Typesetting with LaTeX

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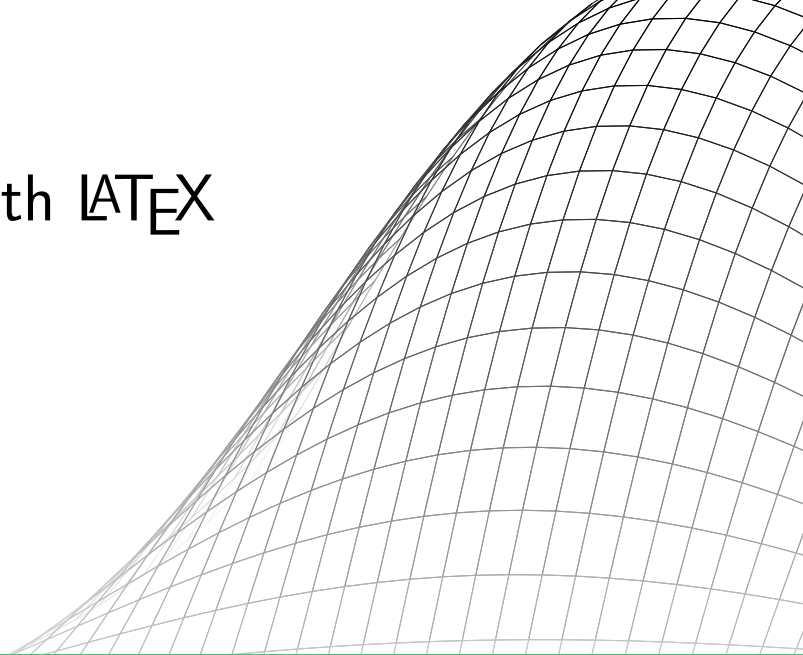

Overview

Creating a Basic Document

- A minimal working example

Write a `.tex` file containing:

```
1 \documentclass[a4paper, 11pt]{article}
2 % Preamble
3 \begin{document}
4   % The body of the document
5   A simple \LaTeX document.
6 \end{document}
```

Declarations & Enviroments

Declarations...

- Are stated once and take effect until further notice
- Changes the formatting globally

Example: `\documentclass`

Enviroments...

- Are delimited by matching `\begin` and `\end` declarations
- Changes the formatting locally

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

Arguments

Required Arguments

- Can not be left out
- Are contained in curly braces: { *required argument* }

Example: `\documentclass{article}`

Optional Arguments

- Can be left out
- Are contained in square brackets: [*optional argument*]

Example: `\documentclass[a4paper, 11pt]{article}`

Special Characters

- \ backslash precedes all LaTeX commands.
- {} curly braces group or seperate commands
- $ dollor sign begin or end inline math mode
- ^ caret is used in math mode for superscripts
- _ underscore is used in math mode for subscripts
- % percentage sign starts a comment
- ~ tilde defines an unbreakable space
- & ampersand is used to align text in certain enviroments

Front Page

A front page with a table of contents, author and date can be created by including the declarations shown below:

```
% Preamble
\title{\LaTeX\ Document Title}
\author{Author}
\date{\today}

\begin{document}
  \maketitle
  \tableofcontents
  % The body of the document
  A simple \LaTeX\ document.
\end{document}
```

Sectioning

In a simple document it is usually sufficient to simply use:

- Level 1: `\section`
- Level 2: `\subsection`

Several other levels of sectioning can be obtained by using:

- Level 0: `\chapter{` *chapter name* `}`
- Level 3: `\subsubsection{` *subsubsection name* `}`
- Level 4: `\paragraph{` *paragraph name* `}`
- Level 5: `\subparagraph{` *subpragraph name* `}`

The level of sectioning that is possible usually depend on the documentclass.

Font Faces

- \emph{Text} → *Text*
- \textbf{Text} → **Text**
- \texttt{Text} → `Text`
- \textrm{Text} → Text
- \textsf{Text} → Text
- \textsc{Text} → TEXT.

