

MPP-E1180 Lecture 5: Intro to Markup Lang. & Literate Programming (2)

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Objectives for the week

- ▶ Housecleaning
- ▶ Review
- ▶ Advanced topics in markup languages and literate programming.
 - ▶ R Markdown Headers
 - ▶ Footnotes
 - ▶ BibTeX/Pandoc and citing R Packages
 - ▶ Time consuming analyses: caching and Make files
- ▶ Begin working on your Assignment 2.

Class reschedule

Result of voting:

[GET]

Assignment 2

Proposal for your Collaborative Research Project.

Deadline: Week 6

Submit: A (max) 2,000 word proposal created with **RMarkdown**.
The proposal will:

- ▶ State your research question. And justify why it is interesting.
- ▶ Provide a basic literature review (properly cited with BibTeX).
- ▶ Identify data sources and appropriate research methodologies for answering your question.

As always, submit the entire GitHub repo.

Assignment 2

Definitely see me with your ideas/draft.

Start thinking about types of models that you want to use. I can include these in Lecture 8 (Statistical Modeling with R).

Review

- ▶ Why is literate programming useful for reproducible research?
- ▶ What is a markup language?
- ▶ What is a code chunk?
- ▶ What is the difference between Weave, Sweave, and knit?
(kind of a trick question)

Example Paper

An example of a paper + analysis + data project using many of the tools we cover today is available at:

`https://github.com/HertieDataScience2014/Examples/
tree/master/SimplePaperWithAnalysis`

R Markdown Headers

An R Markdown file is **just a text file** with markup instructions that **RStudio** understands.

The key to formatting is the **header**.

It is at the start of a file and comes between ---.

The header is written in YAML.

YAML

YAML is basically a human read-able data format.

Elements are separated from values with a colon (:).

Each element is separated by new lines.

Hierarchy is maintained with tabs (very different from R where tabs are meaningless).

Super Nerd Point: YAML is a recursive acronym: "YAML Ain't Markup Language".

Different Presentation Styles

By default, R Markdown uses the isoslides HTML presentation slides style.

You can also use reveal.js.

First install revealjs:

```
devtools::install_github("jjallaire/revealjs")
```

Then in the YAML header use:

```
output: revealjs::revealjs_presentation
```

For further styling see

<https://github.com/jjallaire/revealjs>

Table of contents

You can add a table of contents to your PDF output:

```
output:
  pdf_document:
    toc: true
    number_sections: true
---
```

Figure Options

Create consistent figure formatting:

```
output:  
  pdf_document:  
    fig_width: 7  
    fig_height: 6  
    fig_caption: true
```

`fig_caption: true` attaches captions to figures (unfortunately only for PDFs).

To set the actual caption label, use the `fig.cap='SOME CAPTION'` code chunk option.

Pandoc footnotes

R Markdown can use Pandoc footnotes.

In-text: In the text place a **unique** footnote key in the format:

- ▶ `[^KEY]`

At the end of your document put the full footnote starting with the key, e.g.

- ▶ `[^KEY]: This is a footnote.`

BibTeX citations

BibTeX allows you to create a single data base of all of the literature/packages you cite.

You can then insert them into your text and they will:

- ▶ Be automatically formatted consistently.
- ▶ Generate an appropriately ordered, consistently formatted reference list at the end of your document.

The BibTeX Database

A BibTeX database is just a text file with the extension `.bib`.

Each entry follows a standard format depending on the type of media.

```
@DOCUMENT_TYPE{CITE_KEY,  
  title = {TITLE},  
  author = {AUTHOR},  
  . . . = {. . .},  
}
```

Note: Commas are very important!

The Cite Key

The cite key **links** a specific citation in your presentation document to a specific BibTeX database entry.

They must be **unique**.

It **does not matter** what order your BibTeX entries are in the .bib file.

BibTeX Articles

```
@article{Acemoglu2000,  
  author = {Acemoglu, Daron and Robinson, James A.},  
  title = {Why Did the West Extend the Franchise? Democracy  
          and Growth in Historical Perspective},  
  journal = {The Quarterly Journal of Economics},  
  year = {2000},  
  volume = {115},  
  number = {4},  
  pages = {1167--1199},  
}
```

BibTeX Books

```
@book{Cox1997,  
  title={Making Votes Count: Strategic Coordination in the  
        Electoral Systems},  
  author={Gary W. Cox},  
  year={1997},  
  publisher={Cambridge University Press},  
  address = {Cambridge}  
}
```

More

For more media types and entry fields see
<http://en.wikipedia.org/wiki/BibTeX>.

Tip: Google Scholar

Google scholar generates BibTeX entries.

On an entry click Cite > BibTeX.

