SAVEETHA SCHOOL OF ENGINEERING

SAVEETHA INSTITUTE OF MEDICAL AND TECHNICAL SCIENCES

ITA 0443 - STATISTICS WITH R PROGRAMMING FOR REAL TIME PROBLEM

DAY 2 – LAB EXERCISES

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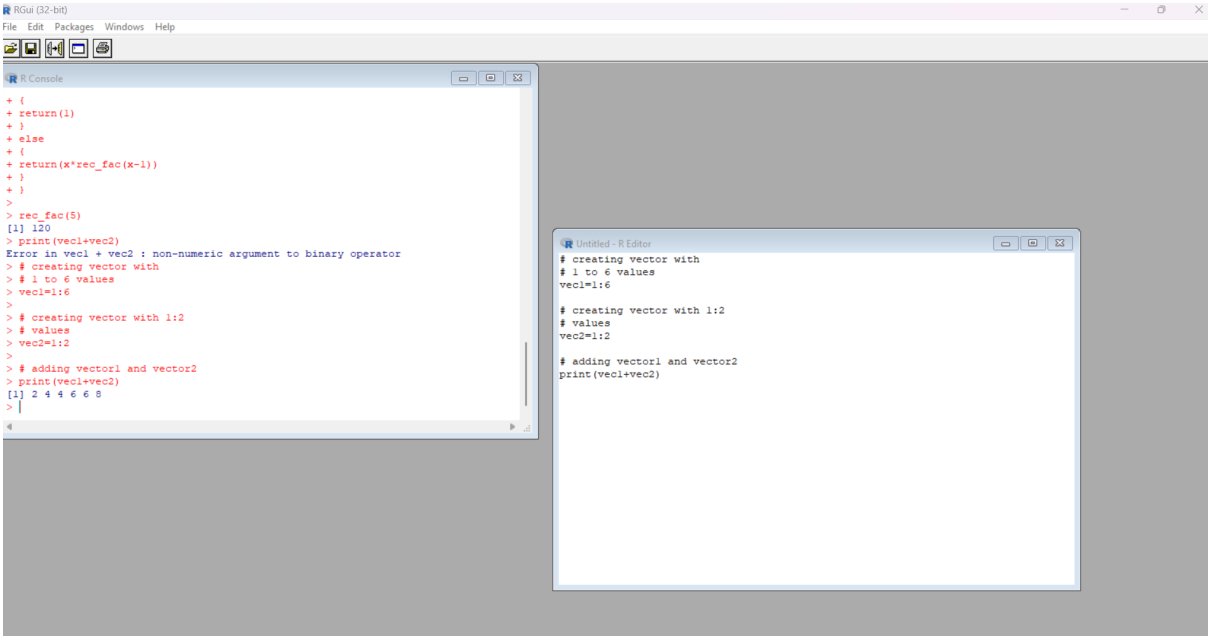
IMPLEMENTATION OF VECTOR RECYCLING, APPLY FAMILY & RECURSION

1. Demonstrate Vector Recycling in R.

```
# creating vector with
# 1 to 6 values
vec1=1:6


# creating vector with 1:2
# values
vec2=1:2


# adding vector1 and vector2
print(vec1+vec2)
```

```
> print(vec1+vec2)
[1] 2 4 4 6 6 8
```



2. Demonstrate the usage of apply function in R

m1 <- matrix(C<-(1:10),nrow=5, ncol=6)

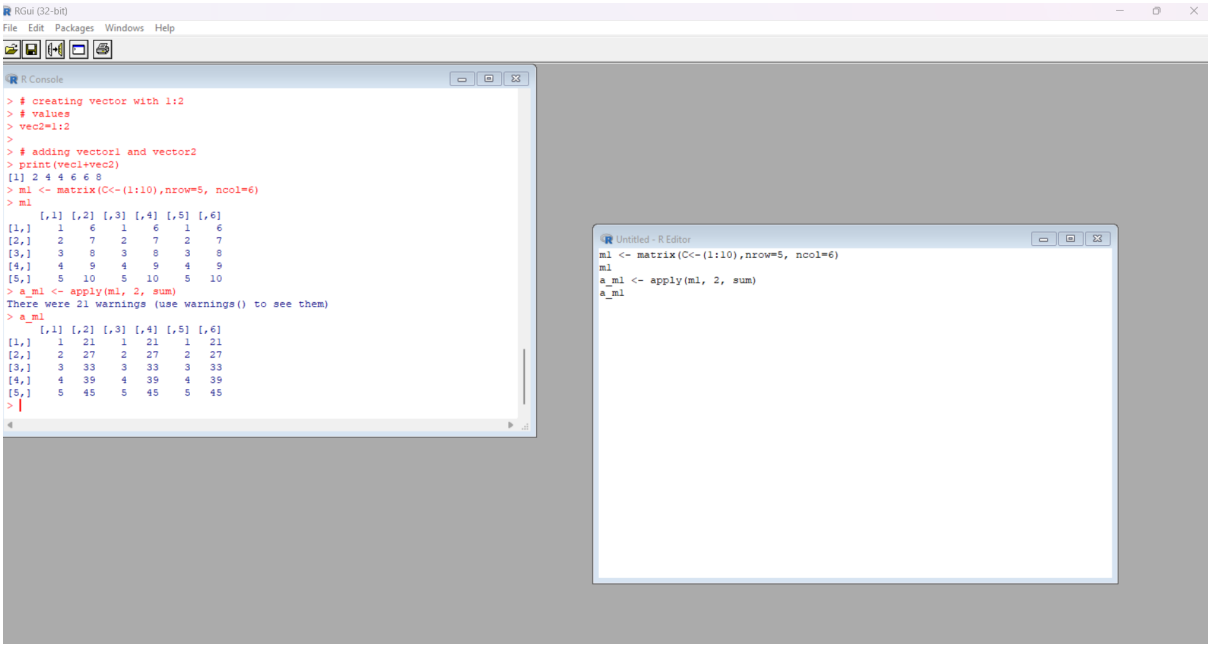
m1

a_m1 <- apply(m1, 2, sum)

a_m1

> a_m1

	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]
[1,]	1	21	1	21	1	21
[2,]	2	27	2	27	2	27
[3,]	3	33	3	33	3	33
[4,]	4	39	4	39	4	39
[5,]	5	45	5	45	5	45



3. Demonstrate the usage of lapply function in R

movies <- c("SPYDERMAN","BATMAN","VERTIGO","CHINATOWN")

movies_lower <-lapply(movies, tolower)

str(movies_lower)

> str(movies_lower)

output:

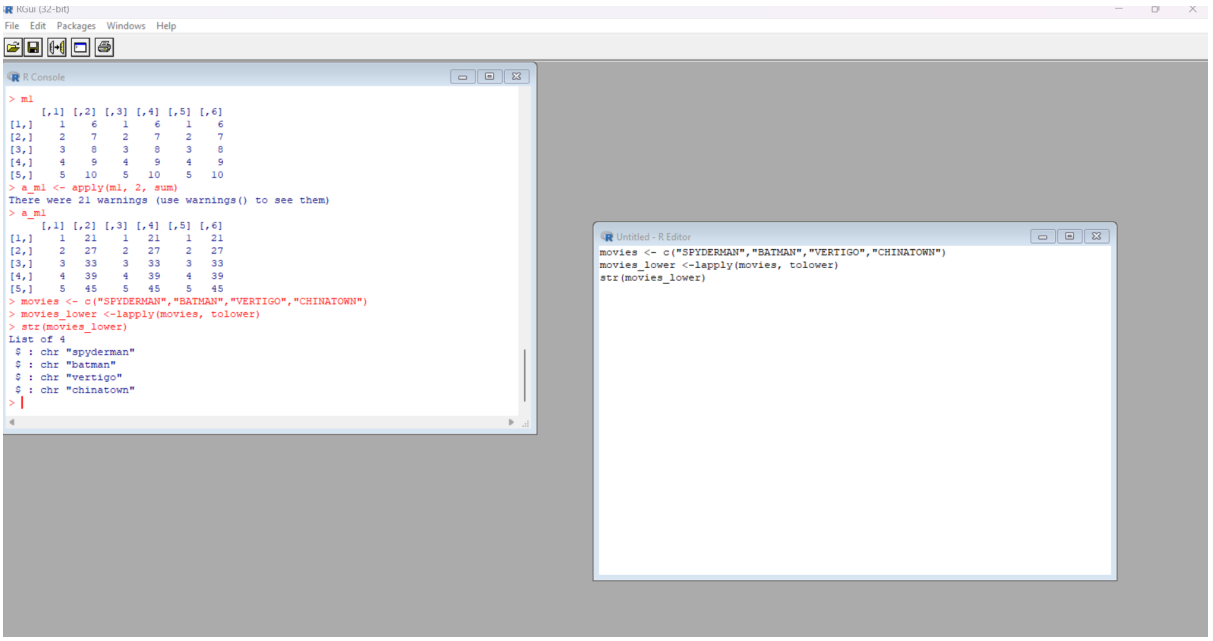
List of 4

$: chr "spyderman"

$: chr "batman"

$: chr "vertigo"

$: chr "chinatown"



4. Demonstrate the usage of sapply function in R

dt <- cars

lmn_cars <- lapply(dt, min)

smn_cars <- sapply(dt, min)

lmn_cars

output :

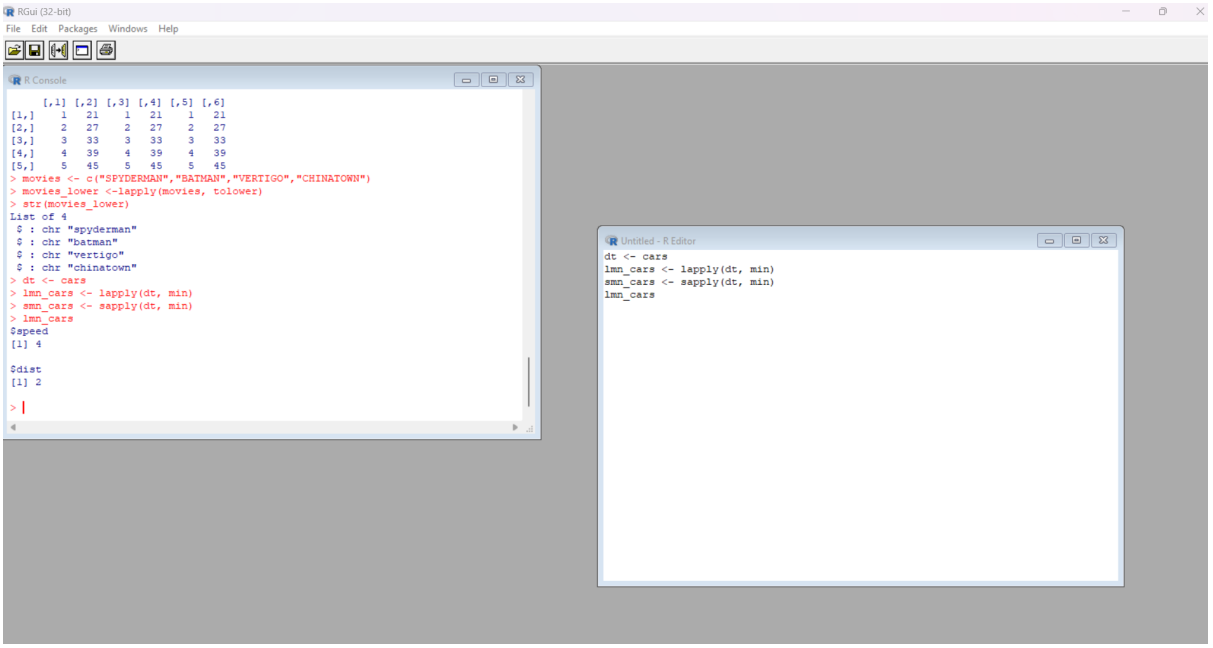
> lmn_cars

$speed

[1] 4

$dist

[1] 2



5. Demonstrate the usage of tapply function in R

data(iris)

