

# R 프로그래밍

## #1

2019. 03. 05

한국생명공학연구원  
김하성

# 2019학기 UST R 프로그래밍과 데이터 분석

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- 장소: 한국생명공학연구원 연구동 세미나실 1213호 (매주수요일 13:00~16:00)
- 강사: 한국생명공학연구원 바이오합성연구센터 김하성
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## 강의 목표

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- 이공계열 대학원생이 통계 분석용 범용 프로그램 언어인 R의 사용법을 익히고 이를 이용한 프로그래밍 기술의 습득을 주요 목적으로 함. 생물 데이터 위주의 분석 예제를 통해 R의 활용 기술을 배움.
- 이 강좌는 오프라인 강의를 기본으로 함. R 사용에 대한 기본 개념과 프로그래밍을 중심으로 필요시 기초 통계지식 강의. 실습 데이터로는 주로 생물데이터를 사용함. 모든 강의 시간 실습을 위한 개인 노트북 지참 필수. 강의 자료는 pdf로 제작하여 수업 진행과 관련된 정보와 함께 웹사이트를 통해 배포됨. 상황에 따라 강의 일정이 조정될 수 있음.

## 참고 자료

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- Using R for Introductory Statistics by John Verzani
  - Free version of 1st Edition
    - <https://cran.r-project.org/doc/contrib/Verzani-SimpleR.pdf>
    - <http://cbb.sjtu.edu.cn/~mywu/bi217/usingR.pdf>
  - Second edition
    - <https://www.crcpress.com/Using-R-for-Introductory-Statistics-Second-Edition/Verzani/p/book/9781466590731>
- R for Data Science (<https://r4ds.had.co.nz>)
- Bioinformatics Data Skills by Vince Buffalo
- 일반통계학 (영지문화사, 김우철 외)

## 평가 세부 항목

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- 출석 50% / 과제 50% / 수업참여 +alpha

<https://github.com/greendaygh/2019-R-programming>

# R is a platform and language for statistical computing

Similar to the S language and environment which was developed at Bell Laboratories



R provides a wide variety of **statistical** (linear and nonlinear modelling, classical statistical tests, time-series analysis, classification, clustering, ...) and **graphical** techniques, and is highly extensible.

# Getting started with R installation

- R site <https://www.r-project.org>
- Windows, Mac and Linux versions available
- Executed using command line, or a graphical user interface (GUI)

## The R Project for Statistical Computing

### Getting Started

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

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

Japan

<https://cran.ism.ac.jp/>

<http://cran.ism.ac.jp/>

<https://ftp.yz.yamagata-u.ac.jp/pub/cran/>

Korea

<https://ftp.harukasan.org/CRAN/>

<https://cran.seoul.go.kr/>

<http://healthstat.snu.ac.kr/CRAN/>

<https://cran.biodisk.org/>

<http://cran.biodisk.org/>

Malaysia

<https://wbc.upm.edu.my/cran/>

<http://wbc.upm.edu.my/cran/>



CRAN  
[Mirrors](#)  
[What's new?](#)  
[Task Views](#)  
[Search](#)

About R  
[R Homepage](#)  
[The R Journal](#)

Software  
[R Sources](#)  
[R Binaries](#)  
[Packages](#)  
[Other](#)

Subdirectories:

[base](#)

[contrib](#)

Binaries for base distribution (managed by Duncan Murdoch). This is what you want to **install R for the first time**.

Binaries of contributed CRAN packages (for R >= 2.11.x; managed by Uwe Ligges). There is also information on [third party software](#) available for CRAN Windows services and

R-3.5.2 for Windows (32/64 bit)

[Download R 3.5.2 for Windows](#) (79 megabytes, 32/64 bit)  
[Installation and other instructions](#)  
[New features in this version](#)

The Comprehensive R Archive Network

#### Download and Install R

Precompiled binary distributions of the base system and contributed packages, **Windows and Mac** users most likely want one of these versions of R:

- [Download R for Linux](#)
- [Download R for \(Mac\) OS X](#)
- [Download R for Windows](#)

