Elementary Statistics 3rd edition Navidi Solutions Manual

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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)

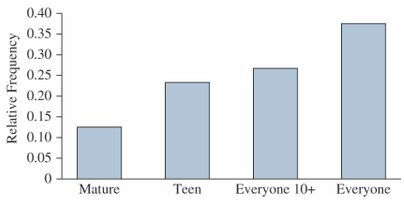
(C) True ($1300 > $1000)

14. **(A)** Type O

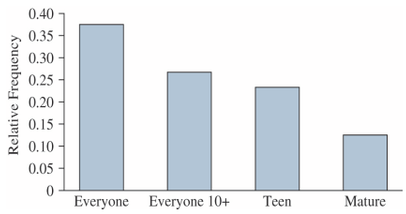
(B) False ($\frac{70}{150} = 46.7\%$)

(C) True

15. **(A)**



(B)

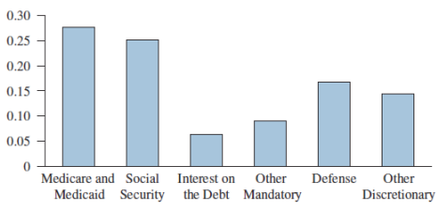


(C) Everyone (E)

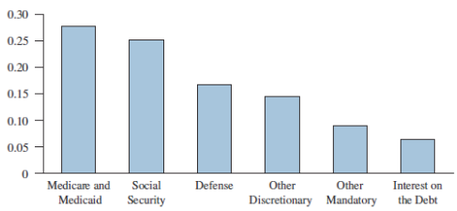
(D) False

(E) True (12.5% < 20%)

16. **(A)**



(B)



(C) Medicare and Medicaid

(D) 68.8% (27.7% + 25.1% + 9.6% + 6.4%)

17. **(A)** West, South

(B) Northeast, Midwest

(C) True

(D) False (the Northeast had around 18%)

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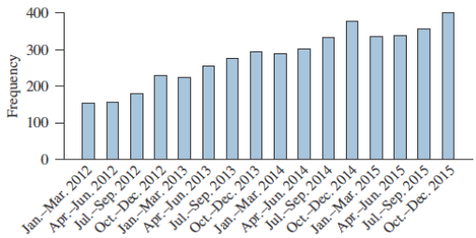
18. **(A)** The game

(B) True

(C) False (men < women)

(D) True (both are about 0.65)

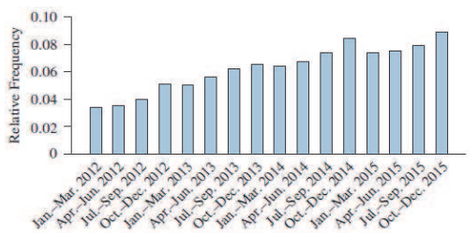
19. **(A)**



(B)

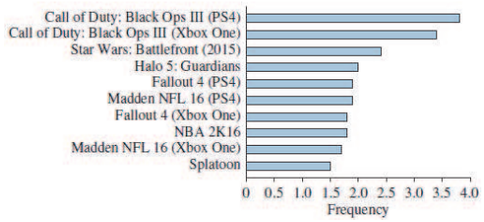
Quarter	Relative Frequency
Jan.–Mar. 2012	0.034
Apr.–Jun. 2012	0.035
Jul.–Sep. 2012	0.040
Oct.–Dec. 2012	0.051
Jan.–Mar. 2013	0.050
Apr.–Jun. 2013	0.056
Jul.–Sep. 2013	0.062
Oct.–Dec. 2013	0.065
Jan.–Mar. 2014	0.064
Apr.–Jun. 2014	0.067
Jul.–Sep. 2014	0.074
Oct.–Dec. 2014	0.084
Jan.–Mar. 2015	0.074
Apr.–Jun. 2015	0.075
Jul.–Sep. 2015	0.079
Oct.–Dec. 2015	0.089

(C)



(D) True

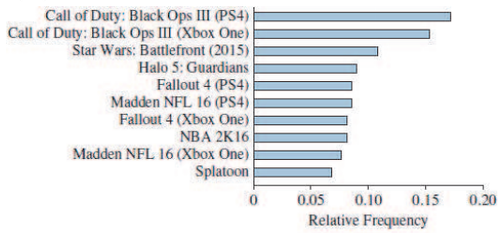
20. **(A)**



(B)

Game	Relative Frequency
Call of Duty: Black Ops III (PS4)	0.171
Call of Duty: Black OPs III (Xbox One)	0.153
Star Wars: Battlefront (2015) (PS4)	0.108
Halo 5: Guardians (Xbox One)	0.090
Fallout 4 (PS4)	0.086
Madden NFL 16 (PS4)	0.086
Fallout 4 (Xbox One)	0.081
NBA 2K16 (PS4)	0.081
Madden NFL 16 (Xbox One)	0.077
Splatoon (Wii U)	0.068

(C)



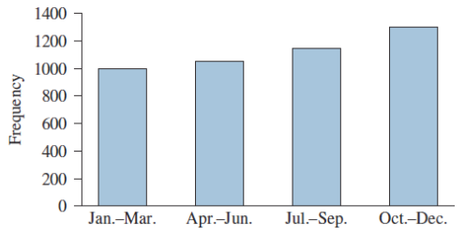
(D) True, $\dfrac{7.2}{22.2} = 0.324$

21. **(A)**

Quarter	Frequency (millions)
Jan.–Mar.	998.1
Apr.–Jun.	1048.8
Jul.–Sep.	1144.1
Oct.–Dec.	1297.8

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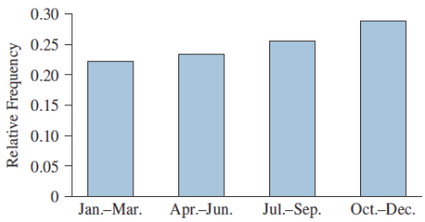
(B)



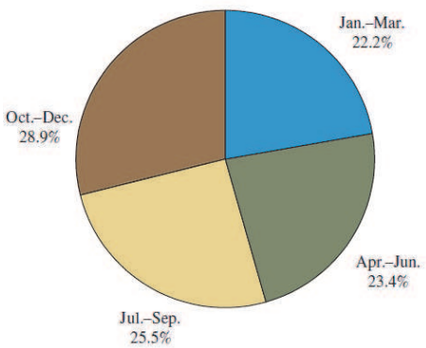
(C)

Quarter	Relative Frequency
Jan.–Mar.	0.222
Apr.–Jun.	0.234
Jul.–Sep.	0.255
Oct.–Dec.	0.289

(D)



(E)

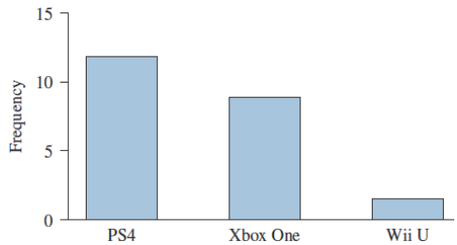


(F) False. 28.9% < 50%.

22. (A)

Platform	Frequency (millions)
PS4	11.8
Xbox One	8.9
Wii U	1.5

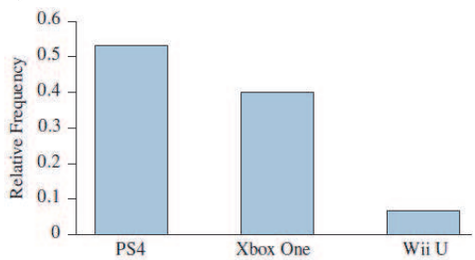
(B)



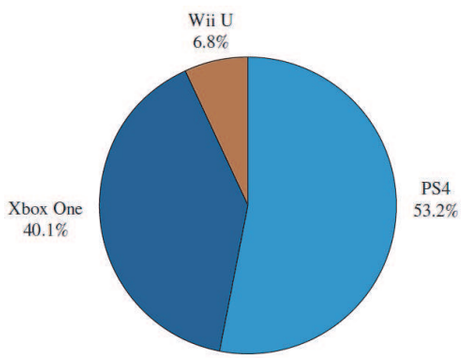
(C)

Platform	Relative Frequency
PS4	0532
Xbox One	0.401
Wii U	0.068

(D)



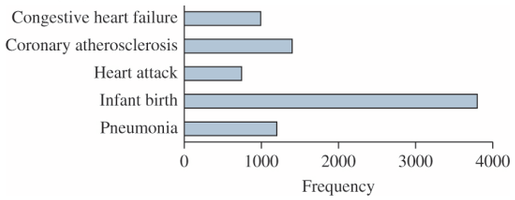
(E)



(F) True. 53.4% > 50%.

