An introduction to LaTeX

Scintilla's LaTeX course

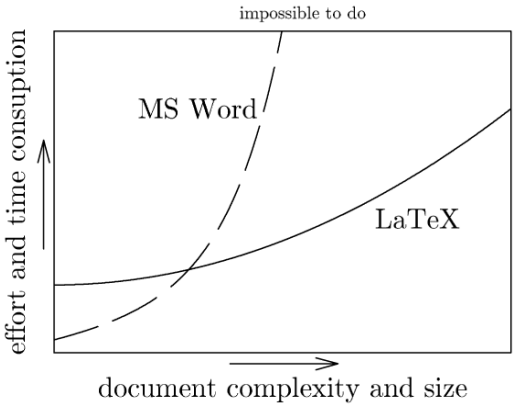
Scintilla's MasterCLASS

November 19, 2019

'Ease' of use

"Latex makes difficult things easy, and easy things very difficult"

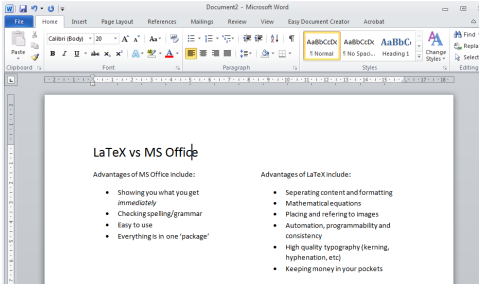
— Umij

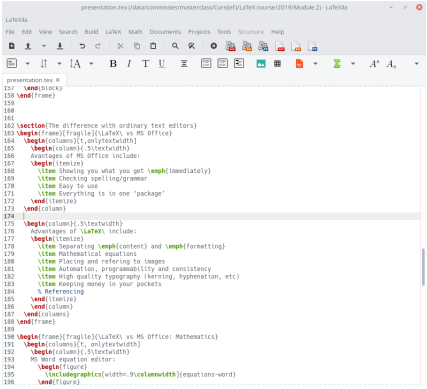


Source: Marko Pinteric

But what *is* LaTeX?

LaTeX is a language that allows you to create documents in almost any text editor by focusing primarily on *content* and *structure*, not *how it looks*.





There is a difference between content and looks!

Example:

To emphasise something in Word, one makes it *italic*.
In LaTeX one places *emphasis*.

One can change how *emphasis* behaves but not how *italic* behaves.

Example:

What is the difference between the following lines?

New Chapter
New Chapter

There is a difference between content and looks!

Example:

To emphasise something in Word, one makes it *italic*.
In LaTeX one places *emphasis*.

One can change how *emphasis* behaves but not how *italic* behaves.

Example:

What is the difference between the following lines?

New Chapter
New Chapter

```
\section*{New Chapter}
\textbf{\Large{New Chapter}}
```

LaTeX vs MS Office

Avantages of MS Office include:

- Showing you what you get *immediately*
- Checking spelling/grammar
- Easy to use
- Everything is in one 'package'

Advantages of LaTeX include:

- Separating *content* and *formatting*
- Mathematical equations
- Placing and refering to images
- Automation, programmability and consistency
- High quality typography (kerning, hyphenation, etc)
- Keeping money in your pockets

Table of Contents

Syntax

Section 4

Commands

A command starts with \ followed by a keyword, e.g. `\documentclass[]{}`.
Where { } define a place for required arguments and [ ] for optional arguments.

Required argument: article, IEEEtran, report, book, *beamer* and more!
Optional argument: 11pt, a4paper, twocolumn, landscape, etc.

Other examples of commands:
`\usepackage[]{}`, `\textbf{}`, `\copyright`

Commands - (Plain) text

Plain text is easy, but LaTeX makes simple things difficult:

- **Bold** text is created using the command: `\textbf{}`
- *Italized* text is created using the command: `\textit{}`
- Characters such as á, à and â are written as `\'a`, `\`a` and `\^a` respectively

And more difficult things easy:

- 20°C is written as `20$^{\circ}$C`
- `$\omega$` produces ω and `$\Omega$` produces Ω
- `\footnote{}`[1]

[1] produces a footnote

Document structure

You need to make a structure for your report. Use a hierarchy:

- `\chapter{<chapter name>}` (Only for report and book class)
- `\section{<section name>}`
- `\subsection{<subsection name>}`
- `\subsubsection{<subsubsection name>}`
- `\paragraph{<paragraph name>}`
- `\subparagraph{<subparagraph name>}`

