

R (programming language)

R is a programming language and free software environment for statistical computing and graphics supported by the R Foundation for Statistical Computing.^[6] The R language is widely used among statisticians and data miners for developing statistical software^[7] and data analysis.^[8] Polls, data mining surveys, and studies of scholarly literature databases show substantial increases in popularity,^[9] as of September 2020, R ranks 9th in the TIOBE index, a measure of popularity of programming languages.^[10]

A GNU package,^[11] the official R software environment is written primarily in C, Fortran, and R itself^[12] (thus, it is partially self-hosting) and is freely available under the GNU General Public License. Pre-compiled executables are provided for various operating systems. Although R has a command line interface, there are several third-party graphical user interfaces, such as RStudio, an integrated development environment, and Jupyter, a notebook interface.^{[13][14]}

Contents

History

Statistical features

Programming features

Packages

Milestones

Interfaces

Implementations

Communities

useR! conferences

The R Journal

Comparison with SAS, SPSS, and Stata

Commercial support for R

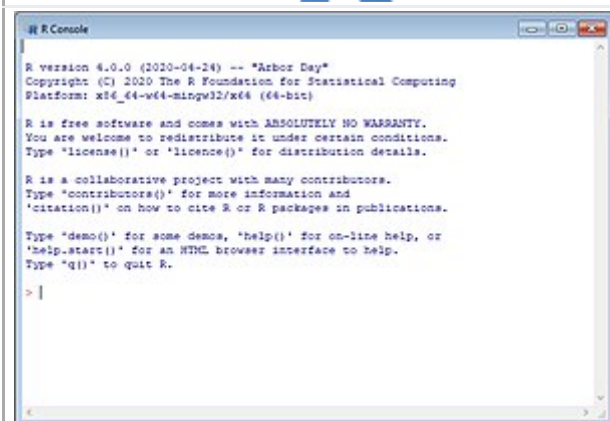
Examples

Basic syntax

Structure of a function

Mandelbrot set

R



R terminal

Paradigms	Multi-paradigm: <u>Array</u> , <u>object-oriented</u> , <u>imperative</u> , <u>functional</u> , <u>procedural</u> , <u>reflective</u>
Designed by	<u>Ross Ihaka</u> and <u>Robert Gentleman</u>
Developer	<u>R Core Team</u> ^[1]
First appeared	August 1993 ^[2]
Stable release	4.0.3 ^[3] / 10 October 2020
Typing discipline	<u>Dynamic</u>
License	<u>GNU GPL v2</u> ^[4]
Filename extensions	.r .rdata .rds .rda
Website	<u>www.r-project.org</u> (<u>https://www.r-project.org</u>) 
Influenced by	<u>Common Lisp</u> · <u>S</u> · <u>Scheme</u> ^[2] · <u>XLispStat</u>
Influenced	<u>Julia</u> ^[5]

History

R is an implementation of the [S programming language](#) combined with [lexical scoping semantics](#), inspired by [Scheme](#).^[15] S was created by [John Chambers](#) in 1976 while at [Bell Labs](#). A commercial version of S was offered as [S-PLUS](#) starting in 1988.

Much of the code written for S-PLUS runs unaltered in R.^[16]

In 1991 [Ross Ihaka](#) and [Robert Gentleman](#)^[17] at the [University of Auckland](#), New Zealand, began an alternative implementation of the basic S language, completely independent of S-PLUS. They publicized this project starting in 1993.^[18] In 1995 Martin Maechler convinced Ihaka and Gentleman to make R [free and open-source software](#) under the [GNU General Public License](#). The *R Development Core Team* was created to manage the further development of R. John Chambers became a member at least as of August 2018.^[19] R is named partly after the first names of the first two R authors and partly as a play on the name of S.^[20]

The first official release came in 1995. The Comprehensive R Archive Network (CRAN) was officially announced 23 April 1997 with 3 mirrors and 12 contributed packages.^[21] The first official "[stable beta](#)" version (v1.0) was released 29 February 2000.^{[22][23][24]}

Statistical features

R and its libraries implement a wide variety of statistical and [graphical](#) techniques, including [linear](#) and [nonlinear](#) modeling, classical statistical tests, [time-series analysis](#), classification, clustering, and others. R is easily extensible through functions and extensions, and the R community is noted for its active contributions in terms of packages. Many of R's standard functions are written in R itself, which makes it easy for users to follow the algorithmic choices made. For computationally intensive tasks, [C](#), [C++](#), and [Fortran](#) code can be [linked](#) and called at run time. Advanced users can write C, C++,^[25] [Java](#),^[26] [.NET](#)^[27] or [Python](#) code to [manipulate R objects directly](#).^[28] R is highly extensible through the use of user-submitted packages for specific functions or specific areas of study. Due to its [S](#) heritage, R has stronger [object-oriented programming](#) facilities than most statistical computing languages. Extending R is also eased by its [lexical scoping rules](#).^[29]

Another strength of R is static graphics, which can produce publication-quality graphs, including mathematical symbols. Dynamic and interactive graphics are available through additional packages.^[30]

R has Rd, its own [LaTeX](#)-like documentation format, which is used to supply comprehensive documentation, both online in a number of formats and in hard copy.^[31]

Programming features

R is an [interpreted language](#); users typically access it through a [command-line interpreter](#). If a user types `2+2` at the R command prompt and presses enter, the computer replies with 4, as shown below:

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

This calculation is interpreted as the sum of two single-element vectors, resulting in a single-element vector. The prefix `[1]` indicates that the list of elements following it on the same line starts with the *first* element of the vector (a feature that is useful when the output extends over multiple lines).

Like other similar languages such as APL and MATLAB, R supports matrix arithmetic. R's data structures include vectors, matrices, arrays, data frames (similar to tables in a relational database) and lists.^[32] Arrays are stored in column-major order.^[33] R's extensible object system includes objects for (among others): regression models, time-series and geo-spatial coordinates. The scalar data type was never a data structure of R.^[34] Instead, a scalar is represented as a vector with length one.^[35]

Many features of R derive from Scheme. R uses S-expressions to represent both data and code. Functions are first-class and can be manipulated in the same way as data objects, facilitating meta-programming, and allow multiple dispatch. Variables in R are lexically scoped and dynamically typed. Function arguments are passed by value, and are lazy—that is to say, they are only evaluated when they are used, not when the function is called^[36].

