition and fees according to campus setting and public versus private support – e.g., for publicly supported schools in a rural setting, the average for tuition and fees is \$5960. Private schools in an urban setting average \$12,668 in tuition and fees. There seems to be a strong relationship between the categorization variables and the amount for tuition and fees.

	F	G	H	I
35	Average of TuitFees	Pub/Priv		
36	Setting	1	2	Grand Total
37	1	9714	12668	11424
38	2	8083	11432	9500
39	3	5960	10331	8291
40	Grand Total	8023	11592	9807

**2.53 c/c/m**

- a. Simple tabulation. Among the 35 cities, 3 received a grade of “2” on financial management, 27 received a “3”, and 5 received a “4”.

	H	I	J	K	L
1	Count	Finance			
2		2	3	4	Grand Total
3	Total	3	27	5	35

- b. Cross tabulation – e.g., 13 of the 35 cities received a “3” on financial management and a “2” on information technology.

	H	I	J	K	L
6	Count	Finance			
7	Info Tech	2	3	4	Grand Total
8	1	0	4	0	4
9	2	2	13	0	15
10	3	1	10	3	14
11	4	0	0	2	2
12	Grand Total	3	27	5	35

- c. Average population according to grades on financial management and information technology. Cities receiving a “2” on each measure have an average population of 277,257. Cities receiving a “4” on each measure were more than twice as large, with an average population of 676,347. There does seem to be some relationship between the population and the grades received. In general, it seems that larger cities tended to receive higher grades on these measures.

	H	I	J	K	L
15	Average of Population	Finance			
16	Info Tech	2	3	4	Grand Total
17	1		630715		630715
18	2	277257	901745		818480
19	3	496938	1650610	431477	1306962
20	4			676347	676347
21	Grand Total	350484	1138950	529425	984292

**2.54 c/c/m**

- a. Simple tabulation. Among the 35 cities, 1 received a grade of “0” on personnel policies, 2 received a “1”, 16 received a “2”, 13 received a “3”, and 3 received a “4”.

	H	I	J	K	L	M	N
24	Count	Personnel					
25		0	1	2	3	4	Grand Total
26	Total	1	2	16	13	3	35

b. Cross tabulation – e.g., 8 of the 35 cities received a “2” on personnel policies and a “3” on managing for results.

	H	I	J	K	L	M	N
29	Count	Personnel					
30	Managing	0	1	2	3	4	Grand Total
31	1	1	1	1	0	0	3
32	2	0	0	5	3	0	8
33	3	0	1	8	10	0	19
34	4	0	0	2	0	3	5
35	Grand Total	1	2	16	13	3	35

c. Average population according to grades on personnel policies and managing for results. Cities receiving a “1” on each measure have an average population of 328,175. Cities receiving a “3” on each measure were more than four times as large, with an average population of 1,346,951. There does seem to be some relationship between the population and the grades received. In general, it seems that larger cities tended to receive higher grades on these measures. However, this trend appears to reverse for very high scores on the measures. For example, cities receiving a “4” on each of these measures had a smaller average population (729,203) than those receiving a “3” on each measure.

	H	I	J	K	L	M
38	Average of Population	Managing				
39	Personnel	1	2	3	4	Grand Total
40	0	496938				496938
41	1	328175		618652		473414
42	2	632945	929400	718732	869356	798032
43	3		1526941	1346951		1388487
44	4				729203	729203
45	Grand Total	486019	1153478	1044106	785264	984292

**CHAPTER EXERCISES**

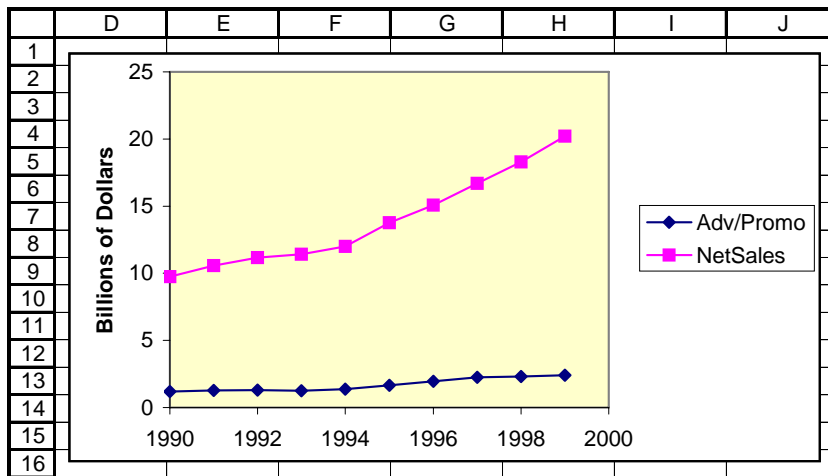
**2.55** c/p/d

a. No. 185 192 207 240 246 250 251 256 259 289 296 305  
308 313 314 320 336 342 353 356 381

b. The left-most column shows the number of values in that stem or lower-value stems for values less than 280, or the number of values in that stem or higher-value stems for values greater than 299.

The number (2) indicates there are two values in the stem for 280-299 and the median is in that stem.

**2.56** c/p/m The Excel chart weakly supports the claim that increases in advertising tend to be accompanied by increases in sales. However, even if the support were stronger, it would not necessarily prove that increases in advertising cause increases in sales. Actually, companies often allocate advertising budgets as a percentage of either actual or anticipated sales. The scale of the vertical axis, combined with the great disparity between annual amounts for sales and advertising, tends to make the advertising/promotion increases a little more difficult to notice here.



**2.57** c/a/m

Homes in the West Region seem to be more expensive.

Price of Home in \$ 1000 units	Total U.S. %	West Region %
Under 100	8.27	2.50
100 - under 150	27.34	19.17
150 - under 200	24.37	23.75
200 - under 300	24.37	32.50
300 or over	15.66	22.08

2.58 c/a/m

a. Stem-and-leaf display.

