Elementary Statistics 2nd edition Navidi Solutions Manual

SKU: 9781259345296-SOLUTIONS

Chapter 2: Graphical Summaries of Data

Section 2.1 Exercises

Exercises 1 – 4 are the Check Your Understanding exercises located within the section. Their answers are found on pages 48 and 49.

Understanding the Concepts

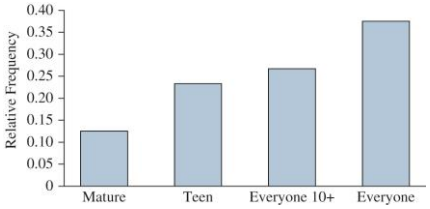
5. frequency
6. relative frequency
7. pareto chart
8. pie chart
9. False. In a frequency distribution, the sum of all frequencies equals the total number of observations.
10. True
11. True
12. False. In bar graphs and Pareto charts, the heights of the bars represent the frequencies or relative frequencies.

Practicing the Skills

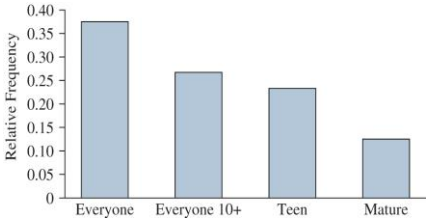
13. **(A)** Meat, poultry, fish, and eggs
(B) False ($450 < $550)
(C) True ($1300 > $1000)

14. **(A)** Type O
(B) False ($\frac{70}{150} = 46.7\%$)
(C) True

15. **(A)**

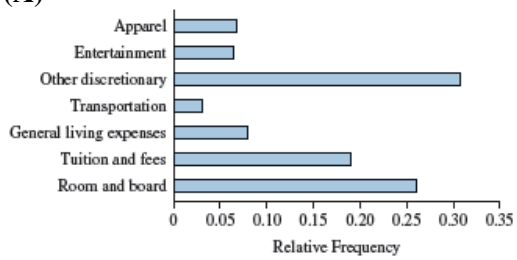


(B)

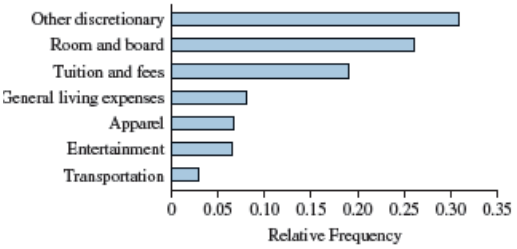


(C) Everyone (E)
(D) False
(E) True (12.5% < 20%)

16. **(A)**



(B)

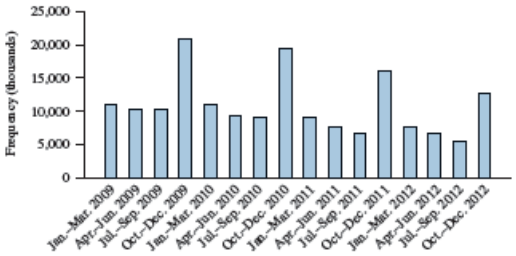


(C) Other discretionary
(D) 8% + 26% + 3% = 37%

17. **(A)** Families and individuals, Businesses, Governments
(B) Produced at home
(C) No, Produced at home is.
(D) Yes

18. **(A)** The game
(B) True
(C) False (men < women)
(D) True (both are about 0.65)

19. **(A)**

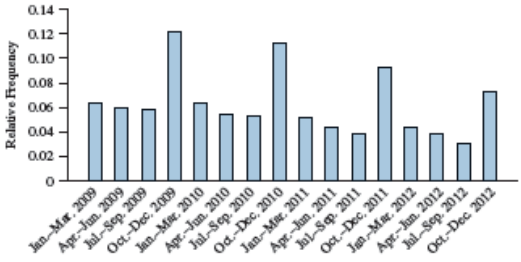


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(B)

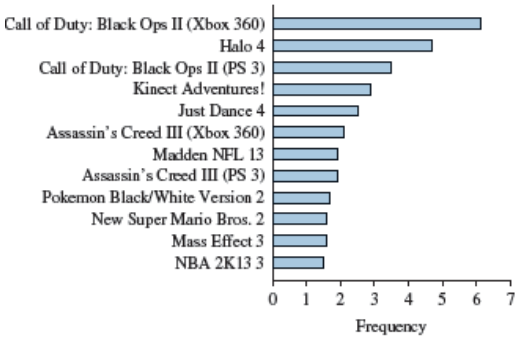
Quarter	Relative Frequency
Jan.–Mar. 2009	0.064
Apr.–Jun. 2009	0.059
Jul.–Sep. 2009	0.059
Oct.–Dec. 2009	0.122
Jan.–Mar. 2010	0.063
Apr.–Jun. 2010	0.055
Jul.–Sep. 2010	0.053
Oct.–Dec. 2010	0.113
Jan.–Mar. 2011	0.052
Apr.–Jun. 2011	0.044
Jul.–Sep. 2011	0.038
Oct.–Dec. 2011	0.089
Jan.–Mar. 2012	0.045
Apr.–Jun. 2012	0.039
Jul.–Sep. 2012	0.031
Oct.–Dec. 2012	0.074

(C)



(D) True

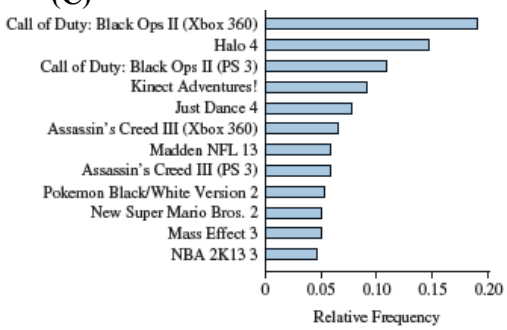
20. (A)



(B)

Game Platform	Relative Frequency
Call of Duty: Black Ops II (Xbox 360)	0.191
Halo 4 (Xbox 360)	0.147
Call of Duty: Black Ops II (PS 3)	0.109
Kinect Adventures! (Xbox 360)	0.091
Just Dance 4 (Wii)	0.078
Assassin's Creed III (Xbox 360)	0.066
Madden NFL 13 (Xbox 360)	0.059
Assassin's Creed III (PS 3)	0.059
Pokemon Black/White Version 2 (DS)	0.053
New Super Mario Bros. 2 (3DS)	0.050
Mass Effect 3 (Xbox 360)	0.050
NBA 2K13 3 (Xbox 360)	0.047

(C)

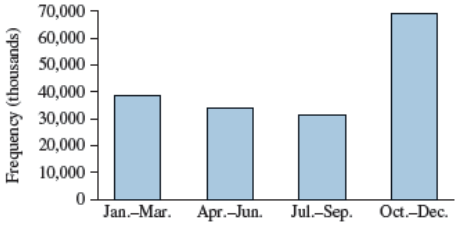


(D) True $\left(\frac{9.6}{32} = 30\% \right) > 20\%$

21. (A)

Quarter	Frequency (thousands)
Jan.–Mar.	38,591
Apr.–Jun.	33,916
Jul.–Sep.	31,183
Oct.–Dec.	68,513

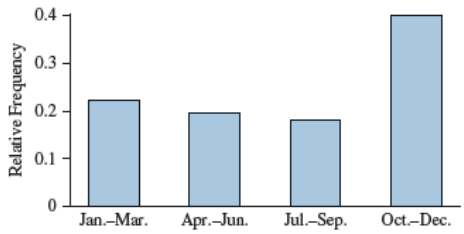
(B)



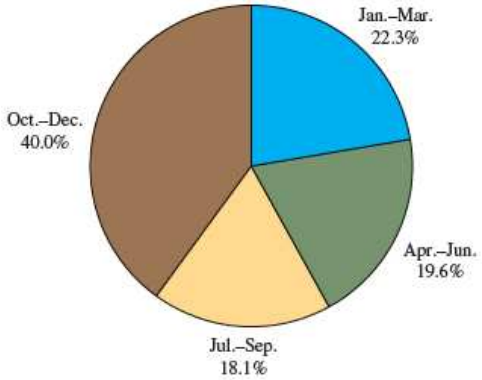
(C)

Quarter	Relative Frequency
Jan.–Mar.	0.224
Apr.–Jun.	0.197
Jul.–Sep.	0.181
Oct.–Dec.	0.398

(D)



(E)

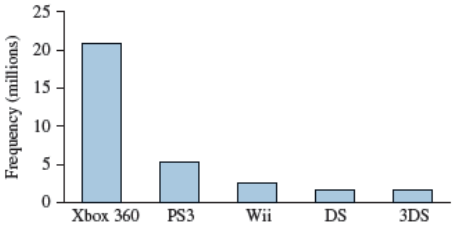


(F) False $\left(\frac{68,513}{172,203} = 39.8\% \right) < 50\%$

22. (A)

Platform	Frequency (millions)
Xbox 360	20.8
PS3	5.4
Wii	2.5
DS	1.7
3DS	1.6

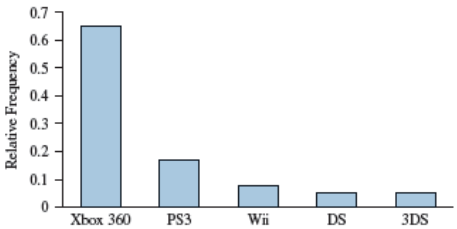
(B)



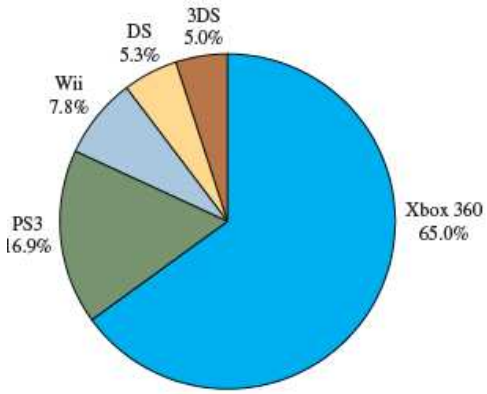
(C)

Platform	Relative Frequency
Xbox 360	0.650
PS3	0.169
Wii	0.078
DS	0.053
3DS	0.050

(D)

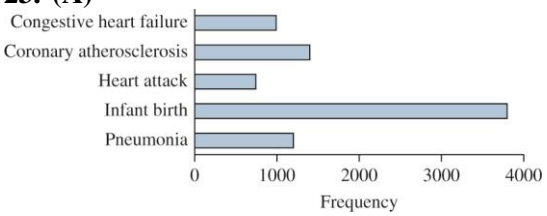


(E)



(F) True (65% > 50%)

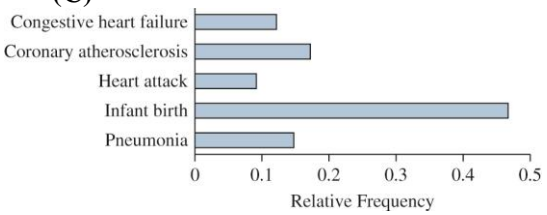
23. (A)



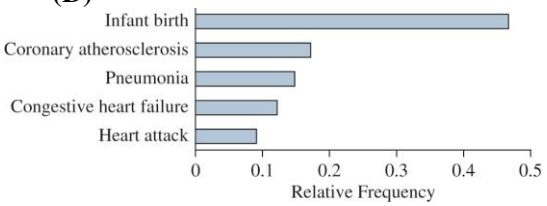
(B)

Reason	Relative Frequency
Congestive heart failure	0.122
Coronary atherosclerosis	0.172
Heart attack	0.091
Infant birth	0.467
Pneumonia	0.148

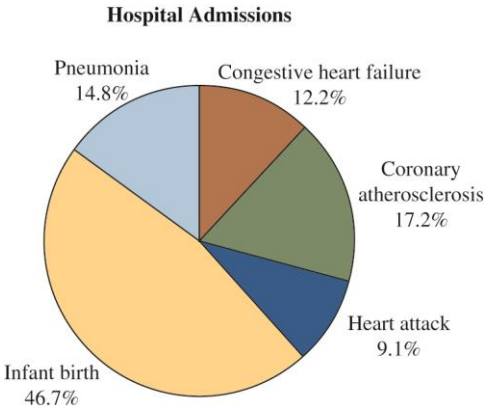
(C)



(D)

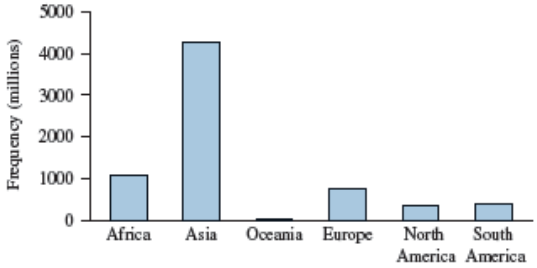


(E)



(F) True. (3800 > 3134)

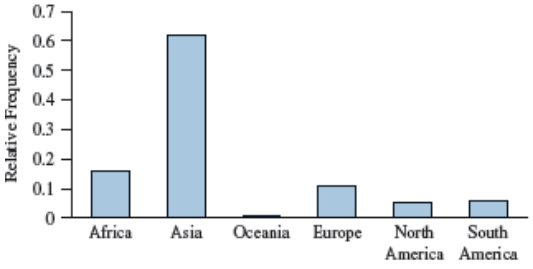
24. (A)



