

Reading data files

Introduction

- ▶ First thing we need to do is to read in data, so that we can use our software to analyze.
- ▶ Consider these:
 - ▶ Spreadsheet data saved as .csv file.
 - ▶ “Delimited” data such as values separated by spaces.
 - ▶ Actual Excel spreadsheets.

Packages for this section

```
library(tidyverse)
```

A spreadsheet

The screenshot shows a LibreOffice Calc spreadsheet titled "test1.xlsx". The interface includes a menu bar (File, Edit, View, Insert, Format, Sheet, Data, Tools, Window, Help), a toolbar with various icons, and a status bar at the bottom. The spreadsheet has five columns labeled A, B, C, D, and E. The data is organized into rows, with row 9 highlighted. The status bar indicates "Sheet1", "Sum=0", and a zoom level of "200%".

	A	B	C	D	E
1	id	x	y	group	
2	p1	10	21	upper	
3	p2	11	20	lower	
4	p3	13	25	upper	
5	p4	15	27	lower	
6	p5	16	30	upper	
7	p6	17	31	lower	
8					
9					
10					
11					

Save as .csv

- ▶ .csv or “comma-separated values” is a way of turning spreadsheet values into plain text.
- ▶ Easy to read into R
- ▶ but does not preserve formulas. (This is a reason for doing all your calculations in your statistical software, and only having data in your spreadsheet.)
- ▶ File, Save As Text CSV (or similar).
- ▶ used name test1.csv.

The .csv file

```
id,x,y,group  
p1,10,21,upper  
p2,11,20,lower  
p3,13,25,upper  
p4,15,27,lower  
p5,16,30,upper  
p6,17,31,lower
```

To read this in:

- ▶ Fire up R Studio at r.datatools.utoronto.ca
- ▶ Upload this .csv file. (Bottom right, next to New Folder, Upload.) Click Choose File, find the file, click Open. Click OK. See the file appear bottom right.

Make a new Quarto document

- ▶ File, New File, Quarto Document
- ▶ ...and get rid of the template document (leaving the first four lines).
- ▶ Make a code chunk and in it put this. Run it.

```
library(tidyverse)
```

Reading in the file

- ▶ Use `read_csv` with the name of the file, in quotes. Save the read-in file in something, here called `mydata`. Make a new code chunk for this:

```
mydata <- read_csv("test1.csv")  
mydata
```

```
# A tibble: 6 x 4  
  id      x      y group  
  <chr> <dbl> <dbl> <chr>  
1 p1      10     21 upper  
2 p2      11     20 lower  
3 p3      13     25 upper  
4 p4      15     27 lower  
5 p5      16     30 upper  
6 p6      17     31 lower
```


More on the above

- ▶ `read_csv` guesses what kind of thing is in each column. Here it correctly guesses that:
 - ▶ `id` and `group` are text (categorical variables). `id` is actually “identifier variable”: identifies individuals.
 - ▶ `x` and `y` are “double”: numbers that might have a decimal point in them.

R Studio on your own computer

- ▶ Put the .csv file in the same folder as your project. Then read it in as above like `read_csv("test1.csv")`.
- ▶ Or, use

```
# f <- file.choose()  
f
```

which brings up a file selector (as if you were going to find a file to load or save it). Find your .csv file, the address of which will be saved in `f`, and then:

```
mydata <- read_csv(f)
```

- ▶ When you have selected the file, comment out the `file.choose` line by putting a `#` on the front of it. That will save you having to find the file again by mistake. (Keyboard shortcut: go to the line, type control-shift-C or Mac equivalent with Cmd.)

Looking at what we read in

- ▶ Again, type the name of the thing to display it:

```
mydata
```

```
# A tibble: 6 x 4
  id      x      y group
<chr> <dbl> <dbl> <chr>
1 p1      10     21 upper
2 p2      11     20 lower
3 p3      13     25 upper
4 p4      15     27 lower
5 p5      16     30 upper
6 p6      17     31 lower
```

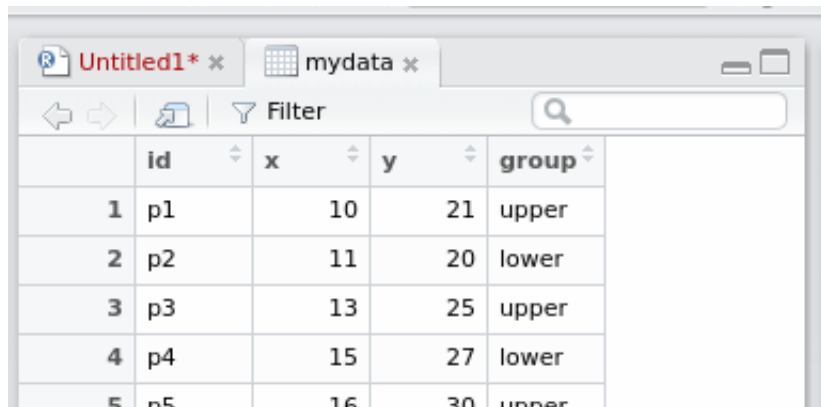
- ▶ This is a “tibble” or data frame, the standard way of storing a data set in R.
- ▶ Tibbles print as much as will display on the screen. If there are more rows or columns, it will say so.
- ▶ You will see navigation keys to display more rows or columns (if there are more).

