Media & Data Science

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Practice with the real-world data

Tidying the new Johns Hopkins Covid-19 time-series datasets

March 23, 2020

By An Accounting and Data Science Nerd's Corner

[This article was first published on **An Accounting and Data Science Nerd's Corner**, and kindly contributed to R-bloggers]. (You can report issue about the content on this page here)

my old blog post about tidying Johns Hopkins CSSE

Download the data for class

Week 2: R Basic Syntax (1)

- Date: 20230309
- Pre-class: Basic syntax, Vector, Array
- Class: Hands-on practice PDF
    - Data in use: COV19_data

Matrix 1: Confirmed cases

	2020-02-01	…	2020-10-01	…	2022-09-01
China	11891	…	90567	…	2510703
Italy					
Japan					
Korea					
Spain					
UK					
US	8	…	7279272	…	94665567

7 rows and 32 columns

Matrix 2: Death cases

	2020-02-01	…	2020-10-01	…	2022-09-01
China	18	…		…	
Italy					
Japan					
Korea					
Spain					
UK					
US	0	…		…	

Access to the matrix

1. UK’s total confirmed cases on 2022-09-01
2. South Korea’s total confirmed cases on 2022-09-01
3. China’s total confirmed cases on 2022-09-01
4. South Korea’s increasing confirmed cases on 2022-09-01 compared to the previous month
5. Japan’s increasing confirmed cases on 2022-09-01 compared to the previous month

Vector 1: GDP

```
country.name<-c("China","Italy","Japan","Korea","Spain","UK","US")
GDP<-c(12237700479375,
1943835376342,
4872415104315,
1530750923149,
1314314164402,
2637866340434,
19485394000000)
names(GDP)<-country.name
```

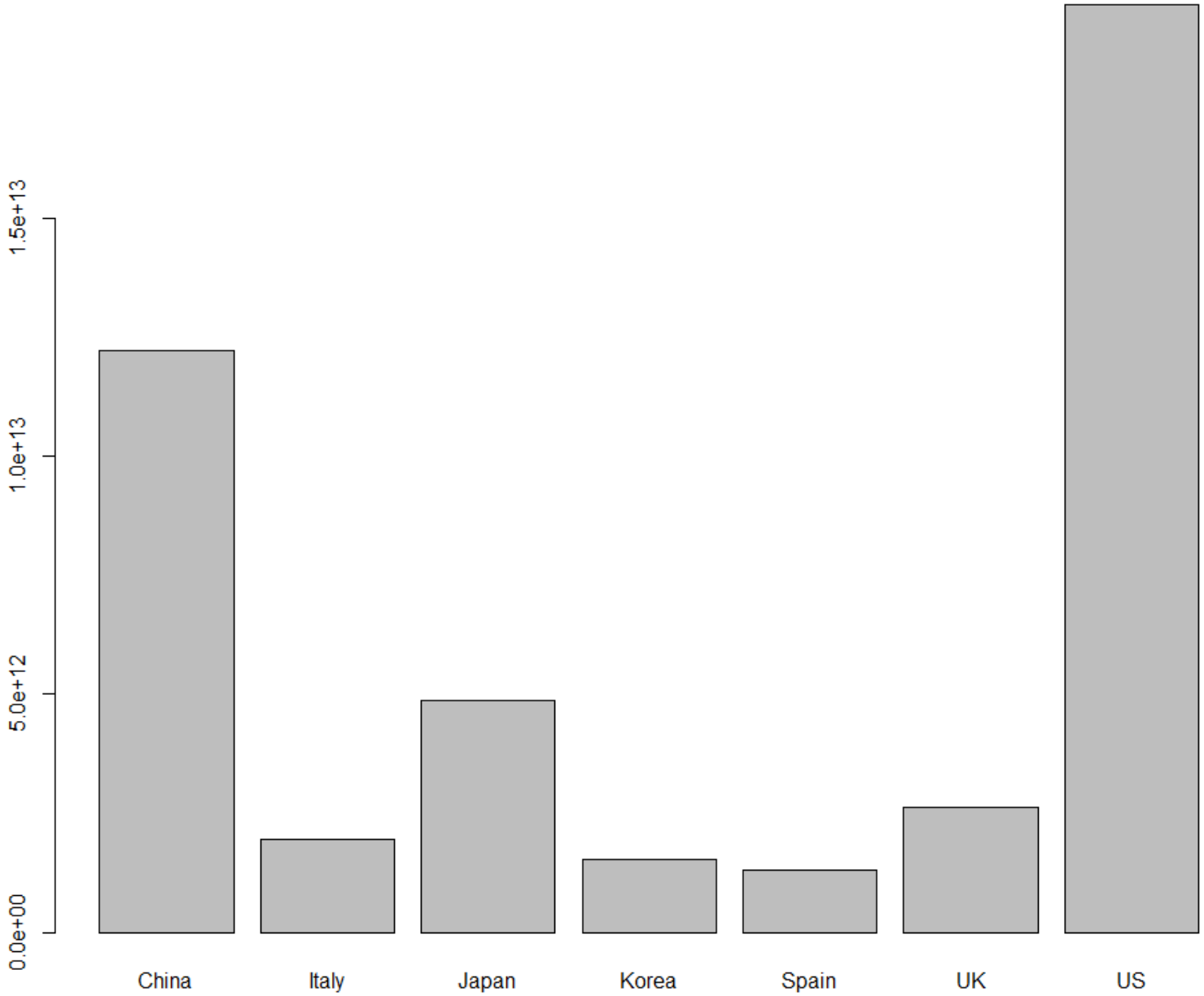
Vector 2: Population

```
pop<-c(1439323776, 60461826, 126476461, 51269185, 46754778,
67886011, 331002651)
names(pop)<-country.name
```

Vector 3: Population Density

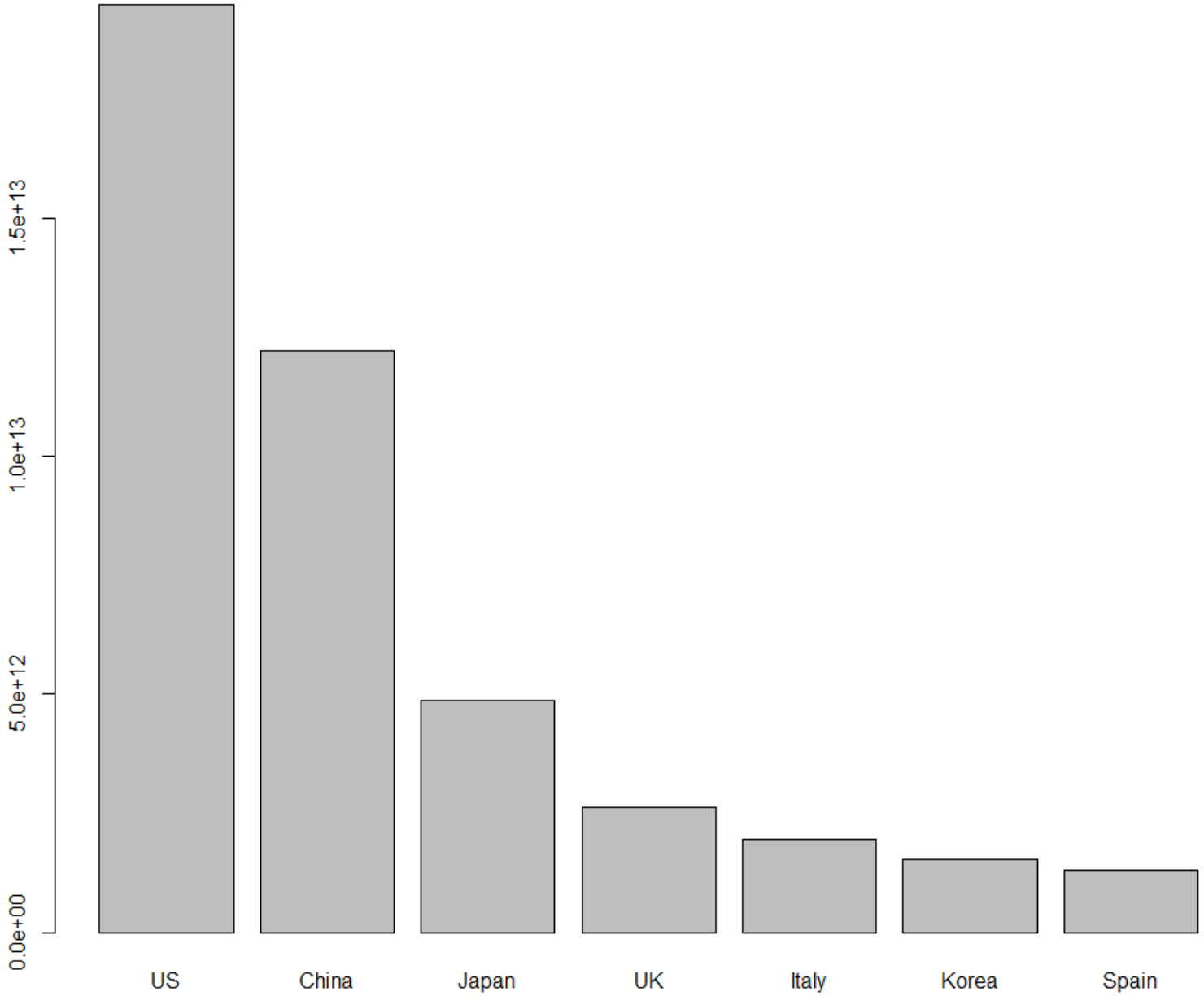
```
country.name<-c("China","Italy","Japan","Korea","Spain","UK","US")
pop.density<-c(148, 205, 347, 530, 94, 275, 36)
names(pop.density)<-country.name
```

barplot(GDP)



barplot(sort(GDP))

barplot(sort(GDP, decreasing = T))

