Welcome! Waiting for Workshop to start.

R for Economics Workshop Day 2: Friday Jan 14, **9am** - 4pm CT

Things to do while you wait:

- Start up RStudio following instructions on u.tamu.edu/R4Econ
- Respond to poll “Are you having technical difficulties…?”
- If you need technical assistance, join the breakout room.

R for Economics

Wesley Brashear

14 January 2022

Day 2 - Friday, January 14th, 9:00-4:00

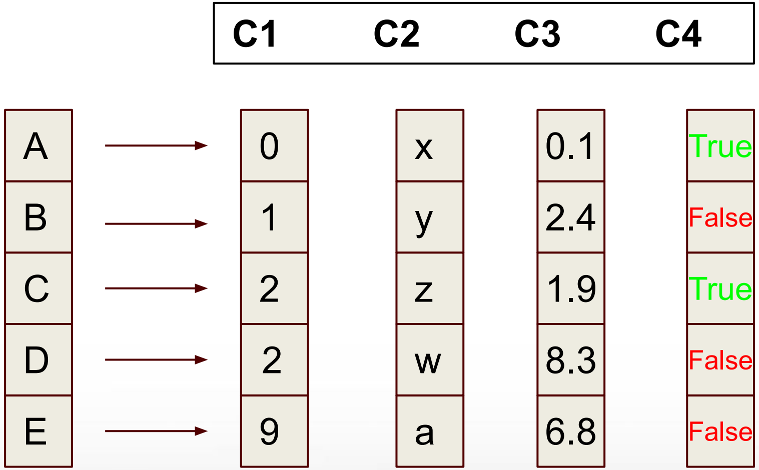
1. Starting RStudio
2. Warm-up Review
3. Matrices
4. Data Frames
5. Data visualization in R
6. User-created functions
7. Working with R markdown

Data Frames

Zhenhua He
14 January 2022

DataFrame

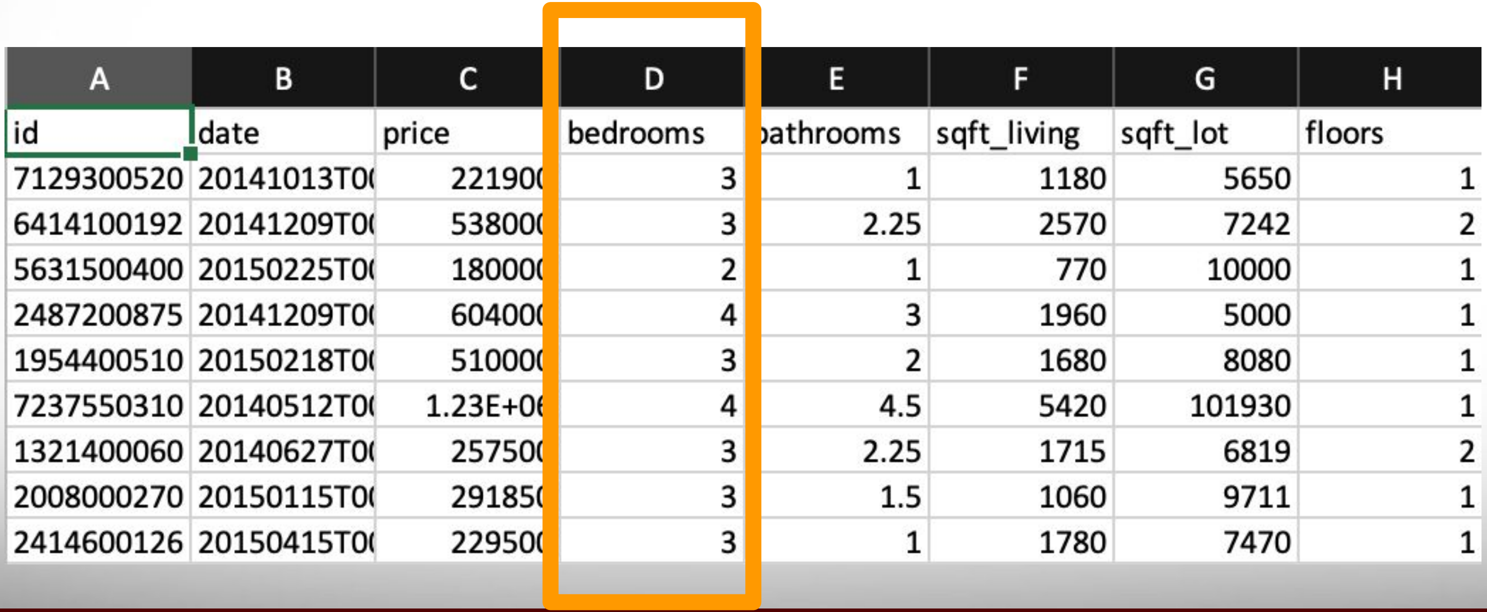
- Primary R data structure
- Two-dimensional size-mutable
- Heterogeneous tabular data structure



	C1	C2	C3	C4
A	0	x	0.1	True
B	1	y	2.4	False
C	2	z	1.9	True
D	2	w	8.3	False
E	9	a	6.8	False

DataFrame Example

house sale data



A	B	C	D	E	F	G	H
id	date	price	bedrooms	athrooms	sqft_living	sqft_lot	floors
7129300520	20141013T0	22190	3	1	1180	5650	1
6414100192	20141209T0	53800	3	2.25	2570	7242	2
5631500400	20150225T0	18000	2	1	770	10000	1
2487200875	20141209T0	60400	4	3	1960	5000	1
1954400510	20150218T0	51000	3	2	1680	8080	1
7237550310	20140512T0	1.23E+0	4	4.5	5420	101930	1
1321400060	20140627T0	25750	3	2.25	1715	6819	2
2008000270	20150115T0	29185	3	1.5	1060	9711	1
2414600126	20150415T0	22950	3	1	1780	7470	1

Creating a Data Frame

Ways to do so:

- from matrix
- from vectors
- Read file (read.csv, read.table, …)

Break until 1 PM CST

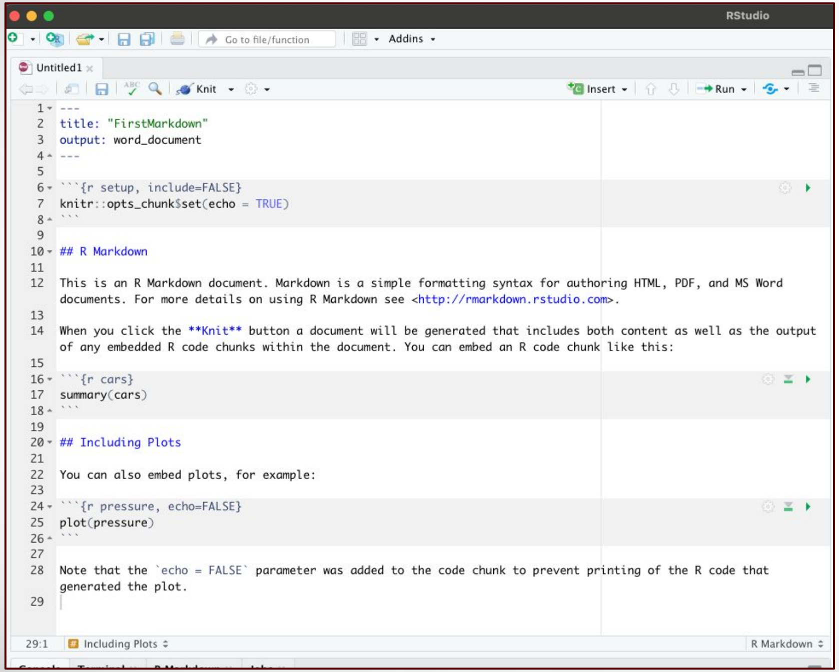
Working with R Markdown

Wesley Brashear
14 January 2022

R Markdown

- Allows users to create reports for data analyzed in R
- Connects data to report = reproducibility
- Supports a variety of outputs:
    - HTML
    - PDF
    - MS word
    - Shiny applications
- Can use multiple languages including R, Python, and SQL

