Answers to Odd-Numbered Problems

Chapter 1 Problems

1. **(a)** 1946
(b) There were more years in which the average number of years completed by the older group exceeded that of the younger group.

3. **(a)** From 1985 to 1990 sales declined.
(b) The total number of cars sold from 1985 to 1987 was 20,693,000 versus 18,120,000 from 1988 to 1990.
(c) No

5. Researchers with such knowledge may be influenced by their own biases concerning the usefulness of the new drug.

7. **(a)** In 1936 automobile and telephone owners were probably not representative of the total voter population.
(b) Yes. Automobile and telephone ownership is now more widespread and thus more representative of the total voter population.

9. The average age of death for U.S. citizens whose obituary is listed in *The New York Times* is about 82.4 years.

11. **(a)** No. Graduates who return the questionnaire may not be representative of the total population of graduates.
(b) If the number of questionnaires returned were very close to 200—the number of questionnaires sent—then the approximation would be better.

13. Graunt implicitly assumed that the parishes he surveyed were representative of the total London population.

15. Data on the ages at which people were dying can be used to determine approximately how long on average the annuity payments will continue. This can be used to determine how much to charge for the annuity.

Introductory Statistics, DOI: 10.1016/B978-0-12-374388-6.00017-x

17. (a) 64%
(b) 10%
(c) 48%

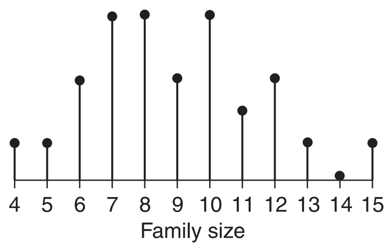
19. (a) Yes
(b) Yes
(c) No
(d) No

Section 2.2

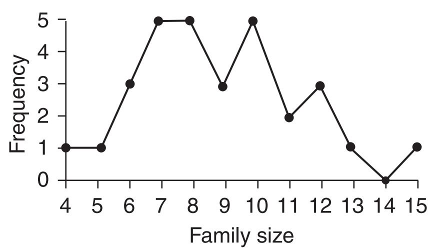
1. (a)

Family size	Frequency
4	1
5	1
6	3
7	5
8	5
9	3
10	5
11	2
12	3
13	1
14	0
15	1

(b)



(c)



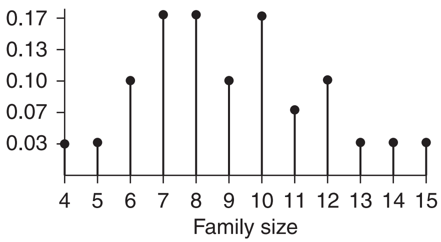
3. **(a)** 12
(b) 1
(c) 11
(d) 3
(e) 3

5.

Value	Frequency
10	8
20	3
30	7
40	7
50	3
60	8

7.

Family size	Frequency	Relative frequency
4	1	0.03
5	1	0.03
6	3	0.10
7	5	0.17
8	5	0.17
9	3	0.10
10	5	0.17
11	2	0.07
12	3	0.10
13	1	0.03
14	0	0.00
15	1	0.03

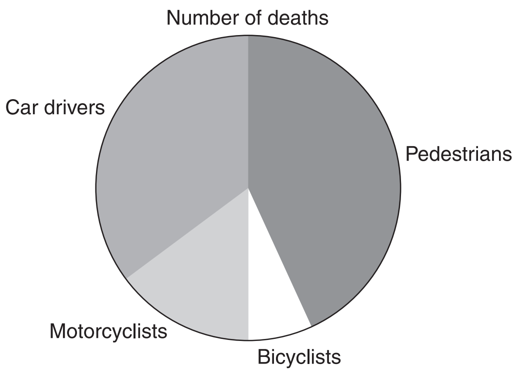


9. **(a)** 0.13
(b) 0.25
(c) No

11. (a) 0.649
(b) 0.162
(c) 0.540

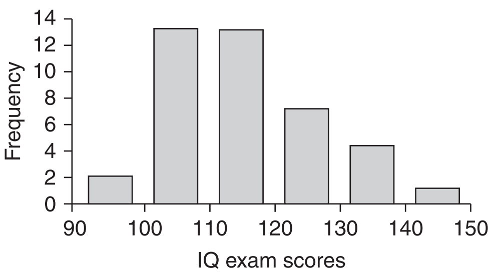
13.

Average number of rainy days in Nov. or Dec.	Frequency
7	1
9	1
10	1
11	1
16	1
17	3
18	1
20	1
23	1
40	1



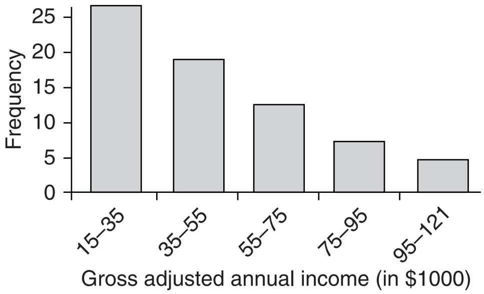
Section 2.3

1. (a)

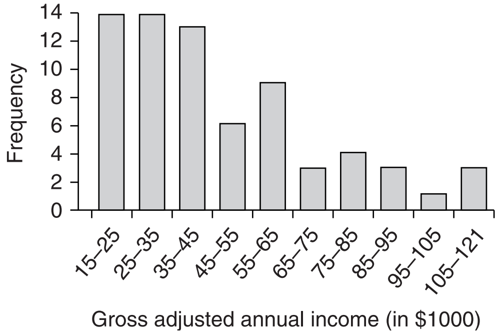


(b) Class intervals 100–110 and 110–120
(c) No
(d) No

3. (a)

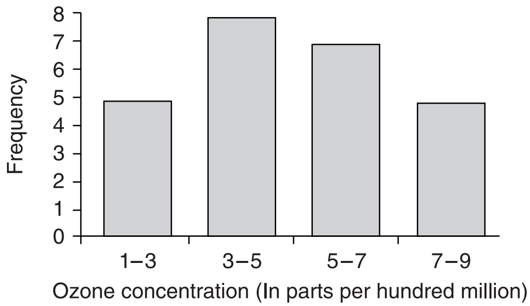


(b)

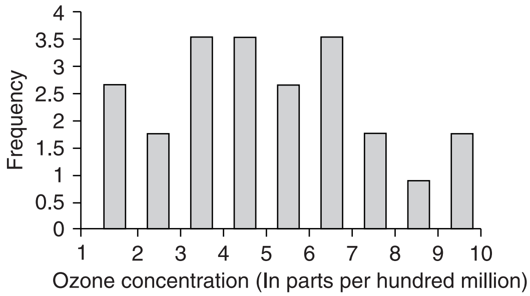


(c) The chart in part (a) seems more informative since it shows a clearer pattern.

5. (a)

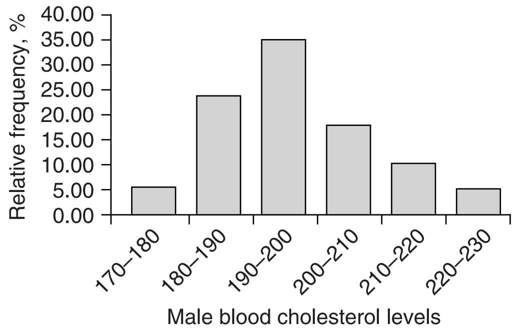


(b)

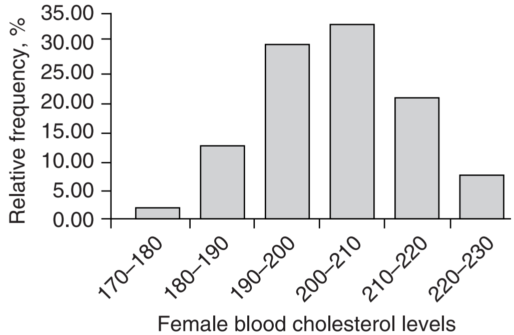


(c) The chart in part (b) seems more informative.

7. **(a)**

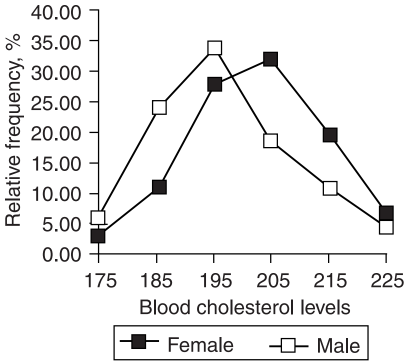


(b)



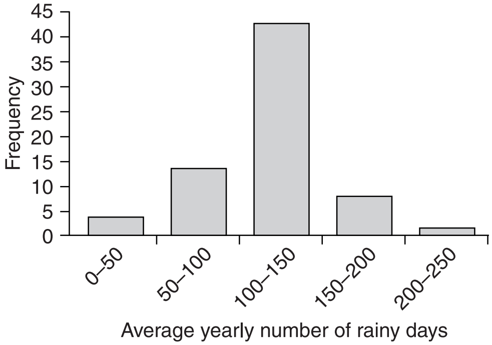
Female cholesterol	Frequency	Relative frequency
170–180	1	1/46 = 0.02
180–190	5	5/46 = 0.11
190–200	13	13/46 = 0.28
200–210	15	15/46 = 0.33
210–220	9	9/46 = 0.20
220–230	3	3/46 = 0.07

Male cholestrol	Frequency	Relative frequency
170–180	3	3/54 = 0.06
180–190	13	13/54 = 0.24
190–200	19	19/54 = 0.35
200–210	10	10/54 = 0.19
210–220	6	6/54 = 0.11
220–230	3	3/54 = 0.06



Female students appear to have higher cholesterol levels.

