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: "Senionr 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 "$g : Y \to Z$".

- Page 9, line -3: "$h(x) = 1 - \frac{x}{3}$" should be "$h(x) = (1 - x)/3$".

- Page 12, line "e_6 is adjacent both to itself and to e_5" should be "e_6 is adjacent to e_5".

- 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 $E(...) = ...$, not $V(...) = ...$.

- 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 54, Definition 2.37: In the 2nd itemized condition "$i \in \{1, \ldots, k-1\}$" should be "$i \in \{0, \ldots, k-1\}$".

- Page 56, Figure 2.18: "ϕ_1" should be "f_1".

- Page 61, Exercise 2.3: add assumption that G is simple.

- Page 61, Exercise 2.11: add assumption that G and G' are simple.

- Page 63, Exercise 2.22: should read "... every regular simple graph is regular.".

- Page 63, Exercise 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, Exercise 2.30: should read "simple contraction" instead of "contraction" in both places.

- Page 64, Exercise 2.26: the second sentence should read "Viewing these paths as subgraphs of G, show that $p_1 \triangle p_2$ 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: "$T_\ell l$" should be "T_ℓ".

- Page 92, line 3: "$i \in \{0, 1, \ldots, n-1\}$" should be "$i \in \{0, 1, \ldots, k-1\}$".

- Page 94, Exercise 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, Exercise 3.18: should start "For all $k \geq 0$, show ...".

- Page 100, Theorem 4.4, as it stands, is not entirely correct: $\tau(G)$ is defined in Definition 4.1 as the number of spanning forests of G, so the note right after Theorem 4.4 is wrong, since $\tau(G - e) \neq 0$. However, if we in Definition 4.1 define $\tau(G)$ to be the number of spanning trees of G, so $\tau(G) = 0$ if G is not connected, then Theorem 4.4 is correct.

- Page 102, lines 16, 25, 27, 30: "Tree to Prüfer code" should be "Tree from Prüfer code".

- 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, Exercise 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, Exercise 4.22: replace "all entries" by "all off-diagonal entries". Alternatively, limit the assertion to graphs with $n \geq 3$ vertices.

- Page 129, Exercise 4.33: should read "... for any $n \geq 2$, ...".

- Page 129, Exercise 4.34: add "... , for $n \geq 3$." at the end of the first sentence.

- Page 130, Exercise 4.38: add assumption that G is loopless.

- Page 130, line -2 (in Exercise 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 148, The second line in the displayed formula should be: "$N^-(u) \cup N^+(u) = V(\vec{G}) \setminus \{u\}$.".

- Page 154, Figure 5.12: in the first graph the directed edge (u_1, u_6) is missing.

- Page 156, Exercise 5.11: "...contain $2k$ vertices..." should read "contain exactly $2k$ vertices...".

- Page 156, Exercise 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 $\mathsf{I}_n - \mathsf{A}(\vec{G})$ is an invertible matrix. Give an example of an simple non-acyclic digraph $\vec{G}$ where $\mathsf{I}_n - \mathsf{A}(\vec{G})$ is invertible. [*Hint:* A simple digraph on $n = 3$ vertices and 4 directed edges will work.]".

- Page 167, Theorem 6.20: should read "For a simple graph G on two or more vertices, we have...".

- 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: should read: "any connected simple graph...". Also, 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 $\vec{G} - M_d$,...", and not "... path in G, ...".

- 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 241, last line of proof of Theorem 8.19 should be "$(\Delta + 1)$-vertex coloring...".

- 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 262, Exercise 8.20: "$d_G(u) \geq \chi(G)$" should be "$d_G(u) \geq \chi(G')$" and "$d_{\overline{G}}(u) \geq \chi(\overline{G})$" should be "$d_{\overline{G}}(u) \geq \chi(\overline{G'})$".

- Page 262, Exercise 8.21, part (c): $\ell(G) - 1$ should read $\ell(G) + 1$.

- Page 263, Exercise 8.30: "$n\binom{k}{2}$" should read "$m\binom{k+1}{2}$".

- 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 298, Exercise 9.26 part (b): "C_2^7" should be "C_7^2".

- Page 306, line -2: "$D = \{u_1, u_5, u_8\}$" should be "$D = \{u_1, u_5, u_7\}$" (as depicted in Figure 10.5.)

- 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 368, lines 5 and 6: "... $+2x^2$" should be "... $-2x^2$" in both places.

- 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 Wissenshaften Leipzig*, Math.-Phys. Klasse **88**, 141 – 164, (1936).

[2] E. M .Andreev; Convex polyhedra in Lobačevskiĭspaces. (Russian), *Matematicheskiĭ 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 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