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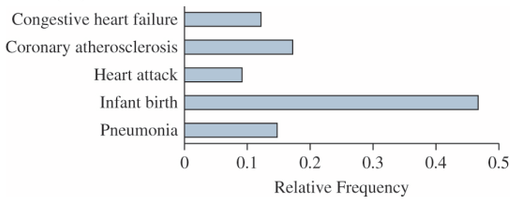
23. (A)



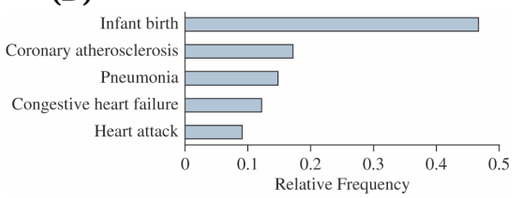
(B)

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

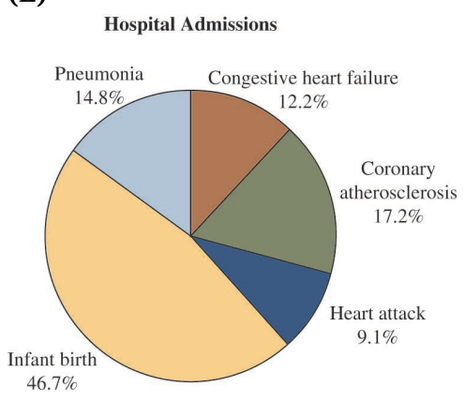
(C)



(D)

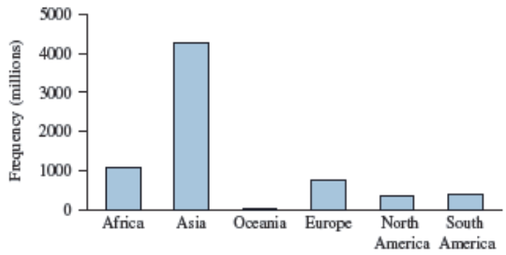


(E)



(F) True. (3800 > 3134)

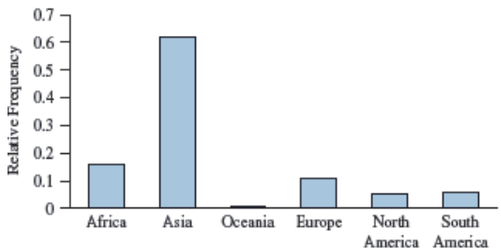
24. (A)



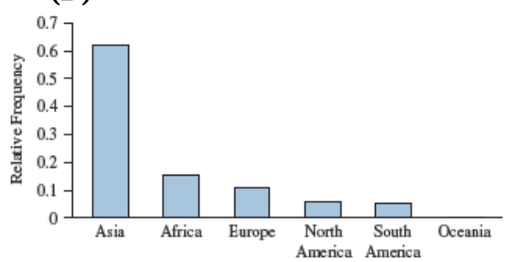
(B)

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

(C)

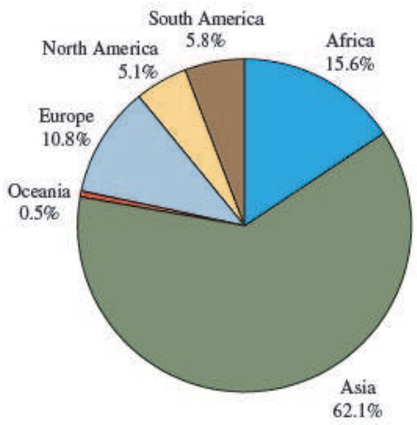


(D)



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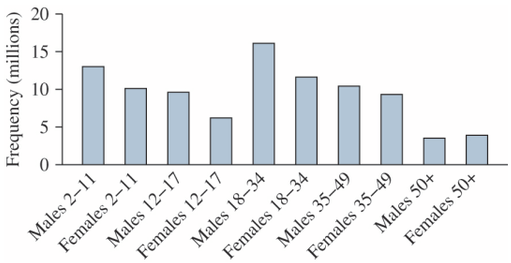
(E)



(F) True. 62.1% > 50%

(G) False. 10.8% < 10.9%

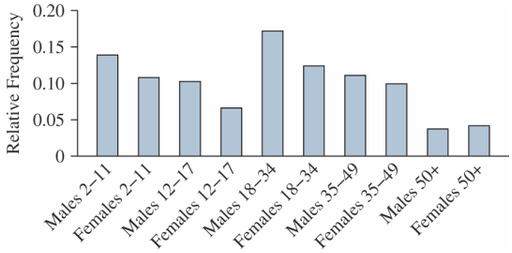
25. (A)



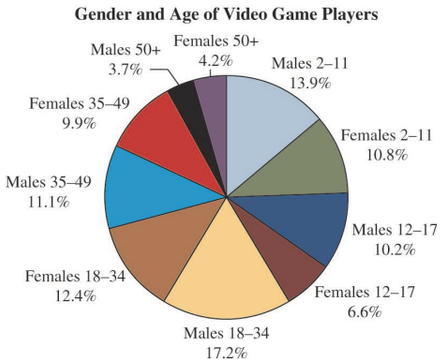
(B)

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)

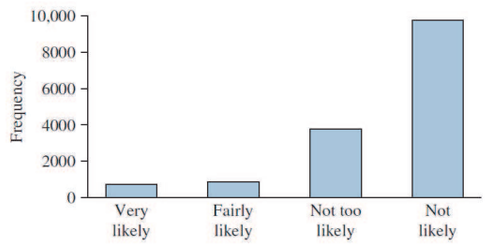


(E) True. (56.1% > 50%)

(F) True. 43.9% are females

(G) 0.289

26. (A)

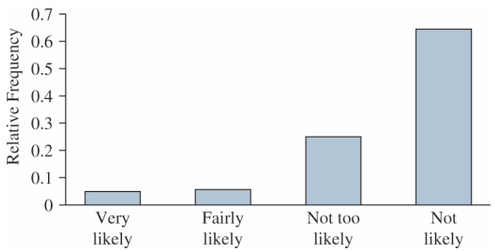


(B)

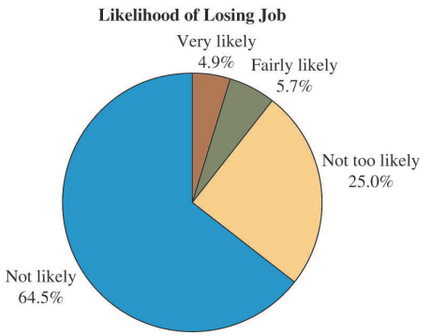
Response	Relative Frequency
Very likely	0.049
Fairly likely	0.057
Not too likely	0.250
Not likely	0.645

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(C)



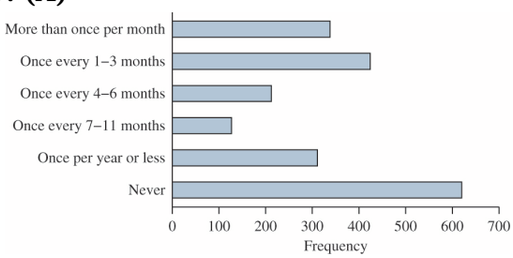
(D)



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

(F) 0.106

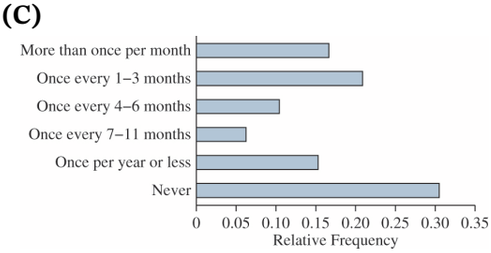
27. (A)



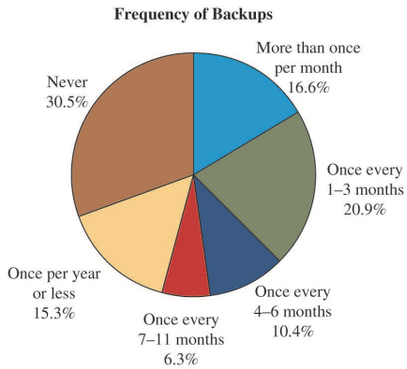
(B)

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)



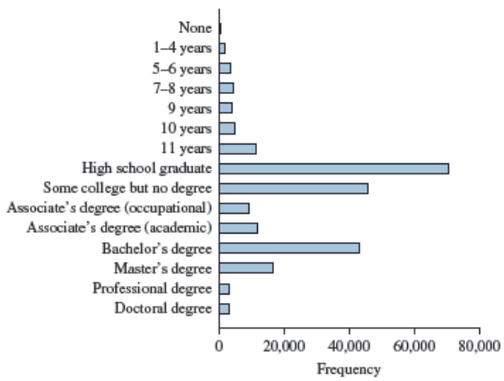
(D)



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

(F) False. 54.2% > 50%.

28. (A)

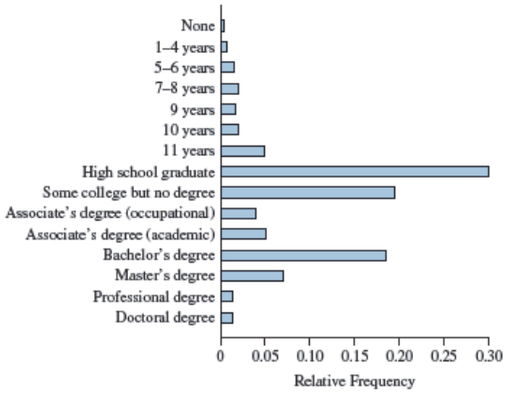


(B)

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

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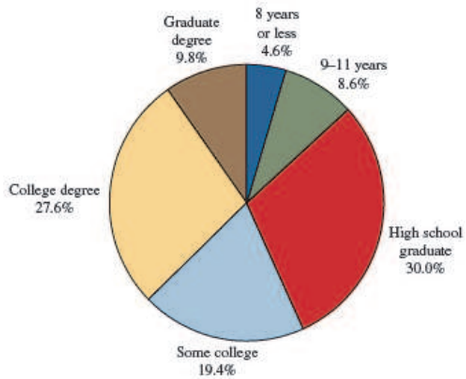
(C)



(D)

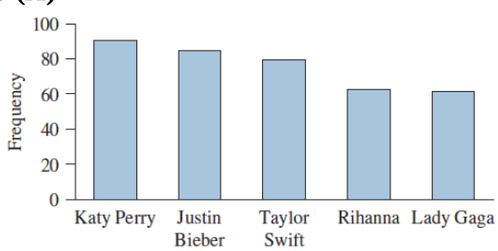
Educational Attainment	Frequency (thousands)
8 years or less	10,791
9–11 years	20,311
High school graduate	70,441
Some college but no degree	45,645
College degree	64,757
Graduate degree	22,915

(E)



(F) 0.132

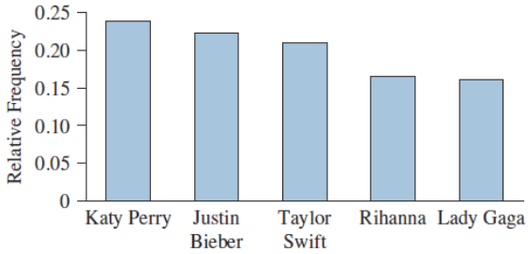
29. (A)



