Lecture 2: R Markdown, Version Control with Git(Hub), and Other Productivity Tools

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*Parts of these slides are adapted from "Advanced Data Analytics" by Nick Hagerty and "Data Science for Economists" by Grant McDermott.

Table of Contents

Prologue

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Before we dive in, let's double check that we all have

- ☑ Installed **R**.
- ☑ Installed **RStudio**.
- ☑ Signed up for an account on **Github**
- ☑ Installed **Git** and **Github Desktop**
- ☑ Log into your Github account on Github Desktop

R Markdown

R Markdown

Before we dive into version control, let's chat about **R Markdown**.

R Markdown is a document type that allows for integration of R code and output into a Markdown document.

Resources:

- Website: **rmarkdown.rstudio.com**
- **R Markdown Cheatsheet**
- Book: **R Markdown: The Definitive Guide** (Yihui Xie, JJ Allaire, and Garrett Grolemund)

R Markdown

Before we dive into version control, let's chat about **R Markdown**.

R Markdown is a document type that allows for integration of R code and output into a Markdown document.

Other points:

- We'll be completing assignments using R Markdown.
- FWIW, my lecture slides and notes are all written in R Markdown too. (E.g. This slide deck is built using the **xaringan** package with the metropolis theme.)

R Markdown: Getting Started

☑ Installed R.

☑ Installed RStudio.