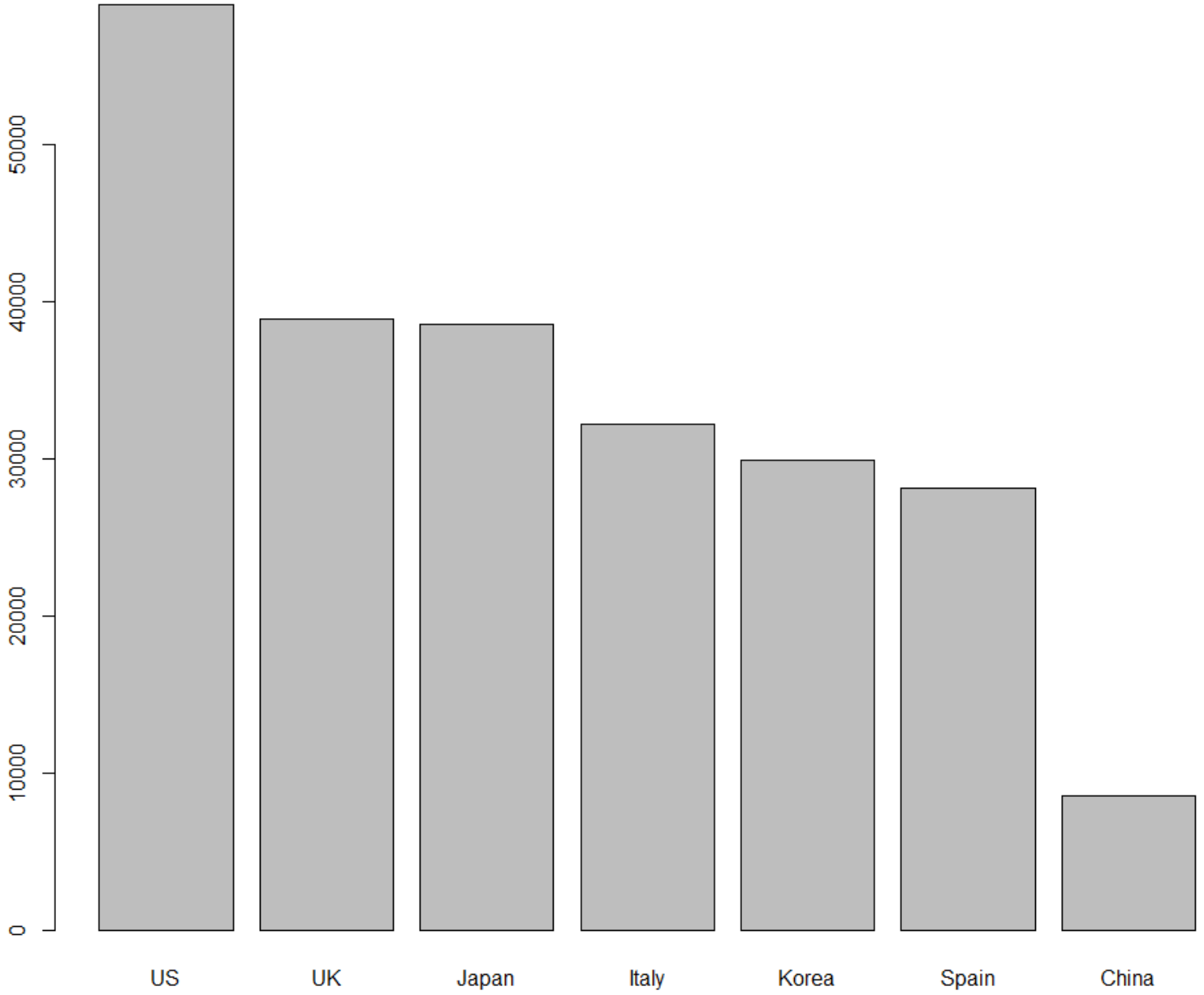


5 mins

Bar graph of GDP per capita

We have
1. GDP vector
2. Population vector

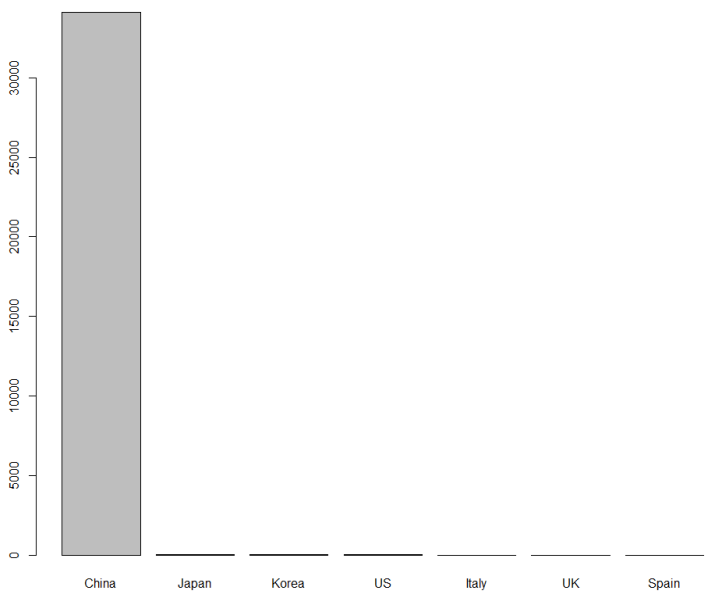
We know
1. barplot()
2. Vector calculation
3. Sort()
4. Decreasing=T option



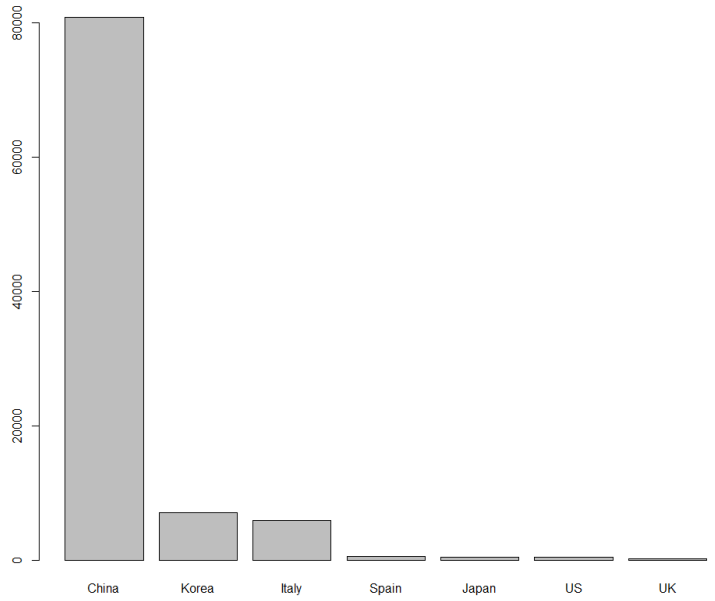
10 mins

Confirmed cases bar graph

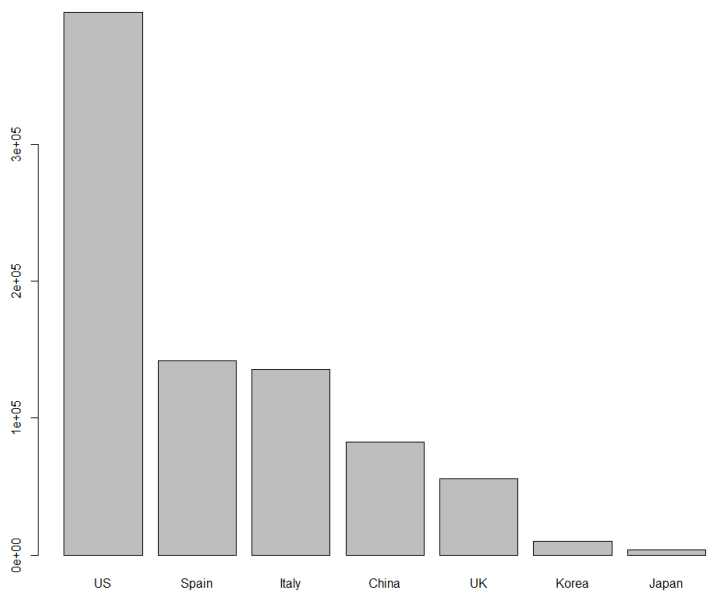
2020-03-01



2020-05-01



2021-10-01



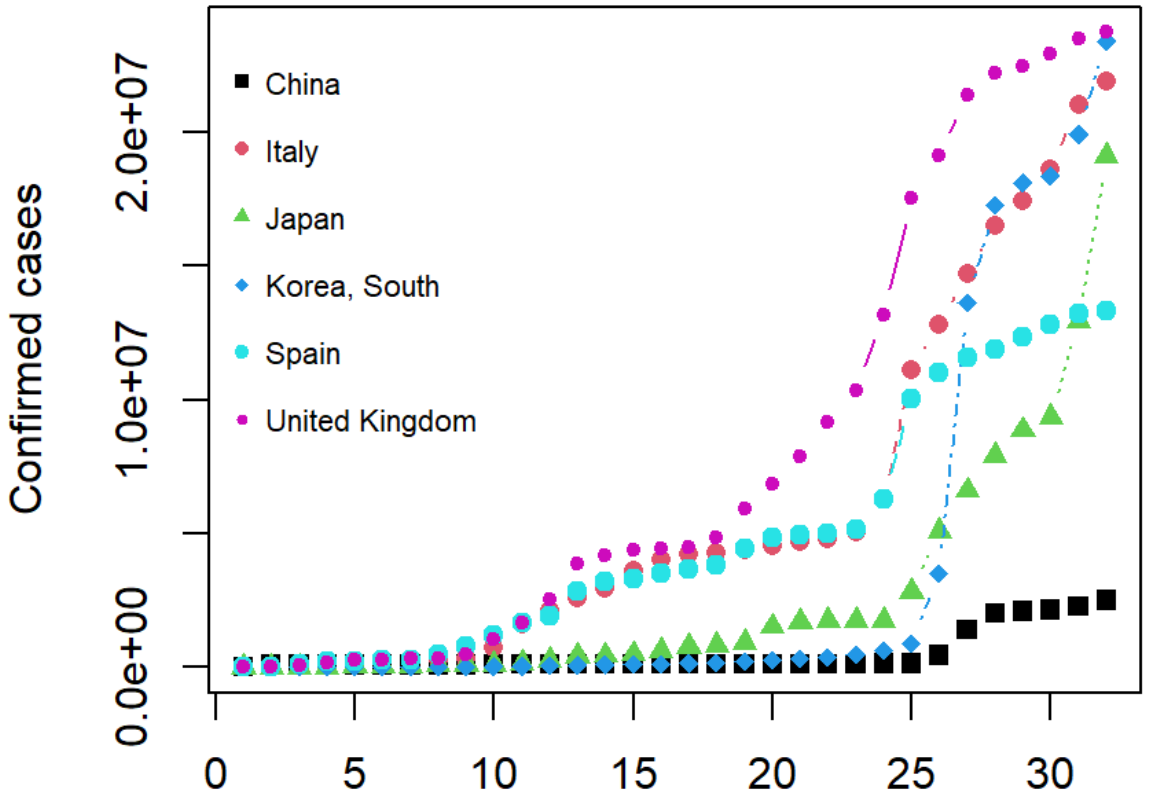
See which columns indicate the dates above (2020-03-01 / 2020-05-01 / 2021-10-01) in the matrix

- Mat.name[,]

Use barplot() , sort() , decreasing=T option

matplot

	2020-01-23	…	2020-02-15	…	2020-04-07
China	643	…	64813	…	82718
Italy					
Japan					
Korea					
Spain					
UK					
US	1	…	13	…	396223



matplot

First, try matplot(m.conf.case)

You must transpose the matrix

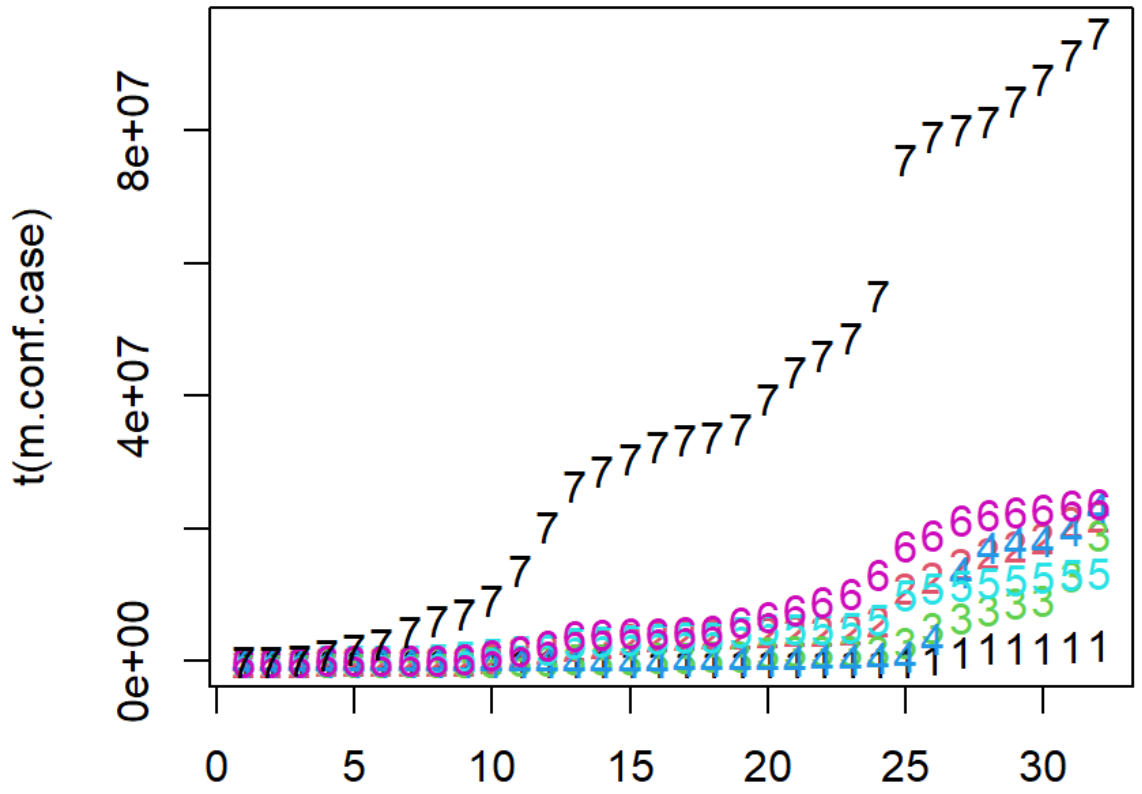
t(m.conf.case)

