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Errata for
Statistics for Environmental Biology and Toxicology

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Errata

The following are errata from the first printing (1997) of *Statistics for Environmental Biology and Toxicology* (see the Web Site at

`http://www.muohio.edu/~ajbailer/book/codetable.htm`

to find the most up-to-date list):

- p. 25: Var[X] should read Var[X] = $e^{2(\mu+\sigma^2)} - e^{2\mu+\sigma^2}$.
- p. 30: In Example 1.3, take $\omega(\beta) = -1/\beta$. The natural parameter is $\omega = -1/\beta$.
- p. 69: The legend in Figure 2.2 should read as follows:

  Plot of –2 log Likelihood versus π with N=20 trials yielding y=10 successes. A horizontal reference line is drawn $\chi^2_{0.05}(1)$ = 3.84 units above the minimum of –2 log Likelihood.

  Note that the text description at the bottom of p. 68 also should reflect that this is a plot of -2log[$\mathscr{L}(\pi)$].
- p. 87: The denominator of the MoM estimating equation at the bottom of the page should read

  $$\hat{\beta}_{\text{MQL}} + \varphi\hat{\beta}^2_{\text{MQL}}.$$

  Also, the corresponding MoM estimator for φ should read $\hat{\varphi}_{\text{MoM}} = (s^2 - \overline{Y})/\overline{Y}^2$.
- p. 94: In Exercise 2.14, let X_i ~ i.i.d. $\mathcal{P}oisson(\mu)$.
- p. 96: The last sentence of Exercise 2.22 should read: Derive the maximum likelihood estimator for the product of μ times π.
- p. 129: The u_i values defined prior to Equation (4.3) should be $u_i = s_i^2/n_i$, i=0,1.
- p. 134: The *P*-value at the bottom of the page should read $2P[Z > |z_{\text{calc}}|]$.
- p. 137: At the end of the first paragraph, the reference is to a $\chi^2(1)$ distribution.
- p. 141: In Table 4.2, the *TOTAL* for Nonaneuploid cells is 305.
- p. 153: In the center of the page, the three control values are Y_{01} = 46, Y_{02} = 43, and Y_{03} = 44. Also, the rank-sum critical point is $w_{0.05}(3,3) = 15$ at α=0.05.
- p. 160: Towards the bottom of the page, the reparameterization involves π_0 and π_1. The nuisance parameter is thus $\tau = \pi_0 + \pi_1$.
- p. 162: In Example 4.2, computational updates are required as follows:
  - $\nu_1 = (0.25)(0.005 + 0.0067) = 0.0029$
  - $V(p_1 - p_0, \tilde{\tau}) = 0.003\{(1.755)(0.245)0.014\} - (0.0008)(0.755)(0.12)$
  - $\mathfrak{z}_{\alpha/2}\Big(V(p_1 - p_0,\tilde{\tau}) + \mathfrak{z}^2_{\alpha/2}\{\nu_1^2(2-\tilde{\tau})\tilde{\tau} + \nu_2^2(1-\tilde{\tau})^2\}\Big)^{1/2} =$

    $$(1.96)\sqrt{0.0011 + (3.84)(3.616\times10^{-6} + 9.132\times10^{-8})} =$$

    $$1.96\sqrt{0.0011 + 1.424\times10^{-5}} = 0.065$$
  - $1 + \nu_1\mathfrak{z}^2_{\alpha/2} = 1.011$
  - $\delta_{\text{lower}} = (0.12 - 0.0012 - 0.065)/1.011 = 0.053$
  - $\delta_{\text{upper}} = (0.12 - 0.0012 + 0.065)/1.011 = 0.182$
  - $0.053 < \delta < 0.182$

  Thus, exposure increased the *in vitro* aneuploid response rate by between 5.3% and 18.2%.
- p. 166: In §4.2.3, Δ is $\mu_1 - \mu_0$. The ratio of means would then be μ_1/μ_0.

