COMPUTATIONAL FINANCE & RISK MANAGEMENT

UNIVERSITY *of* WASHINGTON

Department of Applied Mathematics

Calculating Portfolio Returns

CFRM 425 (009)

R Programming for Quantitative Finance

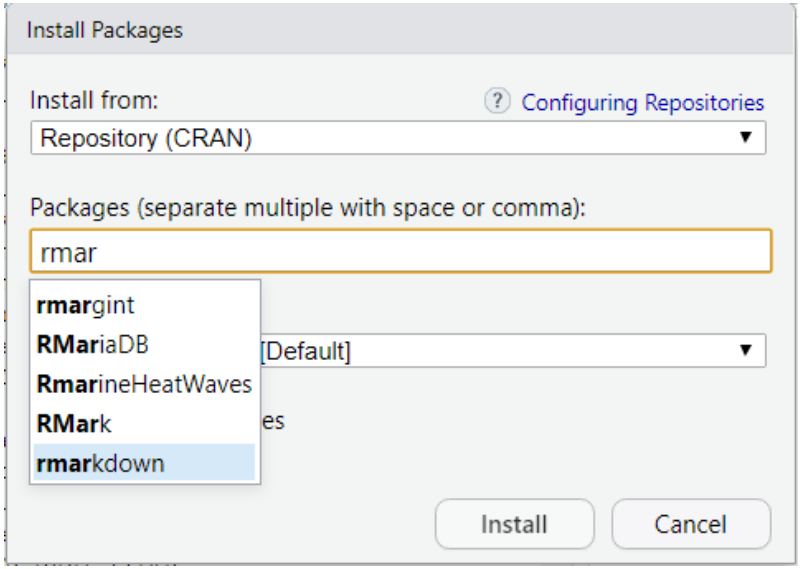
References/Reading/Topics

- These slides

- These URL's (posted on Canvas):
  - https://rmarkdown.rstudio.com/articles_intro.html
  - https://bookdown.org/yihui/rmarkdown/pdf-document.html
  - https://rmarkdown.rstudio.com/authoring_quick_tour.html

Install RMarkdown

- Install the Rmarkdown package, just like any other package

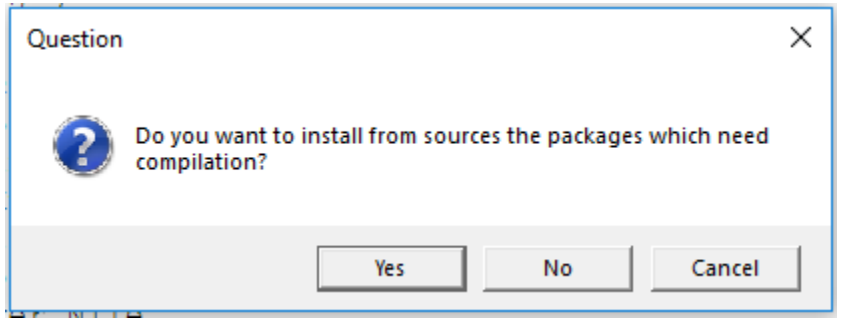


- This should also install dependent packages such as knitr, yaml, etc

```
> install.packages("rmarkdown")
also installing the dependencies 'highr', 'markdown', 'digest', 'rlang', 'glue',
 'magrittr', 'stringi', 'knitr', 'yaml', 'htmltools', 'evaluate', 'base64enc',
 'jsonlite', 'mime', 'tinytex', 'xfun', 'stringr'
```

Install RMarkdown

- Choose Yes:




```
** building package indices
** testing if installed package can be loaded from temporary location
** testing if installed package can be loaded from final location
** testing if installed package keeps a record of temporary installation path
* DONE (stringi)

The downloaded source packages are in
        'C:\Users\djhanson\AppData\Local\Temp\RtmpkNK97F\downloaded_packages'
> |
```

