LaTeX Workshop

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GENESEO

Outline

BDA/MBS and Math/Physics People

People taking BDA (BIOL250) or MBS (BIOL/MATH 340) do not need to know many commands

This is the asterisk/star symbol *

You can type it using Shift-8, and it is an important symbol in LaTeX

Slides marked with * are applicable to BDA/MBS people

Demonstrations are marked with a dagger symbol †

How to Pronounce LaTeX

TeX came first, and LaTeX is an improvement of TeX

TEX is Greek: tau-epsilon-chi (pronounced tech, like technology)

LaTeX Environment

*RStudio and Overleaf

BDA/MBS: Start RStuido $\Longrightarrow$ New RSweave File $\Longrightarrow$ Save File

Everyone else: Create an account at `overleaf.com`
New Project $\Longrightarrow$ Blank Project

Overleaf

Make sure you have this instead

```
1  \documentclass{article}
2  \usepackage[margin=1.25in]{geometry} % Set margins
3
4  \title{\{LaTeX} Workshop}
5  \author{YOUR NAME}
6  \date{\today}
7
8  \begin{document}
9  \maketitle
10
11 \end{document}
```

The Basics

*Basic Commands

LaTeX uses backslash \ for all of its commands, and everything is case sensitive

A command formats a small piece of text
Example: `\newpage` creates a new page and `\huge` increases font size

Some commands can accept arguments
Example: `\textit{hello}` italicize text and `\ul{goodbye}` underlines text

Commands can be combined and nested (starts inside and out)

Example: `\textit{hello \textbf{world}}`

*Basic Environments

An environment formats a large piece of text
Most environments have: `\begin{}` and `\end{}`

Example:
Create document

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

Create lists

```
\begin{enumerate}
...
\end{enumerate}
```

*Spacing

Spacing is important

Use `\indent` to indent (may not always work)

Adding extra space to text does not create extra space

Creating new lines:
`\newline` or `\\`, which is equivalent to `Shift-Enter` in Word

†

*Spacing

Start a new paragraph:

`\par` or empty line between text, which is equivalent to `Enter` in Word

```
1 this line
2
3 new line
```

and

```
1 this line
2 \par new line
```

are the same †

Packages

LaTeX can extend its format capabilities by adding packages

To add a package use `\usepackage{}` before `\begin{document}`

Common packages include:

- `amsmath` or `mathtools` (extra math functions)
- `amssymb` (more math symbols)
- `graphicx` (display figures)

*Structure

Use `\section{}` to create a section

Append "sub" in front of section to create subsections
Add asterisk after section to remove section number
Example:

```
1 \section{This is a section}
2 \subsection{This is a subsection}
3 \subsubsection{This is a sub-subsection}
4 \section*{This is a section without a number}
```

*Lists

The `enumerate` environment creates a numbered list and `itemize` environment creates a bullet list

Use `\item` to make a new entry
List can be nested inside lists

Example:

```
1 \begin{enumerate}
2     \item Fruit
3     \begin{enumerate}
4         \item Apple
5         \item Banana
6     \end{enumerate}
7 \end{enumerate}
```

*Lists

1. Fruit
   1.1 Apple
      1.1.1 Granny Smith
   1.2 Banana
2. Toys

Replace some `enumerate` with `itemize`

- Fruit
  1. Apple
     - Granny Smith
  2. Banana
- Toys

Mathematics in LaTeX

*Different Math Modes

To write math, they have to be in math environments

Two types:
In-line $ ... $ or `\( ... \)` - within text

Display `\[ ... \]` - by itself
Also includes `equation` and `align` environment

Normal text can be inside math environments by using `\text{}` †

*Math Symbols

Symbols can be on the keyboard or be a command

Keyboard Example:

$+ \quad - \quad (\quad) \quad > \quad < \quad =$

Command Example (requires `amssymb`):

`\geq` $\geq$ `\neq` $\neq$ `\{` and `\}`

To find more symbols use

`http://detexify.kirelabs.org/classify.html` †

*Math Commands

Caret symbol (`Shift-6`) for superscripts
Underscore symbol (`Shift-dash`) for subscripts

For multiple characters, enclose in braces

Add spaces in math environment using (from smallest to greatest):

`\,` `\:` `\;` `\quad` `\qquad`

Example:

```
1 $ e^x \qquad e^x^2 + y^2 \qquad e^{x^2 + y^2} $
```

e^x $e^{x2} + y^2$ $e^{x^2+y^2}$

*Math Equations

The `equation` environment creates an equation along with a number

Example:

```
\begin{equation}
    a^2 + b^2 = c^2
\end{equation}
```

$$a^2 + b^2 = c^2 \tag{1}$$

To remove the number, add an asterisk at the end of `equation`

†

Aligned Math

The `align*` environment creates several equations that are aligned together using the ampersand symbol (`Shift-7`)
Use double backslash `\\` to go to the next line

Example:

```
\begin{align*}
    \text{Let } a &= b \\
    a^2 &= ab \\
    a^2 - b^2 &= ab - b^2 \\
    (a - b)(a + b) &= b(a - b) \\
    a + b &= b \\
    b + b &= b \\
    2b &= b \\
    2 &= 1
\end{align*}
```

Aligned Math

$$
\begin{aligned}
\text{Let } a &= b \\
a^2 &= ab \\
a^2 - b^2 &= ab - b^2 \\
(a-b)(a+b) &= b(a-b) \\
a + b &= b \\
b + b &= b \\
2b &= b \\
2 &= 1
\end{aligned}
$$

Fractions

The command is `\frac{}{}`, where the first braces is the numerator and the second braces is the denominator.

The display mode varies based on environment

Example:

```
A linear fractional transformation: $\frac{az + b}{cz + d}$
```

A linear fractional transformation: $\frac{az+b}{cz+d}$

```
\[ \text{A linear fractional transformation: } \frac{az + b}{cz + d} \]
```

A linear fractional transformation: $$\frac{az + b}{cz + d}$$

Fractions

Force display or text fractions using `\dfrac` or `\tfrac` respectively

Example:

```
A linear fractional transformation: $\dfrac{az + b}{cz + d}$
```

A linear fractional transformation: $\dfrac{az + b}{cz + d}$

```
\[ \text{A linear fractional transformation: } \tfrac{az + b}{cz + d} \]
```

A linear fractional transformation: $\tfrac{az+b}{cz+d}$

Calculus

Summation (varies between environments): `\sum_{k=1}^n k`

$$\sum_{k=1}^{n} k$$

$$\sum_{k=1}^{n} k$$

Integral: `\int_a^b x^2 \, dx`

$$\int_a^b x^2 \, dx$$

$$\int_a^b x^2 \, dx$$

Calculus

Use fractions and add d or `\partial` in numerator and denominator

Example:

```
\[ \frac{d y}{d x} = 2x \]
\[ \frac{\partial f}{\partial x} = 2xy + z \]
```

$$\frac{dy}{dx} = 2x$$

$$\frac{\partial f}{\partial x} = 2xy + z$$

Add apostrophe to the function: `f'(x) \qquad f''(x)`

$$f'(x) \qquad f''(x)$$