Errata for Numerical Analysis Edition 8, First Printing

All items that are changed are noted in red.

- Page 29 Two entries in the linear systems have been interchanged They should read

a. $1.130x - 6.990y = 14.20$
$8.110x + 12.20y = -0.1370$

b. $1.013x - 6.099y = 14.22$
$-18.11x + 112.2y = -0.1376$

- Page 75 The parenthetical remark in line -7 should be deleted. Hence it should read
  - If $\alpha = 1$, the sequence is **linearly convergent**.
- In the table for Exercise 2(d) on Page 136, the value for $f'(x)$ when $x = 0.5$ should be 0.45186276.
- There is an incorrect value in the equation for c_1 in the middle of page 148, so there a number of values wrong in the remainder of this example. Given below is what should appear in the this example.

  Solving this system simultaneously for c_0, c_1, c_2 and c_3 gives

$$c_0 = \frac{1}{15}(2e^3 - 12e^2 + 42e - 59),$$
$$c_1 = \frac{1}{15}(-4e^3 + 24e^2 - 39e + 28),$$
$$c_2 = \frac{1}{15}(14e^3 - 39e^2 + 24e - 8),$$
$$c_3 = \frac{1}{15}(-7e^3 + 42e^2 - 12e + 4).$$

  Solving for the remaining constants in the same manner as Example 1 gives

$$b_0 = 1.00000000, \quad b_1 = 2.710162986, \quad b_2 = 7.326516319,$$

  and

$$d_0 = 0.2735993306, \quad d_1 = 0.6951307937, \quad d_2 = 2.019091618.$$

  The complete results are shown in Table 3.16.

  Table 3.16

j	x_j	a_j	b_j	c_j	d_j
0	0	1	1	0.44468249	0.27359933
1	1	2.718281828	2.71016299	1.26548050	0.69513079
2	2	7.389056099	7.32651634	3.35087286	2.01909162
3	3	20.08553692			

Using approximate values for the constants gives the clamped cubic spine described by the piecewise equation

$$S(x) = \begin{cases} 1 + x + 0.44468x^2 + 0.27360x^3, & \text{if } 0 \le x < 1, \\ 2.71828 + 2.71016(x-1) + 1.26548(x-1)^2 + 0.69513(x-1)^3, & \text{if } 1 \le x < 2, \\ 7.38906 + 7.32652(x-2) + 3.35087(x-2)^2 + 2.01909(x-2)^3, & \text{if } 2 \le x \le 3. \end{cases}$$

The graph of the clamped spline and $f(x) = e^x$ are so similar that no difference can be seen.

b. To approximate the integral of f on $[0, 3]$, which has the value

$$\int_0^3 e^x \, dx = e^3 - 1 \approx 20.08553692 - 1 = 19.08553692,$$

we piecewise integrate the clamped spline. As in the previous example, we can use the fact that the nodes are equally spaced to deduce that

$$\int_0^3 S(x) \, dx = (a_0 + a_1 + a_2) + \frac{1}{2}(b_0 + b_1 + b_2) + \frac{1}{3}(c_0 + c_1 + c_2) + \frac{1}{4}(d_0 + d_1 + d_2).$$

So the integral approximation is

$$\begin{aligned} \int_0^3 S(x) \, dx &= (1 + 2.71828 + 7.38906) + \frac{1}{2}(1 + 2.71016 + 7.32652) \\ &\quad + \frac{1}{3}(0.44468 + 1.26548 + 3.35087) + \frac{1}{4}(0.27360 + 0.69513 + 2.01909) \\ &= 19.05965. \end{aligned}$$

The absolute error in the integral approximation using the clamped and natural splines are

$$\text{Natural: } |19.08554 - 19.55229| = 0.46675$$

$$\text{Clamped: } |19.08554 - 19.05965| = 0.02589,$$

so for integration purposes the clamped spline is vastly superior. This should be no surprise since the boundary conditions for the clamped spline are exact, whereas for the natural spline we are assuming that, since $f''(x) = e^x$,

$$0 = S''(x) \approx f''(0) = e^1 = 1 \quad \text{and} \quad 0 = S''(3) \approx f''(3) = e^3 \approx 20. \qquad \square$$

- In Exercise 8(c) on Page 154, the item for $f'(0.1)$ should be -2.8019975.
- In Exercise 1(a) on Page 289, the differential equation should be $y' = te^{3t} - 2y$.
- In Exercise 2(c) on Page 341, the item for $y(1)$ should be 0.9999997.
- In Exercise 12(a) on Page 436, the last portion of the first line should read where $\lambda_1, \ldots, \lambda_n$ are the eigenvalues

- In Exercise 8(a) on Page 607, the first equation should be ${x_1}^2 + x_2^2 - x_1 = 0$.
- In Exercise 1(c) on Page 613, the initial values should be taken as $\mathbf{x}^{(0)} = (2, 2)^t$.
- In Exercise 2(d) on Page 613, the initial values should be taken as $\mathbf{x}^{(0)} = (1, 1, 1)^t$.
- The answer to Section 10.4 Exercise 1(b) given on Page 821, should be $\mathbf{x}^{(1)} = (0.50680304, 0.91780051)^t$.