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(lung cancer|smoker) = .015; odds = .01523

b. P(lung cancer|nonsmoker) = .005; odds = .00502

EXERCISE 6-19

a.

Outcome	Probability	Outcome	Probability
SSSS	.00077	FSSF	.01929
SSSF	.00386	FSFS	.01929
SSFS	.00386	SSFF	.01929
SFSS	.00386	SFFF	.09645
FSSS	.00386	FSFF	.09645
SFFS	.01929	FFSF	.09645
FFSS	.01929	FFFS	.09645
SFSF	.01929	FFFF	.48225

b.

k	$P(W = k)$
0	.4823
1	.3858
2	.1157
3	.0154
4	.0008

c. E(W) = .667 correct answers; var(W) = .556 (correct answers)^2; SD(W) = .745 correct answers

d. .1319

EXERCISE 7-1

24

EXERCISE 7-4

84, $\frac{6}{9} = \frac{2}{3}$

EXERCISE 7-11

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

EXERCISE 7-12

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

d.

p	$P(X = 0)$	$P(X \geq 1)$	$P(X = 2$ or $3)$	$P(X = 3)$	$E(X)$
.4	.216	.784	.352	.064	1.2
.5	.125	.875	.5	.125	1.5
.6	.064	.936	.648	.216	1.8

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 μmol/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 μmol/liter. An approximate 95% confidence interval for the population median based on the binomial(10, .5) distribution is 100.9 to 139.4 μmol/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 = .059; 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 mosquitos 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 mosquitos.

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 × 2 table is 2, two-sided p-value = 2 × .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 $\mu_1 - \mu_3$, $(-.8, .2)$ 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 $(-2.3, -.9)$ for $\mu_1 - \mu_2$, $(-2.3, -1.3)$ for $\mu_1 - \mu_3$, $(-.6, .2)$ 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 $Y = 2.07 + .943\,X$

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 .03.

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 × 2 table is 0, p-value = .2