

## Errata to *Elements of Statistical Computing*

Ronald Thisted

Last revised: 11 April 1996

This is a fairly complete listing of bugs and errors in ESC (I hope!). From the moment the proofs left for the printers I began compiling in my own copy a set of corrections discovered by myself and readers who kindly brought their discoveries to my attention. Unfortunately, the copy of the book with my master set of emendations was stolen. This set back the compilation of an Errata sheet for some time. I have tried to reconstruct from notes as many of the discovered errors as possible. In each case, the first finder of each error (except for intentional ones) is noted below.

In references to line numbers, negative numbers are line counts from the bottom of the page. Lines marked with a double asterisk are substantive corrections, which probably warrant annotation in your copy of the book.

In an effort to discover (and correct) as many remaining errors as possible, I will gladly pay \$1.00 to the first finder of each error not already listed below. Comments and suggestions can be sent to me via electronic mail at [r-thisted@uchicago.edu](mailto:r-thisted@uchicago.edu). Be sure to include your name and surface mail address. Decisions of the judge (RT) are final.

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### Throughout:

Capitalization of section references throughout the book is inconsistent. Each instance should capitalize the word “Section”

[*Ernesto M. Flores-Roux, RT, others*]

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### Throughout:

Standardize usage of non-zero vs nonzero, semi-definite vs semidefinite, multi-dimensional vs multidimensional, non-distinct vs nondistinct, etc.

[*Ernesto M. Flores-Roux, RT, others*]

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### Throughout:

The term “Householder rotation” should be replaced with either the term “Householder reflection” or “Householder transformation,” depending on context.

[*Douglas Bates, others*]

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### Page xix, Headings for Part V and Part VII:

“Computation” should be capitalized

[*RT 1/11/88*]

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### Page 9, 10, 203, 343, 346:

The format used for presenting algorithms varies throughout the book. It shouldn't. The algorithms appearing on the pages cited above should be reformatted in the style of other algorithms, such as those on pages 170–171. The word “Algorithm” and any identifying information should be in boldface and left justified, followed by a colon, and placed on a line by itself.

[*Ernesto M. Flores-Roux, RT 4/90*]

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### \*\*Page 10, line 3:

Should read, “Moreover, Algorithm A as written requires  $3n$  additions and subtractions, . . .” [Algorithm A is easily modified to require only  $3n - 2$ , not counting the calculation of  $n - 1$ , which is an integer, not floating-point, operation.]

[*Lynn Friedman 3/31/88*]

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**\*\*Page 10, Algorithm B:**

Omit the period after “**end**,” and add a line that reads:  
 $s^2 := (sq\_sum - [sum^2/n])/(n - 1).$   
[Ernesto M. Flores-Roux 3/29/90]

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**Page 10, Algorithm B:**

Omit **begin** and **end**  
[RT 4/6/90]

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**Page 10, Algorithm C:**

Change  $s_2$  to  $s^2$ .  
[Ernesto M. Flores-Roux 3/29/90]

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**Page 10, Algorithm C:**

Omit closing period.  
[RT 4/6/90]

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**\*\*Page 10, lines 1–2 after Algorithm B:**

Should read, “This algorithm requires only  $2n + 1$  additions and subtractions, and only  $n + 2$  multiplications and divisions, . . .”  
[Lynn Friedman 3/31/88]

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**Page 13, line -11:**

Change “affords” to “afford”  
[Fred Wright 4/5/90]

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**Page 19, line 21.:**

Change “require” to “requires”  
[Fred Wright 4/5/90]

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**Page 20, line -11:**

Should read “formulæ to”  
[Michael Frigge 4/19/88]

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**Page 24, line 12:**

“manipulation” should be plural.  
[Michael Frigge 4/19/88]

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**Page 26, line 5:**

Should read: “Thus, MACSYMA is a program *that* computes. . . .”  
[RT 3/26/90]

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**Page 28, line 9:**

Should read, “Some problems *that* arise. . . .”  
[Ernesto M. Flores-Roux 4/6/90]

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**Page 32, line 1:**

“formulae” should read “formulæ”  
[Michael Frigge 4/19/88]

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**\*\*Page 35, lines 6–10:**

Should read:

Of the 32 bits in a single word, the first bit is the sign, the next 7 bits are devoted to the exponent, which is an integer in *excess-64* notation; if the binary value of this integer is  $k$ , then the exponent it represents is  $k - 64$ . The remaining 24 bits contain . . . .

[*Michael Frigge 4/19/88*]

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**Page 37, line -8:**

Should read: “. . . our exposition follows . . . .”

[*Michael Frigge 4/19/88*]

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**Page 39, line -1:**

Delete period after “ $f^*$ ”

[*Ernesto M. Flores-Roux 4/6/90*]

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**Page 44, line 6 of Section 2.3.1:**

omit semicolon following  $s := 0$  (for consistency with other algorithms).

[*Ernesto M. Flores-Roux 4/6/90*]

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**Page 45, line above Equation (2.3.1):**

“ $f=x$ ” should read  $f = x$ .

