# *Elementary Statistics 13th edition Triola Solutions Manual*

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# Chapter 2: Exploring Data with Tables and Graphs

## Section 2-1: Frequency Distributions for Organizing and Summarizing Data

1. The table summarizes 50 service times. It is not possible to identify the exact values of all of the original times.
2. The classes of 60 – 120, 120 – 180, …, 300 – 360 overlap, so it is not always clear which class we should put a value in. For example, the value of 120 could go in the first class or the second class. The classes should be mutually exclusive.
3.

| Time (sec) | Relative Frequency |
|---|---|
| 60 – 119 | 14% |
| 120 – 179 | 44% |
| 180 – 239 | 28% |
| 240 – 299 | 4% |
| 300 – 359 | 10% |

4. The sum of the relative frequencies is 125%, but it should be 100%, with a small round off error. All of the relative frequencies appear to be roughly the same, but if they are from a normal distribution, they should start low, reach a maximum, and then decrease.
5. Class width: 10
   Class midpoints: 24.5, 34.5, 44.5, 54.5, 64.5, 74.5, 84.5
   Class boundaries: 19.5, 29.5, 39.5, 49.5, 59.5, 69.5, 79.5, 89.5
   Number: 87
6. Class width: 10
   Class midpoints: 24.5, 34.5, 44.5, 54.5, 64.5, 74.5
   Class boundaries: 19.5, 29.5, 39.5, 49.5, 59.5, 69.5, 79.5
   Number: 87
7. Class width: 100
   Class midpoints: 49.5, 149.5, 249.5, 349.5, 449.5, 549.5, 649.5
   Class boundaries: –0.5, 99.5, 199.5, 299.5, 399.5, 499.5, 599.5, 699.5
   Number: 153
8. Class width: 100
   Class midpoints: 149.5, 249.5, 349.5, 449.5, 549.5
   Class boundaries: 99.5, 199.5, 299.5, 399.5, 499.5, 599.5
   Number: 147
9. No. The maximum frequency is in the second class instead of being near the middle, so the frequencies below the maximum do not mirror those above the maximum.
10. Yes. The frequencies start low, reach a maximum of 36, and then decrease. The values below the maximum are very roughly a mirror image of those above it.
11.

| Duration (sec) | Frequency |
|---|---|
| 125 – 149 | 1 |
| 150 – 174 | 0 |
| 175 – 199 | 0 |
| 200 – 224 | 3 |
| 225 – 249 | 34 |
| 250 – 274 | 12 |

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12. The intensities do not appear to have a normal distribution.

| Tornado F-Scale | Frequency |
|---|---|
| 0 | 24 |
| 1 | 16 |
| 2 | 2 |
| 3 | 2 |
| 4 | 1 |

13.

| Burger King Lunch Service Times (sec) | Frequency |
|---|---|
| 70 – 109 | 11 |
| 110 – 149 | 23 |
| 150 – 189 | 7 |
| 190 – 229 | 6 |
| 230 – 269 | 3 |
| 230 – 269 | 6 |

14.

| Burger King Dinner Service Times (sec) | Frequency |
|---|---|
| 30 – 69 | 1 |
| 70 – 109 | 6 |
| 110 – 149 | 26 |
| 150 – 189 | 7 |
| 190 – 229 | 3 |
| 230 – 269 | 6 |
| 270 – 309 | 1 |

15. The distribution does not appear to be a normal distribution.

| Wendy's Lunch Service Times (sec) | Frequency |
|---|---|
| 70 – 149 | 25 |
| 150 – 229 | 15 |
| 230 – 309 | 6 |
| 310 – 389 | 3 |
| 390 – 469 | 1 |

16. The distribution does appear to be a normal distribution.

| Wendy's Dinner Service Times (sec) | Frequency |
|---|---|
| 30 – 69 | 4 |
| 70 – 109 | 11 |
| 110 – 149 | 15 |
| 150 – 189 | 10 |
| 190 – 229 | 4 |
| 230 – 269 | 6 |

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17. Because there are disproportionately more 0s and 5s, it appears that the heights were reported instead of measured. Consequently, it is likely that the results are not very accurate.