R Markdown



~~~
---
title: "FirstMarkdown"
output: word_document
---

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

R Markdown

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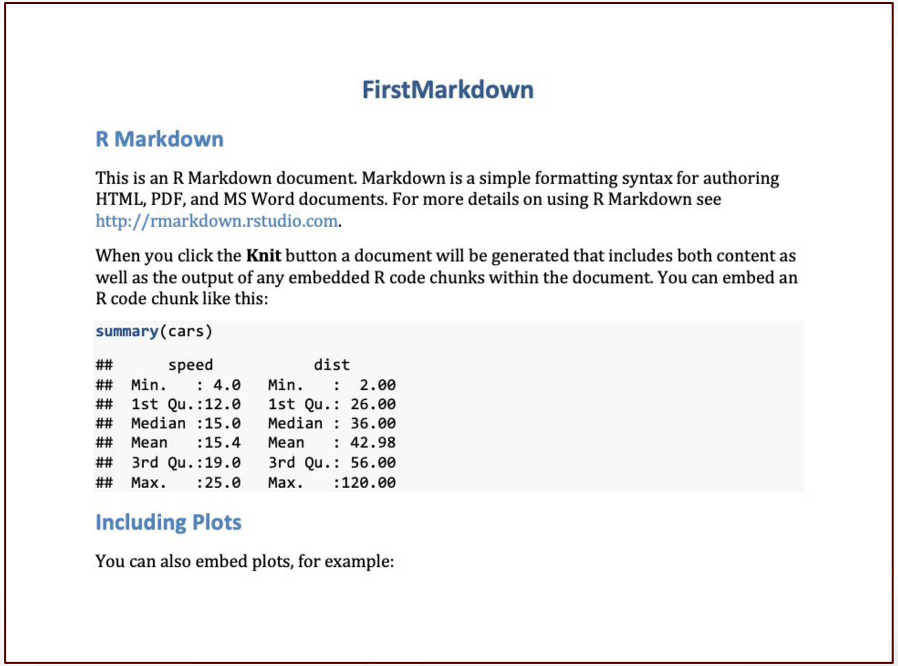

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```

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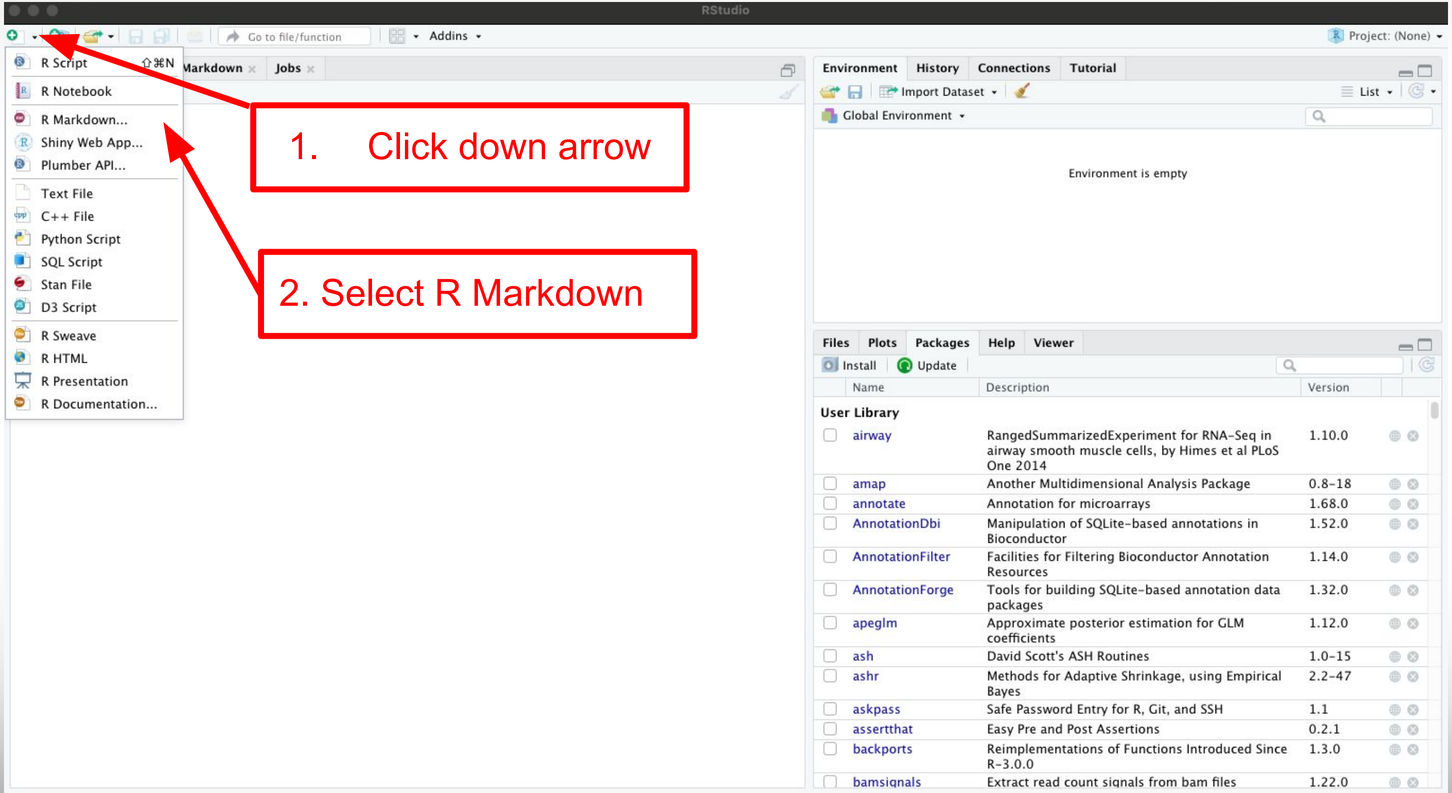
RStudio
Go to file/function
Addins
Project: (None)
R Script ⇧⌘N
R Notebook
R Markdown...
Shiny Web App...
Plumber API...
Text File
C++ File
Python Script
SQL Script
Stan File
D3 Script
R Sweave
R HTML
R Presentation
R Documentation...
Markdown
Jobs
Environment
History
Connections
Tutorial
Import Dataset
List
Global Environment
Environment is empty
Files
Plots
Packages
Help
Viewer
Install
Update

1. Click down arrow

2. Select R Markdown

| | Name | Description | Version |
|---|---|---|---|
| | **User Library** | | |
| ☐ | airway | RangedSummarizedExperiment for RNA-Seq in airway smooth muscle cells, by Himes et al PLoS One 2014 | 1.10.0 |
| ☐ | amap | Another Multidimensional Analysis Package | 0.8-18 |
| ☐ | annotate | Annotation for microarrays | 1.68.0 |
| ☐ | AnnotationDbi | Manipulation of SQLite-based annotations in Bioconductor | 1.52.0 |
| ☐ | AnnotationFilter | Facilities for Filtering Bioconductor Annotation Resources | 1.14.0 |
| ☐ | AnnotationForge | Tools for building SQLite-based annotation data packages | 1.32.0 |
| ☐ | apeglm | Approximate posterior estimation for GLM coefficients | 1.12.0 |
| ☐ | ash | David Scott's ASH Routines | 1.0-15 |
| ☐ | ashr | Methods for Adaptive Shrinkage, using Empirical Bayes | 2.2-47 |
| ☐ | askpass | Safe Password Entry for R, Git, and SSH | 1.1 |
| ☐ | assertthat | Easy Pre and Post Assertions | 0.2.1 |
| ☐ | backports | Reimplementations of Functions Introduced Since R-3.0.0 | 1.3.0 |
