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Chapter 2
Organizing and Graphing Data

Section 2.1

2.1 Data in their original form are often too large and unmanageable. It is easier to make sense of grouped data than ungrouped data and easier to make decisions and draw conclusions using grouped data.

2.2 The relative frequency for a category is obtained by dividing the frequency of that category by the sum of the frequencies of all categories. The percentage for a category is obtained by multiplying the relative frequency of that category by 100. Example 2–2 in the text is an example which shows how relative frequencies and percentages are calculated.

2.3 **a.**

Category	Frequency
Y	23
N	13
D	4

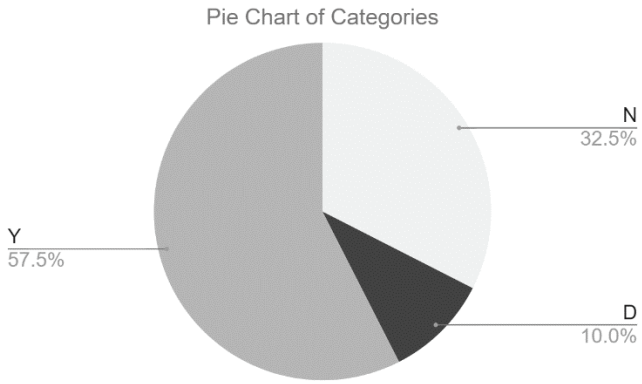
b.

Category	Relative Frequency	Percentage
Y	23/40 = 0.575	57.5
N	13/40 = 0.325	32.5
D	4/40 = 0.100	10.0

c. 57.5% of the elements belong to category Y.

d. 32.5 % + 10.0% = 42.5% of the elements belong to categories N or D.

e.



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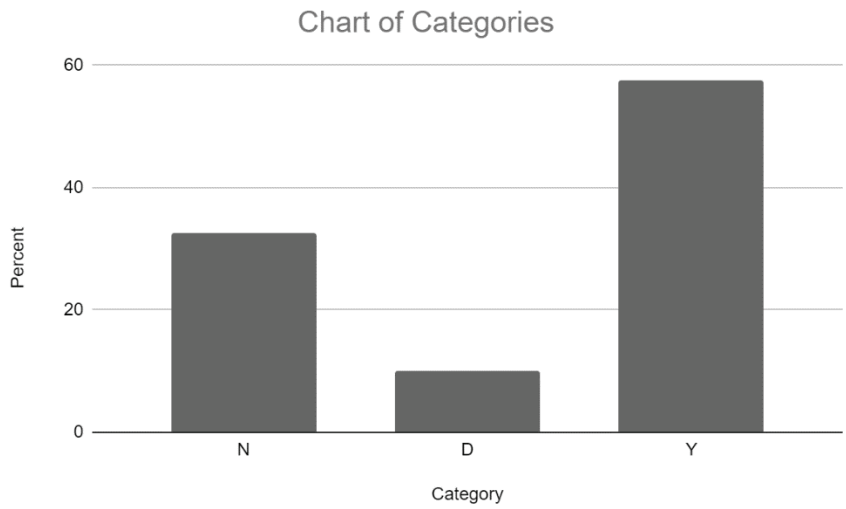

2.4 **a.**

Category	Frequency
G	14
B	21
I	5

b.

Category	Relative Frequency	Percentage
G	14/40 = 0.350	35.0
B	21/40 = 0.525	52.5
I	5/40 = 0.125	12.5

c. Thirty-five percent of the adults in this sample said that building casinos is good.

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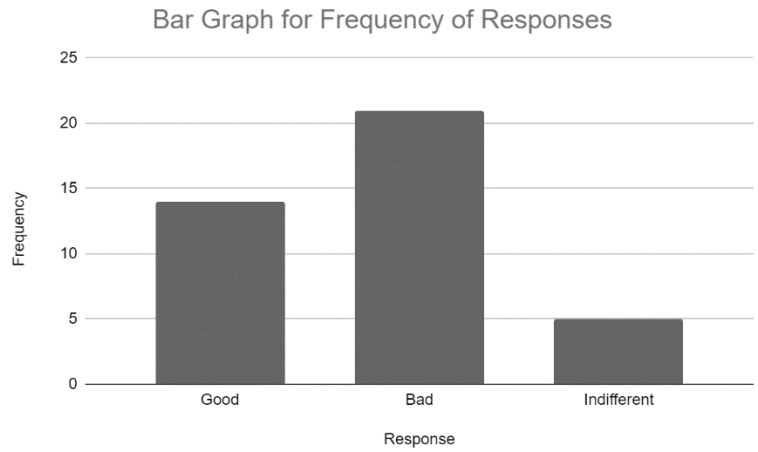
d. 52.5% + 12.5% = 65% of the adults in this sample said that building casinos is either bad or indifferent.

e.



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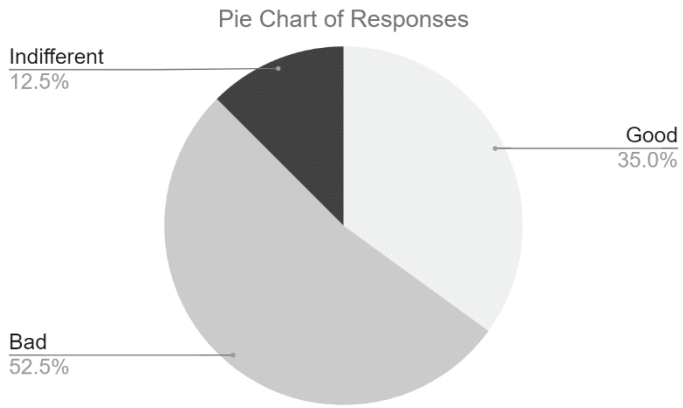


g.

2.5 **a.**

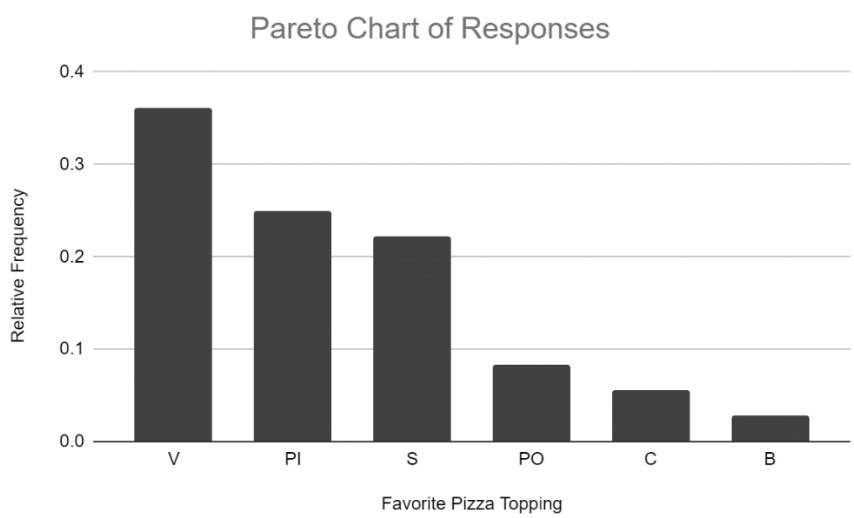
Pizza Topping	Frequency
PI	9
S	8
V	13
PO	3
B	1
C	2

b.

Pizza Topping	Relative Frequency	Percentage
PI	9/36 = 0.250	25.0
S	8/36 = 0.222	22.2
V	13/36 = 0.361	36.1
PO	3/36 = 0.083	8.3
B	1/36 = 0.028	2.8
C	2/36 = 0.056	5.6

c. V + PO + C = 36.1% + 8.3% + 5.6% = 50%
50% of the respondents mentioned vegetables and fruits, poultry, or cheese.

d.



