Lenguaje de programación R

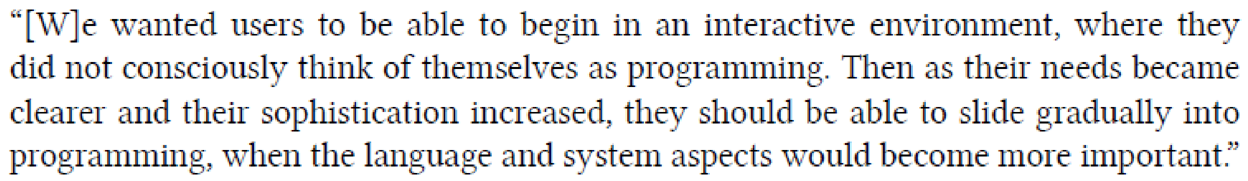
Laboratorio 1

Temas

- ¿Qué es R?
- R y RStudio
- Instalación
- Interfaz de RStudio
- Programación
  - Componentes
  - Estructuras de control
  - Funciones

¿Qué es R?

- Dialecto de S. John Chambers. Bell Labs AT&T 1976



> "[W]e wanted users to be able to begin in an interactive environment, where they did not consciously think of themselves as programming. Then as their needs became clearer and their sophistication increased, they should be able to slide gradually into programming, when the language and system aspects would become more important."

- R. Ross Ihaka y Robert Gentleman. Universidad de Auckland. Nueva Zelanda. 1993
- GNU General Public License. 1995
- R Versión 1.0.0 Released. 2000

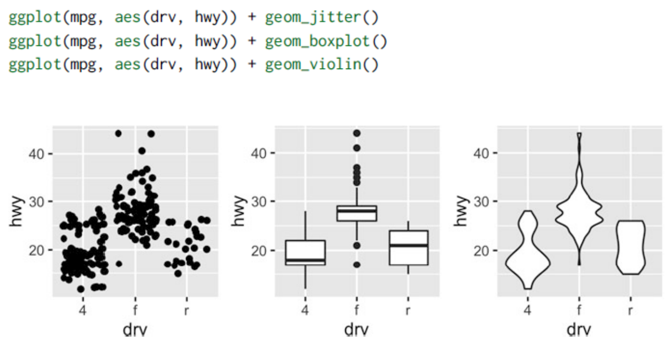
¿Qué es R?

Corre en casi todas las plataformas de computación y Sos

Open Source

Releases muy frecuentes

Capacidades gráficas sofisticadas



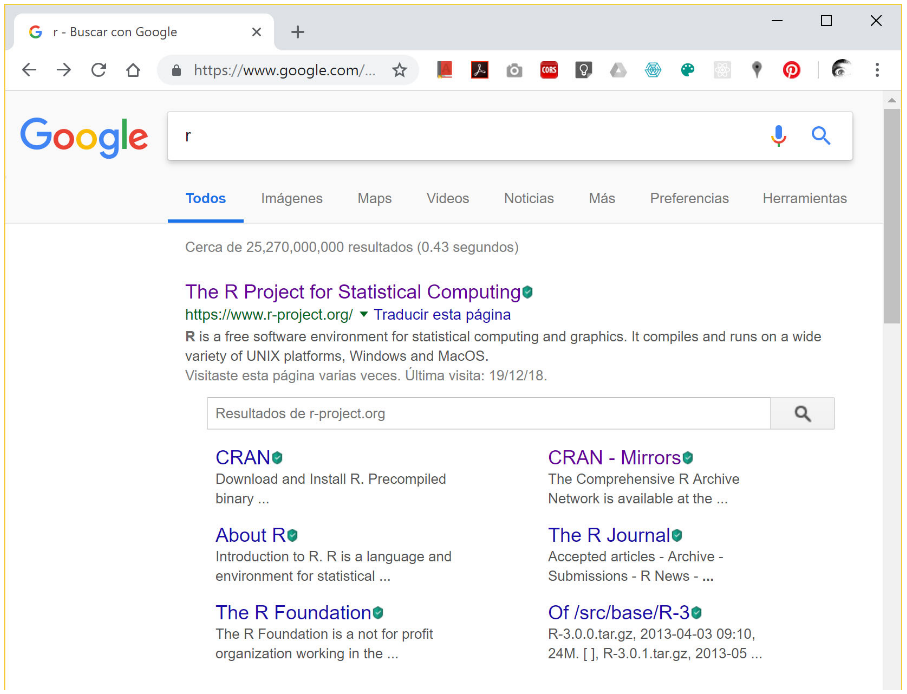
```
ggplot(mpg, aes(drv, hwy)) + geom_jitter()
ggplot(mpg, aes(drv, hwy)) + geom_boxplot()
ggplot(mpg, aes(drv, hwy)) + geom_violin()
```

Programación interactiva

Poderoso lenguaje de programación

Stack Overflow

R y RStudio



r - Buscar con Google

https://www.google.com/...

r

Todos · Imágenes · Maps · Videos · Noticias · Más · Preferencias · Herramientas

Cerca de 25,270,000,000 resultados (0.43 segundos)

The R Project for Statistical Computing
https://www.r-project.org/ ▾ Traducir esta página
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.
Visitaste esta página varias veces. Última visita: 19/12/18.

Resultados de r-project.org

CRAN
Download and Install R. Precompiled binary ...

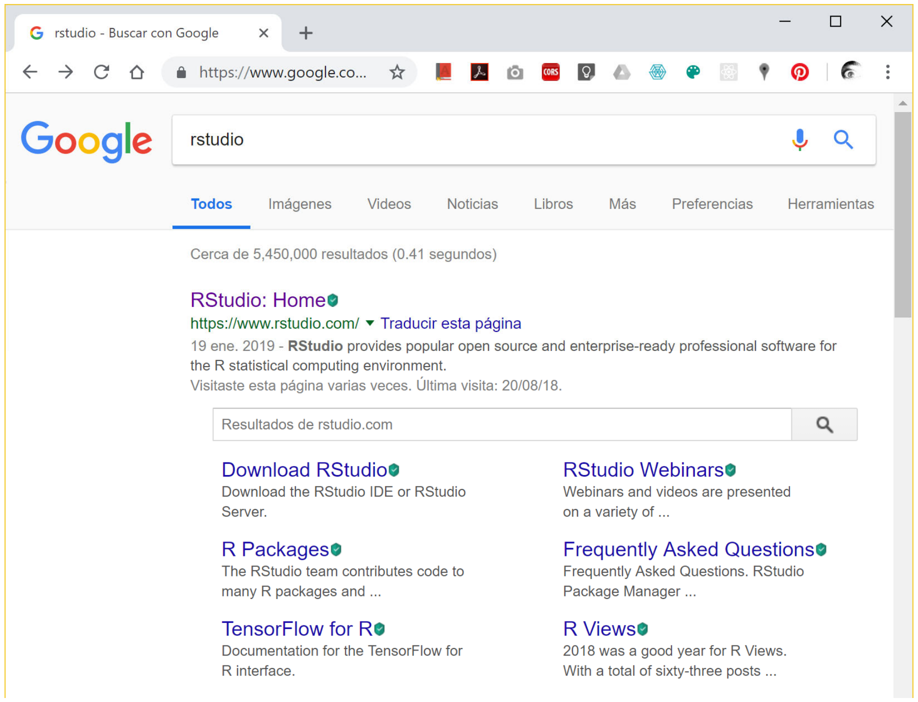
CRAN - Mirrors
The Comprehensive R Archive Network is available at the ...

About R
Introduction to R. R is a language and environment for statistical ...

The R Journal
Accepted articles - Archive - Submissions - R News - ...

The R Foundation
The R Foundation is a not for profit organization working in the ...

Of /src/base/R-3
R-3.0.0.tar.gz, 2013-04-03 09:10, 24M. [ ], R-3.0.1.tar.gz, 2013-05 ...



rstudio - Buscar con Google

https://www.google.co...

rstudio

Todos · Imágenes · Videos · Noticias · Libros · Más · Preferencias · Herramientas

Cerca de 5,450,000 resultados (0.41 segundos)

RStudio: Home
https://www.rstudio.com/ ▾ Traducir esta página
19 ene. 2019 - **RStudio** provides popular open source and enterprise-ready professional software for the R statistical computing environment.
Visitaste esta página varias veces. Última visita: 20/08/18.

Resultados de rstudio.com

Download RStudio
Download the RStudio IDE or RStudio Server.

RStudio Webinars
Webinars and videos are presented on a variety of ...

