Errata and clarifications to I. Stewart's *Galois Theory*

If you don't want to write in your book, you might make these corrections on PostIts, and insert them at the appropriate pages.

P.xxvii, end of middle paragraph: After ''which we denote by G'' add ''; this group is today called the *Galois group* of the polynomial $f(t)$''. (This is to prepare for Stewart's use of that term on the next page.)

P.9, line 3: Change ''We call'' to ''When R is a field we call''.

P.16, **Definition**: After ''A polynomial'' add ''of positive degree''.

P.17, **Theorem 2.1**: Change ''nonzero polynomial'' to ''polynomial of positive degree'' and in the second line of the proof, change ''$\partial g = 0$ or 1'' to ''$\partial g = 1$''.

P.18, **Theorem 2.3**: Change ''*of polynomials*'' to ''*of non-zero polynomials*''.

P.21, 5 lines before **Example** near bottom of page: ''irreducible'' should be ''reducible''. (On the next few lines ''irreducible'' is correct as it stands, so be careful in counting those 5 lines.)

P.24, **Theorem 2.8**: Change ''*a polynomial*'' to ''*a non-zero polynomial*''.

P.29, line before display: K should be L.

P.39: In the second display, the term $(t-3)/13(t+4)$ should be $(t-3)(t+4)/13$.

P.42, Exercise 3.12, first line: Change ''for fields'' to ''for some fields''.

P.46, 4th line from bottom: ''over $\mathbb{Q}$'' should be ''over $\mathbb{Q}(\sqrt{2})$''.

P.47, line 10, third display: $[\mathbb{Q}(\sqrt{2},\sqrt{3})]:\mathbb{Q}$ should be $[\mathbb{Q}(\sqrt{2},\sqrt{3}):\mathbb{Q}]$.

P.49, Exercise 4.1(e): $\mathbb{Q}(3,\sqrt{5},\sqrt{11})$ should be $\mathbb{Q}(\sqrt{3},\sqrt{5},\sqrt{11})$.

P.51, second line of second paragraph: Change ''lines'' to ''line segments''. Similarly, on p.57, Exercise 5.1, in each of (a)-(c), ''line'' should be ''line segment'', and the same applies on p.59 to 5.10(e).

P.54, three lines above **Theorem 5.2**: ''degree 2'' should be ''degree 1 or 2''. When you come to this point in studying the text, you should, after this sentence, read the parenthetical sentence following the second display on the next page before going further.

P.59, Exercise 5.10(a): After ''constructions'' add ''by ruler and compasses''.

P.71, 5th line of 2nd paragraph: Move ''$p \in k[t]$'' to the preceding line, after ''any polynomial''.

P.73, 4th line from bottom: for ''$L^* = 1$ (the identity map on L)'' read ''$L^* = \mathbf{\{}1\mathbf{\}}$ (where 1 denotes the identity map on L)''.

P.76, first line: This statement should begin ''For every finite algebraic extension $L : K$''.

P.82, first words of **Definition**: ''An extension'' should be ''An algebraic extension''.

P.99, statement of Theorem 10.5(2): before ''*normal*'' insert ''*finite*''.

P.109, top line: ''+'' should be ''=''.

P.110: In the last two lists in set-brackets under ''Order 4'', the comma before the final τ should be removed, so that these lists end ''$\sigma^2\tau$'' and ''$\sigma^3\tau$''.

P.115, **Lemma 13.1**: Change the first line of statement 2 to:

2. *Suppose* $H \lhd G$ *and* A *is a subgroup of* G *containing* H. *Then* $H \lhd A$; *moreover,* $A/H \lhd G/H$ *if and only if* $A \lhd G$, *and when these conditions hold we have*

P.116, second display: ''1 +'' should be ''1 =''.

P.118: Add in margin near first display: *Note: he is composing permutations from left to right.*

P.119, 4th and 5th displays: In both, the ''+'' should be an ''=''.

P.128, last display on page: ''$(i \geq 2)$'' should be ''$(i \geq 1)$''.

P.129, middle of second paragraph: Change ''it is pointless to expect everything expressible by the same radicals to be inside the splitting field'' to ''those radicals need not themselves lie in the splitting field''.

P.129, change last sentence of proof of Lemma 14.2 to, ''Since α_i is a member of a radical sequence for a subfield of M, so is β_{ij}. By taking a union of such sequences, we get a radical sequence for M.''

P.135: Change the last 6 lines to the following:

Definition

Let G be a subgroup of the group of all permutations of a set S. We say that G is *transitive* (or *transitive* on S) if for all $s, t \in S$ there exists $\gamma \in G$ such that $\gamma(s) = t$.

If s_0 is any element of S, then to show that a group G of permutations of S is transitive it is enough to show that for all $s \in S$ there exists $\gamma \in G$ such that $\gamma(s_0) = s$, because then given two elements s and t there will exist $\gamma, \delta \in G$ such that $\gamma(s_0) = s$, $\delta(s_0) = t$, whence $(\delta\gamma^{-1})(s) = t$.

P.137, Exercise 14.10: Change the first sentence to ''Show that if $[L:K] = 2$ then $L:K$ is normal''.

