# Introduction to R Software

## Introduction

## ::::

## Help, Demonstration, Examples, Packages and Libraries

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# Starting with R

**To start R, double click on the icon** 

**.**

**Then we get the following Gui (Graphic user interface) window screen**

RGui (64-bit)

File Edit View Misc Packages Windows Help

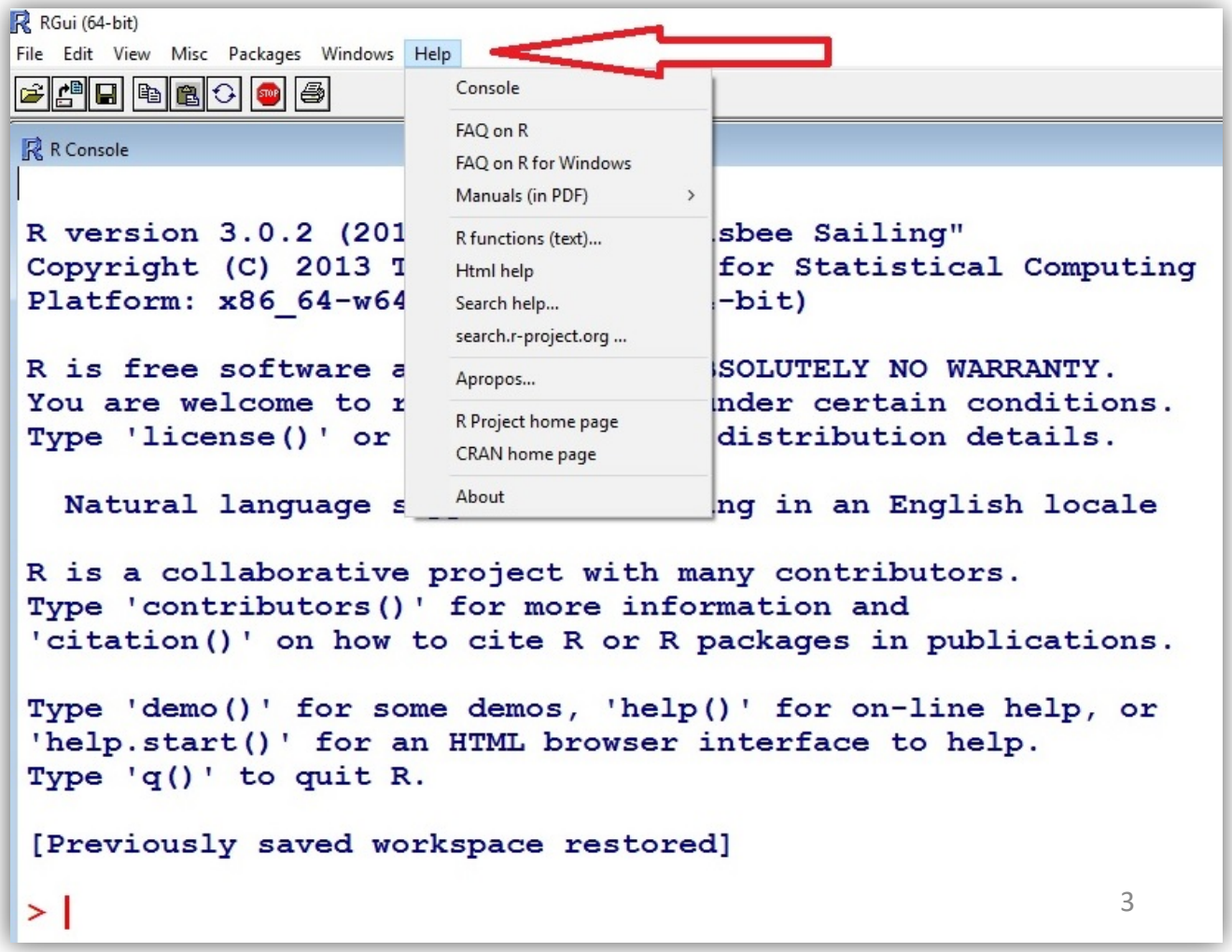
R Console

```
R version 3.2.3 (2015-12-10) -- "Wooden Christmas-Tree"
Copyright (C) 2015 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (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.

[Previously saved workspace restored]

> |
```