**Stem-and-Leaf Display: Temp**

Stem-and-leaf of Temp N = 50  
Leaf Unit = 1.0

LO 90

```

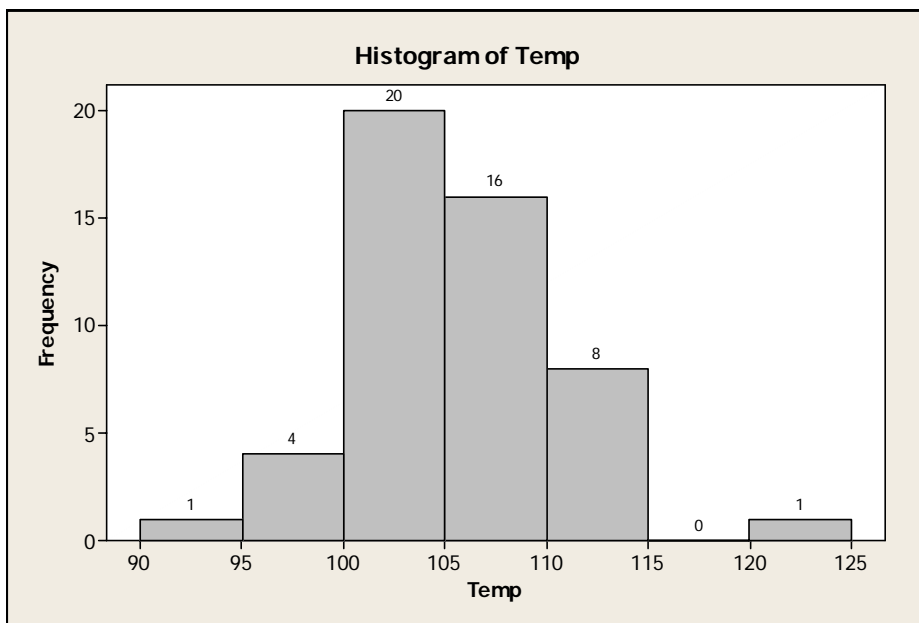
 2   9   5
 3   9   7
 5   9   89
 8   10  001
16   10  22222333
(12) 10  444444444555
22   10  6667777777
12   10  889
 9   11  00011
 4   11  23
 2   11  4
    
```

HI 122

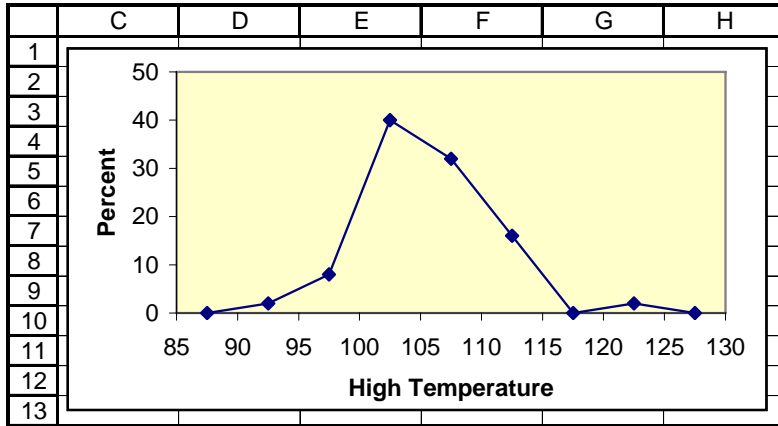
b. and c. Frequency distribution, interval widths, and class marks.

class	frequency	class mark	class width
90 - under 95	1	92.5	5
95 - under 100	4	97.5	5
100 - under 105	20	102.5	5
105 - under 110	16	107.5	5
110 - under 115	8	112.5	5
115 - under 120	0	117.5	5
120 - under 125	1	122.5	5

d. Minitab histogram and Excel relative frequency polygon.







**2.59** c/a/m

- a. 1290 cities    b. 2729 cities    c. 242 cities; 8.65%    d. 175,000  
 e. Relative frequency distribution:

population	percent
10,000 - under 25,000	52.75
25,000 - under 50,000	23.73
50,000 - under 100,000	14.55
100,000 - under 250,000	6.50
250,000 - under 500,000	1.32
500,000 - under 1,000,000	0.82
1,000,000 or more	0.32

**2.60** c/a/m

- b. Stem-and-leaf display.

**Stem-and-Leaf Display: Unemp%**

Stem-and-leaf of Unemp%    N = 50  
 Leaf Unit = 0.10

```

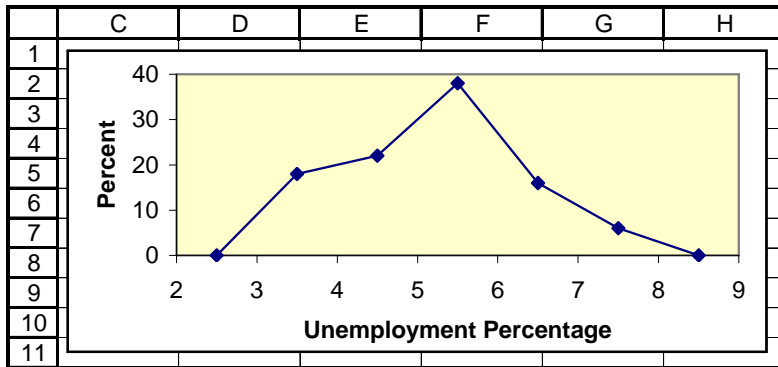
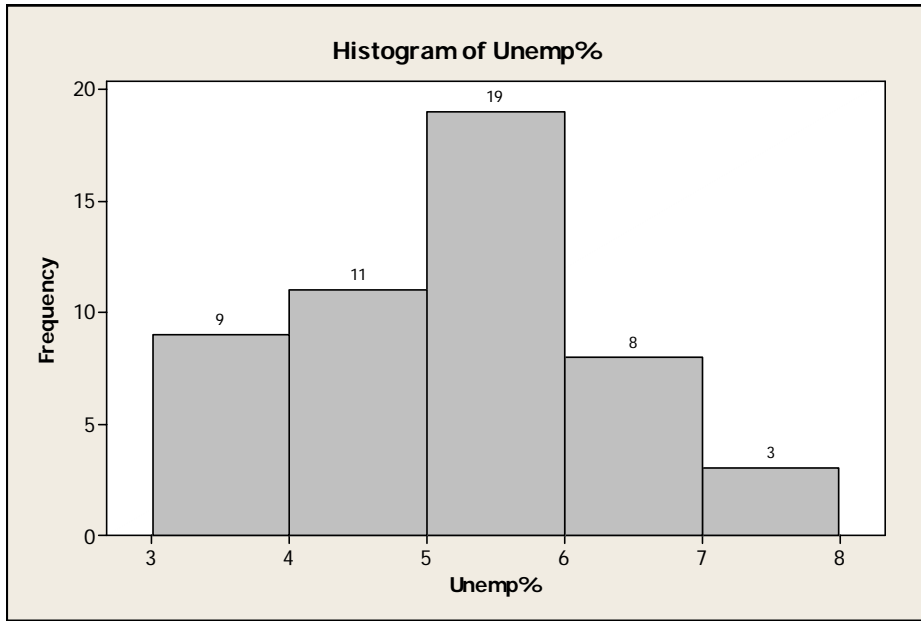
2   3  44
9   3  7778899
11  4  22
20  4  667788999
(12) 5  011123333444
18  5  5667889
11  6  0012223
4   6  9
3   7  0
2   7  56

