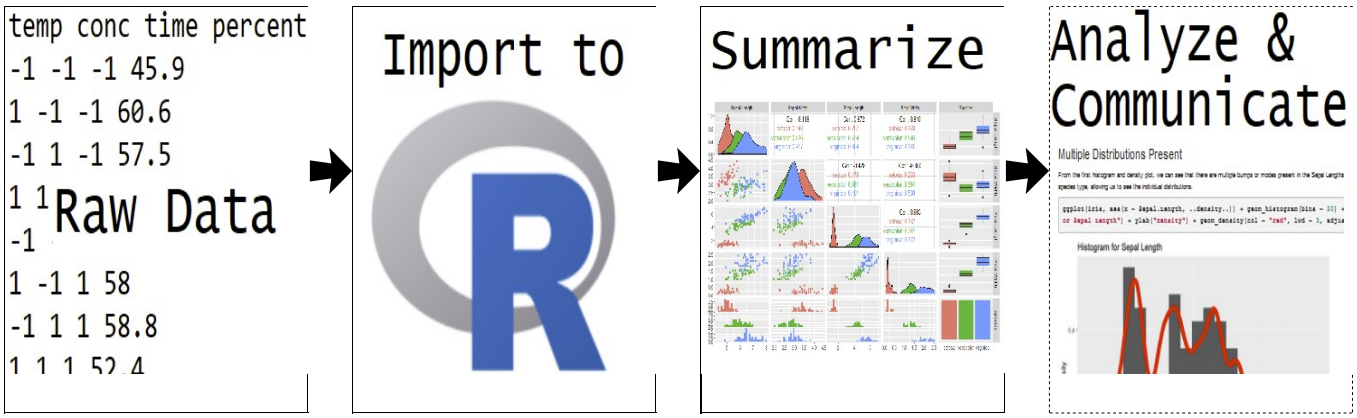
NC STATE UNIVERSITY

Manipulating Data: Documenting with Markdown

Justin Post

What is this course about?

Basic use of R for reading, manipulating, and plotting data!



Recap So Far

Dimension	Homogeneous	Heterogeneous
1d	Atomic Vector	List
2d	Matrix	Data Frame

Basic access via

- Atomic vectors - `x[ ]`
- Matrices - `x[ , ]`
- Data Frames - `x[ , ]` or `x$name`
- Lists - `x[ ]`, `x[[ ]]`, or `x$name`

Recap So Far

- Reading Data

Type of file	Package	Function
Delimited	`readr`	`read_csv()`,`read_tsv()`,`read_table()`, `read_delim(...,delim = ,...)`
Excel (.xls,.xlsx)	`readxl`	`read_excel`
SPSS (.sav)	`haven`	`read_spss`
SAS (.sas7bdat)	`haven`	`read_sas`

- Resources for JSON, XML, databases, and APIs

What is this course about?

Basic use of R for reading, manipulating, and plotting data!

- read and write basic R programs
- import well formatted data into R
- **do basic data manipulation in R**
- produce common numerical and graphical summaries in R
- describe a use case of an analysis done in R

Where do we start?

- Data manipulation idea
- Documenting with Markdown

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- Documenting with Markdown
- Logical statements
- `dplyr`

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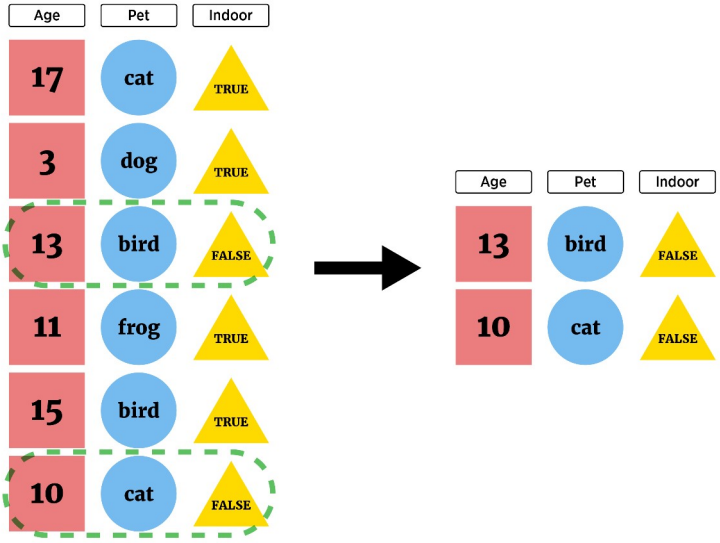
- Data manipulation idea
- Documenting with Markdown
- Logical statements
- `dplyr`
- Creating new variables
    - Conditional execution (if then)
    - For loops
    - Vectorized functions
- Reshaping Data