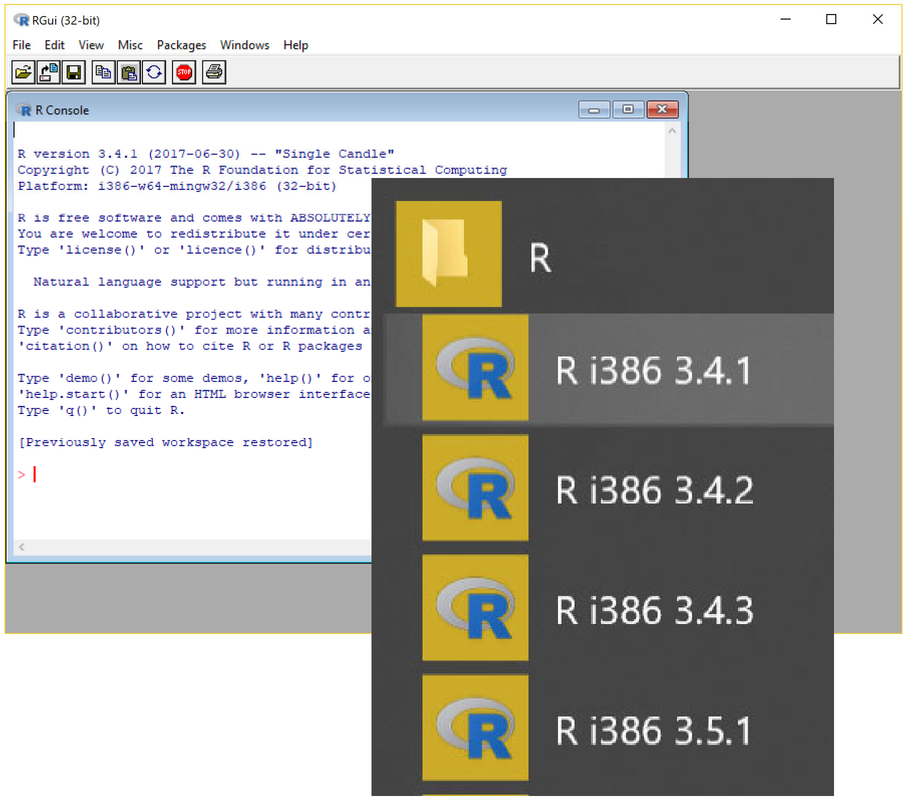
R Packages
The RStudio team contributes code to many R packages and ...

Frequently Asked Questions
Frequently Asked Questions. RStudio Package Manager ...

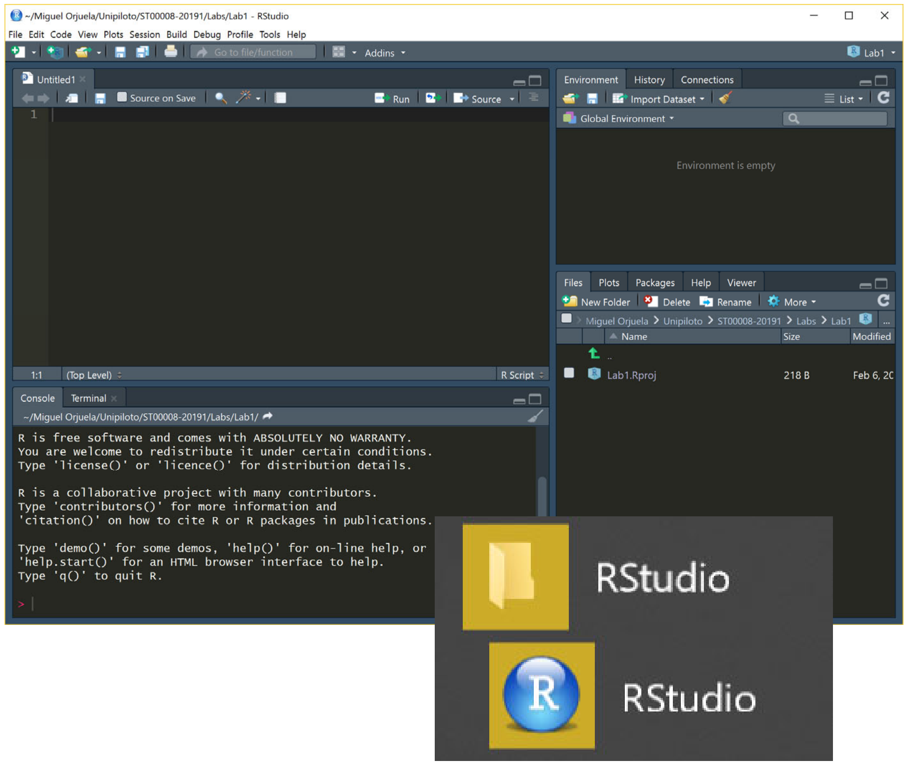
TensorFlow for R
Documentation for the TensorFlow for R interface.

R Views
2018 was a good year for R Views. With a total of sixty-three posts ...

R y RStudio

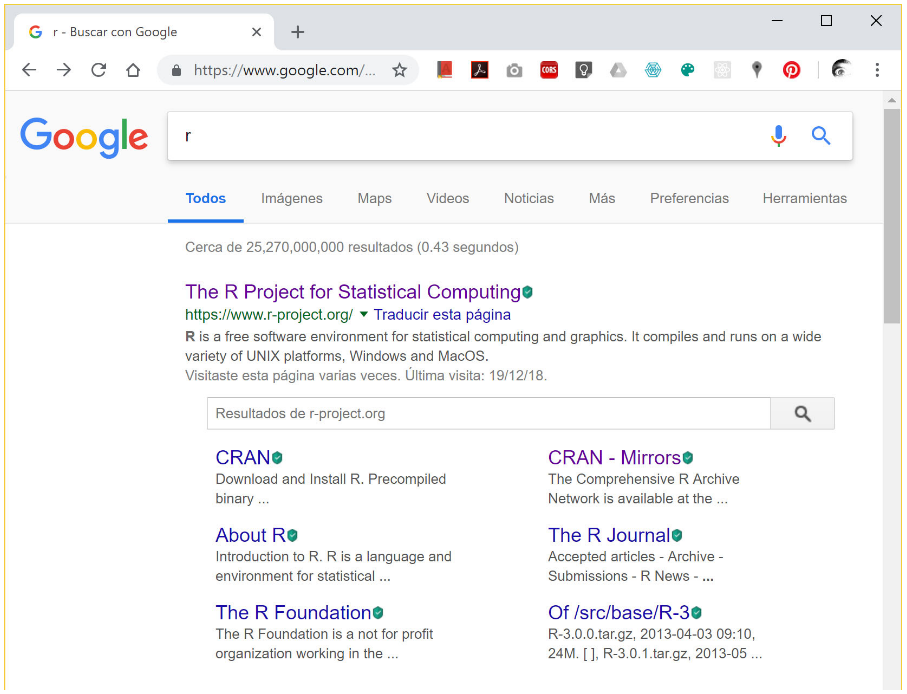


```
R version 3.4.1 (2017-06-30) -- "Single Candle"
Copyright (C) 2017 The R Foundation for Statistical Computing
Platform: i386-w64-mingw32/i386 (32-bit)

R is free software and comes with ABSOLUTELY
You are welcome to redistribute it under cer
Type 'license()' or 'licence()' for distribu

  Natural language support but running in an

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

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

[Previously saved workspace restored]

>
```


~/Miguel Orjuela/Unipiloto/ST00008-20191/Labs/Lab1 - RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Lab1
Untitled1
Source on Save
Run
Source
1:1
(Top Level)
R Script
Environment History Connections
Import Dataset
List
Global Environment
Environment is empty
Files Plots Packages Help Viewer
New Folder Delete Rename More
Miguel Orjuela > Unipiloto > ST00008-20191 > Labs > Lab1
Name Size Modified
Lab1.Rproj 218 B Feb 6, 20
Console Terminal
~/Miguel Orjuela/Unipiloto/ST00008-20191/Labs/Lab1/
RStudio
RStudio

```
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.

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.

>
```

Instalación



r - Buscar con Google

https://www.google.com/...

r

Todos Imágenes Maps Videos Noticias Más Preferencias Herramientas

Cerca de 25,270,000,000 resultados (0.43 segundos)

The R Project for Statistical Computing
https://www.r-project.org/ ▾ Traducir esta página
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.
Visitaste esta página varias veces. Última visita: 19/12/18.

Resultados de r-project.org

CRAN
Download and Install R. Precompiled binary ...

