Numerical Answers to
Selected Exercises

EXERCISE 2-7
minimum = 7 days, first quartile = 440 days, median = 702 days, third quartile = 1,367 days, maximum = 2,509 days

EXERCISE 3-2
mean = 76.05 years, 10% trimmed mean = 76.07 years, weighted mean = 76.31 years

EXERCISE 3-9
mean = 9.65 mg/g, 15% trimmed mean = 9.225 mg/g, median = 8.90 mg/g, range = 11.2 mg/g, interquartile range = 14.0 - 5.1 = 8.9 mg/g, sample standard deviation = 4.91 mg/g

EXERCISE 4-13
b. Listed are, respectively, sample size, mean, median, range, interquartile range, and sample standard deviation for each sport. Units are ml · kg⁻¹ · min⁻¹. Wrestling: 5, 57.58, 58.30, 13.6, 6.6, 5.36; weightlifting: 6, 45.12, 44.45, 10.6, 8, 4.39; shot/discus: 4, 45.60, 45.15, 6.9, 5.8, 3.45; ice hockey: 3, 56.57, 54.60, 7.9, 7.9, 4.30; cross-country skiing: 4, 72.275, 73.45, 14.4, 7.65, 6.04.

EXERCISE 5-9
a. Listed numbers are, respectively, the minimum, first quartile, median, third quartile, maximum. Units for weights, grams; for wing length, millimeters; for condition index, gm/mm.
Hatch year ducks, weight (n = 31): 940, 1,070, 1,140, 1,180, 1,280
After hatch year, weight (n = 19): 1,050, 1,110, 1,220, 1,280, 1,420
Hatch year ducks, wing length (n = 31): 252, 263, 268, 272, 276
After hatch year, wing length (n = 19): 264, 270, 275, 277, 285
Hatch year ducks, condition index (n = 31): 3.71, 3.99, 4.23, 4.39, 4.74
After hatch year, condition index (n = 19): 3.82, 4.12, 4.50, 4.68, 5.26

EXERCISE 6-14
a. \( P(\text{lung cancer}|\text{smoker}) = .015; \text{odds} = .01523 \)
b. \( P(\text{lung cancer}|\text{non smoker}) = .005; \text{odds} = .00502 \)
### EXERCISE 6-19

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Probability</th>
<th>Outcome</th>
<th>Probability</th>
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**b.** $k$  

<table>
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</tr>
<tr>
<td>2</td>
<td>.1157</td>
</tr>
<tr>
<td>3</td>
<td>.0154</td>
</tr>
<tr>
<td>4</td>
<td>.0008</td>
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</table>

**c.** $E(W) = .667$ correct answers; $\text{var}(W) = .556$ (correct answers)$^2$; $\text{SD}(W) = .745$ correct answers

**d.** .1319

### EXERCISE 7-1
24

### EXERCISE 7-4
84, $\theta = \frac{\theta}{3}$

### EXERCISE 7-11

**a.** For $N = 10$, $n = 3$, $m_1 = 5$, and $m_2 = 5$, $P(X = k) = \binom{k}{3}^5 \binom{5}{3}^5 \binom{5}{3}^5$ for $k = 0, 1, 2, 3$

### EXERCISE 7-12

**c.** $P(X = 0) = (1 - p)^3$, $P(X = 1) = 3p(1 - p)^2$, $P(X = 2) = 3p^2(1 - p)$,

**d.**

<table>
<thead>
<tr>
<th>$p$</th>
<th>$P(X = 0)$</th>
<th>$P(X \geq 1)$ or 3</th>
<th>$P(X = 3)$</th>
<th>$P(X = 3)$</th>
<th>$E(X)$</th>
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<tr>
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<td>.125</td>
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<td>.648</td>
<td>.216</td>
<td>1.8</td>
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</table>

### EXERCISE 8-2

**a.** .0475

**b.** .9992

**c.** .0471

**d.** .7486

**e.** .0471

**f.** .9544

**g.** .1587

**h.** .1587

**i.** .0038
EXERCISE 8-18

a. \( E(X) = 2.5, \text{var}(X) = 2.25 \)

b. (i) .8302, (ii) .2364, (iii) .2712, (iv) .9666, (v) .0334

c. (i) .6826, (ii) .1587, (iii) .1587, (iv) .9050, (v) .0099

EXERCISE 9-7

a. .006

b. power equals .6590, .2749, .0199, .0199, .2749, .6590 when \( p \) equals, respectively, 1, 2, 4, 6, 8, 9

EXERCISE 10-1

A 95% confidence interval for the population mean based on the \( t \) distribution with 9 degrees of freedom is 103.61 to 133.39 \( \mu \text{mol/liter} \). An approximate 95% confidence interval for the population mean based on the Wilcoxon signed rank distribution for sample size 10 is 102.5 to 133.5 \( \mu \text{mol/liter} \). An approximate 95% confidence interval for the population median based on the binomial(10, .5) distribution is 100.9 to 139.4 \( \mu \text{mol/liter} \).

EXERCISE 10-8

A large sample approximate 95% confidence interval for the proportion of experimentally treated livers expected to last at least 9.5 hours is .3663 to .5093.

