LaTeX

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Lecture

Goals

- know the difference between content, structure, and form
- be able to use LaTeX (for essays, homework, thesis)
- be able to decide what LaTeX is good for

Theme

▶ TeX is a very cryptic language, LaTeX maybe less, but still. You will probably turn back to Libreoffice or Word back after this lecture

▶ still LaTeX survived many decades in scientific world. Why?

Three perspectives on text

Recipe for Kaiserschmarrn[1]:

```
Kaiserschmarrn as main dish for one person:
```

1. 100g flour
2. 1/8l milk
3. three eggs
4. sugar and a pinch of salt

[1]https://en.wikipedia.org/wiki/Kaiserschmarrn

Three perspectives on text II

Every text has:

1. a *content*: what the text *means*
2. a *structure*: how the text is *organized*
3. a *form*: how the text *looks*

Variation of content

Kaiserschmarrn as main dish for two persons:

1. 200g flour
2. 1/4l milk
3. six eggs
4. sugar and two pinches of salt

Variation of structure

```
For Kaiserschmarrn as main dish for two persons you need
100g flour, 1/4l milk, three eggs, sugar, and one pinch
of salt.
```

Variation of form

Kaiserschmarrn as main dish for one person:

1. **100g** flour
2. **1/8l** milk
3. **three** eggs
4. sugar and a pinch of salt

Separation of concerns

A good document format gives you the ability to describe content, structure, and form separately.

Advantages

▶ if the structure is described separately, then the document viewer can easily navigate through the document, e.g., by creating a table of contents
▶ if the form is described separately, then the editor can change the style easily for the whole document. E.g., you can switch the bibliography style from Harvard to APA easily.
▶ while writing you can concentrate on *content* rather than *styling*

Disadvantages

▶ requires more effort to separate content, structure, and form

Page description languages

- content-oriented: ASCII
- structure+content-: XML, HTML
- structure+content+form-: Word, LaTeX(after compilation)
- form: CSS

What is LaTeX?

- initial release 1984, by Leslie Lamport
- builds upon TeX initially released in 1978
- pure text document which describes *content* and *structure*
- LaTeX program compiles the text and creates the *form*

LaTeX compilation process

▶ create the *.tex* file
▶ compile it to a PDF by using *latexmk* or a LaTeX editor like *Overleaf*

LaTeX compilation process - demo

▶ create a tex file and show the compilation process
▶ discussion: do you see content, structure, and form?

Structure of LaTeX documents

1. document class
2. preamble
3. body

Document class

e.g.,:

- article
- report
- book
- beamer (for presentations)

```
\documentclass[11pt]{article}
```

Commands in LaTeX

general syntax:

`\commandname[options]{argument1}{argument2}`

Preamble

- global settings
- activating packages (like plugins)

```
% dollar sign for comments
\usepackage{babel}  % for culturally determined typographi
\usepackage{graphicx}  % for including graphics
\usepackage{tikz}  % for drawing graphics using TeX syntax
```

Body

body contains actual content:

```latex
\begin{document}

\title{An optimistic perspective on this semester}
\author{Me}
\date{14th September 2020}
\maketitle

\section{Intro}
I was happy.

\section{Conclusion}
I was dancing.

\end{document}
```

Paragraphs

Paragraphs are separated using an empty line (not a single line feed)

This text is part of the first paragraph. The line break here does not have any effect. The word 'here' will be placed probably on the same line as

This is the second paragraph.   Many spaces have   the same effect as single spaces.

Enforcing custom spaces

As a beginner you will probably try to introduce custom spaces between paragraphs, words, etc. Try to concentrate on the content and structure first.

Environments

environments enable structure. E.g, *enumerations* and *lists*:

```
Here is a numbered list:
\begin{enumerate}
\item first point
\item second point
\end{enumerate}
```

Environments II

```
Here is a unnumbered list:
\begin{itemize}
\item first point
\item second point
\end{itemize}
```

Environments - demo

Demonstration of `enumerate` and `itemize` environments

Other environments

There are also other environments, e.g., abstract:

```
...
\maketitle
\begin{abstract}
In our work we will show you a novel way of
saving the world and establishing world peace.
\end{abstract}
```

Typography

Some environments:

- ▶ \emph for emphasizing
- ▶ \textbf for bold text
- ▶ \textsf sans-serif font

Typography - demo

```
It is \emph{very important} to understand this.
It is \textbf{typographically bad practice} to
use bold words in normal text.
```

Demonstration of resulting document

Typography II

Some commands:

- \small
- \normalsize
- \large

Typography II - demo

From this `\small` point the text will be in a smaller font

From this `\larger` point the text will be in a larger font

Note that it is cumbersome to mix many fonts in a document, but it is typographically bad practice anyway.

Demonstration of resulting document

Typography III

Changing the font using packages, e.g. `times`, `GoSans`.

```
\usepackage{times}
% or
\usepackage[sfdefault]{GoSans}
```

Demo

Tables

tabular environment

```
\begin{tabular}{rcc}
\emph{species} & \emph{pop.} & \emph{avg. height} \\\hline
dog            & 129         & 25 cm\\
cat            &  56         & 15 cm\\
mouse          & 295         & 5 cm
\end{tabular}
```

Demo

Math - main strength of LaTeX

LaTeX is very good at typesetting math

- ▶ math env. starts/ends with $
- ▶ _ for subscripts
- ▶ ^ for superscripts

Math - demo

```
$a^2 + b^2 = c^2$\\
$\alpha + \beta = \gamma^2$\\
$\sum_{i=1}^n i = n(n+1)/2$\\
$$\int_{-\infty}^\infty e^{-x^2} dx < \infty$$
```

Demo

Graphics

\includegraphics for various formats, e.g., pdf, jpg, etc

\includegraphics[width=.5\textwidth]{universe}

Demo

Graphics with captions

figure environment

```
\begin{figure}
  \includegraphics[width=.5\textwidth]{universe}
  \caption{The Universe}
  \label{fig:universe}
\end{figure}

Figure \ref{fig:universe} depicts why we are here.
```

Demo

Presentations

use beamer document class. Every slide is described inside a `frame` environment.

```
\documentclass{beamer}
\usetheme{Luebeck}
\title{My Masters Thesis in 10 Minutes}
\author{Me}

\begin{document}
\begin{frame}
  \maketitle
\end{frame}

\begin{frame}{TOC}
  \tableofcontents
\end{frame}

% continues ...
```

Presentations II

```latex
% continues ...

\section{Introduction}

\begin{frame}{Theme}
  \begin{itemize}
  \item I studied bacteria
  \item they were tiny
  \item this led to many problems
  \end{itemize}
\end{frame}
\end{document}
```

Demo using \usetheme{frankfurt} and
\usecolortheme{crane}

LaTeX advantages

- ▶ capable of typesetting books
- ▶ differentiates content, structure, and form
- ▶ capable of creating different formats from a single source, e.g., book and slides
- ▶ good at typesetting math

LaTeX disadvantages

- ▶ you have to learn a new language
- ▶ not *what you see is what you get*
- ▶ creation of own templates is hard
- ▶ very long learning curve

Summary

- documents have content, structure, and form
- LaTeX is a software for typesetting documents which separates contents, structure, and form