Errata List for: Intermediate Probability: A Computational Approach

Chapter 1 (Generating Functions)

1. page 14, first sentence of section 1.1.4. There should be a transpose on the vectors $\mathbf{X}$ and $\mathbf{t}$.

2. page 48. In Program listing 1.4, the code `sum(g.*w')` should be changed to `sum(g.*w.')`, and similarly, in Program listing 1.5, the code `sum(G.*w')` should be changed to `sum(G.*w.')`.

   In Matlab, the transpose operator has two forms. If `x` is a real vector defined in Matlab, then `x'` yields the transpose of `x`. If `x` is a vector of complex numbers, then `x'` computes the complex conjugate transpose of `x`. This can also be computed with `ctranspose(x)`. To get the "regular" transpose of a vector or matrix of complex numbers, use `x.'` (note the dot) or `transpose(x)`. To illustrate, note the difference in output:

   ```
   x=(1:3)+i.*(4:6)  ,  x'  ,  x.'
   ```

   Having made the changes to Programs 1.4 and 1.5, you will see that the output of our program `dft` and that of Matlab's `ifft` are not the same. They are the same if, in `dft`, we set `z=exp(2*pi*i/T)` instead of `z=exp(-2*pi*i/T)`. Similarly, the output from our `idft` and Matlab's `fft` are the same if, in `idft`, we take `z=exp(-2*pi*i/T)`.

3. page 62, footnote 11. Change $2\sin(a)\sin(b)$ to $2\sin(a)\cos(b)$.

Chapter 2 (Sums and Other Functions)

1. page 70, line -5. "Example 6.8" should be "Example I.6.8".

2. page 71, last equation. $\mathrm{e}[S]$ should be $\mathbb{E}[S]$.

3. page 75, Figure 2.3. In graphic (a), the label $(s < S < s+)$ should be $(s < S < s + \mathrm{d}s)$. In graphic (b), the label $(d < D < d + \mathrm{d})$ should be $(d < D < d + \mathrm{d}d)$.

Chapter 3 (The Multivariate Normal Distribution)

1. page 97, second sentence of section 3.1, the function g should be bold faced.

2. page 109, the line of Matlab code after "can be approximated by" should read

   ```
   length( find(y(1,:)<1.5 & y(2,:)<2.5) ) / length(y)
   ```

3. page 110, just before equation (3.20), it should say: the region given by $Y_2 > 0$ and $Y_1 > Y_2$.

4. page 110, equation (3.20) should be $\int_0^\infty \int_y^\infty f_{Y_1,Y_2}(x,y)\mathrm{d}x\ \mathrm{d}y$.

5. page 110, program bvnrectangle, replace `if x>y` with `if x<y`

6. page 111, last line. $M_{\mathbf{X}}$ should be $\mathbb{M}_{\mathbf{X}}$.

7. page 116. Replace the text starting with "Denote the (i,j)th element of..." up to and including equation (3.23) with the following:

Let $\mathbf{Y}_{(1)} = (Y_i, Y_j)'$ and $\mathbf{Y}_{(2)} = \mathbf{Y} \setminus \mathbf{Y}_{(1)}$, i.e., $\mathbf{Y}_{(2)}$ is $\mathbf{Y}$ but with the elements Y_i and Y_j removed. Let $\mathbf{\Sigma}_{11} = \mathbb{V}\left(\mathbf{Y}_{(1)}\right)$, $\mathbf{\Sigma}_{22} = \mathbb{V}\left(\mathbf{Y}_{(2)}\right)$, and $\mathbf{\Sigma}_{12} = \mathbf{\Sigma}_{21}' = \text{Cov}\left(\mathbf{Y}_{(1)}, \mathbf{Y}_{(2)}\right)$, so that

$$\mathbb{V}(\mathbf{Y}) = \begin{bmatrix} \mathbf{\Sigma}_{11} & \mathbf{\Sigma}_{12} \\ \mathbf{\Sigma}_{21} & \mathbf{\Sigma}_{22} \end{bmatrix}.$$

Let $\mathbf{C}$ be the 2×2 conditional covariance matrix given by

$$\mathbf{C} = \begin{bmatrix} \sigma_{11|\mathbf{Y}_{(2)}} & \sigma_{12|\mathbf{Y}_{(2)}} \\ \sigma_{21|\mathbf{Y}_{(2)}} & \sigma_{22|\mathbf{Y}_{(2)}} \end{bmatrix} = \mathbf{\Sigma}_{11} - \mathbf{\Sigma}_{12}\mathbf{\Sigma}_{22}^{-1}\mathbf{\Sigma}_{21} \ .$$

