ERRATA TO EARLIER PRINTINGS OF LANG'S ALGEBRA (3RD EDITION)
and minor errata to the current printing

This list does not include corrections noted in the main part of this ''Companion'', i.e., corrections to the latest printing that seemed important enough to bring to the student's attention. Thus, only students who have earlier printings need to use it. (However, students with the current printing who find a minor typo in their copy of Lang might look below before reporting it, to see whether I had noted it but felt it not sufficiently important to record in the main part of this ''Companion''.)

Below, I will denote the six Addison-Wesley printings by 1a-6a, and the printings of the revised Springer version by 1s, 2s, etc.. (The most recent printing I have, which I am using to update this list, is 4s, though I know that 5s has come out.)

In the code in brackets before each item, numbers in boldface indicate printings to which an erratum applies, while italic numbers are printings to which it does not apply. Thus [**2a**|*4a*] indicates an error found in the 2nd Addison-Wesley printing, and corrected by the 4th; in such cases, it probably also occurred in the 1st printing, and not in printings after the 4th, but I don't know whether it occurred in the 3rd printing. Minor errors still occurring in the latest printing that I have are marked [**4s**]. Occasionally, an error first appears in a later printing; in that case I may have an indication like [*6a*|**1s**], meaning that the error was absent in (and presumably up to) the 6th Addison-Wesley printing, but appeared in the first Springer printing, and has not been corrected in the most recent printing that I have.

I am indebted to students in my past Math 250 classes, especially David Gay (Fall 1993), Chee-Whye Chin (Fall 1995) David Wasserman (Spring 1997) and Steven Sam (Fall 2006) for bringing to my attention many of these errors. While Lang was alive, I would point them out to him, and he generally corrected them; I now similarly communicate them to the publishers. My colleagues Paul Vojta and Bjorn Poonen and students in their courses have also contributed a number of corrections.

Along with errors, I note a few additions of material (mostly new exercises) that have been made in recent printings. Since information about material first added in (say) printing 1s should be of interest to the same set of readers (those having earlier printings) as an error first corrected there, I will mark such cases in the same way, as [**6a**|*1s*]. In such cases I will usually not give full details of the new material; the student interested in those details should find a copy of the relevant printing.

[*6a*|**1s**|*4s*] P.viii, top line of last paragraph: ''Lindeman'' should have a double n.

[**3a**|*4a*] P.xii. The page number for Chapter IV, §4 should be ''186'', and the page number for Chapter VI, §3 should be ''276''.

[**6a**|*1s*] P.xii: The beginning of the title of Chapter IV, §7 has been changed to ''Mason-Stothers theorem''.

[**1s**|*4s*] P.xiii, page number for §IX.1: This should be 378.

[**5a**|*6a*] P.xv, last 3 lines: In the first three printings, these three page numbers should be increased by 2. Starting with the third printing, there is a Bibliography beginning on p.895, which should be shown here, and the page number for the Index should be 901. (The Bibliography is expanded in printing 1s, raising the page number of the index to 903 there.)

[**4s**] P.5 line 12 from bottom: ''thereafter'' should be ''henceforth''.

[**3a**|*4a*] P.7, 4/5 of the way down the page, in the line before the italicized statement, after ''respectively'' the line should end ''under suitable conditions. Namely''.

[**1s**|*4s*] P.9, line 5: For ''We define the product'' read ''We define the law of composition''.

[**3a**|*4a*] P.9, third-from-last display: change all three n's to r's.

[**3a**|*4a*] P.12, line 4, change ''which commute'' to ''whose elements commute''.

[**3a**|*4a*] P.15 line 5: $T_{0,b}$ should be $T_{1,b}$.

[**1s**|*4s*] P.15, line before final display: After ''for example'' add ''letting 0 be the trivial group''.

[**3a**|*4a*] P.17, after first box, ''(1)'' and ''(2)'' should be ''(i)'' and ''(ii)''.

[**1s**|*4s*] P.18: In the last line of Proposition I.3.1, delete comma before ''whose''. At the end of the second line of the proof of that proposition, after ''a cyclic tower'' add ''ending with $\{e\}$''. In the next-to-last line of the page, change ''Theorem 6.4'' to ''Theorem 6.5''.

[**1a**|*2a*] P.19.: Three lines before first (small) display, ''dagonal'' should be ''diagonal''. In the line immediately preceding big matrix: ''$\geq g$'' should be ''≥ 2''.

[**5a**|*6a*] P.19: Two lines after the big matrix, k^r should be k^{n-r}, and on the line after that, ''r-tuple $(a_{1r}, \dots, a_{rn}) \in k^r$. This r-tuple '' should be ''$n-r$-tuple $(a_{1r+1}, \dots, a_{n-r,n}) \in k^{n-r}$. This $n-r$-tuple''. Also, in printings before the 4th, in the big matrix, the term labeled a_{2r} should be labeled $a_{2,r+1}$, the term labeled a_{rn} should be labeled $a_{n-r+1,n}$, and between the last two rows of the matrix there should be a ''...'' to show that there may be more (or fewer) than two rows of 0's.

[**6a**|*1s*] P.19: Two lines after the big matrix, k^{u-r} should be k^{n-r}.

[**4s**] P.20, second paragraph: this definition of ''simple'' is repeated in the sentence preceding Theorem I.3.5 on p.22.

[**4a**|*5a*] P.20, first **Example**, third from last line: The condition that in earlier printings appeared as ''r, s relatively prime'' and in the 4th printing as ''r, s relatively prime > 1'' should just be ''$r, s > 1$''.

[**6a**|*1s*] P.23, top: Another reference has been added: R. SOLOMON, A brief history of the classification of the finite simple groups, *Bull. AMS* **38**, 3 (2001) pp. 315-352.

[**5a**|*6a*] P.25, line preceding (**v**): expand ''so'' to ''$\mathbf{Z}/m\mathbf{Z} \cong G/H$, so $n = md$, $m = n/d$ and''.

[**1a**|*2a*] P.26: on line 4, $x(yx)$ should be $x(ys)$. On line 5: $= e$ should be $= s$. On the line after ''**1. Conjugation**'': yxy^{-1} should be xyx^{-1}.

[**1s**|*4s*] p.26, line 7: ''is permutation'' should be ''is a permutation''.

[**5a**|*6a*] P.26, end of the paragraph ''**1. Conjugation**'': Add ''Automorphisms of G of the form γ_x are called **inner**.''

[**5a**|*6a*] P.27, line 3: before ''not a subgroup'' add ''in general''.

[**5a**|*6a*] P.28, next to last line: before ''connected'' add ''where X is''. Also (in all printings including the 6th), on the preceding line I recommend dropping the word ''universal''.

