Typesetting your dissertation

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Project Dissertation

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16th October 2022

Declaration

Statement 1

This work has not been previously accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed .... Stu Dent (1234567)

Date ....

Statement 2

This thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by citations giving explicit references. A bibliography is appended.

Signed .... Stu Dent (1234567)

Date ....

Statement 3

The University's ethical procedures have been followed and, where appropriate, ethical approval has been granted.

Signed .... Stu Dent (1234567)

Date ....

Abstract

In your abstract you should aim to summarize the core contributions of your work in the context of the problem domain. Start by outlining the domain and the problems posed within it. Discuss how the methods you focus on approach the relevant problems. You should end your abstract by concretely stating the tangible outputs and deliverables you have created in order to complete your work on this document, and whether those outputs represent an improvement or alternative approach to existing methods.

Your abstract should be a couple or so paragraphs long, and roughly approximate the order and flow you then use for structuring the main document. If a reader has read your abstract then they should already understand at a high level what it is you have created and delivered, and whether it is better than or comparable to existing methods. If your project is driven by a research hypothesis then the reader should know what that is at a high level from this section. Reading on, little should surprise the reader.

Acknowledgements

This is an opportunity to acknowledge and thank those who have supported you throughout your studies. Friends and colleagues who you have studied alongside, your families, and your mentors within the department are the usual suspects. You may delete this if you do not want it.

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1   Introduction

This document is intended both as a thesis template and as a short tutorial on typesetting a professional looking academic document in LaTeX. This is a simplified and updated version of the template [13].

The introduction would normally be longer than this and describe the context of the project in some detail. This, however, is just a template showing some of the framework of a potential project dissertation. You have to find the structure that suits your project best. For completeness of the dissertation you should compare it against the marking scheme so that all relevant sections of it are addressed.

1.1   Motivation

Large documents can become cumbersome to work with and format consistently. Inconsistent formatting gives the sense of incomplete or sloppy work. Sensibly chosen aesthetic cues are important to help imply structure and can greatly aid the reader in understanding your work. This LaTeX template uses abstraction to hide the formatting from the author during content preparation, allowing for consistent styling to be applied automatically during document compilation. In contrast, with the accompanying Word template it is the responsibility of the author to manually adhere to the styling laid out in the template.

1.2   Aims and objectives

The aim of this document is to present a tutorial on thesis creation and typesetting, and discuss topics such as literature surveying and proper citation.

The main objectives of this work are:

1. *A LaTeX thesis template*. Modify this document as appropriate and fill with your own material.

2. *A typesetting guide of useful primitive elements*. Use the building blocks within this template to typeset each part of your document. Aim to use simple and reusable elements to keep your LaTeX code neat and to make your document consistently styled throughout.

3. *A review of how to find and cite external resources*. We review techniques and resources for finding and properly citing resources from the prior academic literature and from online resources.

1.3   Overview

The remainder of this section outlines the document structure and the key contributions of this work. Section 2 reviews techniques for finding and properly citing external resources from the academic literature and online. In Section 3 we show examples of how to typeset different types of content, such as internal references, figures, code listings, and tables. And lastly in Section 4 we summarize the main contributions and key points to take away from this template.

2   Finding and citing resources

Finding relevant material for a subject area where you are not yet an expert can be difficult. Your first attempt would be to do a Google search for the relevant topic. Inspect the first couple of pages of results you receive. It is likely that you will get some useful information just from doing this. Among the results there may be a Wikipedia page that often has a decent list of references. Choose the most appropriate sources from the list as a starting point for a set of sources. You should also try a Google Scholar search for more authoritative sources. Usually, you will at this point have enough sources and no longer need to include the Wikipedia page or blog posts in your set of references. You may have to add further resources as you progress.

The university has subscriptions to a vast number of major academic journals spanning a wide range of subject areas. By accessing the internet from a university network connection (Eduroam or Ethernet), the paywalls of many journals will simply vanish without any need for login credentials.