- p. 167: Equation (4.28) should read

$$\bar{Y}_1 - \bar{Y}_0 + 2(\varphi + 1)\upsilon_2 \pm \mathfrak{z}_{\alpha/2}\sqrt{\frac{\bar{Y}_1}{n_1} + \frac{\bar{Y}_0}{n_0} + 2(\varphi+1)\left(\upsilon_1^2 + \upsilon_2^2\right)} \tag{4.28}$$

- p. 171: In Exercise 4.8, operate at $\alpha = 0.05$.
- p. 194: The u_i values defined after Equation (5.8) should be $u_i = s_i^2/n_i$, i=0,…,T.
- p. 197: Equation (5.11) should read

$$z_{i0} = \frac{p_i - p_0}{\left[\dfrac{p_i(1-p_i)}{n_i} + \dfrac{p_0(1-p_0)}{n_0}\right]^{1/2}} \tag{5.11}$$

- p. 198: The parenthetical reference to Fig. 5.4 should note that we use $df_E = \infty$ instead of $df_E = 31$.
- p. 200: The multivariate normal critical points should be $|\mathfrak{z}|^{(0.05)}_{4,0.369} = 2.47$ at $\alpha = 0.05$, or $|\mathfrak{z}|^{(0.01)}_{4,0.369} = 3.01$ at $\alpha = 0.01$.
- p. 206: The u_i values defined in the ν_{ih} terms should be $u_i = s_i^2/n_i$, i=0,…,T.
- p. 224: Equation (6.4) should read

$$\bar{t}_{\text{calc}} = \frac{\hat{\mu}_k - \bar{Y}_{0+}}{\hat{\sigma}\sqrt{\dfrac{2}{r}}} \tag{6.4}$$

- p. 225: Equation (6.5) should read

$$\bar{t}_{\text{calc}} = \frac{\hat{\mu}_k - \bar{Y}_{0+}}{\hat{\sigma}\left(\dfrac{1}{r_0} + \dfrac{1}{r}\right)^{1/2}} \tag{6.5}$$

- p. 225: The title to Example 6.4 should read

  Example 6.4 Body weight changes in mice after exposure to 1,4-dichlorobenzene
- p. 226: The t-statistic near the bottom of the page should display as

$$\bar{t}_{\text{calc}} = \frac{-6.0667 - (-8.9)}{\sqrt{(0.2)(0.3275)}}$$

  As a result, the actual calculated value is $\bar{t}_{\text{calc}} = 11.07$.
- p. 243: In the third paragraph under Example 6.7, the first term in the sum of squares should read $(10)(0 - 157)^2$.
- p. 245: In the paragraph ending Example 6.8, the first term in the numerator of (6.8) should read (196)(0.236 – 1.575)(1.209).
- p. 254: In Figure 6.14, the S-PLUS code line

```
top <-sum( (conc-xbar)*dead )
```

  should be replaced by

```
top <- sum( (conc-xbar)*yy)
```

- p. 260: Equation (6.17) should read

$$z_{QL} = \frac{\sum_{i=0}^{k} r_i (x_i - \bar{x})\bar{Y}_{i+}}{\left\{\sum_{i=0}^{k} (x_i - \bar{x})^2 \sum_{j=1}^{r_i} (Y_{ij} - \bar{Y}_{i+})^2\right\}^{1/2}} . \qquad (6.17)$$

In the following paragraph, the more robust empirical variance estimate is $\sum_{j=1}^{r_i}(Y_{ij} - \bar{Y}_{i+})^2/r_i$.

- p. 261: In Example 6.11 (continued), the denominator of z_{QL} is the square root of

$\sum_{i=0}^{k} \{(x_i - \bar{x})^2 \sum_{j=1}^{r_i}(Y_{ij} - \bar{Y}_{i+})^2\} = (0 - 157)^2(116.4) + (80 - 157)^2(96.5) + \cdots + (310 - 157)^2(124.0) = 8252401.40.$

Thus the test statistic is $z_{QL} = -50108/2872.699 = -17.443$.

