

Day 5: LaTeX, Markdown, and Formatting Documents for Social Science

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- Instructions for how to download LaTeX are here:
<http://blogs.commonsgorgetown.edu/government-math-camp/r-bootcamp/>
- LaTeX takes a long time to download distributions run in the 4-6GB range, make sure you have the storage on your computer to install it and enough time on a strong internet connection.
- Note that you do not need LaTeX installed on your computer to use online LaTeX tools, such as Overleaf.
- However, a variety of R Studio tools for document formatting, including Markdown and Sweave, rely on or have the option to use LaTeX as a pdf conversion tool, so it is useful to have even if you do not plan on working in it directly.

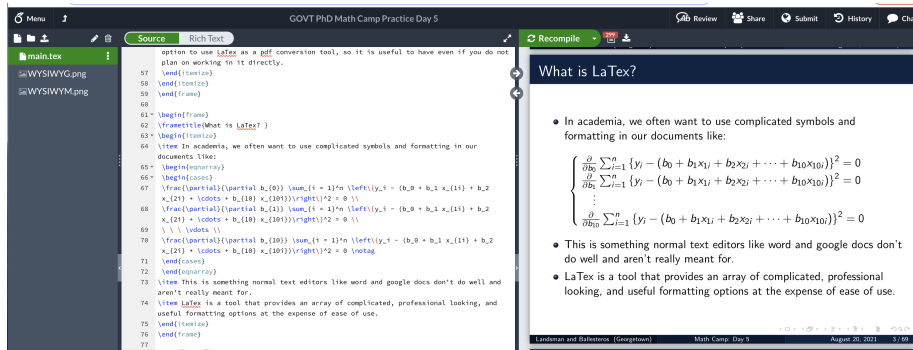
What is LaTeX?

- In academia, we often want to use complicated symbols and formatting in our documents like:

$$\begin{cases} \frac{\partial}{\partial b_0} \sum_{i=1}^n \{y_i - (b_0 + b_1 x_{1i} + b_2 x_{2i} + \cdots + b_{10} x_{10i})\}^2 = 0 \\ \frac{\partial}{\partial b_1} \sum_{i=1}^n \{y_i - (b_0 + b_1 x_{1i} + b_2 x_{2i} + \cdots + b_{10} x_{10i})\}^2 = 0 \\ \vdots \\ \frac{\partial}{\partial b_{10}} \sum_{i=1}^n \{y_i - (b_0 + b_1 x_{1i} + b_2 x_{2i} + \cdots + b_{10} x_{10i})\}^2 = 0 \end{cases}$$

- This is something normal text editors like word and google docs don't do well and aren't really meant for.
- LaTeX is a tool that provides an array of complicated, professional looking, and useful formatting options at the expense of ease of use.

What is LaTeX? Continued



The screenshot shows a LaTeX editor interface. On the left is a file explorer with 'main.tex' selected. The main area displays the source code of 'main.tex', which includes comments and LaTeX commands for creating a document titled 'What is LaTeX?'. The code uses `\begin{cases}` to display a system of equations. On the right is a preview window titled 'What is LaTeX?' showing the rendered output. The preview includes the same text and equations as the source code, demonstrating the professional formatting capabilities of LaTeX.

option to use [LaTeX](#) as a pdf conversion tool, so it is useful to have even if you do not plan on working in it directly.

```
57 \end{itemize}
58 \end{itemize}
59 \end{frame}
60
61 \begin{frame}
62 \frametitle{What is LaTeX?}
63 \begin{itemize}
64 \item In academia, we often want to use complicated symbols and formatting in our documents like:
65 \begin{eqnarray}
66 \begin{cases}
67 \frac{\partial}{\partial b_0} \sum_{i=1}^n \{y_i - (b_0 + b_1 x_{1i} + b_2 x_{2i} + \dots + b_{10} x_{10i})\}^2 = 0 \\
68 \frac{\partial}{\partial b_1} \sum_{i=1}^n \{y_i - (b_0 + b_1 x_{1i} + b_2 x_{2i} + \dots + b_{10} x_{10i})\}^2 = 0 \\
69 \vdots \\
70 \frac{\partial}{\partial b_{10}} \sum_{i=1}^n \{y_i - (b_0 + b_1 x_{1i} + b_2 x_{2i} + \dots + b_{10} x_{10i})\}^2 = 0
71 \end{cases}
72 \end{eqnarray}
73 \item This is something normal text editors like word and google docs don't do well and aren't really meant for.
74 \item LaTeX is a tool that provides an array of complicated, professional looking, and useful formatting options at the expense of ease of use.
75 \end{itemize}
76 \end{frame}
77
```

What is LaTeX?

