PH 718 Data Management and Visualization in R

Part 3: R Markdown

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2026-02-11

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

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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

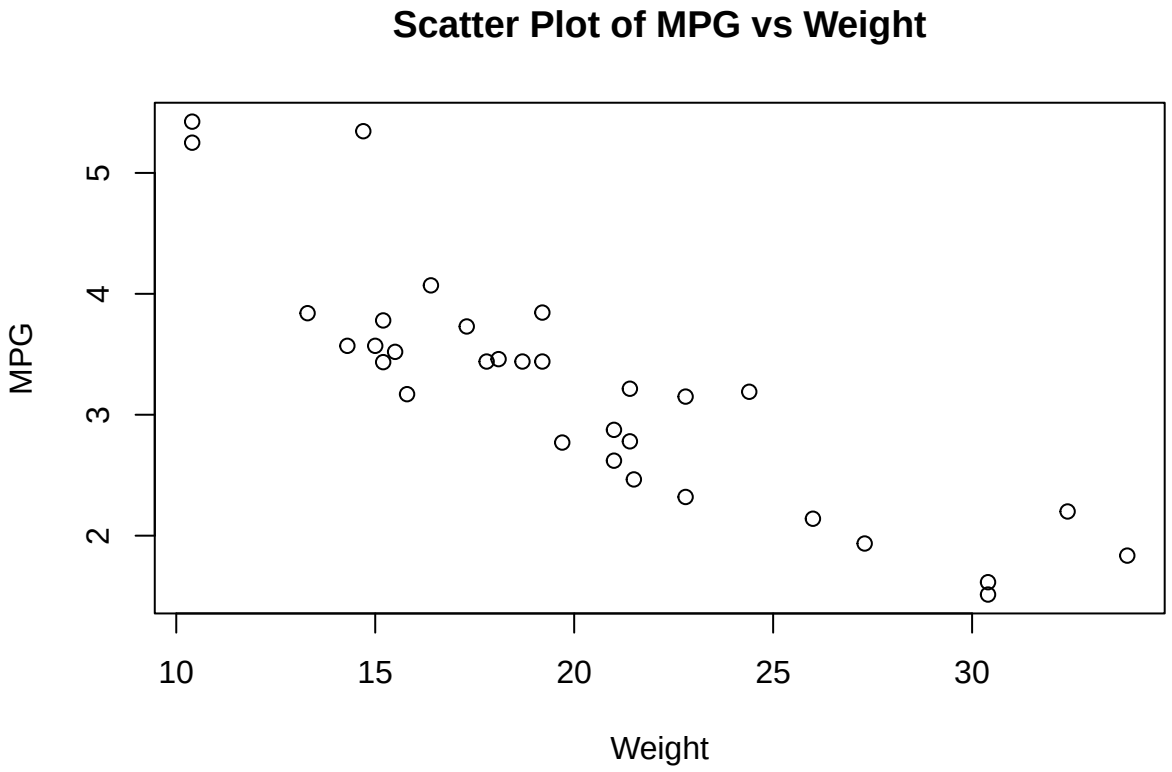
You can include R code inline using backticks and `r`: 4 becomes 4.

Additional features

Plots

Include plots using R code chunks:

```r
# 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:

```r
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