```

- c. and d. Frequency distribution.

class	frequency	class mark	class width
3.0 - under 4.0	9	3.5	1
4.0 - under 5.0	11	4.5	1
5.0 - under 6.0	19	5.5	1
6.0 - under 7.0	8	6.5	1
7.0 - under 8.0	3	7.5	1

e. Minitab histogram and Excel relative frequency polygon.



**2.61** d/p/m Guns, human figures wielding knives, and coffins are some of the possible symbols that would tend to convey a negative image.

**2.62** c/p/d

- 33 36 36 39 45 46 46 47 50 51 52 52 53 53 56 58 60 67 67 69 70
- The left-most column shows the number of values in that stem or lower-value stems for values less than 50, or the number of values in that stem or higher-value stems for values greater than 54. The number (6) indicates there are six values in the stem for 50-54 and the median is in that stem.

**2.63** c/a/m

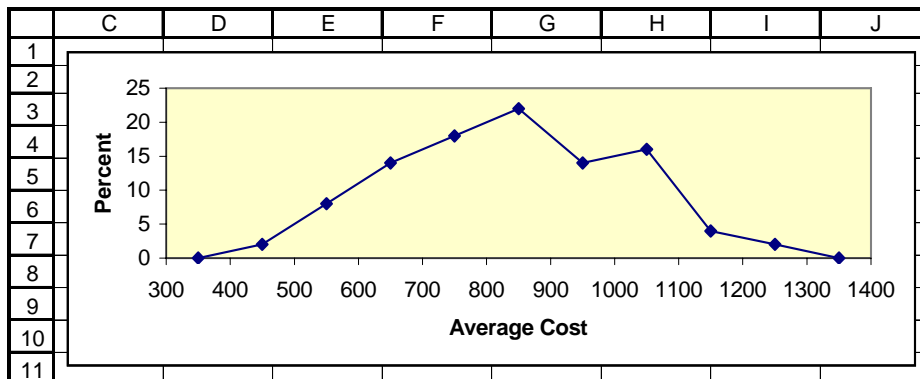
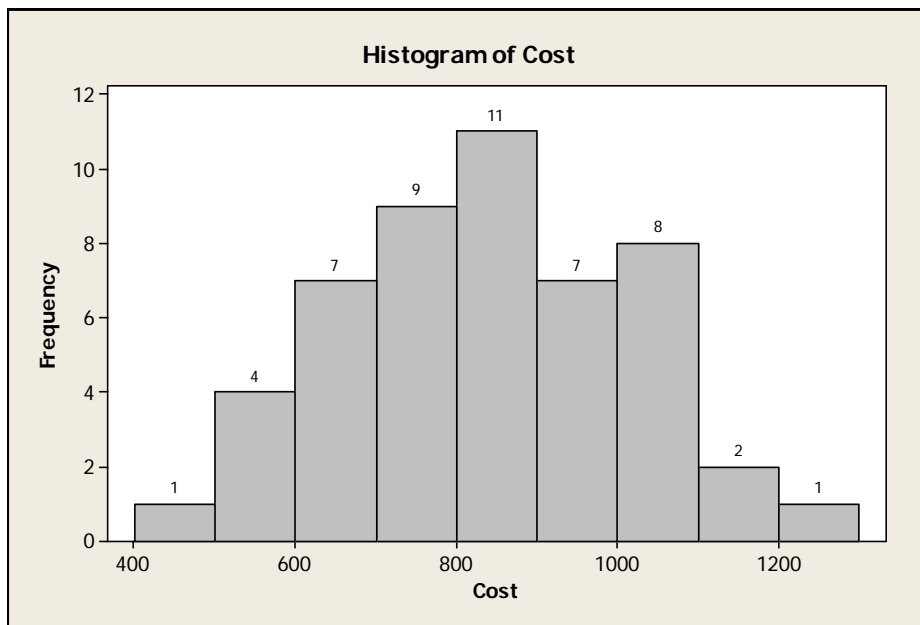
a. Stem-and-leaf display.