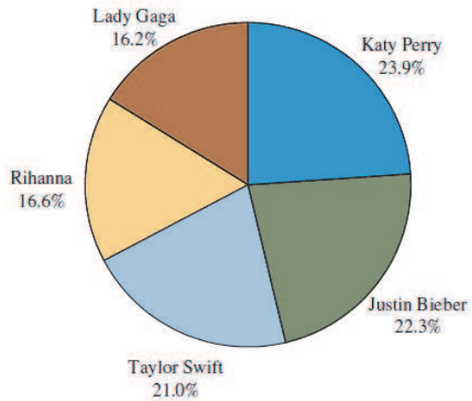
(B)

Singer	Relative Frequency
Katy Perry	0.239
Justin Bieber	0.223
Taylor Swift	0.210
Rihanna	0.166
Lady Gaga	0.162

(C)



(D)



(E) 0.210

30. (A)

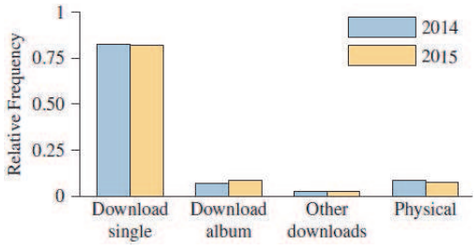
Type of Music	Relative Frequency
Download single	0.823
Download album	0.070
Other downloads	0.024
Physical	0.084

(B)

Type of Music	Relative Frequency
Download single	0819
Download album	0.083
Other download	0.023
Physical	0.075

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(C)



(D) False. Download album increased.

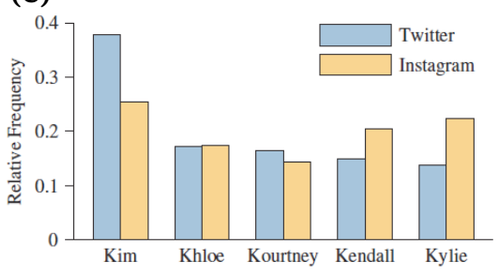
31. (A)

Kardashian	Relative Frequency
Kim	0.379
Khloé	0.172
Kourtney	0.164
Kendall	0.149
Kylie	0.137

(B)

Kardashian	Relative Frequency
Kim	0.255
Khloé	0.175
Kourtney	0.144
Kendall	0.204
Kylie	0.223

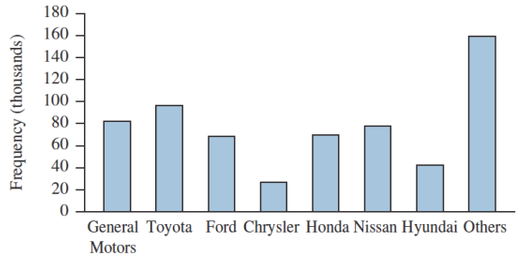
(C)



(D) True

(E) True. 46.5 > 41.1

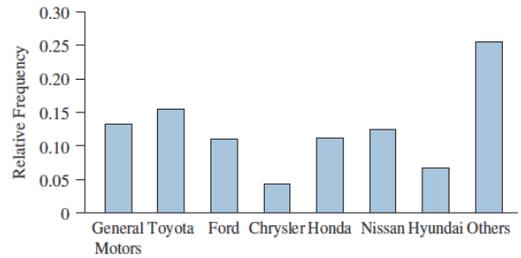
32. (A)



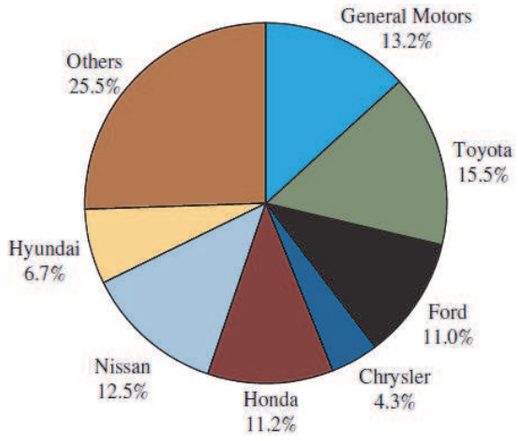
(B)

Manufacturer	Relative Frequency
General Motors	0.132
Toyota	0.155
Ford	0.110
Chrysler	0.043
Honda	0.112
Nissan	0.125
Hyundai	0.067
Other	0.255

(C)



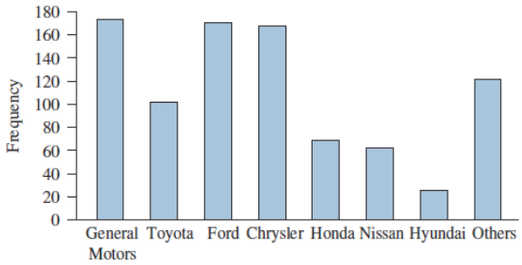
(D)



(E) 0.132

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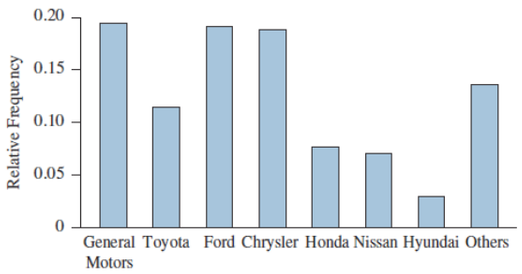
33. (A)



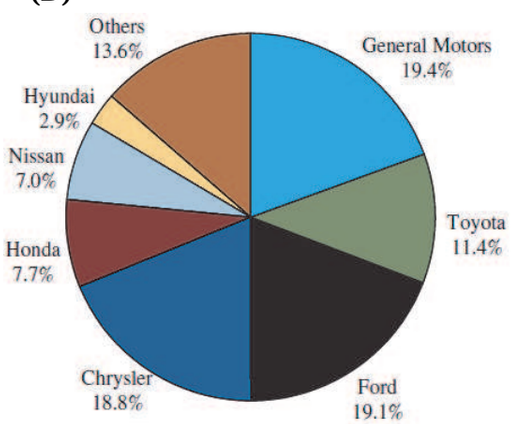
(B)

Manufacturer	Relative Frequency
General Motors	0.194
Toyota	0.114
Ford	0.191
Chrysler	0.188
Honda	0.077
Nissan	0.070
Hyundai	0.029
Others	0.136

(C)



(D)

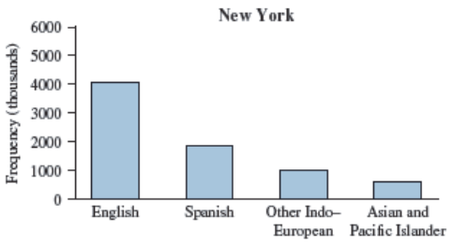


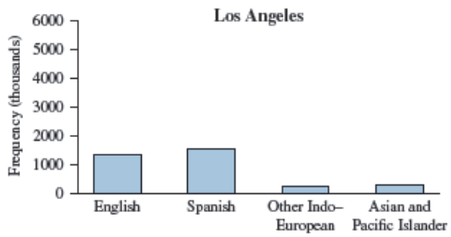
(E) True. 167.9 > 156.

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

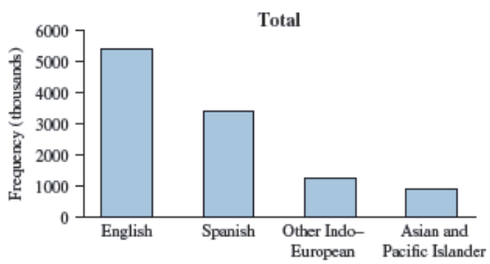
Extending the Concepts

35. (A)



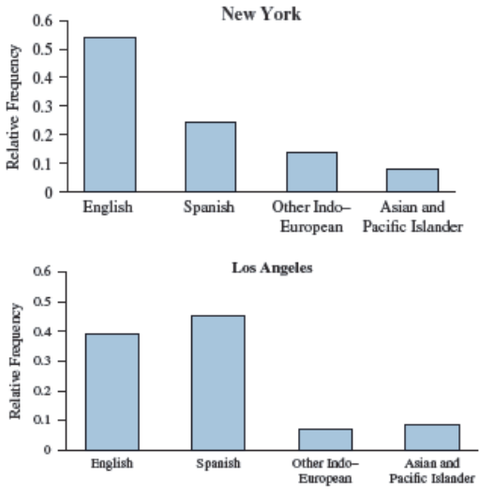


(B)

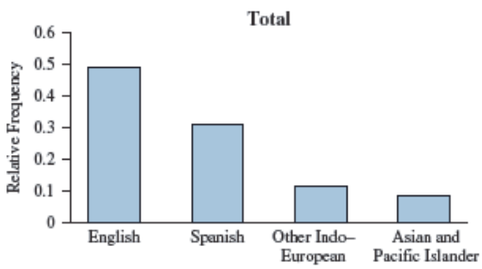


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(C)



(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.

36.(A) No. The proportions are not parts of a whole. In particular, they do not add up to 1.

(B) No. This is not a frequency table.

Section 2.2 Exercises

Exercises 1-4 are the Check Your Understanding exercises located within the section. Their answers are found on page 68.

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

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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 yields the percentage of men with levels above 240. This sum is closest to 30%.
(B) 240-260

22. **(A)** The sum of the proportions in the last 8 rectangles yields the percentage of women with pressures above 120. The sum is closest to 50%.
(B) 130-135

23. **(A)** False
(B) True
(C) 9
(D) No
(E) Skewed to the right.

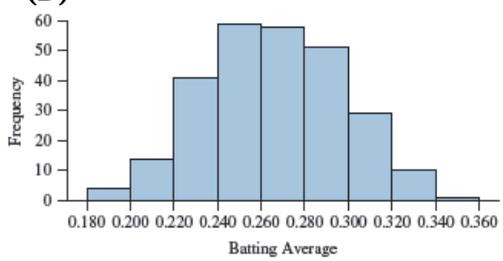
24. **(A)** 50 - 55
(B) 30%
(C) 60 – 70

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

26. **(A)** Right skewed, because there are more people with low incomes than high.
(B) Left skewed, because there are more students finishing the exam close to the allotted 60 minutes.
(C) Right skewed, because there are more people with younger ages than older.