Data manipulation idea

We may want to subset our full data set or create new data

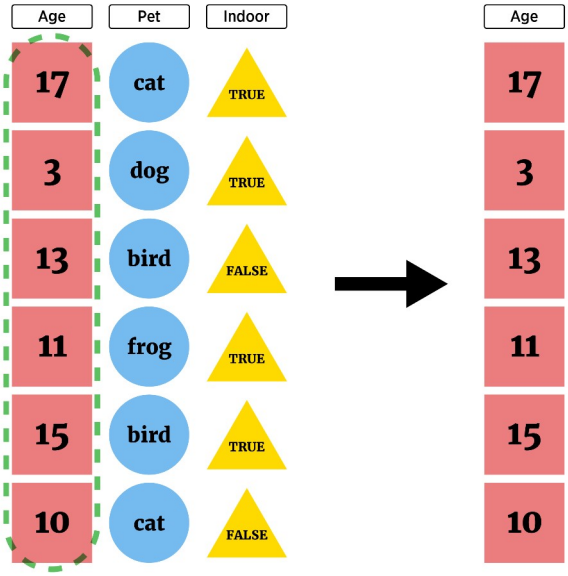
- Grab only certain types of observations (**filter rows**)



Data manipulation idea

We may want to subset our full data set or create new data

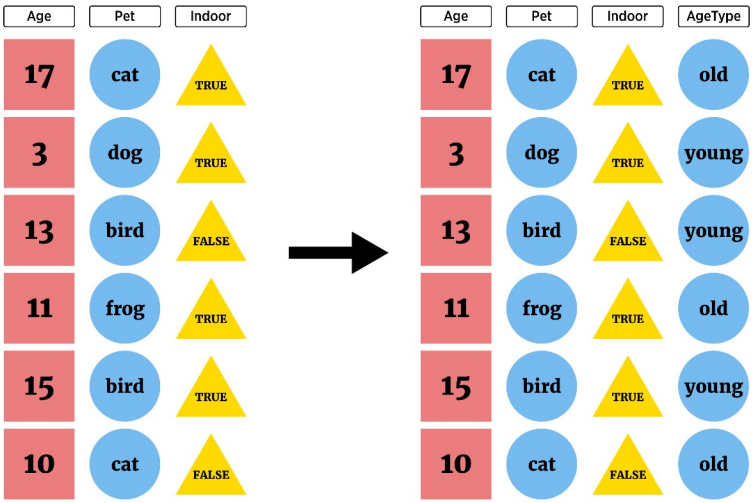
- Look at only certain variables (**select columns**)



Data manipulation idea

We may want to subset our full data set or create new data

- Create new variables



Data manipulation idea

We may want to subset our full data set or create new data

- Vital to make your work reproducible!
- Traditional documentation through comments (`#` in R) in script
- Communication and reproducibility vital!
- May have heard of JUPYTER notebooks
- R Markdown - built in notebook for R studio
- Intro video

Documenting with Markdown

- R Markdown = Digital “Notebook”: Program that weaves word processing and code.
- Designed to be used in three ways (R for Data Science)

Documenting with Markdown

- R Markdown = Digital “Notebook”: Program that weaves word processing and code.
- Designed to be used in three ways (R for Data Science)
  - Communicating to decision makers (focus on conclusions not code)
  - Collaborating with other data scientists (including future you!)
  - As environment to do data science (documents what you did and what you were thinking)