| ☐ | bamsignals | Extract read count signals from bam files | 1.22.0 |

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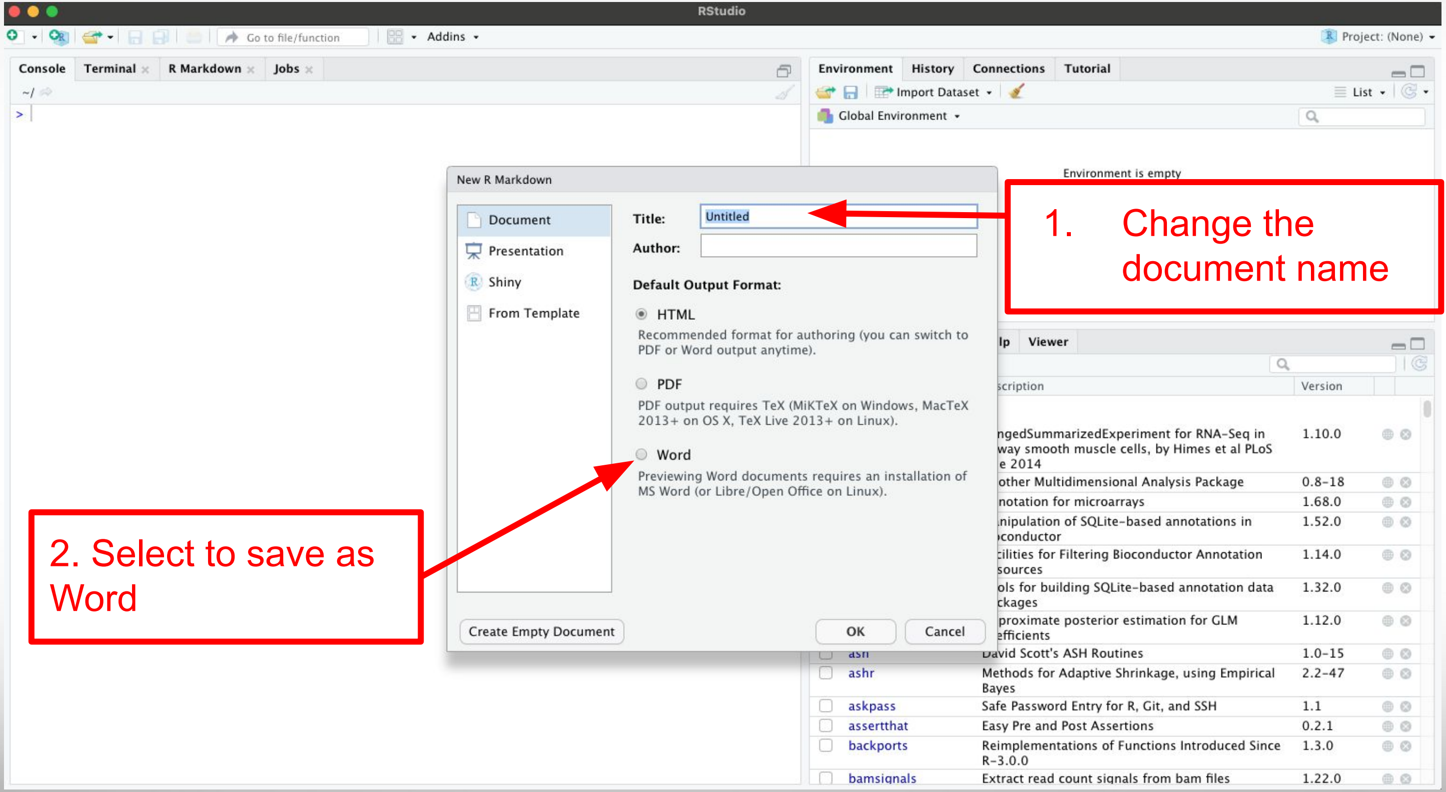
RStudio
Go to file/function
Addins
Project: (None)
Console
Terminal
R Markdown
Jobs
Environment
History
Connections
Tutorial
Import Dataset
List
Global Environment
Environment is empty
lp
Viewer

New R Markdown

- Document
- Presentation
- Shiny
- From Template

**Title:** Untitled

**Author:**

**Default Output Format:**

● HTML

Recommended format for authoring (you can switch to PDF or Word output anytime).

○ PDF

PDF output requires TeX (MiKTeX on Windows, MacTeX 2013+ on OS X, TeX Live 2013+ on Linux).

○ Word

Previewing Word documents requires an installation of MS Word (or Libre/Open Office on Linux).

Create Empty Document | OK | Cancel

| | | scription | Version |
|---|---|---|---|
| | | ngedSummarizedExperiment for RNA-Seq in<br>way smooth muscle cells, by Himes et al PLoS<br>e 2014 | 1.10.0 |
| | | other Multidimensional Analysis Package | 0.8-18 |
| | | notation for microarrays | 1.68.0 |
| | | nipulation of SQLite-based annotations in<br>conductor | 1.52.0 |
| | | cilities for Filtering Bioconductor Annotation<br>sources | 1.14.0 |
| | | ols for building SQLite-based annotation data<br>ckages | 1.32.0 |
| | | proximate posterior estimation for GLM<br>efficients | 1.12.0 |
| ☐ | asn | David Scott's ASH Routines | 1.0-15 |
| ☐ | ashr | Methods for Adaptive Shrinkage, using Empirical Bayes | 2.2-47 |
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1. Change the document name

2. Select to save as Word

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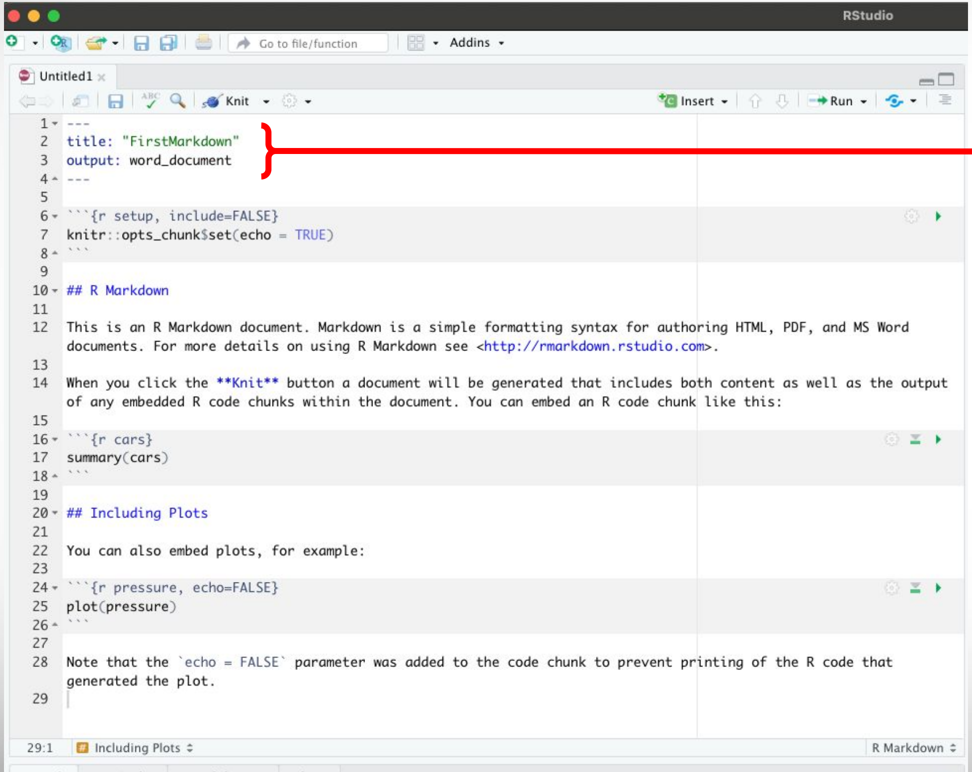

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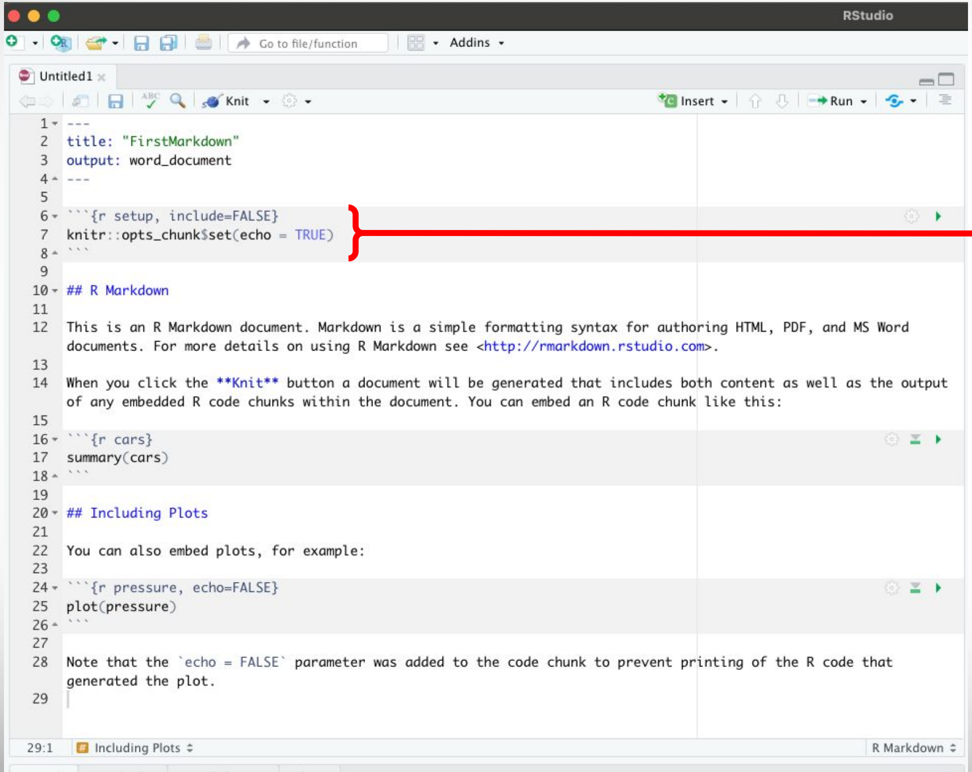
~~~

