

Teknik Asas Jelajahan Data

Mengindeks Struktur Data

1. Pengindeksan mengikut nombor dan nama.

1.1 sampel vektor

```
v = c(1,4,4,3,2,2,3)
v[c(2,4,6)]
```

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

```
v[c(2,1,6,4)]
```

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

1.2 sampel bingkai data

```
data = read.table(header=T, text='
  subject sex size
    1     M   7
    2     F   6
    3     F   9
    4     M  11')
```

```
data[c(1,2),c(1,3)]
```

1.2.1 ambil data baris 1&2, untuk kolum 1&3

```
##   subject size
## 1         1   7
## 2         2   6
```

```
data[c(2,3),c("sex","size")]
```

1.2.2 ambil data baris 2&3, untuk kolom “sex” dan “size”

```
##    sex size
## 2    F     6
## 3    F     9
```

2. Pengindeksan melalui vektor Boolean.

2.1 sampel vektor $V > 2$

```
v[v>2]
```

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

2.2 bingkai data wanita dan size > 6

```
v3 = data$sex == "F" & data$size > 6
data[v3,]
```

```
##    subject sex size
## 3         3    F    9
```

3. Pengindeksan negatif.

3.1 vektor

buang unsur ke 3 dan 6

```
v[-c(3,6)]
```

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

3.2 bingkai data

kekalkan data selain baris 2&3 dan kolom “sex”

```
data[-c(2,3),-2]
```

```
##    subject size
## 1         1     7
## 4         4    11
```

4. Pengekstrakan bersyarat #vektor

```
x = 11:30
```

ambil nombor yang lebih besar dari 12 dan kurang dari 20

```
x[x>12 & x<20]
```

```
## [1] 13 14 15 16 17 18 19
```

ambil nombor bukan 15 dan bukan 20

```
x[x!=15&x!=20]
```

```
## [1] 11 12 13 14 16 17 18 19 21 22 23 24 25 26 27 28 29 30
```

Subset bagi struktur data

1. Subset mengikut nombor dan nama.

1.1 kekalkan nombor subset >3

```
subset(v, v<3)
```

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

1.2 data aksara

```
t = c("small","small","large","small","moderate")
```

keluarkan data “small”

```
subset(t, t!="small")
```

```
## [1] "large"      "moderate"
```

1.3 data frame

```
subset(data,size>6&sex=="M")
```

```
##   subject sex size
## 1         1   M    7
## 4         4   M   11
```

2. Subset bagi baris dan lajur tertentu.

```
subset(data, subject>2, select=c("sex","size"))
```

```
##    sex size
## 3    F     9
## 4    M    11
```

Latihan pilih data dgn size > 6 & <10 serta kekalkan lajur subject & sex

```
subset(data,size>6&size<10, select=c("subject", "sex"))
```

```
##    subject sex
## 1         1  M
## 3         3  F
```

3. Subset berdasarkan Operator Logik (AND).

3.1 pilih data dgn subject <3 dan wanita

```
subset(data, subject<3 & sex=="F")
```

```
##    subject sex size
## 2         2  F     6
```

4. Subset berdasarkan Operator Logik (OR).

4.1 pilih data dgn subject <3 atau wanita

```
subset(data, subject<3 | sex=="F")
```

```
##    subject sex size
## 1         1  M     7
## 2         2  F     6
## 3         3  F     9
```

5. Subset data dengan syarat penjelmaan.

```
subset(data, log2(size)>3)
```

```
##    subject sex size
## 3         3  F     9
## 4         4  M    11
```

```
log2(data$size)
```

```
## [1] 2.807355 2.584963 3.169925 3.459432
```

Mendapat maklumat asas daripada data data(mtcars) mtcars

1. Menyenaraikan nama pembolehubah-pembolehubah dalam set data.

```
names(mtcars)
```

```
## [1] "mpg" "cyl" "disp" "hp" "drat" "wt" "qsec" "vs" "am" "gear"  
## [11] "carb"
```

2. Dapatkan maklumat tentang pembolehubah. (variable)

```
ls() #---to visualize list of set variables
```

```
## [1] "data" "t" "v" "v3" "x"
```

2.1 to remove variable(pembolehubah)

```
rm(v3)  
ls()
```

```
## [1] "data" "t" "v" "x"
```

3. Dapatkan maklumat tentang saiz dan struktur data.

```
str(mtcars)
```

```
## 'data.frame': 32 obs. of 11 variables:  
## $ mpg : num 21 21 22.8 21.4 18.7 18.1 14.3 24.4 22.8 19.2 ...  
## $ cyl : num 6 6 4 6 8 6 8 4 4 6 ...  
## $ disp: num 160 160 108 258 360 ...  
## $ hp : num 110 110 93 110 175 105 245 62 95 123 ...  
## $ drat: num 3.9 3.9 3.85 3.08 3.15 2.76 3.21 3.69 3.92 3.92 ...  
## $ wt : num 2.62 2.88 2.32 3.21 3.44 ...  
## $ qsec: num 16.5 17 18.6 19.4 17 ...  
## $ vs : num 0 0 1 1 0 1 0 1 1 1 ...  
## $ am : num 1 1 1 0 0 0 0 0 0 0 ...  
## $ gear: num 4 4 4 3 3 3 3 4 4 4 ...  
## $ carb: num 4 4 1 1 2 1 4 2 2 4 ...
```

```
class(mtcars)
```

```
## [1] "data.frame"
```

```
nrow(mtcars)
```

```
## [1] 32
```

```
ncol(mtcars)
```

```
## [1] 11
```

```
dim(mtcars)
```

```
## [1] 32 11
```