| x | Frequency |
|---|---|
| 0 | 9 |
| 1 | 2 |
| 2 | 1 |
| 3 | 3 |
| 4 | 1 |
| 5 | 15 |
| 6 | 2 |
| 7 | 0 |
| 8 | 3 |
| 9 | 1 |

18. Because there are disproportionately more 0s and 5s, it appears that the weights were reported instead of measured. Consequently, it is likely that the results are not very accurate.

| x | Frequency |
|---|---|
| 0 | 26 |
| 1 | 1 |
| 2 | 1 |
| 3 | 2 |
| 4 | 2 |
| 5 | 12 |
| 6 | 1 |
| 7 | 0 |
| 8 | 4 |
| 9 | 1 |

19. The actresses appear to be younger than the actors.

| Age When Oscar Was Won | Relative Frequency (Actresses) | Relative Frequency (Actors) |
|---|---|---|
| 20 – 29 | 33.3% | 1.1% |
| 30 – 39 | 39.1% | 32.2% |
| 40 – 49 | 16.1% | 41.4% |
| 50 – 59 | 3.4% | 17.2% |
| 60 – 69 | 5.7% | 6.9% |
| 70 – 79 | 1.1% | 1.1% |
| 80 – 89 | 1.1% | |

20. There do appear to be differences, but overall they are not very substantial differences.

| Blood Platelet Count | Males | Females |
|---|---|---|
| 0 – 99 | 0.7% | |
| 100 – 199 | 33.3% | 17.0% |
| 200 – 299 | 58.8% | 62.6% |
| 300 – 399 | 6.5% | 19.0% |
| 400 – 499 | 0% | 0% |
| 500 – 599 | 0% | 1.4% |
| 600 – 699 | 0.7% | |

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21.

| Age (years) of Best Actress When Oscar Was Won | Cumulative Frequency |
|---|---|
| Less than 30 | 29 |
| Less than 40 | 63 |
| Less than 50 | 77 |
| Less than 60 | 80 |
| Less than 70 | 85 |
| Less than 80 | 86 |
| Less than 90 | 87 |

22.

| Age (years) of Best Actor When Oscar Was Won | Cumulative Frequency |
|---|---|
| Less than 30 | 1 |
| Less than 40 | 29 |
| Less than 50 | 65 |
| Less than 60 | 80 |
| Less than 70 | 86 |
| Less than 80 | 87 |

23. No. The highest relative frequency of 24.8% is not much higher than the others.

| Adverse Reaction | Relative Frequency |
|---|---|
| Headache | 23.6% |
| Hypertension | 8.7% |
| Upper Resp. Tract Infection | 24.8% |
| Nasopharyngitis | 21.1% |
| Diarrhea | 21.9% |

24. Yes, it appears that births occur on the days of the week with frequencies that are about the same.

| Day | Relative Frequency |
|---|---|
| Monday | 13.0% |
| Tuesday | 16.5% |
| Wednesday | 18.0% |
| Thursday | 14.3% |
| Friday | 14.3% |
| Saturday | 10.8% |
| Sunday | 13.3% |

25. Yes, the frequency distribution appears to be a normal distribution.

| Systolic Blood Pressure (mm Hg) | Frequency |
|---|---|
| 80 – 99 | 11 |
| 100 – 119 | 116 |
| 120 – 139 | 131 |
| 140 – 159 | 34 |
| 160 – 179 | 7 |
| 180 – 199 | 1 |

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26. Yes, the frequency distribution appears to be a normal distribution.

| Diastolic Blood Pressure (mm Hg) | Frequency |
|---|---|
| 40 – 54 | 27 |
| 55 – 69 | 107 |
| 70 – 84 | 133 |
| 85 – 99 | 31 |
| 100 – 114 | 2 |

27. Yes, the frequency distribution appears to be a normal distribution.

| Magnitude | Frequency |
|---|---|
| 1.00 – 1.49 | 19 |
| 1.50 – 1.99 | 97 |
| 2.00 – 2.49 | 187 |
| 2.50 – 2.99 | 147 |
| 3.00 – 3.49 | 100 |
| 3.50 – 3.99 | 38 |
| 4.00 – 4.49 | 8 |
| 4.50 – 4.99 | 4 |

