First Contact with R

R Intro

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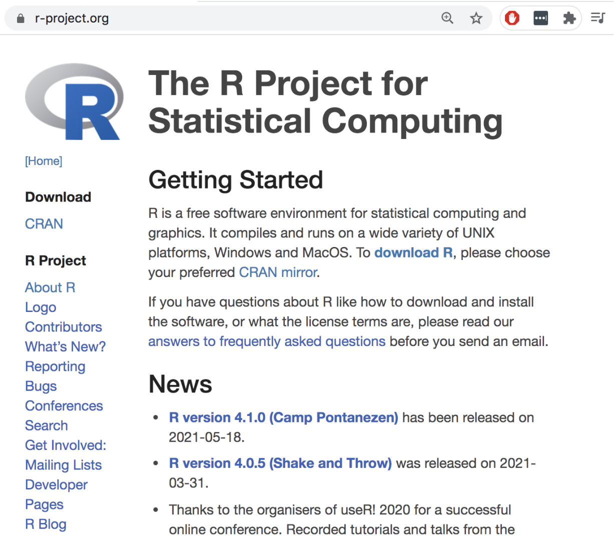
R Coding Compendium

Donate

About

In this slides we'll talk about some of aspects for getting started with R.

R Website



r-project.org

The R Project for Statistical Computing

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Getting Started

R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. To **download R**, please choose your preferred CRAN mirror.

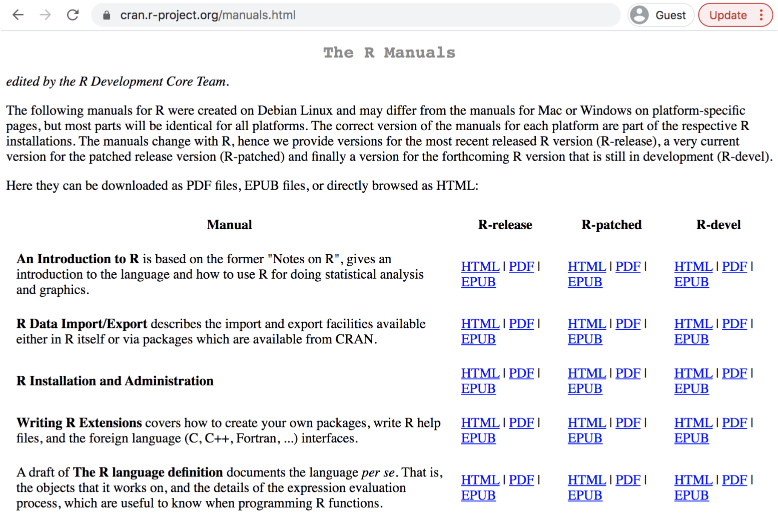
If you have questions about R like how to download and install the software, or what the license terms are, please read our answers to frequently asked questions before you send an email.

News

- **R version 4.1.0 (Camp Pontanezen)** has been released on 2021-05-18.
- **R version 4.0.5 (Shake and Throw)** was released on 2021-03-31.
- Thanks to the organisers of useR! 2020 for a successful online conference. Recorded tutorials and talks from the

https://www.r-project.org/

R Technical Manuals



The R Manuals

edited by the R Development Core Team.

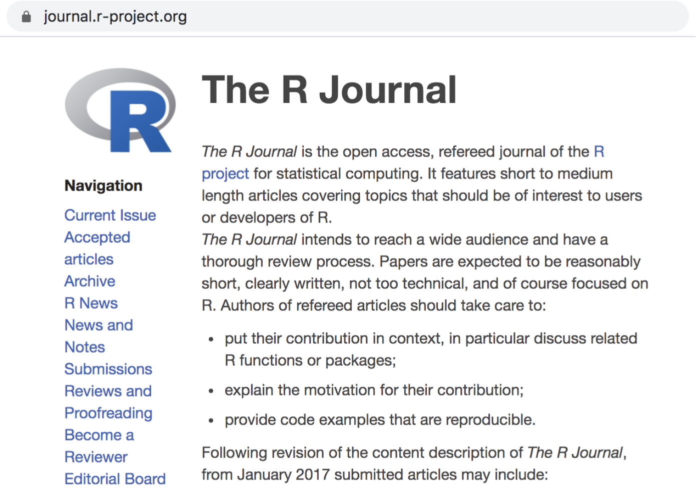
The following manuals for R were created on Debian Linux and may differ from the manuals for Mac or Windows on platform-specific pages, but most parts will be identical for all platforms. The correct version of the manuals for each platform are part of the respective R installations. The manuals change with R, hence we provide versions for the most recent released R version (R-release), a very current version for the patched release version (R-patched) and finally a version for the forthcoming R version that is still in development (R-devel).