YAML header:

- Generated automatically
- Opens and closes with ‘- - -’
- Includes title, output format, can also include author and date

R Markdown



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This section is used to set up global options - can be overwritten in individual code chunk headers
```
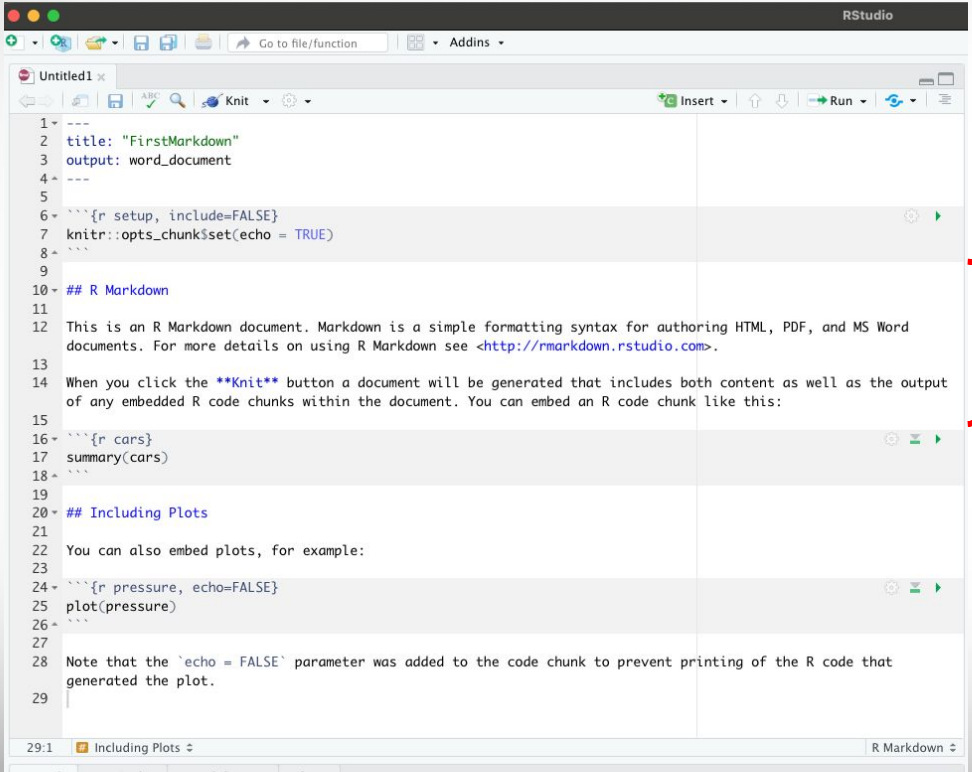

R Markdown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Insert
Run
29:1
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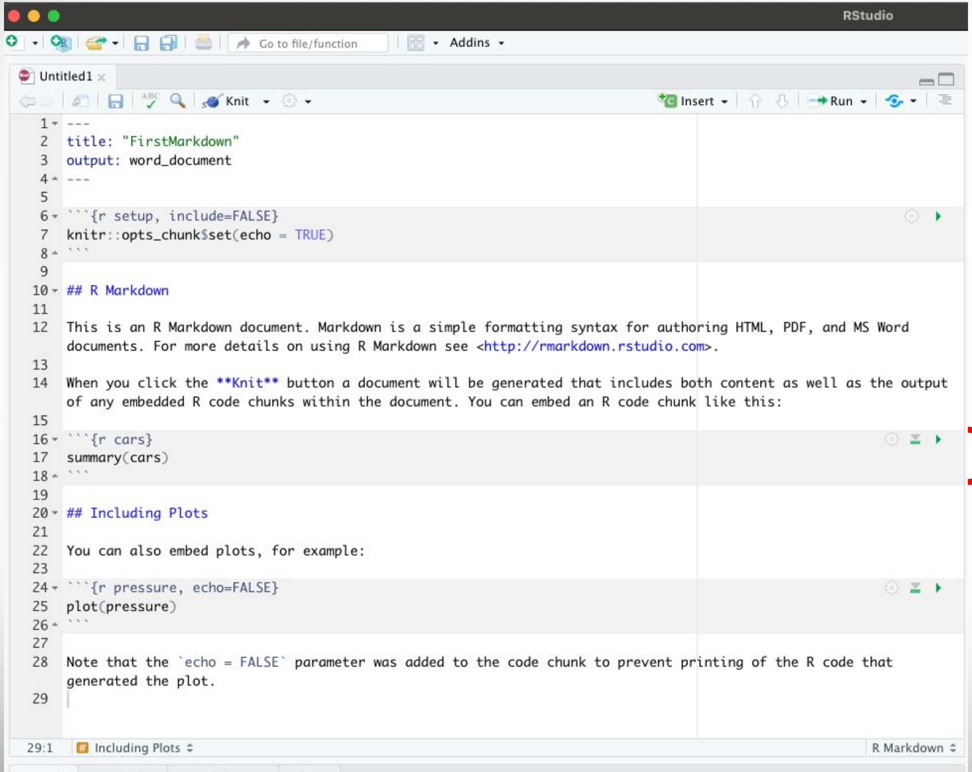

