Business Statistics and Analytics in Practice 9th edition Bowerman Solutions Manual

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CHAPTER 2—Descriptive Statistics and Analytics: Tabular and Graphical Methods

§2.1 CONCEPTS

2.1 Constructing either a frequency or a relative frequency distribution helps identify and quantify patterns that are not apparent in the raw data.

LO2-1

2.2 Relative frequency of any category is calculated by dividing its frequency by the total number of observations. Percent frequency is calculated by multiplying relative frequency by 100.

LO2-1

2.3 Answers and examples will vary.

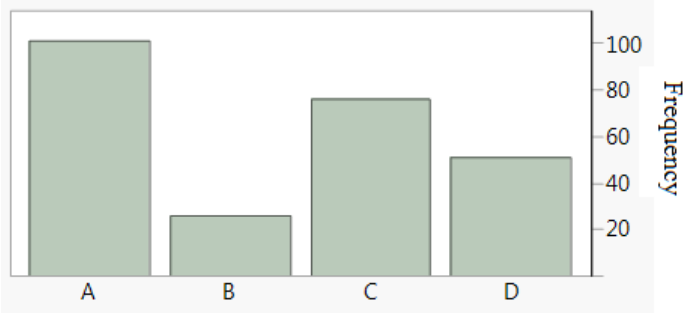
LO2-1

§2.1 METHODS AND APPLICATIONS

2.4 **a.** Frequency, Relative Frequency, and Percent Frequency Table for Question Response

Question Response	Frequency	Relative Frequency	Percent Frequency
A	100	0.4	40%
B	25	0.1	10%
C	75	0.3	30%
D	50	0.2	20%

b. Bar Chart for Question Response



LO2-1

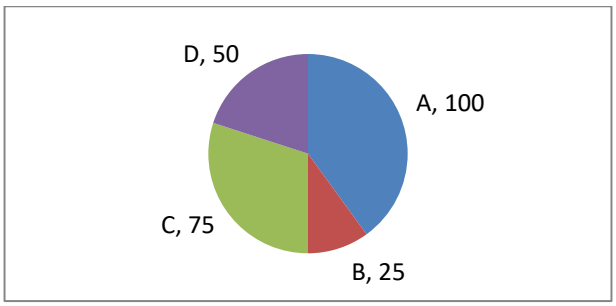
2.5 **a.** $\left({}^{100}/_{250}\right) * 360 \text{ degrees} = 144 \text{ degrees for response (a)}$

b. $\left({}^{25}/_{250}\right) * 360 \text{ degrees} = 36 \text{ degrees for response (b)}$

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c. Pie Chart of Question Response



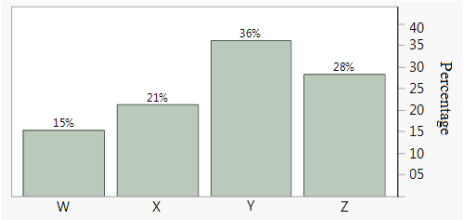
LO2-1

2.6 **a.** Relative frequency for product X is $1 - (0.15 + 0.36 + 0.28) = 0.21$

b. Frequency and Relative Frequency Table for Products W, X, Y, Z

Product	Relative Frequency	Frequency = n * Relative frequency
W	0.15	$500 * 0.15 = 75$
X	0.21	$500 * 0.21 = 105$
Y	0.36	$500 * 0.36 = 180$
Z	0.28	$500 * 0.28 = 140$

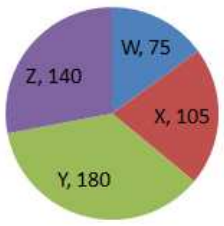
c. Percent Frequency Bar Chart for Products W, X, Y, Z



d. Calculation for Degrees for Pie Chart of Product Frequencies

Product	Relative Frequency	Degrees = 360 * Relative Frequency
W	0.15	$360 * 0.15 = 54$
X	0.21	$360 * 0.21 = 75.6$
Y	0.36	$360 * 0.36 = 129.6$
Z	0.28	$360 * 0.28 = 100.8$

Pie Chart of Product Frequencies



LO2-1

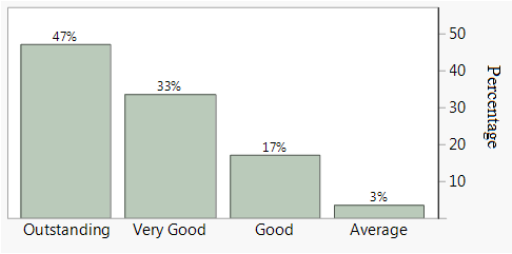
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2.7 **a.** Frequency and Relative Frequency Table for Restaurant Ratings

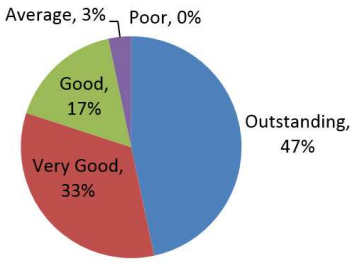
Rating	Frequency	Relative Frequency
Outstanding	14	14/30 = 0.467
Very Good	10	10/30 = 0.333
Good	5	5/30 = 0.167
Average	1	1/30 = 0.033
Poor	0	0/30 = 0

b. Percentage Bar Chart for Restaurant Ratings



*Note – the category Poor is not pictured as its percentage is 0%.

c. Pie Chart of Restaurant Ratings

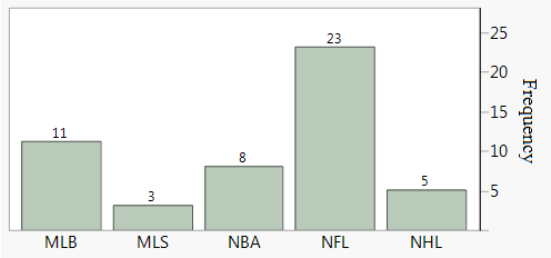


LO2-1

2.8 **a.** Frequency, Relative Frequency, and Percent Frequency Table for Sports League Preference

Sports League	Frequency	Percent Frequency	Percent
MLB	11	0.22	22%
MLS	3	0.06	6%
NBA	8	0.16	16%
NFL	23	0.46	46%
NHL	5	0.10	10%

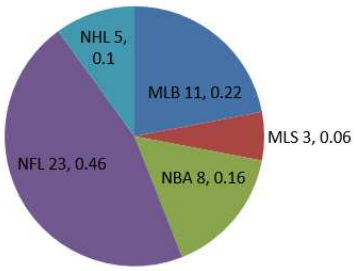
b. Frequency Bar Chart for Sports League Preference



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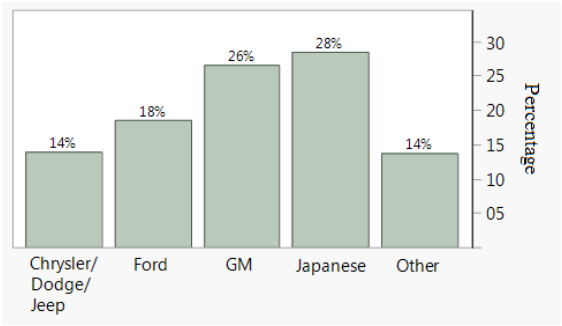
c. Frequency Pie Chart for Sports League Preference



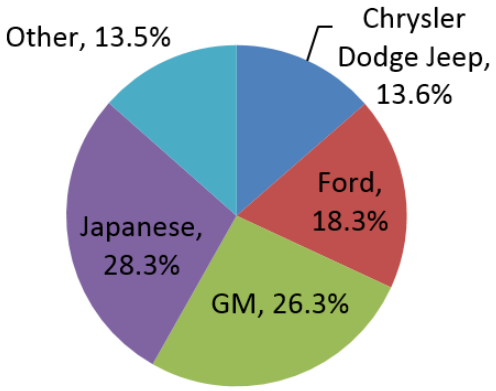
d. The most popular league with these 50 adults is the NFL and the least popular is the MLS.

LO2-1

2.9 Percent Frequency Bar Chart for shares in the new vehicle auto market



Percent Pie Chart for shares in the new vehicle auto market



LO2-1

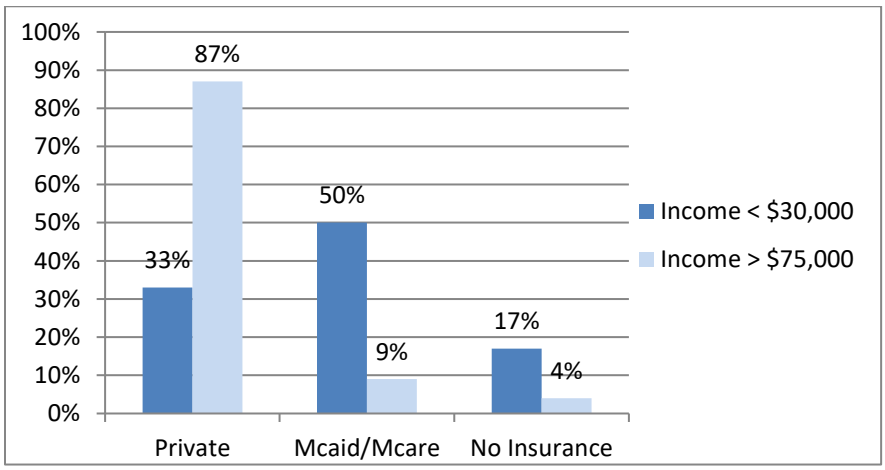
2.10 Comparing the pie chart above with chart for 2014 in the textbook shows that between 2005 and 2014, the three U.S. manufacturers, Chrysler, Ford and GM have all lost market share, while Japanese and other imported models have increased market share.

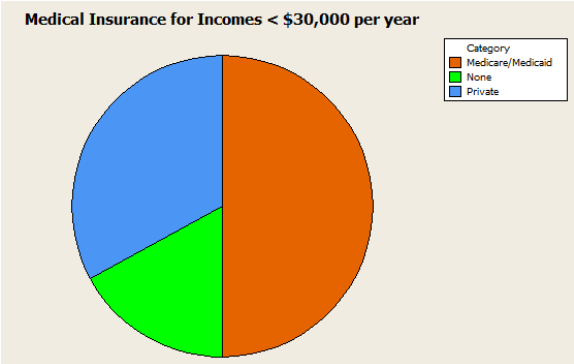
LO2-1

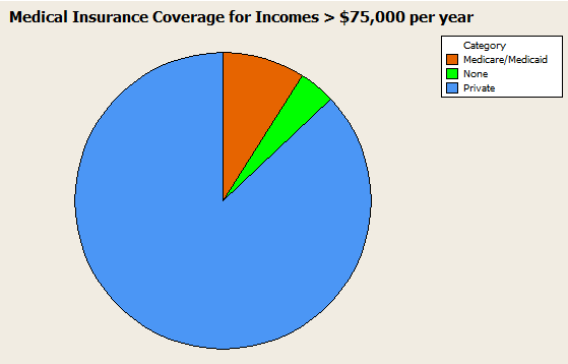
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2.11 Comparing Types of Health Insurance Coverage Based on Income Level







LO2-1

2.12 **a.** Percent of calls that are require investigation or help $= 28.12\% + 4.17\% = 32.29\%$

b. Percent of calls that represent a new problem $= 4.17\%$

c. Only 4% of the calls represent a new problem to all of technical support, but one-third of the problems require the technician to determine which of several previously known problems this is and which solutions to apply. It appears that increasing training or improving the documentation of known problems and solutions will help.

