

PH 718 Data Management and Visualization in R

Part 3: R Markdown

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Introduction

R Markdown is versatile tools for creating documents, presentations, dashboards, and more.

This guide covers basic Markdown syntax, features of R Markdown, and examples to help you get started.

Installation of R Markdown

You can install the R Markdown package from CRAN with:

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

The following link provides a quick tour of R Markdown: <https://rmarkdown.rstudio.com/lesson-1.html>

Basics of Markdown

Markdown is a lightweight language used for formatting text. It is simple to use and widely supported. Here are some basic Markdown features:

Headings: using

- # Heading 1
- ## Heading 2
- ### Heading 3

Emphasis

- **Bold:** ****bold text****
- *Italics:* **italicized text**
- ~~Strikethrough:~~ ~~~~strikethrough~~~~

Lists

- **Unordered list:**
 - Use - or * for items.
 - * Nested list item.
- **Ordered list:**
 1. First item

2. Second item
3. Third item

Links and images

- **Links:** [text](URL)
 - Example: R Markdown website
- **Images:** ![alt text](image_URL)
 - Example: ![Sample Image](https://via.placeholder.com/150)

Code blocks

- Inline code: Use backticks 'code':
- Fenced code block:

```
print("Hello, Markdown!")
```
- Blockquote: > blockquote

Extended syntax

<https://www.markdownguide.org/cheat-sheet/>

Basics of R Markdown

R code chunks

R Markdown extends Markdown by allowing you to embed R code within your document. A chunk starts with three backticks and {r}.

Example:

```
# A simple R code chunk
data(cars)
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
```

```
# A simple R code chunk
result1 = 0
for (i in 1:10^4){
  result1 = result1 + i^2
}
result1
```

```
## [1] 333383335000
```

Inline code

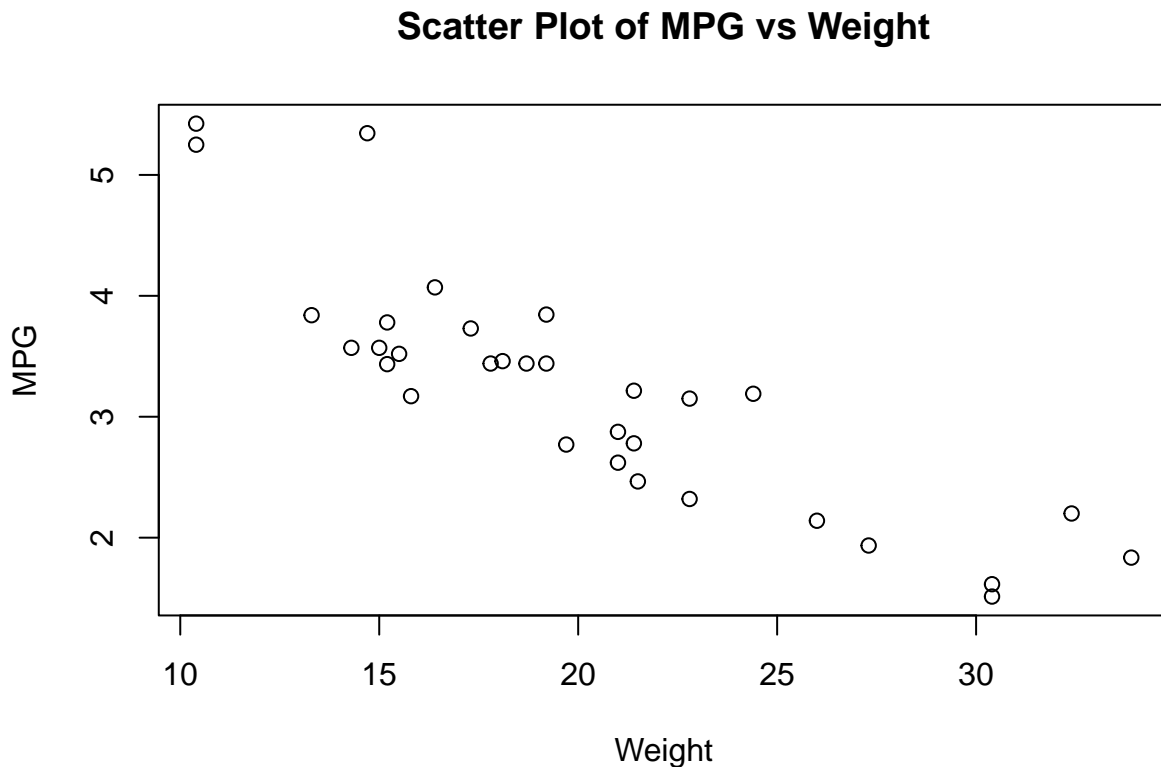
You can include R code inline using backticks and r: 4 becomes 4.

