Errata:
An Introduction to Optimization, Second Edition
by
Edwin K. P. Chong and Stanislaw H. Żak

February 15, 2009

Typos and minor changes (1st printing only)

- p. 19, Exercise 2.6 Hint: Change “Triangle” to “triangle” (lower-case “t”).
- p. 80, third line: Change “signal to interference ratio” to “signal-to-interference ratio” (add hyphens).
- p. 129, six lines from bottom: Put a space between “218,” and “219” (after the comma).
- p. 133, second-last displayed equation, after “Combining the above ...”: The correct inequality should read:

$$\|\boldsymbol{x}^{(k+1)} - \boldsymbol{x}^*\| \geq \sqrt{(1-\gamma_k)\frac{\lambda_{\min}(\boldsymbol{Q})}{\lambda_{\max}(\boldsymbol{Q})}}\|\boldsymbol{x}^{(k)} - \boldsymbol{x}^*\|.$$

- p. 138, Exercise 8.17, append the following to the end of the exercise: “(assuming the gradient exists)”.
- p. 149, Exercise 9.1, part b, change the first sentence to: “Let $y^{(k)} = |x^{(k)} - x_0|$, where $x^{(k)}$ is the kth iterate in Newton’s method.”
- p. 165, Exercise 10.7, part c: Change “explicitly” to “analytically”.
- p. 167, second last line: Change “$+$” to “$-$” in front of α.
- p. 168, first line: Add a “$-$” in front of $\boldsymbol{F}$.
- p. 175, Example 11.2, first line: Change “turns that” to “turns out that” (add “out”).
- p. 185, Exercise 11.2, third line: Change “$\mathbb{R}^{n\times n}$” to “$\mathbb{R}^{2\times 2}$”.
- p. 186, Exercise 11.7, part b: Change “$\boldsymbol{H}_0 > 0$” to “$\boldsymbol{H}_0^{DFP} > 0$ and $\boldsymbol{H}_0^{BFGS} > 0$”.
- p. 188, six lines from bottom: Change “a n-dimensional” to “an n-dimensional”.
- p. 190, 11 lines from bottom: change “matrix if often” to “matrix is often”.
- p. 258, Table 15.1: The entry for column X_4 and row “boxes of material B” should be 12 instead of 2.
- p. 263, 11 lines from bottom, displayed equation for matrix $\boldsymbol{A}$: Remove all instances of p_i in the matrix ($i = 1, \ldots, n$).

- p. 282, line 11: Add "the" between "than" and "value" (should be "than the value").
- p. 285, Exercise 15.9: Change the two occurrences of "`lp`" to "`linprog`" (the Matlab function `lp` is now obsolete).
- p. 293, line 16: Change "then it also" to "then it is also" (add the word "is").
- p. 293, 9 lines from bottom: Change "a $m \times (n-m)$ matrix" to "an $m \times (n-m)$ matrix".
- p. 303, 10 lines from bottom: Change "a $m \times (n-m)$ matrix" to "an $m \times (n-m)$ matrix".
- p. 304, line 17 and p. 305, line 11: Add "function" after "objective".
- p. 311, line 3: Add "of" between "columns" and "$\boldsymbol{A}$".
- p. 311, displayed matrix in the lower-half of the page: change the three occurrences of y_{iq} to y_{pq}.
- p. 327, first line of Phase II: Add the following sentence as the first sentence: "Because phase I terminated with optimal objective function value 0, we proceed with phase II."
- p. 330, three lines from bottom: Change "a $m \times n - 2m$ matrix" to "an $m \times (n-2m)$ matrix".
- p. 356, Section 18.4.5, line 3: Add a comma between "C" and "and" (should be "A, B, C, and D").
- p. 360, line 9: Add a comma between "[38]" and "[52]".
- p. 374, line 3: Change the displayed equation to

$$T(\boldsymbol{x}^*) = \{\boldsymbol{y} \in \mathbb{R}^n : \boldsymbol{x}^T \boldsymbol{y} = 0 \text{ for all } \boldsymbol{x} \in N(\boldsymbol{x}^*)\}.$$

- p. 386, line 13: Change "a $\boldsymbol{x}^*$" to "an $\boldsymbol{x}^*$" (it just sounds better this way!).
- p. 398, third displayed equation from bottom: Change "$\mu_p^*(\boldsymbol{x}^*)$" to "$\mu_p^*$" (remove "$(\boldsymbol{x}^*)$").
- p. 403, line 3: Change "can can" to "can".
- p. 419, two lines above Section 21.2: add "in" at the end of the line after "role".
- p. 467, add the following index entry: "Huang family, 186".

