

Figure 1: Using L^AT_EX to write more efficiently.



Figure 2: Using L^AT_EX to feel superior to Word users.

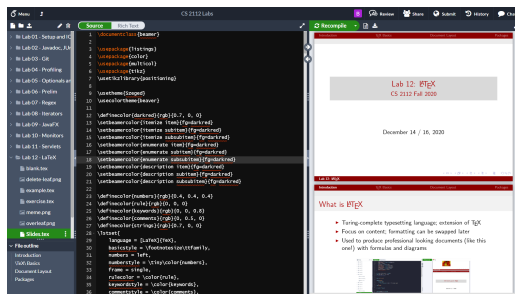
Lab 12: L^AT_EX

CS 2112 Fall 2020

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What is L^AT_EX

- ▶ Turing-complete typesetting language; extension of T_EX
- ▶ Focus on content; formatting can be swapped later
- ▶ Used to produce professional looking documents (like this one!) with formulas and diagrams



Creating L^AT_EX Documents

You can install command-line utilities to parse .tex files and compile them down to .pdf.

Many students find it easier to use a web-based L^AT_EX compiler. The course staff recommends Overleaf.

Syntax Basics

- ▶ T_EX works with a series of tags or commands
- ▶ Each is preceded by a backslash ‘\’ character
- ▶ Arguments are grouped using curly bracelets { } if more than one character long
- ▶ Example: The fraction $\frac{1}{2}$ is declared with the code `\frac{1}{2}`

Preamble

- ▶ Each document starts with a preamble, which is the stuff before the `\begin{document}`
- ▶ The document class defines what type of document you're making; you'll typically use `article`, but others exist (these presentations use `beamer`, for example)
- ▶ You'll also declare any packages you use (more on that later)
- ▶ Finally, declare any information that goes in the title block

```
1 \documentclass{article}
2 \usepackage[utf8]{inputenc}
3
4 \title{First Document}
5 \author{Andrew Myers}
6 \date{December 2019}
```

Document Body

- ▶ After the preamble, the contents of your document go between the `\begin{document}` and the `\end{document}`
- ▶ Add the `\maketitle` command to generate a header block based on the information from your preamble

```
1 \documentclass{article}
2 \usepackage[utf8]{inputenc}
3 \title{First Document}
4 \author{Andrew Myers}
5 \date{December 2020}
6
7 \begin{document}
8 \maketitle
9 Stuff goes here
10 \end{document}
```

Basic Layout

- ▶ Press enter **twice** to start a new paragraph
- ▶ Use `\\` to create a newline
- ▶ Use `\textbf{bold}` to create bold, `\textit{italics}`, or `\underline{underlined}` text
- ▶ Use the `\section{Title}` and `\subsection{Title}` commands to create sections and subsections
- ▶ Use the `\begin{itemize}` and `\end{itemize}` commands to create bulleted lists, or swap `itemize` with `enumerate` to create numbered lists. Add items with `\item`.

Math

- ▶ You'll need to import the `amsmath` package; add the line `\usepackage{amsmath}` to your preamble.
- ▶ Create an inline equation by wrapping your equation in dollar signs or `\(` and `\)`, so `$1+1$` compiles down to $1 + 1$
- ▶ Break the equation onto its own block by using two dollar signs or `\[` and `\]`, as in `$$1+1$$` or `\[1+1\]`
- ▶ There are countless math formatting commands
 - ▶ `$$\frac{n}{d}$$` $\frac{n}{d}$
 - ▶ `$$x^{p}_{b}$$` x_b^p
 - ▶ `$$\lim_{x\to 0}$$` $\lim_{x \rightarrow 0}$
 - ▶ `$$\alpha\beta\infty$` $\alpha\beta\infty$
 - ▶ `$$\sum_{i=0}^n$` $\sum_{i=0}^n$
 - ▶ `$$\int_0^5 x\,dx$` $\int_0^5 x \, dx$
- ▶ Many more available; Google what you need
- ▶ Detexify is a useful tool for looking up symbols

More Math

You can make matrices and vectors in math mode like so:

```
1 \begin{bmatrix}
2   a & b \\
3   c & d \\
4 \end{bmatrix}
```

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

Swap out the `bmatrix` for `pmatrix` for rounded parentheses around the matrix, or just `matrix` for no brackets at all.

