Handbook of Linear Algebra, 2nd Edition
Errata List

June 1, 2024

Changes are shown in red. Minor grammatical/spelling corrections do not appear on this list unless they could cause confusion.

Ch. 0 p. 0-2. The definition of closed half plane should be:

The **closed left half-plane** $\mathbb{C}_0{}^-$ is $\{z \in \mathbb{C} : \mathrm{re}(z) \leq 0\}$.

Ch. 0 p. 0-4. The definition of the gradient should be:

The **gradient** $\nabla f(x_1, \ldots, x_m)$ is the n-vector valued function with ith coordinate $\frac{\partial f}{\partial x_i}$.

Ch. 0 p. 0-7. The definition of **big-theta** is wrong. It should be:

f is $\Theta(g)$ (**big-theta** of g) if f is both $O(g)$ and $\Omega(g)$, i.e., there exist constants $c, C, k > 0$ such that $c|g(x)| \leq |f(x)| \leq C|g(x)|$ for all $x \geq k$.

Ch. 1 p. 1-4, line 2. This line should be:

and a **column vector**, respectively, and they belong to $F^{1\times n}$ and $F^{n\times 1}$, respectively.

Ch. 1 p. 1-10, line 2. This line should be:

in the same variables, such as $\begin{array}{l} a_{11}x_1 + \cdots + a_{1p}x_p = b_1 \\ a_{21}x_1 + \cdots + a_{2p}x_p = b_2 \\ \cdots \\ a_{m1}x_1 + \cdots + a_{mp}x_p = b_m \end{array}$. A **solution** of the system is a p-tuple

Ch. 1 p. 1-10, line 8. This line should be:

For the system $\begin{array}{l} a_{11}x_1 + \cdots + a_{1p}x_p = b_1 \\ a_{21}x_1 + \cdots + a_{2p}x_p = b_2 \\ \cdots \\ a_{m1}x_1 + \cdots + a_{mp}x_p = b_m \end{array}$, the $m \times p$ matrix $A = \begin{bmatrix} a_{11} & \cdots & a_{1p} \\ \vdots & \ldots & \vdots \\ a_{m1} & \cdots & a_{mp} \end{bmatrix}$ is the

Ch. 2 p. 2-11, line 7. This line should be:

are the scalar coefficients $c_1, c_2, \ldots, c_n \in F$ such that $\mathbf{x} = c_1\mathbf{b}_1 + c_2\mathbf{b}_2 + \cdots + c_n\mathbf{b}_n$.

Ch. 3 p. 3-2, Example 3.1.9. The following text should have been included.

Here $\mathbf{u} \times \mathbf{w}$ denotes the cross product of $\mathbf{u}$ and $\mathbf{w}$, i.e.,

$$\mathbf{u} \times \mathbf{w} = [u_2w_3 - u_3w_2, u_3w_1 - u_1w_3, u_1w_2 - u_2w_1]^T.$$

Ch. 10 p. 10-5. The displayed equations in Fact 10.2.7 should be:

$$\rho = \max_{\mathbf{x} \gneq 0} \min_{\{i: x_i > 0\}} \frac{(P\mathbf{x})_i}{x_i} = \max_{\mathbf{x} > 0} \min_i \frac{(P\mathbf{x})_i}{x_i} = \min_{\mathbf{x} > 0} \max_i \frac{(P\mathbf{x})_i}{x_i}.$$

Note that $= \min_{\mathbf{x} \gneq 0} \max_{\{i: x_i > 0\}} \frac{(P\mathbf{x})_i}{x_i}$ should not be listed.

Ch. 10 p. 10-9, Fact 10.3.4(a) should be:

a) [Vic85] λ is a distinguished eigenvalue of P if and only if there is an access class C such that $\rho(C) = \lambda$ and $\rho(C) > \rho(C')$ for every access equivalence class C' such that $C' \neq C$ has access to C.

Ch. 10 p. 10-10. Fact 10.3.6(c) should be:

c) $\rho < \mu$ if and only if $P\mathbf{u} < \mu\mathbf{u}$ for some vector $\mathbf{u} \geq 0$.

Ch. 10 p. 10-14, Example 10.3.1. Assuming the corrected version of Fact 10.3.4(a) described above, the last sentence of should be:

Fact 4(a) and Figure 10.1 imply that the only distinguished eigenvalue of P is 2, while 1 and 2 are distinguished eigenvalues of P^T.

Ch. 11 p. 11-8, lines -12 to -11. The definition of the Kronecker product should be:
Let $A \in F^{m \times n}$ and $B \in F^{p \times q}$. Then the **Kronecker product** (sometimes called the **tensor product**) of A and B, denoted $A \otimes B$, is the $mp \times nq$ partitioned matrix

$$A \otimes B = \begin{bmatrix} a_{11}B & a_{12}B & \cdots & a_{1n}B \\ a_{21}B & a_{22}B & \cdots & a_{2n}B \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1}B & a_{m2}B & \cdots & a_{mn}B \end{bmatrix}.$$

Ch. 43 p. 43-12. Fact 43.9.2 should be:

2. (Ryser's formula) If $A = [a_{ij}]$ is an $n \times n$ matrix over a commutative ring,

$$\operatorname{per}(A) = \sum_{r=1}^{n} (-1)^{n-r} \sum_{\alpha \in Q_{r,n}} \prod_{i=1}^{n} \sum_{j \in \alpha} a_{ij}.$$

Ch. 14 p. 14-2. Fact 14.3 should be (repeated index has been deleted):

3. If φ is a $(p+q)-$linear map from $W_1 \times \cdots \times W_p \times V_1 \times \cdots V_q$ into U, then for every integer i, $1 \le i \le p$, and $\mathbf{w}_i \in W_i$, the map $\varphi_{\mathbf{w}_1,\ldots,\mathbf{w}_p}$ is a q-linear map.

Ch. 47 p. 47-3. Fact 47.1.9 should be stated for graphs, not weighted graphs (the source [But08] states the result only for graphs and the proof provided here is valid only for graphs).

Ch. 71 p. 71-3, lines -14 to -11. The definition of a multivariate normal distribution should be: Then $\mathbf{x}$ is said to follow a **(nonsingular) multivariate normal distribution** when its pdf is

$$f(\mathbf{x} : \boldsymbol{\mu}, \Sigma) = (2\pi)^{-d/2} (\det \Sigma)^{-1/2} \exp\{-\tfrac{1}{2}(\mathbf{x} - \boldsymbol{\mu})^T \Sigma^{-1} (\mathbf{x} - \boldsymbol{\mu})\},$$

where $-\infty < x_j < \infty,\ j = 1, 2, \ldots, d$.

Ch. 71 p. 71-5, lines 1–3. The definition of the likelihood function should be: the **likelihood function** is defined to be the joint pdf of the sample expressed as a function of the unknown parameters, namely,

$$L(\boldsymbol{\mu}, \Sigma) = \prod_{i=1}^{n} f(\mathbf{x}_i; \boldsymbol{\mu}, \Sigma).$$

Ch. 77 p. 7-2, lines 1–2. The definition of the impulse response should be:

The **impulse response** of a linear time-invariant system is the output $\boldsymbol{h}$ that results from applying as input the unit impulse $\boldsymbol{\delta}$ where $\delta(0) = 1$ and $\delta(k) = 0$ for $k \neq 0$.