27. **(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.

(D)

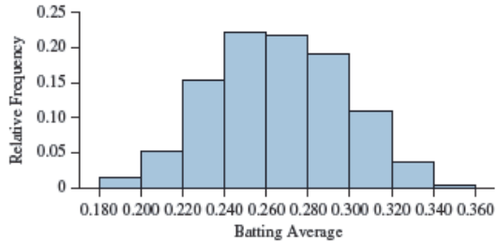


(E)

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

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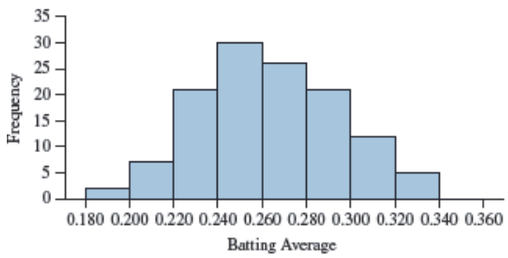
(F)



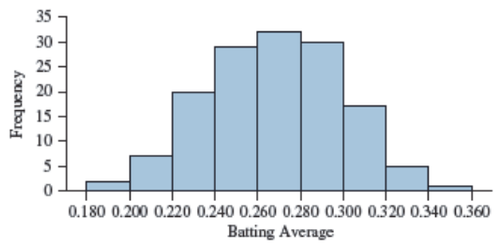
(G) 0.109 + 0.037 + 0.004 = 0.15 = 15%

(H) 0.015 + 0.052 = 0.067 = 6.7%

28. (A)



(B)



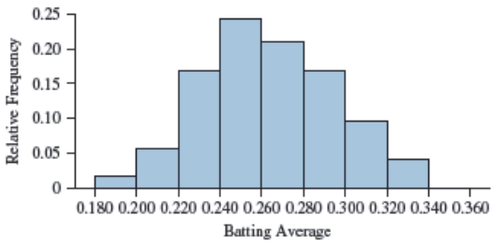
(C)

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

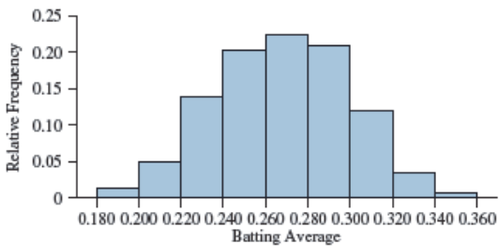
(D)

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%

(I) Batting averages tend to be a bit higher in the National League.

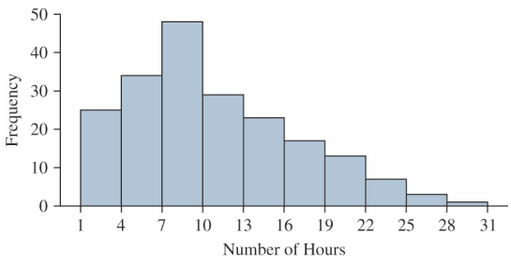
29. (A) 10

(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.

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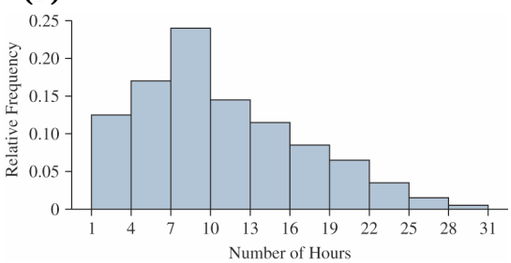
(D)



(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%

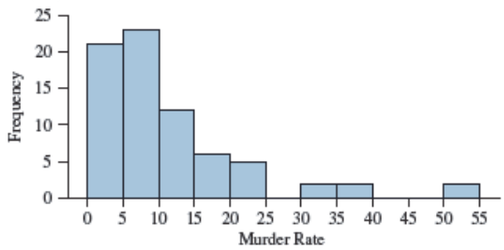
(H) 0.065 + 0.035 + 0.015 + 0.005 = 0.12 = 12.0%

30. (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.

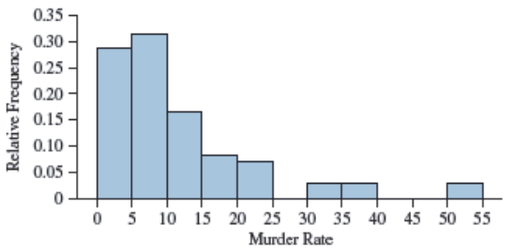
(D)



(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%

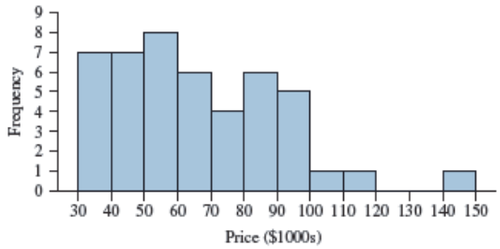
(H) 0.027 + 0.027 + 0.027 = 0.081 = 8.1%

31. (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

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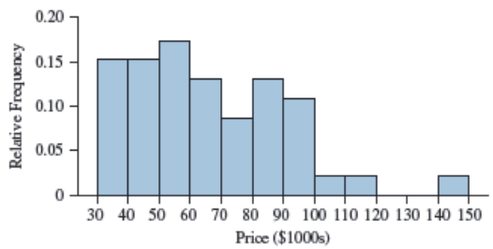
(B)



(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

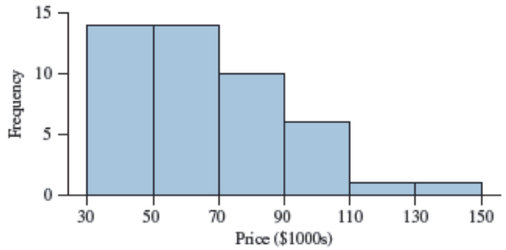
(D)



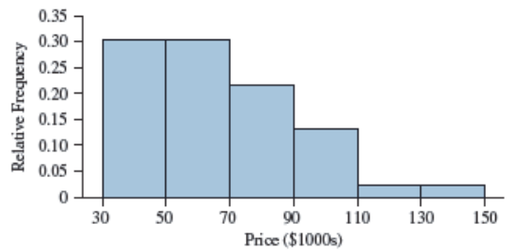
(E) Unimodal

(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



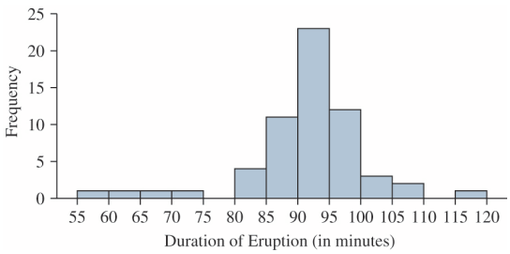
(G) Both are reasonably good choices for class widths. The number of classes are both at least 5, but less than 20. Also, neither class widths are too narrow or too wide.

32. (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

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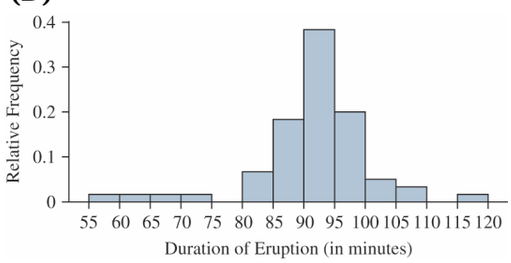
(B)



(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

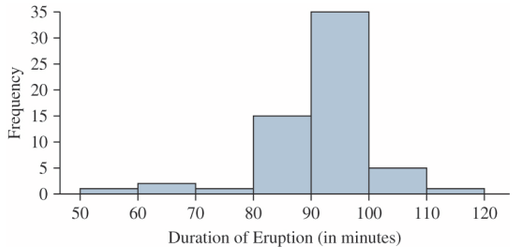
(D)



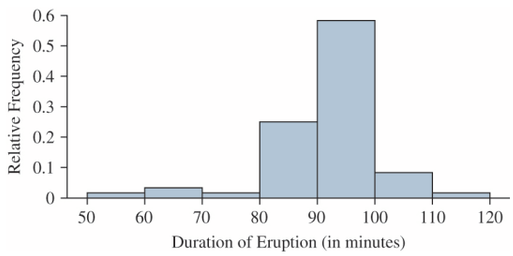
(E) Skewed to the left

(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



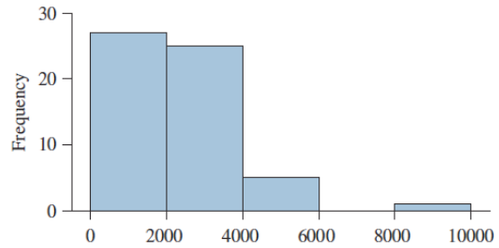
(G) Answers will vary. The class width of 5 provides a more appropriate level of detail in the middle of the histogram, but is very sparse in the tails. The class width of 10 is better in the tails, but most of the data are in only two classes.

