

Errata File for Second Edition

Daniel Sorensen

August 1, 2025

This errata file contains a list of errors, short clarifications and modifications to the manuscript's second edition.

1. Page 171, the first partial derivative below Eq. (4.62).

CHANGE:

$$\frac{\partial \ln p(a, b|y, b_0, a_0, B, G, R)}{\partial b} = -B^{-1}(b - b_0) + XR^{-1}(y - Xb - Za)$$

TO:

$$\frac{\partial \ln p(a, b|y, b_0, a_0, B, G, R)}{\partial b} = -B^{-1}(b - b_0) + X'R^{-1}(y - Xb - Za)$$

2. Page 172, top.

CHANGE: "When B^{-1} implying $B = \infty \dots$ "

TO: "When and if $B^{-1} = 0$ implying $B = \infty \dots$ "

3. Page 172,

CHANGE:

Finally, add and subtract $\hat{\theta}'(W'R^{-1}W + \Sigma)\hat{\theta}$ and rearrange to yield

$$y'R^{-1}y + (\theta - \hat{\theta})'(W'R^{-1}W + \Sigma)(\theta - \hat{\theta})' - \hat{\theta}'(W'R^{-1}W + \Sigma)\hat{\theta} + \theta'_0\Sigma\theta_0$$

TO:

Finally, add and subtract $\hat{\theta}'(W'R^{-1}W + \Sigma)\hat{\theta}$ and rearrange to yield

$$y'R^{-1}y + (\theta - \hat{\theta})'(W'R^{-1}W + \Sigma)(\theta - \hat{\theta})' - \hat{\theta}'(W'R^{-1}W + \Sigma)\hat{\theta} + \theta'_0\Sigma\theta_0$$

4. Page 172, equation at the bottom,

CHANGE:

$$\ln p(\theta|y, \theta_0, B, G, R) \propto -\frac{1}{2}(\theta - \hat{\theta})'(W'R^{-1}W + \Sigma)(\theta - \hat{\theta})'$$

TO:

$$\ln p(\theta|y, \theta_0, B, G, R) \propto -\frac{1}{2} (\theta - \hat{\theta})' (W' R^{-1} W + \Sigma) (\theta - \hat{\theta})$$

5. Page 353, Eq. (7.41), remove "comma" before " $i = 1, \dots, m$ "

CHANGE:

$$y|\mu, \alpha, \delta, \sigma^2 \sim N \left(1\mu + \sum_{i=1}^m X_i(\alpha_i \delta_i), I\sigma^2 \right), \quad i = 1, \dots, m \quad (7.41)$$

TO:

$$y|\mu, \alpha, \delta, \sigma^2 \sim N \left(1\mu + \sum_{i=1}^m X_i(\alpha_i \delta_i), I\sigma^2 \right), \quad i = 1, \dots, m \quad (7.41)$$

6. Page 373, paragraph above Eq. (8.23), defines the number of false discoveries $V(A)$, given that k hypotheses are rejected, as binomially distributed $Bi(k, \Pr(H = 0|z \in A))$. Another definition can be found on page 376, paragraph above Eq. (8.33), concerning the expected number of false discoveries. Both may benefit from a little explanation that is provided below.

Background

Let the binary random variable $V_i = 1$ if hypothesis i is rejected and if hypothesis i is a true null; $V_i = 0$, otherwise. Using the notation on page 363, we can write $V_i = I(H_i = 0, R_i = 1)$, where $R_i = 1$ if $z_i \in A$ and z_i is the observed value of the scalar random variable Z_i . Treating the hypotheses as random, it follows that V_i is a Bernoulli random variable with probability $\Pr(H_i = 0, Z_i \in A)$; that is $V_i \sim Br(\Pr(H_i = 0, Z_i \in A))$.

$$V_i \sim Br(\Pr(H_i = 0, Z_i \in A)).$$

- **Page 373.** Consider the binary random variable $V_i|R_i = 1$ that takes the value 1 if $H_i = 0$ and 0 otherwise. Then $[V_i|R_i = 1] \sim Br(\Pr(H_i = 0|Z_i \in A))$, a Bernoulli distributed random variable. If in a series of independent trials the total number of rejections is $R = k$, among these k rejections, the total number of false discoveries is binomially distributed:

$$[V|R = k] \sim Bi(k, \Pr(H = 0|Z \in A)).$$

The expected number of false discoveries among the k rejections is

$$E(V|R = k) = k \Pr(H = 0|Z \in A).$$

The subscript i has been omitted because $\Pr(H_i = 0|Z_i \in A)$ is the same for each i .

- **Page 376.** Consider an experiment where m independent hypotheses are tested. Given the definition of V_i and the independence assumption, the total number of false discoveries, $V = \sum_{i=1}^m V_i$, is then binomially distributed

$$V \sim Bi(m, \Pr(H = 0, Z \in A)),$$

with expected value

$$E(V) = m \Pr(H = 0, Z \in A) = m \Pr(Z \in A | H = 0) \pi_0,$$

where $\pi_0 = \Pr(H = 0)$, the prior probability of a true null.

Note that: (i) hypotheses H_i are treated as random (with a common prior π_0), (ii) random vectors (H_i, Z_i) , $i = 1, 2, \dots, m$, are independently distributed, (iii) the rejection region A is data-independent and fixed in advance.