

ST340 Lab 0: R Markdown

2020–21

R Markdown

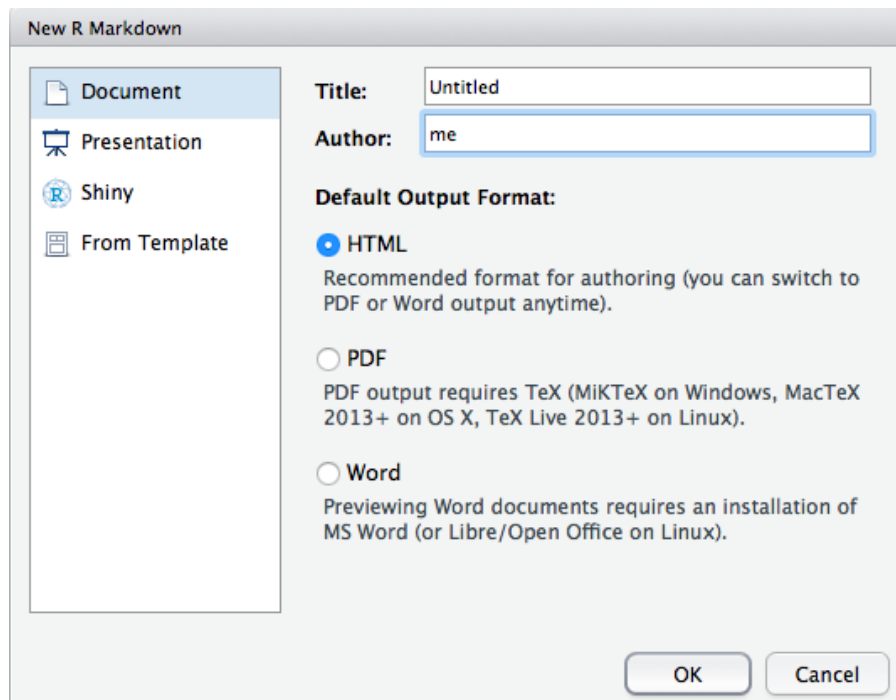
An R Markdown document is a combination of formatted text, $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ equations, and R code. This can be a useful tool for presenting a statistical analysis, since the source code and output can be interleaved with explanatory prose. In data science, this is known as *literate programming*¹. An R Markdown document (`.Rmd` file) can be compiled to produce Adobe PDF, Microsoft Word, or hypertext (HTML) output. You will need to use R Markdown to complete your assignments, but you might also find it useful for your weekly computer laboratory.

Download `Lab0.Rmd` from the Moodle page and open it in RStudio. If you press the **Knit** button, you should be able to compile it into a PDF document.



To create a new R Markdown document, use the menu command File > New File > R Markdown...

You should see a dialogue box similar to the following:



The following are useful resources for R Markdown:

¹Knuth, Donald E. (1992). *Literate Programming*.

- <https://github.com/rstudio/cheatsheets/raw/master/rmarkdown-2.0.pdf>
- http://rmarkdown.rstudio.com/authoring_pandoc_markdown.html
- <http://rmarkdown.rstudio.com/lesson-1.html>
- **Help > Markdown Quick Reference** in RStudio

```
plot(1:5,1:5)
```