☐ Add the `rmarkdown` package

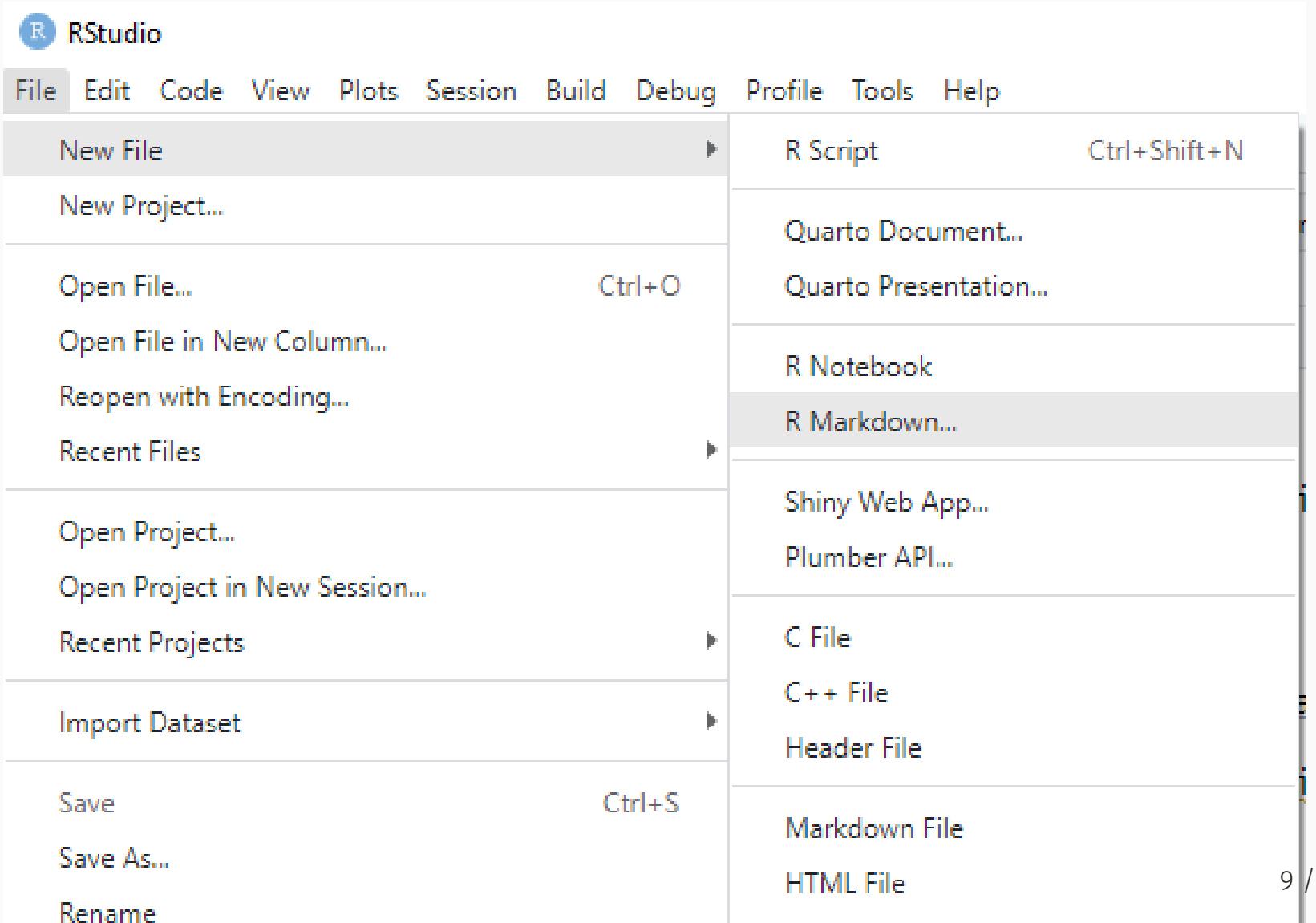
```
install.packages("rmarkdown")
```

☐ Install LaTeX

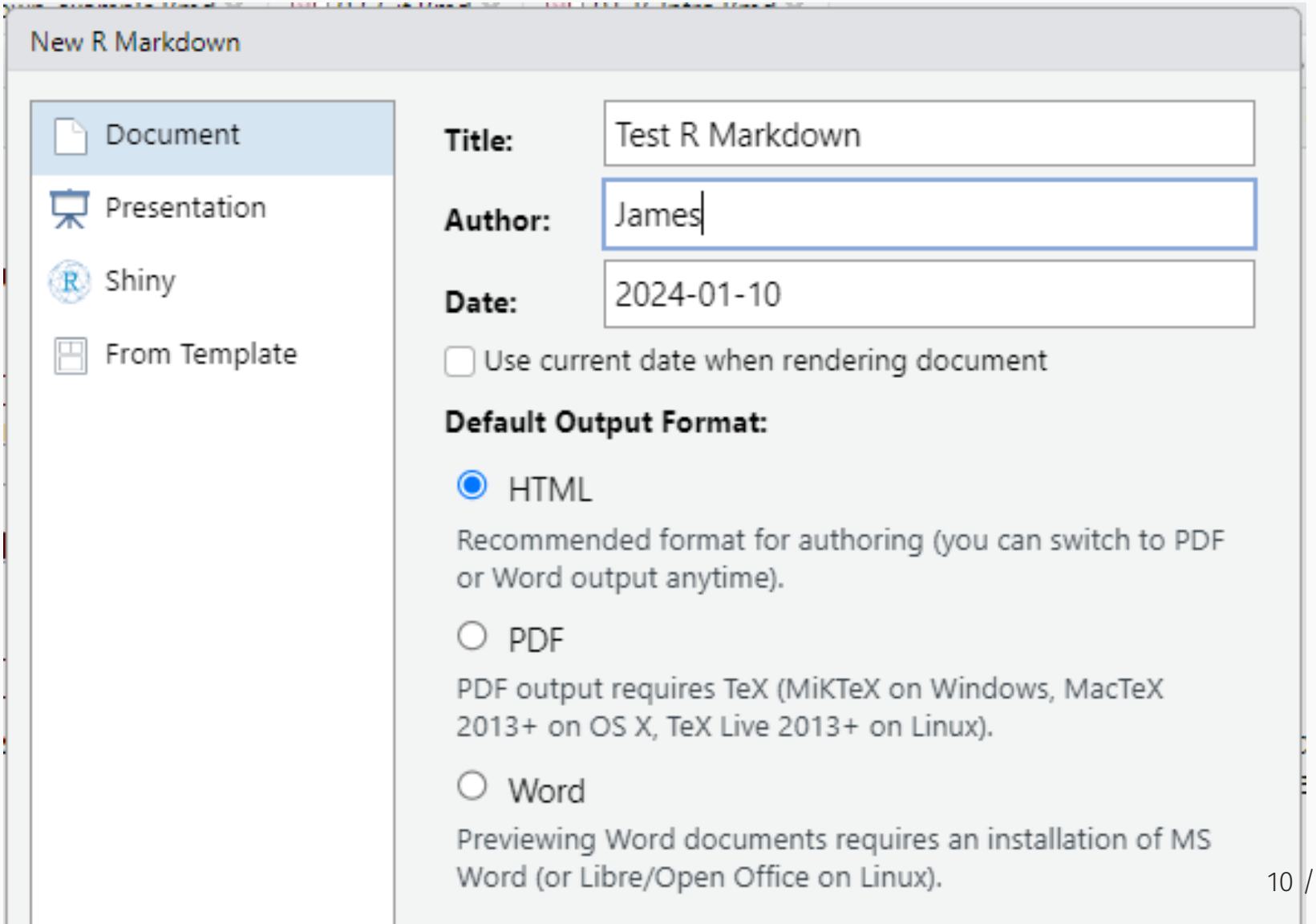
- If just for this, can use **TinyTex**

```
# Install only if you don't have LaTeX already
install.packages("tinytex")
tinytex::install_tinytex()
```