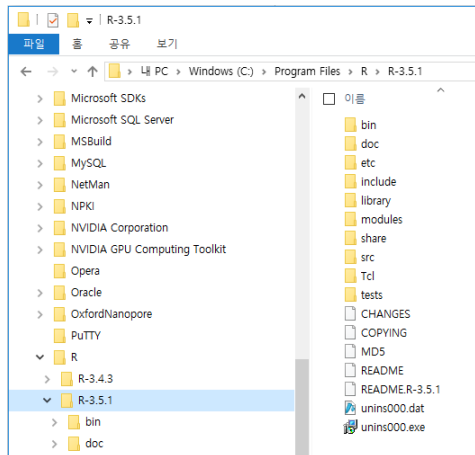
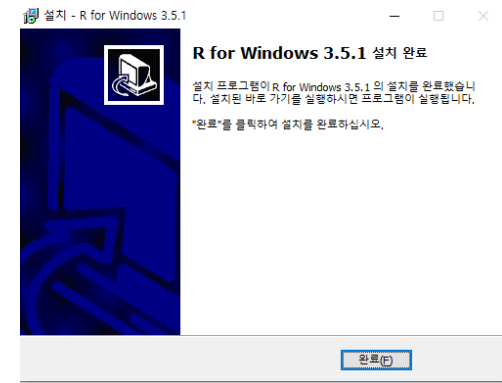
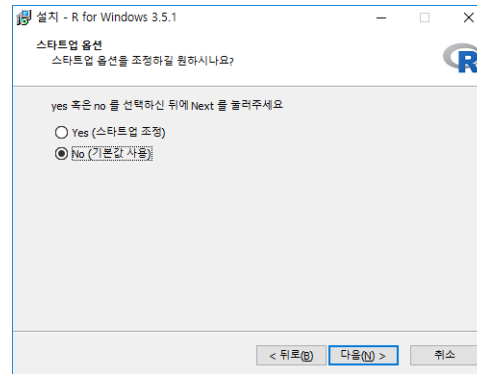
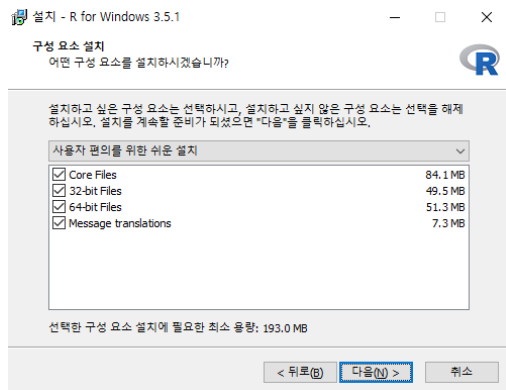
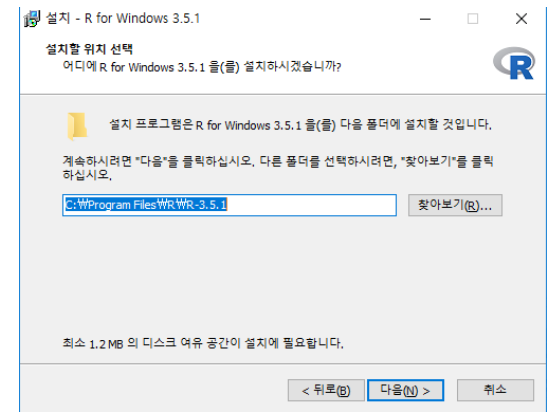
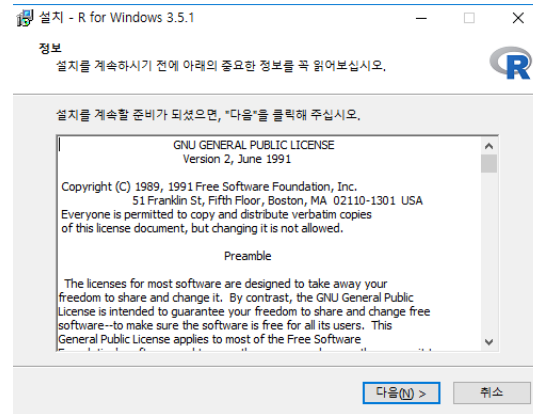
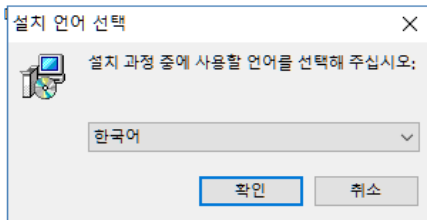
R is part of many Linux distributions, you should check with your Linux package management system in addition to the link above.

#### Source Code for all Platforms

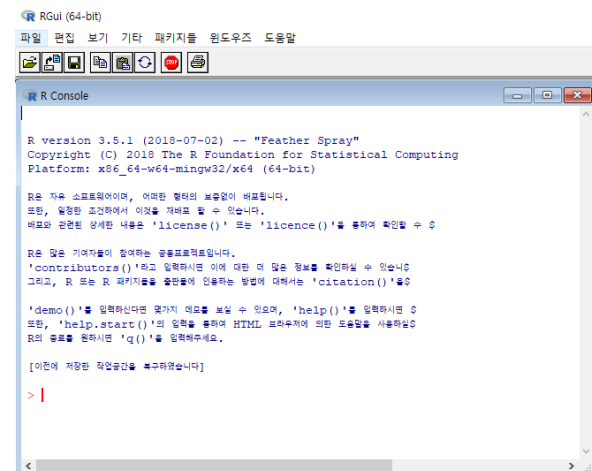
Windows and Mac users most likely want to download the precompiled binaries listed in the upper box, not the source code. The sources have to be compiled before you can use them. If you do not know what this means, you probably do not want to do it!

- The latest release (Friday 2017-06-30, Single Candle) [R-3.4.1.tar.gz](#), read [what's new](#) in the latest version.

# installation

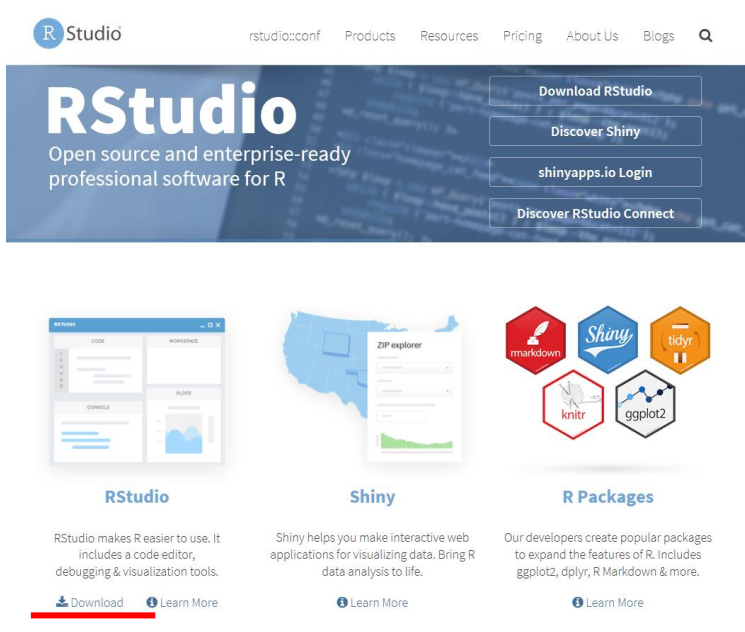


시작  
→ R  
→ R x64 3.5.1



# RStudio installation

<https://www.rstudio.com/>



The RStudio website homepage features a navigation bar with links to 'rstudio::conf', 'Products', 'Resources', 'Pricing', 'About Us', and 'Blogs'. The main header includes the RStudio logo and the tagline 'Open source and enterprise-ready professional software for R'. Below this, there are four buttons: 'Download RStudio', 'Discover Shiny', 'shinyapps.io Login', and 'Discover RStudio Connect'. The page is divided into three sections: 'RStudio', 'Shiny', and 'R Packages'. Each section includes a brief description and a 'Learn More' link. The 'RStudio' section mentions a code editor, console, and plotting tools. The 'Shiny' section describes it as a tool for making interactive web applications. The 'R Packages' section states that developers create popular packages to expand R's features, listing 'ggplot2', 'dplyr', and 'R Markdown' as examples.