Here they can be downloaded as PDF files, EPUB files, or directly browsed as HTML:

Manual	R-release	R-patched	R-devel
An Introduction to R is based on the former "Notes on R", gives an introduction to the language and how to use R for doing statistical analysis and graphics.	HTML | PDF | EPUB	HTML | PDF | EPUB	HTML | PDF | EPUB
R Data Import/Export describes the import and export facilities available either in R itself or via packages which are available from CRAN.	HTML | PDF | EPUB	HTML | PDF | EPUB	HTML | PDF | EPUB
R Installation and Administration	HTML | PDF | EPUB	HTML | PDF | EPUB	HTML | PDF | EPUB
Writing R Extensions covers how to create your own packages, write R help files, and the foreign language (C, C++, Fortran, ...) interfaces.	HTML | PDF | EPUB	HTML | PDF | EPUB	HTML | PDF | EPUB
A draft of **The R language definition** documents the language *per se*. That is, the objects that it works on, and the details of the expression evaluation process, which are useful to know when programming R functions.	HTML | PDF | EPUB	HTML | PDF | EPUB	HTML | PDF | EPUB

https://cran.r-project.org/manuals.html

R Journal



journal.r-project.org

The R Journal

Navigation

- Current Issue
- Accepted articles
- Archive
- R News
- News and Notes
- Submissions
- Reviews and Proofreading
- Become a Reviewer
- Editorial Board

The R Journal is the open access, refereed journal of the R project for statistical computing. It features short to medium length articles covering topics that should be of interest to users or developers of R.

The R Journal intends to reach a wide audience and have a thorough review process. Papers are expected to be reasonably short, clearly written, not too technical, and of course focused on R. Authors of refereed articles should take care to:

- put their contribution in context, in particular discuss related R functions or packages;
- explain the motivation for their contribution;
- provide code examples that are reproducible.

Following revision of the content description of *The R Journal*, from January 2017 submitted articles may include:

https://journal.r-project.org/

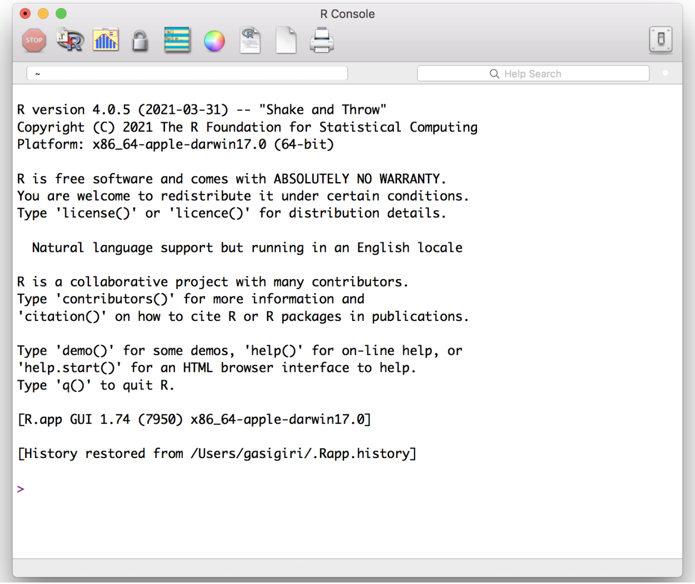
Using R

Using R Interactively

There are three ways to use R interactively:

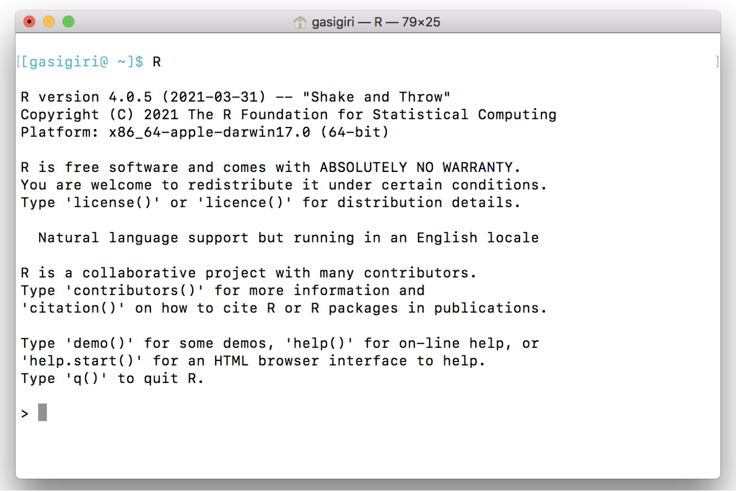
- R's built-in Graphical User Interface (GUI)
- R's console via a command line interface (terminal, shell)
- Via an Integrated Development Environment (IDE) such as RStudio (highly recommended)

R's built-in GUI



```
R version 4.0.5 (2021-03-31) -- "Shake and Throw"
Copyright (C) 2021 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin17.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

  Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[R.app GUI 1.74 (7950) x86_64-apple-darwin17.0]

[History restored from /Users/gasigiri/.Rapp.history]

>
```

R from Terminal



```
[[gasigiri@ ~]$ R                                                              ]

R version 4.0.5 (2021-03-31) -- "Shake and Throw"
Copyright (C) 2021 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin17.0 (64-bit)

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Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> 
```
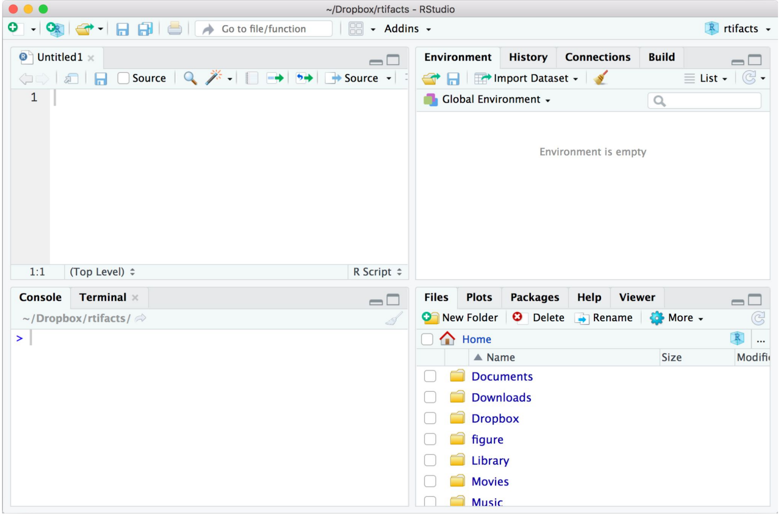

R from RStudio



Environment is empty

R and RStudio

R $\neq$ RStudio

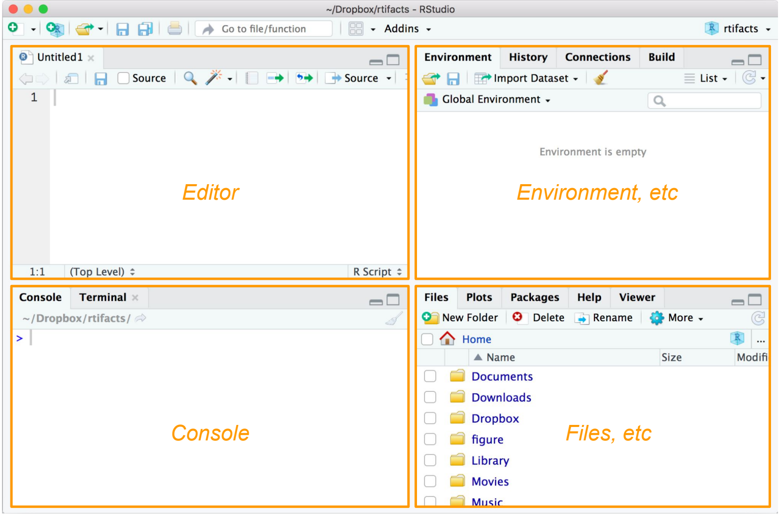
Working with RStudio

RStudio provides an *Integrated Development Environment* (IDE) that makes it really easy to work with R (everything in a single window).