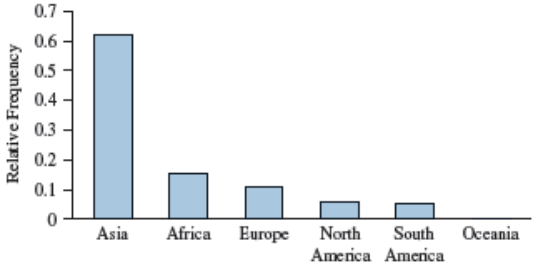
(B)

Continent	Relative Frequency
Africa	0.156
Asia	0.621
Oceania	0.005
Europe	0.108
North America	0.051
South America	0.058

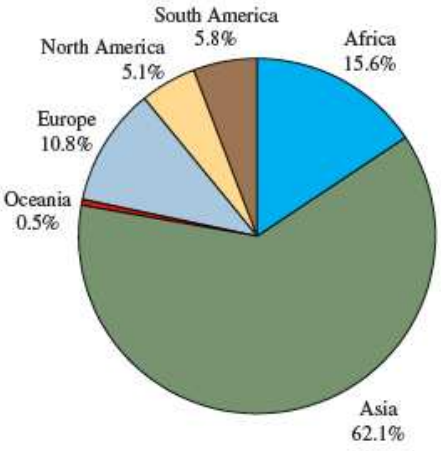
(C)



(D)



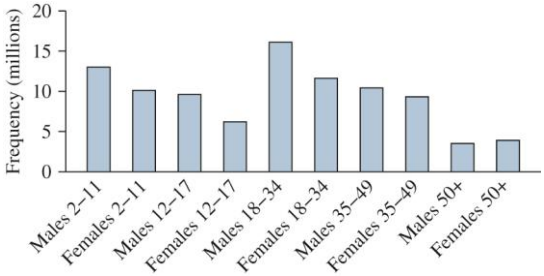
(E)



(F) True. 62.1% > 50%

(G) False. 10.8% < 10.9%

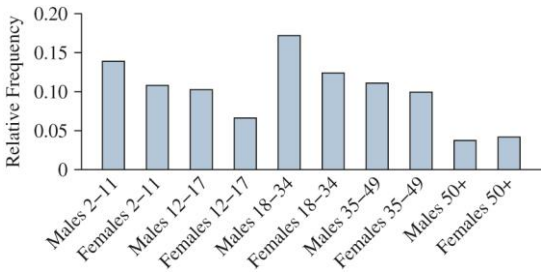
25. (A)



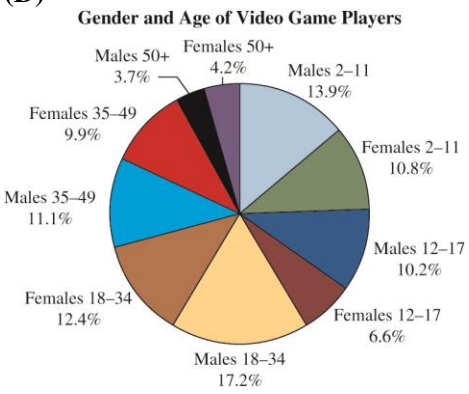
(B)

Gender and Age Group	Relative Frequency
Males 2–11	0.139
Females 2–11	0.108
Males 12–17	0.102
Females 12–17	0.066
Males 18–34	0.172
Females 18–34	0.124
Males 35–49	0.111
Females 35–49	0.099
Males 50+	0.037
Females 50+	0.042

(C)



(D)

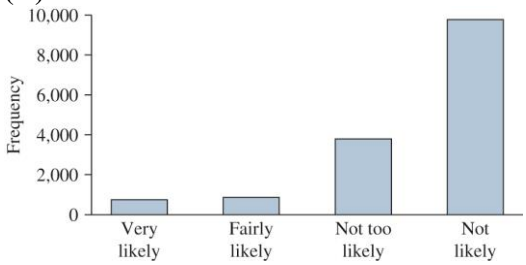


(E) True. (56.1% > 50%)

(F) True. 43.9% are females

(G) 0.289

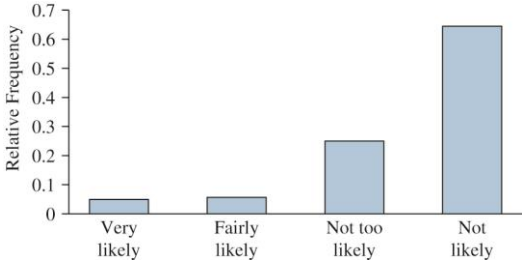
26. (A)



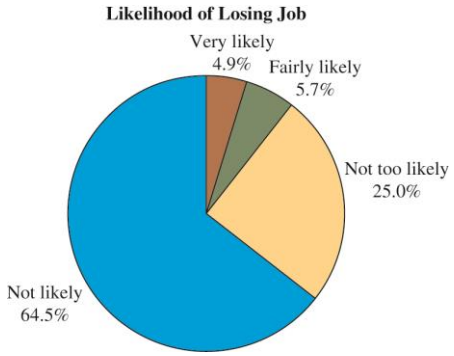
(B)

Response	Relative Frequency
Very likely	0.049
Fairly likely	0.057
Not too likely	0.250
Not likely	0.645

(C)



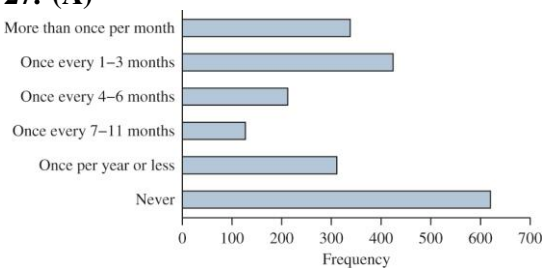
(D)



(E) True. (64.5% > 50%)

(F) 0.106

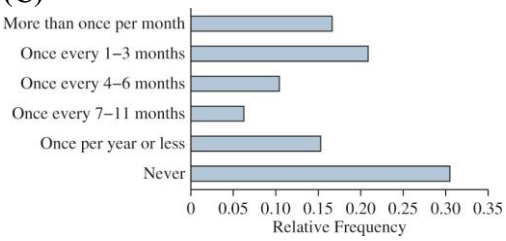
27. (A)



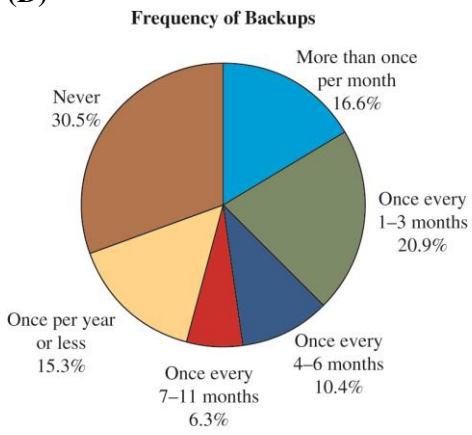
(B)

Response	Relative Frequency
More than once per month	0.166
Once every 1–3 months	0.209
Once every 4–6 months	0.104
Once every 7–11 months	0.063
Once per year or less	0.153
Never	0.305

(C)



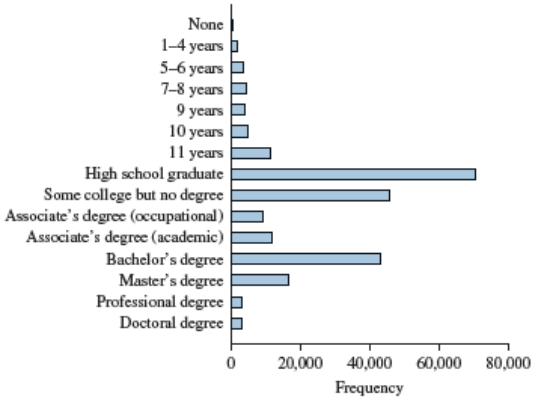
(D)



(E) True. 30.5% never back up their data.

(F) False.

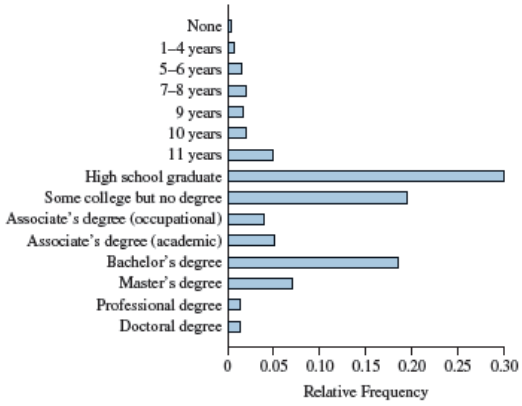
28. (A)



(B)

Educational Attainment	Relative Frequency
None	0.004
1–4 years	0.008
5–6 years	0.015
7–8 years	0.019
9 years	0.017
10 years	0.020
11 years	0.049
High school graduate	0.300
Some college but no degree	0.194
Associate's degree (occupational)	0.040
Associate's degree (academic)	0.052
Bachelor's degree	0.184
Master's degree	0.071
Professional degree	0.013
Doctoral degree	0.014

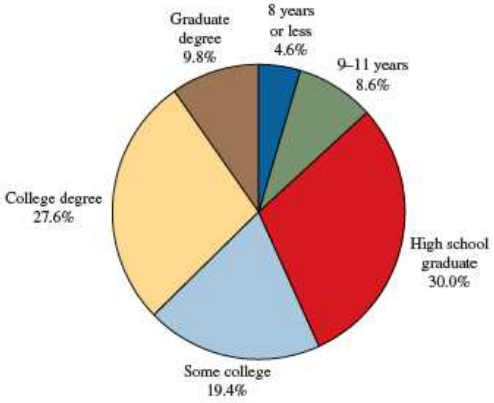
(C)



(D)

Educational Attainment	Frequency (thousands)
8 years or less	10,791
9–11 years	20,311
High school graduate	70,441
Some college but no degree	45,645
College degree	64,757
Graduate degree	22,915

(E)



(F) 0.132

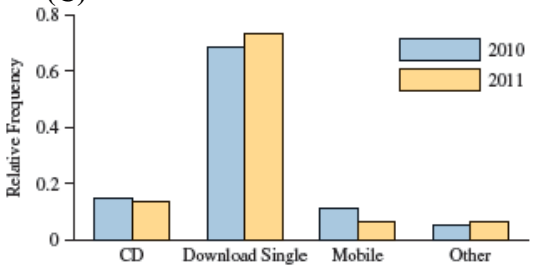
29. (A)

Type of Music	Relative Frequency
CD	0.148
Download single	0.687
Mobile	0.110
Other	0.056

(B)

Type of Music	Relative Frequency
CD	0.136
Download single	0.735
Mobile	0.065
Other	0.064

(C)



(D) True. (0.735 > 0.5)

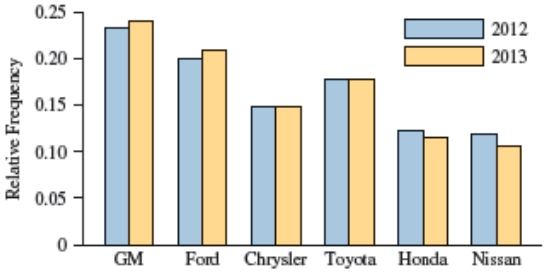
30. (A)

Manufacturer	Relative Frequency
General Motors	0.233
Ford	0.199
Chrysler LLC	0.149
Toyota	0.178
Honda	0.123
Nissan	0.119

(B)

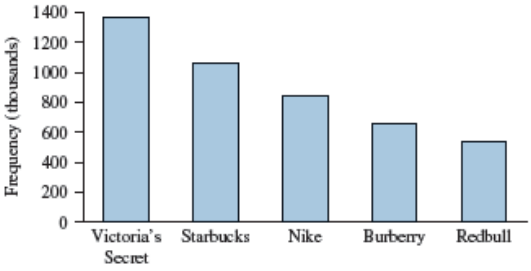
Manufacturer	Relative Frequency
General Motors	0.241
Ford	0.209
Chrysler LLC	0.149
Toyota	0.178
Honda	0.116
Nissan	0.107

(C)



(D) False. Honda's and Nissan's went down.