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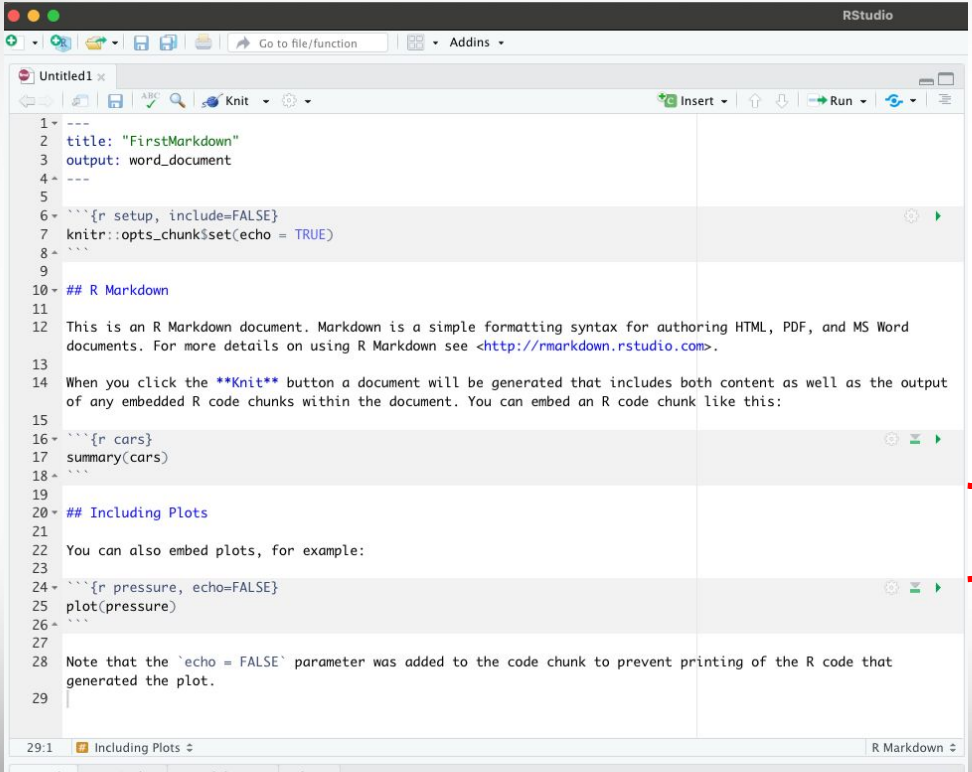
First code chunk.

- Code chunk opens and closes with 3 backticks.
- Curly brackets include r (denoting the language) and the name of the code chunk
- echo = TRUE inherited from code chunk - code will be shown in report

R Markdown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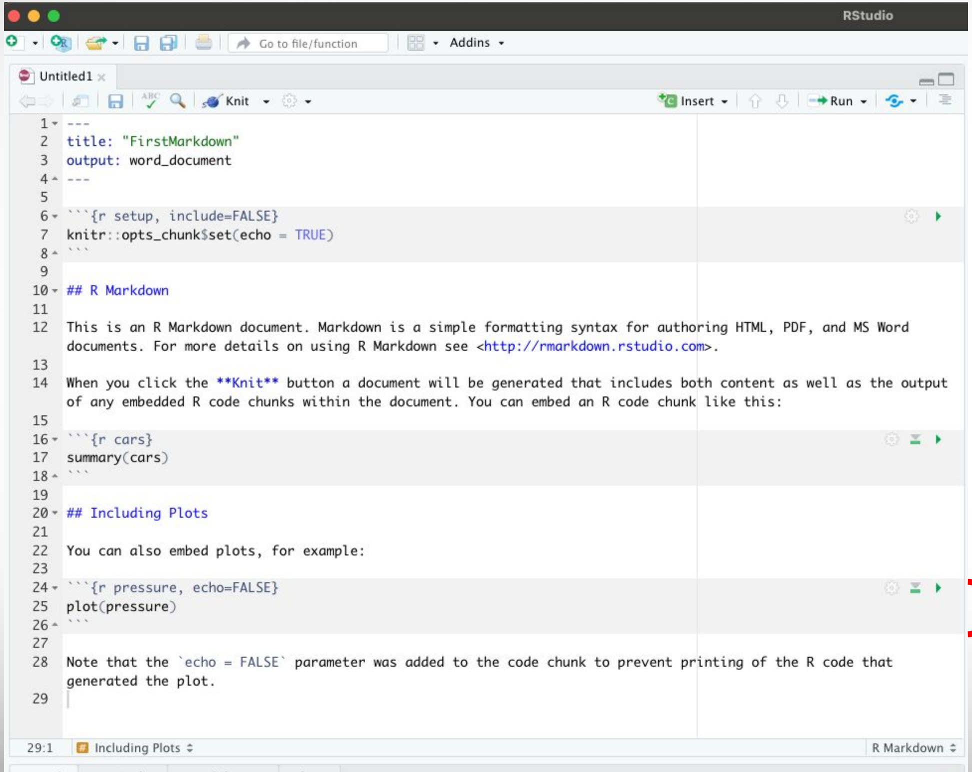

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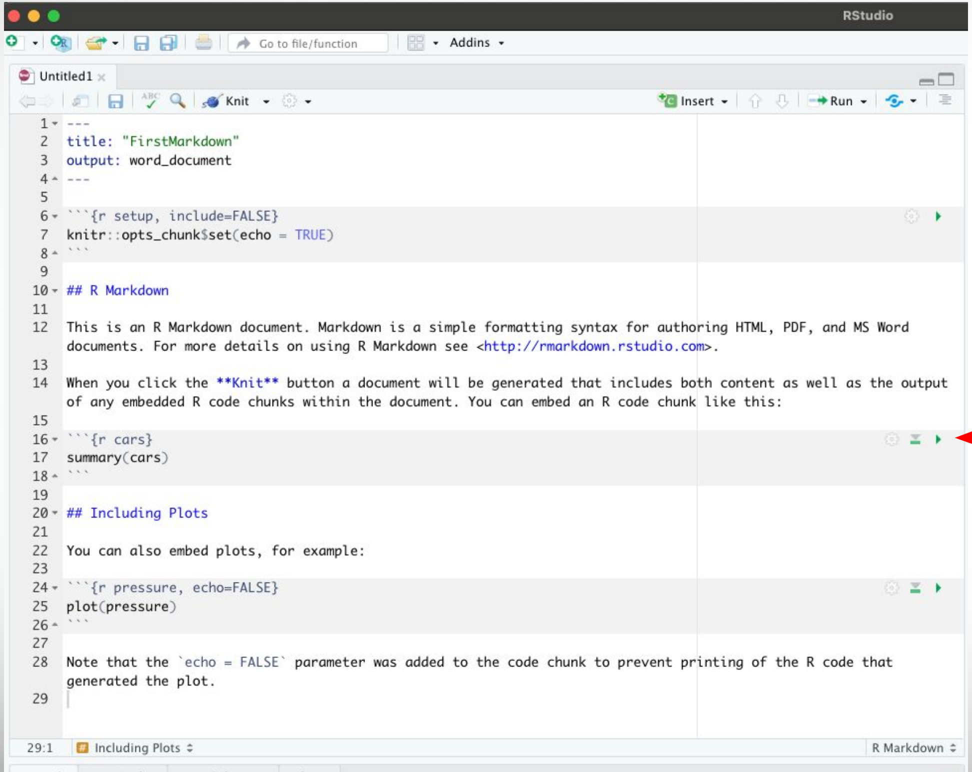
~~~