[**3a**|*4a*] P.29 third display should be

$$S = \bigcup_{i \in I} Gs_i \quad \text{(disjoint)}, \quad \text{also denoted} \quad S = \coprod_{i \in I} Gs_i ,$$

[**6a**|*1s*] P.30, first line of last display: On the right-hand side of the ''='' sign, insert parentheses around the symbols $\pi(\sigma) f$.

[**3a**|*4a*] P.32: In line 5, after the second word, h_v should be H_v. In the fourth line of ''**Remark ...**'', ''Theorem 5.4'' should be ''Proposition 5.3''.

[**1a**|*2a*] P.36, statement of Proposition I.6.8 ''*porimes*'' should be ''*primes*''.

[**3a**|*4a*] P.36, line before first display: ''be'' should be ''by''.

[**5a**|*6a*] P.36, second line of proof of first **Example**: ''the 5-Sylow subgroup'' should be ''a 5-Sylow subgroup''.

[**3a**|*4a*] P.37, statement of Proposition I.7.1: In the first and second printings, after A add $= \oplus A_i$. In the third printing, after the first sentence add ''Let $A = \oplus A_i$''.

[**1a**|*3a*] P.39, two lines above the **Example**, ''element'' should be ''elements''; and on the same page, two lines above the triangular diagram, M should be $K(M)$.

[**1s**|*4s*] P.39, 5th line after first diagram: For ''is a factor group'' read ''is isomorphic to a factor group''.

[**5a**|*6a*] P.40: Move the line ''The universal group $K(M)$ is called the **Grothendieck group**.'' from two thirds of the way down the page to right after line 7.

[**2a**|*4a*] P.44, line 2: First and second printings: add ''We note that the period of $\bar{b}$ is $\leq$ the period of b. If $n = 0$ we are done. Otherwise''. Third printing: similarly, except that the first of these sentences is already there.

[**5a**|*6a*] P.44, line 7: Change ''The'' to ''Then'', and ''remark'' to ''remarks''.

[**1s**|*4s*] P.45, third line from bottom: $y \in A$ should be $y \in S$.
[**5a**|*6a*] P.48, 4 lines after second display: Change $< n$ to $\leq n$.
[**5a**|*6a*] P.49, next-to-last line: change ''sequence'' to ''sequences''.
[**3a**|*4a*] P.49, second and third lines of statement of Theorem I.9.2: ''*right and left*'' should be ''*left and right*''
[**1s**|*4s*] P.50, first two displays: lim should be $\varprojlim$ in both places.
[**6a**|*1s*] P.51, last paragraph: In the current printing this is formulated in terms of Galois groups, like the preceding paragraph.
[**1s**|*4s*] P.52: On line 5, ''for all n'' should be ''for all r''. In the last line of the proof of Theorem I.10.1, ''direct limit'' should be ''inverse limit''. In the sixth-from-last line of the page, ''countably generated'' should be ''finitely generated''. And on the fourth-from-last line, ''**cofinal**'' should be ''**cofinal** in $\mathfrak{F}$''.
[**1s**|*4s*] P.53, statement of **CAT 2**: ''left and right identity'' should be ''right and left identity'' (to match the use of ''respectively'').
[**1s**|*4s*] P.55, next-to-last line: $u_0\, u_0^{-1}$ should be $u \circ u_0^{-1}$.
[**2a**|*3a*] P.56, triangular display: the second ρ should be ρ'.
[**3a**|*4a*] P.56, end of next-to-last line: $x \in G$ should be $x, y \in G$.
[**1s**|*4s*] P.58, 6 lines above ''**Products and coproducts**'': ''situtaions'' should be ''situations''.
[**1s**|*4s*] P.60, line 3: After ''*coproducts exist*'' add '', i.e., every family of objects has a coproduct''.
[**5a**|*6a*] P.60, two lines above first display: Delete ''the complement of x' in'', and if you have a printing before the 4th also delete ''the union of S and''.
[**2a**|*3a*] P.60, three lines above final **Example**: $A \prod B$ should be $A \amalg B$.
[**1s**|*4s*] P.60, line above example at bottom of page: After ''unique isomorphism'' add ''See the comment, the top of p.58.''
[**5a**|*6a*] P.61, second line after the triangular displayed diagram: Change ''morphisms on Z'' to ''morphisms to X and Y over Z''. If you have a printing before the 4th, then on the preceding line also shorten **direct product** to **product**.
[**1a**|*2a*] P.62, first line and first display: arrow to T should go the other way.
[**1s**|*4s*] P.62, **Example** just before the heading **Functors**: For S read $\mathbb{S}$.
[**5a**|*6a*] P.62, bottom line: change this to ''essentially the same definition, but reversing all arrows $F(f)$, i.e.,''.
[**2a**|*3a*] P.64, line 4: the second $=$ should be $\neq$.
[**5a**|*6a*] P.67, equation in the line after the triangular display: g_* should be ψ_*.
[**3a**|*4a*] P.71, middle of page: the displayed equation $f_i \circ g_* = g_i$ should be $g_* \circ f_i = g_i$.
[**1s**|*4s*] P.71, last line of text: For ''This is done by representing the group as follows'' read ''The group can be represented as follows''.
[**5a**|*6a*] P.74, first line of Corollary V.12.8: After ''*groups*'' add ''*with* $G_i \cap G_j = \{1\}$ *if* $i \neq j$''.
[**1s**|*4s*] P.76, first display: The right-hand side should be $(x_1 \psi(h_1) x_2,\ h_1 h_2)$.
[**2a**|*3a*] P.76, Exercise 16: ''Chapter XVIII'' should be ''Chapter XIII''.
[**1a**|*2a*] P.77, Exercise 22, first line: ''grop'' should be ''group''.
[**5a**|*6a*] P.79: Exercise 38(d) should begin ''Assume that n is prime.''
[**1s**|*4s*] P.81, Exercise 51(b): In the next to last line, in the phrase ''into fiber products in the category of sets'', delete the word ''fiber''. (That is, the functor turns fiber products into products.)
[**6a**|*1s*] P.82: Exercise 57 has been added, concerning group actions, with topological applications. The next correction applies to the version of that added exercise in [**1s**]:
[**1s**|*4s*] P.82, next-to-last line: Change ''closed. Then'' to ''closed, and that''.
[**1s**|*4s*] P.84, next-to-last display: The $x_i x_j$ at the end should be $x_i y_j$.
[**3a**|*4a*] P.85, line 4: $x \in A$ should be $x \in S$.
[**1s**|*4s*] P.92, near top, second line of **Examples**: For ''more than 2'' read ''at least 2''.

[**5a**|*6a*] P.93, definition of **field**: Before ''ring'' add ''commutative''. (Also, at the beginning of that line he has ''defined'' for ''define'', even in the 6th printing.)

