Day 2: Advanced LaTeX Techniques

Bibliography Management, Reports, Theses & Presentations

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Today's Agenda

Quick Review

Yesterday we covered:

- Document structure and basic commands
- Text formatting and sections
- Mathematical equations
- Tables and figures
- Cross-references

Today we advance to:

- Professional bibliography management
- Multi-file document organization
- Academic reports and theses
- Creating presentations with Beamer
- Custom commands and packages

Why BibTeX?

The Problem

Managing citations manually is time-consuming and error-prone.

BibTeX Benefits:

- Centralized reference database
- Automatic formatting of citations
- Easy switching between styles
- Reuse references across documents
- Integration with reference managers

Creating a .bib File

Create `references.bib`:

```
articleeinstein1905,author = Albert Einstein,title =
    On Electrodynamics,journal = Annalen der
    Physik,year = 1905,volume = 17,pages =
    891--921book{knuth1984,
        author    = {Donald E. Knuth},
        title     = {The TeXbook},
        publisher = {Addison-Wesley},
        year      = {1984}
}
```

BibTeX Entry Types

Common entry types:

- `@article` - Journal paper
- `@book` - Book
- `@inproceedings` - Conference
- `@phdthesis` - PhD thesis
- `@mastersthesis` - Master's
- `@techreport` - Report
- `@misc` - Other
- `@online` - Web resource
- `@incollection` - Chapter
- `@manual` - Manual

Using BibTeX in Documents

```
\documentclass{article}
\usepackage{cite}

\begin{document}

Recent research \cite{smith2023} shows...
Multiple studies \cite{jones2022,brown2021
    }...

\bibliographystyle{plain}
\bibliography{references}

\end{document}
```

Compilation Process

To compile with BibTeX:

```
pdflatex mydocument.tex
bibtex mydocument
pdflatex mydocument.tex
pdflatex mydocument.tex
```

In Overleaf

Overleaf handles this automatically! Just click "Recompile."

Citation Styles

Change style with `\bibliographystyle{...}`:

plain	Alphabetical, numbered
alpha	Alpha-numeric labels [Ein05]
ieeetr	IEEE Transactions style
apalike	APA-like (author-year)
abbrv	Abbreviated names
unsrt	Unsorted (citation order)

natbib Package

For flexible citations:

```
\usepackage{natbib}

% Textual citation
\citet{smith2023} showed...
% Output: Smith (2023) showed...

% Parenthetical citation
Recent studies \citep{jones2022}...
% Output: Recent studies (Jones, 2022)...

\bibliographystyle{plainnat}
\bibliography{references}
```

Multi-File Projects

For large documents, split into files:

Main file (main.tex):

```
\documentclass{report}
\usepackage{...}

\begin{document}

\input{chapters/chapter1}
\input{chapters/chapter2}
\input{chapters/chapter3}

\bibliography{references}

\end{document}
```

include vs. input

Two commands for external files:

\input{file}

- Simply inserts content
- No new page
- Use for any content

\include{file}

- Starts new page before/after
- Can use `\includeonly`
- Use for chapters

```
\includeonly{chapter2,chapter3}
```

Project Structure

Recommended organization:

- `thesis/`
  - `main.tex`
  - `preamble.tex`
  - `references.bib`
  - `chapters/`
    - `chapter1.tex`
    - `chapter2.tex`
  - `figures/`
  - `tables/`

Report Document Class

The `report` class for longer documents:

```
\documentclass[12pt,a4paper]{report}
\usepackage[margin=1in]{geometry}
\usepackage{graphicx}
\usepackage{natbib}

\title{Research Report}
\author{Your Name}
\date{\today}

\begin{document}
\maketitle
\tableofcontents
\chapter{Introduction}
```

Title Page and Front Matter

```
\begin{document}

% Title page
\maketitle

% Abstract
\begin{abstract}
Research summary...
\end{abstract}

% Contents
\tableofcontents
\listoffigures
\listoftables
```

Chapter vs. Section

In report/book classes:

```
\chapter{Introduction}
\section{Background}
\subsection{Context}
\subsubsection{Details}
```

Numbering:

- Chapters: 1, 2, 3, ...
- Sections: 1.1, 1.2, 2.1, ...
- Subsections: 1.1.1, 1.1.2, ...