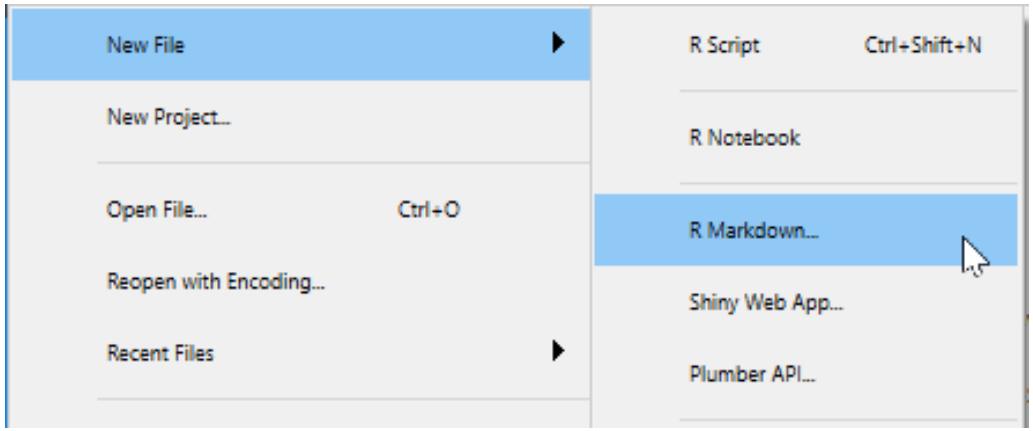
- What follows may take a while
- If you are on Windows, you will need to install rtools (contains a C++ compiler to build packages from source, per above), *beforehand*
- Choose and install Rtools35.exe from

https://cran.r-project.org/bin/windows/Rtools/

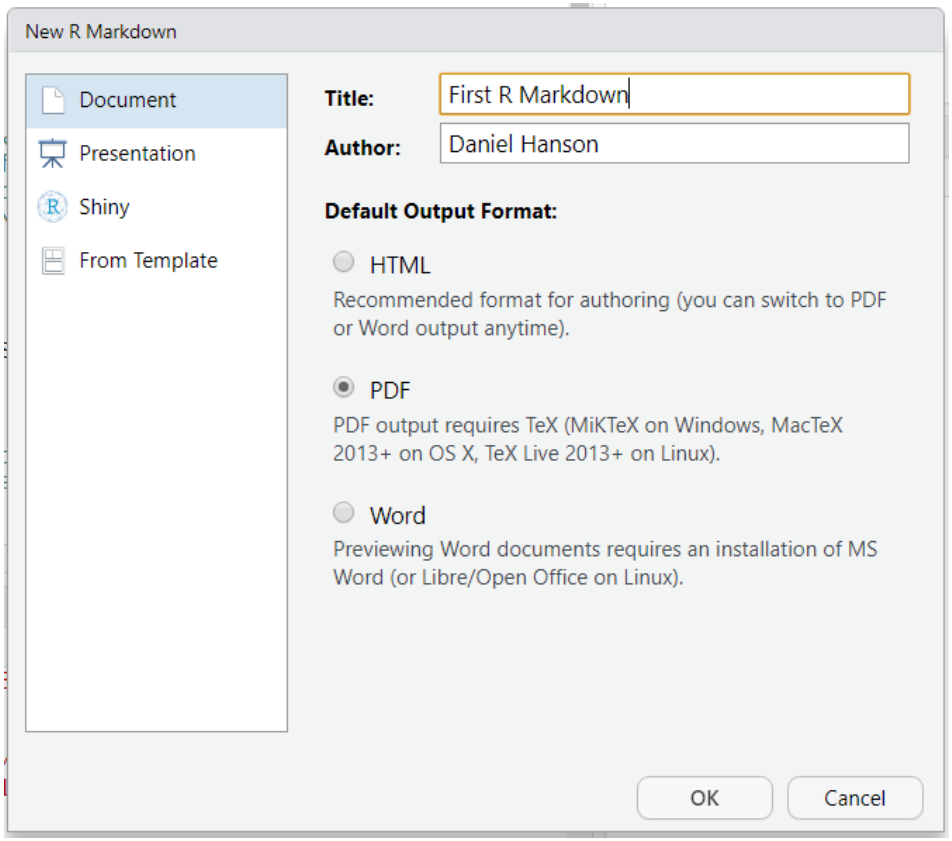
Download	R compatibility	Frozen?
Rtools40 (beta)	Special R-testing build of R 4.0 only, see documentation	-
Rtools35.exe (recommended)	R 3.3.x and later	No
Rtools34.exe	R 3.3.x and later	Yes

