How to write a dissertation in \LaTeX

Computer Science Tripos – Part II

St John’s College

October 19, 2015
Proforma

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College: St John’s College
Project Title: How to write a dissertation in \LaTeX
Examination: Computer Science Tripos – Part II, July 2001
Word Count: 1587\(^1\) (well less than the 12000 limit)
Project Originator: Dr M. Richards
Supervisor: Dr Markus Kuhn

Original Aims of the Project

To write a demonstration dissertation\(^2\) using \LaTeX{} to save student’s time when writing their own dissertations. The dissertation should illustrate how to use the more common \LaTeX{} constructs. It should include pictures and diagrams to show how these can be incorporated into the dissertation. It should contain the entire \LaTeX{} source of the dissertation and the makefile. It should explain how to construct an MSDOS disk of the dissertation in Postscript format that can be used by the book shop for printing, and, finally, it should have the prescribed layout and format of a diploma dissertation.

Work Completed

All that has been completed appears in this dissertation.

Special Difficulties

Learning how to incorporate encapsulated postscript into a \LaTeX{} document on both Ubuntu Linux and OS X.

---

\(^1\)This word count was computed by `\texttt{detex diss.tex | tr -cd \`0-9A-Za-z \n' | wc -w}`

\(^2\)A normal footnote without the complication of being in a table.
Declaration

I, [Name] of [College], being a candidate for Part II of the Computer Science Tripos [or the Diploma in Computer Science], hereby declare that this dissertation and the work described in it are my own work, unaided except as may be specified below, and that the dissertation does not contain material that has already been used to any substantial extent for a comparable purpose.

Signed [signature]

Date [date]
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<th>Page</th>
</tr>
</thead>
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<tr>
<td>3.1</td>
<td>A picture composed of boxes and vectors.</td>
<td>14</td>
</tr>
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<td>15</td>
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<td>16</td>
</tr>
</tbody>
</table>
Acknowledgements

This document owes much to an earlier version written by Simon Moore [2]. His help, encouragement and advice was greatly appreciated.
Chapter 1

Introduction

1.1 Overview of the files

This document consists of the following files:

- **makefile** — The makefile for the dissertation and Project Proposal
- **diss.tex** — The dissertation
- **proposal.tex** — The project proposal
- **figs** — A directory containing diagrams and pictures
- **refs.bib** — The bibliography database

1.2 Building the document

This document was produced using \texttt{LATEX 2\epsilon} which is based upon \texttt{LATEX}[1]. To build the document you first need to generate \texttt{diss.aux} which, amongst other things, contains the references used. This is done by executing the command:

\texttt{pdflatex diss}

Then the bibliography can be generated from \texttt{refs.bib} using:

\texttt{bibtex diss}

Finally, to ensure all the page numbering is correct run \texttt{pdflatex} on \texttt{diss.tex} until the \texttt{.aux} files do not change. This usually takes 2 more runs.

1.2.1 The makefile

To simplify the calls to \texttt{pdflatex} and \texttt{bibtex}, a makefile has been provided, see Appendix B.1. It provides the following facilities:

\texttt{make}

Display help information.
make proposal.pdf
    Format the proposal document as a PDF.

make view-proposal
    Run make proposal.pdf and then display it with a Linux PDF viewer (preferably “okular”, if that is not available fall back to “evince”).

make diss.pdf
    Format the dissertation document as a PDF.

make count
    Display an estimate of the word count.

make all
    Construct proposal.pdf and diss.pdf.

make pub
    Make diss.pdf and place it in my public_html directory.

make clean
    Delete all intermediate files except the source files and the resulting PDFs. All these deleted files can be reconstructed by typing make all.