4. Lihat n baris pertama bagi set data.

```
head(mtcars, 10)
```

```
##           mpg  cyl  disp  hp drat   wt  qsec vs  am gear carb
## Mazda RX4      21.0   6 160.0 110 3.90 2.620 16.46 0   1    4    4
## Mazda RX4 Wag  21.0   6 160.0 110 3.90 2.875 17.02 0   1    4    4
## Datsun 710      22.8   4 108.0  93 3.85 2.320 18.61 1   1    4    1
## Hornet 4 Drive  21.4   6 258.0 110 3.08 3.215 19.44 1   0    3    1
## Hornet Sportabout 18.7   8 360.0 175 3.15 3.440 17.02 0   0    3    2
## Valiant         18.1   6 225.0 105 2.76 3.460 20.22 1   0    3    1
## Duster 360      14.3   8 360.0 245 3.21 3.570 15.84 0   0    3    4
## Merc 240D       24.4   4 146.7  62 3.69 3.190 20.00 1   0    4    2
## Merc 230        22.8   4 140.8  95 3.92 3.150 22.90 1   0    4    2
## Merc 280        19.2   6 167.6 123 3.92 3.440 18.30 1   0    4    4
```

5. Dapatkan jumlah data lenyap.

```
colSums(is.na(mtcars))
```

```
##  mpg  cyl disp  hp drat   wt  qsec   vs   am gear carb
##    0    0   0    0   0    0    0    0    0    0   0   0
```

Pembundaran nombor

1. Membundarkan kepada integer terdekat.

```
x = seq(-2.5,2.5, by=0.03)
round(x,1)
```

```
## [1] -2.5 -2.5 -2.4 -2.4 -2.4 -2.4 -2.3 -2.3 -2.3 -2.2 -2.2 -2.2 -2.1 -2.1 -2.1
## [16] -2.0 -2.0 -2.0 -2.0 -1.9 -1.9 -1.9 -1.8 -1.8 -1.8 -1.8 -1.7 -1.7 -1.7 -1.6
## [31] -1.6 -1.6 -1.5 -1.5 -1.5 -1.4 -1.4 -1.4 -1.4 -1.3 -1.3 -1.3 -1.2 -1.2 -1.2
## [46] -1.2 -1.1 -1.1 -1.1 -1.0 -1.0 -1.0 -0.9 -0.9 -0.9 -0.9 -0.8 -0.8 -0.8 -0.7
## [61] -0.7 -0.7 -0.6 -0.6 -0.6 -0.6 -0.5 -0.5 -0.5 -0.4 -0.4 -0.4 -0.3 -0.3 -0.3
## [76] -0.2 -0.2 -0.2 -0.2 -0.1 -0.1 -0.1 0.0 0.0 0.0 0.0 0.1 0.1 0.1 0.2
## [91] 0.2 0.2 0.3 0.3 0.3 0.4 0.4 0.4 0.4 0.5 0.5 0.5 0.6 0.6 0.6
## [106] 0.6 0.7 0.7 0.7 0.8 0.8 0.8 0.9 0.9 0.9 0.9 1.0 1.0 1.0 1.1
## [121] 1.1 1.1 1.2 1.2 1.2 1.2 1.3 1.3 1.3 1.4 1.4 1.4 1.5 1.5 1.5
## [136] 1.5 1.6 1.6 1.6 1.7 1.7 1.7 1.8 1.8 1.8 1.8 1.9 1.9 1.9 2.0
## [151] 2.0 2.0 2.1 2.1 2.1 2.1 2.2 2.2 2.2 2.3 2.3 2.3 2.4 2.4 2.4
## [166] 2.5 2.5
```

2. Membundarkan ke sempadan atas integer.

```
ceiling(x)
```

```
## [1] -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -1 -1 -1 -1 -1 -1 -1
## [26] -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
## [51] -1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## [76] 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1
## [101] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2
## [126] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
## [151] 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
```

3. Membundarkan ke sempadan bawah integer.

```
floor(x)
```

```
## [1] -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -3 -2 -2 -2 -2 -2 -2 -2
## [26] -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2
## [51] -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
## [76] -1 -1 -1 -1 -1 -1 -1 -1 -1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## [101] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1
## [126] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
## [151] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
```

4. Membundarkan kepada bilangan titik perpuluhan tertentu.

```
xp = c(0.001,0.07,1.2,44.0233,738.1111,27.998)
round(xp,digits=2)
```

```
## [1] 0.00 0.07 1.20 44.02 738.11 28.00
```

Pengisihan (sorting)

1. Pengisihan mengikut tertib menaik.

```
v = rnorm(10)
sort(v)
```

```
## [1] -1.3998170 -1.2243517 -0.9628422 -0.6897731 -0.6181362 -0.3283355
## [7]  0.1190602  0.5680825  0.9275461  1.4947222
```

