

Errata for the book “Parameterized Algorithms” by Marek Cygan, Fedor V. Fomin, Łukasz Kowalik, Daniel Lokshtanov, Dániel Marx, Marcin Pilipczuk, Michał Pilipczuk, and Saket Saurabh

We would like to thank the following people for reporting errors and typos in the book: Ignasi Sau, Yoshio Okamoto, Sahand Mozaffari, Sören Henning, Alejandro Cassis, Jasper Slusallek, Nico Gründel, Jeroen Donners, Jan Arne Telle, Ondra Suchý, Paweł Rzażewski, Aneta Pokorná, James Weigle

- p. viii, line -2: “certain problem” should be “certain problems”
- p. 22, line 9 (i.e., line 2 of Reduction VC.3): “If $k < 0$ and G has more than . . .” should be “If $k < 0$ **or** G has more than . . .”
- p. 24, line -3: $k'^2 + k'$ should be $k'^2 + 2k'$
- p. 39, statement of Theorem 2.26: the proof shows only the bound of $d! \cdot k^d \cdot d$ on the number of sets
- p. 42, last line of Exercise 2.29: “function d ” should be “function f ”
- p. 53–55, Section 3.1: all summands $n\sqrt{m}$ in the running time bounds should be $m\sqrt{n}$.
- p. 76, Bibliographic notes: The discussion on “LP-guided branching” (fourth paragraph) should mention the work of Guillemot (Sylvain Guillemot, *FPT algorithms for path-transversal and cycle-transversal problems*. Discrete Optimization 8(1): 61-71 (2011)) where the first LP-guided branching algorithms were presented.
- p. 79, lines 24–25: two occurrences of “ G_i ” should be “ G_{i+1} ” and “a vertex of size” should be “a vertex cover of size”
- p. 84, line 23: the definition $q = k + 1$ is missing here
- p. 84–85: in the literature, the “natural position” of v is often denoted $p(v)$, not $p[v]$ as in our book
- p. 92, line 24: “find a set S ” should be “find a set X ” and “ $G - S$ ” should be “ $G - X$ ”
- p. 96, hint to Exercise 4.5: in the last bullet, some people find it more intuitive to reduce to the problem of finding a matching of maximum weight in a weighted bipartite graph (instead of maximum matching of minimum cost)
- p. 97: hints to 4.9 and 4.8 are in the wrong order
- p. 104 line -2 to p. 105, line 2: we should additionally add to the definition of $\text{PATH}(S, u)$ that $\text{PATH}(S, u) = \text{False}$ whenever $\chi(u) \notin S$, that is, $u \notin \bigcup_{i \in S} V_i$
- p. 110, line -3: $k/2^i$ should be $\ell/2^i$
- p. 135, line 10: “inequalities are satisfiable” should be “inequalities are satisfied”

- p. 136, line -4 and -3: “ $L_\pi(v)$ is the set of vertices preceding v , and $R_\pi(v)$ is the set of vertices succeeding v ” should be “ $L_\pi(v)$ is the set of neighbors of v preceding v , and $R_\pi(v)$ is the set of neighbors of v succeeding v ”
- p. 143, line -9: “depends only \mathcal{G}_k ” should be “depends only on \mathcal{G}_k ”
- p. 149, hint for 6.19: “yes-instance” should be “no-instance”
- p. 149, line -5: [367] should appear only once in the long list of references
- p. 150, last line of the third paragraph: the second author of the book [366] is Thomassen, not Thomas
- p. 150, line -3: the reference to Sachs is missing: *On spatial representation of finite graphs, in Finite and Infinite Sets*, Vol. I, II (Eger, 1981), 649–662, Colloquial Mathematica Societati Janos Bolyai, Vol. 37, North-Holland, Amsterdam, 1981
- p. 156, line 15: “Similarly, for $j = 1$, we should” should be “Similarly as for $j=1$, we should”
- p. 156, formula (7.2): X_i should be X_j under the max operator
- p. 159, statement of Lemma 7.2: with some care, one can obtain $\mathcal{O}(p \cdot \max(r, |V(G)|))$ running time bound, but the one stated (with p^2) is easier to argue
- p. 160, line -13: the treewidth of $K_{m,n}$ is $\min\{m, n\}$, not $\min\{m, n\} - 1$
- p. 184, line -13: “by bounded by” should be “be bounded by”
- p. 189, line 21: “A bramble is the” should be “A bramble is a”
- p. 191, Theorem 7.17: the work of Bodlaender claims a running time bound $2^{\mathcal{O}(k^3)} \cdot n$, which can be obtained by a careful analysis of the arguments there; the bound stated in the book is the one easier to obtain from the arguments of Bodlaender
- p. 194, line -3: $p < q$ should be $q < p$
- p. 200, line 20: “scope this book” should be “scope of this book”
- p. 205, line -2: “closed under taking of minors” should be “closed under taking minors”
- p. 212, third bullet starting at line 9: the set S we are looking for is a vertex set. Also, “If we take $j = k+1$, then” may be removed, while Corollary 7.34 is applied for $j = k+1$.
- p. 213, line 7: “The proof of the following statement” should be “The following statement”
- p. 220, Fig. 7.8 caption line 2: “that are originate” should be “that originate”
- p. 222, line -6: “got contracted onto w ” should be “got contracted onto $\eta(w)$ ”.
- p. 222, line -5: $G'[J_w]$ should be $G_H[J_w]$
- p. 223, line 2–3: “with its subgraph in \widehat{H} ” should be “with the subgraph in \widehat{H} isomorphic to H ”

