An Interactive Introduction to \LaTeX

Part 2: Structured Documents & More

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Overleaf

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Outline

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Structured Documents

► In Part 1, we learned about commands and environments for typesetting text and mathematics.
► Now, we’ll learn about commands and environments for structuring documents.
► You can try out the new commands in Overleaf:

Click here to open the example document in Overleaf

For best results, please use Google Chrome or a recent FireFox.

► Let’s get started!
Title and Abstract

- Tell \LaTeX{} the \texttt{\textbackslash title} and \texttt{\textbackslash author} names in the preamble.
- Then use \texttt{\textbackslash maketitle} in the document to actually create the title.
- Use the abstract environment to make an abstract.

\documentclass{article}
\title{The Title}
\author{A. Author}
\date{\today}
\begin{document}
\maketitle
\begin{abstract}
Abstract goes here...
\end{abstract}
\end{document}
Sections

- Just use \section and \subsection.
- Can you guess what \section* and \subsection* do?

\documentclass{article}
\begin{document}
\section{Introduction}
The problem of \ldots
\section{Method}
We investigate \ldots
\subsection{Sample Preparation}
\subsection{Data Collection}
\section{Results}
\section{Conclusion}
\end{document}

1 Introduction
The problem of …

2 Method
We investigate …

2.1 Sample Preparation
2.2 Data Collection

3 Results

4 Conclusion
Labels and Cross-References

- Use `\label` and `\ref` for automatic numbering.
- The `amsmath` package provides `\eqref` for referencing equations.

```latex
\documentclass{article}
\usepackage{amsmath} % for \eqref
\begin{document}

\section{Introduction}
\label{sec:intro}
In Section \ref{sec:method}, we \ldots

\section{Method}
\label{sec:method}
\begin{equation}
\label{eq:euler}
e^{i\pi} + 1 = 0
\end{equation}
By \eqref{eq:euler}, we have \ldots

1 Introduction
In Section 2, we \ldots

2 Method
\begin{equation}
e^{i\pi} + 1 = 0 \tag{1}
\end{equation}
By (1), we have \ldots

By \eqref{eq:euler}, we have \ldots
\end{document}
```
Typeset this short paper in \texttt{\LaTeX}: \footnote{From http://pdos.csail.mit.edu/scigen/, a random paper generator.}

Click to open the paper

Make your paper look like this one. Use \texttt{\ref} and \texttt{\eqref} to avoid explicitly writing section and equation numbers into the text.

Click to open this exercise in \texttt{Overleaf}

Once you’ve tried, click here to see my solution.
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Requires the `graphicx` package, which provides the \texttt{\includegraphics} command.

Supported graphics formats include JPEG, PNG and PDF (usually).

\begin{itemize}
\item \texttt{\includegraphics[width=0.5\textwidth]{gerbil}}
\item \texttt{\includegraphics[width=0.3\textwidth, angle=270]{gerbil}}
\end{itemize}

Image license: CC0
Interlude: Optional Arguments

- We use square brackets \([\])\) for optional arguments, instead of braces \(\{\}\).

- \(\texttt{\textbackslash includegraphics}\) accepts optional arguments that allow you to transform the image when it is included. For example, \(\texttt{width=0.3\textwidth}\) makes the image take up 30\% of the width of the surrounding text (\textwidth).

- \(\texttt{\textbackslash documentclass}\) accepts optional arguments, too. Example: \(\texttt{\textbackslash documentclass[12pt, twocolumn]\{article\}}\)
makes the text bigger (12pt) and puts it into two columns.

- Where do you find out about these? See the slides at the end of this presentation for links to more information.
Floats

- Allow \LaTeX to decide where the figure will go (it can “float”).
- You can also give the figure a caption, which can be referenced with \ref.

```latex
\documentclass{article}
\usepackage{graphicx}
\begin{document}

Figure \ref{fig:gerbil} shows \ldots
\begin{figure}
  \centering
  \includegraphics[width=0.5\textwidth]{gerbil}
  \caption{\label{fig:gerbil}Aww\ldots.}
\end{figure}

\end{document}
```

Figure 1: Aww\ldots .

Figure 1 shows ...
Tables

- Tables in *\LaTeX* take some getting used to.
- Use the *tabular* environment from the *tabularx* package.
- The argument specifies column alignment — *left*, *right*, *right*.

```
\begin{tabular}{lrr}
<table>
<thead>
<tr>
<th>Item</th>
<th>Qty</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Widget</td>
<td>1</td>
<td>199.99</td>
</tr>
<tr>
<td>Gadget</td>
<td>2</td>
<td>399.99</td>
</tr>
<tr>
<td>Cable</td>
<td>3</td>
<td>19.99</td>
</tr>
</tbody>
</table>
\end{tabular}
```

