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Faculty of Informatics

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Erklärung zur Verfassung der Arbeit

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Danksagung

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Acknowledgements

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Kurzfassung

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Abstract

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Contents

CHAPTER 1

Introduction to LaTeX

Since LaTeX is widely used in academia and industry, there exists a plethora of freely accessible introductions to the language. Reading through the guide at `https://en.wikibooks.org/wiki/LaTeX` serves as a comprehensive overview for most of the functionality and is highly recommended before starting with a thesis in LaTeX.

1.1 Installation

A full LaTeX distribution consists of not only of the binaries that convert the source files to the typeset documents, but also of a wide range of packages and their documentation. Depending on the operating system, different implementations are available as shown in Table 1.1. **Due to the large amount of packages that are in everyday use and due to their high interdependence, it is paramount to keep the installed distribution up to date.** Otherwise, obscure errors and tedious debugging ensue.

If you use a Windows PC and the recommended MikTeX distribution it will update itself, also it is recommended do activate the option, to automatically install needed packages.

Distribution	Unix	Windows	MacOS
TeX Live	**yes**	yes	(yes)
MacTeX	no	no	**yes**
MikTeX	no	**yes**	no

Table 1.1: TeX/LaTeX distributions for different operating systems. Recomended choice in **bold**.

1.2 Editors

A multitude of TeX editors are available differing in their editing models, their supported operating systems and their feature sets. A comprehensive overview of editors can be found at the Wikipedia page `https://en.wikipedia.org/wiki/Comparison_of_TeX_editors`. The author recommends the editor TeXmaker: `http://www.xm1math.net/texmaker/` because it is a crossplatform editor with the same UI for Windows, Linux and Mac and it has the useful feature to display the compiled `.pdf` file in the same window beside the LaTeX source code.

1.3 Compilation

Modern editors usually provide the compilation programs to generate Portable Document Format (PDF) documents and for most LaTeX source files, this is sufficient. More advanced LaTeX functionality, such as glossaries and bibliographies, needs additional compilation steps, however. It is also possible that errors in the compilation process invalidate intermediate files and force subsequent compilation runs to fail. It is advisable to delete intermediate files (`.aux`, `.bbl`, etc.), if errors occur and persist. All files that are not generated by the user are automatically regenerated. To compile the current document, the steps as shown in Table 1.1 have to be taken.

1.4 Installing Packages and Classes

If you use a new userpackage in your LaTeX editor, the distribution has to download it from Comprehensive TeX Archive Network (CTAN) before the compiler can create the `.pdf` file. Most distributions doe this automatically, but you can also manually install packages, whether you download them from the official repository or create your own. The proceder differs a little bit depending on the distribution, but the procedure is the same, you have to put the package in a folder in the LaTeX folder in your TeX distribution and update the package database. For the distributions listen in table:1.1 the folders and the update commands are listen in table: 1.1

1.5 Basic Functionality

In this section, various examples are given of the fundamental building blocks used in a thesis. Many LaTeX commands have a rich set of options that can be supplied as optional arguments. The documentation of each command should be consulted to get an impression of the full spectrum of its functionality. It is also recommended to read a good LaTeX book, where features are explained. A list of good books are: Der LaTeX-Begleiter, LaTeX : Basissystem, Layout, Formelsatz. Also look at CTAN and Open Books online library (WikiBooks).

	Description
1	Scan for refs, toc/lof/lot/loa items and cites
2	Build the bibliography
3	Link refs and build the toc/lof/lot/loa
4	Link the bibliography
5	Build the glossary
6	Build the acronyms
7	Build the index
8	Link the glossary, acronyms, and the index
9	Link the bookmarks

	Command
1	`pdflatex.exe  example`
2	`bibtex.exe    example`
3	`pdflatex.exe  example`
4	`pdflatex.exe  example`
5	`makeindex.exe -t example.glg -s example.ist -o example.gls example.glo`
6	`makeindex.exe -t example.alg -s example.ist -o example.acr example.acn`
7	`makeindex.exe -t example.ilg -o example.ind example.idx`
8	`pdflatex.exe  example`
9	`pdflatex.exe  example`

Table 1.1: Compilation steps for this document. The following abbreviations were used: table of contents (toc), list of figures (lof), list of tables (lot), list of algorithms (loa).

Distribution	Folder Path	Update
TeX Life	`/usr/local/texlife/2009/texmf/`	`tlmgr update -list`
MacTeX		
MikTeX	`C:\Programs(x86)\MikTeX2.9\tex\latex\`	Refresh FNDB

Table 1.1: installation path for LaTeX packages

1.5.1 Floats

Two main categories of page elements can be differentiated in the usual LaTeX workflow: *(i)* the main stream of text and *(ii)* floating containers that are positioned at convenient positions throughout the document. In most cases, tables, plots, and images are put into such containers since they are usually positioned at the top or bottom of pages. These are realized by the two environments `figure` and `table`, which also provide functionality for cross-referencing (see Table 1.1 and Figure 1.1) and the generation of corresponding entries in the list of figures and the list of tables. Note that these environments solely act as containers and can be assigned arbitrary content.

