A Template for Projects in the School of Mathematical Sciences Final Reports

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Project Area: **WHEN RELEVANT LIST TOPIC AREA**
Project Supervisor: **INSERT NAME**

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Abstract

This report is a simple template intended as a simple, consistent starting point for students to prepare LaTeX reports in the School of Mathematical Sciences at the University of Adelaide.

It is neither complete, nor perfect, but rather is aimed at making it easy for students to present a report which avoids many of the worst errors.

Included in each section are descriptions of how these might be written. However, mileage may vary. You should follow the advice of your lecturer in preference to any statement made here.

Notes: Your report should include a short summary (usually called an abstract). Discuss the role and style of abstract to be included with your supervisor or lecturer.

Some general advice: this should be concise, but clear. If it is too long, it dilutes the important features, too short and it has no information. So it's a balancing act. What are the most important things someone reading your report should know about the task and the results?

In an industry report it might often be called an "executive summary," but in this case, it's even more crucial because it is often the only part your boss or customer will actually read! They don't want to wade through hundreds of pages of technical muck to get the message (they do want the muck – it is needed to support the results – but they might not examine it in detail).

It's also the main draw card of an academic paper – it's how I will decide whether to bother reading the rest of the article.

1 Introduction

The intention of this file is to provide a simple, consistent LaTeX template for the School of Mathematical Sciences at the University of Adelaide. Its goals are

1. to ease production of clean, appealing reports in LaTeX;
2. to allow us to provide consistent guidelines as to the desired length of the reports; and
3. to be a source of advice about writing your report.

The intention is that students can replace text with their own, and so start their report.

The style and formatting here are minimal, so as to maintain a very simple template, but there is no desire that students who wish to go beyond this template should be restrained, as long as their final report is consistent with quality and length requirements. In particular, any alternative should respect the font size (12pt) and the page size, which is A4, with 4cm margins to allow feedback.

This template also suggests a structure, but please replace section headings with meaningful headings of your own.

You may note that some pieces are omitted that you might have often seen added, for instance, there is no Table of Contents. I personally believe that many such things are added because of defunct "rules" rather than for utility, and so prefer a minimalist style, unless the specific features serve a clear purpose.

Notes: An introduction must be strong, or your reader (with their limited time), will give up on the work.

Important facets of an introduction are:

- introduce the basic ideas to be presented (at a high level);
- strongly motivate the work;
- describe what you will do and present; and
- give a summary of key results.

You may notice it sounds a little like the abstract, and it is. However, now you have space and time to go into more detail (though it is still somewhat abstracted from the full detail).

2 Background

The first section, in many cases, that you present should present related background material. In might include:

- literature review or related work section;
- common notation and definitions; and/or
- references for techniques to be used.

The type and detail of the content needed here depends strongly on the audience. Some information may be omitted if it is common knowledge to the specific audience, but care must be taken over any such assumptions. Err on the conservative side.

Notes: Writing a technical document is much like writing any other document. There is still a story you are trying to tell. However, there are certain features common to technical writing that you many not have encountered.

In general, the goal of many technical reports is to convey more precise, quantitative information than, for instance, a novel. Technical writing should be approached by asking "What does my reader need to know so that they could reproduce my results exactly (without asking me any supplemental questions)?"

The first starting point towards this goal is to define (i) any terms or notation used precisely, (ii) provide a reader with definitive references for techniques used, and (iii) to put the work into the correct context within the larger scientific literature.

Your introduction, or this section will be the first place you need to include references. BibTeX, and related tools are a superior means to do so. There is one small example in this template [1]. Using references well is an art. The approach varies depending on the use:

1. to allow a more concise description of a problem or method where it is already described in detail elsewhere;
2. to support arguments;
3. to give credit to other authors for their ideas or tools; and
4. to provide links to additional information for the reader, for instance where to find a particular software package.

3 Methods

The primary tool used in preparation of this report is LaTeX, a markup tool for the preparation of documents primarily used in mathematics and related areas.

Markup tools have the advantage of separating content from style, thus allowing writers to focus on the content, and adding style (for example, the format of section headings) later. It is a flexible and powerful approach.

