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LaTeX for scientists

Julien Riou

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Plan

- What is LaTeX?
- Writing and compiling LaTeX code
- Basic formatting
- Advanced topics
- LaTeX templates for scientists:
  - cover letter
  - scholarly article
  - journal submission
  - presentation

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. . . a sophisticated typesetting system.

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- program the structure and contents of a document
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- professional-looking documents with a pre-specified format
- structure, reproductibility
- maths, cross-referencing, bibliographies

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Less good for:

- creating highly personalized documents

Writing and compiling LaTeX code

In principle, you only need a text editor and a LaTeX compiler:

- write your code and save it as a `.tex` file
  - e.g. with notepad in Windows
- compile the `.tex` file into an output file (generally `.pdf`)
  - e.g. with MiKTeX for Windows or TeX Live for MacOS and Linux

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In practice, it is easier to use an integrated development environment:

- installed on your computer: TeXStudio (`www.texstudio.org`)
  - but you still need to install a compiler!
- online: Overleaf (`www.overleaf.com`)

Commands

LaTeX commands start with \ and are of two kinds:

Declarations

- Are stated once and take effect until further notice

e.g. `\documentclass`, `\centering`, `\textit{}`

Environments

- Have matching `begin` and `end` declarations

e.g. `\begin{itemize} ...\end{itemize}`

Beware, forgetting closing braces or end declarations will give an error!

Arguments

Required arguments...

- Are contained in curly braces
- Must be included

e.g. `\documentclass{letter}`

Optional arguments...

- Are contained in square brackets
- Can be left out
- Give you more control over the commands

e.g. `\documentclass[12pt]{letter}`

A basic `.tex` file

1. Declare the type of document you want (`book`, `article`, `letter`, `report`...) with `\documentclass`
2. Declare additional options or packages (`float`, `amsmath`, `geometry`...) with `\usepackage`
3. Write your content within a `document` environment

A basic `.tex` file

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3. Write your content within a `document` environment

```
\documentclass{}
%\usepackage{}
\begin{document}
  ...
\end{document}
```

Hello, world!

Let's try a simple "Hello, world!" example with LaTeX and Overleaf:

- Go to `www.overleaf.com` and log in with your credentials
- Create a new project, then an empty document named `helloworld.tex`
- Create a `letter` that says "Hello, world!"

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Solution

```
\documentclass{letter}
%\usepackage{}
\begin{document}
        Hello, world!
\end{document}
```

Basic formatting

- font styles
- special characters
- lists
- sectioning
- figures
- cross-referencing
- bibliography
- equations

Font style

Font face:

`\textit{`*Text*`}`, `\textbf{`**Text**`}`, `\texttt{Text}`, `\textsc{`TEXT`}` ...

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`\textit{`*Text*`}`, `\textbf{`**Text**`}`, `\texttt{Text}`, `\textsc{TEXT}` ...

Font size:

`\tiny{`tiny Text`}`, `\scriptsize{`scriptsize Text`}`, `\footnotesize{`footnotesize Text`}`,
`\small{Text}`, `\large{Text}`, `\Large{Text}`, `\huge{Text}`

Font style

Font face:

`\textit{`*Text*`}`, `\textbf{`**Text**`}`, `\texttt{Text}`, `\textsc{Text}` ...

Font size:

`\tiny{`tiny Text`}`, `\scriptsize{`scriptsize Text`}`, `\footnotesize{`footnotesize Text`}`,
`\small{Text}`, `\large{Text}`, `\Large{Text}`, `\huge{Text}`

Alignment:

```
\begin{center/flushright/flushleft}
...
\end{center/flushright/flushleft}
```

Special characters and commands

Special commands

\ or ~ → extra single space

\\ → new line

\hspace{1cm} or \vspace{5mm} → custom space

\clearpage → new page

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Non-standard characters:

\% → % (used for commenting out)

\& → & (used for separations)

\{ → { (used in commands)

\textbackslash → \ (used in commands)

and lots of other symbols: ♠, ϕ, $\mathfrak{R}$, $\mathcal{R}$, †, $\lll$, $\notin$, $\triangle$... (try `detexify`)

Lists

Bullet list:

```
\begin{itemize}
   \item Text
   \item[-] Text
\end{itemize}
```

- Text
- Text

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\begin{itemize}
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Numbered list:

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

1. Text
2. Text

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Bullet list:

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Numbered list:

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\begin{enumerate}
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\end{enumerate}
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1. Text
2. Text

Note: Lists can be nested within other lists.