1.3 Counting words

An approximate word count of the body of the dissertation may be obtained using:
    
    wc diss.tex

Alternatively, try something like:
    
    detex diss.tex | tr -cd '0-9A-Z a-z\n' | wc -w
Chapter 2

Preparation

This chapter is empty!
Chapter 3

Implementation

3.1 Verbatim text

Verbatim text can be included using \begin{verbatim} and \end{verbatim}. I normally use a slightly smaller font and often squeeze the lines a little closer together, as in:

GET "libhdr"

GLOBAL { count:200; all }

LET try(ld, row, rd) BE TEST row=all

THEN count := count + 1

ELSE { LET poss = all & ~(ld | row | rd)

UNTIL poss=0 DO

{ LET p = poss & ~poss

poss := poss - p

try(ld+p << 1, row+p, rd+p >> 1)

}

}

LET start() = VALOF

{ all := 1

FOR i = 1 TO 12 DO

{ count := 0

try(0, 0, 0)

writef("Number of solutions to %i2-queens is \%i5\text{n", i, count)

all := 2*all + 1

}

RESULTIS 0

}
3.2 Tables

Here is a simple example\footnote{A footnote} of a table.

<table>
<thead>
<tr>
<th>Left Justified</th>
<th>Centred</th>
<th>Right Justified</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>A</td>
<td>XXX</td>
</tr>
<tr>
<td>Second</td>
<td>AA</td>
<td>XX</td>
</tr>
<tr>
<td>Last</td>
<td>AAA</td>
<td>X</td>
</tr>
</tbody>
</table>

There is another example table in the proforma.

3.3 Simple diagrams

Simple diagrams can be written directly in \LaTeX. For example, see figure 3.1 on page 14 and see figure 3.2 on page 15.

3.4 Adding more complicated graphics

The use of \LaTeX format can be tedious and it is often better to use encapsulated postscript (EPS) or PDF to represent complicated graphics. Figure 3.3 and 3.5 on page 16 are
3.4. ADDING MORE COMPLICATED GRAPHICS

Figure 3.2: A diagram composed of circles, lines and boxes.

examples. The second figure was drawn using \texttt{xfig} and exported in .\texttt{eps} format. This is my recommended way of drawing all diagrams.

Figure 3.3: Example figure using encapsulated postscript
Figure 3.4: Example figure where a picture can be pasted in

Figure 3.5: Example diagram drawn using xfig
Chapter 4

Evaluation

4.1 Printing and binding

Use a “duplex” laser printer that can print on both sides to print two copies of your dissertation. Then bind them, for example using the comb binder in the Computer Laboratory Library.

4.2 Further information

See the Unix Tools notes at
Chapter 5

Conclusion

I hope that this rough guide to writing a dissertation is \LaTeX{} has been helpful and saved you time.
Bibliography


Appendix A

Latex source

A.1 diss.tex

% Template for a Computer Science Tripos Part II project dissertation
\documentclass[12pt,a4paper,twoside,openright]{report}
\usepackage[pdfborder=(0 0 0)]{hyperref} % turns references into hyperlinks
\usepackage[margin=25mm]{geometry} % adjusts page layout
\usepackage{graphicx} % allows inclusion of PDF, PNG and JPG images
\usepackage{verbatim}
\usepackage{docmute} % only needed to allow inclusion of proposal.tex
\raggedbottom % try to avoid widows and orphans
\sloppy
\clubpenalty1000%
\widowpenalty1000%
\renewcommand{\baselinestretch}{1.1} % adjust line spacing to make
% more readable
\begin{document}
\bibliographystyle{plain}

\begin{center}
\Huge \textbf{How to write a dissertation in \LaTeX} \\
Computer Science Tripos -- Part II \\
St John\'s College \\
\today
\end{center}

\chapter*{Proforma}

\begin{center}
% Proforma, table of contents and list of figures
\end{center}

\chapter{Proforma}
\section*{Original Aims of the Project}

To write a demonstration dissertation\footnote{A normal footnote without the complication of being in a table.} using LaTeX to save student's time when writing their own dissertations. The dissertation should illustrate how to use the more common LaTeX constructs. It should include pictures and diagrams to show how these can be incorporated into the dissertation. It should contain the entire LaTeX source of the dissertation and the makefile. It should explain how to construct an MS-DOS disk of the dissertation in Postscript format that can be used by the book shop for printing, and, finally, it should have the prescribed layout and format of a diploma dissertation.

\section*{Work Completed}

All that has been completed appears in this dissertation.