- p. 223, line 6: “for $(p + 4)(k + 2)$ ” should be “for $f(k) = (p + 4)(k + 2)$ ”
- p. 225, line -7: $G'[Y_i]$ should be $G_H[Y_i]$
- p. 231, line 1: the inequality should read $\text{rw}(G) \leq \text{tw}(G) + 1$
- p. 231, line 7: “Designing dynamic-programming routines” should be “Dynamic-programming routines”
- p. 240: the hints for 7.50 and 7.48 should be swapped
- p. 256, Theorem 8.11: “in graph G ” should be “in a graph G ”
- p. 256, line -11: $2k - \lambda < 0$ should be $2k - \lambda < k$
- p. 258, Theorem 8.14: “superset S'_k of every important (X, Y) -cut” should be “superset S'_k of the set of all important (X, Y) -cuts”
- p. 260, line -9: “Let F contain an edge e if it is incident” should be “Let F be the set containing an edge e if and only if it is incident”
- p. 260, line -3: “As $R \cap Y = \emptyset$ ” may be expanded to “As $R \cap Y = \emptyset$ and e is incident to Y ”
- p. 265, line -3: “are adjacent” should be “is adjacent”
- p. 266, line -7: increases by $|V_i|$, not $|C|$
- p. 267: the recurrence in the middle of the page works for $j \geq |V_i|$; for $j < |V_i|$ it is just $T[i, j] = T[i - 1, j]$
- p. 273, line -2, statement of Theorem 8.39: the theorem should say about DIRECTED EDGE MULTICUT
- p. 274, proof of Lemma 8.40, line 5: “ (X, Y) -cut” should be “ (s_ℓ, T) -cut”
- p. 274, proof of Lemma 8.40, line -3: “ $\Delta(R)$ ” should be “ $\Delta^+(R)$ ”
- p. 276, line -2: $G' \setminus S$ should be $G' \setminus S'$
- p. 277, line -12: “directed $t_i \rightarrow s_i$ path” should be “directed $s_i \rightarrow t_i$ path”
- p. 280, problem 8.2: the quantification for v should be $v \in V(G) \setminus B$, not $v \in V(G)$
- p. 282, hint to 8.2, line 2: “necessary” should be “sufficient”
- p. 283, hint to 8.14: the new edges should be made undeletable, e.g., by introducing each of them in $k + 1$ copies
- p. 283, hint to 8.18, line 2: “no vertex of v ” should be “no vertex of F ”
- p. 297, proof of Lemma 9.7, line 2: “incident to z ” should be “incident to v ”
- p. 297, line 3 after proof of Lemma 9.7: “a vertex of C ” should be “a vertex of A ”

