

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/>

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# 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.

---

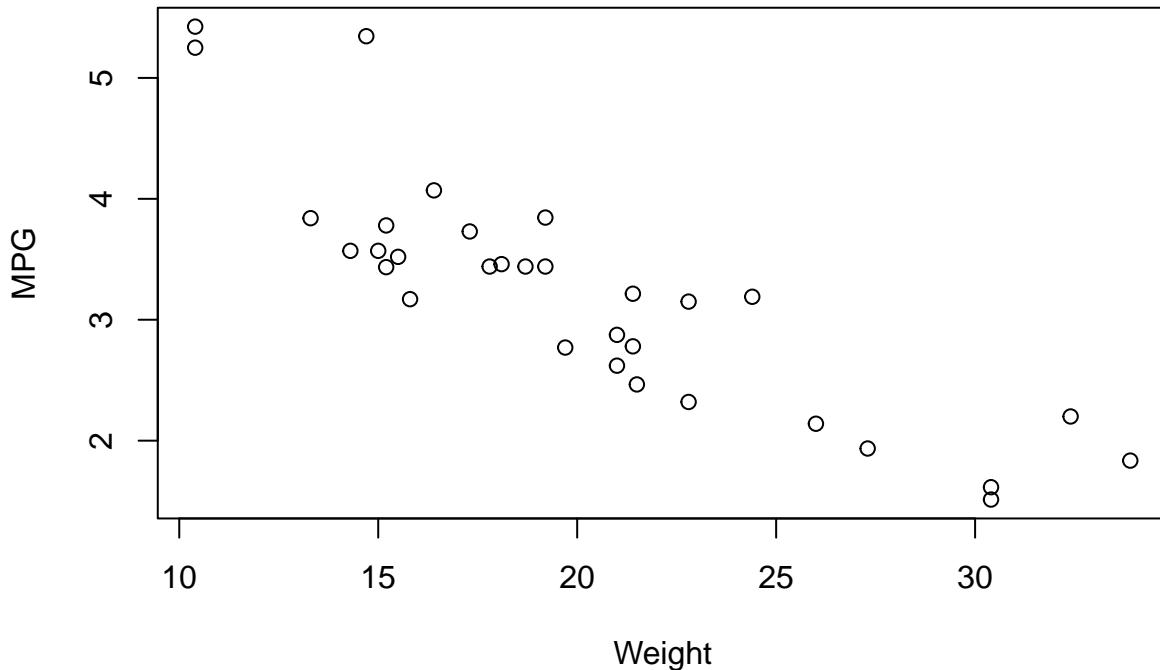
## Additional features

### 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"
)
```

**Scatter Plot of MPG vs Weight**



### 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 Comprehensive TeX Archive Network ({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.

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## **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>