- p. 262: In Fig. 6.16, the S-PLUS code line

```
bot <- sum( nreps*(uconc-xbar)^2*(nreps-1)*vars)
```

should be replaced by

```
bot <- sum( (uconc-xbar)^2*(nreps-1)*vars)
```

The resulting output should read

```
Z.QL=  -17.44283
```

and the result of calling `pnorm(Z.QL)` should read

```
[1] 1.951308e-68
```

- p. 273: In Exercise 6.11, the data are from Cryptorchid male panthers. For the calculations, set $\omega = 3/2$ and use $\bar{t}_{0.05}(5,1) = 2.186$. Continue to use $\beta = 4$.
- p. 283: In Exercise 6.33, parts (b) and (c), test for a *de*creasing trend.
- p. 284: In Exercise 6.35, parts (e) and (f) are not calculable. Omit these.
- p. 291: "chose" should be "choose" on line 11.
- p. 301: The starting value for the join point is $\tau_{start} = \log\{178\} = 5.1818$. (This is correctly entered in the SAS code and output.)
- p. 301: In Fig. 7.5, the data listing in the SAS code includes values for x_i when they should be Y_i from Table 7.1. The SAS output in Fig. 7.6 is based on the correct data, however.
- p. 304: In Fig. 7.7, the data listing in the SAS code includes values for x_i when they should be Y_i from Table 7.1. The SAS output in Fig. 7.8 is based on the correct data, however.
- p. 308: In Equation (7.7), most authors write the mortality term as $[2 - \exp\{\beta_2 x_i\}]_+$. For our presentation, the sign and hence the interpretation of β_2 is reversed.
- p. 310: The initial estimate for b_1 should display as

$$b_1 = \frac{m}{N_0 - Y_1} .$$

- p. 310: Near the bottom of the page, the LS estimate of mutagenicity 'slope' should be $\hat{\beta}_1 = 3.18\times10^{-4}$.
- p. 318: At the bottom of the page, the response variable should be $Y_{ij} \sim \mathcal{P}oisson(\mu_i)$.
- p. 322: Near the bottom of the page, the estimate should read $\hat{\beta}_2 = -2.75\times10^{-5}$.
- p. 324: In the discussion of the change in sign, ignore the symbol β_1 and view this as a discussion on the coefficient of the (uncentered) concentration variable, *x*.
- p. 330: The standard errors for the β-parameters should read se[$\hat{\beta}_0$] = 0.61291 and se[$\hat{\beta}_1$] = 0.05967. Also, the 95% confidence interval on LC_{50} should be $9.0132 < LC_{50} < 10.042$.

- p. 336: Equation (7.19) for $ED_{100\rho}$ should read

$$ED_{100\rho} = \frac{1}{\beta_1}\left[\log\left\{\frac{\rho}{1-\rho}\right\} - \beta_0\right]. \qquad (7.19)$$

- p. 337: The equation for $ED_{100\rho}$ prior to Equation (7.21) should read

$$\frac{1}{\beta_1}\left[\log\left\{\frac{\rho}{1-\rho}\right\} - \beta_0\right]$$

- p. 338: The equation for the ED_{01} at the end of Example 7.4 should read

$$\frac{\log\left\{\frac{0.01}{0.99}\right\} - (-5.8067)}{0.0028} = 432.707 \ \mu\text{mol}.$$

- p. 351: In Exercise 7.11, the fourth dose level for Lab B is 75, not 750.
- p. 353: In Exercise 7.17, replace `SLOPE` with `DOSE`.
- p. 355: In Exercise 7.31(e), $\hat{\beta}_1$ should be b_1 in all occurrences.
- p. 357: In Exercise 7.43, *Hint*: set $\gamma = 0$.
- p. 357: In Exercise 7.46, $F(\eta)$ is an increasing, continuous function such that $0 < F(\eta) < 1$.
- p. 359: In Exercise 7.57(a), graph Y/N vs. *x*. The full data for both groups are:

C	31.0	60	60	C	14.5	60	60	C	11.8	46	60
C	11.2	47	60	C	7.5	10	60	C	3.9	1	60
C	3.3	0	60	C	1.4	2	60	C	0.8	1	60
E	30.6	60	60	E	14.6	60	60	E	12.2	59	60
E	10.9	51	60	E	7.4	24	60	E	3.9	15	60
E	3.3	10	60	E	1.4	11	60	E	0.8	8	60

