BOOK ERRATA –

Foundational and Applied Statistics for Biologists using R

1st printing, 1st edition

updated 10/29/2019

Front material

1. In the cover description "Oreomnos americanus" should be italicized. That is, it should read:
   Oreomnos americanus

2. In the cover description the following superscript correction should be made:
   225 kg^2.

Chapter 1

1. Page 4, § 1.3.1, third from last sentence. ...other equally valid or more valid answers…

2. Page 7, Table 1.1, fourth from last entry.
   …to view evidence for or against hypotheses as a continuum.

3. Page 8, § 1.4.1.3, second sentence. Hans Reichenbach (1891-1953).

4. Page 14, last sentence in §1.7. For consistency with the rest of the book change the font in the word "asbio" from bold to italic. Thus, the end of the sentence should read:
   …after installing and loading *asbio*.

5. Page 15, second paragraph, penultimate sentence. As a result, the field of quantum mechanics…

6. Page 16, Middle of § 1.9. Ronald A. Fisher (1890-1962) has been hailed by…

7. Page 19, Question 10. *reductio ad absurdum*

Chapter 2

1. Page 24, last formula preceding § 2.1.2, eliminate the "and B not subset a subset of S" portion of the formula as shown.
   $B = \varnothing$.

2. Page 34, last sentence in Example 2.6. …where children were taken away…

3. Page 34, last text in Example 2.7. $0.16/0.84 = 0.19$.

4. Page 35, § 2.5, second paragraph.

~~Two~~ Three characteristics will ~~effect~~ affect ~~on~~ the number of outcomes that occur in sample space. These are: 1) whether outcomes are obtained with replacement or without replacement, ~~and~~ 2) whether or not one considers ~~the order of the selection of~~ individual objects ~~to matter~~ to be distinguishable, and 3)~~.~~ whether or not the order of distinguishable objects matters.

5. Page 36, § 2.5, last part of second paragraph
   To explain the importance of order and distinguishability, consider the side-by-side seating arrangement of three individuals on an advisory panel, two females and one male. There are three possible configurations: $\{♀♂♂, ♂♂♀, ♂♀♂\}$. In this case order matters, but only when distinguishing males from females. This is because the females are indistinguishable. ~~As a result we say that *order does not matter*.~~ However, assume that the females are distinguishable as $♂_1♂_2$. Now we have six possible arrangements: $\{♀♂_1♂_2, ♂_1♂_2♀, ♂_1♀♂_2, ♀♂_2♂_1, ♂_2♂_1♀,$ $♂_2♀♂_1\}$ ~~because *order does matter*~~.

6. Page 36, paragraph following Example 2.8.
   The multiplication principle can also be used in situations when ~~order *is* important~~ outcomes *are distinguishable*. Consider a group of five distinct females. If five selections from this group are made *with replacement* (i.e., a single individual can be chosen twice or more), and ~~*order matters*~~ *females are distinguishable*, i.e., the selection $♀_1♀_2$ is considered different than $♀_2♀_1$, then there are $5^5 = 3125$ possible distinct outcomes.

7. Page 36, last words in Example 2.9. …that individual male and female outcomes are indistinguishable from each other~~, that is, order is unimportant~~.

8. Page 37, sentence following Eq. 2.24, delete $♀_6$ symbols.
   Thus, the number of different arrangements of 5 distinguishable female offspring is $5! = 120$, $(♀_1♀_2♀_3♀_4♀_5~~♀_6~~$ and $~~♀_6~~♀_3♀_2♀_4♀_5♀_1$ are two such arrangements).

9. Page 37, sentence following Eq. 2.25.
   For instance, if we choose two females from the group of five females without replacement (the same individual cannot be chosen twice), and permuted each selection, then this describes the number of permutations when choosing two individuals at a time.

10. Page 37, § 2.5.3, first sentence.
    If we are sampling without or with replacement, but order does not matter, then we are interested in the number of *combinations*. The number of combinations of n distinct objects taken r at a time without replacement is:

11. Page 37, § 2.5.3, insert a sentence as shown below.
    It is important to several discrete probability density functions introduced in Ch. 3. The binomial coefficient can also be considered the number of combinations of n indistinguishable objects of which r are of one type and $n - r$ are the other, when sampling with replacement, and order matters.

12. Page 45, Question 13.
    What are all the possible outcomes (in head and tails) for a toss using fives coins~~. Assume that order does not matter~~ (see Theorem 2.2)~~.~~?

13. Page 45, Question 17. …be arranged in a 4 base pair strand.

14. Page 47, Question 31a. …and the ~~TC~~ CT method (this does not…

15. Page 47, Question 31c. …determination was DA for the ~~TC~~ CT method.

Chapter 3

1. Page 50 § 3.1.2, 3rd paragraph. To allow correspondence with Figure 3.1 we should have:
   …in which the outcome 1 occurs ~~3~~2 times, the outcome 2 occurs 5 times, and the outcome 3 occurs ~~2~~3 times…

2. Page 51, R code at top of page. Typesetting removed equals signs from code.

   ```
   hist(c(rep(1, 2), rep(2, 5), rep(3, 3)), breaks = c(0, 1, 2, 3))
   axis(4, at = 0:5, labels = seq(0, 0.5, 0.1))
   mtext("Density", 4, line = 2.7, cex = 1.2)
   ```

3. Page 52, § 3.1.3, first paragraph, last sentence.
   …for ~~the~~ both discrete and continuous random variables.

4. Page 53, Paragraph preceding Ex. 3.1, first sentence. The word "are" is incorrectly italicized. Fragment should read:
   …of cdfs are *survivorship functions* and…

5. Page 54 R code at top of page. Typesetting caused the <, =, and + symbols in R-code to be removed. The code should read:

   ```
   ##pdf
   x <- c(0, 1, 2, 3, 4)
   f.x <- c(0.5, 0.3, 0.1, 0.05, 0.05)
   plot(x, f.x, xlab = "x", ylab = "f(x)", pch  16)
   segments(x, 0, x, f.x)

   ##cdf
   x <- c(0, 1, 2, 3, 4)
   F.x <- c(0.5, 0.8, 0.9, 0.95, 1.0)
   plot(x, F.x, xlab = "x", ylab = "F(x)", pch = 16)
   segments(x, F.x, x + 1, F.x)
   points(1:4, F.x[1:4])
   ```

6. Page 54, paragraph under Fig. 3.3. $F(2) = P(X \leq 2) = 0.1 +$ ~~0.5~~ 0.3 + ~~0.3~~ 0.5 $= 0.9$.

7. Page 56, sentence near middle of page, extra comma. …$\binom{2}{1} = 2 \, \tilde{,}$, which gives…

8. Page 58, example on top of page. $= 1.26 \cdot 10^{14} \times 6.50 \cdot 10^{-5} \times 4.25 \cdot 10^{-13} =$ ~~0.0034~~ 0.0035.

9. Page 61, Example 3.4.
   The total area under the pdf curve in Fig. 3.7 equals one because it is a rectangle whose ~~opposite~~ alternate sides have length 2 and 0.5, and $2 \times 0.5 = 1$.

10. Page 63, text preceding Eq. 3.11. Any outcome, x_i, from any normal distribution…

11. Page 63. The current version of Eq. 3.11 reads:

$$z_i = \frac{x_i - \mu}{\sigma}$$

For simplicity, replace it with:

$$z = \frac{x - \mu}{\sigma}$$

12. Page 64, R code near top of page.
```
integrand <- function(x){1/sqrt(2 * pi) * exp(-1/2 * x^2)}
```

13. Page 65, worked example near middle of page. …= 0.900437~~2~~.

14. Page 68, 2nd paragraph, 2nd sentence. Because each of the columns in `larrea` represents…

15. Page 68, text preceding Fig. 3.12. …and POI(4.04) (Fig 3.12) ~~to test the~~

16. Page 70, Example 3.7. Recently, ~~88~~ 120 goats were randomly sampled from the GYE…

17. Page 74, penultimate sentence preceding § 3.3.2. Replace: "… when $k \to \infty$." With: "… when $k = \infty$."

18. Page 74, § 3.3.2, 2nd sentence. …can be used to mimic normal distribution~~s~~…

19. Page 77, Example 3.11. replace ">" with "≥", replace "<" with "≤", and make other small changes as shown below:

If $X \sim t(5)$, what is $P(-2 \geq X \geq 2)$? See Fig 3.18.