[*RT 1/11/88*]

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**\*\*Page 45, expression (2.3.2):**

The period should be replaced by a comma, and a line of text inserted following the expression: “where  $x_{max}$  denotes the observation whose magnitude (ignoring sign) is largest.”

[*Walter Ambrosius 4/2/92*]

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**Page 47, 73, 165, 167:**

For consistency, algorithms on the pages cited above should not contain any concluding punctuation unless required by context. (But Algorithm 2.3.3 on page 47 and expressions (3.2.8) on page 78 and (3.3.4) on page 83 *do* need a period, since they end sentences!)

[*Ernesto M. Flores-Roux, RT 4/90*]

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**Page 47, Algorithm 2.3.3:**

Omit **end**

[*RT 4/6/90*]

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**Page 49, line -10:**

Add the word “and” before “those computed by . . . .”

[*Ernesto M. Flores-Roux 4/6/90*]

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**Page 49, line -3:**

Change “introduce” to “introduced” (for consistency).

[*Ernesto M. Flores-Roux 4/6/90*]

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**Page 50, line -9:**

Add space between “*formulæ*” and “in”.

[*Peter McCullagh 3/14/88*]

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**Page 52, line 2 of comment:**

Change “*weighted*” to Roman type

[*RT 4/6/90*]

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**Page 52, line -5:**

replace the words “*weighted mean*” by “weighted version of  $\bar{X}$  just defined.”  
[Ernesto M. Flores-Roux 4/6/90]

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**Page 54, Exercise 2.16:**

Capitalize “algorithm”  
[RT 3/29/90]

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**Page 56, line -5:**

Add transpose to definition of  $e$ , that is,  $e = (1, 1, \dots, 1)'$ .  
[Craig Borkowf 4/20/90]

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**Page 57, line -16:**

Add space, to read “(IEEE, 1985).”  
[RT 3/27/90]

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**Page 59, line 17:**

Add space between sentences  
[Ernesto M. Flores-Roux 4/6/90]

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**Page 61, line 7 of Section 3.1.4:**

Add comma after the word “conceptually”  
[Ernesto M. Flores-Roux 4/6/90]

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**Page 64, equation (3.1.8):**

The comma following  $\epsilon_2^*$  should follow the entire expression  
[Stuart Luppescu, 4/9/92]

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**\*\*Page 65, line 14 (and elsewhere):**

The term, “Householder rotation” should be replaced by the term, “Householder transformation”  
[Douglas M. Bates, 2/10/92]

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**\*\*Page 68, line 10 of section 3.1.4:**

$n \times k$  should read:  $n \times q$ .  
[Brian Taylor 6/88]

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**Page 70, line 4:**

Omit “we outlined above,”  
[Michael Frigge 4/19/88]

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**\*\*Page 70, line 9 of Section 3.1.5:**

Place the following footnote after the phrase, “that first position must contain  $\sqrt{n}$ .”  
... or  $-\sqrt{n}$ . The sign here is chosen by convention, and is an exception to the rule for choosing the sign of  $s$  given on page 67. It is an interesting exercise to determine just how much cancellation can occur by adopting this convention. (The answer is “not much.”)  
[Mark Levenson 4/5/90]

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**Page 71, line 15:**

$X_1^*$  should be  $x_1^*$ .  
[David Scott 5/6/88]

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**Page 71, line 22:**

Omit comma following  $X_*^{(1)}$   
[Ernesto M. Flores-Roux 4/6/90]

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**Page 71, line 25:**

Replace  $J$  by  $j$

[*Ernesto M. Flores-Roux 4/6/90*]

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**Page 73, Algorithm MGS:**

Omit **begin** and **end** wherever they appear, and indent the five lines that remain following the first line of the algorithm.

[*RT 4/6/90*]

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**\*\*Page 73, Algorithm MGS:**

Following the computation of  $r_{jj}$ , the procedure should halt if  $r_{jj} \leq 0$ .

[*Ming Long Lam 8/18/93*]

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**\*\*Page 73, Algorithm MGS:**

The upper limit of the summation in the inner loop (that is, in the computation of  $r_{jk}$ ) should be  $n$  rather than  $p$ .

[*Ming Long Lam 8/18/93*]

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**Page 73, line -9:**

Change Björck to Björck

[*RT 1988*]

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**\*\*Page 74, Exercise 3.3:**

The exercise should be omitted. The result to be shown is not true in general.

[*Douglas M. Bates, 2/10/92*]

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**Page 74, Exercise 3.6:**

Replace “rotation” by “orthogonal”, and “x” by “x”.

[*RT 4/9/92*]

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**Page 74, Exercise 3.10:**

$H^{(x)}$  should be replaced by  $H_t^{(x)}$  twice.

[*RT 4/7/92*]

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**Page 75, Exercise 3.14:**

“t-statistic” should be singular.

[*RT 1/8/88*]

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**Page 75, Exercise 3.15:**

“which” should be “that”

[*RT 4/9/92*]

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**Page 75, Expression (3.2.2):**

Omit comma at the end of this expression.

