

Intro to LaTeX Workshop

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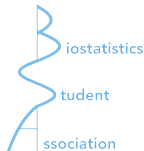
University of North Carolina at Chapel Hill

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What is LaTeX?

- A text editor for more advanced documents, especially those including complex tables and equations
- Uses “code” to create a PDF
- Useful for projects, homework, manuscripts, quals, posters, figures
- Examples (These are local to my computer and won't open if you click them.)
 - [Conference Slides](#)
 - [760 homework](#)
 - [Applied qualification exams](#)
 - [Figure](#)

Getting Started

- 1 Go to the BSA website and download slides:
bsa.web.unc.edu/computing/latex/
- 2 Download the workshop .zip [here](#) (Solutions [here](#))
- 3 Go to [Overleaf](#) and sign up with any email
- 4 Sign in, and click the green upload button on the upper left corner
- 5 Select “upload zip”
- 6 Select the .zip downloaded from the BSA website
- 7 Change the name, date, and title in your document accordingly

```
\section{Homework Examples}
  \begin{enumerate}
    \item

  \end{enumerate}
```

- % is how to comment the code
- `\section*{Homework Examples}`

- `$`'s allow you to enter in and out of equation mode.

Exercise 1: In words, describe what m and b are in the equation
$$y = mx + b.$$

`m` is the slope and `b` is the intercept.

Equation Environments

- \$'s allow you to enter in and out of equation mode.
- Double \$ centers the equation.

Exercise 2: Write $y = mx + b$ as a centered equation.

$$y = mx + b$$

Equation Environments

- \$'s allow you to enter in and out of equation mode.
- Double \$ centers the equation.
- The equation environment will also give you centered equations.

Exercise 3: Write $y = mx + b$ as a centered equation in the equation environment.

```
\begin{equation} y = mx + b \end{equation}
```


Alignment in LaTeX:

- Align columns with `&` symbols
- Align rows with `\\`

Notice the nested enumerate environments so that we have problems 3a and 3b.

Exercise 3a: Rewrite the equation using the equation and aligned environments.

```
\begin{equation}
  \begin{aligned}
    & y = mx + b \\
    & = (m \times x) + b \\
    & \implies 0 = \{(m \times x) + b\} - y
  \end{aligned}
\end{equation}
```

Exercise 3b: Split the last line of 3a onto two different lines

$$0 = \{(m \times x) \\ + b\} - y$$

```
\begin{equation}
  \begin{aligned}
    0 &= \{(m \times x) \\
      &\quad \&\hspace{1cm} + b \} - y \nonumber
  \end{aligned}
\end{equation}
```

Exercise 4: Use alignment syntax and the cases environment to make the following piecewise function

$$y = \begin{cases} x, & 0 < x < 1 \\ mx + b, & x \geq 1 \end{cases}$$

```
$$ y = \begin{cases} x, & 0 < x < 1 \\ mx + b, & x \geq 1 \end{cases} $$
```

What if we have matrices and vectors? [Exercise 5: Replicate the following.](#)

$$E[\mathbf{Y}|\mathbf{X}] = \boldsymbol{\beta} \begin{bmatrix} 1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & 1 \end{bmatrix} + \boldsymbol{\epsilon}$$

```
$$ E[\bs{Y}|\bs{X}] = \bs{\beta} \begin{bmatrix} 1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & 1 \end{bmatrix} + \bs{\epsilon} $$
```

Exercise 6: Replicate the following.

$$s = \left(\frac{\sum_{i=1}^n (y_i - \bar{y})^2}{n - 1} \right)^{1/2}$$

```
$$ s = \sqrt{\frac{\sum_{i=1}^n (y_i - \overline{y})^2}{n - 1}} $$
```

- Use `itemize` instead of `enumerate` to make a bulleted list
- Sometimes we want to skip numbers or letters in `enumerate`
- Note the commands `\addtocounter{enumi}{3}` and `\addtocounter{enumii}{2}` in our next section
- The number of `i`'s in “`enumi`” the first set of brackets determine what level of the `enumerate` to add a counter to
- The number in the second set of brackets determines how many to *add* to the counter (Does not set the counter to that value)

- Tables, figures, and equation environments are what are called floats
- LaTeX will try to put these wherever it thinks is best
- It is generally best to add these to your document last and then play around with how to position it properly

Typically, you would do the following, but because we uploaded the entire .zip, we can skip steps 1-2 for now.