[**4a**|*5a*] P.99, 4th and 3rd lines from bottom, Delete ''$f \in A[X]$ *and*''.

[**1s**|*4s*] P.100: In the line after the Example, the summation should start with $i = 0$. In the third from last line of the page, ''polynomial'' should be ''polynomials''.

[**3a**|*4a*] P.102, immediately after third display: change ''is an isomorphism'' to ''is injective''.

[**3a**|*4a*] P.105, first line, left-hand side: change (t) to (z).

[**3a**|*4a*] P.106, Proposition II.3.1: add at the end the condition ''*and* $h(a) = a$ *for all* $a \in A$''.

[**3a**|*4a*] P.107, statement of Proposition II.3.2, last line (displayed equation): on the right-hand-side, the h should be f. (The h on the left-hand side is correct.)

[**1s**|*4s*] P.107, computation in middle of page: The last line should be $= h(\alpha)h(\beta)$.

[**4a**|*5a*] P.107, display beginning $h(\alpha\beta)$: The second line of this display should be a double summation $\Sigma\Sigma\, f(a_x)\, f(b_y) z$, with the respective ranges of summation as on the preceding line.

[**1s**|*4s*] P.112, second line: change (a, b) to $(a) + (b)$.

[**4s**] P.112, fifth line: same correction as above.

[**6a**|*1s*] P.112, line after the display ''$(a_n) \subseteq (a) \subseteq (a_n)$'': The conclusion after ''Hence'' does not quite follow from what has been said, but becomes correct if one assumes that in the construction of the chain of (a_i), one does not stop at a finite step (a_n) unless the ideal at that step is maximal in S. In printing 1s, Lang has changed this part of the proof, using the preceding sentence to deduce that S is inductive, and applying Zorn's Lemma. My notes for this this page give the approach I prefer.

[**1s**|*4s*] P.112, first line of paragraph starting just below middle of page: ''a_n'' should be ''a''.

[*6a*|**1s**|*4s*] P.113, second line before first Example: **relaively** should be **relatively**.

[**1s**|*4s*] P.115: In the next-to-last line of Exercise 5, change ''those primes of p'' to ''of the form up where p is a prime'', and at the end of the last line add the phrase ''and u is a unit of $S^{-1}A$''. In the first line of Exercise 10: ''all element'' should be ''all elements''.

[**1s**|*4s*] P.116, last line: add ''; Chapter III, Exercises 11-13.''

[**4s**] P.118, fifth line below the word **Examples**, for ''two-sided'' read ''left''. Three lines later, ''More general'' should be ''More generally''.

[**1s**|*4s*] P.118, second line of the paragraph after the **Examples**: ''$a + J$'' should be ''$x + J$''.

[**1s**|*4s*] P.126, line 6 of **Examples: ...** : $F(K') \to$ should be $F(K) \to$.

[**1a**|*3a*] P.128, three lines above the proposition: ''9.1'' should be ''7.1''.

[**6a**|*1s*] P.136, two lines above boxed display: ''left ideal'' should be ''two-sided ideal''.

[**4a**|*5a*] P.142, first two sentences of §III.6, Delete the word ''finite'' in the first sentence. In the second sentence, for ''1-dimensional space'' read ''free module of rank 1''.

[**1a**|*3a*] P.143, line below that on which **dual basis** is defined: ''B of E'' should be ''B of $E^\vee$''.

[**6a**|*1s*] P.145, line 3: **P4** should be **P2**.

[**6a**|*1s*] P.154, Theorem III.7.9: Add an initial sentence, ''*Assume that the elementary matrices in* R *generate* $GL_n(R)$''. In printing 1s Lang has also added at the end of the section a reference to a paper showing that this condition does not always hold.

[**6a**|*1s*] P.155, last line: T should be Γ.

[**6a**|*1s*] P.159: In the line after the first display, ''on cokernels'' should be ''on kernels''. Two lines after the third display, ''image of g'' should be ''image of g_*''.

[**6a**|*1s*] P.160, bottom line: $f^i{}_j(x)$ should be $-f^i{}_j(x)$.

[**6a**|*1s*] P.161, three lines above second display: ''homorphism'' should be ''homomorphism''.

[**1s**|*4s*] P.163, third line of **Examples**: $k[T]$ should be $k[[T]]$.

[**1s**|*4s*] P.165, Exercise 2: Before ''commutative ring'' insert ''non zero''.

[**1s**|*4s*] P.169, Exercise 17(a): Change ''a projective system'' to ''an inverse system''.

[**1s**|*4s*] P.170, Exercise 17(b): Change ''all ideals'' to ''all non zero ideals''.

[**6a**|*1s*] P.172: Three new exercises, on graded algebras, have been added on this (previously blank) page.

The next comment applies to the version of these in printing [**1s**].

[**1s**|*4s*] P.172, line after top display: Delete the sentence ''In particular, A is an A_0-algebra''. (So the word ''algebra'' in later sentences should be understood as meaning ''k-algebra''.)

[**3a**|*4a*] P.175, line after first display: $f - gg$ should be $f - qg$.

[**2a**|*3a*] P.175, five lines above Theorem IV.1.4, add ''A polynomial is called **monic** if it has leading coefficient 1.'' Add to the index a reference to this page for the term ''monic polynomial''.

[**1s**|*4s*] P.176, first display, and line before third display: f_i should be f_j in both places.

[**3a**|*4a*] P.178, line 6 from bottom: ''a polynomial'' should be ''a nonzero polynomial''.

[**1s**|*4s*] P.179, display in statement of Proposition IV.1.12, and the following display: The summations should start with $\nu=0$ and $\mu=0$ respectively.

[**5a**|*6a*] P.181, Theorem IV.2.1, third line of *Proof*, end of line: Change $=1$ to $=0$.

[**3a**|*4a*] P.182, statement of Theorem IV.2.3: change ''*are either primes of* A *or* ...'' to ''*are the primes of* A *and* ...''.

[**5a**|*6a*] P.182, 6 lines from bottom: move the phrase ''From the Gauss lemma'' to modify ''$c = \mathrm{cont}(f)$'' on the preceding line.

[**3a**|*4a*] P.184, end of line 10: delete ''$r \neq m$ and''.

[**2a**|*3a*] P.184, line 3 from bottom: ''E's'' should be ''Eisenstein's''.

[**3a**|*4a*] P.186, Theorem IV.4.1, first line of Proof: The second sentence should begin, ''Let $\mathbf{a}_i$ consist of 0 and the set of elements $a \in A$ ...'' (but with $\mathbf{a}_i$ having the $\mathbf{a}$ in fraktur font, as in the middle of the line after the display).

[**1s**|*4s*] P.186, first line of proof of Theorem IV.4.1: In ''a_i'', the ''a'' should be fraktur, as in the line after the following display, and *A[X]* should be $A[X]$.

