
SYMBOLIC SOFTWARE LAB: LATEX 1

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Jacobs University Bremen

110111 Symbolic Software Lab, Module II

2014-10-31

Goal of Today's Lecture

1. basics of typography: how to make printed text “look good”
(not artistic, but readable in an “enjoyable” way)
2. how to do this using \LaTeX

Outline

1. Introduction: Typography
2. Basics of Typography
3. Introduction: \LaTeX
4. Short Break
5. Using \LaTeX

1. Introduction: Typography

Contents

1. Introduction: Typography

2. Basics of Typography

3. Introduction: \LaTeX

4. Short Break

5. Using \LaTeX

1. Introduction: Typography

Typography—Why Should You Care?

In today's life, printed text is everywhere.

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Now that's a pretty strong claim . . .

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Typography—Why Should You Care?

In today's life, printed text is everywhere.

Now that's a pretty strong claim . . .

but who remembers the last time you were more than 5 metres away from any printed word?

1. Introduction: Typography

Criteria for Good Texts

Suppose you're applying for a job, writing your thesis, . . .

Pay attention to

1. Introduction: Typography

Criteria for Good Texts

Suppose you're applying for a job, writing your thesis, . . .

Pay attention to

- correct content
- correct language
- written in appropriate structure
- typeset correctly

1. Introduction: Typography

What Do You Think?

The British company Sunflower Inc. was founded in 1728 and first did business in producing beer. After its founder

John Shoemaker was killed in a duel,

his wife **Barbara** **continued** expanding the company to the Irish market.

Whiskey sold in red barrels became an instant success in Kent.

Barbara Shoemaker married again
in **1757, soon after** London
experienced a rainy winter.

1. Introduction: Typography

What Do You Think?

Vote: good or bad work?

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Here's What I Think

- absolutely chaotic at first glance
- discard immediately

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1. Introduction: Typography

Here's What I Think

- looks OK at first glance
- but what language is this??

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Here's What I Think

- looks OK at first and second glance
- but contains a lot of nonsense

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Here's What I Think

- looks OK at first, second, and third glance
- worth reading in detail

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2. Basics of Typography

Contents

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2. Basics of Typography

Background: How Does Reading Work?

Since about 1950, FE methods have been developed in engineering and in mathematics. They have become a very popular tool for simulation and the numerical treatment of elliptic and parabolic differential equations. This is due to FE being based on variational formulations of boundary and initial value problems and thus their flexibility with respect to geometry and irregularities in solutions. [264] gives a historical overview on the development of FE methods.

- eye focuses on a few points per line
- recognizes shapes of words rather than individual characters

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Requirements

- guidance through one line
- allow jump to next line

2. Basics of Typography

Document Structure: Article Example

This is the Title

Hendrik Laue Ole Schwen

October 19, 2014

This is the abstract. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis.

Contents

1 Introduction	1
2 Further Sections	2

1 Introduction

Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem in Section 2.

2. Basics of Typography

Font Examples

The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog.

2. Basics of Typography

Font Examples

brown

brown

lazy dog

lazy dog

brown

brown

lazy dog

lazy dog

2. Basics of Typography

Fonts and Font Shapes

- sans-serif font
 - simple shape
 - easily **legible**
 - good for headings, flyers, street signs, . . .
- serif font
 - guides eye through the line
 - easily **readable** (recognizable)
 - good for multiple lines of text
- italic font (not just slanted characters)
 - emphasize text
(think of voice melody/emphasis when speaking)
- bold font
 - titles, headings
(think of shouting vs. speaking)

Handgloves

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2. Basics of Typography

Emphasizing Text

Not all words in a text are of equal importance.

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- ✗ underlining in printed texts is an ugly relic from typewriters
(OK on web pages for hyperlinks)

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Emphasis should be used sparingly, otherwise it does not work. Otherwise, like in these two sentences, it does not become clear what the important or stressed points are.

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2. Basics of Typography

Emphasis Examples

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, *adipiscing vitae*, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem.

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Emphasis Examples

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2. Basics of Typography

Emphasis Non-Examples

Things like

- section headings
- figure captions
- etc.

are structuring, not empasizing.

We'll get to that next week.

2. Basics of Typography

Lists

Not all information needs to be presented in complete sentences.

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Not all information needs to be presented in complete sentences.