Documenting with Markdown

Verbage

- May have heard of HTML (HyperText Mark-up Language)
    - Write plain text that the browser interprets and renders

Documenting with Markdown

Verbage

- May have heard of HTML (HyperText Mark-up Language)
  - Write plain text that the browser interprets and renders
- Markdown is a specific markup language
  - Easier syntax
  - Not as powerful
- Any plain text file can be used (.Rmd extension associates it with R Studio)

Documenting with Markdown

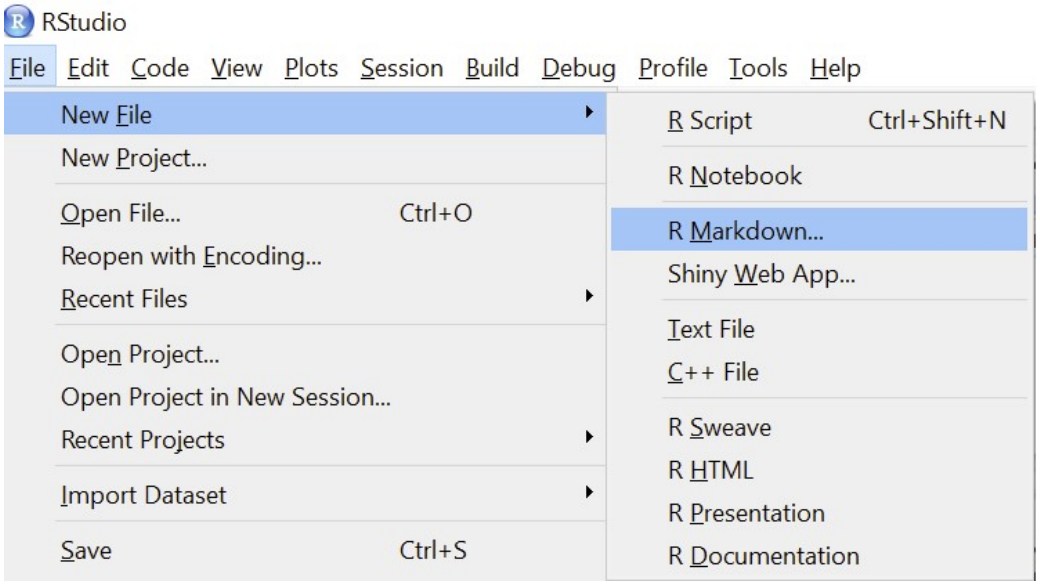
R Markdown file contains three important types of content:

1. (Optional) YAML header surrounded by ---s
2. Chunks of R code
3. Text mixed with simple text formatting instructions

Documenting with Markdown

Creating an R Markdown Document

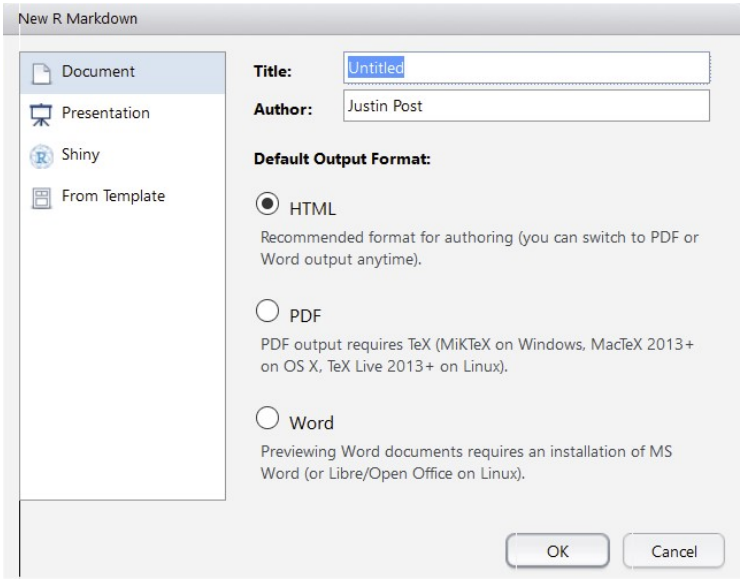
- R Studio makes it easy!