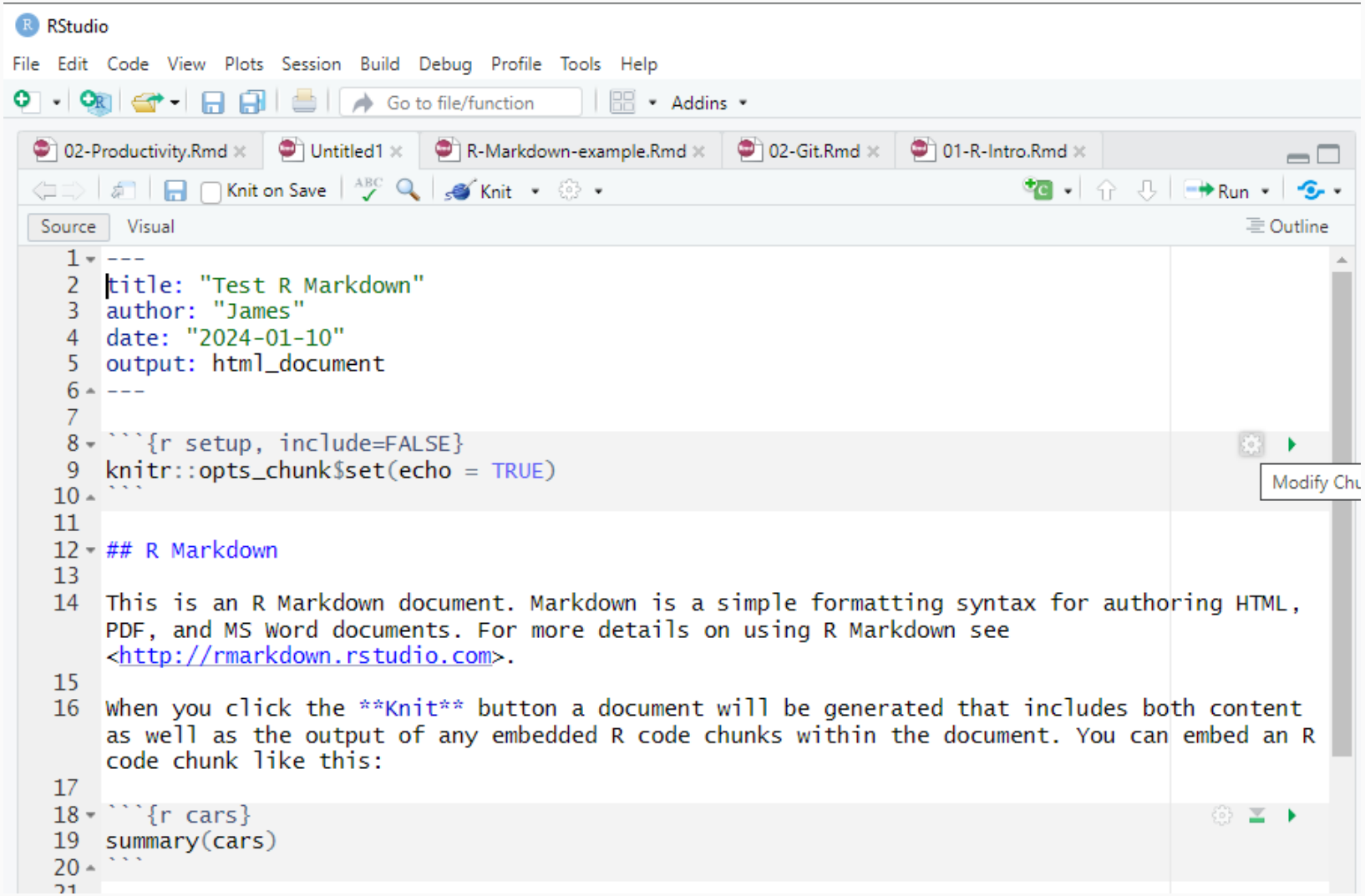
R Markdown: Creating a New .Rmd File



R Markdown: Creating a New .Rmd File



R Markdown: Creating a New .Rmd File



R Markdown Components

R Markdown combines

1. **Markdown:** lightweight markup language
2. **LaTeX:** typesetting for math
3. **R:** include code and generate output

Let's do some practice: **open a new .Rmd file** and try adding content as we go

Markdown

Markdown allows for formatting text in a lightweight way

I highly recommend the handy **Markdown Guide** for more details

Markdown: Heading

Headings emphasize text and add chunks to your script

Largest headingwith one leading # (slide title above)

Second Largest (##)

Third Largest (###)

Getting Smaller... (####)

Normal Text for comparison

Markdown: Text Format

Bold text with **your text**

Italicize with *single asterisks*

Add `code text` with grave accents (the back tick symbol)

- `
- The shift output of the tilde key `~` on keyboard

End a line with two spaces to start a new paragraph

- or leave a line space between sentences

Can also start a new line with backslash (\)

Markdown: Text Format

Add superscripts^{2} with ^carets^

Add ~~strikethroughs~~ with ~tildes~

Add a line break (horizontal rule)

---

with ***

Markdown: Text Format

Draw **tables** using | and -

Col A	Col B	Col C
This	is	a
Table		wow

Markdown: Lists

Add an **ordered list** with **1.**

1. First Item
2. Second Item
3. No need to change the number - keep using 1. It will automatically update.

Add an **unordered list** with *** or -**

- A thing
- Another related thing
    - Indent to nest
        1. Can mix ordered and unordered

Markdown: Inputs

Add a link with []()

- [text label](URL)
- Add direct link with <link> https://www.markdownguide.org

Add an image with

- ![alt text](URL)

practice by adding `images/smile.png`:

R Markdown: LaTeX

Another advantage of R Markdown is that it integrates LaTeX functionality for typesetting math.