- bullet lists
- numbered lists
- dictionary-type lists

2. Basics of Typography

Unordered List Example

Unordered or bullet list

- no complete sentences
- order of points is not essential
- may contain sublists
 - should have ≥ 2 points
 - looks lost otherwise

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Note: same structure as before, different layout (presentation vs. print)

2. Basics of Typography

Ordered List Example

Ordered or enumerated list

1. can also contain sublists
 - 1.1 bla
 - 1.2 blub
2. e.g., step-by-step instructions

This is not really an example for 2.

2. Basics of Typography

Ordered List Example

Ordered or enumerated list

1. can also contain sublists
 - a) bla
 - b) blub
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2. Basics of Typography

Description List Example

A description can be used for explaining terms.

widow last line of a paragraph at the top of a page

orphan first line of a new paragraph at the bottom of a page

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2. Basics of Typography

Individual Characters

- different languages use Latin alphabet plus different accents/special characters: Encyclopædia Britannica, ¿Español?, Français !, București, Erdöl vs. Erdős, ...

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- punctuation marks and spacing are language specific

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- punctuation marks and spacing are language specific in English
 - ‘single’ and “double” quotes (superscript 6-9 rather than "this")
 - no space before : ? !
 - no spacing—as we see here—around dashes
 - abbreviations (i.e., short forms) use no space but use comma (same for “e.g.”)

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 - German: any automatic algorithm frequently gets it wrong or ugly e.g., Rindfleischetikettierungsüberwachungsaufgabenübertragungsgesetz

2. Basics of Typography

Mathematics

- nicely typesetting formulas is nontrivial, but well supported in \LaTeX

2. Basics of Typography

Mathematics

- nicely typesetting formulas is nontrivial, but well supported in \LaTeX
- however, one advantage of Powerpoint and similar tools is that the equation editor is so inconvenient that people make better presentations by avoiding formulas 😊

2. Basics of Typography

Types of Formulas

- formulas like $a^2 + b^2 = c^2$ may just appear in the normal text
 - they should have a font (and font size) matching the text font
 - they should be printed on the same base line as the text
 - ✓ both is (usually) automatically done right by \LaTeX

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 - ✓ both is (usually) automatically done right by \LaTeX
- longer or more complicated formulas can be written as numbered “displayed formulas” such as

$$\int_{\Omega} \partial_t u(t, x) + \int_{\Omega} \nabla u(t, x) = \sum_{a \in A} \int_{T_a} \langle f_a(t, x), v(x) \rangle \quad (1)$$

- this is also useful if Equation 1 is an important equation you want to reference later

2. Basics of Typography

Content of Formulas

Surface area of a cylinder

$$\begin{aligned}A_{\text{total}} &= 2 \cdot A_{\text{cap}} + A_{\text{side}} \\ &= 2 \cdot \pi r^2 + 2\pi r l \\ &\approx 452.35 \text{ cm}^2\end{aligned}$$

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- mathematical variables: italic
- mathematical operators
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- alignment