Thesis-Specific Elements

```
% Dedication
\chapter*{Dedication}
To my family...

% Acknowledgments
\chapter*{Acknowledgments}
I thank...

% Appendices
\appendix
\chapter{Survey Data}
\chapter{Additional Results}
```

Note

After `\appendix`, chapters labeled A, B, C...

SUZA Thesis Requirements

Check with your department:

- Official SUZA thesis template
- Formatting requirements
- Title page layout
- Citation style

Common Requirements:

- Double spacing: `\usepackage{setspace}`
- Specific margins: `\usepackage{geometry}`
- Page numbering styles

Introduction to Beamer

What is Beamer?

LaTeX document class for presentation slides.

Advantages:

- Professional, consistent design
- Easy math formulas
- Version control friendly
- Reuse content from papers
- Automatic navigation

This presentation is made with Beamer!

Basic Beamer Structure

```
\documentclass{beamer}
\usetheme{Madrid}

\title{My Presentation}
\author{Your Name}
\date{\today}

\begin{document}

\frame{\titlepage}

\begin{frame}{First Slide}
Content here...
\end{frame}

\end{document}
```

Beamer Themes

Choose with `\usetheme{}`:

Popular Themes:

- Madrid
- Berlin
- Copenhagen
- Warsaw
- Singapore

Color Themes:

- default
- beaver
- crane
- dolphin
- orchid

Slide Elements

```
\begin{frame}{Title}

\begin{block}{Block Title}
Important content in box.
\end{block}

\begin{alertblock}{Warning}
Pay attention!
\end{alertblock}

\begin{exampleblock}{Example}
Example here...
\end{exampleblock}

\end{frame}
```

Columns and Lists

```
\begin{frame}{Two Columns}
\begin{columns}
\begin{column}{0.48\textwidth}
Left content
\end{column}
\begin{column}{0.48\textwidth}
Right content
\end{column}
\end{columns}
\end{frame}
```

Overlays and Animations

```
\begin{frame}{Progressive}
\begin{itemize}
\item<1-> First appears
\item<2-> Second appears
\item<3-> Third appears
\end{itemize}

\pause
After pause.

\only<1>{Visible slide 1}
\only<2>{Visible slide 2}
\end{frame}
```

Table of Contents

```
\begin{frame}{Outline}
\tableofcontents
\end{frame}

% Highlight current section
\begin{frame}{Outline}
\tableofcontents[currentsection]
\end{frame}

% Define sections
\section{Introduction}
\section{Methods}
```

Why Custom Commands?

Benefits:

- Reduce repetitive typing
- Ensure consistency
- Easy global updates
- More readable code

Example: Instead of typing
`\textbf{\textit{\textcolor{blue}{text}}}`
every time, create:
`\highlight{text}`

Defining Commands

```
% Simple (no arguments)
\newcommand{\suza}{State University of
    Zanzibar}

% One argument
\newcommand{\dept}[1]{Department of #1}

% Multiple arguments
\newcommand{\super}[2]{Supervisor: #1, #2}

% Using them
\suza{}
\dept{Computer Science}
\super{Dr. Smith}{SUZA}
```

Math Commands

```
% Expectation
\newcommand{\E}{\mathbb{E}}

% Probability
\newcommand{\Prob}{\mathbb{P}}

% Vectors
\newcommand{\vect}[1]{\mathbf{#1}}

% Usage
$\E[X]$ is expected value.
$\Prob(A)$ is probability.
$\vect{x} = (x_1, x_2)$
```

Renewing Commands

```
% Modify existing commands
\renewcommand{\vec}[1]{\mathbf{#1}}

% Custom section formatting
\renewcommand{\section}[1]{
        \vspace{1em}
        \textbf{\Large #1}
        \vspace{0.5em}
}
```

Warning

Be careful when renewing standard commands!