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

Number of Words	Frequency
0–1999	27
2000–3999	25
4000–5999	5
6000–7999	0
8000–9999	1

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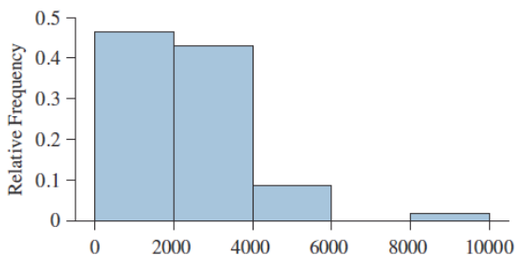
(B)



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

Number of Words	Relative Frequency
0–1999	0.466
2000–3999	0.431
4000–5999	0.086
6000–7999	0.000
8000–9999	0.017

(D)

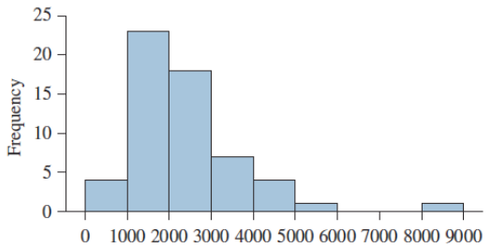


(E) Skewed to the right

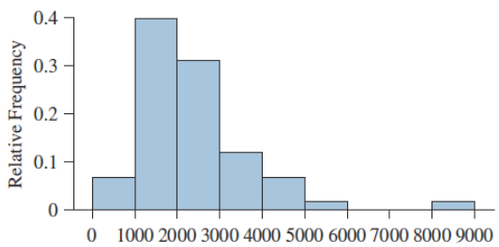
(F) Answers will vary. Here is one possibility:

Number of Words	Frequency
0–999	4
1000–1999	23
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	0.069
1000–1999	0.397
2000–2999	0.310
3090–3999	0.121
4000–4999	0.069
5000–5999	0.017
6000–6999	0.000
7000–7999	0.000
8000–8999	0.017



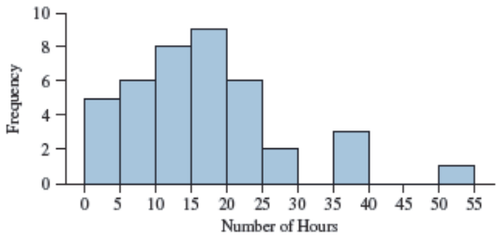
(H) The one with 9 classes is more appropriate than the one with only 5 classes. This is because the one with only 5 classes is too wide. Only the most basic features of the data are visible.

34. (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

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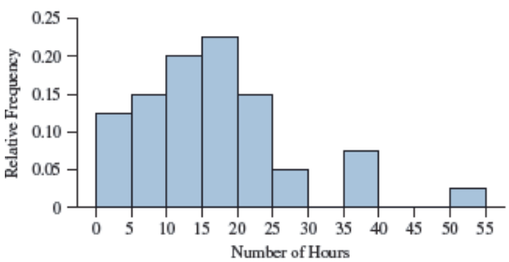
(B)



(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)

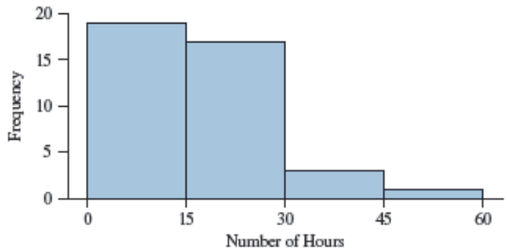


(E) Skewed to the right

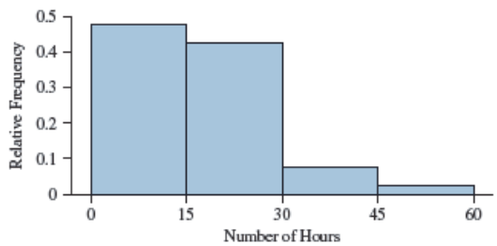
(F) Answers will vary. Here is one possibility:

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

(G)

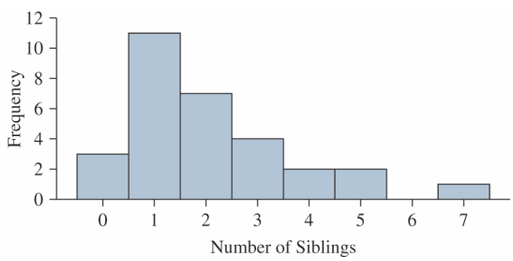


Number of Hours	Relative Frequency
0–14	0.475
15–29	0.425
30–45	0.075
46–60	0.025

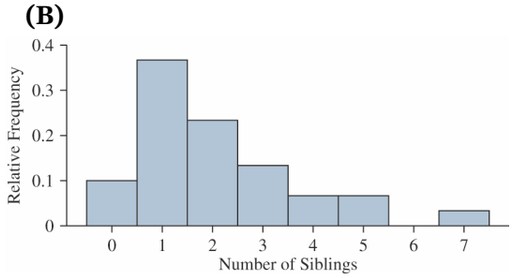


(H) The graphs with nine classes are much more appropriate than those with only 4 classes. This is because only the most basic features of the data are visible, when the class widths are too wide, as they are in the graphs containing only four classes.

35. (A)



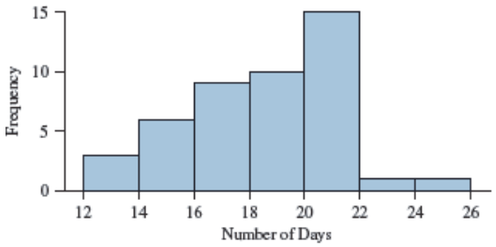
(B)



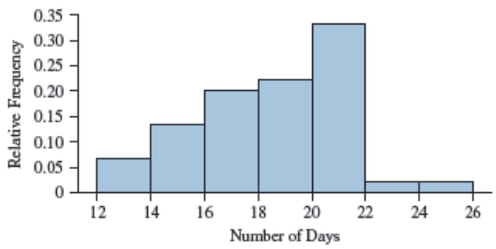
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(C) Skewed to the right

36. (A)



(B)

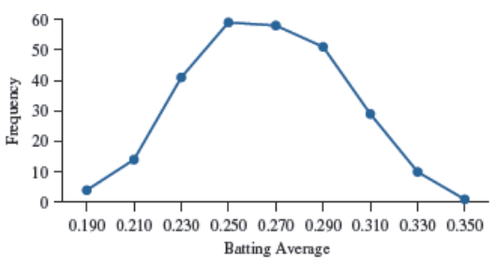


(C) Skewed to the left

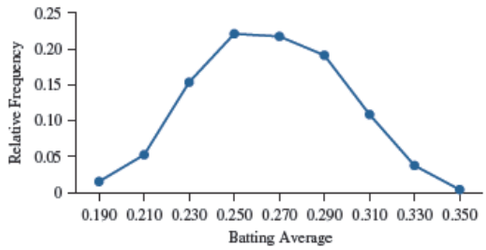
37. Histogram B represents death from accidents. People who die from accidents tend to be younger than those who die from natural causes.

38. There is a gap between the top 15 scores and all of the others.

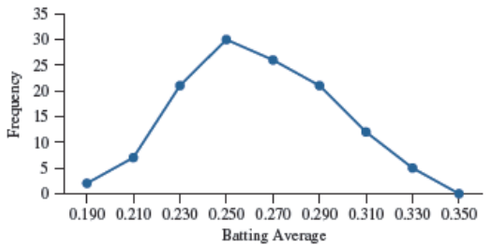
39. (A)



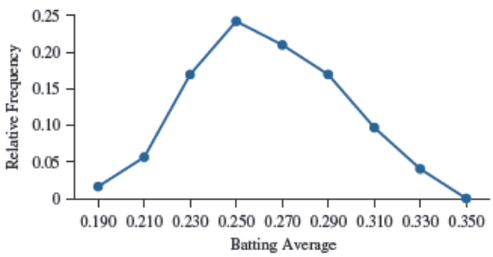
(B)



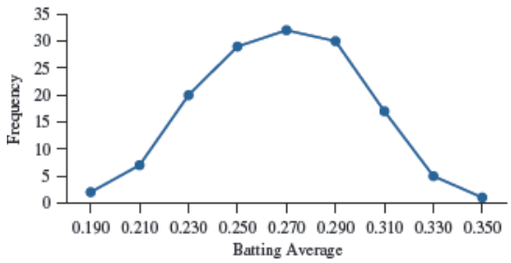
40. (A)



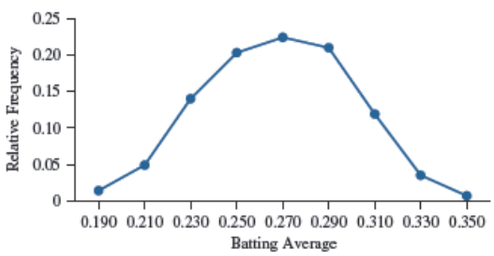
(B)



(C)

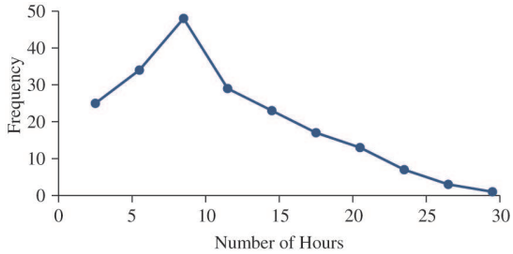


(D)

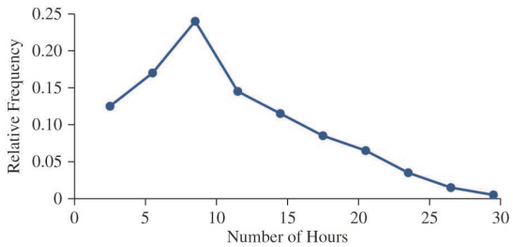


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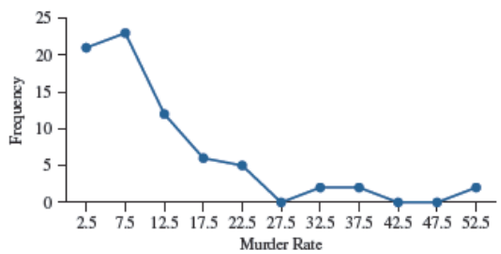
41. (A)



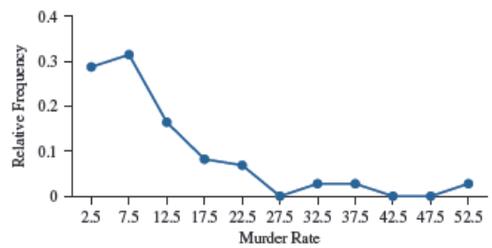
(B)



42. (A)