Typos and minor changes (All printings)

- p. 10, first displayed equation: a_{m2} and a_{2n} should be swapped.

- p. 23, discussion involving $\boldsymbol{T}$ at the bottom half of the page and the top of the following page: To be consistent with the definition of $\boldsymbol{T}$ on p. 21, the matrix $\boldsymbol{T}$ on p. 23 should be $\boldsymbol{T}^{-1}$, so that the role of $\boldsymbol{T}$ and $\boldsymbol{T}^{-1}$ should be swapped. Specifically, we should let $\boldsymbol{T} = [\boldsymbol{v}_1, \boldsymbol{v}_2, \ldots, \boldsymbol{v}_n]^{-1}$, and the part of the paragraph following "Then," should read as follows.

$$\begin{aligned}
\boldsymbol{TAT}^{-1} &= \boldsymbol{TA}[\boldsymbol{v}_1, \boldsymbol{v}_2, \ldots, \boldsymbol{v}_n] \\
&= \boldsymbol{T}[\boldsymbol{Av}_1, \boldsymbol{Av}_2, \ldots, \boldsymbol{Av}_n] \\
&= \boldsymbol{T}[\lambda_1\boldsymbol{v}_1, \lambda_2\boldsymbol{v}_2, \ldots, \lambda_n\boldsymbol{v}_n] \\
&= \boldsymbol{TT}^{-1}\begin{bmatrix} \lambda_1 & & & 0 \\ & \lambda_2 & & \\ & & \ddots & \\ 0 & & & \lambda_n \end{bmatrix} \\
&= \begin{bmatrix} \lambda_1 & & & 0 \\ & \lambda_2 & & \\ & & \ddots & \\ 0 & & & \lambda_n \end{bmatrix},
\end{aligned}$$

because $\boldsymbol{TT}^{-1} = \boldsymbol{I}$.

- p. 41, four lines from bottom: Change "$\boldsymbol{b} \in \mathbb{R}^n$" to "$\boldsymbol{b} \in \mathbb{R}^m$" (the superscript should be changed from n to m).

- p. 53, displayed equation involving $(\boldsymbol{J}_r(\lambda))^k$ in the middle of the page: change the equation to:

$$(\boldsymbol{J}_r(\lambda))^k = \begin{bmatrix} \lambda^k & \binom{k}{k-1}\lambda^{k-1} & \cdots & \binom{k}{k-r+1}\lambda^{k-r+1} \\ 0 & \lambda^k & \cdots & \binom{k}{k-r+2}\lambda^{k-r+2} \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \lambda^k \end{bmatrix},$$

- p. 60, first displayed equation, second line: Should read

$$D(\boldsymbol{x}^T\boldsymbol{Ax}) = \boldsymbol{x}^T(\boldsymbol{A} + \boldsymbol{A}^T) \quad \text{if } m = n.$$

(Add "if $m = n$.")

- p. 60, last line: Change k to c; it should read $h(t) = f(\boldsymbol{g}(t)) = c$.

- p. 80, first displayed equation: Exchange the numerator and denominator. The correct equation should read:

$$f(x) = \frac{1 + (2 - x)^2}{1 + x^2}.$$

- p. 80, second and third displayed equations: The correct equations should read:

$$\begin{aligned} f'(x) &= \frac{-2(2-x)(1+x^2) - 2x(1+(2-x)^2)}{(1+x^2)^2} \\ &= \frac{4(x^2-2x-1)}{(1+x^2)^2}. \end{aligned}$$

- p. 85, Exercise 6.7: In both parts a and b, change "$[x_1, x_1]$" to "$[x_1, x_2]$" (the subscript "1" in the second component should be changed to "2").
- p. 125, 8th line in the proof of Theorem 8.1: Change "∞" to "$-\infty$" ($\log(0)$ is taken to be $-\infty$).
- p. 135, Exercise 8.5, second displayed equation: Change "$\boldsymbol{x}^k$" to "$\boldsymbol{x}^{(k)}$" (parentheses missing).
- p. 136, Exercises 8.8 and 8.10: Change $x^{(k+1)}$ to x_{k+1}, $x^{(k)}$ to x_k, and $x^{(0)}$ to x_0 (to be consistent with the notation for indices of scalar quantities).
- p. 148, line 7: The displayed equation should be

  $$\sum_{i=1}^{m} r_i(\boldsymbol{x}) \frac{\partial^2 r_i}{\partial x_k \partial x_j}(\boldsymbol{x}),$$