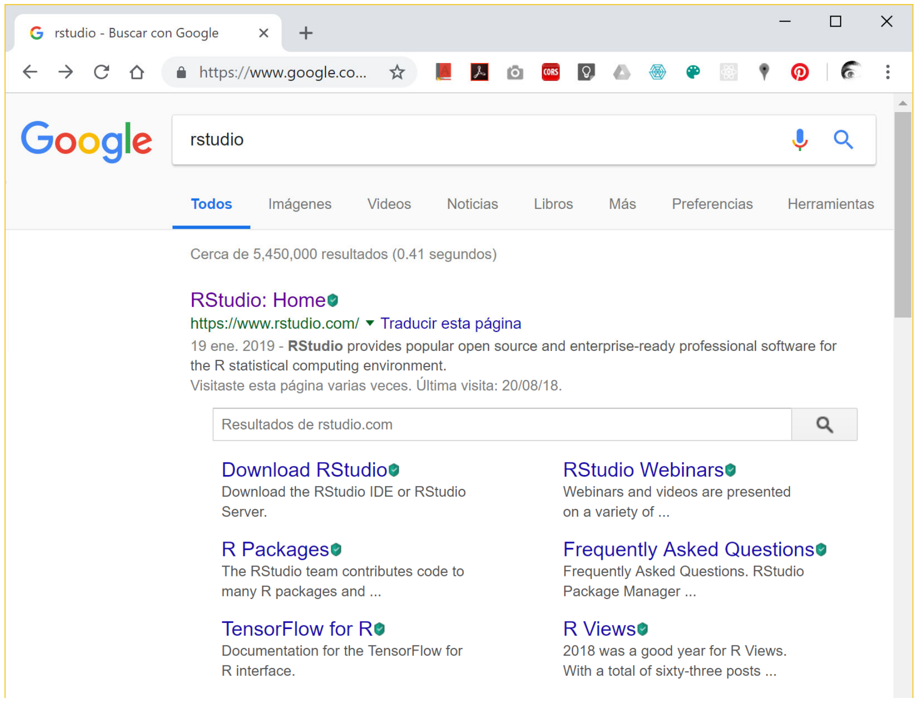
CRAN - Mirrors
The Comprehensive R Archive Network is available at the ...

About R
Introduction to R. R is a language and environment for statistical ...

The R Journal
Accepted articles - Archive - Submissions - R News - ...

The R Foundation
The R Foundation is a not for profit organization working in the ...

Of /src/base/R-3
R-3.0.0.tar.gz, 2013-04-03 09:10, 24M. [ ], R-3.0.1.tar.gz, 2013-05 ...



rstudio - Buscar con Google

https://www.google.co...

rstudio

Todos Imágenes Videos Noticias Libros Más Preferencias Herramientas

Cerca de 5,450,000 resultados (0.41 segundos)

RStudio: Home
https://www.rstudio.com/ ▾ Traducir esta página
19 ene. 2019 - **RStudio** provides popular open source and enterprise-ready professional software for the R statistical computing environment.
Visitaste esta página varias veces. Última visita: 20/08/18.

Resultados de rstudio.com

Download RStudio
Download the RStudio IDE or RStudio Server.

RStudio Webinars
Webinars and videos are presented on a variety of ...

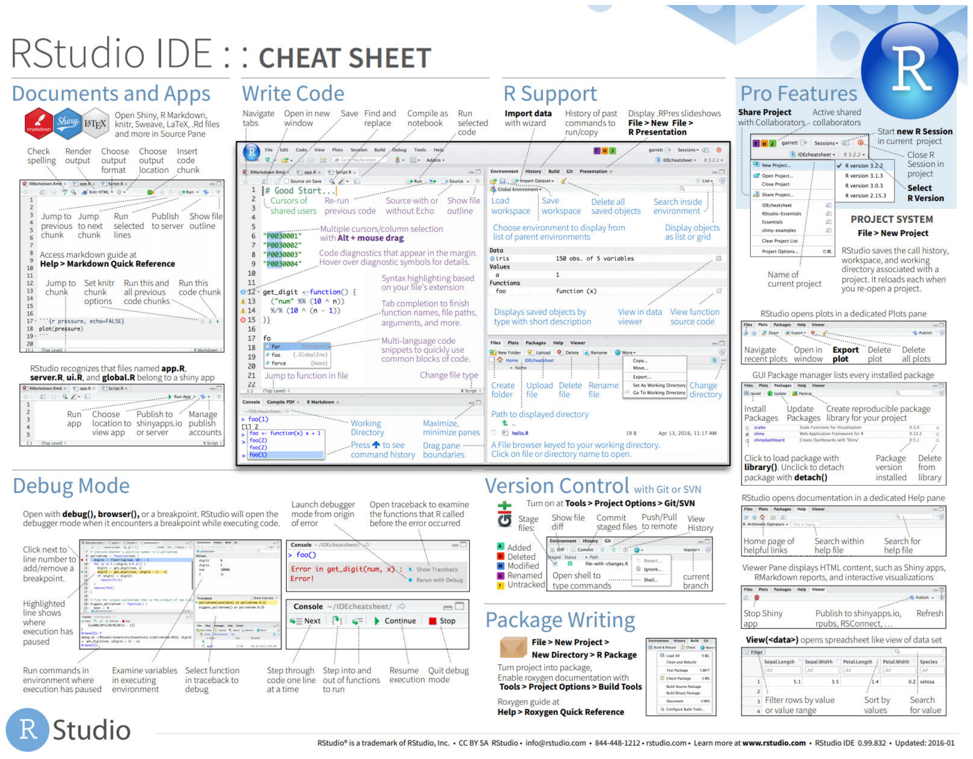
R Packages
The RStudio team contributes code to many R packages and ...

Frequently Asked Questions
Frequently Asked Questions. RStudio Package Manager ...

TensorFlow for R
Documentation for the TensorFlow for R interface.

R Views
2018 was a good year for R Views. With a total of sixty-three posts ...

Interfaz de RStudio



RStudio IDE : : CHEAT SHEET

Documents and Apps

Open Shiny, R Markdown, knitr, Sweave, LaTeX, .Rd files and more in Source Pane

Check spelling · Render output · Choose output format · Choose output location · Insert code chunk

Jump to previous chunk · Jump to next chunk · Run selected lines · Publish to server · Show file outline

Access markdown guide at **Help > Markdown Quick Reference**

Jump to chunk · Set knitr chunk options · Run this and all previous code chunks · Run this code chunk

RStudio recognizes that files named **app.R**, **server.R**, **ui.R**, and **global.R** belong to a shiny app

Run app · Choose location to view app · Publish to shinyapps.io or server · Manage publish accounts

Write Code

Navigate tabs · Open in new window · Save · Find and replace · Compile as notebook · Run selected code

Cursors of shared users · Re-run previous code · Source with or without Echo · Show file outline

Multiple cursors/column selection with **Alt + mouse drag**.

Code diagnostics that appear in the margin. Hover over diagnostic symbols for details.

Syntax highlighting based on your file's extension

Tab completion to finish function names, file paths, arguments, and more.

Multi-language code snippets to quickly use common blocks of code.

Jump to function in file · Change file type

Working Directory · Maximize, minimize panes · Press ↑ to see command history · Drag pane boundaries

```
# Good Start...
"P0030001"
"P0030002"
"P0030003"
"P0030004"
get_digit <-function() {
  ("num" %% (10 ^ n))
  %/% (10 ^ (n - 1))
}}
fo
```

```
> foo(1)
[1] 2
> foo <- function(x) x + 1
> foo(2)
> foo(2)
> foo(1)
```

R Support

Import data with wizard · History of past commands to run/copy · Display .RPres slideshows **File > New File > R Presentation**

Load workspace · Save workspace · Delete all saved objects · Search inside environment

Choose environment to display from list of parent environments · Display objects as list or grid

```
Data
iris          150 obs. of 5 variables
Values
a             1
Functions
foo           function (x)
```

Displays saved objects by type with short description · View in data viewer · View function source code

Create folder · Upload file · Delete file · Rename file · Change directory

Path to displayed directory

```
hello.R          19 B        Apr 13, 2016, 11:17 AM
```

A File browser keyed to your working directory. Click on file or directory name to open.

Pro Features

Share Project with Collaborators · Active shared collaborators · Start **new R Session** in current project · Close R Session in project · **Select R Version** · Name of current project

PROJECT SYSTEM

File > New Project

RStudio saves the call history, workspace, and working directory associated with a project. It reloads each when you re-open a project.