[*Ernesto M. Flores-Roux 4/9/90*]

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**Page 76, line 3:**

Add at the end of this paragraph:

Such a factorization is variously referred to as an *LR* or *LU decomposition* (the  $U$  standing for upper triangular).

Also, add an index entry for *LU decomposition*.

[*RT 1988*]

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**Page 77, line 9:**

Omit comma after Van Loan, and insert left parenthesis before 1983.  
[Ernesto M. Flores-Roux 4/9/90]

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**Page 77, line 14:**

Change  $n - p \times p$  to read  $(n - p) \times p$ .  
[Hiro Minato 4/12/90]

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**Page 77, line -9:**

Should read: "...and (implicitly) *an* orthogonal basis ..."  
[Michael Frigge 4/19/88]

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**Page 78, expression (3.2.8):**

Replace "=" by "==" twice, omit **begin** and **end**, and move the period to follow  $t_{kk}$  in the last line.  
[RT 4/6/90]

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**Page 78, line 1:**

Transpose should be on the second term, that is,  $(X_1^{*-1})(X_1^{*-1})'$ .  
[David Scott 5/6/88]

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**Page 78, line 18:**

$(X_1^*)'$  should be  $X_1^{*-1}$   
[Michael Frigge 6/28/93]

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**Page 78, line -2/3:**

Change "in  $\mathcal{R}^{p+1}$ ; here ..." to read " $\mathcal{R}^{p+1}$ , where ..."  
[Ernesto M. Flores-Roux 4/9/90]

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**Page 78, line -5:**

Delete "such"  
[Michael Frigge 4/19/88]

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**Page 79, line 10:**

Change  $x_i$ s to  $x_i$ 's.  
[Ernesto M. Flores-Roux 4/9/90]

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**Page 79, line 3 after (3.2.9):**

Change "is is" to "it is."  
[Ernesto M. Flores-Roux 4/9/90]

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**Page 79, Expression (3.2.10):**

Add a period at the end of this expression.  
[Ernesto M. Flores-Roux 4/9/90]

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**Page 79, line -3:**

Change  $i$ -th to  $i$ th.  
[Ernesto M. Flores-Roux 4/9/90]

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**Page 81, Exercise 3.22:**

Change both occurrences of "which" to "that" and omit the (only) comma.  
[Ernesto M. Flores-Roux 4/9/90]

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**Page 81, line 10 of section 3.3:**

Add period after "*Cholesky triangle*"  
[RT 1988]

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**Page 82, line 2:**

Change “it is it” to “it is”.  
[Hiro Minato 4/12/90]

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**Page 82, line -7:**

Change “non-negative” to “nonnegative”.  
[Ernesto M. Flores-Roux 4/9/90]

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**Page 82, line -2:**

Change  $s$  to  $S$ .  
[Ernesto M. Flores-Roux 4/9/90]

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**Page 83, expression (3.3.3):**

Insert comma between the first equation and the notation  $i < j$ .  
[Ernesto M. Flores-Roux 4/9/90]

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**Page 83, expression (3.3.4):**

Omit **begin** and **end**, and move the period to follow  $s_{ii}$  in the last line.  
[RT 4/6/90]

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**\*\*Page 85, lines -4–6:**

Should read:

In this context, it is particularly easy to compute simultaneously the regressions of a set of  $q$  responses  $Y$  on a common set of  $p$  predictors  $X$ .

[Hal Stern 5/9/88]

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**Page 86, third line after (3.4.1):**

“square” should be “squares”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 87, line 4:**

Change  $k$ -th to  $k$ th  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 88, third line after (3.4.6):**

“require” should read “requires”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 89, last line of sectino 3.4.3:**

Insert the word, “the” before “construction”  
[Ernesto M. Flores-Roux 5/9/90]

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**\*\*Page 90, displayed expressions following (3.4.8):**

The first line of the display should have the comma following the fraction instead of in the denominator. The second line of the display (defining  $s_{0j}^{(0)}$ ) should replace  $i$  on the right side by  $j$ .

[Ernesto M. Flores-Roux 5/9/90]

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**Page 90, line -2:**

Following the word “preferable”, omit the following comma and the word “then”. The correction reads, “. . . ; it is preferable to perform. . .”