# Getting Help in R

**This can be done in one of the following ways:**

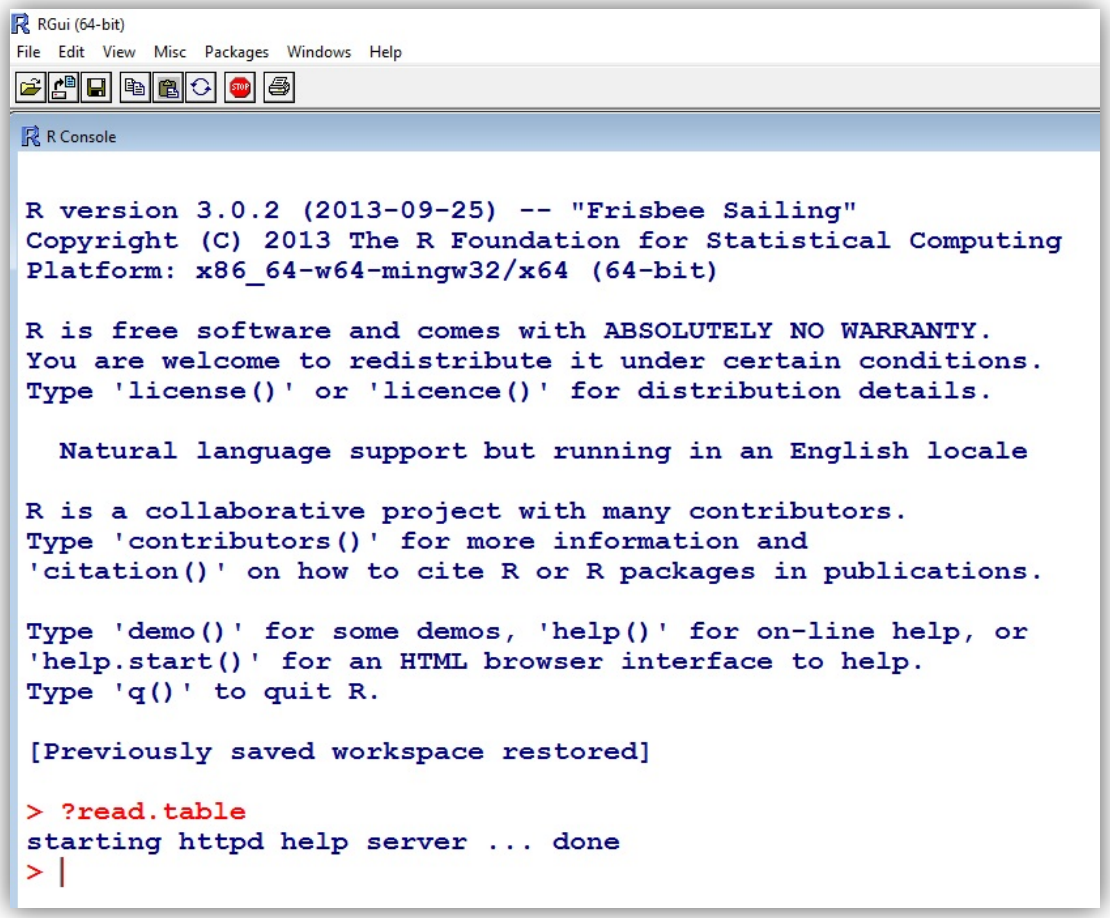
1) **Start R software and click the help button in the toolbar of the R Gui (Graphic user interface) window.**



# Getting Help in R

2. Search for help in Google `www.google.com`

3. If you need help with a function, then type question mark followed by the name of the function. For example, `?read.table` to get help for function `read.table`.



read.table {utils}

Data Input

## Description

Reads a file in table format and creates a data frame from it, with cases corresponding to lines and variables to fields in the file.

## Usage

```
read.table(file, header = FALSE, sep = "", quote = "\"'",
           dec = ".", row.names, col.names,
           as.is = !stringsAsFactors,
           na.strings = "NA", colClasses = NA, nrows = -1,
           skip = 0, check.names = TRUE, fill = !blank.lines.skip,
           strip.white = FALSE, blank.lines.skip = TRUE,
           comment.char = "#",
           allowEscapes = FALSE, flush = FALSE,
           stringsAsFactors = default.stringsAsFactors(),
           fileEncoding = "", encoding = "unknown", text)

read.csv(file, header = TRUE, sep = ",", quote = "\"",
         dec = ".", fill = TRUE, comment.char = "", ...)

read.csv2(file, header = TRUE, sep = ";", quote = "\"",
          dec = ",", fill = TRUE, comment.char = "", ...)

read.delim(file, header = TRUE, sep = "\t", quote = "\"",
           dec = ".", fill = TRUE, comment.char = "", ...)

read.delim2(file, header = TRUE, sep = "\t", quote = "\"",
            dec = ",", fill = TRUE, comment.char = "", ...)
```