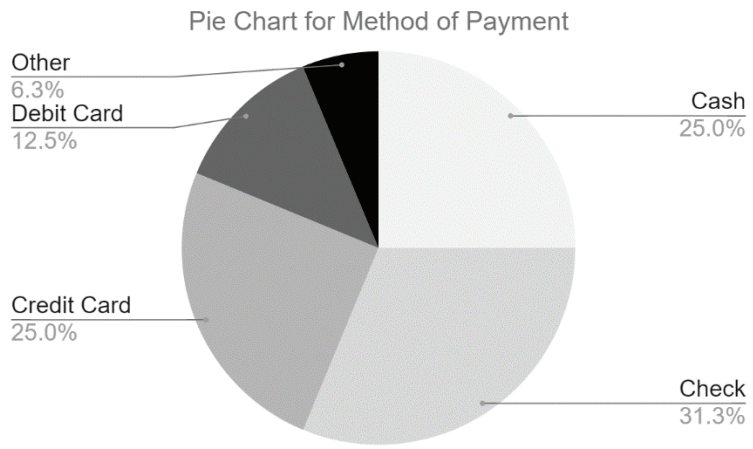
2.6 **a.**

Method of Payment	Frequency
C	4
CK	5
CC	4
D	2
O	1

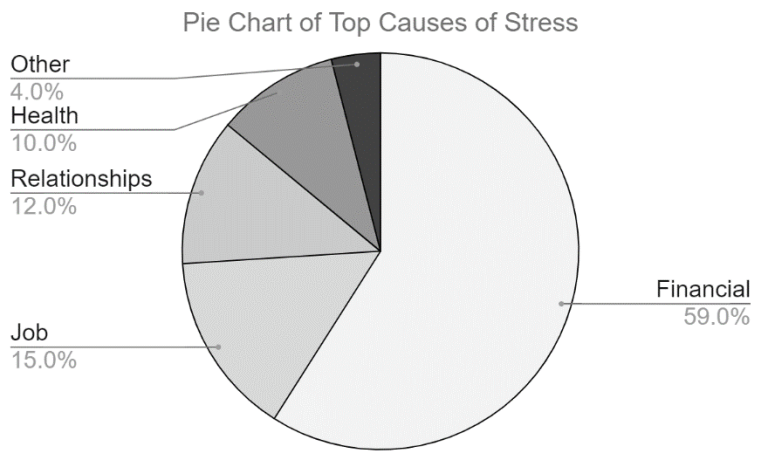
b.

Method of Payment	Relative Frequency	Percentage
C	4/16 = 0.250	25.0
CK	5/16 = 0.313	31.3
CC	4/16 = 0.250	25.0
D	2/16 = 0.125	12.5
O	1/16 = 0.063	6.3

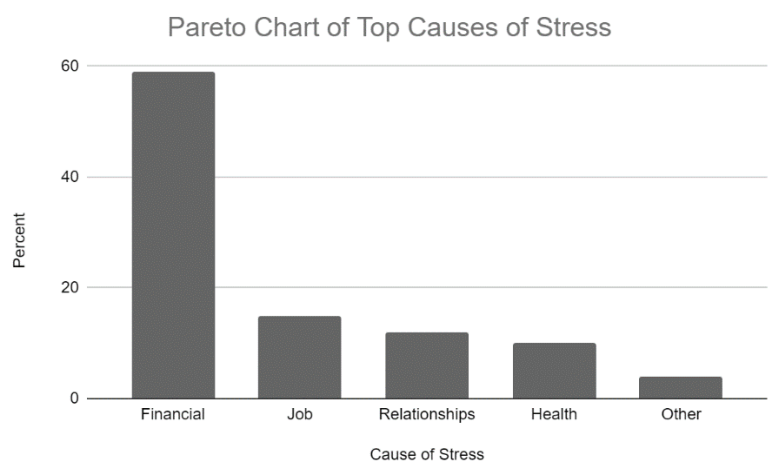
c.



2.7 a.



b.



<u>Section 2.2</u>

2.8 The three decisions that have to be made to group a data set in the form of a frequency distribution table are

1. The number of classes to be used to group the given data.
2. The width of each class.
3. The lower limit of the first class.

2.9 The relative frequency for a class is obtained by dividing the frequency of that class by the sum of frequencies of all classes. The percentage for a class is obtained by multiplying the relative frequency of that class by 100. Example 2–4 is an example that illustrates the calculation of relative frequencies and percentages.

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2.10 A data set that does not contain fractional values is usually grouped by using classes with limits. Example 2–4 is an example of the writing classes using limits method. A data set that contains fractional values is grouped by using the *less than* method. Example 2–5 is an example of the *less than* method. Single-valued classes are used to group a data set that contains only a few distinct (integer) values. Example 2–6 is an example of the single-valued classes method.

2.11 **a.** 31 + 78 + 49 + 81 + 117 + 13 = 369 customers were served.

b. Yes, each class has a width of 4.

Gallons of Gas (Class Limits)	Class Width	Class Midpoint
0 to less than 4	4	$\frac{0+4}{2}=2$
4 to less than 8	4	$\frac{4+8}{2}=6$
8 to less than 12	4	$\frac{8+12}{2}=10$
12 to less than 16	4	$\frac{12+16}{2}=14$
16 to less than 20	4	$\frac{16+20}{2}=18$
20 to less than 24	4	$\frac{20+24}{2}=22$

c.

Gallons of Gas	Number of Customers	Relative Frequency	Percentage
0 to less than 4	31	31/369 ≈ 0.084	8.4
4 to less than 8	78	78/369 ≈ 0.211	21.1
8 to less than 12	49	49/369 ≈ 0.133	13.3
12 to less than 16	81	81/369 ≈ 0.220	22.0
16 to less than 20	117	117/369 ≈ 0.317	31.7
20 to less than 24	13	13/369 ≈ 0.035	3.5

d. 22.0 + 31.7 + 3.5 = 57.2% of the customers purchased 12 gallons or more.

e. The number of customers who purchased 10 gallons or less cannot be determined exactly because 10 is not a boundary value.

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f.

Gallons of Gasoline	Cumulative Frequency	Cumulative Relative Frequency	Cumulative Percentage
0 to less than 4	31	31/369 = 0.084	8.4
0 to less than 8	31 + 78 = 109	109/369 = 0.295	29.5
0 to less than 12	31 + 78 + 49 = 158	158/369 = 0.428	42.8
0 to less than 16	31 + 78 + 49 + 81 = 239	239/369 = 0.648	64.8
0 to less than 20	31 + 78 + 49 + 81 + 117 = 356	356/369 = 0.965	96.5
0 to less than 24	31 + 78 + 49 + 81 + 117 + 13 = 369	1.000	100.0

2.12 a.

Class Limits
\$1 to \$200
\$201 to \$400
\$401 to \$600
\$601 to \$800
\$801 to \$1000
\$1001 to \$1200

b.

Class Limits	Class Midpoints
\$1 to \$200	\$100.5
\$201 to \$400	\$300.5
\$401 to \$600	\$500.5
\$601 to \$800	\$700.5
\$801 to \$1000	\$ 900.5
\$1001 to \$1200	\$1100.5

2.13 a.

Commuting Times	Frequency
0 to 9	2
10 to 19	14
20 to 29	14
30 to 39	13
40 to 49	7

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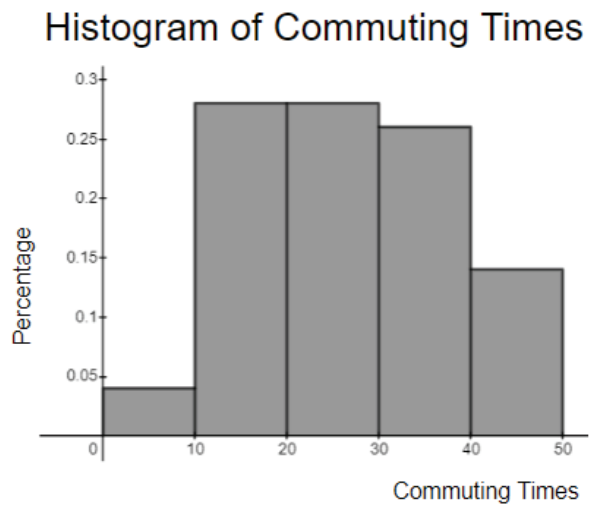
b.