28. No, the frequency distribution does not appear to be a normal distribution.

| Depth (km) | Frequency |
|---|---|
| 0.0 – 9.9 | 539 |
| 10.0 – 19.9 | 49 |
| 20.0 – 29.9 | 10 |
| 30.0 – 39.9 | 1 |
| 40.0 – 49.9 | 1 |

29. An outlier can dramatically increase the number of classes.

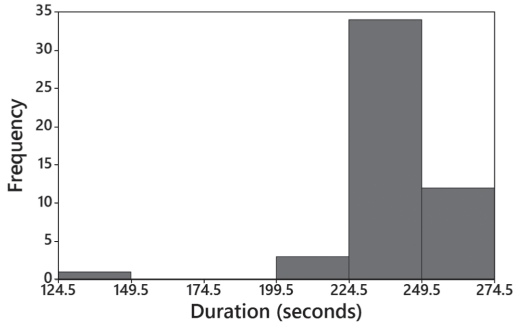
| Weight (lb) | With Outlier | Without Outlier |
|---|---|---|
| 200 – 219 | 6 | 6 |
| 220 – 239 | 5 | 5 |
| 240 – 259 | 12 | 12 |
| 260 – 279 | 36 | 36 |
| 280 – 299 | 87 | 87 |
| 300 – 319 | 28 | 28 |
| 320 – 339 | 0 | |
| 340 – 359 | 0 | |
| 360 – 379 | 0 | |
| 380 – 399 | 0 | |
| 400 – 419 | 0 | |
| 420 – 439 | 0 | |
| 440 – 459 | 0 | |
| 460 – 479 | 0 | |
| 480 – 499 | 0 | |
| 500 – 519 | 1 | |

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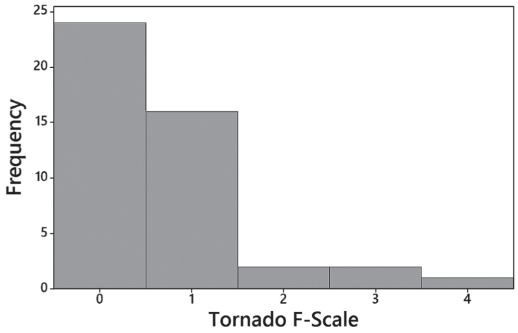
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**Section 2-2: Histograms**

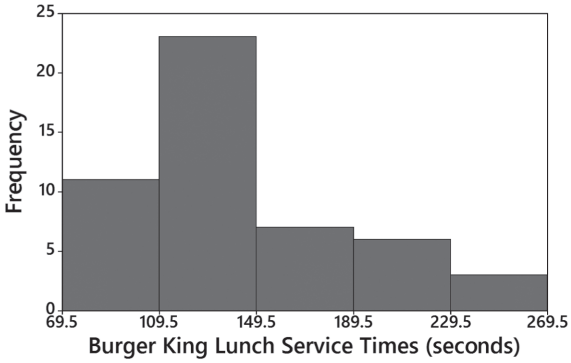
1. The histogram should be bell-shaped.
2. Not necessarily. Because the sample subjects themselves chose to be included, the voluntary response sample might not be representative of the population.
3. With a data set that is so small, the true nature of the distribution cannot be seen with a histogram.
4. The outlier will result in a single bar that is far away from all of the other bars in the histogram, and the height of that bar will correspond to a frequency of 1.
5. 40
6. Approximate values: Class width: 0.1 gram, lower limit of first class: 5.5 grams, upper limit of first class: 5.6 grams
7. The shape of the graph would not change. The vertical scale would be different, but the relative heights of the bars would be the same.
8. 40 of the quarters are "pre-1964" made with 90% silver and 10% copper, and the other 40 quarters are "post-1964" made with a copper-nickel alloy. The histogram depicts weights from two different populations of quarters.
9. Because it is far from being bell-shaped, the histogram does not appear to depict data from a population with a normal distribution.