[Ernesto M. Flores-Roux 5/9/90]

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**Page 91, line 8:**

“depend” should read “depends”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 91, Exercises 3.31 and 3.32:**

The font for the SWEEP and SWEEP<sup>-1</sup> operators are wrong. Also, on pages 87, 88, and 90.  
[Peter McCullagh 3/14/88]

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**Page 91, Exercise 3.37:**

Omit period after “(Dempster, 1969)”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 92, line 3:**

“ $p + 1st$ ” should read “ $(p + 1)$ -st”  
[Ernesto M. Flores-Roux 5/9/90]

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**\*\*Page 93, line 5:**

Should read: “implies that  $u = 0$  when forming  $H_k$ !”  
[Hal Stern 5/9/88]

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**Page 94, line 7:**

$S_{ik}$  should read  $s_{ik}$ .  
[Ernesto M. Flores-Roux 5/9/90]

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**\*\*Page 96–97, 5 lines above Equation (3.5.5) through line 1 of page 97:**

There is an egregious error in the exposition leading up to a formal development of the SVD. The error is in a “motivational” section and resulted from mis-transcribing the text from notes. The misstated “result” is not used anywhere else, and does not affect any subsequent development. Indeed, a careful, correct development is given in full in section 3.9.2. The text here should read as follows:

The answer to this question is (almost) affirmative. There always exists an orthogonal  $p \times p$  matrix  $V$  for which  $\tilde{X}^*V = D$ , where  $D$  is a diagonal matrix with non-negative elements. But while  $\tilde{X}^*$  has the form  $U'X$ , *this*  $U$  does not convert  $X$  into upper triangular form as before. Instead, this orthogonal transformation  $U$  transforms  $X$  so that we may write

$$\begin{aligned} Y^* &= (U'X)\beta + \epsilon^* \\ &= \tilde{X}^*(VV')\beta + \epsilon^* \\ &= \begin{pmatrix} D \\ 0 \end{pmatrix} \theta + \epsilon^*, \end{aligned} \tag{3.5.5}$$

where  $\theta = V'\beta$ .

[Alan J. Miller 7/11/88]

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**Page 97, line 12 (“... called the *singular values*...”):**

Omit the comma after  $V$   
[Ernesto M. Flores-Roux 5/9/90]

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**Page 97, line 18:**

“least-square” should be “least-squares”  
[Ernesto M. Flores-Roux 5/9/90]

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**\*\*Page 97, line -2:**

$\hat{\theta}$  should read  $\hat{\theta}_i$   
[Ernesto M. Flores-Roux 5/9/90]



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**\*\*Page 98, lines 19–21:**

These sentences should be changed to read

The matrix  $U$  in the SVD rotates and/or reflects the points in variable space. Since these operations preserve the sizes of angles, the new (reconfigured) points retain their correlation structure.

[RT 4/16/92]

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**Page 99, line 4:**

“singular values” should not be hyphenated here.

[Ernesto M. Flores-Roux 5/9/90]

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**Page 99, line -8:**

Omit comma after “that”

[Ernesto M. Flores-Roux 5/9/90]

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**Page 101, Theorem 3.5–2:**

The first line should read, “Let  $X$  be a  $p \times p$  nonsingular matrix, . . .”

[Ernesto M. Flores-Roux 5/9/90]

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**\*\*Page 102, line 13:**

the line should begin “by  $SST = |Y|^2 = SSM + SSR$ .” (The definition of SST is what’s new.)

[Ernesto M. Flores-Roux 5/9/90]

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**Page 103, line 8:**

“floating-point” needs to be hyphenated

[Ernesto M. Flores-Roux 5/9/90]

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**Page 103, Section 3.5.5:**

Omit the period after the section title

[Ernesto M. Flores-Roux 5/9/90]

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**Page 104, line 13:**

Omit “that”

[Ernesto M. Flores-Roux 5/9/90]

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**\*\*Page 104, line 25:**

The definition of  $\mathcal{D}^+$  should be transposed, that is,  $\mathcal{D}^+ = \begin{pmatrix} D^{-1} \\ 0 \end{pmatrix}'$ .

[David Scott 5/6/88]

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**Page 104, line -5:**

Change “which has” to “that has”.

[RT 4/26/90]

---

**\*\*Page 105, equation (3.5.12) and 5 lines after (3.5.12):**

Change  $U$  to  $U'$

[RT 4/21/92]

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**Page 105, throughout:**

Omit the tilde from  $\tilde{X}$

[RT 4/21/92]

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**Page 106, exercise 3.45:**

Omit the comma after  $\mathcal{R}^n$

[Ernesto M. Flores-Roux 5/9/90]

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**\*\*Page 106, exercise 3.48:**

$X^+$  should be defined as  $V(\mathcal{D}^+)U'$   
[Ernesto M. Flores-Roux 5/9/90]

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**\*\*Page 106, Exercise 3.55:**

Insert  $\sigma^2$  before  $(X'X)^+$   
[RT 4/21/92]

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**Page 109, line 6 of Comment:**

Change semicolon to colon  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 110, line 11:**

Omit period after “models”  
[Ernesto M. Flores-Roux 5/9/90]

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**\*\*Page 111, lines 12–14:**

Change “*must* reduce” to read “*cannot* increase”  
[Walter Ambrosius 4/21/92]

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**Page 112, line 8:**

Move the comma inside the quotation marks around “small”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 113, line -10:**

Insert hyphen in “*ki*-th”  
[RT 11/27/90]

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**Page 113, line -2:**

“sum of squared errors loss” should read “sum-of-squared-errors loss”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 114, line 2:**

“*index*” should be “*index*)”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page Exercise 3.59, line 2:**