Add an **inline equation** with TeX

$$Var(X) = \sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{n} \qquad Y_{it} = \beta_0 + \beta_1 X_{it} + \epsilon_{it}$$

Add multiple rows of LaTeX with

$$

LaTeX lines here

$$

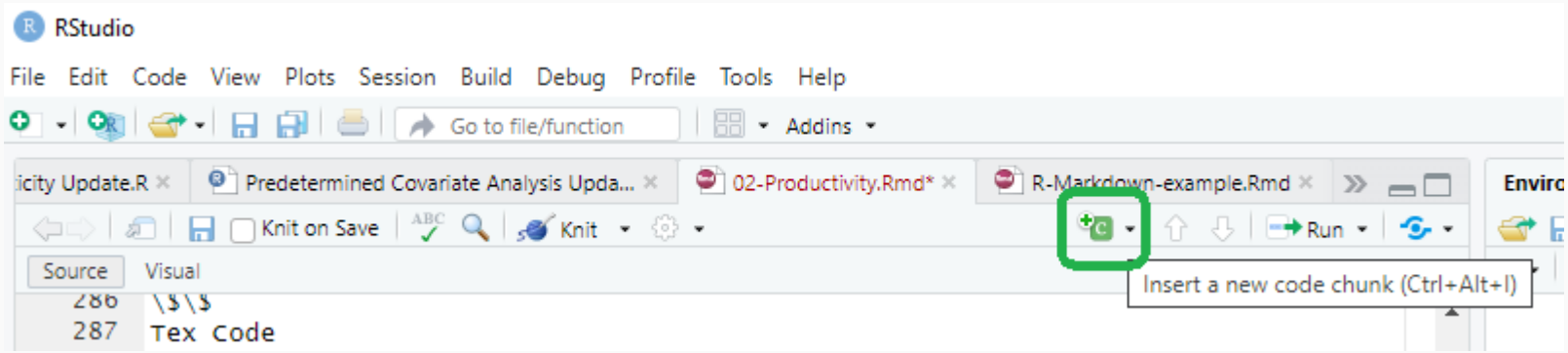
Use the **standard LaTeX commands** for symbols/characters

R Markdown: R Code

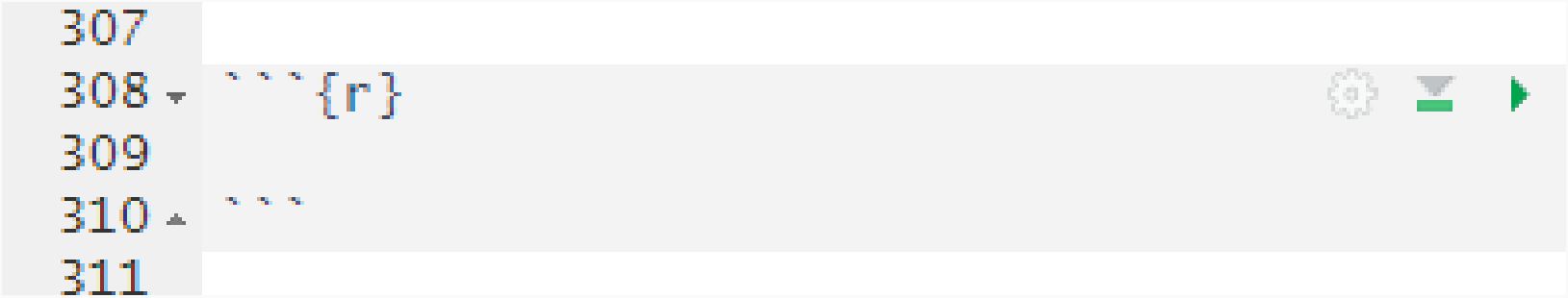
R code is primarily executed with **code chunks**

Add a chunk with

- `Cmd + Option + I (Ctrl + Alt + I on PC)`
- The `Insert` button in the UI
- Manually type



R Markdown: R Code Chunks



Code chunks allow us to add as many lines of code as we want

- Output will appear underneath after executing the full chunk
- Can customize whether it runs, how output is displayed
- Can run manually
  - Line by line with `Cmd/Ctrl + Enter`
  - Entire chunk with `Run Entire Chunk` button

R Markdown: R Code Chunk Options

You can **add chunk options** in brackets after `r` and separated by commas.