	2020-01-23	…	2020-02-15	…	2020-04-07
China	643	…	64813	…	82718
Italy					
Japan					
Korea					
Spain					
UK					
US	1	…	13	…	396223

	China	…	Korea	…	US
2020-01-23	643	…	64813	…	82718
…					
…					
…					
…					
…					
2020-04-07	1	…	13	…	396223

matplot

Let's try matplot(t(m.conf.case))



matplot

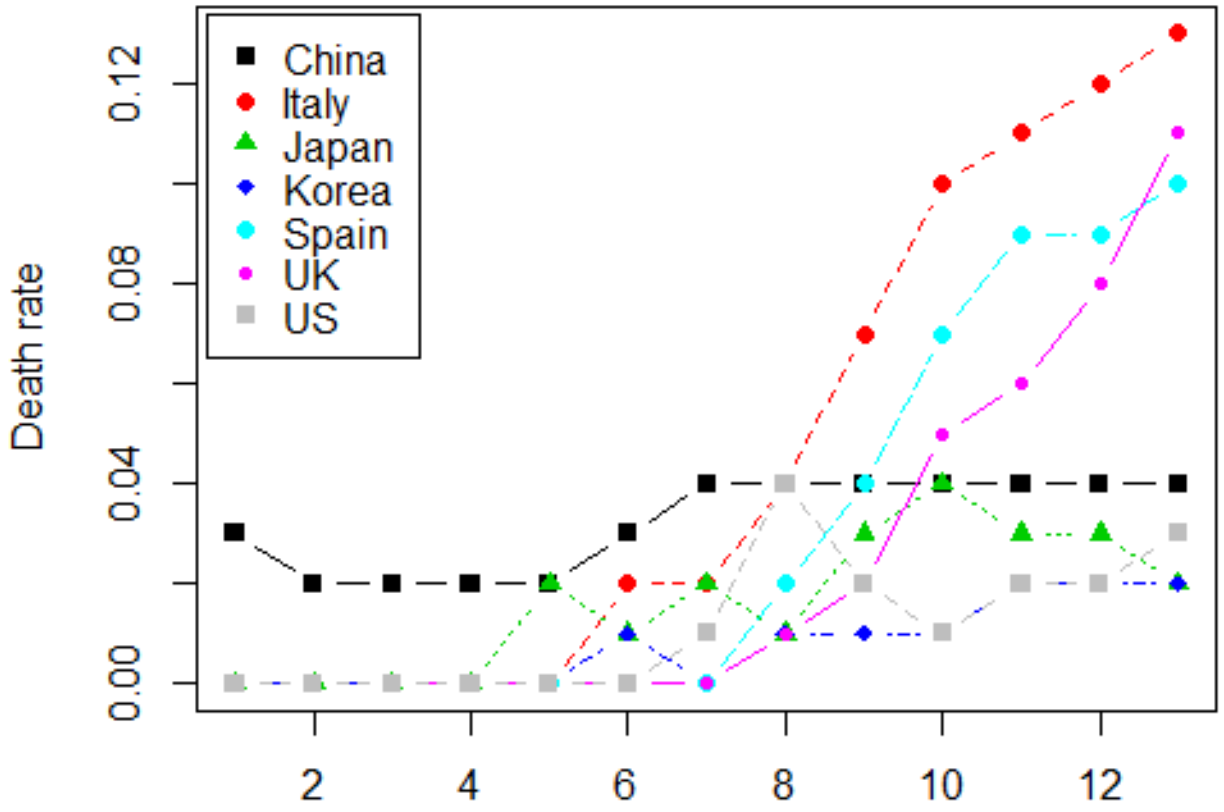
This is the cascade

```
matplot(t(m.conf.case))

matplot(t(m.conf.case), type='b')

matplot(t(m.conf.case), type='b', pch=15:20)

matplot(t(m.conf.case), type='b', pch=15:20, col=c(1:6, 8),
        ylab="Confirmed cases")

legend("topleft", inset=0.01, legend=country.name, pch=15:20,
col=c(1:6, 8), horiz=F)
```

10 mins

matplot

Try the same graph but now use the death rate

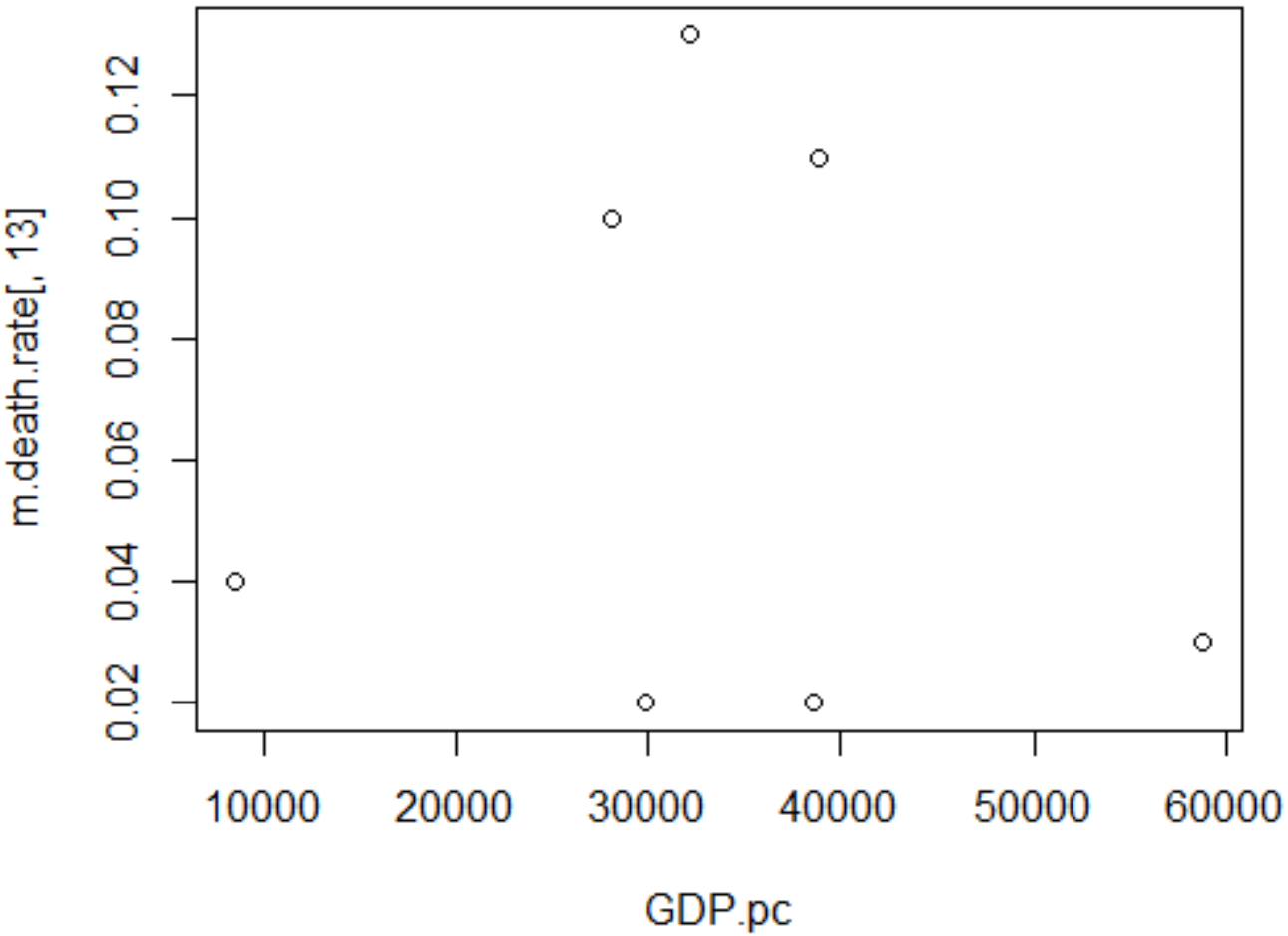


County’s wealth and COVID19

I’m now curious about the relationship between countries’ GDP per capita and the death rate at the latest time

plot

plot(GDP.pc, m.death.rate[,16])

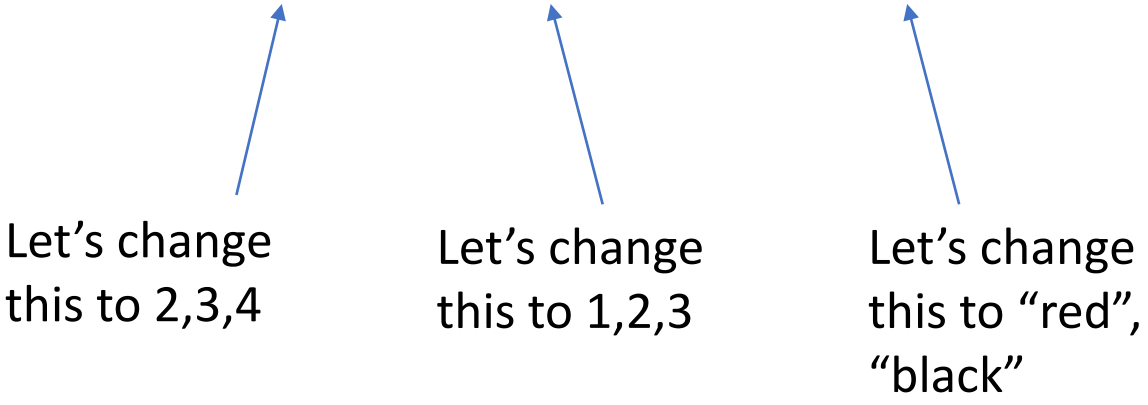


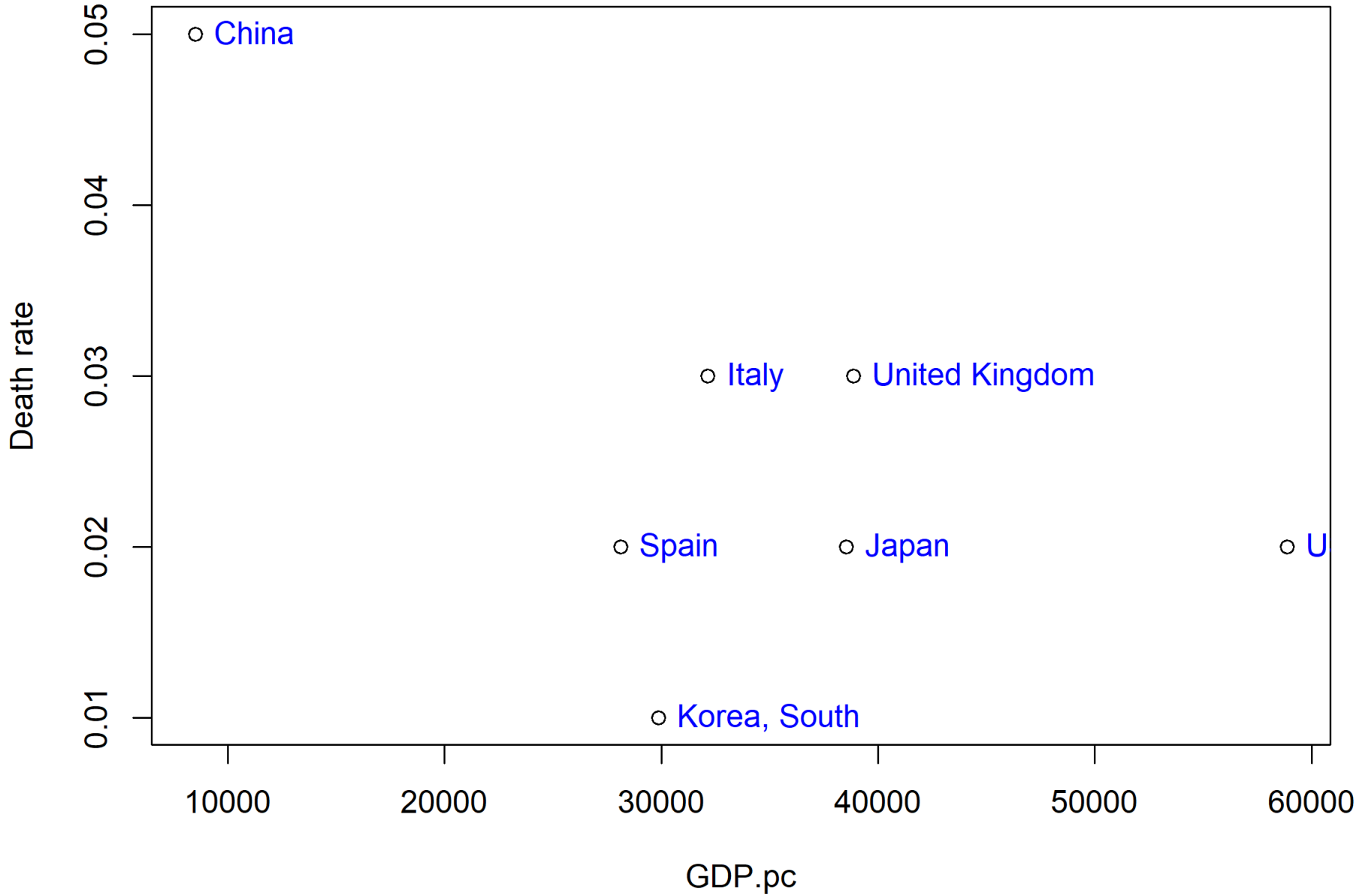
plot

```
plot(GDP.pc, m.death.rate[,32])
```

```
plot(GDP.pc, m.death.rate[,32], ylab="Death rate")
```

```
text(GDP.pc, m.death.rate[,32],  row.names(m.death.rate),
cex=1, pos=4, col="blue")
```