- In academia, we often want to use complicated symbols and formatting in our documents like:

$$\begin{cases} \frac{\partial}{\partial b_0} \sum_{i=1}^n \{y_i - (b_0 + b_1 x_{1i} + b_2 x_{2i} + \dots + b_{10} x_{10i})\}^2 = 0 \\ \frac{\partial}{\partial b_1} \sum_{i=1}^n \{y_i - (b_0 + b_1 x_{1i} + b_2 x_{2i} + \dots + b_{10} x_{10i})\}^2 = 0 \\ \vdots \\ \frac{\partial}{\partial b_{10}} \sum_{i=1}^n \{y_i - (b_0 + b_1 x_{1i} + b_2 x_{2i} + \dots + b_{10} x_{10i})\}^2 = 0 \end{cases}$$

- This is something normal text editors like word and google docs don't do well and aren't really meant for.
- LaTeX is a tool that provides an array of complicated, professional looking, and useful formatting options at the expense of ease of use.

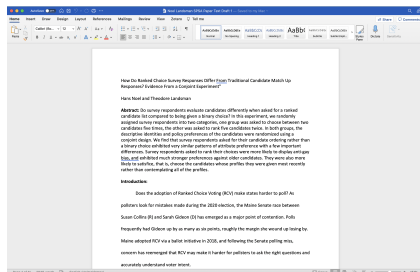
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- Basically, LaTeX turns document preparation into its own form of coding, this coding is less restrictive than R (E.G. Copy-pasted text will still show up as unformatted text without breaking anything), but still tricky to learn.

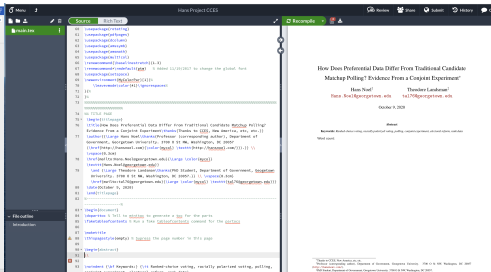
Text Editor Design and Usefulness

- In general, there are two paradigms of text editing, WYSIWYG (what you see is what you get, often referred to as wizywig), and WYSIWYM (what you see if what you mean, often referred to as wizywim).
- In WYSIWYG editors, like word and google docs, you write and format content at the same time.
- In WYSIWYM editors, formatting is done in a separate step (compiling, knitting, etc) with the aid of style commands and a stylesheet.

Text Editor Design Continued



(a) WYSIWYG



(b) WYSIWYM

- Some writers prefer tools that let them write first and format later (like a basic .txt editor) others will write directly into a more formatting oriented tool like Markdown or LaTeX. Almost everyone still uses Word or Google Docs for some tasks.

Quick Aside, Sending Word Files

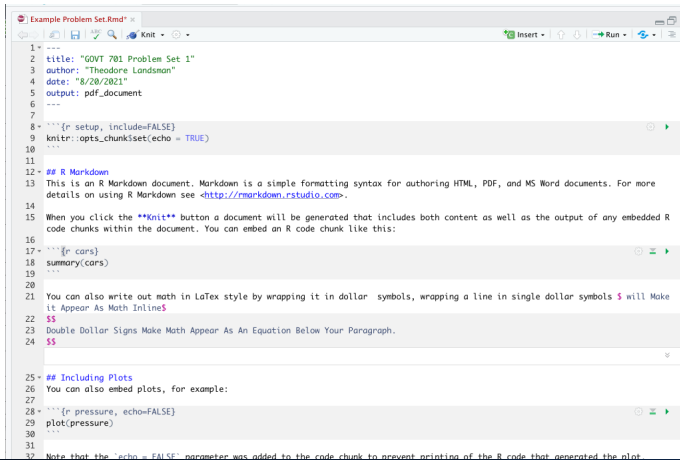
- Whether you choose to use LaTeX, Markdown, or neither, the goal should be to send .pdf files for final documents unless you are strictly required to send a word document.
- This is important for two reasons:
 - ① .doc/.docx/Google Docs type files save meta-data (E.G: edit history) that can be embarrassing.
 - ② PDFs, particularly PDFs generated by Markdown and Latex, but also PDFs exported by Word, have a cleaner more professional look that will improve your confidence in submission and signal to whoever is reading your work that you know what you're doing.
- Share document files when you are collaborating with someone, share pdfs when they are evaluating your work. Where the line between the two is unclear, ask.

