

# Math 2794W An Interactive Introduction to L<sup>A</sup>T<sub>E</sub>X

## Part 2: Structured Documents & More

Original slides written by Dr John D. Lees-Miller (modified with permission)

January 30, 2020



# Outline

## Structured Documents

- Title and Abstract

- Sections

- Labels and Cross-References

- Exercise

## Figures and Tables

- Graphics

- Floats

- Tables

## Bibliographies

- bibTeX

- Exercise

## What's Next?

- More Neat Things  
(Optional)

- More Neat Packages

- Installing L<sup>A</sup>T<sub>E</sub>X

- Online Resources

# 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 `\title` and `\author` names in the preamble.
- ▶ Then use `\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}
```

The Title

A. Author

January 21, 2020

**Abstract**

Abstract goes here...

# 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.

```
\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

\end{document}
```

## 1 Introduction

In Section 2, we ...

## 2 Method

By (1), we have ...

$$e^{i\pi} + 1 = 0$$

(1)

# Structured Documents Exercise

Typeset this short paper in  $\text{\LaTeX}$ : <sup>1</sup>

Click to open the paper

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

Click to open this exercise in **Overleaf**

- ▶ Once you've tried, [click here to see my solution](#).

---

<sup>1</sup>From <http://pdos.csail.mit.edu/scigen/>, a random paper generator.

# Outline

## Structured Documents

Title and Abstract

Sections

Labels and Cross-References

Exercise

## Figures and Tables

Graphics

Floats

Tables

## Bibliographies

bibT<sub>E</sub>X

Exercise

## What's Next?

More Neat Things  
(Optional)

More Neat Packages

Installing L<sup>A</sup>T<sub>E</sub>X

Online Resources



# Graphics

- ▶ Requires the `graphicx` package, which provides the `\includegraphics` command.
- ▶ Supported graphics formats include JPEG, PNG and PDF (usually).

```
\includegraphics[  
  width=0.5\textwidth]{gerbil}
```

```
\includegraphics[  
  width=0.3\textwidth,  
  angle=270]{gerbil}
```



## Interlude: Optional Arguments

- ▶ We use square brackets `[ ]` for optional arguments, instead of braces `{ }`.
- ▶ `\includegraphics` accepts optional arguments that allow you to transform the image when it is included. For example, `width=0.3\textwidth` makes the image take up 30% of the width of the surrounding text (`\textwidth`).
- ▶ `\documentclass` accepts optional arguments, too. Example:  
`\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`.

```
\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....

Figure 1 shows ...

# Tables

- ▶ Tables in  $\text{\LaTeX}$  take some getting used to.
- ▶ Use the `tabular` environment from the `tabularx` package.
- ▶ The argument specifies column alignment — left, right, right.

```
\begin{tabular}{lrr}  
Item & Qty & Unit \ $ \\  
Widget & 1 & 199.99 \\  
Gadget & 2 & 399.99 \\  
Cable & 3 & 19.99 \\  
\end{tabular}
```

Item	Qty	Unit \$
Widget	1	199.99
Gadget	2	399.99
Cable	3	19.99

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

```
\begin{tabular}{|l|r|r|} \hline  
Item & Qty & Unit \ $ \\  
Widget & 1 & 199.99 \\  
Gadget & 2 & 399.99 \\  
Cable & 3 & 19.99 \\  
\end{tabular}
```

Item	Qty	Unit \$
Widget	1	199.99
Gadget	2	399.99
Cable	3	19.99

- ▶ 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).

# Outline

## Structured Documents

Title and Abstract

Sections

Labels and Cross-References

Exercise

## Figures and Tables

Graphics

Floats

Tables

## Bibliographies

bibT<sub>E</sub>X

Exercise

## What's Next?

More Neat Things  
(Optional)

More Neat Packages

Installing L<sup>A</sup>T<sub>E</sub>X

Online Resources

- ▶ Put your references in a .bib file in 'bibtex' database format:

```
@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 Kubiawicz 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.

## bibT<sub>E</sub>X 2

- ▶ 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:

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

- ▶ It's a good idea to use a key based on the name, year and title.
- ▶ L<sup>A</sup>T<sub>E</sub>X can automatically format your in-text citations and generate a list of references; it knows most standard styles, and you can design your own.

## bibT<sub>E</sub>X 3 (Optional)

- ▶ Use the natbib package<sup>2</sup> with `\citet` and `\citep`.
- ▶ Reference `\bibliography` at the end, and specify a `\bibliographystyle`.

```
\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 abbrunat

\end{document}
```

Brooks et al. [1997] show that .... Clearly, all odd numbers are prime [Jacobson, 1999].

### References

Fredrick P. Brooks, John Kubiatowicz, and Christos Papadimitriou. A methodology for the study of the location-identity split. In *Proceedings of OOPSLA*, June 1997.

Van Jacobson. Towards the analysis of massive multiplayer online role-playing games. *Journal of Ubiquitous Information*, 6:75-83, June 1999.

<sup>2</sup>There is a new package with more features named biblatex but most of the articles templates still use natbib.



## 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).

# Outline

## Structured Documents

Title and Abstract

Sections

Labels and Cross-References

Exercise

## Figures and Tables

Graphics

Floats

Tables

## Bibliographies

bib $\TeX$

Exercise

## What's Next?

More Neat Things  
(Optional)

More Neat Packages

Installing  $\LaTeX$

Online Resources

## More Neat Things (Optional)

- ▶ Add the `\tableofcontents` command to generate a table of contents from the `\section` commands.

- ▶ Change the `\documentclass` to

```
\documentclass{scrartcl}
```

or

```
\documentclass[12pt]{IEEEtran}
```

- ▶ Define your own command for a complicated equation:

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

$$\rho_{\text{perf}} = \mathbf{c}'\mathbf{X} + \varepsilon$$

## More Neat Packages

- ▶ `beamer`: for presentations (like this one!)
- ▶ `todonotes`: comments and TODO management
- ▶ `tikz`: make amazing graphics
- ▶ `pgfplots`: create graphs in  $\text{\LaTeX}$
- ▶ `listings`: source code printer for  $\text{\LaTeX}$
- ▶ `spreadtab`: create spreadsheets in  $\text{\LaTeX}$
- ▶ `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 L<sup>A</sup>T<sub>E</sub>X

- ▶ To run L<sup>A</sup>T<sub>E</sub>X on your own computer, you'll want to use a L<sup>A</sup>T<sub>E</sub>X *distribution*. A distribution includes a latex program and (typically) several thousand packages.
  - ▶ On Windows: MikT<sub>E</sub>X or T<sub>E</sub>XLive
  - ▶ On Linux: T<sub>E</sub>XLive
  - ▶ On Mac: MacT<sub>E</sub>X
- ▶ You'll also want a text editor with L<sup>A</sup>T<sub>E</sub>X support. See [http://en.wikipedia.org/wiki/Comparison\\_of\\_TeX\\_editors](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  $\LaTeX$  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 T<sub>E</sub>Xing!