Combinatorial Optimization

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Corrections

Many thanks to the following people, who have reported errors in the published version: Eddie Cheng, Kevin Cheung, Sanjeeb Dash, Elkafi Hassini, Illya Hicks, Tim Huh, Tibor Jordan, Mike Jünger, Charles Lam, Frederic Latour, François Margot, J. Plesnik, Tibor Jordan, J.P. Pretti, and John Proos.

There have been several printings of the book, and some errors in earlier printings have been corrected in later ones. If the list of numbers at the bottom of the copyright page of your copy ends with an i, you have printing i. In this case you do not need to consult the list below for earlier printings, but you need to consult the lists for printing i and all later ones.

Third and Fourth Printings

page x, end of preface, the url should be
`http://www.math.uwaterloo.ca/~whcunnin/bookpage.html.`
page 10, line -10 "*circuit* if it is edge-simple and closed"
page 13, line -2 "edge of a simple path in T"
page 14, line 2 "P be a simple path in H"
page 16, line 3 Insert a parenthesis before "We"
page 27, line 2, Chapter 7 should be Chapter 6.
page 34, Exercise 2.21, delete $(k, 4)$ from L_j.
page 38, in (3.1) replace Σ by $\sum$
page 40, in Proposition 3.2 "(r, s) flow of non-negative value is the sum"
page 46, Exercise 3.13 "Assuming integral capacities, give a good bound"
page 51, in Table 3.2, last column replace R. by F.D.
page 58, line 2–3 Replace this sentence by: "This result appears in N. Garg, V. Vazirani and M. Yannakakis (1996)". (The reference is N. Garg, V. Vazirani and M. Yannakakis, Approximate max-flow min-(multi)cut theorems and their applications. SIAM J. Comput. 25 (1996), no. 2, 235–251.)
page 60, line 5 Delete the braces
page 94, line -5 Replace vw by e
page 104, line 6 Replace $R(T, f)$ by $R(T, h)$

page 106, Figure 4.10, add the demands $b_r = b_q = 1$, $b_v = b_w = -1$
page 112, In Figure 4.13, one of the wr arcs with cost -1 should be reversed
pages 140, 147, 154. All of these perfect matching algorithms should terminate if the input matching is perfect!
page 152, In Figure 5.16 the node labelled C in the left tree should be labelled v, and in the right graph, the circuit should be labelled C
page 164, line -5 (5.24) should be (5.25)
page 165, line -12 J. Geelen should be replaced by J. Plesnik (The reference is J. Plesnik, Equivalence between the minimum covering problem and the maximum matching problem. Discrete Math. 49(1984),315-317.)
page 238, line 14 Replace $t \in \mathcal{P}$ by $t \in \mathcal{O}$
page 249, line -7, Replace "are" by "is"
page 251, line 12 Replace "figure" by "Figure"
page 258, line 13, Replace yAx by yA_1x
page 281, Exercise 8.4, Replace $G \subseteq S$ by $G \backslash S$
page 283, line 1 Replace $\cup$ by $\cap$ (though either is correct)
page 285, line 21 Replace $\emptyset \in \mathcal{I}$ by $J \in \mathcal{I}$
page 285, second sentence after the proof Theorem 8.11, replace "direct sum" by "disjoint union"
page 285, line -7. The three "sentences" beginning with "It will be" and ending with "$T_{\ell+1} = S$" should be deleted.
page 292, 293. Replace the material from line 4 on page 292 to line 6 on page 293 by the following shorter proof.

Lemma 8.16. Let $M = (S, \mathcal{I})$ be a matroid with rank function r, and let $e \in C \subseteq A$, where C is a circuit of M. Then $r(A \backslash \{e\}) = r(A)$.
Proof. Since $C \backslash \{e\} \in \mathcal{I}$, we can extend it to a basis J of $A \backslash \{e\}$. But since $J \cup \{e\}$ contains C, J must also be a basis of A. ∎

Proof of (b) part of Theorem 8.15. By the symmetry between M_1 and M_2 discussed on page 290, it is enough to prove that

$$J' = J \triangle \{e_1, f_1, \ldots, e_m, f_m, e_{m+1}\} \in \mathcal{I}_1.$$

Let $A = J \cup \{e_1, \ldots, e_m, e_{m+1}\}$. Suppose that we delete from A, the elements $f_m, \ldots, f_1$ in that order, finally getting $A = J'$. Just before we delete f_i, A still contains the circuit of M_1 contained in $J \cup \{e_i\}$. (Otherwise, some element of this circuit would have been among $f_m, \ldots, f_{i+1}$, which would imply that $e_k f_i$ is an arc for some $k > i$, contradicting the fact that P is chordless.) Therefore, using the Lemma above repeatedly, we get $r_1(J') = r_1(A)$. But $r_1(A) \geq |J| + 1$, because A contains $J \cup \{e_{m+1}\} \in \mathcal{I}_1$. Therefore, $r_1(J') \geq |J| + 1 = |J'|$, so $J' \in \mathcal{I}_1$. ∎

page 295, line -7 Replace "direct sum" by "disjoint union"
page 296, line -15 Replace "M_i-spans A, and so" by "is an M_i-basis of A, so"
page 305, line -5 Replace "T_ℓ denote $\text{span}_1(J_k)$" by "$T_\ell = J_k \cup \{e \in S \backslash J_k : e \in C \subseteq J_k \cup \{e\}$ for some M_1-circuit $C\}$"
page 329, line -3,-2 Replace x_0 by x^0 (not really wrong)
page 330, line -9 Replace $(y_i^*)^T$ by y_i^*
page 334, line 13 Replace $y_i^T a_i$ by $y^T a_i$
page 342, In the Jünger-Pulleyblank reference, Jahrbuch, Kulish, Braunschweig