China
Italy
United Kingdom
Spain
Japan
U
Korea, South
Death rate
0.01
0.02
0.03
0.04
0.05
10000
20000
30000
40000
50000
60000
GDP.pc

10 mins

County’s pop density and COVID19

Let’s explore the relationship between countries’ population density and the death rate at the latest time

Increasing rate!

When you wonder if the number of confirmed cases is in increasing phase or flattened..

Increasing rate!

	2020-02-01	…	2020-10-01	…	2022-09-01
China					
Italy					
Japan					
Korea					
Spain					
UK					
US					

m1<-m.conf.case[,-1]

	2020-02-01	…	2020-10-01	…	2022-09-01
China					
Italy					
Japan					
Korea					
Spain					
UK					
US					

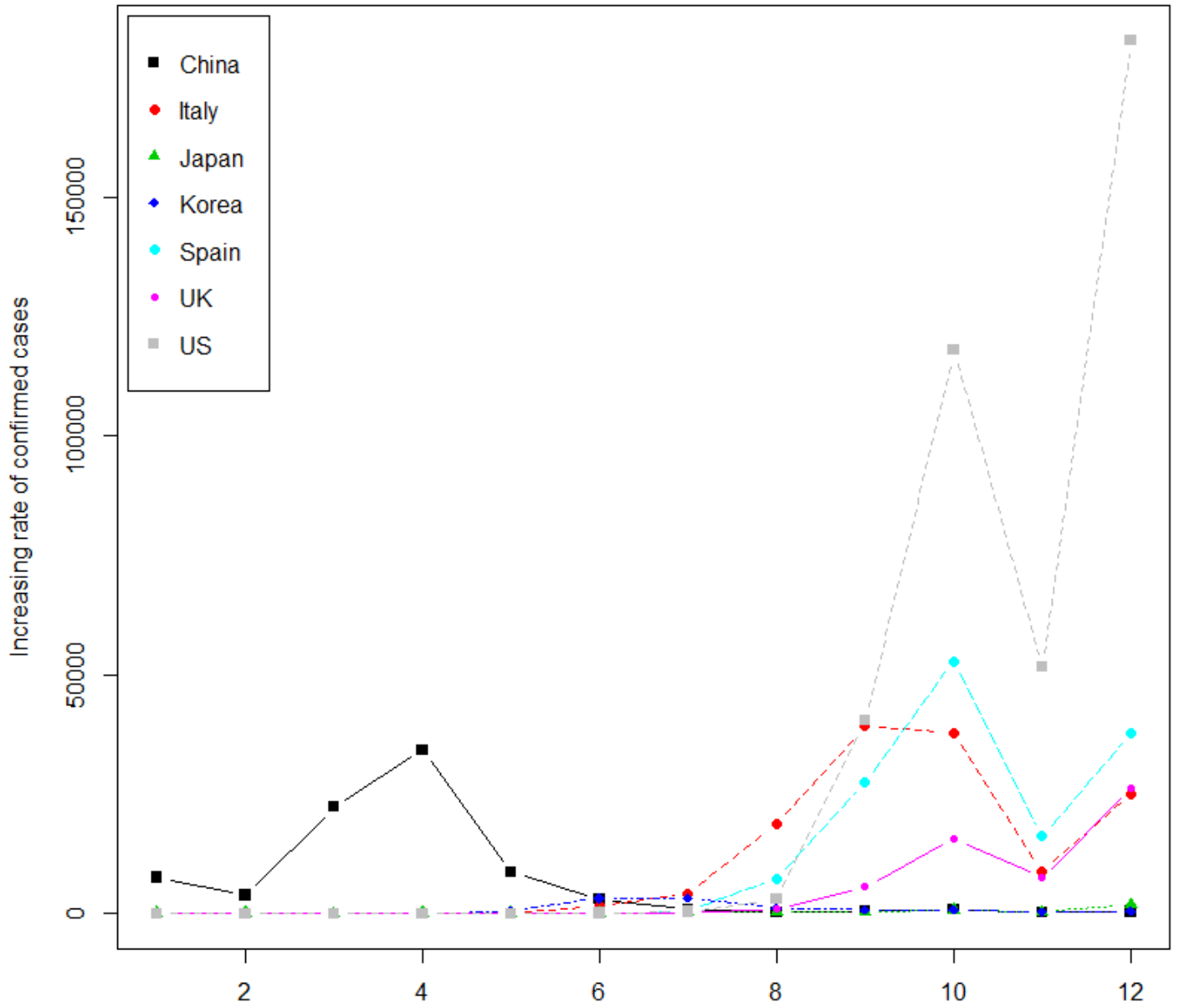
m2<-m.conf.case[,-32]