  (add "$\sum_{i=1}^{m}$" to the front).
- p. 158, first line: Change $\mathbf{0}$ to $\mathbf{0}^T$.
- p. 170, Theorem 11.1, last sentence: Change $0 \leq i \leq k+1$ to $0 \leq i \leq k$.
- p. 180, line 17: Change $-\alpha_k \boldsymbol{g}^{(k)T} \boldsymbol{H}_k \boldsymbol{g}^{(k)}$ to $\alpha_k \boldsymbol{g}^{(k)T} \boldsymbol{H}_k \boldsymbol{g}^{(k)}$ (i.e., delete the negative sign).
- p. 217, Exercise 12.17: In the first line, change "$m \leq n$, rank $\boldsymbol{A} = m$" to "$m \geq n$, rank $\boldsymbol{A} = n$."
- p. 241, just above Figure 14.3: Put a period at the end of the sentence.
- p. 318, Exercise 16.9: Remove part b, and change part c to part b.
- p. 336, Exercise 17.11: Change "maximize" to "minimize" in the second line.
- p. 336, Exercise 17.16, first sentence: Remove "and $\boldsymbol{b}$ a given vector" (after the comma).
- p. 376, displayed equation in middle of page: $h(x)$ should be $h(x^*)$.
- p. 378, four lines from bottom: Insert a period at the end of the sentence.
- p. 403, line 17: Remove one of the occurrences of "function" in "function function".
- p. 404, line 5: After "Theorem 20.1" add ", except for the reversal of the inequality constraint".

- p. 424, line 5: Change "theorem" to "proposition" (referring here to Proposition 21.1).

Other Changes

- p. 58, after last line: Add the following parenthetical sentence: "(The notation $\frac{\partial^2 f}{\partial x_i \partial x_j}$ represents taking the partial derivative of f with respect to x_j first, then with respect to x_i.)"

- p. 130, second paragraph: We should expand this discussion by including definitions of sublinear, linear, and superlinear convergence (with index entries for these terms). Here is a proposed revision:

  > ... If $p = 1$ (first-order convergence) and $\lim_{k\to\infty} \|\boldsymbol{x}^{(k+1)} - \boldsymbol{x}^*\|/\|\boldsymbol{x}^{(k)} - \boldsymbol{x}^*\| = 1$, we say that the convergence is *sublinear*. If $p = 1$ and $\lim_{k\to\infty} \|\boldsymbol{x}^{(k+1)} - \boldsymbol{x}^*\|/\|\boldsymbol{x}^{(k)} - \boldsymbol{x}^*\| < 1$, we say that the convergence is *linear*. If $p > 1$, we say that the convergence is *superlinear*. If $p = 2$ (second-order convergence), we say that the convergence is *quadratic*.

- p. 175, paragraph before Example 11.2: We give the impression here that for the rank one algorithm, the problem with $\boldsymbol{H}_{k+1}$ not being positive definite arises only in the case of non-quadratic objective functions. This is not the case, as one can easily check by applying the rank one algorithm to the problem in Example 11.3. The paragraph needs to be revised to clarify this point. Here is a proposed revision:

  > Unfortunately, the rank one correction algorithm is not very satisfactory for several reasons. First, the matrix $\boldsymbol{H}_{k+1}$ that the rank one algorithm generates may not be positive definite (see Example 11.2 below) and thus $\boldsymbol{d}^{(k+1)}$ may not be a descent direction. This happens even in the quadratic case (try applying the rank one algorithm to the problem in Example 11.3). Furthermore, if
  >
  > $$\Delta \boldsymbol{g}^{(k)}(\Delta \boldsymbol{x}^{(k)} - \boldsymbol{H}_k \Delta \boldsymbol{g}^{(k)})$$
  >
  > is close to zero, then there may be numerical problems in evaluating $\boldsymbol{H}_{k+1}$.

- p. 246, middle of the page: Add the following example in the list of two examples following "For example": $l(**1*) = 0$.

- p. 429, Lemma 21.2 and Theorem 21.6: Change the first sentence to: "Let $f : \Omega \to \mathbb{R}$ be a convex function defined on the convex set $\Omega \subset \mathbb{R}^n$, and $f \in \mathcal{C}^1$ on an open convex set containing Ω."