Professional Tables

Use **booktabs** package:

```
\usepackage{booktabs}

\begin{table}
\centering
\begin{tabular}{lcc}
\toprule
Method & Accuracy & F1 \\
\midrule
Baseline & 0.85 & 0.82 \\
Proposed & 0.92 & 0.90 \\
\bottomrule
\end{tabular}
\end{table}
```

Subfigures

```
\usepackage{subcaption}

\begin{figure}
\begin{subfigure}{0.45\textwidth}
\includegraphics[width=\textwidth]{plot1.pdf}
\caption{First}
\end{subfigure}
\begin{subfigure}{0.45\textwidth}
\includegraphics[width=\textwidth]{plot2.pdf}
\caption{Second}
\end{subfigure}
\caption{Comparison}
\end{figure}
```

Line Spacing and Margins

```
% Line spacing
\usepackage{setspace}
\doublespacing  % or \onehalfspacing

% Custom margins
\usepackage[top=1in, bottom=1in,
left=1.25in, right=1in]{geometry}

% Paragraph spacing
\setlength{\parskip}{1em}
```

Headers and Footers

```
\usepackage{fancyhdr}
\pagestyle{fancy}

\fancyhead[L]{Left Header}
\fancyhead[C]{Center}
\fancyhead[R]{Right}

\fancyfoot[C]{\thepage}

% Remove lines
\renewcommand{\headrulewidth}{0pt}
```

Overleaf Collaboration

Sharing Projects:

- Click "Share" in project
- Invite by email
- Set permissions (view/edit/owner)
- Real-time collaboration

Version History:

- Automatic tracking
- View previous versions
- Compare side-by-side
- Add labels

Comments and Tracking

```
% Comments in code
% TODO: Add details
% FIXME: Check citation

% Or use todonotes
\usepackage{todonotes}

\todo{Review this}
\todo[inline]{Add figure}

% Track changes
\usepackage{changes}
\added{New text}
\deleted{Old text}
```

Git for LaTeX

Why Git?

- Complete version control
- Offline work
- Branching for revisions
- Backup and collaboration

Best Practices:

- Commit frequently
- Use `.gitignore` for aux files
- One sentence per line
- Tag releases

Exercise 1: Bibliography

Task:

1. Create `references.bib` with 5 entries
2. Create document citing all
3. Use `natbib`
4. Try different styles
5. Compile successfully

Time: 20 minutes

Hint: Use Google Scholar's "Cite" for BibTeX!

Exercise 2: Report Template

Task:

1. Multi-chapter report with:
   - Title page with abstract
   - Table of contents
   - 3 chapters
   - Table and figure
   - Bibliography
2. Use `report` class
3. Split chapters into files
4. Add custom command

Time: 25 minutes

Exercise 3: Beamer

Task:

1. 5-slide presentation about research
2. Include:
   - Title slide
   - Table of contents
   - Blocks and columns
   - Equation
   - Progressive reveal
3. Choose and customize theme

Time: 20 minutes

Writing Efficiently

Organization:

- Consistent naming
- One sentence per line
- Comment generously
- Meaningful labels

Performance:

- Use `\includeonly`
- Compress images
- Draft mode

Common Pitfalls

1. Hardcoding numbers
2. Manual spacing
3. Inconsistent formatting
4. Ignoring warnings
5. Not backing up
6. Wrong figure formats

Resources

Documentation:

- CTAN: `https://www.ctan.org`
- Package docs: `texdoc <package>`

Specialized:

- TikZ: `https://tikz.dev`
- PGFPlots: `https://pgfplots.sourceforge.net`

Templates:

- Overleaf: `https://www.overleaf.com/latex/templates`

Tomorrow: AI Integration

Day 3 Topics:

- AI tools for LaTeX assistance
- Generating LaTeX from natural language
- AI citation management
- Automated generation
- Proofreading with AI
- Ethics in AI writing
- Complete research document

Prepare

Bring research topic for final project!

Homework (Optional)

Conference paper template:

- Two-column `article`
- Title, authors, abstract
- Several sections
- 2 figures, 1 table
- 5 citations
- IEEE or ACM style

Bonus: Find Overleaf template for your field!

Thank You!

Day 2 Complete!

Questions? Discussion?

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