We would also like to thank Jefferson Carpenter, James Meiss, Pasha Pylyavskyy, and Alexander Voronov for sending us suggestions and corrections to the printed text and solutions manuals.

Exercise 1.4.17 (a):
Change \((\pi(j), j)\) to \((j, \pi(j))\).

Exercise 3.3.44:
Move Exercise 3.3.44 to the exercise set in following subsection since matrix norms are not introduced until there.

Equation (3.57):
Change \(K = \begin{pmatrix} c^2 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}\) to \(K = \begin{pmatrix} c^2 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{pmatrix}\).

Equation (4.54):
Change \(\|q_6\|^2\) to \(\|q_5\|^2\).

Exercise 5.5.71 (d):
Change “Answer part (d) . . . ” to “Answer part (c) . . . ”

Exercise 6.1.8 (b):
Change “Answer Exercise 6.1.8 when . . . ” to “Answer part (a) when . . . ”

Exercise 6.1.16:
Change “Describe the mass–spring chains that gives rise to . . . ” to “Describe mass–spring chains that give rise to . . . ”

Exercise 8.4.1:
Change \(W \subset \mathbb{R}^2\) to \(W \subset \mathbb{R}^3\)

Exercise 8.6.26 (c):
Change \(\begin{pmatrix} 0 & -1 & 1 \\ 1 & 1 & -1 \\ 3 & 3 & -4 \end{pmatrix}\) to \(\begin{pmatrix} 0 & -1 & 1 \\ 1 & 1 & -1 \\ -3 & 3 & -4 \end{pmatrix}\)
There is a flaw in the proof of Theorem 8.63 as given. The argument in the text establishes the matrix equation

\[ AQ = P \Sigma. \tag{*} \]

If \( A \) has rank \( n \), then \( Q \) is an \( n \times n \) orthogonal matrix, and hence \( QQ^T = I \). Thus, multiplying equation (\( * \)) on the right by \( Q^T \) produces \( A = AQQ^T = P \Sigma Q^T \), which is the singular value decomposition (8.52).

However, if the rank \( r < n \), then \( Q \) is an \( n \times r \) matrix with orthonormal columns, hence \( Q^T Q = I \), but it is \textit{not} necessarily true that \( QQ^T = I \), and so one cannot immediately establish the singular value decomposition (8.52) from (\( * \)). Instead we proceed as follows. Let \( q_{r+1}, \ldots, q_n \) be an orthonormal basis for \( \ker A \), so

\[ A q_i = 0, \quad i = r+1, \ldots, n. \tag{+} \]

These are null eigenvectors of the symmetric matrix \( A^T A \), and hence orthogonal to its other eigenvectors, namely the singular vectors \( q_1, \ldots, q_r \). We deduce that the combined collection \( q_1, \ldots, q_n \) forms an orthonormal basis of \( \mathbb{R}^n \), and hence \( \hat{Q} = (q_1, \ldots, q_n) \), whose columns consist of the singular vectors and null eigenvectors, is an \( n \times n \) orthogonal matrix, thus satisfying \( \hat{Q}^T \hat{Q} = I = \hat{Q} \hat{Q}^T \). Moreover, the preceding two equations (\( * \), (\( + \)), can be combined into a single matrix equation

\[ A \hat{Q} = P \hat{\Sigma}, \quad \text{where} \quad \hat{\Sigma} = (\Sigma \ O) \]

is the \( r \times n \) matrix whose first \( r \) columns coincide with the diagonal \( r \times r \) singular value matrix and whose last \( n - r \) columns form an \( r \times (n - r) \) zero matrix. But now we \textit{can} multiply the latter equation on the right by \( \hat{Q}^T \), leading to

\[ A = A \hat{Q} \hat{Q}^T = P \hat{\Sigma} \hat{Q}^T = P \Sigma Q^T, \]

the final equality following because the last \( n - r \) columns of \( \hat{\Sigma} \) are zero. This proves the singular value decomposition equation (8.52) in general.

Thanks to Pasha Pylyavskyy for pointing this out to me.

\[
\begin{align*}
A^T &= Q \Sigma P^T, \quad \text{(8.56)}
\end{align*}
\]

Exercise 8.8.12:

Change \( \text{dist}(x, L) = \sum_{i=1}^{m} \text{dist}(x_i, L) \) to \( \sum_{i=1}^{m} \text{dist}(x_i, L)^2 \)
Exercise 9.6.19 (e):
Change “... the solution of the linear ...” to “... the solution to the linear ...”

Exercise 9.56:
Change “... can be found [18, 88]...” to “... can be found in [18, 88]...”

Exercise 9.7.1 (a):
Change “... coefficients $c_{j,k}$...” to “... coefficients $c_0$ and $c_{j,k}$ for $j = 0, \ldots, 3$ and $k = 0, \ldots, 2^j - 1$.”

Exercise 9.7.22:
Change $i \geq p$ to $i \geq 3$. Also change “Daubechies scaling equation” to “Daubechies dilation equation”.

Replace the final paragraph by the following:

Before explaining how to solve the Daubechies dilation equation, let us complete our discussion of orthogonality. It is easy to see that, by translation invariance of the inner product integral, since $\varphi(x)$ and $\varphi(x - m)$ are orthogonal whenever $m \neq 0$, so are $\varphi(x - k)$ and $\varphi(x - l)$ for all $k \neq l$. Next we seek to establish orthogonality of $\varphi(x - m)$ and $w(x)$. Combining the dilation equation (9.138) and the definition (9.142) of $w$, and then using (9.147, 148), produces

$$\langle w(x), \varphi(x - m) \rangle = \left\langle \sum_{j=0}^{p} (-1)^j c_{p-j} \varphi(2x - j), \sum_{k=0}^{p} c_k \varphi(2x - 2m - k) \right\rangle$$

$$= \sum_{j,k=0}^{p} (-1)^j c_{p-j} c_k \langle \varphi(2x - j), \varphi(2x - 2m - k) \rangle$$

$$= \sum_{j,k=0}^{p} (-1)^j c_{p-j} c_k \langle \varphi(x), \varphi(x + j - 2m - k) \rangle = \frac{1}{2} \sum_{k} (-1)^k c_{p-2m-k} c_k \| \varphi \|^2,$$

where the sum is over all $0 \leq k \leq p$ such that $0 \leq 2m + k \leq p$. Now, if $p = 2q + 1$ is odd, then each term in the final summation appears twice, with opposite signs, and hence the result is always zero — no matter what the coefficients $c_0, \ldots, c_p$ are! On the other hand, if $p = 2q$ is even, then orthogonality requires all $c_0 = \cdots = c_p = 0$, and hence $\varphi(x) \equiv 0$ is completely trivial and not of interest. Indeed, the particular cases $m = \pm q$ require $c_0 = c_p = 0$; with this, setting $m = \pm (q - 1)$ requires $c_1 = c_{p-1} = 0$, and so on. Thus, to ensure orthogonality of the wavelet basis, the dilation equation (9.138) necessarily has an even number of terms, meaning that $p$ must be an odd integer, as it is in the Haar and Daubechies versions (but not for the hat function). The proof of orthogonality of the translates $w(x - m)$ of the mother wavelet, along with all her wavelet descendants $w(2^j x - k)$, relies on a similar argument, and the details are left as Exercise 9.7.17.