## Arguments

# …continued

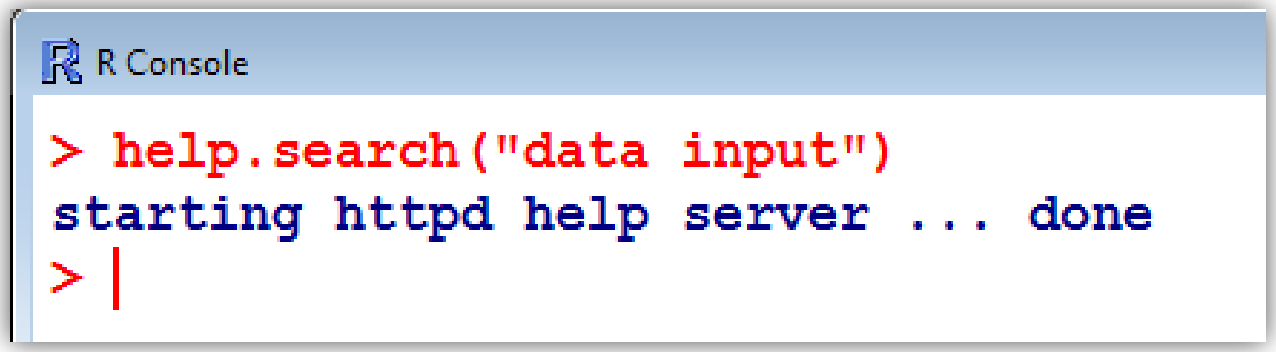
**Arguments**

| | |
|---|---|
| `file` | the name of the file which the data are to be read from. Each row of the table appears as one line of the file. If it does not contain an *absolute* path, the file name is *relative* to the current working directory, `getwd()`. Tilde-expansion is performed where supported. This can be a compressed file (see `file`).<br><br>Alternatively, `file` can be a readable text-mode connection (which will be opened for reading if necessary, and if so `close`d (and hence destroyed) at the end of the function call). (If `stdin()` is used, the prompts for lines may be somewhat confusing. Terminate input with a blank line or an EOF signal, `Ctrl-D` on Unix and `Ctrl-Z` on Windows. Any pushback on `stdin()` will be cleared before return.)<br><br>`file` can also be a complete URL. (For the supported URL schemes, see the 'URLs' section of the help for `url`.) |
| `header` | a logical value indicating whether the file contains the names of the variables as its first line. If missing, the value is determined from the file format: `header` is set to `TRUE` if and only if the first row contains one fewer field than the number of columns. |
| `sep` | the field separator character. Values on each line of the file are separated by this character. If `sep = ""` (the default for `read.table`) the separator is 'white space', that is one or more spaces, tabs, newlines or carriage returns. |
| `quote` | the set of quoting characters. To disable quoting altogether, use `quote = ""`. See `scan` for the behaviour on quotes embedded in quotes. Quoting is only considered for columns read as character, which is all of them unless `colClasses` is specified. |
| `dec` | the character used in the file for decimal points. |
| `row.names` | a vector of row names. This can be a vector giving the actual row names, or a single number giving the column of the table which contains the row names, or character string giving the name of the table column containing the row names.<br><br>If there is a header and the first row contains one fewer field than the number of columns, the first column in the input is used for the row names. Otherwise if `row.names` is missing, the rows are numbered.<br><br>Using `row.names = NULL` forces row numbering. Missing or `NULL` `row.names` generate row names that are considered to be 'automatic' (and not preserved by `as.matrix`). |
| `col.names` | a vector of optional names for the variables. The default is to use `"V"` followed by the column number. |
| `as.is` | the default behavior of `read.table` is to convert character variables (which are not converted to logical, numeric or complex) to factors. The variable `as.is` controls the conversion of columns not otherwise specified by `colClasses`. Its value is either a vector of logicals (values are recycled if necessary), or a vector of numeric or character indices which specify which columns should not be converted to factors.<br><br>Note: to suppress all conversions including those of numeric columns, set `colClasses = "character"`. |