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\section*{Declaration}

\section*{Acknowledgements}

This document owes much to an earlier version written by Simon Moore \cite{Moore95}. His help, encouragement and advice was greatly
This document consists of the following files:

\begin{itemize}
\item \texttt{makefile} --- The makefile for the dissertation and Project Proposal
\item \texttt{diss.tex} --- The dissertation
\item \texttt{proposal.tex} --- The project proposal
\item \texttt{figs} --- A directory containing diagrams and pictures
\item \texttt{refs.bib} --- The bibliography database
\end{itemize}

\section{Building the document}

This document was produced using \LaTeXe\ which is based upon \LaTeX\cite{Lamport86}. To build the document you first need to generate \texttt{diss.aux} which, amongst other things, contains the references used. This if done by executing the command:

\texttt{pdflatex diss}

Then the bibliography can be generated from \texttt{refs.bib} using:

\texttt{bibtex diss}

Finally, to ensure all the page numbering is correct run \texttt{pdflatex} on \texttt{diss.tex} until the \texttt{diss.aux} files do not change. This usually takes 2 more runs.

\subsection{The makefile}

To simplify the calls to \texttt{pdflatex} and \texttt{bibtex}, a makefile has been provided, see Appendix\ref{makefile}. It provides the following facilities:

\begin{description}
\item \texttt{make} \ Display help information.
\item \texttt{make proposal.pdf} \ Format the proposal document as a PDF.
\item \texttt{make view-proposal} \ Run \texttt{make proposal.pdf} and then display it with a Linux PDF viewer (preferably ‘’okular’’, if that is not available fall back to ‘’evince’’).
\item \texttt{make diss.pdf} \ Format the dissertation document as a PDF.
\item \texttt{make count} \ Display an estimate of the word count.
\item \texttt{make all} \ Construct \texttt{proposal.pdf} and \texttt{diss.pdf}.
\end{description}
\item \texttt{make pub} \ \ Make \texttt{diss.pdf} \\
and place it in my \texttt{public_html} directory.

\item \texttt{make clean} \ \ Delete all intermediate files except the 
source files and the resulting PDFs. All these deleted files can 
be reconstructed by typing \texttt{make all}.

\end{description}

\section{Counting words}
An approximate word count of the body of the dissertation may be 
obtained using:

\texttt{wc diss.tex}

Alternatively, try something like:

\verb/detex diss.tex | tr -cd '0-9A-Z a-z\n' | wc -w/

\chapter{Preparation}
This chapter is empty!

\chapter{Implementation}

\section{Verbatim text}
Verbatim text can be included using \verb|\begin{verbatim}| and 
\verb|\end{verbatim}|. I normally use a slightly smaller font and 
often squeeze the lines a little closer together, as in:

\begin{verbatim}
GET "libhdr"
GLOBAL { count:200; all }
LET start() = VALOF
{ all := 1
  FOR i = 1 TO 12 DO
    { count := 0
      try(0, 0, 0)
      writef("Number of solutions to %i2-queens is %i5*n", i, count)
      all := 2*all + 1
    }
  }
RESULTIS 0
\end{verbatim}
Here is a simple example of a table.

\begin{tabular}{l|c|r}
Left & Centred & Right \\
Justified & & Justified \\
\hline\%[-2mm]
First & A & XXX \\
Second & AA & XX \\
Last & AAA & X \\
\end{tabular}

There is another example table in the proforma.

Simple diagrams can be written directly in \LaTeX. For example, see figure ~\ref{latexpic1} on page \pageref{latexpic1} and see figure ~\ref{latexpic2} on page \pageref{latexpic2}.

\begin{figure}
\begin{center}
\begin{picture}(125,100)
\put(0,80){\framebox(50,10){AAA}}
\put(0,60){\framebox(50,10){BBB}}
\put(0,40){\framebox(50,10){CCC}}
\put(0,20){\framebox(50,10){DDD}}
\put(0,00){\framebox(50,10){EEE}}
\put(75,80){\framebox(50,10){XXX}}
\put(75,60){\framebox(50,10){YYY}}
\put(75,40){\framebox(50,10){ZZZ}}
\put(25,80){\vector(0,-1){10}}
\put(25,60){\vector(0,-1){10}}
\put(25,50){\vector(0,1){10}}
\put(25,40){\vector(0,-1){10}}
\put(25,20){\vector(0,-1){10}}
\put(100,80){\vector(0,-1){10}}
\put(100,70){\vector(0,1){10}}
\put(100,60){\vector(0,-1){10}}
\put(100,50){\vector(0,1){10}}
\put(50,65){\vector(1,0){25}}
\put(75,65){\vector(-1,0){25}}
\end{picture}
\caption{A picture composed of boxes and vectors.}
\label{latexpic1}
\end{center}
\end{figure}