RStudio opens plots in a dedicated Plots pane

Navigate recent plots · Open in window · **Export plot** · Delete plot · Delete all plots

GUI Package manager lists every installed package

Install Packages · Update Packages · Create reproducible package library for your project

```
scales          Scale Functions for Visualization     0.3.0
shiny           Web Application Framework for R       0.12.2
shinydashboard  Create Dashboards with 'Shiny'        0.5.1
```

Click to load package with **library()**. Unclick to detach package with **detach()** · Package version installed · Delete from library

RStudio opens documentation in a dedicated Help pane

Home page of helpful links · Search within help file · Search for help file

Viewer Pane displays HTML content, such as Shiny apps, RMarkdown reports, and interactive visualizations

Stop Shiny app · Publish to shinyapps.io, rpubs, RSConnect, … · Refresh

View(<data>) opens spreadsheet like view of data set

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
1	5.1	3.5	1.4	0.2	setosa

Filter rows by value or value range · Sort by values · Search for value

Debug Mode

Open with **debug(), browser(),** or a breakpoint. RStudio will open the debugger mode when it encounters a breakpoint while executing code.

Launch debugger mode from origin of error · Open traceback to examine the functions that R called before the error occurred

Click next to line number to add/remove a breakpoint.

Highlighted line shows where execution has paused

```
> foo()
Error in get_digit(num, x) :
Error!
```

Run commands in environment where execution has paused · Examine variables in executing environment · Select function in traceback to debug · Step through code one line at a time · Step into and out of functions to run · Resume execution · Quit debug mode

Version Control with Git or SVN

Turn on at **Tools > Project Options > Git/SVN**

Stage files: · Show file diff · Commit staged files · Push/Pull to remote · View History

A Added · D Deleted · M Modified · R Renamed · ? Untracked

Open shell to type commands · current branch

Package Writing

File > New Project > New Directory > R Package

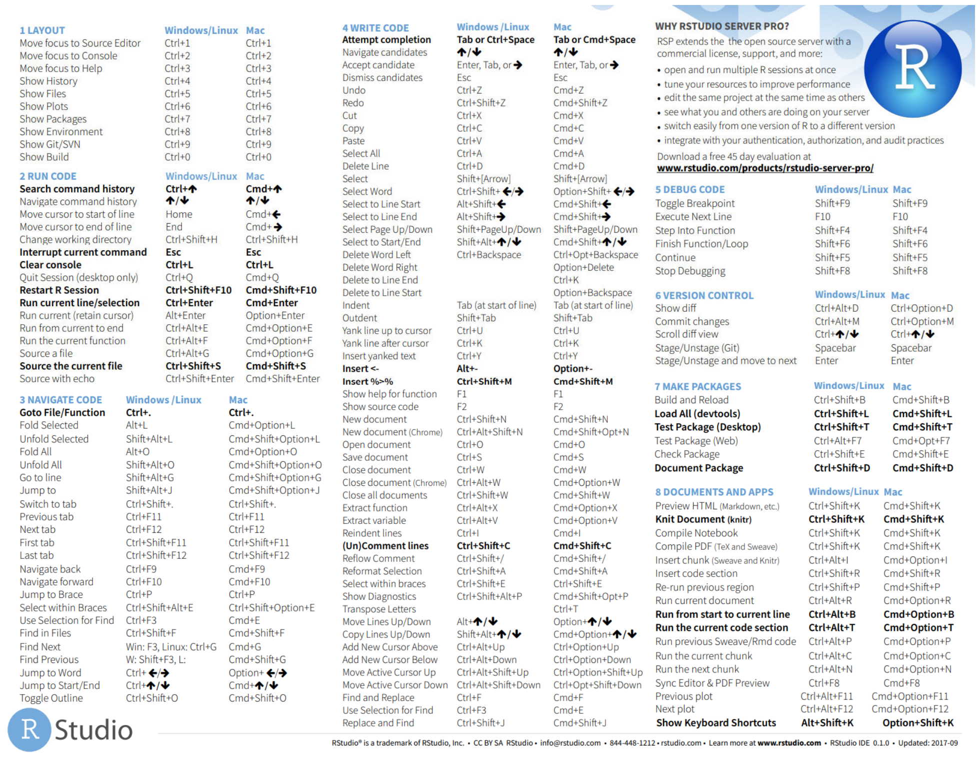
Turn project into package, Enable roxygen documentation with **Tools > Project Options > Build Tools**

Roxygen guide at **Help > Roxygen Quick Reference**

RStudio

RStudio® is a trademark of RStudio, Inc. • CC BY SA RStudio • info@rstudio.com • 844-448-1212 • rstudio.com • Learn more at **www.rstudio.com** • RStudio IDE 0.99.832 • Updated: 2016-01

Interfaz de RStudio



1 LAYOUT	Windows/Linux	Mac
Move focus to Source Editor	Ctrl+1	Ctrl+1
Move focus to Console	Ctrl+2	Ctrl+2
Move focus to Help	Ctrl+3	Ctrl+3
Show History	Ctrl+4	Ctrl+4
Show Files	Ctrl+5	Ctrl+5
Show Plots	Ctrl+6	Ctrl+6
Show Packages	Ctrl+7	Ctrl+7
Show Environment	Ctrl+8	Ctrl+8
Show Git/SVN	Ctrl+9	Ctrl+9
Show Build	Ctrl+0	Ctrl+0

2 RUN CODE	Windows/Linux	Mac
Search command history	**Ctrl+↑**	**Cmd+↑**
Navigate command history	↑/↓	↑/↓
Move cursor to start of line	Home	Cmd+←
Move cursor to end of line	End	Cmd+→
Change working directory	Ctrl+Shift+H	Ctrl+Shift+H
Interrupt current command	**Esc**	**Esc**
Clear console	**Ctrl+L**	**Ctrl+L**
Quit Session (desktop only)	Ctrl+Q	Cmd+Q
Restart R Session	**Ctrl+Shift+F10**	**Cmd+Shift+F10**
Run current line/selection	**Ctrl+Enter**	**Cmd+Enter**
Run current (retain cursor)	Alt+Enter	Option+Enter
Run from current to end	Ctrl+Alt+E	Cmd+Option+E
Run the current function	Ctrl+Alt+F	Cmd+Option+F
Source a file	Ctrl+Alt+G	Cmd+Option+G
Source the current file	**Ctrl+Shift+S**	**Cmd+Shift+S**
Source with echo	Ctrl+Shift+Enter	Cmd+Shift+Enter

3 NAVIGATE CODE	Windows /Linux	Mac
Goto File/Function	**Ctrl+.**	**Ctrl+.**
Fold Selected	Alt+L	Cmd+Option+L
Unfold Selected	Shift+Alt+L	Cmd+Shift+Option+L
Fold All	Alt+O	Cmd+Option+O
Unfold All	Shift+Alt+O	Cmd+Shift+Option+O
Go to line	Shift+Alt+G	Cmd+Shift+Option+G
Jump to	Shift+Alt+J	Cmd+Shift+Option+J
Switch to tab	Ctrl+Shift+.	Ctrl+Shift+.
Previous tab	Ctrl+F11	Ctrl+F11
Next tab	Ctrl+F12	Ctrl+F12
First tab	Ctrl+Shift+F11	Ctrl+Shift+F11
Last tab	Ctrl+Shift+F12	Ctrl+Shift+F12
Navigate back	Ctrl+F9	Cmd+F9
Navigate forward	Ctrl+F10	Cmd+F10
Jump to Brace	Ctrl+P	Ctrl+P
Select within Braces	Ctrl+Shift+Alt+E	Ctrl+Shift+Option+E
Use Selection for Find	Ctrl+F3	Cmd+E
Find in Files	Ctrl+Shift+F	Cmd+Shift+F
Find Next	Win: F3, Linux: Ctrl+G	Cmd+G
Find Previous	W: Shift+F3, L:	Cmd+Shift+G
Jump to Word	Ctrl+ ←/→	Option+ ←/→
Jump to Start/End	Ctrl+↑/↓	Cmd+↑/↓
Toggle Outline	Ctrl+Shift+O	Cmd+Shift+O

