Errata for First Printing

January 18, 2018

All of the following corrections are for Stephan Ramon Garcia and Roger A. Horn, A Second Course in Linear Algebra, ISBN 978-1-107-10381-8, first printing, 2017.

1. Chapter 1, p. 32. In line 1 of \textbf{P.1.15}, “sin 2n\pi t” should be “sin nt”

2. Chapter 2, p. 52. \textbf{P.2.16} part (c) should be “(c) Prove that \( \text{dim} \mathcal{V} \leq n^2 - 1 \).”

3. Chapter 2, p. 53. \textbf{P.2.16} part (e) should be “(e) Find a basis for \( \mathcal{V} \) and show that \( \mathcal{V} = \text{ker} \, \text{tr} \).”

4. Chapter 2, p. 53. At the end of the first line of \textbf{P.2.18}, insert the sentence “Suppose that \( \mathcal{U} \neq \{0\} \) and \( \mathcal{U} \neq \mathcal{W} \).”

5. Chapter 2, p. 53. Following the display (2.6.1), delete the sentence “This identity is used in P.3.25.” and insert in its place “(e) Show that the identity (2.6.1) is valid even if \( \mathcal{U} = \{0\} \) or \( \mathcal{U} = \mathcal{W} \).”

6. Chapter 3, p. 76. In \textbf{P.3.5}, part (b) “ordinary Gaussian elimination” should be “standard row-wise Gaussian elimination”

7. Chapter 3, p. 79. In the display (3.7.8), delete “rank \( A \)” so that the display becomes

\[ \text{rank} \, AB = \text{rank} \, B - \text{dim}(null \, A \cap \text{null} \, B). \]

8. Chapter 3, p. 79. Delete line 4, which is the sentence “Use this identity to prove the two inequalities in (3.3.6).” immediately following the display (3.7.8).

9. Chapter 3, p. 79. In \textbf{P.3.29}, the first display should be

\[
\begin{bmatrix}
I_n & -A \\
B & I_m
\end{bmatrix}
\]

10. Chapter 3, p. 79. The display (3.7.11) should be

\[ \det(I_n + AB) = \det(I_m + BA), \]
11. Chapter 4, p. 101. In the second line of P.4.28, \((2|u_1|^2 + 5|u_2|^2)^{1/2}n\) should be \((2u_1^2 + 5u_2^2)^{1/2}n\).

12. Chapter 5, p. 107. At the end of the first line of Lemma 5.3.10, \(v_1, v_2, \ldots, v_n \in V\) are" should be "\(v_1, v_2, \ldots, v_n \in V\) are nonzero and"

13. Chapter 5, p. 120. In P.5.2, "\(M_{m \times n}(F)\)" should be "\(M_n(F)\)"

14. Chapter 5, p. 120. In P.5.4, "(b) Describe how to use the equation \(x_q = 0\) to compute" should be "(b) Describe how to compute".

15. Chapter 5, p. 121. The line following the display (5.9.1) in P.5.6, should be "for all \(a_1, a_2, \ldots, a_n \in F\) and all \(v \in V\)."

16. Chapter 5, p. 121. In the first sentence of P.5.11, "Let \(V = C[0, 1]\)," should be "Let \(V = C[0, 1]\),"

17. Chapter 5, p. 122. In the second line of P.5.14, "(a) Evaluate \(\phi(w)\) and \(\|w\|\)" should be "(a) Show that \(\phi(w) = \|w\|^2\) ."

18. Chapter 5, p. 122. In the last line of P.5.17, "for all functions of the form" should be "for all functions \(f : \mathbb{R} \rightarrow \mathbb{R}\) of the form"

19. Chapter 5, p. 123. In the last line of P.5.23, "orthonormal basis (see P.4.15)." should be "orthonormal basis."

20. Chapter 6, p. 145. In the first line of P.6.22, "Let \(x, y \in \mathbb{F}^n\) and suppose" should be "Let \(x, y \in \mathbb{R}^n\) and suppose"


22. Chapter 6, p. 145. In the second line of P.6.24, "Show that \(U_wX = X - \left[ \langle x_1, u \rangle u \quad \langle x_2, u \rangle u \quad \cdots \quad \langle x_n, u \rangle u \right]\)." should be "Show that \(U_wX = X - 2 \left[ \langle x_1, u \rangle u \quad \langle x_2, u \rangle u \quad \cdots \quad \langle x_n, u \rangle u \right]\)."

23. Chapter 6, p. 146. In the third line of P.6.35, "Why is \(r_{ij} = 0\) if \(i > j\)?" should be "Why is \(\text{span}\{a_1, a_2, \ldots, a_j\} \subseteq \text{span}\{q_1, q_2, \ldots, q_j\}\) for each \(j = 1, 2, \ldots, n\)? Discuss the case of equality."