Omit “that”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 116, line 5:**

Insert the word “data” after the word “adding”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 116, line -19:**

“*formulae*” should read “*formulæ*”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 117, second line after (3.7.1):**

change *i*-th to *ith*  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 117, line -18:**

omit “and” after the semicolon  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 118, line 3:**

Add space between “formulæ” and “directly”  
[*Brian Taylor, 6/88*]

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**Page 119, line 6:**

“methods” should read “method”  
[*Ernesto M. Flores-Roux 5/9/90*]

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**\*\*Page 120, line 8:**

After the word “unique,” add: “up to a choice of sign.”  
[*Peter McCullagh 3/14/88*]

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**\*\*Page 120, Second paragraph of Comment.:**

The last sentence should be replaced by “The lengths of the axes of this ellipsoid are inversely proportional to the square roots of the eigenvalues of  $A$ .”  
[*Peter McCullagh 3/14/88*]

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**Page 121, line -14:**

“singular-value” (add hyphen)  
[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 122, line 3:**

Insert period after  $\hat{\Sigma} = \hat{\Gamma}'\hat{\Lambda}\hat{\Gamma}$   
[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 123, line 6:**

“singular-value” (add hyphen)  
[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 128, line 2:**

Replace comma by semicolon at the end of the line  
[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 128, line -8:**

Change “QR” to “ $QR$ ” (for consistency)  
[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 129, lines 1 and 4 of 3.9.2:**

Hyphenate “singular value”  
[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 133, 7 lines above section 3.9.4:**

Hyphenate “singular value”  
[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 134, line -14:**

Hyphenate “singular value”  
[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 135, exercise 3.81:**

The reference to Lawson and Hanson should follow the difficulty rating.  
[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 135, last line:**

Change “that” to “then”  
[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 136, line 1:**

Change “which” to “that”.  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 141, line 21:**

GLS should read GLS  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 142, lines 2–5:**

The sentence beginning, “More generally, ...” isn’t clear. It should be replaced by: “More generally, the form of the variance function  $v(\cdot)$  may also change from iteration to iteration. For instance, it is often easiest to take  $v(\cdot) \equiv 1$  on the first iteration (only). If approximations to  $v(\cdot)$  are less expensive to compute than exact expressions, the former can be used for early iterations.”

[Peter McCullagh 11/11/91]

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**Page 142, lines 7–13:**

The order of these three sentences can leave an erroneous impression about the asymptotic variance in GLIM models. The sentences should be reordered, and the final sentence below added, to read: “Under fairly mild conditions, . . . , the matrix  $\hat{\sigma}^2(X'\hat{V}^{-1}X)^{-1}$  will be asymptotically equivalent to the variance matrix of  $\hat{\beta}$ . The method is quite generally useful in solving nonlinear estimation problems; detailed discussion is deferred to Section 4.5.6. For instance, IRLS methods are used in the GLIM computer package. Generalized linear models permit the mean  $\mu$  and the linear predictor  $\eta \equiv X\beta$  to be related by a functional relationship  $\eta = g(\mu)$ ; in this case the variance matrix of  $\hat{\beta}$  is asymptotically equivalent to  $\hat{\sigma}^2(\partial\mu/\partial\eta)'(X'\hat{V}^{-1}X)^{-1}(\partial\mu/\partial\eta)$ .”

[Peter McCullagh 11/11/91]

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**Page 142, exercise 3.90, line 2:**

Remove hyphen from “least-squares”  
[Ernesto M. Flores-Roux 5/9/90]

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**\*\*Page 143, Equation (3.11.2):**

The word “sum” should be replaced by a summation sign, so that the equation reads

$$\beta_i = \frac{1}{a_{ii}} \left( c_i - \sum_{j \neq i} a_{ij} \beta_j \right), \quad (3.11.2)$$

[David Scott 5/6/88]

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**\*\*Page 144, line 10:**

The  $LU$  decomposition referred to here should be the  $LR$  decomposition, for consistency with the rest of the book.

[Sandy Weisberg 4/12/88]

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**\*\*Page 146, Exercises 3.94 and 3.95:**

The proof in the back of the book works only if complex eigenvectors are allowed. These exercises need some work.

[RT 4/28/92]

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**\*\*Page 149, line -3:**

Replace “residuals” by “errors”.  
[Stephen Stigler 6/8/88]

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**\*\*Page 150, Equation (3.12.5):**

Insert  $\sum_{i=1}^n$  after  $\equiv$  on the right-hand side.  
[Brian Taylor, 6/88]

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**\*\*Page 150, Equation (3.12.7):**

Omit “2” from denominator on left-hand side.  
[Stephen Stigler 6/8/88]

---

**Page 150, line -2:**

Replace “exactly that” by “in the form”  
[Stephen Stigler 6/8/88]

---

**Page 151, line 6 after Equation (3.12.8):**

Add after “...LAV estimator.”:  
IRLS is examined in detail in Section 4.5.6.  
[Stephen Stigler 6/8/88]

