Day 1: Introduction to LaTeX Basics

Document Structure, Formatting & Essential Commands

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Today's Agenda

- What is LaTeX?
- 2 Getting Started
- 3 Document Structure
- 4 Text Formatting
- **6** Mathematical Formulas
- 6 Tables and Figures
- Cross-References
- 8 Hands-On Practice
- Troubleshooting
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What is LaTeX?

Definition

LaTeX is a document preparation system for high-quality typesetting, widely used for scientific and technical documents.

Why Use LaTeX?

- Professional type setting, especially for mathematical formulas
- Consistent formatting throughout documents
- Easy management of references and bibliographies
- Industry standard for academic publishing
- Free and cross-platform

LaTeX vs. Word Processors

Traditional Word Processors

- WYSIWYG interface
- Click-and-drag formatting
- Good for simple documents
- Formatting can be inconsistent

LaTeX

- Code-based formatting
- Excellent for complex documents
- Consistent professional output
- Steep learning curve

Installing LaTeX

LaTeX Distributions:

- Windows: MiKTeX or TeX Live
- macOS: MacTeX
- Linux: TeX Live (via package manager)

Online Options (No Installation):

- Overleaf: https://www.overleaf.com
- Papeeria: https://papeeria.com

Recommendation

For today's workshop, we'll use Overleaf for quick access!

Your First LaTeX Document

Basic Structure:

```
\documentclass{article}
\begin{document}
Hello, World!
\end{document}
```

Three essential components:

- \documentclass{article} Document type
- \end{document} Content ends

Document Classes

Choose the right document class:

```
\documentclass{article}  % Papers
\documentclass{report}  % Reports
\documentclass{book}  % Books
\documentclass{beamer}  % Slides
```

Common Options:

```
\documentclass[12pt, a4paper]{article}
```

Preamble: Loading Packages

The preamble comes before \begin{document}:

```
documentclass{article}
% Essential packages
usepackage [utf8] {inputenc}
usepackage { graphicx }
usepackage { amsmath }
title{My Document}
author{Your Name}
begin{document}
% Content here
end{document}
```

Title, Author, and Date

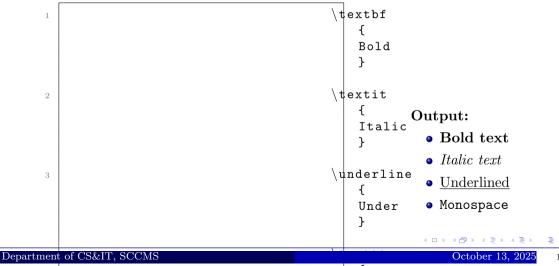
```
\documentclass{article}

\title{Workshop Title}
\author{Your Name}
\date{\today}

\begin{document}
\maketitle
\end{document}
```

Basic Text Formatting

Code:



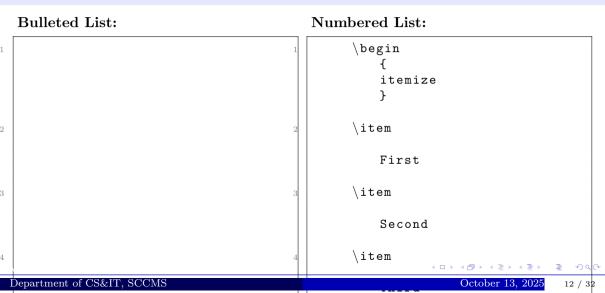
Sections and Subsections

```
This is the introduction.
subsection {Background}
Some background info.
subsubsection {Details}
More detail here.
section { Methods }
Methodology here...
```

section { Introduction }

LaTeX automatically numbers and formats sections.

Lists: Itemize and Enumerate



Description Lists

```
\begin{description}
\item[Term 1] Definition of term 1
\item[Term 2] Definition of term 2
\item[Term 3] Definition of term 3
\end{description}
```

Output:

LaTeX Document preparation system

BibTeX Bibliography management tool

Beamer Presentation package

Inline vs. Display Math

Inline Math

Use \$...\$ for math within text:

The equation $E = mc^2$ is famous.

Output: The equation $E = mc^2$ is famous.

