Computational Bootcamp 5: LaTeX, Markdown, and Formatting Documents for Social Science

Ankushi Mitra

Department of Government

Georgetown University

August 18, 2023

What We'll Be Covering Overall

1. Software installation, file management
2. Basics of R: data structures, writing code, creating objects, packages
3. R: working with datasets
4. More R: data manipulation, visualization
5. LaTex: producing documents with Markdown and Overleaf

What We'll Be Covering Today

1. Why document preparation tools?

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2. RMarkdown

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3. LaTeX in Overleaf

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3. LaTeX in Overleaf
4. LaTeX in RMarkdown

Why document preparation tools?

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

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

- This is something normal text editors like word and google docs don't do well and aren't really meant for.
- LaTeX and RMarkdown are document preparation tools that can help you produce nice-looking, professional documents.

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- Document structure
  - An R Markdown document consists of text written in a combination of plain text and markdown, interspersed with code chunks.

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- Code chunks are blocks of code that you can include within your document to execute and display the results directly in the document output. Code chunks are enclosed in three backticks (```) and specify the programming language (e.g., r for R code).

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````
```{r}
x <- c(1:5)
mean(x)
```
````

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````
```{r setup, include=FALSE, warnings=FALSE,
messages=FALSE, error=FALSE,
pagenumbering="arabic"}
knitr::opts_chunk$set(message = FALSE, warning=FALSE)
library(tidyverse)
library(ggplot2)
library(stargazer)
```
````

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- This is followed by chunk options. include=FALSE indicates that the code and its output within this chunk should not be included in the final rendered document. warnings=FALSE, messages=FALSE, error=FALSE suppress warnings, messages, and errors from appearing in the output. pagenumbering=”arabic” sets the page numbering style.

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- `knitr::opts_chunk` sets global chunk options which will apply to all code chunks within the document. In this case, it suppresses messages and warnings.
- By including this setup code at the beginning of your RMarkdown document, you ensure consistent behavior for code chunks throughout the document.