10. The histogram appears to be skewed to the right (or positively skewed).



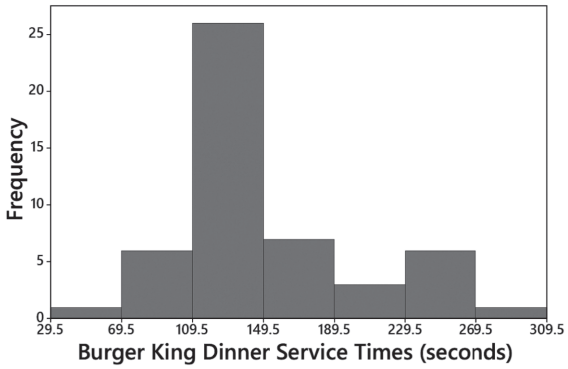

11. The histogram appears to be skewed to the right (or positively skewed).



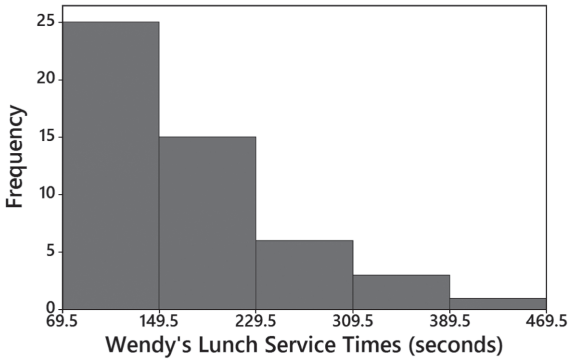

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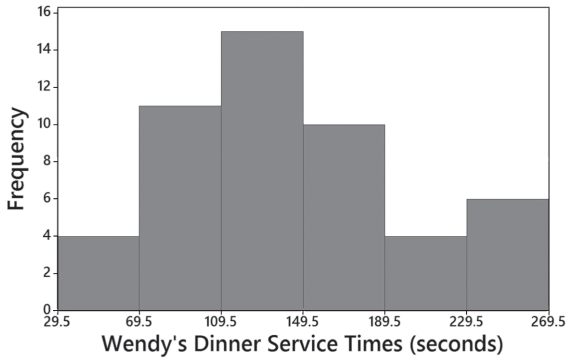
12. Because the histogram isn't close enough to being bell-shaped, it does not appear to depict data from a population with a normal distribution.



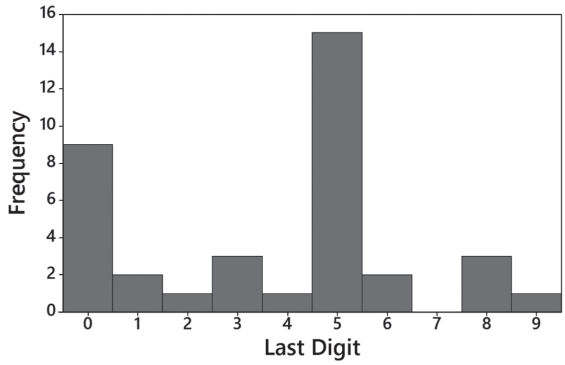

13. The histogram appears to be skewed to the right (or positively skewed).




14. Because the histogram is not close enough to being bell-shaped, it does not appear to depict data from a population with a normal distribution.



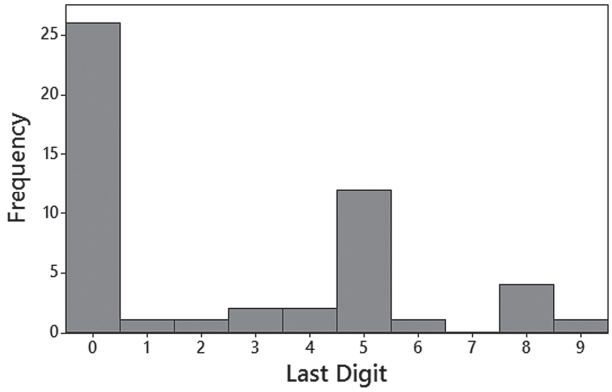

15. The digits 0 and 5 appear to occur more often than the other digits, so it appears that the heights were reported and not actually measured. This suggests that the data might not be very useful.




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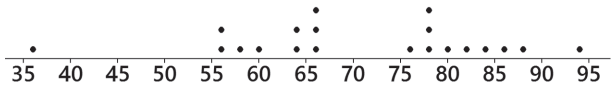
16. The digits 0 and 5 appear to occur more often than the other digits, so it appears that the weights were reported and not actually measured. This suggests that the data might not be very useful.