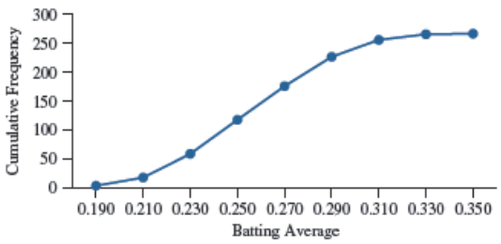
(B)



43. (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

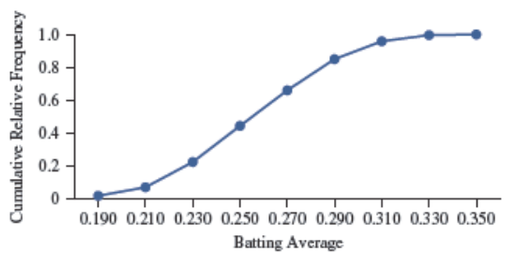
(B)



(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)

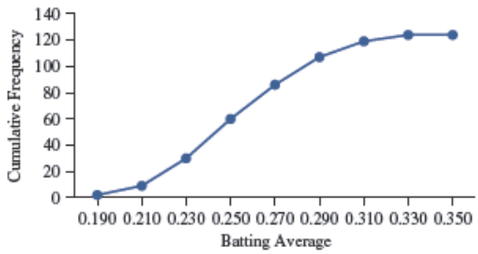


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44. (A)

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

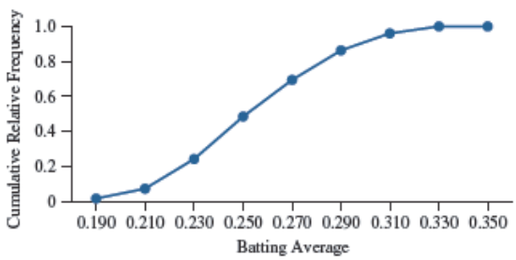
(B)



(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

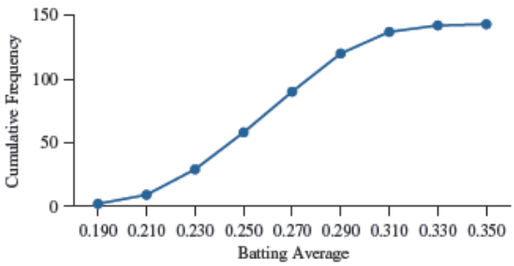
(D)



(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

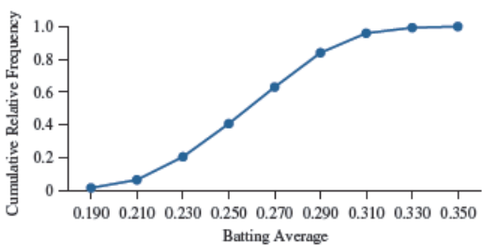
(F)



(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)

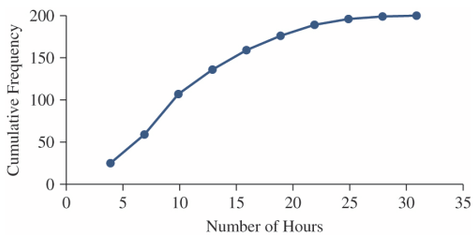


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45. (A)

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

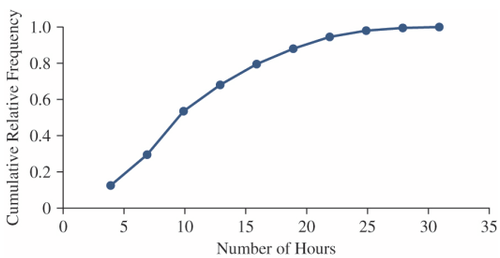
(B)



(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

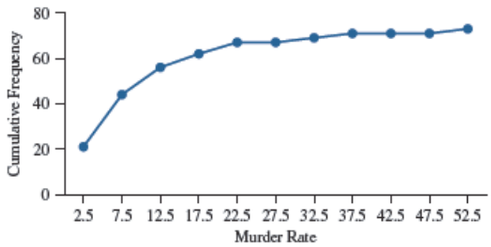
(D)



46. (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

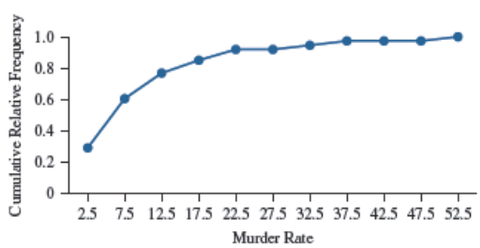
(B)



(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)



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47. It is not possible to construct a histogram for this data set because "30 or more" represents an open ended class.

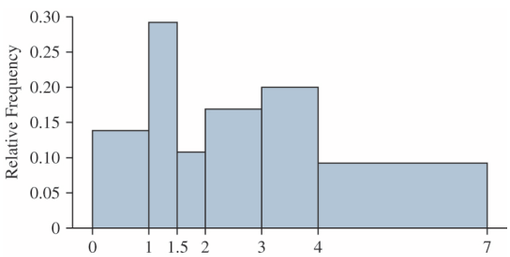
48. Yes. The last class would become 30-34.9.

Extending the Concepts

49. We solve the following equation:
$0.2 + 0.3 + 0.15 + x + 0.1 + 0.1 = 1$
Answer: $x = 0.15$

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

(B)

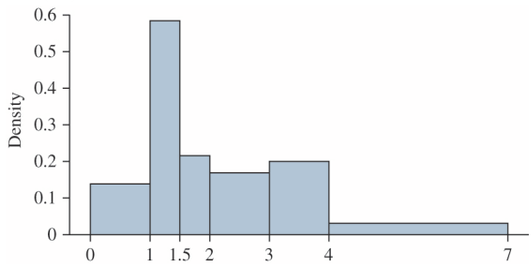


This histogram gives a distorted picture of the data because it makes it look like this is a bimodal distribution, when in reality, Figure 2.6 shows that the data has one mode and is skewed to the right.

(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) Dividing the relative frequency by the class width adjusts for the differing widths of the classes.

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

52. Skewed to the right because the first two classes have relative frequencies of 0.2 and 0.37. The other classes are all less than 0.15.

53. A and B are correct, but C is incorrect.

Section 2.3 Exercises

Exercises 1 and 2 are the Check Your Understanding exercises located within the section. Their answers are found on page 80.

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.

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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

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(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.

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	133
99887777766665555	2	56667778888899
1100	3	01111222222333333
	3	55567888999
	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 see that the Wimbledon champions tend to be younger.

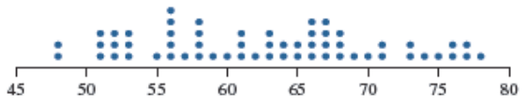
22. (A) In the following back-to-back split stem-and-leaf plot, Leaf 1 displays the lengths of time of the PG-13 movies and Leaf 2 does so for the R rated movies.

PG or PG-13		R
	9	6
	10	2566
	11	237
9741	12	26
6	13	278
76321	14	
21	15	5
42	16	
	17	0
	18	
4	19	

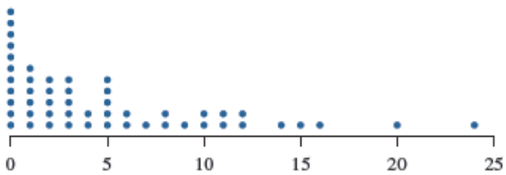
(B) They differ greatly. R-rated movies tend to be shorter.

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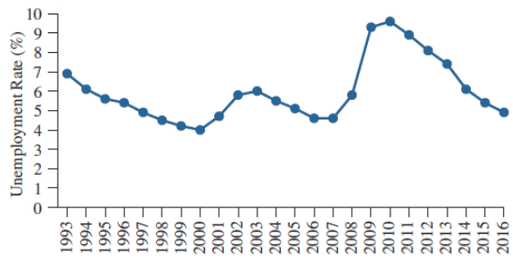
23. Yes, there are three small gaps in the dotplot below for the Macon, GA temperature data.



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

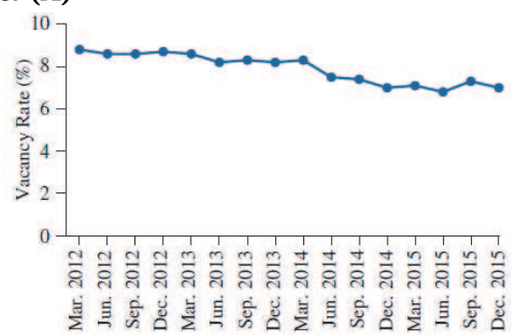


25. (A)



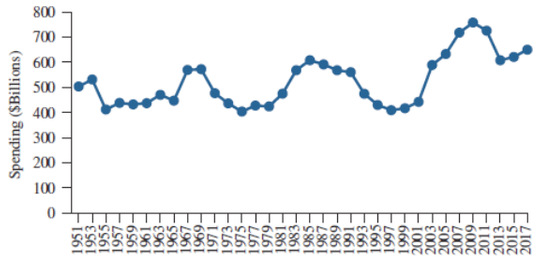
(B) Increasing: 2000–2003; 2007–2010. Decreasing: 1993–2000; 2003–2007; 2010–2016.

26. (A)



(B) Decreasing

27. (A)

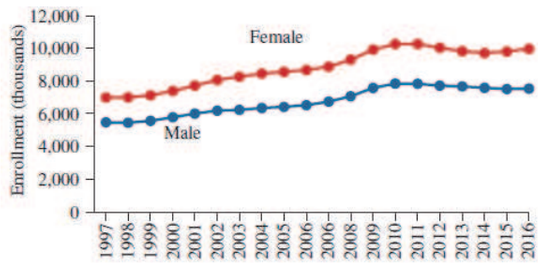


(B) Increased: 1960's, 1980's, 2000's. Decreased: 1950's, 1970's, 1990's, 2010's.

(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) $300 billion

(B) Both are about $320 billion.

