

Typos/errors in “Numerical Methods Using Matlab, 4th edition” by Mathews and Fink

Please let me know if you disagree with any of these, or find any typos in my list of typos!

1. page 8, middle of page (the eqn with a dark square at the end of it):
After the first equality, the “ n ” in “ S_n ” should be a subscript, i.e. S_n ”.
2. page 19, right above ”Scientific Notation” about 3/4 of the way down the page:
“ $S = 8/33$ ” should be “ $S = 3/124$ ”.
3. page 25, near the bottom under Example 1.15:
In (3a), the end of the second sentence should say “approximates x to three significant digits.”
4. page 26, 60% of the way down (2 lines above the solid black box):
should say “true answer $p = 0.544987104184$ to six significant digits”, not five significant digits.
5. page 27, 2 lines below eqn (6):
“rounding the number $d_k d_{k+1} d_{k+2} \dots$ ” should be “rounding the number $d_k . d_{k+1} d_{k+2} \dots$ ”.
6. page 29, last 3 lines:
Definition 1.9 says “whenever $h \leq c$ ”, but example 1.20 has the condition “ $x \geq 1$ ”. When people talk about $O(h^n)$, sometimes they are thinking about $h \rightarrow \infty$ and sometimes about $h \rightarrow 0$. In this case, based on Theorem 1.15 on page 30, I see that the authors intend $h \rightarrow 0$. Example 1.20 is thus backwards; in fact $g(x) = O(f(x))$, rather than $f(x) = O(g(x))$, because no matter what C you choose, if you make h small enough, $|f(h)/g(h)|$ will be larger than C .
7. page 33, equation (17):
the second \hat{p} should be a \hat{q} , i.e. the second piece of the equation should be “ $(\hat{p} + \varepsilon_p)(\hat{q} + \varepsilon_q)$ ”.
8. page 34, very last line:
the “-” after the A should be a “+”, although the next term correctly has a “+” in front of the B .
9. page 35, line 4 not counting the table (the middle line of the first 3-line equation):
same as the previous mistake, the “-” after the A should be a “+”, and again the next term is correct.
10. page 44, Theorem 2.3.
Statement (7) references a fixed-point P that looks like it was only defined in (6) under the additional assumption stated in (6). It would be more clear to add under the assumptions of Theorem 2.3 the statement “Let $P \in [a, b]$ be the fixed point satisfying $P = g(P)$, which we know exists by Theorem 2.2 (3).”
11. page 44, Theorem 2.3.
There is a bigger problem with (7). It is not possible to have a function satisfying the assumptions given, i.e. $g, g' \in C[a, b]$ and $g(x) \in [a, b]$ for all $x \in [a, b]$, yet also have $|g'(x)| > 1$ for all $x \in [a, b]$. (The fact that this is impossible can be proved using the mean value theorem.) The key to solving this error lies in Remark 2; if $g'(x) > 1$ in some neighborhood of P , then P is a repelling fixed point.
12. page 48, Example 2.4, very minor typo:
Under Case (i), near the bottom of the example, it should say “Since $|g'(x)| \geq \frac{3}{2}$ ” rather than “Since $|g'(x)| > \frac{3}{2}$ ” in the closed interval $[-3, -1]$, since $g'(-1) = 3/2$. Similarly for Case (ii), it should be “ $\leq \frac{1}{2}$ ” rather than “ $< \frac{1}{2}$ ”.