LO2-2

§2.2 CONCEPTS

2.13 **a.** We construct a frequency distribution and a histogram for a data set so we can gain some insight into the shape, center, and spread of the data along with whether outliers exist.

b. A frequency histogram represents the frequencies for the classes using bars while in a frequency polygon the frequencies are represented by plotted points connected by line segments.

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c. A frequency ogive represents a cumulative frequency distribution while the frequency polygon represents a frequency distribution. Also, in a frequency ogive, the points are plotted at the upper class boundaries; in a frequency polygon, the points are plotted at the class midpoints.

LO2-3

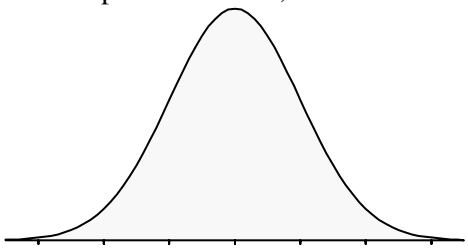
2.14 **a.** To find the frequency for a class, you simply count how many of the observations have values that are greater than or equal to the lower boundary and less than the upper boundary.

b. Once you determine the frequency for a class, the relative frequency is obtained by dividing the class frequency by the total number of observations (data points).

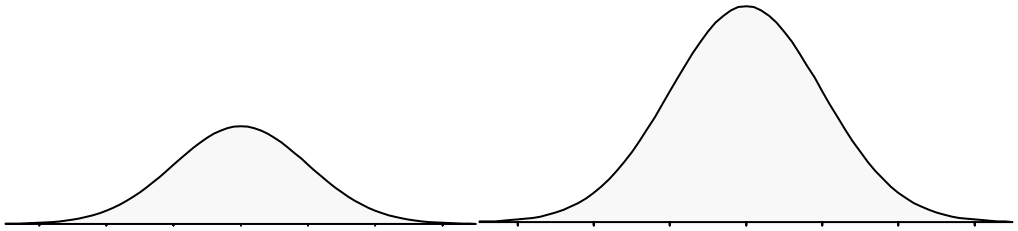
c. The percent frequency for a class is calculated by multiplying the relative frequency by 100.

LO2-3

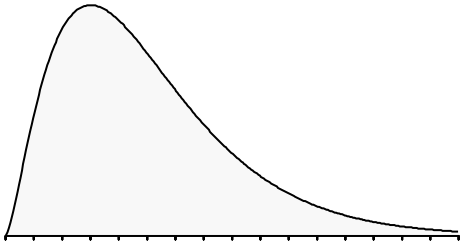
2.15 **a.** Symmetrical and mound shaped:
One hump in the middle; left side is a mirror image of the right side.



b. Double peaked:
Two humps, the left of which may or may not look like the right one, nor is each hump required to be symmetrical



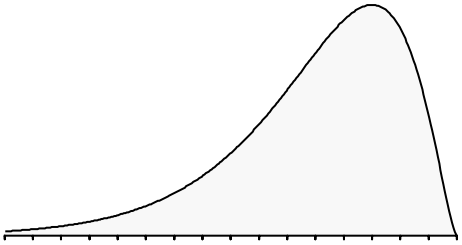
c. Skewed to the right:
Long tail to the right



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d. Skewed to the left:
Long tail to the left



LO2-3

§2.2 METHODS AND APPLICATIONS

2.16 **a.** Since there are 28 points we use 5 classes (from Table 2.5).

b. Class Length (CL) = (largest measurement – smallest measurement) / #classes
$= (46 - 17)/5 = 6$

(we have rounded up to the integer level since the data are recorded to the nearest integer.)

c. The first class's lower boundary is the smallest measurement, 17.

The first class's upper boundary is the lower boundary plus the Class Length, $17 + 6 = 23$

The second class's lower boundary is the first class's upper boundary, 23

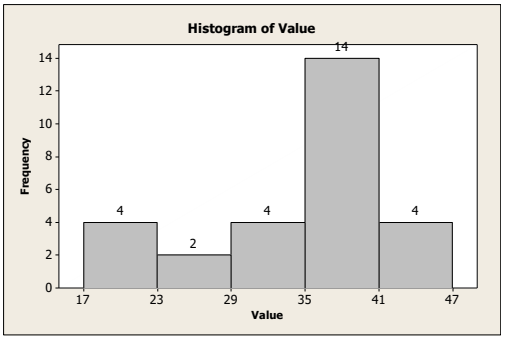
Continue adding the Class Length (width) to lower boundaries to obtain the 5 classes:

$17 \le x < 23 \mid 23 \le x < 29 \mid 29 \le x < 35 \mid 35 \le x < 41 \mid 41 \le x \le 47 \mid$

d. Frequency Distribution for Values

lower	upper	midpoint	width	frequency	percent	cumulative frequency	cumulative percent
17	23	20	6	4	14.3	4	14.3
23	29	26	6	2	7.1	6	21.4
29	35	32	6	4	14.3	10	35.7
35	41	38	6	14	50.0	24	85.7
41	47	44	6	4	14.3	28	100.0

e.



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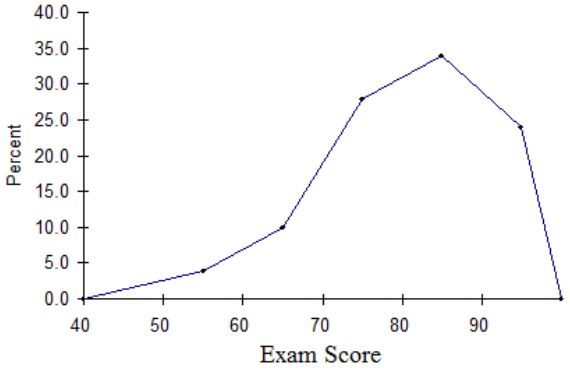
f. See output in answer to **d**.

LO2-3

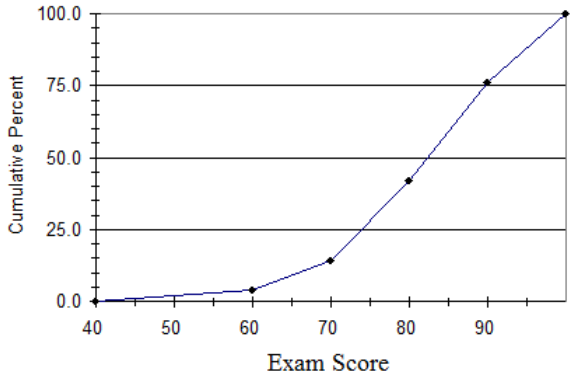
2.17 **a.** and **b.** Frequency Distribution for Exam Scores

lower	upper	midpoint	width	frequency	percent	relative frequency	cumulative frequency	cumulative percent
50	60	55	10	2	4.0	0.04	2	4.0
60	70	65	10	5	10.0	0.10	7	14.0
70	80	75	10	14	28.0	0.28	21	42.0
80	90	85	10	17	34.0	0.34	38	76.0
90	100	95	10	12	24.0	0.24	50	100.0

c. Percent Frequency Polygon



d. Percent Frequency Ogive



LO2-3

2.18 **a.** Because there are 60 data points of design ratings, we use six classes (from Table 2.5).

b. Class Length (CL) = (Max – Min)/#Classes = $(35 - 20) / 6 = 2.5$ and we round up to 3, since the data are recorded to the nearest integer.

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c. The first class's lower boundary is the smallest measurement, 20.

The first class's upper boundary is the lower boundary plus the Class Length, $20 + 3 = 23$

The second class's lower boundary is the first class's upper boundary, 23

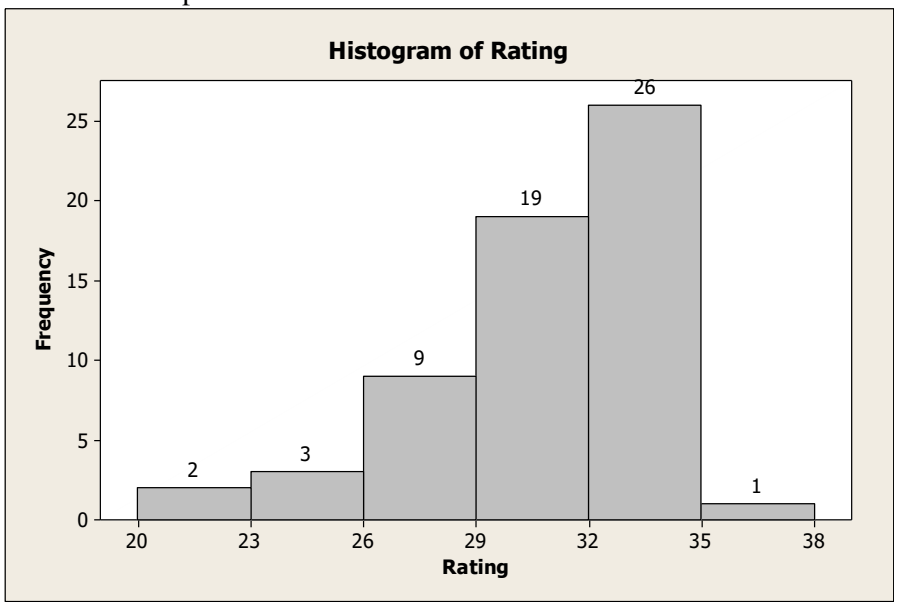
Continue adding the Class Length (width) to lower boundaries to obtain the 6 classes:

$|\ 20 \le x < 23\ |\ 23 \le x < 26\ |\ 26 \le x < 29\ |\ 29 \le x < 32\ |\ 32 \le x < 35\ |\ 35 \le x < 38\ |$

d. Frequency Distribution for Bottle Design Ratings

lower	upper	midpoint	width	frequency	percent	cumulative frequency	cumulative percent
20	23	21.5	3	2	3.3	2	3.3
23	26	24.5	3	3	5.0	5	8.3
26	29	27.5	3	9	15.0	14	23.3
29	32	30.5	3	19	31.7	33	55.0
32	35	33.5	3	26	43.3	59	98.3
35	38	36.5	3	1	1.7	60	100.0

e. Distribution shape is skewed to the left.