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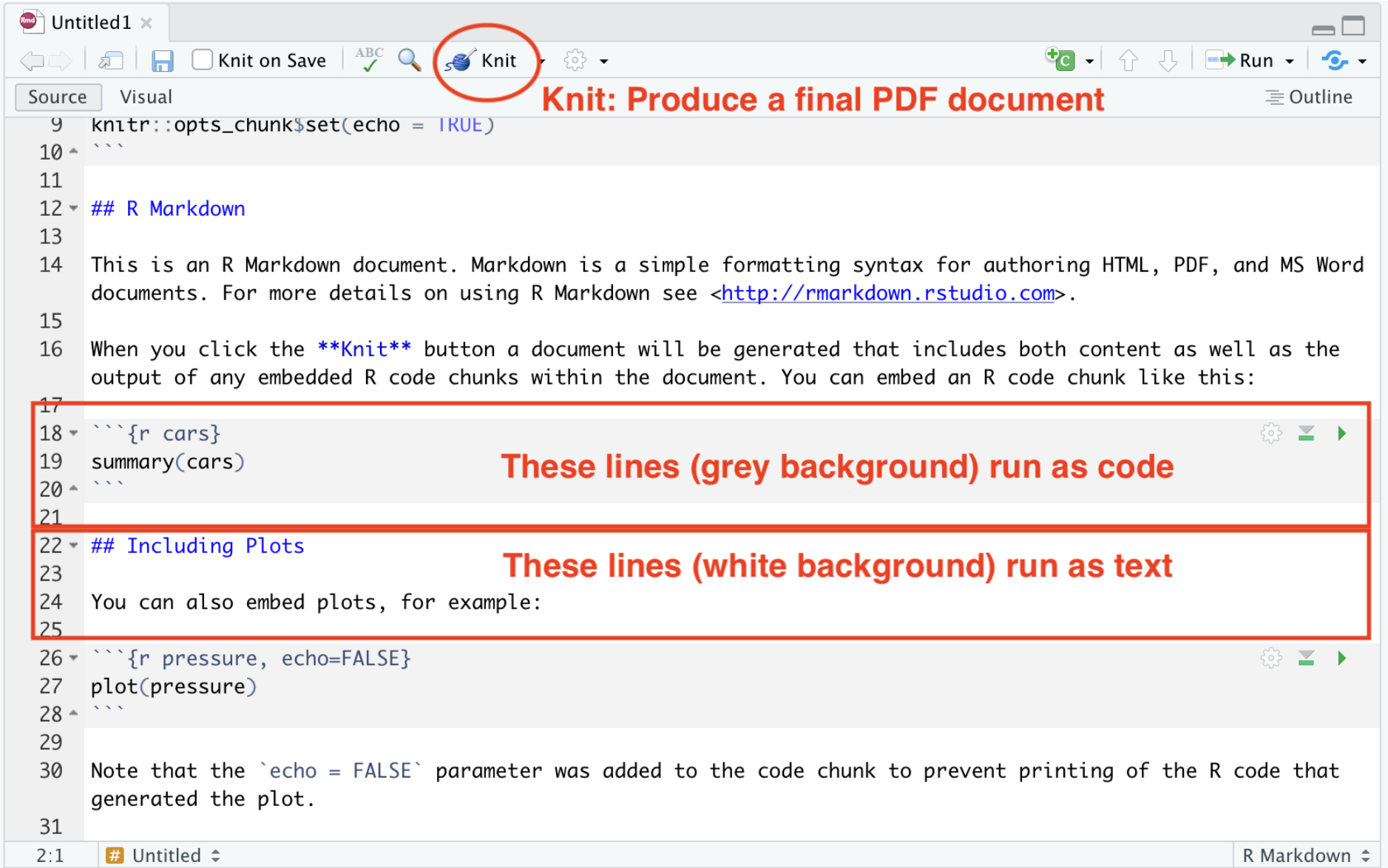
- Click the "Knit" button in RStudio to compile your RMarkdown document. R Markdown will execute the code chunks, generate outputs like plots and tables, and combine everything into the final document.

RMarkdown


Untitled1
Knit on Save
Knit
Run
Source
Visual
Outline
Knit: Produce a final PDF document
knitr::opts_chunk$set(echo = TRUE)
```
## 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:
```{r cars}
summary(cars)
```
These lines (grey background) run as code
Including Plots
These lines (white background) run as text
You can also embed plots, for example:
```{r pressure, echo=FALSE}
plot(pressure)
```
Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.
2:1
Untitled
R Markdown
```

Working with RMarkdown

- Exercise:
  - Create a new RMarkdown document. Specify the output format as PDF.

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- Understanding the interface