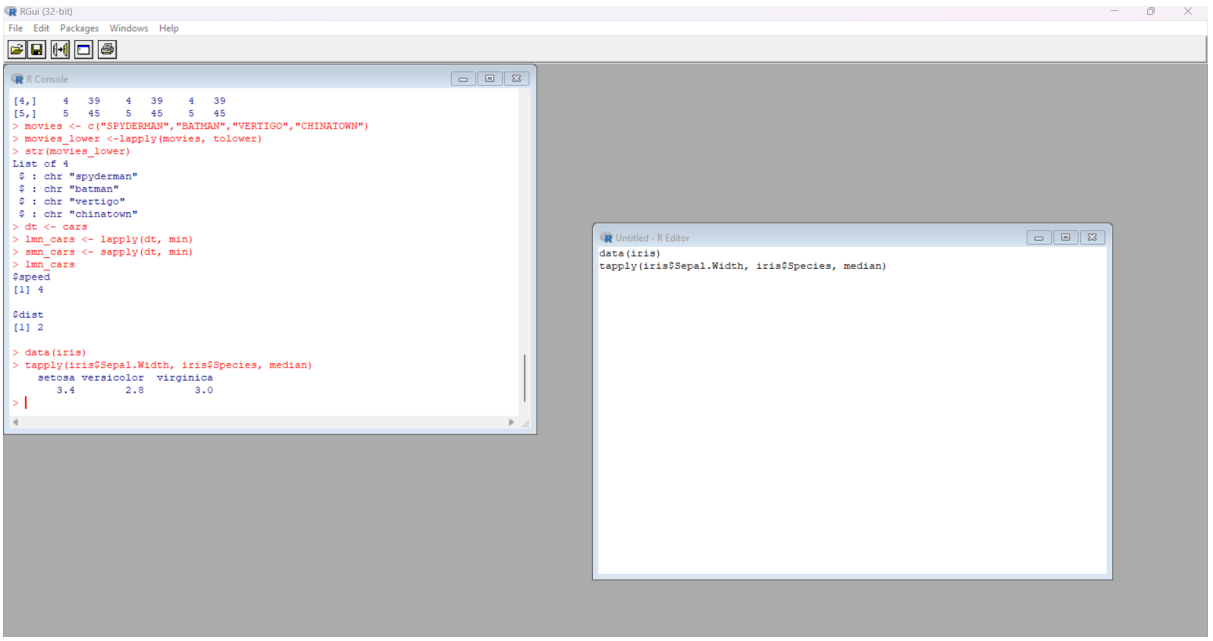
tapply(iris$Sepal.Width, iris$Species, median)

OUTPUT:

tapply(iris$Sepal.Width, iris$Species, median)

setosa versicolor virginica

3.4 2.8 3.0



6. Demonstrate the usage of mapply function in R

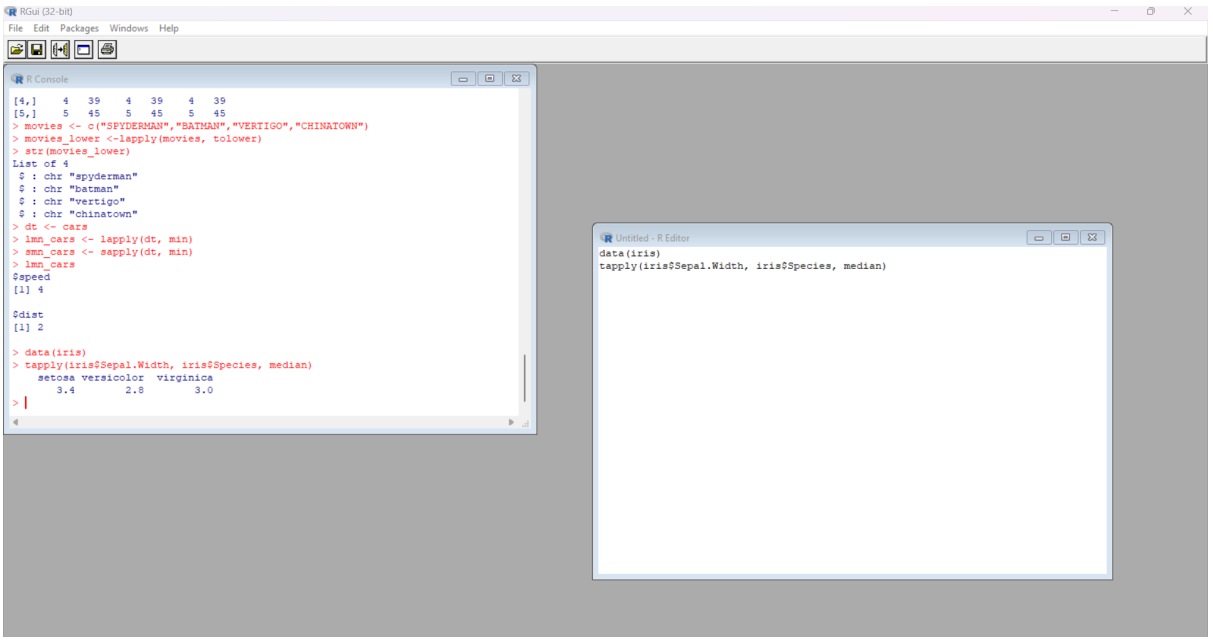
A = list(c(1, 2, 3, 4))

> B = list(c(2, 5, 1, 6))

> result = mapply(prod, A, B)

> print(result)

[1] 1440

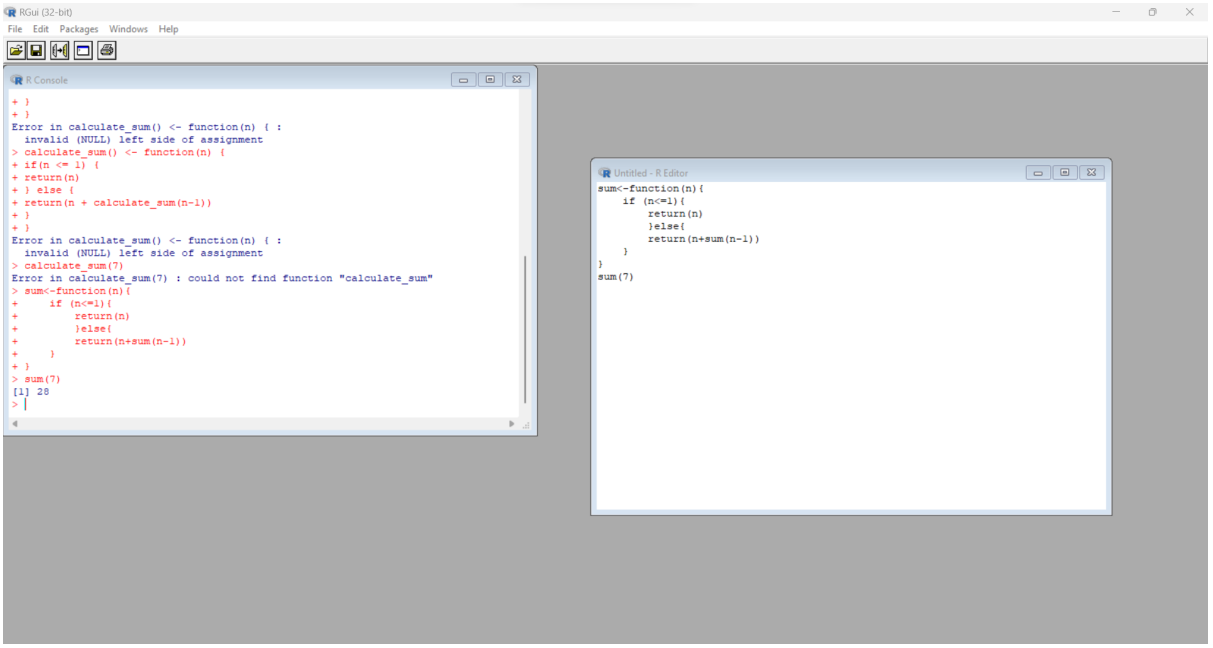


7. Sum of Natural Numbers using Recursion

```
sum<-function(n){
        if (n<=1){
        return(n)
        }else{
        return(n+sum(n-1))
        }
}
sum(7)
```

OUTPUT :

> sum(7)



8. Write a program to generate Fibonacci sequence using Recursion in R

Fibonacci <- numeric(10)

Fibonacci[1] <- Fibonacci[2] <- 1

for (i in 3:10) Fibonacci[i] <- Fibonacci[i - 2] + Fibonacci[i - 1]

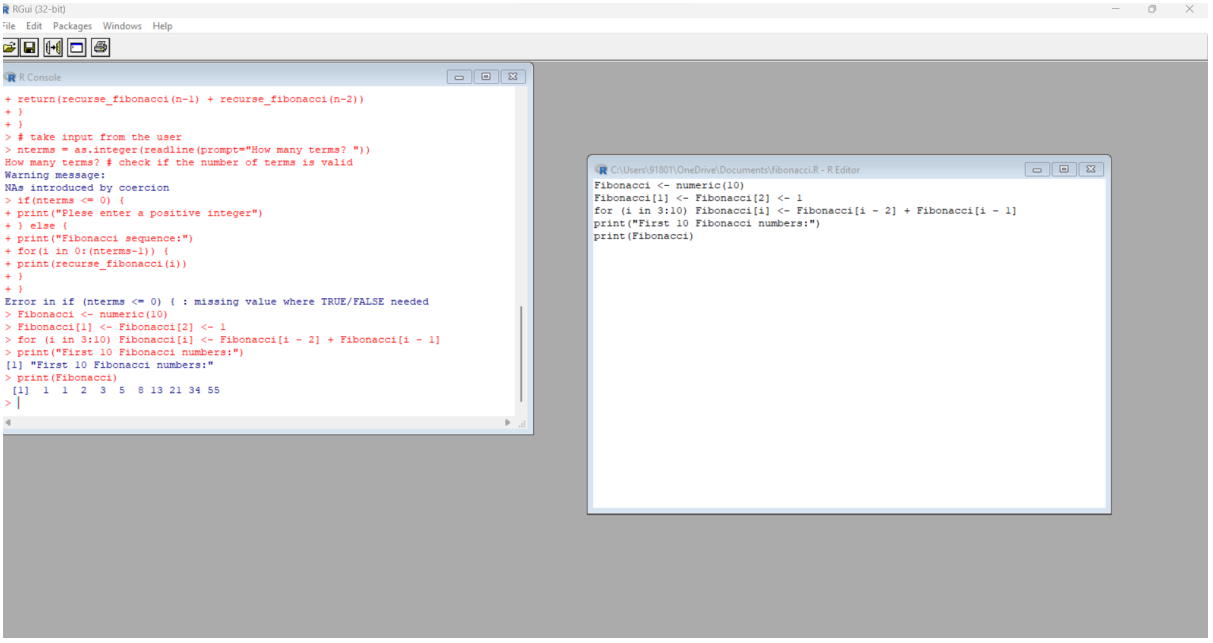
print("First 10 Fibonacci numbers:")

print(Fibonacci)

OUTPUT:

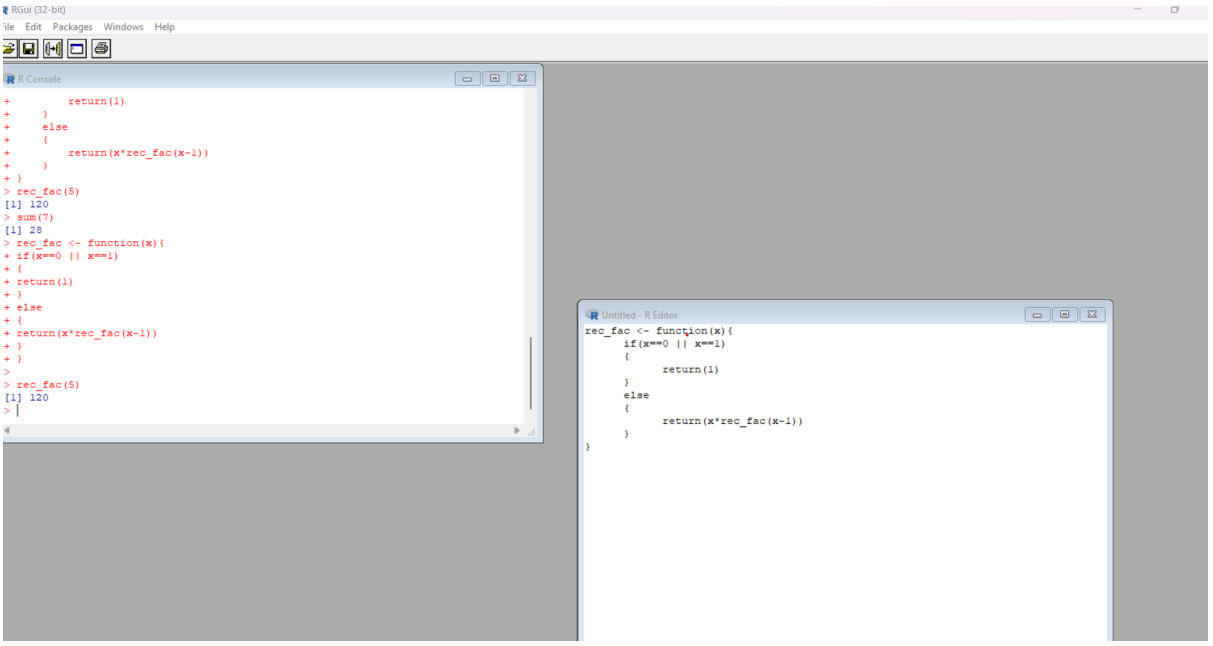
> rec_fac(5)