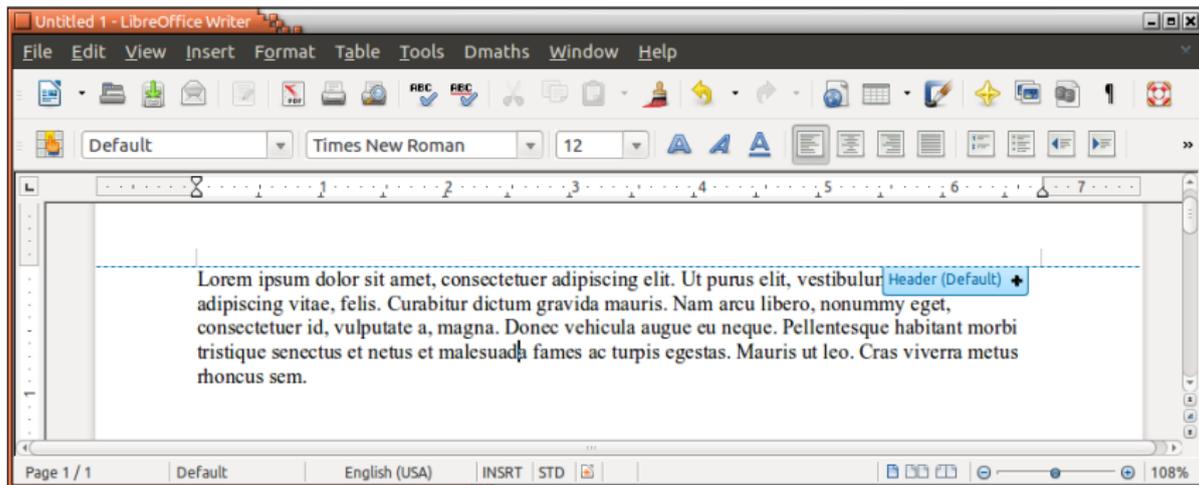
3. Introduction: \LaTeX

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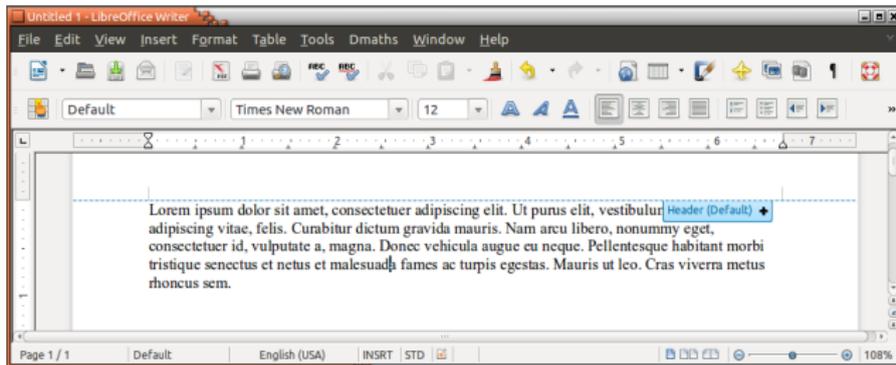
3. Introduction: \LaTeX

Standard Word Processing Software/WYSIWYG



3. Introduction: \LaTeX

Standard Word Processing Software/WYSIWYG



- gives you an immediate visual impression of what you're writing
 - ✗ requires you to think about contents and layout simultaneously
- has a graphical user interface
 - ✗ may be similar or different across platforms or versions
- is available on many platforms
 - ✗ fonts may be missing, page layout may be messed up
 - ✗ does not easily allow cooperation

3. Introduction: \LaTeX

\LaTeX Workflow

Document is written in a **markup language** (what you see is what you *mean*)

3. Introduction: L^AT_EX

L^AT_EX Workflow

Document is written in a **markup language** (what you see is what you *mean*)

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\section{Triangles}
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Pythagoras' theorem \cite{mathTextbook} states  $a^2 + b^2 = c^2$ .
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- use your favorite text editor to *write* document

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- pdf \LaTeX to *compile* and produce a pdf
- use your favorite pdf viewer (e.g., Acrobat Reader) to *view* the result

Advantages

- ✓ allows cooperation using your favorite revision control/diff/merge tools

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- ✓ designed for writing scientific texts (footnotes, citations, cross-references, ...)

3. Introduction: \LaTeX

\LaTeX Workflow

Document is written in a **markup language** (what you see is what you *mean*)

```
\section{Triangles}
```

```
Pythagoras' theorem \cite{mathTextbook} states  $a^2 + b^2 = c^2$ .
```

- use your favorite text editor to *write* document
 - write the text
 - \LaTeX (i.e., its programmers who know know typography) will take care of the layout
- pdf \LaTeX to *compile* and produce a pdf
- use your favorite pdf viewer (e.g., Acrobat Reader) to *view* the result

Advantages

- ✓ allows cooperation using your favorite revision control/diff/merge tools
- ✓ designed for writing scientific texts (footnotes, citations, cross-references, ...)
- ✓ designed for typesetting mathematical formulas

3. Introduction: \LaTeX

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Advantages

- ✓ allows cooperation using your favorite revision control/diff/merge tools
- ✓ designed for writing scientific texts (footnotes, citations, cross-references, ...)
- ✓ designed for typesetting mathematical formulas
- ✓ pdf output will look “the same” for everyone else

3. Introduction: \LaTeX

Hello World Document

```
\documentclass{article}  
\begin{document}  
Hello World!  
\end{document}
```

3. Introduction: \LaTeX

Hello World Document

```
\documentclass{article}  
\begin{document}  
Hello World!  
\end{document}
```

- `\` starts commands

3. Introduction: \LaTeX

Hello World Document

```
\documentclass{article}  
\begin{document}  
Hello World!  
\end{document}
```

- `\` starts commands
- `begin` and `end` encapsulate environments

3. Introduction: L^AT_EX

Hello World Extended

```
\documentclass[12pt]{scrartcl}
\usepackage[utf8]{inputenc}
% so that we can directly input special characters
```

```
\begin{document}
```

The quick brown fox jumps over the lazy dog.