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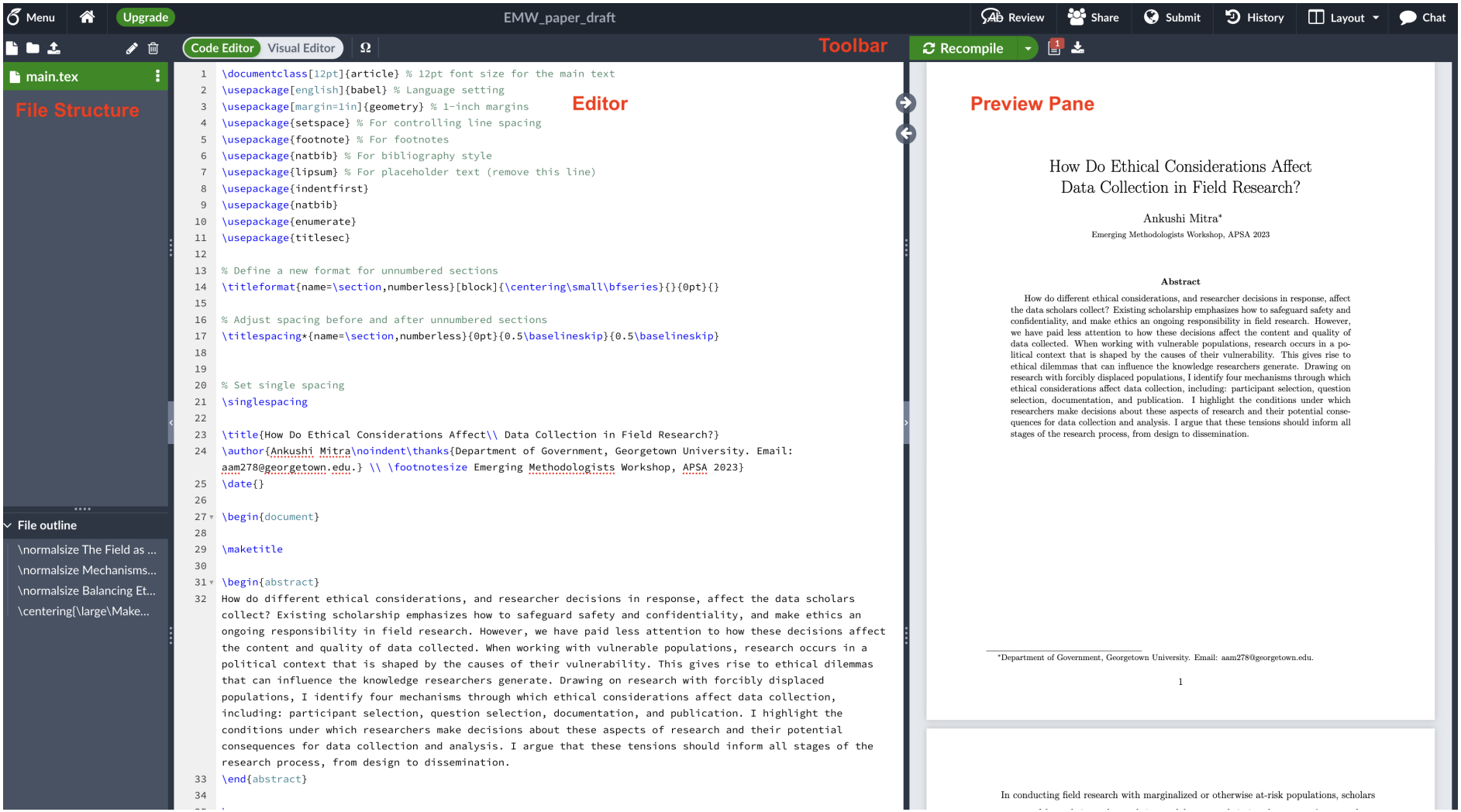


```
\documentclass[12pt]{article} % 12pt font size for the main text
\usepackage[english]{babel} % Language setting
\usepackage[margin=1in]{geometry} % 1-inch margins
\usepackage{setspace} % For controlling line spacing
\usepackage{footnote} % For footnotes
\usepackage{natbib} % For bibliography style
\usepackage{lipsum} % For placeholder text (remove this line)
\usepackage{indentfirst}
\usepackage{natbib}
\usepackage{enumerate}
\usepackage{titlesec}

% Define a new format for unnumbered sections
\titleformat{name=\section,numberless}[block]{\centering\small\bfseries}{}{0pt}{}

% Adjust spacing before and after unnumbered sections
\titlespacing*{name=\section,numberless}{0pt}{0.5\baselineskip}{0.5\baselineskip}


% Set single spacing
\singlespacing

\title{How Do Ethical Considerations Affect\\ Data Collection in Field Research?}
\author{Ankushi Mitra\noindent\thanks{Department of Government, Georgetown University. Email:
aam278@georgetown.edu.} \\ \footnotesize Emerging Methodologists Workshop, APSA 2023}
\date{}

\begin{document}

\maketitle

\begin{abstract}
How do different ethical considerations, and researcher decisions in response, affect the data scholars
collect? Existing scholarship emphasizes how to safeguard safety and confidentiality, and make ethics an
ongoing responsibility in field research. However, we have paid less attention to how these decisions affect
the content and quality of data collected. When working with vulnerable populations, research occurs in a
political context that is shaped by the causes of their vulnerability. This gives rise to ethical dilemmas
that can influence the knowledge researchers generate. Drawing on research with forcibly displaced
populations, I identify four mechanisms through which ethical considerations affect data collection,
including: participant selection, question selection, documentation, and publication. I highlight the
conditions under which researchers make decisions about these aspects of research and their potential
consequences for data collection and analysis. I argue that these tensions should inform all stages of the
research process, from design to dissemination.
\end{abstract}
```