[**6a**|*1s*] P.187, three lines before Corollary IV.4.2: ''numer'' should be ''number''.

[**5a**|*6a*] P.187, statement of Corollary IV.4.2: Change ''*a finitely generated commutative ring containing* A'' to ''*a commutative ring finitely generated over* A''.

[**3a**|*4a*] P.190, from line preceding last display to bottom of page: everywhere change the notation f^{σ} to σf. In particular, on the line following the display, change the incorrect formula $f^{\sigma\tau} = (f^{\sigma})^{\tau}$ to the correct formula $\sigma\tau f = \sigma(\tau f)$.

[**1s**|*4s*] P.191, statement of Theorem IV.6.1, second line: Change ''$\leq d$'' to ''d''.

[**3a**|*4a*] P.193, 6th line of **Cubic Case**: $X_2^n X_3^m$ should be $X_2^m X_3^n$.

[**1s**|*4s*] P.193: In the line after the third-from-last display, ''$D = -\nu a^3 = -\upsilon$'' should be ''$D = \nu a^3 = -\upsilon$'' (i.e., Lang's first minus sign is wrong, while the second is right). And in the line after the next-to-last display, $= 2b^2 = w$ should be $= wb^2 = w$.

[**5a**|*6a*] P.194, 2nd and 4th displays: Reverse the signs on all four ''$\frac{1}{3}$''s (three in the 2nd display and one in the 4th).

[**6a**|*1s*] P.200, end of §IV.8: A reference has been added to the material noted under p.220 below.

[**1s**|*4s*] P.210, first line: ''*post*'' should be ''*posto*''.

[**1s**|*4s*] P.213, first line of Exercise 7: Change ''q elements'' to ''$q = p^m$ elements''.

[**1s**|*4s*] P.214, Exercise 9: After ''automorphism of $A[X]$'' add the words ''inducing the identity on A''.

[**3a**|*4a*] P.214, Exercise 10: Change the first sentence to ''Let K be a field and $K(X)$ the quotient field of $K[X]$.''

[**1s**|*4s*] P.216, first display: b_{d-1} should be b_{d-2}.

[**3a**|*4a*] P.217, line 5, end of line: ''in (a)'' should be ''in (b)''.

[**6a**|*1s*] P.220: Lang has added a paragraph and four references, indicating why what he previously called ''Mason's Theorem'' is now called the ''Mason-Stothers theorem'', and discussing further proofs thereof.

[**3a**|*4a*] P.224, statement of Proposition V.1.2, line 3: ''*a basic*'' should be ''*a basis*''.

[**3a**|*4a*] P.225, middle of page, line following display: ''is **finite**'' should be ''is called **finite**''.

[**5a**|*6a*] P.230, next-to-last line of *Proof* near top of page: before $[E':k]$ delete ''as''. In second and third lines of next paragraph, change ''Then EF is the quotient field of $E[F]$, and also the quotient field of $F[E]$'', to ''Then $E[F] = F[E]$ and EF is the quotient field of this ring''.

[**1s**|*4s*] P.233, statement of Proposition V.2.7: change ''$\leq$ *the number of roots of* p'' to ''$\leq$ deg p'', and add at the end of the second line the words ''*in* k^{a}''.

[**6a**|*1s*] P.235, third line of **Examples**: after ''other automorphisms'' add ''$\neq$ id''.

[*6a*|**1s**] P.235, third line of **Examples**: after ''$\neq$ id'', there should not be a ''.''.

[**3a**|*4a*] P.236, Theorem V.3.1, last line. Change ''*on* K'' to ''*onto* K''. The first two printings also have ''*including*'' instead of ''*inducing*'' on the third line of the theorem.

[**3a**|*4a*] P.239, diagram in middle of page: add a vertical line between F and E. In the first printing (only), λ also goes in the wrong direction: it should go from right to left.

[**3a**|*4a*] P.241, line 3: change ''if α is separable over k, and F is any extension of k'' to ''if $k \subset F \subset K$ and $\alpha \in K$ is separable over k''.

[**3a**|*4a*] P.242, line 5: ''Theorem 4.2'' should be ''Corollary 4.2''.

[**4s**] P.243, line below first display: ''the same field'' should be ''the above field''.

[**3a**|*4a*] P.243, two lines above last display: after ''roots of f'' add ''in a fixed algebraic closure''.

[**3a**|*4a*] P.247, Theorem V.5.5, first line: change ''*Then* $\mathbf{F}_{p^n}$'' to ''*Then in any algebraic closure of* $\mathbf{F}_p$, *the subfield* $\mathbf{F}_{p^n}$''.

[**6a**|*1s*] P.247, last line of Theorem V.5.5: After *cyclic* add *of order* d.

[**3a**|*4a*] P.248, first display: change the three occurrences of the index i to j (since i was given a particular meaning on the preceding page).

[**3a**|*4a*] P.249, Proof of Corollary V.6.4: change ''Obvious'' to ''Immediate by Theorem 4.1''.

[**4s**] P.249, statement of **P.Ins. 2**: For ''the irreducible equation ... is $X^{p^n} - a = 0$'' read ''the irreducible polynomial ... is $X^{p^n} - a$''.

[**3a**|*4a*] P.251: On line 2, K should be k. In the fifth line of the proof of Corollary V.6.10, the phrases ''purely inseparable'' and ''separable'' (in two successive sentences) should be interchanged. In the next line, change ''Iterating'' to ''Similarly''.

[**6a**|*1s*] P.251, third line of statement of Proposition V.6.11: K_G should be K^G.

[**6a**|*1s*] P.252, line after first display: σ_1 should be σ_i.

[**3a**|*4a*] P.252, Corollary V.6.12: Connect the two sentences with ''and'' (so that the hypothesis applies to both).

[**1a**|*2a*] P.256, Exercise 26, second line: before ''irreducible'' add ''monic''.

[**5a**|*6a*] P.256, Exercise 27, second display: X_{n-1} should be X_{n+1}.

[**3a**|*4a*] P.262, line 7: Here Lang indicates the notation $G(K/k)$ or G for the Galois group, and he will indeed use these for the next few sections. But eventually, other notations start cropping up as well; so after ''$G(K/k)$'', add the alternatives ''$G_{K/k}$, Gal(K/k)'', as Lang has done in later printings. Also, on line 7 from the bottom, change ''Chapter VII'' to ''Chapter V''.

[**5a**|*6a*] P.263, two lines above Lemma VI.1.7: Before ''Corollary 1.6'' add ''the last assertion of''.

[**6a**|*1s*] P.264, next-to-last line of proof of Theorem VI.1.8: ''oder'' should be ''order''.

[**3a**|*4a*] P.264, two lines before Corollary VI.1.9: again, ''Chapter VII'' should be ''Chapter V''.