LO2-3

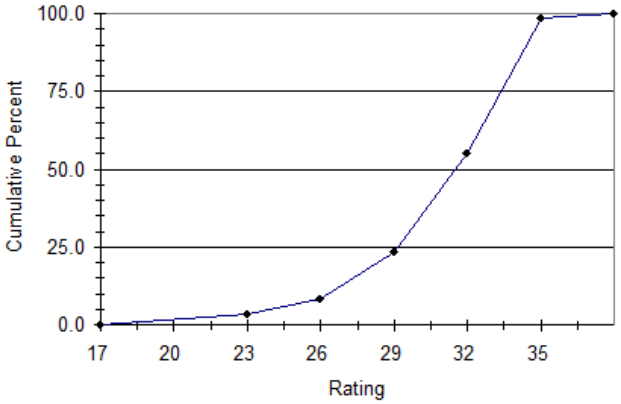
2.19 **a** and **b.** Frequency Distribution for Ratings

lower	upper	midpoint	width	relative frequency	percent	cumulative relative frequency	cumulative percent
20	23	21.5	3	0.033	3.3	0.033	3.3
23	26	24.5	3	0.050	5.0	0.083	8.3
26	29	27.5	3	0.150	15.0	0.233	23.3
29	32	30.5	3	0.317	31.7	0.550	55.0
32	35	33.5	3	0.433	43.3	0.983	98.3
35	38	36.5	3	0.017	1.7	1.000	100.0

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c. Percent Frequency Ogive



LO2-3

2.20 **a.** Omitting Dr. Dre leaves us with the annual earnings of 24 celebrities, ranging from 30 to 115 million. We will use five classes (from Table 2.5).

The first class's lower boundary is the smallest measurement, 30.

Using class length = 18, as prescribed in the problem, the first class's upper boundary is the lower boundary plus the class length, $30 + 18 = 48$

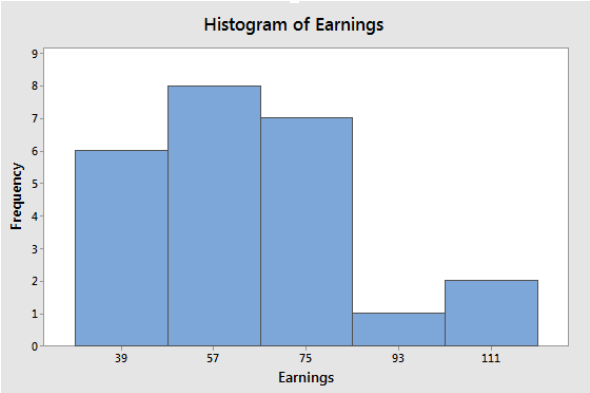
The second class's lower boundary is the first class's upper boundary, 48.

Continue adding the Class Length (width) to lower boundaries to obtain the 5 classes:

$|\ 30 \le x < 48\ |\ 48 \le x < 66\ |\ 66 \le x < 84\ |84 \le x < 102\ |102 \le x < 120\ |$

Frequency Distribution for Earnings (omitting Dr. Dre)

lower	upper	midpoint	width	frequency	percent	cumulative frequency	cumulative percent
30	48	39	18	6	25.0	6	25.0
48	66	57	18	8	33.3	14	58.3
66	84	75	18	7	29.2	21	87.5
84	102	93	18	1	4.2	22	91.7
102	120	111	18	2	8.3	24	100.0

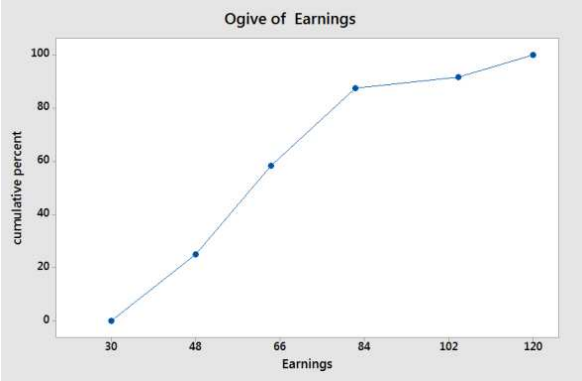


b. See table in part (a) for cumulative distributions.

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c.



d. The first class's lower boundary is the smallest measurement, 30. Using the suggested class length of 120, the first class's upper boundary is the lower boundary plus the class length: $30 + 120 = 150$

The second class's lower boundary is the first class's upper boundary, 150.

Continue adding the Class Length (width) to lower boundaries to obtain the 5 classes:

$|30 \le x < 150|150 \le x < 270|270 \le x < 390|390 \le x < 510|510 \le x < 630|$

Frequency Distribution for Earnings (including Dr. Dre)

lower	upper	midpoint	width	frequency	percent	cumulative frequency	cumulative percent
30	150	90	120	24	96	24	96
150	270	210	120	0	0	24	96
270	390	330	120	0	0	24	96
390	510	450	120	0	0	24	96
510	630	570	120	1	4	25	100

LO2-3

2.21 **a.** The video game satisfaction ratings are concentrated between 40 and 46.

b. Shape of distribution is slightly skewed left. Recall that these ratings have a minimum possible value of 7 and a maximum possible value of 49. This shows that the responses from this survey are close to reaching the upper limit but significantly diminishing on the lower side of the distribution.

Class	**c.** Ratings	**d.** cumulative frequency
1	$34 < x \le 36$	1
2	$36 < x \le 38$	4
3	$38 < x \le 40$	13
4	$40 < x \le 42$	25
5	$42 < x \le 44$	45
6	$44 < x \le 46$	61
7	$46 < x \le 48$	65
8	$48 < x \le 49$	65

LO2-3

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2.22 **a.** The bank wait times are concentrated between 4 and 9 minutes. (You might make a slightly different choice.)

b. The shape of distribution is slightly skewed right. Waiting time has a lower limit of 0 and stretches out to the high side where there are a few people who have to wait longer.

c. The class length is 1 minute.

d. Frequency Distribution for Bank Wait Times

lower	upper	midpoint	width	frequency	percent	cumulative frequency	cumulative percent
-0.5	0.5	0	1	1	1%	1	1%
0.5	1.5	1	1	4	4%	5	5%
1.5	2.5	2	1	7	7%	12	12%
2.5	3.5	3	1	8	8%	20	20%
3.5	4.5	4	1	17	17%	37	37%
4.5	5.5	5	1	16	16%	53	53%
5.5	6.5	6	1	14	14%	67	67%
6.5	7.5	7	1	12	12%	79	79%
7.5	8.5	8	1	8	8%	87	87%
8.5	9.5	9	1	6	6%	93	93%
9.5	10.5	10	1	4	4%	97	97%
10.5	11.5	11	1	2	2%	99	99%
11.5	12.5	12	1	1	1%	100	100%

LO2-3

2.23 **a.** The trash bag breaking strengths are concentrated between 50 and 52.5 pounds. Looking at a broader range, the trash bag breaking strengths are concentrated between 45 and 60 pounds.

b. The shape of distribution is symmetric and mounded.

LO02-3

2.24 **a.** With 30 values, we will use 5 classes**.**

Note that (Max – Min)/#Classes $= (2500 - 485) / 5 = 403$.

For convenience, we will use classes of length 500 and begin the first class at 250.

We obtain the 5 classes:

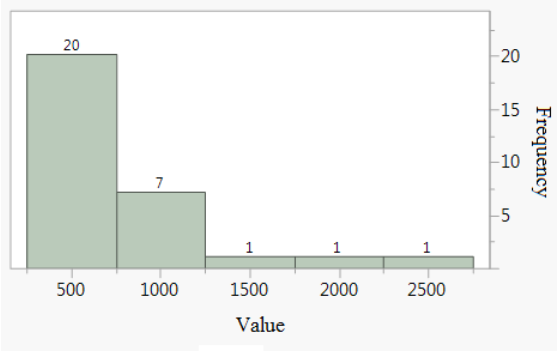
$| 250 \le x < 750 \ | 750 \le x < 1250 \ | 1250 \le x < 1750 \ | 1750 \le x < 2250 \ | 2250 \le x < 2750 |$

Frequency Distribution for MLB Team Values

lower	upper	midpoint	width	frequency	percent
250	750	500	500	20	66.7
750	1250	1000	500	7	23.3
1250	1750	1500	500	1	3.3
1750	2250	2000	500	1	3.3
2250	2750	2500	500	1	3.3

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The distribution is skewed to the right. While the majority of teams have valuations under $750 million, a few franchises have much higher valuations.

b. Again, we will use 5 classes**.**

Note that (Max – Min)/#Classes $= (461 - 159) / 5 = 60.4$.

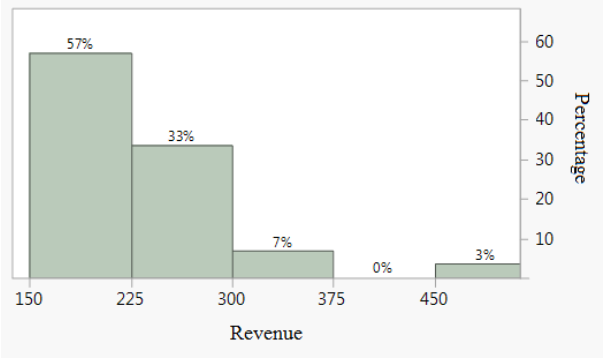
For convenience, we will use classes of length 75 and begin the first class at 150.

We obtain the 5 classes:

$|\ 150 \leq x < 225\ |\ 225 \leq x < 300\ |\ 300 \leq x < 375\ |\ 375 \leq x < 450\ |\ 450 \leq x < 525\ |$

Frequency Distribution for MLB Team Revenues

lower	upper	midpoint	width	frequency	percent
150	225	187.5	75	17	56.7
225	300	262.5	75	10	33.3
300	375	337.5	75	2	6.7
375	450	412.5	75	0	0.0
450	525	487.5	75	1	3.3

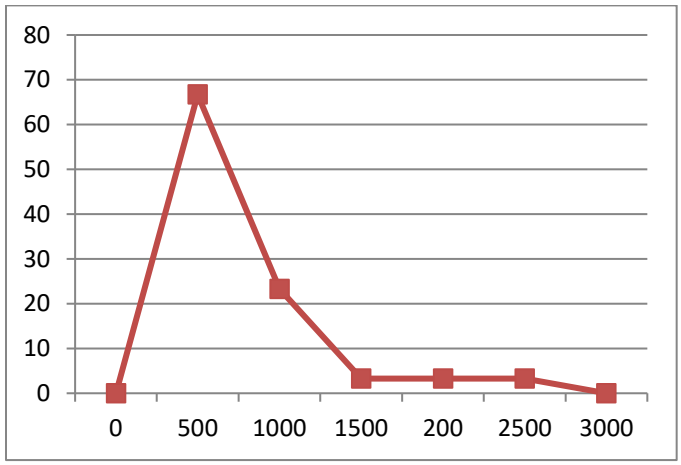


The distribution is skewed to the right. The majority of teams have revenues between $150 and $300 million while a few have revenue between $300 and $375 million and between $450 and $525 million.

