STATS 266 Handout - Rmarkdown and LaTeX

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1 Introduction

Welcome to **STATS 266: Introduction to R**. This handout provides an introduction about writing reports with Rmarkdown. **RMarkdown** is a powerful tool for creating **reproducible reports** that combine **text, R code, and output** (tables, plots, equations).By the end of this document, you should be able to:

- Formatting text in RMarkdown
- Adding code chunks and executing R code
- Creating tables and plots
- Writing mathematical equations using LaTeX

For this part, valuable materials to refer to include https://rmarkdown.rstudio.com/lesson-1.html and https://ourcodingclub.github.io/tutorials/rmarkdown/.

2 Formatting Text in RMarkdown

2.1 Headers

Use `#` for **headers**:

```
# Header 1
## Header 2
### Header 3
```

output:

3 Header 1

3.1 Header 2

3.1.1 Header 3

3.2 Bold, Italic and Inline Code

```
- **Bold** : **text**
- *Italic* : *text*
- `Inline Code` : `x <- 10`
```

- **Bold** : **text**
- *Italic* : *text*
- `Inline Code` : `x <- 10`

3.3 List

```
- Item 1
- Item 2
  - Sub-item 2.1
  - Sub-item 2.2
```

Output:

- Item 1
- Item 2
  - Sub-item 2.1
  - Sub-item 2.2

4 Adding Code Chunks

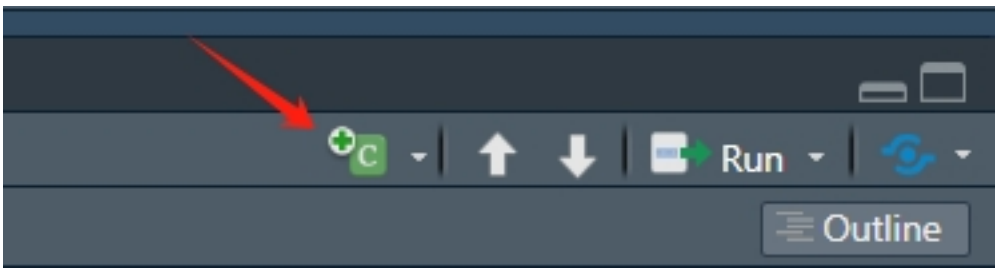
In RMarkdown, R code is placed inside code chunks:

```
# Sample R code
x <- rnorm(100)  # Generate 100 random numbers
mean(x)          # Compute mean
```

```
## [1] -0.08795135
```

You can click the button:

```
knitr::include_graphics(here::here("./pics/rmd.jpg"))
```



Or just input three “’ and finish the chunk with another three.

5 Code Chunk Options

You can modify how code chunks behave by using chunk options:

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -2.05994 -0.52454 -0.03321  0.08913  0.77719  2.89643
```

the argument echo means whether the code will exist in the final pdf/html that you knit. Of course, you can put ggplots in the R chunk and make some plots in the final documents. You can also makes slides with Rmarkdown. Refer to:https://rmarkdown.rstudio.com/lesson-11.html.

6 Include a Picture

As simple as using an R chunk

```
#knitr::include_graphics("path/to/your/jpg")
```

In the chunk options you will be able to modify the size of the figures, alignment of the figures, too.

7 Include a Table