R supports procedural programming with functions and, for some functions, object-oriented programming with generic functions. A generic function acts differently depending on the classes of arguments passed to it. In other words, the generic function dispatches the function (method) specific to that class of object. For example, R has a generic print function that can print almost every class of object in R with a simple `print(objectname)` syntax.^[37]

Although used mainly by statisticians and other practitioners requiring an environment for statistical computation and software development, R can also operate as a general matrix calculation toolbox – with performance benchmarks comparable to GNU Octave or MATLAB.^[38]

Packages

The capabilities of R are extended through user-created *packages*, which allow specialised statistical techniques, graphical devices, import/export capabilities, reporting tools (Rmarkdown, knitr, Sweave), etc. These packages are developed primarily in R, and sometimes in Java, C, C++, and Fortran. The R packaging system is also used by researchers to create compendia to organise research data, code and report files in a systematic way for sharing and public archiving.^[39]

A core set of packages is included with the installation of R, with more than 15,000 additional packages (as of September 2018) available at the Comprehensive R Archive Network (CRAN),^[40] Bioconductor, Omegahat,^[41] GitHub, and other repositories.^[42]

The "Task Views" page (subject list) on the CRAN website^[43] lists a wide range of tasks (in fields such as Finance, Genetics, High Performance Computing, Machine Learning, Medical Imaging, Social Sciences and Spatial Statistics) to which R has been applied and for which packages are available. R has also been identified by the FDA as suitable for interpreting data from clinical research.^[44]

Other R package resources include Crantastic,^[45] a community site for rating and reviewing all CRAN packages, and R-Forge,^[46] a central platform for the collaborative development of R packages, R-related software, and projects. R-Forge also hosts many unpublished beta packages, and development versions of CRAN packages. Microsoft maintains a daily snapshot of CRAN, that dates back to Sept. 17, 2014.^[47]

The Bioconductor project provides R packages for the analysis of genomic data. This includes object-oriented data-handling and analysis tools for data from Affymetrix, cDNA microarray, and next-generation high-throughput sequencing methods.^[48]

A group of packages called the Tidyverse, which can be considered a "dialect of the R language", is increasingly popular in the R ecosystem.^[note 1] The group of packages strives to provide a cohesive collection of functions to deal with common data science tasks, including data import, cleaning, transformation and visualisation (notably with the ggplot2 package).

R is one of 5 languages with an Apache Spark API, the others being Scala, Java, Python, and SQL.^{[49][50]}

Milestones

A list of changes in R releases is maintained in various "news" files at CRAN.^[51] Some highlights are listed below for several major releases.

Release	Date	Description
0.16		This is the last alpha version developed primarily by Ihaka and Gentleman. Much of the basic functionality from the "White Book" (see S history) was implemented. The mailing lists commenced on April 1, 1997.
0.49	1997-04-23	This is the oldest source release which is currently available on CRAN. ^[52] CRAN is started on this date, with 3 mirrors that initially hosted 12 packages. ^[53] Alpha versions of R for Microsoft Windows and the classic Mac OS are made available shortly after this version.
0.60	1997-12-05	R becomes an official part of the GNU Project . The code is hosted and maintained on CVS .
0.65.1	1999-10-07	First versions of <code>update.packages</code> and <code>install.packages</code> functions for downloading and installing packages from CRAN. ^[54]
1.0	2000-02-29	Considered by its developers stable enough for production use. ^[55]
1.4	2001-12-19	S4 methods are introduced and the first version for Mac OS X is made available soon after.
1.8	2003-10-08	Introduced a flexible condition handling mechanism for signalling and handling condition objects.
2.0	2004-10-04	Introduced lazy loading , which enables fast loading of data with minimal expense of system memory.
2.1	2005-04-18	Support for UTF-8 encoding, and the beginnings of internationalization and localization for different languages.
2.6.2	2008-02-08	Last version to support Windows 95, 98, Me and NT 4.0 ^[56]
2.11	2010-04-22	Support for Windows 64-bit systems.
2.12.2	2011-02-25	Last version to support Windows 2000 ^[57]
2.13	2011-04-14	Adding a new compiler function that allows speeding up functions by converting them to byte-code.
2.14	2011-10-31	Added mandatory namespaces for packages. Added a new parallel package.
2.15	2012-03-30	New load balancing functions. Improved serialisation speed for long vectors.
3.0.0	2013-04-03	Support for numeric index values 2^{31} and larger on 64-bit systems.
3.3.3	2017-03-06	Last version to support Microsoft Windows XP.
3.4.0	2017-04-21	Just-in-time compilation (JIT) of functions and loops to byte-code enabled by default.
3.5.0	2018-04-23	Packages byte-compiled on installation by default. Compact internal representation of integer sequences. Added a new serialisation format to support compact internal representations.
3.6.0	2019-04-26	
4.0.0	2020-04-24	R now uses a <code>stringsAsFactors = FALSE</code> default, and hence by default no longer converts strings to factors in calls to <code>data.frame()</code> and <code>read.table()</code> .

Interfaces

The most specialized [integrated development environment \(IDE\)](#) for R is [RStudio](#).^[58] A similar development interface is [R Tools for Visual Studio](#). Some generic IDEs like [Eclipse](#),^[59] also offer features to work with R. R is also often used within a [Jupyter Notebook](#).^[60]

Graphical user interfaces with more of a point-and-click approach include [Rattle GUI](#), [R Commander](#), and [RkWard](#).

Some of the more common editors with varying levels of support for R include [Emacs](#) ([Emacs Speaks Statistics](#)), [Vim](#) ([Nvim-R plugin](#)^[61]), [Neovim](#) ([Nvim-R plugin](#)^[61]), [Kate](#),^[62] [LyX](#),^[63] [Notepad++](#),^[64] [Visual Studio Code](#), [WinEdt](#),^[65] and [Tinn-R](#).^[66]

R functionality is accessible from several scripting languages such as [Python](#),^[67] [Perl](#),^[68] [Ruby](#),^[69] [F#](#),^[70] and [Julia](#).^[71] Interfaces to other, high-level programming languages, like [Java](#)^[72] and [.NET C#](#)^{[73][74]} are available as well.

Implementations

The main R implementation is written in R, C, and Fortran,^[75] and there are several other implementations aimed at improving speed or increasing extensibility. A closely related implementation is [pqR](#) (pretty quick R) by [Radford M. Neal](#) with improved memory management and support for automatic multithreading. [Renjin](#) and [FastR](#) are [Java](#) implementations of R for use in a Java Virtual Machine. [CXXR](#), [rho](#), and [Riposte](#)^[76] are implementations of R in [C++](#). [Renjin](#), [Riposte](#), and [pqR](#) attempt to improve performance by using multiple processor cores and some form of deferred evaluation.^[77] Most of these alternative implementations are experimental and incomplete, with relatively few users, compared to the main implementation maintained by the R Development Core Team.

[TIBCO](#) built a [runtime engine](#) called [TERR](#), which is part of [Spotfire](#).^[78]

Microsoft R Open is a fully compatible R distribution with modifications for multi-threaded computations.^[79]

Communities

R has local communities worldwide for users to network, share ideas, and learn.^{[80][81]}

There are a growing number of R events bringing its users together, such as conferences (e.g. [useR!](#), [WhyR?](#), [conectaR](#), [SatRdays](#)),^{[82][83]} meetups,^[84] as well as [R-Ladies](#) groups^[85] that promote gender diversity and the R Foundation taskforce on women and other under-represented groups.^[86]

useR! conferences

The official annual gathering of R users is called "useR!".^[87] The first such event was useR! 2004 in May 2004, [Vienna, Austria](#).^[88] After skipping 2005, the useR! conference has been held annually, usually alternating between locations in Europe and North America.^[89] Subsequent conferences have included:^[87]

- useR! 2006, Vienna, Austria
- useR! 2007, Ames, Iowa, USA
- useR! 2008, Dortmund, Germany
- useR! 2009, Rennes, France
- useR! 2010, Gaithersburg, Maryland, USA
- useR! 2011, Coventry, United Kingdom
- useR! 2012, Nashville, Tennessee, USA
- useR! 2013, Albacete, Spain
- useR! 2014, Los Angeles, California, USA
- useR! 2015, Aalborg, Denmark
- useR! 2016, Stanford, California, USA

- useR! 2017, Brussels, Belgium
- useR! 2018, Brisbane, Australia
- useR! 2019, Toulouse, France
- useR! 2020, St. Louis, Missouri, USA (Canceled)

Future conferences planned are as follows:^{[87][90]}

- useR! 2021, Zurich, Switzerland

The R Journal

The R Journal is the open access, refereed journal of the R project for statistical computing. It features short to medium length articles on the use and development of R, including packages, programming tips, CRAN news, and foundation news.