**All minor details and explanations of all arguments are given.**

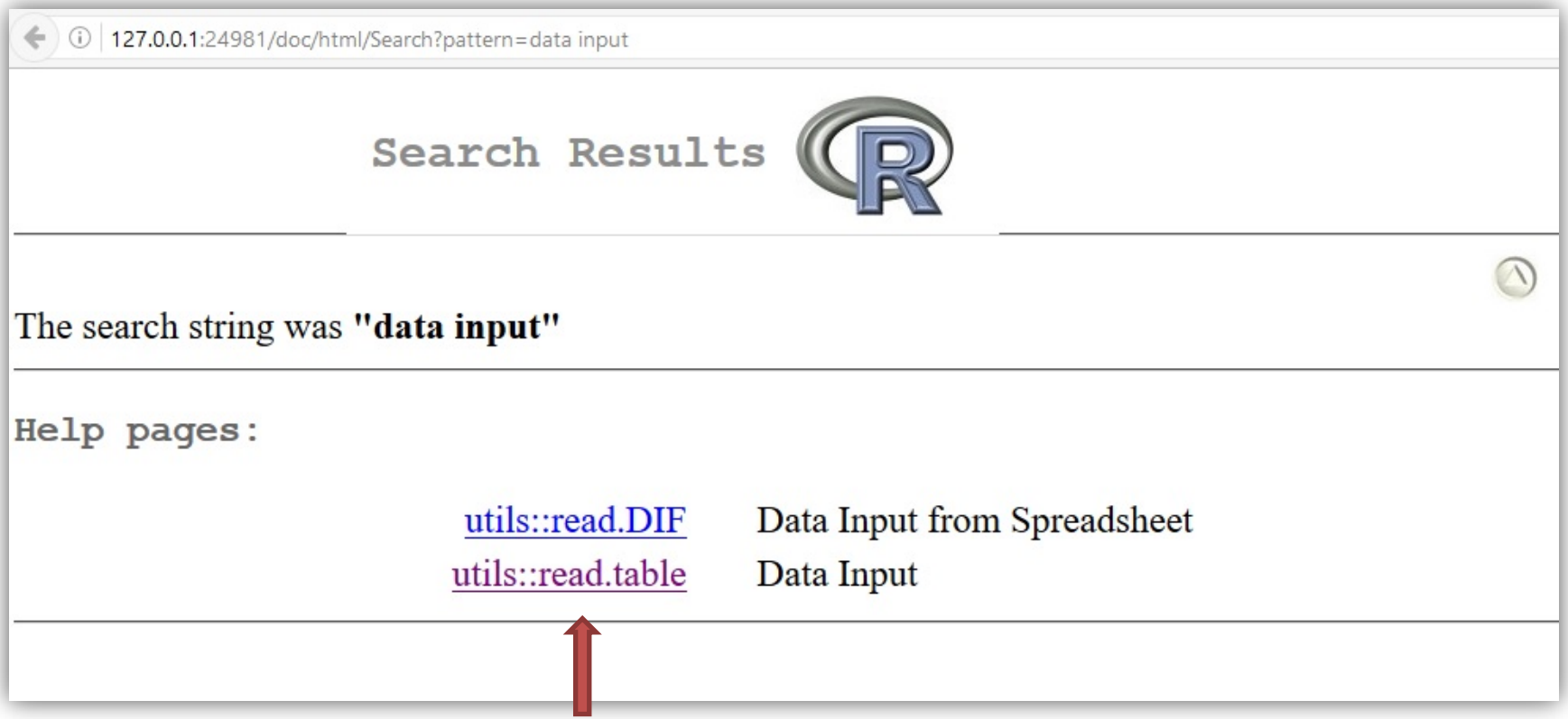
# Getting Help in R

4. Sometimes, you want to search by the subject on which we want help (e.g. data input). In such a case, type `help.search("data input")`




Then we get….

# Then we get….

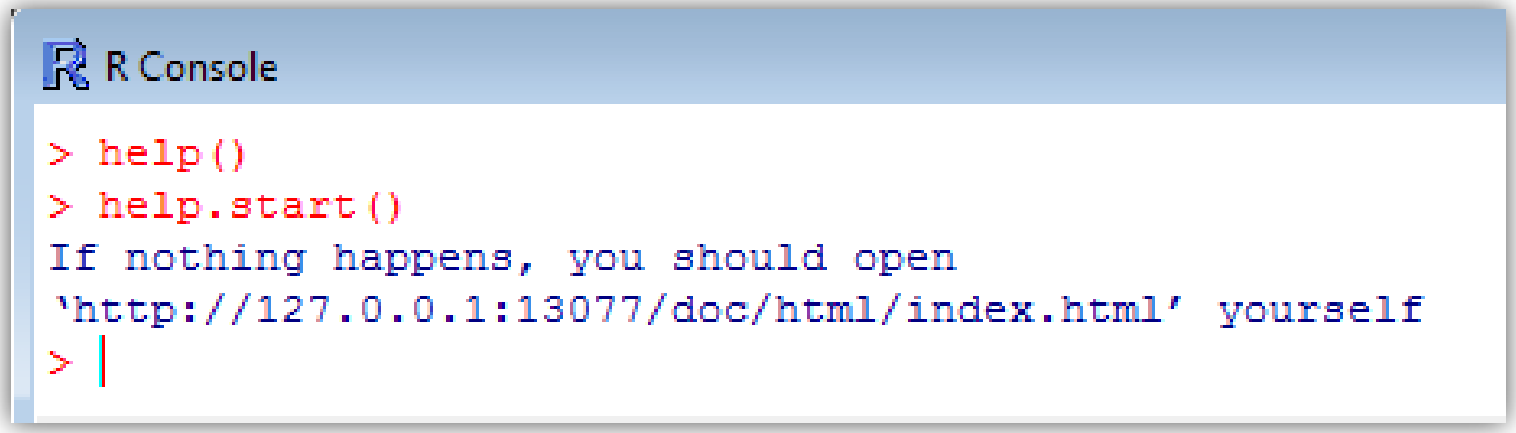



**Clicking over the link give required information**

# Getting Help in R

4. '`help()`' for on-line help,

or '`help.start()`' for an HTML browser interface to help.




Then we get....

127.0.0.1:13077/doc/html/index.html

# Statistical Data Analysis

## Manuals

An Introduction to R
Writing R Extensions
R Data Import/Export
The R Language Definition
R Installation and Administration
R Internals

## Reference

Packages
Search Engine & Keywords

## Miscellaneous Material

About R
License
NEWS
Authors
Frequently Asked Questions
User Manuals
Resources
Thanks
Technical papers