Create a New R Markdown File for pdf

- Now:

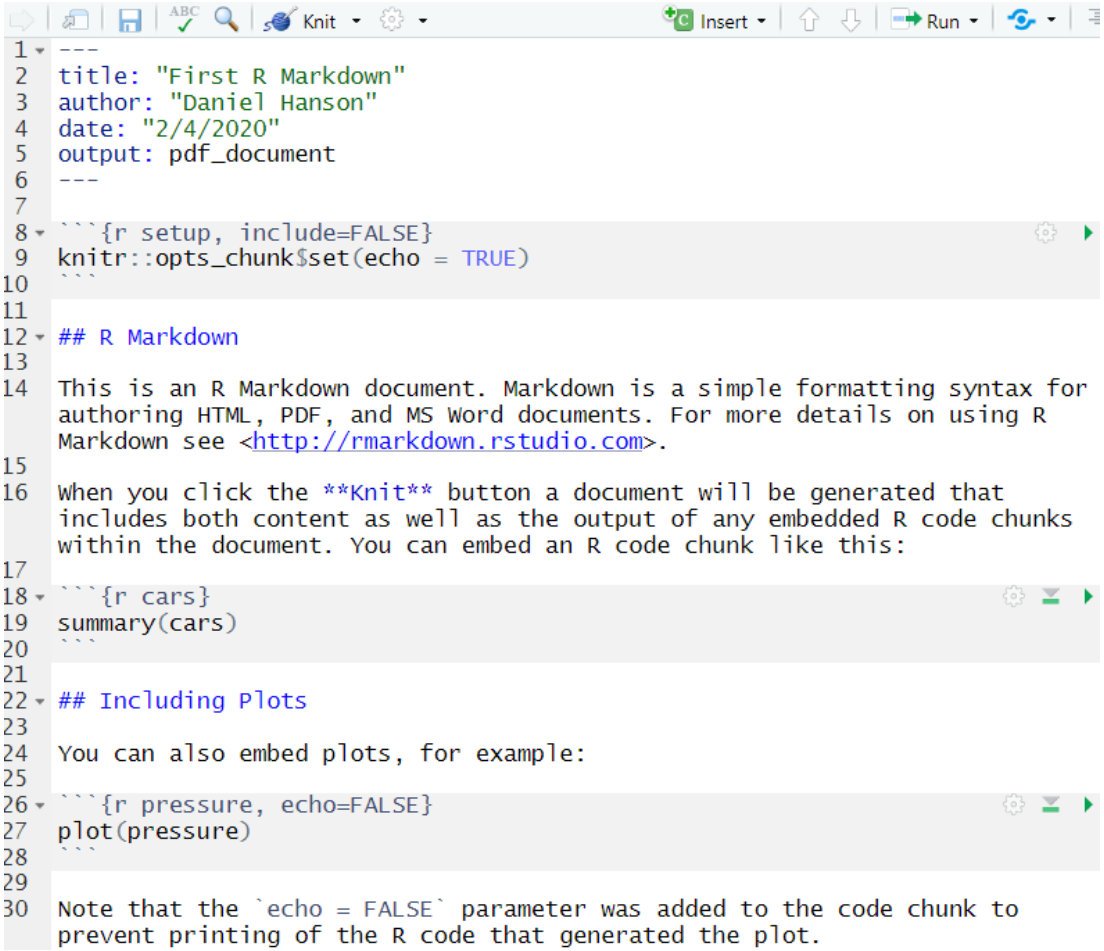


- Then, choose a title, followed by PDF:



Create a New R Markdown File for pdf

- The following default file is loaded:



```
---
title: "First R Markdown"
author: "Daniel Hanson"
date: "2/4/2020"
output: pdf_document
---

```{r setup, include=FALSE}
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)
```

Including Plots

You can also embed plots, for example:

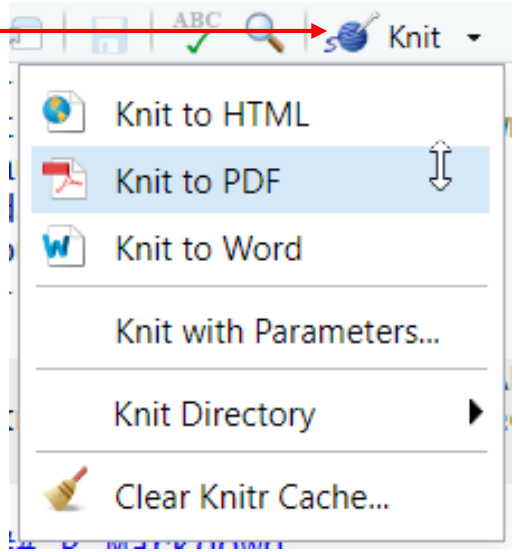
```{r pressure, echo=FALSE}
plot(pressure)
```

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.
```

- Save it as FirstRMarkdown.Rmd

Generate (Render) the PDF

- At the top of Rstudio, click on Knit
- Choose Knit to PDF



- The PDF will be generated and displayed:

First R Markdown

Daniel Hanson

2/4/2020

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.

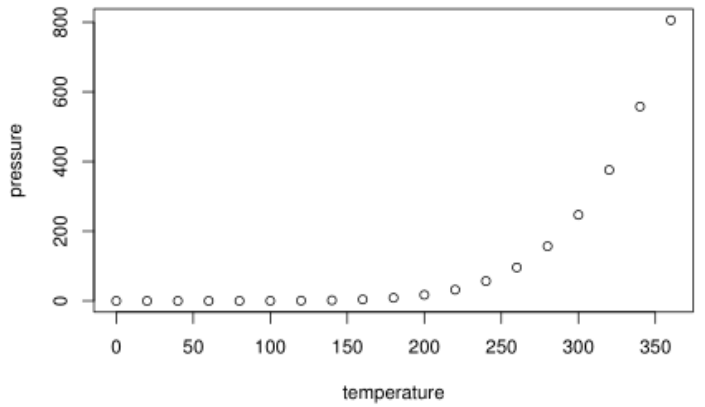
When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

Including Plots

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

Next Let's Try our Own

- Put in title etc:

```
---
title: "Quick and Dirty Intro to R Markdown"
author: "Daniel Hanson"
date: "5 February 2020"
output: pdf_document
---

```{r setup, include=FALSE}
# Just leave this in -- general knitr setting
# from the stock example when creating an Rmd file.
# include=FALSE tells R Markdown
# not to display this code in the document.
knitr::opts_chunk$set(echo = TRUE)
```
```

- Just leave the general knitr setting (comes with the stock example when setting up an Rmd file.

Next Let's Try our Own

- Put in main header with a single #
- Add an introduction:

```
16 # Working with Financial Data
17
18 Let's take a simple example of importing financial price data using
   quantmod, calculating the returns, and plotting the results.  Various
   points about R Markdown with be presented as we progress through the
   discussion.
```

- This will be rendered as follows:

Quick and Dirty Intro to R Markdown

Daniel Hanson

5 February 2020

Working with Financial Data

Let's take a simple example of importing financial price data using quantmod, calculating the returns, and plotting the results. Various points about R Markdown with be presented as we progress through the discussion.