13.



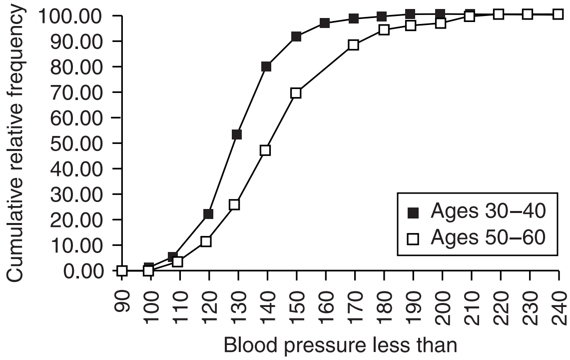
15. **(a)** It is the sum of the relative frequencies for all classes.

(b)

	Percentage of workers	
Blood pressure less than	**Ages 30–40**	**Ages 50–60**
90	0.12	0.14
100	0.79	0.41
110	5.43	3.56
120	23.54	11.35
130	53.78	28.04
140	80.35	48.43
150	92.64	71.27
160	97.36	81.26
170	99.13	89.74
180	99.84	94.53
190	99.96	97.26
200	100.00	98.50
210	100.00	98.91
220	100.00	99.59
230	100.00	99.86
240	100.00	100.00

(c) Ages 30 to 40 tend to have smaller values.

(d)



Section 2.4

1. (a)

11	1, 4, 5, 6, 8, 8, 9, 9, 9
12	2, 2, 2, 2, 4, 5, 5, 6, 7, 7, 7, 8, 9
13	0, 2, 2, 3, 4, 5, 5, 7, 9
14	1, 1, 4, 6, 7

(b)

11	1, 4
11	5, 6, 8, 8, 9, 9, 9
12	2, 2, 2, 2, 4
12	5, 5, 6, 7, 7, 7, 8, 9
13	0, 2, 2, 3, 4
13	5, 5, 7, 9
14	1, 1, 4
14	6, 7

3.

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

The interval 15–20 contains 14 data points.
The interval 16–21 contains 17 data points.

5. (a)

3	2
4	
5	2, 7, 8, 9
6	5, 8, 8
7	1, 4, 5, 5, 7, 8, 9
8	0, 1, 3, 3, 3, 4, 8, 8
9	0, 3, 4, 7
10	0, 4, 8

(b) Yes. The value 32 seems suspicious since it is so much smaller than the others.

7. (a)

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

(b)

0	3, 6, 7, 7, 7, 7, 9
1	0, 0, 0, 0, 0, 0, 3, 4, 4, 6, 6, 7, 7, 9, 9
2	0, 1
3	1

(c)

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

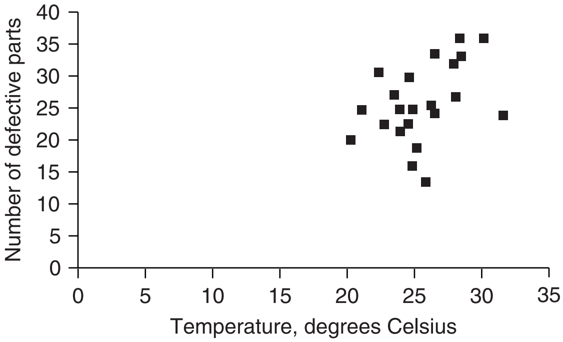
9. (a) 6
(b) 43.75%
(c) 12.5%

11. (a) School B
(b) School A
(c) School A
(d)

5	0, 3
5	5, 7
6	2
6	5, 5, 8, 8, 9, 9
7	0, 2, 3, 4
7	6, 7, 7, 8, 8, 9, 9
8	0, 2, 3, 3
8	5, 5, 6, 6, 6, 7, 7, 8, 8, 9
9	0, 0, 1, 3
9	5, 5, 5, 6, 6, 8, 8
10	0

Section 2.5

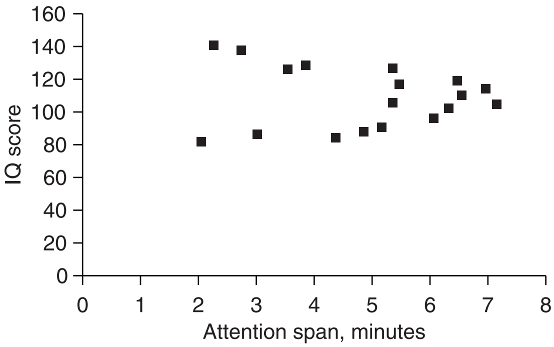
1. (a)



(b) The number of defective parts tends to increase as the temperature increases.

(c) About 23 or 24

5. (a)



(b) Attention span and IQ are not related.

Chapter 2 Review

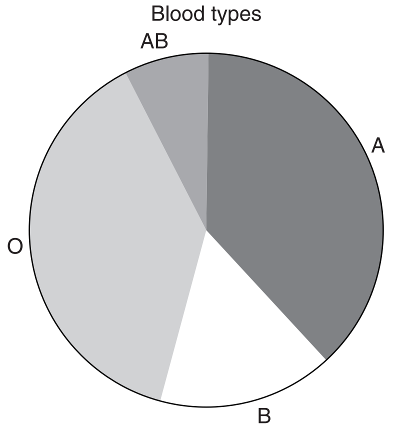
1. (a)

Blood type	Frequency
A	19
B	8
O	19
AB	4

(b)

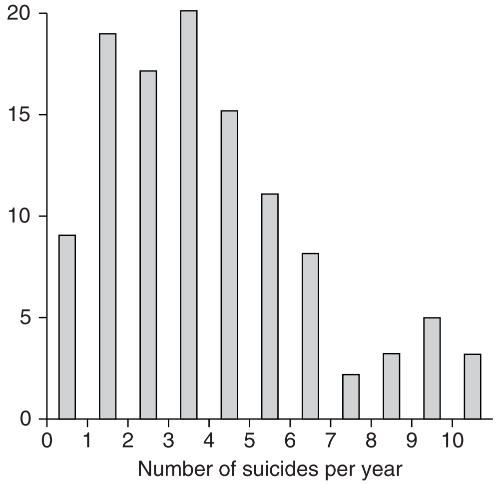
Blood type	Relative frequency
A	0.38
B	0.16
O	0.38
AB	0.08

(c)



3. (a) 389

(b)



5. (a)

Value	Frequency
1	2
2	1
3	4
4	1
5	2

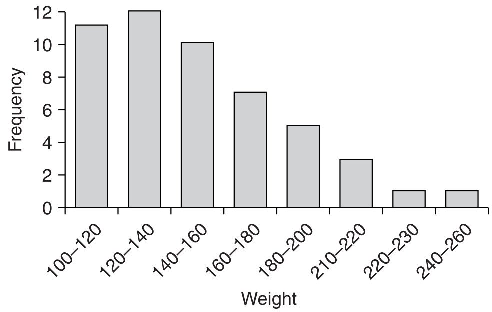
(b)

Value	Frequency
1	2
2	3
3	3
4	2

(c) 3, 2.5

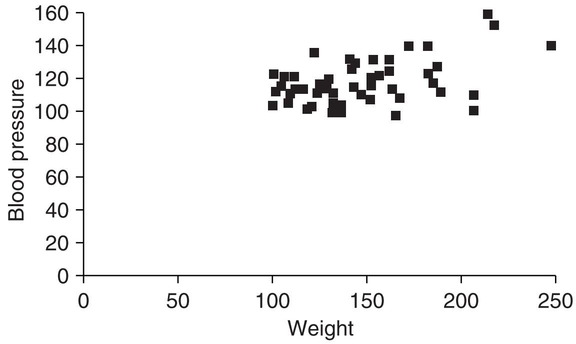
7. **(a)** about 46 percent
(b) about 3 percent

9. **(a)**

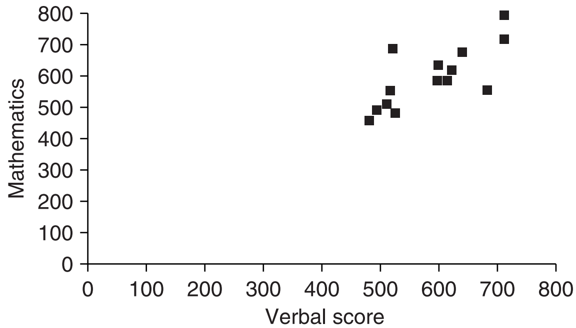


(b) There are relatively few weights near the upper end of the weight range.

