Introduction to R Programming

Reading and Writing Tables

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20 Abril 2020

Before importing data

- Are you in the correct working directory? Are you in a project?
- Remember `getwd()` and `setwd()`.
- Typically we import tables stored in text files or CSV files (comma separated values).
- There are packages that allow import xls and xlsx tables into R, but if you want to read data from excel I reccomend saving your excel worksheet as a CSV or text (tab delimited) file instead.
- It is important to open the file were the table is stored with a text editor and pay attention to the structure of the data.

The source file

What to look for:

- Headers (column names)
- Separator (`","`, `";"`, “\t”, . . .)
- How are strings represented? (with `"\""` ?)
- Decimal separators (`"."`, or `","`?)
- Row names
- How are `NA`s represented? (`" "`, `"NA"`, `"na"`, `"Na"`, `"."`, `"-"`, . . .)

The source file

What to look for:

- Should we read all the lines of the file?
- Is there any metadata? Does the table start in the first line of the file?
- Are there comments? What is the comment character?

Base R functions for reading tables

- All we need is `read.table()`!

But there are some useful wrappers around `read.table()`:

- `read.csv()`
- `read.csv2()`
- `read.delim()`
- `read.delim2()`

These functions read a file in table format and create a data frame that you can assign to an R object.

read.table()

`read.table()` is our powerhouse function for reading tables from external files These are the most important defaults:

```
read.table(file, header = FALSE, sep = "",
           quote = "\"'", dec = ".", row.names,
           col.names, na.strings = "NA",
           nrows = -1, skip = 0, comment.char = "#")
```

- The `file` argument is where you specify the name of the file you want to read.
- If the file is not in the working directory you should indicate the path to the file instead.
- File names and paths must be provided as strings of characters.

`read.table()`

- To the `row.names` argument you can either provide a vector with the names or a single number or character string indicating the position or the name of the column containing the names.
- If there is a header and the first row contains one fewer field than the number of columns, the first column is used for the row names. If `row.names` is missing, the rows are numbered.

Wrappers around `read.table()`

`read.csv()` and `read.csv2()` are identical to `read.table()` except for the defaults. They are intended for reading CSV files with:

- `read.csv()`: `sep = ","` and `dec = "."`
- `read.csv2()`: `sep = ";"` and `dec = ","`

Also, both `read.csv()` and `read.csv2()` have `header = TRUE` and and `comment.char = ""`, which means that the comment character is disabled.

Wrappers around `read.table()`

`read.delim()` and `read.delim2()`are identical to `read.table()` except for the defaults. They are intended for reading TAB delimited files (sep = "\t") with:

- `read.delim()`: dec = "."
- `read.delim2()`: dec = ","

Also, both `read.delim()` and `read.delim2()` have `header = TRUE` and and `comment.char = ""`, which means that the comment character is disabled.

Getting started

- Check your working directory
- Change it if you want
- Put the `mt.csv` file in your current working directory
- Now read it and save the table in an R object named `mt`
- Open the `mt` data frame using your global environment or with `View()`

```
mt <- read.csv(file = "mt.csv")
```

```
View(mt)
```

Getting started

- Now create a new folder on your working directory an name it "datasets".
- Store this lecture's datasets there (except `mt.csv`).

Using `read.csv()`

Read the mtcars0.csv file from the datasets folder and assign it to an objet:

```
mtcars0 <- read.csv(file = "datasets/mtcars0.csv")
```

Using `read.csv()`

Read the mtcars1.csv file from the datasets folder and assign it to an object:

```
mtcars1 <- read.csv(file = "datasets/mtcars1.csv",
                    row.names = 1)
```

Using `read.csv2()`

Read the airquality0.csv file from the datasets folder and assign it to an object:

```
air0 <- read.csv2("datasets/airquality0.csv")
```

Using `read.csv2()`

Read the airquality1.csv file from the datasets folder and assign it to an object:

```
air1 <- read.csv2("datasets/airquality1.csv",
                  row.names = 1)
```

Using `read.delim()`

Read the iris0.txt file from the datasets folder and assign it to an object:

```
iris0 <- read.delim("datasets/iris0.txt")
```

Using `read.delim()`

Read the iris1.txt file from the datasets folder and assign it to an object:

```
iris1 <- read.delim("datasets/iris1.txt",
                    header = FALSE,
                    row.names = 1)
```

Using `read.delim2()`

Read the weight file from the datasets folder and assign it to an object:

```
weight <- read.delim2("datasets/weight.txt")
```

Using `read.delim2()`

Read the womanNA.txt file from the datasets folder and assign it to an object:

```
woman <- read.delim2("datasets/womanNA.txt",
                     na.strings = c("NA", "Na"))
```

Using `read.table()`

Read the woman.txt file from the datasets folder and assign it to an object:

```
woman2 <- read.table("datasets/woman.txt",
                     sep = "\t",
                     header = TRUE)
```

Using `read.table()`

Read the AirPassengers.csv file from the datasets folder and assign it to an object:

```
airPass <- read.table("datasets/AirPassengers.csv",
                      sep = "|")
```

Why didn´t I use `row.names = 1`?