Commuting Times	Frequency	Relative Frequency	Percentage
0 to 9	2	2/50 = 0.04	4
10 to 19	14	14/50 = 0.28	28
20 to 29	14	14/50 = 0.28	28
30 to 39	13	13/50 = 0.26	26
40 to 49	7	7/50 = 0.14	14

e.



d. 26% + 14% = 40% of the workers in the sample commute for 30 minutes or more.

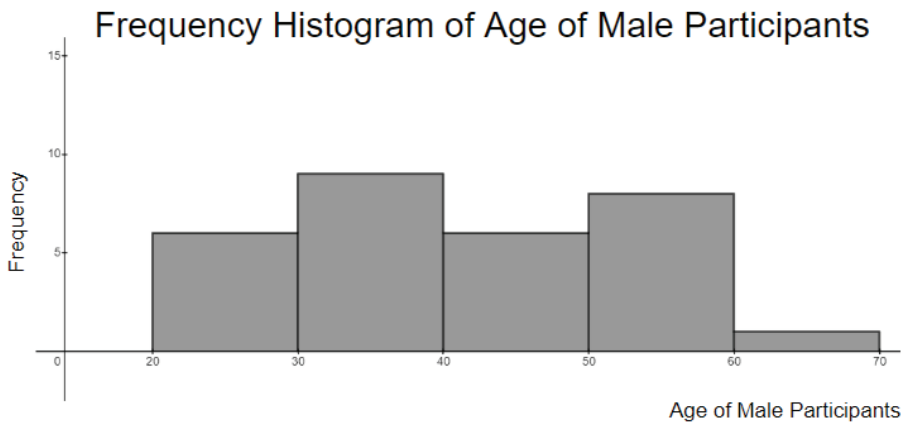
e.

Commuting Times	Cumulative Frequency	Cumulative Relative Frequency	Cumulative Percentage
0 to 9	2	2/50 = 0.04	4
10 to 19	2 + 14 = 16	16/50 = 0.32	32
20 to 29	2 + 14 + 14 = 30	30/50 = 0.60	60
30 to 39	2 + 14 + 14 + 13 = 43	43/50 = 0.86	86
40 to 49	2 + 14 + 14 + 13 + 7 = 50	50/50 = 1.00	100

2.14 **a.** and **b.**

Age	Frequency	Relative Frequency	Percentage
20 to 29	6	6/30 = 0.200	20.0
30 to 39	9	9/30 = 0.300	30.0
40 to 49	6	6/30 = 0.200	20.0
50 to 59	8	8/30 = 0.267	26.7
60 to 69	1	1/30 = 0.033	3.30

c.



d. 20% + 30% = 50% of the male participants are younger than 40 years of age.

2.15 **a.** and **b.**

Age	Frequency	Relative Frequency	Percentage
20 to 29	8	8/30 = 0.267	26.7
30 to 39	9	9/30 = 0.300	30.0
40 to 49	6	6/30 = 0.200	20.0
50 to 59	6	6/30 = 0.200	20.0
60 to 69	1	1/30 = 0.033	3.30

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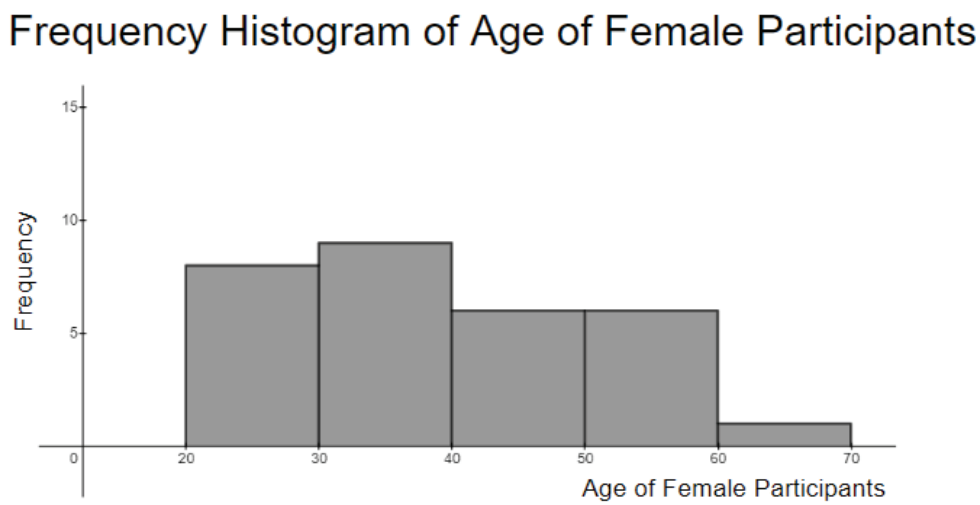
c.



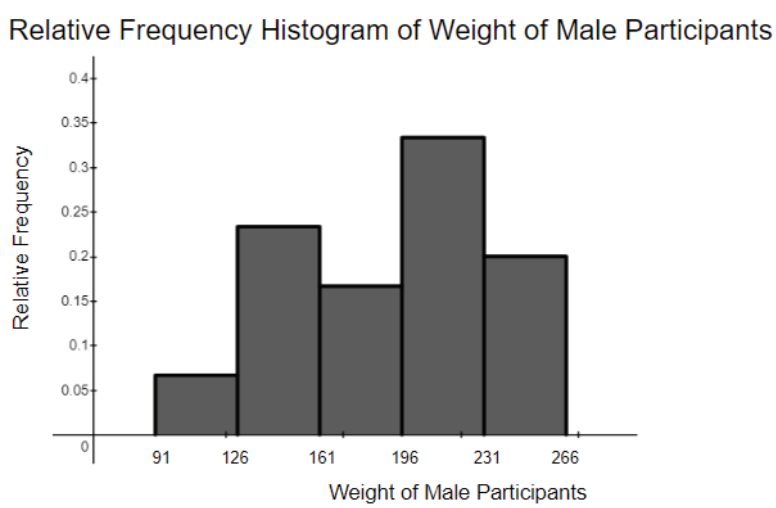
d. 26.7% + 30% = 56.7% of female participants are younger than 40 years of age.

e. The male and female age distributions are fairly similar; however, male ages are more spread out and older than the female ages.

2.16 **a.** and **b.**

Weight	Frequency	Relative Frequency	Percentage
91 to 125	2	2/30 = 0.067	6.7
126 to 160	7	7/30 = 0.233	23.3
161 to 195	5	5/30 = 0.167	16.7
196 to 230	10	10/30 = 0.333	33.3
231 to 265	6	6/30 = 0.200	20.0

c.

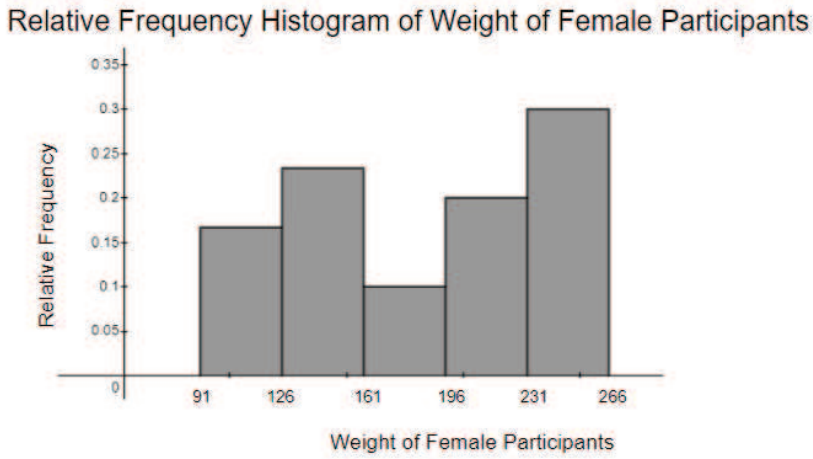


d. 6.7% + 23.3% = 30% of male participants weighed less than 161 pounds.