Sectioning

LaTeX can organize, number, and index sections of document:

```
\section{Introduction}
```

1 Introduction

```
\subsection{Context}
```

1.1 Context

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Layers of sectioning

\part{} \chapter{} \section{} \subsection{} \subsubsection{} \paragraph{}

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`\section{Introduction}` **1 Introduction**

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For the unnumbered version, add an asterisk:

`\section*{Introduction}` **Introduction**

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Note: Add a table of contents with `\tableofcontents`

Figures

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```
\begin{figure}[h]
   \centering
   \includegraphics[width=2cm,height=3cm]{cat.png}
   \caption{This is my cat.}
\end{figure}
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Placement options:

- `h`: approximately at the same point it occurs in the code
- `t`/`b`: at the top/bottom of the page
- `p`: on a special page for figures only
- `H`: *precisely* at the same point in the code (requires a package: `\usepackage{float}`)

Cross-referencing

LaTeX handles all references using unique identifiers.

- place a label after something (section, figure caption...)

```
\begin{figure}[ht]
   \centering
   \includegraphics{cat.png}
   \caption{This is my cat.}
   \label{refcat}
\end{figure}
```

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LaTeX handles all references using unique identifiers.

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```
\begin{figure}[ht]
   \centering
   \includegraphics{cat.png}
   \caption{This is my cat.}
   \label{refcat}
\end{figure}
```

- then refer to the same identifier at any point in the text

```
My cat is very cute (see Fig.\ref{refcat}).
```

→ My cat is very cute (see Fig. 1).

Bibliography I

Same principle for citing books or articles, except that the information must be placed in a separate bibTeX file in the same repertory.

- use the `\cite` command instead:

```
My cat is the product of evolution\cite{darwin1859origin}.
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@book{darwin1859origin,
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   year={1859} }
```

- add a reference to the `foo.bib` file at the end of the source file:

```
\bibliographystyle{plain}
\bibliography{foo}
```

Bibliography II

Several basic styles are included (`apalike`, `unsrt`, `abbrv`) and journal-specific styles can be added.

The bibTeX file can be created:

- manually
- copied from e.g. `https://scholar.google.ch/`

- directly from Zotero or Endnote (export as bibtex)

Equations I

LaTeX allows you to typeset any sort of equations with reliability.

Using math mode

Inline math mode: `$...$`

Consider subject $i \in \{1, \ldots, n\}$...

Numbered equations: `\begin{equation}...\end{equation}`

$$\text{logit}\, \mathbb{E}(Y) = \alpha + \beta x \tag{1}$$

Equations II

Some commands:

$4+2$ $4+2$

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180°C	`180$^{\circ}$C`

Advanced topics

Tables I

Creating tables manually can be tricky.

```
\begin{table}[h]
  \centering
```

Trial	n	t
1	23	2
2	15	10
3	100	20

```
\end{table}
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Advanced topics

Tables II

Beyond simple tables it is preferable to use dedicated tools:

- online convertors (e.g. `https://tablesgenerator.com/`)
- R package: `xtable`
- Stata function: `esttab`

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Collaborating

From simple to more difficult (but more powerful):

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- highlighting modifications using `latexdiff`
- version control: paid overleaf account, `svn`, `git`

LaTeX templates for scientists

Templates to fill the needs of scientists:

- scholarly article
- journal submission
- letters (cover letter, answer to reviewers)
- presentation

Download the files from:

https://github.com/jriou/LaTeX_for_scientists

LaTeX templates for scientists
Scholarly article

Creating professional-looking articles with the same methods used by journal publishers.

Very important for directly published academic documents:

- preprints (e.g. for bioRxiv)
- supplementary appendices

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How to use it

- upload all 3 files in `/scholarly_article` to Overleaf
- select `scholarly_article.tex` and hit the “recompile” button

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Journal submission

Some academic journals provide LaTeX templates for submissions (e.g., PLoS Medicine here).

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How to use it

- upload all 2 files in `/plos_submission_template` to Overleaf
- select `plos_latex_template.tex` and hit the “recompile” button

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LaTeX templates for scientists

Letters

Provided by the University (here)

Especially useful for cover letters and responses to reviewers

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Letters

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How to use it

- open the `/cover_letter` repertory
- open the `.clo` file in any editor to modify the personal settings
- comment out the 5th line (starting with "`\PackageError`")
- upload all 5 files to Overleaf
- start your letter from the `.tex` file
  - options in `\documentclass[]`: english/german, color/bw...
  - recipient address, subject, opening, main text, closing

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Presentation

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How to use it

- upload all 4 files in `/beamer` to Overleaf
- select `unibern-demo.tex` and hit the “recompile” button

Acknowledgments

- MIT Introduction to LaTeX (link)
- Peter Flom, LaTeX for academics and researchers who (think they) don't need it. (link)
- LaTeX wikibook (link)
- LaTeX cheat sheet (Winston Chang)