[1] 120



9. Write a program to find factorial of a number in R using recursion.

```
rec_fac <- function(x){
        if(x==0 || x==1)
        {
                return(1)
        }
        else
        {
                return(x*rec_fac(x-1))
        }
}
```



CREATION AND MANIPULATION OF DATAFRAMES IN R

Exercise 1

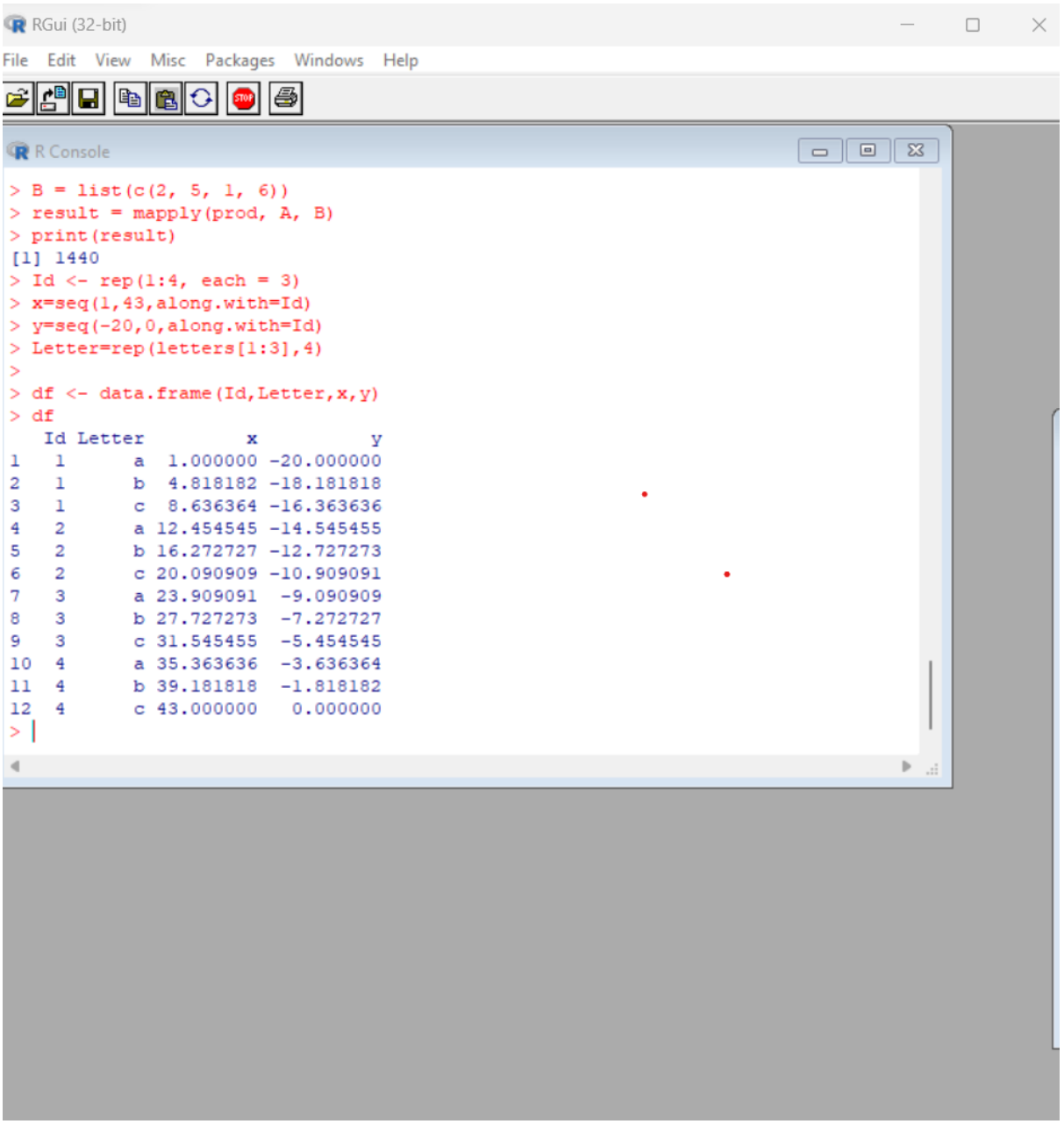
Consider two vectors: `x=seq(1,43,along.with=Id)`
`y=seq(-20,0,along.with=Id)`

Create a data frame 'df' as shown below.

```
>df
Id Letter x y
1 1 a 1.000000 -20.000000
2 1 b 4.818182 -18.181818
3 1 c 8.636364 -16.363636
4 2 a 12.454545 -14.545455
5 2 b 16.272727 -12.727273
6 2 c 20.090909 -10.909091
7 3 a 23.909091 -9.090909
8 3 b 27.727273 -7.272727
9 3 c 31.545455 -5.454545
10 4 a 35.363636 -3.636364
11 4 b 39.181818 -1.818182
12 4 c 43.000000 0.000000
Id <- rep(1:4, each = 3)
```

```
CODE :
x=seq(1,43,along.with=Id)
y=seq(-20,0,along.with=Id)
Letter=rep(letters[1:3],4)

OUTPUT :
> df
   Id Letter          x          y
1   1      a  1.000000 -20.000000
```

```
2    1       b  4.818182 -18.181818
3    1       c  8.636364 -16.363636
4    2       a 12.454545 -14.545455
5    2       b 16.272727 -12.727273
6    2       c 20.090909 -10.909091
7    3       a 23.909091  -9.090909
8    3       b 27.727273  -7.272727
9    3       c 31.545455  -5.454545
10   4       a 35.363636  -3.636364
11   4       b 39.181818  -1.818182
12   4       c 43.000000   0.000000
```



Exercise 2

Using the data frame 'df' in Exercise1, Construct the following data frame. `Id x.ay.ax.by.bx.cy.c 1 1 1.00000 -20.000000 4.818182 -18.181818 8.636364 -16.363636 4 2 12.45455 -14.545455 16.272727 -12.727273`

```
20.090909 -10.909091 7 3 23.90909 -9.090909 27.727273 -7.272727
31.545455 -5.454545 10 4 35.36364 -3.636364 39.181818 -1.818182
43.000000 0.000000
```

Exercise 3

Create two data frame df1 and df2:

> df1

Id Age

1 1 14

2 2 12

3 3 15

4 4 10

> df2

Id Sex Code

1 1 F a

2 2 M b

3 3 M c

4 4 F d

From df1 and df2 create M:

>M

Id Age Sex Code

1 1 14 F a

2 2 12 M b

3 3 15 M c 4 4 10 F d

CODE :

Id <- c(1:4)

> Age <- c(14,12,15,10)

> df1 <- data.frame(Id,Age)

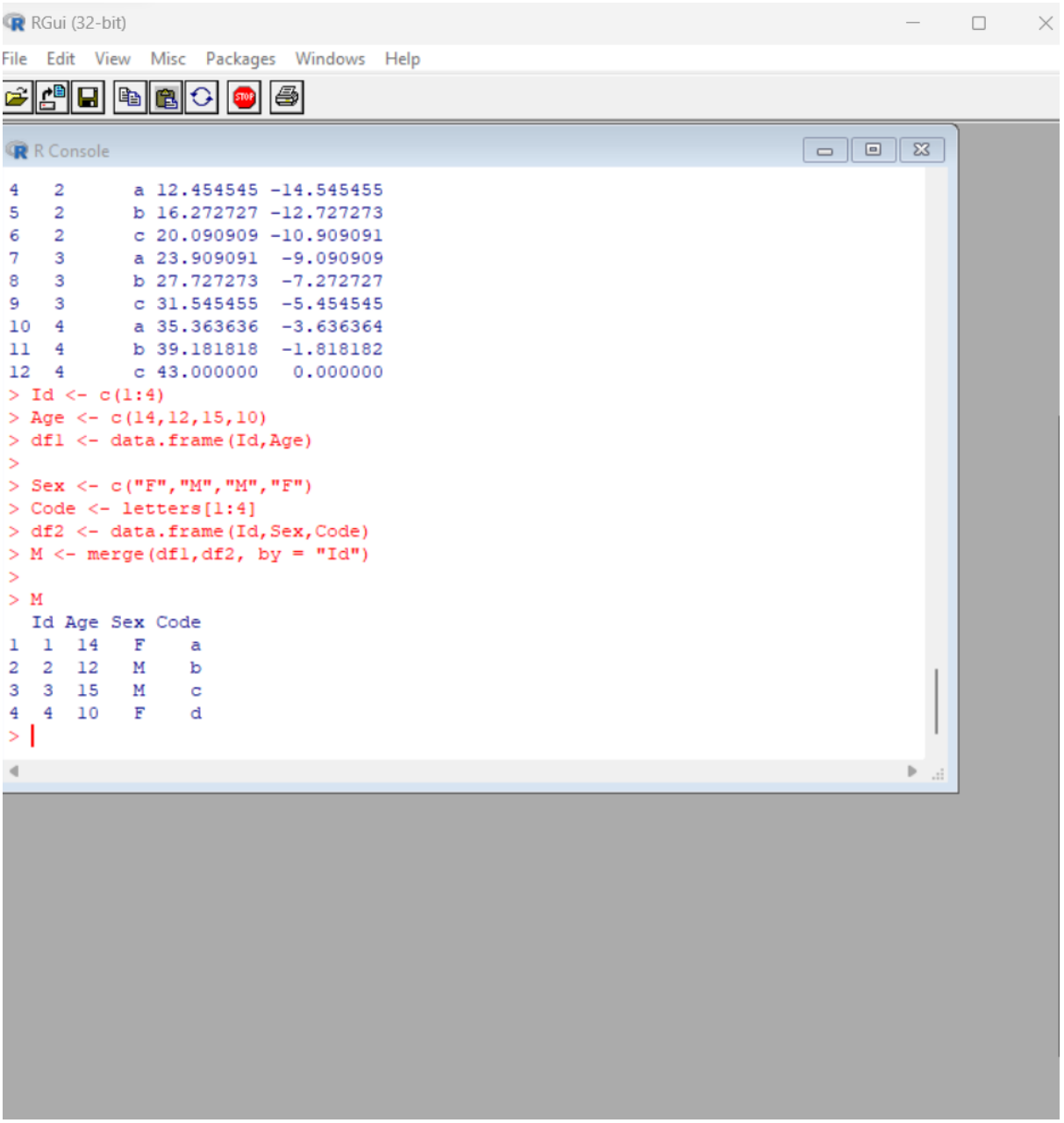
>

> Sex <- c("F","M","M","F")

> Code <- letters[1:4]

> df2 <- data.frame(Id,Sex,Code)

```
> M <- merge(df1,df2, by = "Id")

>

> M

  Id Age Sex Code

1  1  14   F    a

2  2  12   M    b

3  3  15   M    c

4  4  10   F    d
```



Exercise 4

Create a data frame df3:

> df3 id2
score 1 4
100
2 3 98
3 2 94
4 1 99

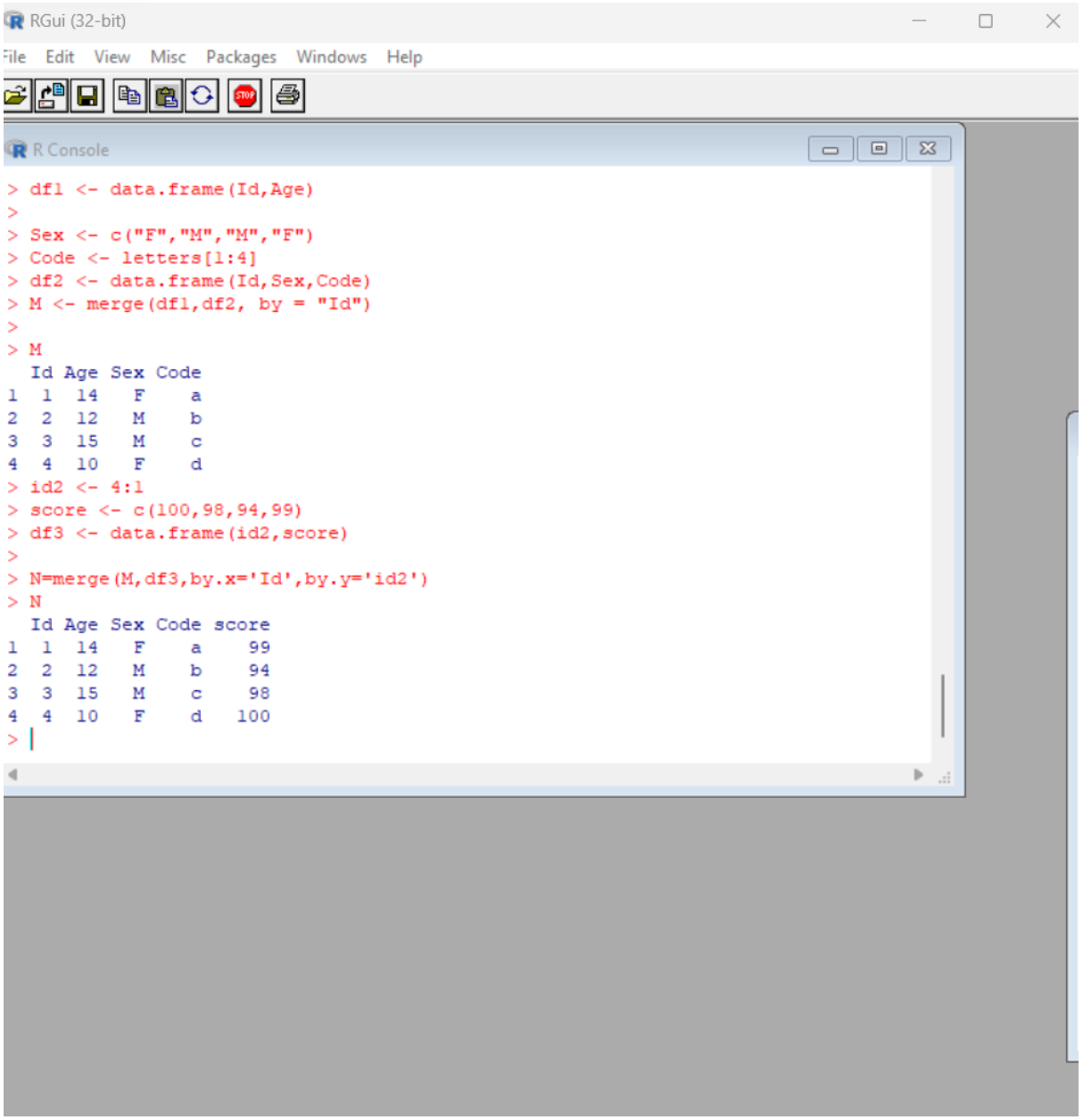
From M (used in Exercise-3) and df3 create N:

Id Age Sex Code score
1 1 14 F a 99
2 2 12 M b 94
3 3 15 M c 98 4 4 10 F d 100

CODE :

```
id2 <- 4:1

> score <- c(100,98,94,99)

> df3 <- data.frame(id2,score)

>

> N=merge(M,df3,by.x='Id',by.y='id2')

> N
```

```
  Id Age Sex Code score
1  1  14   F    a    99
2  2  12   M    b    94
3  3  15   M    c    98
4  4  10   F    d   100
```



Exercise 5

Consider the previous one data frame N:

1) Remove the variables Sex and Code

2) From N, create a data frame:

values ind

1 1 Id
2 2 Id
3 3 Id
4 4 Id
5 14 Age

6 12 Age
7 15 Age
8 10 Age
9 99 score
10 94 score
11 98 score
12 100 score

CODE :

```
> N[,c("Sex")]=NULL

> N[,c("Code")]=NULL

> stack(N)

   values   ind

1       1    Id

2       2    Id

3       3    Id

4       4    Id

5      14   Age

6      12   Age

7      15   Age

8      10   Age

9      99 score

10     94 score

11     98 score
```

12 100 score

> N

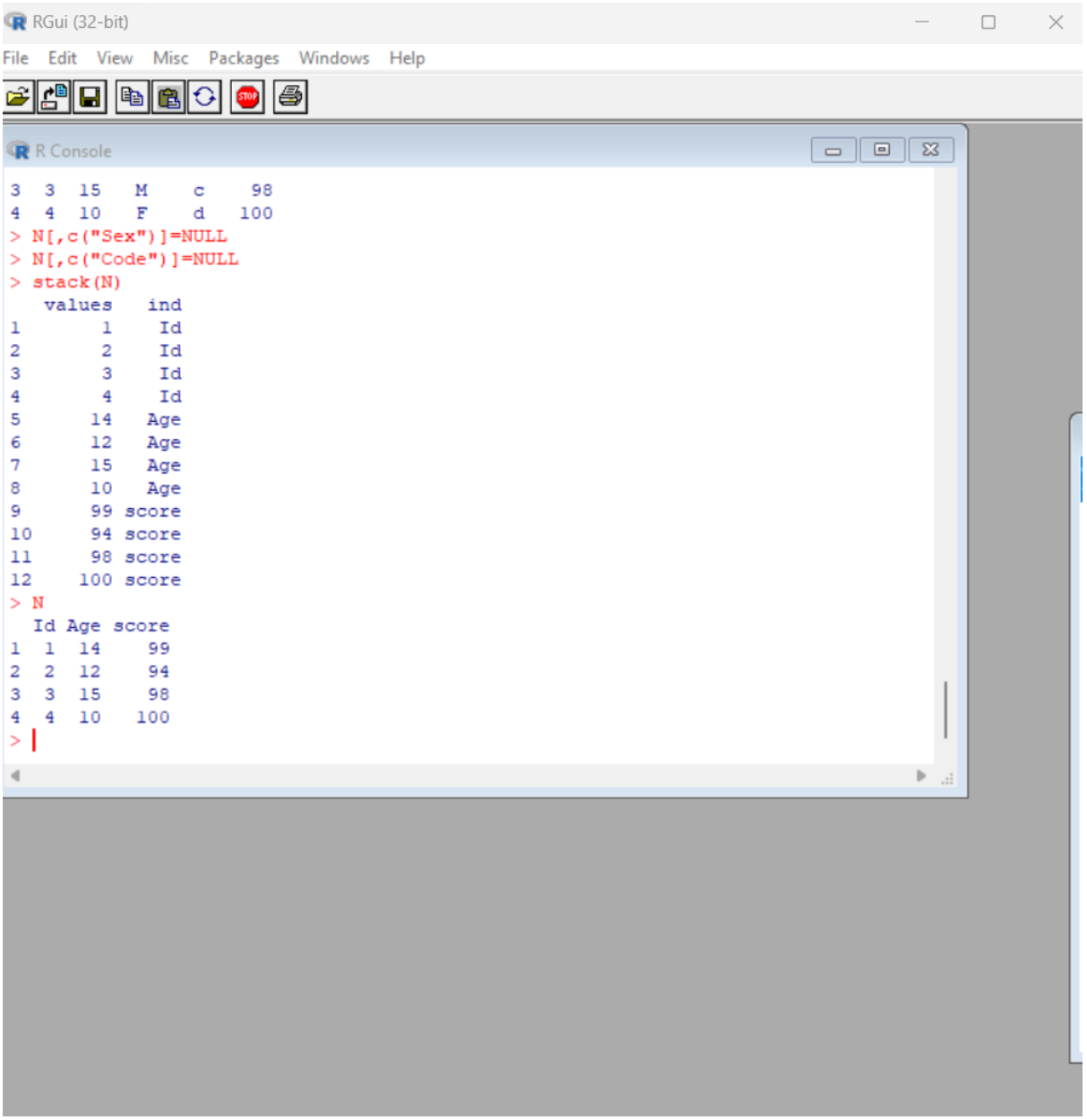
  Id Age score

1 1 14 99

2 2 12 94

3 3 15 98

4 4 10 100



Exercise 6

For this exercise, we'll use the (built-in) dataset trees.

a) Make sure the object is a data frame, if not change it to a data frame.

b) Create a new data frame A:

>A

Girth Height Volume

mean_tree 13.24839 76 30.17097

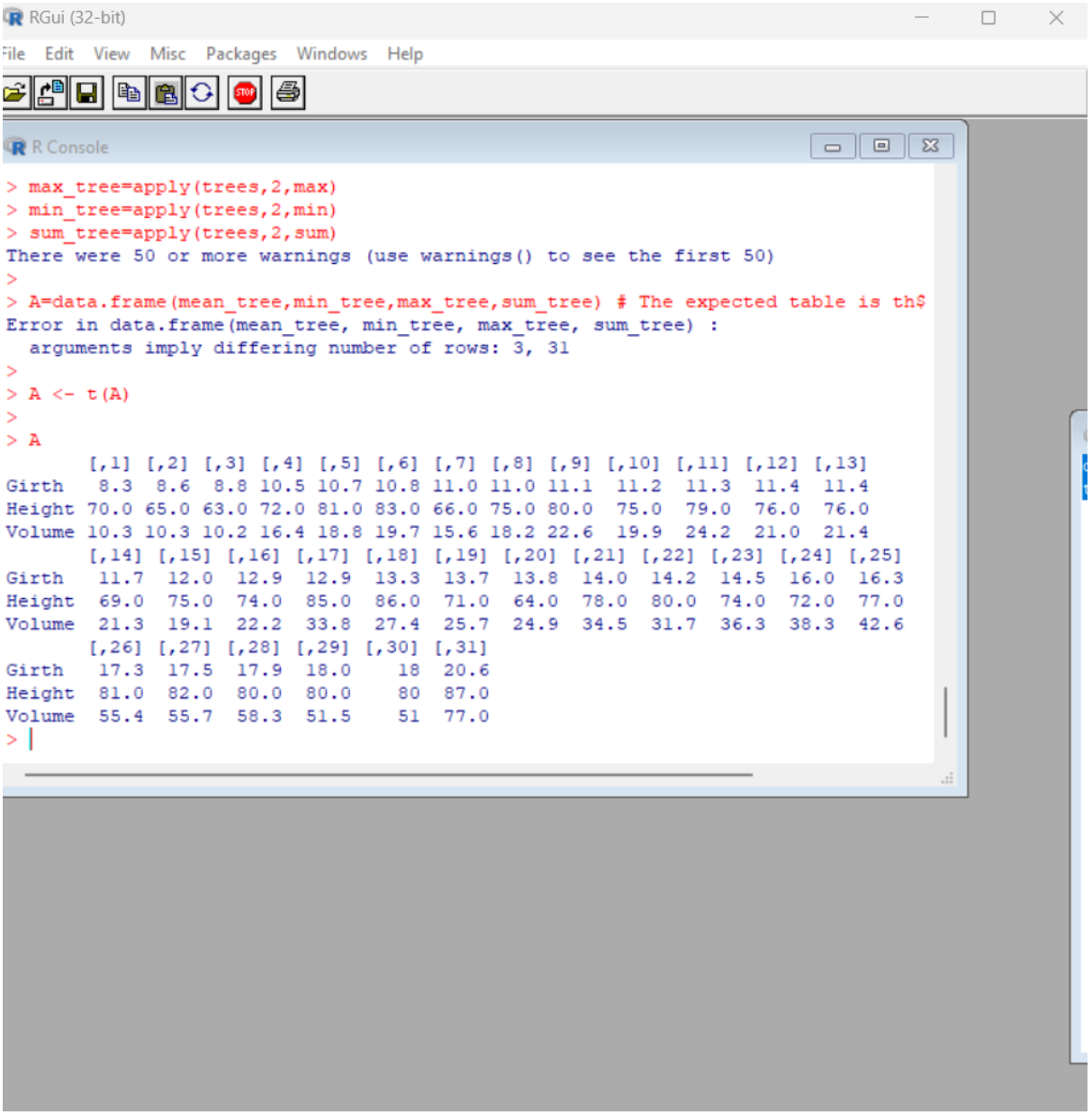
min_tree 8.30000 63 10.20000

max_tree 20.60000 87 77.00000

sum_tree 410.70000 2356 935.30000

> A <- trees

```
> mean_tree=apply(trees,2,mean)
> max_tree=apply(trees,2,max)
> min_tree=apply(trees,2,min)
> sum_tree=apply(trees,2,sum)
There were 50 or more warnings (use warnings() to see the first 50)
>
> A=data.frame(mean_tree,min_tree,max_tree,sum_tree) # The expected table is the
transpose of A.
Error in data.frame(mean_tree, min_tree, max_tree, sum_tree) :
  arguments imply differing number of rows: 3, 31
>
> A <- t(A)
>
> A
       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
Girth   8.3  8.6  8.8 10.5 10.7 10.8 11.0 11.0 11.1  11.2  11.3  11.4  11.4
Height 70.0 65.0 63.0 72.0 81.0 83.0 66.0 75.0 80.0  75.0  79.0  76.0  76.0
Volume 10.3 10.3 10.2 16.4 18.8 19.7 15.6 18.2 22.6  19.9  24.2  21.0  21.4
       [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
Girth   11.7  12.0  12.9  12.9  13.3  13.7  13.8  14.0  14.2  14.5  16.0  16.3
Height  69.0  75.0  74.0  85.0  86.0  71.0  64.0  78.0  80.0  74.0  72.0  77.0
Volume  21.3  19.1  22.2  33.8  27.4  25.7  24.9  34.5  31.7  36.3  38.3  42.6
       [,26] [,27] [,28] [,29] [,30] [,31]
Girth   17.3  17.5  17.9  18.0    18  20.6
Height  81.0  82.0  80.0  80.0    80  87.0
Volume  55.4  55.7  58.3  51.5    51  77.0
>
```



Exercise 7

Consider the data frame A:

1)Order the entire data frame by the first column.