2.17 **a.** and **b.**

Weight	Frequency	Relative Frequency	Percentage
91 to 125	5	5/30 = 0.167	16.7
126 to 160	7	7/30 = 0.233	23.3
161 to 195	3	3/30 = 0.100	10.0
196 to 230	6	6/30 = 0.200	20.0
231 to 265	9	9/30 = 0.300	30.0

c.



d. 16.7% + 23.3% = 40% of female participants weighed less than 161 pounds.

e. The weight distributions were similar, but 10% more of the females had a weight below 161 pounds than did the males. The percentage above 195 pounds was about the same in both distributions, but of these more females fell in the 231 to 265 pounds range than did males.

2.18 **a.** and **b.**

Blood Glucose Level	Frequency	Relative Frequency	Percentage
75 to 89	5	5/30 = 0.167	16.7
90 to 104	7	7/30 = 0.233	23.3
105 to 119	8	8/30 = 0.267	26.7
120 to 134	7	7/30 = 0.233	23.3
135 to 149	3	3/30 = 0.100	10.0

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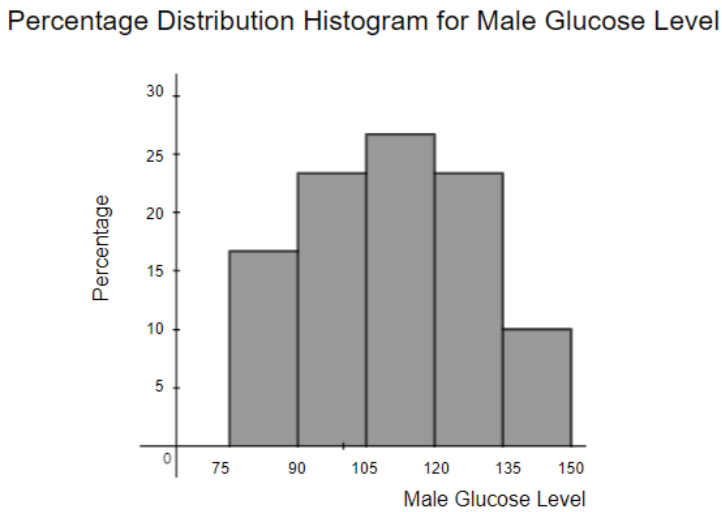
c.



d. 23.3% + 10% = 33.3% of male participants had a blood glucose level higher than 119.

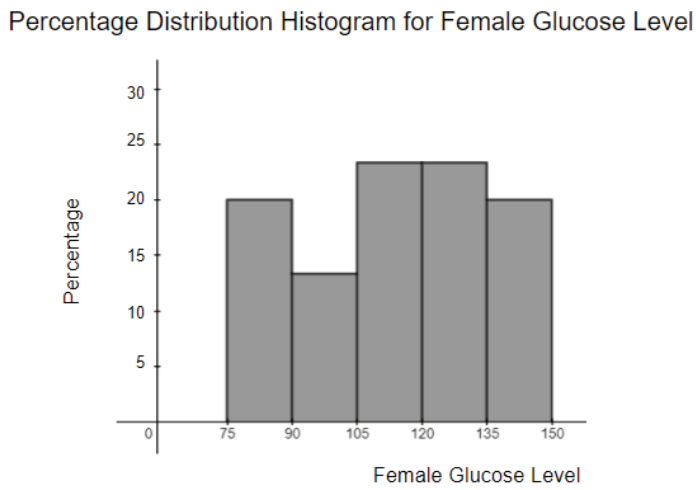
e.

Blood Glucose Level	Cumulative Frequency	Cumulative Relative Frequency	Cumulative Percentage
75 to 89	5	5/30 = 0.167	16.7
75 to 104	5 + 7 = 12	12/30 = 0.400	40.0
75 to 119	5 + 7 + 8 = 20	20/30 = 0.667	66.7
75 to 134	5 + 7 + 8 + 7 = 27	27/30 = 0.900	90.0
75 to 149	5 + 7 + 8 + 7 + 3 = 30	30/30 = 1.000	100.0

2.19 **a.** and **b.**

Blood Glucose Level	Frequency	Relative Frequency	Percentage
75 to 89	6	6/30 = 0.200	20.0
90 to 104	4	4/30 = 0.133	13.3
105 to 119	7	7/30 = 0.233	23.3
120 to 134	7	7/30 = 0.233	23.3
135 to 149	6	6/30 = 0.200	20.0

c.



d. 23.3% + 20.0% = 43.3% of female participants had a blood glucose level higher than 119.

e. Taking the center of both distributions to be the class 105 to 119, the shape of the left and right tails between the two distribution is swapped, meaning there are fewer females with blood glucose levels less than 105 than there are males with such glucose levels, and there are more females with blood glucose level greater than 119 than there are males with such blood glucose levels.

f.

Blood Glucose Level	Cumulative Frequency	Cumulative Relative Frequency	Cumulative Percentage
75 to 89	6	6/30 = 0.200	20.0
75 to 104	6 + 4 = 10	10/30 = 0.333	33.3
75 to 119	6 + 4 + 7 = 17	17/30 = 0.567	56.7
75 to 134	6 + 4 + 7 + 7 = 24	24/30 = 0.800	80.0
75 to 149	6 + 4 + 7 + 7 + 6 = 30	30/30 = 1.000	100.0

2.20 **a.** and **b.**

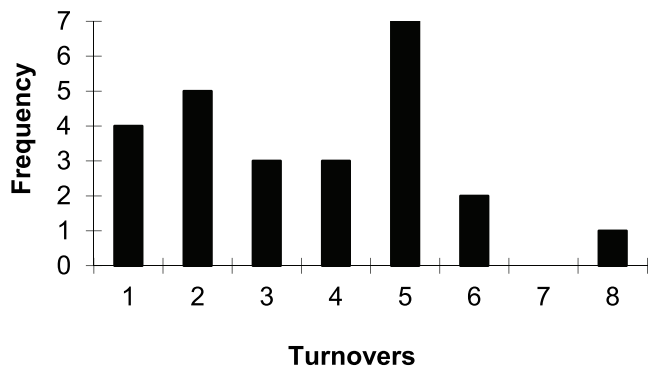
Home Runs	Frequency	Relative Frequency	Percentage
140 to less than 170	5	5/30 = 0.167	16.7
170 to less than 200	1	1/30 = 0.033	3.3
200 to less than 230	11	11/30 = 0.367	36.7
230 to less than 260	9	9/30 = 0.300	30.0
260 to less than 290	2	2/30 = 0.067	6.7
290 to less than 320	2	2/30 = 0.067	6.7

2.21 **a.** and **b.**

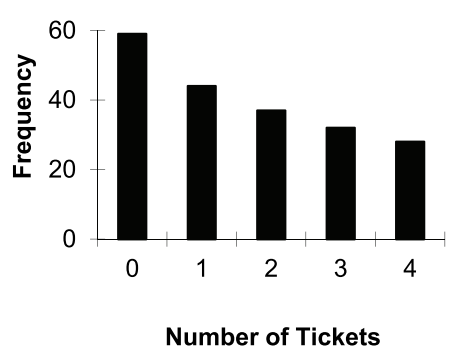
Turnovers	Frequency	Relative Frequency	Percentage
1	4	4/25 = 0.160	16.0
2	5	5/25 = 0.200	20.0
3	3	3/25 = 0.120	12.0
4	3	3/25 = 0.120	12.0
5	7	7/25 = 0.280	28.0
6	2	2/25 = 0.080	8.0
7	0	0/25 = 0.000	0.0
8	1	1/25 = 0.040	4.0

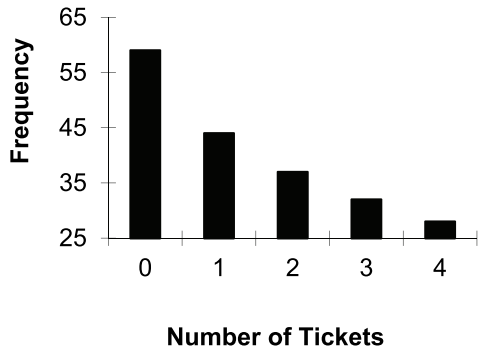
c. 3 + 7 = 10 games had four or five turnovers. The relative frequency is 10/25 = 0.400.

d.