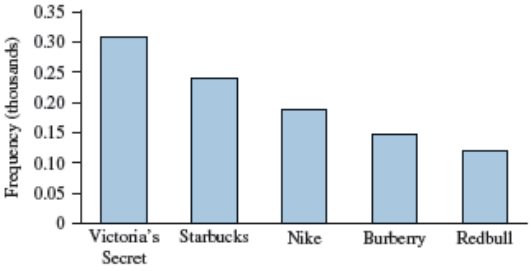
31. (A)



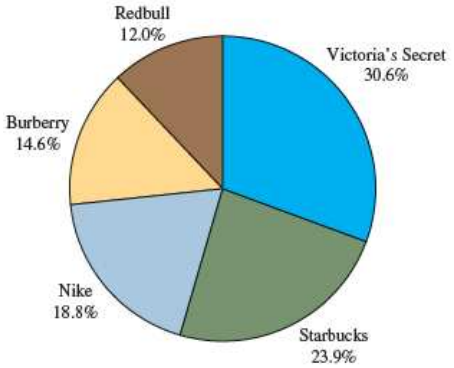
(B)

Brand	Relative Frequency
Victoria's Secret	0.306
Starbucks	0.239
Nike	0.188
Burberry	0.146
Redbull	0.120

(C)

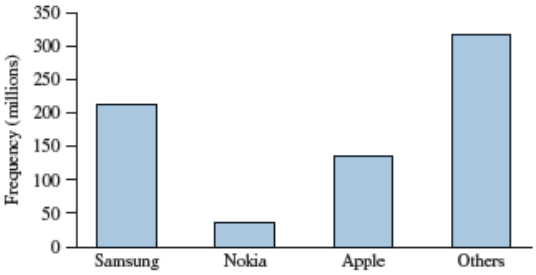


(D)



(E) 0.239

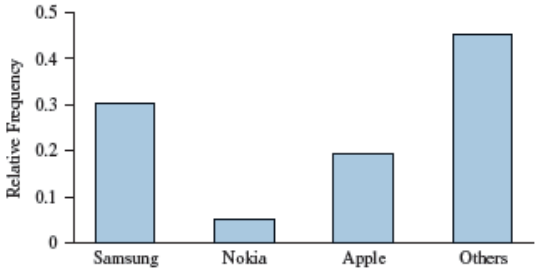
32. (A)



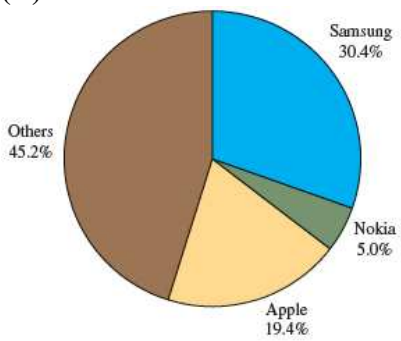
(B)

Vendor	Relative Frequency
Samsung	0.304
Nokia	0.050
Apple	0.194
Others	0.452

(C)

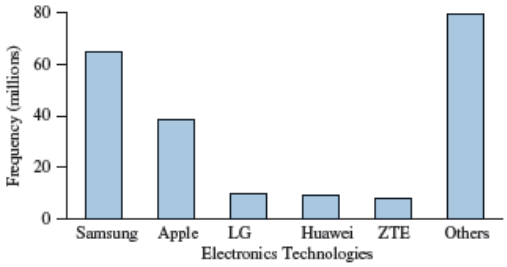


(D)



(E) 0.304

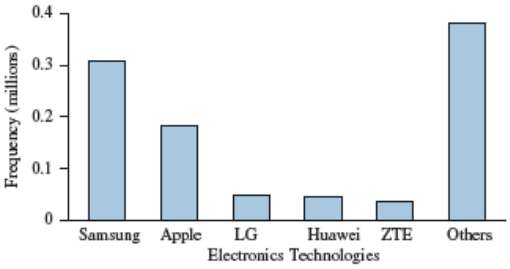
33. (A)



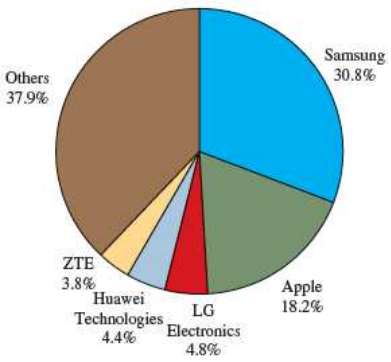
(B)

Company	Relative Frequency
Samsung	0.308
Apple	0.182
LG Electronics	0.048
Huawei Technologies	0.044
ZTE	0.038
Others	0.379

(C)



(D)

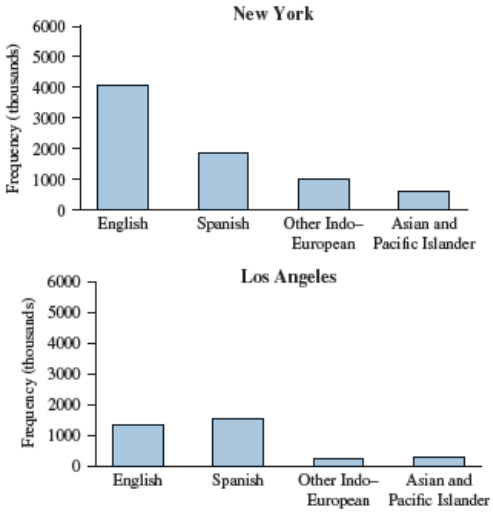


(E) False. (64.74 million < 65.62 million)

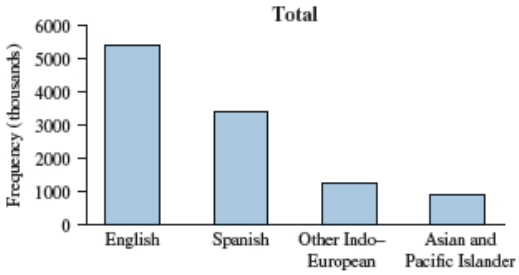
34. This is not a valid relative frequency distribution because the proportions do not sum to 1.

Extending the Concepts

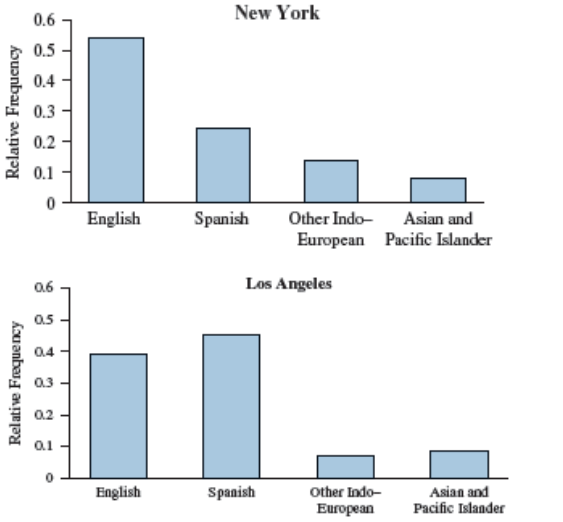
35. (A)



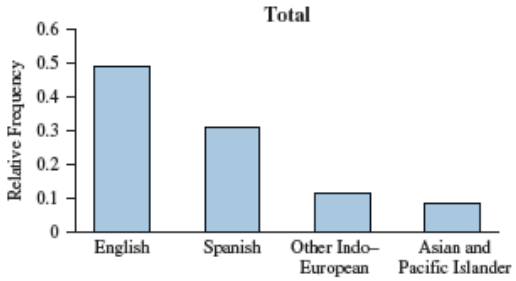
(B)



(C)



(D)



(E) The total frequency is equal to the sum of the frequencies for the two cities.

(F) The total relative frequency is the total frequency divided by the sum of all total frequencies. The relative frequency for each city is the frequency for that city divided by the sum of the frequencies for that city. Since the sum of the frequencies for each city is not the same as the sum of the total frequencies, the total relative frequency is not the sum of the relative frequencies for the two cities.

Section 2.2 Exercises

Exercises 1-4 are the Check Your Understanding exercises located within the section. Their answers are found on page 67.

Understanding the Concepts

5. symmetric
6. left, right
7. bimodal
8. cumulative frequency
9. False. In a frequency distribution, the class width is the difference between consecutive lower class limits.
10. False. The number of classes used has a large effect on the shape of the histogram.
11. True
12. True

Practicing the Skills

13. Skewed to the left
14. Skewed to the right
15. Approximately symmetric
16. Approximately symmetric
17. Bimodal
18. Unimodal

Working with the Concepts

19. **(A)** 11
(B) 1
(C) 70-71
(D) 9%
(E) approximately symmetric

20. **(A)** 3
(B) 19
(C) 3
(D) skewed to the right

21. **(A)** The sum of the proportions in the last 5 rectangles gives the percentage of men with levels above 240. The sum is: $0.13 + 0.1 + 0.05 + 0.01 + 0.02 = 0.31$, which is closest to 30%.
(B) 240-260, because 13% > 8%.

22. **(A)** The sum of the proportions in the last 8 rectangles gives the percentage of women with pressures above 120. The sum is: $0.14 + 0.12 + 0.11 + 0.04 + 0.04 + 0.02 + 0.01 + 0.01 = 0.49$, which is closest to 50%.
(B) 130-135, because 11% > 6%.

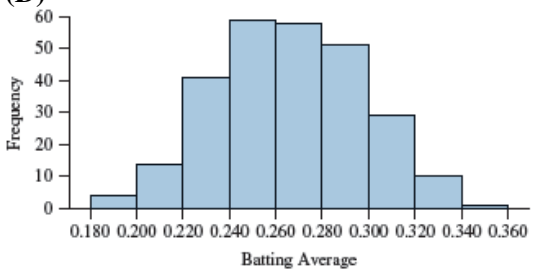
23. **(A)** Right skewed, because there are many more words of small length than of larger length.
(B) Left skewed, because there are many more coins in circulation from recent years than older years.
(C) Left skewed, because there are many more high grades than low ones.

24. **(A)** Right skewed, because there are many more people with low incomes than high.
(B) Left skewed, because there are many more students finishing the exam close to (if not all of) the allotted 60 minutes.
(C) Right skewed, because there are many more people with younger ages than old.

25. **(A)** 9
(B) 0.020
(C) Lower limits: 0.180, 0.200, 0.220, 0.240, 0.260, 0.280, 0.300, 0.320, 0.340.
Upper limits: 0.199, 0.219, 0.239, 0.259, 0.279, 0.299, 0.319, 0.339, 0.359.

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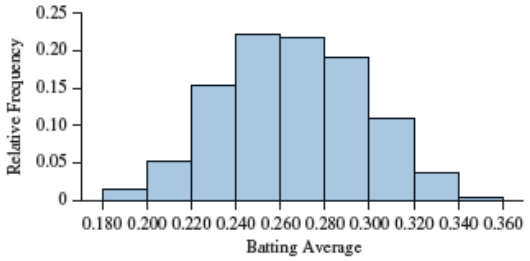
(D)



(E)

Batting Average	Relative Frequency
0.180–0.199	0.015
0.200–0.219	0.052
0.220–0.239	0.154
0.240–0.259	0.221
0.260–0.279	0.217
0.280–0.299	0.191
0.300–0.319	0.109
0.320–0.339	0.037
0.340–0.359	0.004

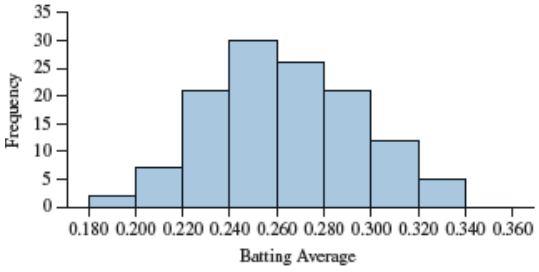
(F)



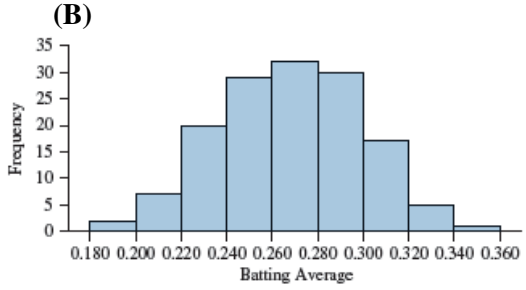
(G) 0.109 + 0.037 + 0.004 = 0.15 = 15%

(H) 0.015 + 0.052 = 0.067 = 6.7%

26. (A)



(B)



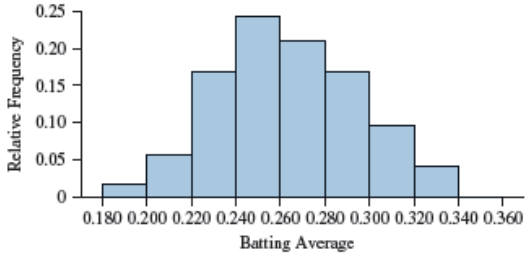
(C)

Batting Average	Relative Frequency
0.180–0.199	0.016
0.200–0.219	0.056
0.220–0.239	0.169
0.240–0.259	0.242
0.260–0.279	0.210
0.280–0.299	0.169
0.300–0.319	0.097
0.320–0.339	0.040
0.340–0.359	0.000

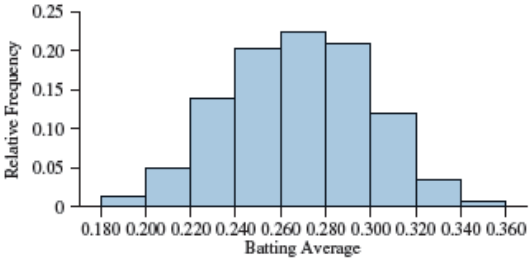
(D)

Batting Average	Relative Frequency
0.180–0.199	0.014
0.200–0.219	0.049
0.220–0.239	0.140
0.240–0.259	0.203
0.260–0.279	0.224
0.280–0.299	0.210
0.300–0.319	0.119
0.320–0.339	0.035
0.340–0.359	0.007

(E)



(F)



(G) 0.097 + 0.04 = 0.137 = 13.7%

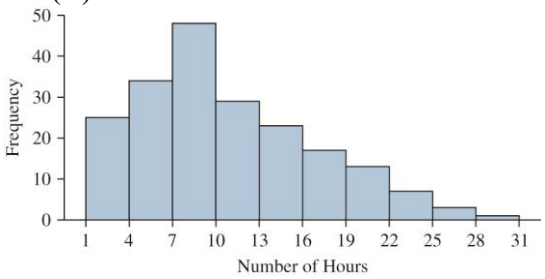
(H) 0.119 + 0.035 + 0.007 = 0.161 = 16.1%

27. (A) 10

(B) 3.0

(C) The lower class limits are 1.0, 4.0, 7.0, 10.0, 13.0, 16.0, 19.0, 22.0, 25.0, and 28.0. The upper class limits are 3.9, 6.9, 9.9, 12.9, 15.9, 18.9, 21.9, 24.9, 27.9, and 30.9.