2.1   Organising your citations in BibTeX

This is confusing so read carefully. BibTeX is both a file format and a tool that produces bibliographies from BibTeX files. There is also BibLaTeX which is a reworking of bibliographies in LaTeX that has different LaTeX commands for creating bibliographies. BibLaTeX also uses BibTeX files but the tool for creating the bibliographies is now Biber. This document uses BibLaTeX with Biber as the backend.

```
@ARTICLE{turing36,
  author = {Turing, Alan M.},
  title = {On computable numbers, with an application to the
    ``{E}ntscheidungsproblem''},
  journal = {Proceedings of the London Mathematical Society},
  year = {1936},
  volume = {42},
  pages = {230--265},
  number = {2}
}
```

Figure 1: An example of a BibTeX entry for a journal paper. This happens to be the paper introducing the Turing machine.

The BibTeX code listing in Figure 1 shows the information expected for a citation to an academic journal. The string `turing36` is an arbitrary chosen key allowing us to cite this in the text as `\cite{turing36}`. This will produce a citation according to the citation style of the document. In this paper the citation style is just a number in square brackets. Here is a reference to Turing machines [11].

Be disciplined when collecting resources. Collect the bibliographic information of resources as you find them. Recollecting the information when writing your dissertation is much harder, takes a lot of time, and is sometimes impossible.

To organise your BibTeX file it is much easier if you use a tool such as Jabref [3], Mendeley [5] or Zotero [14].

2.2   Importance of referencing

First of all, do take referencing seriously. It has been claimed that the degree classification of a dissertation can normally be deduced after a quick read of the bibliography [12].[1]

How are bibliographies evaluated? To understand this we need to explain a little about academia. Within the academic community there is a large emphasis on peer-reviewed research. A peer-reviewed publication is vetted by other researchers and is therefore considered to be more authoritative. In fact, there is a whole scale that academics are schooled to recognise. The top end of the scale is, generally, articles in well-renowned academic journals. The bottom end is self-published material, such as web pages. Hence, many of your markers will complain if your bibliography is dominated by online sources (although the complaint has less to do with *online* and more to do with *self-published*).

In addition, much can be gleaned by the attention to detail in the rendering of the bibliography. Is all the pertinent information present? Is it typeset consistently?

Things that will improve your bibliography:

- Use the most authoritative sources you can find.

- Give all the bibliographic information needed.

- Format your entries consistently.

- Never[2] cite an online version of a paper when there is a published version of the same paper.

- Online academic journals are still academic journals and should be cited as such, not as online material.

2.3   Properly using and formatting citations within the text

The purpose of citations is twofold. It is partly to give credit to the originators and partly to support your assertions. If a reader questions your assertion they can follow your citation to the original source and thereby verify it.

There are various citation styles in use. The important thing is not which citation style you use, but that you use the same one consistently. Here we use a style with numbers in brackets. You can tell Biblatex to use another style.

The citation is often placed at the end of the sentence. However, when we want to name the author it sometimes can move to other places. Such as: In [11] Turing introduces a model of

---

[1]Any claim of this kind should have a citation. In this case we had to protect our source, which is why the bibliographic information is very terse.

[2]Never ever ever.

computation. Do read academic publications to acquaint yourself with various ways of formulating citations.

3   Typesetting your dissertation

The following are some useful online resources for learning about LaTeX:

- *Overleaf Documentation for LaTeX*: Overleaf [7] is an online browser-based LaTeX IDE which stores your document in the cloud and provides live recompilation as you type. The documentation [8] on Overleaf's website has a good knowledge base of examples for how to typeset things cleanly and simply in LaTeX code.

- *TeX StackExchange*: TeX StackExchange [10] is a sub-community of the StackOverflow network dedicated to questions about the TeX family of typesetting tools including LaTeX, BibTeX and others. It is unlikely that the question or issue you are facing is one that has not been encountered before, and this site will more than likely to be able to point you in the right direction.

3.1   Fonts

It is easy to get *emphasised*, **bold face**, *italics*, Small-Caps, `mono-space`, and even some combinations such as ***bold italics*** text. And in maths mode we can get various fancy characters: $\mathscr{G}$ and $\mathbb{R}$.