13. page 59, in Program 2.2:
 Since the number of iterations (**max1**) is set, there is no need for the “**if b-a < delta, break, end**” 5 lines from the end of the function; it is redundant. Also, rather than using “**1 + round()**” to set **max1**, it would be better to simply use **ceil()** to always round up, i.e.
 $\text{max1} = \text{ceil}((\log(\text{b-a}) - \log(\text{delta})) / \log(2))$. As written, sometimes **max1** is one larger than it needs to be (specifically, in those cases where **round()** has already rounded up).
14. page 62, exercise #15:
 The condition $a_0 < 1$ and $b_0 > 3$ should not be here; that was something from exercise #14. In this exercise, we don't know where the zeros of $f(x)$ are, but we simply assume they are within the starting interval $[a_0, b_0]$.
15. page 77, lines 5-6 of text:
 The sentence “The values of $f(p_k)$ in Example 2.15 go to zero faster than the values of $f'(p_k)$, so the quotient $f(p_k)/f'(p_k)$ in formula (4) is defined when $p_k \neq p$.” The second half of the sentence is a non sequitur relative to the first half. Even if $f'(p_k)$ went to zero faster than $f(p_k)$, the quotient would still be defined when $p_k \neq p$, but in that case, the Newton-Raphson iteration would not converge, which is probably what the authors meant to say.
16. page 82, lines 4-5:
 Equation numbers are off (looks like they are from an earlier edition). They should be referring to equations (28) and (21), not (29) and (22).
17. page 82, first line of text below equation (29):
 It should refer to equation (29), not (30).
18. page 84, Program 2.6:
 One major advantage of the secant method as compared to Newton's method is that it only requires one function evaluation per iteration. The version of the program in the book has four function evaluations (via **feval**) per iteration. This can be easily fixed by defining two variables (say **fp0** and **fp1**) which contain $f(p_0)$ and $f(p_1)$ during the current iteration; and calling **feval** only once per iteration.
19. page 93, 2 lines below equation (17):
 It should say “selected from among the old $\{p_0, p_1, p_2\}$ that lie ...” rather than “ $\{p_0, p_1, p_3\}$ ”.
20. page 104, equation (21):
 It would be good to add one more equality, to make it $\mathbf{0} + \mathbf{X} = \mathbf{X} + \mathbf{0} = \mathbf{X}$, otherwise this is just a special case of equation (20).
21. page 107, equation (41):
 Same as the previous item, make this equation $\mathbf{0} + \mathbf{A} = \mathbf{A} + \mathbf{0} = \mathbf{A}$.
22. page 136, third line in (b):
 The command should be `>>[a, j]=max(abs(A(1:4, 1)))`. That is, the curly braces should actually be parentheses.
23. page 136-137, Program 3.2:
 The program as written does not catch the case where the final pivot (in row N, column N) is zero. E.g. if you let $\mathbf{A} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ the program will not recognize that it is singular. Add one more check of the final pivot after the outer **for** loop finishes, before **backsub** is called.
24. page 136-137, Program 3.2:
 If \mathbf{A} is singular, you should **return** rather than **break**. As written, if \mathbf{A} is singular, you will still go down and call **backsub**, but won't get back a meaningful result. By the way, it may also be nice to set $\mathbf{X} = \mathbf{nan}$ if \mathbf{A} is singular before returning.
25. page 158, equations (5):
 The denominator of the first equation should be 2, not 3:

$$x = \frac{-15 + y + 5z}{2}$$

The same mistake is made in equation (6).