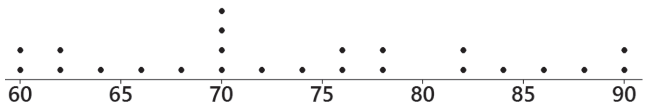

17. The ages of actresses are lower than the ages of actors.
18. Only part (c) appears to represent data from a normal distribution. Part (a) has a systematic pattern that is not that of a straight line, part (b) has points that are not close to a straight-line pattern, and part (d) is really bad because it shows a systematic pattern and points that are not close to a straight-line pattern.

**Section 2-3: Graphs That Enlighten and Graphs That Deceive**

1. The data set is too small for a graph to reveal important characteristics of the data. With such a small data set, it would be better to simply list the data or place them in a table.
2. No. If the sample is a bad sample, such as one obtained from voluntary responses, there are no graphs or other techniques that can be used to salvage the data.
3. No. Graphs should be constructed in a way that is fair and objective. The readers should be allowed to make their own judgments, instead of being manipulated by misleading graphs.
4. Center, variation, distribution, outliers, change in the characteristics of data over time. The time-series graph does the best job of giving us insight into the change in the characteristics of data over time.
5. The pulse rate of 36 beats per minute appears to be an outlier.




6. There do not appear to be any outliers.




7. The data are arranged in order from lowest to highest, as 36, 56, 56, and so on.

3 | 6
4 |
5 | 668
6 | 044666
7 | 6888
8 | 02468
9 | 4

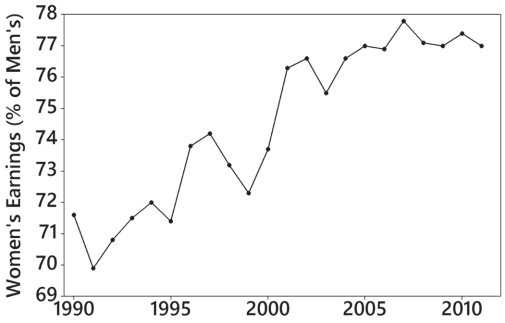
8. The two values closes to the middle are 72 mm Hg and 74 mm Hg.

6 | 0022468
7 | 0000246688
8 | 22468
9 | 00

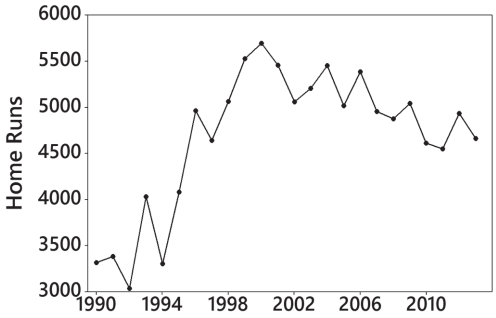
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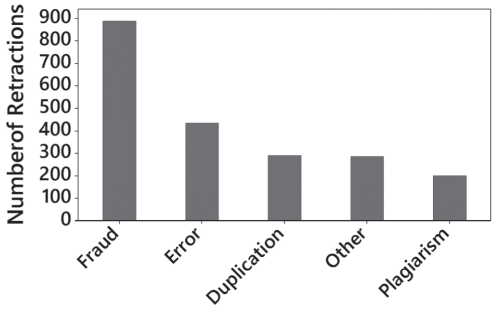
9. There is a gradual upward trend that appears to be leveling off in recent years. An upward trend would be helpful to women so that their earnings become equal to those of men.



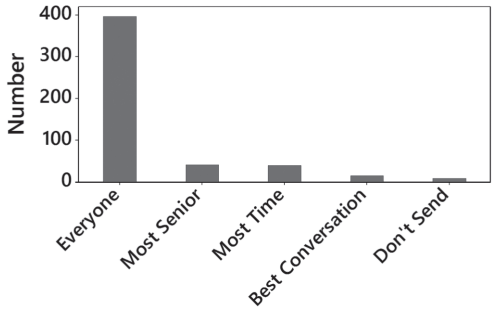

10. The numbers of home runs rose from 1990 to 2000, but after 2000 there has been a gradual decline.




11. Misconduct includes fraud, duplication, and plagiarism, so it does appear to be a major factor.




12. The overwhelming response was that thank-you notes should be sent to everyone who is met during a job interview. Given what is at stake, that seems like a wise strategy.