[**6a**|*1s*] P.266, proof of Corollary VI.1.1: ''... a subgroup of an abelian group is abelian'' should say ''... is normal''.

[**1s**|*4s*] P.269, one line after the proof of Theorem 1.17: ''composite'' should be ''compositum''.

[**6a**|*1s*] P.269, first line of §VI.2: Before ''polynomial'' add ''separable''.

[**3a**|*4a*] P.270: On line 8, ''and assume f is separable'' should be ''Since char $k \neq 2, 3$, f is separable''. On the 6th line from the bottom, ''order 2'' should be ''degree 2''

[**3a**|*4a*] P.271: In line 2 (display), Q should be $\mathbf{Q}$. Also, two lines above the diamond-shaped diagram, ''sending i on $-i$'' should be ''sending i to $-i$'', and similarly four lines below the same diagram ''on the root'' should be ''to the root''.

[**1s**|*4s*] P.274, second line before Example 8: ``[123⋯$p$], which generate $S_p$'' should be ``[12345], which generate S_5''.

[**1s**|*4s*] P.275, lines 5 and 7: P_{n-1} should be P_{n+1} in both places.

[**6a**|*1s*] P.275, paragraph starting below middle of page: After the first sentence, ``Over the field $\mathbf{C}(t)$ ...'', Lang has added a sentence referring to papers on this and a related case. (To make room for this, he has un-displayed two of the four preceding displays, so the page layout looks different; but the content seems the same except for this added sentence.)

[**4a**|*5a*] P.277, three lines above the next-to-last display: In the first three printings, ``prime to'' should be ``not divisible by''. In the 4th printing, ``by to'' should be ``by''.

[*4a*|**5a-1s**|*4s*] P.277, third line from the bottom: ``$G_{\kappa(\zeta)/\kappa}$'' should be $G_{k(\zeta)/k}$.

[**2a**|*3a*] P.277, second line from the bottom: ``$\mathbf{Z}/n\mathbf{Z})^*$'' should begin with an open-parenthesis.

[**1s**|*4s*] P.277, second line from the bottom: $\kappa =$ should be $k =$.

[**3a**|*4a*] P.279, line 5: change ``had seen'' to ``saw''.

[**2a**|*3a*] P.279, display with a fraction-line: the Φ in the denominator should be Φ_d.

[**1a**|*3a*] P.281: on lines 4 and 5, $n \geq e$ should be $j \to \infty$, and ``Conrad'' should be ``Bang''. Two lines later, after ``the coefficient of $X^7$'' add ``and X^{41}''.

[**3a**|*4a*] P.281: in the line before the central display with braces, after ``a nonzero integer'' add ``not divisible by p'', and in that display itself, add to the first line, ``for some $x$'', and to the second line, ``for all x''.

[**4s**] P.282: The extra-long minus sign appearing twice in the third display is a typographical error, with no special meaning.

[**1a**|*2a*] P.283: In the 4th line of the second paragraph of **Examples**, ``Similary'' should be ``Similarly''. And in the line before Theorem VI.4.1: ``thsese'' should be ``these''.

[**3a**|*4a*] P.284, last two displays: As with the notation for Galois groups (first erratum re p.262 above), Lang will use other notations along with those given here. So change ``$N_k^E(\alpha) =$'' to ``$N_{E/k}(\alpha) = N_k^E(\alpha) =$'', and ``$\mathrm{Tr}_k^E(\alpha) =$'' to ``$\mathrm{Tr}_{E/k}(\alpha) = \mathrm{Tr}_k^E(\alpha) =$'', as Lang does in later printings.

[*3a*|**4a-5a**|*6a*] P.284, last display: $T_{r_{E/k}}$ should be $\mathrm{Tr}_{E/k}$.

[**3a**|*4a*] P.285: In the second line of the second paragraph of the Proof, change ``an embedding of $E$ in $k^{\mathrm{a}}$'' to ``an automorphism of k^{a}''. And on the 4th line from bottom, change ``penultimate'' to ``next to highest''.

[**1s**|*4s*] P.286, two and six lines before Corollary VI.5.3: $\hat{E}$ should be $E^{\vee}$. (The earlier, but not the later of these errata was corrected in printing [*6a*].)

[**1s**|*4s*] P.286, statement of Corollary VI.5.4: change ``*the distinct set of embeddings*'' to ``*the distinct embeddings*''.

[**1s**|*4s*] P.288, first and second lines after the last display in the proof of Proposition VI.5.6: $N_{F/k}(\alpha)^r$ and $N_{F/k}(\alpha)^d$ should be $N_{F/k}(\alpha)$ and $N_{F/k}(\alpha)^r$ respectively.

[**1s**|*4s*] P.289: On the second line before Theorem VI.6.2, ``when we apply $\sigma$'' should be ``when we apply $\beta\sigma$''. And on the second line of that theorem, after ``*of* $k$'' add ``(*if not* 0)''. (I suggested that Lang replace ``*prime to*'' on the preceding line by ``*not divisible by*'', but this was the change he made instead. It has the same effect.)

[**3a**|*4a*] P.289, line 4 from bottom: G should be G.

[**3a**|*4a*] P.290, Theorem VI.6.4, third line of Proof: K should be K.

[**4s**] P.290, next-to-last line: $1, \ldots, p$ should be $1, \ldots, p-1$.

[**3a**|*4a*] P.291, line 6: after ``[co]efficient of $X^{d-1}$'' add ``in g''.

[**1s**|*4s*] P.293, third line before **Remark**: Before ``prime degree'' add ``of''.

[**5a**|*6a*] P.293, 5th line of Remark: ``are'' should be ``is''.

[**1s**|*4s*] P.294, second line on page, and also first line of statement of Theorem VI.8.1: Again, after ``characteristic of $k$'' insert ``(if not 0)''. (And again, changing ``prime to'' to ``not divisible by'' would have the same effect.)

