資料輸入與輸出

- Textbook reading: Sections 5.3-5.4
- Working directory (工作目錄). The working directory for R is the default place for R to import/export files. To find out the current working directory, run

  ```
  getwd()
  ```

- To list the files in the working directory, run

  ```
  list.files()
  ```

- Change the working directory using `setwd`.

  ```
  dir.exists("C://temp")    #check whether the directory  "C:\temp" exists
  dir.create("C://temp")   #create the directory "C:\temp" if it does not exist
  setwd("C://temp")        #change the working directory to "C:\temp"
  ```

  目錄中反斜線的打法依作業系統不同而異，此處反斜線的打法適用於Windows作業系統。

- Using `"write.table"` to export data in a matrix.

  Example 1. Construct a matrix `X` and write it into a file called `"tem.txt"` in the working directory.

  ```
  ## Construct a matrix X
  X <- matrix(1:6, 3, 2)

  ## Write X into the file "tem.txt" with supplied column names.
  write.table(X, file="tem.txt", sep=",", row.names=F, col.names=c("A","B"), quote=F)
  ```

- Note.
  - We may run `help(write.table)` to see the usage of `write.table`.
  - We can write `X` into the file `tem.txt` in the directory `C:\temp` by including the file path.

    ```
    write.table(X, file="C://temp//tem.txt")
    ```

  - If the file name is supplied as `""`, then the result is shown on the screen.

    ```
    write.table(X, file="", sep=",", row.names=F, col.names=F)
    ```

- Using `"scan"` to read the file content.

```
scan(file="tem.txt", nlines =3)
scan("tem.txt", what="character", nlines =3)
```

- Using "read.table" to import a table.

  Example 2. Suppose that a file called "tem.txt" is in the working directory, and the file content is shown below.

```
A,B
1,4
2,5
3,6
```

  We can use "read.table" to read the table into an R object called "X".

```
X <- read.table(file="tem.txt", sep=",", header=T)
X
dim(X)[1]   #X的row個數
dim(X)[2]   #X的column個數
names(X)
```

- 矩陣部份選取

```
X <- matrix(1:12, 4,3)
X[1,2] #X的第(1,2)個元素

X[,2]  #X的第2個column形成的向量
X[2,]  #X的第2個row形成的向量
X[2, c(1,3)]  #X的第2個row的第1,3個元素形成的向量

X[, 1:2] #X的第1-2個columns形成的子矩陣
X[c(2,4), ] #X的第2,4個rows形成的子矩陣
X[c(2,4), 1:2] #X的第1-2個columns及第2,4個rows形成的子矩陣
```

- rbind, cbind: 矩陣依照 rows 或依照 columns 合併. 測試:

```
B <- diag(c(1:3))
D <- diag(c(4:6))
rbind(B,D)
cbind(B,D)
```

- Note. "read.table" gives a data frame in R, which can be transformed into a matrix using the command "as.matrix". Under the same set-up in Example 2, try the following.

```
X <- read.table(file="tem.txt", sep=",", header=T)
Y <- as.matrix(X)
Y %*% t(Y)  # matrix product of Y and the transpose of Y
X %*% t(X)
```

- Example 3. Suppose that a file called "tem.txt" is in the working directory, and the file content is shown below.

  ```
  A,4
  B,5
  C,6
  ```

  We can also use "read.table" to read the table into an R object called "X". Note that the second column of "X" is numeric but the first column is not.

  ```
  X <- read.table(file="tem.txt", sep=",")
  X[,2]*2
  X[,1]*2
  ```

  However, rbind and cbind still work for an object like X:

  ```
  rbind(X[1:2,],X[2:3,])
  cbind(X[,2],X[,1])
  ```

- Example 4. Download the file 'exchange_rate.csv at

  https://stat.walkup.tw/teaching/programming_R/data/exchange_rate.csv

  and save it into the R working directory. The file includes USD/TWD exchange rate data from 2016/3/8 to 2016/9/27. The rates for buying are in the 4–12 columns and the rates for selling are in the 15 – 22 columns. Write down R commands for completing the following tasks.

  (a) Use scan to view the first 3 lines of the file.

  (b) Use read.table to read the data into an R object x.

  (c) Compute the average spot rate for selling.

  (d) Compute the average spot rate for buying when the spot rate for selling exceeds 31.

  (e) Write a data table to an external file 'cash_rate.csv in the working directory including only observations for date, the cash rate for buying and the cash rate for selling when the spot rate for selling exceeds 31. Name the three variables "date", "buying", and "selling" respectively.

  (f) Use scan to view the first 3 lines of the file cash_rate.csv. Arrange the output as a matrix of 3 rows.

```
#a
scan("exchange_rate.csv",sep=",",nlines=3,what="character")
#b
x <- read.table("exchange_rate.csv", sep=",", header=T)
#c
sum(x$Spot.1)/length(x$Spot.1)
## x$Spot is the spot rate for buying
## x$Spot.1 is the spot rate for selling

#d
y <- x$Spot[x$Spot.1>31]
sum(y)/length(y)
#e
names(x)[1] <- "Date"
z <- cbind(x$Date, x$Cash, x$Cash.1)
z <- z[x$Spot.1>31,]
colnames(z) <-  c("date", "buying", "selling")
write.table(z, file="cash_rate.csv", sep=",", row.names=F, col.names=T, quote=F)
#f
matrix(scan("cash_rate.csv",sep=",",nlines=3,what="character"),nrow=3,byrow=T)
```

- The current R workspace can be exported using the command `save.image`. The R command

  ```
  save.image("test.RData")
  ```

  saves all objects in the current R workspace to an R workspace file `test.RData` in the working directory.

  - The R command

    ```
    save(X, Y, file="test1.RData")
    ```

    saves only `X` and `Y` to an R workspace file "test1.RData".
  - To list all objects in the current R workspace, use `ls()`.
  - To remove all objects in the current R workspace, use `rm(list=ls())`.

- To load `test1.RData` into the current R workspace, we can run

  ```
  load("test1.RData")
  ```

  in any R session.

- Graph export. The commands `bmp`, `jpeg`, `png` can export a plot in R to external files of extensions `bmp`, `jpeg`, `png` respectively.

  Example 5. Let $f(x) = 1/(1+x)$ for $x > -1$. Plot the graph of f on $[1, 2]$ and save the graph to a png file called "test.png".

```
f <- function(x){ return(1/(1+x)) }
png("test.png")
curve(f, 1, 2)
dev.off()       #finishing writing to the png file
```