11. Weight and blood pressure do not seem related.



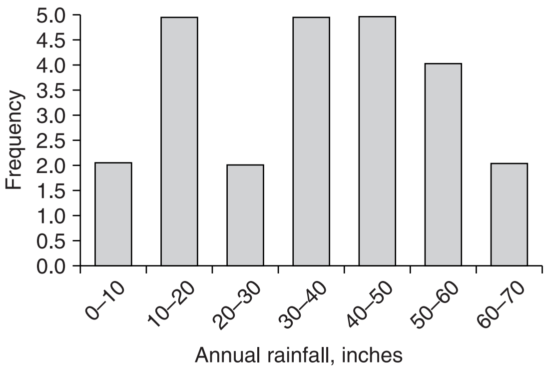
13. Yes, high scores on one examination tend to go along with high scores on the other.



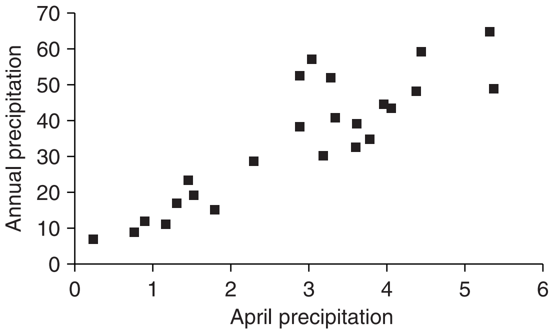
15. **(a)**

0	0.27, 0.78, 0.93
1	0.19, 0.31, 0.49, 0.53, 0.81
2	0.30, 0.92, 0.93
3	0.07, 0.21, 0.32,0.39, 0.66, 0.68, 0.81
4	0.02, 0.11, 0.43, 0.50
5	0.35, 0.41

(b)



(c)



Section 3.2

1. $1196/15 = 79.73$
3. $429.03/13 = 33.00$ inches; $1331/13 = 102.38$ days
5. No. It also depends on the proportions of the two town populations that are women. (For instance, suppose town A has 9 women whose average weight is 110 and 1 man whose weight is 200, while town B has 10 women whose average weight is 100 and 10 men whose average weight is 190.)
7. 8.0943 cases
9. 6; 18; 11
11. 78/11
13. 15
15. $\frac{1}{2}(10) + \frac{1}{6}(20) + \frac{1}{3}(30) = 18.33$
17. \$37,120
19. (a) $-5, -4, -2, 1, 4, 6$
    (b) $-15, -12, -6, 3, 12, 18$
    (c) same as (a)

Section 3.3

1. (a) 6580 yards
   (b) 6545 yards

3. 23
5. (a) 22.0
   (b) 8.1
   (c) 23.68
   (d) 9.68
7. 31.5 inches
9. (a) 99.4
   (b) 14.9
   (c) 204.55
11. (a) 20.74
    (b) 20.5
    (c) 19.74
    (d) 19.5
    (e) Mean = 20.21; median = 20.05
13. 0, 0
15. (a) 32.52
    (b) 24.25
17. (a) 26.8
    (b) 25.0

Section 3.3.1

1. (a) If the data are arranged in increasing order, then the sample 80 percentile is given by the average of the values in positions 60 and 61.
   (b) If the data are arranged in increasing order, then the sample 60 percentile is given by the average of the values in positions 45 and 46.
   (c) If the data are arranged in increasing order, then the sample 30 percentile is the value in position 23.
3. (a) 95.5
   (b) 96
5. (a) 70
   (b) 58
   (c) 52
7. $230c$
11. 25

Section 3.4

1. $1B$, $2C$, $3A$
3. (a) 126
   (b) 102, 110, 114
   (c) 196
5. 5, 6, 6, 6, 8, 10, 12, 14, 23 is one such data set.

7. (a) 8 loops
(b) 2 miles

Section 3.5

1. $s^2 = 0.037$; $\overline{x} = 26.22$

3. (a) 6.18
(b) 6.77

11. (a) $s^2 = 2.5, s = 1.58$
(b) $s^2 = 2.5, s = 1.58$
(c) $s^2 = 2.5, s = 1.58$
(d) $s^2 = 10, s = 3.16$
(e) $s^2 = 250, s = 15.81$

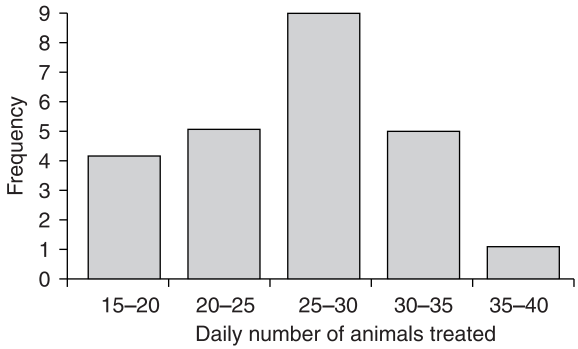
13. For the first 50 students, $s^2 = 172.24$ and $\overline{x} = 115.80$.
For the last 50 students, $s^2 = 178.96$ and $\overline{x} = 120.98$.
The values of the statistics for the two data sets are similar. This is not surprising.

15. 78.56 thousand

17. (a) 0.805
(b) 2.77
(c) 1.22

Section 3.6

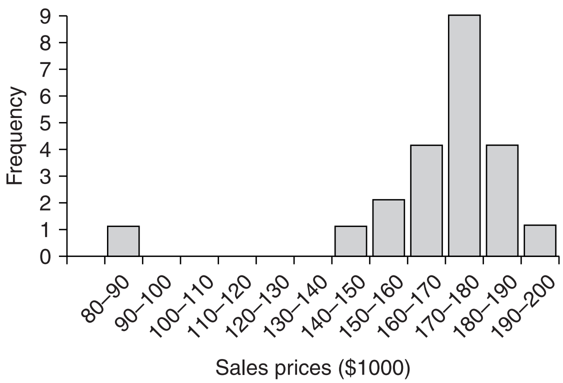
1. (a)



(b) 25.75
(c) 26.5
(d) No

5. (a) 168,045
(b) 172,500

(c)



(d) Yes, if we ignore the data value 82. No, if we use all the data.

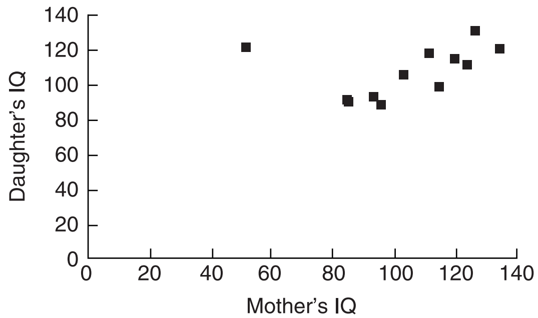
7. 95%, 94.85%

9. Sample mean

Section 3.7

1. Let $(x_i, y_i), i = 1, 2, 3$ be the middle set of data pairs. Then the first set is $(121x_i, 360 + y_i)$ and the third is $(x_i, \frac{1}{2}y_i)$, $i = 1, 2, 3$.

3. (a)



(b) Almost 1

(c) 0.86

(d) There is a relatively strong linear relationship between them.

5. −0.59; the linear relationship is relatively weak.

7. −0.441202; the linear relationship is relatively weak. But there is an indication that when one of the variables is high, then the other tends to be low.

9. 0.99

11. All data = −0.33; first seven countries = −0.046

13. All data = 0.25; first seven countries = −0.3035

15. (d) Correlation is not causation.

17. No, correlation is not causation.

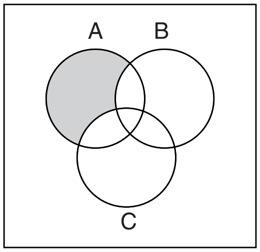
Chapter 3 Review

1. (a) $-2, -1, 1, 2$
   (b) $-2, -1, 0, 1, 2$
   (c) Part (a): mean $= 0$, median $= 0$; part (b): mean $= 0$, median $= 0$
3. (a) 29.3
   (b) No
   (c) First quartile is 27.7; second quartile, 29.3; third quartile, 31.1.
   (d) 31.7
9. No
11. No, association is not causation.
13. $\dfrac{mx_w + nx_m}{n + m}$
15. 0.99846

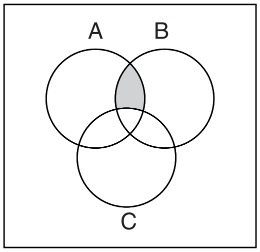
Section 4.2

1. (a) $S = \{(R, R), (R, B), (R, Y), (B, R), (B, B), (B, Y), (Y, R), (Y, B), (Y, Y)\}$
   (b) $\{(Y, R), (Y, B), (Y, Y)\}$
   (c) $\{(R, R), (B, B), (Y, Y)\}$
3. (a) {(U of M, OSU), (U of M, SJSC), (RC, OSU), (RC, SJSC), (SJSC, OSU), (SJSC, SJSC), (Yale, OSU), (Yale, SJSC), (OSU, OSU), (OSU, SJSC)}
   (b) {(SJSC, SJSC), (OSU, OSU)}
   (c) {(U of M, OSU), (U of M, SJSC), (RC, OSU), (RC, SJSC), (SJSC, OSU), (Yale, OSU), (Yale, SJSC), (OSU, SJSC)}
   (d) {(RC, OSU), (OSU, OSU), (SJSC, SJSC)}
5. $S =$ {(France, fly), (France, boat), (Canada, drive), (Canada, train), (Canada, fly)}$A =$ {(France, fly), (Canada, fly)}
7. (a) ø
   (b) {1, 4, 6}
   (c) {1, 3, 4, 5}
   (d) {2}
9. (a) $\{(1, g), (1, f), (1, s), (1, c), (0, g), (0, f), (0, s), (0, c)\}$
   (b) $\{(0, s), (0, c)\}$
   (c) $\{(1, g), (1, f), (0, g), (0, f)\}$
   (d) $\{(1, g), (1, f), (1, s), (1, c)\}$
11. (a) A^c is the event that a rolled die lands on an odd number.
   (b) $(A^c)^c$ is the event a rolled die lands on an even number.
   (c) $(A^c)^c = A$.