View-ing your data frame

- ▶ Another way to examine your data frame is to View it, like this:

```
View(mydata)
```

...or find your data frame in the Global Environment top right and click it. - This pops up a “data frame viewer” top left:



The screenshot shows the RStudio 'Data Viewer' window. The title bar includes 'Untitled1*' and 'mydata'. Below the title bar is a toolbar with navigation icons (back, forward, home), a 'Filter' button with a funnel icon, and a search bar. The main area displays a table with 5 rows and 5 columns. The columns are labeled 'id', 'x', 'y', and 'group'. The rows are numbered 1 through 5. The data is as follows:

	id	x	y	group
1	p1	10	21	upper
2	p2	11	20	lower
3	p3	13	25	upper
4	p4	15	27	lower
5	p5	16	30	upper

This View

- ▶ Read-only: cannot edit data
- ▶ Can display data satisfying conditions: click on Filter, then:
 - ▶ for a categorical variable, type name of category you want
 - ▶ for a quantitative variable, use slider to describe values you want.
- ▶ Can sort a column into ascending or descending order (click little arrows next to column name).
- ▶ Clicking the symbol with arrow on it left of Filter “pops out” View into separate (bigger) window.

Summarizing what we read in

- ▶ It is always a good idea to look at your data after you have read it in, to make sure you have believable numbers (and the right number of individuals and variables).
- ▶ Quick check for errors: these often show up as values too high or too low, so the min and/or max will be unreasonable.
- ▶ Five-number summary:

```
summary(mydata)
```

id	x	y	group
Length:6	Min. :10.00	Min. :20.00	Length:6
Class :character	1st Qu.:11.50	1st Qu.:22.00	Class :character
Mode :character	Median :14.00	Median :26.00	Mode :character
	Mean :13.67	Mean :25.67	
	3rd Qu.:15.75	3rd Qu.:29.25	
	Max. :17.00	Max. :31.00	

- ▶ Quantitative, five-number summary plus mean.
- ▶ Categorical, how many rows.

Reading from a URL

- ▶ Any data file on the Web can be read directly.
- ▶ Example data link:
- ▶ Use URL instead of filename.
- ▶ I like to save the URL in a variable first (because URLs tend to be long), and then put that variable in the `read_` function:

```
my_url <- "http://ritsokiguess.site/datafiles/global.csv"  
my_url
```

```
[1] "http://ritsokiguess.site/datafiles/global.csv"
```

```
global <- read_csv(my_url)
```

The data

```
global
```

```
# A tibble: 10 x 3
  warehouse size cost
  <chr>      <dbl> <dbl>
1 A         225 12.0
2 B         350 14.1
3 A         150  8.93
4 A         200 11.0
5 A         175 10.0
6 A         180 10.1
7 B         325 13.8
8 B         290 13.3
9 B         400 15
10 A        125  7.97
```


Space-delimited files

- ▶ Another common format for data is a text file with the values separated by spaces. Top of some other data:

```
cup tempdiff
Starbucks 13
Starbucks 7
Starbucks 7
Starbucks 17.5
Starbucks 10
Starbucks 15.5
Starbucks 6
Starbucks 6
SIGG 12
SIGG 16
SIGG 9
SIGG 23
SIGG 11
SIGG 20.5
SIGG 12.5
```

Reading the coffee data

- ▶ This file was on my computer so I uploaded it to `r.datatools.utoronto.ca` first.
- ▶ This time, `read_delim`, and we also have to say what the thing is separating the values:

```
coffee <- read_delim("coffee.txt", " ")  
coffee
```

```
# A tibble: 32 x 2  
  cup      tempdiff  
  <chr>      <dbl>  
1 Starbucks    13  
2 Starbucks     7  
3 Starbucks     7  
4 Starbucks   17.5  
5 Starbucks    10  
6 Starbucks   15.5  
7 Starbucks     6  
8 Starbucks     6
```