Font Sizes

- `\tiny{Text}` → \tiny Text
- `\scriptsize{Text}` → \scriptsize Text
- `\footnotesize{Text}` → \footnotesize Text
- `\small{Text}` → \small Text
- `\normalsize{Text}` → \normalsize Text
- `\large{Text}` → \large Text
- `\Large{Text}` → \Large Text
- `\LARGE{Text}` → \LARGE Text
- `\huge{Text}` → \huge Text
- `\Huge{Text}` → \Huge Text

Text Alignment

```
\begin{flushleft}
  Text
\end{flushleft}
```

Text

```
\begin{center}
  Text
\end{center}
```

Text

```
\begin{flushright}
  Text
\end{flushright}
```

Text

Spacing

Horizontal Spacing (↔)

- `~` unbreakable space
- `\hspace{}` user-specifiable spacing
- `\quad`
- `\qquad`
- `\,`
- `\;`

Vertical Spacing (↕)

- `\vspace{}`

Line & Page Breaking

- `\\` starts a new paragraph
- `\\*` starts a new line, but not a new paragraph
- `\cleardoublepage` flushes all material and start a new page
- `\clearpage` flushes all material and starts a new page
- `\linebreak` allow linebreaking here
- `\newline` requests a new line
- `\newpage` requests a new page
- `\nolinebreak` no line break should happen here
- `\nopagebreak` no page break should happen here
- `\pagebreak` encourage page break

List Enviroments

```
\begin{itemize}
  \item Text
  \item Text
\end{itemize}
```

itemize:

- Text
- Text

```
\begin{enumerate}
  \item Text
  \item Text
\end{enumerate}
```

enumerate:

1. Text
2. Text

```
\begin{description}
  \item[P1] Text
  \item[P2] Text
\end{description}
```

description:

P1 Text

P2 Text

Packages

Packages...

- extend the default functionality and customizability of LaTeX.
- are declared in the premable
- are imported using the command:

$$\texttt{\textbackslash usepackage}\{\textit{package name}\}$$

Some packages:

`amsmath`, `amssymb`, `amsthm`, `tikz`, `pgfplots`, `lstlistings`, `url`, `hyperref`, `xcolor`, `float`, `fancyhdr`, `epstopdf` and many more.

Typesetting Math

For mathematical typesetting we include the `amsmath`, `amssymb`, `amsthm` packages:

```
% Preamble
\usepackage{amsmath}
\usepackage{amssymb}
\usepackage{amsthm}
```

These packages contain various enviroments, symbols and commands, that are useful when typesetting mathematics.

Symbols

A huge number of symbols are available in LaTeX. It is thus very convenient to know a number of resources where the commands for these symbols can be found.

Symbol List & Detexify

Having trouble finding a special symbol? Try:

- Detexify
- The comprehensive LaTeX symbol list

Functions

Some common functions can easily be written in LaTeX:

- `\sin` $\rightarrow \sin$
- `\cos` $\rightarrow \cos$
- `\ln` $\rightarrow \ln$
- `\log` $\rightarrow \log$
- `\exp` $\rightarrow \exp$
- `\mod` $\rightarrow \mod$
- `\sqrt{x}` $\rightarrow \sqrt{x}$

These functions will already have the desired formatting in the misc. math enviroments.

Equation Enviroments

Several different equation enviroments exist:

- `equation`
- `align`
- `gather`
- `multiline`
- ... and so on

It is usually sufficient to simply stick with one or two of these and use additional enviroments to obtain the desired formatting.