## RStudio Desktop

	Open Source Edition	Commercial License
Overview	<ul style="list-style-type: none"><li>Access RStudio locally</li><li>Syntax highlighting, code completion, and smart indentation</li><li>Execute R code directly from the source editor</li><li>Quickly jump to function definitions</li><li>Easily manage multiple working directories using projects</li><li>Integrated R help and documentation</li><li>Interactive debugger to diagnose and fix errors quickly</li><li>Extensive package development tools</li></ul>	<p>All of the features of open source; plus:</p> <ul style="list-style-type: none"><li>A commercial license for organizations not able to use AGPL software</li><li>Access to priority support</li></ul>
Support	Community forums only	<ul style="list-style-type: none"><li>Priority Email Support</li><li>8 hour response during business hours (ET)</li></ul>
License	AGPL v3	RStudio License Agreement
Pricing	Free	\$995/year
	<a href="#">DOWNLOAD RSTUDIO DESKTOP</a>	<a href="#">BUY NOW</a>

## Choose Your Version of RStudio

RStudio is a set of integrated tools designed to help you be more productive with R. It includes a console, syntax-highlighting editor that supports direct code execution, and a variety of robust tools for plotting, viewing history, debugging and managing your workspace. [Learn More about RStudio features.](#)



RStudio Desktop Open Source License	RStudio Desktop Commercial License	RStudio Server Open Source License	RStudio Server Pro Commercial License	RStudio Server Pro + RStudio Connect Commercial License
FREE	\$995 per year	FREE	\$9,995 per year	\$29,995 per year
<a href="#">DOWNLOAD</a> Learn More	<a href="#">BUY</a> Learn More	<a href="#">DOWNLOAD</a> Learn More	<a href="#">DOWNLOAD</a> Learn More	<a href="#">TALK</a> Learn More
Integrated Tools for R				

## Installers for Supported Platforms

Installers	Size	Date	MD5
RStudio 1.1.463 - Windows Vista/7/8/10	85.8 MB	2018-10-29	58b3d796d8cf96fb8580c62f46ab64d4
RStudio 1.1.463 - Mac OS X 10.6+ (64-bit)	74.5 MB	2018-10-29	a79032ba4d7daa86a8da01948278d94
RStudio 1.1.463 - Ubuntu 12.04-15.10/Debian 8 (32-bit)	89.3 MB	2018-10-29	8a6755fa9fae2bafce289df3358aaf63

# RStudio interface

RStudio interface showing code editing, environment, and console.

**코드편집창** (Code Editor):

```
1 age <- c(50, 21, 35, 45, 28, 31, 42, 33, 57, 62)
2 weight <- c(70.8, 67.9, 75.3, 61.9, 72.4, 63.5, 78.9, 65.7, 89.5, 54.4)
3 firstName <- c("Adam", "Eve", "John", "Paul", "Joanna", "Matthew", "Jones", "Parker", "Evan", "Baker", "Daniels", "Edwards", "Roberts", "Wilson")
4 secondName <- c("Jones", "Parker", "Evan", "Baker", "Daniels", "Edwards", "Roberts", "Wilson")
5 consent <- c(TRUE, TRUE, FALSE, TRUE, FALSE, FALSE, FALSE, TRUE, FALSE, TRUE)
6 sex <- c("Male", "Female", "Male", "Female", "Male", "Male", "Female", "Male", "Male", "Female")
7 patients <- data.frame(First_Name = firstName,
8                        Second_Name = secondName,
9                        Full_Name = paste(firstName, secondName),
10                       Sex = factor(sex),
11                       Age = age,
12                       weight = weight,
13                       consent = consent,
14                       stringsAsFactors = FALSE)
```

**콘솔창** (Console):

```
R version 3.4.0 (2017-04-21) -- "You Stupid Darkness"
Copyright (c) 2017 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.

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.

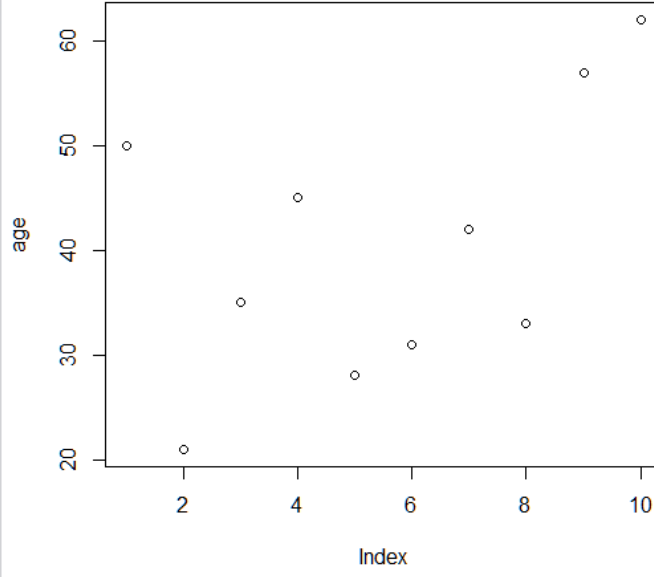
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> age <- c(50, 21, 35, 45, 28, 31, 42, 33, 57, 62)
> plot(age)
>
```