(C) False. 1997 was about $260 billion. Double this amount would be $520 billion, and 2014 wasn't even $400 billion.

(D) It decreased.

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

(B) 85

(C) About the same

31. (A) 28

(B) 1990

(C) Greater than

(D) About the same

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32. The number of participating countries increased between 1952 and 1972.

33. **(A)** 115 inches
(B) 1910
(C) Less than
(D) True. It occurred in the 1880s.
(E) False.

34. **(A)** 2007
(B) False. It decreased several times between 2008 and 2012
(C) The number of three-point shots made increased, then decreased.

35. **(A)** 4%
(B) It increased
(C) It decreased
(D) It increased

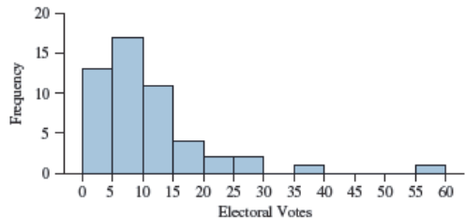
36. **(A)** 2007
(B) 2012
(C) False. It was not in 2013.
(D) False. It increased between 2012 and 2013.

Extending the Concepts

37. **(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 86.

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.

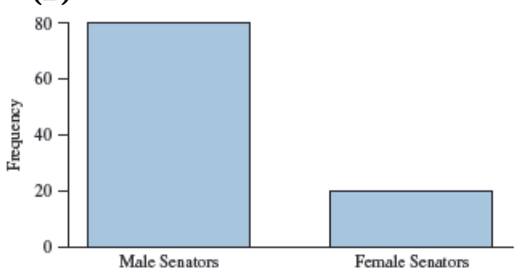
6. The bar graph presents a more accurate picture because its baseline is correctly placed at 0. The time-series plot exaggerates the rate of the increase.

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7. Graph (B) presents the more accurate picture. The baseline is at zero, and the bars are of equal width. The dollar bill graphic does not follow the area principle. The length and width of the smaller image are about 25% less than the length and width of the larger image, so the area of the smaller image is about 50% less than that of the larger image. This exaggerates the
difference.
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 six times that of the smaller image. This exaggerates the difference.
9. The graph is misleading, because the baseline is not at zero.
10. It presents an accurate picture, because the baseline is 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.

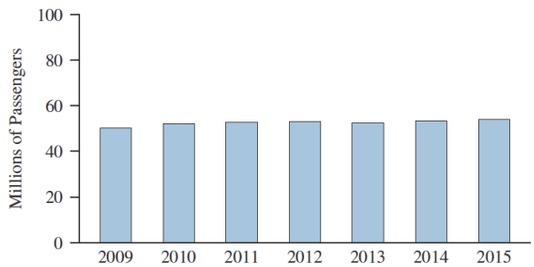
(B)



12. It is misleading because the baseline is not placed at zero.
13. (i) 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. (ii) is more accurate. Time series plot (B), with the baseline at zero, presents an accurate picture. Plot (A) exaggerates the decrease.

Extending the Concepts

15. **(A)**



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

(C) Figure 2.23 has a baseline of zero, and the scale on the *y*-axis is appropriate for the bar height.

Chapter Quiz

1.

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

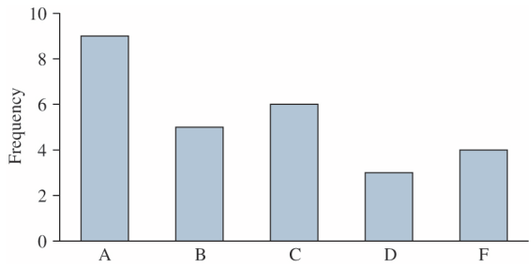
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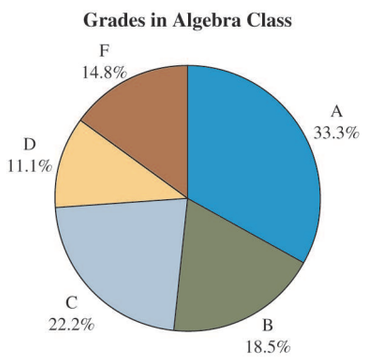
2.

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

3.



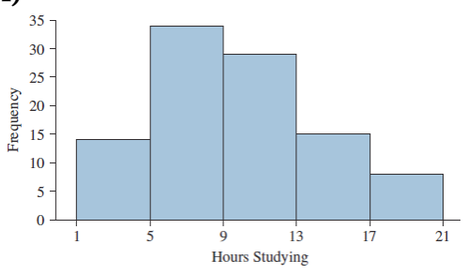
4.



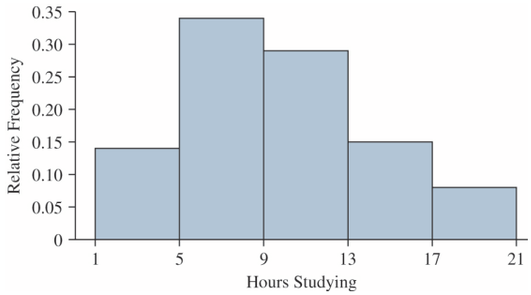
5. The classes are: 5.0-7.9, 8.0-10.9, 11.0-13.9, 14.0- 16.9, and 17.0-19.9. The class width is 3.

6. True

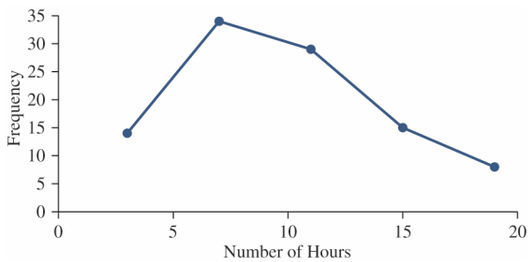
7. **(A)**



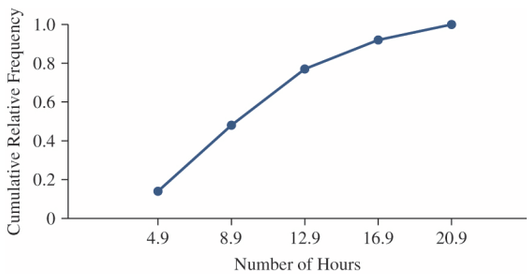
(B)



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.

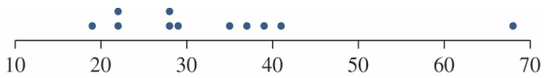
1	9
2	22889
3	579
4	1
5	
6	8

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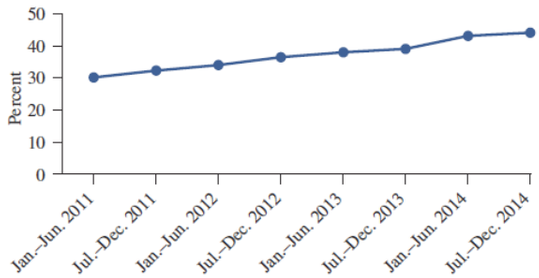
12.

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

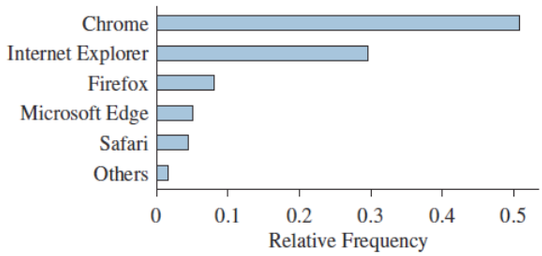
1. **(A)** Somewhat

(B) True

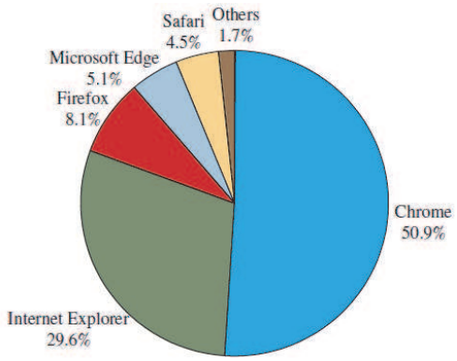
(C) False. Roughly 36% believe these ways, which is less than half.

(D) True

2. **(A)**

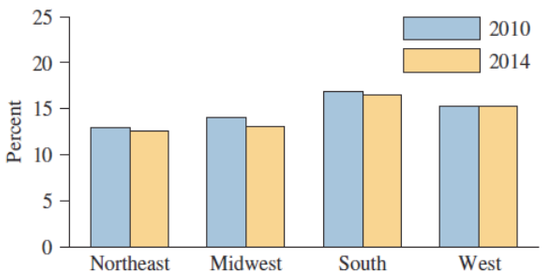


(B)



(C) False, 50.95% < 59.2%.

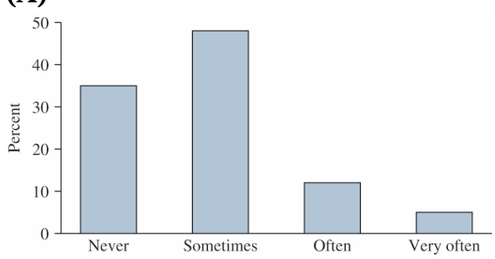
3. **(A)**



(B) True

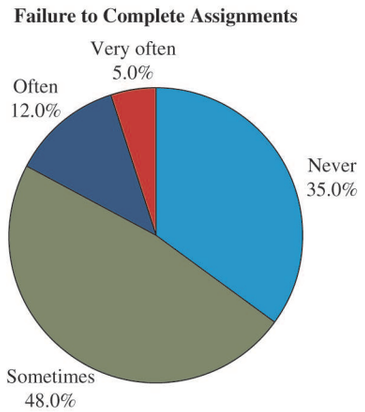
(C) The Midwest

4. **(A)**



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(B)



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

5. **(A)** 7

(B) 10

(C) $\frac{5}{50} = \frac{1}{10} = 10\%$

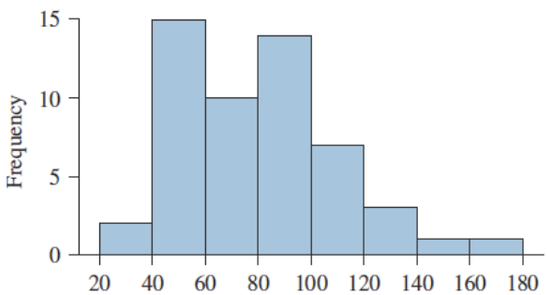
(D) Unimodal

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.