We can calculate this *two-tailed probability* by finding $P(X \leq -2) + 1 - P(X \leq 2)$, by finding $P(X \leq -2) + 1 - P(X \geq 2)$, or (since the distribution is symmetric), by obtaining $2P(X \leq -2)$ or $2P(X \geq |-2|)$.

20. Page 78, penultimate sentence preceding Example 3.12.
…combinations of degrees of freedom ~~combination~~…

21. Page 78, Example 3.12.
Replace:
…by obtaining $P(X < 3) - P(X < 1)$.
With:
…by obtaining $P(X \leq 3) - P(X \leq 1)$.

22. Page 87, sentence preceding Eq. 3.30.
...that Equation ~~3.32~~ 3.29 is an adaptation of Equation ~~3.33~~ 3.30 given below:

23. Page 87, sentence preceding R code near the bottom of page.
…the Barro Colorado Island analysis is shown in ~~here~~ (Figure 3.26~~)~~.

24. Page 88. In Equation 3.32, *s* should be replaced with θ.
    That is, replace:

$$f(x) = \frac{e^{-(x-\beta)/\theta}}{s\left[1+e^{-(x-\beta)/\theta}\right]^2}$$

    With

$$f(x) = \frac{e^{-(x-\beta)/\theta}}{\theta\left[1+e^{-(x-\beta)/\theta}\right]^2}$$

25. Page 89, 2nd paragraph, 1st sentence. …*logistic generalized linear models, that is, GLMs* (*GLMs;* Chapter 9).

26. Page 90, § 3.4, 1st paragraph, 2nd sentence. "…how like likely are is the data a particular null distribution given the data a particular null distribution?"

27. Page 90, § 3.4, 3rd paragraph, 3rd sentence. …will be equivalent to $P(X > x)$.

28. Page 90, Example 3.18, 1st sentence. Change font of word "catsM" to monospace. Should read:
    The dataset `catsM` from library…

29. Page 90, last sentence on page. Change font of word "catsM" to monospace. Should read:
    The second column in `catsM` contains body…

30. Page 93, Table 3.4, 3rd column in the Poisson section of the table.
    Replace:
    MGF = $e^{\lambda(et-1)}$

    With:
    MGF = $e^{\lambda(e^t-1)}$

31. Page 93, Table 3.4, 3rd column in the Geometric section of the table.
    Replace:
    $E(X) = 1/\pi$

    With
    $E(X) = (1-\pi)/\pi$

    (Thanks to Dr. Brian Parker, New York University)

32. Page 95, Table 3.5 footnote.

    The area under the pdf curve) provides probability.

33. Page. 98, Question 13.
    … for negative binomial dispersion parameter m k and mean k m.

34. Page 98, Question 13e.
```
Lambda.hat <- mean(Leaf.obs) mean(rep(Mites.per.leaf,  Leaf.obs))
```

35. Page 98, Question 13f.

    …(negative binomial of or Poisson)…

36. Page 99, Question 21.

    …demonstrate, using *asbio* GUI functions, that…

Chapter 4

1. Page 108, § 4.3.4, 2nd sentence. *Interval estimators*, described in Ch. 65, estimate the bounds of an interval that is expected, preceding sampling, to contain a parameter for a specified proportion of estimates.

2. Page 110, last sentence preceding Example 4.6.
   …large degree of variability among growth rates observations.

3. Page 111 § 4.3.5.3, 2nd paragraph, 1st sentence.
   …where d is the distance and t is the time.

4. Page 114. The paragraph starting: "The mean and the median can be…" and ending: "…in the direction of the outliers." is mistakenly formatted to be a part of Example 4.8.

5. Page 115, R code at bottom of page.
   ```
   x <- c(0.001, 0.002, 1, 2, 2.2, 4, 5, 6, 15, 17)
   ```

6. Page 118, R code in Example 4.10.
   Replace the R output:
   ```
   [1] 986.075 1222.038 1213.260 1213.260 1213.260 1213.260 1213.260
   1213.260
   [9] 1213.260 1213.260 1213.260
   ```

   With:
   ```
   [1] 986.075 1222.038 1213.260 1213.260 1213.260 1213.260 1213.260
   [8] 1213.260 1213.260 1213.260 1213.260
   ```

7. Page 119, § 4.3.7, 3rd sentence. As with the measures of location, there are…

8. Page 123, § 4.3.8.1, 1st sentence. …obtains the value that a continuous random variable will…

9. Page 123, last sentence preceding § 4.3.8.2, remove parentheses and place a "times" sign as shown.
   Analysts often consider observations greater than $1.5 \times (IQR)$ from the median to be outliers.

10. Page 126. For clarity, the description to Eq. 4.29, and the equation itself should concern the *j*th (not the *i*th) moment. That is, these items should read:

The *jth central sample moment* is given by:

$$m_j = \frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^j$$

11. Page 127, § 4.4, 1st sentence.
…are ~~the~~ MOM (described in Section 4.3.9.2), *ordinary least squares* (*OLS*) and *maximum likelihood* (*ML*).

12. Page 133, R code at top of page. In typesetting the "equals" signs and "less than" signs in the code at the top of the page have been deleted. The code should read:

```
trag.sub <- sample(trag, 10, replace = F); p <- seq(35, 80, .1)
anm.loglik(trag, parameter = "mu", dist = "norm", poss = p,
ylim = c(-300, -60), xlim = c(0, 100))
anm.loglik(trag.sub, parameter = "mu", dist = "norm", poss = p,
ylim = c(-300, -60), xlim = c(0, 100))
```

13. Page 135, 1st sentence after Eq. 4.42.
Furthermore, multiplication ~~of~~ by a constant results in a new mean…

14. Page 137, Table 4.2, Median row, 2nd column.
Replace " $\tilde{x}$ " with "*Median*(*x*)"

15. Page 139. Equation for likelihood in the middle of page.
The equation currently reads:
$$f(\text{data}\,|\,\theta) = \mathcal{L}(\theta\,|\,\text{data}) \propto \theta^n(1-\theta)^{n-x}$$
It should be changed to read:
$$f(\text{data}\,|\,\theta) = \mathcal{L}(\theta\,|\,\text{data}) \propto \theta^x(1-\theta)^{n-x}$$

16. Page 140.
The worked example in the bottom third of the page currently reads:
$$f(\theta\,|\,\text{data}) \propto \theta^x(1-\theta)^{n-x}\frac{\Gamma(2)}{\Gamma(1)\Gamma(1)}\theta^1(1-\theta)^1$$
$$\propto \theta^x(1-\theta)^{n-x}\theta^1(1-\theta)^1$$
$$\propto \theta^{x+1}(1-\theta)^{n-x+1}.$$
It should be changed to read:
$$f(\theta\,|\,\text{data}) = \theta^x(1-\theta)^{n-x}\frac{\Gamma(2)}{\Gamma(1)\Gamma(1)}\theta^0(1-\theta)^0$$
$$\propto \theta^x(1-\theta)^{n-x}\theta^0(1-\theta)^0$$
$$\propto \theta^x(1-\theta)^{n-x}.$$

17. Page 140, penultimate sentence preceding Table 4.3.
    We know that the beta prior is conjugate to the binomial likelihood function, and will result in a beta posterior distribution (Ex. 4.17 4.18).

18. Page 143, Question 1. Italicize the indicated words.
    Distinguish the words *parameter*, *estimator*, and *estimate*.

