**Primal-Dual Interior-Point Methods** by Stephen Wright
List of errors and typos, last updated December 12, 1999.

1. page xviii, lines 1 and 3: $(x, \lambda, x)$ should be $(x, \lambda, s)$ (on both lines)

2. page 6, line 4: $\Delta s$ and $\Delta\lambda$ should be swapped. The corrected equation is

$$J(x, \lambda, s) \begin{bmatrix} \Delta x \\ \Delta\lambda \\ \Delta s \end{bmatrix} = -F(x, \lambda, s),$$

3. page 13, lines 12–13: Insert a phrase to stress that we consider only *monotone* LCP in this book, though the qualifier "monotone" is often omitted. Replace the sentence preceding the formula (1.21) by

> The monotone LCP—the qualifier "monotone" is implicit throughout this book—is the problem of finding vectors $x$ and $s$ in $\mathsf{R}^n$ that satisfy the following conditions:

4. page 13, line −12: delete "of." Corrected line is

> because it is such a versatile tool for formulating and solving a wide range

5. page 16, equation (1.25a): "$S^{-1}Xr_c$" should be "$-S^{-1}Xr_c$." Corrected equation is

$$AD^2A^T\Delta\lambda = -r_b + A(-S^{-1}Xr_c + x - \sigma\mu S^{-1}e),$$

6. page 69, line 1: replace (4.2) by (4.4). Corrected line is

> From (4.4) and Lemma 4.1(i)

7. page 74, line 10: "$\leq$" should be "$=$." Corrected line is

$$\|X^{-1}\Delta x\|^2 + \|S^{-1}\Delta s\|^2 = \|V^{-1}D^{-1}\Delta x\|^2 + \|V^{-1}D\Delta s\|^2$$

8. page 76, line −2: "$q(0)-q(\bar{\alpha})$" should be "$q(\bar{\alpha})-q(0)$." Corrected equation is

$$q(\bar{\alpha}) - q(0) \leq -0.15,$$

9. page 79, line 6: "$(\rho - n)x^Ts$" should be "$(\rho - n)\log x^Ts$".

10. page 104, line 7: replace "$\leq$" by "$=$." Corrected formula reads

$$= 2^{-3/2}\|u + v\|^2,$$

11. page 119, line −7: The argument $(\alpha)$ should appear after $r_b^k$ and $r_c^k$. Corrected line is

$$r_b^k(\alpha) = b - Ax^k(\alpha), \qquad r_c^k(\alpha) = A^T\lambda^k(\alpha) + s^k(\alpha) - c,$$

12. page 120, lines 14, 15, 17, 21 are missing an "$n$". Corrected lines should read

$$\begin{aligned} &\leq -0.99\alpha\mu_k + 0.5\alpha\mu_k + \alpha^2 C_2^2\mu_k/n \\ &= -0.49\alpha\mu_k + \alpha^2 C_2^2\mu_k/n. \end{aligned}$$

$$\alpha \leq \frac{0.49n}{C_2^2},$$

$$\bar{\alpha} = \min\left(\frac{n\sigma_{\min}}{C_2^2}, \frac{\sigma_{\min}(1-\gamma)}{C_2^2}, \frac{0.49n}{C_2^2}, 1\right).$$

13. page 122, proof of Theorem 6.8. The use of $\epsilon(A,b,c)$ and consequently the definition of $C_3$ in (6.52) is incorrect. The proof can be fixed by making the following specific amendments to the text on page 122: On line 2, change "any solution" to "any strictly complementary solution". Delete the material starting with "Since we are free ..." to the end of the paragraph, and replace it with the following:

> A similar bound can be found for $s_i$, $i \in \mathcal{B}$. Therefore, the result (6.49) holds when we define
>
> $$C_3 = \bar{C}_3 \min\left(\min_{i\in\mathcal{N}} s_i^*, \min_{i\in\mathcal{B}} x_i^*\right). \qquad (6.52)$$

14. page 137, line −1: replace $\gamma$ by $\tilde{\alpha}$. Corrected line is

> **return** $\tilde{\alpha}$.

15. page 159, Algorithm PC (for LCP). The predictor and corrector steps are reversed in the specification of the algorithm. The correct specification is as follows:

> **Algorithm PC (for LCP)**
> **Given** $(x^0, s^0) \in \mathcal{N}_2(0.25)$;
> **for** $k = 0, 1, 2, \ldots$
> **if** $k$ is even
> solve (8.2) with $\sigma_k = 0$ to obtain $(\Delta x^k, \Delta s^k)$;
> choose $\alpha_k$ as the largest value of $\alpha$ in $[0,1]$ such that
>
> $$(x^k(\alpha), s^k(\alpha)) \in \mathcal{N}_2(0.5);$$

set $(x^{k+1}, s^{k+1}) = (x^k, s^k) + \alpha_k(\Delta x^k, \Delta s^k)$;
**else**
solve (8.2) with $\sigma_k = 1$ to obtain $(\Delta x^k, \Delta s^k)$;
set $(x^{k+1}, s^{k+1}) = (x^k, s^k) + (\Delta x^k, \Delta s^k)$;
**end (if)**
**end (for).**

16. page 162, line −9: replace "that" by "have." Corrected line is

> complementary solution. Some LCPs have solutions but no strictly complementary

17. page 166, formula (8.20): "$(x, s) \geq 0$" should be "$(\lambda, y) \geq 0$".