2.21





The truncated graph exaggerates the difference in the number of students with different numbers of tickets.

Section 2.3

2.23 To prepare a **stem-and-leaf display** for a data set, each value is divided into two parts; the first part is called the *stem* and the second part is called the *leaf*. The stems are written on the left side of a vertical line and the leaves for each stem are written on the right side of the vertical line next to the corresponding stem. Example 2–9 is an example of a stem-and-leaf display.

2.24 The advantage of a stem-and-leaf display over a frequency distribution is that by preparing a stem-and-leaf display we do not lose information on individual observations. From a stem-and-leaf display we can obtain the original data. However, we cannot obtain the original data from a frequency distribution table. Consider the stem-and-leaf display from Example 2–8:

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

The data that were used to make this stem-and-leaf display are: 52, 50, 57, 65, 69, 61, 68, 64, 75, 79, 71, 72, 76, 79, 77, 71, 72, 80, 87, 81, 86, 83, 84, 87, 96, 93, 95, 92, 92, 98

2.25 The data that were used to make this stem-and-leaf display are: 218, 245, 256, 329, 367, 383, 397, 404, 427, 433, 471, 523, 537, 551, 563, 581, 592, 622, 636, 647, 655, 678, 689, 810, 841

2.26

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

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

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2.27 a.

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

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

b.

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

c. Answers will vary, but the split stem-and-leaf display seems to better discern differences in the data in the range 30 – 70.

2.28 a.

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

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

b.

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

2.29

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

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

2.30 a.

2	58							
3	20	45						
4	30	38	60	90				
5	05	30	38	50	60	65	70	75
6	10	17	20	35	38			
7	02	05	06	20	21	28	65	87
8	40	45	68	70	90			
9	57	68						

b.

2-4	58	*	20	45	*	30	38	60	90								
5-6	05	30	38	50	60	65	70	75	*	10	17	20	35	38			
7-9	02	05	06	20	21	28	65	87	*	40	45	68	70	90	*	57	68

Section 2.4

2.31 In order to prepare a **dotplot**, first we draw a horizontal line with numbers that cover the given data set. Then we place a dot above the value on the number line that represents each measurement in the data set. Example 2–12 illustrates this procedure.

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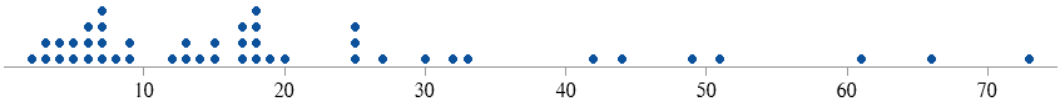
2.32 The benefits of a dot plot is that it is quick to form and it can illustrate where data points in a set naturally cluster.

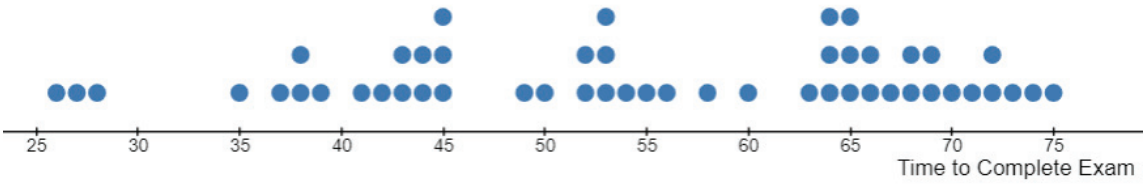
2.33

2.34

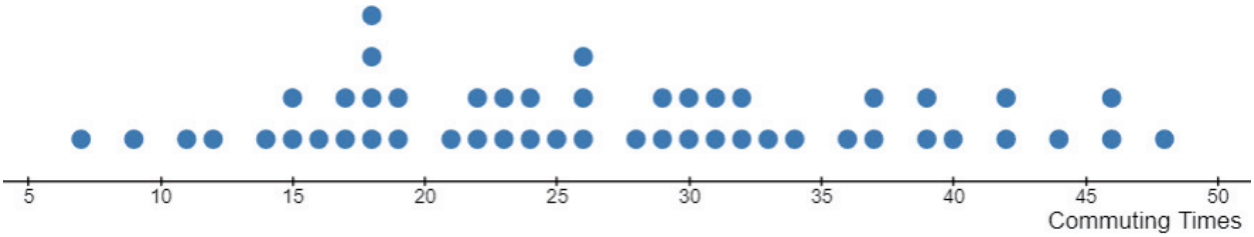


Number of South Carolina Vehicle Fatalities

2.35



2.36



2.37

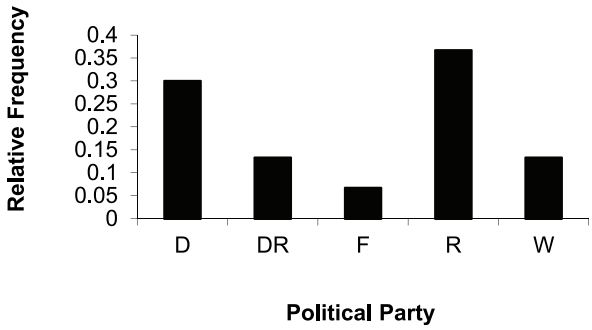
2019 NFL Quarterback Ages

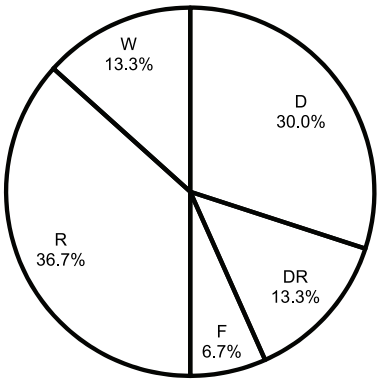
<u>Supplementary Exercises</u>

2.38 **a.** and **b.**

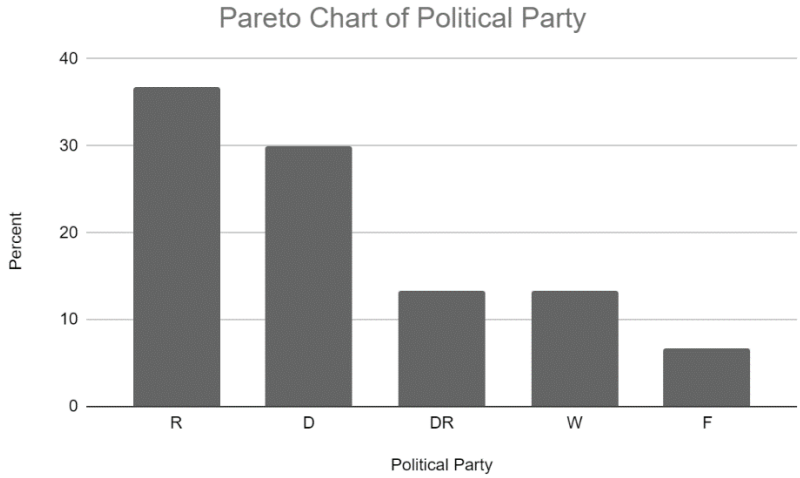
Political Party	Frequency	Relative Frequency	Percentage
D	9	9/30 = 0.300	30.0
DR	4	4/30 = 0.133	13.3
F	2	2/30 = 0.067	6.7
R	11	11/30 = 0.367	36.7
W	4	4/30 = 0.133	13.3

c.





d.

