Tomohisa OKADA

2023-05-31

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
3. R by

4. R by
   R
5. R by
   tidyverse

1.3 R(Studio)

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

- 2:Install RStudio RStudio
- R

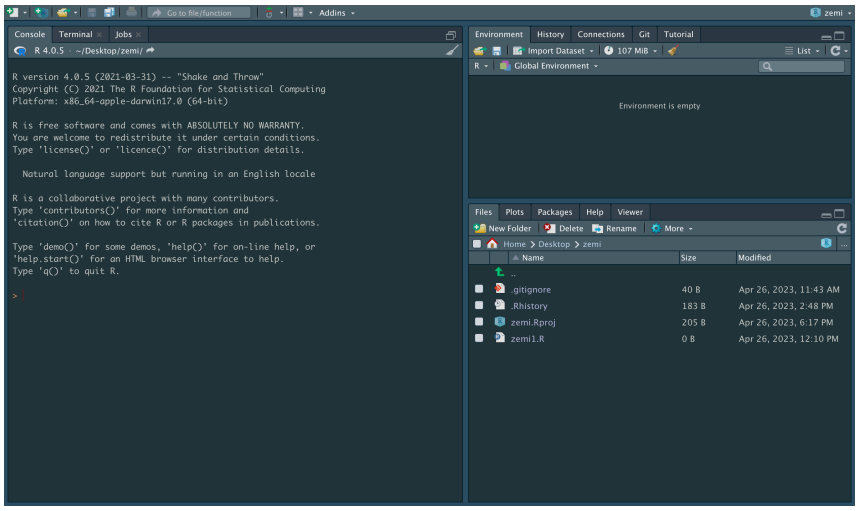
Chapter 2

Go!!

-

2.1 RStudio

- RStudio
-



2.2

-

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

2.3 R

- Rstudio

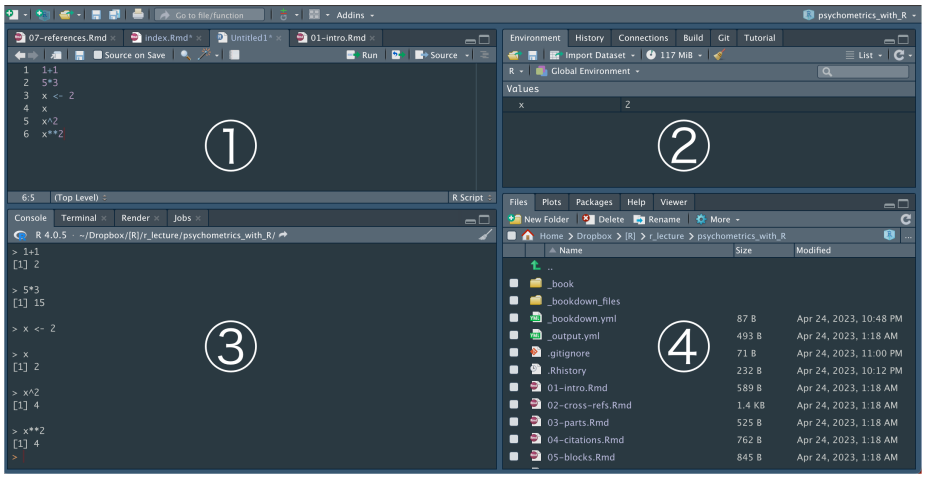
- **R**

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

-

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
```

- $9 \div 2$ 4 1
- 1

: %/%

```
9%/%2
```

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

mod : %%

```
9%%2
```

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

3.2

- [1]

-
-
-

```
x <- 1 # <-

#    #
#
#
```

- x 1
  x OK
- OK

-

```
x
```

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

[1]

-

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

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

-

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

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

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

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

-

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

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

-
-

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

```
## [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
```

- (numeric)

(x)	
log(x)	
log(x, base=y)	y
sqrt(x)	x
exp(x)	x e^x)
abs(x)	x
round(x,y)	y x IEEE754 ※
floor(x)	x
ceiling(x)	x

-

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

3.4

- + 1

```
suuji <- 2
suuji + 1

moji <- "  "
moji + 1
```

- 3
-
- suuji 2 numeric double
- moji character
- character +
- +
- typeof() mode()

```
typeof(suuji)
```

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

```
typeof(moji)
```

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

- TRUE FALSE logical
-

- suuji moji mode(suuji) mode(moji)
- typeof(suuji) mode(suuji)

3.5

- zemi exercise_ch3.R R
- exercise_ch3.R

1. abs(-5)
2. x <- exp(10) log(x)

1. round(0.45, 1) 0.5 0.4
   IEEE 5
2. floor(0.45 * 10)/10 0.5
   x y floor(x * 10^y + 0.5)/10^y

Chapter 4

-

1. in R
2. in R

- R

4.1

- R

4.1.1

- 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

```
v2_6 <- c(2:6) # n:m  n m
v2_6
```

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

- =
-
-

```
v
```

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

```
v+2  #
```

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

```
2*v  #
```

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

- 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
```