**Environment** (Global Environment):

Values
age num [1:10] 50 21 35 45 28 31 42 33 57 62

**Plots** (Viewer):



Index	age
1	50
2	21
3	35
4	45
5	28
6	31
7	42
8	33
9	57
10	62

# Set working directory

File → New file → R script

```
getwd()
```

```
dir()
```

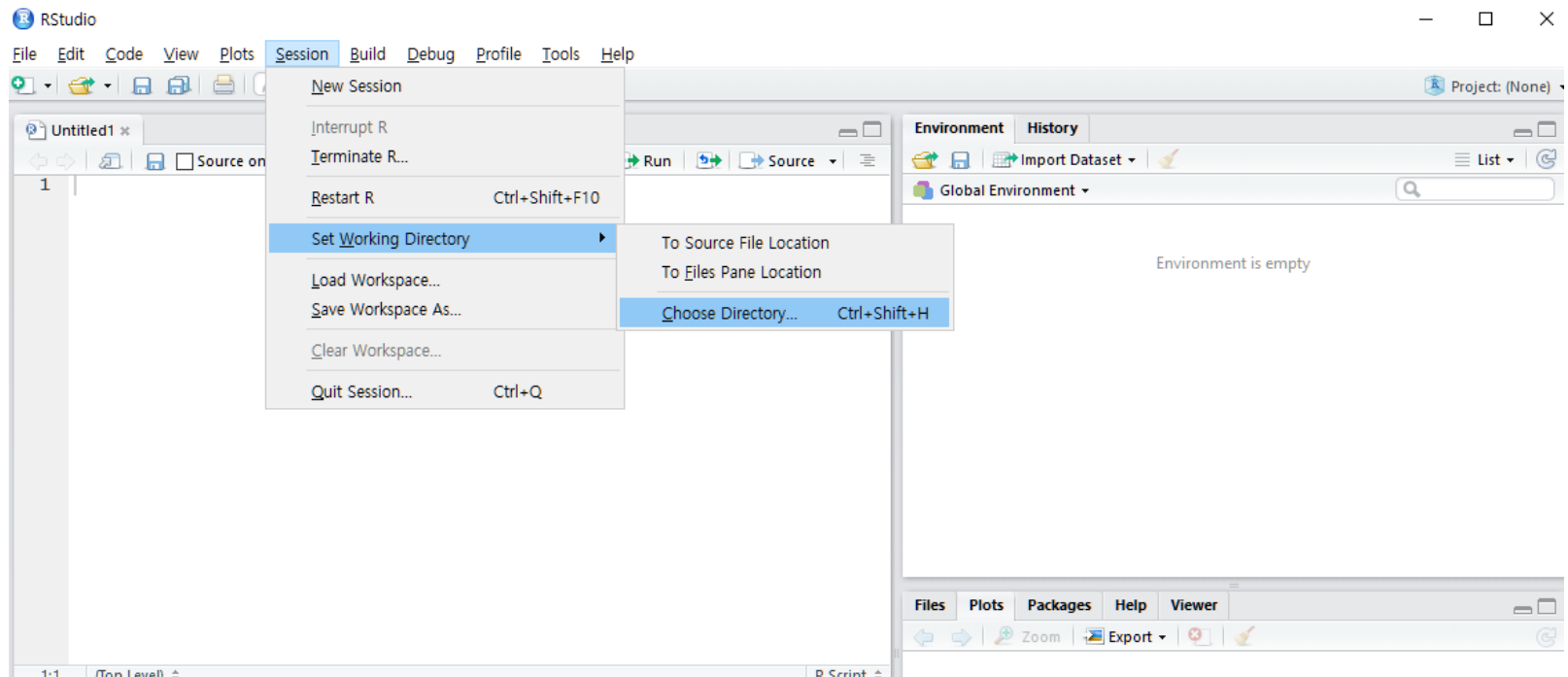
```
## make a directory of "Rwork"
```

```
setwd("C:\\Users\\haseong\\Documents\\Rwork")
```

```
getwd()
```

```
dir()
```

```
## make a new R file, "Rprog01.R"
```





# R's command line (Console)

- R can be used like a calculator

```
>2 + 2  
>((2 - 1)^2 + (1 - 3)^2 )^(1/2)  
>1 / 200 * 30  
>2 + 2; 2 - 2
```

- Combining commands with ;
- Prompt
- Command history (up-arrow / down-arrow keys)
- Errors
  - $2^{2^2}$

# Object

- R is a programming language for statistical computing
- Assignment operator ( `<-` )

Valid object name `<-` value

- keyboard shortcut: Alt + - (the minus sign)
- Variable

```
x <- 2
y <- x^2 - 2*x + 1
y
x <- "two"
some_data <- 9.8
X <- 2
pi
```

# Variable type of (storage) mode

Type	Explanation
285	Numeric (Integer)
34.67	
4.23E-4	
TRUE, T	Logical
FALSE, F	
'B'	Character
"Hello" or 'Hello'	
NULL	NULL

# Name and Case sensitivity

- Characters (letters), numbers, “\_”, “.”
- A and a are different symbols
- Names are effectively unlimited in length

```
i_use_snake_case  
otherPeopleUseCamelCase  
some.people.use.periods  
And_aFew.People_RENOUNCEconvention
```

# Logical & Character vectors

The elements of a logical vector can have the values TRUE, FALSE, and NA (for “not available”)

```
> temp <- 2 > 13  
> x <- c(1:10)  
> temp <- x > 5  
> temp <- x > 2 & x < 7  
> temp <- x > 2 | x < 7
```

Character strings with double (") or single (') quotes

```
x <- c("a", "b", "c")  
?paste  
paste("test", "string", sep="")  
paste(c("a", "b"), 1, sep="-")
```

Q1: 

```
> x <- c("X1", "Y2", "X3", "Y4", "X5", "Y6", "X7", "Y8", "X9", "Y10")  
> x  
> "X1" "Y2" "X3" "Y4" "X5" "Y6" "X7" "Y8" "X9" "Y10"
```

Generate the same x using paste() and seq()

# Object - Vectors

```
> x <- c(10.4, 5.6, 3.1, 6.4, 21.7)
```

This is an assignment statement using the function `c()` which in this context can take an arbitrary number of vector arguments and whose value is a vector got by concatenating its arguments end to end

```
> assign("x", c(10.4, 5.6, 3.1, 6.4, 21.7) )  
> y <- c(x, 0, x)
```

## Vector arithmetic

```
> v <- 2*x + y + 1  
> sum((x - mean(x))^2) / (length(x)-1)
```

## Generating regular sequences

```
> x <- c(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)  
> x <- c(1:10)  
> ?seq  
> x <- seq(1, 10, 1)  
> x <- seq(1, 10, 2)
```

```
> ?rep  
> x <- rep(c(1,2,3), times=3)  
> x <- rep(c(1,2,3), each=5)  
> x <- rep(rep(1:3, each=5), times=3)
```