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c.



LO2-3

2.25 **a.** We will use 6 classes since $n = 40$.

Note that (Max – Min)/#Classes $= (958 - 57) / 6 = 150.2$.

For convenience, we will use classes of length 175 and begin the first class at 0.

We obtain the 6 classes:

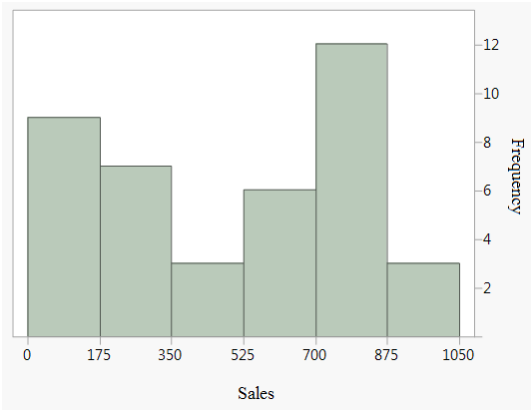
$|\ 0 \le x < 175\ |\ 175 \le x < 350\ |\ 350 \le x < 525\ |\ 525 \le x < 700\ |\ 700 \le x < 875\ |$

$|\ 875 \le x < 1050\ |$

Frequency Distribution for Best Small Company Sales

lower	upper	midpoint	width	frequency
0	175	87.5	175	9
175	350	262.5	175	7
350	525	437.5	175	3
525	700	612.5	175	6
700	875	787.5	175	12
875	1050	962.5	175	3

Frequency Histogram for Best Small Company Sales



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The distribution is bimodal and skewed to the left. There is a large concentration of sales values between \$700 and \$875 million and a smaller concentration of sales values between \$0 and \$350 million.

b. We will again use 6 classes.

Note that (Max – Min)/#Classes $= (75 - 4) / 6 = 11.8$.

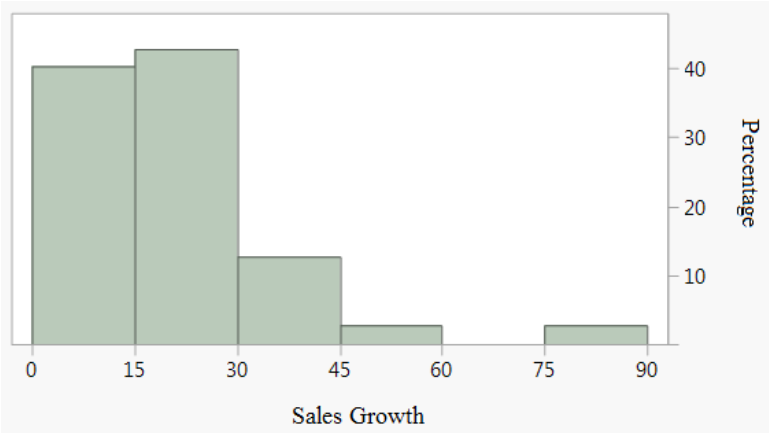
For convenience, we will use classes of length 15 and begin the first class at 0.

We obtain the 6 classes:

$|\ 0 \le x < 15\ |\ 15 \le x < 30\ |\ 30 \le x < 45\ |\ 45 \le x < 60\ |\ 60 \le x < 75\ |\ 75 \le x < 90\ |$

Frequency Distribution for Best Small Company Sales Growth

lower	upper	midpoint	width	frequency	percent frequency
0	15	7.5	175	16	21.3
15	30	22.5	175	17	22.7
30	45	37.5	175	5	6.7
45	60	52.5	175	1	1.3
60	75	67.5	175	0	0.0
75	90	82.5	175	1	1.3



LO2-3

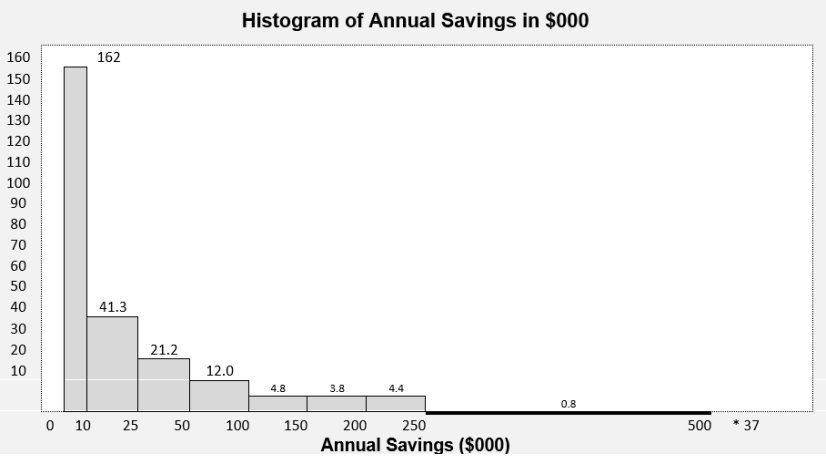
2.26 a. Frequency Distribution for Annual Savings in \$000

lower		upper	midpoint	width	frequency	width = factor base	frequency =height factor
0	<	10	5.0	10	162	10 / 10 =1.0	162 / 1.0 =162.0
10	<	25	17.5	15	62	15 / 10 =1.5	62 / 1.5 =41.3
25	<	50	37.5	25	53	25 / 10 =2.5	53 / 2.5 =21.2
50	<	100	75.0	50	60	50 / 10 =5.0	60 / 5.0 =12
100	<	150	125.0	50	24	50 / 10 =5.0	24 / 5.0 =4.8
150	<	200	175.0	50	19	50 / 10 =5.0	19 / 5.0 =3.8
200	<	250	225.0	50	22	50 / 10 =5.0	22 / 5.0 =4.4
250	<	500	375.0	250	21	250 / 10 =25.0	21 / 25.0 =0.8
500					37		

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2.26 b. and **2.27**



LO2-3

§2.3 CONCEPTS

2.28 The horizontal axis spans the range of observations or measurements, and the dots represent the observations.

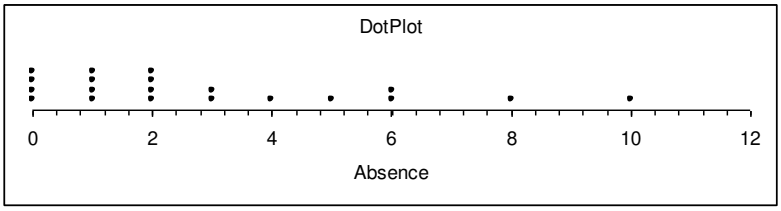
LO2-4

2.29 A dot plot with 1,000 points is not practical. Group the data and use a histogram.

LO2-3, LO2-4

§2.3 METHODS AND APPLICATIONS

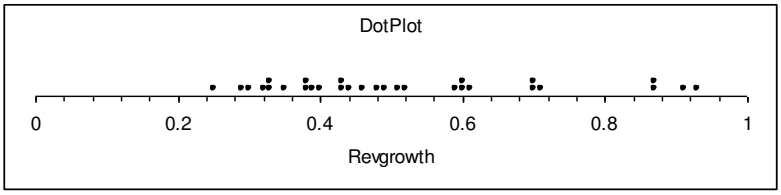
2.30



The distribution is concentrated between 0 and 2 and is skewed to the right. Eight and ten are probably high outliers.

LO2-4

2.31



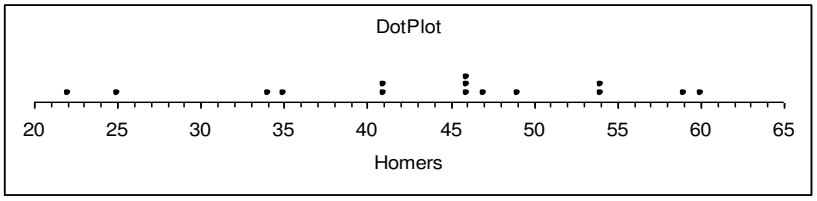
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The distribution is skewed to the right. Most growth rates are no more than 71%, but 4 companies had growth rates of 87% or more.

LO2-4

2.32



The distribution is slightly skewed to the left and centered near 45 home runs.

LO2-4

§2.4 CONCEPTS

2.33 Both the histogram and the stem-and-leaf show the shape of the distribution, but only the stem-and-leaf shows the values of the individual measurements.

LO2-3, LO2-5

2.34 Several advantages of the stem-and-leaf display include that it:
-displays all the individual measurements.
-puts data in numerical order, and
-is simple to construct.

LO2-5

2.35 With a large data set (e.g., 1,000 measurements) it does not make sense to use a stem-and-leaf because it is impractical to write out 1,000 data points. Group the data and use a histogram.

LO2-3, LO2-5

§2.4 METHODS AND APPLICATIONS

2.36 Revenue Growth in Percent (Stem Unit = 10, Leaf Unit = 1)

Stem	Leaf
2	8
3	0 2 3 6
4	2 2 3 4 9
5	1 3 5 6 9
6	3 5
7	0
8	3
9	1

LO2-5

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2.37 Profit Margins (%) (Stem Unit = 1, Leaf Unit =0.1)

Stem	Leaf
10	4 4
11	
12	6
13	2 8 9
14	0 1 4 9
15	2 2 8 9
16	1 1 4 8
17	
18	
19	
20	
21	
22	2
23	
24	
25	2

LO2-5

2.38 Sales ($mil) (Stem Unit = 1000, Leaf Unit = 100)

Stem	Leaf
1	2 4 4 5 7
2	0 4 7 7 8
3	3 3 5 7
4	2 6
5	4
6	0 8
7	9

LO2-5

2.39 **a.** The Payment Times distribution is skewed to the right.
b. The Bottle Design Ratings distribution is skewed to the left.

LO2-5

2.40 The distribution is unimodal and symmetric and centered near 52 pounds.

LO2-5

2.41 Home Runs (Stem unit = 10, Leaf Unit = 1)

Leaf	Stem	Leaf
Roger Maris		Babe Ruth
8	0	
6 4 3	1	
8 6 3	2	2 5
9 3	3	4 5
	4	1 1 6 6 6 7 9
	5	4 4 9
1	6	0

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The 61 home runs hit by Maris would be considered an outlier for him, although an exceptional individual achievement.