m3<-m1-m2

Increasing rate of confirmed cases

Let’s visualize like an example →

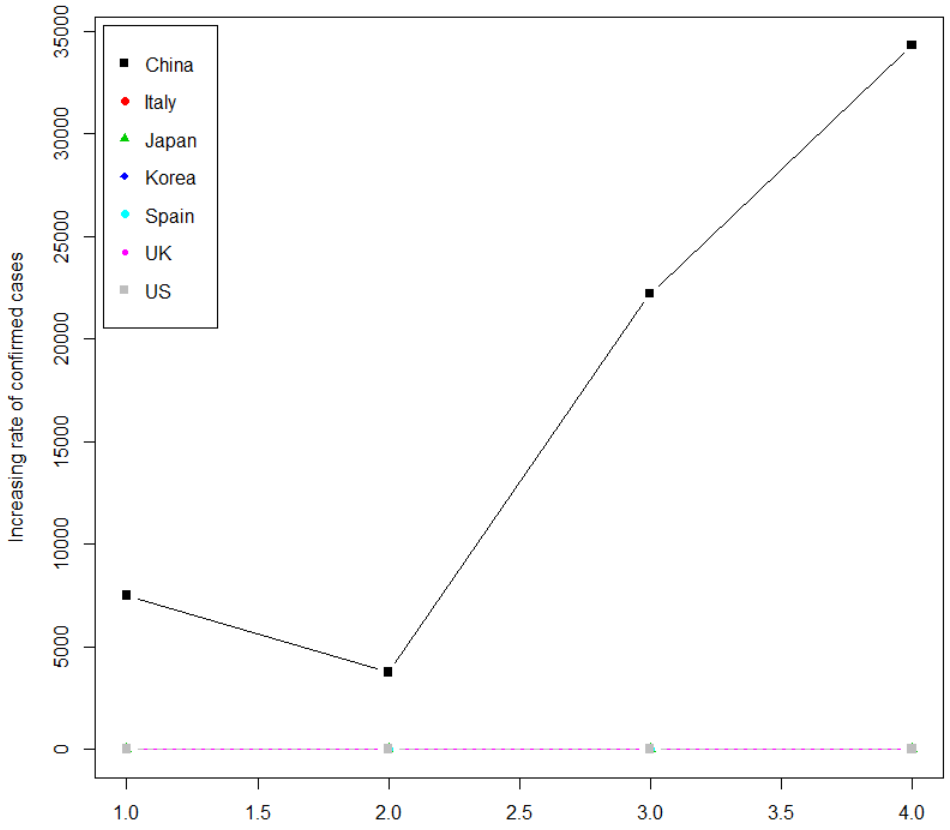
5 mins

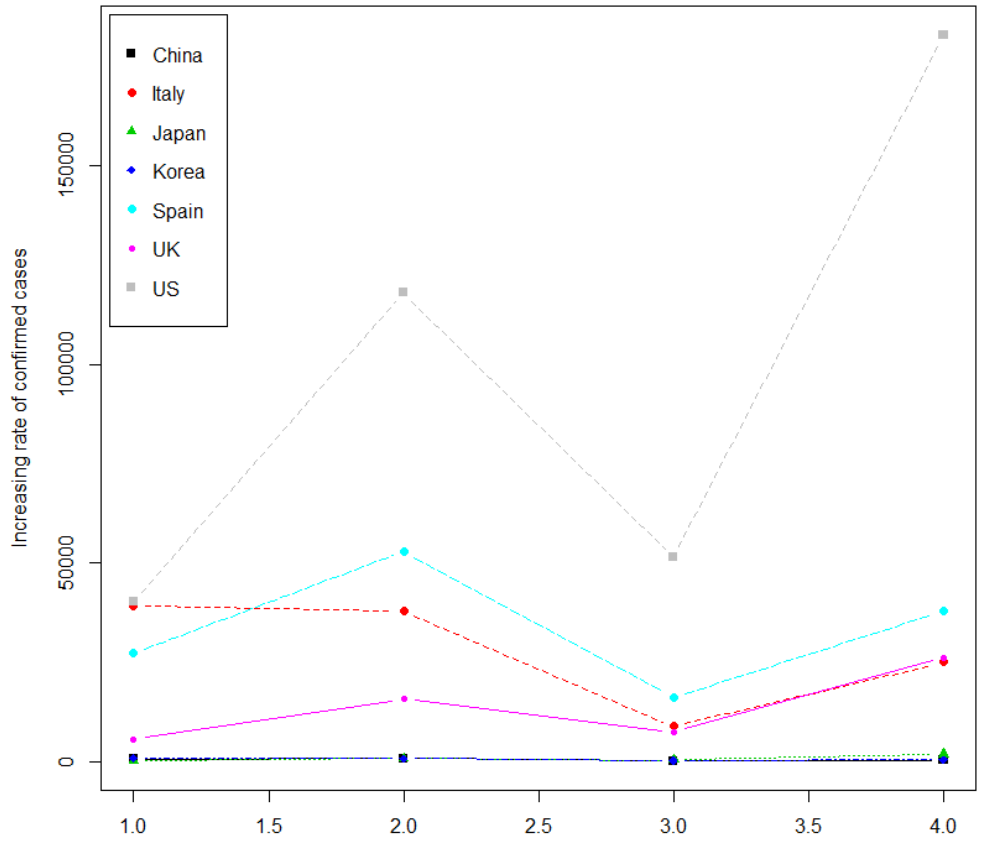


5 mins

Increasing rate of confirmed cases

Let’s also visualize the first four periods and the last (recent) four periods



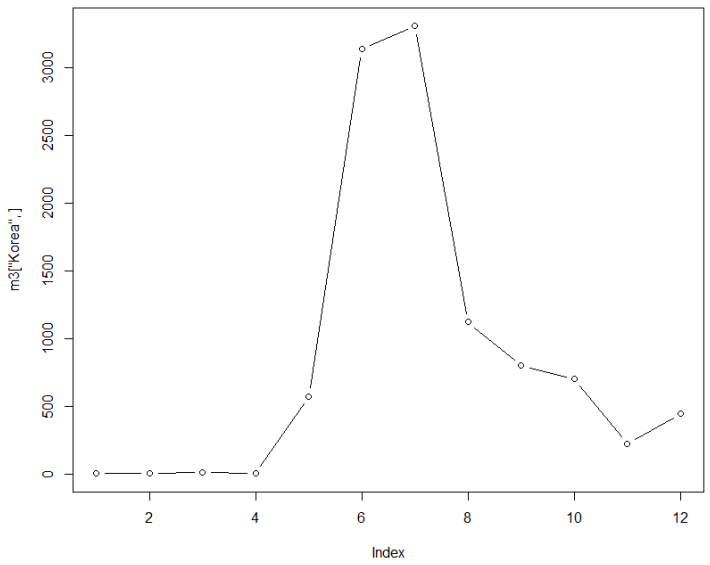


10 mins

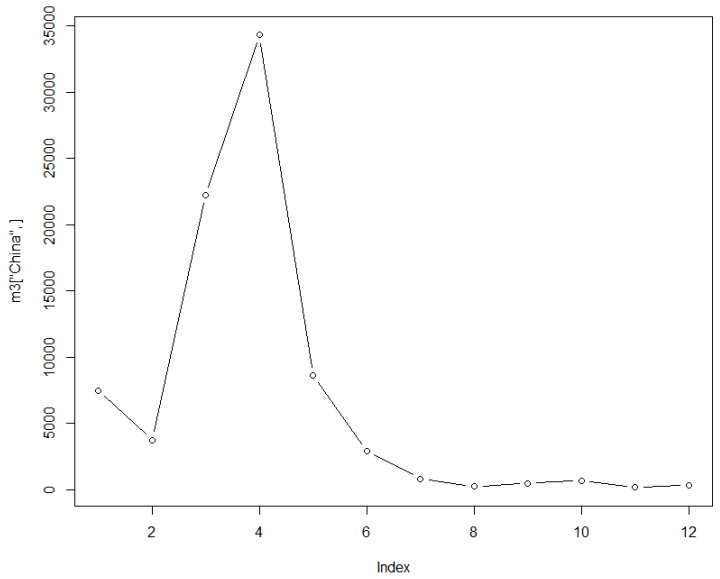
Increasing rate of confirmed cases

Can you also do for the specific countries like Korea, China, and Japan?

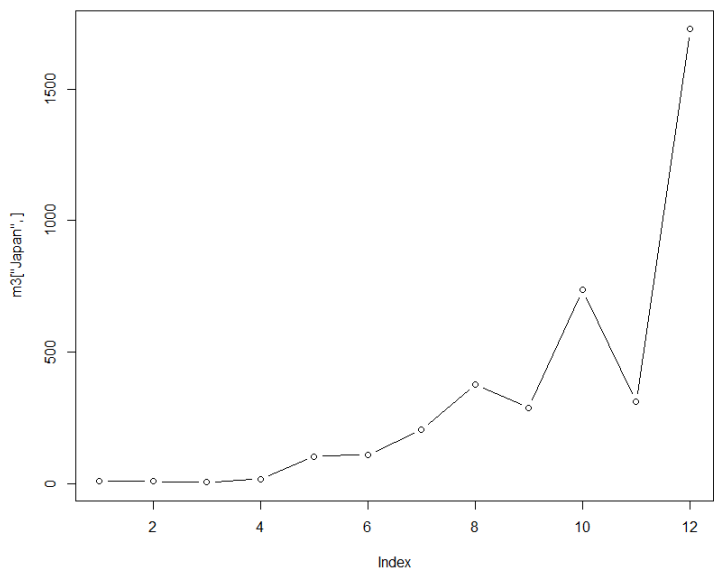
Korea



China

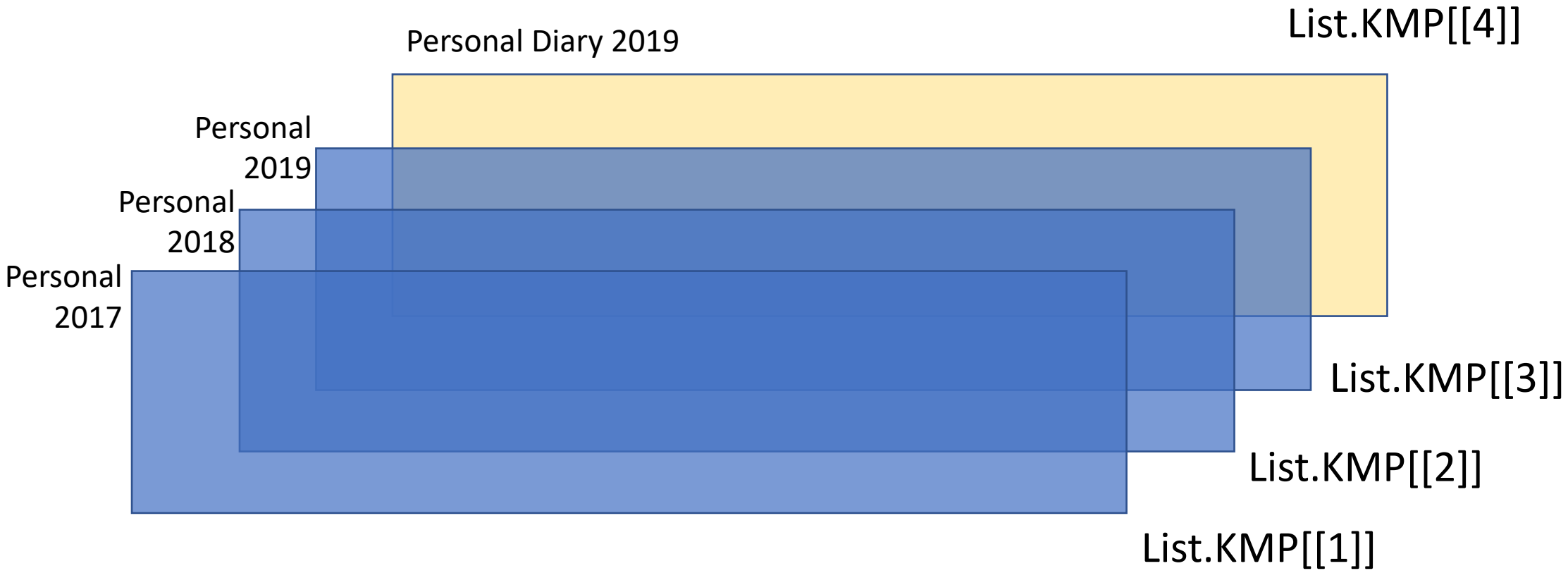


Japan



Practice with
Media Panel Data

List.KMP


Personal Diary 2019
Personal 2019
Personal 2018
Personal 2017
List.KMP[[4]]
List.KMP[[3]]
List.KMP[[2]]
List.KMP[[1]]

List.KMP

Personal Diary 2019

	pid	Smarphone.time	SNS.time	year
1	9920004	0	0	2019
2	12500003	60	0	2019
3	17350004	345	10	2019
4	17670001	90	0	2019
5	23860001	40	0	2019
6	24450001	65	0	2019

Personal 2019

	pid	age	gender	Mobile.lv	Telecom	Smartphone.brand	sp.mobile	sp.device	sp.online.content	sp.offline.contet	year
1	9920004	11	Male	No Smartphone	No Smartphone	No Smartphone	0	0	0	21	2019
2	12500003	28	Male	LTE	LG U+	Apple	60	30	90	0	2019
3	17350004	14	Female	LTE-A	LG U+	Samsung	21	0	21	0	2019
4	17670001	57	Male	LTE	SKT	Samsung	30	0	30	20	2019
5	23860001	72	Male	LTE	KT	LG	0	0	30	0	2019
6	24450001	58	Male	LTE	SKT	Samsung	65	0	65	24	2019
7	27570001	50	Male	LTE	SKT	Samsung	32	0	32	90	2019
8	53620001	68	Male	LTE	SKT	Samsung	58	10	68	0	2019
9	59570001	39	Male	LTE	KT	Samsung	63	0	63	25	2017
10	65840001	37	Female	LTE-A	KT	LG	54	10	114	40	2017

Personal 2018

	pid	age	gender	Mobile.lv	Telecom	Smartphone.brand	sp.mobile	sp.device	sp.online.content	sp.offline.contet	year
1	9920004	10	Male	No Smartphone	No Smartphone	No Smartphone	0	0	0	8	2018
2	12500003	27	Male	LTE-A	LG U+	Samsung	90	60	359	120	2018
3	17350004	13	Female	LTE-A	LG U+	LG	20	35	55	0	2018
4	17670001	56	Male	LTE	KT	Samsung	39	0	39	0	2018
5	23860001	71	Male	No Smartphone	No Smartphone	No Smartphone	30	0	30	0	2018
6	24450001	57	Male	LTE	SKT	Samsung	65	0	65	12	2018
7	27570001	49	Male	LTE	SKT	Samsung	32	0	32	20	2018
8	53620001	67	Male	LTE	SKT	Samsung	58	10	68	0	2018
9	59570001	38	Male	LTE	KT	Samsung	63	0	63	0	2018
10	65840001	36	Female	LTE-A	KT	LG	54	10	114	100	2018

Personal 2017

	pid	age	gender	Mobile.lv	Telecom	Smartphone.brand	sp.mobile	sp.device	sp.online.content	sp.offline.contet	year
1	9920004	9	Male	No Smartphone	No Smartphone	No Smartphone	0	0	0	10	2017
2	12500003	26	Male	LTE	KT	Samsung	42	0	53	22	2017
3	17350004	12	Female	LTE	LG U+	Samsung	19	0	19	0	2017
4	17670001	55	Male	LTE	SKT	Samsung	38	0	38	0	2017
5	23860001	70	Male	No Smartphone	No Smartphone	No Smartphone	18	0	18	0	2017
6	24450001	58	Male	LTE	SKT	Samsung	65	0	65	50	2017
7	27570001	50	Male	LTE	SKT	Samsung	32	0	32	36	2017
8	53620001	68	Male	LTE	SKT	Samsung	58	10	68	0	2017
9	59570001	39	Male	LTE	KT	Samsung	63	0	63	25	2017
10	65840001	37	Female	LTE-A	KT	LG	54	10	114	40	2017