Some commonly-used options include:

- **Chunk label** (`ex_chunk`)
- `include = FALSE` will run the chunk but hide it from the final document
- `eval = FALSE` will display code without evaluating it
- `results = 'hide'` runs code but hides output from the final document

````
52
53 ```{r sum, echo = FALSE, warning = FALSE}
54 2+2
55
56 ```
````

R Markdown: R Code Chunk Options

You can **add chunk options** after `r` and separated by commas.

Some commonly-used options include:

- `echo = FALSE` runs the code but hides the chunk from the final document
- `error = FALSE` (`warning: FALSE`) will hide error (warning) messages generated by the code

- LOTS of options for output figures: figure size (fig.width, fig.height, fig.dim), output document scale (out.width, out.height), alignment (fig.align), caption (fig.cap)

  Learn more **about chunk options here**

R Markdown: R Code

You can call R objects from earlier chunks **inline** with

`` `r` ``

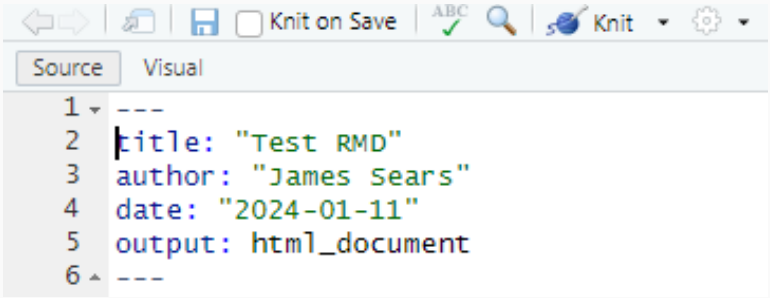
```
four = 2+2
```

This can output in line with text: 2 + 2 = 4

R Markdown File Organization

1. Header

RStudio automatically builds the R Markdown file from a template, which begins with a **header**



- Title
- Author
- Date
- Output Format
  - Main options[1]: HTML (`html_document`), PDF (`pdf_document`), LaTeX (`latex_document`), or Word (`word_document`)

1: See **CH 3 of "R Markdown: The Definitive Guide" for more on how to customize output formats**

2. R Setup

By default, RStudio adds a **setup** code chunk next.

````
```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)
```
````

- Can set global options
- Useful as your preamble
- For **R Notebooks**, this will automatically be run and is the only place where you can change your working directory

