ERRATA: Introduction to Parallel Computing (First Printing)

May 14, 1994

Chapter 2

1. In Problem 2.9 on page 56, both instances of $2^d - 1$ should be 2^{d-1}.
2. In the caption of Figure 2.26 on page 47, P_0 to P_3 should read P_0 to P_4.

Chapter 3

1. Lines 3 and 4 of Program 3.5 on page 83 should read $left := my\_id - (my\_id \mathrm{mod} \sqrt{p}) + (my\_id - 1) \mathrm{mod} \sqrt{p}$; and $right := my\_id - (my\_id \mathrm{mod} \sqrt{p}) + (my\_id + 1) \mathrm{mod} \sqrt{p}$; respectively.
2. Line 4 of Program 3.6 (page 85) and line 5 of Program 3.7 (page 87) should read "**for** $i := 0$ **to** $d - 1$ **do**".
3. On page 90, in the last paragraph of Section 3.4, the expression for the communication time of one-to-all personalized communication on a 2-D square mesh should be $2t_s(\sqrt{p} - 1) + t_w m(p - 1)$.
4. In Figure 3.18 (page 91), the order of messages going from processor 3 to processor 4 and from processor 4 to processor 5 is reversed. The arrows denoting these messages in the top part of the figure should be labeled from 5 to 1 starting from the topmost arrow.
5. In Problem 3.21 (page 111), the expression for the communication time of k-to-all broadcast should be $t_s \log p + t_w m(k \log(p/k) + k - 1)$ and in Problem 3.26 (page 112), the expression for the communication time of k-to-all personalized communication should be $t_s \log p + t_w m(p - k + (p \log k)/2)$.

Chapter 4

1. In Problem 4.4 (page 142), the expression $\Theta((n/p) \log n \log p)$ should read $\Theta((n/p) \log p)$.

Chapter 5

1. Contrary to Equation 5.6 on page 162, the communication time for all-to-all broadcast on a mesh does not improve with CT routing, and the coefficient of t_s should be $2(\sqrt{p} - 1)$ for both SF and CT routing schemes.
2. Equation 5.18 (page 167) should be as follows:
$$p = O\left(\frac{n^2}{\log^2 n}\right)$$
3. In the subsection titled **Performance and Scalability Analysis on a Hypercube** on page 170, the total communication time should be $2(t_s \log \sqrt{p} + t_w (n^2/p)(\sqrt{p} - 1)$. Consequently, Equation 5.19 should read
$$T_P = \frac{n^3}{p} + t_s \log p + 2t_w \frac{n^2}{\sqrt{p}}.$$
In the same subsection, the expression for processor-time product should be $n^3 + t_s p \log p + 2t_w n^2 \sqrt{p}$ and the isoefficiency function due to t_s should be $t_s p \log p$.

4. The last two sentences of the first paragraph on page 178 should read as follows: “The isoefficiency function is $\Theta(p(\log p)^3)$. The parallel system is cost-optimal for $n^3 = \Omega(p(\log p)^3)$, or $p = O(n/(\log n)^3)$.”

5. In the last sentence of the last complete paragraph on page 180, $k \times k$ should read $(n-k) \times (n-k)$.

6. In the last sentence of the first paragraph on page 187, $O(n^2)$ should be $O(n^2 p)$.

7. The last two sentences of the first paragraph on page 192 should read as follows:

   "The difference in work load between any two processors is at most $\Theta(n/\sqrt{p})$ in any iteration, which contributes $\Theta(n\sqrt{p})$ to the overhead function. Since there are n iterations, the cumulative overhead due to processor idling is only $\Theta(n^2\sqrt{p})$ with cyclic mapping in contrast to $\Theta(n^3)$ with block mapping (Problem 5.19)."

8. The second sentence of Problem 5.19 (page 200) should read as follows:

   "Show that this idle time is reduced to $\Theta(n^2 p)$ if a cyclic-striped mapping is used and $\Theta(n^2\sqrt{p})$ if a cyclic-checkerboard mapping is used."