Motivated by the conditional variance in (3.22), the *partial correlation of Y_i and Y_j, given* $\mathbf{Y}_{(2)}$ is defined by

$$\rho_{ij|\left(\mathbf{Y}_{(2)}\right)} = \rho_{ij|(\{1,2,\ldots,n\}\setminus\{i,j\})} = \frac{\sigma_{12|\mathbf{Y}_{(2)}}}{\sqrt{\sigma_{11|\mathbf{Y}_{(2)}}\sigma_{22|\mathbf{Y}_{(2)}}}}. \tag{3.23}$$

If the partial correlation of several pairs of the elements of $\mathbf{Y}$, all conditional on the same set $\mathbf{Y}_{(2)}$, are to be computed, the $\mathbf{C}$ matrix can be appropriately extended; see Example 3.11 below.

8. page 116, first line of Example 3.10, replace $\rho_{13|2}$ with $\rho_{13|(2)}$.

9. page 122, second to last paragraph. Replace "Let $\mathbf{A} > 0$ be a real, symmetric" with: "Let $\mathbf{A}$ be an". In the subsequent sentence, replace the two occurrences of $\mathbf{A} > 0$ with $\mathbf{A}$.

10. page 124, middle. The statement "for conformable matrices $\mathbf{A}$, $\mathbf{B}$ and $\mathbf{C}$, if $\mathbf{B}$ and $\mathbf{C}$ are full rank, then $\text{rank}(\mathbf{A}) = \text{rank}(\mathbf{BAC})$" is obviously wrong—$\mathbf{B}$ and $\mathbf{C}$ need to be full rank *and square*. Best is to just replace the sentence with:[1] "Let $\mathbf{A}$ be an $m \times n$ matrix, $\mathbf{B}$ be an $m \times m$ matrix, and $\mathbf{C}$ be an $n \times n$ matrix. Then if $\mathbf{B}$ and $\mathbf{C}$ are nonsingular, $\text{rank}(\mathbf{A}) = \text{rank}(\mathbf{BAC})$."

11. page 126, middle. Change $V = (X - \mu_2)/\sigma_2$ to $V = (Y - \mu_2)/\sigma_2$.

Chapter 4 (Convergence Concepts)

1. page 130, equation (4.3). The left hand side should be $|\mathbb{E}[UV]|$.

2. page 133, in the second proof of Chebyshev's inequality, remove the $= \sigma^2/b^2$.

3. page 135, equation (4.21), change $f(x_j)$ (in the first sum) to $g(x_j)$.

4. page 141, line -4, "infinity" should be "infinitely".

5. page 147, the equation after equation (4.54). $\Pr(A_*)$ should be: $\Pr((A^c)_*)$.

6. page 148, 2nd line. There is a missing } and the $<$ should be a $>$. It should read: $\Pr\left(\bigcap_{n\geq m}\{|X_n - X| < \epsilon\}\right) > 1 - \delta$.

7. page 154, line -14 (after "Similarly,"). Change $\Pr(X + \delta \leq x)$ to $\Pr(X - \delta \leq x)$.

8. page 166, question 4.18(b), p.d.f. should be p.m.f..

[1] See, e.g., Schott (Matrix Analysis for Statistics, Wiley, 2005, p. 13).

Chapter 5 (Saddlepoint Approximations)

1. page 197. In both Program listings 5.6 and 5.7, the fourth line got accidentally "wrapped" when it was embedded into the latex file, so that one would need to put a comma after the `end` statement on the fourth line (the two programs, as available on the web, are correct).

Chapter 6 (Order Statistics)

1. page 209. The last term in Equation (6.10) should be $F_B(i-1,n,p)$ instead of $F_B(i,n,p)$. The second to last equation should also replace i with $i-1$, and thus read

$$F_B(j-1,100,0.5) - F_B(i-1,100,0.5) \approx 0.95,$$

2. page 210. top line, add the text "so that $i = 41$ and $j = 61$". The second line should read

$$F_B(60,100,0.5) - F_B(40,100,0.5) = 0.954.$$

   The third line should be: Thus, $\Pr(Y_{41} \leq \xi_{0.5} \leq Y_{61}) = 0.954$ based on $n = 100$.

Chapter 7 (Generalizing and Mixing)

1. page 249, line 8, after the expression for the expected shortfall of Z: Add the text "where $b = \beta^-$."