18. page 178, line 15: Replace "all" by "most of". Corrected sentence should read

> The *homogeneous self-dual (HSD)* formulation of Ye, Todd, and Mizuno [159] possesses most of these desirable properties and is quite efficient as well."

(There is an example in the YTM paper [159, page 62] of a problem that is both primal and dual infeasible, for which a solution of the HSD formulation reveals only the primal infeasibility.)

19. page 182, line −9. Replace $z^*$ by $s^*$. Corrected line is

> $(\tau^*, x^*, \lambda^*, \kappa^*, s^*)$ for which $\kappa^* > 0$.

20. page 182-183, proof of Theorem 9.3. This proof is inadequate since it assume feasibility of the primal problem. It should be replaced by the following argument:

*Proof.* Since $\kappa^* > 0$, its complementary variable $\tau^*$ must be zero. It follows from (9.5a) that at least one of $c^T x^*$ and $-b^T \lambda^*$ is negative.

Suppose that $c^T x^* < 0$. Since $\tau^* = 0$, we have from (9.5) that $x^* \geq 0$ and $Ax^* = b\tau^* = 0$. If the dual problem (9.3b) were feasible, we would have a vector $(\bar{\lambda}, \bar{s})$ with $\bar{s} \geq 0$ and $A^T\bar{\lambda} + \bar{s} = c$. By multiplying the latter equation by $(x^*)^T$, we obtain

$$0 > c^T x^* = \bar{\lambda}^T A x^* + \bar{s}^T x^* = \bar{s}^T x^* \geq 0,$$

which is a contradiction. The proof of the second claim is similar.

21. page 197, line −10: replace "that" by "than." Corrected line is

> smaller in norm than the affine-scaling step—in fact, it is often much larger. Even

22. page 198, equation (10.8b): replace $\alpha_{\text{aff}}^{\text{pri}}$ by $\alpha_{\text{aff}}^{\text{dual}}$.

23. page 210, equation (11.3a): "$S^{-1}X$" should be "$-S^{-1}X$." Corrected formula is

$$AD^2A^T\Delta\lambda = -r_b + A(-S^{-1}Xr_c + S^{-1}r_{xs}),$$

24. page 212, line 13: replace $10^{-14}$ by $10^{-16}$. Corrected phrase is

    (typically, $\mathbf{u} \approx 10^{-16}$ for double-precision arithmetic)

    Correspondingly, on page xx, line $-2$, replace $10^{-14}$ by $10^{-16}$.

25. page 212, equation (11.6): Rather than use the undefined symbol " $\sim$, we replace (11.6) and the remainder of the sentence in which it lies by the following passage:

$$\frac{\|\tilde{z} - z\|}{\|z\|} \leq \beta\kappa(M)\mathbf{u},$$

    where $\beta$ is a positive value that is independent of $M$ and $\mathbf{u}$.

26. page 240, line $-13$: replace "$U \in \mathsf{R}^N$" by "$U \subset \mathsf{R}^N$.

27. page 246, line 4. Replace "$f'(t)$" by "$f(t)$" on the right-hand side.

28. page 251, equation (A.24): the formula is incorrect. It should read

$$G^{-1} = \tilde{G}^{-1} - \tilde{G}^{-1}U(I + V^T\tilde{G}^{-1}U)^{-1}V^T\tilde{G}^{-1}.$$

29. page 257, the second and third URLs on this page should be replaced by the following:

    `http://www.mcs.anl.gov/otc/InteriorPoint/`

    `http://www.mcs.anl.gov/otc/Guide/faq/`

30. page 257, line $-2$. Replace "URLs" by "URL"

31. page 258, lines 1 and 2. These two URLs should be replaced by the following single URL:

    `http://www.mcs.anl.gov/neos/Server/`

32. page 258, last line. Replace this URL by the following:

    `http://www.sztaki.hu/ meszaros/bpmpd/`

33. page 259, line 10. Replace the URL on this line by the following:

    `http://www.cplex.com/products/barsolv.html`

34. page 259, line $-2$. Replace the URL on this line by the following:

    `http://www.maths.ed.ac.uk/ gondzio/software/hopdm.html`

35. page 260, line 12. Replace the URL on this line by the following:

    `http://www.caam.rice.edu/ zhang/lipsol/`

36. page 261, line 2. Replace the URL on this line by the following:

    `http://www.orfe.princeton.edu/ loqo/`

37. page 261, line −2. In addition to the URL already on this line, add the following URL:

    `http://www.dashopt.com/`

38. page 263, line 6. Replace the URL on this line by the following:

    `http://www.mcs.anl.gov/otc/Tools/PCx/`

39. page 263, line 11. Replace this paragraph with the following:

    **Input:** AMPL, MPL, MPS, callable. Java and Windows-95 interfaces are available; see the web site.

40. page 263, line 15. Add the following sentence to the end of this paragraph:

    A version for IBM RS6000 machines that calls IBM's solver WSSMP is also available. See the web page for details.

41. page 263, lines −3 to −1. Replace this paragraph by the following:

    **Availability:** Freely available for research and evaluation. A license must be obtained for production use in a commercial environment.

42. page 271, reference [72]: This book—*Solving Least Squares Problems*—was reprinted by SIAM Publications in 1995.

43. page 273. References [92] and [93] are identical.

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