

## ERRATA

GRAPH THEORY: Modeling, Applications, and Algorithms,  
by Geir Agnarsson and Ray Greenlaw  
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- 2nd printed page (Library of Congress, etc.): line 3: “Seniorr Editor” should be “Senior Editor”.
- Page **xii**, line 4: “Almost all proofs other than of some exceptionally technical theorems” (the crucial words “other than” are missing!).
- Page **xvi**, line -12: “ot thak” should be “to thank”.
- Page 9, line -13: “ $g : Y \mapsto Z$ ” should be “ $g : Y \rightarrow Z$ ”.
- Page 9, line -3: “ $h(x) = 1 - \frac{x}{3}$ ” should be “ $h(x) = (1 - x)/3$ ”.
- Page 28, Exercise 1.23: “less than relation ( $<$ )” should be “less than or equal relation ( $\leq$ )”.
- Page 29, Exercise 1.27: “ $G_{\gcd(k,n)}$ ” should be “ $\vec{G}_{\gcd(k,n)}$ ”.
- Page 30, line 3: should read  $E(\dots) = \dots$ , not  $V(\dots) = \dots$ .
- Page 45, line 2: “is satisfied by the graph on the right, but not by the one on the left.”
- Page 51, line 15: “ $G_{\sigma(n)}$ ” should be “ $G_{\sigma(k)}$ ”.
- Page 56, Figure 2.18: “ $\phi_1$ ” should be “ $f_1$ ”.
- Page 61, Excercise 2.3: add assumption that  $G$  is simple.
- Page 61, Excercise 2.11: add assumption that  $G$  and  $G'$  are simple.
- Page 63, Excercise 2.22: should read “... every regular simple graph is regular.”.
- Page 63, Excercise 2.23: should read “Show that if a simple graph  $G$  on  $n > 1$  vertices...” (since 0 is not a natural number, so 1 is not of the given form).
- Page 63, Excercise 2.30: should read “simple contraction” instead of “contraction” in both places.
- Page 64, Excercise 2.26: the second sentence should read “Viewing these paths as subgraphs of  $G$ , show that  $p_1 \Delta p_2$  constitutes an edge-disjoint union of one or more cycles, possibly along with some isolated vertices.”.

- Page 70, Theorem 3.7, 1st line: the assumptions can be weakened by deleting “simple”.
- Page 85, line -5: “ $T_{\ell}$ ” should be “ $T_{\ell}$ ”.
- Page 92, line 3: “ $i \in \{0, 1, \dots, n-1\}$ ” should be “ $i \in \{0, 1, \dots, k-1\}$ ”.
- Page 94, Excercise 3.7: note that the exercise can be improved by asking that the bound from the previous exercise be proved tight for all  $n \geq 2$ .
- Page 95, Excercise 3.18: should start “For all  $k \geq 0$ , show ...”.
- Page 122, line 12: “ $V(e) \geq 0$ ” should be “ $W(e) \geq 0$ ”.
- Page 125, line 2 (Proof of Theorem 4.40): “ $T$ ” should be “ $T_1$ ”.
- Page 128, Excercise 4.19: restrict to loopless general graphs for the second and third questions. The third question should read “... two adjacent vertices ...” instead of “... two distinct pairs of vertices ...”.
- Page 128, Excercise 4.22: replace “all entries” by “all off-diagonal entries”. Alternatively, limit the assertion to graphs with  $n \geq 3$  vertices.
- Page 129, Excercise 4.33: should read “... for any  $n \geq 2$ , ...”.
- Page 129, Excercise 4.34: add “... , for  $n \geq 3$ .” at the end of the first sentence.
- Page 130, Excercise 4.38: add assumption that  $G$  is loopless.
- Page 130, line -2 (in Excercise 4.39): should read “ $W(e)$ ”, not “ $E(e)$ ”.
- Page 133, Definition 5.1: line 1: “if there are  $X$  and  $Y$ ...” should read “if there are nonempty  $X$  and  $Y$ ...”.
- Page 136, Corollary. 5.8: needs to read “A connected non-Eulerian graph  $G$  has ...” (since a trail is allowed to be closed).
- Page 140, Theorem 5.16: the assumptions can be weakened by deleting “simple”.
- Page 154, Figure 5.12: in the first graph the directed edge  $(u_1, u_6)$  is missing.
- Page 156, Excercise 5.11: “...contain  $2k$  vertices...” should read “contain exactly  $2k$  vertices...”.
- Page 156, Excercise 5.12: the penultimate sentence of the exercise should read “... the last edge ...” instead of “... the least edge ...”.