19. Pg. 144. Q. 8. In the table, X should be replaced with x.

20. Page 144, Question 9.
    For the sample, $x = \{2, 3, 1, 5, 4, 5.5, 90, 0.001, 95, 4, 5, 10\}$ calculate the arithmetic mean, mode, trimmed mean ($\alpha\kappa = 0.2$), and Winsorized mean ($\lambda\kappa = 0.2$).

21. Page 145, Question 21b.
    Let $X \sim \text{BIN}(\pi p, n_X)$, $Y \sim \text{BIN}(\pi p, n_Y)$.

22. Page 145, Question 24a, 1st sentence.
    (a) Assume these data are from a normal distribution normally distributed and use the function `anm.loglik.tck` to plot the log-likelihood function for μ.

23. Page 146, Question 26.
    …given the fact that the OLS estimator...

24. Page 146, Question 27a, 1st sentence.
    Assume the data are from a Poisson distribution distributed and use the function `anm.loglik.tck` to plot the log-likelihood function for λ.

25. Pg. 146. Q. 30. To the end of the paragraph describing the problem, the following statement should be added: "Assume J and B are independent."

26. Page 147, Question 32 add words as shown.
    Assume $\theta \sim BETA(\alpha, \beta)$, and $data \mid \theta \sim BETA(\gamma + 1, \eta + 1)$ .for some arbitrary α, β, γ, η.

27. Page 147, Question 32b.
    Plot the three distributions $f(\theta)$, $f(\text{data} \mid \theta)$, and $f(\theta \mid \text{data})$ on a single graph. Use the entire space for which the distributions are defined, [0,1], as the abscissa. When plotting, divide the outcomes from functions by their respective sums to facilitate comparisons. Comment on the results.

Chapter 5

1. Page 149, sentence preceding Example 5.1.
   This chapter concerns interval estimation, and resampling, and simulation methods that allow interval estimation.

2. Page 161, last sentence on page.
   …depending on whether or not the variance of the parent population is known or unknown.

3. Page 162, 3rd sentence following Eq. 5.13. We have $1 - (\alpha/2) = 1 - $ ~~0.975~~0.025 $= $ ~~0.025~~ 0.975

4. Page 162, 4th sentence following Eq. 5.13. …will be above the ~~z~~ $z_{1-(\alpha/2)}$ quantile…

5. Page 164, code at top of page. In typesetting the equals signs have been deleted. The code should read:

   ```
   shade.norm(from = 12.64, to = 16.56, mu = 14.6, tail = "middle")
   ```

6. Page 166, Example 5.8, 1st sentence. …in the *asbio* dataframe `agrostis`.

7. Page 167, Example 5.8, shift the R output from `ci.mu.z` to the right so that column names line up with column information.

   That is, replace:
   ```
   ci.mu.z(agrostis, conf = .95,sigma = 4)
   95% z Confidence interval for population mean
   Estimate     2.5%     97.5%
   14.60    13.03    16.17
   ```

   with:
   ```
   ci.mu.z(agrostis, conf = .95,sigma = 4)
   95% z Confidence interval for population mean
   Estimate     2.5%     97.5%
      14.60    13.03    16.17
   ```

8. Page 167, Example 5.8, shift the R output from `ci.mu.t` to the right so that column names line up with column information.

   That is, replace:
   ```
   ci.mu.t(agrostis, conf = .95)
   95% t Confidence interval for population mean
   Estimate     2.5%     97.5%
   14.60     9.54     19.66
   ```

   With:
   ```
   ci.mu.t(agrostis, conf = .95)
   95% t Confidence interval for population mean
   Estimate     2.5%     97.5%
      14.60     9.54     19.66
   ```

9. Page 167, Example 5.9, 1st paragraph, penultimate sentence.
   …engineers (organisms ~~which~~ that causes physical, chemical, or structural…

10. Page 167, Example 5.9, 1st paragraph, last sentence.
    …Rendezvous Peak in Grand Teton National Park…

11. Page 167-168, Equations 5.16, 5.17. For consistency with the rest of the book, s and $\bar{x}$ should be capitalized in Eqs. 5.16 and 5.17.

12. Page 168, top of page. In typesetting the equals signs in the code have been deleted. The code should read:

```
bplot(y = pika[,2], x = rep(1, 21), int = "CI", conf = .95,
names.arg = "", xlab = "", ylab = "On haypile %N - Off haypile
%N", names = "")
```

13. Page 170, code following Equation 5.22.   `1-(2*(pbinom(qbinom(.025,25,.5)-1, 25, 0.5))`

14. Page 171, 1st paragraph, 3rd sentence. …64% ~~smaller than~~ as large as…

15. Page 171, sentence following 1st block of R code.

    …~~medians~~ means is approximately 64% ~~more~~ as variable ~~than~~ as the distribution of ~~means~~ medians.

16. Page 173, 2nd sentence on page. …to be resampled ~~then~~ than others.

17. Page 173, Equation 5.29. Replace $\widehat{bias}_\theta$ with $\widehat{bias}_{\theta_B}$ to allow correspondence between Eqs. 5.28 and 5.29.

18. Page 174, Example 5.13, sentence near end of example. Each of the ~~the~~ outcomes…

19. Page 176, second sentence on page. This, of course, requires the estimation of $\hat{\sigma}^*_{B_j}$ for each ordered $\hat{\theta}^*_j$.

20. Page 179, sentence preceding § 5.4.2.
    …user specification of bootstrap variances (see Section 5.4.1.2.3)

21. Page 180, penultimate sentence preceding Equation 5.36.
    …will cause $\hat{\sigma}_{\theta_J}$ $\sigma_{\hat{\theta}_J}$ to be underestimated.

22. Page 188, sentence preceding §5.5.2.1.1.1.

    …expected probabilities for $P(X_{10} \mid X_0 = 1)$ = {0.185, 0.352, 0.315, 0.148}.

23. Page 189, last sentence on page.
    …a common jumping distribution is ~~where~~ $N(\theta^{t-1}, \sigma_1^2)$, where σ_1^2 …

24. Pg. 193. Q. 1. To the end of the paragraph describing the problem, the following statement should be added: "Assume J and B are independent."

25. Page 193, Question 1b.

If we record the 1600m times from 42 of Jimmy Joe's races ~~what is the distribution and~~ what is the distribution of $\overline{X}_J$?

26. Page 194, Question 7.
    …that $Z \sim$ ~~$N(1, 0)$~~$N(0, 1)$

27. Pg. 193. Q. 7. To the end of the sentence describing the problem, the following statement should be added: "Assume random variables are independent and that H_0 is true for (d) and (e).".".

28. Page 194, Question 8.
    …that $Z \sim$ ~~$N(1, 0)$~~$N(0, 1)$

29. Page 195, Question 10. In part d replace the text "Question 10" with "Question 9".

30. Page 195, Question 14.
    Redo Example ~~5.9~~ 5.11 by hand…

Chapter 6

1. Page 199, 3rd from final sentence preceding Example 6.2.
   This somewhat complex definition can be summarized succinctly as: ~~$P(H_0|data)$~~ $P(data|H_0)$ if we remember…

2. Page 205, Figure 6.3. In Figure 6.3 the number "-1.6" occurs three times. It should be replaced in each instance with "-1.2".

3. Page 206, 3rd item in bulleted list.
   Observations are independent. That is, <u>they are</u> based on random samples from the population.

4. Page 207, Equation following the Step 4 description, insert absolute value vertical lines on either side of z^*.
   $2[P(Z \geq |z^*|)] = 2[P(Z \geq 2.305)] = 2[P(Z \leq -2.305)] = 0.02117\underline{.}$

5. Page 209, Example 6.5, penultimate sentence, replace –3.18 with -2.304.
   …and test statistic simultaneously as $t_{84} = $ ~~-3.18~~-2.304…

6. Page 210, 1st chunk of R code. Shift the R output from `ci.mu.t` so that column names line up with column information.