4 WRITE CODE	Windows /Linux	Mac
Attempt completion	**Tab or Ctrl+Space**	**Tab or Cmd+Space**
Navigate candidates	↑/↓	↑/↓
Accept candidate	Enter, Tab, or →	Enter, Tab, or →
Dismiss candidates	Esc	Esc
Undo	Ctrl+Z	Cmd+Z
Redo	Ctrl+Shift+Z	Cmd+Shift+Z
Cut	Ctrl+X	Cmd+X
Copy	Ctrl+C	Cmd+C
Paste	Ctrl+V	Cmd+V
Select All	Ctrl+A	Cmd+A
Delete Line	Ctrl+D	Cmd+D
Select	Shift+[Arrow]	Shift+[Arrow]
Select Word	Ctrl+Shift+ ←/→	Option+Shift+ ←/→
Select to Line Start	Alt+Shift+←	Cmd+Shift+←
Select to Line End	Alt+Shift+→	Cmd+Shift+→
Select Page Up/Down	Shift+PageUp/Down	Shift+PageUp/Down
Select to Start/End	Shift+Alt+↑/↓	Cmd+Shift+↑/↓
Delete Word Left	Ctrl+Backspace	Ctrl+Opt+Backspace
Delete Word Right		Option+Delete
Delete to Line End		Ctrl+K
Delete to Line Start		Option+Backspace
Indent	Tab (at start of line)	Tab (at start of line)
Outdent	Shift+Tab	Shift+Tab
Yank line up to cursor	Ctrl+U	Ctrl+U
Yank line after cursor	Ctrl+K	Ctrl+K
Insert yanked text	Ctrl+Y	Ctrl+Y
Insert <-	**Alt+-**	**Option+-**
Insert %>%	**Ctrl+Shift+M**	**Cmd+Shift+M**
Show help for function	F1	F1
Show source code	F2	F2
New document	Ctrl+Shift+N	Cmd+Shift+N
New document (Chrome)	Ctrl+Alt+Shift+N	Cmd+Shift+Opt+N
Open document	Ctrl+O	Cmd+O
Save document	Ctrl+S	Cmd+S
Close document	Ctrl+W	Cmd+W
Close document (Chrome)	Ctrl+Alt+W	Cmd+Option+W
Close all documents	Ctrl+Shift+W	Cmd+Shift+W
Extract function	Ctrl+Alt+X	Cmd+Option+X
Extract variable	Ctrl+Alt+V	Cmd+Option+V
Reindent lines	Ctrl+I	Cmd+I
(Un)Comment lines	**Ctrl+Shift+C**	**Cmd+Shift+C**
Reflow Comment	Ctrl+Shift+/	Cmd+Shift+/
Reformat Selection	Ctrl+Shift+A	Cmd+Shift+A
Select within braces	Ctrl+Shift+E	Ctrl+Shift+E
Show Diagnostics	Ctrl+Shift+Alt+P	Cmd+Shift+Opt+P
Transpose Letters		Ctrl+T
Move Lines Up/Down	Alt+↑/↓	Option+↑/↓
Copy Lines Up/Down	Shift+Alt+↑/↓	Cmd+Option+↑/↓
Add New Cursor Above	Ctrl+Alt+Up	Ctrl+Option+Up
Add New Cursor Below	Ctrl+Alt+Down	Ctrl+Option+Down
Move Active Cursor Up	Ctrl+Alt+Shift+Up	Ctrl+Option+Shift+Up
Move Active Cursor Down	Ctrl+Alt+Shift+Down	Ctrl+Opt+Shift+Down
Find and Replace	Ctrl+F	Cmd+F
Use Selection for Find	Ctrl+F3	Cmd+E
Replace and Find	Ctrl+Shift+J	Cmd+Shift+J

WHY RSTUDIO SERVER PRO?

RSP extends the the open source server with a commercial license, support, and more:

- open and run multiple R sessions at once
- tune your resources to improve performance
- edit the same project at the same time as others
- see what you and others are doing on your server
- switch easily from one version of R to a different version
- integrate with your authentication, authorization, and audit practices

Download a free 45 day evaluation at **www.rstudio.com/products/rstudio-server-pro/**

5 DEBUG CODE	Windows/Linux	Mac
Toggle Breakpoint	Shift+F9	Shift+F9
Execute Next Line	F10	F10
Step Into Function	Shift+F4	Shift+F4
Finish Function/Loop	Shift+F6	Shift+F6
Continue	Shift+F5	Shift+F5
Stop Debugging	Shift+F8	Shift+F8

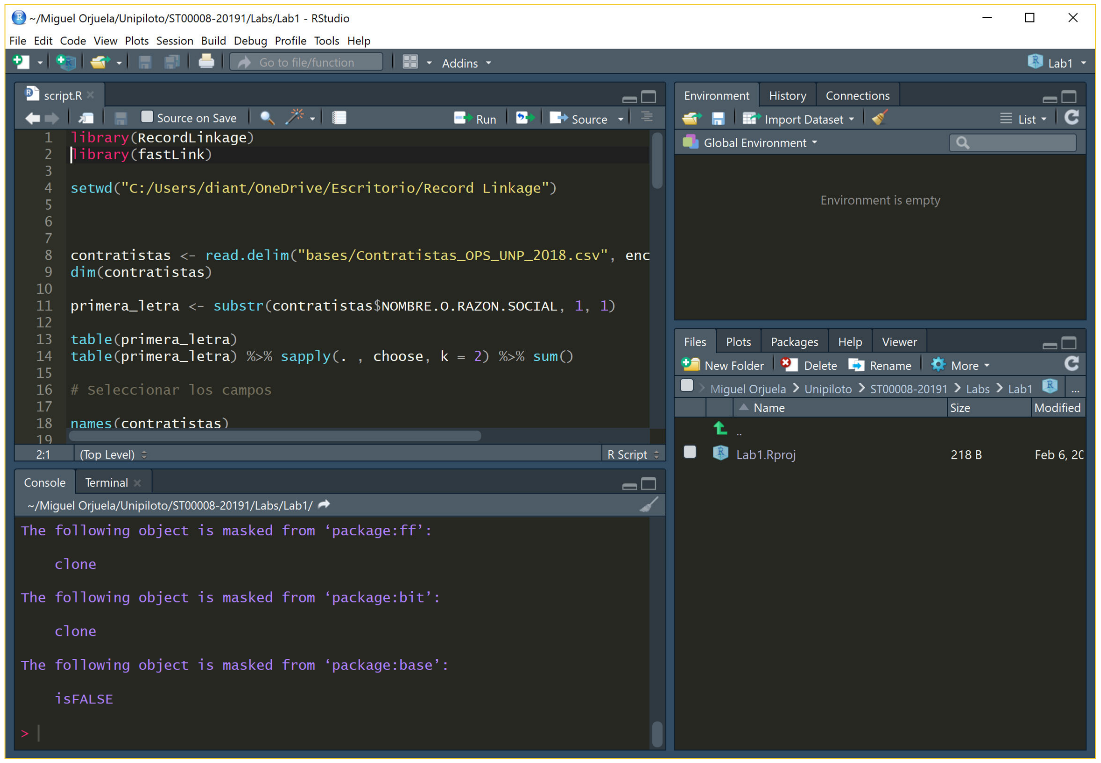
6 VERSION CONTROL	Windows/Linux	Mac
Show diff	Ctrl+Alt+D	Ctrl+Option+D
Commit changes	Ctrl+Alt+M	Ctrl+Option+M
Scroll diff view	Ctrl+↑/↓	Ctrl+↑/↓
Stage/Unstage (Git)	Spacebar	Spacebar
Stage/Unstage and move to next	Enter	Enter

7 MAKE PACKAGES	Windows/Linux	Mac
Build and Reload	Ctrl+Shift+B	Cmd+Shift+B
Load All (devtools)	**Ctrl+Shift+L**	**Cmd+Shift+L**
Test Package (Desktop)	**Ctrl+Shift+T**	**Cmd+Shift+T**
Test Package (Web)	Ctrl+Alt+F7	Cmd+Opt+F7
Check Package	Ctrl+Shift+E	Cmd+Shift+E
Document Package	**Ctrl+Shift+D**	**Cmd+Shift+D**

8 DOCUMENTS AND APPS	Windows/Linux	Mac
Preview HTML (Markdown, etc.)	Ctrl+Shift+K	Cmd+Shift+K
Knit Document (knitr)	**Ctrl+Shift+K**	**Cmd+Shift+K**
Compile Notebook	Ctrl+Shift+K	Cmd+Shift+K
Compile PDF (TeX and Sweave)	Ctrl+Shift+K	Cmd+Shift+K
Insert chunk (Sweave and Knitr)	Ctrl+Alt+I	Cmd+Option+I
Insert code section	Ctrl+Shift+R	Cmd+Shift+R
Re-run previous region	Ctrl+Shift+P	Cmd+Shift+P
Run current document	Ctrl+Alt+R	Cmd+Option+R
Run from start to current line	**Ctrl+Alt+B**	**Cmd+Option+B**
Run the current code section	**Ctrl+Alt+T**	**Cmd+Option+T**
Run previous Sweave/Rmd code	Ctrl+Alt+P	Cmd+Option+P
Run the current chunk	Ctrl+Alt+C	Cmd+Option+C
Run the next chunk	Ctrl+Alt+N	Cmd+Option+N
Sync Editor & PDF Preview	Ctrl+F8	Cmd+F8
Previous plot	Ctrl+Alt+F11	Cmd+Option+F11
Next plot	Ctrl+Alt+F12	Cmd+Option+F12
Show Keyboard Shortcuts	**Alt+Shift+K**	**Option+Shift+K**