1.5.2 Tables

A table in LaTeX is created by using a `tabular` environment or any of its extensions, e.g., `tabularx`. The commands `\multirow` and `\multicolumn` allow table elements to span multiple rows and columns.

Position		
Group	Abbrev	Name
Goalkeeper	GK	Paul Robinson
Defenders	LB	Lucus Radebe
	DC	Michael Duburry
	DC	Dominic Matteo
	RB	Didier Domi
Midfielders	MC	David Batty
	MC	Eirik Bakke
	MC	Jody Morris
Forward	FW	Jamie McMaster
Strikers	ST	Alan Smith
	ST	Mark Viduka

Table 1.1: Adapted example from `https://en.wikibooks.org/wiki/LaTeX/Tables`. This example uses rules specific to the `booktabs` package and employs the multi-row functionality of the `multirow` package.

1.5.3 Images

An image is added to a document via the `\includegraphics` command as shown in Figure 1.1. The `\subcaption` command can be used to reference subfigures, such as Figure 1.1a and 1.1b.

(a) The header logo at text width

(b) The header logo at half the text width

Figure 1.1: The header logo at different sizes.

It is also possible to add an array of images with the `\subcatiption` command such as Figure 1.2

(a) upper left

(b) upper right

(c) Ball lower left

(d) Pen lower right

Figure 1.2: four figures in an array

1.5.4 Mathematical Expressions

One of the original motivation to create the TEX system was the need for mathematical typesetting. To this day, LATEX is the preferred system to write math-heavy documents and a wide variety of functions aids the author in this task. A mathematical expression

can be inserted inline as $\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$ outside of the text stream as

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$$

or as numbered equation with

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}. \tag{1.5.4.1}$$

Mathematical formulas and expression can also be used in a flowtext, for example: The mathematical expression $10 \cdot 100 = 10^{10}$ is simple.

1.5.5 Pseudo Code

The presentation of algorithms can be achieved with various packages, such as `algorithmic`, `algorithm2e`, `algorithmicx`, or `algpseudocode`. See `https://tex.stackexchange.com/questions/229355` for an overview. An example of the use of the `alogrithm2e` package is given with Algorithm 1.1.

Algorithm 1.1: Gauss-Seidel

Input: A scalar ϵ, a matrix $\mathbf{A} = (a_{ij})$, a vector $\vec{b}$, and an initial vector $\vec{x}^{(0)}$
Output: $\vec{x}^{(n)}$ with $\mathbf{A}\vec{x}^{(n)} \approx \vec{b}$

for $k \leftarrow 1$ **to** *maximum iterations* **do**
  for $i \leftarrow 1$ **to** n **do**
    $x_i^{(k)} = \frac{1}{a_{ii}} \left(b_i - \sum_{j<i} a_{ij} x_j^{(k)} - \sum_{j>i} a_{ij} x_j^{(k-1)} \right)$;
  end
  if $|\vec{x}^{(k)} - \vec{x}^{(k-1)}| < \epsilon$ **then**
    break for;
  end
end
return $\vec{x}^{(k)}$;

1.6 Bibliography

The referencing of prior work is a fundamental requirement of academic writing and well supported by LaTeX. The BibTeX reference management software is the most commonly used but because of the advanced features it is advised to use BibLaTeX as a system for this purpose. With BibLaTeX it is also possible and advised to use proprietery bibliography management software in Figure 1.1 a short overview of commonly used ones is given. The author uses Zotero,it needs a bit more fiddling before it works properly with BibLaTeX than eg. Jabref, but the advanced importing features of Zotero make it worth the extra effort.

Name	Platform	BibLaTeX	BibTeX	Filemanager	Sync
Zotero	All	Yes	Yes	Partial	Yes
Jabref	Java	Yes	Yes	Partial	No
medeley	All + Android	No	Yes	Yes	Yes, forced file sync

Table 1.1: BibLaTeX editors, *Platfrom: All = Windows, Mac, Linux*

To get propper BibLaTeX support and the ability to QuickCopy the proprietery plugin better Bibtex hase to be implemented, which can be found on GitHub. For instructions on better Bibtex use the GitHub wiki site of the project. To use the bibliography from Zotero it hase to be exported to a `.bib` file. Zotero supports the function to sync a collection to a certain `.bib` file and keep that file updated.

Using the `\cite` command, it is possible to reference entries in a `.bib` file out of the text stream, e.g., as [**?**]. If you are using Zotero you can copy the citation key to the clipboard with the QuickCopy function, to activate this function use the keyboard shortcut `ctl + shift + C` The generation of the formatted bibliography needs a separate execution of `bibtex.exe` (see Table 1.1).

1.7 Table of Contents

The table of contents is automatically built by successive runs of the compilation, e.g., of `pdflatex.exe`. The command `\setsecnumdepth` allows the specification of the depth of the table of contents and additional entries can be added via `\addcontentsline`. The starred versions of the sectioning commands, i.e., `\chapter*`, `\section*`, etc., remove the corresponding entry from the table of contents.