---

**Page 159, line 6:**

Add a prime to the vector so that it now reads  $(\theta_1, \dots, \theta_p)'$   
[Sergio Chayet 4/30/92]

---

**\*\*Page 160, Exercise 4.4:**

At the end of the second sentence, insert “, where the components of  $X$  are independent random variables”  
[Sergio Chayet 4/30/92]

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**\*\*Page 164, lines 12–13 of Section 4.2.2:**

The sequence exhibits convergence of order  $\beta$ :  
provided that  $\epsilon_i \rightarrow 0$  and  $\epsilon_{i+1}/\epsilon_i^\beta \rightarrow c$   
[Stephen Stigler 6/8/88]

---

**\*\*Page 169, line 16:**

“Table 4.3.3” should read “Table 4.2.3”  
[Sandy Weisberg 4/18/88]

---

**Page 174, line 2:**

The term “finite differences” should be followed by a reference to Section 4.4.  
[Sandy Weisberg 4/18/88]

---

**\*\*Page 174:**

Should read: “will correspond to a *local* maximum ...”  
[Stephen Stigler 6/8/88]

---

**\*\*Page 179, Exercise 4.10:**

Insert  $f'(x)$  before “does not change sign”  
[Walter Ambrosius, 4/27/92]

---

**\*\*Page 180, Exercise 4.17:**

$g(\theta)$  should be  $f(\theta)$   
[Qi Zhang 4/30/92]

---

**\*\*Page 181, line -10:**

Should read: “we write  $f'(x)y$ .”  
[Hal Stern 5/9/88]

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**\*\*Page 182, line 6 of Section 4.3.2 (Clarification):**

After the sentence ending "... becomes the next iterate." add:

Equivalently, Newton-Raphson approximates  $F$  by a quadratic surface—the two-term Taylor series—and then uses the maximum or minimum on this surface as the next iterate.

[*Sandy Weisberg 4/18/88*]

---

**Page 184, line 15:**

Delete comma after  $\{h_j\}$ .

[*Brian Taylor, 6/88*]

---

**Page 188, Section 4.3.5 title:**

Change "statistical" to "statistical"

[*RT 1/8/88*]

---

**\*\*Page 189, equation (4.3.9):**

$p$  in the denominator of the first term on the right side of the equation should be  $\xi$

[*Emmanuel Lazaridis 4/30/92*]

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**Page 192, line 4 of section 4.3.5.2:**

Reference to Thisted and Efron should be 1987.

[*RT 5/10/88*]

---

**\*\*Page 192, lines 8–10:**

The indices  $k$  and  $x$  should be replaced by  $j$ , so that the lines read:

We take each  $y_j$  to have a Poisson distribution with parameter  $\lambda_j$ . A model for the Shakespearean canon presented by Thisted and Efron predicts a mean number of such words to be  $\nu_j$ . For  $j = 1, 2, \dots, 99$  we take  $\log(\lambda_j) = \log(\nu_j) + \alpha + \beta \log(j + 1)$ .

[*Sandy Weisberg 4/18/88*]

---

**Page 193, equation (4.3.18):**

Add a comma after  $\beta' x_j$

[*Ernesto M. Flores-Roux 5/9/90*]

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**Page 193, equation (4.3.20):**

Equation should end with a period.

[*Ernesto M. Flores-Roux 5/9/90*]

---

**Page 194–195, throughout both pages:**

Replace "gender" by "sex"

[*RT 5/5/92*]

---

**\*\*Page 197, line 17:**

"Section 4.3.4.1" should read "section 4.3.3.1"

[*David van Dyk 4/10/96*]

---

**\*\*Page 207, line -14:**

The phrase "whenever  $\lambda > \lambda_{min}$ " should read, "whenever  $\lambda > \max(-\lambda_{min}, 0)$ ." If  $F''$  is positive definite, then this condition is just  $\lambda > -\lambda_{min}$ .

[*Peter McCullagh 3/14/88*]

---

**\*\*Page 212, equation (4.5.5):**

Replace " $-2(A + G)$ " by " $A + G$ ".

[*Hal Stern 5/9/88*]

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**Page 213, line -9:**

Interchange space and comma after Schnabel.  
[Peter McCullagh 3/14/88]

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**Page 217, line 3 of Comment:**

“generalized linear models.” (plural).  
[RT 3/27/90]

---

**Page 217, line -3:**

Omit second right parenthesis in definition of  $w_i$ .  
[RT 3/27/90]

---

**\*\*Page 220, four lines after Section 4.5.7.2:**

“ $\beta$  is  $p \times 1$ ,” not  $p \times p$ .  
[David Scott 5/6/88]

---

**\*\*Page 224, line 14:**

The alleged hat matrix should read:  $X(X'X)^{-1}X'$ .  
[Hal Stern 5/9/88]

---

**Page 227:**

Reference to Efron and Diaconis should be to Diaconis and Efron.  
[RT 10/19/90]

---

**\*\*Page 230, line -12:**

Should read “ $E(y_i | x_{i1}) = f_{10}(x_{i1})$ .”  
[David Scott 5/6/88]