The other key advantage of LaTeX is the high quality of its mathematical typesetting. There are no better tools for this task, though there are many variants of LaTeX and tools through which to use it.

Notes: This template suggests that your next section should describe methods used or developed in this report. Methods that are simple background material should go in the previous section. This section focuses on those that are novel, or in some cases just more difficult and more important for the work.

Sometimes the section will be called "methods," but I find a more specific, and descriptive heading is usually preferable.

Your focus in describing these should be reproducibility. A reader should ideally be able to recreate your work from your description.

Describe data, experiments, simulations, or solution techniques such that your reader can understand exactly what you did. It may be helpful to keep trying to answer the 6Ws: Why, When, Where, What, Who and How.

However, the art of such writing is to balance detail and precision with brevity. Concise descriptions are to be preferred because the information is more accessible. Often we use references to allow us to abbreviate or omit some details that are common to other experiments or problems.

Mathematical notation is also very useful in composing precise, yet concise descriptions of a problem. However, do not use mathematics or jargon for its own sake. Clarity is important, and mathematics or complicated technical terms can either enhance this (when used appropriately) or detract from it (if used carelessly). Your goal is *not* to try to seem smart by using complicated words. Your goal is to communicate!

I have not sought to include a tutorial or examples of LaTeX use here as there are now many sources of such information. For instance see `http://www.maths.adelaide.edu.au/anthony.roberts/LaTeX/index.html`.

4 Results

This template has no results to report.

Notes: Remember the advice from the previous section. You need your results to be concise, but once again be concrete, quantitative, and provide enough information that the results could be reproduced and verified.

Figures and tables can be very useful. However, while a picture is worth a thousand words, this is not true by itself. Any graph of figure included in a report MUST have:

1. a detailed caption describing exactly what the figure shows (it should almost stand alone);
2. appropriate axes with labels including units; and
3. discussion in the text of the document, not just the caption (make sure you refer to exact figure numbers in the text).

Moreover, they should be easy to read with large enough text, and clearly marked data points. Tables should be treated similarly. A few such in a document are very useful, but be aware that deluging a reading with figures and tables can be counter-productive. Part of the art of technical writing is choosing good ways of informing the reader of the critical information without diluting it with volumes of irrelevancies.

5 Conclusion

This brief template is intended to provide a simple starting point for students preparing LaTeX reports.

It includes some advice about that report, but the brevity of this report means that this advice is simplified and generic. You should consult your lecturer for more detailed and specific advice.

Notes: All works should have a conclusion. Briefly summarise your report (once again). Discuss the most important features of what you have achieved, and the implications of your results. The conclusion should not introduce new information or ideas, however, if you feel it is appropriate, you may speculate on directions for future work.

Acknowledgements

This template has grown out of earlier versions written by many others in the School of Mathematical Sciences: Ben Binder and Liz Cousins and others. This version has benefited from feedback from Jono Tuke and Danny Stevenson.

Notes: It is common that you will want to acknowledge the contribution of others to your work, even though these might not have been sufficient to warrant being a co-author.

Consider who might have provided valuable discussions, funding support, or moral support for the work.

BTW, you don't have to start each section on a new page. I have done that here for clarity, but it isn't usually needed.

A Appendices

This is a short appendix, just included as an example.

Notes: An appendix can be used to include material that is important, but not needed in the main body of the text, and which it might detract from the main point of the report.

A common example is code. You should not include code in the main body of a report unless it is particularly important or revealing.

However, for the convenience of your supervisors who may wish to examine the code, and for your own benefit (in having a self-contained document), you may wish to include the code in an appendix. If so, have a look at the `listings` package for LaTeX. For Matlab, there is also a `matlab-prettifier` package that may work more easily for you.

References

[1] Some Guy. A thing I wrote. *The Journal of Stuff*, 1:101–110, 2017.

Notes: A critical component of the work is the list of references. We have discussed their use earlier – here I simply make some notes on their presentation.

This is one of the hardest parts to get just right. BibTeX can help a great deal, but you need to put a good deal of care in to make sure that

- the references are in a consistent format;
- all information is correct; and
- the information included is in the correct style for the intended audience.

Details *really* matter in this section. It's easy to lose marks in this section.