It is also possible to enforce size changes but, in general, this should not be needed. Headings are already typeset large enough.

However, choosing font families in LaTeX has been less than easy and is still dependent on which exact version of TeX-engine is used. This document uses `fontspec` and expects the document to be typeset with the `LuaTeX` or `XeTeX` engine, i.e., the `lualatex` or `xelatex` programs.

Unless you have very specific reasons to change font families we would recommend not bothering as the learning curve is steep.

3.2   Referencing items within a document

In Section 2.1 we saw examples of how to typeset citations for resources external to the document. However, often we would like to refer to an item or a location elsewhere in the document. To do this we annotate our LaTeX code with `\label{key}` statements which will take on the numeric (or otherwise formatted) identifier for the current chapter, section, figure, table, equation, etc. To insert an inline reference to the label you can use the `\ref{key}` command which works similarly to the `\cite{key}` used for external references.

In the event we chose to reorder or add additional content to the document, which would change the section numbering, the document will still compile to a pdf with the correct references inserted for each `\ref{key}` command.

When referring to an item or location within the document we are naming it. Therefore it should be capitalised. Thus, we refer to Section 2, Figure 1, and so on.

3.3 Mathematics

Typesetting mathematics is one of the things that LaTeX does best. We will not provide a tutorial here but rather just give some examples of the most commonly used features.

3.3.1 Inline formulas

Small equations like $x = 0$ and $n! = \prod_{i=1}^{n} i$ can be written directly within the text by using LaTeX's maths mode.

3.3.2 Displayed formulas

For larger formulas it is best to break the main text and display the formula on its own line. The length of a vector

$$\boldsymbol{a} = \begin{pmatrix} a_0 \\ a_1 \\ \vdots \\ a_n \end{pmatrix}$$

is defined to be

$$\|\boldsymbol{a}\| = \sqrt{a_0^2 + a_1^2 + \cdots + a_n^2}.$$

The Fibonacci numbers are defined inductively by

$$f_n = \begin{cases} 0 & \text{if } n = 0, \\ 1 & \text{if } n = 1, \\ f_{n-1} + f_{n-2} & \text{if } n \geq 2. \end{cases} \tag{1}$$

Using a numbered equation as above give us the ability to refer to it later in the text as Equation 1.

3.3.3 Multi-line formulas

Sometimes we need several lines to express something. There are a number of LaTeX commands for this provided by the amsmath package [1]. For example, we can typeset the following bogus proof showing that $1 = -1^3$.

$$\begin{aligned} 1 &= \sqrt{1} \\ &= \sqrt{(-1)^2} \\ &= \sqrt{-1}\sqrt{-1} \\ &= i \cdot i \\ &= -1. \end{aligned}$$

---

[3] Bonus marks for anyone identifying the problem.

3.4 Figures

Figures are useful to quickly demonstrate things that are difficult to explain in text. Note that all figures should have a caption that explains their purpose and they should also be referenced in the main text.

Producing good quality figures to support the text is often time consuming but can greatly improve the document. Figure 2 shows a simple graph drawing produced with the TikZ package [9]. Alternatively, you can use external drawing programs to produce images which can subsequently be included.
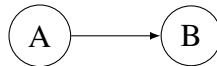

Figure 2: A simple graph drawing showing how to get from A to B.

Images are usually included as figures as well. Figure 3 shows a screenshot taken while preparing this document.
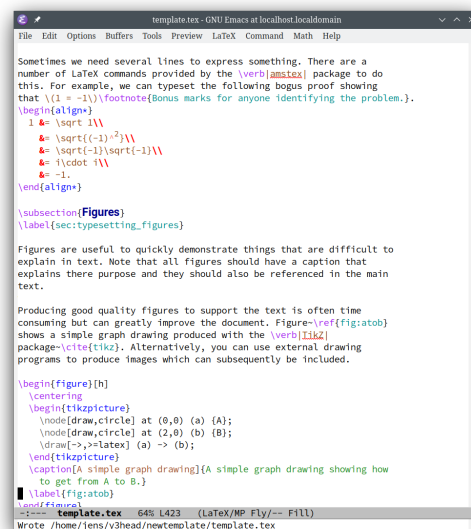

Figure 3: Screenshot showing LaTeX document under preparation.