# Index vectors & subsets of a vector

Subsets of the elements of a vector can be selected by appending to the name of the vector an *index vector* in square brackets.

```
> x <- c("X1", "Y2", "X3", "Y4", "X5", "Y6", "X7", "Y8", "X9", "Y10")
> x[1]
> "X1"
```

A vector of negative integral quantities

```
> x <- c("X1", "Y2", "X3", "Y4", "X5", "Y6", "X7", "Y8", "X9", "Y10")
> x[-1]
> x[-c(1:5)]
```

A vector of character strings

```
> fruit <- c(5, 10, 1, 20)
> names(fruit) <- c("orange", "banana", "apple", "peach")
> lunch <- fruit[c("apple", "orange")]
```

Logical vectors

```
> x <- c(1:10)
> temp <- x > 2 & x < 7
> x[temp]
```

# Basic concepts in R - functions

- Define a function

```
my_sine <- function(x){  
  y <- sin(x)  
  return(y)  
}
```

- Use

```
> my_sine(pi)
```

- This returns the sine of pi
  - One parameter: x
  - One argument: pi



# Arguments

- Default arguments, named arguments

```
mean(x, trim=0.5)  
mean(x)
```

# Built-in Functions

- called by their names followed by ()
- arguments separated by commas
- Tab completion
- “combine function” creates a data set
- “mean” takes several numbers and summarizes with one

```
x <- pi
sin(x)
sqrt(x)
log(x)
log(x, 10)
x <- c(74, 122, 235, 111, 292)
mean(x)
sum(x)/length(x)
```

# Generic functions

- Same name but different function
- Choice depends on the class of the first argument
- confusion at first but no need to remember all the names of functions

```
x <- c(74, 122, 235, 111, 292)
y <- c(T, F, T, T)
summary(x)
summary(y)
```

# Vectorized functions

- Do the same thing for each number of a vector

```
x <- seq(1, 10)
x + x
sqrt(x)
x - mean(x)
```

# Keyboard shortcut

- <https://support.rstudio.com/hc/en-us/articles/200711853-Keyboard-Shortcuts>
- Tools → Keyboard shortcut Quick Reference (Alt + Shift + K)
- 코드편집창 이동 (Ctrl+1) 콘솔창 이동(Ctrl+2)
- 한 줄 실행 (Ctrl+Enter)
- 주석처리 (Ctrl + Shift + C)
  - Starting with a hashmark ('#'), everything to the end of the line is a comment

```
> # this is a comment line  
> this is a comment line
```

# Environment

The screenshot displays the RStudio IDE interface. The top menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. The toolbar contains icons for file operations and a 'Go to file/function' search bar. The main editor window shows a script with the following code:

```
1 x <- c(74, 122, 235, 111, 292)
2 y <- c(T, F, T, T)
3
```

The Environment pane on the right shows the Global Environment with the following variables:

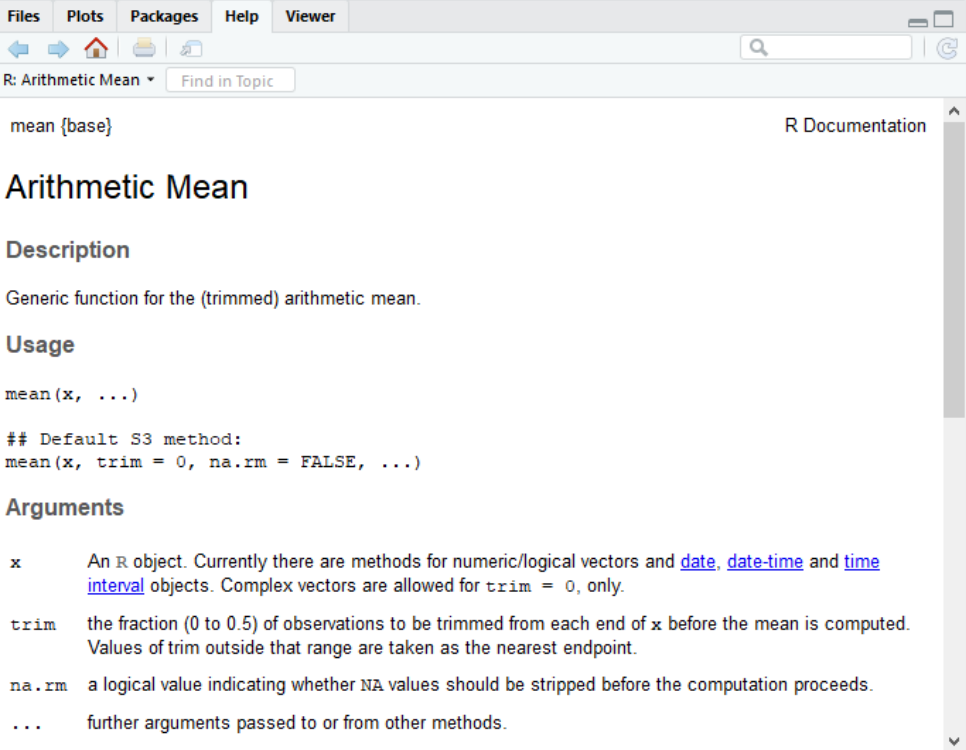
Variable	Value
x	num [1:5] 74 122 235 111 292
y	logi [1:4] TRUE FALSE TRUE TRUE
tv	function (x, k1 = 1, k2 = 0.1, k3 = 0.1)

The Files pane at the bottom right displays a 'Find in Topic' search bar and a list of R resources and manuals. The Console pane at the bottom left shows the R startup message and the execution of the script, resulting in the following output:

```
[workspace loaded from ~/.RData]
> 2+2
[1] 4
> 2^2
Error: unexpected 'A' in "2^A"
> y <- c(T, F, T, T)
> 2^2
Error: unexpected 'A' in "2^A"
> x <- c(74, 122, 235, 111, 292)
>
```

# Help

```
>?mean  
>help("mean")  
>example("mean")  
>help.search("mean")  
>help(package="MASS")
```



The screenshot shows the R Help Viewer window. The title bar includes tabs for Files, Plots, Packages, Help, and Viewer. The main content area displays the documentation for the 'mean' function. The title 'Arithmetic Mean' is prominently displayed. Below it, the 'Description' section states it is a generic function for the (trimmed) arithmetic mean. The 'Usage' section shows the function signature: `mean(x, ...)`. The 'Arguments' section lists the parameters: `x` (An R object), `trim` (the fraction of observations to be trimmed), and `na.rm` (a logical value indicating whether NA values should be stripped).