   That is, replace:

   ```
   ci.mu.t(n = 85, xbar = 128, s = 12, summarized = TRUE)
   95% t Confidence interval for population mean
   Estimate 2.5% 97.5%
   128.0000 125.4117 130.5883
   ```

   With

   ```
   ci.mu.t(n = 85, xbar = 128, s = 12, summarized = TRUE)
   ```

```
95% t Confidence interval for population mean
Estimate      2.5%      97.5%
128.0000 125.4117 130.5883
```

7. Page 216. Errors occur in the worked example for *MSE* and *t**.

The example *currently* reads:

$$\sqrt{MSE} = \sqrt{\frac{12(0.00034) + 24(0.00027)}{34}} = 0.01757838$$

$$t^* = \frac{(0.114 - 0.099) - 0}{0.0176\sqrt{3/24}} = 2.4607$$

The example *should* read:

$$\sqrt{MSE} = \sqrt{\frac{11(0.00034) + 23(0.00027)}{34}} = 0.01706 \,.$$

$$t^* = \frac{(0.114 - 0.099) - 0}{0.0171\sqrt{3/34}} = 2.4607$$

8. Page 216, text preceding final chunk of R code.
   …estimated effect size = ~~7×10^{-5}~~ $\overline{x}_{BH} - \overline{x}_{ER} = 0.015$,…

9. Page 219, last chunk of R code preceding § 6.3. Remove `data = magnets` argument.

```
t.test(Score_1 - Score_2 ~ Active, alternative = "greater", mu = 0,
paired = FALSE, data = magnets)
```

10. Page 219, penultimate sentence preceding § 6.3.
    …will consider the magnet group to be…

11. Page 221, penultimate sentence preceding Example 6.10. …effect size being used, ~~and~~ the type of statistical analysis one…

12. Page 221, 3rd paragraph, 2nd sentence. We are interested in the lower-tailed alternative hypothesis that smoking…

13. Page 222, 1st sentence on page. …and power ~~error~~ can be…

14. Page 223.   She wants to use $\alpha = 0.05$ and $\beta = $ 1 - 0.8.
15. Page 223.
    Replace:
$$n = \frac{(1.645 - 0.842)^2 100}{(-5 - 0)^2} = 24.7$$
    With:

$$n = \frac{(1.645+0.842)^2 100}{(-5-0)^2} = 24.7$$

16. Page 234. In a lower tailed test, the test statistic W^* will <u>also</u> be ~~W_2~~<u>W_1</u>.

17. Page 243, Question 9. By typing `book.`~~`mneu`~~<u>`menu`</u>`()`

18. Page 225, last non-footnote paragraph on page, penultimate sentence.
    …can be specified as ~~$\mathcal{L}(\text{data} \mid \theta)$~~ $\mathcal{L}(\theta \mid \text{data})$

19. Page 229, last bit of R code preceding § 6.2.2. Replace 10000 with 100001.

    ```
    (length(perm[perm>=0.2395476])+1)/1000010001
    [1] 3e-04
    ```

20. Page 233, sentence approximately in the middle of page.
    …test (the kind we are interested in), <u>the</u> test statistic, V^*, will…

21. Page 236, sentences near top of page. Insert spaces that typesetting removed, and make other indicated changes.

    We can get the lower tailed P-value directly by finding $P(W \geq 66)$, where $W \sim WRankSum(10, 10)$. ~~-~~The function `pwilcox` provides the Wilcoxon rank sum distribution cdf.
    ```
    pwilcox(6665, 10, 10, lower.tail = FALSE)
    #Subtract 1 from W* in upper-tailed test since H0 dist. is discrete
    [1] 0.1087813 0.1237253
    ```

22. Page 236, sentence preceding penultimate R chunk.

    The ~~lower~~ <u>upper</u> tailed P-value associated with this hypothesis is

23. Page 236, Sentence preceding final R chunk. Extra horizontal space has been inserted between the words "function" and "`wilcox.test`".

    The phrase currently reads:

    …we can use the function

    `wilcox.test`.

    It should read:

    …we can use the function `wilcox.test`.

24. Page 236, last R chunk. Remove the "data = myeloma" argument.

```
wilcox.test(mglobulin ~ drug, alternative = "greater", data = myeloma, correct
= FALSE)
```

25. Page 237, § 6.6.3, 1st paragraph, last sentence.

    …if underlying populations were <u>not</u> normal, and recommended a test utilizing *M*-estimators for skewed heteroscedastic distributions.

26. Page 237. Example 6.18. The R code in the example contains formatted quotes.

    The code:
    ```
    ci.boot.M(mglobulin[drug=="Control"],mglobulin[drug=="Trt"])
    ```

    Should read:
    ```
    ci.boot.M(mglobulin[drug=="Control"],mglobulin[drug=="Trt"])
    ```

27. Page 241. Question 1
    a. Null hypothesis
    b. Alternative hypothesis
    c. Test statistic
    d. <u>*P*-value</u>
    ~~d~~e. Significance level
    ~~e~~f. Critical value
    ~~f~~g. Decision rule
    ~~g~~h. Type I error
    ~~h~~i. Type II error
    ~~i~~j. Power

28. Page 241, Question 4b should read:
    b. Conduct a null hypothesis test following the steps described for the hybrid <u>method</u> and verify your result using the function `one.sample.z`. State your conclusions correctly.

29. Page 242, Question 5b should read:
    b. Use **R** to calculate ~~population~~ <u>sample</u> means and variances.

30. Page 242, Question 6b should read:
    Use **R** to calculate ~~population~~ sample means and sample variances.

31. Page 243, Question 11a:
    …~~click~~ <u>turn off the</u> ~~on~~ *Variance equal* widget.

32. Page 243, Question 14b
    …A is ~~greater than~~ <u>shifted above</u> B…

33. Page 244, Question 23
    …with three samples ~~with~~ <u>from</u> X_1 and…

Chapter 7

1. Page 250, § 7.2.1.3, 3rd sentence. … will always be *natural integers*; that is…

2. Page 253, Example 7.3, 2nd paragraph, 1st sentence. …prescription ~~of~~ antidepressants…

3. Page 255, 1st paragraph, last sentence. …that ~~are~~ is poorly representative.

4. Page 256, § 7.5, 3rd paragraph. …instead, he or she randomly selects experimental units…

5. Page 258. Equation 7.2. Equation should have n/N, not N/n.
   Thus, replace.

   $$\bar{X} \pm t_{(1-\alpha/2,n-1)}\sqrt{1-\frac{N}{n}} \cdot \frac{S}{\sqrt{n}}$$

   With

   $$\bar{X} \pm t_{(1-\alpha/2,n-1)}\sqrt{1-\frac{n}{N}} \cdot \frac{S}{\sqrt{n}}$$

6. Page 259. Figure 7.4 caption.
   Two distributions for growth…

7. Page 261. Curly brackets around confidence interval bounds should be replaced with parentheses to indicate that the interval includes the bounds. That is,
   Replace:
   {61.59, 94.34}
   With
   (61.59, 94.34)
   And Replace:
   {43050, 65943}
   With:
   (43050, 65943)

8. Page 267, Footnote. …data will still have the same "problems" ~~it~~ they had in the first place…

9. Page 275, § 7.6.4.1, 2nd paragraph, last sentence.
   …we would expect a tree to grow, on average, 2.1m for each 1% increase of N in soils.

10. Page 275, § 7.6.4.1, last sentence.
    …nonrandom assignment of treatments given ~~the~~ categorical explanatory variables.

11. Page 277, last item in the 1st bulleted list.
    - Other ~~P~~particular variants on a predictor, for example, "high", "medium", and "low"

12. Page 278, § 7.6.5.3.1, 2nd sentence.
    In a *completely randomized design* (*CRD*) experimental units are randomly assigned to factor levels ~~design~~ without constraints like blocking (Fig. 7.9a).

13. Page 279, Figure 7.9 caption, last sentence.
Here, EUs are randomly assigned to either ~~A~~ A_1 or ~~B~~ A_2, and then are assigned to the treatment they did not initially receive.