Stem (100s)	Leaf (tens)
4	8
5	0035
6	1255677
7	003467789
8	22335667889
9	0014667
10	12345589
11	34
12	2

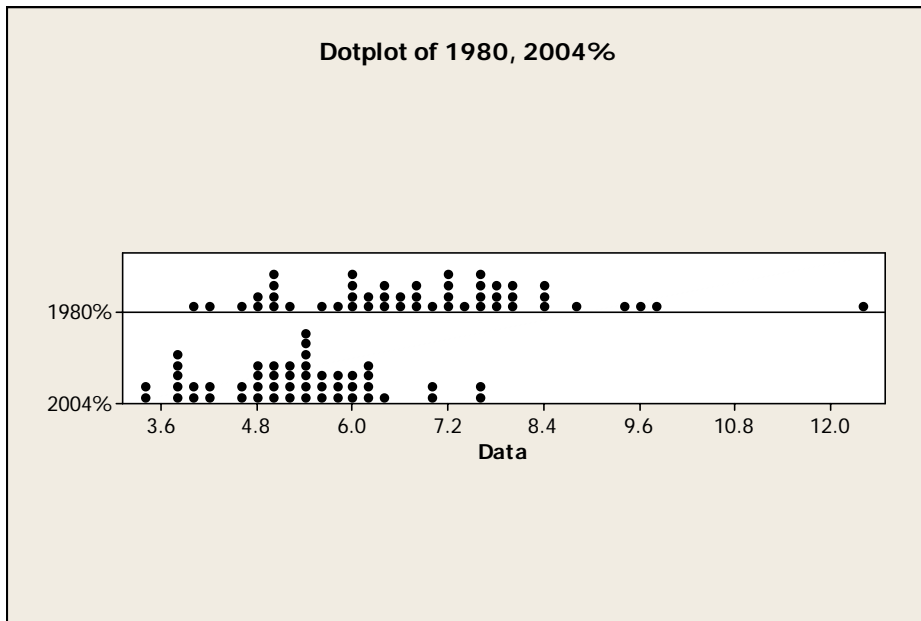
b. and c. Frequency distribution, interval widths, and class marks.

class	frequency	class mark	class width
400 - under 500	1	450	100
500 - under 600	4	550	100
600 - under 700	7	650	100
700 - under 800	9	750	100
800 - under 900	11	850	100
900 - under 1000	7	950	100
1000 - under 1100	8	1050	100
1100 - under 1200	2	1150	100
1200 - under 1300	1	1250	100

d. Minitab histogram and Excel relative frequency polygon.

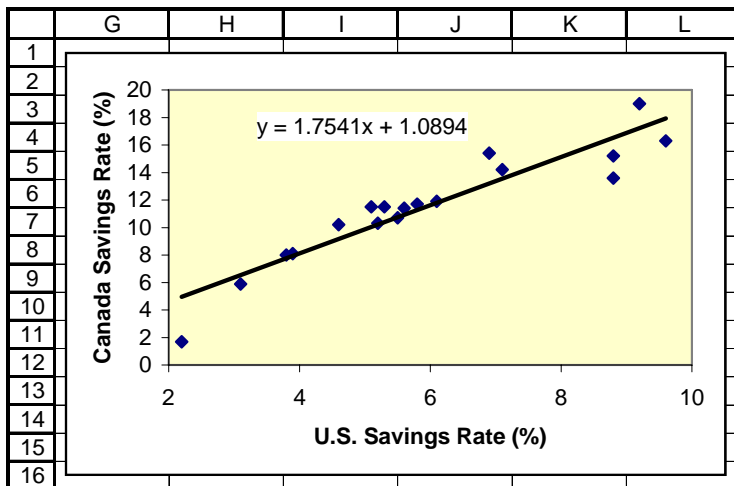


**2.64** c/c/m It is apparent that the 2004 percentages are shifted considerably to the left compared to the 1980 data. In 2004, there also seem to be fewer outliers at the high end than in the 1980 period.



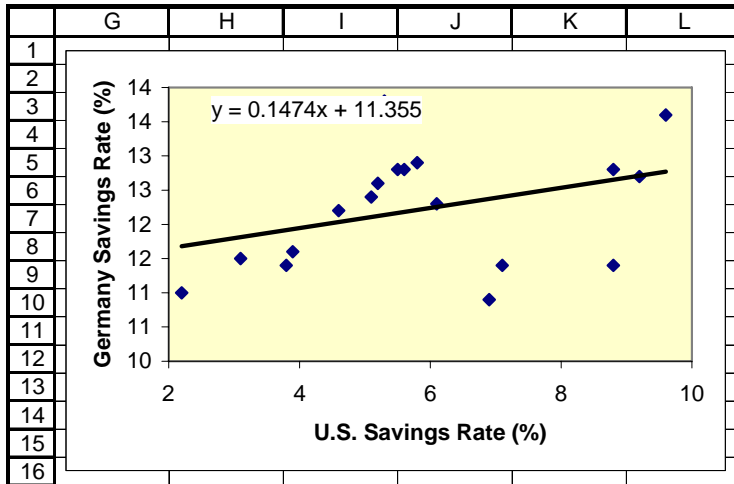
**2.65** c/c/m The scatter diagram and fitted equation are shown together.

- If we consider only the points in the scatter diagram, it is obvious that higher U.S. saving rates tend to be accompanied by higher saving rates in Canada.
- The fitted linear equation has a positive slope and supports this observation



**2.66** c/c/m The scatter diagram and fitted equation are shown together.

- If we consider only the points in the scatter diagram, higher saving rates in the U.S. would appear to be accompanied by higher saving rates in Germany, but the relationship might be curvilinear rather than linear. As U.S. rates go from approximately 6% to approximately 9%, the rates in Germany decrease, then begin to increase again.
- The fitted linear equation is not a very good fit, but it has a positive slope and supports the observation made in part (a).



**2.67 c/c/m**

- a. Mechanical supplier 1 supplied the mechanical components for 50 of the air compressors and mechanical supplier 2 provided the mechanical components for the other 50.

	E	F	G	H
1	Count	MechSup		
2		1	2	Grand Total
3	Total	50	50	100

- b. Crosstab showing how many compressors had each combination of mechanical supplier and electrical supplier.