[**6a**|*1s*] P.294, line just above the next-to-last display on the page: Delete the final word, ''hence''.
[**5a**|*6a*] P.297, 8 lines from bottom: After ''hence'' add ''inductively''.
[**1s**|*4s*] P.297, last line: α should be a.
[**5a**|*6a*] P.298, 2nd display: The index υ (occurring twice) should be v, as in the preceding display. (Also, if you have a printing before the 4th, the value on top of the Π should be p, as in the preceding display.) On the same page, 8 lines from the bottom, $\pm c^2 i$ should be $\pm 2c^2 i$.
[*3a*|**4a-5a**|*6a*] P.299, lines 8 and 15 from bottom: k^a should be k^{a}.
[**1s**|*4s*] P.299, last display and line following it: v should be υ in both places.
[**5a**|*6a*] P.300, 2 lines before Theorem VI.9.4: ''given'' should be ''gives''. Also, if you have a printing before the 4th, in the second display on that page, the exponent $b(n)$ should be $b(\sigma)$.
[**4s**] P.300, 4th line of proof of Theorem VI.9.4: ''given'' should be ''give''.
[**3a**|*4a*] P.301, line 9 from bottom: ''had never published'' should be ''never published''.
[**1s**|*4s*] P.303, end of second line of the proof of Lemma VI.10.2: Add a second '')''.
[**5a**|*6a*] p.321, end of second line of Exercise 5: ''of f'' should be ''of F''.
[**1s**|*4s*] P.322: On line 5, $X^4 + 4x^2 + 2$ should be $X^4 + 4X^2 + 2$. On the next-to-last line of Exercise 8(b), after ''to a subgroup'', add ''of''. On the second line of Exercise 11, change ''a real subfield k of the complex numbers'' to ''a subfield $k \subset \mathbf{R} \subset \mathbf{C}$''.
[**3a**|*4a*] p.322 Exercise 8, part (b), line after display: the case $\alpha^2 - \beta^2 \in \mathbf{Q}$ does not actually occur. It corresponds to a subgroup of $D_8 \subseteq S_4$ which is indeed isomorphic to $\mathbf{Z}/2\mathbf{Z} \times \mathbf{Z}/2\mathbf{Z}$, but which is not transitive on $\{1,2,3,4\}$, so it is excluded by the assumption that f is irreducible.
[*3a*|**4a-5a**|*6a*] p.322 Exercise 8, part (b), last two lines: D_∞ should be D_8, and in $Z/2Z \times Z/2Z$, the Z's should be $\mathbf{Z}$'s, and the sentence should (and in the 5th printing does) end with a close-parenthesis.
[**5a**|*6a*] P.322, bottom or p.323 top: Add the two lines

contains enough cycles to generate S_n. Use the Chinese remainder theorem, also to
be able to apply Eisenstein's criterion.]

[**1s**|*4s*] P.323, ''Note'' starting after Exercise 20: Delete the ''['' at the beginning of the Note, which is never closed.
[**1s**|*4s*] P.325: On the top line, after ''and G'' insert ''$\neq \{1\}$''. On the third line: After ''non-zero'' insert ''relatively prime''.
[**3a**|*4a*] P.327: On the last line of Exercise 38, at the beginning of the line add ''or $2d_n$''. On the 5th line of Exercise 39, K should be K (3 occurrences).
[**1s**] P.356, statement of Theorem VIII.1.1: There is a space in the last line of the statement of the theorem, which should contain a $\mathfrak{B}$.
[**5a**|*6a*] P.356, statement and proof of Theorem VIII.1.1. The proof given is incorrect. Make the following changes:

In the statement of the theorem, change ''*If* Γ *is a set of generators of* K *over* k'' to ''*If* Γ *is a subset of* K *such that* K *is algebraic over* $k(\Gamma)$''.

In the second line of the proof, after $m \geq 1$ add '', m minimal''. Three lines later, before ''polynomial'' add ''irreducible''.

Now, for everything from the word ''Furthermore'' after the first display through the last display on the page, substitute the following. (What follows is approximately the corrected proof that Lang has, starting with the 6th Addison-Wesley printing, but incorporates the main clarifications to that proof that I give in the body of this Companion.)

This is true by the sentence preceding the theorem, and the fact that we can clear denominators to turn a polynomial with coefficients in $k(x_1, \ldots, x_m)$ into one with coefficients in $k[x_1, \ldots, x_m]$. Now since $w_1, \ldots, w_n$ are algebraically independent, f_1 must involve at least one x_i; by renumbering $x_1, \ldots, x_m$ we may assume this is x_1, and so write $f_1 = \Sigma\, g_j(w_1, x_2, \ldots, x_m)x_1^j$ with $g_N \neq 0$ for some $N \geq 1$. No irreducible factor of g_N vanishes on $(w_1, x_2, \ldots, x_m)$, otherwise w_1 would be a root of two distinct irreducible polynomials over $k(x_1, \ldots, x_m)$ (namely f_1 and this irreducible factor, which by the assumption that it vanishes at the indicated point must involve w_1 by algebraic independence of the x's, and which cannot coincide with f_1 because it does not involve x_1). Hence f_1 is a nonzero polynomial satisfied by x_1 over $k(w_1, x_2, \ldots, x_m)$, so x_1 is algebraic over that field, hence $w_1, x_2, \ldots, x_m$ are algebraically independent over k, otherwise the minimality of m would be contradicted.

Suppose inductively that after a suitable renumbering of $x_2, \ldots, x_m$ we have found that K is algebraic over $k(w_1, \ldots, w_r,\ x_{r+1}, \ldots, x_m)$. Then there exists a nonzero polynomial f in $m+1$ variables with coefficients in k such that

$$f(w_{r+1}, w_1, \ldots, w_r,\ x_{r+1}, \ldots, x_m) = 0.$$

Since the w's are algebraically independent over k, it follows by the same argument as in the first step that some x_j, say x_{r+1}, is algebraic over $k(w_1, \ldots, w_{r+1},\ x_{r+2}, \ldots, x_m)$.

Now continue in Lang, from ''Since a tower ...'', and, after finishing those four lines, go to the comment on the last line of that page in the body of this Companion.

[**6a**|*1s*] P.364, 10 lines from bottom: ''Proposition (iii)'' should be ''Proposition 3.3''.

[**4s**] P.364, next-to-last line: the name **MacLane** should be **Mac Lane** (with a space before the L). The same correction applies to the reference to Mac Lane in the index.

[**6a**|*1s*] P.366: In the first line of Lemma VIII.4.10, ''alebraically'' should be ''algebraically''. In the sixth line from bottom, ''Lemma 4.11'' should be ''Lemma 4.10''.

[**1s**|*4s*] P.375, Exercise 6(a): $k(y_1, \ldots, y_r)$ should be $k_u(y_1, \ldots, y_r)$.

[**1s**|*4s*] P.425, Proof of Theorem X.4.4: In the display, ''E'' should be F, the second $\subset$ should be $\oplus$, and the final ''$\supseteq$'' should be $\oplus$. Also, throughout the proof, P_o is a typo for P_0 (but the notation is at least consistent). If you have an Addison Wesley printing, see next correction instead.

[**6a**|*1s*] P.425, Theorem X.4.4 (but if you have a Springer printing, see preceding correction instead): In the first line of the statement, before *projective* add *finite*.