P.138, Exercise 14.14: Above the display, ''unique homomorphism'' should be ''unique surjective homomorphism'', and in the display, s should range, not over the integers from 1 to $p-1$, but over the group Γ; and ''ζ^s'' should be $s(\zeta)$. (Alternatively, one could keep the latter two symbols as in Stewart, and redefine χ as the unique surjective homomorphism from the multiplicative group of $\mathbb{Z}_p \setminus \{0\}$ to $\{\pm 1\}$.) The first sentence of this exercise also assumes you know Lemmas 16.8 and 17.9. Fortunately, you are likely to have seen these in Math 113.

P.139, 3rd-from-last line of first paragraph: After ''all quintic polynomials'' add ''with rational coefficients''.

P.140, last line: β should be β_1.

P.141, first line of §15.2: Delete the word ''the''.

P.144, §15.3, 1st paragraph, 5th line: After ''every quintic'' add ''with coefficients in K''.

P.146, fourth line from bottom, beginning of line: 14.4 should be 14.3.

P.148, (c), first display under ***Cubic***: The term $s_2 t^3$ should be $s_2 t$.

P.157, second line before first display: Change ''So'' to ''Now''.

P.158, second line of proof of Lemma 16.5: After ''Then'' add ''for each i,''.

P.159, Example 2, third line: ''$a = b\alpha$'' should be ''$a + b\alpha$''.

P.164, second line of **Lemma 17.2**: Change ''$\in K(\alpha)$'' to ''*lie in* $K(\alpha)$'', and in the next line, change ''*some suitable finite set of*'' to ''*the set of all*''.

P.165: In **Theorem 17.3**, after ‘‘$P \subseteq \mathbb{R}^2$’’ add ‘‘*containing the points* (0,0) *and* (0,1)’’.

P.166, top line: Make the same change.

P.169, line after first display: Before ‘‘*odd primes*’’ add ‘‘*distinct*’’. On the same page, in the third line of the Proof, change ‘‘Theorem 17.3’’ to ‘‘Lemma 17.5’’, and four lines from the bottom of the page, change ‘‘14.4’’ to ‘‘14.3’’.

P.170, last sentence: Change ‘‘radical expressions’’ to ‘‘expressions in iterated square roots’’.

P.173, last line: The ‘‘+’’ should be ‘‘=’’.

P.180, statement of **Theorem 18.2**, point 3: At the beginning, add ‘‘*If* $\Delta(f) \neq 0$, *then*’’, and after ‘‘*the Galois group of* f’’ add ‘‘*, regarded as a group of permutations of the zeros of* f,’’.

P.180, last two lines: ‘‘$\subset$’’ should be ‘‘$\subseteq$’’ (twice).

P.181, line before third-from-last display: Change this one-word line, ‘‘Define’’, to ‘‘Hence let $x_1, \ldots, x_n$ be independent indeterminates, let β be defined as above, and for every $\sigma \in \mathbf{S}_n$ define’’.

P.181, first line of last paragraph: ‘‘if $s \neq$’’ should be ‘‘if $\sigma \neq$’’.

P.183, top: In the first line, change γ to γ_x. In the third line, change $\gamma\alpha^{-1}$ to $\gamma_\alpha{}^{-1}$ twice.

P.183, Exercise 18.4, first line: Change ‘‘δ’’ to ‘‘δ or $-\delta$’’.

P.184: At the end of Exercise 18.6 add ‘‘or a conjugate of one of these subgroups.’’ In the first line of the next exercise on the same page, before ‘‘irreducible’’ add ‘‘monic’’. In each of parts (c), (d), (e) of that exercise, change ‘‘splits over’’ to ‘‘has a zero in’’, and after both ‘‘$= \mathbf{D}_8$’’ and ‘‘$= \mathbf{C}_4$’’ add ‘‘or a conjugate thereof’’.

P.185: After the third word of text, ‘‘is’’, add ‘‘said to be’’.

P.186, top of page: At the end of the Definition, after ‘‘The relations $<$, $\geq$, $>$ are defined in the obvious way’’, add ‘‘in terms of $\leq$’’.

P.187, 6th line from bottom: ‘‘equal to b’’ should be ‘‘equal to $b/2$’’.

P.188, Exercise 19.8 and p.189, Exercise 19.9: ‘‘R’’ should be ‘‘$\mathbb{R}$’’ (3 occurrences).

P.189, Exercise 19.10(h): Change ‘‘be ordered’’ to ‘‘be given an ordering making it an ordered field’’.

P.189, Exercise 19.10(i): Change ‘‘positive’’ to ‘‘nonnegative’’.

P.191: In the answer to 4.18, change the next-to-last letter from T to F.

P.192: The answer to 8.2 should be ‘‘2, 4, 4’’, not ‘‘2, 4, 12’’.

Errata to my handouts

Handout supplementing Chapter 5 of Stewart: The heading should end ‘‘... to be read after §5.1’’.

Same handout: The construction described in the first long paragraph of the proof yields a line segment of length bc/a rather than ab/c. So to obtain the desired length ab/c, interchange the roles of a and c.

Handout entitled ‘‘Addendum to §8.3’’: Title should be ‘‘Addendum to Chapter 8’’.

Same handout, second page, at start of **Proof** insert: ‘‘If K has characteristic 0, this follows from Proposition 8.6, so in what follows let us assume that K has prime characteristic p.’’

Same proof, first sentence of second paragraph after diagram: References to polynomials satisfied by α and α^p should, rather, refer to β and β^p.

Handout on Theorem 13.2, on p.2, two lines before last display: change N_j to F_j.