Second code chunk

- Creates a plot
- echo = FALSE - plot will be in report, but code will not

R Markdown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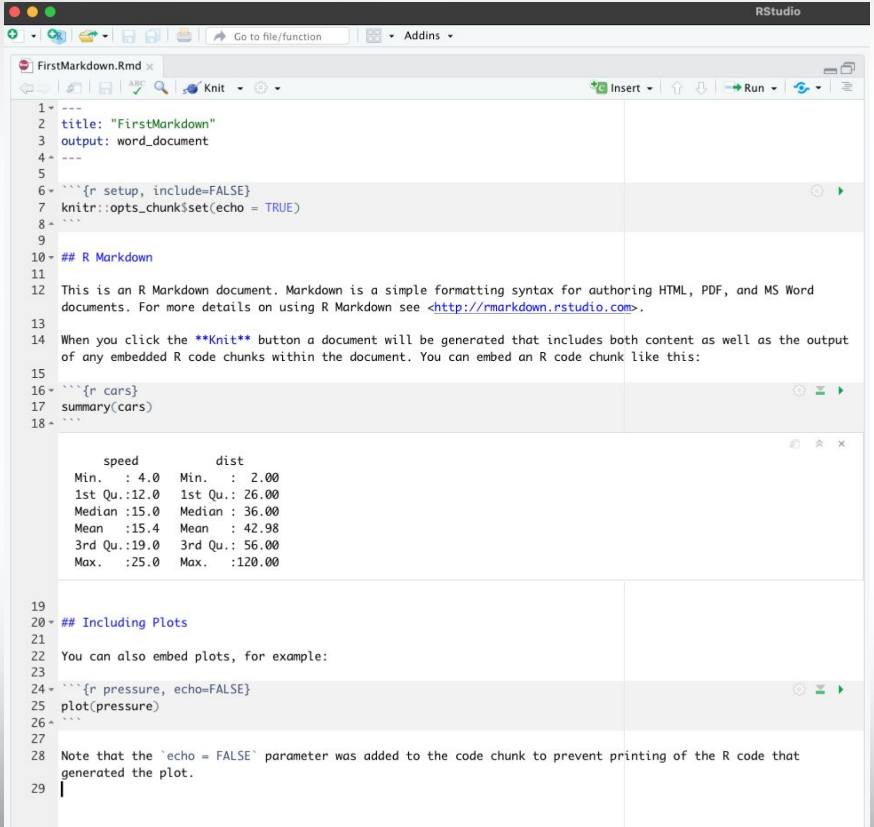
```

This icon allows you to run individual code chunks.
```

R Markdown



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Output

- Allows you to check code before generating report
```

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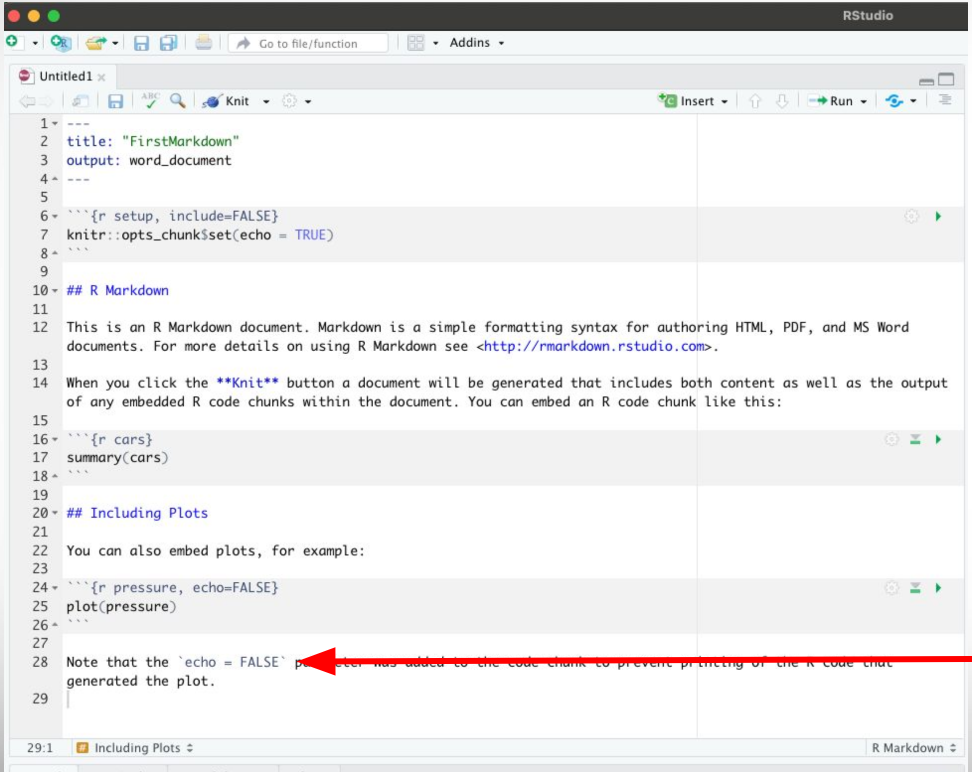
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Inline code opens and closes with single backtick.

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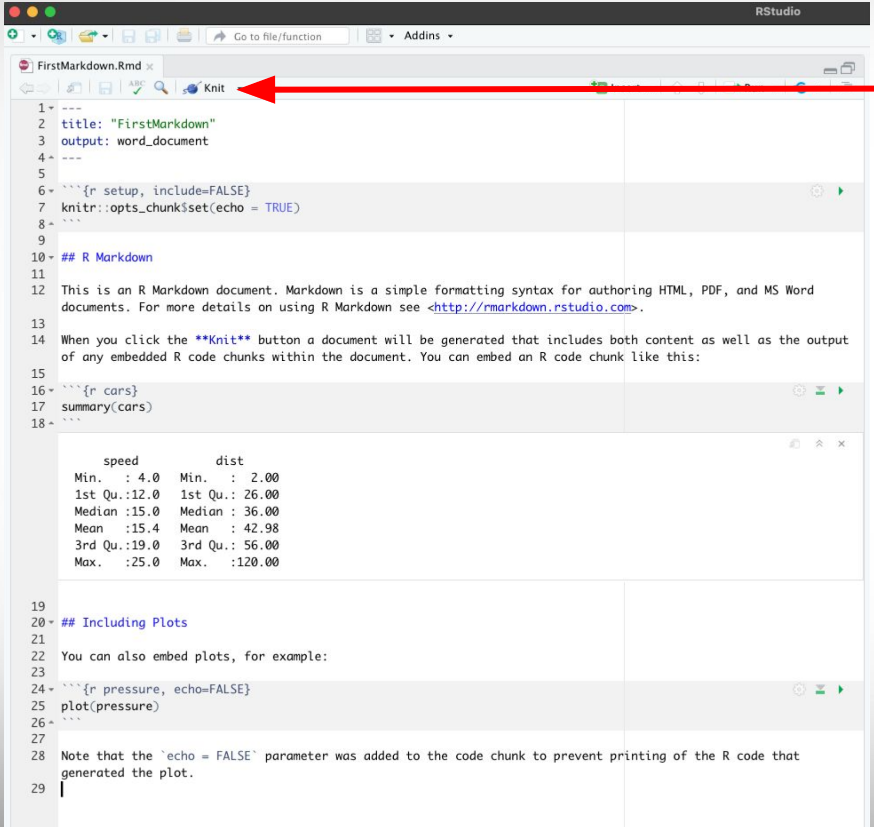

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Click “Knit” to generate report
```

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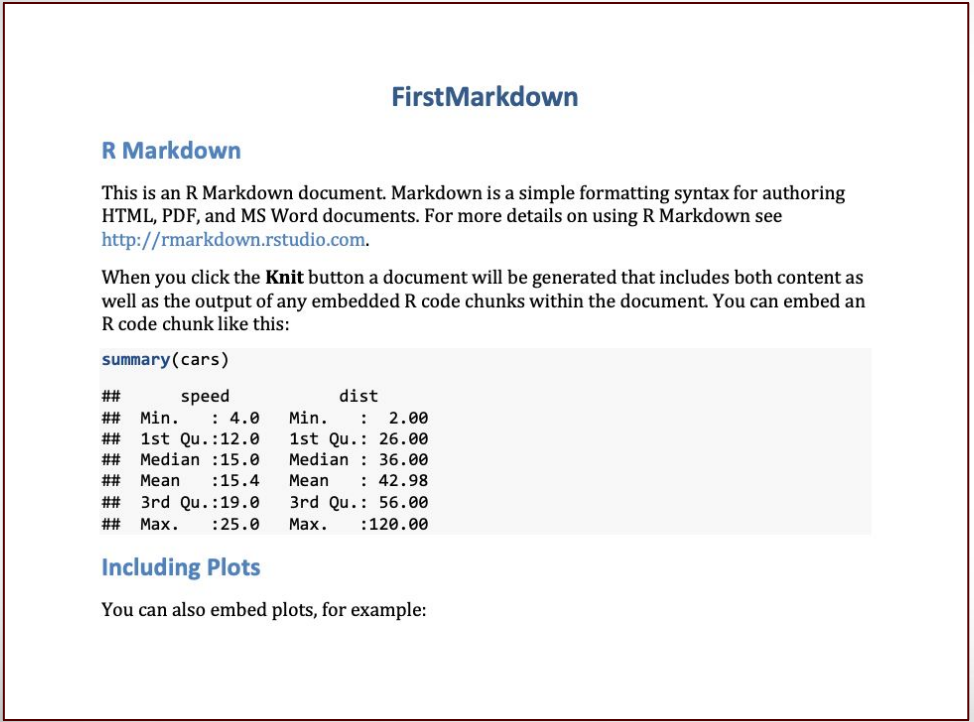