Don't want numbered sections, use an asterix:
`\section*{<section name>}`

Environments

Environments are used to encapsulate information and are a container for text and are formatted according to a keyword:

```
\begin{figure}
 \centering
 \includegraphics[width=?]{LaTeX_usage}{
 \caption{A graph showing the increase of EEMCS-students
 using LaTeX.}
 \label{figure:latex_usage}
\end{figure}
```

```
\begin{tabular}{l|c|c|c|}
& 2017 & 2018 & 2019\\
\hline
# of EEMCS-students using LaTeX & 3 & 21 & >9000\\
\end{tabular}
```

Mathematics (1/2)

There are two environments for mathematics:

- Inline: `$...$`
- Or the environment `\begin{equation} ... \end{equation}`

The latter offers more possibilities:

- Multi-line equations
- `\begin{\split} ... \end{split}`
- Referencing it using `\ref{}`

$$\begin{aligned} A &= \frac{\pi r^2}{2} \\ &= \frac{1}{2}\pi r^2 \end{aligned}$$

Mathematics (2/2)

Within a mathematics environment many symbols can be used:
`\omega` $= \omega$, `\Omega` $= \Omega$, `\pi` $= \pi$, `\pm` $= \pm$,
`a^{b}` $= a^b$ and `a_{b}` $= a_b$

And default constructions can be used:
`\frac{...}{...}` $= \frac{a}{b}$,
`\sqrt{...}` $= \sqrt{a}$,
`\int_{...}^{...}` $= \int_a^b$

Figures (1/2)

Graphics are loaded from the folder where the `.tex` file is located. Use the *graphicx* package to manage images.

They be included in a `\begin{figure}[t/b/h]` environment using:
`\includegraphics[width=.5\textwidth]{<file name>}`

Use `\caption{<description of image>}` to caption your image.
Use `\label{fig:<keyword>}` to reference it in your text.

Figures (2/2)

Images can be:

- Scaled: `[scale=1.5]`
- Stretched: `[width=3cm,height=4cm]`
- Rotated: `[angle=45]`
- Wrapped: Use package *wrapfig* with `\begin{wrapfigure}`

An overview of all images can be made using `\listoffigures`.

A picture of a cute cat.

Tables (1/2)

LaTeX is good at many things, tables is not one of them...

```
\begin{tabular}{m{7em}|c|c|c}
  & 2017 & 2018 & 2019\\
  \hline
  \# of EEMCS-students using
  LaTeX & 3 & 21 & >9000\\
\end{tabular}
```

	2017	2018	2019
# of EEMCS-students using LaTeX	3	21	>9000

Tables (2/2)

There are however many options with regard to layout:

- `\multicolumn{2}{c}{<cell contents>}`
- Coloured rows using `\usepackage{xcolor}` and `{\rowcolors{2}{gray!30}{gray!15}`

Table header	
Cell1	Cell 2
Cell3	Cell 4
Cell5	Cell 6
Cell7	Cell 8

An overview of all tables can be made using `\listoftables`

Lists

There are two types of lists:

- Those with unnumbered items
- Created using:

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

Lists

There are two types of lists:

- Those with unnumbered items
- Created using:

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

1. And those with numbered items
2. Created using:

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

3. Which can contain many items
   - 3.1 Which can be nested
     - 3.1.1 Nestception

Cross-referencing

Section 5

Cross-referencing

Label an image/table/section, using: `\label{fig/tab/sec:<name>}`

And refer to it in your text:

- Use `\ref{fig/tab/sec:<name>}` to create a reference
- Use `\pageref{fig/tab/sec:<name>}` to refer to the page of the object
- More options using the *hyperref* package:
  - Clickable (hyper-)links
  - Advanced PDF options

Referring to literature

Section 6

Literature references - LaTeX

Used if you need a few and quick references. Start it with:
`\begin{thebibliography}{<number of references>}`

And add bibliography items:

```
\bibitem{greenwade93}
    George D. Greenwade,
    The {C}omprehensive {T}ex {A}rchive {N}etwork
    ({CTAN}),
    1993,
    TUGBoat,
    342--351.
```

And after all `\bibitems` close the environment with
`\end{thebibliography}`

Literature references - BibTEX Package

For more and complex references use the *BibTEX* package. Load using:
`\usepackage{bibtex}`

The .bib file

BibTEX utilises a separate file for referencing with extension `.bib`, a plain text file (edit with notepad). It contains the details on all references.