RStudio

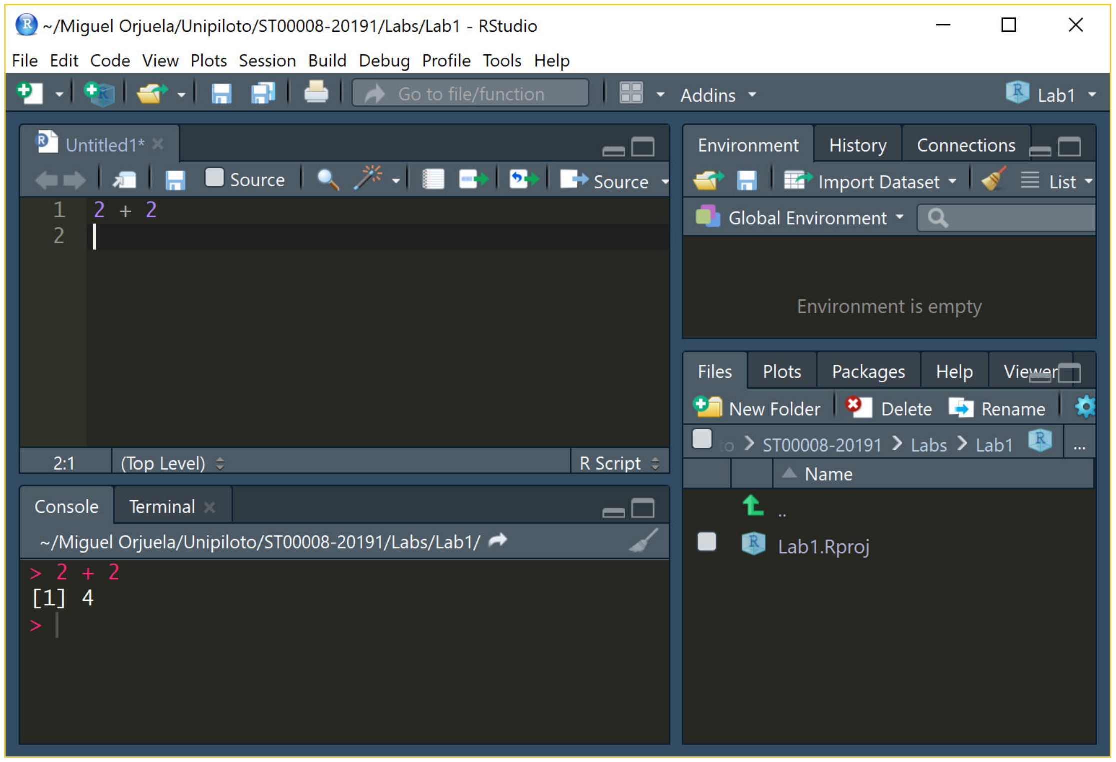
Interfaz de RStudio



```r
library(RecordLinkage)
library(fastLink)

setwd("C:/Users/diant/OneDrive/Escritorio/Record Linkage")



contratistas <- read.delim("bases/Contratistas_OPS_UNP_2018.csv", enc
dim(contratistas)

primera_letra <- substr(contratistas$NOMBRE.O.RAZON.SOCIAL, 1, 1)

table(primera_letra)
table(primera_letra) %>% sapply(. , choose, k = 2) %>% sum()

# Seleccionar los campos

names(contratistas)
```

```
The following object is masked from ‘package:ff’:

    clone

The following object is masked from ‘package:bit’:

    clone

The following object is masked from ‘package:base’:

    isFALSE

> 
```

Interfaz de RStudio


~/Miguel Orjuela/Unipiloto/ST00008-20191/Labs/Lab1 - RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Lab1
Untitled1*
Source
Source
Environment History Connections
Import Dataset
List
Global Environment
Environment is empty
Files Plots Packages Help Viewer
New Folder Delete Rename
ST00008-20191 > Labs > Lab1
Name
Lab1.Rproj
2:1 (Top Level) R Script
Console Terminal
~/Miguel Orjuela/Unipiloto/ST00008-20191/Labs/Lab1/

```
2 + 2
```

```
> 2 + 2
[1] 4
>
```

Paso 1: Escriba 2 + 2

Paso 2: Oprima Ctrl+Enter

Paso 3: Oprima Ctrl+L

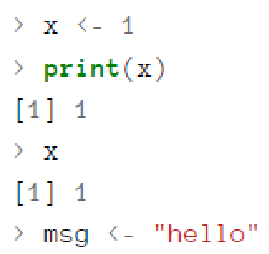
Programación

1. Ingresando expresiones
2. Evaluación de expresiones
3. Objetos
4. Números
5. Atributos
6. Vectores
7. Objetos mixtos
8. Conversión explícita (Coercion)
9. Matrices
10. Listas
11. Factores
12. Valores faltantes/nulos (Missings)
13. Data frames
14. Nombres

Calculadora

Ingresando expresiones

Operador de asignación <-



```
> x <- 1
> print(x)
[1] 1
> x
[1] 1
> msg <- "hello"
```

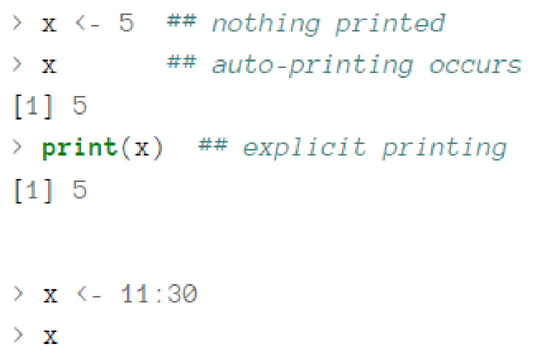
La gramática del lenguaje determina si una expresión está completa o no

Comentarios con #

Consejo: Alt + - inserta asignaciones

Evaluación de expresiones

Ingreso, evaluación, resultado impreso (autoprint)



```
> x <- 5   ## nothing printed
> x        ## auto-printing occurs
[1] 5
> print(x)  ## explicit printing
[1] 5

> x <- 11:30
> x
```

¿Qué indica [1]?

?

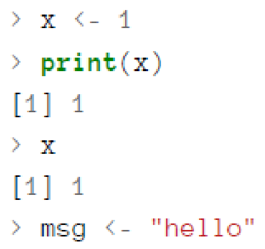
Objetos

Clases básicas o **atómicas** de objetos
- character
- numeric (números reales)
- integer
- complex
- logical (true/false)

Vectores y listas
- vector – objetos de la misma clase
- list – objetos de diferente clase

Números

Números en R se tratan como objetos numéricos (reales de doble precision)



```
> x <- 1
> print(x)
[1] 1
> x
[1] 1
> msg <- "hello"
```

Si queremos hacer enteros le ponemos el surfijo L

Verificar con commandos class, typeof, str

Infinito **Inf**

Not a number **NaN**

Atributos

Los objetos de R tienen metadata, muy útil para describir el objeto

Algunos atributos son:

- names, dimnames
- dimensions
- class
- length
- Otros definidos por el usuario

Los atributos se consultan con **attributes()**. Si no tiene retorna **null**

Vectores

Función **c()** concatena objetos y hace vectores

```
> x <- c(0.5, 0.6)        ## numeric
> x <- c(TRUE, FALSE)     ## logical
> x <- c(T, F)            ## logical
> x <- c("a", "b", "c")   ## character
> x <- 9:29               ## integer
> x <- c(1+0i, 2+4i)      ## complex
```

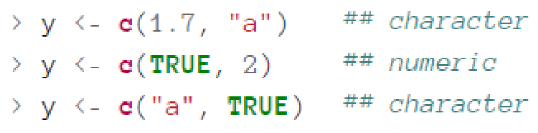
Se puede usar la función **vector()** para inicializar vectores

```
> x <- vector("numeric", length = 10)
> x
 [1] 0 0 0 0 0 0 0 0 0 0
```