## Material specific to the Windows port

CHANGES up to R 2.15.0
Windows FAQ

# Getting Help in R

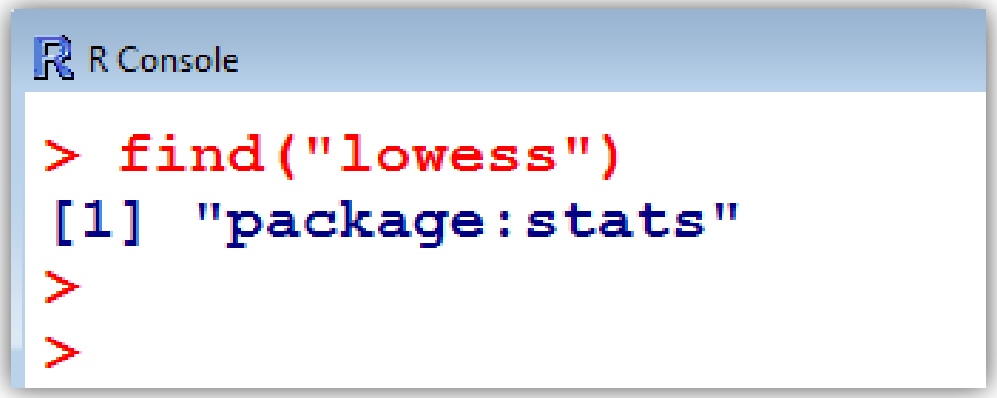
5) Other useful functions are `find` and `apropos`.

6) The `find` function tells us what package something is in.

For example

`> find("lowess")` returns

```
[1] "package:stats"
```



# Getting Help in R

**7) The apropos returns a character vector giving the names of all objects in the search list that match your enquiry.**

`apropos("lm")` **returns**

R Console

```
> apropos("lm")
 [1] ".__C__anova.glm"          ".__C__anova.glm.null"     ".__C__glm"
 [4] ".__C__glm.null"           ".__C__lm"                 ".__C__mlm"
 [7] ".__C__optionalMethod"     ".colMeans"                "anova.glm"
[10] "anova.glmlist"            "anova.lm"                 "anova.lmlist"
[13] "anova.mlm"                "colMeans"                 "contr.helmert"
[16] "getAllMethods"            "glm"                      "glm.control"
[19] "glm.fit"                  "hatvalues.lm"             "KalmanForecast"
[22] "KalmanLike"               "KalmanRun"                "KalmanSmooth"
[25] "kappa.lm"                 "lm"                       "lm.fit"
[28] "lm.influence"             "lm.wfit"                  "model.frame.glm"
[31] "model.frame.lm"           "model.matrix.lm"          "nlm"
[34] "nlminb"                   "plot.lm"                  "plot.mlm"
[37] "predict.glm"              "predict.lm"               "predict.mlm"
[40] "print.glm"                "print.lm"                 "residuals.glm"
[43] "residuals.lm"             "rstandard.glm"            "rstandard.lm"
[46] "rstudent.glm"             "rstudent.lm"              "summary.glm"
[49] "summary.lm"               "summary.mlm"
```

# Worked Examples of Functions

**To see a worked `example` just type the function name, e.g., `lm` for linear models:**

```
example(lm)
```

**and we see the printed and graphical output produced by the `lm` function.**

R Console

```
> example(lm)

lm> require(graphics)

lm> ## Annette Dobson (1990) "An Introduction to Generalized Linear Models".
lm> ## Page 9: Plant Weight Data.
lm> ctl <- c(4.17,5.58,5.18,6.11,4.50,4.61,5.17,4.53,5.33,5.14)

lm> trt <- c(4.81,4.17,4.41,3.59,5.87,3.83,6.03,4.89,4.32,4.69)

lm> group <- gl(2, 10, 20, labels = c("Ctl","Trt"))

lm> weight <- c(ctl, trt)

lm> lm.D9 <- lm(weight ~ group)

lm> lm.D90 <- lm(weight ~ group - 1) # omitting intercept

lm> ## No test:
lm> anova(lm.D9)
Analysis of Variance Table

Response: weight
          Df Sum Sq Mean Sq F value Pr(>F)
group      1 0.6882 0.68820  1.4191  0.249
Residuals 18 8.7292 0.48496

lm> summary(lm.D90)
```