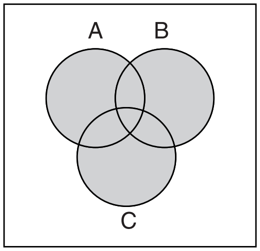
13. (a)



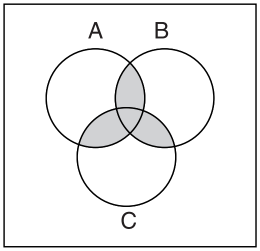
(b)



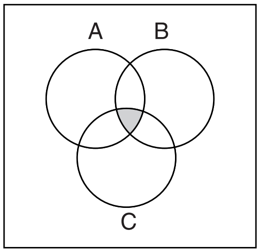
(c)



(d)



(e)



Section 4.3

1. **(a)** $P(E) = 0.35; P(E) = 0.65; P(G) = 0.55$
(b) $P(E \cup F) = 1$
(c) $P(E \cup G) = 0.8$
(d) $P(F \cup G) = 0.75$
(e) $P(E \cup F \cup G) = 1$
(f) $P(E \cap F) = 0$
(g) $P(F \cap G) = 0.45$
(h) $P(E \cap G) = 0.1$
(i) $P(E \cap F \cap G) = 0$

3. 1/10,000

5. If they are disjoint, it is impossible. If they are not disjoint, it is possible.

7. **(a)** 1
(b) 0.8
(c) 0.5
(d) 0.1

9. (a) 0.95
   (b) 0.80
   (c) 0.20
11. 0.7
13. 0.31%
15. 0.6
17. (a) $A \cap B^c$
   (b) $A \cap B$
   (c) $B \cap A^c$
   (d) $P(\mathrm{I}) + P(\mathrm{II}) + P(\mathrm{III})$
   (e) $P(\mathrm{I}) + P(\mathrm{II})$
   (f) $P(\mathrm{II}) + P(\mathrm{III})$
   (g) $P(\mathrm{II})$

Section 4.4

1. $88/216 \approx 0.41$
3. (a) $4/52 \approx 0.08$
   (b) $48/52 \approx 0.92$
   (c) $13/52 \approx 0.25$
   (d) $1/52 \approx 0.02$
5. 2/3
7. (a) 0.56
   (b) 0.1
9. (a) 0.4
   (b) 0.1
11. 56
13. 1/19
15. (a) 0.1
   (b) 0.1
17. (a) 10/31
   (b) 9/31
   (c) 1/3
   (d) 11/31
   (e) 7/31

Section 4.5

1. (a) $0.02/0.3 \approx 0.067$
   (b) $0.02/0.03 \approx 0.667$
3. (a) 0.245
   (b) 0.293
5. (a) 0.145
   (b) 0.176

(c) 0.215
(d) 0.152

7. (a) 0.46
(b) 0.65

9. (a) 262/682
(b) 262/682
(c) 350/682
(d) 602/682
(e) 598/682
(f) 519/682

11. $1/169 \approx 0.006$

13. 0.6960

15. (a) $19/34 \approx 0.56$
(b) $1 - 19/34 \approx 0.44$
(c) $1/17 \approx 0.06$

17. Since $P(B|A) > P(B), P(A \cap B) > P(B)P(A)$

Hence, $P(A/B) = \dfrac{P(A \cap B)}{P(B)} > \dfrac{P(B)P(A)}{P(B)} = P(A)$

19. 0.24

21. 0.68

23. (a) $7/12 \approx 0.58$
(b) 50
(c) $13/119 \approx 0.11$
(d) $35/204 \approx 0.17$
(e) 0.338

25. (a) 0.79; 0.21
(b) 0.81; 0.27

27. (a) 1/2
(b) 3/8
(c) 2/3

29. 1/16

31. No; the friends do not know each other.

33. $P(A) = 1/13$; $P(B) = 1/4$; $P(A \cap B) = 1/52$; thus $P(A \cap B) = P(A)P(B)$.

35. 1/365

37. (a) 0.64
(b) 0.96
(c) 0.8704

39. Yes, $P(A)P(B) = P(A \cap B)$.

41. (a) $32/4805 \approx 0.0067$
(b) $729/1922 \approx 0.38$
(c) 0.060
(d) 0.045

(e) 0.006
(f) 0.111

43. (a) 1/4
(b) 2/3

Section 4.6

1. (a) 0.55
(b) 5/9
3. (a) 0.672
(b) 0.893
5. 0.398
7. (a) 0.534
(b) 0.402
9. (a) 0.0103
(b) 0.3046

Chapter 4 Review

1. (a) 3/4
(b) 3/4
(c) 6/11
(d) 1/22
(e) 9/22
3. (a) 0.68
(b) 0.06
(c) 0.12
5. (a) 11/24
(b) 13/23
7. (a) 1/64
(b) 1/64
(c) 1/64
9. (a) $S =$ {(chicken, rice, melon), (chicken, rice, ice cream), (chicken, rice, gelatin), (chicken, potatoes, melon), (chicken, potatoes, ice cream), (chicken, potatoes, gelatin), (roast beef, rice, melon), (roast beef, rice, ice cream), (roast beef, rice, gelatin), (roast beef, potatoes, melon), (roast beef, potatoes, ice cream), (roast beef, potatoes, gelatin)}
(b) {(chicken, potatoes, ice cream), (chicken, potatoes, gelatin), (roast beef, potatoes, ice cream), (roast beef, potatoes, gelatin)}
(c) 1/3
(d) 1/12

11. (a) 1/3
(b) 1/3
(c) 1/3
(d) 1/2

13. $14/33 \approx 0.424$

15. (a) 1/52
(b) 1/52
(c) equally
(d) 1/52

17. (a) 0.42
(b) 0.18
(c) 0.24
(d) 0.58
(e) 0.724

19. No

21. (a) 0.496
(b) 54/252
(c) 36/248
(d) No

23. (a) 4
(b)(i) 4/86
(b)(ii) 1/2
(b)(iii) No

25. (a) 0.077
(b) 0.0494
(c) 0.0285

27. (a) 0.64
(b) 0.06, assuming independence

29. (a) 0.5
(b) 0.44
(c) 0.024
(d) 0

31. 0.28

Section 5.2

1. $P\{Y = 0\} = 1/4$
$P\{Y = 1\} = 3/4$

3. (a) 5/12
(b) 5/12
(c) 0
(d) 1/4

5.

i	$P\{Y=i\}$
1	11/36
2	1/4
3	7/36
4	5/36
5	1/12
6	1/36

7.

i	$P\{X=i\}$
2	0.58
3	0.42

9.

i	$P\{X=i\}$
0	1199/1428
1	55/357
2	3/476

11.

i	$P\{X=i\}$
0	0.075
1	0.325
2	0.6

13. No; $P(4)$ is negative.

15.

i	$P\{X=i\}$
0	38/223
1	82/223
2	57/223
3	34/223
4	10/223
5	2/223

17. **(a)** 0.1
(b) 0.5

19.

i	$P\{X=i\}$
0	0.30
1	0.35
2	0.20
3	0.15

Section 5.3

1. (a) 2
   (b) 5/3
   (c) 7/3
3. \$8.40
5. 1.9
7. (a) 2.53
   (b) 4.47
9. \$880
11. (a) 2/3
    (b) 4/3
    (c) 2
13. (a) Second location
    (b) First location
15. −\$5
17. (a) No
    (b) No
    (c) Yes
    (d) $4/95 \approx 0.042$
19. −\$0.40
21. 2.5
23. \$150
25. 0
27. (a) \$16,800
    (b) \$18,000
    (c) \$18,000
29. 3
31. (a) 7
    (b) 7
33. 12
35. 3.6

Section 5.4

1. $\mathrm{Var}(U) = 0, \mathrm{Var}(V) = 1, \mathrm{Var}(W) = 100$
3. 0
5. 0.49
7. 0.25
9. (b) 0.8
   (c) 0.6