Compruebe el tipo de x usando las funciones **class(), typeof()** y **str()**

Vectores

Creando vectores con objetos de diferente tipo

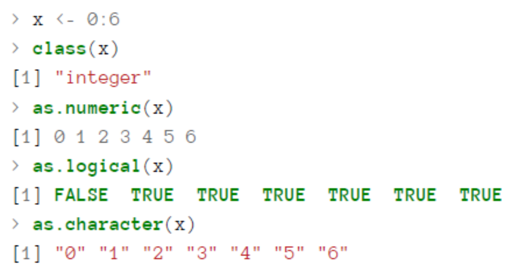


```
> y <- c(1.7, "a")    ## character
> y <- c(TRUE, 2)     ## numeric
> y <- c("a", TRUE)   ## character
```

Cuando esto sucede, R realiza una conversión implícita de los objetos

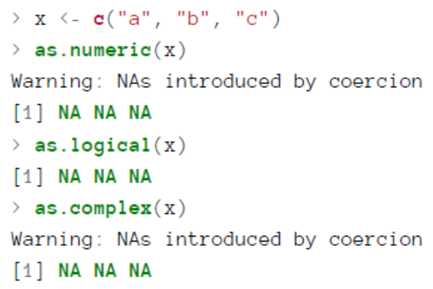
Conversión explícita

Funciones para hacer casting entre tipos de variables



```
> x <- 0:6
> class(x)
[1] "integer"
> as.numeric(x)
[1] 0 1 2 3 4 5 6
> as.logical(x)
[1] FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
> as.character(x)
[1] "0" "1" "2" "3" "4" "5" "6"
```

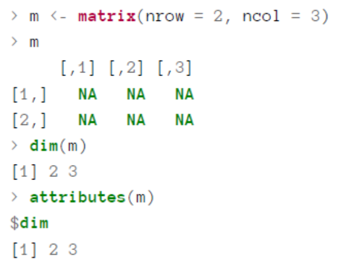
¿Qué pasa cuando no hay forma razonable de transformar los datos?



```
> x <- c("a", "b", "c")
> as.numeric(x)
Warning: NAs introduced by coercion
[1] NA NA NA
> as.logical(x)
[1] NA NA NA
> as.complex(x)
Warning: NAs introduced by coercion
[1] NA NA NA
```

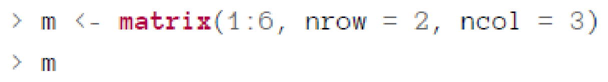
Matrices

Son vectores con un atributo de dimension. La dimension es un vector de enteros de longitud 2 (num filas, num columnas)



```
> m <- matrix(nrow = 2, ncol = 3)
> m
     [,1] [,2] [,3]
[1,]   NA   NA   NA
[2,]   NA   NA   NA
> dim(m)
[1] 2 3
> attributes(m)
$dim
[1] 2 3
```

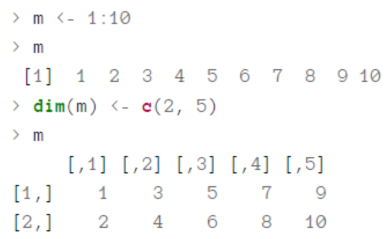
Las matrices son orientadas por columnas



```
> m <- matrix(1:6, nrow = 2, ncol = 3)
> m
```

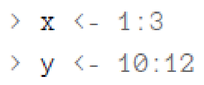
Matrices

Se pueden crear de un vector agregandole dimension

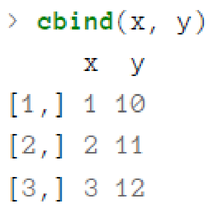


```
> m <- 1:10
> m
 [1]  1  2  3  4  5  6  7  8  9 10
> dim(m) <- c(2, 5)
> m
     [,1] [,2] [,3] [,4] [,5]
[1,]    1    3    5    7    9
[2,]    2    4    6    8   10
```

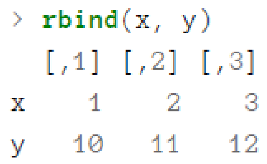
También se crean pegando vectores filas o vectores columnas



```
> x <- 1:3
> y <- 10:12
```



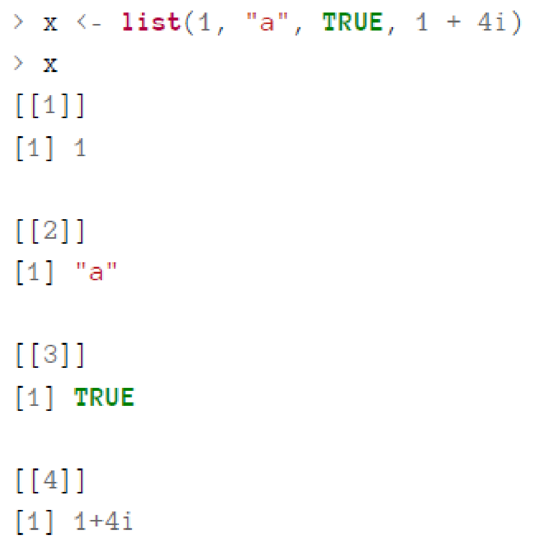
```
> cbind(x, y)
     x  y
[1,] 1 10
[2,] 2 11
[3,] 3 12
```



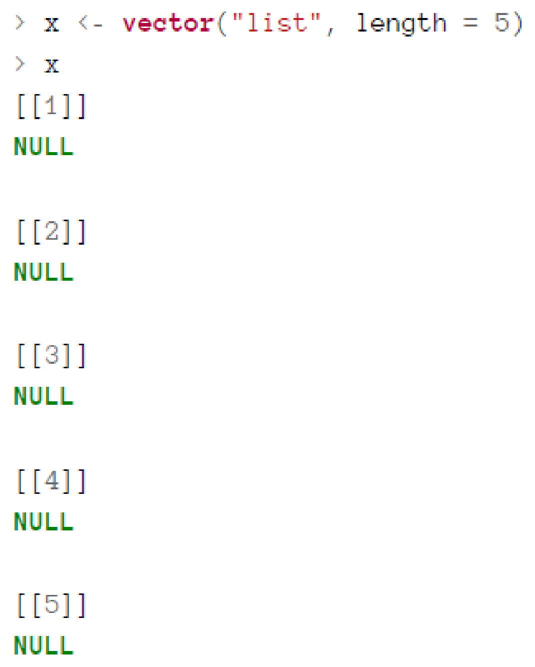
```
> rbind(x, y)
  [,1] [,2] [,3]
x    1    2    3
y   10   11   12
```

Listas

Vectores con elementos de diferentes clases



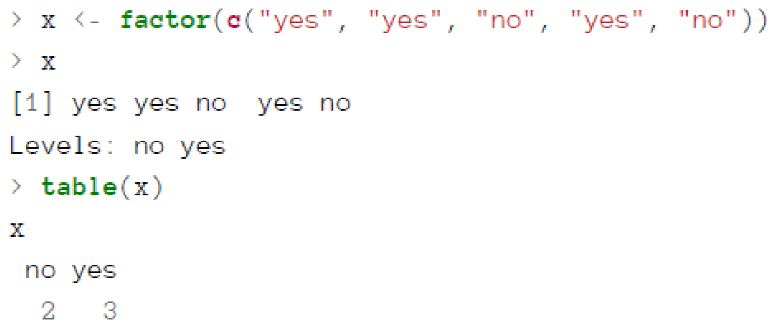
```
> x <- list(1, "a", TRUE, 1 + 4i)
> x
[[1]]
[1] 1

[[2]]
[1] "a"

[[3]]
[1] TRUE

[[4]]
[1] 1+4i
```



```
> x <- vector("list", length = 5)
> x
[[1]]
NULL

[[2]]
NULL

[[3]]
NULL

[[4]]
NULL

[[5]]
NULL
```

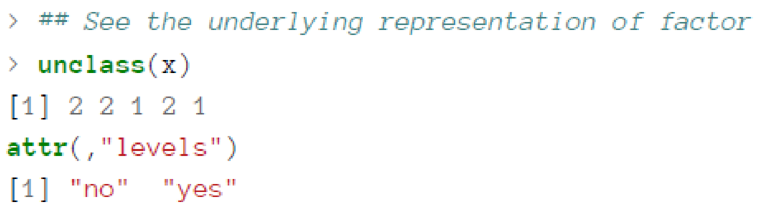
Factores

Representan datos categóricos. Pueden ser desordenados u ordenados



```
> x <- factor(c("yes", "yes", "no", "yes", "no"))
> x
[1] yes yes no  yes no
Levels: no yes
> table(x)
x
 no yes
  2   3
```