14. Page 280, …~~block~~randomize what you can ~~randomize~~block-what you cannot

15. Page 282, 5th sentence from top of page.
…most importantly, in a randomized block design~~,~~ we assume…

16. Page 283, § 7.6.5.3.5, 2nd paragraph, 2nd sentence.
…that mean the exact~~ly~~ same thing in other whole plots.

17. Page 285, 3rd paragraph, 4th sentence, insert "s" and a comma.
…on human subject<u>s,</u> variability in…

18. Page 286, § 7.6.6, 3rd item in bulleted list. …distance released from home burrow X = {~~10 m~~ <u>near</u>, ~~100 m~~ <u>far</u>}…

19. Page 288, last words preceding Exercises. …test hypotheses of independence ~~and~~ <u>or</u> causality…

20. Page 291. Question 16. …two teaching approaches ~~with respect to~~ <u>using</u> test scores.
21. Page 291. Question 12. A sample represents a 5 km^2 <u>area</u>.
22. Page 291. Question 12b and 12c. Change the order of these questions.
23. Page 291. Question 12d. Replace the symbol $S_{\bar{Y}_{str}}$ with $\hat{\sigma}_{\bar{Y}_{str}}$
24. Page 291. Question 12e. Replace the symbol $S_{\hat{T}}$ with $\hat{\sigma}_{\hat{T}}$

Chapter 8

1. Page 299, Equation 8.4. Sigma symbols should be bolded. That is, replace the two occurrences in the equation of σ with **σ**.

2. Page 299, § 8.2.2, 4th paragraph, 2nd sentence.
Figure 8.3 shows the ~~standard~~ *bivariate standard normal distribution*.

3. Page 300, very top of page. Equal signs in R code for Fig 8.3 have been deleted. Code should read:

```
bvn.plot(mu = c(0, 0), vr = c(1, 1), cv = 0, res = 0.1)
```

4. Page 302. Sentence preceding Eq. 8.7.
The ~~least squares~~ estimator for the standard deviation of the sampling distribution of *r* is:

5. Page 303. Figure 8.6 caption. …if ρ is close to 0 ~~or 1~~.

6. Page 305, very top of page. Equal signs in code for Fig 8.7 have been deleted. Code should read:

```
plot(crab.weight, xlab = "Gill weight (mg)", ylab = "Body weight (g)")
```

7. Page 305, R code chunk under Fig. 8.7.
   ```
   var(crab.weight)
   ```

8. Page 310. Equal signs in code for Fig 8.8 have been deleted. Code should read:

   ```
   plot(bats, xlab = "Age (days)", ylab = "Forearm length (mm)")
   ```

9. Page 311, 1st chunk of R code.

   ```
   cor(bats$forearm.length, bats$days, method="spearman")

   0.9660772
   ```

10. Page 311, Equation in middle of page. Replace > signs with $\geq$, and replace 4.192384e-09 with 4.2×10^{-9}. That is, replace:

$$2 \times P\left(Z > \left|r_S \sqrt{n-1}\right|\right) = 2 \times P(Z > 0.9660772\sqrt{37}) = 2 \times P(Z > 5.876418) = 4.192384\text{e-}09$$

With:

$$2 \times P\left(Z \geq \left|r_S \sqrt{n-1}\right|\right) = 2 \times P(Z \geq 0.9660772\sqrt{37}) = 2 \times P(Z \geq 5.876418) = 4.2 \times 10^{-9}$$

11. Page 312, § 8.3.1.2, 3rd paragraph. …possible combinations of (Y_{1i}, Y_{1j}) and (Y_{2i}, Y_{2j}), where…

12. Page 314, R code chunk beginning `sum.T.Y.2…` .

   ```
   sum.T.Y.2 <- print((2^3 - 2)/12 + (2^3 - 2)/12 + (2^3 - 2)/12 + (2^3 -
   2)/12)
   [1] 2
   ```

13. Page 314, text under equation in center of page. The coefficient indicates a strong positive...

14. Page 314, equation near bottom of page. Replace > signs with $\geq$.
    That is, replace:

$$2 \times P\left(Z > \left|\frac{K}{\sqrt{Var_K}}\right|\right) = 2 \times P\left(Z > \left|\frac{610 - 29}{\sqrt{6193.341}}\right|\right) = 2 \times P(Z > 7.382673) = 1.552 \times 10^{-13}$$

With:

$$2 \times P\left(Z \geq \left|\frac{K}{\sqrt{Var_K}}\right|\right) = 2 \times P\left(Z \geq \left|\frac{610 - 29}{\sqrt{6193.341}}\right|\right) = 2 \times P(Z \geq 7.382673) = 1.552 \times 10^{-13}$$

15. Page 316, text preceding Example 8.9. The sample biweight ~~midvariance~~ midcorrelation (along with the...

16. Page 316, last sentence on page. The sample bivariate ~~midvariance~~ midcorrelation has a high breakdown...

17. Page 318, last sentence preceding § 8.5. ...for the true correlation will ~~also be suspected~~ be suspect.

18. Page 319. Question 3a.
    …calculate the two-tailed ~~p~~P-values "by hand"…

Chapter 9

1. Page 325. Penultimate sentence preceding Eq. 9.11.
   The ith fitted value, $\hat{Y}_i$, represents an estimate for the true mean ~~for~~ of Y given X_i.

2. Page 328. Typesetting removed equal signs in the code for Fig. 9.3. It should read:

   ```
   plot(vol, freq, xlab = expression(paste("Estimated gular pouch
   size ( ",cm^3,")")),ylab = "Fundamental frequency (Hz)")
   abline(beta.hat0, beta.hat1)
   ```

3. Page 330. penultimate sentence on page. We have very little ~~no~~ evidence..,

4. Page 331. sentence preceding Eq. 9.19. …squared deviations between each ~~predicted~~ fitted Y value and…

5. Page 333. Example 9.5. The pressure reading in example should be -1.5 MPa, not 1.5 MPa.
   Thus, the fragment of concern should read:
   …the permanent wilt point of plants ($\psi_{soil} = $ -1.5 MPa) and the length of the…

6. Page 333. sentence following Eq. 7.13. …In regression, $\mathbf{Y}$ is a ~~(~~$n \times 1$~~;~~ (i.e., n row and…

7. Page 335. Eq. 9.27 currently reads:
   $$MSR = \hat{\boldsymbol{\beta}}'\mathbf{X}'\mathbf{Y} - \left(\frac{1}{n}\right)\mathbf{Y}'\mathbf{Y}/(p-1)$$
   It should be corrected to read:
   $$MSR = \hat{\boldsymbol{\beta}}'\mathbf{X}'\mathbf{Y} - \left(\frac{1}{n}\right)\mathbf{Y}'\mathbf{1Y}/(p-1)$$

8. Page 335. Eq. 9.28 currently reads:
   $$MSE = \mathbf{Y}'\mathbf{Y} - \boldsymbol{\beta}'\mathbf{X}'\mathbf{Y}/(n-p)$$
   It should be corrected to read:
   $$MSE = \mathbf{Y}'\mathbf{Y} - \hat{\boldsymbol{\beta}}'\mathbf{X}'\mathbf{Y}/(n-p)$$

9. Page 335. Eq. 9.29 currently reads:

$$\hat{\sigma}_{\hat{b}}^2 = MSE(\mathbf{X'X})^{-1}$$

It should be corrected to read:

$$\hat{\sigma}_{\hat{\beta}}^2 = MSE(\mathbf{X'X})^{-1}$$

10. Page 340. Penultimate R code chunk, insert right parenthesis at end of code.

```
anova(lm(Y ~ X2 + X1 + X4 + X5 + X3, data = wash.rich))
```

11. Page 342. First two lines at the top of page. The number the "577.1022" is currently spread across two lines. Can it be placed on a single line?

12. Page 342. Middle of third paragraph. The number the "577.1022" is currently spread across two lines. Can it be placed on a single line?