11. **(a)** 0.5
(b) 0.5

13. **(a)** 0
(b) $3666

15. **(a)** 4.06
(b) 1.08

17. 3 SD(X) = 6

19. **(a)** 2
(b) 2

Section 5.5

1. **(a)** 24
(b) 120
(c) 5040

3. 3,628,800

5. **(a)** 0.278692
(b) 0.123863
(c) 0.00786432

7. **(a)** 0.468559
(b) 0.885735

9. **(a)** 3 or more
(b) 0.00856

11. 0.144531

13. **(a)** 0.517747
(b) 0.385802
(c) 0.131944

15. **(a)** 0.421875
(b) 0.421875
(c) 0.140625
(d) 0.015625

17. **(a)** 10/3
(b) 20/3
(c) 10
(d) 50/3

19. **(a)** 0.430467
(b) 0.382638
(c) 7.2
(d) 0.72

21. (a) 0.037481
(b) 0.098345
(c) 0.592571
(d) 1.76
(e) 0.992774
23. (a) 0.00604662
(b) 0
25. (a) 50; 5
(b) 40; 4.89898
(c) 60; 4.89898
(d) 25; 3.53553
(e) 75; 6.12372
(f) 50; 6.12372

Section 5.6

1. Hypergeometric, $n = 20, N = 200, p = 0.09$
3. Hypergeometric, $n = 6, N = 54, p = 6/54$
5. Hypergeometric, $n = 20, N = 100, p = 0.05$
7. Binomial, $n = 10, p = 1/13$

Chapter 5 Review

1. (a) 0.4
(b) 0.6
3. (a) 1, 2, 3, 4
(b)

i	$P(X = i)$
1	0.3
2	0.21
3	0.147
4	0.343

(c) 0.7599
(d) 2.53
(e) 1.53
5. (a) 0.723
(b) No, because if she wins then she will win \$1, whereas if she loses then she will lose \$3.
(c) -0.108

7. (a)

i	$P(X = i)$
0	0.7
4000	0.15
6000	0.15

(b) 1500
(c) 5,550,000
(d) 2,355.84

9. The low bid will maximize their expected profit.

11. (a) 1/3
(b) 1/4
(c) 7/24
(d) 1/12
(e) 1/24
(f) \$625
(g) \$125

13. (a) 0
(b) −68,750
(c) −68,750

17. (a) 0.6
(b) 0.648
(c) 0.68256
(d) 0.710208
(e) 0.733432
(f) 0.813908

19. (a) 0.064
(b) 0.432
(c) 0.820026

21. It is more likely that it does not.

Section 6.2

1. (a) 0.29
(b) 0.56
(c) 0.33
(d) 0.27

3. (a) 2/3
(b) 0.7
(c) 0.6
(d) 0.6

5. **(a)** 2/3
(b) 1/6
(c) 1/3

7. **(a)** 1/2
(b) 0
(c) 3/4
(d) 3/8

Section 6.3

1. **(a)** 108.8 to 148
(b) 89.2 to 167.6
(c) 69.6 to 187.2

3. **(b)**

5. **(d)**

7. **(c)**

9. **(a)**

11. **(b)**

13. **(d)**

15. **(b)**

17. **(a)** Y
(b) X
(c) X and Y are equally likely to exceed 100.

19. **(a)** No
(b) No
(c) No
(d) Yes

Section 6.4

1. **(a)** 0.9861
(b) 0.1357
(c) 0.4772
(d) 0.7007
(e) 0.975
(f) 0.2358
(g) 0.899
(h) 0.2302
(i) 0.8710

3. 3

7. **(a)** 1.65
(b) 1.96
(c) 2.58

(d) 0
(e) 0.41
(f) 2.58
(g) 1.15
(h) 0.13
(i) 0.67

Section 6.6

1. Since $x > a$, $x - u > a - u$. It follows that $\frac{x-u}{\sigma} > \frac{a-u}{\sigma}$ since σ is positive.
3. 0.3085
5. (a) 0.6179
   (b) 0.8289
   (c) 0.4468
7. 0.008
9. (a) 0.1587
   (b) 0.2514
   (c) 0.4772
11. 0.8664
13. 6.31
15. (a) 0.2660
    (b) 0.9890
    (c) 0.7230
    (d) 0.9991
    (e) 0.0384
17. (a) 0.6915
    (b) 0.24

Section 6.7

1. (a) 1.48
   (b) 1.17
   (c) 0.52
   (d) 1.88
   (e) −0.39
   (f) 0
   (g) −1.64
   (h) 2.41
3. (a) 50
   (b) 57.68

(c) 61.76
(d) 40.16
(e) 57.02

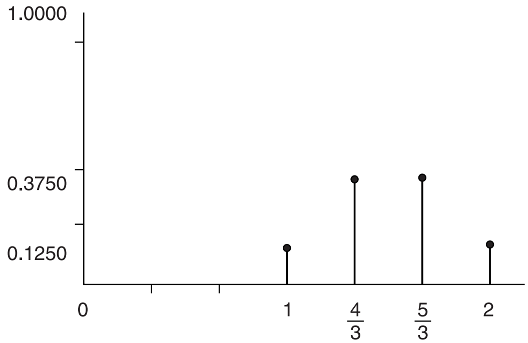
5. 464.22
7. 525.6
9. 746
11. (a) True
(b) True
13. 99.28

Chapter 6 Review

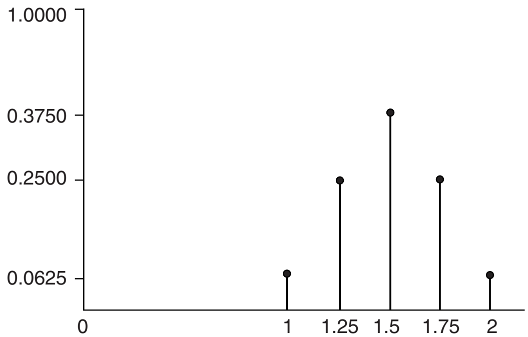
1. (a) 0.9236
(b) 0.8515
(c) 0.0324
(d) 0.9676
(e) 0.1423
(f) 0.0007
(g) 75.524
(h) 73.592
(i) 68.3
3. 4.969
5. (a) 0.1587
(b) 0.1587
(c) 0.1886
(d) 576.8
7. (a) 0.881
(b) 0.881
(c) 0.762
9. (a) 0.4483
(b) 0.201
(c) 0.4247
11. (a) 0.6915
(b) 0.3859
(c) 0.1587
13. (a) 1/4
(b) 0.28965
15. (a) 0.8413
(b) 0.042
(c) independence

Section 7.3

1. **(a)** $\mathrm{SD}(\overline{X}) = \frac{1/2}{\sqrt{3}} \approx 0.29$



(b) $\mathrm{SD}(\overline{X}) = \frac{1/2}{\sqrt{4}} = 0.25$



3. **(a)** 2

(b) $\sqrt{2/3} \approx 0.82$

(c)

i	$P\{\overline{X} = i\}$
1	1/9
1.5	2/9
2	3/9
2.5	2/9
3	1/9

(d) $E(\overline{X}) = 2, \mathrm{SD}(\overline{X}) = 1/\sqrt{3} \approx .58$

(e) Yes

5. **(a)** $E(\overline{X}) = 2.4, \mathrm{SD}(\overline{X}) = 0.2/\sqrt{36} \approx 0.033$

(b) $E(\overline{X}) = 2.4, \mathrm{SD}(\overline{X}) = 0.2/\sqrt{64} \approx 0.025$

(c) $E(\overline{X}) = 2.4, \mathrm{SD}(\overline{X}) = 0.2/\sqrt{100} \approx 0.02$

(d) $E(\overline{X}) = 2.4, \mathrm{SD}(\overline{X}) = 0.2/\sqrt{900} \approx 0.007$

7. Expected value $= 15,500$, standard deviation $= 2800$

Section 7.4

1. (a) 0.5468
   (b) 0.7888
   (c) 0.9876
3. 0.7888
5. (a) 0.0062
   (b) 0.7888
7. 0.9713
9. 0.1416
11. (a) 0.905
    (b) 0.5704
13. (a) 0
    (b) 0
15. (a) 0.6826
    (b) 0.9544
    (c) 1
    (d) 1
    (e) 1

Section 7.5

1. (a) $E(\overline{X}) = 0.6, \mathrm{SD}(\overline{X}) = 0.15$
   (b) $E(\overline{X}) = 0.6, \mathrm{SD}(\overline{X}) = 0.049$
   (c) $E(\overline{X}) = 0.6, \mathrm{SD}(\overline{X}) = 0.015$
   (d) $E(\overline{X}) = 0.6, \mathrm{SD}(\overline{X}) = 0.0049$
3. (a) 0.0122
   (b) 0.119
   (c) 0.5222
9. (a) 0.0125
   (b) 0.8508
11. 0.1949
13. 0.4602
15. (a) 0.9147
    (b) 0.0043
    (c) 0.5188
17. (a) 0.9599
    (b) 0.3121
19. (a) 0.9974
    (b) 0.0268

Section 7.6

1. (a) 5.7; 4 degrees of freedom
   (b) 0.018; 5 degrees of freedom
   (c) 1.13; 2 degrees of freedom