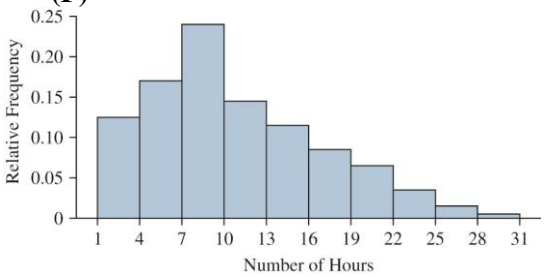
(D)



(E)

Number of Hours	Relative Frequency
1.0 – 3.9	0.125
4.0 – 6.9	0.170
7.0 – 9.9	0.240
10.0 – 12.9	0.145
13.0 – 15.9	0.115
16.0 – 18.9	0.085
19.0 – 21.9	0.065
22.0 – 24.9	0.035
25.0 – 27.9	0.015
28.0 – 30.9	0.005

(F)



(G) 0.125 + 0.17 + 0.24 = 0.535 = 53.5%

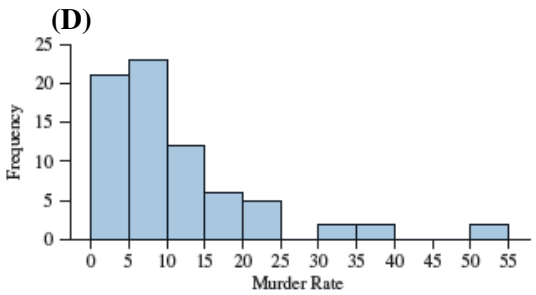
(H) 0.065 + 0.035 + 0.015 + 0.005 = 0.12 = 12.0%

28. (A) 11

(B) 5

(C) The lower class limits are 0.0, 5.0, 10.0, 15.0, 20.0, 25.0, 30.0, 35.0, 40.0, 45.0, and 50.0. The upper class limits are 4.9, 9.9, 14.9, 19.9, 24.9, 29.9, 34.9, 39.9, 44.9, 49.9, and 54.9.

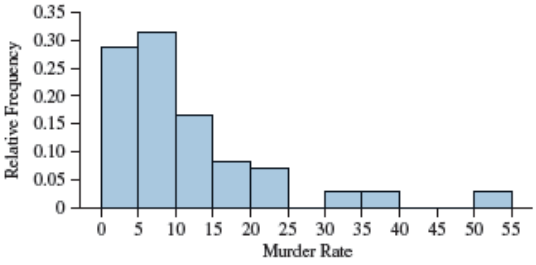
(D)



(E)

Murder Rate	Relative Frequency
0.0–4.9	0.288
5.0–9.9	0.315
10.0–14.9	0.164
15.0–19.9	0.082
20.0–24.9	0.068
25.0–29.9	0.000
30.0–34.9	0.027
35.0–39.9	0.027
40.0–44.9	0.000
45.0–49.9	0.000
50.0–54.9	0.027

(F)



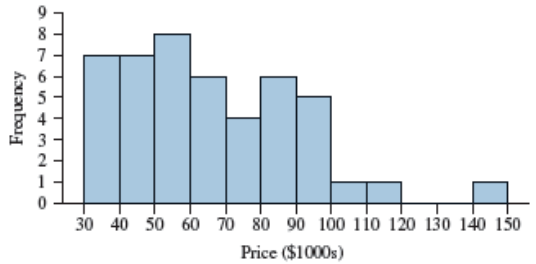
(G) 0.288 + 0.315 = 0.603 = 60.3%

(H) 0.027 + 0.027 + 0.027 = 0.081 = 8.1%

29. (A)

Price ($1000s)	Frequency
30–39.9	7
40–49.9	7
50–59.9	8
60–69.9	6
70–79.9	4
80–89.9	6
90–99.9	5
100–109.9	1
110–119.9	1
120–129.9	0
130–139.9	0
140–149.9	1

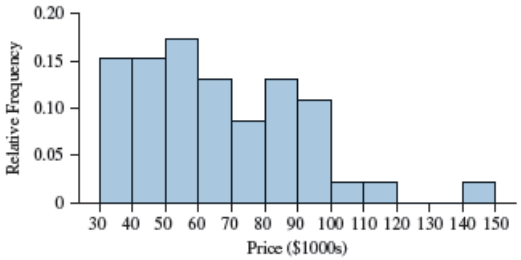
(B)



(C)

Price ($1000s)	Relative Frequency
30–39.9	0.152
40–49.9	0.152
50–59.9	0.174
60–69.9	0.130
70–79.9	0.087
80–89.9	0.130
90–99.9	0.109
100–109.9	0.022
110–119.9	0.022
120–129.9	0.000
130–139.9	0.000
140–149.9	0.022

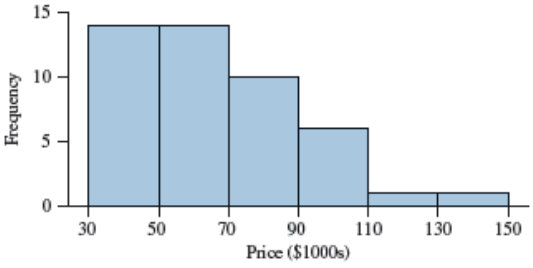
(D)



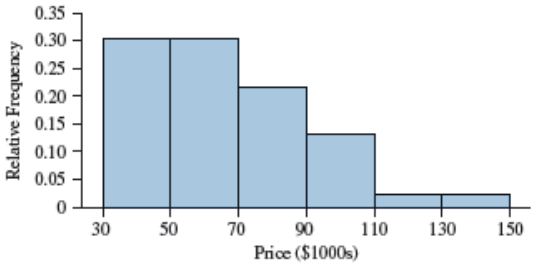
(E) Unimodal

(F)

Price ($1000s)	Frequency
30–49.9	14
50–69.9	14
70–89.9	10
90–109.9	6
110–129.9	1
130–149.9	1



Price ($1000s)	Relative Frequency
30–49.9	0.304
50–69.9	0.304
70–89.9	0.217
90–109.9	0.130
110–129.9	0.022
130–149.9	0.022

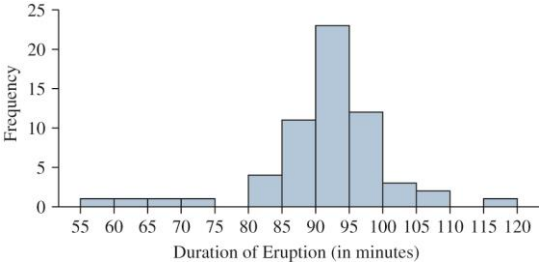


(G) Both are reasonably good choices for class widths. The number of classes are both at least 5, but less than 20. Also, neither class widths are too narrow or too wide.

30. (A)

Dormancy Period	Frequency
55 – 59.9	1
60 – 64.9	1
65 – 69.9	1
70 – 74.9	1
75 – 79.9	0
80 – 84.9	4
85 – 89.9	11
90 – 94.9	23
95 – 99.9	12
100 – 104.9	3
105 – 109.9	2
110 – 114.9	0
115 – 119.9	1

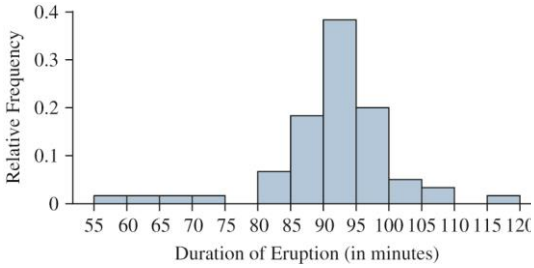
(B)



(C)

Dormancy Period	Frequency
55 – 59.9	0.017
60 – 64.9	0.017
65 – 69.9	0.017
70 – 74.9	0.017
75 – 79.9	0.000
80 – 84.9	0.067
85 – 89.9	0.183
90 – 94.9	0.383
95 – 99.9	0.200
100 – 104.9	0.050
105 – 109.9	0.033
110 – 114.9	0.000
115 – 119.9	0.017

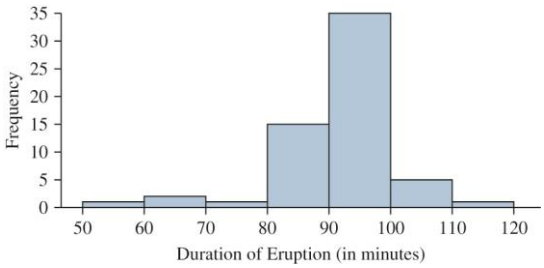
(D)



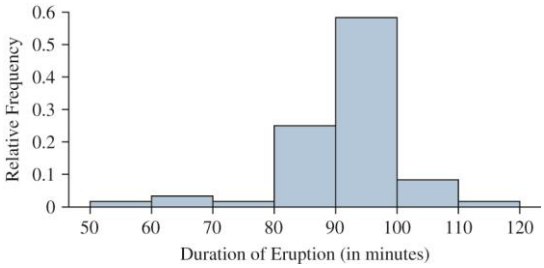
(E) skewed to the left

(F)

Dormancy Period	Frequency
50 – 59.9	1
60 – 69.9	2
70 – 79.9	1
80 – 89.9	15
90 – 99.9	35
100 – 109.9	5
110 – 119.9	1



Dormancy Period	Frequency
50 – 59.9	0.017
60 – 69.9	0.033
70 – 79.9	0.017
80 – 89.9	0.250
90 – 99.9	0.583
100 – 109.9	0.083
110 – 119.9	0.017

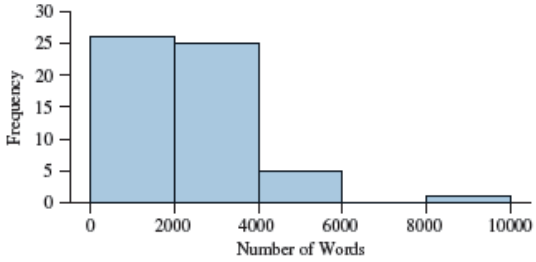


(G) Both are reasonably good choices for class widths. The number of classes are both at least 5, but less than 20. Also, neither class widths are too narrow or too wide.

31. (A) Answers will vary. Here is one possibility:

Number of Words	Frequency
0–1999	26
2000–3999	25
4000–5999	5
6000–7999	0
8000–9999	1

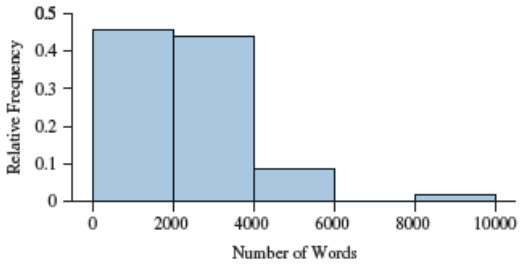
(B)



(C) Answers will vary. Here is one possibility:

Number of Words	Relative Frequency
0–1999	0.456
2000–3999	0.439
4000–5999	0.088
6000–7999	0.000
8000–9999	0.018

(D)

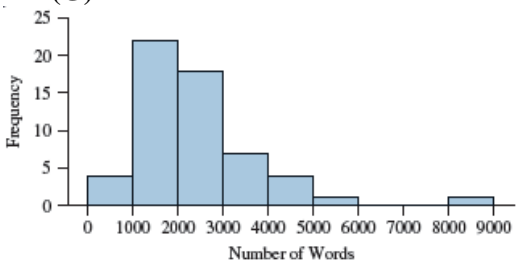


(E) skewed to the right

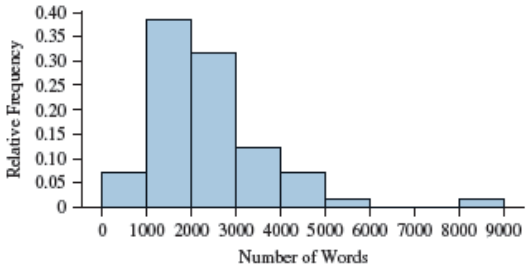
(F) Answers will vary. Here is one possibility:

Number of Words	Frequency
0–999	4
1000–1999	22
2000–2999	18
3090–3999	7
4000–4999	4
5000–5999	1
6000–6999	0
7000–7999	0
8000–8999	1

(G)



Number of Words	Relative Frequency
0–999	0.070
1000–1999	0.386
2000–2999	0.316
3090–3999	0.123
4000–4999	0.070
5000–5999	0.018
6000–6999	0.000
7000–7999	0.000
8000–8999	0.018

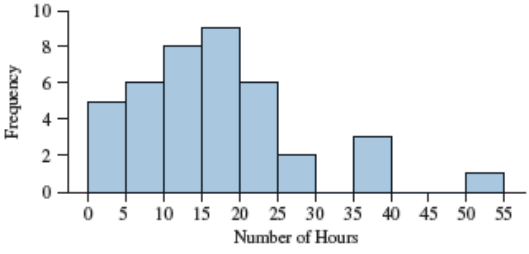


(H) The one with 9 classes is more appropriate than the one with only 5 classes. This is because the one with only 5 classes is too wide. Only the most basic features of the data are visible.