Comparison with SAS, SPSS, and Stata

R is comparable to popular commercial statistical packages such as SAS, SPSS, and Stata, but R is available to users at no charge under a free software license.^[91]

In January 2009, the *New York Times* ran an article charting the growth of R, the reasons for its popularity among data scientists and the threat it poses to commercial statistical packages such as SAS.^[92] In June 2017 data scientist Robert Muenchen published a more in-depth comparison between R and other software packages, "The Popularity of Data Science Software".^[93]

R is more procedural-code oriented than either SAS or SPSS, both of which make heavy use of pre-programmed procedures (called "procs") that are built-in to the language environment and customized by parameters of each call. R generally processes data in-memory, which limits its usefulness in processing extremely large files.^[94]

Commercial support for R

Although R is an open-source project supported by the community developing it, some companies strive to provide commercial support and/or extensions for their customers. This section gives some examples of such companies.

In 2007, Richard Schultz, Martin Schultz, Steve Weston and Kirk Mettler founded Revolution Analytics to provide commercial support for Revolution R, their distribution of R, which also includes components developed by the company. Major additional components include: ParallelR, the R Productivity Environment IDE, RevoScaleR (for big data analysis), RevoDeployR, web services framework, and the ability for reading and writing data in the SAS file format.^[95] Revolution Analytics also offer a distribution of R designed to comply with established IQ/OQ/PQ criteria which enables clients in the pharmaceutical sector to validate their installation of REvolution R.^[96] In 2015, Microsoft Corporation completed the acquisition of Revolution Analytics.^[97] and has since integrated the R programming language into SQL Server 2016, SQL Server 2017, Power BI, Azure SQL Database, Azure Cortana Intelligence, Microsoft R Server and Visual Studio 2017.^[98]

In October 2011, Oracle announced the *Big Data Appliance*, which integrates R, Apache Hadoop, Oracle Linux, and a NoSQL database with Exadata hardware.^[99] As of 2012, Oracle R Enterprise^[100] became one of two components of the "Oracle Advanced Analytics Option"^[101] (alongside Oracle Data Mining).

IBM offers support for in-Hadoop execution of R,^[102] and provides a programming model for massively parallel in-database analytics in R.^[103]

Tibco offers a runtime-version R as a part of Spotfire.^[104]

Mango Solutions offers a validation package for R, ValidR,^{[105][106]} to make it compliant with drug approval agencies, like FDA. These agencies allow for the use of any statistical software in submissions, if only the software is validated, either by the vendor or sponsor itself.^[107]

Examples

Basic syntax

The following examples illustrate the basic syntax of the language and use of the command-line interface.

In R, the generally preferred^[108] assignment operator is an arrow made from two characters `<-`, although `=` can usually be used instead.^[109]

```
> x <- 1:6 # Create vector.
> y <- x^2 # Create vector by formula.
> print(y) # Print the vector's contents.
[1] 1 4 9 16 25 36

> mean(y) # Arithmetic mean of vector.
[1] 15.16667

> var(y) # Sample variance of vector.
[1] 178.9667

> model <- lm(y ~ x) # Linear regression model y = A + B * x.
> print(model) # Print the model's results.

Call:
lm(formula = y ~ x)

Coefficients:
(Intercept)          x
      -9.333         7.000

> summary(model) # Display an in-depth summary of the model.

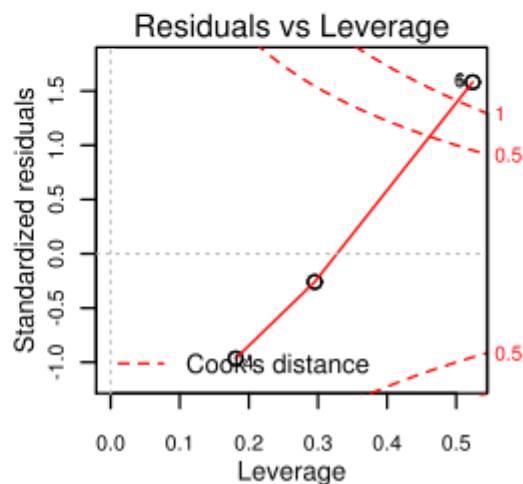
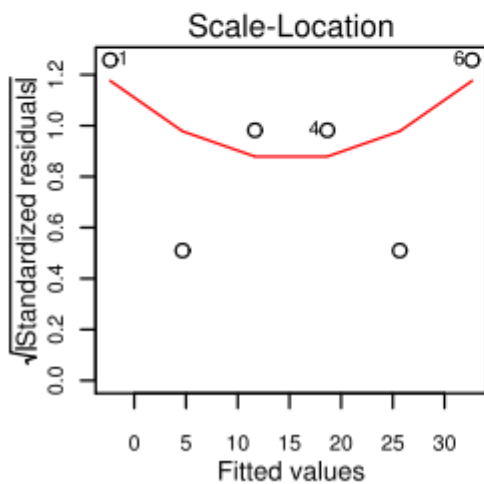
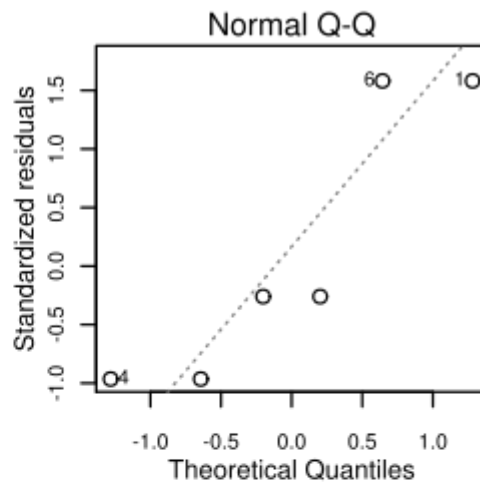
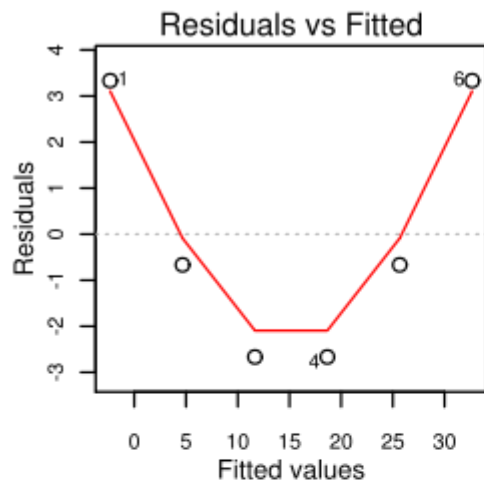
Call:
lm(formula = y ~ x)

Residuals:
    1     2     3     4     5     6 
3.3333 -0.6667 -2.6667 -2.6667 -0.6667  3.3333 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  -9.3333     2.8441   -3.282  0.030453 *
x              7.0000     0.7303    9.585  0.000662 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.055 on 4 degrees of freedom
Multiple R-squared:  0.9583, Adjusted R-squared:  0.9478 
F-statistic: 91.88 on 1 and 4 DF, p-value: 0.000662

> par(mfrow = c(2, 2)) # Create a 2 by 2 layout for figures.
> plot(model) # Output diagnostic plots of the model.
```