Looking at the values (some)

```
coffee
```

```
# A tibble: 32 x 2
  cup      tempdiff
  <chr>      <dbl>
1 Starbucks    13
2 Starbucks     7
3 Starbucks     7
4 Starbucks   17.5
5 Starbucks    10
6 Starbucks   15.5
7 Starbucks     6
8 Starbucks     6
9 SIGG        12
10 SIGG        16
# i 22 more rows
```

These were four brands of travel mug (in cup), and for each, how much the temperature of the coffee in the mug decreased over 20

Reading from the Web; the soap data

- ▶ Use the URL in place of the filename.
- ▶ Save the URL in a variable first:

```
url <- "http://ritsokiguess.site/datafiles/soap.txt"  
soap <- read_delim(url, " ")
```

The soap data (some)

```
soap
```

```
# A tibble: 27 x 4
  case scrap speed line
  <dbl> <dbl> <dbl> <chr>
1     1     1    218   100 a
2     2     2    248   125 a
3     3     3    360   220 a
4     4     4    351   205 a
5     5     5    470   300 a
6     6     6    394   255 a
7     7     7    332   225 a
8     8     8    321   175 a
9     9     9    410   270 a
10    10    10    260   170 a
# i 17 more rows
```

Data aligned in columns

- Sometimes you see data aligned in columns, thus:

DrugA	DrugB	DrugC
4	6	6
5	8	7
4	4	6
3	5	6
2	4	7
4	6	5
3	5	6

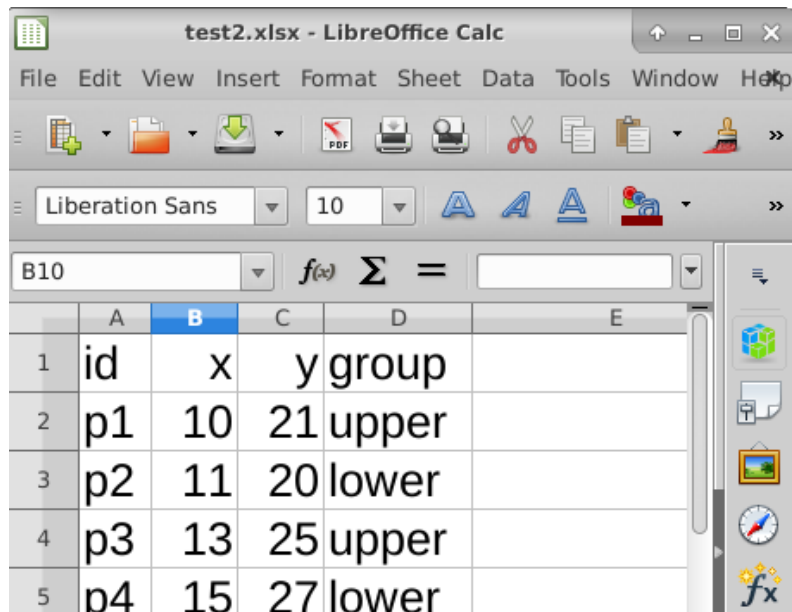
Reading in column-aligned data

```
drugs <- read_table("migraine.txt")  
drugs
```

```
# A tibble: 9 x 3  
  DrugA DrugB DrugC  
  <dbl> <dbl> <dbl>  
1     4     6     6  
2     5     8     7  
3     4     4     6  
4     3     5     6  
5     2     4     7  
6     4     6     5  
7     3     5     6  
8     4    10     5  
9     4     6     5
```

Reading an Excel sheet directly

- ▶ Here is my spreadsheet from before, but tarted up a bit:



The screenshot shows the LibreOffice Calc application window titled "test2.xlsx - LibreOffice Calc". The menu bar includes File, Edit, View, Insert, Format, Sheet, Data, Tools, Window, and Help. The toolbar contains icons for opening, saving, printing, and editing. The spreadsheet has 5 columns (A-E) and 5 rows (1-5). The data is as follows:

	A	B	C	D	E
1	id	x	y	group	
2	p1	10	21	upper	
3	p2	11	20	lower	
4	p3	13	25	upper	
5	p4	15	27	lower	

Reading it in

- ▶ Read into R, saying that we only want the sheet "data".
Upload spreadsheet first.
- ▶ Excel spreadsheets must be "local": cannot read one in from a URL.

```
# install.packages("readxl")  
library(readxl)  
mydata2 <- read_excel("test2.xlsx", sheet = "data")  
mydata2
```

```
# A tibble: 6 x 4  
  id      x      y group  
  <chr> <dbl> <dbl> <chr>  
1 p1      10     21 upper  
2 p2      11     20 lower  
3 p3      13     25 upper  
4 p4      15     27 lower  
5 p5      16     30 upper  
6 p6      17     21 lower
```