Introduction to Scientific Working

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Summary of last lecture

Writing Workshop

1. **Topic analysis**
   - Open issues
   - Literature search
   - Narrow down the topic
2. **Literature analysis**
3. **Literature qualification**
4. **Topic structuring**
   - Goal and questions
   - Exposé
   - Draft
5. **Work composition**
   - Provisional version(s)
   - Final steps

Homework

- Read chapters 1–3 of "Not so short introduction to LaTeX"

Lecture Content

Research and Understanding

Understanding and summarizing of scientific text, Literature research,
Internet search, Citing, Practical scientific work

Structuring Scientific Works

Kinds: Seminar, Bachelor and Master theses,
Topic analysis and paper structuring

LaTeX

Interaction, Typesetting of text, Images, Diagrams, Lists, Tables,
Mathematics, Fonts, Special cases

Evaluation, Checking and Presentation

Evaluation of work of others, Review system in computer science,
Introduction to presentation

What is LaTeX?

- TeX?
- LaTeX?
- Interaction?

Examples

```latex
\begin{equation*}
  \frac{\partial^2 f}{\partial \xi^2} =
  - e^{-\frac{\xi^2}{2}}
  + \xi^2 e^{-\frac{\xi^2}{2}}
\end{equation*}
```
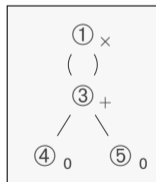
$$\frac{\partial^2 f}{\partial \xi^2} = -e^{-\frac{\xi^2}{2}} + \xi^2 e^{-\frac{\xi^2}{2}}$$

```latex
\begin{eqnarray}
  \lefteqn{ \cos x = 1
    -\frac{x^2}{2!} +{} }
  \nonumber
  \\
  & & {} +\frac{x^4}{4!}
    -\frac{x^6}{6!} + \cdots
\end{eqnarray}
```

$$\cos x = 1 - \frac{x^2}{2!} +$$
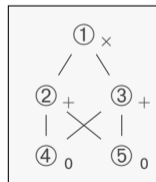$$+ \frac{x^4}{4!} - \frac{x^6}{6!} + \cdots \tag{1}$$

Examples

```
\begin{tikzpicture}%
    [node distance=8mm %
    , bg/.style ={fill=black!3,draw=black,minimum width=2.cm}]

    \begin{scope}[xshift=-3.4cm]
    \tnode[]{A1}{$\cOne$}{$\mTimes$}
    \tnode[below of=A1]{A2}{$\cThree$}{$\mPlus$}
    \tnode[below of=A2, xshift=-5mm]{A3}{$\cFour$}{$\mZ$}
    \tnode[below of=A2, xshift=5mm]{A4}{$\cFive$}{$\mZ$}
```
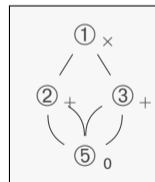

$T_1 \quad\quad\quad\quad T_2 \quad\quad\quad\quad T_3$

Why use LaTeX?

Input files

How to input:

- Text
- Comments
- LaTeX commands

How does whitespace work? Examples?

File structure

Explain:

```
\documentclass[options]{class}
```

Preambule?

```
\begin{document}
.
.
\end{document}
```

Document classes

```
article
report
book
scrartcl, scrreprt, scrbook    KOMA-Classes
scrlttr2
beamer
```

Packages

```
\usepackage[options]{package}
```

Special characters

```
$ & % # _ { } ~ ^ " \ | < >
```

Example

```
\documentclass{clseminar}

\usepackage[utf8]{inputenc}
\usepackage{listings}

\begin{document}
\title{Title}
\mailaddress{christian.sternagel@uibk.ac.at}
\author{Christian~Sternagel}
\date{\today}
\supervisor{Dr.~Christian~Sternagel}
\abstract{\input{abstract}}

\maketitle
\tableofcontents

\include{content}

\end{document}
```

What are these?

```
\usepackage[ngerman]{babel}
\selectlanguage{naustrian}
\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
```

Hyphenation?

```
Das Ende von Wörtern und
Sätzen wird durch
Leerzeichen
gekennzeichnet.
Hierbei spielt es keine
Rolle, ob man ein
  oder 100 Leerzeichen
macht.

Absätze werden durch
(mehrere) Leerzeilen markiert.
```

Das Ende von Wörtern und Sätzen wird durch Leerzeichen gekennzeichnet. Hierbei spielt es keine Rolle, ob man ein oder 100 Leerzeichen macht.

