An Introduction to Parallel Programming: Errata

Peter Pacheco

Last update May 12, 2017

General

- Kindle edition only. The plural of a C type is printed as the type followed by a space and an “s.” For example, “doubles” is printed as “double s.” (May 21, 2011)

- Kindle edition only. Formatting of displayed code that is not enclosed in a box has no indentation. (May 26, 2011)

Table of Contents

- Kindle edition only. The link to Chapter 6 takes you to the first paragraph of Chapter 6. However, this paragraph is placed between the end of the Chapter 6 Exercises and the beginning of the Chapter 6 Programming Assignments. (November 26, 2011)

Chapter 2

- Section 2.3.3, p. 37, next to last sentence in paragraph 3: The number of links in a ring is \( p \) and the number of links in a toroidal mesh is \( 2p \). (Sept 8, 2011; corrected in second printing.)

- Section 2.3.3, p. 38, last sentence. The plus sign (+) should be a minus sign (−). That is, the formula for the number of links should be \( p^2/2 - p/2 \). Thanks to Curtis Gehman for spotting this. (November 6, 2011, corrected in second printing.)

- Section 2.3.4, p. 46, second pair of displayed, nested for loops: the outer loop for core 1 should start with \( \text{iter\_count} \), not \( \text{iter\_count+1} \):

  ```c
  for (i = iter_count; i < 2*iter_count; i++)
  ```
Section 2.7.1, p. 69, Figure 2.2.2: It looks like there is an arrow from the oval in the third row labelled \texttt{loc\_bin\_cts[b-1]++} to the oval labelled \texttt{bin\_counts[b]+}. This is actually a continuation of the arrow from the oval labelled \texttt{loc\_bin\_cts[b]++} in the second row. (July 5, 2011; corrected in second printing.)

Exercise 2.16b, p. 79. Feng Chen pointed out that this is false. As an example, he gives $T_{\text{serial}} = 8 + n^2$ and $T_{\text{overhead}} = n$. Then clearly, $T_{\text{serial}}$ grows faster than $T_{\text{overhead}}$, since

$$\frac{d}{dn} T_{\text{serial}} = 2n > 1 = \frac{d}{dn} T_{\text{overhead}}$$

for all $n \geq 1$. However, if, for example, $p = 2$, $n_1 = 1$ and $n_2 = 2$, we see that

$$E(n_1) = \frac{1}{1 + 2 \cdot 1/(8 + 1)} = 9/11 \approx 0.82,$$

and

$$E(n_2) = \frac{1}{1 + 2 \cdot 2/(8 + 4)} = 3/4 = 0.75.$$  

However,

$$T_{\text{overhead}}(n_2) - T_{\text{overhead}}(n_1) = 2 - 1 = 1,$$

and

$$T_{\text{serial}}(n_2) - T_{\text{overhead}}(n_1) = 12 - 9 = 3.$$  

So $T_{\text{overhead}}$ is growing more slowly than $T_{\text{serial}}$, and the efficiency is decreasing. (May 11, 2017)

Chapter 3

Section 3.1.1, p. 85, displayed command for compiling: Mohammed Sourouri points out that many C compilers will object to the \texttt{for} statement in Program 3.1:

```c
for (int q = 1; q < comm_sz; q++)
```

This is because it includes a declaration of the variable \texttt{q} in the \texttt{for} statement. This can be suppressed if you’re using \texttt{gcc} by including the \texttt{-std=c99} option on the command line:

```
$ mpicc -g -Wall -std=c99 -o mpi_hello mpi_hello.c
```

Thanks to Mohammed for spotting this. (February 19, 2012)
• Section 3.3.2, p. 100, code at bottom of page: call to \texttt{Get\_data} should be a call to \texttt{Get\_input}. Thanks to Wes Brewer for spotting this. (Oct 12, 2011; corrected in second printing.)

• Section 3.4.6, p. 110, Table 3.4: column 10 “+6” should be “2”. Thanks to Andrew Neiderer for spotting this. (January 14, 2012; corrected in second printing.)

• Section 3.5, p. 117, end of second paragraph: needs a closing period after \texttt{MPI\_Pack/Unpack}. (Corrected in second printing.)

• Section 3.6.2, p. 125: Line 3 should be

\[ T_{\text{parallel}}(16, 384, 4) = 3.9 \times T_{\text{parallel}}(8192, 4) \]

(Corrected in second printing.)

• Exercise 3.4, p. 140: The possessives in the last line should have apostrophes: “process 0’s output first, then process 1’s …” (Corrected in second printing.)

• Exercise 3.11b, p. 142: “x\_is” (in fixed-width font) should be “\textit{x_i}” (in math font). (July 14, 2011; corrected in second printing.)

\textbf{Chapter 4}

• Section 4.2, p. 154, Program 4.1. line 33. The assignment

\[ \text{long my_rank = (long) rank} \]

should be terminated by a semi-colon. Thanks to Wes Brewer for spotting this. (January 14, 2012; corrected in second printing.)