Documenting with Markdown

Creating an R Markdown Document

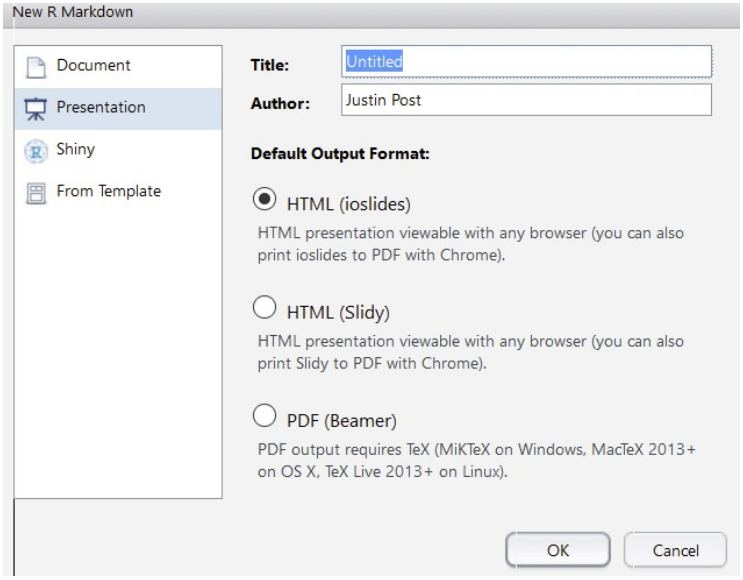
- Commonly used document types can be created



Documenting with Markdown

Creating an R Markdown Document

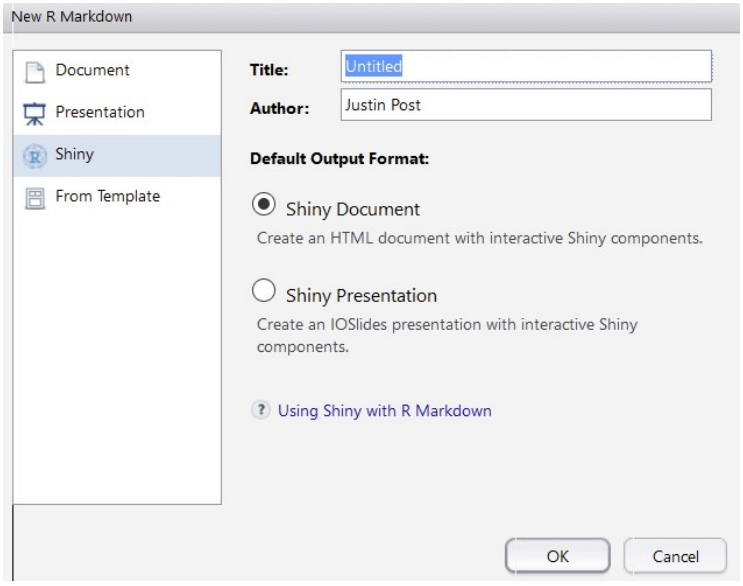
- Slide presentations



Documenting with Markdown

Creating an R Markdown Document

- Truly Interactive Documents/Pages (require R backend)



Documenting with Markdown

YAML Header

- Define settings for document

```
---
title: "Untitled"
author: "First Last"
date: "xxxx"
output: html_document
---
```

- CTRL/CMD + Shift + k **knits** via this info

Documenting with Markdown

Code Chunks

- Below YAML header: ‘r chunk’

````
```{r ggplot,eval=FALSE}
select(iris, Sepal.Width)
ggplot(iris, aes(x = Sepal.Width, y = Sepal.Length)) +
geom_point()
```
````

- Start code chunk by typing ```{r} out or with CTRL/CMD + Alt/Option + I
- Code will be executed when document is created
- Can specify options on individual code chunks

Documenting with Markdown

Markdown Syntax

- Below code chunk is plain text with markdown sytnax

```
## 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.
```

- When file created, “##” becomes a header, “<…>” a link, and `**Knit**` bold font

Documenting with Markdown

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.