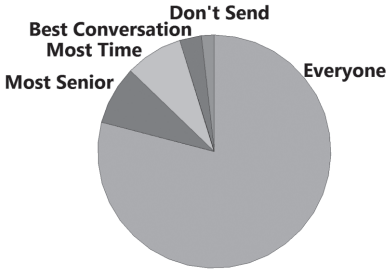

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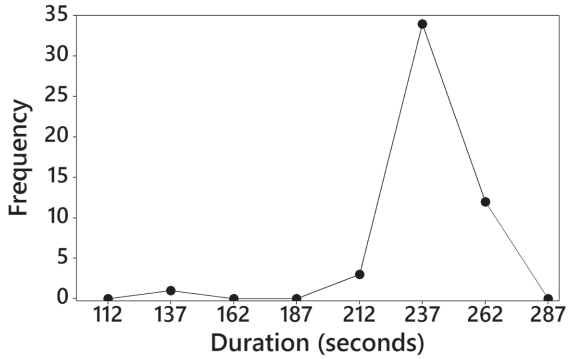
13.



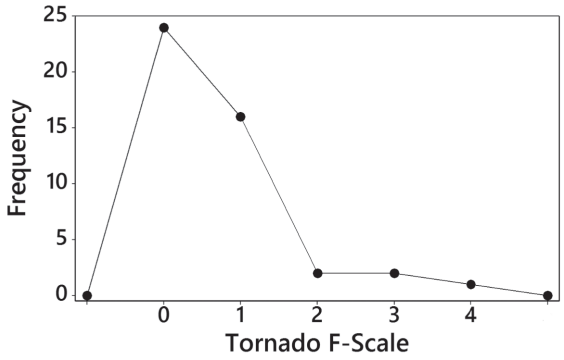

14.




15. The distribution appears to be skewed to the left (or negatively skewed).




16. The distribution appears to be skewed to the right (or positively skewed).




17. Because the vertical scale starts with a frequency of 200 instead of 0, the difference between the "no" and "yes" responses is greatly exaggerated. The graph makes it appear that about five times as many respondents said "no," when the ratio is actually a little less than 2.5 to 1.

18. The fare increased from \$1 to \$2.50, so it increased by a factor of 2.5. But when the larger bill is drawn so that the width is 2.5 times that of the smaller bill and the height is 2.5 times that of the smaller bill, the larger bill has an area that is 6.25 times that of the smaller bill (instead of being 2.5 times its size, as it should be). The illustration greatly exaggerates the increase in the fare.

19. The two costs are one-dimensional in nature, but the baby bottles are three-dimensional objects. The \$4500 cost isn't even twice the \$2600 cost, but the baby bottles make it appear that the larger cost is about five times the smaller cost.

20. The graph is misleading because it depicts one-dimensional data with three-dimensional boxes. See the first and last boxes in the graph. Workers with advanced degrees have annual incomes that are roughly 3 times the incomes of those with no high school diplomas, but the graph exaggerates this difference by making it appear that workers with advanced degrees have incomes that are roughly 27 times the amounts for workers with no high school diploma.

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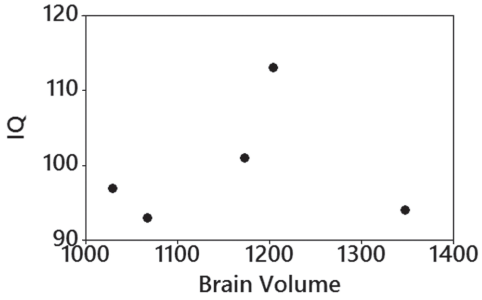
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21.