2. In the discussion of the IHS distribution on page 251, it should be mentioned that $\sinh^{-1}(y) = \ln\left(y + \sqrt{1+y^2}\right)$. (This is derived in the lecture slides.) Also, the c.d.f. calculation via integration is can be replaced by the much simpler observation that:

$$F_Y(y) = \Pr\left(\sinh(\lambda + \theta Z) \leq y\right) = \Pr\left(Z \leq \frac{\sinh^{-1}(y) - \lambda}{\theta}\right) = \Phi\left(\frac{\sinh^{-1}(y) - \lambda}{\theta}\right).$$

   Finally, the reference on page 251 to Choi, Nam and Arize (2007) should be changed to Choi and Nam (2008). See also the change to the References below.

3. page 260, last 2 lines. The three occurrences of u in e^{ut} should be μ.

4. page 268, line 11, in the stand-alone equation for $\mathbb{E}[X]$, the term $\mu(X \mid V = v)$ should be $\mu_1'(X \mid V = v)$

Chapter 8 The Stable Paretian Distribution

1. page 281, equation (8.8), second part. Replace $\ln|t|$ with $\ln|ct|$.

Chapter 9 (Generalized Inverse Gaussian and Generalized Hyperbolic Distributions)

1. page 301, equation (9.6), change $\Gamma(\nu)$ to $\Gamma(|\nu|)$.

2. page 311, first equation of section 9.4.2.4: $f_{\mathrm{Exp}}(\psi/2)$ should be $f_{\mathrm{Exp}}(x;\psi/2)$.

3. page 315, 7th line from the bottom, in the description of the domain of variation of the parameters of the GHyp. In the first of the three cases, change $\lambda = 0$ to $\lambda \in \mathbb{R}$.

4. page 321, in the 4-line equation (9.45). In the line 1, $f_{\text{GIG}}(z;\chi,\delta^2,0)$ should be $f_{\text{GIG}}(z;\lambda,\delta^2,0)$. In line 3, denominator, $\sqrt{2\pi}$ should be $\sqrt{\pi}$.

5. page 324, Section 9.5.2.6. First paragraph: Change "just take the p.d.f. of HAt for $\lambda=-1/2$" to "just take the p.d.f. of HAt for $n=1$, which corresponds to $\lambda=-1/2$". Throughout section 9.5.2.6, in all (five) occurrences of either $f_{\text{HA}t}(x;-1/2,\ldots)$ or HA$t(-1/2,\ldots)$, replace $-1/2$ with 1.

6. page 325, top line, $-\alpha-\beta\leq t\leq\alpha+\beta$ should be $-\alpha-\beta\leq t\leq\alpha-\beta$. Same in equation (9.52).

7. page 326, Table 9.2. The parameter range for β for the HAt should be $\beta\in\mathbb{R}$ and not $\beta\geq 0$.

8. page 329, the 4-line equation just before Section 9.6.2. In the 4th line, change $a\delta$ to $|a|\delta$.

Chapter 10 (Noncentral Distributions)

1. page 341, bottom. Change $\mathbf{X}=(X_1,\ldots,X_n)$ to $\mathbf{X}=(X_1,\ldots,X_n)'$.

2. page 342, middle of page, $X=\mathbf{X'X}=\mathbf{XB'BX}=\ldots$ should be $X=\mathbf{X'X}=\mathbf{X'B'BX}=\ldots$

3. page 342, footnote, end of first line. Remove the transpose on $\boldsymbol{\mu}$, i.e., replace $\boldsymbol{\mu}'=\mathbf{b}_1'\theta^{1/2}$ with $\boldsymbol{\mu}=\mathbf{b}_1'\theta^{1/2}$.

4. page 345, first line, replace both k with i.

5. page 354, program `spaweightedsumsadroot`. The program has been improved by ensuring that, in the root search, s lies in its allowed range.

6. page 373, line 2, equation (10.57). Replace $f_T\left(t;\mu,k\right)$ with $f_T\left(t;k,\mu\right)$.

7. page 376. End of 4th line after equation (10.68) should read: "could have been".

8. page 381. Replace the equation which directly follows (10.72) with "from which the variance can be computed".

Appendix (Notation and Distribution Tables)

1. page 395, in the notation for the Generalized Asymmetric t distribution, the abbreviation GAT should be GAt.

References

1. The entry for Choi, Nam and Arize (2007) should be replaced by:

   Choi, P. and Nam, K. (2008). 'Asymmetric and Leptokurtic Distribution for Heteroscedastic Asset Returns: The S_U-normal Distribution', *Journal of Empirical Finance*, **15**:41–63.