Chapter 7 Review

1. (a) 0.8413
   (b) 0.5
   (c) 0.0228
   (d) 0.0005
3. $E(\overline{X}) = 3; \mathrm{SD}(\overline{X}) = 1/\sqrt{2} \approx 0.71$
5. (a) Mean $= 12$, standard deviation $= 3.25$
   (b) 0.5588
7. (a) 300
   (b) $7\sqrt{2} \approx 31.3$
   (c) 0.5
9. 0.1003
11. (a) 0.3669
    (b) 0.9918
    (c) 0.9128

Section 8.2

1. 145.5
5. 165.6 hours
7. 12
9. 3.23
11. (a)

Section 8.3

1. 0.3849
3. 0.65; 0.107
5. 0.412; 0.05
7. (a) 0.122
   (b) 0.01
9. (a) 0.0233
   (b) 0.0375
   (c) 0.0867
11. (a) 0.245
    (b) 0.022
13. (c); accurate in terms of lowest standard error

Section 8.3.1

1. 0.28
3. (b) 3.32; 1.73; 1.45

Section 8.4

1. 18.36
3. 799.7; 193.12
5. 21.27
7. 30.5
9. 12.64
11. 1.35
13. 0.0474; 0.2386

Section 8.5

1. (a) (3.06, 3.24)
   (b) (3.03, 3.27)
3. (11.43, 11.53)
5. (a) (8852.87, 9147.13)
   (b) (8824.69, 9175.31)
7. (72.53, 76.67)
9. (a) (1337.35, 1362.65)
   (b) (1334.92, 1365.08)
   (c) (1330.18, 1369.82)
11. 13.716
13. 3176
15. (a) 72.99
   (b) 72.53
   (c) 76.67
   (d) 77.53
17. No

Section 8.6

1. (a) (5.15, 5.25)
   (b) (5.13, 5.27)
3. (a) (73.82, 93.91)
   (b) (71.63, 96.10)
   (c) (66.89, 100.84)

5. (a) (127.71, 163.29)
   (b) (119.18, 171.82)
7. (446.28, 482.01)
9. (280.04, 284.96)
11. (1849.4, 2550.6)
13. (a) (4.60, 4.80)
    (b) (4.58, 4.82)
15. (1124.95, 1315.05)
17. No
19. (a) (27.59, 38.64)
    (b) No
21. 68.897, 98.836
23. The average daily receipts exceed \$2857.

Section 8.7

1. (0.548, 0.660)
3. (a) (0.502, 0.519)
   (b) (0.498, 0.523)
5. (0.546, 0.734)
7. (0.359, 0.411)
9. (0, 0.306)
11. (0.801, 0.874)
13. (0, 0.45)
15. (a) (0.060, 0.108)
    (b) (0.020, 0.052)
    (c) (0.448, 0.536)
17. (a) A 95% confidence interval is given by 0.75 ± 0.0346.
    (b) Rather than using $\hat{p}$ to estimate p in the standard error term they used the upper bound $p(1-p) \leq 1/4$.
19. (a) 1692
    (b) Less than 0.04 but greater than 0.02
    (c) (0.213, 0.247)
21. 6147
23. 0.868
25. (a) 0.139
    (b) 0.101
27. (a) No
    (b) No

Chapter 8 Review

1. (a)
3. (22.35, 26.45)
5. (316.82, 323.18)
7. (a) (44.84, 54.36)
   (b) (45.66, 53.54)
9. (1527.47, 2152.53)
11. (a) 88.56
    (b) (83.05, 94.06)
13. (a) (34.02, 35.98)
    (b) (33.04, 36.96)
    (c) (31.08, 38.92)
15. (0.487, 0.549)
17. 0.004
19. (a) (0.373, 0.419)
    (b) (0.353, 0.427)
21. Upper

Section 9.2

1. (a) Hypothesis *B*
3. (d) is most accurate; (b) is more accurate than not.

Section 9.3

1. TS = 1.55; $z_{\alpha/2} = 1.96$; do not reject H_0.
3. (a) 0.0026
   (b) 0.1336
   (c) 0.3174
   At the 5% level of significance we reject H_0 in (a). At the 1% level of significance we reject H_0 in (a).
5. Yes
7. (a) No
   (b) 0
9. The data do not support a mean of 13,500 miles.
11. Yes; Yes
13. The *p* value is 0.281. Thus we reject this hypothesis at a level of significance of 0.281 or greater.
15. (a) 0.2616
    (b) 0.2616
    (c) 0.7549

Section 9.3.1

1. (a) No
   (b) No
   (c) 0.091
3. (a) 0
   (b) 0
   (c) 0.0085
5. (a) Yes
   (b) No, because the reduction in cavities is so small.
7. Yes, but increase the sample size.
9. The mean amount dispensed is less than 6 ounces; H_0: $\mu \geq 6$; H_1: $\mu < 6$; p value $= 0$.

Section 9.4

1. The evidence is not strong enough to discredit the manufacturer's claim at the 5% level of significance.
3. (a) Yes
   (b) No
5. (a) No
   (b) No
   (c) No
   (d) The p value is 0.108.
7. Yes
11. H_0: $\mu \geq 23$ versus H_1: $\mu < 23$. The judge should rule for the bakery.
13. (a) H_0: $\mu \geq 31$
    (b) H_1: $\mu < 31$
    (c) No
    (d) No
15. No, the p value is 0.0068.
17. No; no

Section 9.5

1. p value $= 0.0365$; normal approximation is 0.0416
3. No
5. (a) H_0: $p \leq 0.5$; H_1: $p > 0.5$
   (b) 0.1356
   (c) 0.0519
   (d) 0.0042
   As n increases, the p value decreases, because we have more confidence in the estimate for larger n.

7. (a) No
   (b) No
   (c) No
   (d) Yes
9. No; no
11. No
13. (a) Yes
   (b) No
   (c) 0.2005

Chapter 9 Review

1. (b)
5. (a) No
   (b) Yes
   (c) Yes
7. There is insufficient evidence to support the claim at the 5% level of significance.
9. One would probably rule against Caputo since the p value of the test H_0: $p = 1/2$ against H_1: $p \neq 1/2$ is 0.000016.
15. (a) 20
   (b) 0.4526

Section 10.2

1. (a) No
   (b) 0
3. (a) There is evidence to support the hypothesis that the mean lengths of their cuttings are equal.
   (b) 0.8336
5. It suffices to relabel the data sets and use the given test.
7. No

Section 10.3

1. Yes; H_0: $\mu_x = \mu_y$; H_1: $\mu_x \neq \mu_y$; p value $= 0.0206$
3. p value $= 0.5664$
5. Yes; 0
7. No; H_0: $\mu_x \leq \mu_y$; H_1: $\mu_x > \mu_y$, where x corresponds to rural students and y corresponds to urban students.
9. H_0: $\mu_B \leq \mu_A$; H_1: $\mu_B > \mu_A$; p value $= 0.0838$. At the 5% level of significance supplier B should be used.
11. (a) H_0: $\mu_m \leq \mu_f$; H_1: $\mu_f < \mu_m$

(c) It indicates that the female average wage is less than the male average wage.

13. (a) The null hypothesis should be rejected for $\alpha = 0.01$.
(b) 0.0066
(c) Reduction in mean score

Section 10.4

1. No; yes
3. (a) No
(b) No
5. Yes
7. Reject H_0: $\mu_x = \mu_y$ for $\alpha = 0.05$; p value $= 0.0028$.
9. (a) Reject H_0: $\mu_x = \mu_y$
(b) Reject H_0: $\mu_x = \mu_y$
(c) Do not reject H_0: $\mu_x = \mu_y$

Section 10.5

1. (a) Reject the hypothesis at $\alpha = 0.05$.
(b) p value $= 0.0015$
3. Do not reject H_0.
5. (a) Do not reject the hypothesis.
(b) There is not evidence to reject the hypothesis at the 5% level of significance.
7. Reject the hypothesis at $\alpha = 0.05$.
9. (a) H_0: $\mu_{\text{before}} \leq \mu_{\text{after}}$; H_1: $\mu_{\text{before}} > \mu_{\text{after}}$
(b) No
11. The null hypothesis is not rejected.

Section 10.6

1. (a) No
(b) No
3. (a) Yes
(b) 0.0178
5. (a) No
(b) 0.0856
7. Reject the hypothesis that the proportions were the same in 1983 and 1990; p value $= 0.0017$.
9. Reject the hypothesis for $\alpha = 0.05$; p value $= 0$.
11. (a) Yes
(b) 0

13. No
15. Yes; H_0: $\hat{p}_{\text{placebo}} \le \hat{p}_{\text{aspirin}}$ (where $\hat{p}$ is the proportion that suffered heart attacks); $\hat{p}$ value $= 0$.

Chapter 10 Review

1. (a) Reject H_0: $\mu_x = \mu_y$
   (b) 0
3. (a) Do not reject the hypothesis that the probabilities are the same.
   (b) 0.5222
   (c) No
   (d) $\alpha \ge 0.2611$
5. (a) Reject H_0: $\mu_x = \mu_y$
   (b) 0.0497
7. Do not reject the hypothesis that the probabilities are the same.
9. Do not reject the hypothesis (p value $= 0.79$).
11. Do not reject the hypothesis that the proportions are the same in both sports.