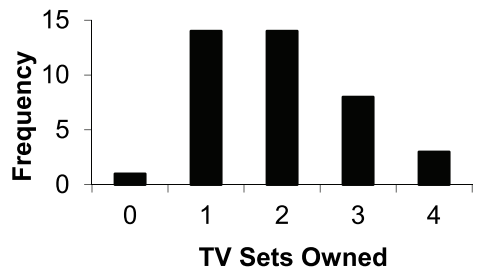


e. 13.3% of these presidents were Whigs.

2.39 **a.** and **b.**

TV sets owned	Frequency	Relative Frequency	Percentage
0	1	1/40 = 0.025	2.5
1	14	14/40 = 0.350	35.0
2	14	14/40 = 0.350	35.0
3	8	8/40 = 0.200	20.0
4	3	3/40 = 0.075	7.5

c.

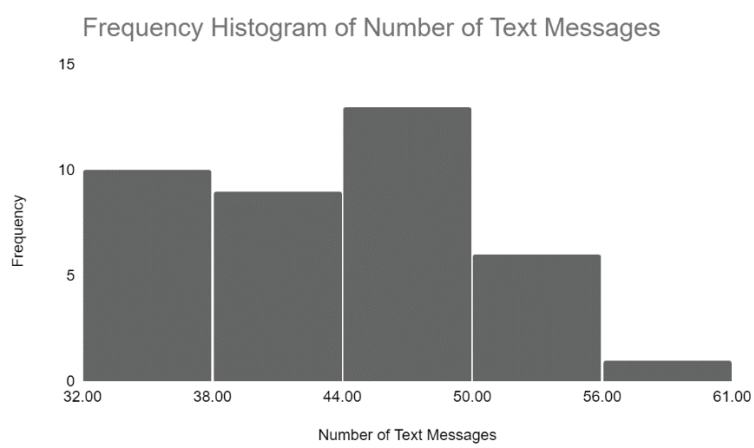


d. 35.0% + 20.0% + 7.5% = 62.5% of the households own two or more television sets.

2.40 **a.** and **b.**

Number of Text Messages	Frequency	Relative Frequency	Percentage
32−37	10	10/40 = 0.250	25.0
38−43	9	9/40 = 0.225	22.5
44−49	13	13/40 = 0.325	32.5
50−55	6	6/40 = 0.150	15.0
56−61	2	2/40 = 0.050	5.0

c.



d. On 32.5% + 15.0% + 5.0% = 52.5% of the 40 days, the student sent more than 44 text messages.

e.

Number of Text Messages	Cumulative Frequency	Cumulative Relative Frequency	Cumulative Percentage
32−37	10	10/40 = 0.250	25.0
38−43	19	19/40 = 0.475	47.5
44−49	32	32/40 = 0.800	80.0
50−55	38	38/40 = 0.950	95.0
56−61	40	40/40 = 1.000	100.0

2.41 **a.** and **b.**

Number of Orders	Frequency	Relative Frequency	Percentage
23 – 29	4	4/30 = 0.133	13.3
30 – 36	9	9/30 = 0.300	30.0
37 – 43	6	6/30 = 0.200	20.0
44 – 50	8	8/30 = 0.267	26.7
51 – 57	3	3/30 = 0.100	10.0

c. For 20.0% + 26.7% + 10.0% = 56.7% of the hours in this sample, the number of orders was more than 36.

d.

Number of Orders	Cumulative Frequency	Cumulative Relative Frequency	Cumulative Percentage
23 – 29	4	4/30 = 0.133	13.3
30 – 36	13	13/30 = 0.433	43.3
37 – 43	19	19/30 = 0.633	63.3
44 – 50	27	27/30 = 0.900	90.0
51 – 57	30	3/30 = 1.000	100.0

2.42 **a.** and **b.**

Concession (dollars)	Frequency	Relative Frequency	Percentage
0 to less than 6	9	9/30 = 0.300	30.0
6 to less than 12	10	10/30 = 0.333	33.3
12 to less than 18	5	5/30 = 0.167	16.7
18 to less than 24	4	4/30 = 0.133	13.3
24 to less than 30	2	2/30 = 0.067	6.7

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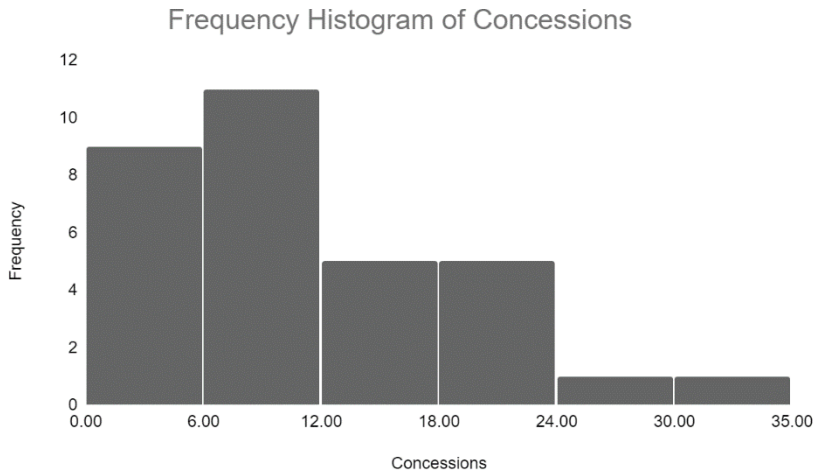
c.



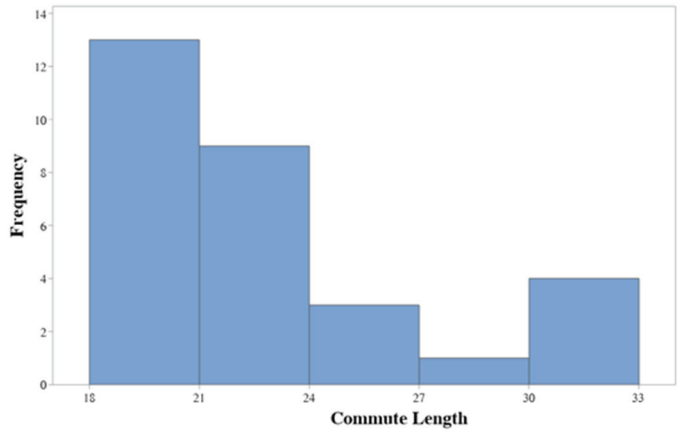
d.

Concession (dollars)	Cumulative Frequency	Cumulative Relative Frequency	Cumulative Percentage
0 to less than 6	9	9/30 = 0.300	30.0
6 to less than 12	19	19/30 = 0.633	63.3
12 to less than 18	24	24/30 = 0.800	80.0
18 to less than 24	28	28/30 = 0.933	93.3
24 to less than 30	30	30/30 = 1.000	100.0

2.43 **a.** and **b.**

Commute Length (in minutes)	Frequency	Relative Frequency	Percentage
18 to less than 21	13	13/30 = 0.433	43.3
21 to less than 24	9	9/30 = 0.300	30.0
24 to less than 27	3	3/30 = 0.100	10.0
27 to less than 30	1	1/30 = 0.033	3.3
30 to less than 33	4	4/30 = 0.133	13.3

c.



d.