**…and other details follow further**

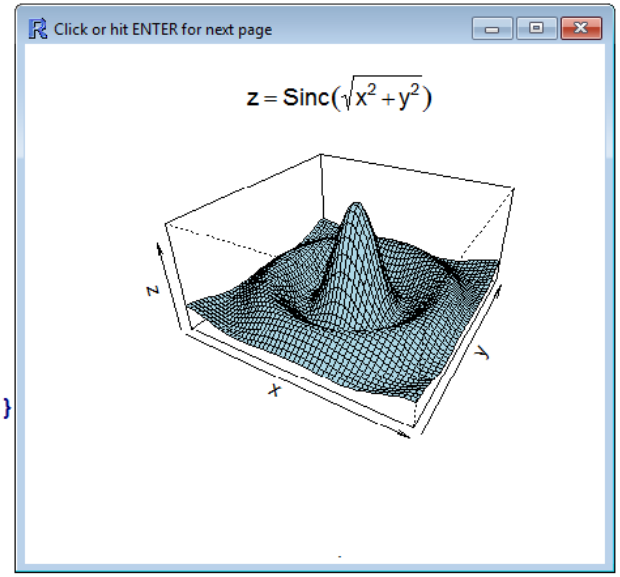
# Demonstration of R Functions

**This can be useful for seeing the type of things that R can do.**

**`demo(persp)`  `[persp` is a command for 3d surface plots`]`**

R Console

```
> demo(persp)


        demo(persp)
        ---- ~~~~~

Type  <Return>   to start :

> ### Demos for  persp()  plots   -- things not in  example(persp)
> ### ------------------------
>
> require(datasets)

> require(grDevices); require(graphics)

> ## (1) The Obligatory Mathematical surface.
> ##     Rotated sinc function.
>
> x <- seq(-10, 10, length.out = 50)

> y <- x

> rotsinc <- function(x,y)
+ {
+     sinc <- function(x) { y <- sin(x)/x ; y[is.na(y)] <- 1; y }
+     10 * sinc( sqrt(x^2+y^2) )
+ }

> sinc.exp <- expression(z == Sinc(sqrt(x^2 + y^2)))

> z <- outer(x, y, rotsinc)

> oldpar <- par(bg = "white")

> persp(x, y, z, theta = 30, phi = 30, expand = 0.5, col = "lightblue")
Waiting to confirm page change...
```




**…and it continues**

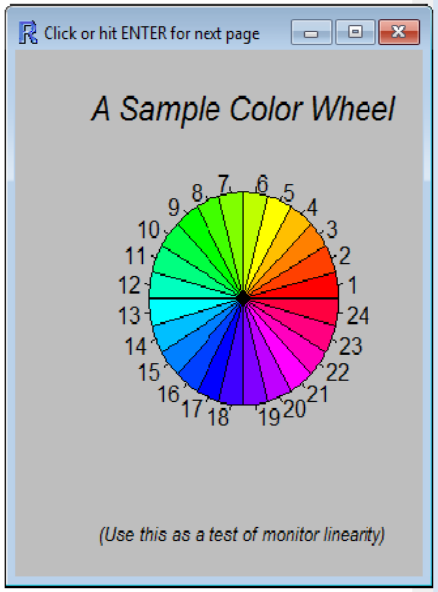
# Demonstration of R Functions

**This can be useful for seeing the type of things that R can do.**

## `demo(graphics)`

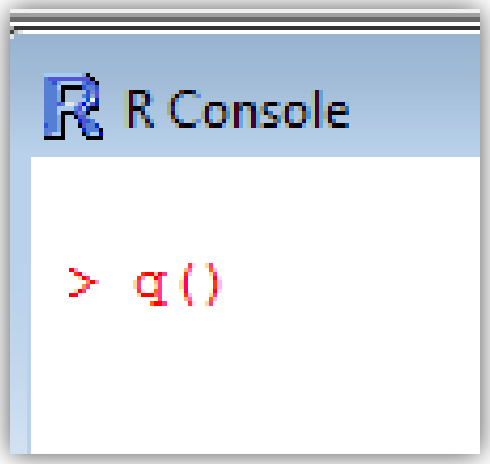
R Console

```
> demo(graphics)

        demo(graphics)
        ---- ~~~~~~~~

Type  <Return>   to start :

> #  Copyright (C) 1997-2009 The R Core Team
>
> require(datasets)

> require(grDevices); require(graphics)

> ## A little color wheel.       This code just plots equally spaced hues in
> ## a pie chart.       If you have a cheap SVGA monitor (like me) you will
> ## probably find that numerically equispaced does not mean visually
> ## equispaced.  On my display at home, these colors tend to cluster at
> ## the RGB primaries.  On the other hand on the SGI Indy at work the
> ## effect is near perfect.
>
> par(bg = "gray")

> pie(rep(1,24), col = rainbow(24), radius = 0.9)
Waiting to confirm page change...

> title(main = "A Sample Color Wheel", cex.main = 1.4, font.main = 3)

> title(xlab = "(Use this as a test of monitor linearity)",
+       cex.lab = 0.8, font.lab = 3)

> ## We have already confessed to having these.  This is just showing off X11
> ## color names (and the example (from the postscript manual) is pretty "cute".
>
```



# How to quit in R

**Type '`q()`' to quit R.**



# Libraries in R

**R provides many functions and one can also write own.**

**Functions and datasets are organised into libraries**

**To use a library, simply type the `library` function with the name of the library in brackets.**

```
library(.)
```

**For example, to load the `spatial` library type:**

```
library(spatial)
```

# Libraries in R

**Examples of libraries that come as a part of base package in R.**

**`MASS` : package associated with Venables and Ripley's book entitled *Modern Applied Statistics using S-Plus.***

**`mgcv` : generalized additive models.**

# Contents of Libraries

**It is easy to use the `help` function to discover the contents of library packages.**

**Here is how we find out about the contents of the `spatial` library:**

`library(help=spatial)` **returns**

```
     Information on package 'spatial'
Description:
Package:  spatial
Priority: recommended
Version:  7.3-8
```

**followed by a list of all the functions and data sets.**

Then we get….