- Page 157, Exercise 5.20: This problem doesn't make sense as is. It should be as follows:

“Let  $G$  be a simple graph on  $n$  vertices and  $k$  components. Show that

$$d_G(u) + d_G(v) \leq 2n - k - 1,$$

for all  $u, v \in V(G)$ . Show further that the upper bound of  $2n - k - 1$  can be reached for all  $n$  and  $k$ . Also show that if we assume  $u$  and  $v$  to be in distinct components, then the upper bound is  $n - k$ , and that this is also sharp.”

- Page 159, Exercise 5.43: the second line should read “contain a directed cycle.”.
- Page 159, Exercise 5.46: the problem is not correct as stated. It should read “ Let  $\vec{G}$  be a digraph on  $n$  vertices, and let  $I_n$  be the  $n \times n$  identity matrix. Show that if  $\vec{G}$  is acyclic, then  $I_n - A(\vec{G})$  is an invertible matrix. Give an example of a simple non-acyclic digraph  $\vec{G}$  where  $I_n - A(\vec{G})$  is invertible. [Hint: A simple digraph on  $n = 3$  vertices and 4 directed edges will work.]”.
- Page 167, Theorem 6.20: add assumption that  $G$  has  $n \geq 2$  vertices.
- Page 167, Note 6.21: should read “... for all  $n \geq 2$ .”.
- Page 167, Example 6.22: should read “... integers with  $n - 1 \leq m \leq n(n - 1)/2$ . ...”. (This is so that the Harary graph will be simple.)
- Page 169, Corollary. 6.28: add assumption that  $G$  has no isolated vertices.
- Page 171, Theorem 6.33: condition 3 should read “... there are two paths in  $G$  connecting them which are vertex-disjoint except at the endvertices.”
- Page 187, Corollary 6.54: add assumption that  $u \neq v$ .
- Page 187, Theorem 6.55: add assumption that  $u \neq v$ .
- Page 188, Theorem 6.56: add assumption that  $u \neq v$  and there is no edge in  $G$  from  $u$  to  $v$ .
- Page 189, Theorem 6.57: add assumptions that  $u \neq v$  and  $u$  not adjacent to  $v$ .
- Page 190, Exercise 6.5: add at the end “and there is some  $u, v$ -path in  $G$ .”.
- Page 190, Exercise 6.6: add the hypothesis that  $G$  has  $n \geq 2$  vertices.
- Page 190, Exercise 6.7: add the hypothesis that  $G$  has  $n \geq 2$  vertices.

- Page 191, Exercise 6.13: correct the hypothesis to  $n \geq 2$ .
- Page 191, Exercise 6.15: add the hypotheses that  $\Delta \geq 2$  and  $n \geq \Delta + 1$ .
- Page 192, Exercise 6.26: the hint should read that  $0 \leq f(e) \leq c(e)$  for every edge  $e$  of the network.
- Page 192, Exercise 6.30: the last sentence should read “In general, is it possible to have an arbitrary number of maximum flows ...”.
- Page 194, Exercise 6.40: the 2nd line should read “Show that for any distinct vertices  $u$  and  $v$ , the minimum number ...”.
- Page 194, Exercise 6.41: the 10th line should read “...path in  $\vec{G} - M_d, \dots$ ”, and not “... path in  $G, \dots$ ”.
- Page 200, Note 7.8: “can made” should be “can be made”.
- Page 201, line 10: “We conclude this chapter” should be “We conclude this section”.
- Page 202, Cor. 7.15: add assumption that  $n \geq 3$ .
- Page 208, Note 7.29, 1st line: should read “...homeomorphic to a given graph  $H$  with no vertices of degree 2, then ...”.
- Page 214, 2nd sentence of 1st paragraph after Note 7.34: should read “A property of graphs which is preserved under taking minors is called hereditary.”
- Page 226, Cor. 7.54: add assumption that  $n \geq 3$ .
- Page 226, Theorem 7.55: should read “... on  $n \geq 3$  vertices, ...”.
- Page 228, Exercise 7.1: “ $r_2, r_3$  and  $r_4$ ” should be “ $r_1, r_2$  and  $r_3$ ”.
- Page 229, Exercise 7.5: should read “Let  $G$  be a plane graph ...”.
- Page 229, Exercise 7.6: should read “Show that a simple plane graph ...”.
- Page 230, Exercise 7.23: should read “Eulerian” instead of “Euler” in four places.
- Page 230, Exercise 7.26: 2nd line should read “vertex disjoint paths from  $u$  to  $v$ ”.
- Page 231, Exercise 7.28: Theorem 7.59 is not correct as stated. Condition 2 should read “No subgraph of  $G$  can be obtained from  $K_4$  or  $K_{2,3}$  by subdividing edges.”.
- Page 231, Exercise 7.34: should read “... in a simple graph with ...”.