Commute Length (in minutes)	Cumulative Frequency	Cumulative Relative Frequency	Cumulative Percentage
18 to less than 21	13	13/30 = 0.433	43.3
21 to less than 24	22	22/30 = 0.733	73.7
24 to less than 27	25	25/30 = 0.833	83.3
27 to less than 30	26	26/30 = 0.867	86.7
30 to less than 33	30	30/30 = 1.000	100

2.44

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

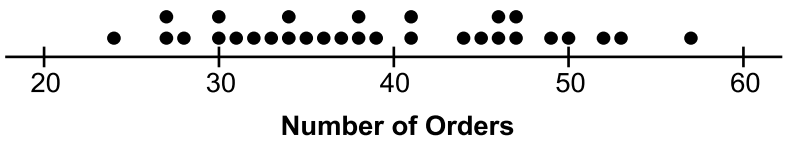
2.45

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

2.46

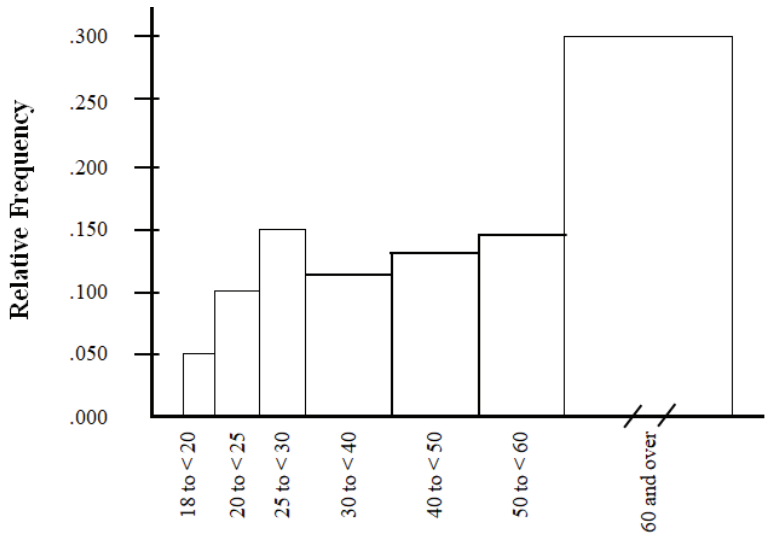
3	2 3 3 4 5 5 7 7 7 7 8 9
4	0 1 1 2 2 2 3 4 4 5 5 5 7 7 7 7 7 8 8 9
5	0 0 1 2 3 4 9
6	1

2.47



2.48 **a.**

Age	Frequency	Relative Frequency
18 to less than 20	7	7/117 = 0.060
20 to less than 25	12	12/117 = 0.103
25 to less than 30	18	18/117 = 0.154
30 to less than 40	14	14/117 = 0.120
40 to less than 50	15	15/117 = 0.128
50 to less than 60	16	16/117 = 0.137
60 and over	35	35/117 = 0.299



b. This histogram is misleading because the class widths differ.

c. If you were to change the frequency distribution so that the class widths were equal, the resulting histogram would give a clearer picture.

2.49 **a.** Using Sturge's formula:

$$c = 1 + 3.3\log n = 1 + 3.3\log 135$$
$$= 1 + 3.3(2.13033377)$$
$$= 1 + 7.03 = 8.03 \simeq 8$$

b. Approximate class width $= \dfrac{\text{Largest value} - \text{smallest value}}{\text{Number of classes}} = \dfrac{53-20}{8} = 4.125.$

Use a class width of 5.

2.50 **a.** The top money winners on the men's tour tend to make more money per tournament than those on the women's tour. Earnings on the men's tour begin at $2300, and more of the data points are toward the higher end of the scale. Earnings on the women's tour begin at $800, and more of the data points are toward the lower end of the scale.

b. Typical earnings per tournament played for the women's tour would be around $2500; typical earnings per tournament played for the men's tour would be around $3650.

c. The data do not appear to have similar spreads for the two tours. Earnings on the men's tour begin at $2300, the largest grouping is between $2300 and $4800, and go up to $9500. Earnings on the women's tour begin at $800, the largest grouping is between $1100 and $2600, and only go up to $7500.

d. On the women's tour, the $7500 earnings level appears to be an outlier; on the men's tour, both the $8700 and $9500 earnings levels appear to be outliers.

2.51 **a.** Answers will vary.

b. **i.**

9	9					
10	2	8	8			
11	0	4	5	5	6	9
12	3	3	3	5	8	8
13	2	3	8			
14	6	7	7	8		
15	5	9				
16	1	2	4	8		
17	4	4	5	9	9	9
18	0	2	3	9		
19	3	3	5			
20	2	4				

ii. The display shows a bimodal distribution, due to the presence of both females and males in the sample. The males tend to be heavier, so their weights are concentrated in the larger values, while the females' weights are found primarily in the smaller values.

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c.

Females							Males					
					9	9						
			8	8	2	10						
9	6	5	5	4	0	11						
8	8	5	3	3	3	12						
					3	13	2	8				
			8	7	6	14	7					
					5	15	9					
					4	16	1	2	8			
						17	4	4	5	9	9	9
						18	0	2	3	9		
						19	3	3	5			
						20	2	4				

Males are heavier than females. Females concentrate around smaller stems, but males concentrate among higher stems.

Self-Review Test

1. An **ungrouped data set** contains information on each member of a sample or population individually. The first part of Example 2–1 in the text, listing the responses of each of the 30 employees, is an example of ungrouped data. Data presented in the form of a frequency table are called **grouped data**. Table 2.4 in the solution of Example 2–1 is an example of grouped data.

2. **a.** 5 **b.** 7 **c.** 17 **d.** 13 **e.** 90 **f.** 0.3

3. A histogram that is identical on both sides of its central point is called a **symmetric histogram**. A histogram that is **skewed to the right** has a longer tail on the right side, and a histogram that is **skewed to the left** has a longer tail on the left side. Figure 2.9 in the text provides graphs of symmetric histograms, Figure 2.10a displays a histogram skewed to the right, and Figure 2.10b displays a histogram that is skewed to the left.

4. **a.**

Net Worth	Frequency
M	12
L	18
N	6

b.

Net Worth	Relative Frequency	Percentage
M	12/36 = 0.333	33.3
L	18/36 = 0.500	50.0
N	6/36 = 0.167	16.7

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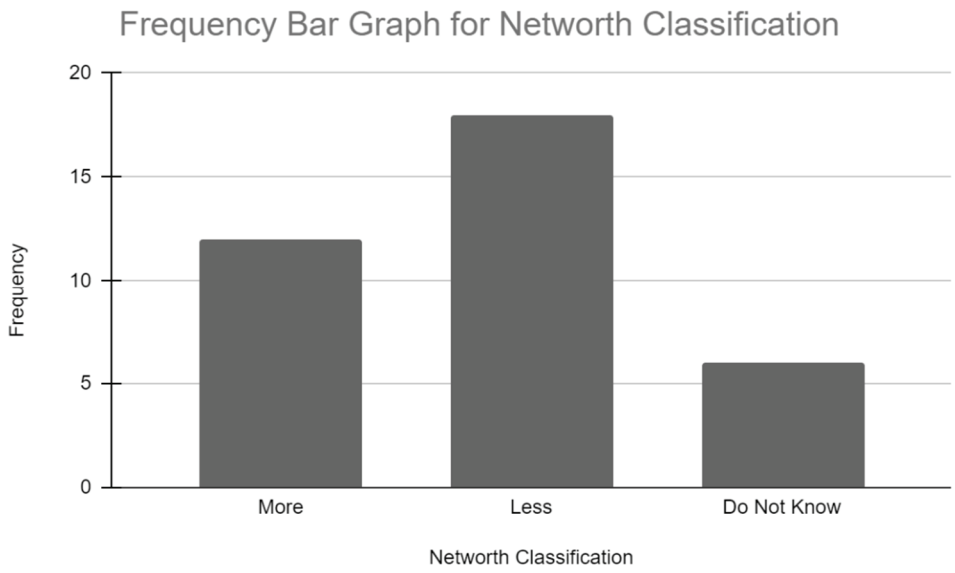
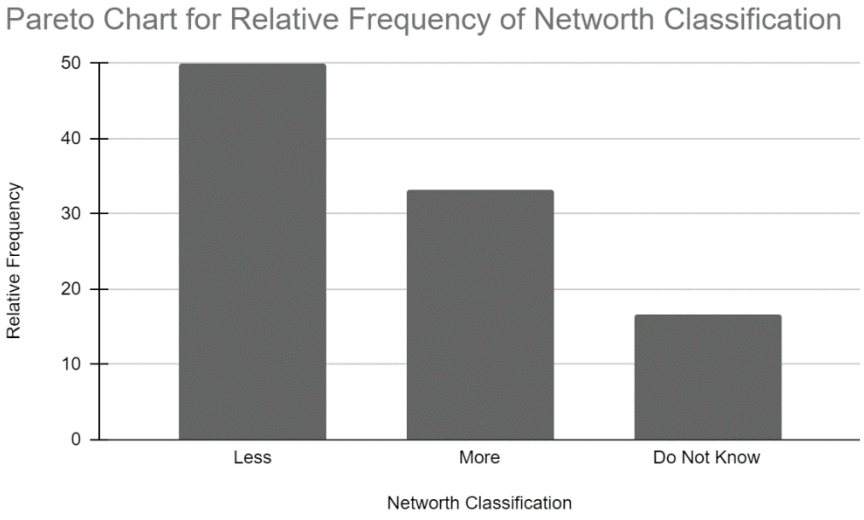
c. 18/36 = 50% of senior citizens claim to have net worth less than $200,000.