	E	F	G	H
5	Count	MechSup		
6	ElectSup	1	2	Grand Total
7		1	17	34
8		2	17	34
9		3	16	32
10	Grand Total	50	50	100

- c. Table showing average pressure (psi) for each combination of mechanical supplier and electrical supplier. Compressors associated with mechanical supplier 2 and electrical supplier 1 had the highest average pressure (408.74). Those associated with mechanical supplier 1 and electrical supplier 3 had the lowest average pressure (388.11).

	E	F	G	H
12	Average of PSI	MechSup		
13	ElectSup	1	2	Grand Total
14		404.43	408.74	406.58
15		400.32	396.60	398.46
16		388.11	394.02	391.07
17	Grand Total	397.81	399.90	398.86

- d. Overall, the compressors associated with electrical supplier 3 had an average pressure of only 391.07 psi. Regardless of which mechanical supplier was involved, compressors associated with electrical supplier 3 had the lowest average output. For electrical supplier 3, note the 388.11 psi average when

associated with mechanical supplier 1 and the 394.02 psi average when associated with mechanical supplier 2.

**2.68 c/c/m**

- a. Electrical supplier 1 supplied the electrical components for 34 of the air compressors. Electrical suppliers 2 and 3 provided the electrical components for 34 and 32 compressors, respectively.

	E	F	G	H	I
1	Count	ElectSup			
2		1	2	3	Grand Total
3	Total	34	34	32	100

- b. Crosstab showing how many compressors had each combination of electrical supplier and final assembly technician.

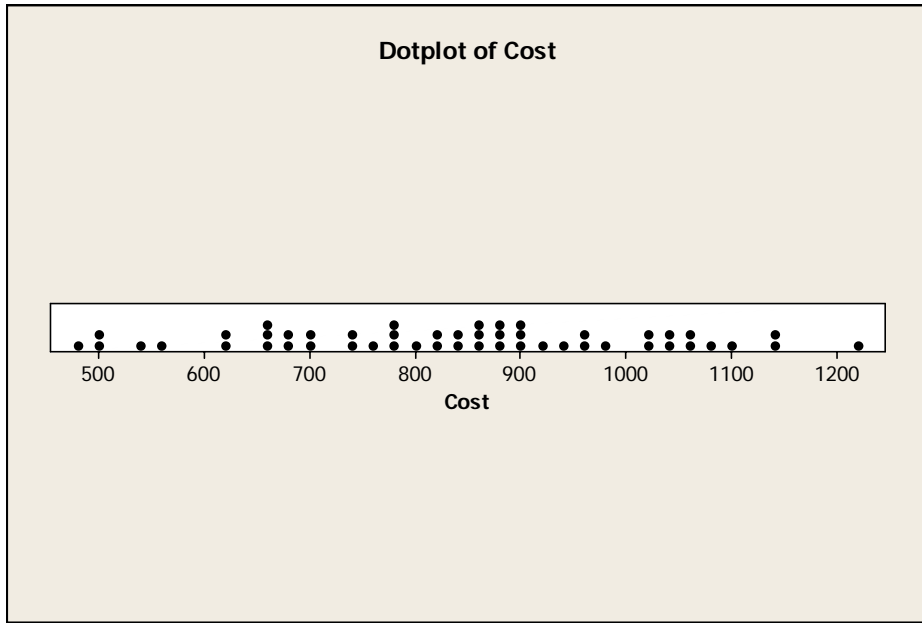
	E	F	G	H	I
5	Count	ElectSup			
6	Tech	1	2	3	Grand Total
7	1	17	17	16	50
8	2	17	17	16	50
9	Grand Total	34	34	32	100

- c. Table showing average pressure (psi) for each combination of electrical supplier and final assembly technician. Compressors associated with electrical supplier 1 and final assembly technician 2 had the highest average pressure (408.47). Those associated with electrical supplier 3 and final assembly technician 1 had the lowest average pressure (387.53).

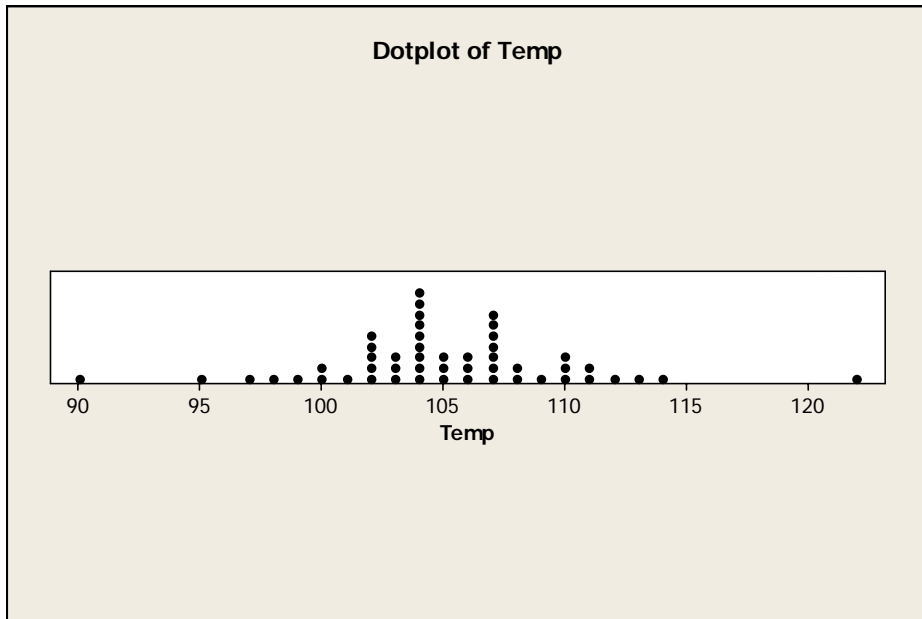
	E	F	G	H	I
11	Average of PSI	ElectSup			
12	Tech	1	2	3	Grand Total
13	1	404.69	391.99	387.53	394.88
14	2	408.47	404.94	394.60	402.83
15	Grand Total	406.58	398.46	391.07	398.86

- d. Overall, the compressors associated with final assembly technician 1 had an average pressure of only 394.88 psi. Regardless of which electrical supplier was involved, compressors associated with final assembly technician 1 had a lower average output than those associated with the other technician. For final assembly technician 1, note the 404.69 psi average when associated with electrical supplier 1, the 391.99 psi average when associated with electrical supplier 2, and the 387.53 psi average when associated with electrical supplier 3.

