### **Elementary Statistics 2nd 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 
$$\left(\frac{70}{150} = 46.7\%\right)$$

(C) True





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## **(B)**

Quarter	Relative Frequency
JanMar. 2009	0.064
AprJun. 2009	0.059
JulSep. 2009	0.059
OctDec. 2009	0.122
JanMar. 2010	0.063
AprJun. 2010	0.055
JulSep. 2010	0.053
OctDec. 2010	0.113
JanMar. 2011	0.052
AprJun. 2011	0.044
JulSep. 2011	0.038
OctDec. 2011	0.089
JanMar. 2012	0.045
AprJun. 2012	0.039
JulSep. 2012	0.031
OctDec. 2012	0.074





#### 20. (A)



(]	B)
	TM

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





**(D)** True 
$$\left(\frac{3.0}{32} = 30\%\right) > 20\%$$

21. (A)

Quarter	Frequency (thousands)
Jan.–Mar.	38,591
AprJun.	33,916
JulSep.	31,183
OctDec.	68,513



(**C**)

Quarter	Relative Frequency
JanMar.	0.224
AprJun.	0.197
JulSep.	0.181
OctDec.	0.398

**(D)** 















#### **(C)**





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



## **(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









(**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**





- (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.





## **(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



and 30.9.



(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.



(]	E)
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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



**(H)** 0.027 + 0.027 + 0.027 = 0.081 = 8.1%29. (A)

• (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>(B)</b>		
9		
1 -		

Price (\$1000s)

90 100 110 120 130 140 150

Frequency

0 30 40 50 60 70 80

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J	Ľ	_)	

$(\mathbf{U})$		
	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





	riequency
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.

Ň	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>B</b> )	
25 -		
20 -		
fon 15 -		
nbə. 10 -		
щ .e		
5 -		_
0 -	55 60 65 70 75 80	) 85 90 95 100
	Duration of	f Fruntion (in minute





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



(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
8000-99999	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.

/		
	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



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



(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.







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



	(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



**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</b> )	
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
<b>(D)</b>	
â 1.0 -	
.8 -	
2 0.6 -	
19 0.4 -	1 million and a second
N 02 -	
0.190 0.210 0.2	30 0.250 0.270 0.290 0.310 0.330 0.350
	Batting Average
<b>(E)</b>	
Batting Avera	age Cumulative Frequency
0.190 0.100	2
0.180-0.199	2
0.200-0.219	2 9
0.200-0.219 0.220-0.239	2 9 29
0.200-0.219 0.220-0.239 0.240-0.259	2 9 29 58
0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279	2 9 29 58 90
0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299	2 9 29 58 90 120
0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319	2 9 29 58 90 120 137
0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319 0.320-0.339	2 9 29 58 90 120 137 142
0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319 0.320-0.339 0.340-0.359	2 9 29 58 90 120 137 142 143
0.100-0.199 0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319 0.320-0.339 0.340-0.359 (F)	2 9 29 58 90 120 137 142 143
0.100-0.199 0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319 0.320-0.339 0.340-0.359 (F)	2 9 29 58 90 120 137 142 143
0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319 0.320-0.339 0.340-0.359 (F)	2 9 29 58 90 120 137 142 143
0.100-0.199 0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319 0.320-0.339 0.340-0.359 (F)	2 9 29 58 90 120 137 142 143
0.100-0.199 0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319 0.320-0.339 0.340-0.359 (F)	2 9 29 58 90 120 137 142 143
0.100-0.199 0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319 0.320-0.339 0.340-0.359 (F)	2 9 29 58 90 120 137 142 143
0.180-0.199 0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319 0.320-0.339 0.340-0.359 (F) 150 100 50 50	2 9 29 58 90 120 137 142 143
0.100-0.199 0.200-0.219 0.220-0.239 0.240-0.259 0.260-0.279 0.280-0.299 0.300-0.319 0.320-0.339 0.340-0.359 (F)	2 9 29 58 90 120 137 142 143

	4		١
(	ļ	J	)

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



0.190 0.210 0.230 0.250 0.270 0.290 0.310 0.330 0.350 Batting Average

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</b> )	
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





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



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



- **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.



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.

1	1	1
J	Ľ	ノノ

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



- (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 <u>leaf</u> must be a single digit.
- 9. True

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

#### **Practicing the Skills**

#### 11.

## 12.

- 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



#### 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

3	113
3	7999
4	344
4	7888
5	03

**(B)** 

- (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)

  - 7 011334566778

## **(B)**

- (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-andleaf 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.



- (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 stemand-leaf plot, Leaf 1 displays the lengths of time of the PG movies and Leaf 2 does so for the R rated movies.

	R
8	8
9	34577
10	
11	0188
12	02
13	
14	
15	7
16	5
	8 9 10 11 12 13 14 15 16

(**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.

	: ::		<b>.</b>		<b>.</b> :		
45	50	55	60	65	70	75	80

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



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



(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**

33	• (A)		
		0	333333344444
		0	55566666677788999
		1	00001111234
		1	5668
		2	00
		2	99
		3	
		3	8
		4	
		4	
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	0	5	10 15 20 25 30 35 40 45 50 55 60 Electoral Votes
			ADDREADED FOR STORES

(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.



**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**



- (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
	Α	9
	В	5
	С	6
	D	3
	F	4
2.		

Grade	Relative Frequency
Α	0.333
В	0.185
С	0.222
D	0.111
F	0.148



**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.









## **Review Exercises**

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



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



- (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**)

(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



Presid	ents		Monarchs
		1	25
		2	8
		3	235
	96	4	0012368999
87	763	5	124566889
877765443	300	6	457777889
9887432	110	7	0167
85	310	8	11
3	300	9	
(B)			
Presidents		<u>Mo</u>	narchs
	1	2	
	1	5	
	2		
	2	8	
	3	23	
	3	5	
	4	001	23
96	4	689	999
3	5	124	ţ
8776	5	566	5889
443300	6	4	
877765	6	577	77889
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.



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



- (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 I	Late-Mode	l Cars Ge	t 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	

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

- 4	
~	٠

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.

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**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.