\begin{figure}
\begin{center}
\begin{picture}(100,70)
\put(47,65){\circle{10}}
\put(37,45){\circle{10}}
\put(37,51){\line(1,1){7}}
\end{picture}
\caption{A picture composed of boxes and vectors.}
\label{latexpic2}
\end{center}
\end{figure}
\section{Adding more complicated graphics}

The use of \LaTeX\ format can be tedious and it is often better to use encapsulated postscript (EPS) or PDF to represent complicated graphics. Figure \ref{epsfig} and \ref{xfig} on page \pageref{xfig} are examples. The second figure was drawn using \texttt{xfig} and exported in \texttt{.eps} format. This is my recommended way of drawing all diagrams.

\begin{figure}[tbh]
\centerline{\includegraphics{figs/cuarms.pdf}}
\caption{Example figure using encapsulated postscript}
\label{epsfig}
\end{figure}

\begin{figure}[tbh]
\vspace{4in}
\caption{Example figure where a picture can be pasted in}
\label{pastedfig}
\end{figure}

\begin{figure}[tbh]
\centerline{\includegraphics{figs/diagram.pdf}}
\caption{Example diagram drawn using \texttt{xfig}}
\label{xfig}
\end{figure}

\chapter{Evaluation}

\section{Printing and binding}

Use a "duplex" laser printer that can print on both sides to print two copies of your dissertation. Then bind them, for example using the comb binder in the Computer Laboratory Library.

\section{Further information}

See the Unix Tools notes at
\url{http://www.cl.cam.ac.uk/teaching/current-1/UnixTools/materials.html}

\chapter{Conclusion}
I hope that this rough guide to writing a dissertation is \LaTeX\ has been helpful and saved you time.

\begin{center}
\Large
Computer Science Tripos -- Part II -- Project Proposal
\end{center}

\textbf{Project Supervisor:} Dr M.~Richards

Originator: Dr M.~Richards

14 October 2011

\textbf{Project Supervisor:} Dr M.~Richards
The problem to be addressed.

Many students write their CST dissertations in \LaTeX\ -- and spend a fair amount of time learning just how to do that. The purpose of this project is to write a demonstration dissertation that provides a starting point to show how it is done.

This core proposal document will be augmented by a separately-printed cover sheet at the front and a resource form at the end. Additional sheets for risk assessment and human resources may also need to be included.

This document will elaborate much of the material that is summarised on the additional sheets.

Describe existing state of the art, previous work in this area, libraries and databases to be used. Describe the state of any existing codebase that is to be built on.

I am already able to write prose using the English language. I have an online dictionary, etc.

A note of the resources required and confirmation of access.

For this project I shall mainly use my own quad-core computer that runs Fedora Linux. Backup will be to github and/or to an SVN repository on an external hard disk that is dumped to writable CD/DVD media. I have another similar computer to hand should my main machine suddenly fail. I require no other special resources.

The project breaks down into the following sub-projects:

The construction of a skeleton dissertation with the required structure. This involves writing the Makefile and making dummy files for the title page, the proforma, chapters 1 to 5, the appendices and the proposal.

Filling in the details required in the cover page and proforma.

Writing the contents of chapters 1 to 5, including examples of common \LaTeX\ constructs.

Adding a example of how to use floating figures and ‘encapsulated PostScript’ or PDF diagrams.
Describe what you expect to be able to demonstrate at the end of the project and how you are going to evaluate your achievement.

The project will be a success if I have a completed dissertation with the correct chapter titles and I have achieved my other success criteria, which are to blah.

Possible extensions

Potential further envisaged evaluation metrics or extensions.

If I achieve my main result early I shall try the following alternative experiment or method of evaluation.

Timetable

A workplan of perhaps ten or so two-week work-packages, as well as milestones to be achieved along the way. Provide a target date for each milestone.