2. Pengisihan mengikut tertib menurun.

```
sort(v, decreasing=T)
```

```
## [1]  1.4947222  0.9275461  0.5680825  0.1190602 -0.3283355 -0.6181362
## [7] -0.6897731 -0.9628422 -1.2243517 -1.3998170
```

3. Pengisihan dalam bingkai data sepadan dengan beberapa ciri tertentu.

```
attach(mtcars) #supaya boleh call column tanpa '$'
```

3.1 isih mengikut susunan p/ubah mpg

```
newdata = mtcars[order(mpg),]
```

3.2 isih mengikut susunan p/ubah mpg & cyl

```
newdata2 = mtcars[order(cyl,mpg),]
newdata2
```

```
##           mpg cyl  disp  hp drat   wt  qsec vs am gear carb
## Volvo 142E   21.4   4 121.0 109 4.11 2.780 18.60  1  1    4    2
## Toyota Corona 21.5   4 120.1  97 3.70 2.465 20.01  1  0    3    1
## Datsun 710   22.8   4 108.0  93 3.85 2.320 18.61  1  1    4    1
## Merc 230     22.8   4 140.8  95 3.92 3.150 22.90  1  0    4    2
## Merc 240D    24.4   4 146.7  62 3.69 3.190 20.00  1  0    4    2
## Porsche 914-2 26.0   4 120.3  91 4.43 2.140 16.70  0  1    5    2
## Fiat X1-9    27.3   4  79.0  66 4.08 1.935 18.90  1  1    4    1
## Honda Civic  30.4   4  75.7  52 4.93 1.615 18.52  1  1    4    2
## Lotus Europa 30.4   4  95.1 113 3.77 1.513 16.90  1  1    5    2
## Fiat 128     32.4   4  78.7  66 4.08 2.200 19.47  1  1    4    1
## Toyota Corolla 33.9   4  71.1  65 4.22 1.835 19.90  1  1    4    1
## Merc 280C    17.8   6 167.6 123 3.92 3.440 18.90  1  0    4    4
```


## Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
## Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
## Ferrari Dino	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
## Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
## Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
## Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
## Cadillac Fleetwood	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
## Lincoln Continental	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
## Camaro Z28	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4
## Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
## Chrysler Imperial	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
## Maserati Bora	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
## Merc 450SLC	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
## AMC Javelin	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
## Dodge Challenger	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
## Ford Pantera L	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
## Merc 450SE	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
## Merc 450SL	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
## Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
## Pontiac Firebird	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2

Latihan

isih data susunan menurun p/ubah cyl & susnan meningkat p/ubah hp

```
newdata3 = mtcars[order(-cyl,hp),]
newdata3
```

##	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
## Dodge Challenger	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
## AMC Javelin	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
## Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
## Pontiac Firebird	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2
## Merc 450SE	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
## Merc 450SL	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
## Merc 450SLC	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
## Cadillac Fleetwood	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
## Lincoln Continental	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
## Chrysler Imperial	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
## Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
## Camaro Z28	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4
## Ford Pantera L	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
## Maserati Bora	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
## Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
## Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
## Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
## Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
## Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
## Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
## Ferrari Dino	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
## Honda Civic	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
## Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
## Toyota Corolla	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1

## Fiat 128	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
## Fiat X1-9	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
## Porsche 914-2	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
## Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
## Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
## Toyota Corona	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
## Volvo 142E	21.4	4	121.0	109	4.11	2.780	18.60	1	1	4	2
## Lotus Europa	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2

Perawakan

1. Perawakan tertib vektor.

```
v = 11:20
vi2 = sample(v)
vi2
```

```
## [1] 20 18 11 15 13 12 19 17 14 16
```

2. Perawakan tertib bingkai data.

```
data3 = data.frame(label=letters[1:5], number=11:15)
data4 = data3[sample(1:nrow(data3)),]
data4
```

```
##   label number
## 2     b     12
## 4     d     14
## 5     e     15
## 3     c     13
## 1     a     11
```

aras dalam p/ubah faktor (rename classes)

1. Membina pembolehubah faktor baharu.

```
fi = c("alpha","beta","gamma","alpha","beta")
xf = as.factor(fi)
class(xf)
```

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

```
xf
```

```
## [1] alpha beta gamma alpha beta
## Levels: alpha beta gamma
```

2. Mengtakrif pembolehubah faktor bertertib.

```
ses = c("low", "middle", "low", "low", "low", "middle", "low", "middle", "middle", "high", "high")
ses2 = as.factor(ses)
ses.f = factor(ses, levels=c("low", "middle", "high"))
ses.f

## [1] low middle low low low middle low middle middle high
## [11] high
## Levels: low middle high
```

2.2 bingkai data

```
mtcars$cyl = as.factor(mtcars$cyl)
mtcars$gear = factor(mtcars$gear, levels=c("3", "4", "5"))
mtcars$gear

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

