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Errata to Fomin, Lokshtanov, Saurabh, and Zehavi "Kernelization" book

The page and statement numbers follow Cambridge's final (printed) edition.

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- page xii, 8th line mulivariate -> multivariate

- page 5, 12th line. Reduction Rule Reduction Rule -> Reduction Rule

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- page 6, In the chess example, the knight moves to e7 instead of f7

- page 15p, 5th line. graphs of girth 5 -> graphs of girth at least 5

- page 16, 19th line. Vertex Cover, Feedback Arc Set in Tournaments, Vertex Cover, Feedback Arc Set in Tournaments (FAST) -> Vertex Cover, Feedback Arc Set in Tournaments (FAST)

- page 16, 20th line. graphs of girth 5 -> graphs of girth at least 5

- page 22 line 4 of Section 2.4 : "The Dominating Set problem it is known..." => "The
Dominating Set problem is known..."

- page 23, 10th line. white vertex dominating more than k black vertices -> white vertex dominating more than $k-|R|$ black vertices

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- page 24: |B| <= k^2 should be |B| <= k(k+1), since one black vertex
covers at most (k+1) black vertices (including itself). The bounds on
W and R+W+B are also affected.

- page 26: In most of reduction rules here, we can use "at least |S|"
instead of "more than |S|"

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- page 27, 6th line of the proof of Lemma 2.11) a vertex cover of size $\ell-1$. -> a vertex cover of size at most $\ell-1$.

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- page 27, 11th line of the proof of Lemma 2.11) should belong to C. -> should belong to C'.

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- pages 29-30: Problem 2.8: Here r is a constant that may be hidden by big-O.

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- page 33, Section 3.1 2nd line. "NonBlocker" => "Max Leaf Subtree"

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- page 36 line 4: "u and v become leaves": this is not true, since x or y may
coincide with u or v. Here we have to argue that if x coincides with u, then adding xy destroys at most one leaf.

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- page 37, 3rd line of Lemma 3.3. The number of subdivided edges is not at most $|L|$, but $|L|+|B|-1\leq 2|L| -3$. This propagates with applications of Lemma 3.3; for instance (3.3) in 44p, 5th line from the bottom of 44p, and 3rd line from the bottom of 46p.

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- page 43: FVS.4 "delete it v" => "delete v"

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- page 43: FVS.5 "none-isolated" => "non-isolated"
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- page 43 line 20 "G'-S contain" => "G'-S contains"

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- page 43. Before reduction FVS.5 we need one more reduction rule. Without it rule FVS.5 is not safe.

Lemma: Let v be in T1, and suppose its neighborhood in F is a double edge clique C. Then there exists an optimal FVS S in G that avoids v.

Proof: Let S be an optimal FVS of G. If v \notin S we are done. If v is in S, observe that there is at most one vertex x of C that is is not in S. Let S' = (S-{v}) \cup C, we have that |S'| \leq |S|. We claim that S' is an FVS. Indeed v has degree at most one in G-S' and so there are no cycles in G-S' containing v. Cycles in G-S' avoiding v also avoid S, contradicting that S is an FVS.

Corollary: Let v in T1 and c be any vertex in C adjacent to v by a double edge. There exists an optimal FVS of G containing c.
Pf: take one that avoids v, it contains c.

This leads to an extra Reduction Rule FVS.4B: if v is in T1 and its neighborhood is a double Edge Clique C, and v is adjacent to c in C by a double Edge, then remove c and reduce the parameter k by 1.

Assuming this rule is applied exhaustively v is not incident to any double edges and the rule may now be applied

Proof of Claim 3.12. (Opposite direction.)

Let v be the vertex of degree 1 in T whose neighborhood in T is a double edge clique. Let u be its neighbor in T. Let w be the vertex resulting from the contraction. We want to prove that if G/uv has a FVS S' of size at most k then G has a FVS of size at most k.
Let S' be an FVS of G/uv.

Case 1: S' does not contain w. Then S' is a vertex set in G, and we claim that S' is a FVS in G. We have that (G-S') / uv = (G/uv) - S'. So (G-S') / uv is acyclic. Contracting an edge (when keeping double edges) can not turn a cyclic graph into acyclic, thus G-S' is acyclic as well.

Case 2: S' contains w. Let S = (S' - {w})\cup {u}. We claim that S is a FVS of G. Suppose not, and let Q be a cycle in G - S. We have that G-S = (G-S’) \cup v. So G-S is an acyclic graph (namely G-S’) plus one vertex v. So Q must go through v. Because of the reduction rule FVS4.a, there are no double edges connecting v with vertices of C. Thus the neighbors of v in Q are two different vertices.
But (since u is in S), both neighbors of v in Q are both in C, contradicting that Q is an induced cycle (since these two neighbors are connected by a double edge in C and thus form a cycle in G and in G'). This is a contradiction.