Using `read.table()`

Read the ChickWeight.txt file from the datasets folder and assign it to an object:

```
chick <- read.table("datasets/ChickWeight.txt",
                    sep = "&",
                    row.names = 1)
```

Using `read.table()`

Read the iris.csv file from the datasets folder and assign it to an object:

```
iris2 <- read.table("datasets/iris.csv",
                    sep = ";",
                    dec = ",",
                    header = TRUE)
```

Using `read.table()`

Read the irisNA.csv file from the datasets folder and assign it to an object:

```
iris3 <- read.table("datasets/irisNA.csv",
                    sep = ";",
                    dec = ",",
                    header = TRUE,
                    na.strings = "-")
```

Using `read.table()`

Read the irisNA2.csv file from the datasets folder and assign it to an object:

```
iris4 <- read.table("datasets/irisNA2.csv",
                    sep = ";",
                    dec = ",",
                    header = TRUE,
                    na.strings = "-",
                    skip = 5)
```

Using `read.table()`

Read the irisNA3.csv file from the datasets folder and assign it to an object:

```
iris5 <- read.table("datasets/irisNA3.csv",
                    sep = ";",
                    dec = ",",
                    header = TRUE,
                    na.strings = "-",
                    skip = 3,
                    comment.char = "%")
```

Reading a file from the internet

It's also possible to use any of the functions that we've just learned to import files from the web:

```
my_data <- read.delim(
  "http://www.sthda.com/upload/boxplot_format.txt")

head(my_data)
```

```
##    Nom variable Group
## 1 IND1       10     A
## 2 IND2        7     A
## 3 IND3       20     A
## 4 IND4       14     A
## 5 IND5       14     A
## 6 IND6       12     A
```

Writing data

After doing calculations with imported data, we usually want to store tables with our results in a local file.

This can be done with:

- `write.table()`
- `write.csv()`
- `write.csv2()`

Writing data

- `write.table()` is like `write.table()` in reverse.
- Likewise, `write.csv()` and `write.csv2()` are wrappers around `write.table()` differing only in the default values.

Writing data

These are the most important default values of `write.table()`:

```
write.table(x, file = "", quote = TRUE, sep = " ",
            na = "NA", dec = ".", row.names = TRUE,
            col.names = TRUE)
```

- `write.table()` prints object `x` (after converting it to a data frame if it is not one nor a matrix) to a local file.
- In the `file argument` you should indicate a character string naming the output file (with the respective path, in case you don't want to store the file in the working directory).
- The `quote` argument indicates if character and factor columns should be surrounded by double quotes in the output.

Writing data

- The `sep` argument stipulates how the values of the table should be separated in the output file.
- The `na` arguments indictes how the `NA` values should be displayed in the output file
- `row.names` and `col.names` indicate whether or not row names and column names should be printed to the output file.

Writing data

- `write.csv` uses `","` as separator and `"."` as decimal point
- `write.csv2` uses `";"` as separator and `","` as decimal point

Writing data

By default:

- In your working directory, create a new folder called outputs.

Writing data

Write the mtcars1 dataframe to a CSV file with row names and column names.

```
write.csv(x = mtcars1,
          file = "outputs/mtcars1.csv")
```

Or:

```
write.table(x = mtcars1,
            file = "outputs/mtcars1.csv",
            sep = ";")
```

Writing data

Write the mtcars1 dataframe to a CSV file with row names, column names, and values separated with ";". Use "," as the decimal separator.

```
write.csv2(x = mtcars1,
           file = "outputs/mtcars1_v2.csv")
```

Or:

```
write.table(x = mtcars1,
            file = "outputs/mtcars1_v2.csv",
            sep = ";",
            dec = ",")
```

Writing data

Write the air0 dataframe to a tab delimited file (.txt). Include column names but not row names, and identify the NAs with "-".

```
write.table(air0, file = "outputs/air0.txt",
            sep = "\t",
            row.names = FALSE,
            na = "-")
```

Writing data

Write the chick dataframe to a text file without row names nor column names. Table values in the output should be separated by "|".

```
write.table(chick, file = "outputs/chick.txt",
            sep = "|",
            row.names = FALSE,
            col.names = FALSE)
```