```
str(mtcars)
```

```
## 'data.frame': 32 obs. of 11 variables:
## $ mpg : num 21 21 22.8 21.4 18.7 18.1 14.3 24.4 22.8 19.2 ...
## $ cyl : Factor w/ 3 levels "4","6","8": 2 2 1 2 3 2 3 1 1 2 ...
## $ disp: num 160 160 108 258 360 ...
## $ hp : num 110 110 93 110 175 105 245 62 95 123 ...
## $ drat: num 3.9 3.9 3.85 3.08 3.15 2.76 3.21 3.69 3.92 3.92 ...
## $ wt : num 2.62 2.88 2.32 3.21 3.44 ...
## $ qsec: num 16.5 17 18.6 19.4 17 ...
## $ vs : num 0 0 1 1 0 1 0 1 1 1 ...
## $ am : num 1 1 1 0 0 0 0 0 0 0 ...
## $ gear: Factor w/ 3 levels "3","4","5": 2 2 2 1 1 1 1 2 2 2 ...
## $ carb: num 4 4 1 1 2 1 4 2 2 4 ...
```

3. Namakan semula aras faktor.

```
library(plyr) #use "plyr" library
xf2 = revalue(xf, c("beta"="delta", "gamma"="zeta"))
xf2
```

```
## [1] alpha delta zeta alpha delta
## Levels: alpha delta zeta
```

4. Menambah dan menurunkan aras dalam pembolehubah faktor.

```
# ses.f = factor(ses.f, levels=c(levels(ses.f), "very high"))
ses.f
```

```
## [1] low middle low low low middle low middle middle high
## [11] high
## Levels: low middle high
```

```
levels(ses.f)
```

```
## [1] "low" "middle" "high"
```

```
newdata = droplevels(ses.f)
newdata
```

```
## [1] low middle low low low middle low middle middle high
## [11] high
## Levels: low middle high
```

Jujukan dalam blok

1. Mentakrifkan saiz blok.

```
x = rnorm(22)*100
x
```

```
## [1] 9.589828 49.797149 -42.536516 32.686738 -79.609431 65.065751
## [7] 128.100297 173.974533 93.533002 20.985516 33.338105 -34.912885
## [13] 26.584963 -149.449494 -171.190954 110.072201 -40.016634 -150.935714
## [19] -48.426914 202.405847 -7.117705 -109.495718
```

1.1 blok saiz 4

```
block = ceiling(length(x)/4)*4
block #24 values needed for block size 4 required
```

```
## [1] 24
```

2. Menggantikan nilai yang terkurang dengan NA.

```
x[block] = NA
x[23]
```

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

3. Membina matriks blok baris.

```
xm = matrix(x,nrow=4)
xm
```

```
##           [,1]      [,2]      [,3]      [,4]      [,5]      [,6]
## [1,]  9.589828 -79.60943  93.53300   26.58496 -40.01663  -7.117705
## [2,] 49.797149  65.06575  20.98552 -149.44949 -150.93571 -109.495718
## [3,] -42.536516 128.10030  33.33811 -171.19095  -48.42691         NA
## [4,] 32.686738 173.97453 -34.91289  110.07220  202.40585         NA
```

4. Menghitung ukuran statistik lajur.

```
colMeans(xm,na.rm=T)
```

```
## [1] 12.384300 71.882788 28.235935 -45.995821 -9.243354 -58.306712
```

5. Jalankan Pengekoden Panjang (Run Length Encoding).

hitung bilangan nilai seragam dalam jujukan

```
vr = c("A","A","A","B","B","B","B","X","L","C","C","B","C","C","C")
```

```
vlr = rle(vr)
```

```
vlr #results will be A 3 times, B 4 times, X once, L once....
```

```
## Run Length Encoding
## lengths: int [1:7] 3 4 1 1 2 1 3
## values : chr [1:7] "A" "B" "X" "L" "C" "B" "C"
```

```
test = as.factor(vr)
summary(test)
```

```
## A B C L X
## 3 5 5 1 1
```

ifelse dan nested ifelse

1. Pernyataan mudah ifelse().

```
mydata = data.frame(x1=seq(1,20,by=2), x2=sample(100:200,10,FALSE), x3=LETTERS[1:10])
mydata
```

```
##      x1  x2 x3
## 1      1 190 A
## 2      3 170 B
## 3      5 162 C
## 4      7 189 D
## 5      9 134 E
## 6     11 168 F
## 7     13 137 G
## 8     15 117 H
## 9     17 136 I
## 10    19 181 J
```

1.1 bina binari p/ubah y (-1 atau 0) #jika x2>150, maka y=-1 #jika sebaliknya y=0

```
mydata$y = ifelse(mydata$x2>150, -1, 0)
mydata
```

```
##      x1  x2 x3  y
## 1      1 190 A -1
## 2      3 170 B -1
## 3      5 162 C -1
## 4      7 189 D -1
## 5      9 134 E  0
## 6     11 168 F -1
## 7     13 137 G  0
## 8     15 117 H  0
## 9     17 136 I  0
## 10    19 181 J -1
```

2. Fungsi ifelse() terhadap pemboleh ubah kualitatif (aksara).

2.1 bina data y2

jika x3 ialah A & D, x1 darab dengan 2 selainnya x1 darab dengan 3

```
mydata$y2 = ifelse(mydata$x3=="A"|mydata$x3=="D", mydata$x1*2, mydata$x1*3)
mydata$y2 = ifelse(mydata$x3%in%c("A","D"), mydata$x1*2, mydata$x1*3)
mydata
```