2)Rename the row names as follows: mean, min, max, tree

> A[order(A[,1]),]

[,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]

Girth 8.3 8.6 8.8 10.5 10.7 10.8 11.0 11.0 11.1 11.2 11.3 11.4 11.4

Volume 10.3 10.3 10.2 16.4 18.8 19.7 15.6 18.2 22.6 19.9 24.2 21.0 21.4

```
Height 70.0 65.0 63.0 72.0 81.0 83.0 66.0 75.0 80.0  75.0  79.0  76.0  76.0
      [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
Girth   11.7  12.0  12.9  12.9  13.3  13.7  13.8  14.0  14.2  14.5  16.0  16.3
Volume  21.3  19.1  22.2  33.8  27.4  25.7  24.9  34.5  31.7  36.3  38.3  42.6
Height  69.0  75.0  74.0  85.0  86.0  71.0  64.0  78.0  80.0  74.0  72.0  77.0
      [,26] [,27] [,28] [,29] [,30] [,31]
Girth   17.3  17.5  17.9  18.0    18  20.6
Volume  55.4  55.7  58.3  51.5    51  77.0
Height  81.0  82.0  80.0  80.0    80  87.0
> row.names(A)
[1] "Girth"  "Height" "Volume"
> row.names(A) <- c("mean","min","max","tree")
Error in dimnames(x) <- dn :
  length of 'dimnames' [1] not equal to array extent
>
> row.names(A) <- c("mean","min","max")
> a
Error: object 'a' not found
> A
     [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13] [,14]
```

mean 8.3 8.6 8.8 10.5 10.7 10.8 11.0 11.0 11.1 11.2 11.3 11.4 11.4 11.7

min 70.0 65.0 63.0 72.0 81.0 83.0 66.0 75.0 80.0 75.0 79.0 76.0 76.0 69.0

max 10.3 10.3 10.2 16.4 18.8 19.7 15.6 18.2 22.6 19.9 24.2 21.0 21.4 21.3

    [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25] [,26]

mean 12.0 12.9 12.9 13.3 13.7 13.8 14.0 14.2 14.5 16.0 16.3 17.3

min   75.0 74.0 85.0 86.0 71.0 64.0 78.0 80.0 74.0 72.0 77.0 81.0

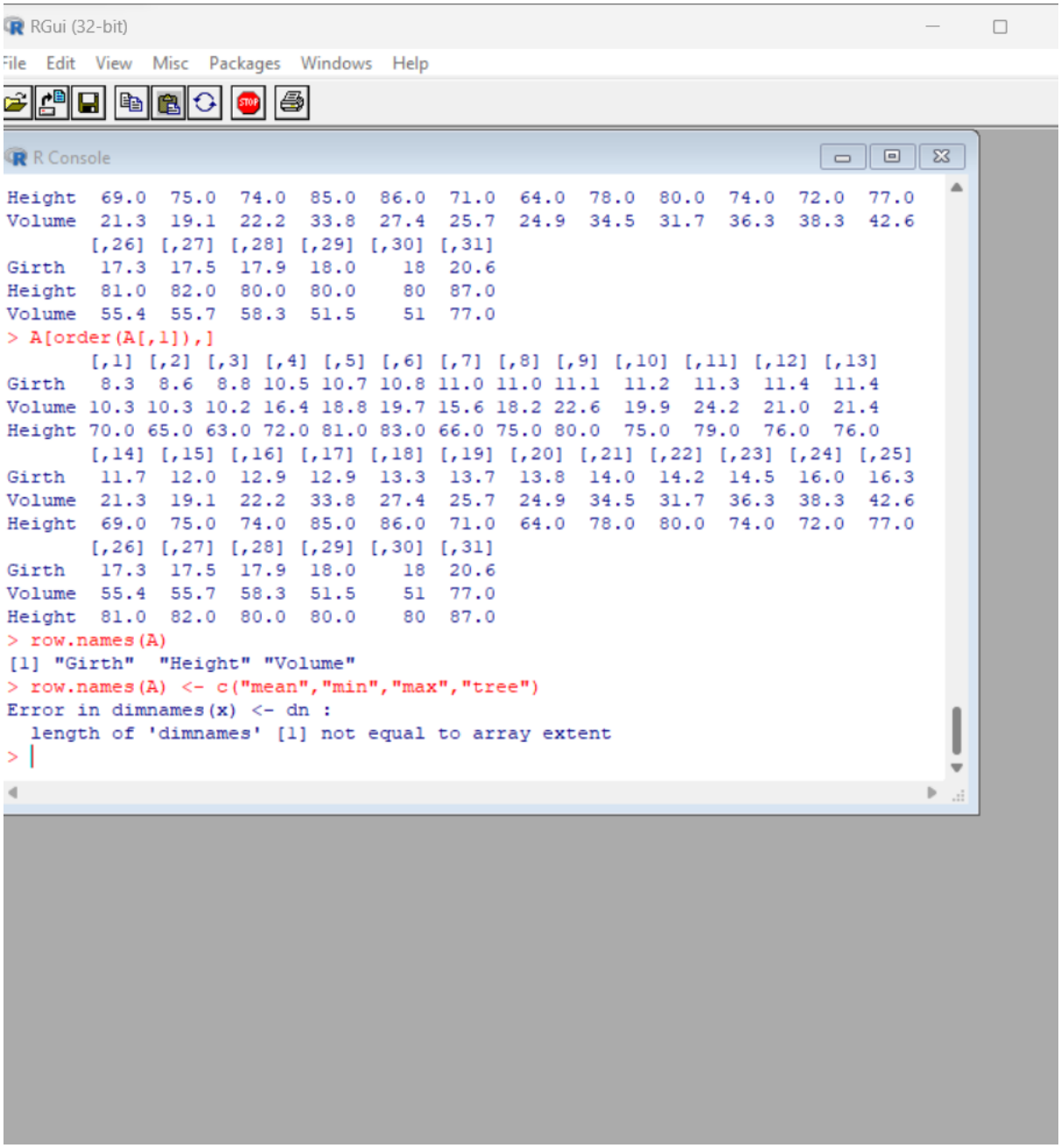
max   19.1 22.2 33.8 27.4 25.7 24.9 34.5 31.7 36.3 38.3 42.6 55.4

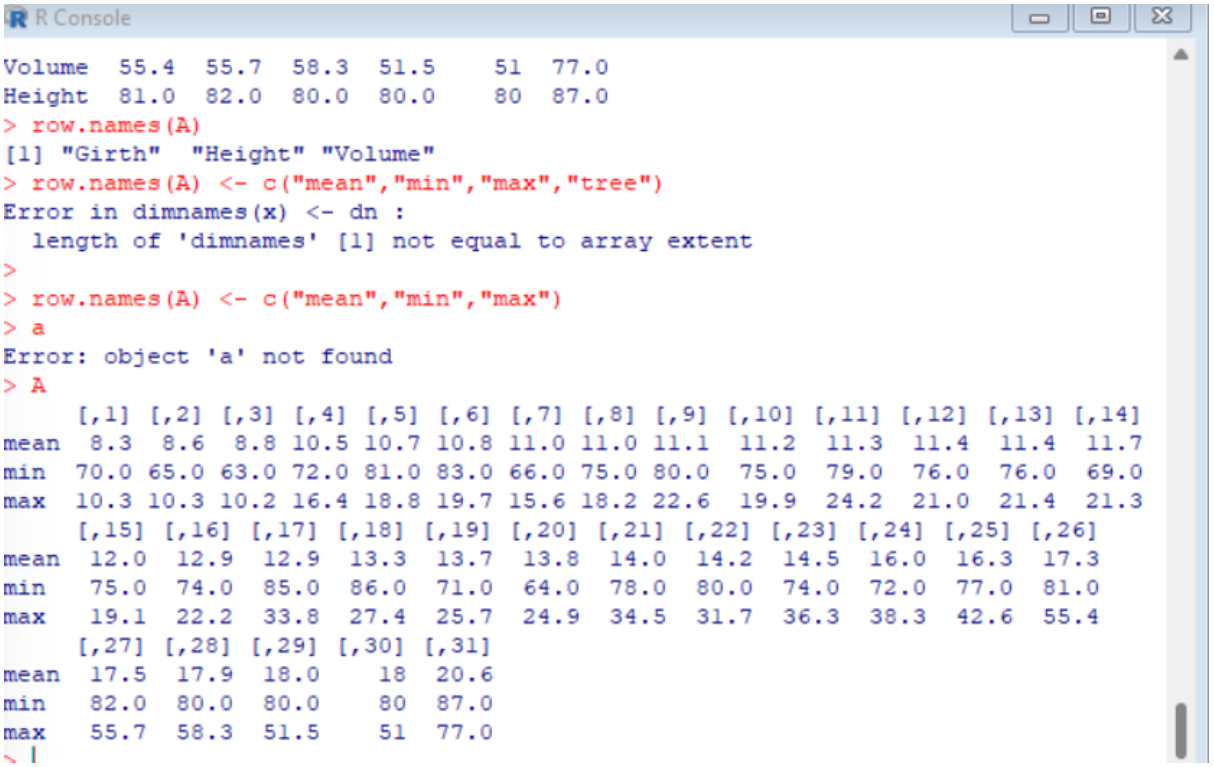
    [,27] [,28] [,29] [,30] [,31]

mean 17.5 17.9 18.0   18 20.6

min   82.0 80.0 80.0   80 87.0

max   55.7 58.3 51.5   51 77.0


RGui (32-bit)
File Edit View Misc Packages Windows Help
R Console
Height 69.0 75.0 74.0 85.0 86.0 71.0 64.0 78.0 80.0 74.0 72.0 77.0
Volume 21.3 19.1 22.2 33.8 27.4 25.7 24.9 34.5 31.7 36.3 38.3 42.6
[,26] [,27] [,28] [,29] [,30] [,31]
Girth 17.3 17.5 17.9 18.0 18 20.6
Height 81.0 82.0 80.0 80.0 80 87.0
Volume 55.4 55.7 58.3 51.5 51 77.0
> A[order(A[,1]),]
[,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
Girth 8.3 8.6 8.8 10.5 10.7 10.8 11.0 11.0 11.1 11.2 11.3 11.4 11.4
Volume 10.3 10.3 10.2 16.4 18.8 19.7 15.6 18.2 22.6 19.9 24.2 21.0 21.4
Height 70.0 65.0 63.0 72.0 81.0 83.0 66.0 75.0 80.0 75.0 79.0 76.0 76.0
[,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
Girth 11.7 12.0 12.9 12.9 13.3 13.7 13.8 14.0 14.2 14.5 16.0 16.3
Volume 21.3 19.1 22.2 33.8 27.4 25.7 24.9 34.5 31.7 36.3 38.3 42.6
Height 69.0 75.0 74.0 85.0 86.0 71.0 64.0 78.0 80.0 74.0 72.0 77.0
[,26] [,27] [,28] [,29] [,30] [,31]
Girth 17.3 17.5 17.9 18.0 18 20.6
Volume 55.4 55.7 58.3 51.5 51 77.0
Height 81.0 82.0 80.0 80.0 80 87.0
> row.names(A)
[1] "Girth" "Height" "Volume"
> row.names(A) <- c("mean","min","max","tree")
Error in dimnames(x) <- dn :
length of 'dimnames' [1] not equal to array extent
>