Second Printing

Note. *In addition to* the corrections above, the following apply to the second printing.

page x, end of preface, add the following sentence.
Information on this book, including a list of errors, can be found on the web at `http://www.math.uwaterloo.ca/~whcunnin/bookpage.html`.
page 34, line 6, $L(v)$ should be L_v.
page 47, line 14, $E =$ should be $E \subseteq$.
page 55, Replace the first sentence of the proof of Theorem 3.17 by "First, we observe that any $\ell_e = -\infty$ can be replaced by $-M$ where M is integral and very large, without affecting either the existence of the desired circulation or the condition of the theorem."
page 56, line 17, "will be no feasible" should be "may be no feasible".
page 75, line -1, The final $=$ should be $\leq$.
page 76, line 5, The final $=$ should be $\leq$.
page 81, line -3, minimum (v, w)-cut.
page 97, line 22, $x_{fg} = 0$ (not -2)

page 97, line 23 should read

$$\sum_v x_{vf} \quad - \quad \sum_g x_{gf} \quad + \quad \sum_g x_{fg} \quad = \quad \begin{cases} -4 & \text{if } f \text{ is external} \\ \ \ 4 & \text{otherwise.} \end{cases}$$

page 133, line 15, M should be M_1.
page 140, line 6, should read Case: $w \notin V(T)$, w is M'-exposed
page 146, line -5. Replace $v \notin V(T)$ by $w \notin A(T)$.
page 156, line -10. All three occurrences of C should be C'.
page 157, line -6. Delete the second "the".
page 165. Exercise 5.37 should be attributed also to J. Plesnik.
page 169, line -7. Replace this line by
$c(J \backslash E(P)) + c(E(P')) - 2c((J \backslash E(P)) \cap E(P'))$.
page 175, line -4, $G = (V, E)$, (not (V', E'))
page 205, line 7. Replace w by w^T.
pages 223, 224. "directed tree" should be "tree" here.
page 226, line -5. Using a generalization of Theorem 6.29.
page 231, line -9. $c'x$ should be $(c')^T x$.
page 240, line -15. Exercise 39 should be Exercise 6.39.
page 266, line -13. $A \subseteq \delta(H)$.
page 267, line 10. Section 7.2, not Section 7.3.
page 279, lines 15,16. Order S as $\{e_1, \ldots, e_n\}$ so that $c_{e_1} \geq \ldots \geq c_{e_m} > 0 \geq c_{e_{m+1}} \geq \ldots \geq c_{e_n}$ and, if $c_{e_i} = c_{e_j}$, $e_i \in J$, $e_j \notin J$, then $i < j$.
page 280, line -9. Corollary 8.5 should be Theorem 8.5.
page 295, line 16. $|J| = \min\{|\overline{A}| + \sum_{i=1}^{k} r_i(A) \ : \ A \subseteq S\}$.
page 299, line -11. Replace polyhedron by polytope.
page 313, line 22, It should be repeated here that A must solve Π.
page 327. In the statement of Corollary A.3, replace the second c by c^T.

First Printing

Note. *In addition to* the corrections above, the following corrections apply to the first printing.

page 10, line 7, "edges" and "nodes" should be interchanged.
page 22, Table 2.1. r in row 1, column 3 should be rb, and rb in row 4, column 4 should be r.

page 27, (2.16), $y_v - y_w = c_{vw}$ should be $y_w - y_v = c_{vw}$.
page 73, line 6, E' should be E.
page 74, line 8, G'_{vw} should be G_{vw}.
page 88, line 14, the second E should be $|E|$.
page 88, line 15, $\mathcal{P}$ should be $\mathcal{P}'$.
page 88, lines 15 and 17, $\mathcal{E}'$ should be E'.
page 88, line 19, b should be u.
page 121, The B used in Theorem 4.20 is defined at the top of page 118.
page 128, The definition of augmenting path should make it clear that the end nodes must be distinct.
page 134, Exercise 5.4 is false if the graph has no edges.
page 154, Replace the last four sentences on the page by:
Consider the sum of $|S(v)|$ over odd pseudonodes v of T, minus the sum of $|S(v)|$ over pseudonodes of G' not in T. (Recall the definition of the set of nodes $S(v)$ given on page 138.) An expansion decreases this quantity, and a shrinking or tree-extension does not increase it. Therefore, there are $O(n)$ expansions. Similarly, each shrinking increases the sum of $|S(v)|$ over even pseudonodes of T, and no other step decreases it, so the number of shrinkings is $O(n)$.
page 155, line 2. Delete the first "of".
page 177, line 10. At the beginning of this line, add the phrase, "where A is the set of switched nodes".
page 181, Exercise 5.42. Replace "negative" by "positive".
page 182, line -17. Replace $\mathbf{Z}^E$ by $\mathbf{Z}^V$.
page 184, line -11. b-matching should be b-factor.
page 203, line 12. The definition of y^{k+i} should occur one sentence earlier.
page 211, Exercise 6.9. The condition that $b(V)$ is even is needed here.
page 225, in (6.13) the second w should be w^T.
page 233, line 7. $\bar{P} \cap \{x : c^T x \leq \lfloor d \rfloor,\ w^T x = \lfloor l \rfloor\} = \emptyset$.
page 252, Exercise 7.5. Theorem 7.1, not 7.2.
page 252, Exercise 7.5. the cost should be defined to be $\lfloor (|i-j|+1)/2 \rfloor$.
page 330, line 12, $z \leq 0$ should be $z \geq 0$.