Falsches Üben von Xylophonmusik quält jeden größeren Zwerg.

```
\end{document}
```

3. Introduction: L^AT_EX

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- scrartcl is slightly adapted to “European” standards

3. Introduction: L^AT_EX

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- [12pt] selects basic font size

3. Introduction: L^AT_EX

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- [12pt] selects basic font size
- \usepackage allows using hundreds of useful packages

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- [options] are specified like this

3. Introduction: L^AT_EX

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- `[12pt]` selects basic font size
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- `[options]` are specified like this
- `%` starts a comment (no output produced)

3. Introduction: \LaTeX

Hello World Extended

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```
\begin{document}
```

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Falsches Üben von Xylophonmusik quält jeden größeren Zwerg.

```
\end{document}
```

- `scrartcl` is slightly adapted to “European” standards
- `[12pt]` selects basic font size
- `\usepackage` allows using hundreds of useful packages
- `[options]` are specified like this
- `%` starts a comment (no output produced)
- line breaks in input are ignored, double line breaks start new paragraph

3. Introduction: \LaTeX

Document Titles

```
\documentclass[12pt]{scrartcl}

\title{This is the Title}
\author{Hendrik Laue \and Ole Schwen}
\date{\today}

\begin{document}
\maketitle
Lorem ipsum dolor sit amet, consectetur adipiscing
[...]
\end{document}
```

3. Introduction: \LaTeX

Document Titles

This is the Title

Hendrik Laue

Ole Schwen

October 19, 2014

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem.

4. Short Break

Contents

1. Introduction: Typography

2. Basics of Typography

3. Introduction: \LaTeX

4. Short Break

5. Using \LaTeX

4. Short Break

The quick brown fox jumps over the lazy dog.



[http://www.youtube.com/watch?v=00E_LVo_aTo]

5. Using \LaTeX

Contents

1. Introduction: Typography
2. Basics of Typography
3. Introduction: \LaTeX
4. Short Break
5. Using \LaTeX

5. Using \LaTeX

Document Structure: Sections

This is the Title

Hendrik Laue Ole Schwen

October 19, 2014

This is the abstract. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis.

Contents

1	Introduction	1
2	Further Sections	2

1 Introduction

Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem in Section 2.

5. Using \LaTeX

Document Structuring I

- `\section{Heading}` starts a new section

5. Using \LaTeX

Document Structuring I

- `\section{Heading}` starts a new section
 - numbered and formatted automatically
 - permits referencing (e.g., ... see the detailed discussion in Section 42)
 - used for table of contents
 - used in page header (if enabled)

5. Using \LaTeX

Document Structuring I

- `\section{Heading}` starts a new section
 - numbered and formatted automatically
 - permits referencing (e.g., ... see the detailed discussion in Section 42)
 - used for table of contents
 - used in page header (if enabled)
- `\section[Short Heading]{Long Heading}`
alternate text for TOC and page header
- `\section*{Less Prominent Section}`
not numbered, not in TOC and page header

5. Using \LaTeX

Document Structuring II

Sectioning Levels

- `part` (scrbook only)
- `chapter` (scrbook and scrreprt only)
- `section`
- `subsection`
- `subsubsection`
- `paragraph`
- `subparagraph`

5. Using \LaTeX

Document Structuring II

Sectioning Levels

- `part` (scrbook only)
- `chapter` (scrbook and scrreprt only)
- `section`
- `subsection`
- `subsubsection`
- `paragraph`
- `subparagraph`

Numbering and TOC entries controlled by so-called **counters**

- `\setcounter{tocdepth}{1}` to only list sections
- `\addcounter{secnumdepth}{-1}` to number one level of sections less

5. Using \LaTeX

Document Structure: Cross-Referencing

This is the Title

Hendrik Laue Ole Schwen

October 19, 2014

This is the abstract. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis.

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1 Introduction

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5. Using \LaTeX

Document Structuring III

Table of contents

- produced by `\tableofcontents`

5. Using \LaTeX

Document Structuring III

Table of contents

- produced by `\tableofcontents`

Defining Labels