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- page 45 line 11: "To follows our strategy" => "To follow our strategy"

- page 45: FVS.6 "delete v" => "delete f"

-page 46 line 18. … which endpoints -> whose endpoints

- page 46: Proof of Claim 3.15. “is almost identical to the proof of Claim 3.15”-> Lemma 2.11?

- page 46, 7th line from the bottom. Dince the number of pairs is bounded by $k(k+1)(2k-1)$, then the bound $|T_2|$, $2k(k+1)(2k-1)$ is correct. This propagates to the last two formulas on page 46.

- page 47: Problem 3.3: This problem is very easy since every graph without isolated vertices has a dominating set of size at most n/2, so simple kernel with 2k vertices follows. More interesting questions is a 5/3k kerenel, from the original paper.

- page 57, 4th line of Section 4.4. contains a cycle on ℓ vertices. -> contains a cycle on at least $ \ell$ vertices.

- page 58, 2nd line of Problem 4.1. graph G -> a graph G

- page 63, 9th line. from the bottom) $|B|\geq|A|$. -> $|B|\geq q|A|$.

- page 63, 2nd line of the proof of Lemma 5.2 "Next, suppose that that..." => "Next, suppose that..."

- page 72: in Reduction COC.2: "If |B| >=" => "If w(B) >="

- page 73, 11th line. size at least ℓ. -> size at least $\ell+1$.

- page 73: missing qed in the end of the proof of the claim

- page 76, 7th line. allowsus -> allow us

- page 77, in (v): "to the the subtree" => "to the subtree"

- page 79 3rd line: "by more that" => "by more than"

- page 80 item 3 of Reduction FVS12: "Add edges between v and vertices in S such that..." => "Add edges between v and vertices in S in such a way that..."

- page 81 line 14: "such a feedback vertex set the set..." => "such a feedback vertex set..."

- page 82: For Problem 5.7 a quadratic kernel is easily obtained with simpler techniques. It is better to ask here for a linear kernel.

- page 91, 10th line of the proof of Theorem 6.5. Conversely, let S be a minimal vertex cover of size k. -> Conversely, let S be a minimal vertex cover of size at most k.

- page 97, 9th line from the bottom. not exist a (resp. strictly) reducible pair -> not exist a (resp. strictly) f-reducible pair

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- page 100, 11th line from the bottom. f-reducible -> f-reducible

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- page 112, 2nd line. $|N_G(A)|\leq|A|$ -> $|N_{G_{mathcal{P}}}(A)|\leq|A|$.

- page 112, 3rd line. Define Y as $\delta(\mathcal{P})\setminus A$, instead of $\delta(\mathcal{P})\setminus\{e|e\in A\}$.

- page 112, 4th line the sets of H -> the subsets of $V(H)$

- page 112, 5th line Consider the following partition of H, -> Consider the following partition of $V(H)$,

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- page 113, 12th line flopping -> flipping

- page 113, 6th line from the bottom H is a hypertree -> H has a hypertree

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- page 115, Reduction IST.1 Otherwise, proceed to Rule IST.3. -> Otherwise, proceed to Rule IST.2.

- page 117, Theorem 7.13 ISTadmits -> IST admits

- page 121, 3rd line a an area -> an area

- page 124, 11th line from the bottom Reduction Rule 8.4 -> Reduction Rule SP.1

- page 128, 4th line from the bottom: Let us note that since every K_{d,d}-free graph is also d-degenerate... ->Let us note that since every d-degenerate graph is also K_{d,d}-free...

- page 128, 9th line from the bottom $\leq=$ -> $\leq$

- page 129, 3rd line of the proof of Lemma 8.6) Between -> Because

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- page 129, 5th line of the proof of Lemma 8.6 $|F(X)|\leq j$. -> $|F(X)|<j$.

- page 130, 8th line of the proof of Claim 8.8 $|N(w)\cap I|<ik^{i-p-1}$ -> $|N(w)\cap I|<ik^{j-p-1}$

- page 131, 3rd line $I=\bigcap_{x\in S}N(u_x)$, -> $I=\bigcap_{u_x\in S}N(u_x)$,

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- page 131, 17th line Theorem 8.6 -> Lemma 8.6

- page 136, 2nd line from the bottom in the proof Lemma 9.5 -> in the proof of Lemma 9.5

- page 139, grey box, Out first observation -> Our first observation

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- page 140, 13th line. "than one unaffected clique" -> "than one unaffected maximal clique."

- page 141, Figure 9.3. both incident to K_1 and K_2 -> both incident to K_1 or K_2.