Equation Enviroments

With numbering:

```
\begin{align}
  2x + 3y = 6
\end{align}
```

`align`:

$$2x + 3y = 6 \qquad (1)$$

```
\begin{equation}
  2x + 3y = 6
\end{equation}
```

`equation`:

$$2x + 3y = 6 \qquad (2)$$

Equation Enviroments

Without numbering:

```
\begin{align*}
  2x + 3y = 6
\end{align*}
```

`align`:

$$2x + 3y = 6$$

```
\begin{equation*}
  2x + 3y = 6
\end{equation*}
```

`equation`:

$$2x + 3y = 6$$

Aligning Several Equations

The following LaTeX code:

```
\begin{align*}
  2x + 3y &= 6 \\
  3x + 4y &= 8 \\
  4x + 5y &= 9
\end{align*}
```

Produces:

$$\begin{aligned} 2x + 3y &= 6 \\ 3x + 4y &= 8 \\ 4x + 5y &= 9 \end{aligned}$$

The following LaTeX code:

```
\begin{align*}
  2x + 3y &= 6, & a = 1\\
  3x + 4y &= 8, & b = 2\\
  4x + 5y &= 9, & c = 3
\end{align*}
```

Produces:

$$\begin{aligned} 2x + 3y &= 6, & a &= 1 \\ 3x + 4y &= 8, & b &= 2 \\ 4x + 5y &= 9, & c &= 3 \end{aligned}$$

Subscripts & Superscripts

Caret ^ and underscore _ are used for superscripts and subscripts. Two examples of their use:

```
\begin{align*}
  \prod_{i=1}^{n} i
\end{align*}
```

Produces:

$$\prod_{i=1}^{n} i$$

```
\begin{align*}
  \sum_{i = 0}^{\infty} x^i
\end{align*}
```

Produces:

$$\sum_{i=0}^{\infty} x^i$$

Matrix Enviroments

```
\begin{Vmatrix}
  a & b \\
  c & d
\end{Vmatrix}
```

Vmatrix: $\begin{Vmatrix} a & b \\ c & d \end{Vmatrix}$

```
\begin{vmatrix}
  a & b \\
  c & d
\end{vmatrix}
```

vmatrix: $\begin{vmatrix} a & b \\ c & d \end{vmatrix}$

```
\begin{Bmatrix}
  a & b \\
  c & d
\end{Bmatrix}
```

Bmatrix: $\begin{Bmatrix} a & b \\ c & d \end{Bmatrix}$

Matrix Enviroments

```
\begin{Bmatrix}
  a & b \\
  c & d
\end{Bmatrix}
```

bmatrix: $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$

```
\begin{matrix}
  a & b \\
  c & d
\end{matrix}
```

matrix: $\begin{matrix} a & b \\ c & d \end{matrix}$

```
\begin{pmatrix}
  a & b \\
  c & d
\end{pmatrix}
```

pmatrix: $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$

Definitions, Theorems & More...

... Can be created by including the `amsthm` package and defining in the preamble:

```
% Preamble
\newtheorem{theorem}{Theorem}
```

A theorem and corresponding proof can then be written:

```
% The body of the document
\begin{theorem}
  % Theorem content
\end{theorem}
\begin{proof}
  % Proof content
\end{proof}
```

Labeling & Referencing

Labeling

A label can be assigned to a certain enviroment:

```
\label{ label name }
```

Referencing

The enviroment can then be referenced, by using the label:

```
\ref{ label name }
```

Labeling & Referencing Example

The following LaTeX code:

```
\begin{align} \label{eq:SimpleEq}
  a_1 = b_1 + c_1
\end{align}
We reference Eqn.~\ref{eq:SimpleEq}.
```

Produces:

$$a_1 = b_1 + c_1 \tag{3}$$

We reference Eqn. 3.

Creating a Bibliography

A simple bibliography entry in the `thebibliography` enviroment:

```
\begin{thebibliography}{0}
  \bibitem{ItemName}
  Author One and Author Two,
  \textit{Article Title}.
  Journal,
  Year,
  Vol.,
  pp. 0--9999.
\end{thebibliography}
```

Citations

After a bibliography has been created the entries can be cited:

```
1  \cite{ItemName} % Cite article
2  \cite[p.~9999]{ItemName} % Cite article page
3  \cite[pp.~0--9999]{ItemName} % Cite article page range
```

Additional Resources

Misc. introductory material, useful packages and other things:

- LaTeX on Wikibooks
- The Not So Short Introduction to LaTeX
- LaTeX on AoPS
- TikZ (package)
- PGFPlots (package)

Contact Information

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