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Contents

Chapter 1

Ready?

1.1 R(Studio)

- R
- RStudio R R

- OK

1.2 Tips!

- R

1. R by
   R
2. R by &
   Tidyverse R

1.3 R(Studio)

- (https://posit.co/download/rstudio-desktop/)
- 1:Install R R
- 2:Install RStudio RStudio
- R

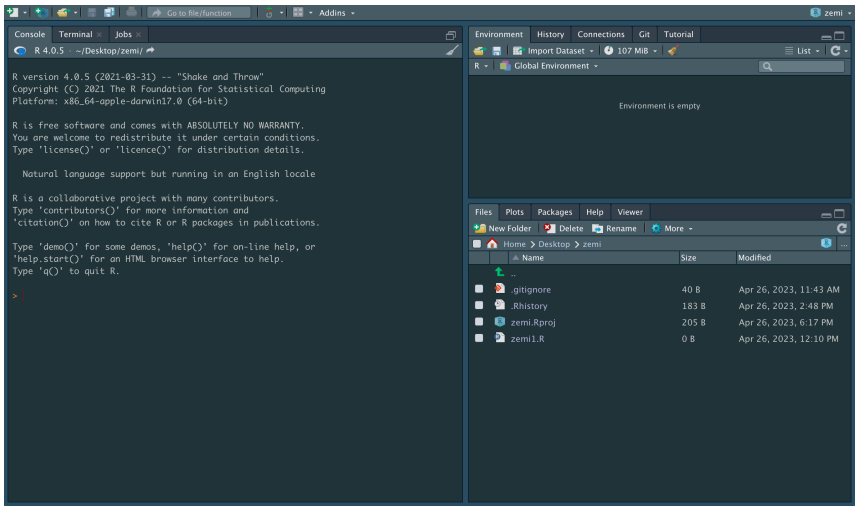
Chapter 2

Go!!

-

2.1 RStudio

- RStudio
-



2.2

-

- Console
-
- > 1+1 **Enter mac return**
- [1] 2
- 2 1+1 [1] 1

2.3 R

- Rstudio

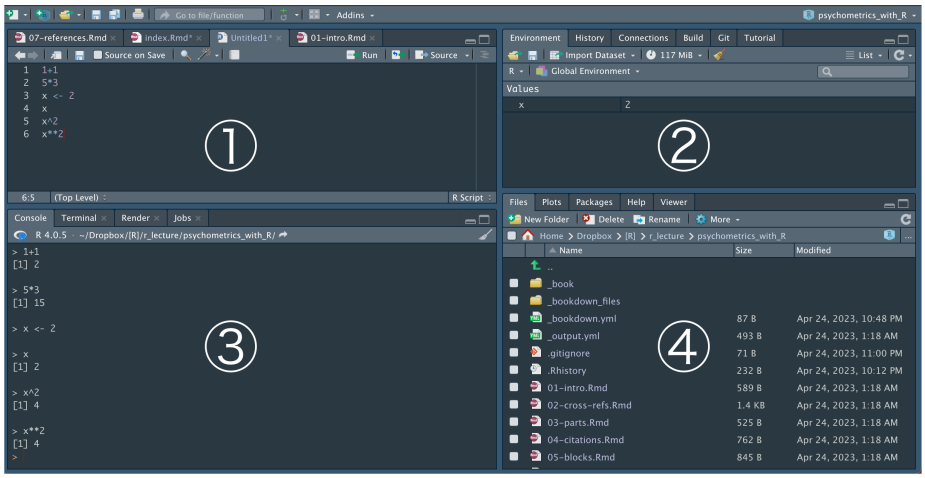
- **R**

R

- RStudio R Script
- R
  untitled1 R

RStudio

-



R

R

- untitled1
- 1 `1+1` **ctrl+Enter mac command+return**
- (`[1] 2`)

- R **ctrl+s mac command+s**

- test.R
- R test.R ×
- R
  test.R
- R

-
- 2 `5-2`
- 2 **ctrl+Enter**
- 2 (`[1] 3`)
- 1 **ctrl+Enter**
- 1 (`[1] 2`)
- **ctrl+Enter**
- **ctrl+shift+Enter mac command+shift+return**
- **ctrl+Enter**

R

1.
2.

3.
   …

2.4

- R
- R

- New Directry → New Project

- Create Project
-
- .Rproj
- mac Document sugoi_project
-
-

1. .Rproj Rstudio
2.