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```
\section{Introduction}
```

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```
\textbf{Bold text}
\textit{Italic text}

\begin{itemize}
    \item Item 1
    \item Item 2
\end{itemize}
```

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\end{itemize}
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- Add equations:

```
\begin{equation}
    E=mc^2
\end{equation}
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Formatting Regression Tables

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- Exercise: Pass the regression model you created from the *economics* dataset as an argument to the *stargazer()* function in your RMarkdown document.

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- Exercise: Pass the regression model you created from the *economics* dataset as an argument to the *stargazer()* function in your RMarkdown document.
- Copy and paste the output from the console to the editor window in Overleaf. Make sure it is enclosed within `\begin{document}` and `\end{document}`. Click Recompile.

Regressions in R

```
> model <- lm(uempmed ~ pce + psavert, data = economics)
> summary(model)

Call:
lm(formula = uempmed ~ pce + psavert, data = economics)

Residuals:
    Min      1Q  Median      3Q     Max
-7.6236 -1.3653 -0.1258  0.9355 10.3775

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -6.451e+00  6.342e-01  -10.17   <2e-16 ***
pce          1.459e-03  4.354e-05   33.50   <2e-16 ***
psavert      9.372e-01  5.225e-02   17.94   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.259 on 571 degrees of freedom
Multiple R-squared:  0.6984,    Adjusted R-squared:  0.6974
F-statistic: 661.2 on 2 and 571 DF,  p-value: < 2.2e-16
```

Output in R Console

Table 1:

	Dependent variable:
	uempmed
pce	0.001^{***}
	(0.00004)
psavert	0.937^{***}
	(0.052)
Constant	-6.451^{***}
	(0.634)
Observations	574
R^2	0.698
Adjusted R^2	0.697
Residual Std. Error	2.259 (df = 571)
F Statistic	661.223^{***} (df = 2; 571)
Note:	*p<0.1; **p<0.05; ***p<0.01

Output in Overleaf

LaTeX in RMarkdown

- You can also use LaTeX in RMarkdown. One way is to use the distribution TinyTex.

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

- Once TinyTeX is installed, you can use it to compile your RMarkdown documents that include LaTeX code. When you render your RMarkdown document, TinyTeX will automatically handle the LaTeX compilation process to generate the PDF output.

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- Exercise:
  - Load the packages *tidyverse*, *stargazer* and *tinytex* in RMarkdown.
  - Specify results='asis' as a chunk option to indicate that the output of the R code within the chunk should be directly inserted into the document.

````
```{r, results='asis'}
# your code here
```
````

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    ```
    ```{r, results='asis'}
    # your code here
    ```
    ```

- Pass the regression model you created from the *economics* dataset as an argument to the *stargazer()* function within this code chunk.

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    # your code here
    ```
    ```

- Pass the regression model you created from the *economics* dataset as an argument to the *stargazer()* function within this code chunk.
- Knit the RMarkdown document. Examine the PDF output.

Formatting Regression Tables

- Try modifying the chunk option to also include echo=FALSE. Knit the RMarkdown document. Examine the PDF output.

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```
```{r, results='asis', echo=FALSE}
#Run regression
model <- lm(uempmed ~ pce + psavert, data = economics)
#Create stargazer table
stargazer(model)
```
```

Resources for RMarkdown and LaTeX

- R Markdown: The Definitive Guide

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- R Markdown: The Definitive Guide
- R Markdown: R For Data Science

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- R graph gallery