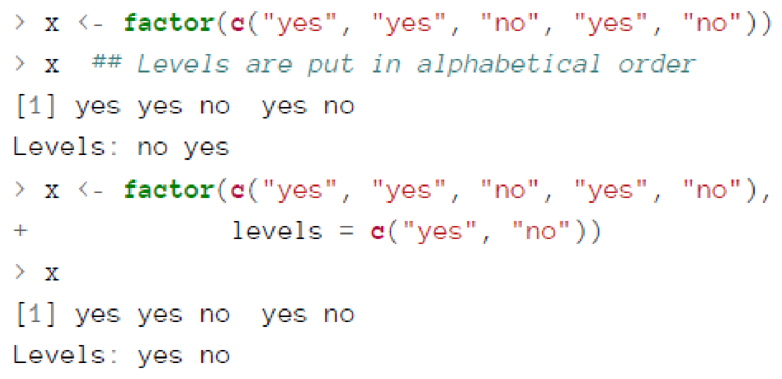
¿Cómo están representados realmente?



```
> ## See the underlying representation of factor
> unclass(x)
[1] 2 2 1 2 1
attr(,"levels")
[1] "no"  "yes"
```

Factores

Agregando orden a las categorías

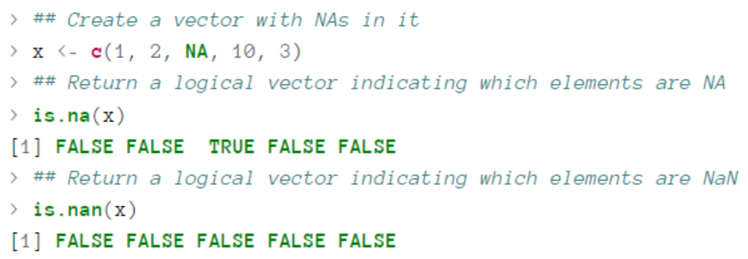


```
> x <- factor(c("yes", "yes", "no", "yes", "no"))
> x  ## Levels are put in alphabetical order
[1] yes yes no  yes no
Levels: no yes
> x <- factor(c("yes", "yes", "no", "yes", "no"),
+               levels = c("yes", "no"))
> x
[1] yes yes no  yes no
Levels: yes no
```

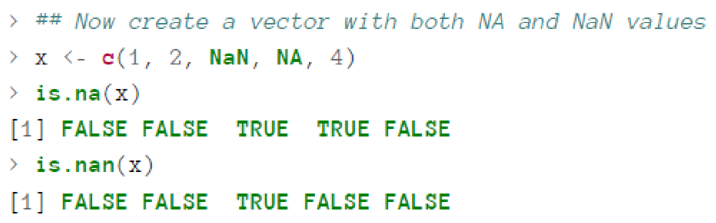
Valores faltantes/nulos (missings)

Detectar valores nulos y no numéricos

Un NaN es también un NA, pero un NA no es NaN



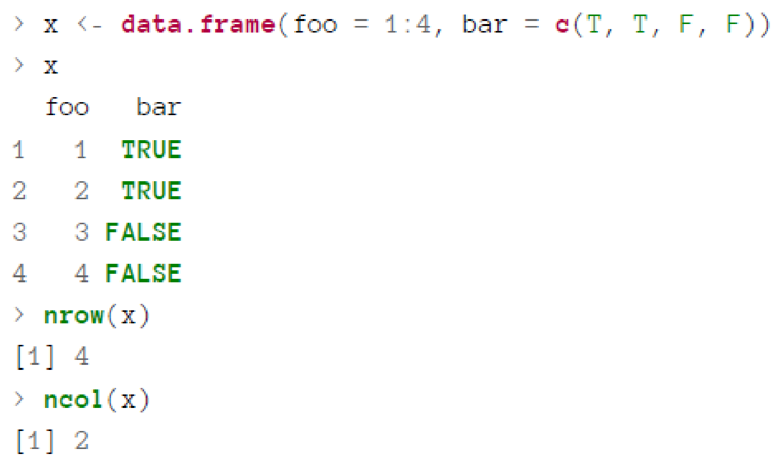
```
> ## Create a vector with NAs in it
> x <- c(1, 2, NA, 10, 3)
> ## Return a logical vector indicating which elements are NA
> is.na(x)
[1] FALSE FALSE  TRUE FALSE FALSE
> ## Return a logical vector indicating which elements are NaN
> is.nan(x)
[1] FALSE FALSE FALSE FALSE FALSE
```



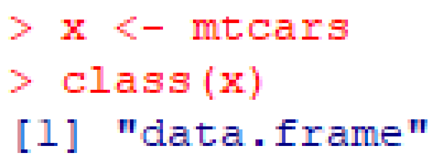
```
> ## Now create a vector with both NA and NaN values
> x <- c(1, 2, NaN, NA, 4)
> is.na(x)
[1] FALSE FALSE  TRUE  TRUE FALSE
> is.nan(x)
[1] FALSE FALSE  TRUE FALSE FALSE
```

Data frames

Tipo especial de matriz que puede guardar diferentes tipos de elementos en cada columna y todas las columnas tienen el mismo tamaño



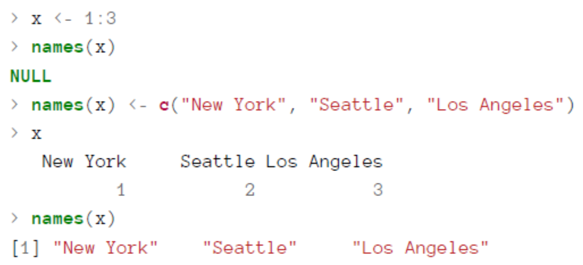
```
> x <- data.frame(foo = 1:4, bar = c(T, T, F, F))
> x
  foo   bar
1   1  TRUE
2   2  TRUE
3   3 FALSE
4   4 FALSE
> nrow(x)
[1] 4
> ncol(x)
[1] 2
```



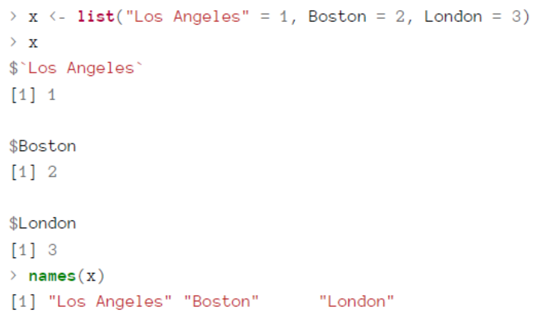
```
> x <- mtcars
> class(x)
[1] "data.frame"
```

Names

Metadata que hace que los objetos se autodescriban



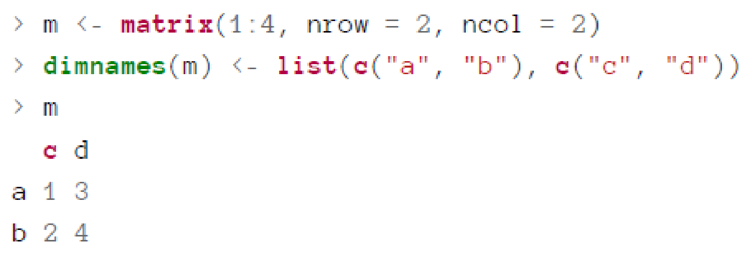
```
> x <- 1:3
> names(x)
NULL
> names(x) <- c("New York", "Seattle", "Los Angeles")
> x
   New York     Seattle Los Angeles
          1           2           3
> names(x)
[1] "New York"    "Seattle"     "Los Angeles"
```



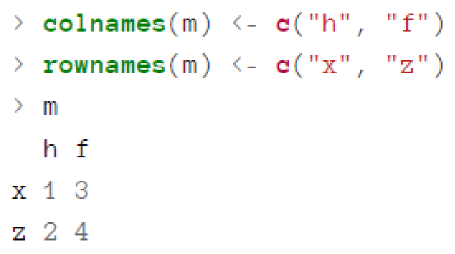
```
> x <- list("Los Angeles" = 1, Boston = 2, London = 3)
> x
$`Los Angeles`
[1] 1

$Boston
[1] 2

$London
[1] 3
> names(x)
[1] "Los Angeles" "Boston"      "London"
```

Names

Metadata que hace que los objetos se autodescriban



```
> m <- matrix(1:4, nrow = 2, ncol = 2)
> dimnames(m) <- list(c("a", "b"), c("c", "d"))
> m
  c d
a 1 3
b 2 4
```



```
> colnames(m) <- c("h", "f")
> rownames(m) <- c("x", "z")
> m
  h f
x 1 3
z 2 4
```

Estructuras de control

- if-else
- for loops
- for anidados
- while
- repeat
- next, break

Funciones

- Funciones en R
- Primer función
- Función recursiva
- Argumentos

Gracias

Fuente: Peng, Robert. *R Programming for Data Science*