Section 11.2

1. (a) $\overline{X}_1 = 8, \overline{X}_2 = 14, \overline{X}_3 = 11$
   (b) $\overline{\overline{X}} = 11$
3. Yes
5. No
7. Do not reject the hypothesis for $\alpha = 0.05$.
9. Reject the hypothesis that death rates do not depend on season for $a = 0.05$.
11. No

Section 11.3

1. $\hat{\alpha} = 68.8, \hat{\alpha}_1 = 14.2, \hat{\alpha}_2 = 6.53, \hat{\alpha}_3 = -3.47, \hat{\alpha}_4 = -3.47, \hat{\alpha}_5 = -13.8,$
   $\hat{\beta}_1 = 0.8, \hat{\beta}_2 = -2.4, \hat{\beta}_3 = 1.6$
3. $\hat{\alpha} = 28.33, \hat{\alpha}_1 = 1, \hat{\alpha}_2 = -2, \hat{\alpha}_3 = 1, \hat{\beta}_1 = 3.67, \hat{\beta}_2 = -0.67, \hat{\beta}_3 = -3$
7. $\hat{\alpha} = 9.585, \hat{\alpha}_1 = -1.74, \hat{\alpha}_2 = -1.96, \hat{\alpha}_3 = 4.915, \hat{\alpha}_4 = -1.36,$
   $\hat{\alpha}_5 = -3.335, \hat{\beta}_1 = 0.495, \hat{\beta}_2 = -0.405,$
   $\hat{\beta}_3 = 0.795, \hat{\beta}_4 = -0.885$
9. (a) 44
   (b) 48
   (c) 52
   (d) 144

Section 11.4

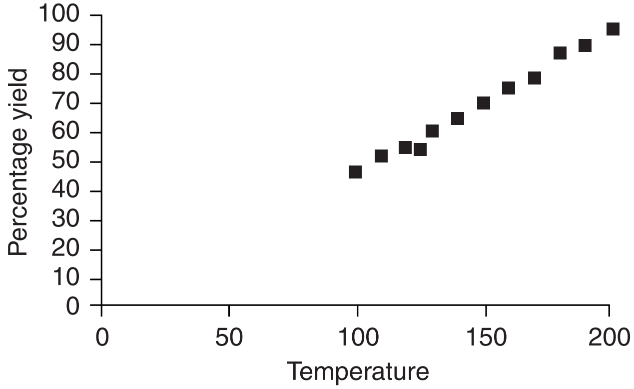
1. (a) Yes
   (b) No
3. (a) No
   (b) No
5. (a) No (Reject H_0)
   (b) Yes (Do not reject H_0)
7. The p-value in both cases is less than 0.0001.
9. (a) Reject the hypothesis for $\alpha = 0.05$.
   (b) Do not reject the hypothesis for $\alpha = 0.05$.

Chapter 11 Review

1. Reject the hypothesis for $\alpha = 0.05$.
3. Yes for $\alpha = 0.05$.
5. Do not reject the hypothesis for $\alpha = 0.05$.
7. (a) Do not reject the hypothesis for $\alpha = 0.05$.
   (b) 30.6
   (c) Reject the hypothesis for $\alpha = 0.05$.
9. (a) Do not reject the hypothesis for $\alpha = 0.05$.
   (b) Reject the hypothesis for $\alpha = 0.05$.

Section 12.2

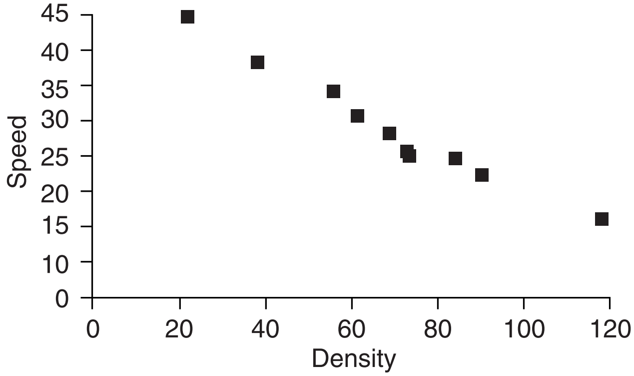
1. (a)



   (b) Yes

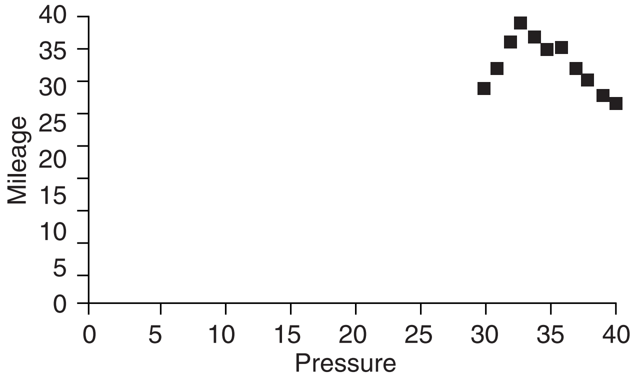
3. **(a)** Density; speed

(b)



(c) Yes

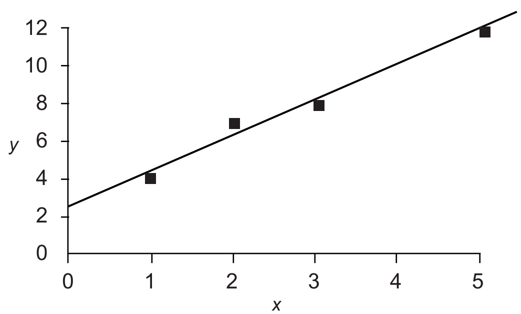
5. **(a)**

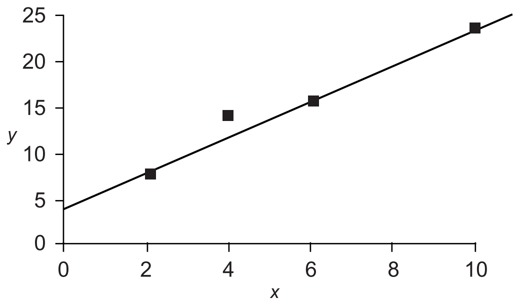


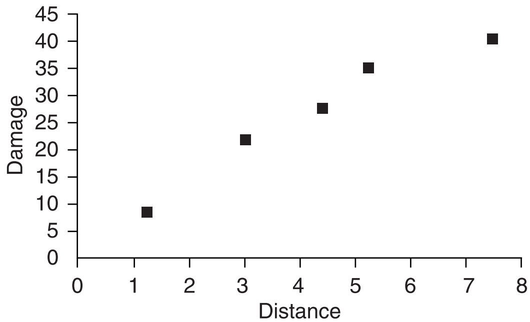
(b) No

Section 12.3

1. **(a)**



(b) 

3. (a) 

(c) $y = 14.79 + 2.43x$

7. (a) $y = -8.31 + 0.27x$
(b) 31.66
(c) $y = 31.66 + 3.61x$
(d) 147.12

9. At random

11. (a) $y = 67.56 + 0.23x$
(b) 204.62
(c) 261.73
(d) 296.00

13. 121.85

Section 12.4

1. 2.32

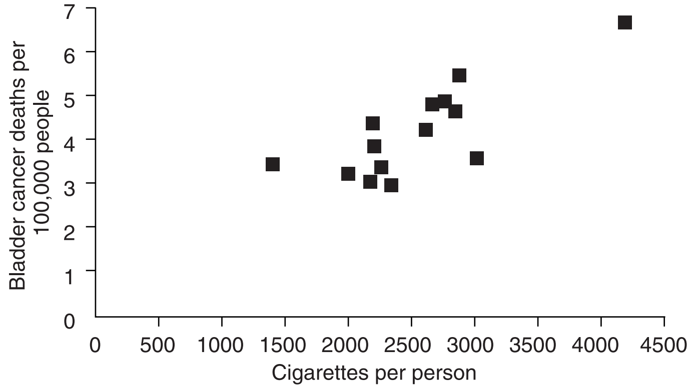
3. (a) 6
(b) 6
(c) 76

5. 0.000156

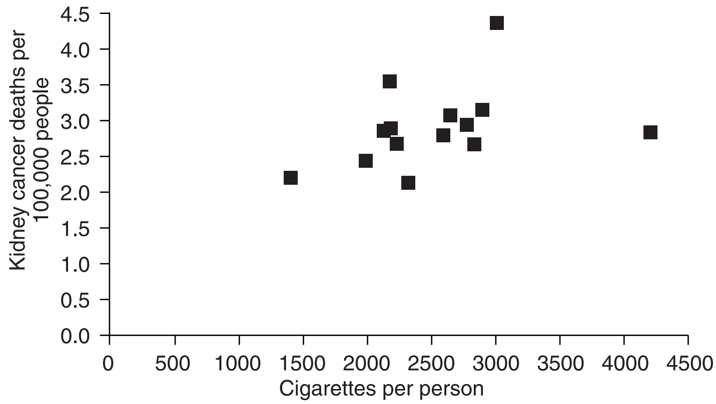
7. 6970.21

Section 12.5

1. Do not reject H_0: $\beta = 0$.
3. Reject the hypothesis.
5. (a)



   (b) $y = 0.75 + 0.0013x$
   (c) Reject the hypothesis.
   (d) Reject the hypothesis.
7. (a)



   (b) $y = 2.12 + 0.0003x$
   (c) Do not reject the hypothesis.
   (d) Do not reject the hypothesis.
9. Reject the hypothesis.