Structure of a function

One of R's strengths is the ease of creating new functions. Objects in the function body remain local to the function, and any data type may be returned.^[110] Here is an example user-created function:

```
# Declare function "f" with parameters "x", "y"
# that returns a linear combination of x and y.
f <- function(x, y) {
  z <- 3 * x + 4 * y
  return(z)
}
```

```
> f(1, 2)
[1] 11

> f(c(1,2,3), c(5,3,4))
[1] 23 18 25

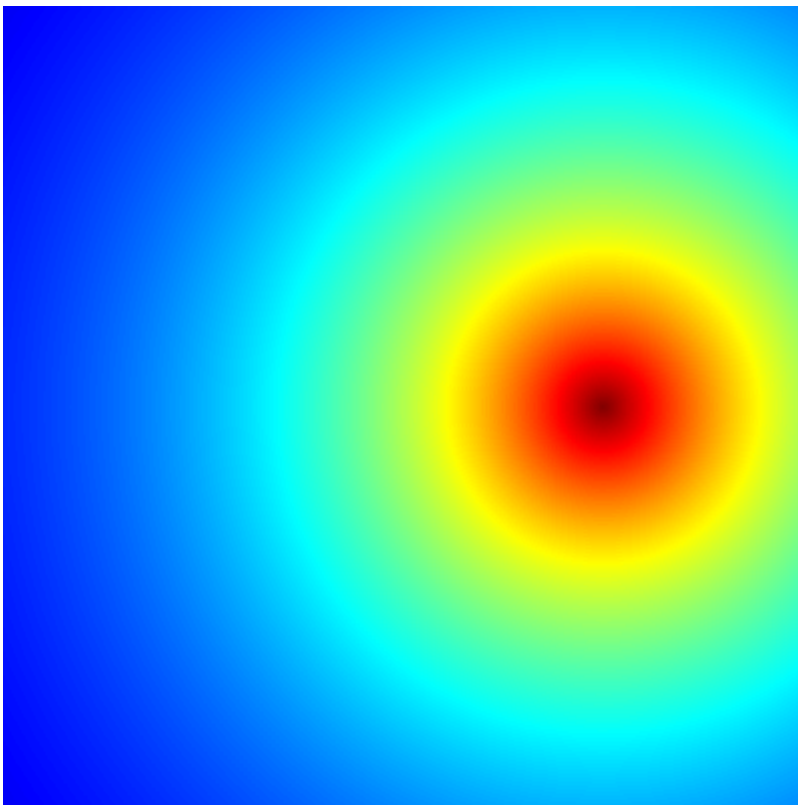
> f(1:3, 4)
[1] 19 22 25
```

Mandelbrot set

Short R code calculating Mandelbrot set through the first 20 iterations of equation $z = z^2 + c$ plotted for different complex constants c . This example demonstrates:

- use of community-developed external libraries (called packages), in this case caTools package
- handling of complex numbers
- multidimensional arrays of numbers used as basic data type, see variables C, Z and X.

```
install.packages("caTools") # install external package
library(caTools)           # external package providing write.gif function
jet.colors <- colorRampPalette(c("red", "blue", "#007FFF", "cyan", "#7FFF7F",
                                "yellow", "#FF7F00", "red", "#7F0000"))
dx <- 1500                  # define width
dy <- 1400                  # define height
C <- complex(real = rep(seq(-2.2, 1.0, length.out = dx), each = dy),
              imag = rep(seq(-1.2, 1.2, length.out = dy), dx))
C <- matrix(C, dy, dx)     # reshape as square matrix of complex numbers
Z <- 0                      # initialize Z to zero
X <- array(0, c(dy, dx, 20)) # initialize output 3D array
for (k in 1:20) {          # loop with 20 iterations
  Z <- Z^2 + C              # the central difference equation
  X[, , k] <- exp(-abs(Z))  # capture results
}
write.gif(X, "Mandelbrot.gif", col = jet.colors, delay = 100)
```



See also

- Comparison of numerical-analysis software
- Comparison of statistical packages
- List of numerical-analysis software
- List of statistical software
- Rmetrics
- RStudio
- Statcheck

- Tidyverse

Notes

1. As of 2020-06-13, Metacran (<https://www.r-pkg.org/downloaded>) listed 7 of the 8 core packages of the Tidyverse in the list of most download R packages.

References

1. Hornik, Kurt (26 November 2015). "R FAQ" (https://cran.r-project.org/doc/FAQ/R-FAQ.html#What-is-R_003f). *The Comprehensive R Archive Network*. 2.1 What is R?. Retrieved 5 August 2018.
2. Ihaka, Ross (1998). *R : Past and Future History* (<https://www.stat.auckland.ac.nz/~ihaka/downloads/Interface98.pdf>) (PDF) (Technical report). Statistics Department, The University of Auckland, Auckland, New Zealand.
3. "R 4.0.3 is released" (<https://stat.ethz.ch/pipermail/r-announce/2020/000662.html>); author name string: Peter Dalgaard; publication date: 10 October 2020; retrieved: 10 October 2020.
4. "R license" (<https://www.r-project.org/COPYING>). r-project. Retrieved 5 August 2018.
5. "Introduction" (<https://web.archive.org/web/20180620172516/https://docs.julialang.org/en/stable/manual/introduction/#man-introduction-1#man-introduction-1>). *The Julia Manual*. Archived from the original (<https://docs.julialang.org/en/stable/manual/introduction/#man-introduction-1>) on 20 June 2018. Retrieved 5 August 2018.
6. R language and environment

- Hornik, Kurt (4 October 2017). "R FAQ" (https://cran.r-project.org/doc/FAQ/R-FAQ.html#What-is-R_003f). *The Comprehensive R Archive Network*. 2.1 What is R?. Retrieved 6 August 2018.

R Foundation

- Hornik, Kurt (4 October 2017). "R FAQ" (https://cran.r-project.org/doc/FAQ/R-FAQ.html#What-is-the-R-Foundation_003f). *The Comprehensive R Archive Network*. 2.13 What is the R Foundation?. Retrieved 6 August 2018.

The R Core Team asks authors who use R in their data analysis (<https://cran.r-project.org/doc/FAQ/R-FAQ.html#Citing-R>) to cite the software using:

- R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <http://www.R-project.org/>.