13. Page 344, § 9.7.2, 4th sentence.
The second approach provides an interval estimate for a future value of Y given a particular value, X_hs.

14. Page 346. Typesetting removed equal signs in the code for Fig. 9.6. Change as indicated.

```
with(Fbird, plotCI.reg(vol, freq, xlab = expression(paste("Gular
pouch size ( ",cm^3,")")),ylab = "Fundamental frequency (Hz)"))
```

15. Page 346. Eq. 9.39. Replace TSS with SSTO in denominators of ratios. That is, replace:

$$R^2 = 1 - \frac{SSE}{TSS} = \frac{SSR}{TSS}$$

With

$$R^2 = 1 - \frac{SSE}{SSTO} = \frac{SSR}{SSTO}$$

16. Page 347. Eq. 9.40 is incorrect.
Replace:

$$R_{adj}^2 = 1 - \frac{SSE}{SSTO} \times \frac{n-1}{n-p}$$

With

$$R_{adj}^2 = 1 - \left(\left(1 - \frac{SSR}{SSTO} \right) \left(\frac{n-1}{n-p} \right) \right)$$
$$= 1 - \left(\left(1 - R^2 \right) \left(\frac{n-1}{n-p} \right) \right)$$

17. Page 348. § 9.9, last sentence.
From the output above it appears that a sample size of approximately 19 $-\pm 2 =$ ~~17~~21 is required.

18. Page 350, third paragraph, 2nd sentence.
…that it may ~~appear~~ suggest that there are problems with independence or nonconstant variance.

19. Page 350, penultimate paragraph preceding § 9.10.1, penultimate sentence.
...and corrective procedures that will be required.

20. Page 351. Typesetting removed equals signs in the code for Fig. 9.8. Code should read:

```
par(mfrow = c(2, 2), mar = c(4, 4, 2, 1.5))
plot(Fbird.lm)
```

21. Page 352. Last R chunk on page on page. Insert a line of input code (as shown below) and change output slightly.

```
shapiro.test(resid(Fbird.lm))

                Shapiro-Wilk normality test

data:  resid(Fbird.lm)
W = 0.9746, p-value = 0.8785
```

22. Page 352. 3rd from last sentence on page. "As ~~in~~ indicated...."

23. Page 354. 4th sentence.
Non-linearity in simple linear and multiple regression can be addressed ~~for~~ with...

24. Page 357. Typesetting removed equal signs and plusses in the code for Fig. 9.9. Change as shown:

```
lm1245 <-lm(Y ~ X1 + X2 + X4 + X5, data = wash.rich)
par(mfrow = c(2, 2), mar = c(4, 4.5, 2, 1))
partial.resid.plot(lm1245)
```

25. Page 362, 3rd paragraph, 2nd sentence. ~~Without back-transformation, t~~The slope estimate for this…

26. Page 363. 1st paragraph, 1st sentence.
The 95% confidence interval for λ ~~contains~~ includes both -1 and 0.

27. Page 364. Eq. 9.57 currently reads:

$$w_i = \frac{1}{s_i^2}$$

s_i^2 should be capitalized so that the equation reads:

$$w_i = \frac{1}{S_i^2}$$

28. Page 364. Eq. 9.58 currently reads:

$$Q = \sum_{i=1}^{n} w_i (y_i - (\hat{\beta}_0 + \hat{\beta}_1 x_{1i} + \hat{\beta}_2 x_{2i} + ... + \hat{\beta}_{p-1} x_{p-1i}))^2 = \sum_{i=1}^{n} w_i (y_i - \hat{y}_i)^2$$

xs and ys should be capitalized so that the equation reads:

$$Q = \sum_{i=1}^{n} w_i (y_i - (\hat{\beta}_0 + \hat{\beta}_1 X_{1i} + \hat{\beta}_2 X_{2i} + ... + \hat{\beta}_{p-1} X_{p-1i}))^2 = \sum_{i=1}^{n} w_i (Y_i - \hat{Y}_i)^2$$

29. Page 366. Eq. 9.62 currently reads:

$$x_i = X_i - \bar{X}$$

It should be corrected to read:

$$X_i' = X_i - \bar{X}$$

30. Page 368, 2nd paragraph, 1st sentence. A test ~~testing~~ for the equality of regression slopes…

31. Page 369. R code in Example 9.21. The function `Anova` from library *car* (not `anova`) is required here. Thus, the code in the example should read:

```
library(car)
aAnova(lm(log(ant.mass) ~ log(head.width) + direction +
log(head.width):direction, data = ant.dew))# type II SS
```

32. Page 379, 2nd sentence following Eq. 9.75. *M* estimator functions down-weight but ~~does~~ do not completely eliminate outliers.

33. Page 380, sentence following 1st R code chunk.
Here ~~are the coefficients from~~ is the OLS regression model.

34. Page 387, 3rd item in bulleted list, last sentence. Replace upper case "G" with lower case "g".
…can be specified using ~~G~~gaussian(link = "identity")

35. Page 387. Last two equations on page. Replace occurrences of X_1 with X_i
That is, replace:

$$Y_i = \beta_0 + \beta_1 X_1 + \varepsilon_i,$$
$$E(Y_i) = \beta_0 + \beta_1 X_1.$$

With:

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i,$$
$$E(Y_i) = \beta_0 + \beta_1 X_i.$$

36. Page 389. Eq. 9.86. Use of λ is for log-likelihood confusing. Replace occurrences of λ with ℓ.

37. Page 392, paragraph preceding 9.20.5.3.
     The *sensitivity* (i.e., true positive rate) is the number of true positives ~~multiplied~~ divided by the number of observed positives and false negatives: $14/15 = 0.93$. The *specificity* (i.e., *true negative rate*) is the number of true negatives divided by the number of observed negatives and false positives: $6/9 = 0.67$ (also see Example 2.11).

38. Page 397, penultimate sentence preceding § 9.20.7.2.
     …as a function of the linear predicted values, and re-emphasi~~i~~zes the presence of the three outliers.

39. Page 398. Typesetting removed equal signs in the code for Fig. 9.23. Change as indicated:

     ```
     par(mfrow = c(2, 2), mar = c(4, 4, 2, 1.5))
     plot(beetle.glm)
     ```

40. Page 399, 3rd sentence before Eq. 9.99. …(it is the mean times one minus the ~~mean~~ probability of success).

41. Page 400, § 9.20.7.4, 2nd sentence. …certain X~~,~~ threshold,…

42. Page 400, sentence preceding Eq. 9.101. Parameter~~s~~ estimates are obtained using…

43. Page 403. 1st sentence of section 9.22. We calculate estimates of parameters for a …

44. Page 406. Typesetter error. The conventional equation describing predicted values from the linear model should be bolded to indicate matrices. That is, the sentence at the end of the 2nd paragraph on this page should read:
     Given outcomes from Equations 9.109 and 9.110, fitted values can be obtained using $\hat{\mathbf{Y}} = \mathbf{X}\hat{\boldsymbol{\beta}}$.

45. Page 409, sentence preceding § 9.22.4.1.
     …will not be obtained as the result of spline, and mixed ~~parametric~~ non-spline/spline fitting.

46. Page 409, last sentence on page.
     …eliminates the need for subjective assignment of knot location and…

47. Page 410, § 9.22 2nd paragraph, 1st sentence. …assess the legitimacy of binomial and Poisson errors, which have dispersion…

48. Page 412, Figure 9.26. A couple of typesetter errors here. First, the code for the figure is given twice on this page. The 2nd iteration (just above the figure) is actually incorrect and should be removed as it leaves out equal signs in the arguments. Second, important commas have been left off the X and Y axes in the figure. The X and Y axes should read: $\beta_0 \mid Y, \sigma^2$ and $\beta_1 \mid Y, \sigma^2$, respectively.

49. Page 416, Question 9d currently reads:

Calculate $SSR = \hat{\boldsymbol{\beta}}\mathbf{X'Y} - \left(\dfrac{1}{n}\right)\mathbf{Y'1Y}$.