```
\section{Introduction}\label{sec:intro}
```

5. Using \LaTeX

Document Structuring III

Table of contents

- produced by `\tableofcontents`

Defining Labels

`\section{Introduction}\label{sec:intro}`

Cross-Referencing

- `\ref{sec:intro}` prints the number of the label
- `\pageref{sec:intro}` prints the page number

5. Using L^AT_EX

Document Structuring III

Table of contents

- produced by `\tableofcontents`

Defining Labels

`\section{Introduction}\label{sec:intro}`

Cross-Referencing

- `\ref{sec:intro}` prints the number of the label
- `\pageref{sec:intro}` prints the page number

What happens “under the hood”?

- `\label` saves the number of the counter that was last increased and page number
 - ⚡ Put label to the right position!
- value is saved to `.aux` file during one pdfL^AT_EX run and available only in the next run
 - ⚡ may need to run pdfL^AT_EX twice or three times to get references right

5. Using \LaTeX

Document Structure: Special Sections

This is the Title

Hendrik Laue Ole Schwen

October 19, 2014

This is the abstract. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis.

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1 Introduction

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5. Using \LaTeX

Document Structuring IV

“Special Sections”

- Abstract: `\begin{abstract}[\dots]\end{abstract}`
- `\tableofcontents`
- `\listoffigures`, `\listoftables` work similar but are seldom useful (see next week’s lecture for figures and tables)
- Appendix is started by `\appendix` (mainly changes section numbering)
- Bibliography (see next week’s lecture)

5. Using \LaTeX

Article Example

This is the Title

Hendrik Laue Ole Schwen

October 19, 2014

This is the abstract. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis.

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1 Introduction

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5. Using L^AT_EX

Article Example

```
\documentclass[12pt]{scrartcl}

\title{This is the Title}
\author{Hendrik Laue \and Ole Schwen}
\date{\today}

\begin{document}
\maketitle
\begin{abstract}
  This is the abstract. [...]
\end{abstract}
\tableofcontents

\section{Introduction}
[...]
\end{document}
```

5. Using \LaTeX

Text Formatting

- `\emph{text}` to emphasize text
If you are in an *emphasized part of text*, emphasizing again works.
- `\textbf{text}` to obtain **bold text**
similarly, `\mathbf{x}` works in math mode (but not for all symbols)
- `\textsc{text}` to obtain SMALL CAPS

5. Using \LaTeX

Text Formatting: Things You Should Use With Care I

Font Sizes (relative to document font size)

<code>\tiny</code>	penguin
<code>\scriptsize</code>	penguin
<code>\footnotesize</code>	penguin
<code>\small</code>	penguin
<code>\normalsize</code>	penguin
<code>\large</code>	penguin
<code>\Large</code>	...
<code>\LARGE</code>	penguin
<code>\huge</code>	...
<code>\Huge</code>	penguin

- note: \LaTeX commands are case sensitive

5. Using \LaTeX

Text Formatting: Things You Should Use With Care II

Fonts

<code>\textrm{text}</code>	<code>{\rmfamily text}</code>	The quick brown fox
<code>\textsf{text}</code>	<code>{\sffamily text}</code>	The quick brown fox
<code>\texttt{text}</code>	<code>{\ttfamily text}</code>	The quick brown fox

5. Using \LaTeX

Text Formatting: Things You Should Use With Care II

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<code>\textrm{text}</code>	<code>{\rmfamily text}</code>	The quick brown fox
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Bold vs. normal

<code>\textmd{text}</code>	<code>{\mdseries text}</code>	The quick brown fox
<code>\textbf{text}</code>	<code>{\bfseries text}</code>	The quick brown fox

5. Using \LaTeX

Text Formatting: Things You Should Use With Care II

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Bold vs. normal

<code>\textmd{text}</code>	<code>{\mdseries text}</code>	The quick brown fox
<code>\textbf{text}</code>	<code>{\bfseries text}</code>	The quick brown fox

Font Shapes

<code>\textup{text}</code>	<code>{\upshape text}</code>	The quick brown fox
<code>\textit{text}</code>	<code>{\itshape text}</code>	<i>The quick brown fox</i>
<code>\textsl{text}</code>	<code>{\slshape text}</code>	<i>The quick brown fox</i>
<code>\textsc{text}</code>	<code>{\scshape text}</code>	THE QUICK BROWN FOX

5. Using \LaTeX

Text Formatting: Things You Should Use With Care II

Fonts

<code>\textrm{text}</code>	<code>{\rmfamily text}</code>	The quick brown fox
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<code>\textsc{text}</code>	<code>{\scshape text}</code>	THE QUICK BROWN FOX

- `\textrm{text}` uses standard document font
- `*family`, `*series` and `*shape` can be combined (use with care!)
- notice the difference between italic and slanted

5. Using \LaTeX

Itemized Lists

