R Markdown and Packages

Statistics 427: R Programming

Module 8

2020

Markdown

Markdown is a plain-text formatting syntax that can be converted to 'XHTML' or other formats including .html, .doc, .pdf, and more (`.doc` and `.pdf` will only work if you have Word and the full version of LaTeX installed).

Markdown requires the use of the `markdown` *package* as well as several other dependent packages. Now is a great time to discuss packages

Packages

Not all the commands that you could use are installed in the "base package" of `R`. Since `R` is open source, many people have made contributions of their created functions to `R` and its users. The functions are usually grouped and installed together in a *package.*

Once a package is installed, it needs to be loaded during the current `R` session (and any session you want to use the package in) for use of its functions.

`stargazer()` package

The package `stargazer()` will produce a nice table of summary statistics (model estimates for comparison among a few) of a data frame. To use a character variable as a grouping variable, the data need to be subsetted before using `stargazer()`.

The `stargazer` package will help with tables, and can also output the LaTeX code (similar to Markdown). You can have text, html or LaTeX code printed to the console or saved as a file. The LaTeX code does not always translate to Markdown code (some LaTeX can be used with Markdown but not all LaTeX code works in Markdown).

Installation and use of `stargazer`

Install and load the `stargazer` package and the command to use is called `stargazer()`

In `RStudio`, packages can be installed through the console (code) or through the `Packages` tab in the bottom right window (It has multiple tabs called `Files`, `Plots`, `Packages`, `Help` (and possibly `Viewer`)). From the `Packages` tab, click `Install` and type in the name of the package.

Or you can use `install.packages('pkg.name')` where `pkg.name` is the name of the package you want to install, in quotes.

Loading a package after installation

Once the package is downloaded and installed, you will need to load the package for use during the session. You can click in the `Packages` tab and select (check the box) next to the package you want to load or use

`library()`. Once your `R` session ends, it will unload. You can manually unload it by unclicking the box in the `Packages` tab.

Package installation and loading example

```r
# not run because it is already installed on my computer
# install.packages("stargazer")
library(stargazer)
```

General Form of `stargazer()`

`stargazer(data,title='',digits=,type='',out='',covariate.lables=c('','',...),flip=T,...)`

`data`: the data frame
`title`: give the table you are making a title
`digits`: an integer that indicates how many decimal places should be used
`type`: can be 'latex' (default), 'text', 'html'
`covariate.labels`: labels for the variable names
`flip`: logical, default is FALSE, TRUE will transpose the table
...: more options

`stargazer()` example

```r
stargazer(faithful,type='text')
```

```
=============================================================
Statistic  N    Mean   St. Dev.  Min  Pctl(25) Pctl(75)  Max
-------------------------------------------------------------
eruptions 272 3.488    1.141    1.600  2.163     4.454   5.100
waiting   272 70.897   13.595    43     58        82      96
-------------------------------------------------------------
```

```r
stargazer(faithful,type='text',flip=T)
```

```
===========================
Statistic eruptions waiting
---------------------------
N             272     272
Mean         3.488   70.897
St. Dev.     1.141   13.595
Min          1.600    43
Pctl(25)     2.163    58
Pctl(75)     4.454    82
Max          5.100    96
---------------------------
```

Outputting to HTML, Word, and PDF

A way to write a *document* in `R` is to use R Markdown, a package that is used to write such documents with embedded plots, graphs, calculations, and much more.

The packages needed are `markdown` and `rmarkdown` and *all* of their dependencies.

As long as you have MikTex/MacTex and Word installed on your machine, you can export to PDF and Word. Html can be done without a different program like PDF and Word.

Markdown to do list

Start by creating a new Markdown document (once the packages are installed, these options become available to you) either `File->New File->R Markdown` or click the document picture (under `File`) with the plus symbol (`+`) and choose R Markdown. A window opens to start the document. You can input a title and your name, choose the file type (PDF, Word or html – this is not set so if you change your mind on the type of output, you can change it when you go to Knit the document) and other things. A new document will open in your script window and is a template to start you off. You can change the headings at the top if you like (know that the template can be Knitted so you can see what it looks like).

First markdown file

The file needs the following header:

```
---
Title: "Title"
Author: "Author"
Date: "date"
output: pdf_document
---
```

Type text here.

Document Headers

You can have headers that will break up your document (as in break it up by topic, etc.)

```
# Level 1 header (large)
## Level 2 header (medium)
### Level 3 header (small)
```
etc. (up to 5 levels)

Misc logistics

To create a carriage return, put a double space after your last character. It will show up as a carriage return on your document.

To print code and its output to the report, use the tick mark (just above the tab key, it's the one with the tilde – just no shift). Three tick marks followed by an open brace `{r}` and then put in code and close the chunk (yes – official notation) with another three ticks at the end of the chunk of code.