You can align equations using the `align*` environment, like so:

```
1 \begin{align*}
2   2x - 5y &= 8 \\
3   9y &= -12 \\
4 \end{align*}
```

$$\begin{aligned} 2x - 5y &= 8 \\ 9y &= -12 \end{aligned}$$

Commands

You can define your own commands using

`\newcommand{\R}{\mathbb{R}}`. The first argument (in this case `\R`) is the command you're defining; the second is what the command should turn into (in this case `\mathbb{R}`).

Specify the number of parameters in square brackets and use them like #1 for the first parameter, etc.

```
1 \newcommand{\plusbinomial}[3]{(#2 + #3)^#1}
2 \plusbinomial{3}{x}{y}
```

$$(x + y)^3$$

Redefine previous commands using `\renewcommand{\S}{\mathbb{S}}`

Importing Packages

- ▶ As stated earlier, import packages using `\usepackage{package_name}` in the preamble
- ▶ Countless useful packages; we'll show just a sampling here
- ▶ Nice-to-knows:
 - ▶ `geometry` Page orientation and margins
 - ▶ `amsmath` Powerful math tools
 - ▶ `amssymb` Extended range of math symbols
 - ▶ `listings` Include syntax-highlighted code
 - ▶ `graphicx` Import pictures
 - ▶ `tikz` Create diagrams

Page Margins

Using the `geometry` package, you can customize the size, margins, and orientation of your page.

For example, including the following in your preamble will make the page landscape with 2-inch margins.

```
1 \usepackage[letterpaper, landscape, margin=2in]{geometry}
```

Sample Graphics

The following is will import a picture, as long as the `graphicx` package is included. This T_EX code is taken from the first slide of this presentation

```
1 \includegraphics[height=3in]{meme.png}
```

Sample Code Block

The following will render out a code block, as long as the `listings` package is included. Use the `\lstset` command to customize language, syntax highlighting, line numbers, and more.

```
1 \begin{lstlisting}
2     public static void main(String[] args) {
3         System.out.println("Hello World");
4     }
5 \end{lstlisting}
```

Sample Diagram

The following will render out a diagram with the `tikz` package. Tikz is a very complex with tons of options beyond the scope of this lab, but hopefully this gives you a taste of what is possible.

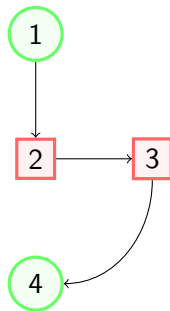
```

1 \begin{tikzpicture}[
2   roundnode/.style=
3     {circle, draw=green!60, fill=green!5, very thick, minimum size=7mm},
4   squarednode/.style=
5     {rectangle, draw=red!60, fill=red!5, very thick, minimum size=5mm},
6 ]
7   %Nodes
8   \node[squarednode]      (maintopic)                                {2};
9   \node[roundnode]       (uppercircle)      [above=of maintopic] {1};
10  \node[squarednode]      (rightsquare)      [right=of maintopic] {3};
11  \node[roundnode]       (lowercircle)      [below=of maintopic] {4};
12
13  %Lines
14  \draw[->] (uppercircle.south) -- (maintopic.north);
15  \draw[->] (maintopic.east) -- (rightsquare.west);
16  \draw[->] (rightsquare.south) .. controls +(down:7mm) and +(right:7mm) ..
17    (lowercircle.east);
18 \end{tikzpicture}

```

Sample Diagram

This is what the diagram on the previous page renders out to:



Exercise

On the course website, under today's lab, there's a link labeled "Exercise" that leads to a pdf document created with L^AT_EX. Please try to recreate it.

The End + Thank You

It has been a pleasure working with all of you this semester. Best of luck on all your future endeavors, and thanks for coming to lab.

- Ted Bauer, Ashneel Das, Shirley Huang, Annabel Lin, Changyuan Lin, Bryan Tabor, Michael Xing