Additional features

Plots

Include plots using R code chunks:

```
# Example of a scatter plot
data(mtcars)
plot(
  mtcars$mpg,
  mtcars$wt,
  main = "Scatter Plot of MPG vs Weight",
  xlab = "Weight",
  ylab = "MPG"
)
```



Tables

Use functions like `knitr::kable()` or `gt` for formatted tables:

```
library(knitr)
kable(head(mtcars), caption = "Sample Table of mtcars Dataset")
```

Table 1: Sample Table of mtcars Dataset

	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

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
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

Caching

Speed up document rendering with caching:

```
# Cached code chunk
summary(mtcars)
```

```
##      mpg          cyl          disp          hp
##  Min.   :10.40   Min.   :4.000   Min.   : 71.1   Min.   : 52.0
## 1st Qu.:15.43   1st Qu.:4.000   1st Qu.:120.8   1st Qu.: 96.5
## Median :19.20   Median :6.000   Median :196.3   Median :123.0
## Mean   :20.09   Mean   :6.188   Mean   :230.7   Mean   :146.7
## 3rd Qu.:22.80   3rd Qu.:8.000   3rd Qu.:326.0   3rd Qu.:180.0
## Max.   :33.90   Max.   :8.000   Max.   :472.0   Max.   :335.0
##      drat          wt          qsec          vs
##  Min.   :2.760   Min.   :1.513   Min.   :14.50   Min.   :0.0000
## 1st Qu.:3.080   1st Qu.:2.581   1st Qu.:16.89   1st Qu.:0.0000
## Median :3.695   Median :3.325   Median :17.71   Median :0.0000
## Mean   :3.597   Mean   :3.217   Mean   :17.85   Mean   :0.4375
## 3rd Qu.:3.920   3rd Qu.:3.610   3rd Qu.:18.90   3rd Qu.:1.0000
## Max.   :4.930   Max.   :5.424   Max.   :22.90   Max.   :1.0000
##      am          gear          carb
##  Min.   :0.0000   Min.   :3.000   Min.   :1.000
## 1st Qu.:0.0000   1st Qu.:3.000   1st Qu.:2.000
## Median :0.0000   Median :4.000   Median :2.000
## Mean   :0.4062   Mean   :3.688   Mean   :2.812
## 3rd Qu.:1.0000   3rd Qu.:4.000   3rd Qu.:4.000
## Max.   :1.0000   Max.   :5.000   Max.   :8.000
```

Incorporating references using a BibTeX (.bib) file

Citing the works of others in your writing is essential

- Acknowledgment of original ideas: citations give proper credit to the original authors for their contributions, recognizing their intellectual property and efforts.
- Upholding academic integrity: Citing sources is crucial to avoid plagiarism, which is the unethical practice of presenting someone else's work or ideas as your own.
- Demonstrating research depth: By referencing existing literature, you showcase the breadth and depth of your research, indicating a comprehensive understanding of the subject matter.
- Supporting your arguments: Citations provide evidence for your claims, strengthening your arguments by linking them to established knowledge.
- Facilitating further research: Proper citations allow readers to trace the original sources, enabling them to explore the topic further and verify information.

Create a BibTeX (.bib) file:

Begin by creating a .bib file that contains all your bibliographic entries. Each entry should follow the BibTeX format.

Templates for different types of entries

An article from a magazine or a journal. For example:

```
@article{greenwade93,  
  author   = "George D. Greenwade",  
  title    = "The {C}omprehensive {T}ex {A}rchive {N}etwork ({CTAN})",  
  year     = "1993",  
  journal  = "TUGBoat",  
  volume   = "14",  
  number   = "3",  
  pages    = "342--351"  
}
```

A published book. For example:

```
@book{goossens93,  
  author    = "Michel Goossens and Frank Mittelbach and Alexander Samarin",  
  title     = "The LaTeX Companion",  
  year      = "1993",  
  publisher = "Addison-Wesley",  
  address   = "Reading, Massachusetts"  
}
```

An article accepted by a conference. For example:

```
@inproceedings{lesk:1977,  
  title={Computer Typesetting of Technical Journals on {UNIX}},  
  author={Michael Lesk and Brian Kernighan},  
  booktitle={Proceedings of American Federation of  
             Information Processing Societies: 1977  
             National Computer Conference},  
  pages={879--888},  
  year={1977},  
  address={Dallas, Texas}  
}
```

You can find more information about other entry types [here](#).

Link the .bib file to your .Rmd file

In the header of your .Rmd file, specify the path to your bibliography file. If the .bib and .Rmd files are in the same folder, you may merely specify the name of the .bib file rather than the full path to it.

```
bibliography: ph718.bib
```

Cite references

Use the @ symbol followed by the key of corresponding entry.

In-text citation: @Wickham2016

As demonstrated in Wickham (2016), data visualization is a powerful tool.

Parenthetical citation: [`@Wickham2016`]

Data visualization is a powerful tool (Wickham, 2016).

For multiple citations, separate the keys with semicolons

Several R packages (R Core Team, 2024; Wickham, Vaughan, & Girlich, 2024) are fairly useful.

Generate the bibliography

The cited references are automatically included at the end of your document, even if you haven't explicitly added a section header.

Resources

- Markdown Guide
- R Markdown Documentation

References

R Core Team. (2024). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from <https://www.R-project.org/>

Wickham, H. (2016). *ggplot2: Elegant graphics for data analysis*. Springer-Verlag New York. Retrieved from <https://ggplot2.tidyverse.org>

Wickham, H., Vaughan, D., & Girlich, M. (2024). *Tidyr: Tidy messy data*. Retrieved from <https://CRAN.R-project.org/package=tidyr>