The .bib file - An example

```
@article{greenwade93,
  author  = "George D. Greenwade",
  title   = "The {C}omprehensive {T}ex {A}rchive
  {N}etwork ({CTAN})",
  year    = "1993",
  journal = "TUGBoat",
  volume  = "14",
  number  = "3",
  pages   = "342--351"
}
```

The .bib file - Entries & Fields

There are different types of citations (entries):

@article,**@book**,@collectedbook,@conference,@electronic,@ieeetranbstctl,@inbook,
@incollectedbook,@incollection,@injournal,@inproceedings,@manual,@mastersthesis,
@misc,@patent,@periodical,@phdthesis,@preamble,@proceedings,@standard,@string,
@techreport,@unpublished

Within an entry there are several (required) fields:

address,annote,author,booktitle,chapter,crossref,edition,editor,howpublished,
institution,journal,key,month,note,number,organization,pages,publisher,school,
series,title,type,volume,year

The .bib file - URL's

Either use `\url` (requires *hyperref* package) in *howpublished*, or using the *url* field.

An example of a reference with URL:


Wikibooks, "*LaTeX/Bibliography Management — Wikibooks, The Free Textbook Project*", 2019, https://en.wikibooks.org/w/index.php?title=LaTeX/Bibliography_Management&oldid=3584255, [Online; accessed 20-October-2019]

Reference in text

To cite simply use `\cite{<cite_key>}` for both LaTeX and BibTeX.

To include a *bibliography* at the end use:

```
\bibliographystyle{<bibliography style>}
\bibliography{<name of .bib file>}
```

Bibliography styles - Plain

`plain`

Items are cited: *The LaTeX Companion* book [2], the Einstein journal paper [1], and The LaTeX related items are [2, 3].

References

[1] Albert Einstein. Zur Elektrodynamik bewegter Körper. (German) [On the electrodynamics of moving bodies]. *Annalen der Physik*, 322(10):891–921, 1905.

[2] Michel Goossens, Frank Mittelbach, and Alexander Samarin. *The LaTeX Companion*. Addison-Wesley, Reading, Massachusetts, 1993.

[3] Donald Knuth. Knuth: Computers and typesetting.

Bibliography styles - APA like

`apalike`

Items are cited: *The LaTeX Companion* book [Goossens et al., 1993], the Einstein journal paper [Einstein, 1905], and The LaTeX related items are [Goossens et al., 1993, Knuth,].

References

[Einstein, 1905] Einstein, A. (1905). Zur Elektrodynamik bewegter Körper. (German) [On the electrodynamics of moving bodies]. *Annalen der Physik*, 322(10):891–921.

[Goossens et al., 1993] Goossens, M., Mittelbach, F., and Samarin, A. (1993). *The LaTeX Companion*. Addison-Wesley, Reading, Massachusetts.

[Knuth,] Knuth, D. Knuth: Computers and typesetting.

Bibliography styles - IEEE Transactions

`IEEEtran`

Items are cited: *The LaTeX Companion* book [1], the Einstein journal paper [2], and The LaTeX related items are [1, 3].

References

[1] M. Goossens, F. Mittelbach, and A. Samarin, *The LaTeX Companion*. Reading, Massachusetts: Addison-Wesley, 1993.

[2] A. Einstein, "Zur Elektrodynamik bewegter Körper. (German) [On the electrodynamics of moving bodies]," *Annalen der Physik*, vol. 322, no. 10, pp. 891–921, 1905.

[3] D. Knuth, "Knuth: Computers and typesetting."

Using multiple files

Section 7

Using multiple files for 1 document

Input

`\input{epic_file.tex}`

- Input content of file `epic_file.tex` directly
- Can be nested

Include

`\include{epic_file.tex}`

- Applies `\pagebreak` inserts the code and applies pagebreak again
- Perfect for combining chapters
- Cannot be nested

How to setup LaTeX

Section 8

How to 'install' LaTeX

LaTeX is plain-text which can be written in an *editor*:

- **TeXworks** (Simple)
- TeXnicCenter (Full editor)
- TeXstudio
- LaTeXila (Linux)

The plain-text can be compiled using LaTeX *engines*:

- **pdfLaTeX**
- XeLaTeX (LaTeX3)
- LuaLaTeX

Additional functionality is applied using *packages*. Can be downloaded using a *manager*:

- **MikTeX** (Windows)
- TeX Live (Unix/Linux/Windows)
- MacTeX (Mac OSX)

Alternatively use `https://overleaf.com` which is all-in-one.

How to get help?

- The LaTeX Wikibook for reference
- The TeX Stack Exchange for questions
- The instructors
- And remember: Google is your friend!