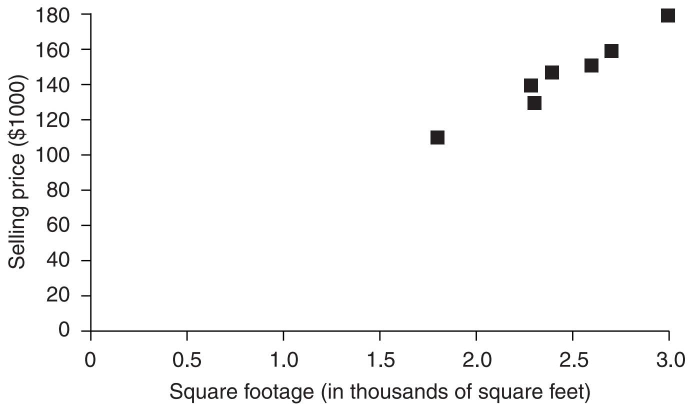
Section 12.6

1. (a) $\alpha = 10.48$, $\beta = 0.325$
   (b) Yes
7. Not as well as the heights

Section 12.7

1. (a) 12.6
   (b) (6.4, 18.8)
3. (a) $y = 44.818 - 0.3138x$
   (b) 28.814
   (c) (25.083, 32.545)
   (d) (6026.89, 9520.09)
5. (a) 2.501
   (b) (2.493, 2.510)
7. (a) $33,266
   (b) (27,263, 39,268)
   (c) $42,074; (35,608, 48,541)

Section 12.8

1. (a)


   (b) $y = 8.885 + 56.32x$
   (c) 97%
   (d) (144,628, 165,929)
3. (a) 0.9996
   (b) Yes
   (c) 41.975
   (d) (40.692, 43.258)
5. 0.149
7. 0.059

Section 12.9

1. (a) 0.9796; 0.9897
   (b) 0.9796; 0.9897

This indicates that the value of the sample correlation coefficient does not depend on which variable is considered the independent variable.

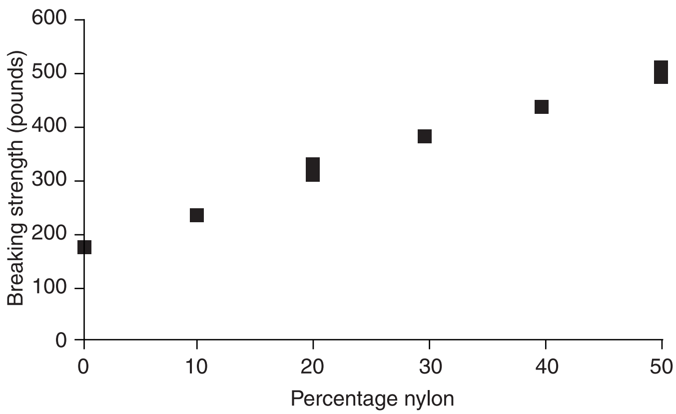
3. (a) 0.8
   (b) 0.8
   (c) -0.8
   (d) -0.8
5. (a) $y = -3.16 + 1.24x$
   (b) $y = 7.25 + 0.66x$
   (c) 0.818; 0.904
   (d) 0.818; 0.904

Section 12.11

3. $y = -153.51 + 51.75x_1 + 0.077x_2 + 20.92x_3 + 13.10x_4$; 183.62
5. 69.99

Chapter 12 Review

1. (a)



   (b) $y = 177.93 + 6.89x$
   (c) 522.61
   (d) (480.53, 564.68)
3. (a) $\alpha = 94.13$; $\beta = 0.155$
   (b) (93.17, 132.34)
   (c) 100%
5. Not necessarily, doing well (or poorly) might just be a chance phenomenon that will tend to regress to the mean on the next attempt.
9. (a) 34.9
   (b) (4.34, 23.40)
11. (a) $y = 177.41 + 1.07x_1 + 11.7x_2$
   (b) 241.90

15. Alcohol consumption, which is associated with both cigarette consumption and bladder cancer incidence, might be the primary cause. A multiple linear regression would be useful.

Section 13.2

1. (a) 15.086
   (b) 11.070
   (c) 23.209
   (d) 18.307
   (e) 31.410
3. H_0: $P_1 = 0.52, P_2 = 0.32, P_3 = 0.16$. No, H_0 is not rejected.
5. Yes, the null hypothesis is rejected.
7. No, p value $= 0.0002$.
9. Yes; yes
11. Yes
13. Do not reject the hypothesis.
15. Reject the hypothesis.

Section 13.3

1. (a) 7.08
   (b) Yes
   (c) No
3. Reject the hypothesis.
5. Do not reject that the characteristics are independent.
7. Reject the hypothesis.
9. No
11. Reject the hypothesis; reject the hypothesis.
13. Do not reject the hypothesis.

Section 13.4

1. No, we cannot conclude that smoking causes lung cancer, but we can conclude that the per capita lung cancer rate is higher for smokers than for nonsmokers.
3. Do not reject the hypothesis.
5. No
7. Yes; no
9. Do not reject in each case.

Chapter 13 Review

1. Do not reject the hypothesis.
5. Reject the hypothesis.

7. Do not reject the hypothesis for $\alpha = 0.05$.
9. Yes
11. No; no
13. (a) Do not reject the hypothesis.
    (b) 0.208
15. Do not reject the hypothesis; do not reject the hypothesis.

Section 14.2

1. (a) p value $= 0.057$. Reject the null hypothesis at any significance level greater than or equal to 0.057.
   (b) p value ≈ 0. Reject the null hypothesis at any significance level.
   (c) p value ≈ 0. Reject the null hypothesis at any significance level.
3. We cannot reject the null hypothesis that the two guns are equally effective.
5. Since n is small we use the binomial distribution to calculate the p value $=$ 0.291. Thus we cannot reject the hypothesis that the median score will be at least 72.
7. Yes, this discredits the hypothesis. p value $= 0.0028$.

Section 14.3

1. (a) TS $= 39$
   (b) TS $= 42$
   (c) TS $= 20$
3. (a) p value $= 0.2460$
   (b) p value $= 0.8336$
   (c) p value $= 0.1470$
5. (a) Yes, how the paper is presented had an effect on the score given.
   (b) p value $= 0.0102$
7. (a) The null hypothesis is rejected at any significance level greater than or equal to 0.1250.
   (b) The null hypothesis is rejected at any significance level greater than or equal to 0.0348.
9. No, we cannot reject the null hypothesis. Painting does not affect an aircraft's cruising speed.

Section 14.4

1. (a) 94
   (b) 77
3. p value $= 0.8572$
5. Since the p value $= 0.2112$, we cannot reject the null hypothesis that the starting salary distribution for MBAs from the two schools are the same.
7. p value $= 0.4357$

Section 14.5

1. (a) 41
   (b) 2
3. Since the p value $= 0.0648$, we cannot reject the hypothesis that the data constitutes a random sample.
5. Since the p value $= 0.0548$, we cannot reject the null hypothesis that the interviewer interviewed them in a randomly chosen order.
7. (a) Median $= 163.5$
   (b) Seven runs
   (c) Since the p value $= 0.0016$, we must reject the null hypothesis at any significance level greater than or equal to 0.0016. The sequence of values do not constitute a random sample.

Section 14.7

1. The data strongly support the hypothesis that the student improved as the semester progressed.

Chapter 14 Review

1. Using the rank-sum test with TS $= 113$, we obtain a p value of 0.0348. So we cannot reject the null hypothesis at the 1% level of significance, but we must reject the null hypothesis at the 5% level.
3. Since p value ≈ 0, reject the null hypothesis, the median net worth has decreased.
5. We do a runs test, with median $= 145$ and $n = m = 20$, and $r = 21$. Since $5 = 21$, the p value is 1.0.
9. Using the signed–rank test with TS $= 0$. The p value $= 0.0444$. Thus we reject the null hypothesis that there is no difference in the shoe sales at any level of significance above 4.44%.
11. Since the p value $= 0.5620$, we cannot reject the null hypothesis.

Section 15.2

1. (a) LCL $= 85$, UCL $= 115$
   (b) LCL $= 86.58$, UCL $= 113.42$
   (c) LCL $= 87.75$, UCL $= 112.25$
   (d) LCL $= 90.51$, UCL $= 109.49$
3. LCL $= 66.58$, UCL $= 93.42$. Since subgroup 9 falls outside this range, the process would have been declared out of control at that point.
5. LCL $= -0.00671$, UCL $= 0.00671$. Since all the subgroups are within these control limits, the process is in control.

Section 15.3

1. LCL = 0, UCL = 13.23. Since all the subgroups are within the control limits, the process is in control.
3. (a) Since all the subgroups are within the control limits, the process is in control.
   (b) LCL = 0, UCL = 9.88

Chapter 15 Review

1. LCL = 1.4985, UCL = 1.5015.
3. LCL = 0, UCL = 13.23. Since all the subgroups are within these control limits, the process is in control.