- 1 Select PROJECT > Files... > Computer
- 2 Drag and drop or select the image file from your downloaded folder.
- 3 Use the following code to include the image in your document.

Exercise 4c:

```
\begin{figure}[h!]  
  \centering  
  \includegraphics[scale = 0.3]{Histogram.png}  
  \label{fig:malezinc}    \caption{A histogram of serum  
zinc levels in men.}  
\end{figure}
```

- The `[h!]` forces the location as best as possible, based on the size of the image. Some options are `t` for top, `b` for bottom, `h` for here (inline).
- You can play with the `[scale =]` option to resize. Instead, you could use `[height = <value>, width = <value>, keepaspectratio]`
- You can also include a command in the figure environment, `\label{<name>}`. Then in your article text, you can use `Figure \ref{<name>}` to correctly call the figure number, e.g., “Figure 1”

```

\begin{table}[h!]
  \caption{Parameter estimates for Model 1.}
  \centering
  \begin{tabular}{ccc}
    \hline
      Effect      & Variable & Estimate \\
    \hline
      Intercept &  $\beta_0$  & 0.45 \\
      Gender    &  $\beta_1$  & 4.74 \\
      Age       &  $\beta_2$  & 7.32 \\
    \hline
  \end{tabular}
  \label{tab:Model1}
\end{table}

```

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```

Now, try changing one of the c's after tabular to an l or r. Then try adding a | between them. Note the changes in your table.

- We sometimes wish to include our code as an appendix or in a problem
- We can use the `lstlisting` environment for R or the `minted` environment for SAS
- Whatever is typed in this environment is produced exactly as is in the document in a different font

- R in text

```
\begin{lstlisting}[language = R, caption = R Code]
  x <- rnorm(100)
\end{lstlisting}
```

- R file

```
\lstinputlisting{<filename>.R}
```

- SAS in text

```
\begin{lstlisting}[language = SAS, caption = SAS Code]
  PROC FREQ ...
\end{lstlisting}
```

My Project is Finished. Now What?

- To download a copy of the pdf, simply click PDF
- To download a copy of the pdf, tex file, and all accompanying files, select PROJECT > DOWNLOAD AS ZIP
- Works similarly to Google Docs

You can also create templates and quickly make copies on Overleaf

- Use `\text{}` to include text in equation environments.

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- Use the tilde apostrophe to make “quotes” face the correct way.

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- [Cheatsheet](#) and [symbols](#) .pdfs are useful resources.

- [Excel2Latex](#) add on allows you to create tables in Excel and produce the LaTeX code needed.

Tips and Tricks: Efficiently creating tables

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- `xtable` package in R will take dataframes in R and output the LaTeX code.

- Cheatsheet has lots of formatting help
 - fontsize
 - margins
 - in text changes to fontsize
 - quotation environment
 - hspace and vspace

- You can label equations the same way we label figures and tables

- External files: .cls, .sty, .bib

- .bib files
- [Google scholar](#) is your friend
- biblatex package in your *preamble* (not .bib)

```
\usepackage[style=apa,backend=biber]{biblatex}
\addbibresource{<filename>.bib}
\begin{document}
.
.
.
\printbibliography
\end{document}
```
- `\cite{}` in text for the bib-key
- multibib package for multiple .bib files in different sections

- Beamer document class
- Sections, enumerate, itemize, almost everything is the same

- To make a new frame:

```
\begin{frame}  
\frametitle{Frametitle goes here}  
:  
\end{frame}
```

- `\begin{frame}[< +- >]` ... to give the PowerPoint effect
- `\vfill` is your friend, please use it
- Different themes are available [here](#), or use our template on the [BSA](#) website!

Sometimes you want a block of text.

```
\begin{block}{Theorem}
  If something happens, then this other thing happens.
\end{block}
```

Theorem

If something happens, then this other thing happens.

Conclusion

- LaTeX has a lot of capabilities and flexibility in total customization via coding language
- The ceiling is the roof
- Online documentation, StackExchange, [Cheatsheet](#), [LaTeX symbols document](#), Friends
- [BSA](#) website templates for MS paper, beamer, homework
- Use the LaTeX package `tikz` to draw figures in LaTeX. Examples [here](#).

Questions?
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