Files Plots Packages Help Viewer

R: Arithmetic Mean Find in Topic

mean {base} R Documentation

## Arithmetic Mean

### Description

Generic function for the (trimmed) arithmetic mean.

### Usage

```
mean(x, ...)
```

## Default S3 method:  
mean(x, trim = 0, na.rm = FALSE, ...)

### Arguments

<code>x</code>	An R object. Currently there are methods for numeric/logical vectors and <a href="#">date</a> , <a href="#">date-time</a> and <a href="#">time interval</a> objects. Complex vectors are allowed for <code>trim = 0</code> , only.
<code>trim</code>	the fraction (0 to 0.5) of observations to be trimmed from each end of <code>x</code> before the mean is computed. Values of <code>trim</code> outside that range are taken as the nearest endpoint.
<code>na.rm</code>	a logical value indicating whether NA values should be stripped before the computation proceeds.
<code>...</code>	further arguments passed to or from other methods.

# R packages

R comes ready loaded with various libraries of functions called packages  
ex) `sum()` is in the “base” package and `sd()` in the “stats” package

The packages can be found in numerous server locations on the web called **repositories**

## **The Comprehensive R Archive Network (CRAN)**

<http://cran.r-project.org/web/views/>

**Bioconductor** specialised in genomics

<http://www.bioconductor.org/>

## **To find functionality**

Metacran <http://www.r-pkg.org/>



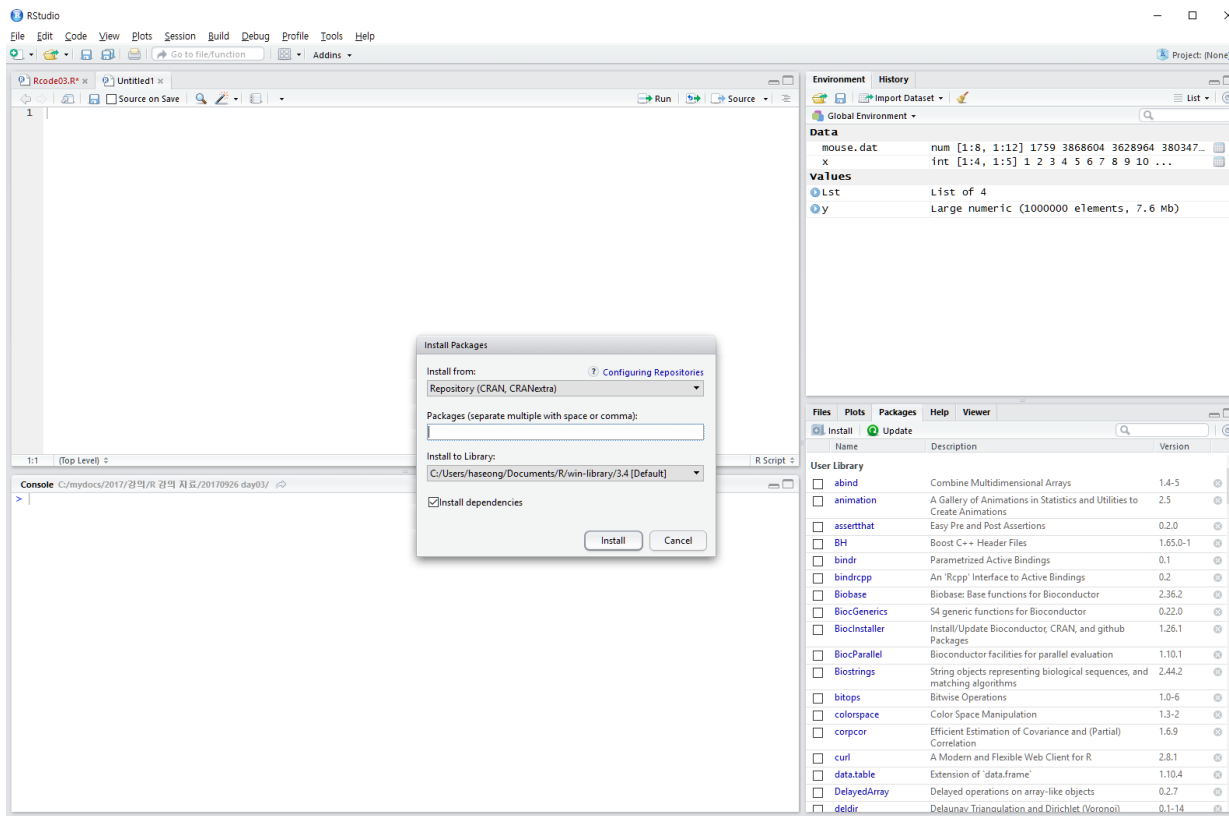
# Installing packages

## The Comprehensive R Archive Network (CRAN)

```
install.packages(name.of.package)
```

## Bioconductor

```
if (!requireNamespace("BiocManager"))  
  install.packages("BiocManager")  
BiocManager::install()
```



Toggle checkbox  
Load / Unload

## Packages → Install

Install Packages

Install from: [? Configuring Repositories](#)

Repository (CRAN, CRANextra) ▼

Packages (separate multiple with space or comma):

UsingR

Install to Library:

C:/Users/user/Documents/R/win-library/3.4 [Default] ▼

☒ Install dependencies

Install Cancel

```
> install.packages("UsingR")
Installing package into 'C:/Users/user/Documents/R/win-library/3.4'
(as 'lib' is unspecified)
also installing the dependency 'HistData'

trying URL 'https://cran.rstudio.com/bin/windows/contrib/3.4/HistData_
0.8-4.zip'
Content type 'application/zip' length 359785 bytes (351 KB)
downloaded 351 KB

trying URL 'https://cran.rstudio.com/bin/windows/contrib/3.4/UsingR_2.
0-6.zip'
Content type 'application/zip' length 2081603 bytes (2.0 MB)
downloaded 2.0 MB

package 'HistData' successfully unpacked and MD5 sums checked
package 'UsingR' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
C:\Users\user\AppData\Local\Temp\RtmpwdxEQ7\downloaded_package
s
> |
```