Sometimes they need to be **cleaned** a little.

Linking your .bib file.

To link your .bib file to your RMarkdown document add:

`bibliography:`

- `BIB_FILE_NAME.bib`
- `ANOTHER_BIB_FILE_NAME.bib`

Note: The files should be in the same directory as you R Markdown file.

Including BibTeX citations in RMarkdown

RMarkdown uses Pandoc syntax to include a citation in text.

General format: @CITE_KEY.

So if the cite key is Box1973 then @Box1973 will return Box and Tiao (1973) in the text of the presentation document.

Formatting In-Text Citations

Markup	Result
<code>[@Box1973]</code>	(Box and Tiao 1973)
<code>[see @Box1973]</code>	(see Box and Tiao 1973)
<code>[see @Box1973, 33–40]</code>	(see Box and Tiao 1973, 33–40)
<code>[@Box1973; @Acemoglu2000]</code>	(Box and Tiao 1973 Acemoglu and Rob
<code>@Box1973 [33–40]</code>	Box and Tiao (1973, 33–40)

Reference List

A reference list with the full bibliographic details of all cited documents will be **automatically created** at the end of your document.

Tip: Put a `## References` at the very end of your R Markdown document to have a section heading before the reference list.

Citing R and R Packages

Why cite?

- ▶ Give **credit** to the package authors (just like when citing literature).
- ▶ Enable reproducible research: identify which software you used and **which version**.

Citing R and R Packages

Base R way: print citation, copy BibTeX entry into your *.bib* file.

Cite R:

```
toBibtex(citation())
```

```
## @Manual{,  
##   title = {R: A Language and Environment for Statistical  
##   author = {{R Core Team}},  
##   organization = {R Foundation for Statistical Computing  
##   address = {Vienna, Austria},  
##   year = {2014},  
##   url = {http://www.R-project.org/},  
## }
```

Citing R and R Packages

Cite R Packages:

```
toBibtex(citation('dplyr'))
```

```
## Warning: no date field in DESCRIPTION file of package 'dplyr'
```

```
## @Manual{,  
##   title = {dplyr: dplyr: a grammar of data manipulation},  
##   author = {Hadley Wickham and Romain Francois},  
##   note = {R package version 0.3},  
##   url = {https://github.com/hadley/dplyr},  
## }
```

Citing R and R Packages: LoadandCite

The dynamic literate programming way: Use LoadandCite from the repmis package.

Load all of the packages at the beginning of you RMarkdown file in a chunk with `include=FALSE`.

LoadandCite loads the packages and creates a BibTeX file with all of the citations.

```
pkgs <- c('dplyr', 'ggplot2')  
  
repmis::LoadandCite(pkgs, file = 'RpackageCitations.bib')
```

Note: Use a file name that is different from your literature BibTeX file!

Citing R and R Packages: Load and Cite

Include the .bib file in your RMarkdown header.

Each **cite key** follows: R-PKG_NAME.

R itself has the key CiteR.

So @R-dplyr and @CiteR create the citations:

- ▶ Wickham and Francois (2014)
- ▶ R Core Team (2014)

Time Consuming/Intensive Analyses

Knitting your analysis and presentation documents together by placing all of your R code into code chunks can sometimes be **problematic**:

- ▶ When they are time consuming (requires a lot of computational time).
- ▶ When they access files over the internet (bad practice to make many repeated calls to the same URL, can crash the site).
- ▶ When they are many lines long.

Solutions

- ▶ Long lines: use `source()` to run R code in other files.
- ▶ `cache=TRUE` code chunk option: only runs the chunk when the **chunk code changes**.

Make files

Make files are the ultimate solution to these problems.

Make is a command line program.

Big Idea: run a *make* file that runs a list of specific files in order.

Files are only run if they have been changed since the last time the make file was last run.

See me if you might want to do this.

Seminar: Begin working on your Proposal

Begin working with your partner on your research proposal.

- ▶ Identify the research area and key literature.
- ▶ Create a new repo and R Markdown document for your proposal.
- ▶ Begin building a BibTeX database for your key literature and try including them in your proposal.
- ▶ Begin identifying data sources.

References

Acemoglu, Daron, and James A. Robinson. 2000. "Why Did the West Extend the Franchise? Democracy, Inequality, and Growth in Historical Perspective." *The Quarterly Journal of Economics* 115 (4): 1167–99.

Box, G. E. P., and G. C. Tiao. 1973. *Bayesian Inference in Statistical Analysis*. New York: Wiley Classics.

R Core Team. 2014. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. <http://www.R-project.org/>.

Wickham, Hadley, and Romain Francois. 2014. *dplyr: dplyr: a Grammar of Data Manipulation*.
<https://github.com/hadley/dplyr>.