24. Chapter 6, p. 146. The display in P.6.38 should be

\[
F_n^2 = \frac{1}{n} \left[ \sum_{k=1}^{n} (\omega^{i+j-2})^{k-1} \right]_{i,j=1}^{n} = \left[ \begin{array}{cc} 1 & 0 \\ 0 & K_{n-1} \end{array} \right];
\]

25. Chapter 7, p. 154. In the display following (7.2.8), there is too much space between the first and second rows of the first array, which is the matrix \(A\).
26. Chapter 7, p. 154. In the display preceding (7.2.9), there is too much space between the first and second rows of the array, which is the matrix AA*.

27. Chapter 8, p. 188. In the line above (8.4.6), “divide by \(\|x\|_\infty\)” should be “divide by \(x_k\)”

28. Chapter 8, p. 188. The display (8.4.6) should be

\[
\lambda - a_{kk} = \sum_{j \neq k} a_{kj} \frac{x_j}{x_k}.
\]

29. Chapter 8, p. 188. The display (8.4.7) should be

\[
|\lambda - a_{kk}| = \left| \sum_{j \neq k} a_{kj} \frac{x_j}{x_k} \right| \leq \sum_{j \neq k} |a_{kj}| \left| \frac{x_j}{x_k} \right| \leq \sum_{j \neq k} |a_{kj}| = R'_k(A)
\]

30. Chapter 8, p. 196. In line 11, “up to a nonzero scalar,” should be “up to a nonzero scalar factor.”

31. Chapter 8, p. 197. In line 1 of P.8.6, “Suppose that \(A \in M_n(\mathbb{R})\)” should be “Suppose that \(A \in M_n(\mathbb{R})\) and \(k \geq 1\).”

32. Chapter 8, p. 198. In line 1 of P.8.9, “If \(v\) is orthogonal to \(e\),” should be “If \(v\) is nonzero and orthogonal to \(e\),”

33. Chapter 8, p. 198. In line 1 of P.8.14, “Suppose that \(a_{ij} \neq 0\)” should be “Suppose that \(n \geq 2, a_{ij} \neq 0\)”

34. Chapter 8, p. 199. In lines 6-9 of P.8.25, delete all of the text “(b) If \(m \geq 2\) . . . the second column.” and replace it with “(b) If \(j \geq 2\) then \(y_j\) has the entry 0 in position \(i_k\) for each \(k < j\), and (c) \(\|y_j\|_\infty = 1\). Hint: Let \(i_1\) be the index of any largest-modulus entry of \(x_1\). Let \(y_1 = x_1/\|x_1\|_\infty\) and add suitable scalar multiples of \(y_1\) to \(x_2, x_3, \ldots, x_m\) to obtain columns that have a 0 entry in position \(i_1\). Repeat, starting with the second column.”

35. Chapter 9, p. 216. In the first line of P.9.1, “Is there an \(A \in M_5\)” should be “Is there a \(B \in M_5\)”

36. Chapter 9, p. 217. In the first line of part (c) P.9.11, “why are \(-\lambda\) and \(\hat{\lambda}\) also eigenvalues” should be “why are \(-\lambda, \hat{\lambda}, \) and \(-\hat{\lambda}\) eigenvalues”

37. Chapter 9, p. 217. In the first line of part (d) P.9.11, “are the eigenvalues of \(C\), explain why the” should be “are the \(2n\) eigenvalues of \(C\), explain why the”