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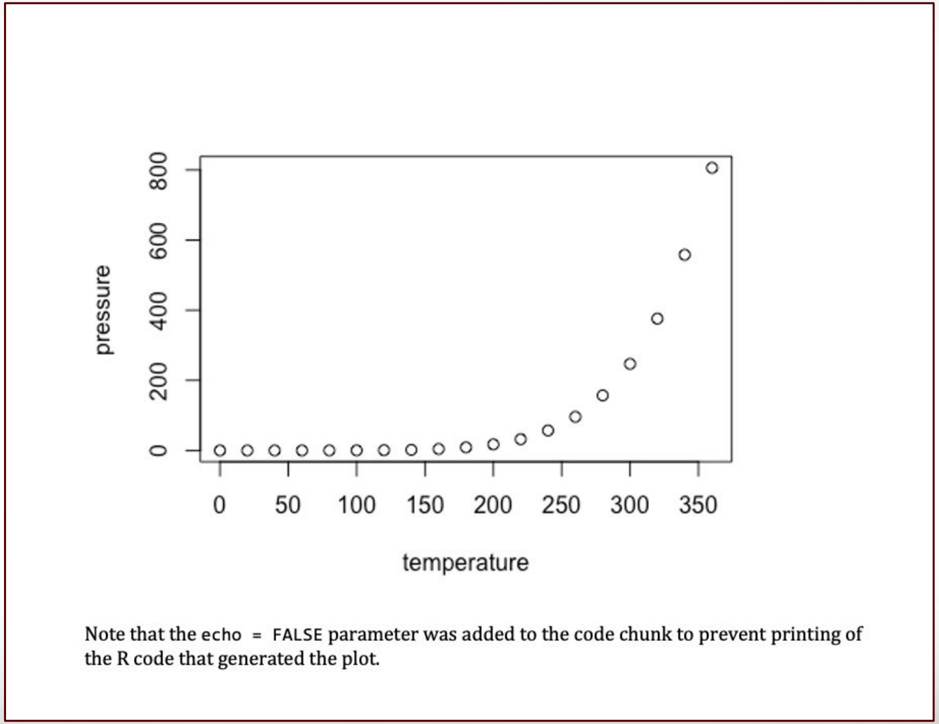

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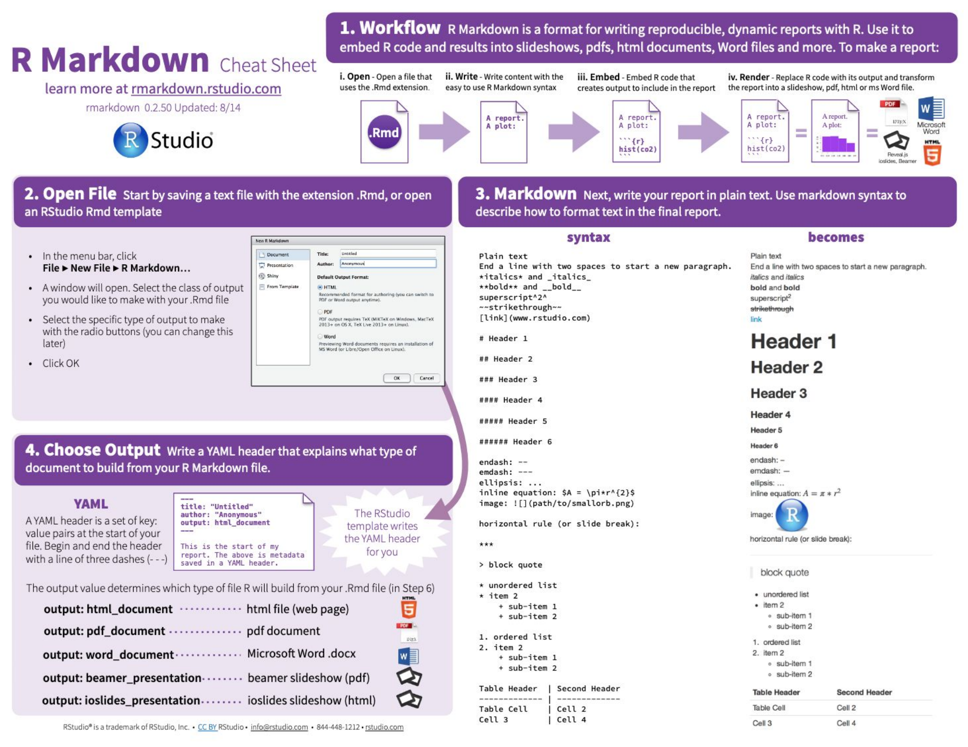
R Markdown Cheat Sheet:

https://www.rstudio.com/wp-content/uploads/2015/02/rmarkdown-cheatsheet.pdf



R Markdown Cheat Sheet
learn more at rmarkdown.rstudio.com
rmarkdown 0.2.50 Updated: 8/14

1. Workflow R Markdown is a format for writing reproducible, dynamic reports with R. Use it to embed R code and results into slideshows, pdfs, html documents, Word files and more. To make a report:

i. Open - Open a file that uses the .Rmd extension.

ii. Write - Write content with the easy to use R Markdown syntax

iii. Embed - Embed R code that creates output to include in the report

iv. Render - Replace R code with its output and transform the report into a slideshow, pdf, html or ms Word file.

.Rmd
A report.
A plot:
```{r}
hist(co2)
```
=
PDF
LaTeX
Microsoft Word
Reveal.js
ioslides, Beamer
HTML

2. Open File Start by saving a text file with the extension .Rmd, or open an RStudio Rmd template

- In the menu bar, click **File ▶ New File ▶ R Markdown...**
- A window will open. Select the class of output you would like to make with your .Rmd file
- Select the specific type of output to make with the radio buttons (you can change this later)
- Click OK

New R Markdown

Title: Untitled
Author: Anonymous

Default Output Format:

● HTML
Recommended format for authoring (you can switch to PDF or Word output anytime).

○ PDF
PDF output requires TeX (MiKTeX on Windows, MacTeX 2013+ on OS X, TeX Live 2013+ on Linux).

○ Word
Previewing Word documents requires an installation of MS Word (or Libre/Open Office on Linux).