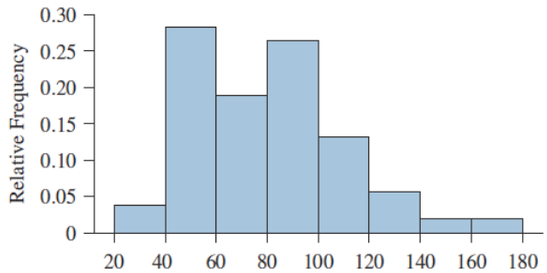
(D)



(E)

Number of Freshmen	Relative Frequency
20–39	0.038
40–59	0.283
60–79	0.189
80–99	0.264
100–119	0.132
120–139	0.057
140–159	0.019
160–179	0.019

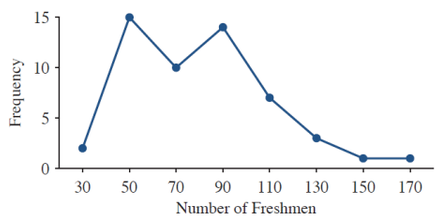
(F)



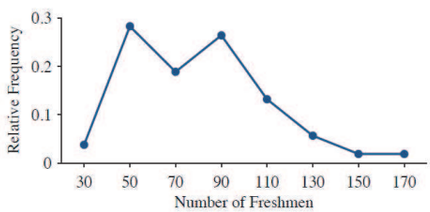
(G) $\frac{12}{53} = 0.226 = 22.6\%$

(H) $\frac{17}{53} = 0.321 = 32.1\%$

7. **(A)**

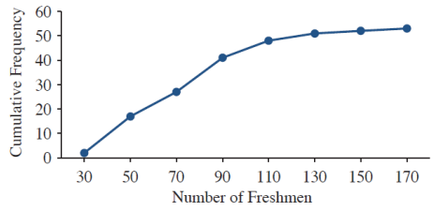


(B)

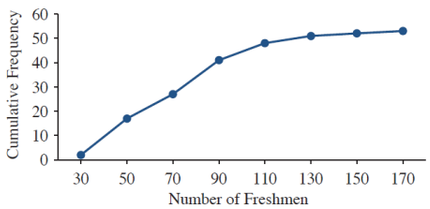


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(C)



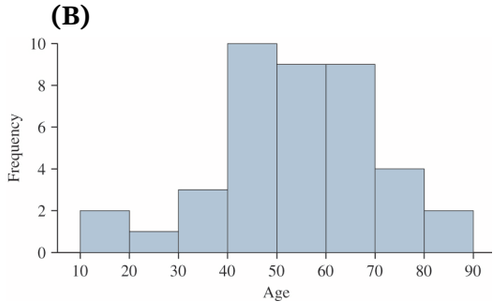
(D)



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

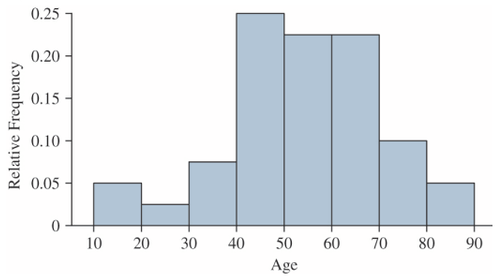
(B)



(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)



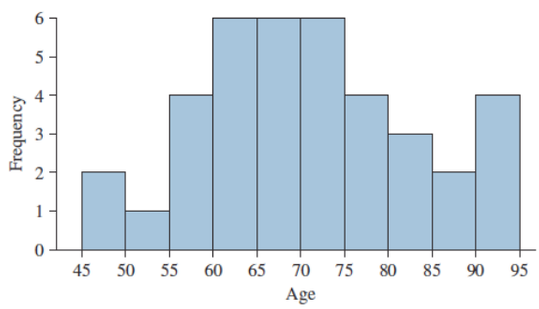
9.

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)

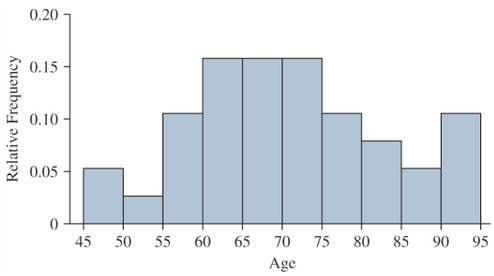


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(C)

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)



(B)

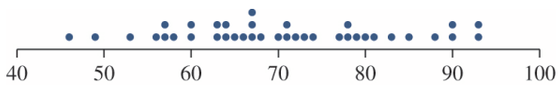
Presidents		Monarchs
	1	2
	1	5
	2	
	2	8
	3	23
	3	5
	4	00123
96	4	68999
3	5	124
8776	5	566889
443300	6	4
877765	6	57777889
432110	7	01
9887	7	67
310	8	11
85	8	
3300	9	
	9	

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

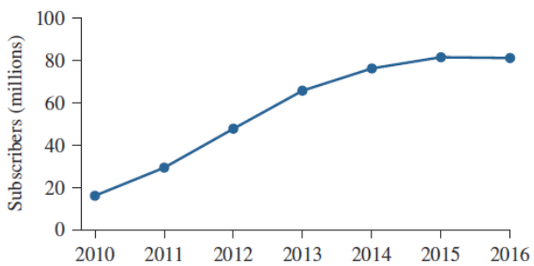
11. (A)

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	

12.

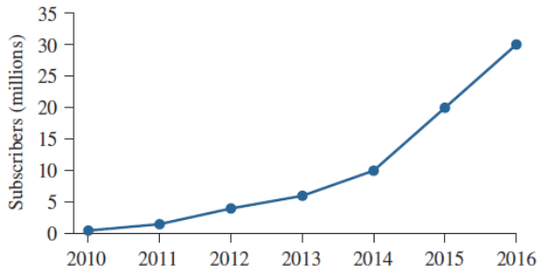


13. (A)



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(B)



(C) The number of Pandora subscribers increased from 2010 to 2015, then decreased slightly between 2015 and 2016. The number of Spotify subscribers increased steadily from 2010 to 2016.

14. **(A)** Highest in 1990, lowest in 1930.
(B) Increasing
(C) Life expectancy has increased.

15. Option (i) is the correct statement. 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 Hybrid Cars Get Better Gas Mileage?

1.

Mileage	Frequency
20.0–21.9	5
22.0–23.9	0
24.0–25.9	1
26.0–27.9	5
28.0–29.9	7
30.0–31.9	7
32.0–33.9	2
34.0–35.9	2
36.0–37.9	3
38.0–39.9	1
40.0–41.9	8
42.0–43.9	6
44.0–45.9	2
46.0–47.9	2
48.0–49.9	0
50.0–51.9	3
52.0–53.9	1
54.0–55.9	0
56.0–57.9	1

2. A class width of two is too narrow for these data because there are 19 classes, which is too many for a data set containing only 56 data values.

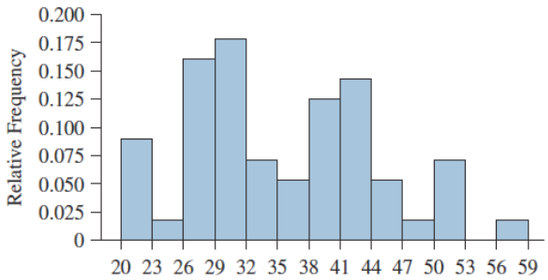
3.

Mileage	Frequency	Relative Frequency
20.0–22.9	5	0.089
23.0–25.9	1	0.018
26.0–28.9	9	0.061
29.0–31.9	10	0.179
32.0–34.9	4	0.071
35.0–37.9	3	0.054
38.0–40.9	7	0.125
41.0–43.9	8	0.143
44.0–46.9	3	0.054
47.0–49.9	1	0.018
50.0–52.9	4	0.071
53.0–55.9	0	0.000
56.0–58.9	1	0.018

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4. The histogram is bimodal with little skewness.



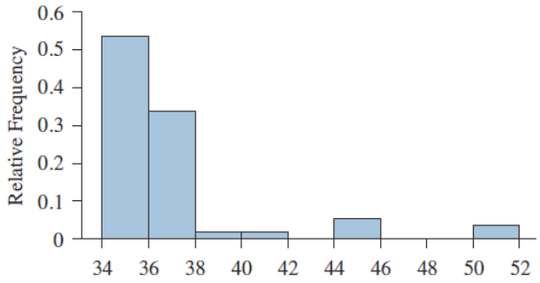
5. Answers will vary. Here is a frequency distribution with a class width of 2.

Mileage	Frequency
34.0–35.9	30
36.0–37.9	19
38.0–39.9	1
40.0–41.9	1
42.0–43.9	0
44.0–45.9	3
46.0–47.9	0
48.0–49.9	0
50.0–51.9	2

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

Mileage	Relative Frequency
34.0–35.9	0.536
36.0–37.9	0.339
38.0–39.9	0.018
40.0–41.9	0.018
42.0–43.9	0.000
44.0–45.9	0.054
46.0–47.9	0.000
48.0–49.9	0.000
50.0–51.9	0.036

7. The relative frequency histogram is unimodal and skewed to the right.



8. The mileages vary more for the hybrid cars.

9.

Hybrid		Non-hybrid
11000	2	
9998888666665	2	
44321110000	3	44444444444
8777	3	55555555555555555556666666666666777779
422222211000000	4	04
765	4	55
2000	5	00
6	5	

Answers may vary as to which illustrates the comparison more effectively. The back-to-back stem-and-leaf plot puts the data sets next to each other on the same axis. The histograms arguably illustrate the outliers more clearly.

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