Combining Coding and Formatting

- Both coding and WYSIWYM editors require tediously explaining to the computer in painstaking detail what you want, but what if there was a way to do both at the same time?
- Enter RMarkdown, a filetype that combines the functionality of R scripting with much of the functionality of LaTeX.

Markdown and RMarkdown

- Markdown trades some of LaTeX's range of use for significant improvements in ease of use.
- RMarkdown combines Markdown with an R script editor that is almost as clear as the normal R script editor.



The screenshot shows an RStudio window with a file named "Example Problem Set.Rmd". The editor displays R Markdown code. The code includes a YAML header with metadata (title, author, date, output), R code chunks for setting up the document, a text block explaining R Markdown, an R code chunk for summarizing cars, a text block explaining LaTeX-style math formatting, and another R code chunk for plotting pressure. The code is as follows:

```
1- ---
2- title: "GOVT 701 Problem Set 1"
3- author: "Theodore Landsman"
4- date: "8/20/2021"
5- output: pdf_document
6- ---
7-
8- ```{r setup, include=FALSE}
9- knitr::opts_chunkset(echo = TRUE)
10- ```
11-
12- ## R Markdown
13- This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more
14- details on using R Markdown see <http://rmarkdown.rstudio.com>.
15-
16- When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R
17- code chunks within the document. You can embed an R code chunk like this:
18-
19- ```{r cars}
20- summary(cars)
21- ```
22-
23- You can also write out math in LaTeX style by wrapping it in dollar symbols, wrapping a line in single dollar symbols $ will Make
24- it Appear As Math Inline$
25-
26- Double Dollar Signs Make Math Appear As An Equation Below Your Paragraph.
27-
28-
29- ## Including Plots
30- You can also embed plots, for example:
31-
32- ```{r pressure, echo=FALSE}
33- plot(pressure)
34- ```
35-
36- Note that the "echo = FALSE" parameter was added to the code chunk to prevent printing of the R code that generated the plot.
```

RMarkdown Output

The image shows a side-by-side comparison of R Markdown source code and its rendered output. On the left, the RStudio editor displays the source file 'Example Problem Set.Rmd'. A red circle highlights the 'Knit' button in the top toolbar, with a red arrow pointing to the rendered output on the right. The source code includes a YAML header, a title, author, date, and output format (pdf_document). It also contains R code chunks for setting options, summarizing the 'cars' dataset, and displaying a summary of 'cars'. The rendered output on the right shows the resulting PDF document, which includes the title 'GOVT 701 Problem Set 1', author 'Theodore Landsman', date '8/20/2021', and the R Markdown text. The summary of 'cars' is displayed as a table, and the 'summary(cars)' command is wrapped in LaTeX to show the distribution of 'speed' and 'displacement'.

```
1 ---
2 title: "GOVT 701 Problem Set 1"
3 author: "Theodore Landsman"
4 date: "8/20/2021"
5 output: pdf_document
6 ---
7
8 [r setup, include=FALSE]
9 knitr::opts_chunk$set(echo = TRUE)
10
11
12 ## R Markdown
13 This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents.
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17 code chunks within the document. You can embed an R code chunk like this:
18
19 [r cars]
20 summary(cars)
21
22 You can also write out math in LaTeX style by wrapping it in dollar symbols, wrapping a line in single dollar
23 symbols will make it appear as Math Inlines
24
25 Double Dollar Signs Make Math Appear As An Equation Below Your Paragraph.
26
27 [r cars]
28
29 Chunk 2: cars
```

