Creating documents in R

author: Kevin Shook date: January 24, 2018

Why create documents in R?

- Makes research reproducible
- combines code with output
- allows detailed explanation of the code
- Makes your research document more reproducible
- will always contain up-to-date values
- Allows you to distribute you results to others

R documents

- Can include
- text
- live R code
  - output from code
- figures
- images
- equations

R document types

- Reports
- Research notebooks
- Slides
- Documentation
- Books
- Web apps

Output formats

- html
- pdf
- Word

Creating R documents

- Write plain text using Markdown
- text markup language
- simpler than LaTex (can also use LaTex)
- Install package **rmarkdown**
- Needs to have several packages installed
- slow, but only needs to be done once

- Need LaTex installed if you use equations
- Install Pandoc to convert output formats http://pandoc.org

Markdown

- All documents, regardless of type or output format use same formatting
- R studio has built-in cheatsheets
- Command is **Help|Cheatsheets**

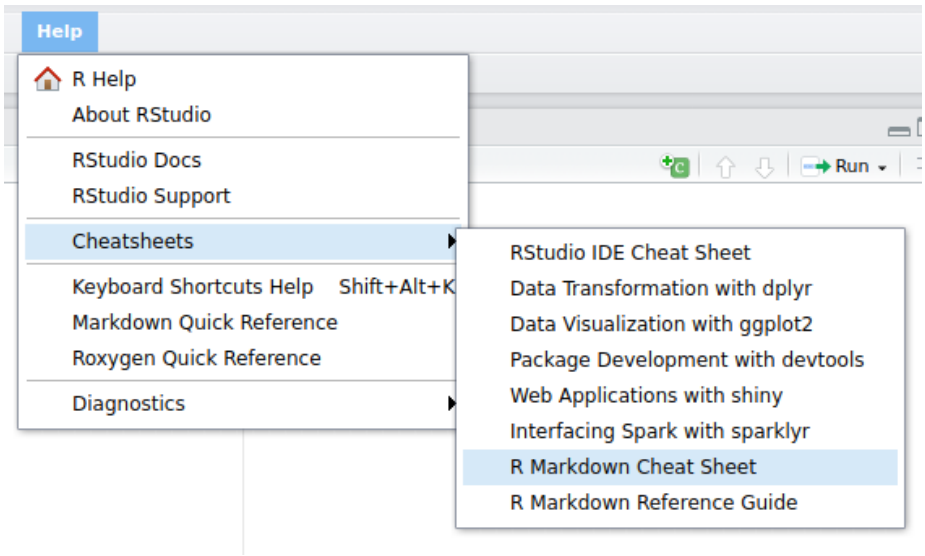

Figure 1:

Markdown formatting

Text

- All text is in paragraphs, even if you manually break the line
- To force a line break, put 2 spaces at the end of a line

This is an example
of how to break text

Emphasis

- put asterisks or underscores before and after text to emphasize it
- – italics * -> *italics*
- ** bold ** -> **bold**

Titles

- Titles indicated using leading `#` symbols

`# Header 1 # Header 1`## Header 2 ## Header 2 *** ‘### Header 3 ### Header 3

Bullets

- Each bullet is prefixed by a hyphen
- indent using tab or 2 spaces

Images

- Use command
  `![optional text](filename)`

Inline R code

- Put code between back ticks following “r”: ‘r “ ‘ “‘

Example:

There were ‘ r nrow(cars)‘ cars studied

Will produce:

There were 50 cars studied

R code chunks

- R code can be placed in chunks of multiple lines
- Each chunk can be executed separately
- Insert a new chunk by pressing **[Ctrl][Alt][i]**

Running a chunk

- Click on the green triangle to run
- Click on the gear to set options

```
1 2 3 4 5 6 7 8 9 10
```

LaTex

- Equations can be added by enclosing them with $
- Use `$$` to centre equation on the line

```
$$\frac{\alpha}{\beta} = \gamma$$
```

$$\frac{\alpha}{\beta} = \gamma$$

Tables

- Create a table using pipes (|) and hyphens

```
header1|header2
-------|-------
row1|row1
row2|row2
```

header1	header2
row1	row1
row2	row2

Formatting R output

- Many R commands produce tables of output
- work well for monospaced text
- not optimised for proportionally-spaced text

```
head(mtcars)
```

```
                   mpg cyl disp  hp drat    wt  qsec vs am gear carb
Mazda RX4         21.0   6  160 110 3.90 2.620 16.46  0  1    4    4
Mazda RX4 Wag     21.0   6  160 110 3.90 2.875 17.02  0  1    4    4
Datsun 710        22.8   4  108  93 3.85 2.320 18.61  1  1    4    1
Hornet 4 Drive    21.4   6  258 110 3.08 3.215 19.44  1  0    3    1
Hornet Sportabout 18.7   8  360 175 3.15 3.440 17.02  0  0    3    2
Valiant           18.1   6  225 105 2.76 3.460 20.22  1  0    3    1
```