32. (A)

Number of Hours	Frequency
0–4	5
5–9	6
10–14	8
15–19	9
20–25	6
25–29	2
30–34	0
35–39	3
40–44	0
45–49	0
50–54	1

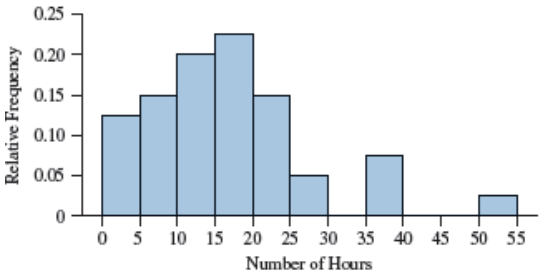
(B)



(C)

Number of Hours	Relative Frequency
0–4	0.125
5–9	0.150
10–14	0.200
15–19	0.225
20–25	0.150
25–29	0.050
30–34	0.000
35–39	0.075
40–44	0.000
45–49	0.000
50–54	0.025

(D)

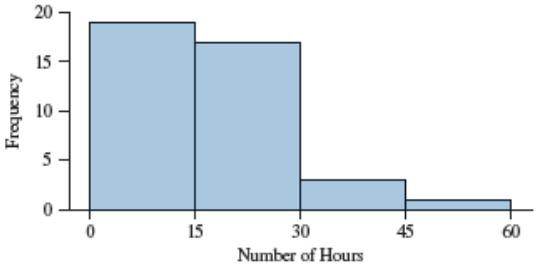


(E) skewed to the right

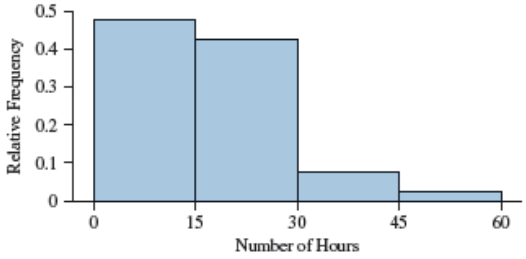
(F) Answers will vary. Here is one possibility:

Number of Hours	Frequency
0–14	19
15–29	17
30–45	3
46–60	1

(G)

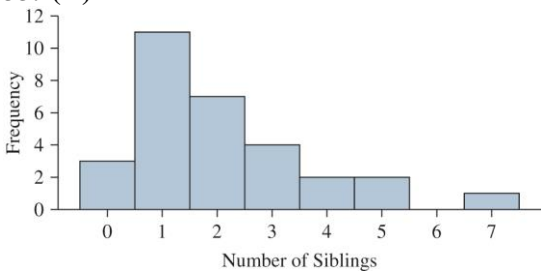


Number of Hours	Relative Frequency
0–14	0.475
15–29	0.425
30–45	0.075
46–60	0.025

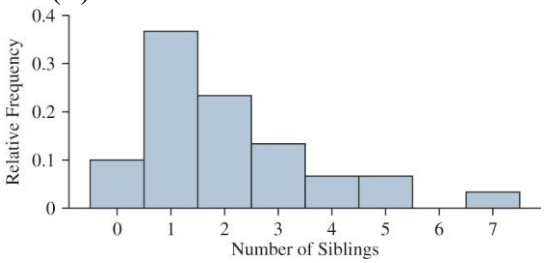


(H) The graphs with nine classes are more appropriate much than those with only 4 classes. This is because only the most basic features of the data are visible, when the class widths are too wide, as they are in the graphs containing only four classes.

33. (A)

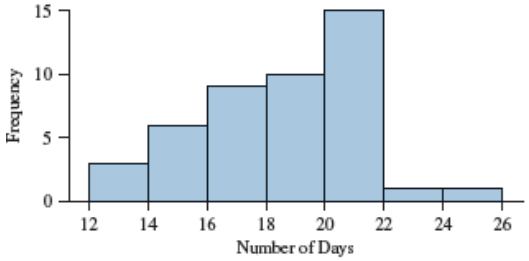


(B)

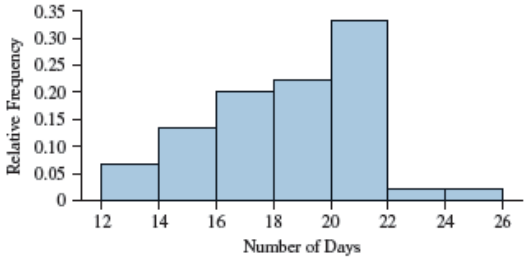


(C) skewed to the right

34. (A)

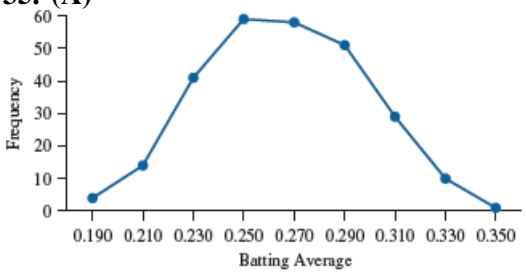


(B)

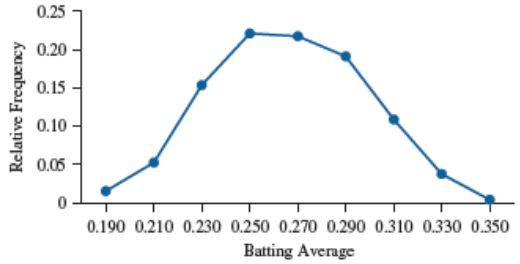


(C) skewed to the left

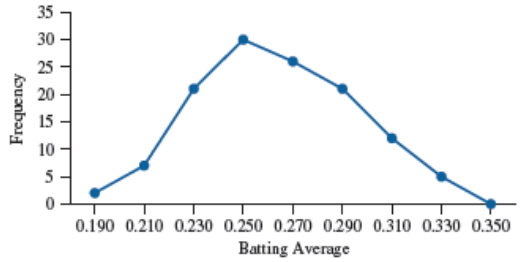
35. (A)



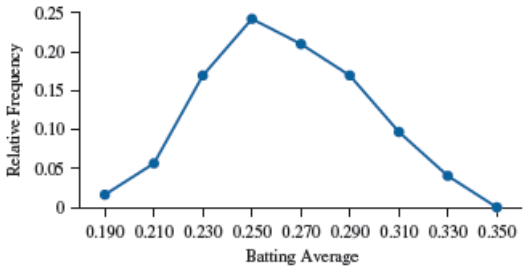
(B)



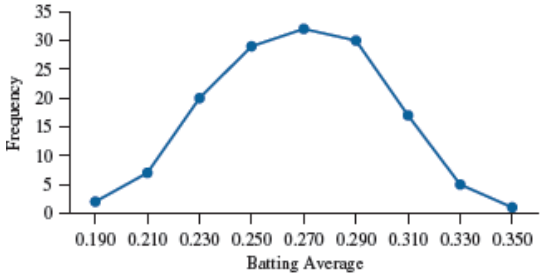
36. (A)



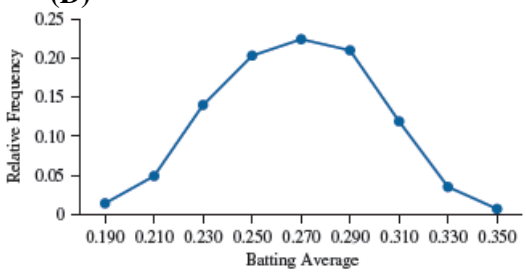
(B)



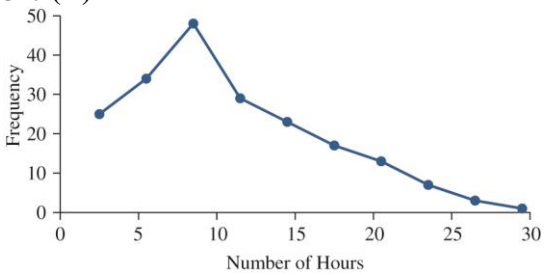
(C)



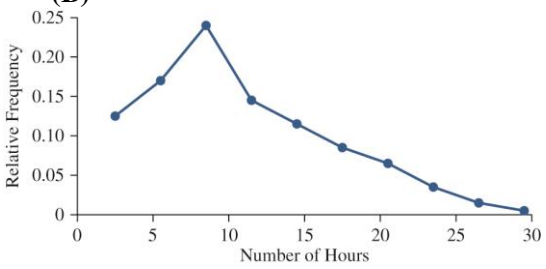
(D)



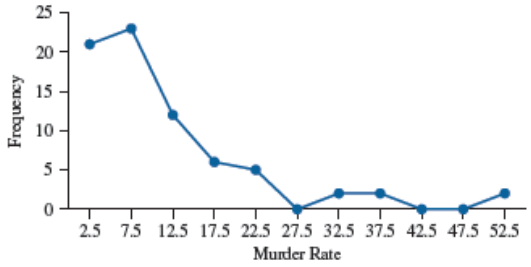
37. (A)



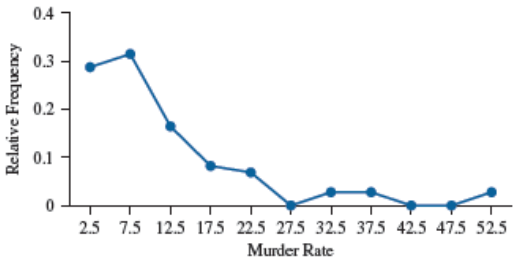
(B)



38. (A)



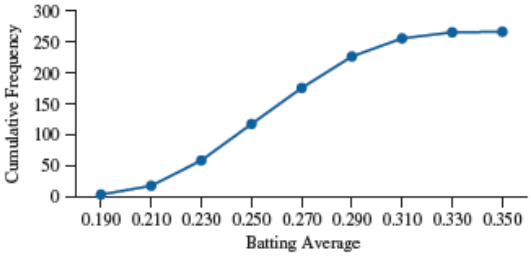
(B)



39. (A)

Batting Average	Cumulative Frequency
0.180–0.199	4
0.200–0.219	18
0.220–0.239	59
0.240–0.259	118
0.260–0.279	176
0.280–0.299	227
0.300–0.319	256
0.320–0.339	266
0.340–0.359	267

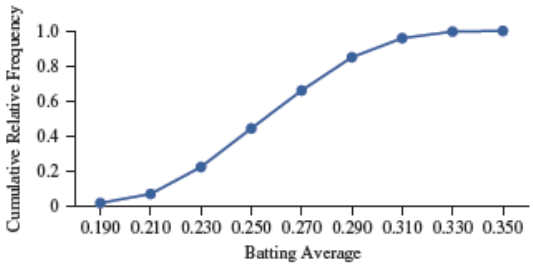
(B)



(C)

Batting Average	Cumulative Relative Frequency
0.180–0.199	0.015
0.200–0.219	0.067
0.220–0.239	0.221
0.240–0.259	0.442
0.260–0.279	0.659
0.280–0.299	0.850
0.300–0.319	0.959
0.320–0.339	0.996
0.340–0.359	1.000

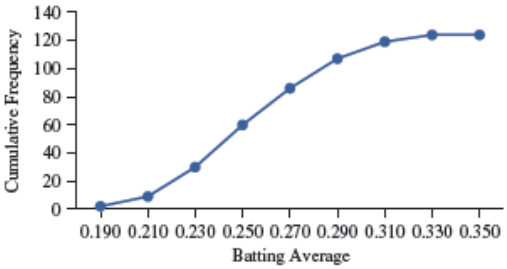
(D)



40. (A)

Batting Average	Cumulative Frequency
0.180–0.199	2
0.200–0.219	9
0.220–0.239	30
0.240–0.259	60
0.260–0.279	86
0.280–0.299	107
0.300–0.319	119
0.320–0.339	124
0.340–0.359	124

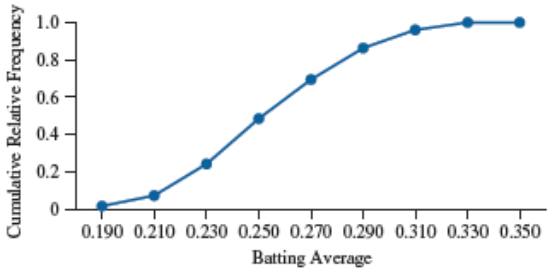
(B)



(C)

Batting Average	Cumulative Relative Frequency
0.180–0.199	0.016
0.200–0.219	0.073
0.220–0.239	0.242
0.240–0.259	0.484
0.260–0.279	0.694
0.280–0.299	0.863
0.300–0.319	0.960
0.320–0.339	1.000
0.340–0.359	1.000