```
##      x1  x2 x3  y y2
## 1      1 190 A -1  2
## 2      3 170 B -1  9
## 3      5 162 C -1 15
## 4      7 189 D -1 14
## 5      9 134 E  0 27
## 6     11 168 F -1 33
## 7     13 137 G  0 39
## 8     15 117 H  0 45
## 9     17 136 I  0 51
## 10    19 181 J -1 57
```

3. Pernyataan Nested ifelse().

3.1 bina data y3 x1 darab dengan 5 jika x3 ialah nilai A, B, dan D

jika nilai x3 ialah C&H x1 darab 10

selainnya x2 darab dengan 20

```
mydata$y3 = ifelse(mydata$x3%in%c("A","B","D"), mydata$x1*5,
                  ifelse(mydata$x3%in%c("C","H"), mydata$x1*10,
                        mydata$x2*20) )
mydata
```

```
##      x1  x2 x3  y  y2  y3
## 1     1 190  A -1   2    5
## 2     3 170  B -1   9   15
## 3     5 162  C -1  15   50
## 4     7 189  D -1  14   35
## 5     9 134  E  0  27 2680
## 6    11 168  F -1  33 3360
## 7    13 137  G  0  39 2740
## 8    15 117  H  0  45  150
## 9    17 136  I  0  51 2720
## 10   19 181  J -1  57 3620
```

Aggregate data

1. Pengagregatan satu pemboleh ubah & kumpulan berdasarkan satu pemboleh ubah.

```
df = data.frame(team=c('A','A','A','B','B','B','C','C'), event=c('E','E','W','W','W','W','W','W'), point=c(2,3,3,5,5,5,8,8))
```

hitung purata point berdasarkan team

```
aggregate(point~team,data=df,FUN=mean)
```

```
##      team    point
## 1      A 2.333333
## 2      B 5.333333
## 3      C 8.000000
```

2. Pengagregatan satu pemboleh ubah & kumpulan berdasarkan pemboleh ubah berganda. #2.1 hitung purata point berdasarkan team dan event

```
aggregate(point~team+event, data=df, FUN=mean)
```

```
##   team event   point
## 1    A     E 2.000000
## 2    A     W 3.000000
## 3    B     W 5.333333
## 4    C     W 8.000000
```

2.2 sishan piawai

```
aggregate(point~team+event, data=df, FUN=sd)
```

```
##   team event   point
## 1    A     E 1.414214
## 2    A     W      NA
## 3    B     W 1.527525
## 4    C     W 1.414214
```

3. Pengagregatan pemboleh ubah berganda & kumpulan berdasarkan satu pemboleh ubah.

hitung purata point dan level berdasarkan team

```
aggregate(cbind(point,level)~team, data=df, FUN=mean)
```

```
##   team   point   level
## 1    A 2.333333 7.333333
## 2    B 5.333333 4.000000
## 3    C 8.000000 13.500000
```

4. Pengagregatan pemboleh ubah berganda & kumpulan berdasarkan pemboleh ubah berganda.

hitung purata point dan level berdasarkan team dan event

```
aggregate(cbind(point,level)~team+event, data=df, FUN=mean)
```

```
##   team event   point level
## 1    A     E 2.000000   7.0
## 2    A     W 3.000000   8.0
## 3    B     W 5.333333   4.0
## 4    C     W 8.000000  13.5
```

Penggelungan

1. Fungsi Apply


```
dat = data.frame(x=c(1:5,81), z=c(1,1,99,0,1,0), y=5*c(1:6))
dat #cari nilai maksimum bagi setiap baris apply(dat,1,max)
```

```
##      x  z  y
## 1    1  1  5
## 2    2  1 10
## 3    3 99 15
## 4    4  0 20
## 5    5  1 25
## 6   81  0 30
```

cari nilai maksimum bagi setiap lajur for loop

```
x=NULL
for(i in 1:ncol(dat)) {x[i] = max(dat[i])}
x
```

```
## [1] 81 99 30
```

#Pakej DPLYR library(dplyr)

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:plyr':
##
##      arrange, count, desc, failwith, id, mutate, rename, summarise,
##      summarize
```

```
## The following objects are masked from 'package:stats':
##
##      filter, lag
```

```
## The following objects are masked from 'package:base':
##
##      intersect, setdiff, setequal, union
```

```
mydata = read.csv("G:/My Drive/Master-Data-Science/Semester_1/Data_Mining/Data/sampleddata.csv")
head(mydata)
```

```
##   Index   State   Y2002   Y2003   Y2004   Y2005   Y2006   Y2007   Y2008
## 1     A  Alabama 1296530 1317711 1118631 1492583 1107408 1440134 1945229
## 2     A   Alaska 1170302 1960378 1818085 1447852 1861639 1465841 1551826
## 3     A  Arizona 1742027 1968140 1377583 1782199 1102568 1109382 1752886
## 4     A Arkansas 1485531 1994927 1119299 1947979 1669191 1801213 1188104
```

```
## 5      C California 1685349 1675807 1889570 1480280 1735069 1812546 1487315
## 6      C   Colorado 1343824 1878473 1886149 1236697 1871471 1814218 1875146
##      Y2009  Y2010  Y2011  Y2012  Y2013  Y2014  Y2015
## 1 1944173 1237582 1440756 1186741 1852841 1558906 1916661
## 2 1436541 1629616 1230866 1512804 1985302 1580394 1979143
## 3 1554330 1300521 1130709 1907284 1363279 1525866 1647724
## 4 1628980 1669295 1928238 1216675 1591896 1360959 1329341
## 5 1663809 1624509 1639670 1921845 1156536 1388461 1644607
## 6 1752387 1913275 1665877 1491604 1178355 1383978 1330736
```