- p. 317, exercise 9.5: CVC.4 should be CVC.6
- p. 318, hint to 9.10: it suffices to get an $\mathcal{O}(r + k)$ bound on the number of vertices within distance exactly d from S
- p. 334, line -3: $(b + c)va =$ should be $(b + c) \cdot a$
- p. 335, line 13: “and then they correspond” should be “and correspond”
- p. 343, Theorem 10.23, line 2: “family of sets” should be “family of subsets”
- p. 345, proof of Lemma 10.24: for the bound $\mathcal{O}(km)$ on the number of field operations, one needs to additionally precompute $\sum_{\ell \in X} y_{v,\ell}$ for every $v \in V(G)$
- p. 347, Case 1, line -2: “exactly in the same so” should be “exactly the same so”
- p. 351, second paragraph, line 4: it would be more clear if the main formula of the line reads $v_i, v_{i+1}, \dots, v_j = v_j, v_{j-1}, \dots, v_i$
- p. 352, Problem 10.5: of course, we want to show that it is impossible *in FPT time* to count solutions for STEINER TREE
- p. 367, line -1 of the grey box: last subclause should read “if they give a connected subgraph when joined”
- p. 367, line -10: “carnality” should be “cardinality”
- p. 369, line 1: “modulo 1” should be “modulo 2”
- p. 369, line 2: “number of partitions” should be “number of cuts”
- p. 370, Theorem 11.11: the factor $2^{\mathcal{O}(|U|)}$ in the running time can be replaced with $|U|^{\mathcal{O}(1)}$ as if $|\mathcal{A}| \leq 2^{|U|-1}$, then we can output \mathcal{A} directly without any work
- p. 374, hint to 11.10: STEINER TREE should be LONGEST PATH
- p. 375, line -1: ω here is the matrix multiplication exponent
- p. 377, lines 16–17: “then we can use” should be “then using”
- p. 379, section 12.1.1: the first paragraph uses too much jargon; vectors v_e should be chosen from a vector space over some field \mathbb{F} and they should be taken from the same vector space for every $e \in U$
- p. 380, line 5 of Section 12.1.2: α_e^{k-1} should be α_i^{k-1}
- p. 383, line -10: “disjoint sums” should be “direct sums”
- p. 401, line -17: $\binom{(ek)^d}{d}$ should be $\binom{(ek)^d}{k}$
- p. 408, equation (12.3): the equation should read

$$|\tilde{\mathcal{P}}_{uv}^{p,q}| \leq n \cdot \max_{w \in V(G)} |\hat{\mathcal{P}}_{uw}^{p-1,q+1}|$$

- p. 409, line -11: “a feel of Theorem 12.15” should be “a feel of Theorem 12.31”
- p. 425, line 8: “problem B” should be “problem A”
- p. 426, line -1: “an equivalent instance of C ” should be “an equivalent instance (x'', k'') of C ”
- p. 427, line 6–8: the second occurrence of $f_1(k)$ in the equations should be raised to the power c_1
- p. 430, caption of Figure 13.1: “connectes” should be “connects”
- p. 433, point (iii) on the second list: $e \in X$ should be $e \in U$
- p. 436, line 2 after the grey box: “the value of the output gate is 1 in an assignment to the input gates” should be “the value of the output gate is 1 given a fixed assignment to the input gates”
- p. 442, line -12: missing closing parenthesis after the dollar sign
- p. 443, line 6: “ $a_{i,j}$ ” should be “ $a_{i,j,\sigma}$ ”
- p. 445, line -13: “ v_i ” and “ v_j ” should be “ v^i ” and “ v^j ”, respectively
- p. 447, item (ii): $1 \leq j \leq i$ should be $1 \leq j \leq n$
- p. 450, line -14: “we many omit” should be “we may omit”
- p. 458, line 4: $e_{i,j}$ should be $w_{e_{i,j}}$ in the definition of the set S
- p. 463, hint to 13.28, line 2: the vertices of G , not B
- p. 464, third paragraph, line 1: [149] should appear once in the reference list
- p. 469, line 5: “the q -SAT is” should be “the q -SAT problem is”
- p. 469, line 21: “infinimum” should be “infimum”
- p. 471, line 13: “providing” should be “provided”
- p. 479, line 19: “ c_{j_i} ” should be “ $c_i^{j_i}$ ”
- p. 499, line -8: “at distance at least 1” should be “at distance at least 2”
- p. 513, line -18: “ P_i ” should be “ P^i ”
- p. 515, line 14: “ $u_{\psi_i}^i$ ” should be “ $v_{\psi_i}^i$ ”
- p. 516, exercise 14.9: the notation $2^{o(k \log \ell)}$ is a bit informal; we ask here for an $2^{\Omega(k \log k)}$ lower bound in instances where ℓ is a nonconstant polynomial of k
- p. 537, line 11: “be an index” should be “be the index”
- p. 554, hint for 15.4, point 14, line 2: “four colors” should be “three colors”

- p. 579, line 1: “A G graph” should be “A graph G ”
- p. 579, third paragraph, lines 2-3: “on $V(T)$ ” should be moved to the end of the sentence
- p. 590, definition of INDEPENDENT SET: X should be of size at least k , not at most k .
- p. 594: PLANAR VERTEX DELETION should be later in the alphabetical order