3. Markdown Next, write your report in plain text. Use markdown syntax to describe how to format text in the final report.

syntax

```
Plain text
End a line with two spaces to start a new paragraph.
*italics* and _italics_
**bold** and __bold__
superscript^2^
~~strikethrough~~
[link](www.rstudio.com)

# Header 1

## Header 2

### Header 3

#### Header 4

##### Header 5

###### Header 6

endash: --
emdash: ---
ellipsis: ...
inline equation: $A = \pi*r^{2}$
image: ![](path/to/smallorb.png)

horizontal rule (or slide break):

***

> block quote

* unordered list
* item 2
    + sub-item 1
    + sub-item 2

1. ordered list
2. item 2
    + sub-item 1
    + sub-item 2

Table Header  | Second Header
------------- | -------------
Table Cell    | Cell 2
Cell 3        | Cell 4
```

becomes

Plain text
End a line with two spaces to start a new paragraph.
italics and *italics*
bold and **bold**
superscript^2
~~strikethrough~~
link

Header 1

Header 2

Header 3

Header 4

Header 5

Header 6

endash: –
emdash: —
ellipsis: ...
inline equation: $A = \pi * r^2$
image:
horizontal rule (or slide break):

> block quote

- unordered list
- item 2
    - sub-item 1
    - sub-item 2

1. ordered list
2. item 2
    - sub-item 1
    - sub-item 2

Table Header	Second Header
Table Cell	Cell 2
Cell 3	Cell 4

4. Choose Output Write a YAML header that explains what type of document to build from your R Markdown file.

YAML

A YAML header is a set of key: value pairs at the start of your file. Begin and end the header with a line of three dashes (- - -)

```
---
title: "Untitled"
author: "Anonymous"
output: html_document
---

This is the start of my
report. The above is metadata
saved in a YAML header.
```

The RStudio template writes the YAML header for you

The output value determines which type of file R will build from your .Rmd file (in Step 6)

output: html_document	html file (web page)
output: pdf_document	pdf document
output: word_document	Microsoft Word .docx
output: beamer_presentation	beamer slideshow (pdf)
output: ioslides_presentation	ioslides slideshow (html)

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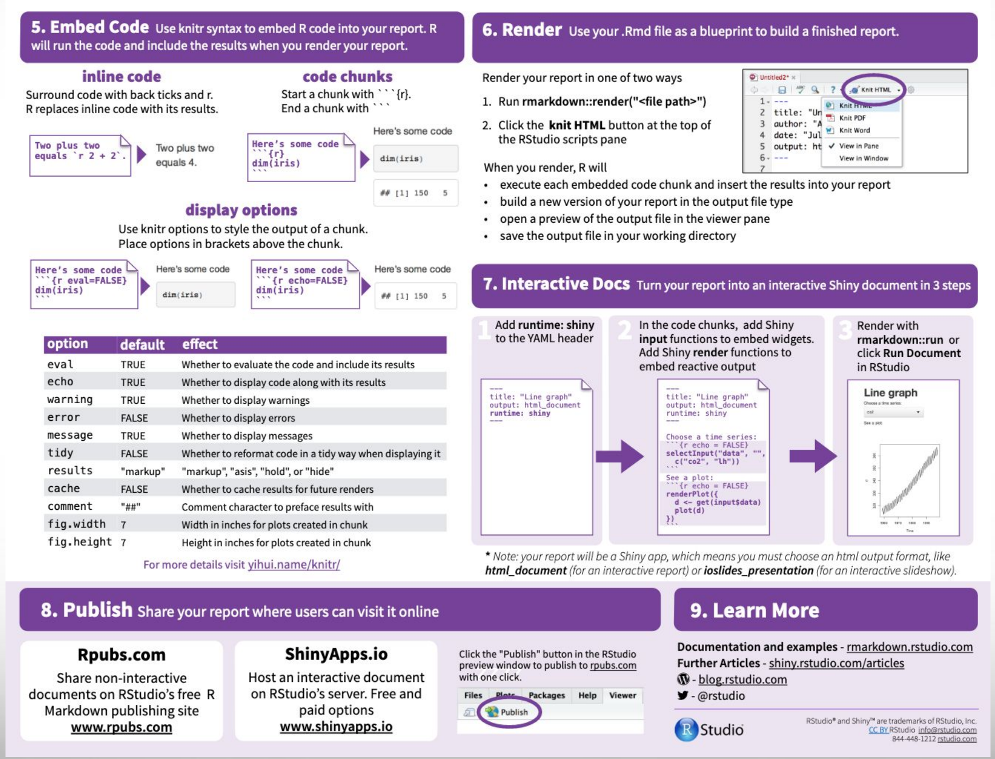
R Markdown Cheat Sheet:

https://www.rstudio.com/wp-content/uploads/2015/02/rmarkdown-cheatsheet.pdf



5. Embed Code
Use knitr syntax to embed R code into your report. R will run the code and include the results when you render your report.

inline code
Surround code with back ticks and r.
R replaces inline code with its results.

```
Two plus two
equals `r 2 + 2`.
```

Two plus two equals 4.

code chunks
Start a chunk with ```{r}.
End a chunk with ```

~~~
Here's some code
```{r}
dim(iris)
```
~~~

Here's some code

```
dim(iris)
```

```
## [1] 150   5
```

display options
Use knitr options to style the output of a chunk.
Place options in brackets above the chunk.

~~~
Here's some code
```{r eval=FALSE}
dim(iris)
```
~~~

Here's some code

```
dim(iris)
```

~~~
Here's some code
```{r echo=FALSE}
dim(iris)
```
~~~

Here's some code

```
## [1] 150   5
```

option	default	effect
eval	TRUE	Whether to evaluate the code and include its results
echo	TRUE	Whether to display code along with its results
warning	TRUE	Whether to display warnings
error	FALSE	Whether to display errors
message	TRUE	Whether to display messages
tidy	FALSE	Whether to reformat code in a tidy way when displaying it
results	"markup"	"markup", "asis", "hold", or "hide"
cache	FALSE	Whether to cache results for future renders
comment	"##"	Comment character to preface results with
fig.width	7	Width in inches for plots created in chunk
fig.height	7	Height in inches for plots created in chunk

For more details visit yihui.name/knitr/

6. Render
Use your .Rmd file as a blueprint to build a finished report.

Render your report in one of two ways

1. Run **rmarkdown::render("<file path>")**
2. Click the **knit HTML** button at the top of the RStudio scripts pane

```
---
title: "Un
author: "A
date: "Jul
output: ht
---
```

When you render, R will

- execute each embedded code chunk and insert the results into your report
- build a new version of your report in the output file type
- open a preview of the output file in the viewer pane
- save the output file in your working directory

7. Interactive Docs
Turn your report into an interactive Shiny document in 3 steps

1 Add **runtime: shiny** to the YAML header

```
---
title: "Line graph"
output: html_document
runtime: shiny
---
```

2 In the code chunks, add Shiny **input** functions to embed widgets. Add Shiny **render** functions to embed reactive output

~~~
---
title: "Line graph"
output: html_document
runtime: shiny
---

Choose a time series:
```{r echo = FALSE}
selectInput("data", "",
  c("co2", "lh"))
```
See a plot:
```{r echo = FALSE}
renderPlot({
  d <- get(input$data)
  plot(d)
})
```
~~~

3 Render with **rmarkdown::run** or click **Run Document** in RStudio

* *Note: your report will be a Shiny app, which means you must choose an html output format, like* ***html_document*** *(for an interactive report) or* ***ioslides_presentation*** *(for an interactive slideshow).*

8. Publish
Share your report where users can visit it online

Rpubs.com
Share non-interactive documents on RStudio's free R Markdown publishing site
www.rpubs.com

ShinyApps.io
Host an interactive document on RStudio's server. Free and paid options
www.shinyapps.io

Click the "Publish" button in the RStudio preview window to publish to rpubs.com with one click.

9. Learn More

Documentation and examples - rmarkdown.rstudio.com
Further Articles - shiny.rstudio.com/articles
- blog.rstudio.com
- @rstudio

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R for Economics Day 2 - Workshop Close

Thank you for attending the workshop!

Resources for the workshop are available at
https://hprc.tamu.edu/events/workshops/2022-01-11-REcon.html

For any questions please email help@hprc.tamu.edu with “R for Economics” in the subject line

For help with technical issues with R you can register for a “Bring Your Own Code” session here:
https://docs.google.com/forms/d/e/1FAIpQLSceBxSHiaPGd-oFWZ8d5024aWfBZyeGUy6RYposaYGpENpUsg/viewform?usp=sf_link

10 minute break