LO2-5

2.42 **a.** Bank Customer Wait Time (Stem unit = 1, Leaf Unit = 0.1)

Stem	Leaf
0	4 8
1	1 3 4 6 8 8
2	0 2 3 4 5 7 8 9 9
3	1 2 4 5 6 7 7 8 8 9 9
4	0 0 1 2 3 3 3 4 4 5 5 5 6 7 7 8 9
5	0 1 1 2 2 3 4 4 5 6 6 7 8 8 8
6	1 1 2 3 3 3 4 5 5 6 7 7 8
7	0 2 2 3 4 4 5 7 8 9
8	0 1 3 4 6 6 7
9	1 2 3 5 8 9
10	2 7 9
11	6

b. The distribution of wait times is very slightly skewed to the right.

LO2-5

2.43 **a.** Video Game Satisfaction Ratings (Stem unit = 1, Leaf Unit = 0.1)

Stem	Leaf
36	0
37	
38	0 0 0
39	0 0 0 0
40	0 0 0 0 0
41	0 0 0 0 0 0
42	0 0 0 0 0 0
43	0 0 0 0 0 0 0 0
44	0 0 0 0 0 0 0 0 0 0 0 0 0
45	0 0 0 0 0 0 0 0 0
46	0 0 0 0 0 0 0
47	0 0 0
48	0

b. The video game satisfaction ratings distribution is slightly skewed to the left.

c. Since 19 of the 65 ratings (29%) are below the "very satisfied" level of 42, it would *not* be accurate to say that almost all purchasers are very satisfied.

LO2-5

§2.5 CONCEPTS

2.44 Contingency tables are used to study the association between two variables.

LO2-6

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2.45 We fill each cell of the contingency table by counting the number of observations that have both of the specific values of the categorical variables associated with that cell.

LO2-6

2.46 (1) A row percentage is calculated by dividing the cell frequency by the total frequency for that particular row and by expressing the resulting fraction as a percentage.

(2) A column percentage is calculated by dividing the cell frequency by the total frequency for that particular column and by expressing the resulting fraction as a percentage.

Row percentages show the distribution of the column categorical variable for a given value of the row categorical variable.

Column percentages show the distribution of the row categorical variable for a given value of the column categorical variable.

LO2-6

§2.5 METHODS AND APPLICATIONS

2.47 Cross tabulation of Brand Preference vs. Rola Purchase History

		Purchased Rola?		
Brand Preference		**No**	**Yes**	**Total**
Koka	**Observed**	**14**	**2**	**16**
	% of row	87.5%	12.5%	100%
	% of column	66.7%	10.5%	40%
	% of total	35.0%	5.0%	40%
Rola	**Observed**	**7**	**17**	**24**
	% of row	29.2%	70.8%	100%
	% of column	33.3%	89.5%	60%
	% of total	17.5%	42.5%	60%
Total	**Observed**	**21**	**19**	**40**
	% of row	52.5%	47.5%	100%
	% of column	100.0%	100.0%	100%
	% of total	52.5%	47.5%	100%

a. 17 shoppers who preferred Rola-Cola had purchased it before.

b. 14 shoppers who preferred Koka-Cola had not purchased Rola before.

c. If you have purchased Rola previously you are more likely to prefer Rola.

If you have not purchased Rola previously you are more likely to prefer Koka.

LO2-6

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2.48 Cross tabulation of Brand Preference vs. Sweetness Preference

		Sweetness Preference			
Brand Preference		**Very Sweet**	**Sweet**	**Not So Sweet**	**Total**
Koka	**Observed**	**6**	**4**	**6**	**16**
	% of row	37.5%	25.0%	37.5%	100%
	% of column	42.9%	30.8%	46.2%	40%
	% of total	15.0%	10.0%	15.0%	40%
Rola	**Observed**	**8**	**9**	**7**	**24**
	% of row	33.3%	37.5%	29.2%	100%
	% of column	57.1%	69.2%	53.8%	60%
	% of total	20.0%	22.5%	17.5%	60%
Total	**Observed**	**14**	**13**	**13**	**40**
	% of row	35.0%	32.5%	32.5%	100%
	% of column	100.0%	100.0%	100.0%	100%
	% of total	35.0%	32.5%	32.5%	100%

a. $8 + 9 = 17$ shoppers who preferred Rola-Cola also preferred their drinks Sweet or Very Sweet.

b. 6 shoppers who preferred Koka-Cola also preferred their drinks not so sweet.

c. Rola drinkers may prefer slightly sweeter drinks than Koka drinkers.

LO2-6

2.49 Cross tabulation of Brand Preference vs. Number of 12-Packs Consumed Monthly

		Consumption			
Brand Preference		**0 to 5**	**6 to 10**	**>10**	**Total**
Koka	**Observed**	**12**	**3**	**1**	**16**
	% of row	75.0%	18.8%	6.3%	100%
	% of column	60.0%	17.6%	33.3%	40%
	% of total	30.0%	7.5%	2.5%	40%
Rola	**Observed**	**8**	**14**	**2**	**24**
	% of row	33.3%	58.3%	8.3%	100%
	% of column	40.0%	82.4%	66.7%	60%
	% of total	20.0%	35.0%	5.0%	60%
Total	**Observed**	**20**	**17**	**3**	**40**
	% of row	50.0%	42.5%	7.5%	100%
	% of column	100.0%	100.0%	100.0%	100%
	% of total	50.0%	42.5%	7.5%	100%

a. $8 + 14 = 22$ shoppers who preferred Rola-Cola purchase 10 or fewer 12-packs.

b. 3 + 1 = 4 shoppers who preferred Koka-Cola purchase 6 or more 12-packs.

c. People who drink more cola seem more likely to prefer Rola.

LO2-6

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2.50 **a.** 16%, 56%

b. Row Percentage Table

	Watch Tennis	Do Not Watch Tennis	Total
Drink Wine	40%	60%	100%
Do Not Drink Wine	6.7%	93.3%	100%

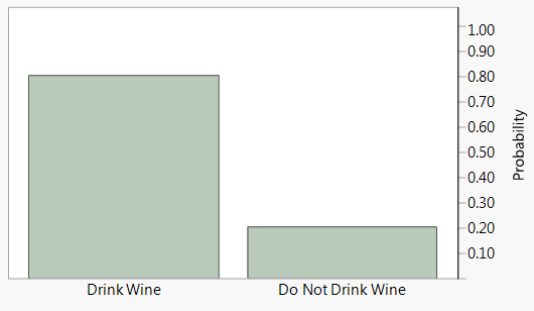
c. Column Percentage Table

	Watch Tennis	Do Not Watch Tennis
Drink Wine	80%	30%
Do Not Drink Wine	20%	70%
Total	100%	100%

d. People who watch tennis are more likely to drink wine than those who do not watch tennis.

e.

Bar Chart for Watch Tennis



Bar Chart for Do Not Watch Tennis



LO2-1, LO2-6

2.51 **a.**

	TV Violence		
TV Quality	**Increased**	**Not Increased**	**Total**
Worse	362	92	454
Not Worse	359	187	546
Total	721	279	1000

b. Row percentages

	TV Violence		
TV Quality	**Increased**	**Not Increased**	**Total**
Worse	79.7%	20.3%	100%
Not Worse	65.8%	34.2%	100%

c. Column percentages

	TV Violence	
TV Quality	**Increased**	**Not Increased**
Worse	50.2%	33.0%
Not Worse	49.8%	67.0%
Total	100%	100%

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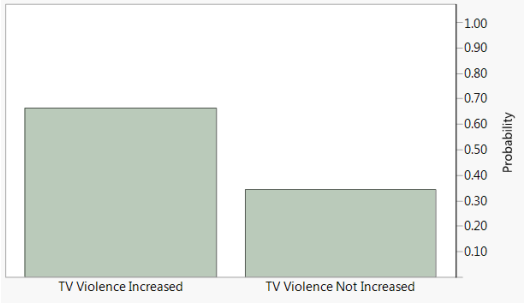
d. Those people who think TV violence has increased are more likely to think TV quality has gotten worse.

e.

Bar Chart for TV Quality Worse

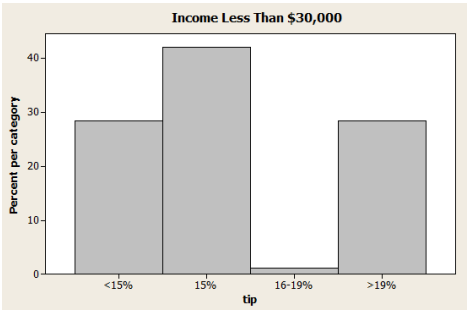


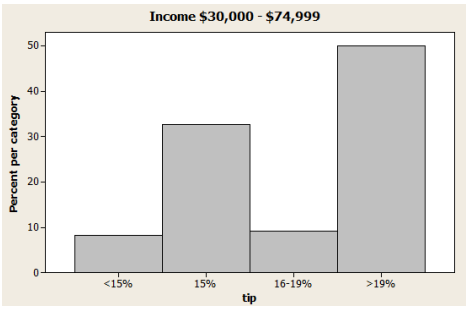
Bar Chart for TV Quality Not Worse

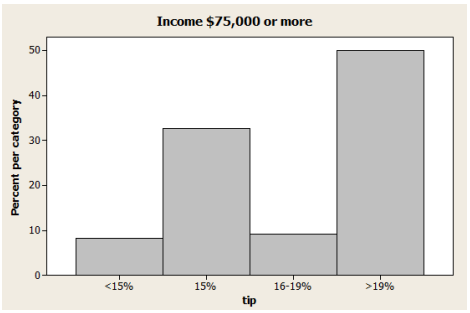


LO2-1, LO2-6

2.52 **a.** As income increases, the percent of people seeing larger tips as appropriate also increases.



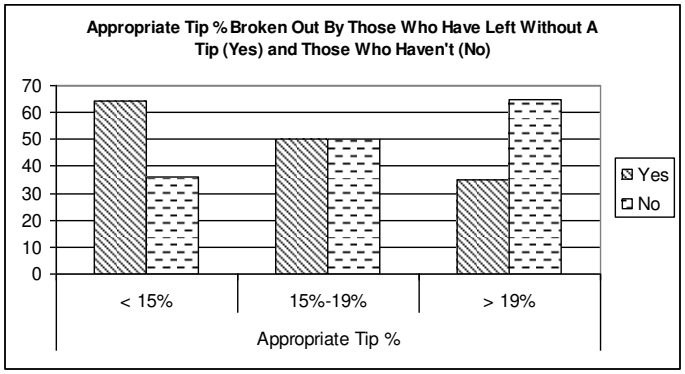




b. People who have left at least once without leaving a tip are more likely to think a smaller tip is appropriate.