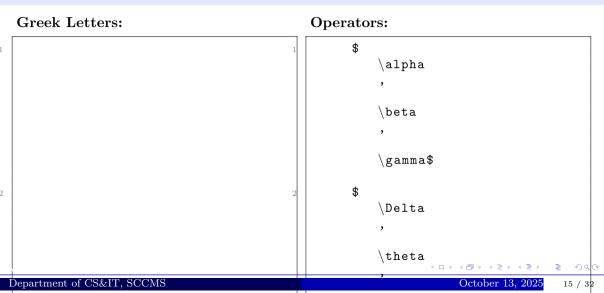
Display Math

\begin{equation}
E = mc^2
\end{equation}

Output:

$$E=mc^2$$

Common Math Symbols



Fractions and Subscripts

```
$\frac{numerator}{denominator}$

$x^2$ % Superscript

$x_i$ % Subscript

$x_i^2$ % Both
```

Examples:

- Fraction: $\frac{a+b}{c+d}$
- Power: $x^2 + y^2 = r^2$
- Subscript: x_1, x_2, \ldots, x_n

Summation and Integration

```
$\sum_{i=1}^{n} x_i$
\int \int dx dx
$\prod_{k=1}^{n} a_k$
```

Display versions:

- Department of CS&IT, SCCMS

Complex Equations

```
\begin{equation}
f(x) = \int_{-\infty}^{\infty}
\hat{f}(\xi) e^{2\pi i \xi x} d\xi
\end{equation}
```

Output:

$$f(x) = \int_{-\infty}^{\infty} \hat{f}(\xi)e^{2\pi i\xi x}d\xi \tag{2}$$

Multi-line Equations

```
x \&= a + b \setminus 
z \&= e + f
end{align}
```

\begin{align}

Output:

$$x = a + b$$
$$y = c + d$$

z = e + f

(3)

(4)

(5)

Creating Tables

```
begin{table}[h]
centering
caption {Sample Data}
begin{tabular}{|c|c|c|}
hline
Name & Age & Grade \\
ackslash \mathtt{hline}
Alice & 22 & A \\
Bob & 23 & B \\
hline
end{tabular}
end{table}
```

Table Alignment

```
_____
```

% 1 = left, c = center, r = right

Name	\mathbf{Age}	\mathbf{Grade}
Alice	22	A
Bob	23	B+
Charlie	21	A-

\begin{tabular}{lcc}

Including Figures

Size Options:

- width=0.5\textwidth
- height=5cm
- scale=0.8

Figure Placement

```
\begin{figure}[htbp]
% h = here
% t = top of page
% b = bottom of page
% p = separate page
% ! = override LaTeX rules
\end{figure}
```

Tip

Use [!h] to force placement approximately here.

Labels and References

```
\label{sec:intro}
See Section \ref{sec:intro} for details.
\begin{equation}
E = mc^2
\label{eq:einstein}
end{equation}
Equation ~\ref{eq:einstein} shows...
```

section{Introduction}

Note: Use ~ for non-breaking space before ref.

Label Naming Convention

Good Practice:

```
\label{sec:introduction} % Sections
\label{fig:results} % Figures
\label{tab:data} % Tables
\label{eq:quadratic} % Equations
```

Benefits:

- Easy to remember
- Avoid naming conflicts
- Clear documentation
- Better organization

Practice Exercise 1

Create your first document:

- Open Overleaf, create new project
- 2 Add title, author, date
- **3** Create 3 sections
- Add one bulleted list
- Include one equation
- Compile and check PDF

Time: 15 minutes

Tip

Start simple! You can always add more later.

Practice Exercise 2

Advanced formatting:

- Create a 3x4 table with headers
- Add a figure (use placeholder or example-image)
- 3 Label your sections, table, and figure
- Add cross-references in text
- Compile successfully

Time: 15 minutes

Help Available

Raise your hand if you need assistance!

Common Errors

- Missing \$ inserted
 - Forgot to close math mode with \$
 - Special characters need escaping
- Undefined control sequence
 - Misspelled command
 - Missing package in preamble
- File not found
 - Check image path and filename
 - Ensure file is uploaded to project

Debugging Tips

When compilation fails:

- Read error message carefully
- 2 Check line number indicated
- **3** Look for:
 - Unclosed braces {}
 - Missing \end{...}
 - Special characters without backslash
- Omment out recent changes
- Search error online

Pro Tip

Compile frequently! Easier to find errors when you know what changed.

Learning Resources

Documentation & Tutorials:

- Overleaf Learn: https://www.overleaf.com/learn
- LaTeX Wikibook: https://en.wikibooks.org/wiki/LaTeX
- CTAN: https://www.ctan.org

Q&A Communities:

- TeX Stack Exchange: https://tex.stackexchange.com
- r/LaTeX: https://reddit.com/r/LaTeX

Tools:

- Detexify (draw symbols): http://detexify.kirelabs.org
- Tables Generator: https://www.tablesgenerator.com

Day 2 Preview

Tomorrow we'll cover:

- Bibliography management with BibTeX
- Advanced document structuring
- Custom commands and environments
- Multi-file projects
- Professional reports and theses
- Beamer presentations

Optional Homework

Create a 2-page document about your research topic with sections, equations, a table, and a figure.

Thank You!

Questions?

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See you tomorrow for Day 2!