Exercise 8

Create an empty data frame with column types:

>df

IntsLogicals Doubles Characters

(or 0-length row.names)

> df <- data.frame(Ints=integer(),

Logicals=logical(),Doubles=double(),Characters=character())

> df

```
> df <- data.frame(Ints=integer(), Logicals=logical(),Doubles=double(),Characte$
> df
[1] Ints       Logicals   Doubles    Characters
<0 rows> (or 0-length row.names)
>
```

Exercise 9

Create a data frame XY

X=c(1,2,3,1,4,5,2)

Y=c(0,3,2,0,5,9,3)

> XY

X Y

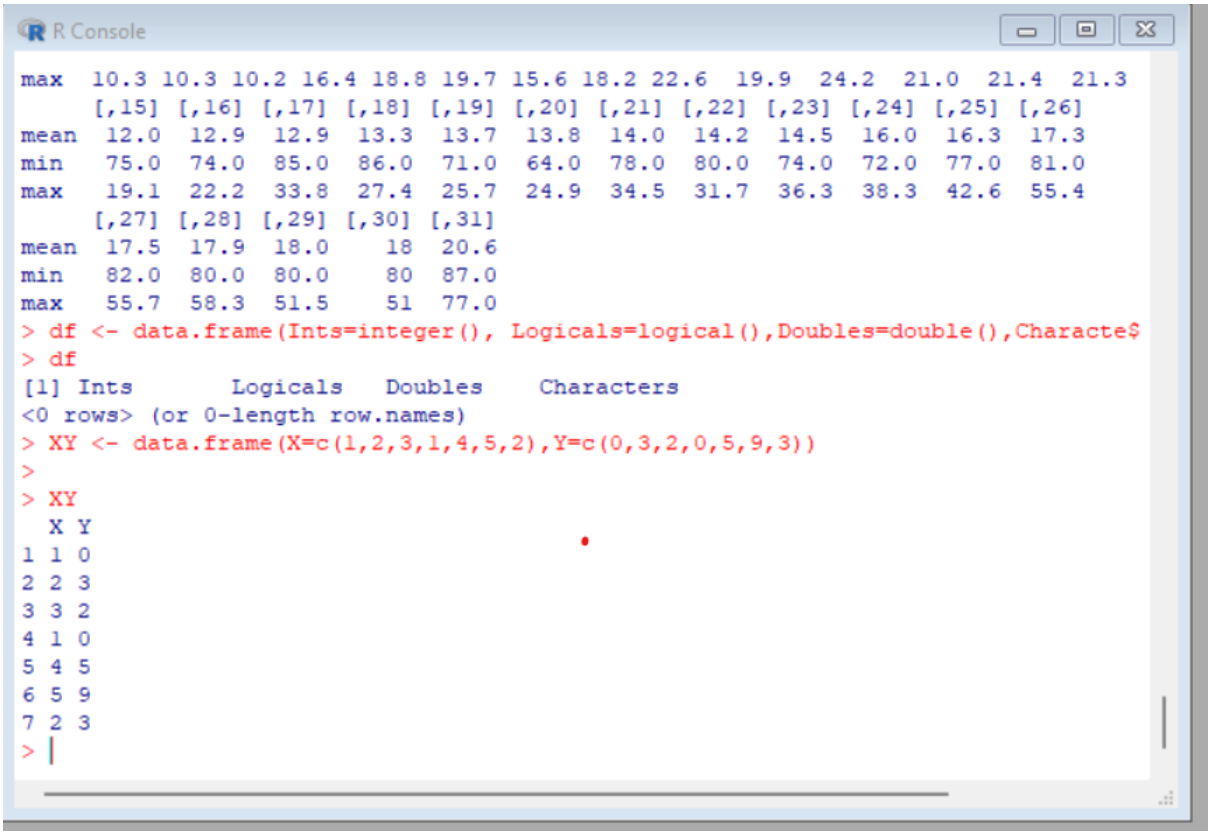
1 1 0

2 2 3

3 3 2
4 1 0
5 4 5
6 5 9
7 2 3

1) look at duplicated elements using a provided R function.
2) keep only the unique lines on XY using a provided R function.

```
> XY <- data.frame(X=c(1,2,3,1,4,5,2),Y=c(0,3,2,0,5,9,3))

>

> XY

  X Y

1 1 0

2 2 3

3 3 2

4 1 0

5 4 5

6 5 9

7 2 3
```



> duplicated(XY)

[1] FALSE FALSE FALSE TRUE FALSE FALSE TRUE

unique(XY)

X Y

1 1 0

2 2 3

3 3 2

5 4 5

6 5 9

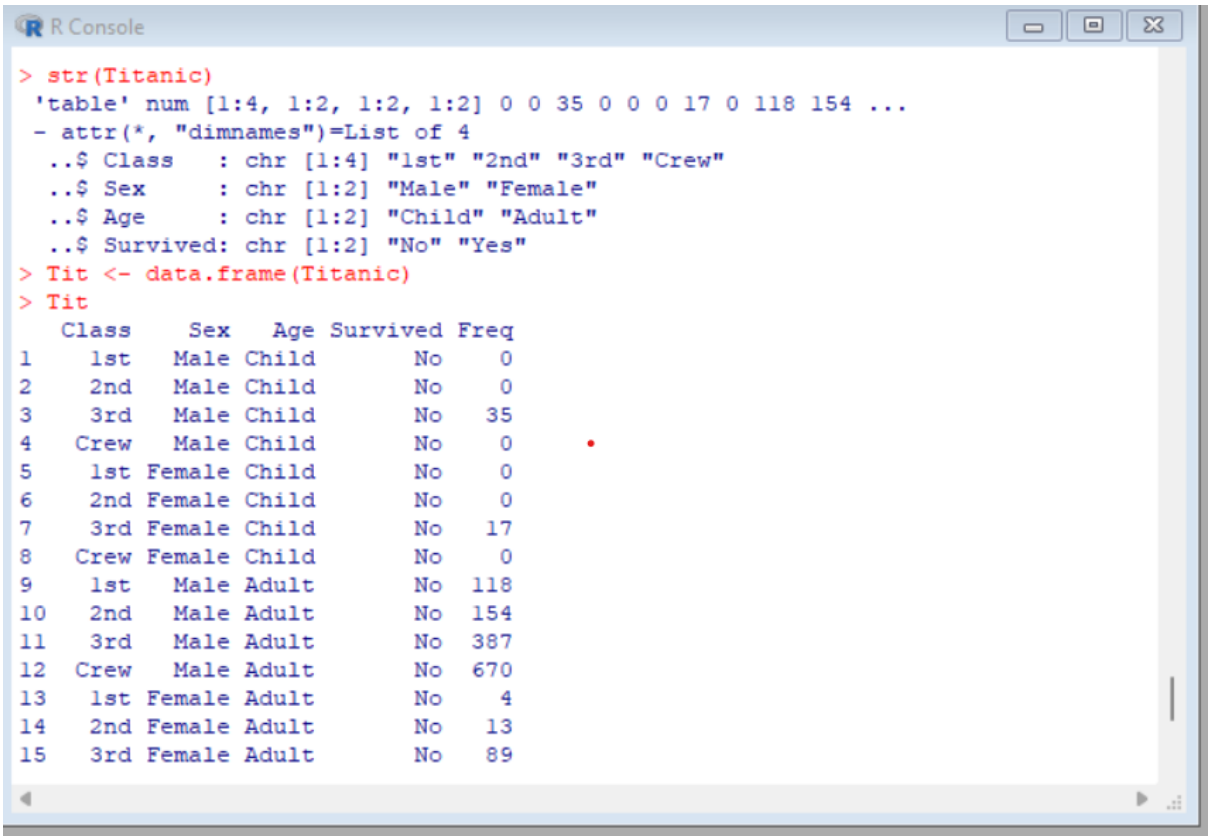
Exercise 10

Use the (built-in) dataset Titanic.

a) Make sure the object is a data frame, if not change it to a data frame.

```
> str(Titanic)
 'table' num [1:4, 1:2, 1:2, 1:2] 0 0 35 0 0 0 17 0 118 154 ...
 - attr(*, "dimnames")=List of 4
  ..$ Class   : chr [1:4] "1st" "2nd" "3rd" "Crew"
  ..$ Sex     : chr [1:2] "Male" "Female"
  ..$ Age     : chr [1:2] "Child" "Adult"
  ..$ Survived: chr [1:2] "No" "Yes"
> Tit <- data.frame(Titanic)
> Tit
   Class    Sex   Age Survived Freq
1    1st   Male Child       No    0
2    2nd   Male Child       No    0
3    3rd   Male Child       No   35
4   Crew   Male Child       No    0
5    1st Female Child       No    0
6    2nd Female Child       No    0
7    3rd Female Child       No   17
8   Crew Female Child       No    0
9    1st   Male Adult       No  118
10   2nd   Male Adult       No  154
11   3rd   Male Adult       No  387
12  Crew   Male Adult       No  670
13   1st Female Adult       No    4
14   2nd Female Adult       No   13
15   3rd Female Adult       No   89
16  Crew Female Adult       No    3
17   1st   Male Child      Yes    5
18   2nd   Male Child      Yes   11
19   3rd   Male Child      Yes   13
20  Crew   Male Child      Yes    0
21   1st Female Child      Yes    1
22   2nd Female Child      Yes   13
23   3rd Female Child      Yes   14
24  Crew Female Child      Yes    0
25   1st   Male Adult      Yes   57
26   2nd   Male Adult      Yes   14
27   3rd   Male Adult      Yes   75
28  Crew   Male Adult      Yes  192
29   1st Female Adult      Yes  140
30   2nd Female Adult      Yes   80
31   3rd Female Adult      Yes   76
```

32 Crew Female Adult Yes 20



b) Define a data frame with value 1st in Class variable, and value NO in Survived variable and variables Sex, Age and Freq.

Sex Age Freq
1 Male Child 0
5 Female Child 0
9 Male Adult 118
13 Female Adult 4

> df <- subset(Tit, subset = Class=='1st' & Survived=='No',select=c(Sex,Age,Freq))

>

> df

Sex Age Freq

1 Male Child 0

5 Female Child 0

9 Male Adult 118

13 Female Adult 4

```
> df <- subset(Tit, subset = Class=='1st' & Survived=='No',select=c(Sex,Age,Fre$
>
> df
      Sex   Age Freq
1    Male Child    0
5  Female Child    0
9    Male Adult  118
13 Female Adult    4
> |
```

MERGING DATAFRAMES

Exercise 11 a)

Create the following dataframes to merge:

buildings<- data.frame(location=c(1, 2, 3), name=c("building1", "building2","building3"))

data <-
data.frame(survey=c(1,1,1,2,2,2),location=c(1,2,3,2,3,1),efficiency=c(51,64,70,7,80,58))

The dataframes, *buildings*and *data*have a common key variable called, “location”.

Use the merge() function to merge the two dataframes by “location”, into a new dataframe,“buildingStats”.