1. Pemilihan rawak N baris.

```
sample_n(mydata, 10)
```

```
##      Index      State  Y2002  Y2003  Y2004  Y2005  Y2006  Y2007  Y2008
## 1      0      Ohio 1802132 1648498 1441386 1670280 1534888 1314824 1516621
## 2      H      Hawaii 1461570 1200280 1213993 1245931 1459383 1430465 1919423
## 3      F      Florida 1964626 1468852 1419738 1362787 1339608 1278550 1756185
## 4      N      New York 1395149 1611371 1170675 1446810 1426941 1463171 1732098
## 5      M      Michigan 1295635 1149931 1601027 1340716 1729449 1567494 1990431
## 6      N New Hampshire 1419776 1854370 1195119 1990062 1645430 1286967 1762936
## 7      I      Iowa 1499269 1444576 1576367 1388924 1554813 1452911 1317983
## 8      W      Wyoming 1775190 1498098 1198212 1881688 1750527 1523124 1587602
## 9      L      Louisiana 1584734 1110625 1868456 1751920 1233709 1920301 1185085
## 10     D      Delaware 1330403 1268673 1706751 1403759 1441351 1300836 1762096
##      Y2009  Y2010  Y2011  Y2012  Y2013  Y2014  Y2015
## 1 1511460 1585465 1887714 1227303 1840898 1880804 1573117
## 2 1928416 1330509 1902816 1695126 1517184 1948108 1150882
## 3 1818438 1198403 1497051 1131928 1107448 1407784 1170389
## 4 1426216 1604531 1683687 1500089 1718837 1619033 1367705
## 5 1575185 1267626 1274673 1709853 1815596 1965196 1646634
## 6 1763211 1265642 1704297 1131298 1197576 1242623 1963313
## 7 1150783 1751389 1992996 1501879 1173694 1431705 1641866
## 8 1504455 1282142 1881814 1673668 1994022 1204029 1853858
## 9 1124853 1498662 1210385 1234234 1287663 1908602 1403857
## 10 1553585 1370984 1318669 1984027 1671279 1803169 1627508
```