- p. 369: In Example 8.3, $c(y,\varphi)$ should be $\varphi^{-1}\log(y/\varphi) - \log\{y\Gamma(1/\varphi)/I_{(0,\infty)}(y)\}$.
- p. 385: In Fig. 8.4, the output line for `INTERCEPT` under `Analysis Of Parameter Estimates` should read

```
INTERCEPT         1       0.7643       0.1531      24.9371  0.0001
```

- p. 396: The Dinse-Lagakos formulation models the tumor onset probability as logistic in dose, x_2, and survival time, x_1.
- p. 405: In Exercise 8.8(f), write $\partial\theta_i/\partial\beta_m$ as $\hbar'(\eta_i)x_{im}/V(\mu_i)$.
- p. 408: In Exercise 8.20, the scale parameter must be assumed known (or estimated first using, e.g., a no-interaction model). Use the pre-specified value $\varphi = 3.7$.
- p. 460: In Exercises 9.27(d), 9.27(e), and 9.27(f), the logarithms are to the base 10. Also, the last parameter estimate as given by Piegorsch et al. (1988) is incorrect. The correct estimate is (in their notation) $b_{12} = 0.142$. Thus:

$$\hat{\omega}(\text{TNF},\text{IF}\gamma) = 0.088 - 0.447\log_{10}\{\text{TNF}\} + 0.519(\log_{10}\{\text{TNF}\})^2 - 0.134\log_{10}\{\text{IF}\gamma\} + 0.098(\log_{10}\{\text{IF}\gamma\})^2 + 0.142\log_{10}\{\text{TNF}\}\log_{10}\{\text{IF}\gamma\}.$$

- p. 466: The expression for the standard error should read

$$se_0[b] = \frac{1}{\dfrac{n_0}{(1+\Omega_{01})\sigma_0^2} + \left\{(1+\Omega_{01}+\Omega_{01}^2)\sigma_\theta^2 + \dfrac{\Omega_{01}\sigma_0^2}{n_0} + \dfrac{\Omega_{01}^2\sigma_0^2}{n_0} + \dfrac{\sigma_c^2}{n_c}(1+\Omega_{01})^2\right\}^{-1}} .$$

- p. 470: The factorial operator is related to the gamma function via $m! = \Gamma\{m+1\}$.

- p. 471: The exact conditional *P*-value should be P = 0.0448. The agreement with the approximate *P*-value is now marginal-to-good.
- p. 473: With no historical data, the dispersion parameter, δ, should be set to ∞ in the Tarone statistic; λ is irrelevant. See also p. 477, Exercise 10.7.
- p. 473: The standard error for the historical control *T*-statistic should read

$$se[T] = \left\{ \tilde{Y}_0 \left[\sum_{i=0}^{k} r_i x_i^2 - \left(\frac{1}{(\lambda\delta)^{-1} + r_+} \right) \left(\sum_{i=0}^{k} r_i x_i \right)^2 \right] \right\}^{1/2} .$$

- p. 476: In Exercise 10.4(b), the historical control incidence is 29.49%.
- p. 477: In Exercise 10.7, set the dispersion parameter, δ, to ∞. Do not specify a value for λ.
- p. 477: In Exercise 10.8, the historical control data *replace* the current control data.
- p. 477: In Exercise 10.9, assume $\delta = 0$.
- p. 487: In Example 11.2, $\mathrm{Var}[\hat{S}_{PL}(100)] = 0.0018$. This gives $se[\hat{S}_{PL}(t)] = 0.0424$, as indicated.
- p. 521: At the bottom of the page, the Fisher information is derived from $-\partial^2\ell^*/\partial\beta^2$.
- p. 527: In Exercise 11.5, parts (c) and (d), use $t = 39.5$.
- p. 533: In Exercise 11.38, set $t = 8$ for the terminal sacrifice time.
- p. 536: The reference to Bailer (1989) should read:

  Bailer, A.J. (1989) Testing variance equality with randomization tests. *Journal of Statistical Computation and Simulation*, **31**, 1–8.
- p. 539: The reference to Chanter (1984) should be Chanter (1982) and should read:

  Chanter, D.O. (1982) Curtailed sigmoid dose-response models for fungicide experiments. In *Conferência Internacional de Biometria*, **10ª**: 553-561, Basîlia: EMBRAPA-DID.