A plot!

```r
plot(waiting~eruptions)
```
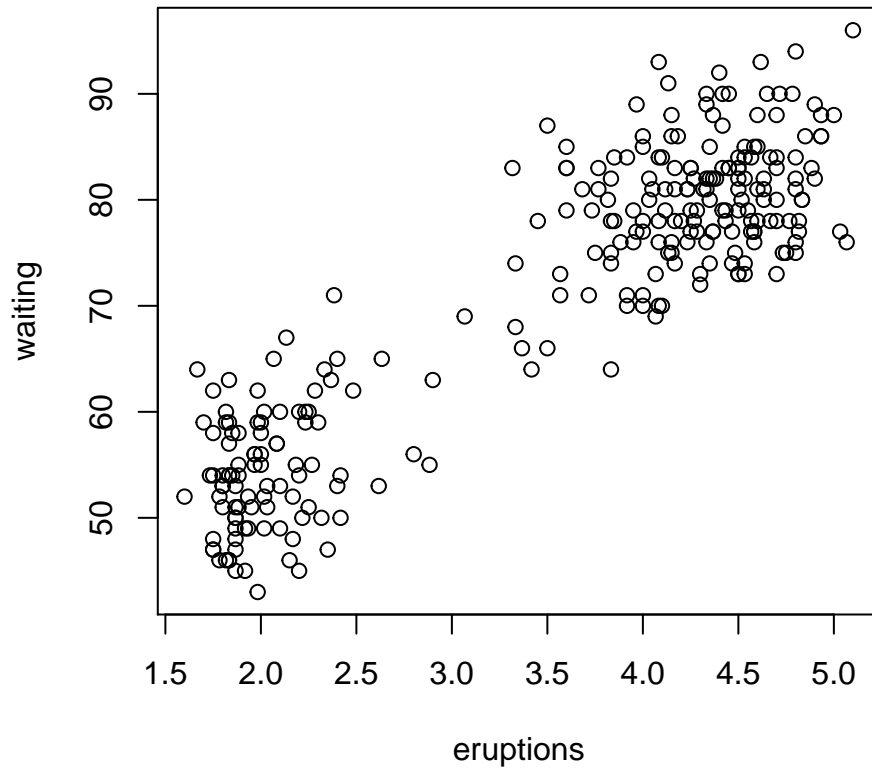
R chunk options I

The code that you want to run results for will be highlighted in your script window. There are options to suppress certain things (like the printing of the code), running the code, etc.) that can be picked up. As an example, by default, the results from `R` will have `##` preceding the results in your report (and I do not like it); to suppress it, you'd use `comment=''` option with nothing inside the quotes.

```
plot(waiting~eruptions)
```
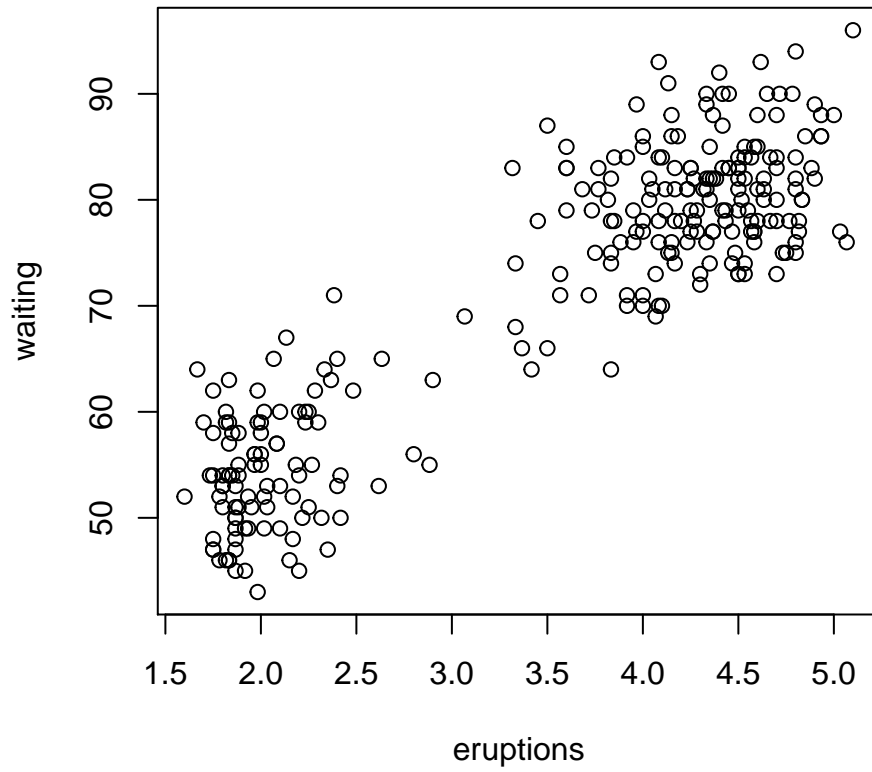
R chunk options II