7. widely used

- Fox, John & Andersen, Robert (January 2005). "Using the R Statistical Computing Environment to Teach Social Statistics Courses" (<https://socialsciences.mcmaster.ca/jfox/Teaching-with-R.pdf>) (PDF). Department of Sociology, McMaster University. Retrieved 6 August 2018.
- Vance, Ashlee (6 January 2009). "Data Analysts Captivated by R's Power" (<https://www.nytimes.com/2009/01/07/technology/business-computing/07program.html>). *New York Times*. Retrieved 6 August 2018. "R is also the name of a popular programming language used by a growing number of data analysts inside corporations and academia. It is becoming their lingua franca..."

8. Vance, Ashlee (6 January 2009). "Data Analysts Captivated by R's Power" (<https://www.nytimes.com/2009/01/07/technology/business-computing/07program.html>). *New York Times*. Retrieved 6 August 2018. "R is also the name of a popular programming language used by a growing number of data analysts inside corporations and academia. It is becoming their lingua franca..."
9. R's popularity
 - David Smith (2012); *R Tops Data Mining Software Poll* (<http://java.sys-con.com/node/2288420>), Java Developers Journal, May 31, 2012.
 - Karl Rexer, Heather Allen, & Paul Gearan (2011); *2011 Data Miner Survey Summary* (<http://www.rexeranalytics.com/Data-Miner-Survey-Results-2011.html>), presented at Predictive Analytics World, Oct. 2011.
 - Robert A. Muenchen (2012). "The Popularity of Data Analysis Software" (<http://r4stats.com/articles/popularity/>).
 - Tippmann, Sylvia (29 December 2014). "Programming tools: Adventures with R" (<https://doi.org/10.1038%2F517109a>). *Nature*. **517** (7532): 109–110. doi:10.1038/517109a (<https://doi.org/10.1038%2F517109a>). PMID 25557714 (<https://pubmed.ncbi.nlm.nih.gov/25557714>).
10. "TIOBE Index - The Software Quality Company" (<https://www.tiobe.com/tiobe-index/>). *TIOBE*. Retrieved 9 September 2020.
11. GNU project
 - "GNU R" (<http://directory.fsf.org/project/gnur/>). Free Software Foundation (FSF) Free Software Directory. 23 April 2018. Retrieved 7 August 2018.
 - R Project (n.d.). "What is R?" (<https://www.r-project.org/about.html>). Retrieved 7 August 2018.
12. Wrathematics (27 August 2011). "How Much of R Is Written in R" (<https://web.archive.org/web/20180612142342/http://librestats.com/2011/08/27/how-much-of-r-is-written-in-r/>). librestats. Archived from the original (<http://librestats.com/2011/08/27/how-much-of-r-is-written-in-r/>) on 12 June 2018. Retrieved 7 August 2018.
13. "7 of the Best Free Graphical User Interfaces for R" (<http://www.linuxlinks.com/article/20110306113701179/GUIsforR.html>). *linuxlinks.com*. Retrieved 9 February 2016.
14. "List of R Editors" (<https://r-dir.com/blog/2013/01/list-of-r-editors.html>). *r-dir*. Retrieved 7 August 2018.
15. Morandat, Frances; Hill, Brandon; Osvald, Leo; Vitek, Jan (2012). "Evaluating the design of the R language: objects and functions for data analysis" (<http://r.cs.purdue.edu/pub/ecoop12.pdf>) (PDF). *ECOOP'12 Proceedings of the 26th European Conference on Object-Oriented Programming*. Retrieved 17 May 2016.
16. "R: What is R?" (<https://www.r-project.org/about.html>). *R-Project*. Retrieved 7 August 2018.
17. Gentleman, Robert (9 December 2006). "Individual Expertise profile of Robert Gentleman" (<http://web.archive.org/web/20110723215206/http://myprofile.cos.com/rgentleman>). Archived from the original (<http://myprofile.cos.com/rgentleman>) on 23 July 2011. Retrieved 20 July 2009.
18. Ross Ihaka; Robert Gentleman (September 1996), "R: A Language for Data Analysis and Graphics", *Journal of Computational and Graphical Statistics*, **5** (3): 299, doi:10.2307/1390807 (<https://doi.org/10.2307%2F1390807>), ISSN 1061-8600 (<https://www.worldcat.org/issn/1061-8600>), JSTOR 1390807 (<https://www.jstor.org/stable/1390807>), Wikidata Q56268347, cited from Roger D. Peng (3 September 2020), *R Programming for Data Science* (<https://bookdown.org/rdpeng/rprogdatascience/>), Wikidata Q101068131, section 2.4.
19. Thieme, Nick (August 2018). "R generation" (<https://doi.org/10.1111%2Fj.1740-9713.2018.01169.x>). *Significance*. **15** (4): 14–19. doi:10.1111/j.1740-9713.2018.01169.x (<https://doi.org/10.1111%2Fj.1740-9713.2018.01169.x>).
20. Kurt Hornik. *The R FAQ: Why R?* (https://cran.r-project.org/doc/FAQ/R-FAQ.html#Why-is-R-named-R_003f). ISBN 3-900051-08-9. Retrieved 29 January 2008.