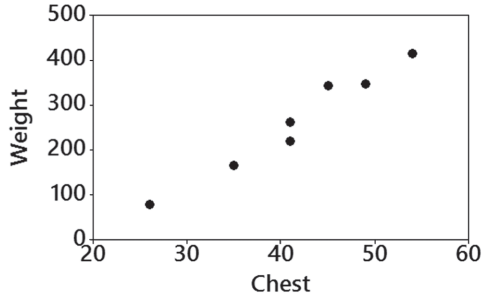
96 |
96 | 59
97 | 0001112333444
97 | 55666666788888999
98 | 555566666666666666677777788888889
96 | 001244
96 | 56

**Section 2-4: Scatterplots, Correlation, and Regression**

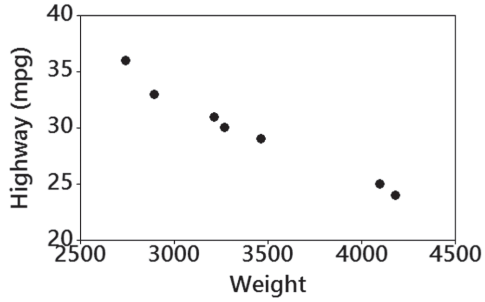
1. The term linear refers to a straight line, and $r$ measures how well a scatterplot of the sample paired data fits a straight-line pattern.
2. No. Finding the presence of a statistical correlation between two variables does not justify any conclusion that one of the variables is a cause of the other.
3. A scatterplot is a graph of paired $(x, y)$ quantitative data. It helps us by providing a visual image of the data plotted as points, and such an image is helpful in enabling us to see patterns in the data and to recognize that there may be a correlation between the two variables.
4. a. 1
   b. 0
   c. 0
   d. –1
5. There does not appear to be a linear correlation between brain volume and IQ score.




6. There does appear to be a linear correlation between chest sizes and weights of bears.



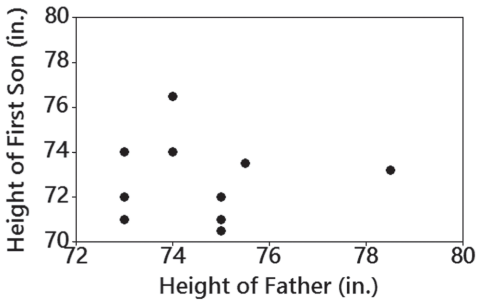

7. There does appear to be a linear correlation between weight and highway fuel consumption.




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8. There does not appear to be a linear correlation between heights of fathers and the heights of their first sons.




9. With $n = 5$ pairs of data, the critical values are $\pm 0.878$. Because $r = 0.127$ is between $-0.878$ and $0.878$, evidence is not sufficient to conclude that there is a linear correlation.
10. With $n = 7$ pairs of data, the critical values are $\pm 0.754$. Because $r = 0.980$ is in the right tail region beyond $0.754$, there are sufficient data to conclude that there is a linear correlation.
11. With $n = 7$ pairs of data, the critical values are $\pm 0.754$. Because $r = 0.987$ is in the left tail region below $-0.754$, there are sufficient data to conclude that there is a linear correlation.
12. With $n = 10$ pairs of data, the critical values are $\pm 0.632$. Because $r = 0.017$ is between $-0.632$ and $0.632$, evidence is not sufficient to conclude that there is a linear correlation.
13. Because the *P*-value is not small (such as 0.05 or less), there is a high chance (83.9% chance) of getting the sample results when there is no correlation, so evidence is not sufficient to conclude that there is a linear correlation.
14. Because the *P*-value is small (such as 0.05 or less), there is a small chance of getting the sample results when there is no correlation, so there is sufficient evidence to conclude that there is a linear correlation.
15. Because the *P*-value is small (such as 0.05 or less), there is a small chance of getting the sample results when there is no correlation, so there is sufficient evidence to conclude that there is a linear correlation.
16. Because the *P*-value is not small (such as 0.05 or less), there is a high chance (96.3% chance) of getting the sample results when there is no correlation, so the evidence is not sufficient to conclude that there is a linear correlation.

**Quick Quiz**

1. Class width: 3. It is not possible to identify the original data values.
2. Class boundaries: 17.5 and 20.5
   Class limits: 18 and 20.
3. 40
4. 19 and 19
5. pareto chart
6. histogram
7. scatterplot
8. No, the term “normal distribution” has a different meaning than the term “normal” that is used in ordinary speech. A normal distribution has a bell shape, but the randomly selected lottery digits will have a uniform or flat shape.
9. variation
10. The bars of the histogram start relatively low, increase to some maximum, and then decrease. Also, the histogram is symmetric, with the left half being roughly a mirror image of the right half.