2. Pemilihan rawak pecahan/peratusan baris.

```
sample_frac(mydata, 0.5)
```

```
##      Index      State  Y2002  Y2003  Y2004  Y2005  Y2006  Y2007  Y2008
## 1      K      Kentucky 1813878 1448846 1800760 1250524 1137913 1911227 1301848
## 2      V      Vermont 1146902 1832249 1492704 1579265 1332048 1563537 1123567
## 3      I      Iowa 1499269 1444576 1576367 1388924 1554813 1452911 1317983
## 4      N      Nevada 1426117 1114500 1119707 1758830 1694526 1765826 1903270
## 5      N      Nebraska 1885081 1309769 1425527 1240465 1500594 1278272 1140598
## 6      V      Virginia 1134317 1163996 1891068 1853855 1708715 1197698 1803330
## 7      W West Virginia 1677347 1380662 1176100 1888948 1922085 1740826 1238174
```

```

## 8      W      Wisconsin 1788920 1518578 1289663 1436888 1251678 1721874 1980167
## 9      N North Carolina 1616742 1292223 1482792 1532347 1158716 1827420 1267737
## 10     O      Oklahoma 1173918 1334639 1663622 1798714 1312574 1708245 1256746
## 11     I      Idaho 1353210 1438538 1739154 1541015 1122387 1772050 1335481
## 12     M      Michigan 1295635 1149931 1601027 1340716 1729449 1567494 1990431
## 13     A      Alaska 1170302 1960378 1818085 1447852 1861639 1465841 1551826
## 14     S South Dakota 1159037 1150689 1660148 1417141 1418586 1279134 1171870
## 15     L      Louisiana 1584734 1110625 1868456 1751920 1233709 1920301 1185085
## 16     F      Florida 1964626 1468852 1419738 1362787 1339608 1278550 1756185
## 17     A      Alabama 1296530 1317711 1118631 1492583 1107408 1440134 1945229
## 18     W      Washington 1977749 1687136 1199490 1163092 1334864 1621989 1545621
## 19     A      Arkansas 1485531 1994927 1119299 1947979 1669191 1801213 1188104
## 20     M      Maryland 1579713 1404700 1849798 1397738 1310270 1789128 1112765
## 21     T      Tennessee 1811867 1485909 1974179 1157059 1786132 1399191 1826406
## 22     C      Connecticut 1610512 1232844 1181949 1518933 1841266 1976976 1764457
## 23     A      Arizona 1742027 1968140 1377583 1782199 1102568 1109382 1752886
## 24     M      Minnesota 1729921 1675204 1903907 1561839 1985692 1148621 1328133
## 25     N      New Jersey 1605532 1141514 1613550 1181452 1541327 1156804 1568034
## 26     M      Montana 1877154 1540099 1332722 1273327 1625721 1983568 1251742
##      Y2009  Y2010  Y2011  Y2012  Y2013  Y2014  Y2015
## 1  1956681 1350895 1512894 1916616 1878271 1722762 1913350
## 2  1618583 1326369 1792600 1714960 1146278 1282790 1565924
## 3  1150783 1751389 1992996 1501879 1173694 1431705 1641866
## 4  1231480 1526066 1143343 1980195 1283813 1225348 1903804
## 5  1270585 1128711 1187207 1569665 1690920 1459243 1802211
## 6  1590043 1516758 1171686 1262342 1647032 1706707 1850394
## 7  1539322 1539603 1872519 1462137 1683127 1204344 1198791
## 8  1901394 1648755 1940943 1729177 1510119 1701650 1846238
## 9  1116168 1791535 1553750 1472258 1104893 1596452 1229085
## 10 1853142 1673831 1822933 1674707 1900523 1956742 1307678
## 11 1748608 1436809 1456340 1643855 1312561 1713718 1757171
## 12 1575185 1267626 1274673 1709853 1815596 1965196 1646634
## 13 1436541 1629616 1230866 1512804 1985302 1580394 1979143
## 14 1852424 1554782 1647245 1811156 1147488 1302834 1136443
## 15 1124853 1498662 1210385 1234234 1287663 1908602 1403857
## 16 1818438 1198403 1497051 1131928 1107448 1407784 1170389
## 17 1944173 1237582 1440756 1186741 1852841 1558906 1916661
## 18 1555554 1179331 1150089 1775787 1273834 1387428 1377341
## 19 1628980 1669295 1928238 1216675 1591896 1360959 1329341
## 20 1967225 1486246 1872327 1175819 1314343 1979529 1569566
## 21 1326460 1231739 1469785 1849041 1560887 1349173 1162164
## 22 1972730 1968730 1945524 1228529 1582249 1503156 1718072
## 23 1554330 1300521 1130709 1907284 1363279 1525866 1647724
## 24 1890633 1995304 1575533 1910216 1972021 1515366 1864553
## 25 1357418 1443718 1390010 1202326 1100990 1850165 1183568
## 26 1592690 1350619 1520064 1185225 1465705 1110394 1125903

```

3. Menyusun semula pembolehubah.

```

mydata5 = select(mydata, State, Y2002, Index, everything())
mydata5

```

##	State	Y2002	Index	Y2003	Y2004	Y2005	Y2006	Y2007
## 1	Alabama	1296530	A	1317711	1118631	1492583	1107408	1440134
## 2	Alaska	1170302	A	1960378	1818085	1447852	1861639	1465841
## 3	Arizona	1742027	A	1968140	1377583	1782199	1102568	1109382
## 4	Arkansas	1485531	A	1994927	1119299	1947979	1669191	1801213
## 5	California	1685349	C	1675807	1889570	1480280	1735069	1812546
## 6	Colorado	1343824	C	1878473	1886149	1236697	1871471	1814218
## 7	Connecticut	1610512	C	1232844	1181949	1518933	1841266	1976976
## 8	Delaware	1330403	D	1268673	1706751	1403759	1441351	1300836
## 9	District of Columbia	1111437	D	1993741	1374643	1827949	1803852	1595981
## 10	Florida	1964626	F	1468852	1419738	1362787	1339608	1278550
## 11	Georgia	1929009	G	1541565	1810773	1779091	1326846	1223770
## 12	Hawaii	1461570	H	1200280	1213993	1245931	1459383	1430465
## 13	Idaho	1353210	I	1438538	1739154	1541015	1122387	1772050
## 14	Illinois	1508356	I	1527440	1493029	1261353	1540274	1747614
## 15	Indiana	1776918	I	1734104	1269927	1204117	1848073	1129546
## 16	Iowa	1499269	I	1444576	1576367	1388924	1554813	1452911
## 17	Kansas	1509054	K	1290700	1522230	1532094	1104256	1863278
## 18	Kentucky	1813878	K	1448846	1800760	1250524	1137913	1911227
## 19	Louisiana	1584734	L	1110625	1868456	1751920	1233709	1920301
## 20	Maine	1582720	M	1678622	1208496	1912040	1438549	1330014
## 21	Maryland	1579713	M	1404700	1849798	1397738	1310270	1789128
## 22	Massachusetts	1647582	M	1686259	1620601	1777250	1531641	1380529
## 23	Michigan	1295635	M	1149931	1601027	1340716	1729449	1567494
## 24	Minnesota	1729921	M	1675204	1903907	1561839	1985692	1148621
## 25	Mississippi	1983285	M	1292558	1631325	1943311	1354579	1731643
## 26	Missouri	1221316	M	1858368	1773451	1573967	1374863	1486197
## 27	Montana	1877154	M	1540099	1332722	1273327	1625721	1983568
## 28	Nebraska	1885081	N	1309769	1425527	1240465	1500594	1278272
## 29	Nevada	1426117	N	1114500	1119707	1758830	1694526	1765826
## 30	New Hampshire	1419776	N	1854370	1195119	1990062	1645430	1286967
## 31	New Jersey	1605532	N	1141514	1613550	1181452	1541327	1156804
## 32	New Mexico	1819239	N	1226057	1935991	1124400	1723493	1475985
## 33	New York	1395149	N	1611371	1170675	1446810	1426941	1463171
## 34	North Carolina	1616742	N	1292223	1482792	1532347	1158716	1827420
## 35	North Dakota	1618807	N	1510193	1876940	1443172	1425030	1868788
## 36	Ohio	1802132	O	1648498	1441386	1670280	1534888	1314824
## 37	Oklahoma	1173918	O	1334639	1663622	1798714	1312574	1708245
## 38	Oregon	1794912	O	1726665	1805445	1133510	1502242	1419251
## 39	Pennsylvania	1320191	P	1446723	1218591	1122030	1971479	1563062
## 40	Rhode Island	1501744	R	1942942	1266657	1961923	1835983	1234040
## 41	South Carolina	1631522	S	1803455	1425193	1458191	1538731	1825195
## 42	South Dakota	1159037	S	1150689	1660148	1417141	1418586	1279134
## 43	Tennessee	1811867	T	1485909	1974179	1157059	1786132	1399191
## 44	Texas	1520591	T	1310777	1957713	1907326	1873544	1655483
## 45	Utah	1771096	U	1195861	1979395	1241662	1437456	1859416
## 46	Vermont	1146902	V	1832249	1492704	1579265	1332048	1563537
## 47	Virginia	1134317	V	1163996	1891068	1853855	1708715	1197698
## 48	Washington	1977749	W	1687136	1199490	1163092	1334864	1621989
## 49	West Virginia	1677347	W	1380662	1176100	1888948	1922085	1740826
## 50	Wisconsin	1788920	W	1518578	1289663	1436888	1251678	1721874
## 51	Wyoming	1775190	W	1498098	1198212	1881688	1750527	1523124
##	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015
## 1	1945229	1944173	1237582	1440756	1186741	1852841	1558906	1916661