21. Kurt Hornik (23 April 1997), "Announce: CRAN" (<https://stat.ethz.ch/pipermail/r-announce/1997/000001.html>), *r-help*, Wikidata Q101068595.
22. "R : Past and Future History -- A Free Software Project" (https://cran.r-project.org/doc/html/interface98-paper/paper_2.html). *cran.r-project.org*. Retrieved 30 May 2016.
23. "Over 16 years of R Project history" (<http://blog.revolutionanalytics.com/2016/03/16-years-of-r-history.html>). *Revolutions*. Retrieved 30 May 2016.
24. Ihaka, Ross. "The R Project: A Brief History and Thoughts About the Future" (<https://www.stat.auckland.ac.nz/~ihaka/downloads/Massey.pdf>) (PDF). *stat.auckland.ac.nz*.
25. Eddelbuettel, Dirk; Francois, Romain (2011). "Rcpp: Seamless R and C++ Integration" (<https://doi.org/10.18637%2Fjss.v040.i08>). *Journal of Statistical Software*. **40** (8). doi:10.18637/jss.v040.i08 (<https://doi.org/10.18637%2Fjss.v040.i08>).
26. "nution-j2r: Java library to invoke R native functions" (<https://gitlab.nuiton.org/nuiton/nuiton-j2r>). Retrieved 13 September 2018.
27. .NET Framework
 - "Making GUIs using C# and R with the help of R.NET" (<http://psychwire.wordpress.com/2011/06/19/making-guis-using-c-and-r-with-the-help-of-r-net/>). Retrieved 13 September 2018.
 - "R.NET homepage" (<http://rldotnet.codeplex.com/>). Retrieved 13 September 2018.
 - Haynold, Oliver M. (April 2011). *An Rserve Client Implementation for CLI/.NET* (<https://web.archive.org/web/20151129223447/http://www.rinfinance.com/agenda/2011/OliverHaynold.pdf>) (PDF). *R/Finance 2011* (<http://www.rinfinance.com/RinFinance2011/agenda/>). Chicago, IL, USA. Archived from the original (<http://www.rinfinance.com/agenda/2011/OliverHaynold.pdf>) (PDF) on 29 November 2015. Retrieved 13 September 2018.
28. R manuals. "Writing R Extensions" (<https://cran.r-project.org/doc/manuals/r-release/R-exts.html>). *r-project.org*. Retrieved 13 September 2018.
29. Jackman, Simon (Spring 2003). "R For the Political Methodologist" (https://web.archive.org/web/20060721143309/http://polmeth.wustl.edu/tpm/tpm_v11_n2.pdf) (PDF). *The Political Methodologist*. Political Methodology Section, American Political Science Association. **11** (1): 20–22. Archived from the original (http://polmeth.wustl.edu/tpm/tpm_v11_n2.pdf) (PDF) on 21 July 2006. Retrieved 13 September 2018.
30. "CRAN Task View: Graphic Displays & Dynamic Graphics & Graphic Devices & Visualization" (<https://cran.r-project.org/web/views/Graphics.html>). The Comprehensive R Archive Network. Retrieved 13 September 2018.
31. "Rd format" (http://www.hep.by/gnu/r-patched/r-exts/R-exts_49.html). *hep.by*. Retrieved 13 September 2018.
32. Dalgaard, Peter (2002). *Introductory Statistics with R* (https://archive.org/details/introductorystat00dalg_885). New York, Berlin, Heidelberg: Springer-Verlag. pp. 10 (https://archive.org/details/introductorystat00dalg_885/page/n26)–18, 34. ISBN 0387954759.
33. *An Introduction to R*, Section 5.1: Arrays. Retrieved in 2010-03 from <https://cran.r-project.org/doc/manuals/R-intro.html#Arrays>.
34. Ihaka, Ross; Gentleman, Robert (September 1996). "R: A Language for Data Analysis and Graphics" (<https://www.stat.auckland.ac.nz/~ihaka/downloads/R-paper.pdf>) (PDF). *Journal of Computational and Graphical Statistics*. American Statistical Association. **5** (3): 299–314. doi:10.2307/1390807 (<https://doi.org/10.2307%2F1390807>). JSTOR 1390807 (<https://www.jstor.org/stable/1390807>). Retrieved 12 May 2014.
35. "Data structures · Advanced R." (<http://adv-r.had.co.nz/Data-structures.html>) *adv-r.had.co.nz*. Retrieved 26 September 2016.
36. <http://adv-r.had.co.nz/Functions.html#lazy-evaluation>
37. R Core Team. "Print Values" (<https://stat.ethz.ch/R-manual/R-devel/library/base/html/print.html>). *R Documentation*. R Foundation for Statistical Computing. Retrieved 30 May 2016.

38. "Speed comparison of various number crunching packages (version 2)" (<https://web.archive.org/web/20071016130210/http://www.sciviews.org/benchmark/>). SciView. 2003. Archived from the original (<http://www.sciviews.org/benchmark>) on 16 October 2007. Retrieved 3 November 2007.
39. Marwick, Ben; Boettiger, Carl; Mullen, Lincoln (26 August 2017). "Packaging data analytical work reproducibly using R (and friends)" (<https://peerj.com/preprints/3192/?td=wk>). *PeerJ Preprints*. doi:10.7287/peerj.preprints.3192v1 (<https://doi.org/10.7287%2Fpeerj.preprints.3192v1>). ISSN 2167-9843 (<https://www.worldcat.org/issn/2167-9843>).
40. "The Comprehensive R Archive Network" (<https://cran.r-project.org/>). Retrieved 16 September 2018.
41. "Omegahat.net" (<http://www.omegahat.net/>). Omegahat.net. Retrieved 16 September 2018.
42. packages available from repositories
 - Robert A. Muenchen (2012). "The Popularity of Data Analysis Software" (<http://r4stats.com/articles/popularity/>).
 - Tippmann, Sylvia (29 December 2014). "Programming tools: Adventures with R" (<https://doi.org/10.1038%2F517109a>). *Nature*. **517** (7532): 109–110. doi:10.1038/517109a (<https://doi.org/10.1038%2F517109a>). PMID 25557714 (<https://pubmed.ncbi.nlm.nih.gov/25557714>).
 - "Search all R packages and function manuals | Rdocumentation" (<http://www.rdocumentation.org/>). *Rdocumentation*. 16 June 2014. Retrieved 16 September 2018.
43. "CRAN Task Views" (<https://cran.r-project.org/web/views/>). *cran.r-project.org*. Retrieved 16 September 2018.
44. "FDA: R OK for drug trials" (<http://blog.revolutionanalytics.com/2012/06/fda-r-ok.html>). Retrieved 16 September 2018.
45. "It's crantastic!" (<http://crantastic.org/>). Retrieved 16 September 2018.
46. "R-Forge: Welcome" (<https://r-forge.r-project.org/>). Retrieved 16 September 2018.
47. "CRAN Time Machine. MRAN" (<https://mran.microsoft.com/timemachine>). Retrieved 26 December 2019.
48. Huber, W; Carey, VJ; Gentleman, R; Anders, S; Carlson, M; Carvalho, BS; Bravo, HC; Davis, S; Gatto, L; Girke, T; Gottardo, R; Hahne, F; Hansen, KD; Irizarry, RA; Lawrence, M; Love, MI; MacDonald, J; Obenchain, V; Oleś, AK; Pagès, H; Reyes, A; Shannon, P; Smyth, GK; Tenenbaum, D; Waldron, L; Morgan, M (2015). "Orchestrating high-throughput genomic analysis with Bioconductor" (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4509590>). *Nature Methods*. Nature Publishing Group. **12** (2): 115–121. doi:10.1038/nmeth.3252 (<https://doi.org/10.1038%2Fnmeth.3252>). PMC 4509590 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4509590>). PMID 25633503 (<https://pubmed.ncbi.nlm.nih.gov/25633503>).
49. "Spark API Documentation" (<https://spark.apache.org/docs/latest/api.html>). *Spark*.
50. "SparkR (R on Spark)" (<https://spark.apache.org/docs/latest/sparkr.html>). *Spark*.
51. Changes in versions 3.0.0 onward: "R News" (<https://cran.r-project.org/src/base/NEWS>). *cran.r-project.org*. Retrieved 3 July 2014. Earlier change logs (by major release number):
 - "NEWS" (<https://cran.r-project.org/src/base/NEWS>). *cran.r-project.org*. Retrieved 28 June 2020.
 - "NEWS.3" (<https://cran.r-project.org/src/base/NEWS.3>). *cran.r-project.org*. Retrieved 28 June 2020.
 - "NEWS.2" (<https://cran.r-project.org/src/base/NEWS.2>). *cran.r-project.org*. Retrieved 8 April 2017.
 - "NEWS.1" (<https://cran.r-project.org/src/base/NEWS.1>). *cran.r-project.org*. Retrieved 8 April 2017.
 - "NEWS.0" (<https://cran.r-project.org/src/base/NEWS.0>). *cran.r-project.org*. Retrieved 8 April 2017.