> buildings <- data.frame(location=c(1, 2, 3), name=c("building1", "building2", "building3"))

> data <- data.frame(survey=c(1,1,1,2,2,2), location=c(1,2,3,2,3,1),

+

+ efficiency=c(51,64,70,71,80,58))

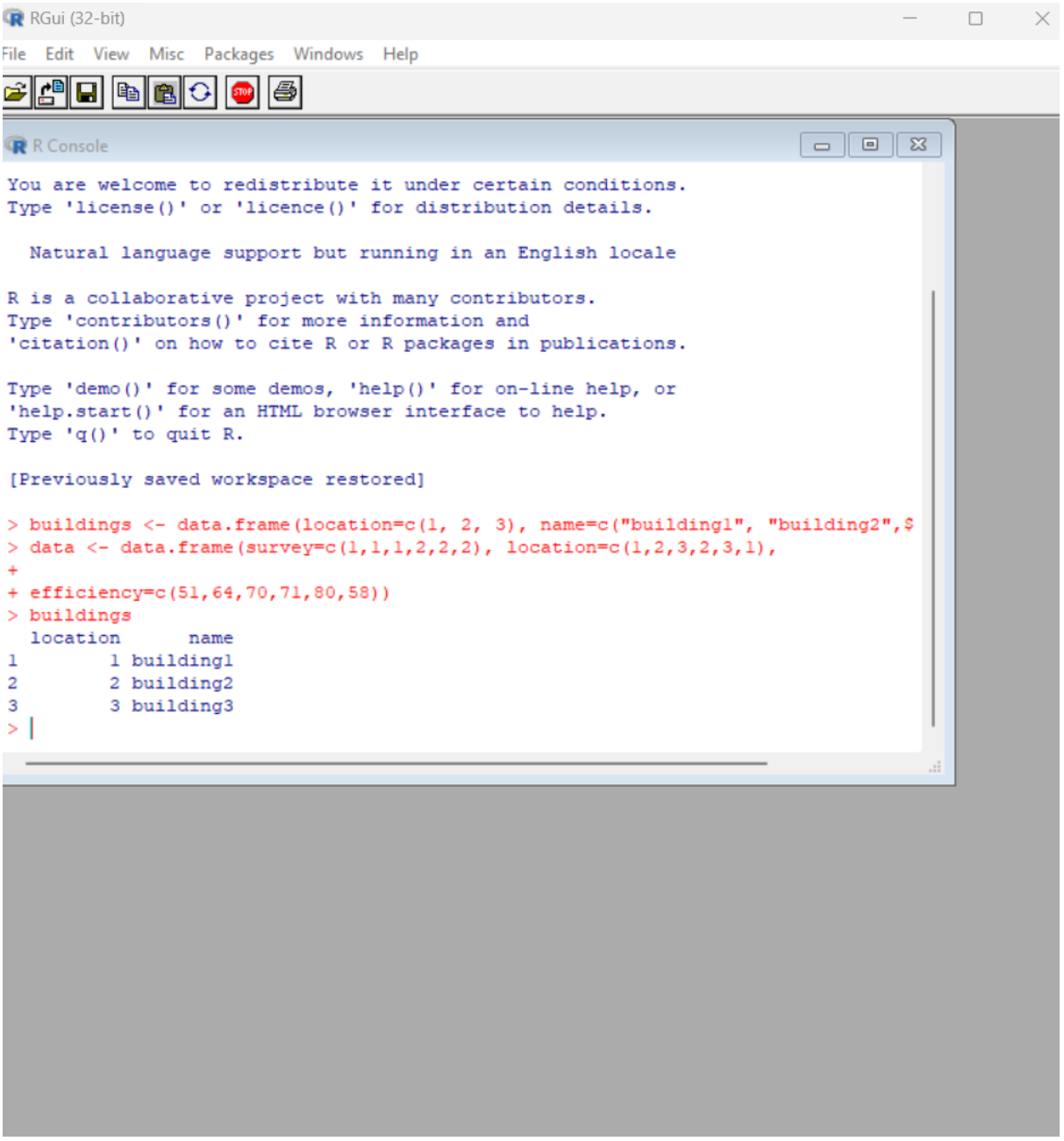
> buildings

location name

1 1 building1

2 2 building2

3 3 building3



Exercise 11 b)

Give the dataframes different key variable names:

buildings<- data.frame(location=c(1, 2, 3), name=c("building1","building2", "building3"))

data <- data.frame(survey=c(1,1,1,2,2,2), LocationID=c(1,2,3,2,3,1),

efficiency=c(51,64,70,71,80,58))

The dataframes, buildings and data have corresponding variables called, location, and LocationID. Use the merge() function to merge the columns of the two dataframes by the corresponding variables.

> buildings <- data.frame(location=c(1, 2, 3), name=c("building1", "building2", "building3"))

```
>

> data <- data.frame(survey=c(1,1,1,2,2,2), LocationID=c(1,2,3,2,3,1),

+

+ efficiency=c(51,64,70,71,80,58))

> buildings

  location      name

1        1 building1

2        2 building2

3        3 building3
```

DIFFERENT TYPES OF MERGE IN R

Exercise 12a)InnerJoin:

The R merge() function automatically joins the frames by common variable names. In that case, demonstrate how you would perform the merge in **Exercise 11a** without specifying the key variable.

Exercise 12b)OuterJoin:

Merge the two dataframes from **Exercise 11a**. Use the "all=" parameter in the merge() function to return all records from both tables. Also, merge with the key variable, "location".

Exercise 12c)Left Join:

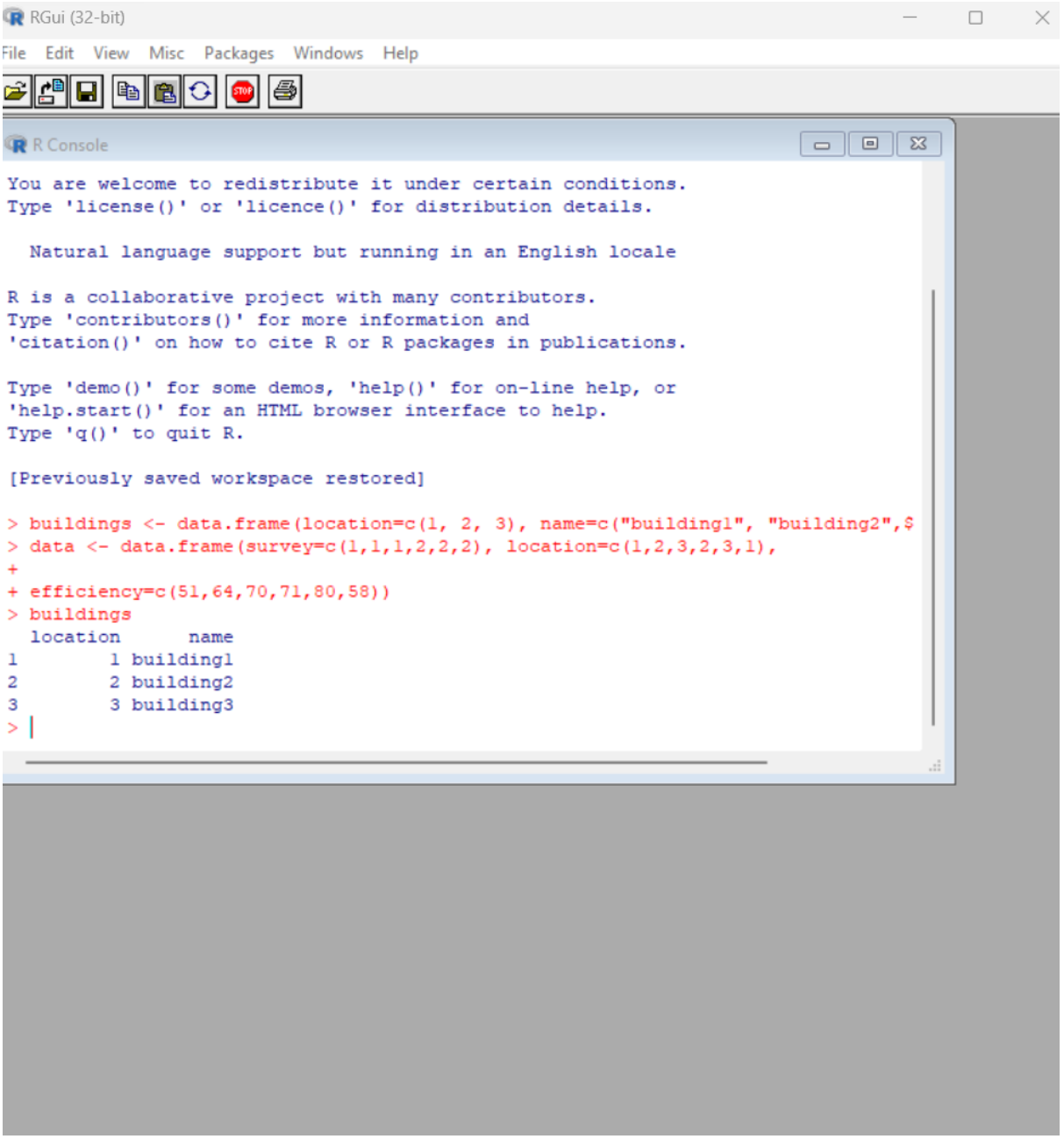
Merge the two dataframes from **Exercise 11a**, and return all rows from the left table. Specify the matching key from **Exercise 11a.**

Exercise 12d)Right Join:

Merge the two dataframes from **Exercise 11a,** and return all rows from the right table. Use the matching key from **Exercise 11a** to return matching rows from the left table.

Exercise 12e)Cross Join:

Merge the two dataframes from **Exercise 11a**, into a "Cross Join" with each row of "buildings" matched to each row of "data". What new column names are created in "buildingStats"?



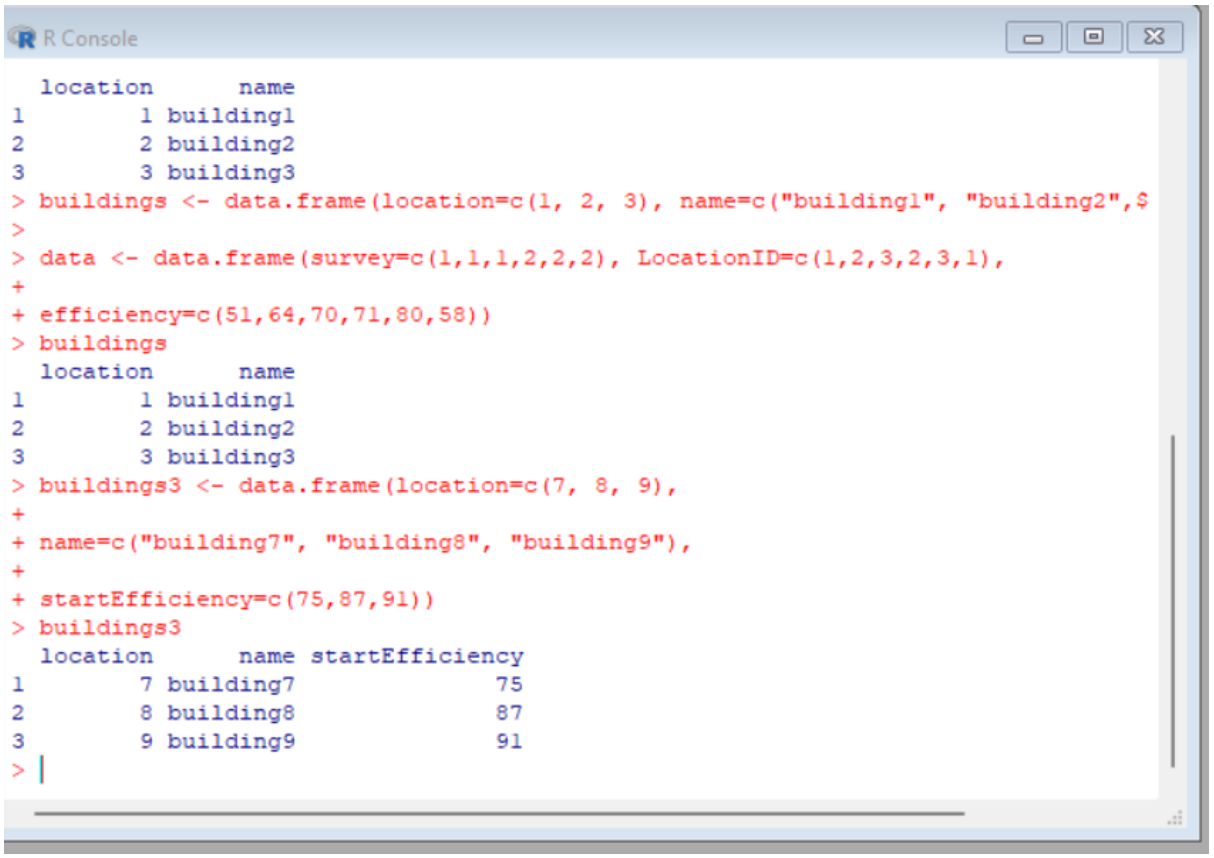
Exercise 13MergingDataframe rows:

To join two data frames (datasets) vertically, use the rbind function. The two data frames must have the same variables, but they do not have to be in the same order.