**2.69** c/c/m California (\$1221) has the highest average cost and is nearly \$100 beyond the next-highest states.

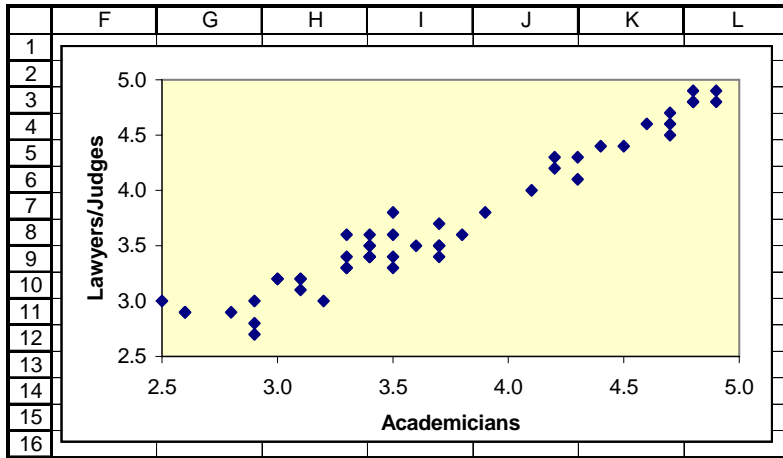


**2.70** c/c/m Phoenix, AZ (122 degrees) is an outlier at the high end, Juneau, AK (90 degrees) at the low end.

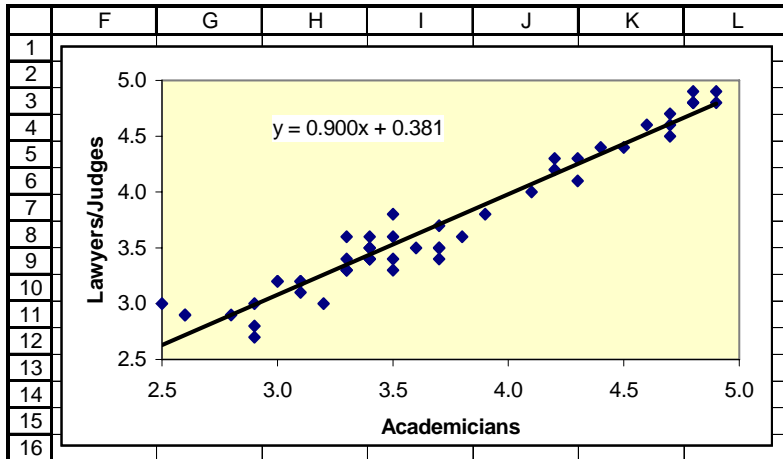


2.71 c/c/m

- a. Considering only the scatter diagram, the schools given higher scores by the academicians tend to receive higher scores from the lawyers/judges as well.



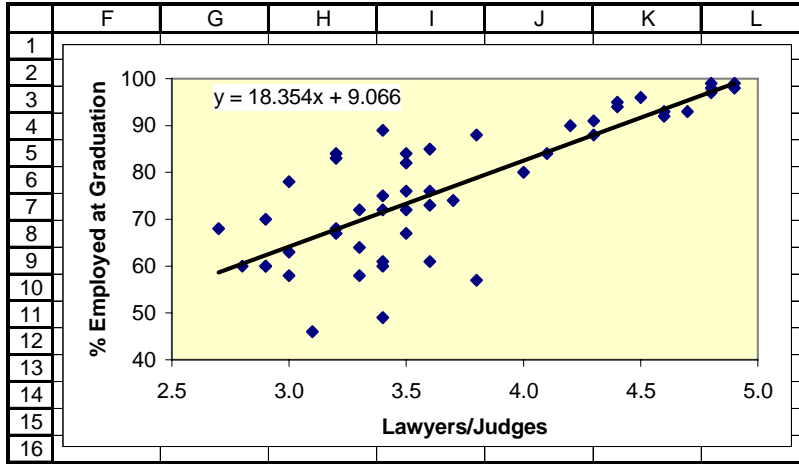
- b. The slope of the fitted equation is positive, reflecting the same observation made in part (a).





2.72 c/c/m The scatter diagram and fitted equation are shown together.

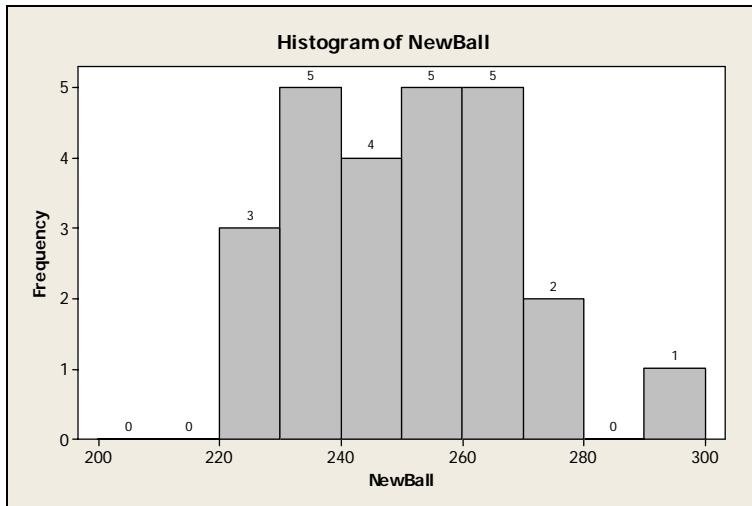
- a. Considering the points in the scatter diagram, it is obvious that schools rated higher by lawyers and judges tend to produce graduates who are more likely to be employed upon graduation.
- b. The fitted linear equation has a positive slope and supports this observation.