List.KMP

Personal 2017

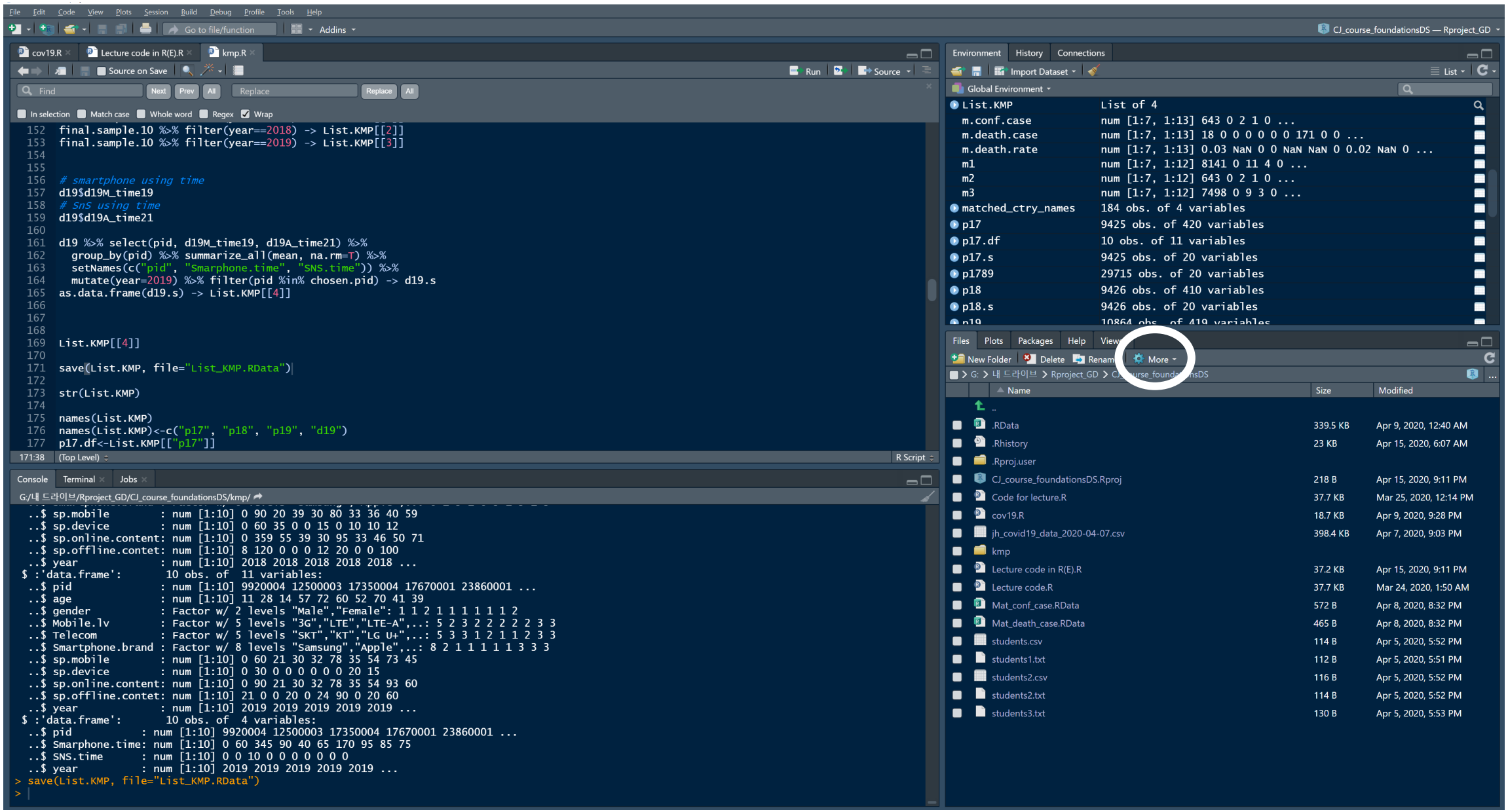
	pid	age	gender	Mobile.lv	Telecom	Smartphone.brand	sp.mobile	sp.device	sp.online.content	sp.offline.contet	year
1	9920004	9	Male	No Smartphone	No Smartphone	No Smartphone	0	0	0	10	2017
2	12500003	26	Male	LTE	KT	Samsung	42	0	53	22	2017
3	17350004	12	Female	LTE	LG U+	Samsung	19	0	19	0	2017
4	17670001	55	Male	LTE	SKT	Samsung	38	0	38	0	2017
5	23860001	70	Male	No Smartphone	No Smartphone	No Smartphone	18	0	18	0	2017
6	24450001	58	Male	LTE	SKT	Samsung	65	0	65	50	2017
7	27570001	50	Male	LTE	SKT	Samsung	32	0	32	36	2017
8	53620001	68	Male	LTE	SKT	Samsung	58	10	68	0	2017
9	59570001	39	Male	LTE	KT	Samsung	63	0	63	25	2017
10	65840001	37	Female	LTE-A	KT	LG	54	10	114	40	2017

List.KMP

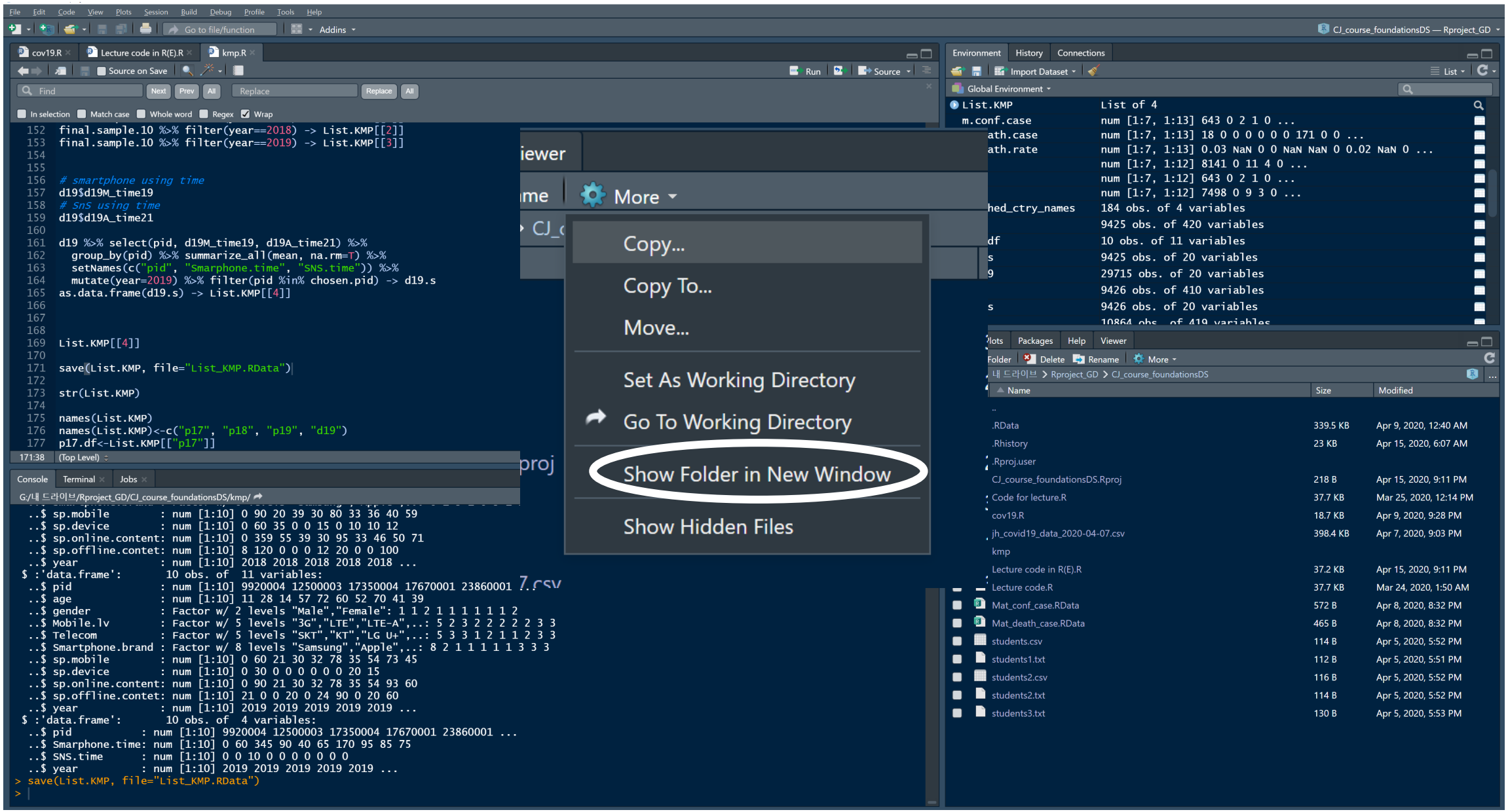
Diary 2019

	pid	Smarphone.time	SNS.time	year
1	9920004	0	0	2019
2	12500003	60	0	2019
3	17350004	345	10	2019
4	17670001	90	0	2019
5	23860001	40	0	2019
6	24450001	65	0	2019
7	27570001	170	0	2019
8	53620001	95	0	2019
9	59570001	85	0	2019
10	65840001	75	0	2019

