SIAM LaTeX Boot Camp

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What is LATEX?

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- LaTeX ships with its own editor and compiler.
- Many people opt to use an editor of their choice.
- We suggest participants use Overleaf: https://www.overleaf.com/

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  - Options within square braces
- Enter (in-line) math-mode with a dollar sign,
- Line comments with a percent sign,
- Unspecified is plaintext.

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Syntax Example

The code snippet:

```
1  % Binomial coefficient
2  For $k \leq n \in \mathbb{N}$,
3  $$\binom{n}{k} = \frac{n!}{k!(n-k)!}.$$
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Produces the following output:

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- Each `class` has its own flavor of commands.
- Common choices of `option` are `12pt`, `letterpaper`, `twocolumn`, `twoside`, or `landscape`.

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`\usepackage[options]{package}`.

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Next, import packages with
`\usepackage[options]{package}`.

- Common choices of `package` are `amsmath`, `tikz`, `graphicx`, `geometry`.
- Can package your own commands in `.sty`-files.

If desired, can specify the document header.

- Change details with `\title{title}`, `\author{author}`, and `\date{date}`.

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\begin{document}...\end{document}.

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  \begin{env}...\end{env}.
- Use *math mode* for math and special commands.

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- Must escape \ (\textbackslash), {, \$, &, and %.
- Can insert space with \, or \!.
- Larger space with \vspace*{space}, \hspace*{space}.
- Line breaks with \\ or \newline.

Math Mode

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- Write in-line math with $...$, \(...\).
- Write display math with $$...$$, \[...\].
- Can also use the `align` or `equation` environments.

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Most commands have different in-line / display behavior.

- Can force display behaviour with `\displaystyle`.

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Math Mode Example

The code snippet:

```
1  \begin{align}
2      & y_0 = y(0), \\
3      & y_{n+1} = \Delta x \cdot y'(x_n) + y_n.
4  \end{align}
```

Math Mode Example

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2      & y_0 = y(0), \\
3      & y_{n+1} = \Delta x \cdot y'(x_n) + y_n.
4  \end{align}
```

produces the following output:

$$y_0 = y(0), \tag{1}$$
$$y_{n+1} = \Delta x \cdot y'(x_n) + y_n. \tag{2}$$

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- Use `tabular` and `array` for tables or matrices.
- Use `figure` for graphics.

Environments

Some special environments help with document structure.

- Use `align` and `equation` for multi-line display math.
- Use `itemize` and `enumerate` for lists.
- Use `tabular` and `array` for tables or matrices.
- Use `figure` for graphics.

Each environment has special commands and control characters.

Environments Example

The code snippet:

```
1  \begin{itemize}
2      \item[1.] Step 1,
3      \item[a.] Step 2,
4      \item Step 3.
5  \end{itemize}
```

Environments Example

The code snippet:

```
1  \begin{itemize}
2      \item[1.] Step 1,
3      \item[a.] Step 2,
4      \item Step 3.
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```

creates a list with three items whose labels are "1.", "a.", and "∘".

Graphics

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- Insert images with
  `\includegraphics[options]{path}`
- Specify graphics path with
  `\graphicspath{{path}}`
- Use the `figure` environment for positioning, captions, and tags.

Graphics Example

The code snippet:

```
1  \begin{figure}[h]
2      \centering
3      \includegraphics[width=0.4\textwidth]{my-pic}
4      \caption{My beautiful selfie.}
5      \label{me}
6  \end{figure}
```

Graphics Example

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1  \begin{figure}[h]
2      \centering
3      \includegraphics[width=0.4\textwidth]{my-pic}
4      \caption{My beautiful selfie.}
5      \label{me}
6  \end{figure}
```

places the picture at path `my-pic` *here*, centered, scaled to 0.4-times text width, and adds the caption "My beautiful selfie."
Additionally, we may reference the photo with `\ref{me}`.

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- Rename a label with `\tag{name}`
- Use `\cite{name}` for bibliography items.

If you import the `href` package, references are clickable.

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- Create an item with `@type{name,...}`.
- Cite bib. items with `\cite{name}`.
- Make references page from `bibtex` file with `\bibliography{path}`.

Reference Example

The code snippet:

```
1  \begin{equation}\label{SODE} \tag{$\Delta$}
2      my'' + by' + ky = f(t)
3  \end{equation}
```

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Reference Example

The code snippet:

```
1 \begin{equation}\label{SODE} \tag{$\Delta$}
2     my'' + by' + ky = f(t)
3 \end{equation}
```

creates the following output:

$$my'' + by' + ky = f(t), \tag{Δ}$$

which we may reference with `\eqref{SODE}`, resulting in (Δ).

Bibliography Example

The code snippet (in, say, `biblio.bib`):

```
1  @book{DF,
2      author={David S. Dummit, Richard M. Foote},
3      title={Abstract Algebra}
4  }
```

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Bibliography Example

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1  @book{DF,
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```

creates a bib. entry which we may cite with
`\cite{DF}`.
Calling `\bibliography{biblio}` creates the
bibliography page, with all *used* citations.

Theorems

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Theorems

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- To access, must use the package `amsthm`.
- Built in are the `theorem` and `proof` environments.
- Create a theorem with
  `\begin{env}[Name]...\end{env}`
- Make your own theorem type with
  `\newtheorem{env}{name}`
- Specify theorem style with
  `\theoremstyle{style}`

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Theorem Example

The code snippet:

```
1  \begin{theorem}[FT Finite Abelian Groups]
     \label{FTFAG}
2     Let $G$ finite Abelian. Then, $G \cong
         \bigoplus_{i=1}^k \mathbb{Z} / n_i\mathbb{Z}$.
3  \end{theorem}
```

Theorem Example

The code snippet:

```
1  \begin{theorem}[FT Finite Abelian Groups]
      \label{FTFAG}
2     Let $G$ finite Abelian. Then, $G \cong
          \bigoplus_{i=1}^k \mathbb{Z} / n_i\mathbb{Z}$.
3  \end{theorem}
```

results in the following named theorem:

Theorem (FT Finite Abelian Groups)

Let G finite Abelian. Then, $G \cong \bigoplus_{i=1}^k \mathbb{Z}/n_i\mathbb{Z}$,

which we may reference with \ref{FTFAG}.

Fancy Text

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- Add diacritics with `\tilde`, `\hat`, `\overline`, `\dot`, etc.

Macros

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- Use `\declaremathoperator` for *text* commands with no arguments

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Macros Example

If we declare the following commands at the start of our document:

```
1  \DeclareMathOperator{\spn}{span}
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```

to produce the following output:

$$\mathfrak{sl}(2) = \operatorname{span} \left\{ h, e, f \right\}, \dots$$

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Closing

Questions?

Closing

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To continue your LaTeX journey...

Bibliography

📄 The LaTeX project.
https://www.latex-project.org.

📄 Overleaf documentation.
https://www.overleaf.com/learn.

📄 Several LaTeX project templates.
https://www.overleaf.com/read/qdfmzmmmpwvq.

📄 This beamer presentation.
https://www.overleaf.com/read/rxkjkqhhtmcz.