---

**Page 260, line 1:**

Add period after “... Kahaner, 1983)”  
[Brian Taylor, 6/88]

---

**Page 261, Table 5.1.1:**

Remove indentations preceding  $\mathcal{S}_n$  and  $\mathcal{C}^n$ .  
[Peter McCullagh 3/14/88]

---

**Page 262, answer 2.12:**

Capitalize reference to Algorithm 2.3.1.  
[Hiro Minato 4/2/90]

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**Page 263, answer 2.30:**

Change  $\bar{X}$  to  $\bar{x}$ . (twice)  
[Hiro Minato 4/2/90]

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**\*\*Page 265, line 13:**

Change  $|E_j|$  to  $E_j$   
[Michael Frigge 6/1/89]

---

**\*\*Page 265, lines 22–23:**

Change  $I_{j+1}$  to  $|I_{j+1}|$  in both lines.  
[Michael Frigge 6/1/89]

---

**Page 268, 7 lines above equation (5.1.10):**

Change “approximation stop” to read “approximation be stopped”  
[Brian Taylor, 6/88]

---

**\*\*Page 268, 2 lines above equation (5.1.10):**

Should read:

... and let  $h$  here denote  $(b - a)/n$ , the distance between evaluation points used to obtain  $I_j$ .  
[Brian Taylor, 6/88]

---

**Page 275, line -10:**

Should read: "step size increases"

[Michael Frigge 6/8/89]

---

**Page 276, line 2 of section 5.2.2:**

Change "which" to "that"

[RT]

---

**\*\*Page 289, line 18:**

Change the reference from "Press, Flannery, Teukolsky, and Vetterling (1986)" to "Piessens, de Doncker-Kapenga, Überhuber, and Kahaner (1983)"

[John Bennett, 5/28/93]

---

**\*\*Page 295, Equation (5.5.2):**

Should read:  $x_1 \leq x < x_2$ .

[Hal Stern 5/9/88]

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**Page 297, line 16:**

Definition of periodic spline should have  $0 \leq k \leq n - 1$ .

[Hal Stern 5/9/88]

---

**Page 300, lines 1-2:**

Replace "which they produce" by "that it produces"

[RT 3/27/90]

---

**Page 307, line 2:**

Update Shaw reference to 1988 *Annals of Statistics* paper.

[RT 3/27/90]

---

**Page 313, line 6 of section 5.7.4:**

Update Evans and Swartz (1986) to (1988b).

[RT 11/7/91]

---

**\*\*Page 314, line 8:**

Add the following paragraph after the existing first paragraph:

For  $\mu = 0$  and  $k = 2$ , the positive orthant probability is  $\arccos(-\rho/2\pi)$ , where  $\rho$  is the correlation coefficient. For  $\mu = 0$ ,  $k = 3$ , and correlations  $\rho_{ij}$ , the positive orthant probability is  $[\arccos(-\rho_{12}) + \arccos(-\rho_{13}) + \arccos(-\rho_{23}) - \pi]/(4\pi)$ . (Reference: Plackett, R. L. (1954). "A reduction formula for normal multivariate integrals," *Biometrika* **41**, 351-360.)

[RT 1989]

---

**\*\*Page 314, line 16:**

Add the following paragraph after the existing paragraph:

For  $\mu \neq 0$  and  $k = 2$ , algorithms are available. Donnelly (1973) gives an algorithm that permits computation of bivariate probabilities over rectangular regions. (Reference: Donnelly, T. G. (1973). "Algorithm 462: Bivariate normal distribution," *Communications of the ACM*, **16**, 638.)

[RT 1989]



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**Page 314, line 17:**

Update Evans and Swartz reference to (1988a).  
[RT 11/7/91]

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**Page 319, Problem 5.76:**

The problem should refer to expression (5.8.6), not (5.8.5).  
[Hal Stern 5/9/88]

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**\*\*Page 326, Equation 5.9.9:**

The third term in the continued fraction should read

$$\frac{-2 \cdot 3}{x^2 + 7}$$

[Peter McCullagh 3/14/88]

---

**Page 333, line -8:**

Delete “the that of”  
[Brian Taylor, 6/88]

---

**Page 334, line above equation (5.10.15):**

The line should read:  
smaller  $n$ ; it is given by the slightly more complicated formula  
[RT 1/28/88]

---

**\*\*Page 334, Equation (5.10.15):**

Insert  $\pm$  in front of right-hand side of the equation  
[RT ]

---

**\*\*Page 346, Equation (6.2.5):**

Summation is over  $j \in N_i$ , not  $j \in N_I$ .  
[Hal Stern 5/9/88]

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**Page 347, line -1:**

Italicize “smoothers” at end of sentence.  
[Ernesto M. Flores-Roux 4/6/90]

---

**Page 351, line 9:**

Change “Methods which” to “Methods that”  
[RT 11/20/91]

---

**\*\*Page 351, line -16:**

“posterior mean value” should read “posterior mode”  
[Mark Levenson, 11/20/91]