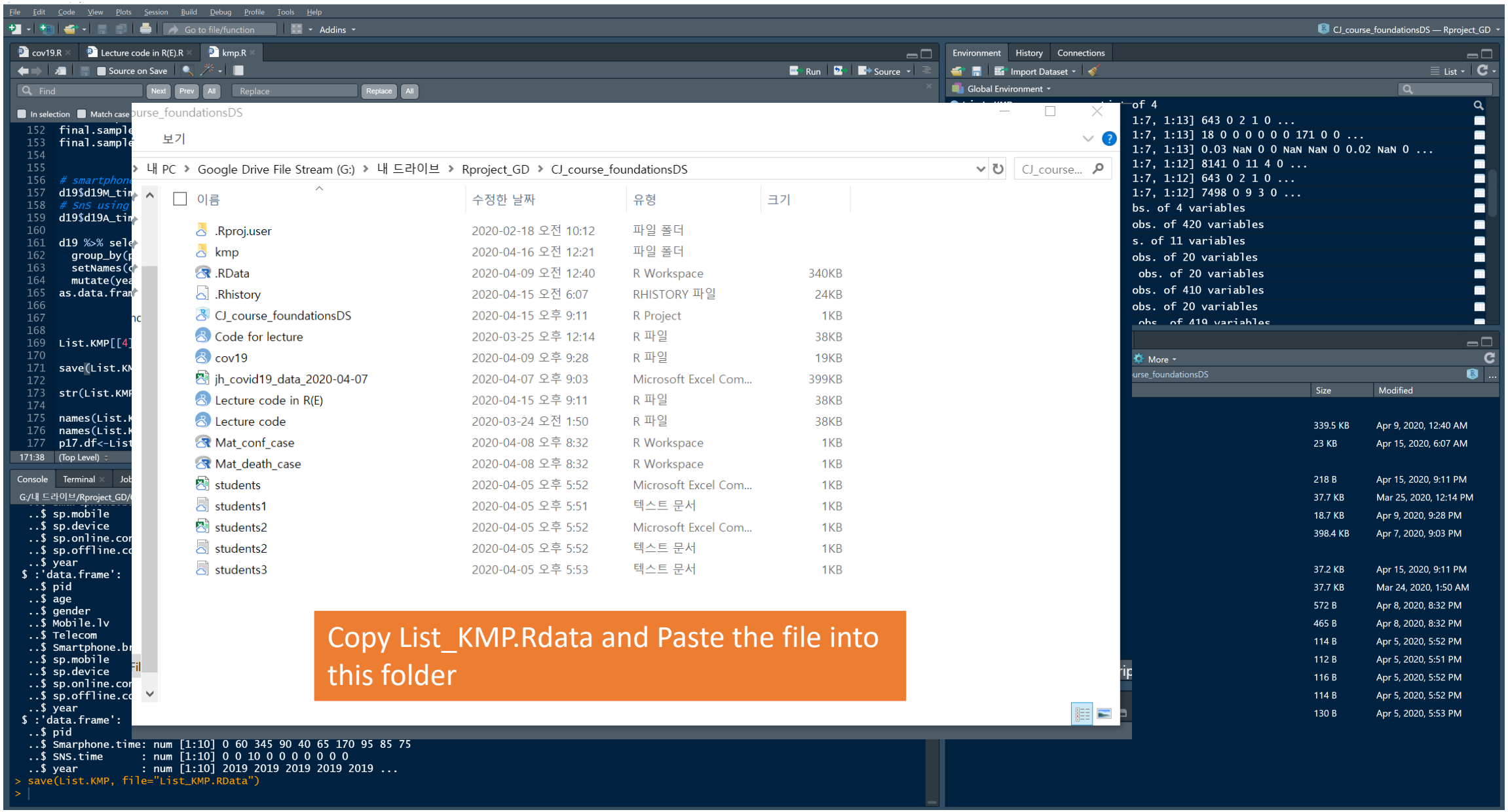
Load List.KMP



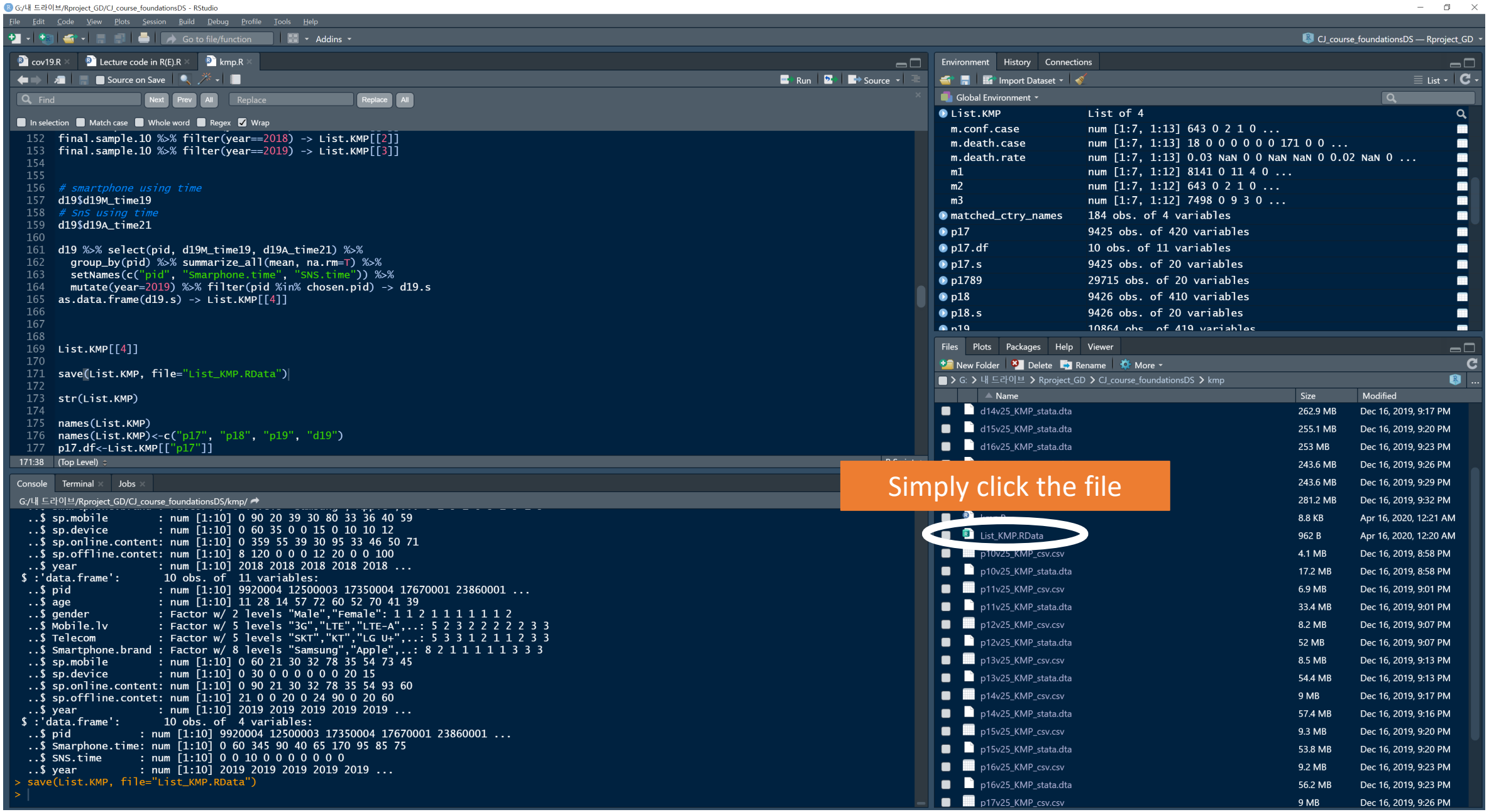
Load List.KMP



Load List.KMP



Load List.KMP



OK, let's see the structure of List.KMP

Str(List.KMP)

```
List of 4
 $ :'data.frame':       10 obs. of  11 variables:
  ..$ pid              : num [1:10] 9920004 12500003 17350004 17670001 23860001 ...
  ..$ age              : num [1:10] 9 26 12 55 70 58 50 68 39 37
  ..$ gender           : Factor w/ 2 levels "Male","Female": 1 1 2 1 1 1 1 1 1 2
  ..$ Mobile.lv        : Factor w/ 5 levels "3G","LTE","LTE-A",..: 5 2 2 2 5 2 2 2 2 3
  ..$ Telecom          : Factor w/ 5 levels "SKT","KT","LG U+",..: 5 2 3 1 5 1 1 1 2 2
  ..$ Smartphone.brand : Factor w/ 8 levels "Samsung","Apple",..: 8 1 1 1 8 1 1 1 1 3
  ..$ sp.mobile        : num [1:10] 0 42 19 38 18 65 32 58 63 54
  ..$ sp.device        : num [1:10] 0 0 0 0 0 0 0 10 0 10
  ..$ sp.online.content: num [1:10] 0 53 19 38 18 65 32 68 63 114
  ..$ sp.offline.contet: num [1:10] 10 22 0 0 0 50 36 0 25 40
  ..$ year             : num [1:10] 2017 2017 2017 2017 2017 ...
 $ :'data.frame':       10 obs. of  11 variables:
  ..$ pid              : num [1:10] 9920004 12500003 17350004 17670001 23860001 ...
  ..$ age              : num [1:10] 10 27 13 56 71 59 51 69 40 38
  ..$ gender           : Factor w/ 2 levels "Male","Female": 1 1 2 1 1 1 1 1 1 2
  ..$ Mobile.lv        : Factor w/ 5 levels "3G","LTE","LTE-A",..: 5 3 3 2 5 2 2 2 3 3
  ..$ Telecom          : Factor w/ 5 levels "SKT","KT","LG U+",..: 5 3 3 2 5 3 1 2 1 2
  ..$ Smartphone.brand : Factor w/ 8 levels "Samsung","Apple",..: 8 1 3 1 8 3 1 3 1 3
  ..$ sp.mobile        : num [1:10] 0 90 20 39 30 80 33 36 40 59
  ..$ sp.device        : num [1:10] 0 60 35 0 0 15 0 10 10 12
  ..$ sp.online.content: num [1:10] 0 359 55 39 30 95 33 46 50 71
  ..$ sp.offline.contet: num [1:10] 8 120 0 0 0 12 20 0 0 100
  ..$ year             : num [1:10] 2018 2018 2018 2018 2018 ...
 $ :'data.frame':       10 obs. of  11 variables:
  ..$ pid              : num [1:10] 9920004 12500003 17350004 17670001 23860001 ...
  ..$ age              : num [1:10] 11 28 14 57 72 60 52 70 41 39
  ..$ gender           : Factor w/ 2 levels "Male","Female": 1 1 2 1 1 1 1 1 1 2
  ..$ Mobile.lv        : Factor w/ 5 levels "3G","LTE","LTE-A",..: 5 2 3 2 2 2 2 2 3 3
  ..$ Telecom          : Factor w/ 5 levels "SKT","KT","LG U+",..: 5 3 3 1 2 1 1 2 3 3
  ..$ Smartphone.brand : Factor w/ 8 levels "Samsung","Apple",..: 8 2 1 1 1 1 1 3 3 3
  ..$ sp.mobile        : num [1:10] 0 60 21 30 32 78 35 54 73 45
  ..$ sp.device        : num [1:10] 0 30 0 0 0 0 0 0 20 15
  ..$ sp.online.content: num [1:10] 0 90 21 30 32 78 35 54 93 60
  ..$ sp.offline.contet: num [1:10] 21 0 0 20 0 24 90 0 20 60
  ..$ year             : num [1:10] 2019 2019 2019 2019 2019 ...
 $ :'data.frame':       10 obs. of  4 variables:
  ..$ pid           : num [1:10] 9920004 12500003 17350004 17670001 23860001 ...
  ..$ Smarphone.time: num [1:10] 0 60 345 90 40 65 170 95 85 75
  ..$ SNS.time      : num [1:10] 0 0 10 0 0 0 0 0 0 0
  ..$ year          : num [1:10] 2019 2019 2019 2019 2019 ...
```

Let’s give names for the list elements

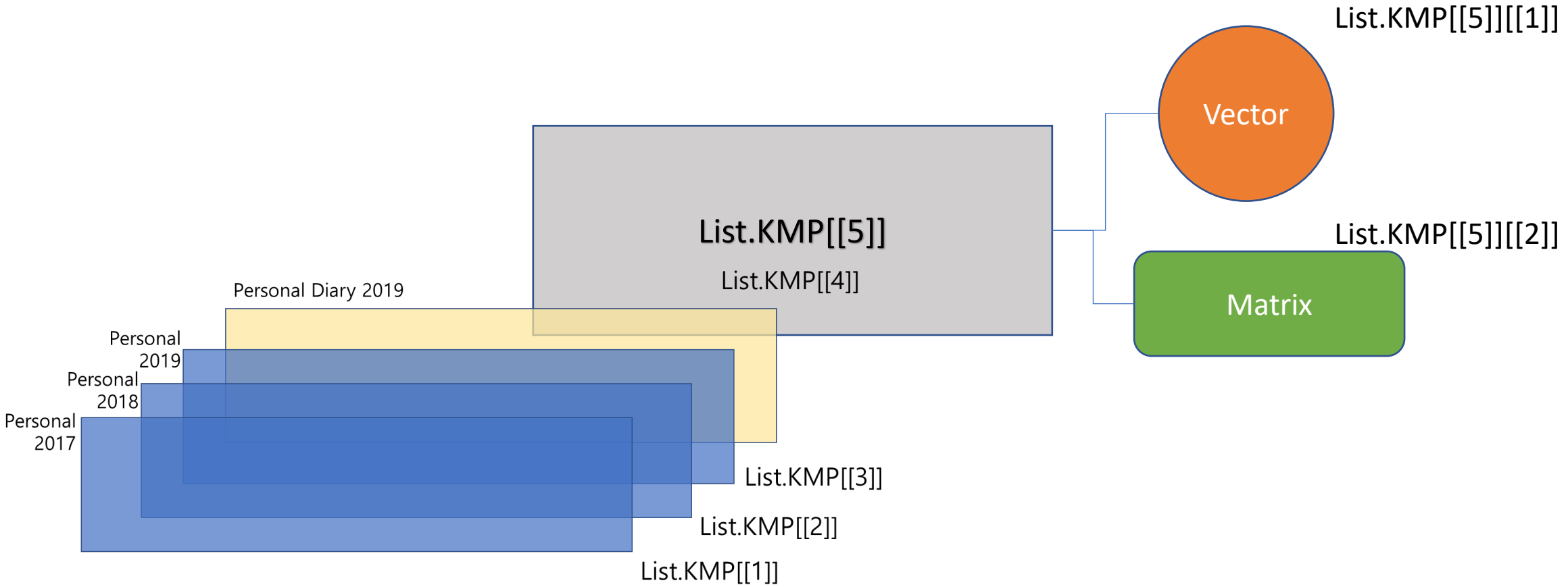
names(List.KMP)

names(List.KMP)<-c("p17", "p18", "p19", "d19")

How can we extract the first element?