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LO2-1, LO2-6

§2.6 CONCEPTS

2.53 A scatterplot is used to look at the relationship between two quantitative variables.

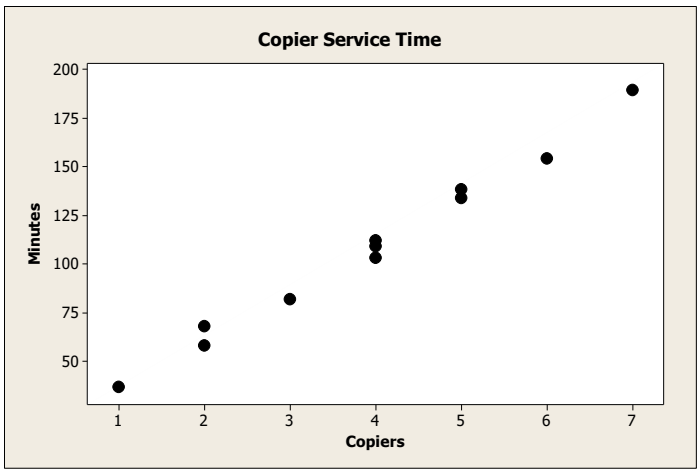
LO2-7

2.54 On a scatter plot, each value of y is plotted against its corresponding value of x.
On a times series plot, each individual process measurement is plotted against its corresponding time of occurrence.

LO2-7

§2.6 METHODS AND APPLICATIONS

2.55 The scatterplot shows an increase in the number of copiers is related to an increase in the service time in a positive linear fashion. This relationship is fairly strong.

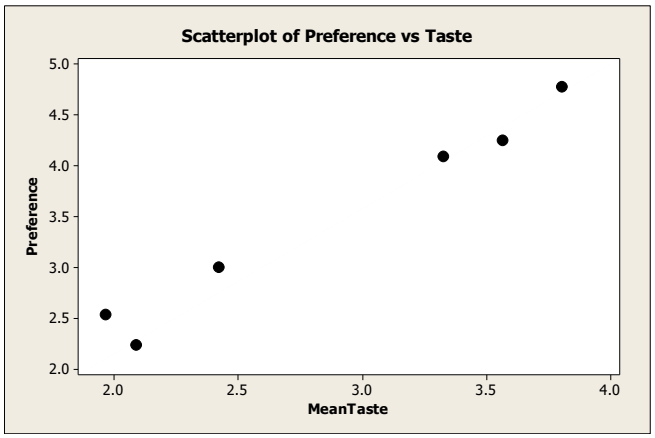


LO2-7

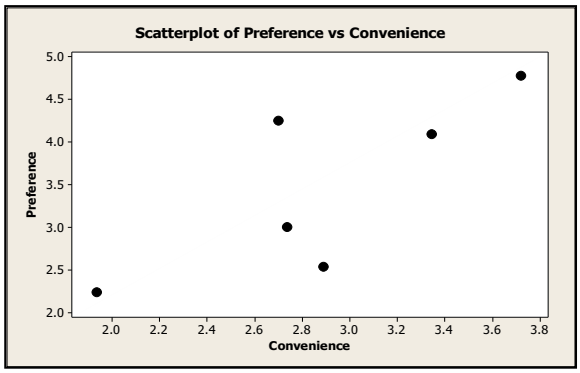
2.56 The scatterplot shows that the average rating for taste is related to the average rating for preference in a positive linear fashion. This relationship is fairly strong.

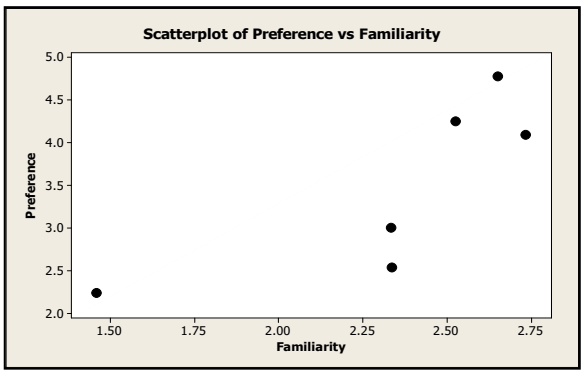
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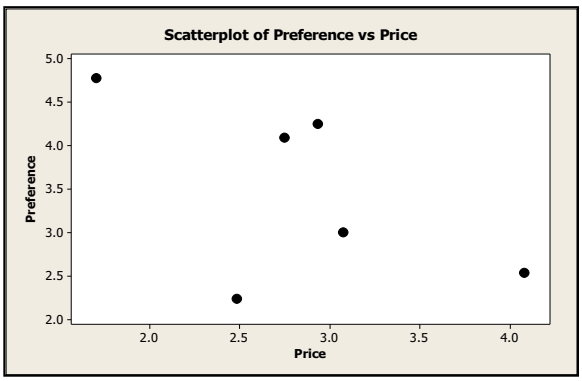
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The scatterplots below show that average convenience, familiarity, and price are all approximately linearly related to average preference in a positive, positive, and negative fashion (respectively). These relationships are not as strong as the one between taste and preference.







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2.57 It appears that Cable Rates decreased around the same time Non-Cable Services became available. However as Non-Cable Services became more established, both rates for Cable and Non-Cable Services increased at similar rates.

LO2-7

§2.7 CONCEPTS

2.58 When the vertical axis does not start at zero, the bars themselves will not be as tall as if the bars had started at zero. Hence, the relative differences in the heights of the bars will be more pronounced.

LO2-8

2.59 Examples and reports will vary.

LO2-8

§2.7 METHODS AND APPLICATIONS

2.60 The administration's compressed plot indicates a steep increase of nurses' salaries over the four years, while the union organizer's stretched plot shows a more gradual increase of the same salaries over the same time period.

LO2-8

2.61 **a.** No. The graph of the number of private elementary schools is showing only a very slight (if any) increasing trend when scaled with public schools.

b. Yes. The graph of the number of private elementary schools is showing strong increasing trend, particularly after 1950.

c. The line graph is more appropriate because it shows growth.

d. Neither graph gives an accurate understanding of the changes spanning a half century. Because of the very large difference in scale between private and public schools, a comparison of growth might be better described using percent increase.

LO2-8

§2.8 CONCEPTS

2.62 (1) A gauge allows us to visualize an organization's key performance indicators in way that is similar to an automobile speedometer.

(2) A bullet graph displays a measure of performance as a horizontal (or vertical) bar that extends into ranges representing qualitative measures of performance. Many bullet graphs compare the measure of performance (bar) to a target or objective.

(3) A treemap displays information in a series of clustered rectangles. The sizes of the rectangles represent values of a first variable, and the colors of the rectangles represent a second variable.

(4) A sparkline is a line chart that shows the pattern of variation of variable (usually over time).

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LO2-9

2.63 Data drill down is a version of data discovery which reveals more detailed data underlying a higher level data summary.

LO2-9

§2.8 METHODS AND APPLICATIONS

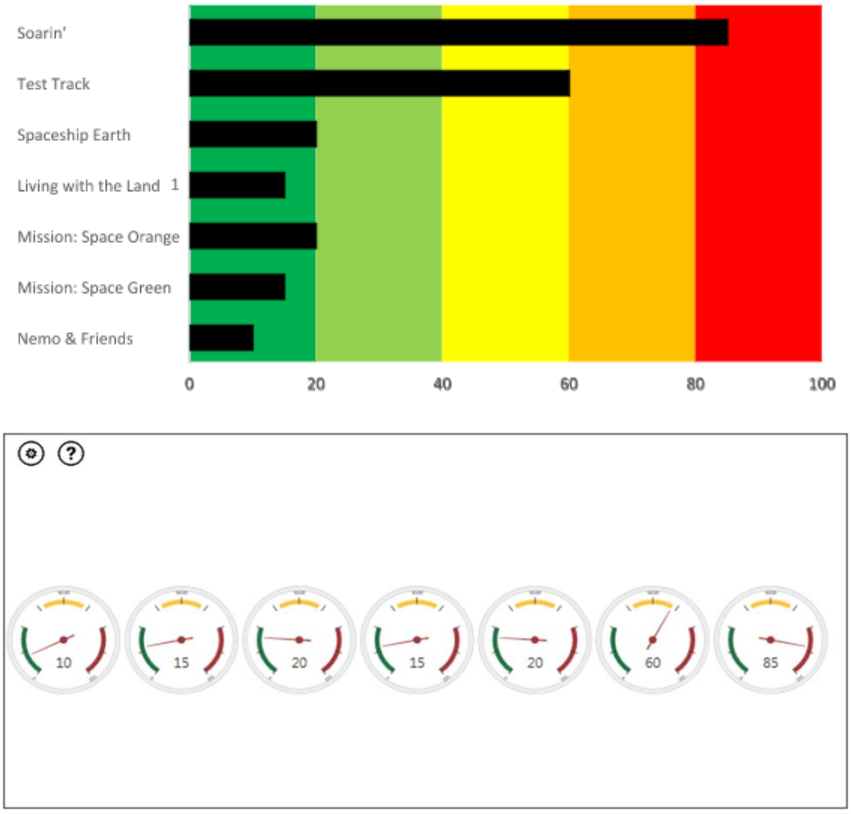
2.64 The company has met the targets for revenue and customer satisfaction, but has not met the targets for profit, average order size, and new customers.

LO2-9

2.65 The ozone level is higher in Chicago because the corresponding rectangle is more nearly red.

LO2-9

2.66

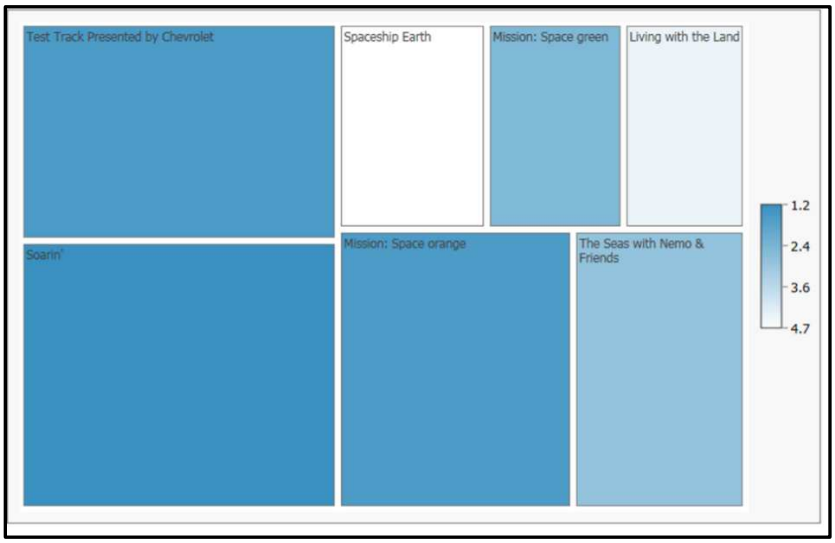


LO2-9

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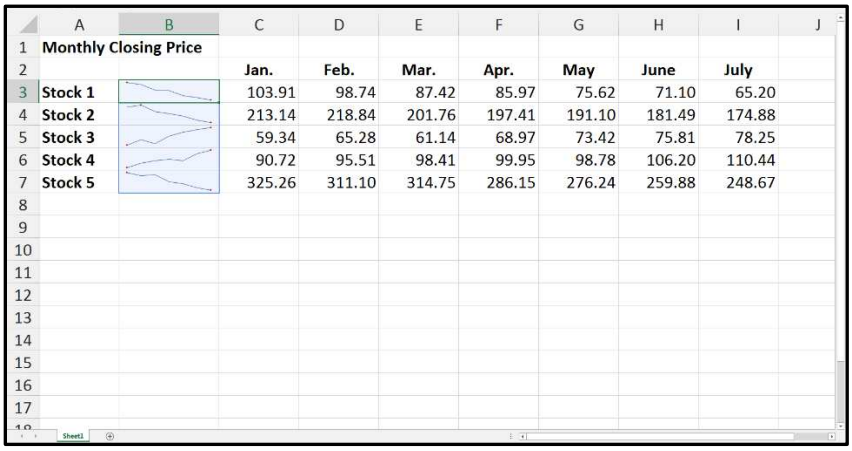
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2.67