GOVT 701 Problem Set 1

Theodore Landsman

8/20/2021

R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
## speed      dist
## Min.   : 4.0   Min.   : 2.00
## 1st Qu.:12.0   1st Qu.: 26.00
## Median :15.0   Median : 36.00
## Mean   :15.4   Mean   : 42.08
## 3rd Qu.:19.0   3rd Qu.: 56.00
## Max.   :25.0   Max.   :120.00
```

You can also write out math in LaTeX style by wrapping it in dollar symbols, wrapping a line in single dollar symbols will make it appear as Math Inlines

$$\frac{1}{x^2} = x^{-2}$$

Double Dollar Signs Make Math Appear As An Equation Below Your Paragraph.

$$E = mc^2$$

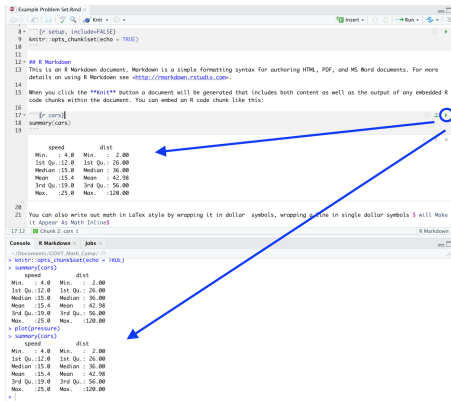
Including Plots You can also embed plots, for example:

pressure

temperature

Note that the echo = FALSE parameter was added to the code chunk to prevent printing of the R code that generated the plot.

RMarkdown Scripting



```
8 > rmarkdown::render("example-problem-set.Rmd", output_format = "pdf", quiet = TRUE)
9 knitr::opts_chunk$set(echo = TRUE)
10
11
12 ## R Markdown
13 This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more
14 details on using R Markdown see <http://rmarkdown.rstudio.com>.
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18
19 ```{r cars}
20 summary(cars)
21 ```
22
23 You can also write out math in LaTeX style by wrapping it in dollar symbols, wrapping a line in single dollar symbols $ will make
24 it appear as math inline.
```

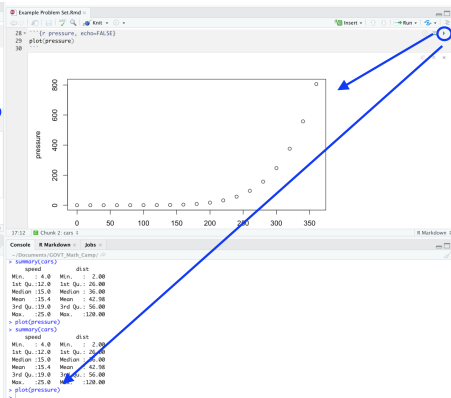
Chunk 2: cars

```
summary(cars)
  speed      dist
Min.   : 4.0  Min.   : 2.00
1st Qu.:12.0  1st Qu.: 26.00
Median :15.0  Median : 36.00
Mean   :15.4  Mean   : 42.98
3rd Qu.:19.0  3rd Qu.: 56.00
Max.   :25.0  Max.   :120.00
```

Console

```
> summary(cars)
  speed      dist
Min.   : 4.0  Min.   : 2.00
1st Qu.:12.0  1st Qu.: 26.00
Median :15.0  Median : 36.00
Mean   :15.4  Mean   : 42.98
3rd Qu.:19.0  3rd Qu.: 56.00
Max.   :25.0  Max.   :120.00
```

(c) Console Output with RMarkdown



(d) Plot Output with RMarkdown

Problem Sets for GOVT 701

- Because RMarkdown allows you to include code in your writeup, with `“{r include = TRUE}”` it is great for projects where we are evaluating your coding skills like 701 problem sets.
- For those of you who are going on to 701 with some coding background. Writing problem sets in RMarkdown is a great way to make the class a little more challenging while preparing yourself for academic paper writing.
- If you want an even harder challenge, using Sweave or Overleaf for Data Essays is also an option, but has a lower value-add for work required relative to RMarkdown for problem sets.
- Don't kill yourself trying to do this if you aren't there! Submitting a word document and r script for problem sets is also fine.

Conclusion

- That's it for math camp, its been a pleasure teaching you all, and happy to answer any questions you have about Latex and Markdown.
- We will take a quick break, then have a quick session where you can ask any questions you have about PhD student life.