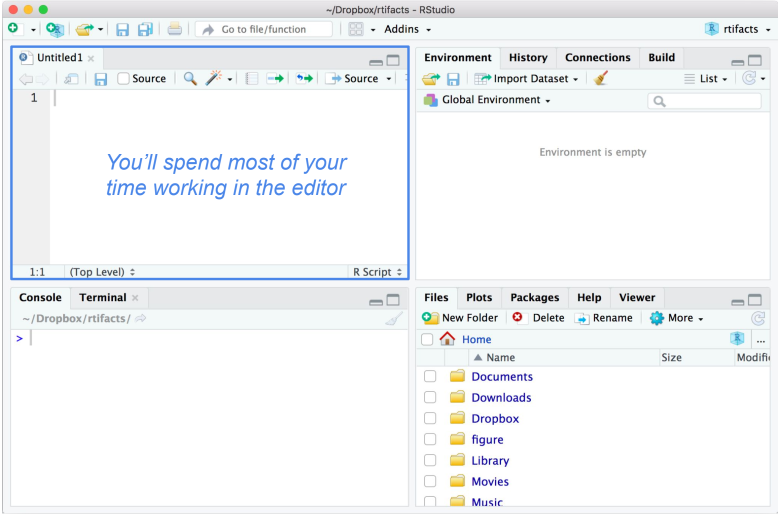
RStudio layout has four quadrants or *panes*:

- console pane
- editor pane
- environment & history pane
- files, plots, and help pane

RStudio Panes



RStudio Panes



You'll spend most of your time working in the editor

Main source files

I'm assuming that you are going to use RStudio.

The most common way to interact with R is by using `R` script file(s) and/or an `Rmd` file(s)

- `R` script files contain just R code.
- `Rmd` files are dynamic (or computational) documents where you can mix narrative and code.

Typing simple commands in R's Console

Entering Input

At the R prompt, > , we type *expressions*.

```
> 5 + 3
>
> "some text"
>
> 3^2
```

CalculatoR

You can use R as a calculator; this is perhaps the simplest way to “break the ice” with R (especially if you are new to programming)

```r
2 + 3
4 - 1
3 * 4
10 / 2
3^3
```

Using functions

You'll be constantly using functions:

```r
sqrt(9)

log(5)

exp(1)

(1.3 - 5)^2 + (log(5) / 3.14)
```

Assignments

You can assign values to objects using the assignment operator **<-** or the equal sign **=** :

```
# assignment with 'arrow'
a <- 2 + 3

# assignment with 'equal'
b = 2 * 3
```

Comments

The hash symbol # (or number sign) indicates a comment. Anything to the right of # is ignored.

```r
# this is a comment
txt <- 'this is some text'

sqrt(9)  # example of square root

# -------------
# more comments
# -------------
```

R basics

R is case sensitive!

```r
# Z different from z
Z <- 1
z <- 2
Z + z
```

```
## [1] 3
```

R basics

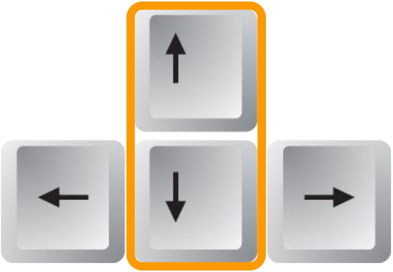
Case sensitive: this means that "hello" is not the same as "Hello" or "HELLO"

```r
hello <- "hello"
Hello <- "Hello"

# are they equal?
hello == Hello
```

```
## [1] FALSE
```

R basics

When working in the R's console, use the up and down arrows to navigate through previous commands or instructions:



R basics

Many languages use semicolons after each line. But in R there's (almost) no need to use semicolons

```r
# no need for semicolons
2 + 4
2 + 4;

# except in this case (which I don't recommend)
# to include various statements in the same line
2 + 4; A <- 2 * 5; B <- 'abc'
```