• Section 4.9.2, p. 186, Program 4.12. The published version fails to lock the mutex associated with the first node of the list. The code should be

\begin{verbatim}
int Member(int value) {
    struct list_node_s *temp_p, *old_temp_p;

    pthread_mutex_lock(&head_p_mutex);
    temp_p = head_p;

    /* If list is not empty, acquire the mutex
    * associated with first node */
\end{verbatim}
if (temp_p != NULL)
    pthread_mutex_lock(temp_p->mutex);

/* Don’t need head_p mutex anymore */
pthread_mutex_unlock(&head_p_mutex);

while (temp_p != NULL && temp_p->data < value) {
    if (temp_p->next != NULL)
        pthread_mutex_lock(&(temp_p->next->mutex));

    /* Advance to next element */
    old_temp_p = temp_p;
    temp_p = temp_p->next;

    /* Now unlock previous element’s mutex */
    pthread_mutex_unlock(&(old_temp_p->mutex));
}

if (temp_p == NULL || temp_p->data > value) {
    if (temp_p != NULL)
        pthread_mutex_unlock(&temp_p->mutex);
    return 0;
} else { /* temp_p != NULL && temp_p->data == value */
    pthread_mutex_unlock(&temp_p->mutex);
    return 1;
}
} /* Member */

I’m grateful to Steffen Christgau and Bettina Schnor for both finding and correcting
the errors. (February 21, 2017)

• Section 4.11, p. 197, fourth and fifth sentences of last paragraph: “In some cases, the
C standard specifies an alternate, thread-safe version of a function. In fact, there is
a thread-safe version of strtok.” Ivar Ursin Nikolaisen pointed out that this seems
to suggest that strtok_r is part of the C standard. He goes on to observe that
“strtok_r is not in the current C standard. It is however in Posix.1-2008. In the
upcoming C1X standard there is a similar (optional) function strtok_s introduced in
annex k.” Thanks to Ivar for pointing this out. (November 3, 2011)

• Section 4.11, p.197, last sentence: The text in fixed width font, saveptr Append
‘‘p’’ to ‘‘saveptr’’, should just be saveptr_p. Thanks to Lucas Levrel for spotting this. (February 2, 2012)

• Section 4.12, p. 200, second paragraph, next to last sentence. “Serval” should be “several.” Thanks to Wes Brewer for spotting this. (January 14, 2012; corrected in second printing.)

• Kindle edition only. Exercise 4.7: next to last sentence should end with “thread \((q - 1 + t) \mod t?\)”. The “mod t?” is missing.

• Kindle edition only. Exercise 4.15: the sizes of the matrices should be \(k \times (k \cdot 10^6)\), \((k \cdot 10^3) \times (k \cdot 10^3)\), and \((k \cdot 10^6) \times k\). (Corrected in second printing.)

• Exercise 4.17e, p. 206: “falses sharing” should be “false sharing.” (May 21, 2011; corrected in second printing.)

• Programming Assignment 4.2, p. 206: “it’s area” should be “its area.” (May 21, 2011; corrected in second printing.)

Chapter 5

• Section 5.1.2, p. 212, last paragraph: in the prototype for \texttt{strtol}, “number p” should be “number_p” and “end p” should be “end_p.” Thanks to Lucas Levrel for spotting these. (February 2, 2012)

• Section 5.10, p. 257, Caption for Program 5.6: “multi threaded” should be “multi-threaded”. (Corrected in second printing.)

• Section 5.10, p. 258, fourth and fifth sentences of second paragraph. See note for Section 4.11, p.197, above. (Nov 3, 2011)

• Exercise 5.5, p. 263. The array \(a\) should be declared as

\[
\text{float a[]} = \{2.0, 2.0, 4.0, 1000.0\};
\]

(Corrected in second printing.)

• Exercise 5.12, p. 265. The parenthesis before “With \texttt{gcc}” should be deleted. (Corrected in second printing.)

• Programming Assignment 5.4, p. 269: the last line before the bulleted list should be terminated with a colon, not a period. (Corrected in second printing.)
Chapter 6

- Kindle edition only. The introductory paragraph to Chapter 6 has been placed between the end of the Chapter 6 Exercises and the beginning of the Chapter 6 programming assignments. (Nov 26, 2011)

- Section 6.1.2, p. 277, last block of displayed code: the line

  \[ \text{forces} = \text{memset(} \text{forces, 0, n*sizeof(vect_t)}; \]

is missing a closing parentheses. It should be

  \[ \text{forces} = \text{memset(} \text{forces, 0, n*sizeof(vect_t)}); \]

Thanks to Lucas Levrel for spotting this. (February 2, 2012)

- Section 6.1.6, p. 284, fourth line from bottom of page: the comment /* Can be faster than memset */ should be deleted. (Corrected in second printing.)

- Section 6.2.1, p. 302, Program 6.4: The argument \text{city} to the function \text{Remove_last_city} isn’t needed (and isn’t used in the program). (Corrected in second printing.)

- Exercise 6.15, p. 345, last line: The list of basic arithmetic operators should include the modulus operator \%. (Oct 15, 2011)

- Kindle edition only. Exercise 6.23, second sentence. The word “information” is enclosed in \hbox{...}. The \hbox{ and the } shouldn’t be in the text. (November 26, 2011; corrected in second printing.)

Source Code

- Chapter 3: Deleted redundant code from \text{Merge_low} function in mpi_odd_even.c (July 26, 2011)

- Chapter 4: Added \text{pth_mat_vect_rand_split.c} to archive.

- Chapter 4: Modified \text{pth_mat_vect_rand_split.c} (May 10, 2011)

- Chapter 5: Added \text{omp_mat_vect_rand_split.c} to archive. (May 26, 2011)

- Chapter 5: Modified documentation for \text{omp_mat_vect_rand_split.c}. Added \text{timer.h}. (July 5, 2011)
• Chapter 6: Modified documentation for `Compute_force` function in `omp_nbody_basic.c`. (October 23, 2011)

• Chapter 6: Modified documentation for `mpi_tsp_stat.c`: eliminated reference to nonexistent file `ipp_mpi.c`. (January 15, 2012)

PowerPoint Slides

• Chapter 3, Table 3.5, slide 93. “Seconds” should be “milliseconds.” Thanks to Wes Brewer for spotting this. (January 14, 2012)