1.8 Acronyms / Glossary / Index

The list of acronyms, the glossary, and the index need to be built with a separate execution of `makeindex` (see Table 1.1). Acronyms have to be specified with `\newacronym` while glossary entries use `\newglossaryentry`. Both are then used in the document content with one of the variants of `\gls`, such as `\Gls`, `\glspl`, or `\Glspl`. Index items are simply generated by placing `\index{`⟨*entry*⟩`}` next to all the words that correspond to the index entry ⟨*entry*⟩. Note that many enhancements exist for these functionalities and the documentation of the `makeindex` and the `glossaries` packages should be consulted.

1.9 Tips

Since TeX and its successors do not employ a What You See Is What You Get (WYSIWYG) editing scheme, several guidelines improve the readability of the source content:

- Each sentence in the source text should start with a new line. This helps not only the user navigation through the text, but also enables revision control systems (e.g. Subversion (SVN), Git) to show the exact changes authored by different users. Paragraphs are separated by one (or more) empty lines.

- Environments, which are defined by a matching pair of `\begin{name}` and `\end{name}`, can be indented by whitespace to show their hierarchical structure.

- In most cases, the explicit use of whitespace (e.g. `\hspace{4em}` or `\vspace{1.5cm}`) violates typographic guidelines and rules. Explicit formatting should only be employed as a last resort and, most likely, better ways to achieve the desired layout can be found by a quick web search.

- The use of bold or italic text is generally not supported by typographic considerations and the semantically meaningful `\emph{...}` should be used.

The predominant application of the LaTeX system is the generation of PDF files via the PdfLaTeX binaries. In the current version of PdfLaTeX, it is possible that absolute file paths and user account names are embedded in the final PDF document. While this poses only a minor security issue for all documents, it is highly problematic for double blind reviews. The process shown in Table 1.1 can be employed to strip all private information from the final PDF document.

	Command
1	Rename the PDF document `final.pdf` to `final.ps`.

2	Execute the following command:
	`ps2pdf -dPDFSETTINGS#/prepress ^`
	`-dCompatibilityLevel#1.4 ^`
	`-dAutoFilterColorImages#false ^`
	`-dAutoFilterGrayImages#false ^`
	`-dColorImageFilter#/FlateEncode ^`
	`-dGrayImageFilter#/FlateEncode ^`
	`-dMonoImageFilter#/FlateEncode ^`
	`-dDownsampleColorImages#false ^`
	`-dDownsampleGrayImages#false ^`
	`final.ps final.pdf`

On Unix-based systems, replace # with = and ^ with \.

Table 1.1: Anonymization of PDF documents.

1.10 Resources

1.10.1 Useful Links

In the following, a listing of useful web resources is given.

`https://en.wikibooks.org/wiki/LaTeX` An extensive wiki-based guide to LaTeX.

`http://www.tex.ac.uk/faq` A (huge) set of Frequently Asked Questions (FAQ) about TeX and LaTeX.

`https://tex.stackexchange.com/` The definitive user forum for non-trivial LaTeX-related questions and answers.

1.10.2 CTAN

The CTAN is the official repository for all TeX related material. It can be accessed via `https://www.ctan.org/` and hosts (among other things) a huge variety of packages that provide extended functionality for TeX and its successors. Note that most packages contain PDF documentation that can be directly accessed via CTAN.

In the following, a short, non-exhaustive list of relevant CTAN-hosted packages is given together with their relative path.

algorithm2e Functionality for writing pseudo code.

amsmath Enhanced functionality for typesetting mathematical expressions.

amssymb Provides a multitude of mathematical symbols.

booktabs Improved typesetting of tables.

enumitem User control over the layout of lists (`itemize`, `enumerate`, `description`).

fontenc Determines font encoding of the output.

glossaries Create glossaries and list of acronyms.

graphicx Insert images into the document.

inputenc Determines encoding of the input.

l2tabu A description of bad practices when using LaTeX.

mathtools Further extension of mathematical typesetting.

memoir The document class on upon which the `vutinfth` document class is based.

multirow Allows table elements to span several rows.

pgfplots Function plot drawings.

pgf/TikZ Creating graphics inside LaTeX documents.

subcaption Allows the use of subfigures and enables their referencing.

symbols/comprehensive A listing of around 5000 symbols that can be used with LaTeX.

voss-mathmode A comprehensive overview of typesetting mathematics in LaTeX.

xcolor Allows the definition and use of colors.

List of Figures

List of Tables

List of Algorithms

Index

Glossary

GitHub a web based project repository and host site for developers, which offers commit based management. 7

editor A text editor is a type of program used for editing plain text files.. 2

QuickCopy QucikCopy is a Zotero function, where you can copy the citation code of a entry to the clipboard. 7

Acronyms

CTAN Comprehensive TeX Archive Network. 2, 9

FAQ Frequently Asked Questions. 9

PDF Portable Document Format. 2, 8, 9, 11

SVN Subversion. 8

WikiBooks Open Books online library. 2

WYSIWYG What You See Is What You Get. 7

Bibliography

Bibliography