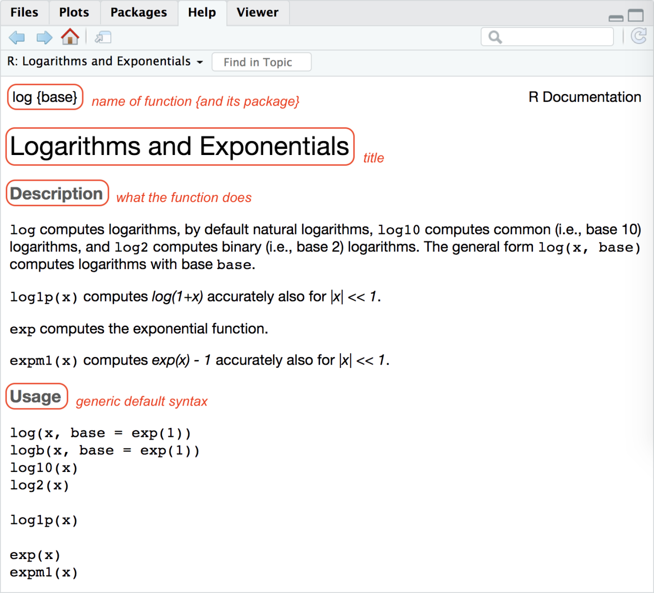
Help (manual) Documentation

Help

To know about a function, use the `help()`

For example, say you want to know about the `log()` function:

```r
help("log")

# equivalent
?log
```



log {base} *name of function {and its package}*

R Documentation

Logarithms and Exponentials

title

Description

what the function does

`log` computes logarithms, by default natural logarithms, `log10` computes common (i.e., base 10) logarithms, and `log2` computes binary (i.e., base 2) logarithms. The general form `log(x, base)` computes logarithms with base `base`.

`log1p(x)` computes $log(1+x)$ accurately also for $|x| << 1$.

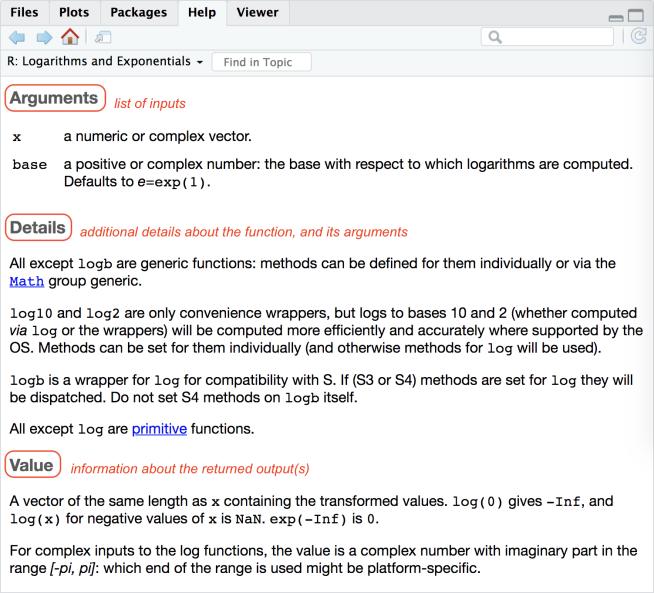
`exp` computes the exponential function.

`expm1(x)` computes $exp(x) - 1$ accurately also for $|x| << 1$.

Usage

generic default syntax

```
log(x, base = exp(1))
logb(x, base = exp(1))
log10(x)
log2(x)

log1p(x)

exp(x)
expm1(x)
```



Arguments

list of inputs

`x` a numeric or complex vector.

`base` a positive or complex number: the base with respect to which logarithms are computed. Defaults to `e=exp(1)`.

Details

additional details about the function, and its arguments

All except `logb` are generic functions: methods can be defined for them individually or via the [`Math`] group generic.

`log10` and `log2` are only convenience wrappers, but logs to bases 10 and 2 (whether computed *via* `log` or the wrappers) will be computed more efficiently and accurately where supported by the OS. Methods can be set for them individually (and otherwise methods for `log` will be used).

`logb` is a wrapper for `log` for compatibility with S. If (S3 or S4) methods are set for `log` they will be dispatched. Do not set S4 methods on `logb` itself.