Merge the rows of the following two dataframes:

buildings<- data.frame(location=c(1, 2, 3), name=c("building1",
"building2", "building3"))
buildings2 <- data.frame(location=c(5, 4, 6), name=c("building5", "building4", "building6"))

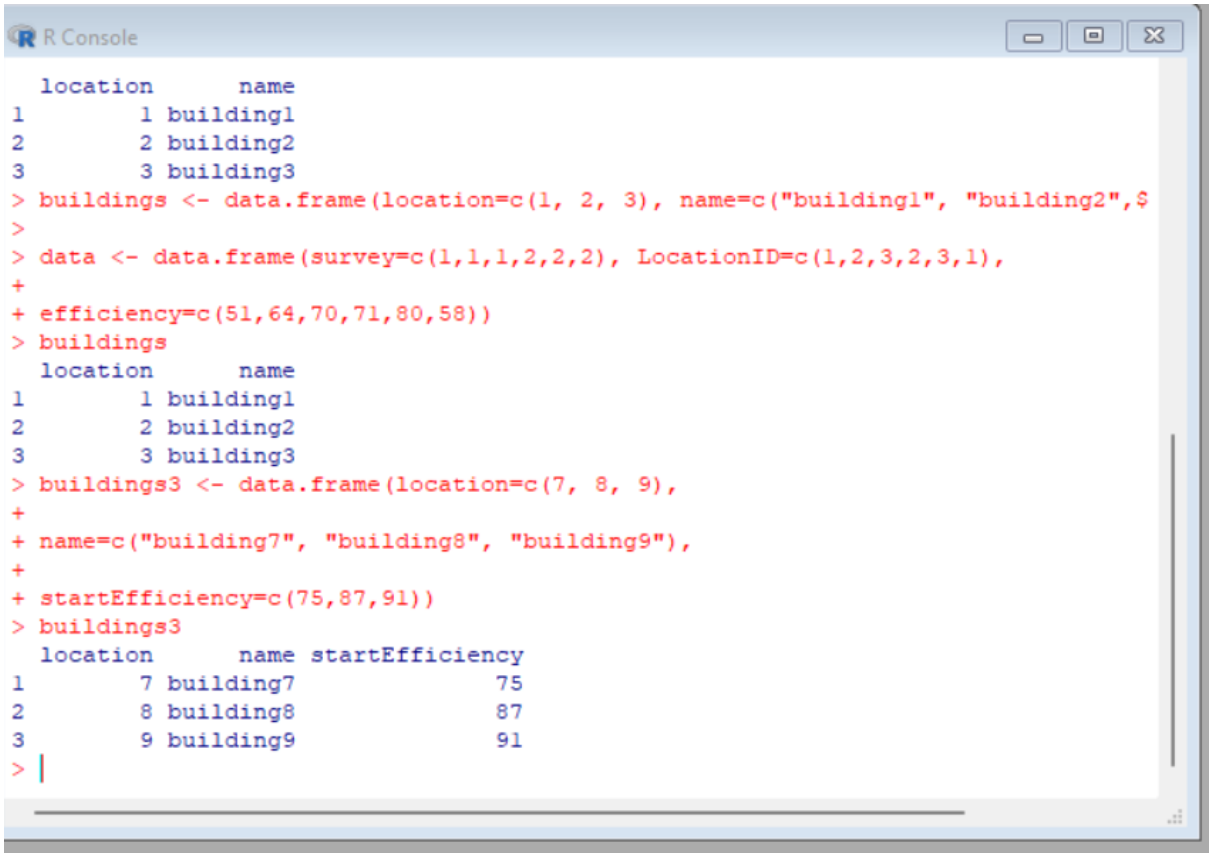
Also, specify the new dataframe as, “allBuidings”.



Exercise 14
Create a new dataframe, buildings3, that has variables not found in the previous dataframes.

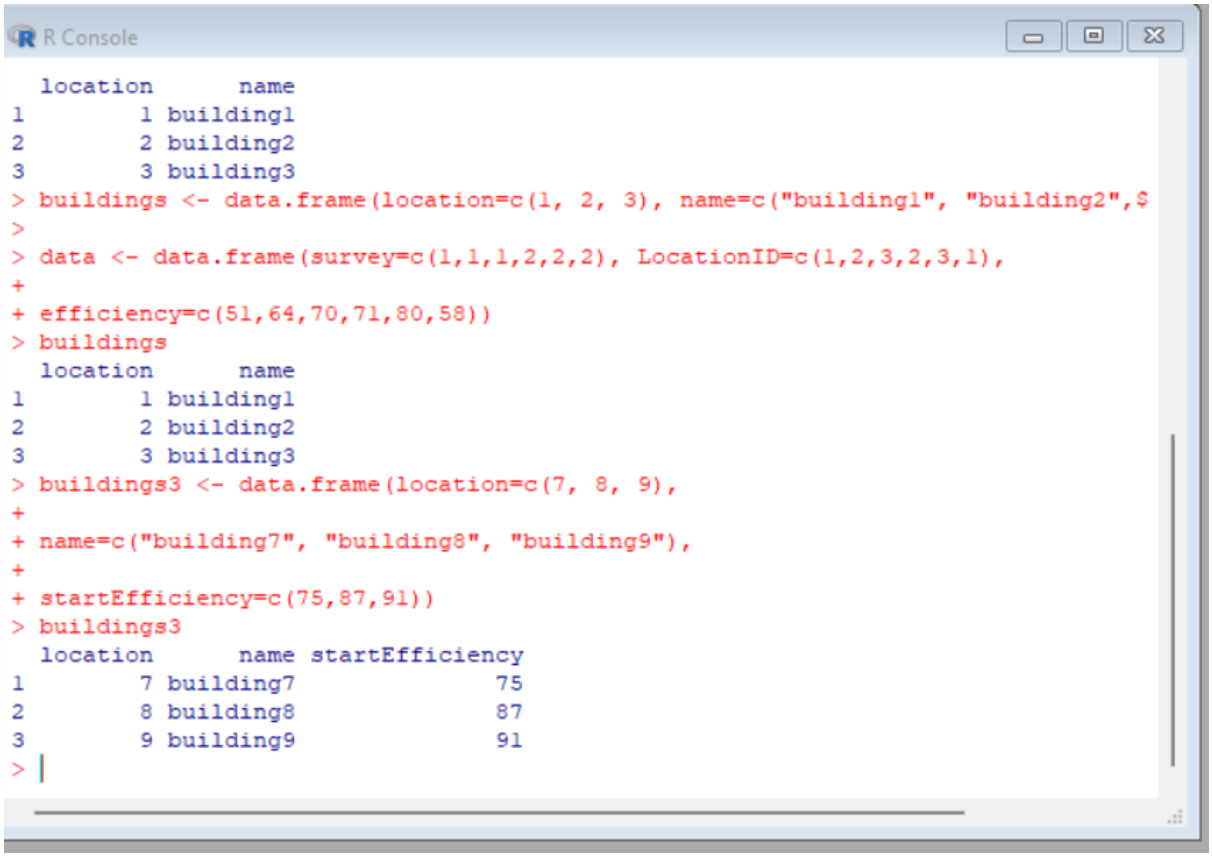
buildings3 <- data.frame(location=c(7, 8, 9), name=c("building7", "building8", "building9"),
startEfficiency=c(75,87,91))

Create a new buildings3 without the extra variables.



Exercise 15

Instead of deleting the extra variables from $_{buildings3}$. append the buildings, and buildings2 with the new variable in buildings3, **(from Exercise 14).** Set the new data in $_{buildings}$ and $_{buildings2}$, (**from Exercise 13)**, to NA.



RESHAPE FUNCTION IN R

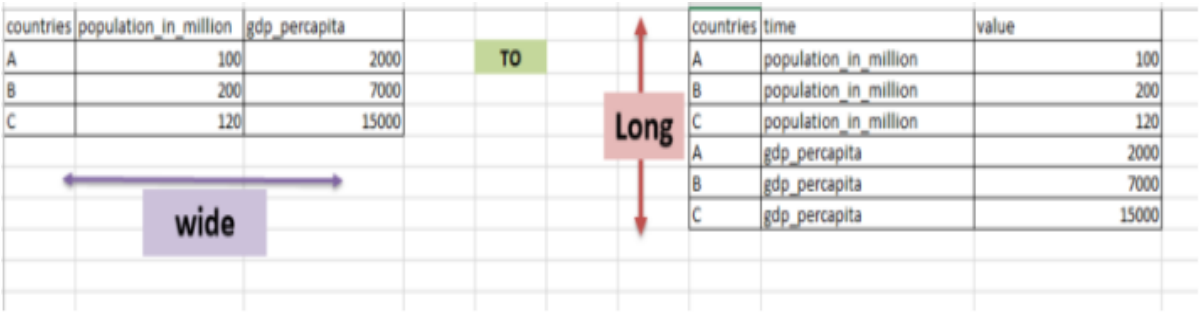
Exercise: 16

Construct the following data frame 'country'.

	countries	value.population_in_million	value.gdp_percapita
1	A	100	2000
2	B	200	7000
3	C	120	15000

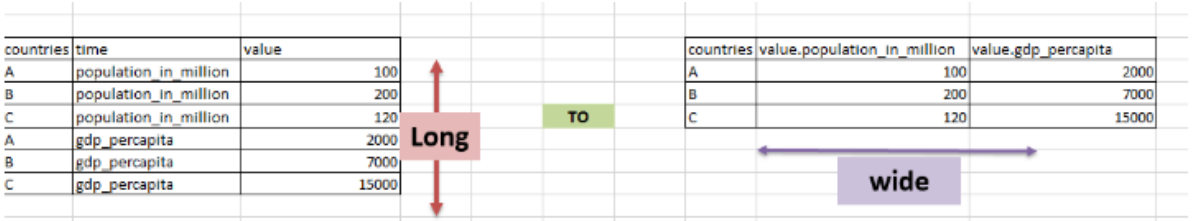
a) Reshape in R from wide to long:

Reshape the above data frame from wide to long format in R.



- data frame "country" is passed to reshape function
- idvar is the variable which need to be left unaltered which is "countries"
- varying are the ones that needs to converted from wide to long
- v.names are the values that should be against the times in the resultant data frame.
- new.row.names is used to assign row names to the resultant dataset
- direction is, to which format the data needs to be transformed

b) Reshape in R from long to wide:



- data (country_w_to_L) which is in long format, is passed to reshape function
- idvar is the variable which need to be left unaltered, which is "countries"
- timevar are the variables that needs to converted to wide format
- v.names are the value variable
- direction is, to which format the data needs to be transformed

7. MELTING AND CASTING IN R

Exercises 17 :

1. Melt airquality data set and display as a long – format data ?
2. Melt airquality data and specify month and day to be "ID variables" ?
3. Cast the molten airquality data set .

4. Use cast function appropriately and compute the average of Ozone, Solar.R , Wind and temperature per month ?

```
> x = data.frame(subject = c("John", "Mary"),
+                time = c(1,1),
+                age = c(33,NA),
+                weight = c(90, NA),
+                height = c(2,2))
> x
  subject time age weight height
1    John    1  33     90      2
2    Mary    1  NA     NA      2
```

```
x = data.frame(subject = c("John", "Mary"),
               time = c(1,1),
               age = c(33,NA),
               weight = c(90, NA),
               height = c(2,2))
x
subject time age weight height
   John    1  33     90      2
   Mary    1  NA     NA      2
```

5.

8 FILE MANUPULATION IN R

Exercise 18

1. Consider the following data present. Create this file using windows notepad . Save the file as **input.csv** using the save As All files(*.*) option in notepad.

```
id,name,salary,start_date,dept
1,Rick,623.3,2012-01-01,IT
2,Dan,515.2,2013-09-23,Operations
3,Michelle,611,2014-11-15,IT
4,Ryan,729,2014-05-11,HR
5,Gary,843.25,2015-03-27,Finance
6,Nina,578,2013-05-21,IT
7,Simon,632.8,2013-07-30,Operations
8,Guru,722.5,2014-06-17,Finance
```

2. Use appropriate R commands to read **input.csv** file.

3. Analyze the CSV File and compute the following.

a. Get the maximum salary

b. Get the details of the person with max salary

c. Get all the people working in IT department

d. Get the persons in IT department whose salary is greater than 600

e. Get the people who joined on or after 2014

```
  cannot open file 'input.csv': No such file or directory
> print(data)
  survey LocationID efficiency
1      1          1         51
2      1          2         64
3      1          3         70
4      2          2         71
5      2          3         80
6      2          1         58
> data <- read.csv("input.csv")
> print(is.data.frame(data))
[1] TRUE
> print(ncol(data))
[1] 3
> print(nrow(data))
[1] 6
```

4. Get the people who joined on or after 2014 and write the output onto a file called output.csv