Where do we go from here?

Briefly investigate:

- Markdown syntax
- Code chunks and their options
- Changing type of output

Documenting with Markdown

Markdown syntax

- `[Cheat Sheet link](https://www.rstudio.com/wp-content/uploads/2015/03/rmarkdown-reference.pdf)` becomes [Cheat Sheet link](https://www.rstudio.com/wp-content/uploads/2015/03/rmarkdown-reference.pdf)

Documenting with Markdown

Markdown syntax

- `[Cheat Sheet link](https://www.rstudio.com/wp-content/uploads/2015/03/rmarkdown-reference.pdf)` becomes Cheat Sheet link
- `# Header 1` becomes a large font header
- `## Header 2` becomes a slightly smaller font header
- Goes to 6 headers
    - Use of headers can automatically create a Table of Contents!

Documenting with Markdown

Markdown syntax

- `[Cheat Sheet link](https://www.rstudio.com/wp-content/uploads/2015/03/rmarkdown-reference.pdf)` becomes Cheat Sheet link
- `# Header 1` becomes a large font header
- `## Header 2` becomes a slightly smaller font header
- Goes to 6 headers
    - Use of headers can automatically create a Table of Contents!
- `**bold**` **and** `__bold__`
- `` `code` `` becomes `code`

Documenting with Markdown

Markdown syntax

- Can do lists: be sure to end each line with two spaces!
    - Indent sub lists four spaces

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

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

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

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

Documenting with Markdown

Markdown syntax

- Can include basic tables (renders differently in slides than html doc)

```
Table Header  | Second Header | Col 3
------------- | ------------- | -----------
Table Cell    | Cell (1, 2)   | Cell (1, 3)
Cell (2, 1)   | Cell (2, 2)   | Cell (2, 3)
```

Table Header	Second Header	Col 3
Table Cell	Cell (1, 2)	Cell (1, 3)
Cell (2, 1)	Cell (2, 2)	Cell (2, 3)

Documenting with Markdown

Code chunks and their options

- Any R code can go into the chunk
- Chunks evaluate sequentially (can use output from prior chunk)
- Code can be added in line: Ex: The Iris dataset has 150 observations
- Added by beginning with back-tick `r` and ending with a back-tick: Iris has `` `r length(iris$Sepal.Length)` ``

Documenting with Markdown

Code chunks and their options

- Many options depending on chunk purpose!
- Can hide/show code with `echo = FALSE/TRUE`
- Can choose if code is evaluated with `eval = TRUE/FALSE`
- `message = TRUE/FALSE` and `warning = TRUE/FALSE` can turn on/off displaying messages/warnings

Documenting with Markdown

Code chunks and their options

- Many options depending on chunk purpose!
- Can hide/show code with `echo = FALSE/TRUE`
- Can choose if code is evaluated with `eval = TRUE/FALSE`
- `message = TRUE/FALSE` and `warning = TRUE/FALSE` can turn on/off displaying messages/warnings
- Can set global options for all chunks

```
opts_chunk$set(echo = FALSE, eval = TRUE, warning = FALSE)
```

- Allows for easy change of audience!

Documenting with Markdown

Changing type of output

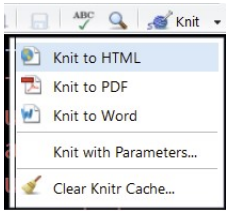
R Markdown really flexible!