Planned starting date is 16/10/2011.

\begin{enumerate}
\item Michaelmas weeks 2--4 Learn to use X. Read book Y. Read papers Z.
\item Michaelmas weeks 5--6 Do preliminary test of Q.
\item Michaelmas weeks 7--8 Start implementation of main task A.
\item Michaelmas vacation Finish A and start main task B.
\item Lent weeks 0--2 Write progress report. Generate corpus of test examples. Finish task B.
\item Lent weeks 3--5 Run main experiments and achieve working project.
\item Lent weeks 6--8 Second main deliverable here.
\item Easter vacation Extensions and writing dissertation main chapters.
\item Easter term 0--2 Further evaluation and complete dissertation.
\item Easter term 3 Proof reading and then an early submission so as to concentrate on examination revision.
\end{enumerate}
Appendix B

Makefile

B.1 makefile

# This is the makefile for the Part II demonstration dissertation
#
# Rule that continuation lines require '\' and
# that a TAB character precedes any shell command line

.DELETE_ON_ERROR:

# Rules for building LaTeX documents (see Unix Tools course)
%.pdf %.aux %.idx: %.tex
    pdflatex -halt-on-error $<
    while grep 'Rerun to get ' $*.log ; do pdflatex $< ; done
%.ind: %.idx
    makeindex $*
%.bbl: %.aux
    bibtex $*
# Rules for exporting xfig diagrams into PDF or EPS
%.pdf: %.eps
    epstopdf --outfile=$@ $<
%.eps: %.fig
    fig2dev -L eps $< $@
%.pdf_t: %.fig
    fig2dev -L pdf_t -p $*.pdf_t $< $*.pdf_t
help:
    @echo
diss.pdf: figs/cuarms.pdf figs/diagram.pdf makefile.txt proposal.tex diss.bbl
makefile.txt: makefile
view-%: %.pdf
    ( okular --unique $< || evince $< ) &
diss.pdf: figs/cuarms.pdf figs/diagram.pdf makefile.txt proposal.tex diss.bbl
makefile.txt: makefile
expand makefile >makefile.txt

count:
detex diss.tex | tr -cd '0-9A-Za-z \n' | wc -w

all: proposal.pdf diss.pdf

pub: diss.pdf
     rsync -t $* $(HOME)/public_html/demodiss.pdf

clean:
     rm -f *.aux *.log *.err *.out
     rm -f *~ *.lof *.toc *.blg *.bbl
     rm -f makefile.txt

distclean: clean
     rm -f figs/*.pdf proposal.pdf diss.pdf

B.2 refs.bib

@BOOK{Lamport86,
    TITLE = "LaTeX --- a document preparation system --- user's guide and reference manual",
    AUTHOR = "Lamport, L.",
    PUBLISHER = "Addison-Wesley",
    YEAR = "1986"
}

@REPORT{Moore95,
    TITLE = "How to prepare a dissertation in LaTeX",
    AUTHOR = "Moore, S.W.",
    YEAR = "1995"
}
Appendix C

Project Proposal

Computer Science Tripos – Part II – Project Proposal

How to write a dissertation in $\LaTeX$

M. Richards, St John’s College
Originator: Dr M. Richards
14 October 2011

Project Supervisor: Dr M. Richards
Director of Studies: Dr M. Richards
Project Overseers: Dr F. H. King & Dr A. W. Moore

Introduction

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A note of the resources required and confirmation of access.

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Work to be done

Describe the technical work.

The project breaks down into the following sub-projects:

1. The construction of a skeleton dissertation with the required structure. This involves writing the Makefile and making dummy files for the title page, the proforma, chapters 1 to 5, the appendices and the proposal.

2. Filling in the details required in the cover page and proforma.

3. Writing the contents of chapters 1 to 5, including examples of common \LaTeX constructs.

4. Adding a example of how to use floating figures and “encapsulated PostScript” or PDF diagrams.

Success criteria

Describe what you expect to be able to demonstrate at the end of the project and how you are going to evaluate your achievement.

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Potential further envisaged evaluation metrics or extensions.

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8. **Easter vacation**: Extensions and writing dissertation main chapters.

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