Next Let's Try our Own

- Initial formatting issues
  - Vertical spaces
    - Need two white spaces at the end of the previous line
    - Additional blank line indicated by two white spaces
    - Cannot add additional blank lines this way
  - No spell check
  - Italics: `*put in italics*` or `_put in italics_`
  - Bold: `**put in bold**` or `__put in bold__`
  - Italics and Bold: `__*Now I'll show real anger!*__`
  - "Code font": `` `head(AMZN)` ``

You might also be asking, how did I put words in *italics*? If you look at the Rmd file, you'll see the word is enclosed in two asterisks. It is also possible to put the *text inside two underscore characters*; again, you'll need to look at the Rmd file.

If you're after stronger emphasis, or just plain angry, you can **put in a bold font**. This is accomplished by surrounding your text in double asterisks. Likewise, **one can use double underscores**. Finally, if you want both italics and bold, the way your instructor does it is with ***double underscores on the outside with single asterisks on the inside***. There exist other variations.

Next Let's Try our Own

- Embedding R Code
  - Simplest way

```
```{r}
# Put R code here:
head(AMZN)
tail(AMZN)
```
```

- Output embedded in document:

```
head(AMZN)
```

```
##            AMZN.Open AMZN.High AMZN.Low AMZN.Close AMZN.Volume AMZN.Adjusted
## 2010-12-31    181.96    182.30   179.51      180.00      3451900         180.00
## 2011-01-03    181.37    186.00   181.21      184.22      5331400         184.22
## 2011-01-04    186.15    187.70   183.78      185.01      5031800         185.01
## 2011-01-05    184.10    187.45   184.07      187.42      3418800         187.42
## 2011-01-06    186.50    187.41   185.25      185.86      3179700         185.86
## 2011-01-07    187.88    188.45   183.74      185.49      5221700         185.49
```

```
tail(AMZN)
```

```
##            AMZN.Open AMZN.High AMZN.Low AMZN.Close AMZN.Volume AMZN.Adjusted
## 2013-12-20    396.55    404.72   395.78      402.20      5033900         402.20
## 2013-12-23    403.69    405.00   399.20      402.92      2659500         402.92
## 2013-12-24    402.52    403.72   396.37      399.20      1380400         399.20
## 2013-12-26    401.79    404.52   396.81      404.39      1868500         404.39
## 2013-12-27    404.65    405.63   396.25      398.08      1986900         398.08
## 2013-12-30    399.41    399.92   392.45      393.37      2487100         393.37
```

Next Let's Try our Own

- Embedding R Code: Often there is "garbage" output to the console

```
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric

## Registered S3 method overwritten by 'xts':
##   method     from
##   as.zoo.xts zoo

## Loading required package: TTR

## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

- We can eliminate it this way (`results = 'hide'`):

````
```{r, results='hide'}
rm(list = ls())   # unload quantmod so we can load it again
library(quantmod)

# We can also put comments in the embedded R code
# in the usual way with the hash marks.
getSymbols("AMZN", from = "2010-12-31", to = "2013-12-31")