38. Chapter 9, p. 218. In line 3, which is the penultimate line of P.9.12, “(1,1) and (1,2)” should be “(1,1) and (2,1)”
39. Chapter 10, p. 234. In line -5, “integers $q_i$ so that $m_{A_i}$” should be “integers $q_i$ such that $m_{A_i}$.”
40. Chapter 10, p. 241. In line -7, which is part (a) of P.10.40, “$A^\top \otimes I_m - I_m \otimes B$” should be “$I_m \otimes A - B^\top \otimes I_m$”
41. Chapter 10, p. 241. In line -5, which is part (b) of P.10.40, “$A^\top \otimes I_m - I_m \otimes B$” should be “$I_m \otimes A - B^\top \otimes I_m$”
42. Chapter 10, p. 241. In line -3, which is part (c), of P.10.40, “$\text{spec } A \cap \text{spec } (-B) = \emptyset$” should be “$\text{spec } A \cap \text{spec } B = \emptyset$”
43. Chapter 11, p. 271. In line 2, which is the display in P.11.2, the display should be
$$J_{k+1} = \begin{bmatrix} e_2^\top & 0 \\ J_k & e_{k-1} \end{bmatrix} = \begin{bmatrix} J_k & e_k \\ 0^\top & 0 \end{bmatrix}.$$ 
44. Chapter 11, p. 271. In the first line of P.11.13, “$A \in M_{pq}$” should be “$A \in M_{pq}$ is nilpotent.”
45. Chapter 11, p. 271. In lines -3, -4, which is the last sentence in P.11.13, delete the sentence “For a special case of this phenomenon, see Example 11.9.6.”
46. Chapter 11, p. 272. Lines 1-2, which are parts (a) and (b) of P.11.14 should be “(a) Show that the (1,2) block of $A^k$ is $\sum_{j=0}^{k-1} B^j C D^{k-j-1}$. (b) Prove that $A$ is nilpotent, with index at most $q_1 + q_2$.”
47. Chapter 11, p. 276. In the first line of P.11.50, “symmetric (Theorem 11.8.1), show” should be “symmetric, show.”
48. Chapter 11, p. 276. In the last line of P.11.58, “$J_q(\lambda) \otimes J_p(0)$” should be “$J_p(\lambda) \otimes J_q(0)$”
49. Chapter 12, p. 299. In line 4 of P.12.16, “$\sum_i \xi_{ij} = \xi_{ij} + \overline{\mu_j} = 0$ for all $i, j$.” should be “$\sum_i \xi_{ij} = \xi_{ij} + \overline{\mu_j} = 0$ for all $i, j$.”
50. Chapter 12, p. 301. In lines 6-7 of P.12.34, part (d) should be “(d) Let $n = 3$. Show that either $A = cI + e\theta H$ as in (a), or $A = cI + rU$ as in (b).”
52. Chapter 12, p. 302. Line 3 of P.12.48 should be “$AP = PA$, which is Theorem 12.9.15.b.”
53. Chapter 13, p. 324. In the second line of P.13.22, “leading principle” should be “leading principal”
54. Chapter 13, p. 326. In the second line of P.13.47, “H(AX) = B; see Definition 12.6.6.” should be “AX + XA = B.”

55. Chapter 13, p. 326. In line 4 of P.13.48, “is positive semidefinite.” should be “is positive definite.”

56. Chapter 14, p. 343. Line 1 should be “I^2_{xx}: Show that (a) |A|U_x = |A^*|, (b) U_x U is unitary, (c) A = |A^*|(U_x U) is a polar

57. Chapter 14, p. 343. In line 3 of P.14.22, “S = PU” should be “S = |S^*|U”

58. Chapter 14, p. 344. Replace the second sentence of P.14.28 with “Show that A ⊗ B = (V ⊗ X)D(W ⊗ Y)*.”

59. Chapter 14, p. 344. Following the fourth sentence of P.14.28, which is “What are the singular values of A ⊗ B?” insert a new sentence “Exhibit a singular value decomposition of A ⊗ B.”

60. Chapter 15, p. 369. Delete the line following the display (15.9.5). This is the last line of P.15.41.

61. Chapter 15, p. 369. In the first line of P.15.44, “idempotent” should be “an involution”

62. Chapter 16, p. 393. In P.16.22, the second display should be

\[ S = \begin{bmatrix} I_k & 0 \\ -A_{12}^*A_{11}^{-1} & I_{n-k} \end{bmatrix} \in M_n. \]

63. Chapter 16, p. 394. Replace problem P.16.24 with the following: Let A, B ∈ M_n be Hermitian. If B has exactly p positive eigenvalues and 1 ≤ p ≤ n − 1, use Weyl’s inequalities to show that the increasingly ordered eigenvalues of A and A + B satisfy

\[ \lambda_i(A + B) \leq \lambda_{i+p}(A), \quad i = 1, 2, \ldots, n - p. \]

If B has exactly q negative eigenvalues and 1 ≤ q ≤ n − 1, show that

\[ \lambda_{i-q}(A) \leq \lambda_i(A + B) \quad i = q + 1, q + 2, \ldots, n. \]

64. Chapter 16, p. 395. At the end of the first line of part (c) of P.16.30, “of C_f are” should be “of C_f satisfy”

65. Chapter 16, p. 395. The first line of the display in part (c) of P.16.30 should be

\[ \sigma_1^2 = \frac{1}{2} \left( c + 1 + \sqrt{(c+1)^2 - 4|c_0|^2} \right) \]
66. Chapter 16, p. 395. The third line of the display in part (c) of P.16.30 should be
\[ \sigma_n^2 = \frac{1}{2} \left( c + 1 - \sqrt{(c + 1)^2 - 4|c_0|^2} \right) \]


68. Appendix A, p. 405. In line 4, “Re z\bar{w}” should be “Re(z\bar{w})”

69. Appendix A, p. 405. In line 5, “Re z\bar{w}” should be “Re(z\bar{w})”

70. Appendix A, p. 405. In line 8, “Re z\bar{w}” should be “Re(z\bar{w})”

71. Appendix A, p. 409. In P.A.11, “Re z^{-1}w” and “Im z^{-1}w” should be “Re(z^{-1})” and “Im(z^{-1})”, respectively.