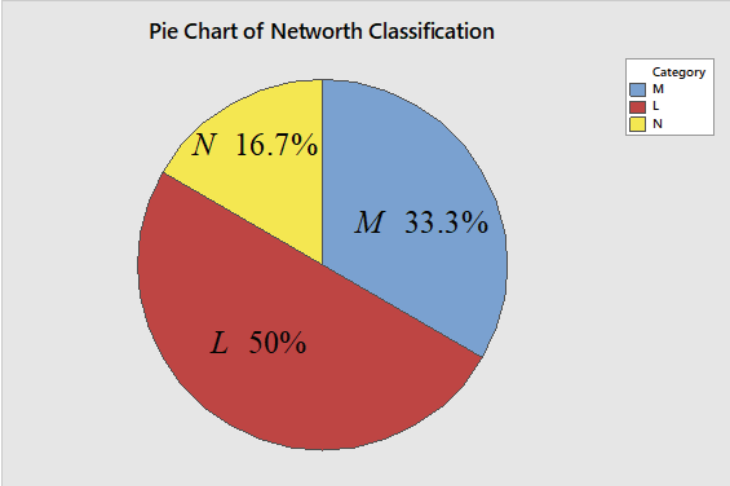
d.



e.



f.



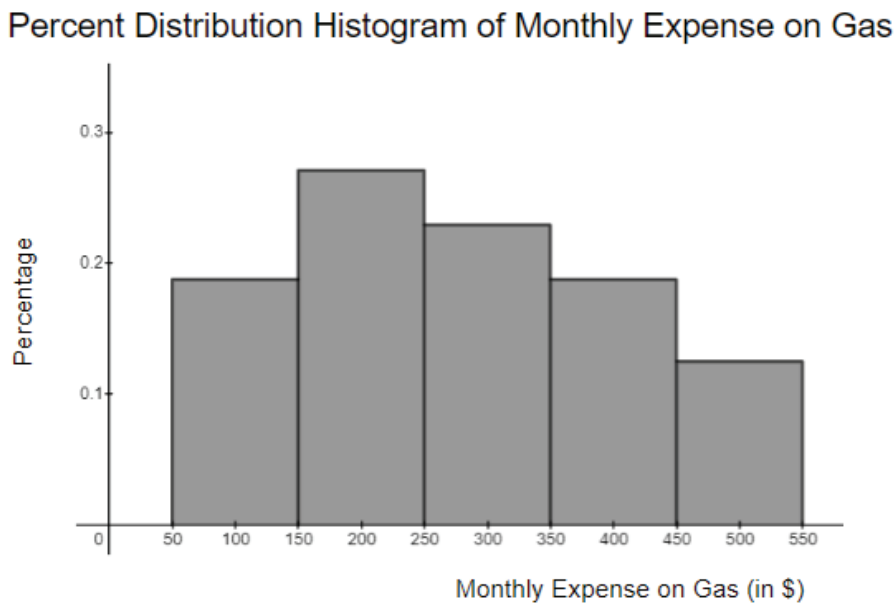
5 **a.**

Monthly Expense on Gas (in dollars)	Frequency
50 to 149	9
150 to 249	13
250 to 349	11
350 to 449	9
450 to 549	6

b.

Monthly Expense on Gas (in dollars)	Relative Frequency	Percentage
50 to 149	9/48 = 0.188	18.8
150 to 249	13/48 = 0.271	27.1
250 to 349	11/48 = 0.229	22.9
350 to 449	9/48 = 0.188	18.8
450 to 549	6/48 = 0.125	12.5

c.



d. 18.8% + 12.5% = 31.3% of car owners in this sample spent $350 or more on gas per month.

e.

Monthly Expense on Gas	Cumulative Frequency	Cumulative Relative Frequency	Cumulative Percentage
50 to 149	9	9/48 = 0.188	18.8
150 to 249	9 + 13 = 22	22/48 = 0.458	45.8
250 to 349	9 + 13 + 11 = 33	33/48 = 0.688	68.8
350 to 449	9 + 13 + 11 + 9 = 42	42/48 = 0.875	87.5
450 to 549	9 + 13 + 11 + 9 + 6 = 48	48/48 = 1.000	100.0

6. a.

Shopping Expense (in dollars)	Frequency
20 to less than 60	6
60 to less than 100	8
100 to less than 140	7
140 to less than 180	5
180 to less than 220	4

b. The width of each class is 40 dollars.

c.

Shopping Expense (in dollars)	Relative Frequency	Percentage
20 to less than 60	6/30 = 0.200	20.0
60 to less than 100	8/30 = 0.267	26.7
100 to less than 140	7/30 = 0.233	23.3
140 to less than 180	5/30 = 0.167	16.7
180 to less than 220	4/30 = 0.133	13.3

d. 20% + 26.7% + 23.3% = 70% of these customers spent less than $140 at this grocery store.

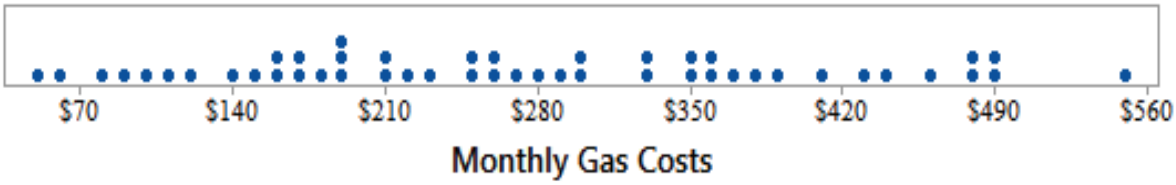
e.

f.

Shopping Expense (in dollars)	Cumulative Frequency	Cumulative Relative Frequency	Cumulative Percentage
20 to less than 60	6	6/30 = 0.200	20.0
60 to less than 100	6 + 8 = 14	14/30 = 0.467	46.7
100 to less than 140	6 + 8 + 7 = 21	21/30 = 0.700	70.0
140 to less than 180	6 + 8 + 7 + 5 = 26	26/30 = 0.867	86.7
180 to less than 220	6 + 8 + 7 + 5 + 4 = 30	30/30 = 1.000	100.0

7.

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

8. 30 33 37 42 44 46 47 49 51 53 53 56 60 67 67 71 79

9.