List.KMP[[1]]
List.KMP[[“p17”]]

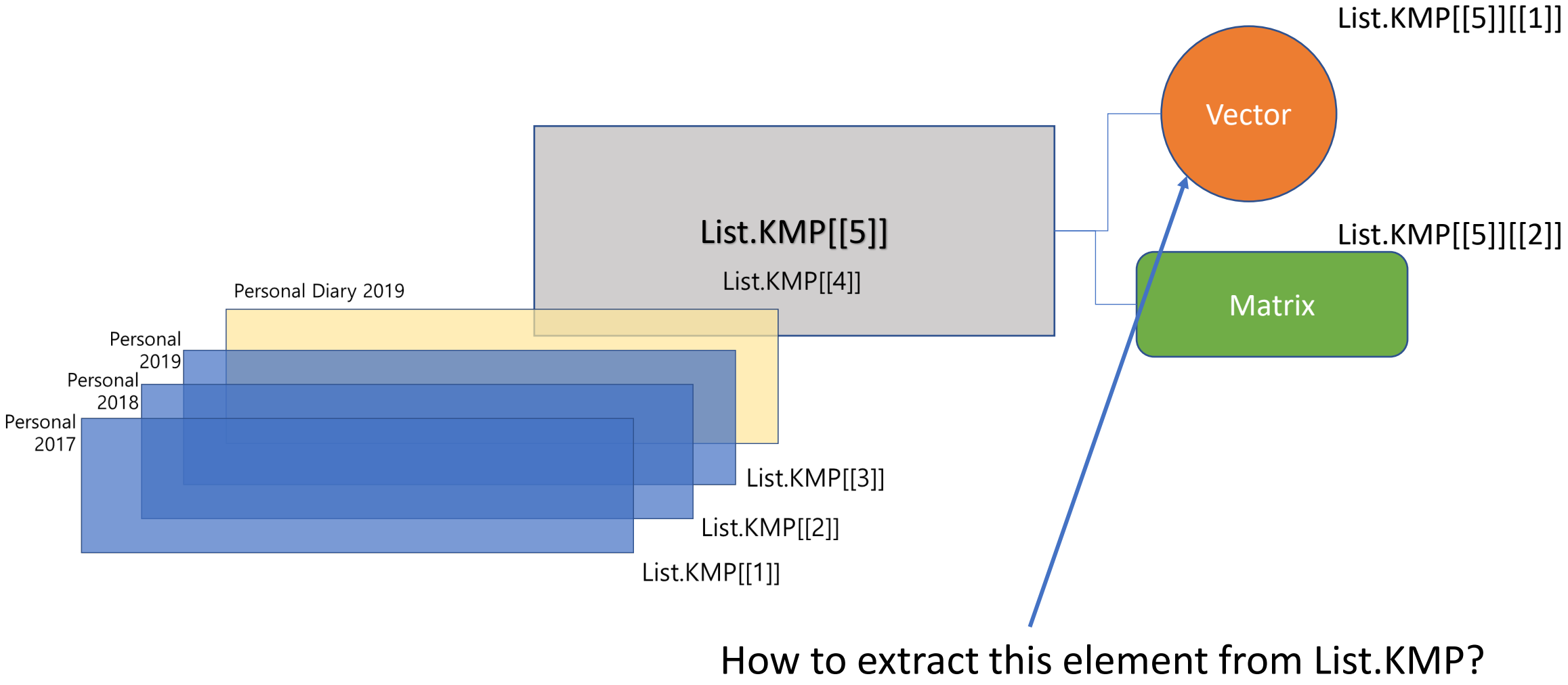
List of List??



List.KMP[[5]]<-list(0)

List.KMP[[5]][[1]]<-c(1:10)
List.KMP[[5]][[2]]<-matrix(c(1:12), nrow=4)

List of List??



How to extract this element from List.KMP?

Let’s draw only p17

p17.df<-List.KMP[["p17"]]

Summary statistics

summary(p17.df)

Among 10 people,
How many people use Samsung phone?

How much do people spend for the mobile communication **on average**?

Do the same thing to 2019 dataset and answer the questions below.

1. In 2019, how many people use Samsung phone?

2. Draw boxplot of people's spending on the mobile communication
   *Hint: use boxplot()

Do the same thing to 2019 dataset and answer the questions below.

1. In 2019, how many people use Samsung phone?

```
> summary(p19.df)
      pid                age             gender          Mobile.lv          Telecom       Smartphone.brand
 Min.   : 9920004   Min.   :11.00   Male  :8   3G             :0   SKT            :3   Samsung       :5
 1st Qu.:17430003   1st Qu.:30.75   Female:2   LTE            :6   KT             :2   LG            :3
 Median :24155001   Median :46.50              LTE-A          :3   LG U+          :4   Apple         :1
 Mean   :31235002   Mean   :44.40              5G             :0   MVNO           :0   No Smartphone:1
 3rd Qu.:47107501   3rd Qu.:59.25              No Smartphone:1   No Smartphone:1   Pantech       :0
 Max.   :65840001   Max.   :72.00                                                   Xiaomi        :0
                                                                                    (Other)       :0
   sp.mobile       sp.device      sp.online.content sp.offline.contet      year
 Min.   : 0.0   Min.   : 0.00   Min.   : 0.0      Min.   : 0.00      Min.   :2019
 1st Qu.:30.5   1st Qu.: 0.00   1st Qu.:30.5      1st Qu.: 0.00      1st Qu.:2019
 Median :40.0   Median : 0.00   Median :44.5      Median :20.00      Median :2019
 Mean   :42.8   Mean   : 6.50   Mean   :49.3      Mean   :23.50      Mean   :2019
 3rd Qu.:58.5   3rd Qu.:11.25   3rd Qu.:73.5      3rd Qu.:23.25      3rd Qu.:2019
 Max.   :78.0   Max.   :30.00   Max.   :93.0      Max.   :90.00      Max.   :2019
```

In 2019 dataset,

1. Draw histogram of people's spending on the mobile communication *Hint: use hist()

2. Try this code and explain the role of the option

```
hist(p19.df$sp.mobile, breaks=10)
```

3. Try this code and explain the role of the option

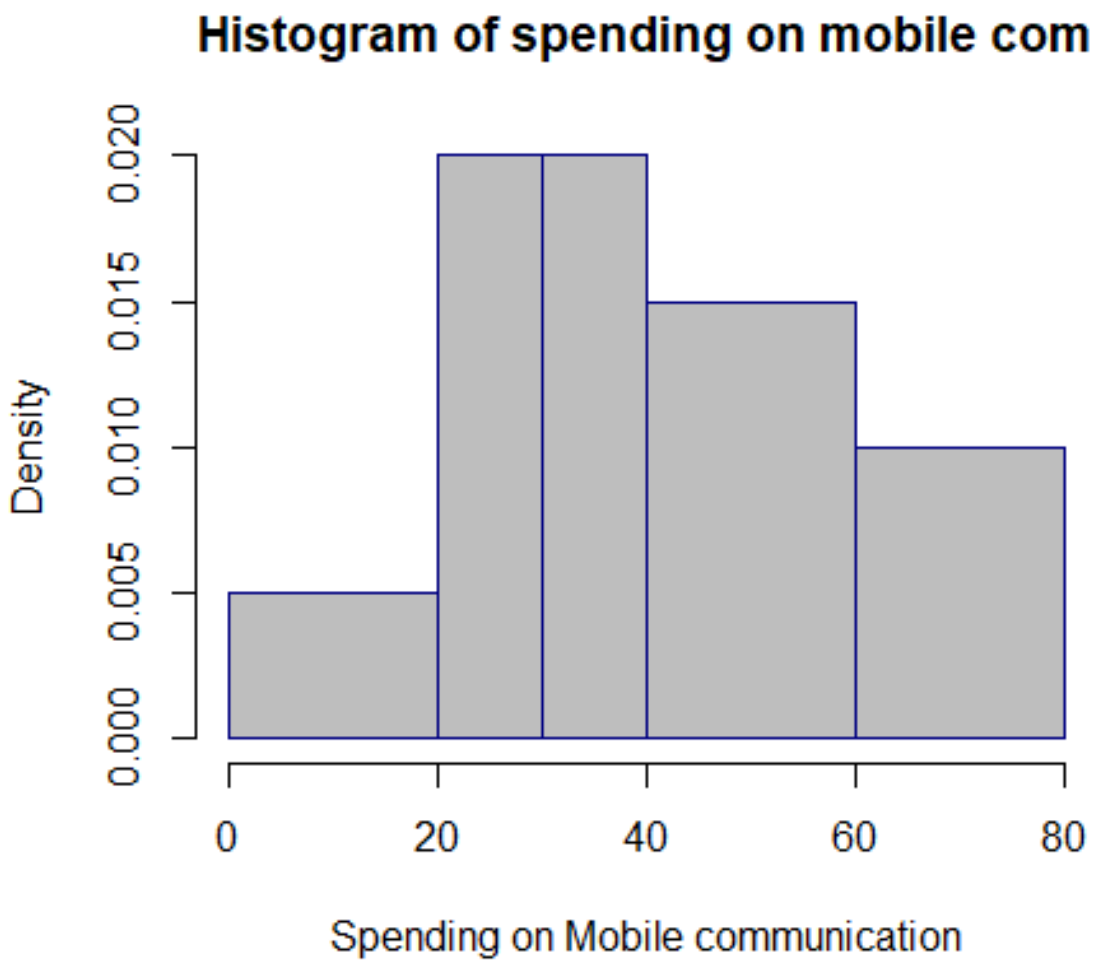
```
hist(p19.df$sp.mobile, breaks=10, freq=T)
```

4. Try this code and explain the role of the option

```
hist(p19.df$sp.mobile, breaks=c(0,20,40,100))
```

5. Try this code and explain the role of the option

```
hist(p19.df$sp.mobile, las=1)
```

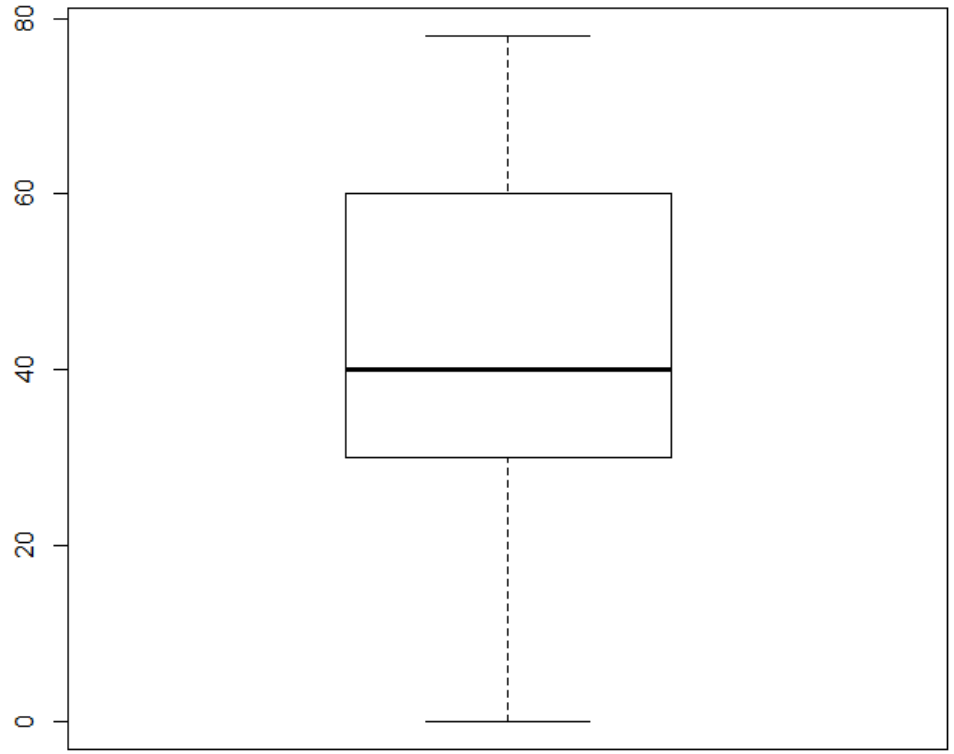


Make the graph left

- col="filled color"
- border="border color"
- main="Main title"
- xlab="x-axis label"
- breaks=c( )

In 2019 dataset,

1. Draw boxplot of people's spending on the mobile communication
   *Hint: use boxplot()



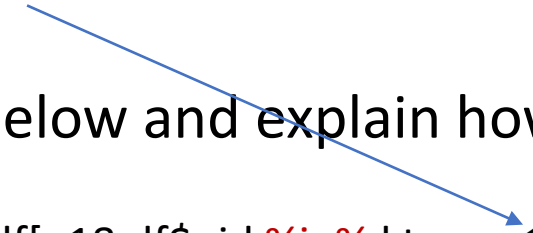
Did ‘KT’ users in 2017 change their telecom companies in 2018 and 2019?

1. Let’s extract data.frames from the List

```
p17.df<-List.KMP[["p17"]]
p18.df<-List.KMP[["p18"]]
```

2. Find the pid(personal ID) whose telecom company was “KT”

Hint: Vector.name <- p17.df[ ]=="KT", " "]



3. Try the code below and explain how it works

```
kt.user.18<-p18.df[p18.df$pid %in% kt.user.17.pid, c("pid", "Telecom")]
kt.user.19<-p19.df[p19.df$pid %in% kt.user.17.pid, c("pid", "Telecom")]
```

4. Merge the two data.frames above by the key variable “pid”, and Change the second and the third column names to “y2018” and “y2019”

Hint 1: DF3<-merge(DF1, DF2, by="pid")
Hint 2: name(DF3)[c(,)]<-c(“ ”, “ ”)

Did ‘Samsung’ users in 2017 change their phone brand in 2018 and 2019?