```
\begin{itemize}
\item no complete sentences
\item order of points is not essential
\item may contain sublists
  \begin{itemize}
  \item should have  $\geq 2$  points
  \item looks lost otherwise
  \end{itemize}
\end{itemize}
```

5. Using \LaTeX

Itemized Lists

Unordered or bullet list

- no complete sentences
- order of points is not essential
- may contain sublists
 - should have ≥ 2 points
 - looks lost otherwise

5. Using \LaTeX

Enumerated Lists

```
\begin{enumerate}
\item can also contain sublists
  \begin{enumerate}
    \item bla
    \item blub
  \end{enumerate}
\item e.g., \ step-by-step instructions\label{item:steps}
\end{enumerate}
```

5. Using \LaTeX

Enumerated Lists

```
\begin{enumerate}
\item can also contain sublists
  \begin{enumerate}
    \item bla
    \item blub
  \end{enumerate}
\item e.g., \ step-by-step instructions\label{item:steps}
\end{enumerate}
```

- separate type of list environment and starting new item
- when nesting, types can of course be mixed

5. Using \LaTeX

Enumerated Lists

Ordered or enumerated list

1. can also contain sublists
 - a) bla
 - b) blub
2. e.g., step-by-step instructions

This is not really an example for 2.

5. Using \LaTeX

Description List

```
\begin{description}
```

```
\item[widow] last line of a paragraph at the top of a page
```

```
\item[orphan] first line of a new paragraph at the bottom  
of a page
```

```
\end{description}
```

5. Using \LaTeX

Description Lists

A description can be used for explaining terms.

widow last line of a paragraph at the top of a page

orphan first line of a new paragraph at the bottom of a page

5. Using \LaTeX

Special Characters

- special characters can be typed directly when saving as utf8 and using `\usepackage[utf8]{inputenc}`

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- otherwise, there is \LaTeX syntax like `\'e` (for é) you can look up if needed

5. Using \LaTeX

Special Characters

- special characters can be typed directly when saving as utf8 and using `\usepackage[utf8]{inputenc}`
- otherwise, there is \LaTeX syntax like `\'e` (for é) you can look up if needed
- a huge number of symbols is available
 - see “The Comprehensive LATEX Symbol List” or ask your favorite search engine
 - may require `\usepackage{somepackage}`

5. Using L^AT_EX

Special Characters

- special characters can be typed directly when saving as utf8 and using `\usepackage[utf8]{inputenc}`
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- a huge number of symbols is available
 - see “The Comprehensive L^AT_EX Symbol List” or ask your favorite search engine
 - may require `\usepackage{somepackage}`
- ```quotation marks'`: “quotation marks”

5. Using L^AT_EX

Special Characters

- special characters can be typed directly when saving as utf8 and using `\usepackage[utf8]{inputenc}`
- otherwise, there is L^AT_EX syntax like `\' {e}` (for é) you can look up if needed
- a huge number of symbols is available
 - see “The Comprehensive L^AT_EX Symbol List” or ask your favorite search engine
 - may require `\usepackage{somepackage}`
- “quotation marks”: “quotation marks”
- distinguish dashes
 - standard (enter as one -): non-native
 - long (--): pages 35–74, Michaelis–Menten equation
 - em-dash (---): with—as we can see here—no spacing

