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UNIVERSITI BRUNEI DARUSSALAM

SM-2302 Software for Mathematicians

LaTeX2: Structured Documents & More

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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 **\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

October 1, 2022

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}
```

1 Introduction

The problem of . . .

2 Method

We investigate . . .

2.1 Sample Preparation

2.2 Data Collection

3 Results

4 Conclusion

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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 . . .

2 Method

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

By (1), we have . . .

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Structured Documents Exercise

Typeset this short paper in LaTeX: [1]

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 .

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[1] From http://pdos.csail.mit.edu/scigen/, a random paper generator.

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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}
```


Image license: CC0

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 LaTeX take some getting used to.
- Use the **tabular** environment from the **tabularx** package.
- The argument specifies column alignment — **l**eft, **r**ight, **r**ight.

```latex
\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.

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

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BibLATEX 1

- 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 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.

BibLATEX 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.
- 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.

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BibLATEX 3

- Use the **biblatex** package with the **natbib** option.
- The bibliography file must be called using the **\addbibresource** command.
- At the end, print the bibliography using **\printbibliography**.

```latex
\documentclass{article}
\usepackage[natbib,style=apa]{biblatex}
\addbibresource{bib-example.bib}
% if 'bib-example' is the name of your bib file

\begin{document}

\citet{Brooks1997Methodology} show that \ldots.
Clearly, all odd numbers are prime
\citep{Jacobson1999Towards}.

\printbibliography

\end{document}
```

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

References

Brooks, F. P., Kubiatowicz, J., & Papadimitriou, C. (1997). A methodology the study of the location-identity split. *Proceedings of OOPSLA*.

Jacobson, V. (1999). Towards the analysis of massive multiplayer online role playing games. *Journal of Ubiquitous Information, 6*, 75–83.

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- Several `style` to choose from (`apa`, `numeric`, `authoryear`, and other journal styles too). See this link.
- Previously, the package `bibtex` and `natbib` were very commonly used; and these provided several citation commands such as `\citet`, `\citep`, `\citeyear`, etc. See this link.
- The `biblatex` package provides much more customisation to your bibliography.
  - Change the title: `\printbibliography[title={My title}]`
  - Print only certain types: `\printbibliography[type=article,title={Articles only}]`, `\printbibliography[keyword={physics},title={Physics-related only}]`
  - Adding bibliography to TOC: `\printbibliography[heading=bibintoc]`

For more customisation options, see the package documentation.

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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).

More Neat Things

- 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}}}
$$
\rperf = {\bf c}'{\bf X} + \varepsilon
$$
```

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

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 TEXLive
  - On Linux: TEXLive
  - On Mac: MacTEX
- 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.

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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.

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