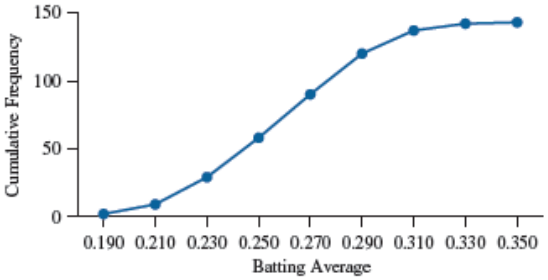
(D)



(E)

Batting Average	Cumulative Frequency
0.180–0.199	2
0.200–0.219	9
0.220–0.239	29
0.240–0.259	58
0.260–0.279	90
0.280–0.299	120
0.300–0.319	137
0.320–0.339	142
0.340–0.359	143

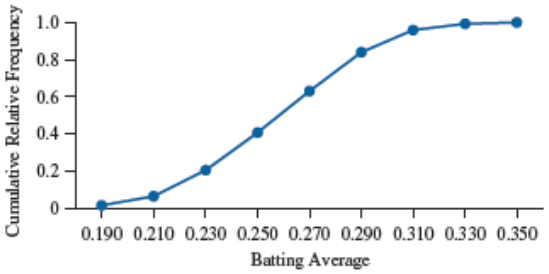
(F)



(G)

Batting Average	Cumulative Relative Frequency
0.180–0.199	0.014
0.200–0.219	0.063
0.220–0.239	0.203
0.240–0.259	0.406
0.260–0.279	0.629
0.280–0.299	0.839
0.300–0.319	0.958
0.320–0.339	0.993
0.340–0.359	1.000

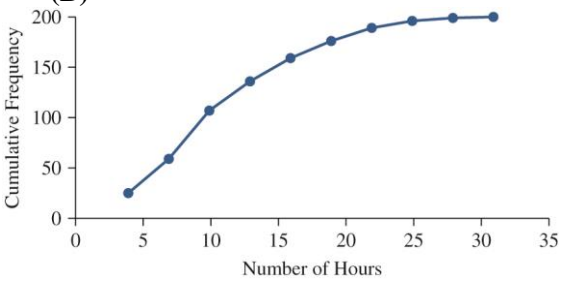
(H)



41. (A)

Number of Hours	Cumulative Frequency
3.9	25
6.9	59
9.9	107
12.9	136
15.9	159
18.9	176
21.9	189
24.9	196
27.9	199
30.9	200

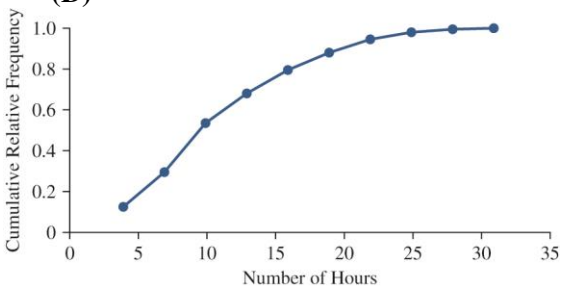
(B)



(C)

Number of Hours	Cumulative Relative Frequency
3.9	0.125
6.9	0.295
9.9	0.535
12.9	0.680
15.9	0.795
18.9	0.880
21.9	0.945
24.9	0.980
27.9	0.995
30.9	1.000

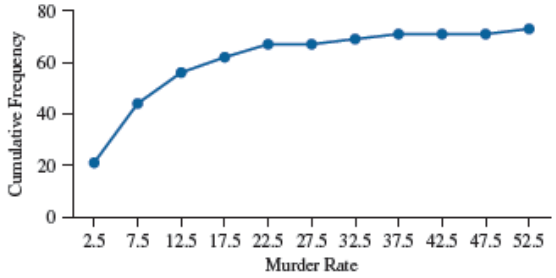
(D)



42. (A)

Murder Rate	Cumulative Frequency
0.0–4.9	21
5.0–9.9	44
10.0–14.9	56
15.0–19.9	62
20.0–24.9	67
25.0–29.9	67
30.0–34.9	69
35.0–39.9	71
40.0–44.9	71
45.0–49.9	71
50.0–54.9	73

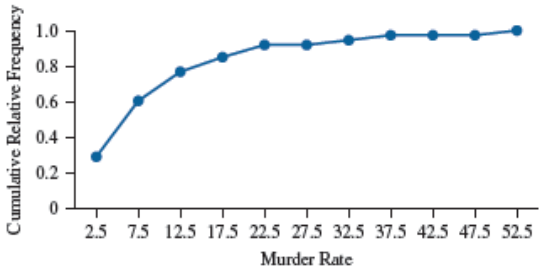
(B)



(C)

Murder Rate	Cumulative Frequency
0.0–4.9	0.288
5.0–9.9	0.603
10.0–14.9	0.767
15.0–19.9	0.849
20.0–24.9	0.918
25.0–29.9	0.918
30.0–34.9	0.945
35.0–39.9	0.973
40.0–44.9	0.973
45.0–49.9	0.973
50.0–54.9	1.000

(D)



43. Because "30 or more" represents an open ended class.

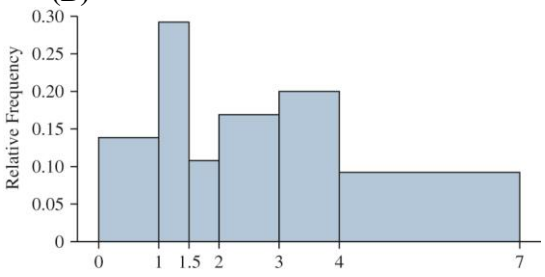
44. Yes. The last class would become 30-34.9.

Extending the Concepts

45. We need to solve the following equation: 0.2 + 0.3 + 0.15 + x + 0.1 + 0.1 = 1 Answer: x = 0.15

46. (A) The respective class widths are 1, 0.5, 0.5, 1, 1, and 3.

(B)

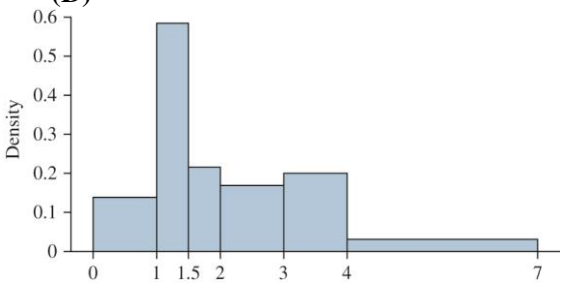


This histogram gives a distorted picture of the data because it makes it look like this is a bimodal distribution, when in reality, Figure 2.6 shows that the data has one mode and is skewed to the right.

(C)

Class	Relative Frequency	Density
0.00–0.99	0.138	0.138
1.00–1.49	0.292	0.584
1.50–1.99	0.108	0.216
2.00–2.99	0.169	0.169
3.00–3.99	0.200	0.200
4.00–6.99	0.092	0.031

(D)



(E) The histogram in part (D) also has only one mode and is skewed to the right, just as the histogram in Figure 2.6. The differing class widths in a density histogram do not distort the data because dividing the relative frequency by the class width puts the proportionality into the respective classes.

47. (i) is skewed and **(ii)** is approximately symmetric

48. Skewed to the right because the first two classes have relative frequencies of 0.2 and 0.37, whereas the rest are all less than 0.15.

Section 2.3 Exercises

Exercises 1 and 2 are the Check Your Understanding exercises located within the section. Their answers are found on page 78.

Understanding the Concepts

3. leaf

4. stems

5. time-series plot

6. time

7. True

8. False. In a stem-and-leaf plot, each leaf must be a single digit.

9. True

10. False. In a time-series plot, the horizontal axis represents time.

Practicing the Skills

11.

1	1225566
2	0012779
3	19
4	556
5	02578

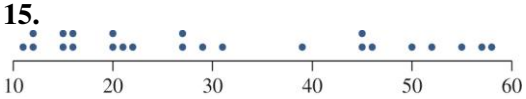
12.

48	019
49	12445999
50	13345
51	047799
52	2455

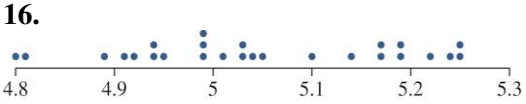
13. The list is: 30 30 31 32 35 36 37 37 39 42 43 44 45 46 47 47 47 47 48 48 49 50 51 51 51 52 52 52 52 54 56 57 58 58 59 61 63

14. The list is: 14.4 14.6 14.8 14.9 15.1 15.2 15.2 15.4 15.5 15.7 15.7 15.8 16.0 16.1 16.1 16.1 16.2 16.3 16.7 16.7 16.9 18.2 18.3 18.8

15.



16.



Working with the Concepts

17. (A)

3	1137999
4	3447888
5	0355678
6	0034459
7	0458
8	12679
9	001447
10	8
11	5
12	
13	
14	1

(B)

3	113
3	7999
4	344
4	7888
5	03
5	55678
6	00344
6	59
7	04
7	58
8	12
8	679
9	00144
9	7
10	
10	8
11	
11	5
12	
12	
13	
13	
14	1
14	

(C) The one in part (A) is more appropriate because part (B) has too many stems with no leaves. The stem-and-leaf plot in part (A) shows that most prices are in the 30's, 40's, and 50's, and that the data is skewed to the right.

18. (A)

4	88
5	111222333566666788889
6	011123334455666677778889
7	011334566778

(B)

4	
4	88
5	111222333
5	566666788889
6	0111233344
6	55666677778889
7	011334
7	566778

(C) The one in part (B) is more appropriate because most of the leaves are on three stems (temperatures in the 50's, 60's, and 70's). For this reason, the stem-and-leaf plot in part (A) does not reveal much detail about the data.

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19. (A)

0	3
0	55669999
1	01111112222333344
1	555666889
2	11124
2	556777
3	0111334
3	555678
4	02
4	6
5	
5	9
6	
6	66

(B) Both plots show that more leaves are on stem 1 than all other stems. However, the advantage to the split stem-and-leaf plot in part (A) is that it much better shows how the emissions data is skewed to the right.

20.

2	458
3	67
4	56
5	00179
6	1
7	01
8	
9	2889
10	8
11	9
12	4
13	017
14	
15	7
16	5
17	
18	2

21. (A)

Wimbledon		Master's
	1	
87	1	
44444433322222222221111110	2	33
998777766665555	2	5666777888899
1100	3	01111222222333333
	3	5567888999
	4	123
	4	6

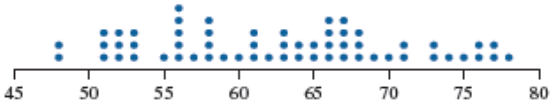
(B) Leaf 1 represents the ages of the Wimbledon winners and Leaf 2 represents the ages of the winners of the Master's. From this back-to-back split stem-and-leaf plot, we clearly see that the Wimbledon champions tend to be younger.

22. (A) In the following back-to-back split stem-and-leaf plot, Leaf 1 displays the lengths of time of the PG movies and Leaf 2 does so for the R rated movies.

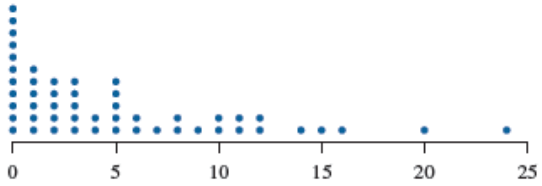
PG or PG-13		R
98	8	8
8877	9	34577
80	10	
542	11	0188
76	12	02
	13	
5	14	
	15	7
6	16	5

(B) They are roughly similar. Notice that the rows are roughly equal.

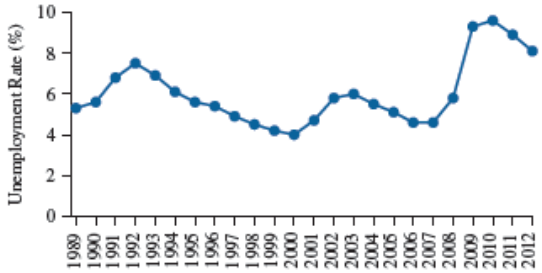
23. Yes, there are some gaps in the dotplot below for the Macon, GA temperature data.



24. This dotplot shows that the data is skewed to the right.

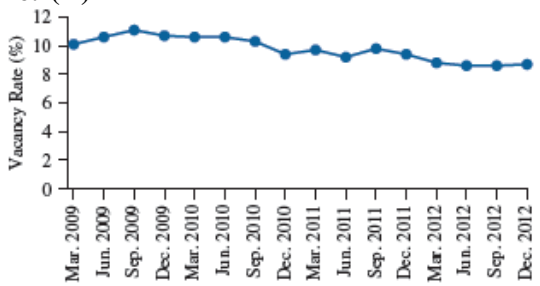


25. (A)



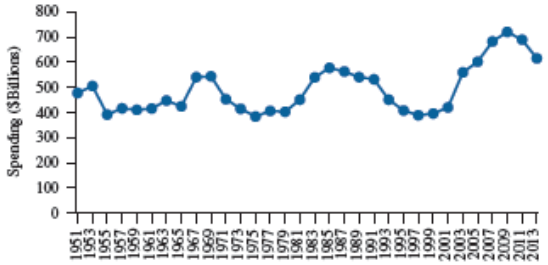
(B) Increasing: 89-92, 00-03, and 07-10
Decreasing: 92-00, 03-07 (06 = 07), and 10-12.