---

**Page 360, line -9:**

Delete the word “a” before “measurements”  
[Ernesto M. Flores-Roux 4/6/90]

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**Page 360, line -3:**

Should read: “The hazard function . . . .”  
[Hal Stern 5/9/88]

---

**Page 361, line 1:**

Should read: “. . . then we write . . . .”  
[Zettel, 8/89]

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**\*\*Page 367, Answer to 3.55:**

$V(\hat{\beta})$  should be  $\text{Var}(\hat{\beta})$ ;  $V(X+Y)$  should be  $\text{Var}(X+Y)$ ; insert  $\sigma^2$  after the second, third, fourth, and fifth equality signs

[RT 4/21/92]

---

**\*\*Page 373, Answer to 4.16:**

Add a citation to Ferguson, Thomas S. (1978), "Maximum likelihood estimates of the parameters of the Cauchy distribution for samples of size 3 and 4," *Journal of the American Statistical Association*, **73**, 211–214. Ferguson derives closed-form expressions for the joint maximum likelihood estimates of location and scale in Cauchy samples of size 3 and 4, and conjectures that no such expressions exist for larger sample sizes.

[Stephen Stigler 6/8/88]

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**\*\*Page 373, Answer to 4.16:**

Also, possibly of interest is Z. D. Bai and J. C. Fu (1987), "On the maximum-likelihood estimator for the location parameter of a Cauchy distribution," *Canadian Journal of Statistics*, **15**, 137–146. [RT hasn't yet read this one.]

[RT 3/27/90]

---

**\*\*Page 380, Answer to 5.7:**

Change  $f(x-1)$  to  $f(x_1)$

[Brian Taylor, 6/88]

---

**\*\*Page 381, Answers to 5.14–5.16:**

The estimate  $\hat{k}_{n-1}$  is all wet (or mostly so, anyway). If we assume that the error at stage  $i$  and step size  $h_i$  is  $ch_i^k$ , then  $\rho_i \equiv (I_n - I_{n-1})/(I_n - I_{n-2}) = 1/(2^k + 1)$ , assuming that  $h_i = h_{i-1}/2$ . This leads to the estimate  $\hat{k} = \log_2(\rho_i^{-1} - 1)$  instead of the cited estimate  $-\log_2(\rho_i)$ . This changes the numerical results, making the empirical estimates much closer to the true values.

[Nicholas J. Higham, 3/20/90]

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**Page 390, Entry for Bentley and Cooke:**

Year of publication was 1973, not 1974.

[Susan Groshong 9/26/88]

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**Page 391, Reference to Björck:**

Change Björck to Björck

[RT 1988]

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**\*\*Page 392:**

Reference to (Cody, *et al*, 1984) found on pages 37 and 59 is missing from references. Reference should be Cody, W. J., *et al* (1984). A proposed radix- and word-length-independent standard for floating-point arithmetic. *IEEE Micro*, **4**, 86–100.

[RT ]

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**Page 395:**

Evans and Swartz (1986) technical report was published. The reference is (1988a), *Journal of Statistical Computation and Simulation*, **30**, 117–128.

[RT 11/7/91]

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**Page 395:**

Evans and Swartz (1987) article in press was published in later year. The reference is (1988b), *SIAM Journal of Scientific and Statistical Computing*, **9**, 950–961.

[RT 11/7/91]

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**Page 404, Entry for Press, et al:**

Add a comma after “William H.”  
[RT 1989]

---

**Page 406, Shaw entry:**

Technical report has appeared as Shaw (1988) *Annals of Statistics*, **16**, 895–914.  
[RT 1988]

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**Page 408, Thisted (1987):**

“resgression” should be “regression”  
[RT 9/13/90]

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**Page 416, Entry for Gauss, Carl Friedrich:**

Add entry for page 117.  
[Stephen Stigler 6/8/88]

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**Page 417, column 1, line -3:**

Change “Green, P. J.” to “Green, Peter James”. Also, omit second citation of page 219.  
[RT 1989]

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**Page 417, column 2, line 21:**

Interchange references to pages 391 and 398 for Hastie entry.  
[RT 1989]

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**\*\*Page 419, column 2, line 30:**

Change entry for LR decomposition to “75–76.”; Add entry “LU decomposition  $\equiv$  LR decomposition.”  
[RT 1989]

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**Page 423, column 2, line -13:**

Insert page number 25 into self-referential entry.  
[RT 4/4/88]

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**Page 424:**

Change “Singular value decomposition” to “Singular-value decomposition”  
[Ernesto M. Flores-Roux 5/9/90]

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**Page 425, column 2, line 13.5:**

Insert entry: “Thisted, Linda Jeane Soder, v.”  
[RT 1/8/88]

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**Page 426, Index entry for Walker, Isabelle:**

Change to “Isabelle Margaret”  
[RT 1/8/88]

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**Page 426, Index entry for Wallace, David:**

Change “Lew” to “Lee”  
[RT 11/8/91]

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