2.5

- zemi
- zemi
- zemi.Rproj

※ **zemi**

Chapter 3

-

1. in R
2. in R

3.1

: +

```
1 + 1
```

```
## [1] 2
```

: -

```
5 - 2
```

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

: *

```
4 * 5
```

```
## [1] 20
```

: /

```
8 / 2
```

```
## [1] 4
```

: ^ ** 4^2

```
4 ^ 2
```

```
## [1] 16
```

```
4 ** 2
```

```
## [1] 16
```

3.2

- [1]
-
-
-

```
x <- 1 # <-

#    #
#
#
```

- x 1
  x OK
- OK
-

```
x
```

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

-

```
y <- 1
z <- 2
y * z # 1*2
```

```
## [1] 2
```

-

```
x <- 1 #x 1
x
```

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

[1] tidyverse

```
x <- 2 #x 2
x
```

```
## [1] 2
```

-

```
x <- 2+5
x #   7
```

```
## [1] 7
```

-
-

```
z <- 2 #z 2
z <- z + 1 #z=2 1       z
z #  z
```

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

-
- moji

```
#   "      "
# '       '
#

moji <- "    "
moji
```

```
## [1] "    "
```

{-} - x 3 y 6 - x y 2 45

3.3

- R
- sqrt()
- ()

```
sqrt(2)
```

```
## [1] 1.414214
```

- xxx()
- ( )
-

- sqrt(2) 2 1.414214

-
- log()
- 10

```
log(10)
```

```
## [1] 2.302585
```

- 2 base=10 10

```
log(10, base = 10)
```

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

-

- help()
- () help()
- log() help(log)
- Rstudio

3.4

- R

3.4.1

- 1
- c()
-
- 5 2,4,2,3,5 v

```
v <- c(2, 4, 2, 3, 5) #
v # v
```

```
## [1] 2 4 2 3 5
```

- 2,3,4,5,6

```
v <- c(2:6) # n:m  n m
v
```

```
## [1] 2 3 4 5 6
```

- =
-
-

```
v+2  #
```

```
## [1] 4 5 6 7 8
```

```
2*v  #
```

```
## [1]  4  6  8 10 12
```

- v v-2 v/2 v^2

- R
- 2

```
v1 <- c(1, 2)
v2 <- c(2, 4)
```

- +
- 1 2 (2 4)

```
v1 + v2
```

```
## [1] 3 6
```

- * 1 2

```
v1 * v2
```

```
## [1] 2 8
```

-
- R %*%

```
v1 %*% v2
```

```
##      [,1]
## [1,]   10
```

- =

```
# v1 3    v2 2
#  v2 1    v1

v1 <- c(1, 2, 3)  #3
```

```
v2 <- c(2, 4) #2
v1 + v2 #
```

```
## Warning in v1 + v2: longer object length is not a multiple of shorter object
## length
```

```
## [1] 3 6 5
```

- v1 v2 - / ^
- 1 2

- n
- x n x[n]
- v=c(2,4,2,3,5)
- 2 4 v[2]

```
v[2]
```

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

- 2 (4,2,3) v[2:4]

```
v[2:4]
```

```
## [1] 3 4 5
```

3.4.2

- 2
- 2 3 $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$ M matrix()

```
# 1:6 c(1:6) 1,2,3,4,5,6
# 6 2 (row) 3 (col)
#byrow = T 6 z
#byrow = T

M <- matrix(1:6, nrow = 2, ncol = 3, byrow = T)
M
```

```
##      [,1] [,2] [,3]
## [1,]    1    2    3
## [2,]    4    5    6
```

-

```
v1 <- c(1,2,3)
v2 <- c(1,1,1) #2   v1 v2

rbind(v1, v2) #v1 v2 (row)
```

```
##    [,1] [,2] [,3]
## v1    1    2    3
## v2    1    1    1
```

```
cbind(v1, v2) #v1 v2 (column)
```

```
##      v1 v2
## [1,]  1  1
## [2,]  2  1
## [3,]  3  1
```

```
rbind(M, v1) #
```

```
##    [,1] [,2] [,3]
##       1    2    3
##       4    5    6
## v1    1    2    3
```

- x x[ ]
- M

```
# 2 1    M21
M21 <- M[2,1]

# 2
M[2,]
```

```
## [1] 4 5 6
```

```
# 1
M[,1]
```

```
## [1] 1 4
```

```
# 1,2  1,3
M[c(1,2),c(1,3)]
```

```
##      [,1] [,2]
## [1,]    1    3
## [2,]    4    6
```