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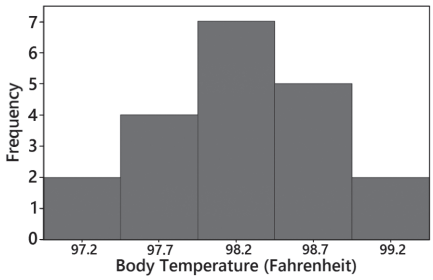
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**Review Exercises**

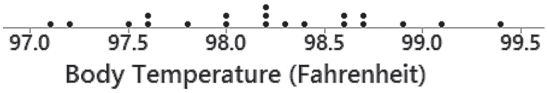
1.

| Temperature (°F) | Frequency |
|---|---|
| 97.0–97.4 | 2 |
| 97.5–97.9 | 4 |
| 98.0–98.4 | 7 |
| 98.5–98.9 | 5 |
| 99.0–99.4 | 2 |

2. Yes, the data appear to be from a population with a normal distribution because the bars start low and reach a maximum, then decrease, and the left half of the histogram is approximately a mirror image of the right half.



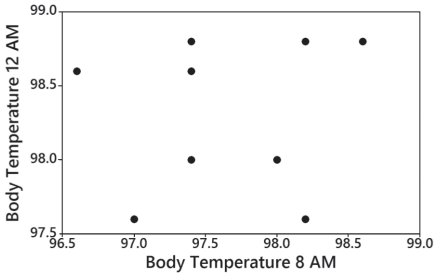

3. The distribution is closer to being a normal distribution than the others.




4. There are no outliers.

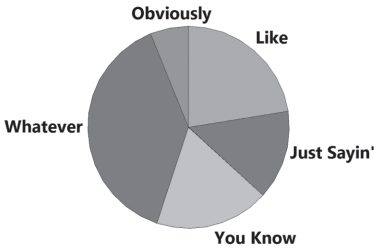
```
97.|125668
98.|002223466779
99.|14
```

5. No. There is no pattern suggesting that there is a relationship.




6. a. time-series graph
   b. scatterplot
   c. pareto chart

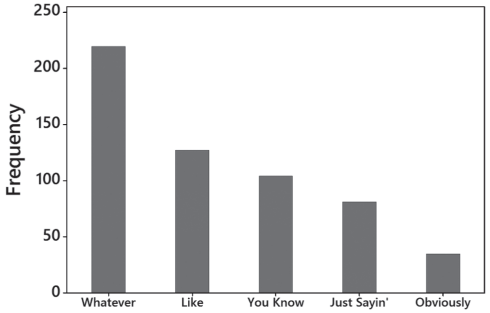
7. A pie chart wastes ink on components that are not data; pie charts lack an appropriate scale; pie charts don't show relative sizes of different components as well as some other graphs, such as a Pareto chart.




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8. The Pareto chart does a better job. It draws attention to the most annoying words or phrases and shows the relative sizes of the different categories.

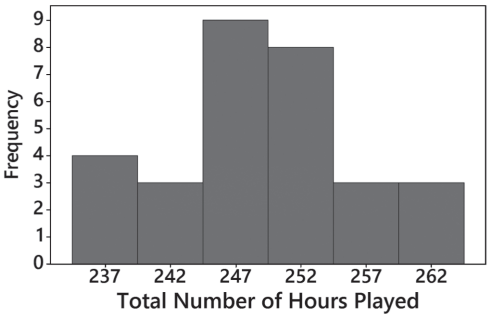



**Cumulative Review Exercises**

1.

| Total Hours | Frequency |
|---|---|
| 235–239 | 4 |
| 240–244 | 3 |
| 245–249 | 9 |
| 250–254 | 8 |
| 255–259 | 3 |
| 260–264 | 3 |

2. a. 235 hours and 239 hours
   b. 234.5 hours and 239.5 hours
   c. 237 hours
3. The distribution is closer to being a normal distribution than the others.




4. Start the vertical scale at a frequency of 2 instead of the frequency of 0.
5. Looking at the stemplot sideways, we can see that the distribution approximates a normal distribution.

```
23 | 6789
24 | 112555677889
25 | 00012233888
26 | 024
```

6. a. continuous
   b. quantitative
   c. ratio
   d. convenience sample
   e. sample

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