- Page 242, line -2: should read “adjacent” instead of “connected” in both places.
- Page 248, Theorem 8.28: should read “For a loopless planar graph ...”.
- Page 249, Theorem 8.29: should read “For a loopless planar graph ...”.
- Page 249, Theorem 8.30: should read “For a loopless graph  $G$  ...”.
- Page 250, Theorem 8.31: should read “For a loopless graph  $G$  ...”.
- Page 251, line 10 (first displayed formula): “ $2e$ ” should be “ $2m$ ”.
- Page 253, line 1: “ $V(E)$ ” should be “ $E(G)$ ”.
- Page 259, line 18: “...when  $n$  is odd...” should be “...when  $n$  is even...”.
- Page 259, line 19: “...when  $n$  is even.” should be “...when  $n$  is odd.”.
- Page 264, Exercise 8.37: 1st line should read “... a simple graph  $G$  ... if  $\chi(G) \leq 4$ ?”. 2nd line should read “... a simple planar graph ...”.
- Page 282, Theorem 9.24: Strictly speaking, this theorem should be attributed to Koebe [1] and Andreev [2] in addition to Thurston. Koebe’s original proof only covered the case for fully triangulated planar graphs. Thurston rediscovered the theorem and reduced the proof to a theorem by Andreev. His proof works for all planar graphs. Thurston never formally published his proof, but a sketch of his proof is in his cited lecture notes. For additional citations and history see [3, p. 118].
- Page 318, line -6: “ $a \in A \setminus \{x\}$ ” should be “ $a \in S \setminus \{x\}$ ”.
- Page 352, Exercise 11.12, line 4: “ $F_1 = 0, F_1 = 1$ ” should be “ $F_1 = 1, F_2 = 1$ ”.
- Page 417, Exercise 13.7: should read “Is it true that  $\lg(O(f(n))) = O(\lg(f(n)))$ ? Justify your answer.”.
- Page 444, Index: “Seymour, Paul” and “Seymour, Paul D.” are the same person and should be listed once as “Seymour, Paul D.”. Similarly, “Slater, Peter J.” should be listed once.

## References

- [1] Paul Koebe; Kontaktprobleme der konformen Abbildung, *Ber. Verh. Sächs. Akademie der Wissenschaften Leipzig, Math.-Phys. Klasse* **88**, 141 – 164, (1936).
- [2] E. M. Andreev; Convex polyhedra in Lobačevskiĭspaces. (Russian), *Matematicheskĭ Sbornik. Novaya Seriya*, **81 (123)**, 445 – 478, (1970).

- [3] Günter M. Ziegler: Lectures on Polytopes, *Graduate Texts in Mathematics*, **GTM 152**, Springer-Verlag New York Inc. (1995).

I will do my best to maintain this errata sheet for further printings and for possible additional editions of the book. Please drop me a line at [geir@math.gmu.edu](mailto:geir@math.gmu.edu) if you find a typo/mistake. On behalf of the authors, Ray and me, I thank you all collectively for your input and help.

Yours, Geir Agnarsson