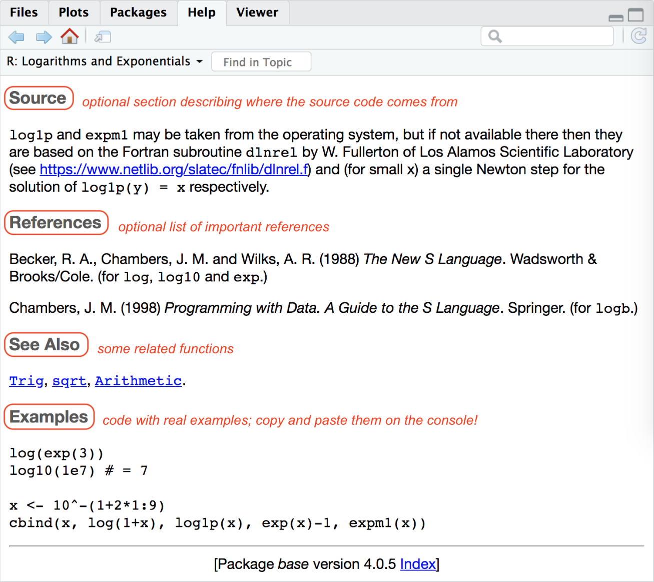
All except `log` are primitive functions.

Value

information about the returned output(s)

A vector of the same length as `x` containing the transformed values. `log(0)` gives `-Inf`, and `log(x)` for negative values of `x` is `NaN`. `exp(-Inf)` is `0`.

For complex inputs to the log functions, the value is a complex number with imaginary part in the range *[-pi, pi]*: which end of the range is used might be platform-specific.



Source

optional section describing where the source code comes from

`log1p` and `expm1` may be taken from the operating system, but if not available there then they are based on the Fortran subroutine `dlnrel` by W. Fullerton of Los Alamos Scientific Laboratory (see https://www.netlib.org/slatec/fnlib/dlnrel.f) and (for small x) a single Newton step for the solution of `log1p(y) = x` respectively.

References

optional list of important references

Becker, R. A., Chambers, J. M. and Wilks, A. R. (1988) *The New S Language*. Wadsworth & Brooks/Cole. (for `log`, `log10` and `exp`.)

Chambers, J. M. (1998) *Programming with Data. A Guide to the S Language*. Springer. (for `logb`.)

See Also

some related functions

`Trig`, `sqrt`, `Arithmetic`.

Examples

code with real examples; copy and paste them on the console!

```
log(exp(3))
log10(1e7) # = 7

x <- 10^-(1+2*1:9)
cbind(x, log(1+x), log1p(x), exp(x)-1, expm1(x))
```

[Package *base* version 4.0.5 Index]

Terminate an R session

To quit a session simply type `quit()` or `q()`

```r
# saves your workspace
quit(save = "yes")
```

```r
# doesn't save your workspace
quit(save = "no")
```

Terminate an R session

- If you use `quit("yes")` or `q("yes")` R will save your workspace (the created objects and variables).
- The workspace is saved in an `.RData` file.
- Next time you open R, the saved workspace should be available.

Saved Workspace

If you previously typed `q("yes")`, open a new R session and inspect what objects do you have:

```
# list objectst in your workspace
ls()
```

Recording your work

- In addition to `quit(save = "yes")`, there's also the function `savehistory()`
- You can use `savehistory()` to save everything you did
- It may be useful to call `savehistory()` at the end of a session
- By default, the commands-history will be saved in a file called `.Rhistory` (you can use other extension)
- You can open this file in any text editor

Recording your work

Type some expressions, save your commands-history, and then quit R (without saving workspace)

```
2 * 2
2^10

# first comment
course <- "stat133"

# converting units
height_ft <- 5.9
height_in <- height_ft * 12
height_m <- height_ft * 0.3048

savehistory(file = 'test-session.R')
quit(save = "no")
```

Open the file `"test-session.R"` and see what's in it

R Console

- Minimal GUI
- The console is OK for short expressions.
- The console is good as a calculator.
- But very limited for longer expressions.
- It's better to alternate with **source scripts** such as `R` script file(s) or `Rmd` file(s).

Learning R

While learning R (or any programming language), keep in mind:

- You'll get frustrated
- It takes time to become fluent
- Lots of trials and errors
- Be patient
- Practice, practice, practice

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