The `echo=F` option will not display the code but will still generate the output. Several options can be used at the same time if desired.
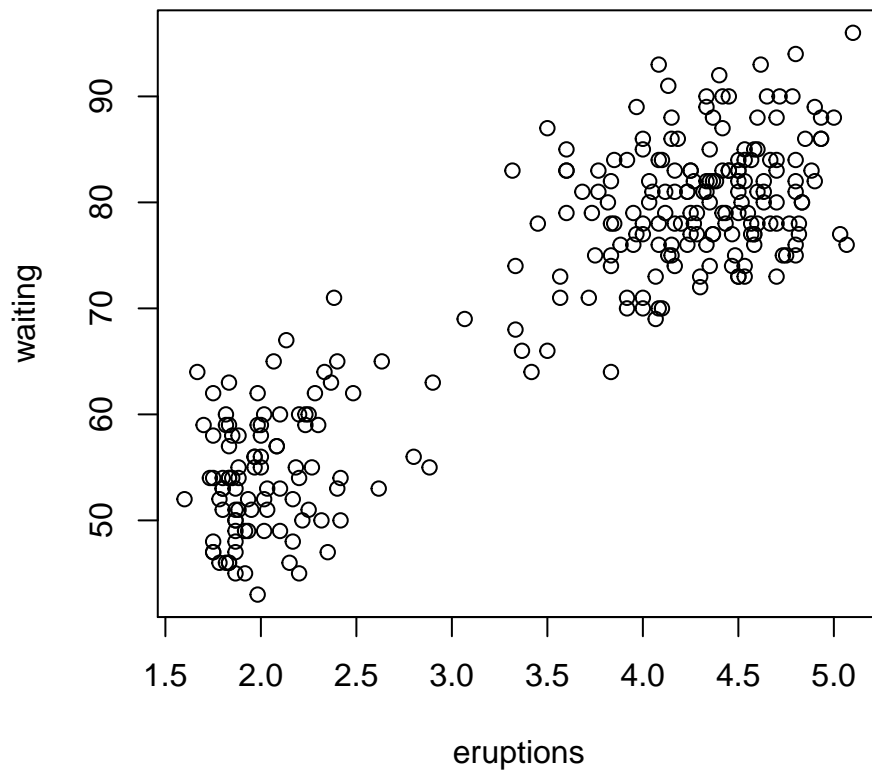
Inserting math equations. . . pretty ones

Another thing that makes this a great tool is that you can insert equations and have them print nicely, not linearly. [In fact, `LaTeX` was created for scientific (math) writing]

You need code for the symbols, fractions, etc.; most are the same or similar to html code for the same things. Operations (sums, fractions, etc.) need a backslash before the operator word.

Equations I

`\sum x_i` the subscript is denoted with an underscore
`\frac{a}{b}`

If more than one subscript is needed, you will need to use braces to isolate the subscripts.

Equations II

More than one subscript?

`x_i,x_ij` or `x_{ij}`?

`$x_i$`= x_i, `$x_ij$`= x_ij, and `$x_{ij}$`= x_{ij}

To do this in Markdown, all formulas need to be enclosed in $ signs. If Markdown sees `$code$` (or `$$code$$`), then it will treat what is in between the $ signs as code to run.

Equations III

`$\sum_{i=1}^n x_i$` will print as

$\sum_{i=1}^n x_i$

Note that the equation format is called "inline".

To get display form, use `$$code$$`.

`$$\sum_{i=1}^n x_i$$` will print as

$$\sum_{i=1}^n x_i$$

Equations IV

Greek letters are somewhat intuitive if you know how to spell the letter names (in English), like μ is spelled `mu` in English. Lowercase Greek letters are spelled with all lowercase letters and uppercase letters are spelled with a capital letter at the beginning of the word.

`\delta` (δ) is lowercase and `\Delta` (Δ) is uppercase

Some capital letters in the Greek alphabet are really the same as English uppercase letters. For example,

`\chi` (χ) is lowercase chi and an uppercase `X` is an uppercase chi; `\tau T`

Other formatting options I

Insert a horizontal rule (a horizontal line across a page) or page break: A line containing a row of three or more `*`, `-`, or `_` characters (optionally separated by spaces) produces a horizontal rule:

`***`
`---`

`---`

(In fact when you do 3 dashes or underscores in a row in Word, it will auto format to a horizontal line across the page)

Other formatting options II

You can insert code inside your text and have it appear as `R` code. All you need to do is use tick marks.

You can also have the function you are talking about appear in the font that `R` uses so that if you want to talk about the plot function, you could type it as the `plot()` function. You can also insert math into your text that needs to be computed. Use tick marks and `r` designation like when you insert chunks of code. Type r mean(eruptions) inside tick marks.
Example: The mean of eruptions of Old Faithful is 3.4877831.

Other formatting options III

There are many more things that can be done with Markdown, this presentation has covered the basics to get you started. Use the examples to see what is there and how the raw unprocessed document looks like.