R Console

```
> library(help=spatial)
```

Documentation for package 'spatial'

```
                Information on package 'spatial'

Description:

Package:            spatial
Priority:           recommended
Version:            7.3-11
Date:               2015-08-29
Depends:            R (>= 3.0.0), graphics, stats, utils
Suggests:           MASS
Authors@R:          c(person("Brian", "Ripley", role = c("aut", "cre",
                    "cph"), email = "ripley@stats.ox.ac.uk"),
                    person("Roger", "Bivand", role = "ctb"),
                    person("William", "Venables", role = "cph"))
Description:        Functions for kriging and point pattern analysis.
Title:              Functions for Kriging and Point Pattern Analysis
LazyLoad:           yes
ByteCompile:        yes
License:            GPL-2 | GPL-3
URL:                http://www.stats.ox.ac.uk/pub/MASS4/
NeedsCompilation:   yes
Packaged:           2015-08-28 15:25:37 UTC; ripley
```

# Installing Packages and Libraries

**The base R package contains programs for basic operations.**

**It does not contain some of the libraries necessary for advanced statistical work.**

**Specific requirements are met by special packages.**

**They are downloaded and their  downloading is very simple.**

# Installing Packages and Libraries

**To install any package,**

- **run the R program,**

- **then on the command line, use the `install.packages` function to download the libraries we want.**

# Installing Packages and Libraries

**Examples :**

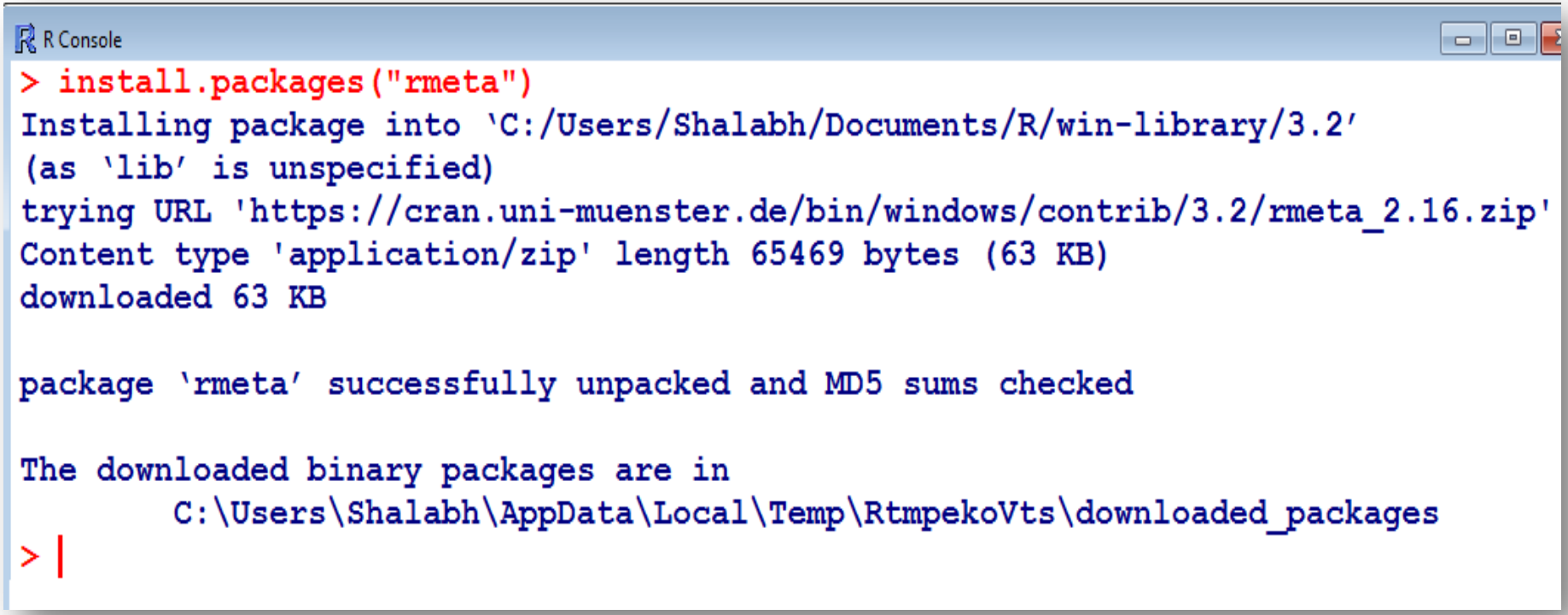
- **The package `rmeta` contains the statistical tools for meta analysis.**
- **The package `Agreement` contains statistical tools for measuring agreement.**