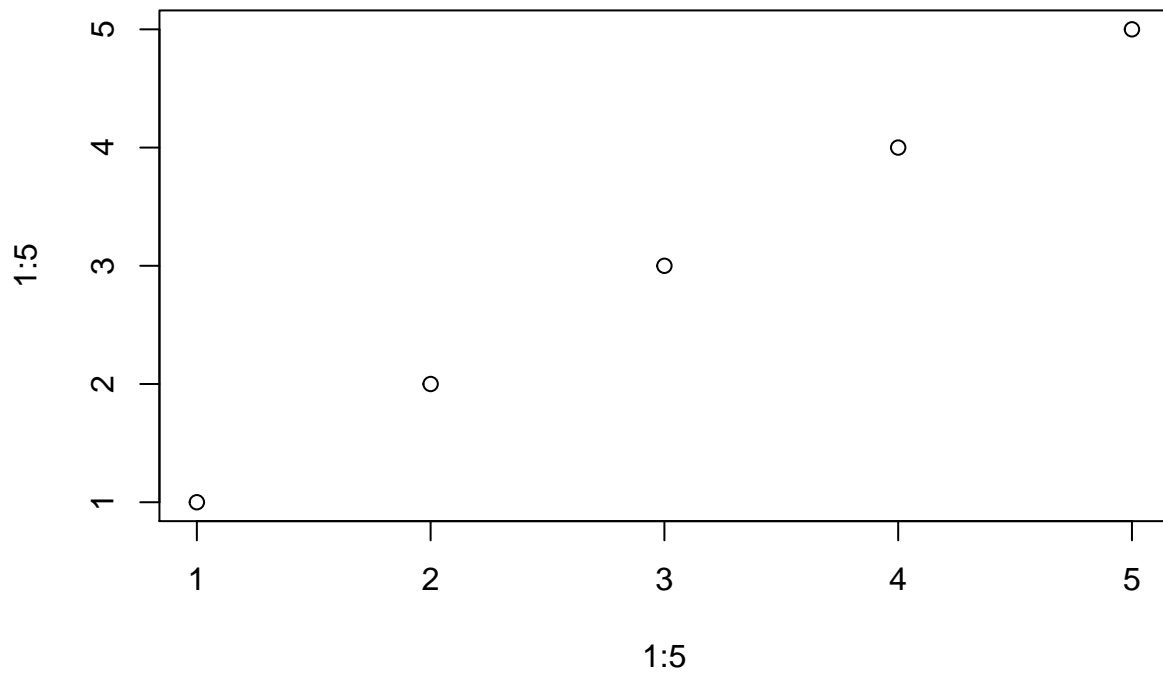


Figure 1: fig1

R Programming Exercises

These math / programming problems are the first 7 Project Euler problems. There are many more at <http://projecteuler.net/>

Problem 1: Multiples of 3 and 5

If we list all the natural numbers below 10 that are multiples of 3 or 5, we get 3, 5, 6 and 9. The sum of these multiples is 23. Find the sum of all the multiples of 3 or 5 below 1000.

```
library(magrittr)

multiples_3_or_5 = vector(length = 999)

for(i in 1:999){
  multiples_3_or_5[i] = (i%%3 == 0 | i%%5 == 0)
}

c(1:999)[multiples_3_or_5] %>%
  sum() %>%
  print()

## [1] 233168
```

Problem 2: Even Fibonacci numbers

Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ... By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Problem 3: Largest prime factor

The prime factors of 13195 are 5, 7, 13 and 29. What is the largest prime factor of the number 600851475143?

Problem 4: Largest palindrome product

A palindromic number reads the same both ways. The largest palindrome made from the product of two 2-digit numbers is $9009 = 91 \times 99$. Find the largest palindrome made from the product of two 3-digit numbers.

Hint: try “`strsplit`” to find an analogue of `rev()` for strings

Problem 5: Smallest multiple

2520 is the smallest number that can be divided by each of the numbers from 1 to 10 without any remainder. What is the smallest positive number that is evenly divisible by all of the numbers from 1 to 20?

Problem 6: Sum square difference

The sum of the squares of the first ten natural numbers is $1^2 + 2^2 + \dots + 10^2 = 385$. The square of the sum of the first ten natural numbers is $(1 + 2 + \dots + 10)^2 = 55^2 = 3025$. Hence the difference between the sum of the squares of the first ten natural numbers and the square of the sum is $3025 - 385 = 2640$.

Find the difference between the sum of the squares of the first one hundred natural numbers and the square of the sum.

Problem 7: 10001st prime

By listing the first six prime numbers: 2, 3, 5, 7, 11, and 13, we can see that the 6th prime is 13. What is the 10 001st prime number?