9. In the last sentence of Problem 5.22 on page 200, Figure 5.18 should be Figure 5.19.

Chapter 6

1. The fourth sentence of Problem 6.1 (page 250) should read, "Processor P_j compares x_1 with y_1 and then sends the larger element back to processor P_i and keeps the smaller element for itself."

2. In the fifth line of Problem 6.19 (page 253), 2^{d-1} should be 2^{i-1}.

3. The correct volume and year for the bibliographic item [NS79] on page 255 are C–28(1), January 1979.

Chapter 7

1. In the second line of the last paragraph on page 257, "$i = 0, 2, \ldots, k-1$" should read "$i = 0, 1, 2, \ldots, k-1$."

Chapter 8

1. In Figure 8.5(c) on page 307, the box labeled 21 to the right of the shaded box labeled 18 should not be there.

Chapter 9

1. The hint for Problem 9.5 (page 372) should read as follows:

   Hint: Consider the blocked-cyclic mapping instead of the cyclic-striped mapping.

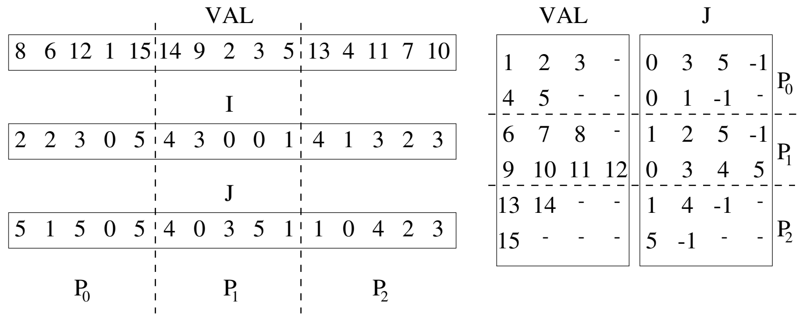
2. The algorithm for merging two files in Problem 9.7 (page 372) is actually a greedy algorithm and not a DP algorithm. Parallel formulations of the algorithm can however be derived using principles illustrated in the chapter.

Chapter 10

1. In Problem 10.1 (page 404), the expression for T_P should be $(t_c n \log n)/p + (t_w n \log p)/p + (t_h n \log p)/p$.

2. The correct entry for the bibliographic citation [GK93] appearing on pages 62, 147, and 406 is as follows:

   A. Gupta and V. Kumar. The scalability of FFT on parallel computers. *IEEE Transactions on Parallel and Distributed Systems*, 4(8):922–932, August 1993. A detailed version available as Technical Report TR 90-53, Department of Computer Science, University of Minnesota, Minneapolis, MN.



(a) A sparse matrix in coordinate format (b) The matrix in Ellpack-Itpack format

Figure 11.29 A 6×6 sparse matrix in the coordinate and Ellpack-Itpack formats.

Figure 1: The correct version of Figure 11.29 (page 477).

Chapter 11

1. In Problem 11.1 (page 477), Figure 11.29 is incorrect. The correct figure and caption appear as Figure 1 here.
2. The hint of Problem 11.2 (page 478) should read as follows:

   Hint: Two communication operations are involved–an all-to-all broadcasts with messages of size, at most, n/p and an all-to-all personalized communication with messages of size, at most, n/p^2.
3. In the last sentence (before the hint) of Problem 11.4 on page 478, “the average number of zeros” should read “the average number of nonzeros.”

Chapter 12

1. In the last sentence on page 504, and also in Problem 12.4 (page 520), $t-1$ should be t and $(2t)$ should be $(2t+1)$.
2. In the second sentence of Problem 12.1 (page 520), $\log n$ should be $\log m$.

Chapter 13

1. In the first line of page 545, “left and up” should read “right and down”.