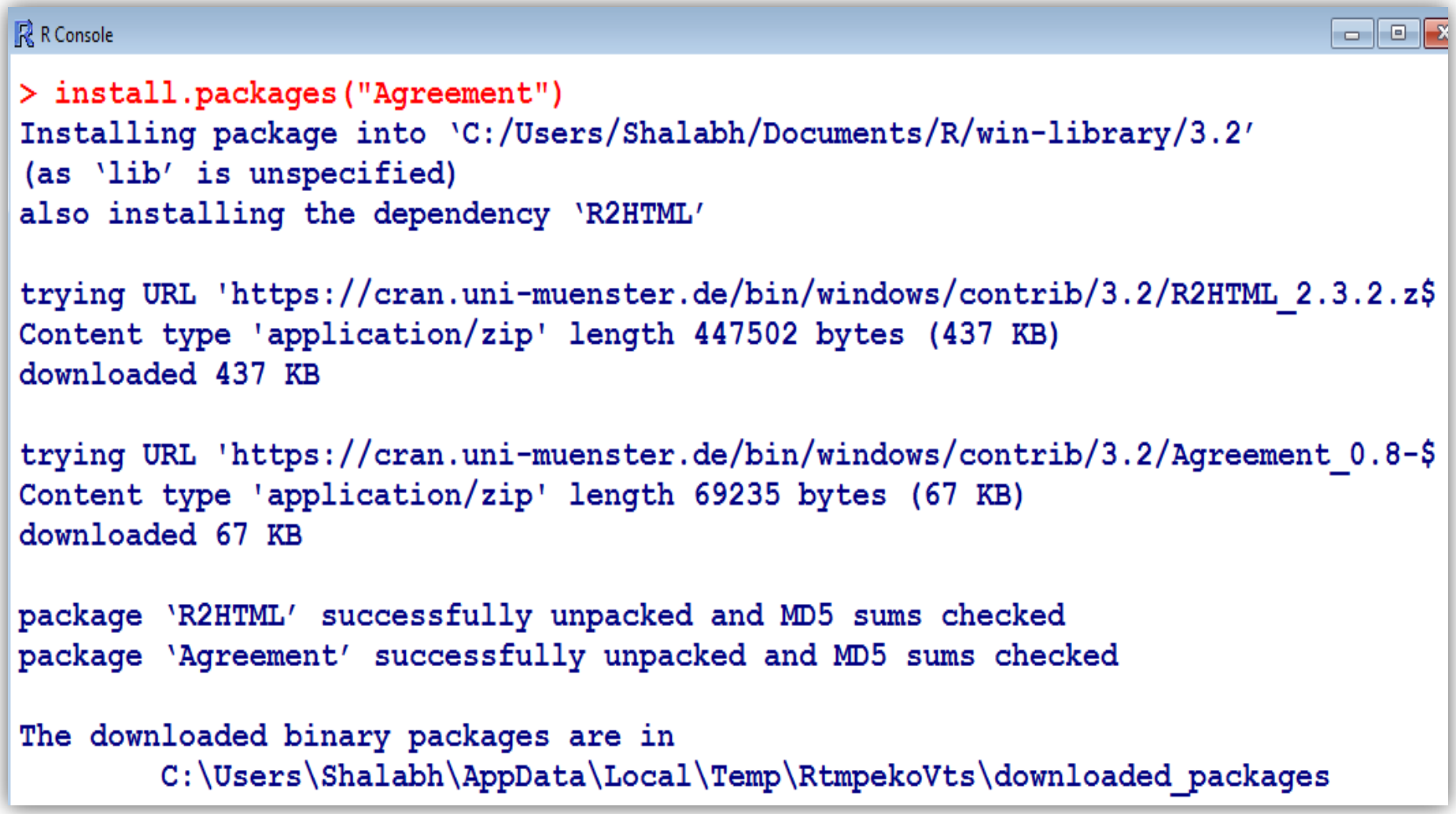
**The packages `rmeta` or `Agreement` can be installed by**

```
install.packages("rmeta")
```

```
install.packages("Agreement")
```

Then we get...


R Console
> install.packages("rmeta")
Installing package into 'C:/Users/Shalabh/Documents/R/win-library/3.2'
(as 'lib' is unspecified)
trying URL 'https://cran.uni-muenster.de/bin/windows/contrib/3.2/rmeta_2.16.zip'
Content type 'application/zip' length 65469 bytes (63 KB)
downloaded 63 KB
package 'rmeta' successfully unpacked and MD5 sums checked
The downloaded binary packages are in
C:\Users\Shalabh\AppData\Local\Temp\RtmpekoVts\downloaded_packages
>


R Console
> install.packages("Agreement")
Installing package into 'C:/Users/Shalabh/Documents/R/win-library/3.2'
(as 'lib' is unspecified)
also installing the dependency 'R2HTML'
trying URL 'https://cran.uni-muenster.de/bin/windows/contrib/3.2/R2HTML_2.3.2.z$
Content type 'application/zip' length 447502 bytes (437 KB)
downloaded 437 KB
trying URL 'https://cran.uni-muenster.de/bin/windows/contrib/3.2/Agreement_0.8-$
Content type 'application/zip' length 69235 bytes (67 KB)
downloaded 67 KB
package 'R2HTML' successfully unpacked and MD5 sums checked
package 'Agreement' successfully unpacked and MD5 sums checked
The downloaded binary packages are in
C:\Users\Shalabh\AppData\Local\Temp\RtmpekoVts\downloaded_packages