EXERCISE 10-9

a. test statistic = -4.02, two-sided \( p \)-value = .016, 90% confidence interval for the population mean is 19.046 to 20.954 ounces

b. test statistic = 0, two-sided \( p \)-value = .599; approximate 90% confidence interval for the population mean is 19.25 to 21.00 ounces

c. test statistic = 0, two-sided \( p \)-value = .0625, approximate 90% confidence interval for the population median is 19.18 to 21.15 ounces

EXERCISE 10-10

A large-sample test statistic = 4.35, two-sided \( p \)-value = .0001, approximate 95% confidence interval for the carrier population mean is 112.5 to 239.3 units.

EXERCISE 11-1

b. For a paired \( t \) test, test statistic = -3.60, two-sided \( p \)-value = .0058; for a Wilcoxon signed rank test, test statistic = 0, two-sided \( p \)-value = .006; for a sign test, test statistic = 0, two-sided \( p \)-value = .002.

c. A 95% confidence interval for the mean difference in numbers of mosquitoes captured, based on a \( t \) distribution is -97.8 to -22.2; approximate 95% confidence interval for the mean difference based on a Wilcoxon signed rank distribution is -105.0 to -28.0; approximate 95% confidence interval for the median difference based on a binomial distribution is -77.67 to -25.6 mosquitoes.

EXERCISE 11-2

a. A large-sample test statistic = 3.76, two-sided \( p \)-value < .0004.

b. Approximate 99% confidence interval for the difference between the two proportions is .0104 to .0553.

EXERCISE 11-3

b. For a two-sample \( t \) test, test statistic = 1.72, two-sided \( p \)-value = .11; for a Wilcoxon–Mann–Whitney test, test statistic = .83, two-sided \( p \)-value = .1;
for the median test, smallest frequency in \(2 \times 2\) table is 2, two-sided \(p\)-value = \(2 \times .143 = .286\).

**c.** A 95% confidence interval for the difference between the two mean scores based on a \(t\) distribution is \(-.6\) to 5.35; 95–96% confidence interval for the difference between the two mean scores based on a Wilcoxon–Mann–Whitney distribution is \(-1.001\) to 6.000.

**EXERCISE 11-9**

A large-sample test statistic = 9.2, two-sided \(p\)-value < .0001; approximate 99% confidence interval for the difference between the two mean lifetimes is 206 to 367 days.

**EXERCISE 12-5**

**b.** test statistic = 63.45 with 2 and 9 degrees of freedom, \(p\)-value < .0001; separate 99% confidence intervals are \((-2.5, -.8)\) for \(\mu_1 - \mu_2\), \((-2.6, -1.2)\) for \(\mu_1 - \mu_3\), \((-0.8, 2)\) for \(\mu_2 - \mu_3\). The mean volume increase for flour type 1 seems to be less than the mean for flour type 2 and the mean for flour type 3; we cannot distinguish between flour types 2 and 3.

**c.** test statistic = 8.2, \(p\)-value = .02; separate 97% confidence intervals are \((-2.3, -0.9)\) for \(\mu_1 - \mu_2\), \((-2.3, -1.3)\) for \(\mu_1 - \mu_3\), \((-0.6, 2)\) for \(\mu_2 - \mu_3\). Conclusions are the same as for part (b).

**EXERCISE 12-10**

**c.** test statistic for treatment differences is 1.24 with 3 and 12 degrees of freedom, \(p\)-value = .3; test statistic for block differences is 3.51 with 4 and 12 degrees of freedom, \(p\)-value = .04.

**e.** Friedman’s test statistic for treatment difference equals 3.4, \(p\)-value = .3.

**EXERCISE 13-1**

**c.** test statistic for brand differences equals 39.6 with 1 and 12 degrees of freedom, \(p\)-value < .0001; test statistic for material differences equals 65.45 with 1 and 12 degrees of freedom, \(p\)-value < .0001; test statistic for interaction effects equals .62 with 1 and 12 degrees of freedom, \(p\)-value = .4.

**EXERCISE 14-1**

**b.** test statistic = 5.57, \(p\)-value = .04

**c.** A 95% confidence interval for the ratio of the two population variances (smaller stress level over greater stress level) is .78 to 39.79.

**EXERCISE 14-2**

**b.** test statistic = 46.2, \(p\)-value < .0001

**c.** A 99% confidence interval for the population variance is 27,570 to 1,121,542 grams$^2$.

**EXERCISE 14-12**

**b.** Bartlett’s test statistic = 1.8, \(p\)-value = .9

**c.** Levene's test statistic = .41, \(p\)-value = .8

**EXERCISE 15-1**

**b.** linear correlation coefficient = -.22, test statistic = -.64, \(p\)-value = .5

**c.** rank correlation coefficient = .055, test statistic = 156, \(p\)-value = .9
EXERCISE 15-10
b. $Y = 4.68 + .887X$
c. $Y = .71 + .997X$
d. equation of standard deviation line if $Y =$ second reading and $X =$ first reading is $Y = 2.07 + .943X$

EXERCISE 15-11
b. $Y = 2.5 + 3.99X$
c. test statistic = 291.37, $p$-value < .0001
d. test statistic = .20, $p$-value = 0.8
f. $R^2 = 1.0$

EXERCISE 15-22
Final estimated model is: distance = 12.8 + .556(right leg strength) + .272(overall leg strength) with both $p$-values less than .05.

EXERCISE 16-3
Test statistic = 1.47, $p$-value = .7

EXERCISE 16-9
Test statistic = 11.7, $p$-value = .003

EXERCISE 16-14
a. Test statistic = 9.235, $p$-value = .002
b. Smallest frequency in the $2 \times 2$ table is 0, $p$-value = .2