```
````

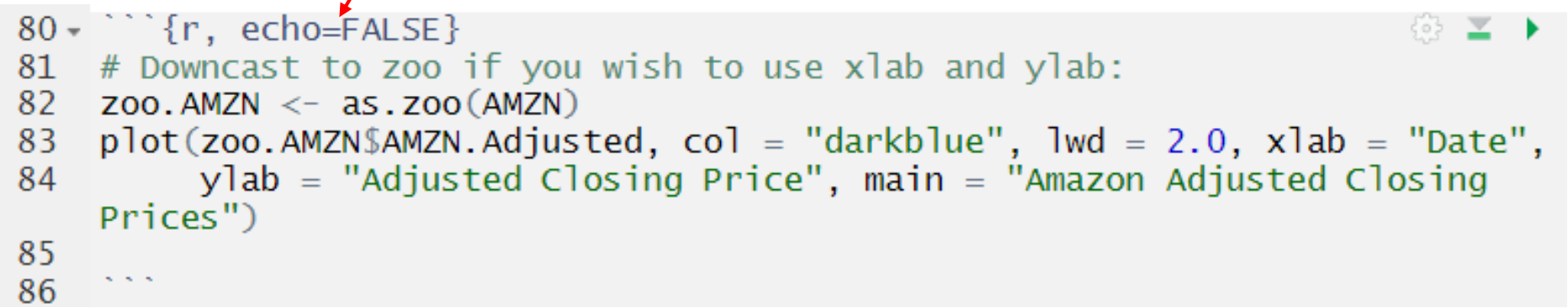
Next Let's Try our Own

- Plotting: Just put the plot command inside the code block, and let it rip:

```
70 ```{r}
71 # Downcast to zoo if you wish to use xlab and ylab:
72 zoo.AMZN <- as.zoo(AMZN)
73 plot(zoo.AMZN$AMZN.Adjusted, col = "darkblue", lwd = 2.0, xlab = "Date",
74      ylab = "Adjusted Closing Price", main = "Amazon Adjusted Closing
   Prices")
75
76 ```
```

Next Let's Try our Own

- Plotting: We might, however, just wish to show the plot alone, without showing the R code
- Use the echo=FALSE parameter in the heading:



```
80 ```{r, echo=FALSE}
81 # Downcast to zoo if you wish to use xlab and ylab:
82 zoo.AMZN <- as.zoo(AMZN)
83 plot(zoo.AMZN$AMZN.Adjusted, col = "darkblue", lwd = 2.0, xlab = "Date",
84      ylab = "Adjusted Closing Price", main = "Amazon Adjusted Closing
   Prices")
85
86 ```
```

Next Let's Try our Own

- Mathematical Notation:
  - On same line: Put in between single dollar signs:

```
$\log(S_{t}/S_{t-1})$
```

  - To put in its own line/paragraph, use $$

```
$$\log(S_{t}/S_{t-1})$$
```

To obtain log returns, we need to calculate $\log(S_t/S_{t-1})$ for each pair of adjacent equity prices.

Mathematical Notation

First, how did we display mathematical notation? Also, how can we drop it down a line like this?

$$\log(S_t/S_{t-1})$$

Next Let's Try our Own

- Mathematical Notation: For a detailed description of typically used mathematical notation, refer to

https://www.calvin.edu/~rpruim/courses/s341/S17/from-class/MathinRmd.html

Mathematical Notation

Here are some common mathematical things you might use in statistics

$x = y$	`$x = y $`
$x < y$	`$x < y $`
$x > y$	`$x > y $`
$x \le y$	`$x \le y $`
$x \ge y$	`$x \ge y $`
x^n	`$x^{n}$`
x_n	`$x_{n}$`
$\overline{x}$	`$\overline{x}$`
$\hat{x}$	`$\hat{x}$`
$\tilde{x}$	`$\tilde{x}$`
$\frac{a}{b}$	`$\frac{a}{b}$`
$\frac{\partial f}{\partial x}$	`$\frac{a}{b}$`
$\displaystyle \frac{\partial f}{\partial x}$	`$\displaystyle \frac{a}{b}$`
$\binom{n}{k}$	`$\binom{n}{k}$`

Summary

- Now, let's look at the actual Rmd file, and generate the pdf
- There is additional stuff to learn, but you can pick it up as you get more experience and by using online references such as

https://rmarkdown.rstudio.com/articles_intro.html

https://bookdown.org/yihui/rmarkdown/pdf-document.html

https://rmarkdown.rstudio.com/authoring_quick_tour.html

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

- It gets easier the more you use R Markdown

[END]