5. Using \LaTeX

Special Characters

- special characters can be typed directly when saving as utf8 and using `\usepackage[utf8]{inputenc}`
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 - standard (enter as one -): non-native
 - long (--): pages 35–74, Michaelis–Menten equation
 - em-dash (---): with—as we can see here—no spacing
- ellisp... , erm, ellipsis is produced by `\ldots`
 -  `\ldots bla` produces ...bla (space signals end of command), use `\ldots\ bla` if appropriate to obtain ... bla

5. Using \LaTeX

Spacing and Line Breaks

Spacing

- standard spacing is obtained by typing one or more spaces
- non-breakable space (no line break in “type A”, “page 5”) by `type~A`, `page~5`
- narrow non-breakable space (e.g., between number and unit as in 5 cm) by `\,`

5. Using L^AT_EX

Spacing and Line Breaks

Spacing

- standard spacing is obtained by typing one or more spaces
- non-breakable space (no line break in “type A”, “page 5”) by `type~A`, `page~5`
- narrow non-breakable space (e.g., between number and unit as in 5 cm) by `\,`

Line Breaks

- you usually want to start a new paragraph by leaving a blank line
- manually control hyphenation by typing `\-` inside word if L^AT_EX gets it wrong
- prevent line breaks in word or block by `\mbox{text}`

5. Using \LaTeX

Spacing and Line Breaks

Spacing

- standard spacing is obtained by typing one or more spaces
- non-breakable space (no line break in “type A”, “page 5”) by `type~A`, `page~5`
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Line Breaks

- you usually want to start a new paragraph by leaving a blank line
- manually control hyphenation by typing `\-` inside word if \LaTeX gets it wrong
- prevent line breaks in word or block by `\mbox{text}`

you usually should *not* use (unless you know what you are doing)

- `\newline` or `\\` starts a new line
- `\linebreak` starts a new line and justifies the previous one

5. Using \LaTeX

Mathematics: Basics

- formula in text is enclosed in $\$ \dots \$$
- characters for symbols can be typed directly $\$a(y)+b(x)=c(x,y)\$$:
 $a(y) + b(x) = c(x, y)$
- subscript and superscript by $\$a_{\{0\}}+a_{\{1\}}=c^{\{2\}}\$$: $a_0 + a_1 = c^2$
- greek letters $\$\alpha, \beta, \Omega\$$: α, β, Ω
- spaces typed in the formula do not matter

Make sure to get symbols right in the text:

If r is the radius and l the length of a cylinder C , its volume is given by $V = l\pi r^2$.

5. Using \LaTeX

Mathematics: Displayed Equations

- are obtained by

```
\begin{equation}
  \label{eq:nonsense}
  1+1=3
```

```
\end{equation}
```

Einstein never claimed Equation~\ref{eq:nonsense}.

Output:

$$1 + 1 = 3 \tag{2}$$

Einstein never claimed Equation 2.

- numbering can (but usually should not) be suppressed by using `equation*` instead of `equation`
- we'll cover vertical alignment next week

5. Using \LaTeX

Mathematics: Symbols and Operators

- sinus, logarithm and similar functions are typeset upright
`\sin(x)`, `\log(y)`: $\sin(x)$, $\log(y)$

5. Using \LaTeX

Mathematics: Symbols and Operators

- sinus, logarithm and similar functions are typeset upright
 $\text{\sin}(x)$, $\text{\log}(y)$: $\sin(x)$, $\log(y)$
- a huge number of symbols is available via different packages, the names are usually somewhat intuitive
 \rightarrow , \Leftrightarrow , \oplus

5. Using \LaTeX

Mathematics: Symbols and Operators

- sinus, logarithm and similar functions are typeset upright
 $\$ \sin(x), \log(y) \$$: $\sin(x), \log(y)$
- a huge number of symbols is available via different packages, the names are usually somewhat intuitive
 $\$ \rightarrow, \Leftrightarrow, \oplus \$$: $\rightarrow, \Leftrightarrow, \oplus$
- integral, summation, product look slightly different in displayed formulas
 $\$ \sum_{i=0}^n a_i + \prod_{j=0}^m b_j = \int_s^t f(x) \$$

$$\sum_{i=0}^n a_i + \prod_{j=0}^m b_j = \int_s^t f(x) \quad (3)$$

5. Using \LaTeX

Mathematics: Fractions and Roots

- fractions

$$\frac{4x}{5y}$$

(4)