Documenting with Markdown

Changing type of output

Change output type in the YAML header:

- Use CTRL/CMD + Shift + k or the Knit menu:



- Use code explicity:
  `rmarkdown::render("file.Rmd", output_format = "word_document")`

Documenting with Markdown

Changing type of output

For HTML & PDF can include Table of Contents with options

```
output:
  html_document:
    toc: true
    toc_float: true
```

Documenting with Markdown

Changing type of output

For HTML & PDF can include Table of Contents with options

```
output:
  html_document:
    toc: true
    toc_float: true
```

For HTML another option is to make the code chunks hidden by default, but visible with a click:

```
output:
  html_document:
    code_folding: hide
```

Documenting with Markdown

Changing type of output

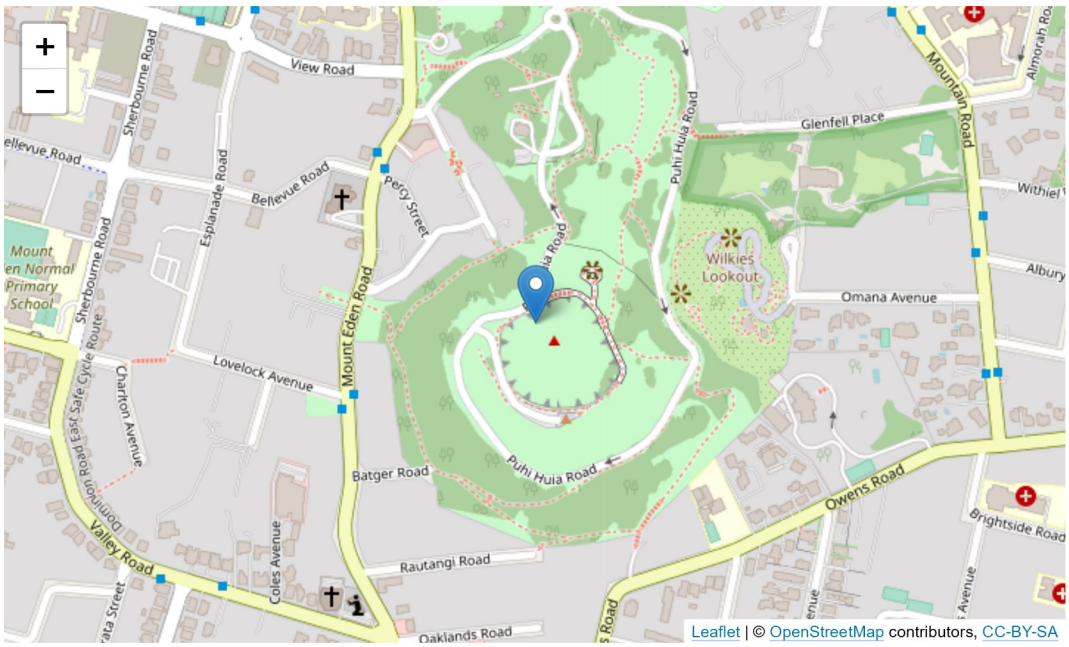
HTML documents inherently interactive

- Widgets can be included with appropriate **R package**

```
library(leaflet)
leaflet() %>%
  setView(174.764, -36.877, zoom = 16) %>%
  addTiles() %>%
  addMarkers(174.764, -36.877, popup = "Maungawhau")
```

Documenting with Markdown

Changing type of output



Documenting with Markdown

Changing type of output

- PDF
  - Install MikTex and update its packages or install a smaller version using the `tinytex` package: `tinytex::install_tinytex()`

```
output: pdf_document
```

Documenting with Markdown

Changing type of output

- PDF
    - Install MikTex and update its packages or install a smaller version using the `tinytex` package: `tinytex::install_tinytex()`

```
output: pdf_document
```

- Word

```
output: word_document
```

Documenting with Markdown

Changing type of output

- PDF
  - Install MikTex and update its packages or install a smaller version using the `tinytex` package: `tinytex::install_tinytex()`

```
output: pdf_document
```

- Word

```
output: word_document
```

- Slides (## for new slide)

```
output: ioslidespresentation
```

Recap/Next Up!

- Data manipulation idea
- Documenting with Markdown
- Logical statements
- `dplyr`
- Creating new variables
    - Conditional execution (if then)
    - For loops
    - Vectorized functions
- Reshaping Data