- n n + −
- %*%

```
M #   2 3
```

```
##      [,1] [,2] [,3]
## [1,]    1    2    3
## [2,]    4    5    6
```

```
M2 <- matrix(c(1,2,0,1,0,2), nrow = 3, ncol = 2, byrow = T) #  3 2
M2 #  2 3
```

```
##      [,1] [,2]
## [1,]    1    2
## [2,]    0    1
## [3,]    0    2
```

```
#    MN
M %*% M2
```

```
##      [,1] [,2]
## [1,]    1   10
## [2,]    4   25
```

```
#    MN
M2 %*% M
```

```
##      [,1] [,2] [,3]
## [1,]    9   12   15
## [2,]    4    5    6
## [3,]    8   10   12
```

```
v <- c(1,2,3) #

#       %*%
#
v %*% M2 #   M2%*%v
```

```
##      [,1] [,2]
## [1,]    1   10
```

3.5

- rbind() cbind()
-

-

(x)	
summary(x)	
max(x)	x
min(x)	x
mean(x)	x
median(x)	x
var(x)	x
sd(x)	x
sum(x)	x
range(x)	x
length(x)	x
sort(x)	x
sort(x, decreasing = TRUE)	x

- 5

```
age <- c(36, 16, 43, 18, 22) #5
```

- age

```
summary(age) #
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##      16      18      22      27      36      43
```

```
max(age) #      5    43
```

```
## [1] 43
```

```
mean(age) #   5    27
```

```
## [1] 27
```

```
var(age) #   5    141
```

```
## [1] 141
```

```
length(age) #        5    5
```

```
## [1] 5
```

- age min(), median(),sd(),sum(),range(),sort()
-
- M

-
-

(x)		
matrix(0, nrow=2, ncol=3)	2 3	
diag(5)	5×5	
diag(X) <- 1	X	1
t(X)	X	
solve(X)	X	
det(X)	X	
rowSums(X)	X	
colSums(X)	X	
RowMeans(X)	X	
colMeand(X)	X	

- M

3.6

- a 149cm, b 153cm, c 169cm, d 174cm
- a 36kg, b 48kg, c 61kg, d 65kg

1. 4 h

2. h

3.
   1cm 0.39

4. 4 w
5. h w 2×4 M

6. M b
7. w h2

Chapter 4

- R

4.1

4.2 OK

- R
-
-
-

```
  <- function ( ) {

}
```

- $a/(1-x)$ a x
- inf_geo()

```
inf_geo <- function (a, x) {
  a/(1-x)
}
```

-

```
#a=1 x=0.8
inf_geo(1, 0.8)
```

```
## [1] 5
```

4.2

-
-
- R

4.3

-
- install.packages()
- tidyverse [1]
- **tidyverse** **R**

```
#
install.packages("tidyverse") #  "      "
```

- tidyverse

```
# RStudio
library(tidyverse) #  "      "
```

- install.packages()
- library() Rstudio
- R library( )

[1] tidyverse

Chapter 5

-

1. in R
2. in R

R

age_vector gender_vector `data.frame()`

```
age <- c(18, 21, 22, 23, 34) #
gender <- c("female", "male", "male", "female", "female") #
first_dataframe <- data.frame(age, gender)
first_dataframe
```

```
##   age gender
## 1  18 female
## 2  21   male
## 3  22   male
## 4  23 female
## 5  34 female
```

1 18 2 21 ... Excel R

$ first_dataframe

```
first_dataframe$gender
```

```
## [1] "female" "male"   "male"   "female" "female"
```

```
mean(first_dataframe$age)
```

```
## [1] 23.6
```

- income 10, 100, 1000, 10000, 100000
- city ”ibaraki”, “takatsuki”, “ibaraki”, “takatsuki”, “takatsuki”
- income city income_data
- income_data income
-
  RStudio

5.1

Chapter 2

CSV .csv Excel .xlsx, .xls

1

5.2

5.2.1 CSV .csv

CSV `read.csv` sotsuron.csv

```
data_original <- read.csv("sotsuron.csv")
```

csv data_original data_original

- tidy_data.csv https://www.dropbox.com/s/wm46esg4dicye8j/tidy_data.csv?dl=0
- `read.csv` data

5.3

“Environment” data `head(data)` `str(data)`