26. **(A)**



(B) Decreasing over that period.

27. **(A)**

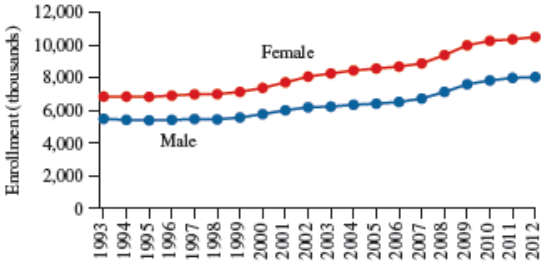


(B) It increased in the 50's, 60's, 80's, and 00's. It decreased in the 70's and 90's.

(C) It caused a big decrease.

(D) It increased from 1965 to 1969, and then decreased from 1969 to 1975.

28. **(A)**



(B) Female enrollment is growing faster.

29. **(A)** $800 billion

(B) $300 billion. From $700 billion to $1 trillion.

(C) True. $1100 is approximately twice $600.

(D) False. Almost, but it dipped from 2008 to 2009.

30. **(A)** 1980. As evidenced by 0 gold medals.

(B) 85

(C) Staying about the same

31. **(A)** 115 inches

(B) 1910

(C) Less than

(D) True. It occurred in the 1880s.

(E) False.

32. **(A)** 1999

(B) The two events decreased their average salaries.

33. **(A)** False. It increased in 5 years and decreased in only 2.

(B) True.

(C) False. 2005 spent less than 2009.

(D) True.

34. **(A)** 1991

(B) 2011

(C) True.

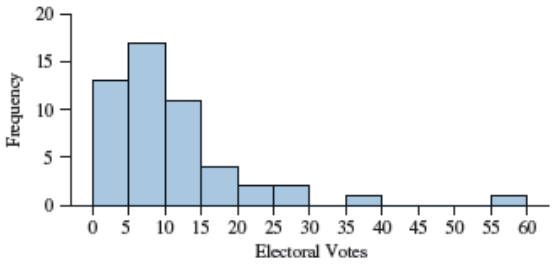
(D) False. It increased in 5 of those years.

Extending the Concepts

35. **(A)**

0	3333333344444
0	55566666677788999
1	00001111234
1	5668
2	00
2	99
3	
3	8
4	
4	
5	
5	5

(B)



(C) They both have the same shape (skewed to the right), because the class width in the histogram is 5, as is each line for each stem 5. The number of leaves in each stem is the frequency of occurrence, which is also the height of the bars in the histogram.

Section 2.4 Exercises

Exercises 1 and 2 are the Check Your Understanding exercises located within the section. Their answers are found on page 85.

Understanding the Concepts

3. 0

4. proportional

5. (i). Graph (A) presents an accurate picture, because the baseline is at zero. Graph (B) exaggerates the decline, because the baseline is above zero.

6. The bar graph does presents a more accurate picture because its baseline is correctly placed at 0. The time-series plot exaggerates the rate of the increase.

7. The bar graph is more accurate. The pictures of the dollars make the difference appear much larger than the bar graph does. The reason is that both the height and length of the dollar has been increased.

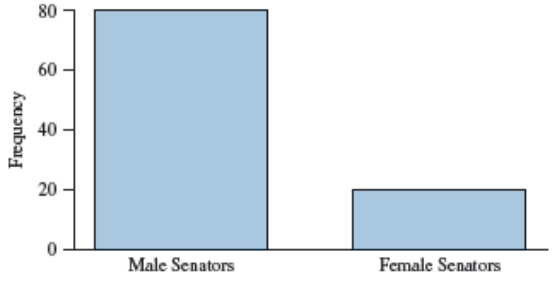
8. Graph (B) presents the more accurate picture, because it follows the area principle. In Graph (A), the area of the larger image is about four times that of the smaller image. This exaggerates the difference.

9. The bar graph is an accurate depiction because the baseline is at 0.

10. It is misleading because the baseline is not placed at zero.

11. **(A)** It is misleading because you can see the tops of the bars in the three-dimensional graph. This often causes them to look shorter than they really are.

(B)



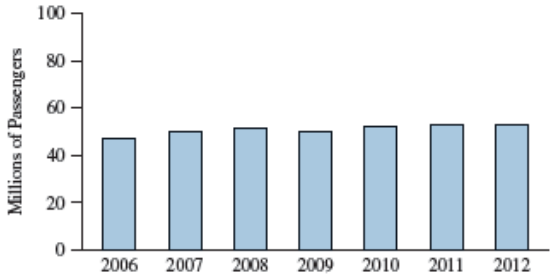
12. It is misleading because the baseline is not placed at zero.

13. (ii) is more accurate. The plot on the left has its baseline at zero, and presents an accurate picture. The plot on the right exaggerates the increase.

14. Option (ii) is the correct one, because it correspondingly matches up with graph (A) which is the correct one. Graph (B) does not have a baseline value of zero, so it gives the incorrect description of option (i).

Extending the Concepts

15. **(A)**



(B) Yes, it makes the differences look smaller, because the scale on the *y*-axis extends much farther than the largest bar height.

(C) Figure 2.23 does. It has a baseline of zero (unlike Figure 2.24), with a more accurate depiction of the range of data values than the graph in part (A) above.

Chapter Quiz

1.

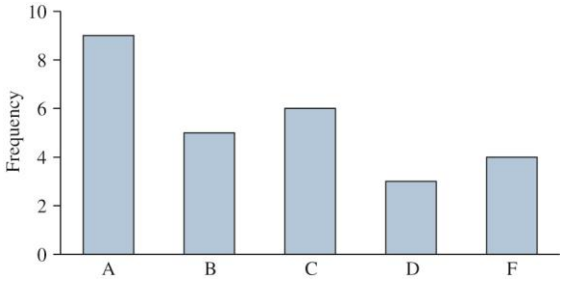
Grade	Frequency
A	9
B	5
C	6
D	3
F	4

2.

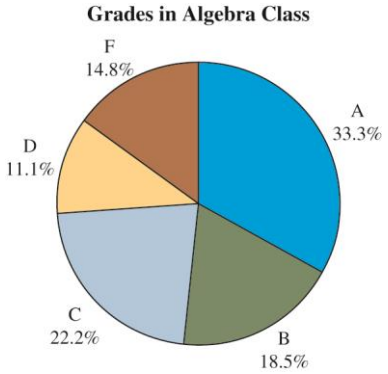
Grade	Relative Frequency
A	0.333
B	0.185
C	0.222
D	0.111
F	0.148

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3.



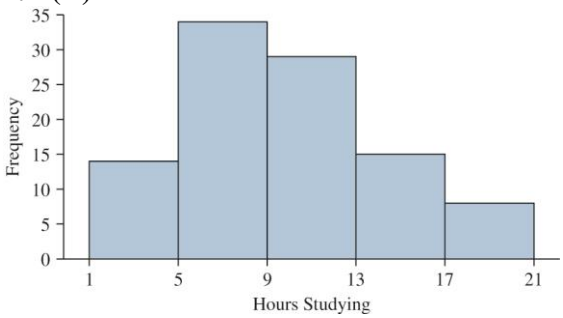
4.



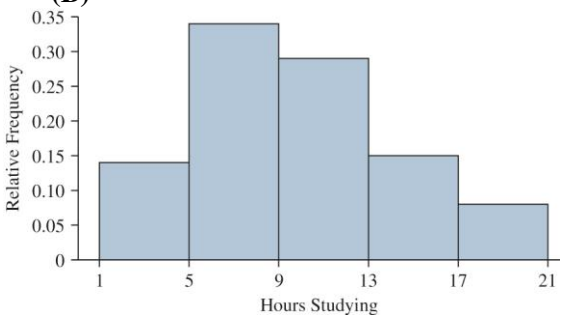
5. The classes are: 5.0-7.9, 8.0-10.9, 11.0-13.9, 14.0- 16.9, and 17.0-19.9. The class width is 3.

6. True

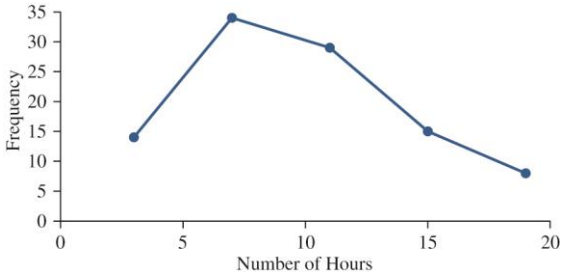
7. **(A)**



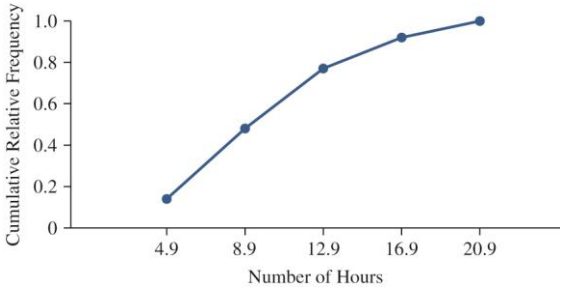
(B)



8.



9.



10. 11 11 15 15 19 19 19 22 22 23 25 27 28 30 30 38 44 45 47 48 50 51 53 53 55 56 58

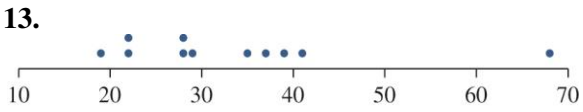
11.

1	9
2	22889
3	579
4	1
5	
6	8

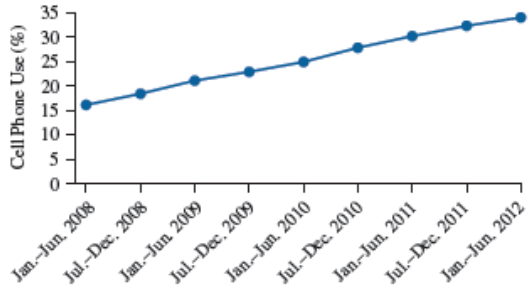
12.

Espresso Makers		Coffee Makers
	1	9
5	2	22889
10	3	579
0	4	1
600	5	
5	6	8
70	7	
	8	
99	9	

13.



14.

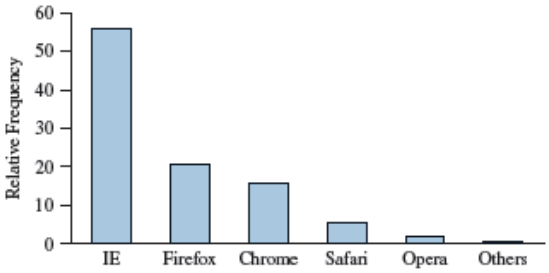


15. Twice

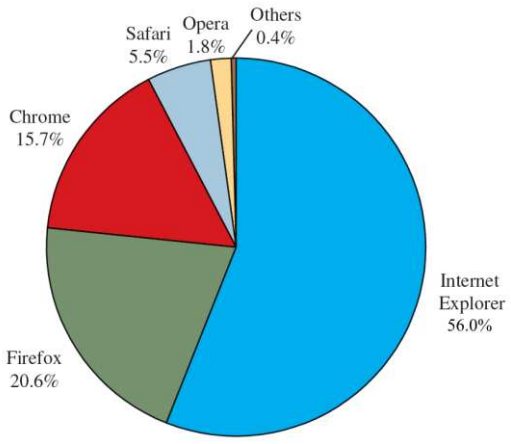
Review Exercises

1. **(A)** Somewhat
(B) True
(C) False. Roughly 36% believe these ways, which is less than half.
(D) True

2. **(A)**

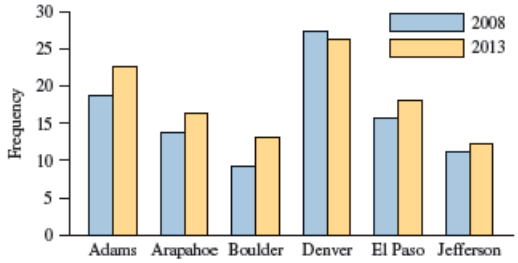


(B)



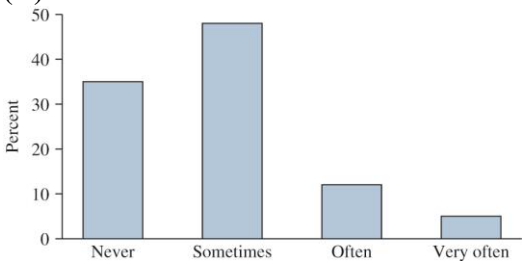
(C) False, they account for 21.2%, which is less than 30%.