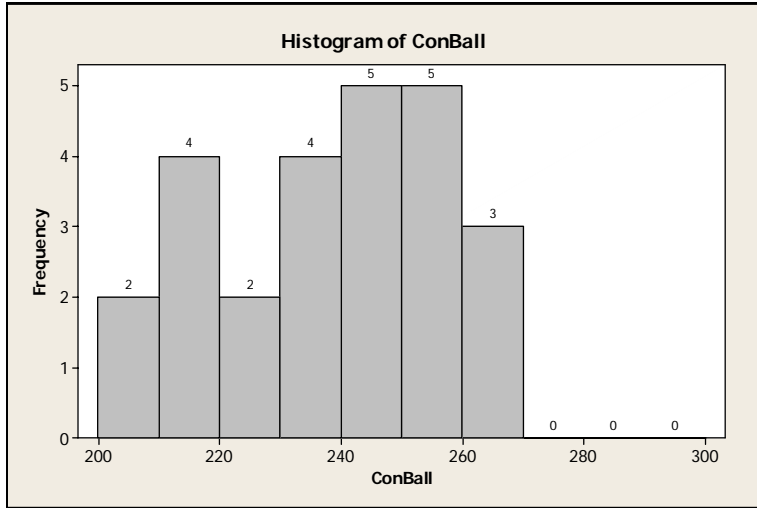


### INTEGRATED CASES

#### THORNDIKE SPORTS EQUIPMENT (ALSO SEE THORNDIKE VIDEO UNIT ONE)

1. and 2. Minitab histograms describing the frequency distributions for the distances traveled by the new and the conventional golf ball types – e.g., for the new ball, there are 5 observations in the "250-under 260" class and 1 observation in the "290-under 300" class.



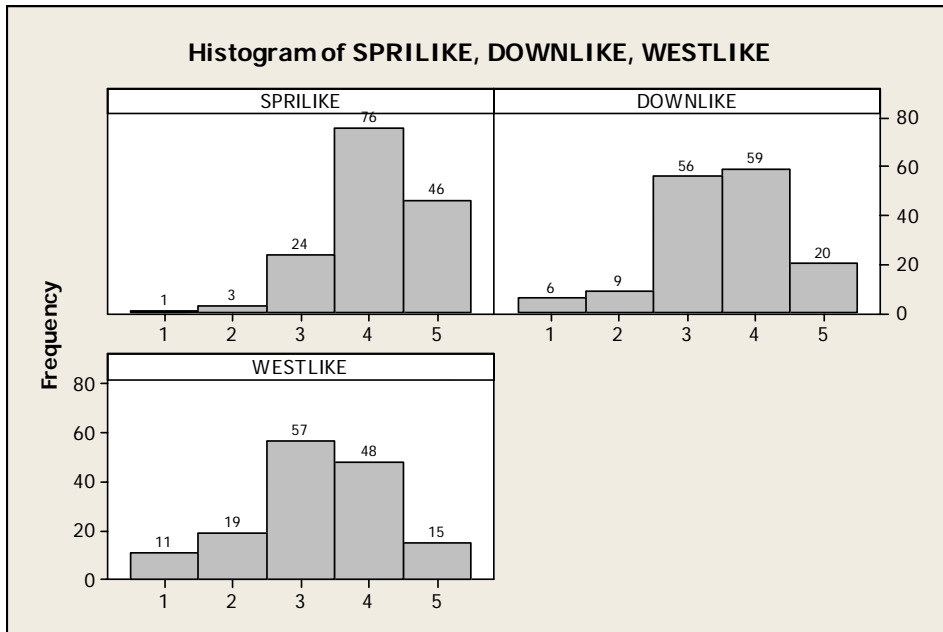


3. The distance traveled by the new golf ball has a tendency to be greater than for the conventional ball.

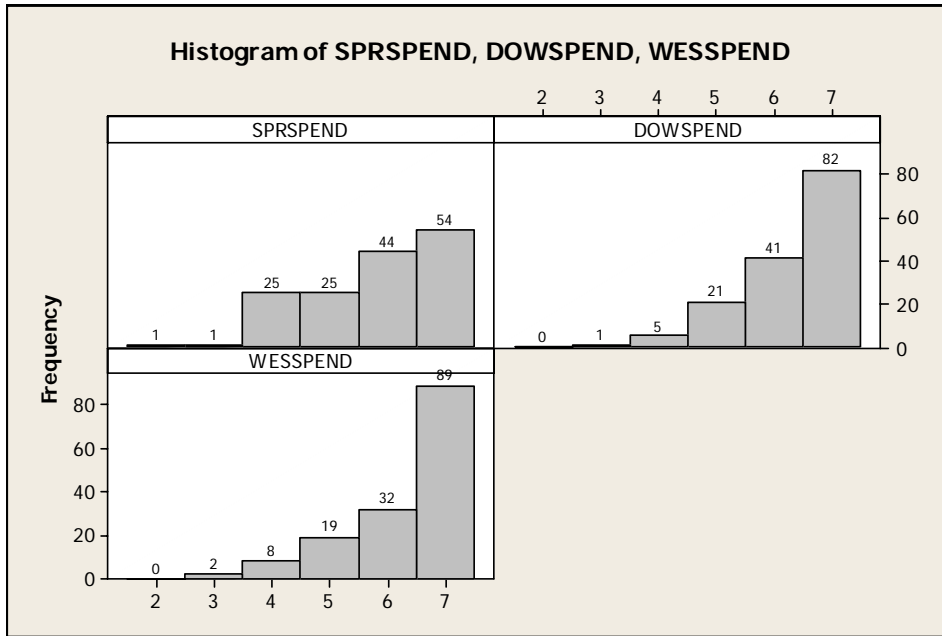
### SPRINGDALE SHOPPING SURVEY

This exercise is based on SHOPPING, the Springdale shopping survey database. There are 30 variables and 150 cases (respondents) in this database. This solution relies on Minitab and SHOPPING.MTW.