The proof given assumes incorrectly (in the 3rd and 4th lines) that A has no zero-divisors; so use instead the following proof:

Given $x_1, \ldots, x_n \in E$ as in the sentence beginning ''In fact'', let F be a free module with basis $e_1, \ldots, e_n$, and $f: F \to E$ the homomorphism taking each e_i to x_i. We want to prove f an isomorphism. By Lemma 4.3, f is surjective. Since E is projective, it follows that f splits, i.e., we can write $F = P_0 \oplus P_1$, where $P_0 = \mathrm{Ker}(f)$ and P_1 is mapped isomorphically to E by f. Now the linear independence of $x_1, \ldots, x_n$ mod $\mathbf{m}E$ shows that

$$P_0 \subseteq \mathbf{m}F = \mathbf{m}P_0 \oplus \mathbf{m}P_1,$$

hence $P_0 \subseteq \mathbf{m}P_0$. Also, as a direct summand in a finitely generated module, P_0 is finitely generated. So by Lemma 4.3, $P_0 = (0)$, and f is an isomorphism, as was to be proved.

The final statement follows because we can complete a sequence of the indicated sort to one that is linearly independent over $A/\mathbf{m}$, and apply the first result.

[**1s**|*4s*] P.426, 2nd line: ''lineary'' should be ''linearly''.

[**6a**|*1s*] P.468, fourth from last line of §XII.1: ''*u*t'' should be ''to''.

[**6a**|*1s*] P.470, top line: Change ''$\leq$'' to ''$=$''.

[**5a**|*6a*] P.470, next-to-last display: The ξ or χ (depending on which printing you have) should be an x.

[**5a**|*6a*] P.472, various displays: All $+$ signs should be $-$ signs. (In recent printings there were just three such signs still needing correcting, in the 1st, 5th and 6th displays. In the first one or two printings, there were more.)

[**4s**] P.476 reference [Se 62]: ''complêtement'' should be ''complètement''. (In printings through [**1s**], the same error also occurs in this reference on p.899 or p.900, depending on printing.)

[**6a**|*1s*] P.512: At end of line, add ''with $j = i+1$''.

[**1a**|*3a*] P.519, third line from bottom: ''Proposition 4.15'' should be ''Proposition 4.16''.

[**6a**|*1s*] P.520, Proposition XIII.4.19: Change ''*Let* Δ *be*'' to ''*Let* $\{\Delta\}$ *be*''.

[**6a**|*1s*] P.522, line after last display: ''subscript'' should be ''prefix''.

[**6a**|*1s*] P.529, first two lines of proof of Proposition XIII.6.1: ''Fix a basis of E'' should be ''Fix bases of E and F'', and ''elements of E'' should be ''elements of these modules''.

[**1s**|*4s*] P.531, second display: The first ''='' sign should be a ''+''.

[**6a**|*1s*] P.547, Exercise 25: Add the condition $n > 1$.

[**4s**] P.549, parenthetical sentence before list of references: this should end with '')''.

[**6a**|*1s*] P.550, exercise 32: Lang originally cited only a paper of his with Kolchin. As of the first Springer addition, he also shows the much older reference, A. Speiser, Zahlentheoretische Sätze aus der Gruppentheorie, *Math. Z.* (1919) **5**, pp.1-6.)

[**6a**|*1s*] P.552: There is a new exercise, 36, on irreducibility of $\mathbf{sl}_n(F)$ under conjugation by $SL_n(F)$.

[**6a**|*1s*] P.555, next-to last display: The v's should all be υ's.

[**6a**|*1s*] P.561, second line after second display: R should be k.

[**6a**|*1s*] P.565, two lines above third display: For ''its expansion according to the first column'' read ''its expansion as a sum over permutations''.

[**6a**|*1s*] P.570: There is a new exercise, 26, on the subgroup of $SL_n(\mathbf{C})$ consisting of diagonal positive matrices with positive real entries, and its normalizer.

[**1s**|*4s*] P.603, last line: ''over k'' should be ''over R''.

[**1s**|*4s*] P.611: In the line after the third-from-last display, the comma after ''id'' should be a period. And in the next-to-last line, x'' should be x, and E'' should be E.

[**6a**|*1s*] P.617, next-to-last line: $E_1 \otimes E_2$ should be $E_1 \oplus E_2$.

[**1s**|*4s*] P.618, line following the second diagram: $E_1 \otimes E_2$ should be $E_1 \oplus E_2$.

[**6a**|*1s*] P.618, third-from-last line: ''Proposition 2.6'' should be Proposition 2.7.

[**6a**|*1s*] P.619, ''Remark on abstract nonsense'': In the fifth line, after the assumption that $B \mapsto T(A, B)$ is right exact for each A, add the assumption that $A \mapsto T(A, B)$ is right exact for each B. In the next two lines, ''T-exactness'' is defined for objects of both categories; however, in the case of objects of $\mathfrak{B}$ he should call this ${}^tT$-exact (i.e., exact as a second argument of T) since he uses that notation in the next paragraph. In the third paragraph, for ''Instead of an ideal $\mathbf{a}$ in R'' read ''For the analog of Proposition 3.7''.

[**1s**|*4s*] P.619: In the fourth and fifth lines above the first display, interchange ''${}^t\boldsymbol{T}$**-exactness**'' and ''$\boldsymbol{T}$**-exactness**''. In the second line above that display, B should be $\mathfrak{B}$. In the third line after the second display, the second word, ''then'', should be ''taken''.

[**6a**|*1s*] P.621: In the first line of Lemma XVI.3.10, delete ''*finite*''. And in the last display, $\beta_j \otimes y_j$ should be $\beta_j y_j$.

[**6a**|*1s*] P.623, line preceding Proposition XVI.4.1: ''From Proposition 1.2'' should be ''From Proposition 2.3''.

[**6a**|*1s*] P.628, Corollary XVI.5.4: Change ''*functorial*'' to ''*natural*''.

[**6a**|*1s*] P.633, line 4: ''(mapping k ...)'' should be ''(mapping R ...)''.

[**6a**|*1s*] P.639, Hint to Exercise 13: where Lang speaks of (ii)⇒(iii) holding by ''the preceding exercise'', he means by Exercise 11. In the third-to-last line of the Hint, (iii) should be (iv). In the last sentence, *Algebre* should be *Algèbre*.

[**6a**|*1s*] Pp.639-640: There is a new exercise, 36, on the Casimir element of $E \otimes E$, where E is a vector space (over any field) with a nondegenerate symmetric bilinear form.

[**3a**|*4a*] P.645, first line of Lemma XVII.2.1: ''*nonnecessarily*'' should be ''*not necessarily*''.

[**6a**|*1s*] P.786, next-to-last display: Mark the arrow $M \to T$ as f. (It is referred to by that letter a few lines later.)

[**6a**|*1s*] P.830, Exercise 20: Before ''ring'' add ''Noetherian''.

[**4s**] P.876, line preceding the definition of **finite**: for ''of course'' read ''in particular''. Also, if you have a printing before [*6a*], in the second line of Proposition A2.1.1 change ''*namely*'' to ''*say*''.