Files	Plots	Packages	Help	Viewer
Install		Update		
		Name	Description	
<input type="checkbox"/>		UsingR	Data Sets, Etc. for the Text "Using R for Introductory Statistics", Second Edition	
<input type="checkbox"/>		ggplot2	Create Elegant Data Visualisations Using the Grammar of Graphics	
<input type="checkbox"/>		munsell	Utilities for Using Munsell Colours	
<input type="checkbox"/>		rsbml	R support for SBML, using libsbml	
<input type="checkbox"/>		stats4	Statistical Functions using S4 Classes	

```
> library("UsingR", lib.loc="~/R/win-library/3.4")
```

필요한 패키지를 로딩중입니다: MASS  
필요한 패키지를 로딩중입니다: HistData  
필요한 패키지를 로딩중입니다: Hmisc  
필요한 패키지를 로딩중입니다: lattice  
필요한 패키지를 로딩중입니다: survival  
필요한 패키지를 로딩중입니다: Formula  
필요한 패키지를 로딩중입니다: ggplot2

다음의 패키지를 부착합니다: 'Hmisc'

The following objects are masked from 'package:base':

format.pval, units

다음의 패키지를 부착합니다: 'UsingR'

# Packages loading

```
library(readxl)
```

```
> library(usingR)
```

다음의 패키지를 부착합니다: 'usingR'

The following object is masked from 'package:survival':

cancer

warning message:

패키지 'usingR'는 R 버전 3.4.4에서 작성되었습니다

```
> |
```

## R 설치 디렉토리

## R 패키지 설치 디렉토리

```
.libPaths()
```

```
path.package()
```

```
> path.package()
```

```
[1] "C:/Program Files/R/R-3.4.0/library/stats"      "C:/Program Files/R/R-3.4.0/library/graphics"  
[3] "C:/Program Files/R/R-3.4.0/library/grDevices"  "C:/Program Files/R/R-3.4.0/library/utils"  
[5] "C:/Program Files/R/R-3.4.0/library/datasets"    "C:/Program Files/R/R-3.4.0/library/methods"  
[7] "C:/PROGRA~1/R/R-34~1.0/library/base"
```

```
> library(readxl)
```