- length()

```
length(v1)
```

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

- v1 v2 - / ^
- 1 2

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

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

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

4.1.2

- 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]
M21
```

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

```
# 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
```

4.2

- `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
```

- age min(), median(),sd(),sum(),range(),length(),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

4.3

3.7 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
```

4.4

- R
- R
-
-
-

4.5

- `zemi` `exercise_ch4.R` R
- `exercise_ch4.R`

- 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

1. x y `sisya_gonyu(x,y)`
2. `sisya_gonyu(0.4445,3)`

Chapter 5

- R

5.1

-
-
- R

5.2

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

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

5.3

-
- tidyverse

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

- install.packages()

[1]

- `library()` Rstudio
- R `library( )`

Chapter 6

-

1. in R

- R

6.1

-
- 4

Name	Age	Height	Weight	Gender
Tanaka	10	149.5	36	male
Suzuki	18	153	65	female
Okada	41	171	58	male
Watanabe	26	174.5	127	male

- R [1]

6.1.1

- `data.frame()`

```
#
name <- c("Tanaka", "Suzuki", "Okada", "Watanabe")
age <- c(10, 18, 36, 23) #
height <- c(149.5, 153.0, 171.0, 174.5)
weight <- c(36, 65, 58, 127)
```

[1]

```
gender <- c("male", "female", "male", "male")

# data.frame()
#          df
df <- data.frame(name, age, height, weight, gender)
df
```

```
##       name age height weight gender
## 1   Tanaka  10  149.5     36   male
## 2   Suzuki  18  153.0     65 female
## 3    Okada  36  171.0     58   male
## 4 Watanabe  23  174.5    127   male
```

6.1.2

- df age $

```
df$age
```

```
## [1] 10 18 36 23
```

- df$age

```
toshi <- df$age
toshi
```

```
## [1] 10 18 36 23
```

6.2

-
-
- CSV .csv Excel .xlsx, .xls
-

6.2.1

- [2]
- R
- R
- 2

-
-

[2] tidyverse magrittr

6.2.2 csv

- csv read.csv() [3]
- sokutei.csv csv data
- head()

```
data <- read.csv("sokutei.csv")

head(data) #head()
```

6.2.3 Excel

- Excel readxl
- readxl read_excel()
- sokutei.xls sokutei

```
install.packages("readxl") #
library(readxl)
sokutei <- read_excel("sokutei.xls")
```

6.2.4

-
-
- data
- sokutei.csv read.csv("data/sokutei.csv")

6.3

1. zemi data
2. sokutei.csv data
3. sokutei_csv
4. head() sokutei_csv
5. sokutei.xls data
6. sokutei_excel
7. head() sokutei_excel
8. sokutei_excel weight w

[3] R ver4.1.0 tidyverse |> %>%

9. `w`

- Wooldridge
- wooldridge
-

1. wooldridge
2. wooldridge
3. `data("wage1")` wooldridge `wage1` [4]
4. `head(wage1)` `wage1`
5. `help(package="wooldridge")` `wage1`

[4] `TRUE` `FALSE` `filter(bmi >= 19)` `TRUE`

Chapter 7

-

1. in R

7.1

-
-
- tidyverse
- tidyverse [1]

```
library(tidyverse)
```

7.2

- tidyverse (%>%) [2] [3]
- R
- x

```
x <- c(1,2,3,4,5)

sd(x)
```

```
## [1] 1.581139
```

-

[1]

[2] tidyverse magrittr

[3] R ver4.1.0 tidyverse |> %>%

```
x %>% sd()
```

```
## [1] 1.581139
```

-
-
- df

```
df %>% head() #
```

```
##       name age height weight gender
## 1   Tanaka  10  149.5     36   male
## 2   Suzuki  18  153.0     65 female
## 3    Okada  36  171.0     58   male
## 4 Watanabe  23  174.5    127   male
```

-

```
read.csv("data/sokutei.csv") %>% head()
```

```
##        Name Age Height Weight Gender
## 1    Tanaka  10  149.5     36   male
## 2    Suzuki  18  153.0     48 female
## 3     Okada  41  171.0     58   male
## 4  Watanabe  26  174.5     65   male
## 5      Sato  32  159.0     54 female
## 6 Takahashi  16  169.0     87   male
```

-
-

```
sd_x <-
  x %>%
  var() %>% #x
  sqrt()    #

#
#   sd(x)
sd_x
```

```
## [1] 1.581139
```

-
-

7.3

- tidyverse dplyr
-

- dplyr select()
- df name

```
df %>%
  select(age, height, weight, gender)
```

```
##   age height weight gender
## 1  10  149.5     36   male
## 2  18  153.0     65 female
## 3  36  171.0     58   male
## 4  23  174.5    127   male
```

- df name
- select() - !