- It also specifies vertical lines; use *\hline* for horizontal lines.

```
\begin{tabular}{|l|r|r|} \hline
<table>
<thead>
<tr>
<th>Item</th>
<th>Qty</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Widget</td>
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<td>399.99</td>
</tr>
<tr>
<td>Cable</td>
<td>3</td>
<td>19.99</td>
</tr>
</tbody>
</table>
\hline
\end{tabular}
```

- Use an ampersand & to separate columns and a double backslash \ to start a new row (like in the *align* environment that we saw in part 1).
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Put your references in a `.bib` file in ‘bibtex’ database format:

```latex
@Article{Jacobson1999Towards,
    author = {Van Jacobson},
    title = {Towards the Analysis of Massive Multiplayer Online Role-Playing Games},
    journal = {Journal of Ubiquitous Information},
    Month = jun,
    Year = 1999,
    Volume = 6,
    Pages = {75--83}}

@InProceedings{Brooks1997Methodology,
    author = {Fredrick P. Brooks and John Kubiatowicz and Christos Papadimitriou},
    title = {A Methodology for the Study of the Location-Identity Split},
    booktitle = {Proceedings of OOPSLA},
    Month = jun,
    Year = 1997}
```

Most reference managers can export to `bibtex` format.
Each entry in the .bib file has a key that you can use to reference it in the document. For example, Jacobson1999Towards is the key for this article:

```latex
@Article{Jacobson1999Towards,
  author = {Van Jacobson},
  ...
}
```

It’s a good idea to use a key based on the name, year and title.

\LaTeX\ can automatically format your in-text citations and generate a list of references; it knows most standard styles, and you can design your own.
Use the \texttt{natbib} package\textsuperscript{2} with \texttt{\citet} and \texttt{\citep}.

Reference \texttt{\bibliography} at the end, and specify a \texttt{\bibliographystyle}.

\begin{verbatim}
\documentclass{article}
\usepackage{natbib}
\begin{document}
\citet{Brooks1997Methodology} show that \ldots. Clearly, all odd numbers are prime \citep{Jacobson1999Towards}.

\bibliography{bib-example}
% if `bib-example' is the name of % your bib file

\bibliographystyle{plainnat}
% try changing to abbrvnat
\end{document}
\end{verbatim}

\textsuperscript{2}There is a new package with more features named \texttt{biblatex} but most of the articles templates still use \texttt{natbib}.

\begin{center}
\begin{minipage}{.5\textwidth}
Brooks et al. [1997] show that \ldots. Clearly, all odd numbers are prime [Jacobson, 1999].

\textbf{References}


\end{minipage}
\end{center}
Exercise: Putting it All Together

Add an image and a bibliography to the paper from the previous exercise.

1. Download these example files to your computer.

   Click to download example image
   Click to download example bib file

2. Upload them to Overleaf (use the project menu).
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More Neat Things

- Add the \texttt{\tableofcontents} command to generate a table of contents from the \texttt{\section} commands.
- Change the \texttt{\documentclass} to \texttt{\documentclass{scrartcl}}
  or
  \texttt{\documentclass[12pt]{IEEEtran}}
- Define your own command for a complicated equation:

```latex
\newcommand{\rperf}{\%
  \rho_{\text{perf}}\}
\rho_{\text{perf}} = \mathbf{c}'\mathbf{X} + \varepsilon
```

\hspace{1cm} $\rho_{\text{perf}} = \mathbf{c}'\mathbf{X} + \varepsilon$
More Neat Packages

- **beamer**: for presentations (like this one!)
- **todonotes**: comments and TODO management
- **tikz**: make amazing graphics
- **pgfplots**: create graphs in \LaTeX
- **listings**: source code printer for \LaTeX
- **spreadtab**: create spreadsheets in \LaTeX
- **gchords, guitar**: guitar chords and tabulature
- **cwpuzzle**: crossword puzzles

See https://www.overleaf.com/latex/examples and http://texample.net for examples of (most of) these packages.
Installing \LaTeX

To run \LaTeX\ on your own computer, you’ll want to use a \LaTeX\ distribution. A distribution includes a \latex\ program and (typically) several thousand packages.

- On Windows: MikTeX or \TeX\Live
- On Linux: \TeX\Live
- On Mac: Mac\TeX

You’ll also want a text editor with \LaTeX\ support. See http://en.wikipedia.org/wiki/Comparison_of_TeX_editors for a list of (many) options.

You’ll also have to know more about how \latex\ and its related tools work — see the resources on the next slide.
Online Resources

- The Overleaf Learn Wiki — hosts these slides, more tutorials and reference material
- The \( \LaTeX \) Wikibook — excellent tutorials and reference material.
- \( \TeX \) Stack Exchange — ask questions and get excellent answers incredibly quickly
- \( \LaTeX \) Community — a large online forum
- Comprehensive \( \TeX \) Archive Network (CTAN) — over four thousand packages plus documentation
- Google will usually get you to one of the above.
Thanks, and happy \TeXing!