```
library(knitr)
kable(head(mtcars), caption = "Table of `mtcars` Data")
```

Table 1: Table of `mtcars` Data

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225	105	2.76	3.460	20.22	1	0	3	1

8 Latex Equations

A big advantage of Rmarkdown is that it's perfectly integrated to write equations in the Latex. Begin with dollar signs:

$$\beta_1 = \frac{\sum(X_i - \bar{X})(Y_i - \bar{Y})}{\sum(X_i - \bar{X})^2}$$

Refer to: https://www.bu.edu/math/files/2013/08/LongTeX1.pdf for a summary of commonly used Latex commands.

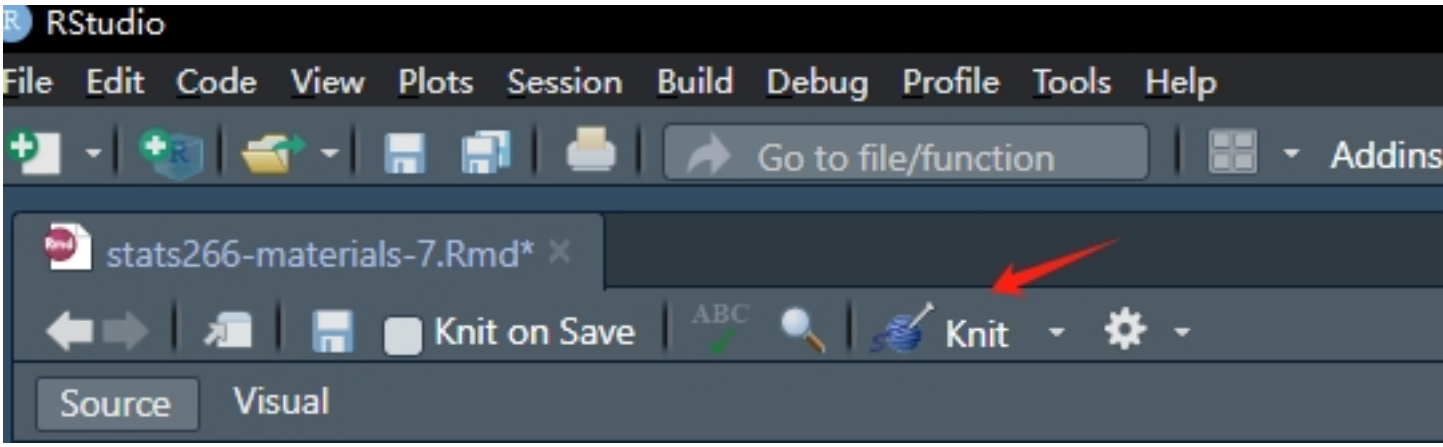
9 Rendering RMarkdown to Different Formats

You can convert .Rmd files to different formats:

- HTML: output: html_document
- PDF : output: pdf_document
- Word : output: word_document

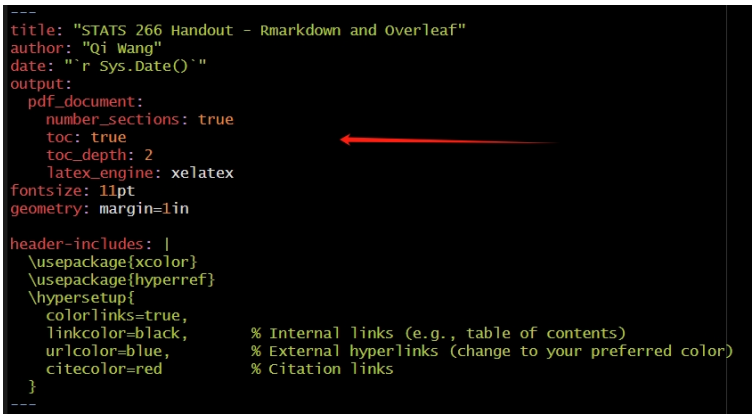
You can simply click the "knit" to render your file:

```
knitr::include_graphics(here::here("./pics/knit.jpg"))
```



Note: If you want to knit to a pdf document, it sometimes report weird bugs. Most of the time it can be solved via installing the tinytex and use the xelatex engine. Remember, the yaml of the file can be revised to adjust the format of the files.

```
knitr::include_graphics(here::here("./pics/yaml.jpg"))
```



9.1 More in PDF

I believe most of you are solely interested in knitting to PDF since you can write a paper, or submit a homework in this format. Let me talk more about it.

9.1.1 Install TinyTeX (If not installed)

```
# install.packages("tinytex")
# tinytex::install_tinytex()
```

I commented it since I don't need, but when you run this code, get rid of "#".

9.1.2 Modify the yaml

```
---
title: "My Document"
author: "Your Name"
date: "2025-03-01"
output:
  pdf_document:
    latex_engine: xelatex
fontsize: 12pt
mainfont: "Times New Roman"
---
```

The most important part is the output part, based on the pdf_document, now we have another argument, latex engine. Choose that to be xelatex. If you want to include latex packages add:

```
header-includes:
  - \usepackage{graphicx}
  - \usepackage{amsmath}
```

to the yaml. Refer to: https://bookdown.org/yihui/rmarkdown-cookbook/latex-extra.html.

10 More..

Remember, when writing a paper including many equations, latex is my personal recommendation. It's is a powerful paper tools that can include professional looking paper. Usually, the journal will provide some template files, and you can work directly on the template. There is also an online LaTeX editor known as Overleaf, where collaborators can work together on writing a document. Refer to: https://www.overleaf.com/learn/latex/Tutorials for more information of Overleaf. I strongly recommend getting used to this online writing tool.

11 Ackowledgement

This teaching material is adapted from the previous material of this course made by Marcela Alfaro-Córdoba and Sheng Jiang.