The $\hat{\boldsymbol{\beta}}$ term needs to be transposed (i.e., given a " $'$ "), and *MSR* should be calculated instead *SSR*. Thus, the question should be changed to read:

Calculate $MSR = \hat{\boldsymbol{\beta}}'\mathbf{X'Y} - \left(\dfrac{1}{n}\right)\mathbf{Y'1Y}/(p-1)$.

50. Page 416, Question 9e currently reads:

Calculate $SSE = \mathbf{Y'Y} - \boldsymbol{\beta}'\mathbf{X'Y}$.

The $\boldsymbol{\beta}$ term needs to be given a hat, and *MSE* should be calculated instead *SSE*. Thus, the question should be changed to read:

Calculate $MSE = \mathbf{Y'Y} - \hat{\boldsymbol{\beta}}'\mathbf{X'Y}/(n-p)$.

51. Page 416, Question 9g currently reads:

Calculate $\mathbf{e} = \mathbf{Y} - \hat{\mathbf{Y}}$

It should be changed to read:

52. Page 417, Question 9p, remove word "optimal".
Perform diagnostics on the ~~optimal~~ model using…

53. Page 417, Question 9q, remove word "optimal".
Create partial residual plots of the ~~optimal~~ model…

54. Page 417, Question 9s, remove word "optimal".
Calculate *VIF*s for the ~~optimal~~ model…

53. Page 417. Question 10.
~~b~~c. Adjust the slider widgets, or simply click *Refresh* repeatedly (> 30 times). Are *MSE* and *MSR* consistently ~~greatly~~ greater than or less than *E*(*MSE*) and *E*(*MSR*). Why?

Chapter 10

1. Page 422, first bullet item near bottom of page. Factor~~s~~ ~~levels~~ will be indicated….

2. Page 431, Example 10.3 text following the equation.
Note that this is identical to the third default contrast from `lm.baby` in Example 10.2 obtained by typing `summary(lm.baby)` ~~summary(baby.lm)~~.

3. Page 434, 3rd sentence on page. …first two alphanumeric factor~~s~~ levels.

4. Page 435, § 10.3.3.3, 3rd sentence …because the last factor level is not included…

5. Page 436, § 10.3.5, 3rd sentence. ~~Four~~ Five important methods are briefly described here.

6. Page 436, § 10.3.5, 2nd paragraph, last sentence.
   That is, if H_0: $D = 0$ is rejected at α, then the $(1 - \alpha)100\%$ confidence interval for D will not contain 0.

7. Page 437, in last sentence on page insert a period.
   …will also reject H_0 at α (Milliken and Johnson 2009). This is…

8. Page 438, sentence following Eq. 10.17.
   …is the F-quantile function with $a - 1$ numerator degrees of freedom, and $n - a$ denominator degrees of freedom, evaluated at the probability $1 - \alpha$.

9. Page 438, last equation on page. Replace semicolons with commas. That is,
   Replace:
   $$T = \frac{1}{\sqrt{2}} q_{(1-\alpha;a;n-a)}$$
   With:
   $$T = \frac{1}{\sqrt{2}} q_{(1-\alpha,a,n-a)}$$

10. Page 441, § 10.3.6, sentence following numbered list.
    Holm's procedure is more powerful than a strict Bonferroni correction because ~~smaller~~ larger significance levels are used for all but the first comparison.

11. Page 442. § 10.3.7, 3rd sentence.
    We note that the interval for the single significant comparison, AE versus C, does not contain zero.

12. Page 447. Eq. 10.30. Replace $\hat{\sigma}_A$ with $\hat{\sigma}_A^2$.
    That is, replace:
    $$\hat{\sigma}_A = \frac{MS_A - MSE}{n_0}$$
    With:
    $$\hat{\sigma}_A^2 = \frac{MS_A - MSE}{n_0}$$

13. Page 447. § 10.5.1, last paragraph, penultimate sentence.
    First, MSE can potentially be ~~less~~ greater than MS_A, making $\hat{\sigma}_A^2$ negative.

14. Page 450, § 10.5.3, 3rd item in bulleted list, penultimate sentence.
    …there must be ~~a~~ replication ~~available~~ for the nested factor.

15. Page 450, § 10.5.3, 5th item in bulleted list, 1st sentence. The argument `weights` allow~~s~~ modeling of heteroscedasticity of the…

16. Page 453. The sign for 369.5417 in the calculation for G^2 needs to be changed as shown below: $G^2 = 2(\underline{-}369.5417 + 378.3228) = 17.562$.

17. Page 453, last sentence preceding § 10.6. ~~That is~~ Specifically, we conclude that ~~at least some of the~~ laboratories vary in their…

18. Page 455. In typesetting the equals signs in the code at the top of the page have been deleted.

    ```
    baby.lm <- lm(date ~ treatment, data = baby.walk)
    par(mfrow = c(2, 2), mar = c(4, 4, 2, 1.5))
    plot(baby.lm)
    ```

19. Page 457, 1st paragraph, 2nd sentence.
    Sentence currently reads:
    The procedure calculates $d_{ij} = \left| \hat{\varepsilon}_{ij} - \tilde{\varepsilon}_i \right.$ where…

    It should be changed to read:
    The procedure calculates $d_{ij} = \left| \hat{\varepsilon}_{ij} - \tilde{\varepsilon}_i \right|$ where…

20. Page 458. In typesetting the equals signs in the code at the top of the page have been deleted. The code should read:

    ```
    plot(ref.K, cex = 1.2, grid = F, id = .05, adj = -0.5)
    qqnorm(ref.K, cex = 1.2, main = "", id = .05, adj = -0.5)
    plot(ref.K, resid(., type = "p") ~ fitted(.) | lab, abline = 0)
    qqnorm(ref.K, ~ ranef(.), cex = 1.2, grid = F, id = .05, adj = -0.5)
    ```

21. Page 459, 2nd sentence on page.
    …contour cutoff for outliers at `1 - id/2` (see code ~~below~~ for Fig. 10.7).

22. Page 459, § 10.8, 2nd sentence. Remove semicolon, insert period, defining two separate sentences as shown.
    …factorial design, factors are fully crossed~~;~~. ~~t~~That is, every experimental…

23. Page 459, § 10.8, 3rd sentence. Remove dash between "factor and "level" as shown.
    … an equal number of experimental units assigned to each factor-level combination…

24. Page 461, paragraph following Eq. 10.35, last sentence.
    …ε_{ijk}s are independent random errors that follow $N(0, \sigma^2)$.

25. Page 462, Table 10.4, *df* column, last cell. Replace n with n_0.
    That is, replace
    $ab(n - 1)$
    With
    $ab(n_0 - 1)$

26. Page 462, Table 10.4, MS column, last cell. Replace n with n_0.
That is, replace
$$\frac{SSE}{ab(n-1)}$$
With
$$\frac{SSE}{ab(n_0-1)}$$

27. Page 465, 3rd line of code in final R code chunk.
```
anova(pot.ref.ML, pot.nested.1ML)
```

28. Page 466, § 10.9, 2nd paragraph, last sentence.
…ε_{ijk}s are independent random errors that follow $N(0, \sigma^2)$.

29. Page 469, § 10.9.1, 3rd paragraph, 1st sentence.
The random block ~~randomized design~~ model can be expressed in the form of…

30. Page 470, Example 10.12, 2nd sentence following 1st block of R code.
Sentence currently reads
…that `loc, block%in%loc` and `cross:loc` are random effects.

The font in `cross:loc` should be converted entirely to monospace so that it reads
…that `loc, block%in%loc` and `cross:loc` are random effects.