- page 142, 11th line from the bottom) Observation 9.3 -> Lemma 9.10

- page 148p, 18th line. "all its children are either leaves or labeld by" -> "each of its children either is a leaf or is labeled by."

- page 150, Lemma 9.22. Let G be graph -> Let G be a graph

- page   154, 5th line of the proof of Lemma 9.28."that do not have both endpoints in M" -> “that neither of its ends are in M."
(*235p, 7th line) What is $\tilde{O}$?

- page 169, 6th line. ... if it forms a spanning forest in ... ->... if it forms a   forest in ...

- page 235, 7th line. $x,k\tilde{O}$ -> $(x,k’)$.

- page 239. The title of section 13.2.1. Should be Planar Connected Vertex Cover (not Planar Cluster Vertex Deletion)

- page 159, 4th line. ket -> let

- page 222, inequality in 10th line, $\geq|T''|+k$ -> $\geq|\mathcal{T}''+k$

- page 234, 8th line. least $2k$ -> least $2k'$

- page 234, 16th line. $\geq2k$ -> $\geq2k'$

- page 237, Theorem 13.1. Then? -> Then

- page 240_7 Let C be a *connected* vertex cover...

- page 241^1 Instead of $|N_2|\leq k$ should be $|N_2|=0$.

- page 260 line 19:   a \in \chi(\partial_T(B)) should be u \in \chi(\partial_T(B))

- page 263, 4th line of Lemma 14.18 and 7th line of the proof of Lemma 14.18: $\chi(b')=\chi(b)$. -> $\chi'(b')=\chi(b)$.

- page 264, 11th line from the bottom. $\chi:V(T)\rightarrow V(G)$ -> $\chi:V(T)\rightarrow 2^{V(G)}$

- page 267, the middle equation. Two $\setminus$ between χ functions are missed.

- page 272, 19th line. $OPT_2=(OPT\setminus V_{b_1})\cup X_2$ -> $OPT_2=(OPT_1\setminus V_{b_2})\cup X_2$.

- page 273, Lemma 14.33. k is the width of the tree decomposition.

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- page 291, Theorem 14.56. Robertson et al. et al. -> Robertson et al.

- page 291, Theorem 14.56. For any G excluding H as a minor -> For any G excluding a planar H as a minor

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- page   292 Theorem 14.58. If G is planar -> If G is a connected planar graph.

- page 307. line 5 of the proof of Lemma 15.13.
$G[\chi(T_{v_i} - M_{i-1})]$ should be
$G[\chi(T_{v_i}) \setminus \chi(M_{i-1})]$
Similar corrections for
      line 7 $G[\chi(T - M_i)]$ -> $G[\chi(T) \setminus \chi(M_i)]$
and
line 15
$G[\chi(T_{v_j} - M_{j-1})]$ should be
$G[\chi(T_{v_j}) \setminus \chi(M_{j-1})]$

- pages 310-312 All \hat symbols over T_a χ like in $(\hat{T_a},\hat{\chi_a})$ should be removed.

- page 313, Theorem 15.22) Dominating Set (vc) on planar graphs -> Dominating Set on planar graphs. "

- page 315, 4th line. Set admits $2^{o(n)}$ time algorithm -> Set admits no $2^{o(n)}$ time algorithm
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- page   328, 2nd line. linear linear -> linear

- page 333, Statement of Lemma 16.23

Instead
Moreover, there is an algorithm that, given as input a graph G, a vertex $v\in V(G)$ and integers p and q, outputs in time
 $\cO(|E(G)|+|V(G)|\cdot \binom{p+q}{p} \cdot (p+q)^{\cO(1)})$
  all   pairs (P,Q) such that P is a connected vertex set of size $p+1$ containing v, $Q=N_G(P)$ and $|Q|=q$.

it should be

Moreover, there is an algorithm that, given as input a graph G, and integers p and q, outputs in time
 $\cO(|E(G)|+|V(G)|\cdot \binom{p+q}{p} \cdot (p+q)^{\cO(1)})$
  all   pairs (P,Q) such that P is a connected vertex set of size $p+1$, $Q=N_G(P)$ and $|Q|=q$.

- page 371, last line: Should be “All but one of its vertices are in S.”

- page 437, 14th line from the bottom. is the restriction of $\Gamma^-_{t,d}$ -> is the restriction of $\Gamma_{t,d}$.

- page 438, 4th line, it suffices to given -> it suffices to give

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- page 440, line 13: “no more hold” should be “no longer hold”.

- page 440, line 14: “setup” should be “set up”.

- page 441 19th line. instance (I,k) In this chapter -> instance (I,k). In this chapter

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- page 454, Definition 23.17. (fEfficient PSAKS) -> (Efficient PSAKS)

- page 481, Question of Multicolored Biclique. $1\leq i\leq\ell$ -> $1\leq i\leq k$