[**1s**|*4s*] P.877, second line of proof of Proposition A2.1.4: What looks like x_v is an x_y that didn't print right.

[**3a**|*4a*] P.877, two lines before Proposition A2.1.5: ''and is denumerable'' should be ''and D is denumerable''.

[**1s**|*4s*] P.880: On line 6, ''Example 2'' should be ''Example 1''. And on the fifth line of the last paragraph of the page, the J near the end of the line should be J'.

[**3a**|*4a*] P.880, two lines below Zorn's Lemma: the words ''Chapters I, §10 and XV, §2'' should read ''Chapters I, §7 and XIV, §2''.

[**3a**|*4a*] P.881: On the line following the second display, and three times in next line, change w to z, since w already means something else. And in condition **3.** later on the page, before ''totally ordered'' add ''non-empty''.

[**3a**|*4a*] P.883, proof of Lemma A2.2.3: Starting two lines below the first display, the proof is garbled. It is corrected in later printings; I won't go into details, because I prefer the development in my handout on the Axiom of Choice etc.

[**3a**|*4a*] P.884, Corollary A2.2.4: change the three occurrences of S in the proof (2nd and 3rd lines) to A.

[**5a**|*1s*] P.885: Until the first Springer printing, Lang did not mention comparability of cardinals (see my handout on *The Axiom of Choice, Zorn's Lemma, and all that*), though he used that fact on p.889. Subsequently, he added it to this page – in two different places. Since one suffices, I will indicate the shorter one: Before the italicized line ''*Let* f: ...'' on this page, insert: ''Using Zorn's Lemma, it is easy to show (see Exercise 14) that $\mathrm{card}(A) \leq \mathrm{card}(B)$ or $\mathrm{card}(B) \leq \mathrm{card}(A)$.''

[*6a*|**1s**|*4s*] P.885, first display: ''card($A \leq$'' should be ''$\mathrm{card}(A) \leq$''.

[**4a**|*5a*] P.886, first line: $f(b)$ should be $g(b)$.

[**1s**|*4s*] P.886, end of line 4: $H(f^{-1}(b))$ should be $h(f^{-1}(b))$.

[**1s**|*4s*] P.888, second line of proof of Theorem 3.6: ''$f: B \times B$ is a bijection'' should just be ''f is a bijection''.

[**1s**|*1s*] P.889: Delete ''$\mathrm{card}(M) \leq$'' from the first display, and ''by Bernstein's Theorem'' from the next line.

Reading further in the paragraph, you will see that Lang considers the two cases $\mathrm{card}(C) \leq \mathrm{card}(M)$ and $\mathrm{card}(M) \leq \mathrm{card}(C)$, and then, on the very last line (added in the 6th Addison Wesley printing), to be able to assert that one or the other of these must hold, he calls on Exercise A2:L14, which sketches a proof of Comparability of Cardinals. We saw that result proved from Zorn's Lemma in the handout on the Axiom of Choice.

[**5a**|*6a*] P.889, Corollary A2.3.8: After ''*nonempty sets*'' add ''*with* A_n *infinite*''.

[**3a**|*4a*] P.890 line 3: ''Corollary 3.4'' should be ''Corollary 3.7'' here, and again 11 lines from the bottom of the page.

[**1s**|*4s*] P.892, fifth line of proof of Theorem A2.4.1: ''the initial segment'' should be ''an initial segment''.

[**3a**|*4a*] P.892, 4th from last line of Proof: X_j should be $X_j \cap Y$.

[**6a**|*1s*] P.892, 3rd from last line of Proof: ''$(X, \omega$'' should be ''(X, ω)''.

[**4a**|*5a*] P.893, Exercise 4: the comma after the exercise-number should be a period.

[**1a**|*5a*] P.893, Exercise 13. Lang notes in brackets a question whose answer he ''doesn't know''. I sent him the answer (noted at the end of *Some inequalities for ordinals* in this Companion, discussion concerning p.191), and starting with the 4th printing, he notes this, though in that printing, Solovay's name is misspelled.

[**3a**|*4a*] P.893, end. Add:

14. Let A, B be non-empty sets. Prove that

$$\mathrm{card}(A) \leq \mathrm{card}(B) \quad \text{or} \quad \mathrm{card}(B) \leq \mathrm{card}(A).$$

[Hint: consider the family of pairs (C, f) where C is a subset of A and $f: C \to B$ is an injective map. By Zorn's lemma there is a maximal element. Now finish the proof].

[**4s**] P.895: In title of [Art 24], the first word should end with -ung, not -umg.

[**6a**|*1s*] P.895, reference [Boun 1854]: ''invarialb es'' should be ''invariables''.

[*6a*|**1s**|*4s*] P.899: There are three references [Neu 69]; these should be [Neu 69a], [Neu 69b] and [Neu 69c]. In the second of these, ''*p*-adische'' should be ''*p*-adische**n**''. In reference [Ph 89] part II is shown as ''to appear'', but there is full information for it and for part III on p.360. Reference [Pop 94] should be ''On Grothendieck's conjecture of birational anabelian geometry, *Annals of Math.* (2) **139** (1994) 145-182.''

[**1s**|*4s*] P.901: In [Wit 36] (the first of the two references so numbered in the pre-Springer printings), ''der der'' should be a single ''der'' and ''Charakteristi**c**'' should be ''Charakteristi**k**''. In [Wit 37] (in the pre-Springer printings shown as the second of two references ''[Wi 36]''), ''mit vollkommene**n**'' should be ''mit vollkommene**m**''.

[**4s**] Index: The entry ''algebraically closed'', in addition to p.272, should show pages 178 and 231, while the entry ''algebraic closure'' should refer to only one page, 232. In the entry ''cocycle'', delete the comma after the subheading ''Hilbert's theorem'', since this refers to Hilbert's ''theorem 90'', not to a theorem on p.90.

[**1s**|*4s*] Index: The entry ''adjoint functor'' should be deleted; it does not occur in this book. (The topic is developed in my Math 245 notes.) To the entry for ''discriminant'' add page 270. To the entry for ''*G*-set'' add page 25. In the entry for ''symmetric group'', 29 should be 28, 30.

[**6a**|*1s*] Index: In the entry for ''Jordan-Hölder'', the page number 157 should be 156. In the entry for ''Noetherian'', 407 should be 408.

[**3a**|*4a*] Index: Add to the entry for ''algebraically independent'' the page-number 102. In the entry for ''cyclic extension'' change 388 to 266, 288. Under ''Hilbert'', delete the comma after the subheading ''theorem'', since this again refers to Hilbert's ''theorem 90'', not to a theorem on p.90. The first three page-numbers under ''Riemann surface'' should go instead under ''Riemann-Roch''.