3. **(A)**

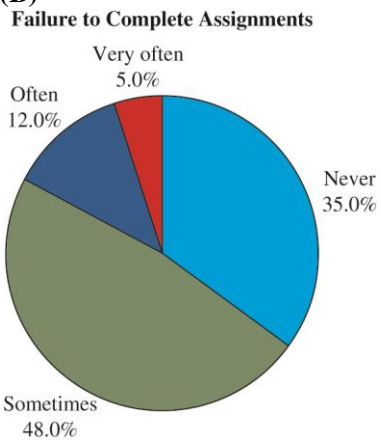


(B) False, this statement was almost true. It did increase for every county except Denver.
(C) Adams. It went up 4%.

4. **(A)**



(B)

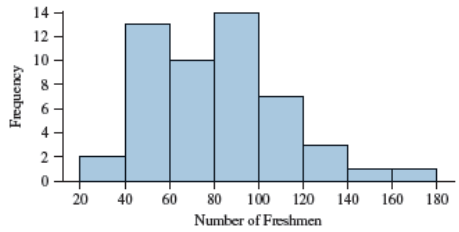


(C) False. 48% is less than half.

5. **(A)** 7
(B) 10
(C) $\frac{5}{50} = \frac{1}{10} = 10\%$
(D) Unimodal

6. **(A)** 8
(B) 20
(C) The lower class limit are 20, 40, 60, 80, 100, 120, 140, and 160. The upper class limits are 39, 59, 79, 99, 119, 139, 159, and 179.

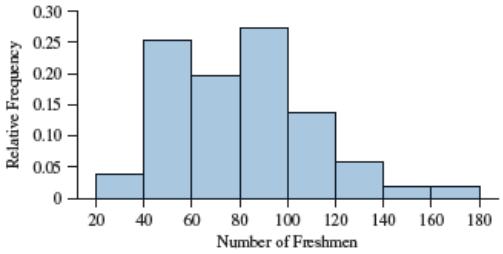
(D)



(E)

Number of Freshmen	Relative Frequency
20–39	0.039
40–59	0.255
60–79	0.196
80–99	0.275
100–119	0.137
120–139	0.059
140–159	0.020
160–179	0.020

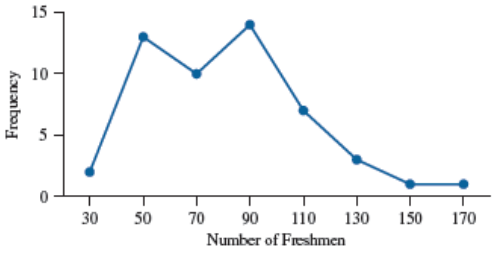
(F)



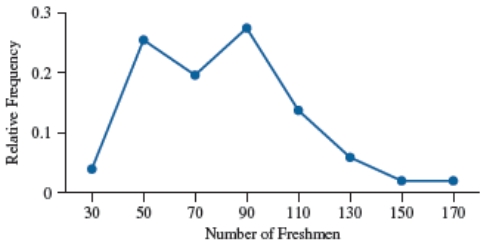
(G) $\frac{12}{51} = .235 = 23.5\%$

(H) $\frac{15}{51} = .294 = 29.4\%$

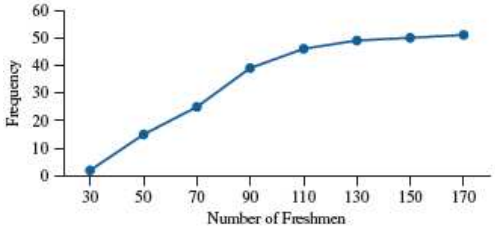
7. (A)



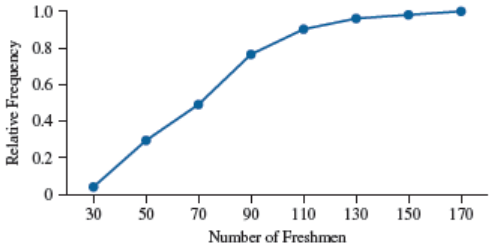
(B)



(C)



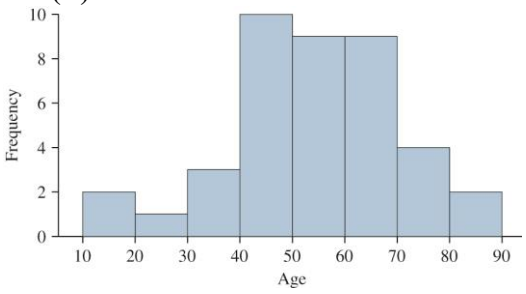
(D)



8. (A)

Age	Frequency
10–19	2
20–29	1
30–39	3
40–49	10
50–59	9
60–69	9
70–79	4
80–89	2

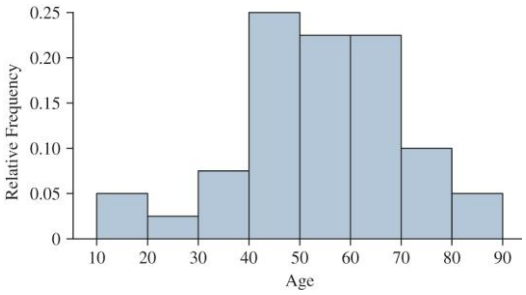
(B)



(C)

Age	Relative Frequency
10–19	0.050
20–29	0.025
30–39	0.075
40–49	0.250
50–59	0.225
60–69	0.225
70–79	0.100
80–89	0.050

(D)



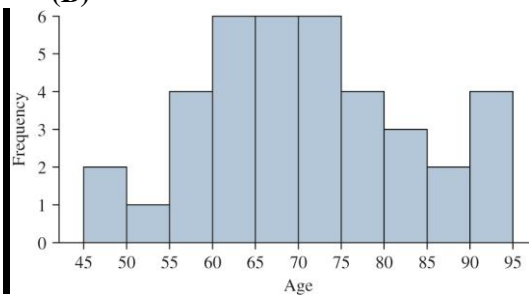
9.

1	25
2	8
3	235
4	0012368999
5	124566889
6	457777889
7	0167
8	11

10. (A)

Age	Frequency
45–49	2
50–54	1
55–59	4
60–64	6
65–69	6
70–74	6
75–79	4
80–84	3
85–89	2
90–94	4

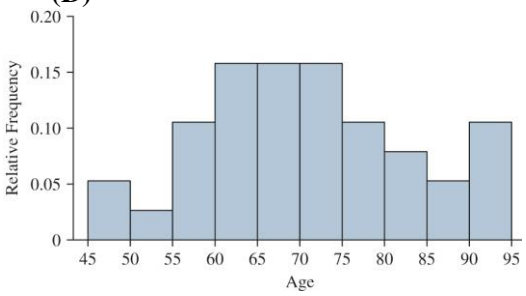
(B)



(C)

Age	Relative Frequency
45–49	0.053
50–54	0.026
55–59	0.105
60–64	0.158
65–69	0.158
70–74	0.158
75–79	0.105
80–84	0.079
85–89	0.053
90–94	0.105

(D)



11. (A)

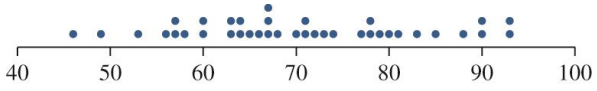
Presidents		Monarchs
	1	25
	2	8
	3	235
96	4	0012368999
87763	5	124566889
877765443300	6	457777889
9887432110	7	0167
85310	8	11
3300	9	

(B)

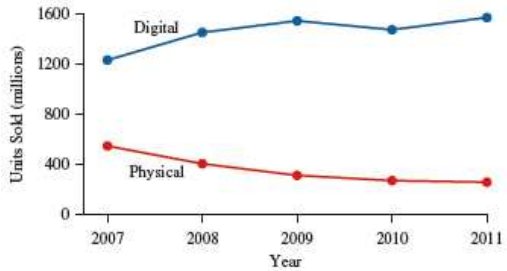
Presidents		Monarchs
	1	2
	1	5
	2	
	2	8
	3	23
	3	5
	4	00123
96	4	68999
3	5	124
8776	5	566889
443300	6	4
877765	6	57777889
432110	7	01
9887	7	67
310	8	11
85	8	
3300	9	
	9	

(C) The one with split stems in part (B) provides a more appropriate level of detail.

12.

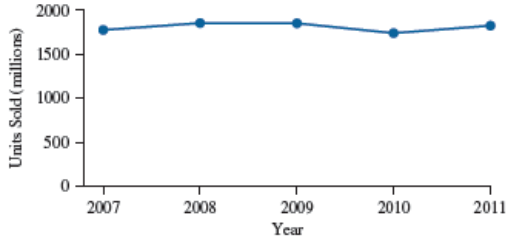


13. (A)

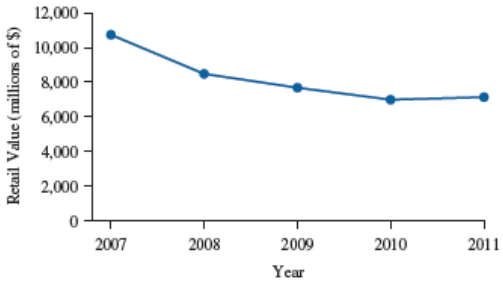


(B) They are inversely related. That is, as digital sales increase, physical sales decrease.

14. (A)



(B)



(C) The total units sold has been increasing, but the total retail value has been decreasing. This is because the total sold is going up due to increased units sold of the cheaper format (digital).

15. Option (i) is the correct statement, because the second graph is misleading due to the fact that its baseline does not start at zero.

Write About It

1. A frequency bar graph and the relative frequency bar graph for the same data are identical except for the scale on the vertical axis. This is because the relative frequency bar graph converts the frequencies to their corresponding proportional equivalents.
2. The main difference between frequency distributions for qualitative and quantitative data is that there are no natural categories for quantitative data. For quantitative data, the data must be divided into classes
3. Answers will vary.
4. Answers will vary.
5. Answers will vary.

Case Study: Do Late-Model Cars Get Better Gas Mileage?

1.

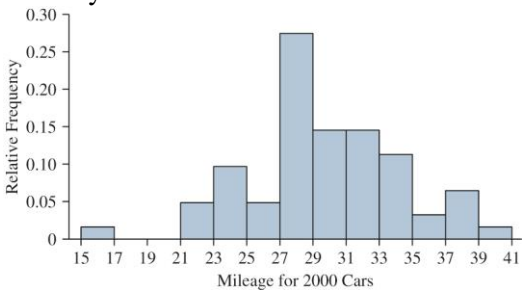
Mileage	Frequency
16.0–16.9	1
17.0–17.9	0
18.0–18.9	0
19.0–19.9	0
20.0–20.9	0
21.0–21.9	3
22.0–22.9	0
23.0–23.9	3
24.0–24.9	3
25.0–25.9	0
26.0–26.9	3
27.0–27.9	9
28.0–28.9	8
29.0–29.9	3
30.0–30.9	6
31.0–31.9	6
32.0–32.9	3
33.0–33.9	4
34.0–34.9	3
35.0–35.9	1
36.0–36.9	1
37.0–37.9	1
38.0–38.9	3
39.0–39.9	0
40.0–40.9	1

2. A class width of one is too narrow for these data because there are many classes with 0 or 1 car in them.

3.

Mileage	Frequency	Relative Frequency
15.0–16.9	1	0.016
17.0–18.9	0	0.000
19.0–20.9	0	0.000
21.0–22.9	3	0.048
23.0–24.9	6	0.097
25.0–26.9	3	0.048
27.0–28.9	17	0.274
29.0–30.9	9	0.145
31.0–32.9	9	0.145
33.0–34.9	7	0.113
35.0–36.9	2	0.032
37.0–38.9	4	0.065
39.0–40.9	1	0.016

4. We can see from the relative frequency histogram below, that it is unimodal, with very little skew.



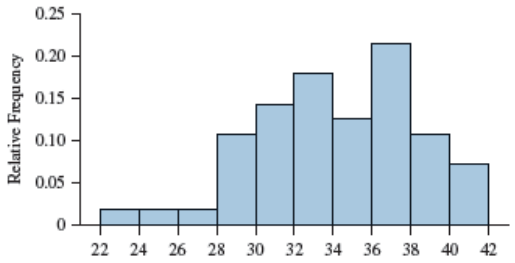
5. Answers will vary. Here is a frequency distribution with a class width of 2.

Mileage	Frequency
22–23.9	1
24–25.9	1
26–27.9	1
28–29.9	6
30–31.9	8
32–33.9	10
34–35.9	7
36–37.9	12
38–39.9	6
40–41.9	4

6. Answers will vary. Here is a relative frequency distribution with a class width of 2.

Mileage	Relative Frequency
22–23.9	0.018
24–25.9	0.018
26–27.9	0.018
28–29.9	0.107
30–31.9	0.143
32–33.9	0.179
34–35.9	0.125
36–37.9	0.214
38–39.9	0.107
40–41.9	0.071

7. We can see from the relative frequency histogram below, that it is unimodal, with slight skew to the left.



8. 2013 cars tend to have the higher MPG's.

9. The back-to-back stem-and-leaf plot (displayed immediately below) illustrates the comparison better than the histograms (displayed above) do. This is because all of the data in the comparison is right there in one plot, as opposed to having to look between two different histograms.

2000 Cars		2013 Cars
	1	
6	1	
444333111	2	2
99988888888777777777666	2	57999999
4443333222111111000000	3	000001112222233333444
88765	3	555666667777778889996
0	4	0000