

LaTeX Tutorial

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About why do we use LaTeX...

- Here are some answers from Google:

1. Your paper will just look better!

Using LaTeX, we are able to produce documents with **higher typographical quality**, especially for documents that are heavy on mathematics.

Because LaTeX uses typesetting algorithms to output optimal layout of your document based on many typographical rules.

2. Longevity:

TeX hasn't changed very much for around 30 years. But if you use a Word 2007 to open a file written in Word '97, part of the file will mess up.

LaTeX files are also independent of operating systems.

3. It's free and works on all operating systems

Software Installation

- Online: Overleaf
- Apps: TexStudio, TeXworks, TeX Live

Create a LaTeX document

`\documentclass`

- When processing an input file, LaTeX needs to know which layout standard to use by `\documentclass` command:

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

where `class` can be `article`, `IEEEtran`, `report`, ... and `options` customizes the behavior of the document class

- For example,

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

`\usepackage`

- If you want to include graphics, colored text, or algorithm in your documents, these additional types of functionalities are called packages. The command to use a package is pretty simple:

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

- For example,

```
\usepackage{xcolor}
```

```
\usepackage{graphicx}
```

```
\usepackage{algorithm2e}
```

OR `\usepackage{xcolor, graphicx, algorithm2e}`

The document environment

Top matter

- At the beginning of your document there will be information such as title, data, authors, etc, which is referred to as *top matter*.
- Example:

```
\documentclass[11pt,a4paper]{report}

\begin{document}
\title{How to Structure a LaTeX Document}
\author{Andrew Roberts}
\date{December 2004}
\maketitle
\end{document}
```

The above information will
NOT appear without this
command!

Abstract

- The abstract of your paper goes after the top matter, but before the main sections of the body.
- Note that abstract is available for the document classes such as article and report, but not book.
- For example:

```
\documentclass{article}
\begin{document}

\begin{abstract}
Your abstract goes here...
...
\end{abstract}

...
\end{document}
```

Abstract

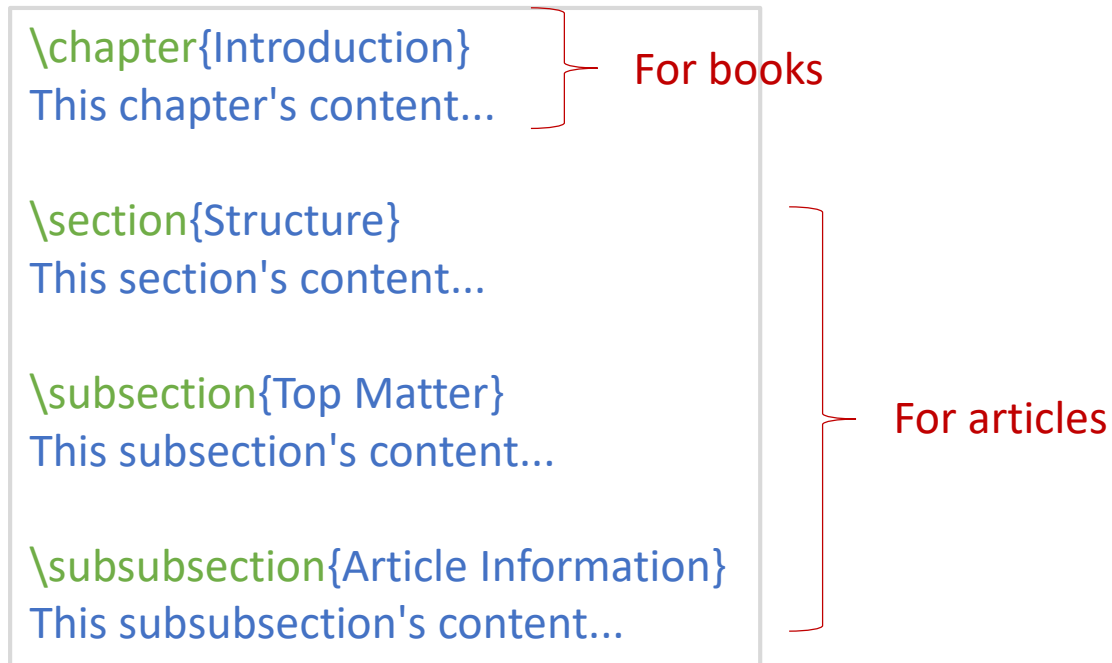
- By default, LaTeX will use “Abstract” as the title of hour abstract. If you want to change it into anything else, for example, “Executive Summary”, add the following line before the abstract body:

```
\renewcommand{\abstractname}{Executive Summary}
```

Sectioning commands

Inserting sections

- The commands for inserting sections are fairly intuitive. For example:



- Note that you do not need to specify section numbers, LaTeX will sort that out for you

Inserting sections

- LaTeX provides 7 levels of depth for defining sections. Each section in the table bis a subsection of the one above it.