52. ["Index of /src/base/R-0"](https://cran.r-project.org/src/base/R-0/) (<https://cran.r-project.org/src/base/R-0/>).
53. ["ANNOUNCE: CRAN"](https://stat.ethz.ch/pipermail/r-announce/1997/000001.html) (<https://stat.ethz.ch/pipermail/r-announce/1997/000001.html>).
54. <https://cran.r-project.org/src/base/NEWS.0>
55. Peter Dalgaard. ["R-1.0.0 is released"](https://stat.ethz.ch/pipermail/r-announce/2000/000127.html) (<https://stat.ethz.ch/pipermail/r-announce/2000/000127.html>). Retrieved 6 June 2009.
56. <https://cran-archive.r-project.org/bin/windows/base/old/2.7.0/CHANGES.R-2.7.0>
57. ["R FAQ"](https://cran.r-project.org/bin/windows/base/rw-FAQ.html#How-do-I-install-R-for-Windows_003f) (https://cran.r-project.org/bin/windows/base/rw-FAQ.html#How-do-I-install-R-for-Windows_003f). Retrieved 20 March 2020.
58. ["Poll: R GUIs you use frequently \(2011\)"](http://www.kdnuggets.com/polls/2011/r-gui-used.html) (<http://www.kdnuggets.com/polls/2011/r-gui-used.html>). *kdnuggets.com*. Retrieved 18 September 2018.
59. Unknown. ["StatET for R"](http://www.walware.de/goto/statet) (<http://www.walware.de/goto/statet>).
60. ["Using the R programming language in Jupyter Notebook"](https://docs.anaconda.com/anaconda/navigator/tutorials/r-lang/) (<https://docs.anaconda.com/anaconda/navigator/tutorials/r-lang/>). *Anaconda*. Retrieved 14 September 2020.
61. ["Nvim-R - Plugin to work with R : vim online"](https://www.vim.org/scripts/script.php?script_id=628) (https://www.vim.org/scripts/script.php?script_id=628). *www.vim.org*. Retrieved 6 March 2019.
62. ["Syntax Highlighting"](https://web.archive.org/web/20080707062903/http://www.kate-editor.org/downloads/syntax_highlighting) (https://web.archive.org/web/20080707062903/http://www.kate-editor.org/downloads/syntax_highlighting). Kate Development Team. Archived from the original (http://kate-editor.org/downloads/syntax_highlighting) on 7 July 2008. Retrieved 9 July 2008.
63. Paul E. Johnson & Gregor Gorjanc. ["LyX with R through Sweave"](http://wiki.lyx.org/LyX/LyXWithRThroughSweave) (<http://wiki.lyx.org/LyX/LyXWithRThroughSweave>). Retrieved 4 April 2017.
64. ["NppToR: R in Notepad++"](http://sourceforge.net/projects/npptor/) (<http://sourceforge.net/projects/npptor/>). *sourceforge.net*. 8 May 2013. Retrieved 18 September 2013.
65. Uwe Ligges. ["RWinEdt: R Interface to 'WinEdt' "](https://cran.r-project.org/web/packages/RWinEdt/index.html) (<https://cran.r-project.org/web/packages/RWinEdt/index.html>). Retrieved 4 April 2017.
66. ["Tinn-R"](https://nbcgib.uesc.br/tinnr/en/) (<https://nbcgib.uesc.br/tinnr/en/>). Retrieved 5 March 2019.
67. Gautier, Laurent (21 October 2012). ["A simple and efficient access to R from Python"](http://rpy.sourceforge.net) (<http://rpy.sourceforge.net>). Retrieved 18 September 2013.
68. Florent Angly. ["Statistics::R - Perl interface with the R statistical program - metacpan.org"](http://metacpan.org/module/Statistics::R) (<http://metacpan.org/module/Statistics::R>).
69. alexgutteridge. ["GitHub - alexgutteridge/rsruby: Ruby - R bridge"](https://github.com/alexgutteridge/rsruby) (<https://github.com/alexgutteridge/rsruby>). *GitHub*.
70. BlueMountain Capital. ["F# R Type Provider"](https://bluemountaincapital.github.io/FSharpRProvider/) (<https://bluemountaincapital.github.io/FSharpRProvider/>).
71. ["Embedded R within Julia"](https://github.com/JuliaInterop/RCall.jl) (<https://github.com/JuliaInterop/RCall.jl>).
72. ["Rserve TCP/IP server"](https://www.rforge.net/Rserve/) (<https://www.rforge.net/Rserve/>).
73. ["RserveCLI2 - a .NET/CLR client for Rserve"](https://github.com/konne/RserveCLI2) (<https://github.com/konne/RserveCLI2>).
74. ["R.NET"](https://jmp75.github.io/rdotnet/) (<https://jmp75.github.io/rdotnet/>).
75. ["r-source: Read only mirror of R source code on GitHub"](https://github.com/wch/r-source) (<https://github.com/wch/r-source>). *GitHub*. Retrieved 14 September 2019.
76. Talbot, Justin; DeVito, Zachary; Hanrahan, Pat (1 January 2012). ["Riposte: A Trace-driven Compiler and Parallel VM for Vector Code in R"](https://doi.org/10.1145/2370816.2370825). *Proceedings of the 21st International Conference on Parallel Architectures and Compilation Techniques*. ACM: 43–52. doi:10.1145/2370816.2370825 (<https://doi.org/10.1145/2370816.2370825>). S2CID 1989369 (<https://api.semanticscholar.org/CorpusID:1989369>).
77. Neal, Radford (25 July 2013). ["Deferred evaluation in Renjin, Riposte, and pqr"](https://radfordneal.wordpress.com/2013/07/24/deferred-evaluation-in-renjin-riposte-and-pqr/) (<https://radfordneal.wordpress.com/2013/07/24/deferred-evaluation-in-renjin-riposte-and-pqr/>). *Radford Neal's blog*. Retrieved 6 March 2017.
78. Jackson, Joab (May 16, 2013). ["TIBCO offers free R to the enterprise"](http://www.pcworld.com/article/2038944/tibco-offers-free-r-to-the-enterprise.html) (<http://www.pcworld.com/article/2038944/tibco-offers-free-r-to-the-enterprise.html>). *PC World*. Retrieved July 20, 2015.