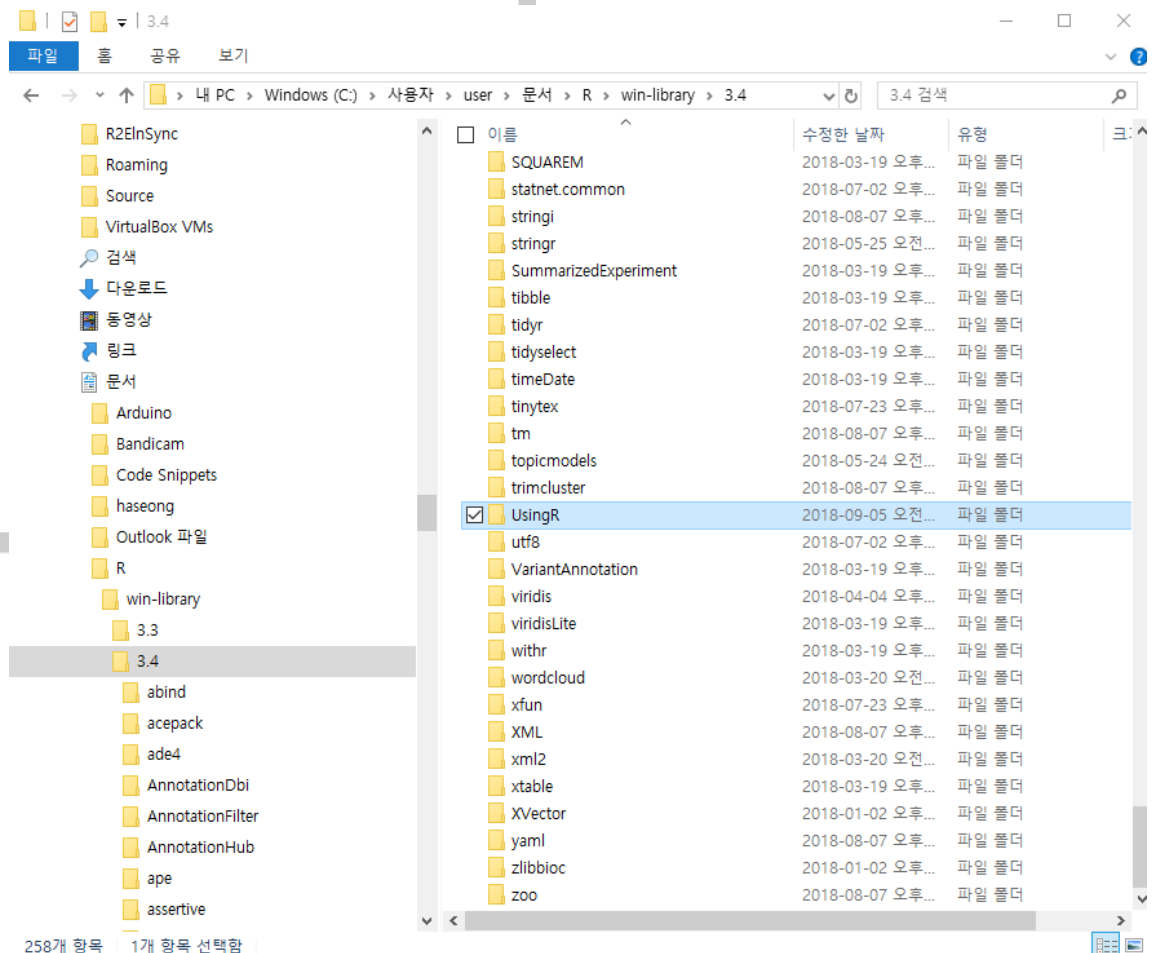
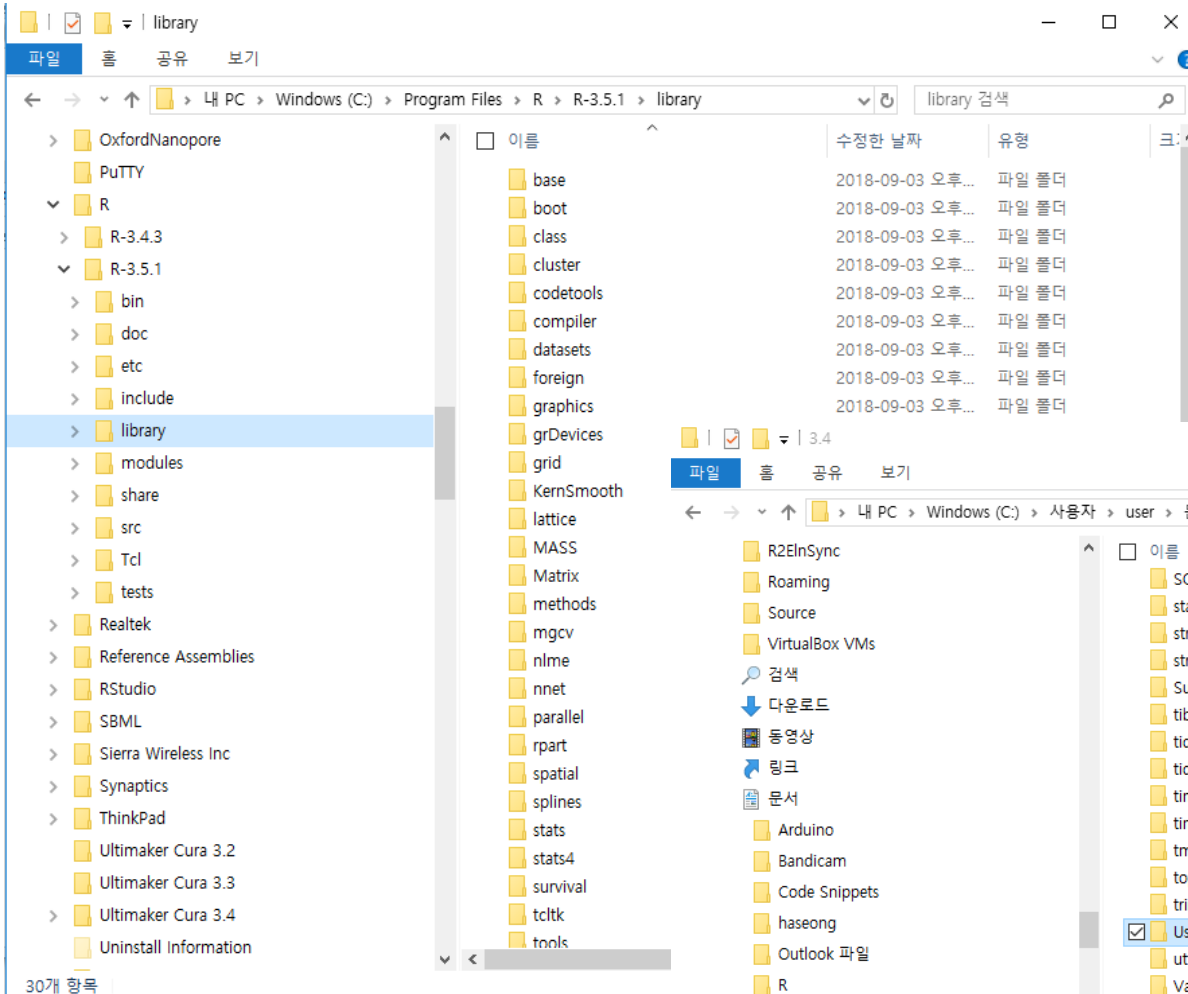
warning message:

패키지 'readxl'는 R 버전 3.4.1에서 작성되었습니다

```
> path.package()
```

```
[1] "C:/Users/haseong/Documents/R/win-library/3.4/readxl" "C:/Program Files/R/R-3.4.0/library/stats"  
[3] "C:/Program Files/R/R-3.4.0/library/graphics"         "C:/Program Files/R/R-3.4.0/library/grDevices"  
[5] "C:/Program Files/R/R-3.4.0/library/utils"             "C:/Program Files/R/R-3.4.0/library/datasets"  
[7] "C:/Program Files/R/R-3.4.0/library/methods"          "C:/PROGRA~1/R/R-34~1.0/library/base"
```

```
> |
```



# 교재 및 참고자료

- R 기본 문서들 (소개, 사용, 설치, 운영)

- <https://cran.r-project.org/doc/manuals/r-release/R-intro.html>
- <https://cran.r-project.org/doc/manuals/r-release/R-data.html>
- <https://cran.r-project.org/doc/manuals/r-release/R-admin.html>

- 참고 사이트

- R home (<https://www.r-project.org/>)
- Packages for biologists (<http://www.bioconductor.org/>)
- R studio (<https://www.rstudio.com/>)
- R-bloggers (<https://www.r-bloggers.com/>)
- Revolutionanalytics (<http://blog.revolutionanalytics.com/>)
- R 레퍼런스카드 (<https://cran.r-project.org/doc/contrib/Short-refcard.pdf>)

- 튜토리얼

- <https://www.codeschool.com/courses/try-r>
- <https://www.youtube.com/playlist?list=PLFe6bHk0eK-AaHbHnbwLhrhE1Gyc5UOkE>
- [https://www.bioconductor.org/help/course-materials/2017/OMRF/B2\\_Common\\_Operations.html](https://www.bioconductor.org/help/course-materials/2017/OMRF/B2_Common_Operations.html)
- <http://r4ds.had.co.nz/>

- 
- <http://tutorials.iq.harvard.edu/R/Rintro/Rintro.html>
  - <https://web.stanford.edu/class/bios221/labs/>
  - <https://www.stat.berkeley.edu/~s133/>

# Next

- Get KRIBB email ID / Password
- R basics I
  - Matrix, Data.frame, List
  - Building functions