31. Page 471, paragraph following Eq. 10.38, last sentence.
…ε_{ijk}s are independent and follow $N(0, \sigma^2)$.

32. Page 471. Table 10.9. In the SS column. The SS for $B(A)$ currently reads:
$$n_0 \sum_{j=1}^{b} (\bar{Y}_j - \bar{Y})^2$$
It should be corrected to read:
$$n_0 \sum_{i=1}^{a} \sum_{j=1}^{b} (\bar{Y}_{j(i)} - \bar{Y})^2$$

33. Page 471. Table 10.9. In the SS column. The SS for the Error currently reads:
$$\sum_{i=1}^{a} \sum_{j=1}^{b} \sum_{k=1}^{n_0} (Y_{ijk} - \bar{Y}_{ij})^2$$
It should be corrected to read:
$$\sum_{i=1}^{a} \sum_{j=1}^{b} \sum_{k=1}^{n_0} (Y_{j(i)k} - \bar{Y}_{j(i)})^2$$

34. Page 472. Table 10.10 caption
…Two-Factor Nested Model~~s~~

35. Page 472, Table 10.10, A and B fixed column, 1st row. The expected mean squares for A
   currently reads:

$$\sigma^2 + bn_0 \frac{\sum_{i=1}^{a} \alpha_i}{a-1}$$

It should be corrected to read:

$$\sigma^2 + bn_0 \frac{\sum_{i=1}^{a} \alpha_i^2}{a-1}$$

36. Page 472, Table 10.10, A and B fixed column, 2nd row. The expected mean squares for $B(A)$
   currently reads:

$$\sigma^2 + n_0 \frac{\sum_{i=1}^{a}\sum_{j=1}^{b} \beta_i^2}{a(b-1)}$$

It should be corrected to read:

$$\sigma^2 + n_0 \frac{\sum_{i=1}^{a}\sum_{j=1}^{b} \beta_{j(i)}^2}{a(b-1)}$$

37. Page 472, Table 10.11, last row in Table.
   Replace:

Error	σ^2	σ^2	σ^2

With:

Error	σ^2	MSE	MSE

38. Page 474, paragraph following Eq. 10.39, last sentence.
   …ε_{ijk}s are independent random errors that follow $N(0, \sigma^2)$.

39. Page 474, penultimate paragraph, penultimate sentence.
   As a result, we assume that A and B are additive; that is we assume $(\alpha\beta\gamma)_{ij} = 0$.

40. Page 476, Example 10.15, 2nd sentence.
   …alfalfa plants stop ~~acquiring~~ adding above-ground biomass…

41. Page 479, 2nd paragraph 2nd sentence.
   ~~For instance,~~ Examples include *order effects* in which…

42. Page 486, Example, 10.20, 1st paragraph, last sentence.

As a concomitant variable, thorax length (a known predictor of male longevity) was also measured.

43. Page 487, sentence following 1st block of R code.
    A nonsignificant test for interactions indicates…

44. Page 494, § 10.15.4.3, 2nd paragraph, 1st sentence.
    A variant on ANOVA can be used which replaces the sample means and standard error estimates ~~are replaced~~ with trimmed estimates

45. Page 496, Example 10.23, 1st block of R code.
    ~~1~~bayes.lm(baby.walk$date, X)

46. Page 496, § 10.17, 3rd bullet. Bold the X.
    The design matrix **X** can take on a large number of forms, but…

47. Page 497, § 10.17, last bullet.
    …standard uniform priors is presented in ~~the preceding s~~Section 10.16.

48. Page 498, Question 5. …restricted diet of 40 kcal/week after ~~feeding~~ weaning.

49. Page 499, Question 7. Summarize your results~~., that is~~ In particular, what hypotheses do the…

50. Page 500, Question 13
Replace:

```
scores<-data.frame(APscores = c(4.6, 4.8, 4, 3.4, 3.4, 2.1, 4.1, 3.9, 4,
4.1, 2.3, 1.2), school = factor(rep(1:2, each = 6)), town = c("Burley",
"Pocatello", "Boise"), instructor = factor(rep(c(rep(1, 3), rep(2, 3)),
2)))
```

With:
```
scores <- data.frame(APscores = c(4.6, 4.8, 4, 3.4, 3.4, 2.1, 4.1, 3.9, 4,
4.1, 3.8, 1.2, 4.5, 4.9, 4.3, 3.5, 3.6, 3.2, 3.9, 4.3, 3.8, 4.2, 4.4,
2.4), school = factor(rep(c(1,2), each = 6)), town = c("Burley",
"Pocatello", "Boise"), instructor = factor(rep(c(rep(1, 3), rep(2, 3)),
2)), class=factor(rep(c(1,2), each=12)))
```

51. Page 500, Question 13a. …variance components analysis using lme~~r of the model~~ output and…

52. Page 500, Question 13b
(b) Perform an appropriate hypothesis test~~s~~ for the town fixed ~~each~~ factor using nested and reference models, using lme~~r~~ to help.

53. Page 500, Question 14. …(using only lm and anova).

54. Page 500, Question 16.
    …with respect to corn hybrids (~~whole~~ split plots) and nitrogen, in lbs per acre (~~split~~ whole plots).

55. Page 500, Question 16a. Analyze the data correctly (with block in hybrid as a random effect) using `aov`.

56. Page 500, Question 16c. Reanalyze the data, and repeat the hypothesis tests using lmer. Define block and hybrid as random effects.

Chapter 11

1. Page 503, Example 11.1, last sentence.
   …countering the supposition that ~~it~~ cocaine is a relatively safe drug.

2. Page 507, sentence preceding Eq. 11.9. Because the standard normal distribution squared is…

3. Page 508, sentence preceding Eq. 11.11.
   …that allows testing of the null hypothesis that all $\pi_i = \pi_{i0}$.

4. Page 515, Figure 11.2 caption … (cf. Fig. 9.~~12~~13)

5. Page 517, first paragraph, last sentence.
   Two approximate parametric methods have been developed that are appropriate for obtaining confidence intervals for the true relative risk or selection ratio (Katz et al. 1978, Koopman 1984, Aho and Bowyer 2015).

6. Page 517, last sentence in § 11.4.7.
   …simultaneous inference given multiple resources or risk ratios.

7. Page 528, Figure 11.3. The first (upper left hand) cell of the marginal table (far right-hand table) should read 31, not 1. Thus, this portion of the figure should be corrected to read:

	X_1	X_2
Y_1	31	23
Y_2	36	23

8. Page 530, R code at top of page. Typesetting removed equal and plus signs in the code. Code should be changed to read:

```
paik(survival ~ smoke + age, counts = count, data = whickham,
xlab = "Smoke", leg.title = "Age", ylab = "Proportion surviving")
```

9. Page 535, Example 11.4. For naming clarity, the following corrections should be made to R code:

```
        PM.S = update(PM.SP, ~ . - sex : predation)
        SP.M = update(SM.SP, ~ . - sex : marrow)
        SM.P = update(SM.PM, ~ . - predation : marrow)
```

10. Page 536, Table 11.8. The following corrections should be made in column 1:
    (PM,S) (SM,P), (SP,M)

11. Page 537, sentence under R chunk at top of page.
    We would reject H₀ (although this decision is precluded by the significant three-way interaction)
    and conclude that marrow and predation are associated when holding sex, a constant.

12. Page 537, § 11.11, last sentence on page. …its extension, and the multinomial distribution.

Appendices

1. Page 549, *P(A) 1* 1 – *P(A)* = *P(A')*

References

2. Page 555,
   Replace:
   Aho, K., Derryberry, D., Peterson, T. In press. Model selection for ecologists: The worldviews
   of AIC and BIC. *Ecology*.

   With:
   Aho, K., Derryberry, D., Peterson, T. 2014. Model selection for ecologists: The worldviews of
   AIC and BIC. *Ecology* 95(3): 631-636.

3. Page 555, Insert the following citation (it is now cited in Ch 11, see Ch. 11 changes).
   Aho, K. and Bowyer, R.T. 2015. Confidence intervals for ratios of proportions: implications for
   selection ratios. *Methods in Ecology and Evolution* 6: 121-132.

Back cover

1. Penultimate sentence.
   Unlike classic biometric texts, this book provides you with an understanding of the mechanics
   underlying statistics involved in the analysis of biological applications data.