Command	Level	Comment
<code>\part{'part'}</code>	-1	not in letters
<code>\chapter{'chapter'}</code>	0	only books and reports
<code>\section{'section'}</code>	1	not in letters
<code>\subsection{'subsection'}</code>	2	not in letters
<code>\subsubsection{'subsubsection'}</code>	3	not in letters
<code>\paragraph{'paragraph'}</code>	4	not in letters
<code>\subparagraph{'subparagraph'}</code>	5	not in letters

Section numbering

- You can change the depth to which section number occurs, so that you can turn the numbering off selectively:

```
\setcounter{secnumdepth}{1}
```

- To get an unnumbered section heading, add an asterisk after the command name & before the curly brace:

```
\subsection*{Introduction}
```

- If you need to clear the page between sections/chapters, just use:

```
\clearpage
```

Citations and Bibliography

- LaTeX has two ways of inserting references into a document:
 - Embed them within the document itself. But it can be time-consuming if you are writing several papers that cite the same reference(s)
 - Store them in an external BibTeX file (.bib) and then link them by `\bibliography{name_of_bibtex_file}`

- For example:

```
@book{schilling1990fundamentals,  
  title={Fundamentals of robotics: analysis and  
  control},  
  author={Schilling, Robert J},  
  volume={629},  
  year={1990},  
  publisher={Prentice Hall New Jersey}  
}
```

@article (journal/magazine articles)
@inproceedings (conference papers)
@misc (all others)

Insert citations



```
\cite{schilling1990fundamentals}
```

Miscellaneous

Define macros

- To add your own commands, use

`\newcommand{\name}[num]{definition}`

- `name` (required): the name of the command you want to create
 - `definition` (required): the definition of the command
 - `num` (optional): the number of arguments the new command takes (default is 0, i.e., no argument allowed)
- New commands can be defined anywhere in the document!

Figures and Tables

- Figures: `\includegraphics[args]{image_name.jpg}`
 - Need to use the `graphicx` package
 - Optional: Use `\graphicspath{{image_folder}}` to tell LaTeX that the images are kept in a folder named *image_folder*
 - `\begin{figure}` and `\end{figure}` puts the image in a new environment to avoid mixing it with text
- Tables:
 - The *tabular* environment is the default LaTeX method to create tables
 - You must specify a parameter, such as `{c c c}`, to tell LaTeX that there will be 3 columns and the text in each one of them must be centered
- We can add captions and labels to Figures and Tables

Mathematical expressions and Equations

- Inline mode: write formulas as part of a text
- Display mode: write formulas in a separate environment

`\begin{equation} ... \end{equation}`

- To align equations with multiple lines, use `\begin{align} ... \end{align}` in `amsmath` package
- Look up letters and symbols online:
https://www.overleaf.com/learn/latex/List_of_Greek_letters_and_math_symbols

Labels

- In LaTeX, you can easily reference almost anything that can be numbered, and have LaTeX automatically updating the numbering for you whenever necessary
- To do this, add a label to the objects you want to refer by

`\label{marker}`

- Then you can refer to them by

`\ref{marker}`

- It's a good practice to use a few letters to describe what you are referencing by the table below:

<code>ch:</code>	chapter
<code>sec:</code>	section
<code>subsec:</code>	subsection
<code>fig:</code>	figure
<code>tab:</code>	table
<code>eq:</code>	equation
<code>lst:</code>	code listing
<code>itm:</code>	enumerated list item
<code>alg:</code>	algorithm
<code>app:</code>	appendix subsection

Further reading

- LaTeX wikibook: <https://en.wikibooks.org/wiki/LaTeX>
- Overleaf latex documentation: <https://www.overleaf.com/learn>

That's it! Thank you!