Absätze werden durch (mehrere) Leerzeilen markiert.

Do these always work same?

`overfull hbox`, `underfull hbox`?
`draft` option

`\hyphenation{ori-gami Nij-me-gen}\\`

Inline hyphenation using $\backslash-$

Quotations

```
"asd"
``asd''
\usepackage[babel,german=quotes]{csquotes}
\enquote{asd}
```

Ligatures

Combinations of letters:

fi fl AV Te ...   fi fl AV Te ...

Can be avoided with \\/

Example

```
Nicht Auflage (Au-fl-age)\\
sondern Auf\/lage (Auf-lage)
```

Nicht Auflage (Au-fl-age)
sondern Auflage (Auf-lage)

Special characters

- Chapter headings
- Footnotes[1]

  ```
  Footnotes\footnote{This is a footnote.}
  ```

---

[1]This is a footnote.

Bold
Italic
<u>under</u>
SmallCaps
textsf

Lists (itemize, enumerate, description)

Example

```
\begin{enumerate}
\item It
\item Can
  \begin{enumerate}
  \item Be used
  \item When
  \end{enumerate}
\item etc.
\end{enumerate}
```

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Tables. Typeset:

7C0	hexadezimal
3700	oktal
11111000000	binär
1984	dezimal

Graphics

What are the options?

Homework / Work Here

- Finish chapter 1–3 of "Not so short introduction to LaTeX" (focus on math)
- Recreate the features of this LaTeX document. Text not important:

Progress in LaTeX typesetting

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Abstract—Formula

$$\int_0^\infty \frac{e^{-(x-1)^2}}{\sqrt{x}}\,dx$$

.

I. Introduction

COMPUTER certified formal proofs are today one of the most important techniques used in formal methods[1]. They are used to guarantee the correctness of compilers [1], operating systems [2], hardware [3], as well as to certify mathematical results that involve computation [4].

- We provide an infrastructure for more elegant proofs (section II);
- We formalize all basic algebraic Mizar structures in Isabelle (Figure 1).

II. Structures

Every Mizar structure signature is defined as a as set of assignments. Each assignment is of the form $sel \rightarrow spec$, where sel is a unique structure element label (called selector in the Mizar language) and $spec$ is the specification of the type of the respective element of the structure. The signature of a group is the addLoopStr structure. It is specified in MML as follows:

```
struct (ZeroStr,addMagma) addLoopStr (#
    carrier -> set,
    addF -> BinOp of the carrier,
    ZeroF -> Element of the carrier #);
```

And example Isabelle formalization is:

definition TheSelectorOf (the - of - 190) **where**
func the sel of Term → object means λit.
for T be object st |sel, T| in Term holds it = T

[1]Part of the EwA course.

Figure 1. Lattice of the basic algebraic structures

References

[1] X. Leroy, "Formal verification of a realistic compiler," *Commun. ACM*, vol. 52, no. 7, pp. 107–115, 2009.
[2] G. Klein, J. Andronick, K. Elphinstone, T. C. Murray, T. Sewell, R. Kolanski, and G. Heiser, "Comprehensive formal verification of an OS microkernel," *ACM Trans. Comput. Syst.*, vol. 32, no. 1, p. 2, 2014.
[3] J. Harrison, "Floating-point verification," *J. UCS*, vol. 13, no. 5, pp. 629–638, 2007. doi: 10.3217/jucs-013-05-0629
[4] G. Gonthier, "The four colour theorem: Engineering of a formal proof," in *Computer Mathematics, 8th Asian Symposium, ASCM 2007*, ser. LNCS, D. Kapur, Ed., vol. 5081. Springer, 2008, p. 333.