79. "Microsoft R Open: The Enhanced R Distribution" (<https://mran.microsoft.com/open>). Retrieved 30 June 2018.
80. "Local R User Group Directory" (<http://blog.revolutionanalytics.com/local-r-groups.html>). *Revolutions Blog*. Retrieved 12 May 2018.
81. "A list of R conferences and meetings" (<https://jumpingrivers.github.io/meetingsR/index.html>). *Jumping Rivers*. Retrieved 12 May 2018.
82. "official website of WhyR? conference" (<http://whyR.pl/>). *WhyR?*. Retrieved 26 June 2019.
83. "SatRdays listing" (<https://satrdays.org/>). *SatRdays*. Retrieved 26 June 2019.
84. "R Project for Statistical Computing" (<https://www.meetup.com/topics/r-project-for-statistical-computing/>). *Meetup*. Retrieved 12 May 2018.
85. "R Ladies" (<https://rladies.org>). *R Ladies*. Retrieved 12 May 2018.
86. "Forwards" (<https://forwards.github.io/>). Retrieved 23 March 2020.
87. "R: Conferences" (<https://www.r-project.org/conferences/>). *r-project.org*. 1 November 2019. Retrieved 19 November 2019.
88. "useR! 2004 - The R User Conference" (<http://www.ci.tuwien.ac.at/Conferences/useR-2004/>). 27 May 2004. Retrieved 9 September 2018.
89. R Project (9 August 2013). "R-related Conferences" (<https://www.r-project.org/conferences>). Retrieved 15 August 2019.
90. "UseR! 2021 - The R User Conference" (<https://user2021.r-project.org/>). Retrieved 23 March 2020.
91. Burns, Patrick (27 February 2007). "Comparison of R to SAS, Stata and SPSS" (http://www.burns-stat.com/pages/Tutor/R_relative_statpack.pdf) (PDF). Retrieved 18 September 2013.
92. R as competition for commercial statistical packages
 - Vance, Ashlee (7 January 2009). "Data Analysts Are Mesmerized by the Power of Program R: [Business/Financial Desk]" (<https://www.nytimes.com/2009/01/07/technology/business-computing/07program.html>). *The New York Times*.
 - Vance, Ashlee (8 January 2009). "R You Ready for R?" (<http://bits.blogs.nytimes.com/2009/01/08/r-you-ready-for-r/>). *The New York Times*.
93. Muenchen, Robert (19 June 2017). "The Popularity of Data Science Software" (<http://r4stats.com/articles/popularity/>). Retrieved 21 November 2018.
94. "R vs. SPSS" (<https://www.educba.com/r-vs-spss/>).
95. Morgan, Timothy Prickett (2011-02-07). "'Red Hat for stats' goes toe-to-toe with SAS". *The Register*, 7 February 2011. Retrieved from https://www.theregister.co.uk/2011/02/07/revolution_r_sas_challenge/.
96. "Analyzing clinical trial data for FDA submissions with R" (<http://blog.revolutionanalytics.com/2009/01/analyzing-clinical-trial-data-with-r.html>). *Revolution Analytics*. 14 January 2009. Retrieved 20 September 2018.
97. Sirosh, Joseph. "Microsoft Closes Acquisition of Revolution Analytics" (<http://blogs.technet.com/b/machinelearning/archive/2015/04/06/microsoft-closes-acquisition-of-revolution-analytics.aspx>). *blogs.technet.com*. Microsoft. Retrieved 20 September 2018.
98. "Introducing R Tools for Visual Studio" (<https://blogs.msdn.microsoft.com/visualstudio/2016/03/22/introducing-r-tools-for-visual-studio-3/>). Retrieved 20 September 2018.

99. Oracle Corporation's Big Data Appliance

- Doug Henschen (2012); *Oracle Makes Big Data Appliance Move With Cloudera* (<http://www.informationweek.com/software/information-management/oracle-makes-big-data-appliance-move-wit/232400021>), InformationWeek, January 10, 2012.
 - Jaikumar Vijayan (2012); *Oracle's Big Data Appliance brings focus to bundled approach* (http://www.computerworld.com/s/article/9223325/Oracle_s_Big_Data_Appliance_brings_focus_to_bundled_approach), ComputerWorld, January 11, 2012.
 - Timothy Prickett Morgan (2011); *Oracle rolls its own NoSQL and Hadoop* (https://www.theregister.co.uk/2011/10/03/oracle_big_data_appliance/), The Register, October 3, 2011.
00. Chris Kanaracus (2012); *Oracle Stakes Claim in R With Advanced Analytics Launch* (http://www.pcworld.com/article/249509/oracle_stakes_claim_in_r_with_advanced_analytics_launch.html), PC World, February 8, 2012.
01. Doug Henschen (2012); *Oracle Stakes Claim in R With Advanced Analytics Launch* (<http://www.informationweek.com/software/business-intelligence/oracle-makes-its-big-play-for-analytics/232800252>), InformationWeek, April 4, 2012.
02. "What's New in IBM InfoSphere BigInsights v2.1.2" (https://web.archive.org/web/20140906200802/http://www-01.ibm.com/software/data/infosphere/biginsights/whats_new.html). IBM. Archived from the original (http://www-01.ibm.com/software/data/infosphere/biginsights/whats_new.html) on 6 September 2014. Retrieved 8 May 2014.
03. "IBM PureData System for Analytics" (https://web.archive.org/web/20140517153029/http://mainline.com/_web/_shared/pdfs/brochures/IBM-PureData-System-Overview.pdf) (PDF). IBM. Archived from the original (http://mainline.com/_web/_shared/pdfs/brochures/IBM-PureData-System-Overview.pdf) (PDF) on 17 May 2014. Retrieved 8 May 2014.
04. Tibco. "Unleash the agility of R for the Enterprise" (<http://spotfire.tibco.com/discover-spotfire/what-does-spotfire-do/predictive-analytics/tibco-enterprise-runtime-for-r-terr>). Retrieved 15 May 2014.
05. "ValidR on Mango website" (<https://www.mango-solutions.com/products/validr/>). Retrieved 24 September 2018.
06. Andy Nicholls at Mango Solutions. "ValidR Enterprise: Developing an R Validation Framework" (<https://www.lexjansen.com/phuse/2016/ad/AD12.pdf>) (PDF). Retrieved 24 September 2018.
07. FDA. "Statistical Software Clarifying Statement" (<https://www.fda.gov/downloads/ForIndustry/DataStandards/StudyDataStandards/UCM587506.pdf>) (PDF). Retrieved 24 September 2018.
08. most used assignment operator in R is <-
- R Development Core Team. "Writing R Extensions" (<https://cran.r-project.org/doc/manuals/R-exts.html#Tidying-R-code>). Retrieved 11 September 2018. "[...] we recommend the consistent use of the preferred assignment operator '<-' (rather than '=' for assignment."
 - "Google's R Style Guide" (<https://google.github.io/styleguide/Rguide.xml#assignment>). Retrieved 11 September 2018.
 - Wickham, Hadley. "Style Guide" (<http://stat405.had.co.nz/r-style.html>). Retrieved 11 September 2018.
 - Bengtsson, Henrik (January 2009). "R Coding Conventions (RCC) – a draft" (<https://docs.google.com/document/preview?id=1esDVxyWvH8AsX-VJa-8oqWaHLS4stGIbK8kLc5VlII&pli=1>). Retrieved 11 September 2018.
09. R Development Core Team. "Assignments with the = Operator" (<https://developer.r-project.org/equalAssign.html>). Retrieved 11 September 2018.
10. Kabacoff, Robert (2012). "Quick-R: User-Defined Functions" (<http://www.statmethods.net/management/userfunctions.html>). *statmethods.net*. Retrieved 28 September 2018.

External links

- [Official website \(https://www.r-project.org/\)](https://www.r-project.org/)  of the R project
-

Retrieved from "[https://en.wikipedia.org/w/index.php?title=R_\(programming_language\)&oldid=992879640](https://en.wikipedia.org/w/index.php?title=R_(programming_language)&oldid=992879640)"

This page was last edited on 7 December 2020, at 16:19 (UTC).

Text is available under the Creative Commons Attribution-ShareAlike License; additional terms may apply. By using this site, you agree to the Terms of Use and Privacy Policy. Wikipedia® is a registered trademark of the Wikimedia Foundation, Inc., a non-profit organization.