26. page 168, equations (3):
The first equation should be $x^2 - 2x - y + 0.5 = 0$, i.e. the “ $-y$ ” is missing.
27. page 178, the function $\mathbf{F}(\mathbf{X})$ defined under the “Matlab” section:
in this section (3.7) of the text, column vectors are generally used. But this function returns a row vector, which makes it somewhat inconsistent with the mathematical notation. This also requires the transpose to be used in Program 3.7, in the line $\mathbf{Q} = \mathbf{P} - (\mathbf{J}\backslash\mathbf{Y})'$; . If the function $\mathbf{F}(\mathbf{X})$ is written to return a column vector instead, it will be more consistent with the text, and that line of Program 3.7 can be changed to the simpler $\mathbf{Q} = \mathbf{P} - \mathbf{J}\backslash\mathbf{Y}$; .
28. pages 179–180:
Program 3.6 has the line $\mathbf{A}=\text{feval}('G',\mathbf{X})$; while Program 3.7 has the lines $\mathbf{Y}=\text{feval}(\mathbf{F},\mathbf{P})$; , $\mathbf{J}=\text{feval}(\mathbf{JF},\mathbf{P})$; and $\mathbf{Z}=\text{feval}(\mathbf{F},\mathbf{Q})$; . Notice the quotes in the line from Program 3.6, and the lack of quotes in the lines from Program 3.7. As written, in Program 3.7, \mathbf{F} and \mathbf{JF} should be variables containing the names of the functions to call (as strings), or inline functions, which does not match the documentation at the beginning of the function. In Program 3.6, the function \mathbf{G} will be called (which matches the comments in the function), but this then ignores the first parameter passed to the function, making that parameter useless. I believe the behavior in Program 3.7 is better, since it lets you specify what function you want to call. Its documentation should be changed (e.g. so it is similar to Programs 2.5 and 2.6). And Program 3.6 should be changed so it calls $\mathbf{A}=\text{feval}(\mathbf{G},\mathbf{X})$; without quotes.
29. page 190, equation for $|E_{15}(1)|$ in the middle of the page:
the “ \leq ” should be an “ $=$ ” because $|f^{(16)}(c)| = e^c$.
30. page 192, the line right below equation (8):
It should say “ $M \geq \max \dots$ ”, rather than “ $M \leq \max \dots$ ” since M is supposed to be an upper bound for $f^{(N+1)}(c)$.
31. page 215, Figure 4.13:
The scale of the y axis seems to be wrong, at least for Figure 4.13(a). According to the graph, the lowest value of $y = E_2(x)$ is about -0.007 (at least, it is definitely larger than -0.008). Yet Table 4.7 on the following page (and the text below the table) indicate that $E_2(1) = -0.008416$. The table and text are right; the figure is slightly wrong. There is also something wrong if you compare Figure 4.13(b) with Table 4.7; the figure indicates that $E_3(0.6) \approx 0.0005$, while Table 4.7 shows $E_3(0.6) = 0.00089$. In this case, I believe the figure is correct and the table is wrong, as I calculated $E_3(0.6) \approx 0.0004886$.
32. page 217, Program 4.1:
To be clear, the comments at the top of the program should clearly state that \mathbf{Y} needs to be a *row* vector, because of the way it’s used in the last line of the function. (If you wanted to make the function work whether \mathbf{Y} is a row vector or column vector, change the last line of the program to be $\mathbf{C} = \mathbf{Y}(:)'\ast\mathbf{L}$; to force \mathbf{Y} into row form before using it.) Also, this is as good a place as any to point out that the indentation in many of the programs has problems; e.g. see the **end** statement just above the $\mathbf{L}(\mathbf{k},:)=\mathbf{V}$; line, which is too far to the left.
33. page 224, Table 4.8:
The right square bracket is missing from the last line of the second-to-last column.
34. page 233, equation (10):
This should have $Q(x)$, not $T(x)$, i.e. it should say:

$$\max_{-1 \leq x \leq 1} \{|Q(x)|\} = \frac{1}{2^N}.$$

35. page 235, Figure 4.16 and accompanying text:
Similar to the error on page 215. The text says the largest error in $P(x)$ is at $x = 0.75490129$ and that the error is less than 0.00998481 for all $x \in [-1, 1]$, but in Figure 4.16(a), the error near $x = 0.7549$ has magnitude larger than 0.01. I can’t tell by eye if Figure 4.16(b) has the same trouble.