3.4.1 Avoid directly importing other peoples images

It is best if you produce figures/images that are directly relevant to your project rather than taking images from other people. If you do take images from other sources these need to be cited in the caption with an entry in the bibliography.

3.5 Code listings

Code listings can be useful to describe key points in an implementation. In this document we have used the listings package [4]. If you desire more advanced code highlighting then you

may want to look at the `minted` package [6].

Code listings generally use a monospace font so characters line up vertically.

```c
#include <stdio.h>

/* The main method. */
int main(int argc, char *argv[]) {
  printf("Hello world.\n");
  return 0;
}
```

Listing 1: An implementation of an important algorithm from our work.

It is also possible to use code fragments inline. For example, `int argc`.

3.6 Tables

A table is a very good way to present a modest amount of data. It should be quite clear from Table 1 that the optimisation really improved the running times, and also that the improvements were better for Algorithm A than for Algorithm B. As with figures, tables should have captions and be referenced in the text. We have made use of the package `booktabs` [2] for more pleasing results.

	Non-optimised		Optimised	
	Steps	Time (ms)	Steps	Time (ms)
Algorithm A	4711	13.9	2424	6.9
Algorithm B	2800	16.2	2022	11.2

Table 1: Reporting on some ficticious optimisation results.

4 Conclusions

Finally, it is time to write up a summary of the things accomplished. In our case this is a template that may be used as a basis for your own dissertation.

You would normally also discuss future work. This might be improvements to the project that has come to light while reflecting on the outcomes, or it could be open questions that so far remain unanswered.

References

[1] *Amsmath*. Comprehensive TeX Archive Network. 2021. URL: https://ctan.org/pkg/amsmath (visited on 07/06/2022).

[2] *Booktabs*. Comprehensive TeX Archive Network. 2020. URL: https://ctan.org/pkg/booktabs (visited on 07/06/2022).

[3]   *JabRef*. JabRef Maintainers. 2022. URL: https://www.jabref.org/ (visited on 27/05/2022).

[4]   *Listings*. Comprehensive TeX Archive Network. 2020. URL: https://ctan.org/pkg/listings (visited on 07/06/2022).

[5]   *Mendeley*. Mendeley Ltd. 2021. URL: https://www.mendeley.com/ (visited on 27/05/2022).

[6]   *Minted*. Comprehensive TeX Archive Network. 2021. URL: https://ctan.org/pkg/minted (visited on 07/06/2022).

[7]   *Overleaf*. Overleaf. 2022. URL: https://www.overleaf.com/ (visited on 07/06/2022).

[8]   *Overleaf Documentation*. Overleaf. 2022. URL: https://www.overleaf.com/learn (visited on 07/06/2022).

[9]   Till Tantau. *PGF/TikZ Manual*. 2022. URL: https://tikz.dev/ (visited on 07/06/2022).

[10]   *TeX StackExchange*. Stack Overflow. 2022. URL: https://tex.stackexchange.com (visited on 07/06/2022).

[11]   Alan M. Turing. 'On computable numbers, with an application to the "Entscheidungs-problem"'. In: *Proceedings of the London Mathematical Society* 42.2 (1936), pp. 230–265.

[12]   Unnamed Lecturer (Swansea University). *Private communication*. 2022.

[13]   Joss Whittle. *Thesis Template*. 2022. URL: https://github.com/CS-Swansea/Computer-Vision-and-Machine-Learning-Wiki/tree/master/thesis-templates (visited on 07/06/2022).

[14]   *Zotero*. Corporation for Digital Scholarship. 2022. URL: https://www.zotero.org/ (visited on 27/05/2022).

A Implementation of main algorithm

```c
#include <stdio.h>

/* The main method. */
int main(int argc, char *argv[]) {
  printf("Hello world.\n");
  return 0;
}
```

Listing 2: An implementation of an important algorithm from our work.