```
df %>%
  select(-name) #    - !
```

```
##   age height weight gender
## 1  10  149.5     36   male
## 2  18  153.0     65 female
## 3  36  171.0     58   male
## 4  23  174.5    127   male
```

7.4

- rename()
- df age toshi

```
df %>%
  rename(toshi = age) #        =
```

```
##       name toshi height weight gender
## 1   Tanaka    10  149.5     36   male
## 2   Suzuki    18  153.0     65 female
## 3    Okada    36  171.0     58   male
## 4 Watanabe    23  174.5    127   male
```

- select()
- df name age toshi

```
df %>%
  select(toshi = age, height, weight, gender)
```

```
##   toshi height weight gender
## 1    10  149.5     36   male
## 2    18  153.0     65 female
## 3    36  171.0     58   male
## 4    23  174.5    127   male
```

7.5

-
- dplyr filter()
- age 18

```
df %>%
  filter(age >= 18) # filter()
```

```
##       name age height weight gender
## 1   Suzuki  18  153.0     65 female
## 2    Okada  36  171.0     58   male
## 3 Watanabe  23  174.5    127   male
```

7.6

- age >= 18 bmi 19
- [4]

>	a > b	a b
>=	a >= b	a b
<	a < b	a b
<=	a <= b	a b
==	a == b	a b
!=	a != b	a b
%in%	a %in% c(a, b, c)	a c(a, b, c)

!	!(a==b)	a b
&	a & b	a b
&&	a && b	a b
|	a | b	a b
||	a || b	a b

- df
- select()

1. age 18 weight 60kg
2.
3.

[4] TRUE FALSE filter(bmi >= 19) TRUE

7.7

- dplyr mutate()
- df BMI
  BMI kg ÷ (m)^2

```
df <- df %>%
  mutate(bmi = weight / (height/100)^2) #BMI    df

df
```

```
##       name age height weight gender      bmi
## 1   Tanaka  10  149.5     36   male 16.10720
## 2   Suzuki  18  153.0     65 female 27.76710
## 3    Okada  36  171.0     58   male 19.83516
## 4 Watanabe  23  174.5    127   male 41.70738
```

2

- age 18 1 18 0 is_child
- mutate() if_else()

```
df <- df %>%
  mutate(is_child =
           if_else(
             age < 18, #if_else()
             1, #2      TRUE
             0 #      FALSE
           ))

df
```

```
##       name age height weight gender      bmi is_child
## 1   Tanaka  10  149.5     36   male 16.10720        1
## 2   Suzuki  18  153.0     65 female 27.76710        0
## 3    Okada  36  171.0     58   male 19.83516        0
## 4 Watanabe  23  174.5    127   male 41.70738        0
```

- if_else() 3
- 3 case_when
- (WHO) BMI

BMI
16

BMI	
16.00 16.99	
17.00 18.49	
18.50 24.99	
25.00 29.99	
30.00 34.99	(1)
35.00 39.99	(2)
40.00	(3)

- fat

```
df <- df %>%
  mutate( fat =
            case_when(
              bmi < 16 ~ "  ",
              bmi >= 16 & bmi < 17 ~ " ",
              bmi >= 17 & bmi < 18.5 ~ "  ",
              bmi >= 18.50 & bmi < 25 ~ "  ",
              bmi >= 25 & bmi < 30  ~ "  ",
              bmi >= 30 & bmi < 35 ~ " (1 )",
              bmi >= 35 & bmi < 40 ~ " (2 )",
              #      TRUE~
              TRUE~" (3 )" #   bmi >= 40 ~ " (3 )",
            ))

df
```

```
##       name age height weight gender      bmi is_child       fat
## 1   Tanaka  10  149.5     36   male 16.10720        1
## 2   Suzuki  18  153.0     65 female 27.76710        0
## 3    Okada  36  171.0     58   male 19.83516        0
## 4 Watanabe  23  174.5    127   male 41.70738        0  (3 )
```

7.8

- dplyr arrange()
- df age

```
df <- df %>% arrange(age)

df
```

```
##       name age height weight gender      bmi is_child       fat
## 1   Tanaka  10  149.5     36   male 16.10720        1
## 2   Suzuki  18  153.0     65 female 27.76710        0
## 3 Watanabe  23  174.5    127   male 41.70738        0  (3 )
```

```
## 4    Okada  36  171.0     58   male 19.83516        0
```

7.9

- dplyr summarise() [5]
-
- df age mean_age

```
df %>%
  summarise(mean_age = mean(age))
```

```
##   mean_age
## 1    21.75
```

- mean(df$age)
- summarise() group_by()
- group_by()
-

```
df %>%
  group_by(gender) %>% #
  summarise(mean_age = mean(age)) #
```

```
## # A tibble: 2 x 2
##   gender mean_age
##   <chr>     <dbl>
## 1 female       18
## 2 male         23
```

- summarise()
-

```
df %>%
  group_by(gender) %>% #
  summarise(n = n(),
            height_mean = mean(height),
            height_median = median(height),
            height_sd = sd(height),
            #
            #         (NA)
            )
```

```
## # A tibble: 2 x 5
##   gender     n height_mean height_median height_sd
##   <chr>  <int>       <dbl>         <dbl>     <dbl>
## 1 female     1         153           153      NA
## 2 male       3         165           171      13.5
```

[5] summarize()

7.10