

Reading in data

Section 1

Reading in data

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

test1.xlsx - LibreOffice Calc

File Edit View Insert Format Sheet Data Tools Window Help

Liberation Sans 10

D9 $f(x)$ Σ =

	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 `jupyter.utoronto.ca`. (this said `rstudio.cloud` until a few minutes ago)
- 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 notebook

- ...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")
```

```
## Rows: 6 Columns: 4
```

```
## -- Column specification -----
```

```
## Delimiter: ","
```

```
## chr (2): id, group
```

```
## dbl (2): x, y
```

```
##
```

```
## i Use `spec()` to retrieve the full column specification for this data
```

```
## i Specify the column types or set `show_col_types = FALSE` to suppress this message
```

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
```

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

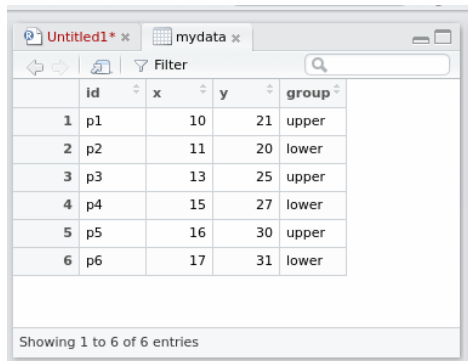
- This is a “tibble” or data frame, the standard way of storing a data set in R.
- Tibbles print as much as will display on the screen. If there are more rows or columns, it will say so.
- You will see navigation keys to display more rows or columns (if there are more).

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'. The window contains a table with 6 rows and 5 columns. The columns are labeled 'id', 'x', 'y', and 'group'. The rows are numbered 1 through 6. The 'id' column contains values 'p1' through 'p6'. The 'x' column contains values 10, 11, 13, 15, 16, 17. The 'y' column contains values 21, 20, 25, 27, 30, 31. The 'group' column contains values 'upper', 'lower', 'upper', 'lower', 'upper', 'lower'. A search bar is visible at the top right of the table. At the bottom of the window, it says 'Showing 1 to 6 of 6 entries'.

	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
6	p6	17	31	lower

Showing 1 to 6 of 6 entries

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

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 <- url("http://ritsokiguess.site/datafiles/global.csv")
global <- read_csv(my_url)
```

```
## Rows: 10 Columns: 3
## -- Column specification -----
## Delimiter: ","
## chr (1): warehouse
## dbl (2): size, cost
##
## i Use `spec()` to retrieve the full column specification for this
## i Specify the column types or set `show_col_types = FALSE` to qu
```


The data

```
global
```

warehouse	size	cost
A	225	11.95
B	350	14.13
A	150	8.93
A	200	10.98
A	175	10.03
A	180	10.13
B	325	13.75
B	290	13.30
B	400	15.00
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
```

Reading the coffee data

- This file was on my computer so I uploaded it to `jupyter.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", " ")
```

```
## Rows: 32 Columns: 2
```

```
## -- Column specification -----
```

```
## Delimiter: " "
```

```
## chr (1): cup
```

```
## dbl (1): tempdiff
```

```
##
```

```
## i Use `spec()` to retrieve the full column specification for
```

```
## i Specify the column types or set `show_col_types = FALSE`
```

```
coffee
```

Looking at the values (some)

coffee

cup	tempdiff
Starbucks	13.0
Starbucks	7.0
Starbucks	7.0
Starbucks	17.5
Starbucks	10.0
Starbucks	15.5
Starbucks	6.0
Starbucks	6.0
SIGG	12.0
SIGG	16.0
SIGG	9.0
SIGG	23.0
SIGG	11.0

Reading from the Web; the soap data

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

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

```
## Rows: 27 Columns: 4
```

```
## -- Column specification -----
```

```
## Delimiter: " "
```

```
## chr (1): line
```

```
## dbl (3): case, scrap, speed
```

```
##
```

```
## i Use `spec()` to retrieve the full column specification for
```

```
## i Specify the column types or set `show_col_types = FALSE`
```

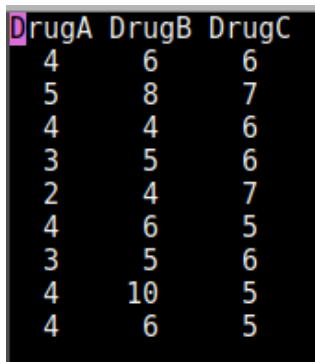
The soap data (some)

soap

case	scrap	speed	line
1	218	100	a
2	248	125	a
3	360	220	a
4	351	205	a
5	470	300	a
6	394	255	a
7	332	225	a
8	321	175	a
9	410	270	a
10	260	170	a
11	241	155	a
12	331	190	a
13	275	140	a

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
4	10	5
4	6	5

- `read_delim` will not work: values separated by more than one space.
- The number of spaces between values is not constant, because there is one fewer space before the 10.
- `read_table` works for this.

Reading in column-aligned data

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

```
##  
## -- Column specification -----  
## cols(  
##   DrugA = col_double(),  
##   DrugB = col_double(),  
##   DrugC = col_double()  
## )
```

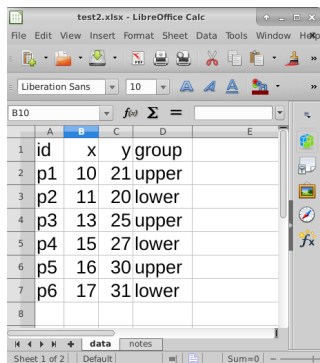

The data

drugs

DrugA	DrugB	DrugC
4	6	6
5	8	7
4	4	6
3	5	6
2	4	7
4	6	5
3	5	6
4	10	5
4	6	5

Reading an Excel sheet directly

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



test2.xlsx - LibreOffice Calc

File Edit View Insert Format Sheet Data Tools Window Help

Liberation Sans 10

B10 f(x) Σ =

	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					

data notes

Sheet 1 of 2 | Default | Sum=0

- It is now a workbook with a second sheet called “notes” (that we don't want).
- Install package `readxl` first.

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.

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

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