R Markdown

1 Objectives

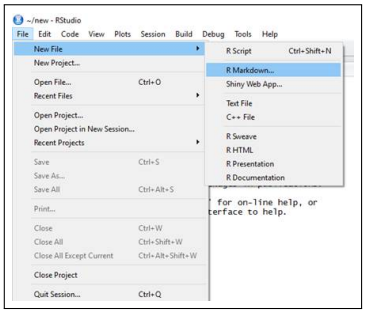
R Markdown serves the purpose of creating documents, which contain both text and code. It has thus the following advantages:

- Research becomes reproducible.
- One can easier exchange results and their documentation with others.
- When a document is created ("knitted"), the embedded code is executed and shown along with its descriptions.
- A single file is created, where the R code invokes no warnings or errors.
- Output is in different formats, for instance, Word, HTML or PDF files.

2 Creating a Document

After launching RStudio, it takes only a couple of clicks to create a template of a file with embedded R Markdown.

Open RStudio:
File → New File → R Markdown . . .

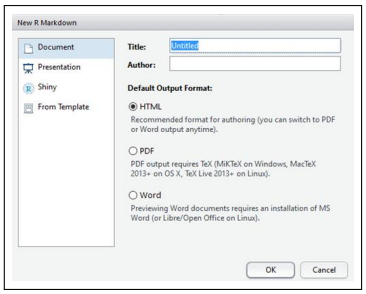


This sequence of clicks creates a template file for delineating R Markdown. The configuration block at the top (the so-called YAML header) specifies title,

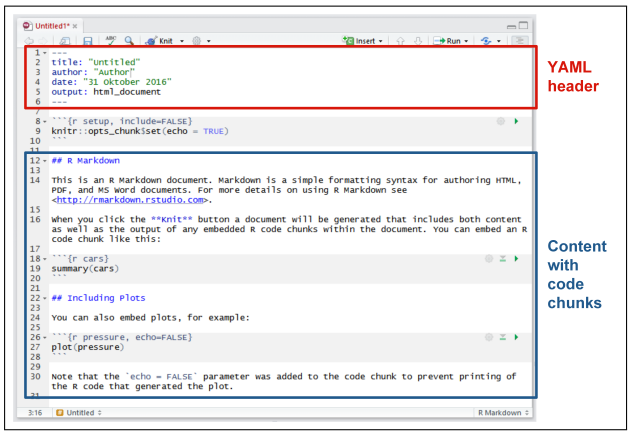
Top: Title of the document

Bottom: Choose the output format

Finalize the dialog by clicking OK



author and output format of the resulting document. In the generated template, you will already find inserted title (`title: [Untitled]`) and author from the dialogue box. Further options of the YAML header allow to include a table of contents, change the layout, etc.



Save: The document can now be saved. The default file extension is `*.Rmd`.

3 Possible output formats

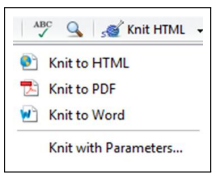
The YAML header also defines the output format. The table below provides an overview of the most important types.

Type	Format	Option in the YAML header
Web page	HTML	`output: html_document`
Document	PDF	`output: pdf_document`
Document (Word)	RTF	`output: word_document`
Presentation (beamer)	PDF	`output: beamer_presentation`
Presentation (ioslides)	HTML	`output: ioslides_presentation`

Note: The generation of PDFs is disabled by default, as it requires the installation of additional software, i. e. LaTeXdistribution such as MikTeX or TeXlive.

4 Knitting an R Markdown file

The R Markdown file can now be converted into one of the output formats, as defined by the YAML header. The program code will be executed and appended to the resulting document. This procedure is known as knitting and is called from the corresponding menu.



By default, the option “Knit to PDF” is disabled and does not appear in the list of possible output formats. If one nevertheless wants a PDF, the easiest option create a Word file first via “Knit to Word” and, subsequently, save it as PDF directly from Word.

5 Program Code

It is possible to insert both code and documentation directly into the output document. The code will be inserted in blocks called “chunks”:

````
```{r}
3 + 4
# additional code
```
````

Recommendation: the hotkey to insert an empty chunk is “Ctrl + Alt + I”. Alternatively click 

.

Chunks can be assigned different names, which is useful in lengthy documents. The button  shows the structure of chunks and chapters. Further options are available to customize the output. For instance, the chunk below is named `sqrt2`, while `echo=FALSE` disables the display of the R code and thus shows only the results.

````
```{r sqrt2, echo=FALSE}
sqrt(2)
```
````

Code chunks are not only executed during knitting, but they can run at any time when desired:

- Hotkey “Ctrl + R” executes the current line.
- The “play” button  in the upper right corner of the chunk runs the entire chunk code. Alternatively, use “Ctrl + Shift + Enter”.

6 Formatting a Document

Text formatting within the R Markdown framework is achieved through macros that indicate the layout after knitting. It is worth noting that text is always interpreted as such, unless it appears in code chunks or the YAML header. Paragraphs are separated by a empty line. There are further macros for custom formatting:

Syntax	Output
Text Format and Images	
`Text`	Text
`*italics*  _italics_`	*kursiv*
`**bold**  __bold__`	**bold**
`` `verbatim code` ``	`verbatim code`
`~~strikethrough~~`	~~strikethrough~~
`[link](www.is.uni-freiburg.de)`	link
`Equation: $A = \setminus \pi r^2$`	Equation: $A = \pi * r^2$
`Image: ![] (path/to/image.png)`	Image: 
Horizontal rule: `***`	---
`> block quote`	block quote
Captions	
`# Header 1`	Header 1
`## Header 2`	Header 2
`### Header 3`	Header 3
`#### Header 4`	Header 4
`##### Header 5`	Header 5
Numeration and Itemization	

`* unordered list`
`* item 2`
`  + sub-item 1`
`  + sub-item 2`
	• unordered list
	• item 2
	  - sub-item 1
	  - sub-item 2

`1. ordered list`
`2. item 2`
`  + sub-item 1`
`  + sub-item 2`
	1. ordered list
	2. item 2
	  - sub-item 1
	  - sub-item 2

Indentations (”tabs”) by 4 space characters	
Tabels	

`Table Header | Table Header`
`---|---`
`Cell 1 | Cell 2`
`Cell 3 | Cell 4`
	Table Header **Table Header**
	Cell 1 Cell 2
	Cell 3 Cell 4

7 Further Information

R Markdown is valuable in complex research because it automatically sets the current folder as working directory, and, therefore, makes it redundant to repeatedly invoke `setwd(path)`.

The following reading materials are recommend as additional readings:

- Official page of R Markdown: `http://rmarkdown.rstudio.com/`
- Short video introduction with detailed explanations: `http://rmarkdown.rstudio.com/lesson-1.html`
- The most important commands as a Cheat Sheet: `http://rmarkdown.rstudio.com/lesson-15.html`