LO2-9

2.68



	A	B	C	D	E	F	G	H	I	J
1	**Monthly Closing Price**									
2			**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	
3	**Stock 1**		103.91	98.74	87.42	85.97	75.62	71.10	65.20	
4	**Stock 2**		213.14	218.84	201.76	197.41	191.10	181.49	174.88	
5	**Stock 3**		59.34	65.28	61.14	68.97	73.42	75.81	78.25	
6	**Stock 4**		90.72	95.51	98.41	99.95	98.78	106.20	110.44	
7	**Stock 5**		325.26	311.10	314.75	286.15	276.24	259.88	248.67	
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										

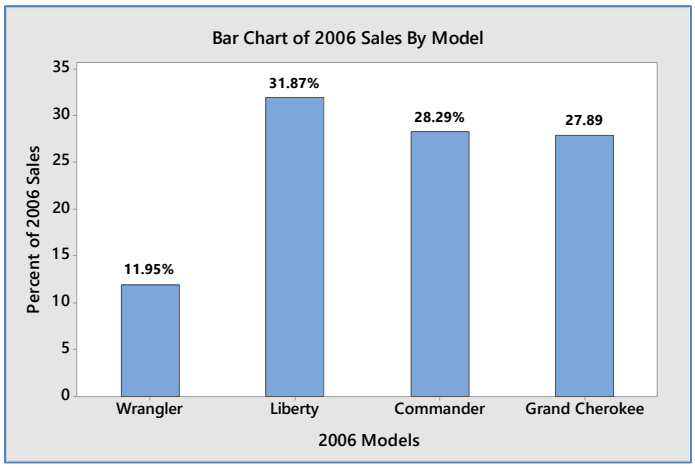
LO2-9

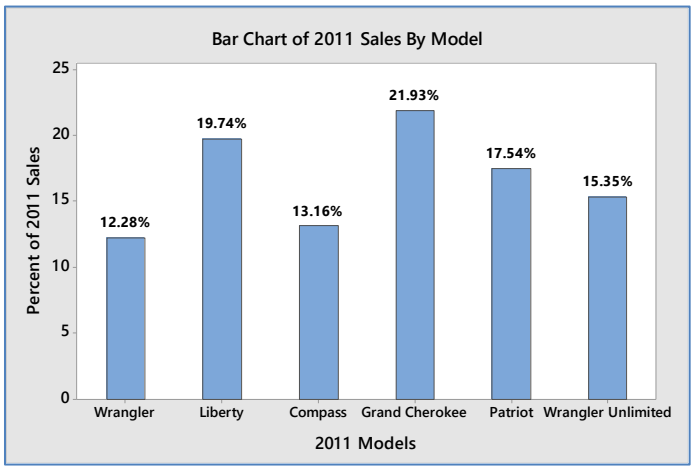
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Supplementary Exercises

2.69





Reports will vary but should mention that although Liberty sales declined, this is not surprising since Liberty was one of 4 models in 2006 but one of 6 in 2011. As the dealer's second most popular model in 2011, it is still an important part of his sales.

LO2-1

2.70 Bar Chart for Mechanical Quality Ratings

lower	upper	midpoint	frequency
1.5	2.5	2	6
2.5	3.5	3	16
3.5	4.5	4	9
4.5	5.5	5	1

The most common mechanical quality rating is 3 while only one, the Lexus, got a 5.

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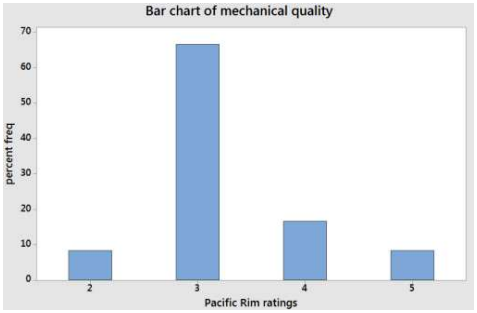
2.71 Bar Chart for Mechanical Quality Ratings

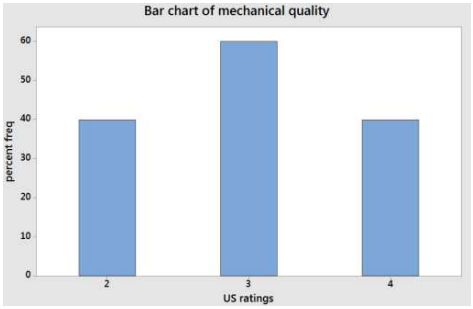
lower	upper	midpoint	frequency	relative frequency
1.5	2.5	2	4	0.125
2.5	3.5	3	23	0.719
3.5	4.5	4	3	0.094
4.5	5.5	5	2	0.063

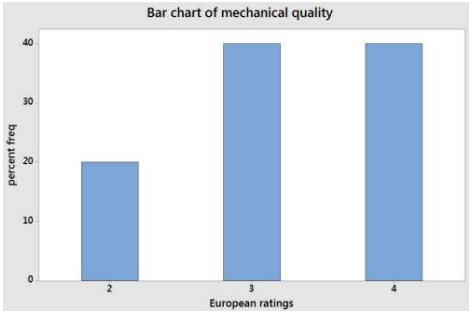
The majority of the cars (23 of 32) received a design rating of 3.

LO2-2

2.72







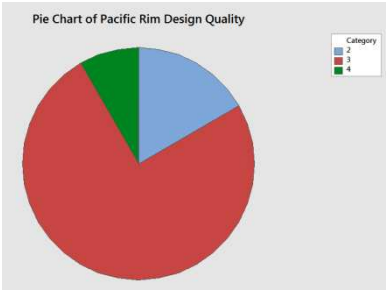
The US and Europe have very similar mechanical quality ratings although the US ratings are slightly lower than the European ones. The Pacific Rim cars overwhelmingly receive ratings of 3.

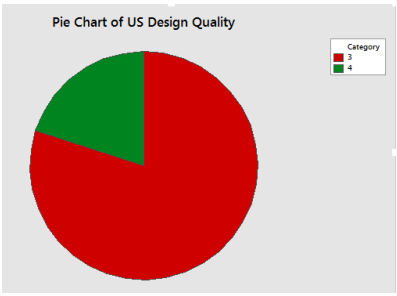
LO2-2

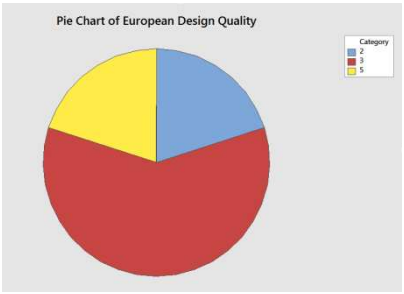
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2.73







All three regions have a majority of models rated 3 in design. Europe has the only models with ratings of 5, but like the Pacific Rim, it also has models rated 2, unlike the US.

LO2-2

2.74

Region	Among the best	Better than most	About average	The rest	Total
United States	0 0.0	3 30.0	4 40.0	3 30.0	10 100
Pacific Rim	1 8.3	2 16.7	8 66.7	1 8.3	12 100
Europe	0 0.0	4 40.0	4 40.0	2 20.0	10 100
Total	1 3.1	9 28.1	16 50.0	6 18.8	32 100

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Pacific Rim cars are likely to be about average in mechanical quality. European cars are the most likely to be above average (40% vs 30% for US and 25% for Pacific Rim).

LO2-2

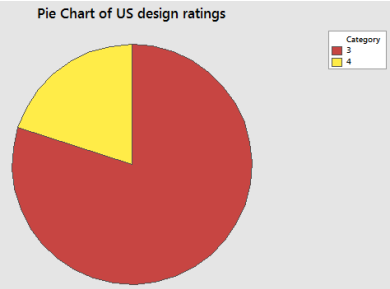
2.75 See table in 2.74 and the bar charts in 2.72

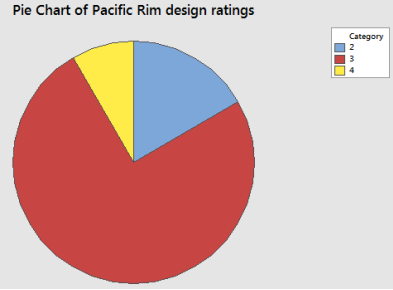
2.76

Region	Among the best	Better than most	About average	The rest	Total
United States	0 0.0	2 20.0	8 80.0	0 0.0	10 100
Pacific Rim	0 0.0	1 8.3	9 75.0	2 16.7	12 100
Europe	2 20.0	0 0.0	6 60.0	2 20.0	10 100
Total	2 6.3	3 9.4	23 71.9	4 12.5	32 100

All three regions tend to receive average design ratings, but the Pacific Rim region seems weakest in design. Only one model (8%) received a rating above average. In the US, 2 models (20%) received above average ratings and in Europe, 2 (20%) received "among the best" ratings.

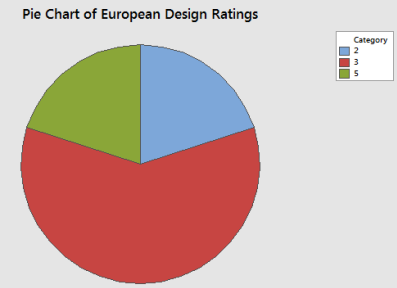
2.77 See the table in 2.76**.**





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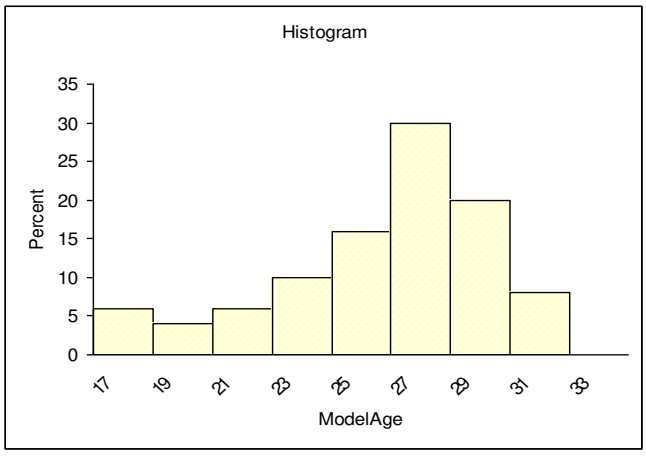
Same observations as in 2.76.