are obtained by `\frac{4x}{5y}`

5. Using \LaTeX

Mathematics: Fractions and Roots

- fractions

$$\frac{4x}{5y} \tag{4}$$

are obtained by `\frac{4x}{5y}`

- roots

$$\sqrt{x}, \sqrt[3]{y} \tag{5}$$

are obtained by `\sqrt{x}`, `\sqrt[3]{y}`

5. Using \LaTeX

Mathematics: Text in Formulas

As we've seen, not everything in formulas is mathematical.
The total time t_{total} is calculated as

$$t_{\text{total}} = \max_{i \in M} t_i \tag{6}$$

5. Using \LaTeX

Mathematics: Text in Formulas

As we've seen, not everything in formulas is mathematical.
The total time t_{total} is calculated as

$$t_{\text{total}} = \max_{i \in M} t_i \quad (6)$$

is obtained by (requires `\usepackage{amsmath}`)

The total time t_{total} is calculated as

```
\begin{equation}
  t_{\text{total}} = \max_{i \in M} t_{i}
\end{equation}
```

- distinguish the mathematical operator `\max` from the text `max`
- getting things like this right proves that you have understood what you're writing

5. Using \LaTeX

Mathematics: Brackets

$$\pi\left(\frac{a+b}{c} + \sqrt{42}\right)\delta(x) + 23f(x)(\kappa + (\sin(b)\cos(t))^2) \quad (7)$$

(8)

- more complicated mathematical formulas often require brackets to become readable

5. Using \LaTeX

Mathematics: Brackets

$$\pi\left(\frac{a+b}{c} + \sqrt{42}\right)\delta(x) + 23f(x)(\kappa + (\sin(b)\cos(t))^2) \quad (7)$$

$$= \pi\left(\frac{a+b}{c} + \sqrt{42}\right)\delta(x) + 23f(x)\left(\kappa + \left[\sin(b)\cos(t)\right]^2\right) \quad (8)$$

- more complicated mathematical formulas often require brackets to become readable
- size can be adapted automatically by using `\left(... \right)`

5. Using \LaTeX

Mathematics: Brackets

$$\pi\left(\frac{a+b}{c} + \sqrt{42}\right)\delta(x) + 23f(x)(\kappa + (\sin(b)\cos(t))^2) \quad (7)$$

$$= \pi\left(\frac{a+b}{c} + \sqrt{42}\right)\delta(x) + 23f(x)\left(\kappa + \left[\sin(b)\cos(t)\right]^2\right) \quad (8)$$

- more complicated mathematical formulas often require brackets to become readable
- size can be adapted automatically by using `\left(... \right)`
- sometimes `\big(... \Big) \bigg[... \Bigg]` is useful (use with care)

5. Using \LaTeX

Formulas: Why Should You Care?

$$\pi((t_{total} + \max_{i \in M} y_i) / c + \sqrt{42}) \delta(x) + 23 f(x) (\kappa + (\sin(b) \cos(t))^2)$$

- formulas are very condensed information
- reader should be able to understand
- you should give the impression you have understood what you write

$$\pi \left(\frac{t_{total} + \max_{i \in M} y_i}{c} + \sqrt{42} \right) \delta(x) + 23 f(x) \left(\kappa + [\sin(b) \cos(t)]^2 \right)$$

5. Using \LaTeX

Further Reading

- Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl: [The not so short introduction to \$\LaTeX\$ 2 \$\epsilon\$](#) (search for l2short.pdf)
A general introduction to using \LaTeX
- Markus Kohm, Jens-Uwe-Morawski: [KOMA-Script, a versatile \$\LaTeX\$ 2 \$\epsilon\$ bundle](#) (search for scrguien.pdf)
A detailed manual of different document classes with quite some typographical background
- Scott Pakin: [The Comprehensive LATEX Symbol List](#) (search for symbols-a4.pdf)

5. Using \LaTeX

Info about In-Class Final (Next Friday)

1. 120 minutes: from 14:15 to 16:15
2. you may use your own laptop or a CLAMV computer
3. you may bring and use any printed or electronic document
4. you may use the internet and any search results you find
5. you may **not** use (electronic or personal) communication among each other and with people outside the classroom, such as e-mail, instant messaging, facebook, discussion boards, forum posts, ...
6. submission by email or via USB stick
7. no late submission