Using other packages

- Package **printr** automatically tidies tables

```
library(printr)
head(mtcars)
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225	105	2.76	3.460	20.22	1	0	3	1

Types of documents

Notebooks

- Creates a notebook of R code, using chunks
- use **File|New File|Notebook**
- Creates a skeleton document
- Default output is html, can be changed

Example notebook

- Small piece of R work
- Combines text, an image, R code, output (including figures)
- Output table is formatted

Notebook parameters

- Parameters can be passed to notebooks
- Useful for creating custom reports
- See http://rmarkdown.rstudio.com/developer_parameterized_reports.html?version=1.1.414&mode=deskt

Slides

- You can create 2 types of presentations:

1. **.Rpres** presentations
2. **.Rmd** presentations

.Rpres presentations

- This presentation is an example
- Stored in file with extension .Rpres
- Requires RStudio to view
- To create a presentation, use **File|New File|R Presentation**
- Each slide has a title line with at least 3 equals signs underneath:

Slide title
‘==========

.Rmd presentations

- Can produce more sophisticated slides
- Requires LaTex
- To create a presentation, use **File|New File|R Markdown**

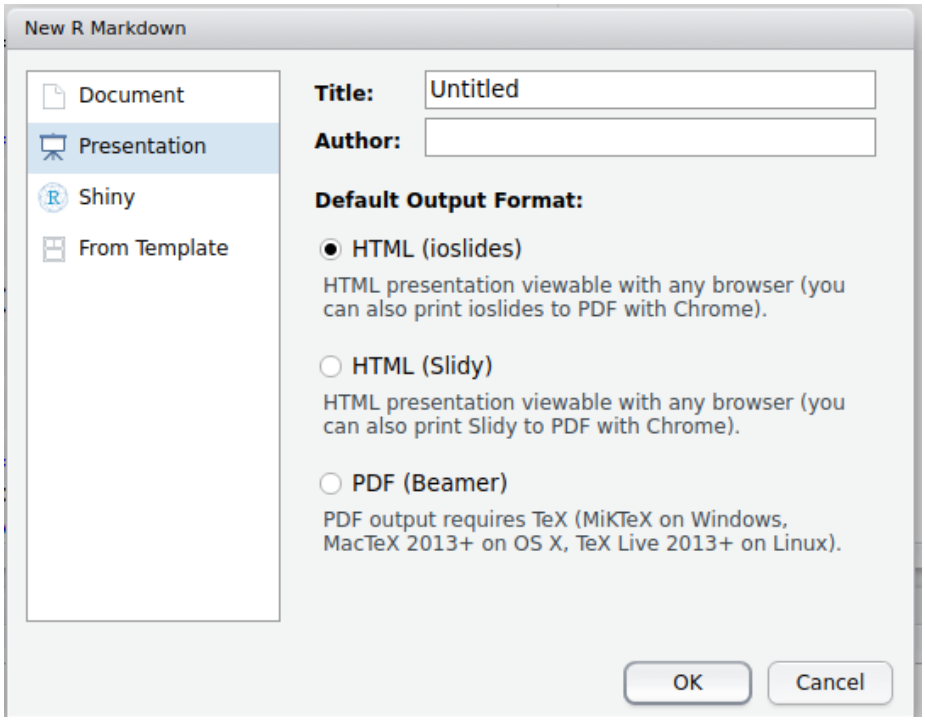
New R Markdown
Document
Presentation
Shiny
From Template
Title:
Untitled
Author:
Default Output Format:
HTML (ioslides)
HTML presentation viewable with any browser (you can also print ioslides to PDF with Chrome).
HTML (Slidy)
HTML presentation viewable with any browser (you can also print Slidy to PDF with Chrome).
PDF (Beamer)
PDF output requires TeX (MiKTeX on Windows, MacTeX 2013+ on OS X, TeX Live 2013+ on Linux).
OK
Cancel

Figure 2:

Documentation

- Each R function in a package needs to be documented
- R package documentation can include **vignettes**
- long form documentation, written in Markdown
- A great way to contribute to an R package
- a great way to learn about R packages
- Command is **File|New File|R Markdown...**
- select **From Template**, then **Package Vignette (HTML)**

Books

- The manual for ggplot2 is written in Markdown.
- You can download it and build the document https://github.com/hadley/ggplot2-book
- Uses lots of add-in packages, and there can be issues with their versions
- I have already built the book, you can download the file **ggplot-book.pdf** from the github repository for this seminar

Bookdown

- Can create books (printed or eBooks) in R
- Get package **bookdown**
- Books can be in PDF, LaTeX, HTML, EPUB, or Word
- E books can also be published to web: https://bookdown.org

Thesis

- It is possible to write a thesis in R!
- A package **thesisdown** was created by Reed College
- Requires **bookdown** https://github.com/ismayc/thesisdown

Shiny

- For building websites powered by R
- Install package **shiny** normally
- See website https://shiny.rstudio.com/ for more info
- Code can run on your own computer, or on a cloud server (free for up to 5 apps, $ for more) or a local server

- Shiny app has 2 parts:
- ui - creates the user interface
- server - runs on the server

Summary

- You *can* create a wide variety of documents in **R**
- Whether or not you *should* depends on your use
- also depends on what the final purpose of your document will be, and who will be using it