Assorted tips on project reports

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> *Writing well is a two-stage process: (1) write not so well; (2) fix it.*
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> —Jim Holt, The Value and Virtue of Good Writing. *New York Times*, 17 May 2017.

This document is for undergraduate students doing a project with me. You'll find lots of information on projects at https://info.maths.ed.ac.uk/teaching/ug/projects.html, covering the learning and investigation process, the report, and the talk. Here I'll add a few more points, mostly based on things I've seen go wrong in student projects in the past.

Leave two weeks of editing time This is probably the longest piece of mathematical writing you've ever done. Many students don't realize how much editing time is needed for a composition of this length. By 'editing time', I mean the time after you finish a complete first draft and before you hand it in. You'll need this time to catch typos and inconsistencies and unclear writing, to remove weak material, to make sure you've got everything in the logically correct order, to make sure you've defined everything you need to define (but not more than once!), to find and fix mathematical mistakes, to sort out formatting/Latex problems, and so on.

Two weeks is not long to do all this, but realistically, that's probably all the time you can spare.

Introduce everything There's an old piece of advice:

> *Tell them what you're going to say. Say it. Tell them what you've just said.*

Writing mathematics is not like writing a novel. Unless you're *very* sure of what you're doing, don't keep your readers in suspense. Instead, focus on being clear.

The project should begin with an introduction, including (but not limited to) a summary of what's in each chapter. Each chapter should begin with an introduction, including (but not limited to) a summary of what's in each section. Each section should begin with a few lines of introduction too. And the whole project should end with a short conclusion.

You don't have to follow that advice *absolutely* to the letter, but it's safer to follow it than not.

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The bibliography Most student projects could be a bit better on this front. Tips:

- Be inclusive. We *like* it (and reward it with marks) if you show your knowledge of the literature. So if in doubt about whether or not to include a reference, include it.
- At the minimum, each entry in the bibliography must include enough information that it's easy for the reader to find the book, paper, etc., that you're referring to. To learn how to format bibliography entries, have a look at the end of a few mathematics textbooks or journal papers. (Different subjects have different bibliographic conventions, so stick to mathematics texts here.)
- Put the entries in alphabetical order of the surname of the first (or only) author.
- Don't put things like 'Chapter 6' in the reference list. The place for that is in the main body of the project, at the point where you're citing the text. Relatedly...
- When you cite a text, say *where* in the text you're referring to. Suppose, for instance, that you're omitting a proof and instead referring to the book [3]. It's needlessly cruel to write 'For the proof, see [3]', because then the poor reader has to figure out for themselves where exactly in [3] this proof is. (The longer the text is, the more cruel you're being.) It costs you little extra effort, and helps the reader a lot, if you say 'For the proof, see Theorem 19.7 of [3]'.

Plagiarism I hope I don't need to say that plagiarism is taken very, very seriously. The penalties are severe. At worst, you can be kicked out of university and fail your degree. I am not joking.

If you're unsure what plagiarism is, talk to me or your personal tutor, or look on the university website. In a nutshell, plagiarism means presenting someone else's work as if it was your own. For instance, if you use someone else's words, you *must* format the copied passage as a quotation (in quotation marks or indented) and specify where you've quoted it from. The same goes if you reproduce a figure from someone else's book or paper: that's OK, but you *must* state clearly that the figure is not your own and say where you took it from.

Occasionally, students 'pseudo-copy', making trivial changes to an existing book or paper. For instance, they might change 'Let $x = y^2 + 3$' to 'Put $u = v^2 + 3$'. This is little different from copying word for word, and really just looks like an attempt to hide what you're doing. It's still pretending that something is yours when it's not.

If, for some reason, you do include text that's almost identical to some existing source, you *must* say that's what you're doing. You can use some words such as 'The rest of this section is taken almost verbatim from Section 2.3 of [1]' or, if the resemblance isn't quite that close, 'The rest of this section is adapted from Section 2.3 of [1]'.

Close the book No one expects undergraduate projects to contain original work. So, what you write is bound to be closely related to existing texts, and you might be wondering how to avoid 'pseudo-copying'.

The key is to *close the book*. If you write with your source out of sight (and don't keep peeking!), you'll find that you naturally present things differently. As markers, what we're looking for is evidence that you understand what you're writing. When

you say it in your own words, your understanding shines through. And you can also take this opportunity to present the subject in the way that you think is best.

Do paragraph breaks correctly For some reason I can't fathom, many undergraduates end their paragraphs in Latex by using a double backslash (\\). This is wrong. It produces visually bad results, and, incidentally, takes more keystrokes than doing it right. The right way is to leave a blank line in the source. In other words, end a paragraph by hitting the return key twice.

The only time you should use a double backslash is in math mode, to end a line in a matrix or array. Never use a double backslash in text mode.

Number everything in sequence Make sure you set up Latex so that all the numbered theorems, lemmas, definitions, remarks, etc. are in a single sequence. For instance, you might have Definition 1.1, then Lemma 1.2, then Remark 1.3, then Theorem 1.4. If you have separate sequences for each environment then you're liable to end up with Remark 4.1 sandwiched between Lemma 4.7 and Corollary 4.3, which makes things unnecessarily hard to find.

Put defined terms in bold When you're defining a term, put it in bold (or italics if you prefer). For instance: 'a positive integer is **prime** if it has exactly two factors'. This serves two purposes: it makes clear which term you're defining, and it makes it easier to find the definition later.

Theorems should be in bijection with proofs Every theorem (and lemma, proposition, and corollary) should have either a proof or a reference to a proof.

Conversely, anything formatted as a formal proof (I mean, any paragraph beginning '**Proof:** ...') should accompany a formally-stated theorem. For instance, formally-formatted proofs shouldn't follow definitions, examples, or statements made in explanatory text. They should only follow theorems.