1. Frequency distributions (Minitab histograms with center points) for variables 7, 8, and 9. Respondents tend to like Springdale Mall the most and West Mall the least.

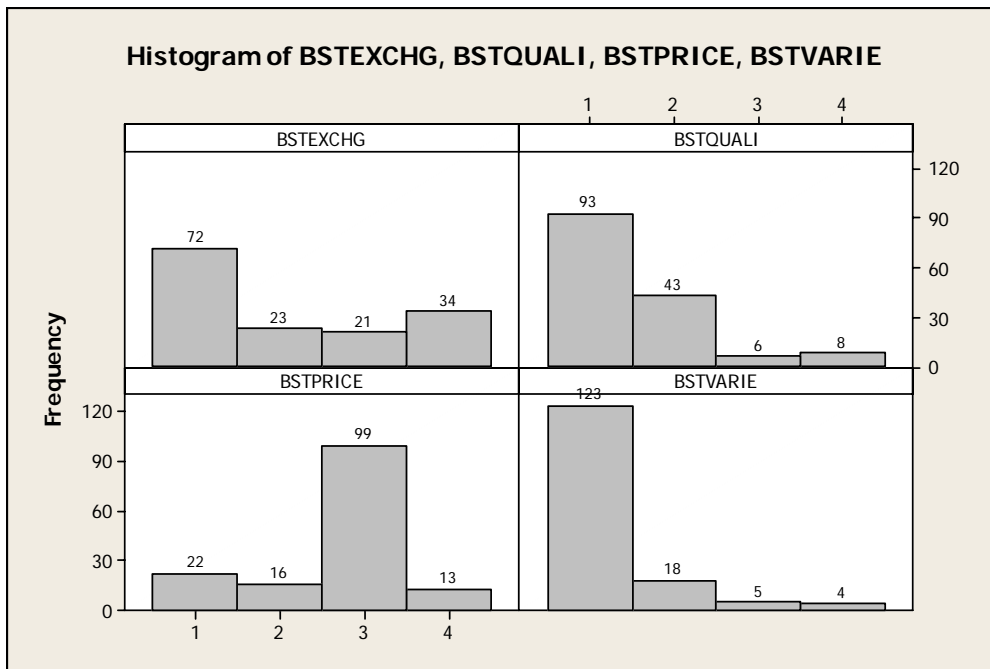


2. Construction/comparison of frequency distributions for variables 4, 5, and 6.



Respondents tend to be more frugal during visits to West Mall and Downtown, and least frugal on visits to Springdale Mall. Of the 150 respondents, 121 spend under \$25 (categories 6 and 7) during a typical visit to West Mall, with 123 persons in these categories for Downtown and 98 for Springdale Mall.

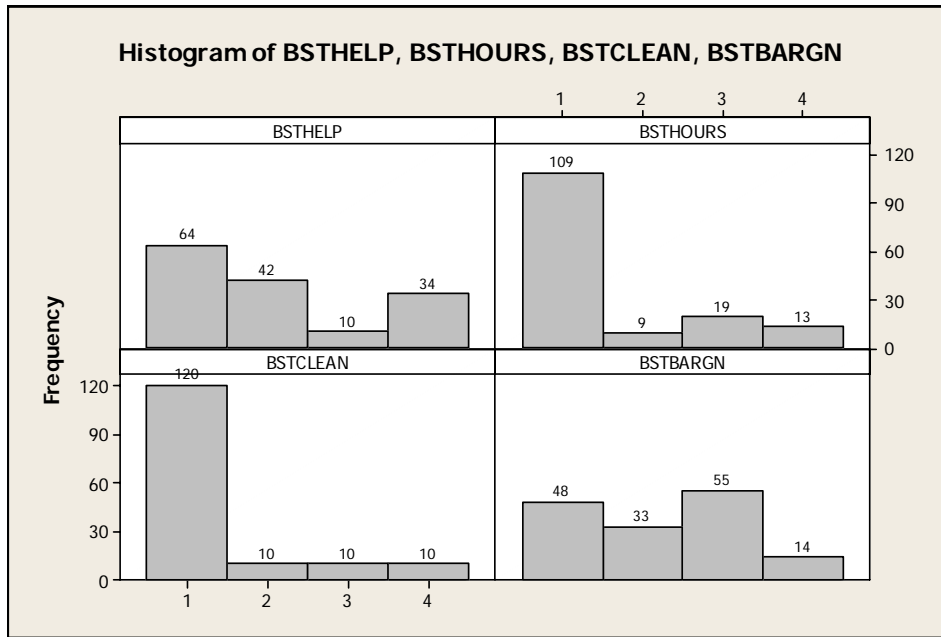
3. "Best-fit" scores for the shopping areas on variables 10 through 17.



Springdale Mall is viewed as the best area for returning/exchanging merchandise, West Mall is seen as being the worst.

Springdale Mall is seen as having the highest quality goods, with Downtown coming in second.

West Mall is strongly perceived as the best shopping area for low prices.  
 Springdale Mall is seen as having the best variety of goods, with each of the other areas far behind.



Springdale Mall is viewed as having the most helpful/friendly sales personnel.  
 Springdale Mall is far ahead in having the most convenient shopping hours.  
 Springdale Mall is viewed as having the cleanest stores and surroundings.  
 West Mall is the "bargain mall," most highly seen as having a lot of bargain sales.

4. Crosstab using categorization variables 26 (gender) and variable 28 (marital status), with cells showing the average for variable 30 (respondent age).

Rows: RESPGEN	Columns: RESPMARI		
	1	2	All
1	24 44.750	34 27.647	58 34.724
2	43 34.791	49 26.490	92 30.370
All	67 38.358	83 26.964	150 32.053

Cell Contents --  
 Count  
 RESPAGE: Mean

The 24 males (RESPGEN = 1) who are married (RESPMARI = 1) have the highest average age, 44.750 years. The youngest respondents are the unmarried females, with an average age of 26.490 years. The average age for all respondents is 32.053 years.