36. page 266, the Matlab commands in the middle of the page:
Note that `fmins` has been replaced by `fminsearch` in newer versions of Matlab. I notice that Matlab version 6.5 still has it, although the documentation warns that it will go away soon. As of version 7.0, Matlab no longer has `fmins`.
37. page 269, second column of the second line of Table 5.6:
The first “+” should be an “=”, i.e. it should be $y = \frac{-1}{C}(xy) + \frac{D}{C}$.
38. page 269, the fourth function in Table 5.6:
The first and second column contradict each other. To be consistent and keep the linearized form looking like $Y = AX + B$, the first column should be changed. Rather than $y = \frac{x}{Ax+B}$, it should be $y = \frac{x}{Bx+A}$.
39. page 354, two lines above equation (3):
The “ $(n+1)!a_{n-1}$ ” should actually be “ $(n+1)!a_{n+1}$ ”.
40. page 436, Table 8.5:
Some students didn’t realize they need to re-sort the points after some steps. E.g. if $f(R) < f(G)$ but $f(B) < f(R)$ (so we do the first action under Case (i), i.e. “replace W with R ”), after that step, the new points will satisfy $f(W) < f(G)$. You may want to add a remark somewhere in the table to re-sort the points after each step.
41. page 436, Table 8.5:
Another thing is unclear about the table. Under Case (ii), if $f(R) < f(W)$ then you replace W with R . The instructions then say to compute $C = (W + M)/2$ or $C = (M + R)/2$. But if one has already replaced W with R , then both of those C ’s will be the same. To be more clear, I’d change that first half of Case (ii) to compute the C ’s first (and also include a brief explanation of choose C as explained on page 434, to make the table more self-contained):
Compute $C_1 = (W + M)/2$ and $C_2 = (M + R)/2$.
Let C be C_1 or C_2 , whichever one has the smaller function value $f(C_1)$ or $f(C_2)$.
IF $f(R) < f(W)$ THEN
 replace W with R
IF $f(C) < f(W)$ THEN
 :
 :
42. page 462, Figure 9.4 caption:
It should be $y' = f(t, y)$, not $f' = f(x, y)$.
43. page 463, second line of Matlab code at top of page:
The `dt=ones(5,4)`; command should actually be `dt=ones(4,5)`;
44. page 486, header of last (rightmost) column of Table 9.7:
I believe it should be $O(h^4)$, not $O(h^2)$.
45. page 588, line 1 (in Theorem 11.3):
The “ldots” should be “...”; there must have been a missing backslash in the \LaTeX command.
46. page 600, third line below table 11.1:
It should be “The sequence of vectors converges to $\mathbf{V} = \left[\frac{2}{5} \quad \frac{3}{5} \quad 1 \right]^T, \dots$ ”. (It currently says 2/3 rather than 2/5.)
47. page 600, last line (equation 7):
The left-hand side of the second equation on this line should say $|x_j^{(k)}|$, i.e. it needs absolute values on it. Actually I’m not quite right about this, but I haven’t thought of the best notation to fix the problem here, although I do think it should be adjusted slightly. Same comment applies to the item on page 604, below.

48. page 601, last line:

The exponents on the $\left(\frac{\lambda_i}{\lambda_1}\right)$ factors should each be k , not $k - 1$. (The equations just above got it right; this typo only appeared in the last line.) That is, it should be

$$\mathbf{X}_k = \frac{\lambda_1^k}{c_1 c_2 \dots c_k} \left(b_1 \mathbf{V}_1 + b_2 \left(\frac{\lambda_2}{\lambda_1}\right)^k \mathbf{V}_2 + \dots + b_n \left(\frac{\lambda_n}{\lambda_1}\right)^k \mathbf{V}_n \right)$$

49. page 604, equation (19):

The left-hand side of the second equation needs absolute values on it, $|x_j^{(k)}|$ as in the second typo on page 600.

50. page 613, the line between eqns (15) and (16), and also eqn (16) itself:

You should be writing \mathbf{D}_n rather than \mathbf{D}_k to be consistent with the preceding text. However, this risks confusion with the fact that there are n eigenvalues (because presumably \mathbf{A} is an $n \times n$ matrix, although this was not explicitly stated, but it is implied by the diagonal matrix on the right-hand side of eqn (16)). So in fact it would be better to switch to k when writing subscripts, i.e. \mathbf{D}_k and \mathbf{R}_k , beginning in equation (13), i.e. $\mathbf{D}_k \approx \mathbf{D}$, and similarly for equations (14), (15), and (16), along with the text between equations (15) and (16). (Keep using n for the λ 's and \mathbf{X} 's.)

51. page 647, Section 1.3 #5 (a):

$\ln((x+2)/x)$ should be $\ln((x+1)/x)$.

52. page 655, Section 4.1 #8 (c):

“the minimum of $|f^{(4)}(x)|$ ” should say “the maximum of $|f^{(4)}(x)|$ ”.