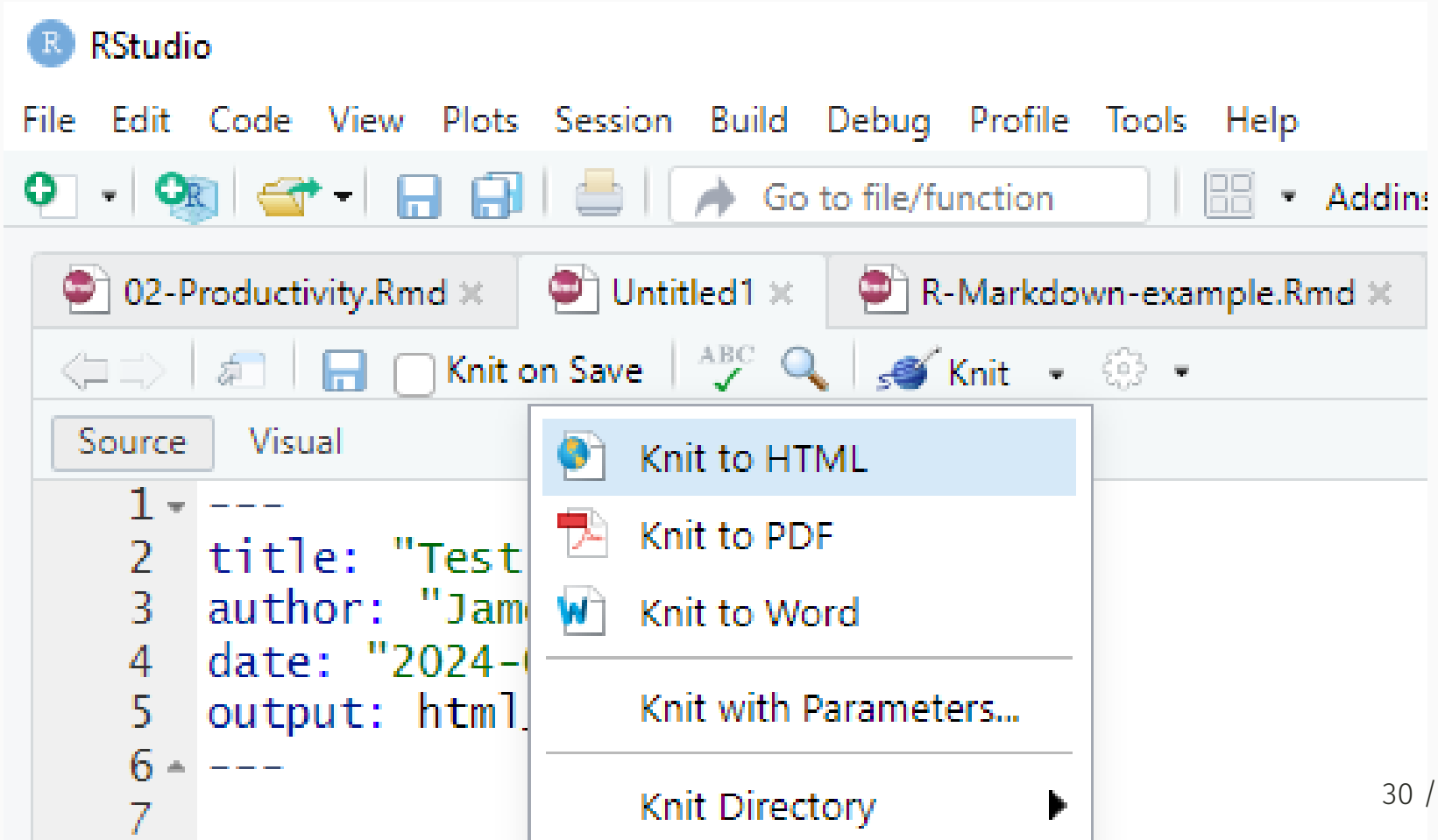
3. Contents

From here on you can build the report/notebook as needed for the task.

- Add any writing and outside graphics or **bibTeX citations**
- Add code chunks to carry out desired analysis
- Employ sections and formatting to structure the document as desired

Compiling/Knitting

When you are ready to compile your final document, use the `Knit` button or `Ctrl/Cmd + Shift + K`



R Markdown: Knit to Compile Output

Markdown Practice!

Markdown Practice

1. Create a new R Markdown file named "R-Markdown-Ex.RMD"
2. In the setup chunk, load the `dslabs` and `tidyverse` packages
    - Use the `data()` function to read in the `divorce_margarine` dataset
3. Add a header labeled "Correlation vs. Causation" and a text explanation below for why we often want to differentiate between the two
4. Add a code chunk with the label `plot`
    - Type the following code:

```
ggplot(divorce_margarine) +
geom_point(aes(x = margarine_consumption_per_capita,
           y = divorce_rate_maine)) +
labs(title = "Relationship between Margarine Consumption and
          Divorce Rates in Maine",
 subtitle = "2000-2009",
 x = "Margarine Consumption per Capita",
y = "Divorce Rate")`
```

5. Knit and save a PDF/HTML copy of the file to the "output" folder