2.78 a. Frequency Distribution for Model Age

Lower	Upper	Midpoint	Width	Frequency	Percent	Cumulative Frequency	Cumulative Percent
17	19	18	2	3	6	3	6
19	21	20	2	2	4	5	10
21	23	22	2	3	6	8	16
23	25	24	2	5	10	13	26
25	27	26	2	8	16	21	42
27	29	28	2	15	30	36	72
29	31	30	2	10	20	46	92
31	33	32	2	4	8	50	100

While the rule suggests using 6 classes, we are using 8 as suggested in the problem.

b.



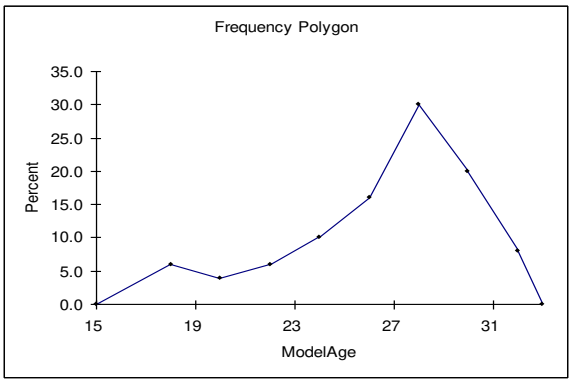
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c. This distribution is skewed to the left.

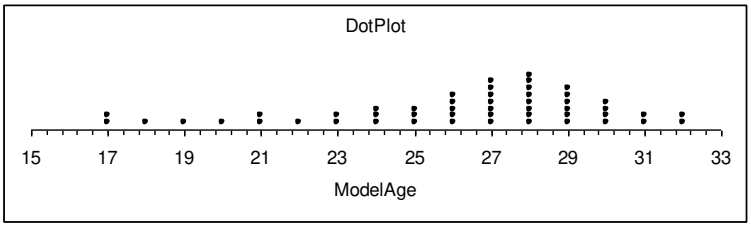
LO2-3

2.79



LO2-3

2.80

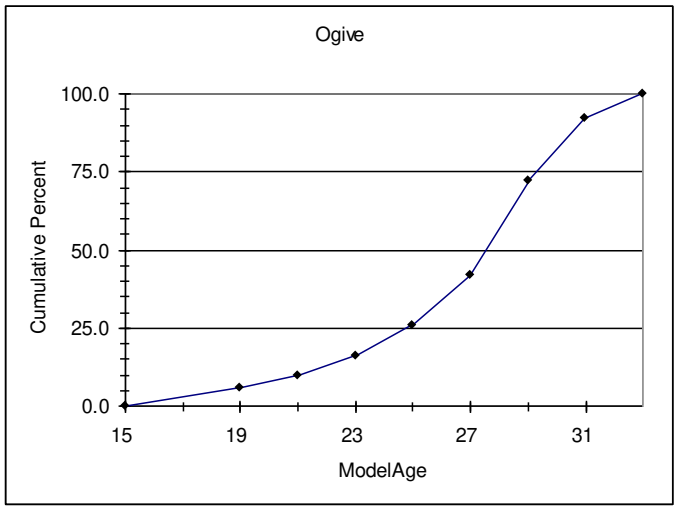


26% of the perceived ages are below 25. This is probably too high.

LO2-4

2.81 **a & b & c.** See table in 2.78

d.



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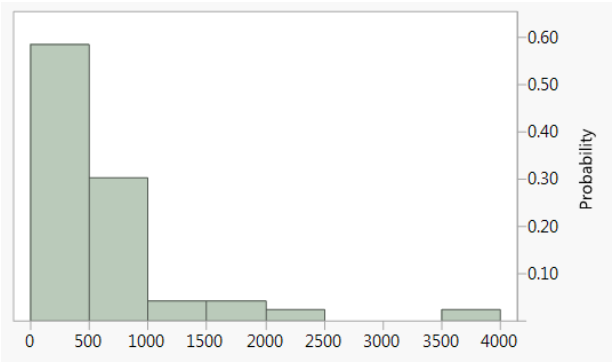
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e. 36 out of 50 = 72%

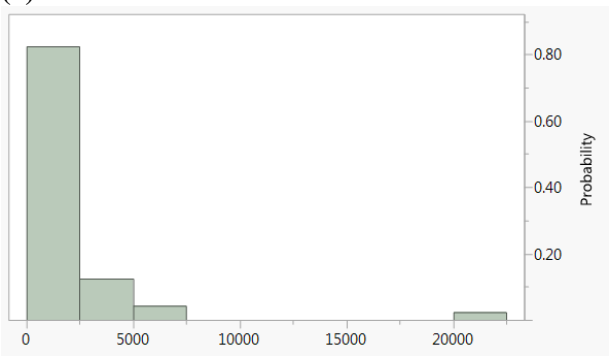
f. 8 out of 50 = 16%

LO2-3

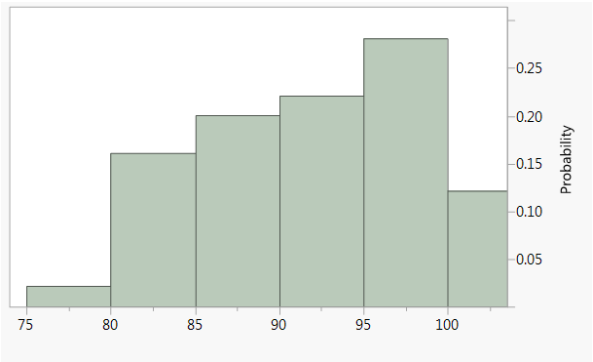
2.82 **a.** **(1)**



(2)



(3)



b. The histograms depicting private support and total revenues are quite skewed to the right while the histogram depicting fundraising efficiencies is skewed to the left.

2.83 Distribution has one high outlier and with or without the outlier is skewed right.

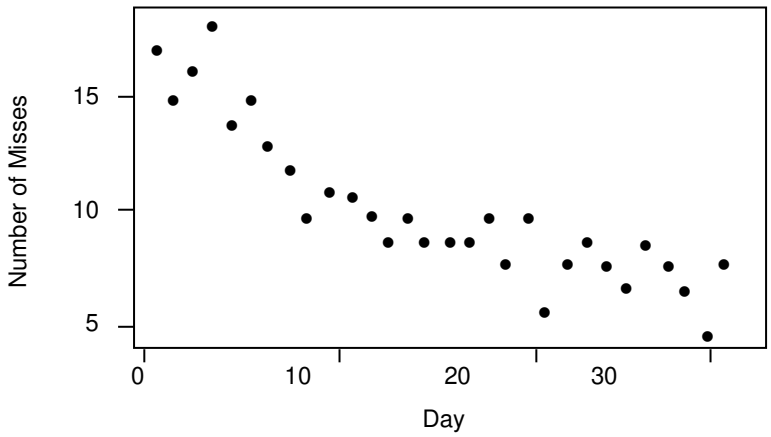
2.84 Shots Missed (Stem Unit = 1, Leaf Unit = 0.1)

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Stem	Leaf
5	0
6	0
7	0 0
8	0 0 0 0 0
9	0 0 0 0 0 0
10	0 0 0 0 0
11	0 0
12	0
13	0
14	0
15	0 0
16	0
17	0
18	0

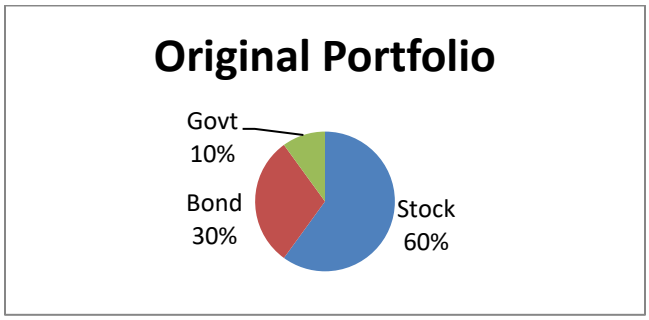
Time Series Plot



The time series plot shows the player is improving over time. Therefore the distribution in the stem-and-leaf display is not a good indicator of how well the player will shoot in the future.

LO2-5, LO2-7

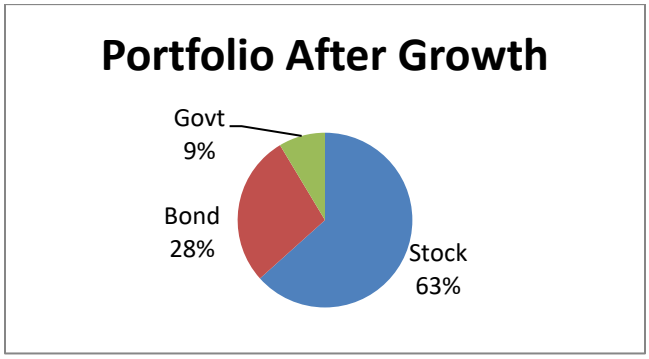
2.85 **a.** Stock funds: $60,000; bond funds: $30,000; govt. securities: $10,000



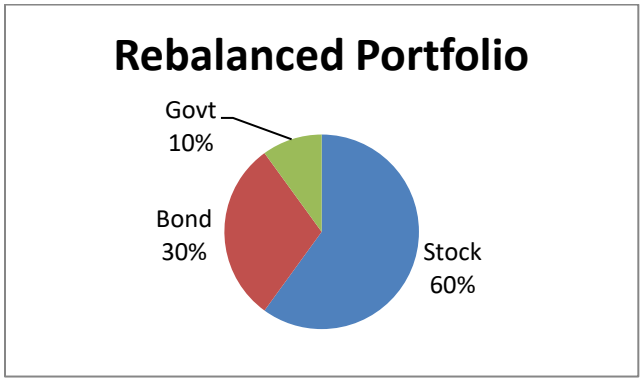
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b. Stock funds: $78,000 (63.36%); Bond funds: $34,500 (28.03%); Govt. securities: $10,600 (8.61%)



c. Stock funds: $73,860; Bond funds: $36,930; Govt. securities: $12,310



LO2-1

2.86 The graph indicates that Chevy trucks far exceed Ford and Dodge in terms of resale value, but the y-axis scale is misleading.

LO2-8

INTERNET EXERCISES

2.87 Answers will vary depending on which poll(s) the student refers to.

LO2-1 through LO2-8

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