## 2	1551826	1436541	1629616	1230866	1512804	1985302	1580394	1979143
## 3	1752886	1554330	1300521	1130709	1907284	1363279	1525866	1647724
## 4	1188104	1628980	1669295	1928238	1216675	1591896	1360959	1329341
## 5	1487315	1663809	1624509	1639670	1921845	1156536	1388461	1644607
## 6	1875146	1752387	1913275	1665877	1491604	1178355	1383978	1330736
## 7	1764457	1972730	1968730	1945524	1228529	1582249	1503156	1718072
## 8	1762096	1553585	1370984	1318669	1984027	1671279	1803169	1627508
## 9	1193245	1739748	1707823	1353449	1979708	1912654	1782169	1410183
## 10	1756185	1818438	1198403	1497051	1131928	1107448	1407784	1170389
## 11	1773090	1630325	1145473	1851245	1850111	1887157	1259353	1725470
## 12	1919423	1928416	1330509	1902816	1695126	1517184	1948108	1150882
## 13	1335481	1748608	1436809	1456340	1643855	1312561	1713718	1757171
## 14	1871645	1658551	1422021	1751422	1696729	1915435	1645465	1583516
## 15	1139551	1883976	1999102	1559924	1905760	1129794	1988394	1467614
## 16	1317983	1150783	1751389	1992996	1501879	1173694	1431705	1641866
## 17	1949478	1561528	1550433	1465812	1882929	1410249	1930090	1385528
## 18	1301848	1956681	1350895	1512894	1916616	1878271	1722762	1913350
## 19	1185085	1124853	1498662	1210385	1234234	1287663	1908602	1403857
## 20	1295877	1969163	1627262	1706080	1437088	1318546	1116792	1529233
## 21	1112765	1967225	1486246	1872327	1175819	1314343	1979529	1569566
## 22	1978904	1567651	1761048	1658538	1482203	1731917	1669749	1963337
## 23	1990431	1575185	1267626	1274673	1709853	1815596	1965196	1646634
## 24	1328133	1890633	1995304	1575533	1910216	1972021	1515366	1864553
## 25	1428291	1568049	1383227	1629132	1988270	1907777	1649668	1991232
## 26	1735099	1800620	1164202	1425363	1800052	1698105	1767835	1996005
## 27	1251742	1592690	1350619	1520064	1185225	1465705	1110394	1125903
## 28	1140598	1270585	1128711	1187207	1569665	1690920	1459243	1802211
## 29	1903270	1231480	1526066	1143343	1980195	1283813	1225348	1903804
## 30	1762936	1763211	1265642	1704297	1131298	1197576	1242623	1963313
## 31	1568034	1357418	1443718	1390010	1202326	1100990	1850165	1183568
## 32	1237704	1820856	1801430	1653384	1475715	1623388	1533494	1868612
## 33	1732098	1426216	1604531	1683687	1500089	1718837	1619033	1367705
## 34	1267737	1116168	1791535	1553750	1472258	1104893	1596452	1229085
## 35	1720352	1671468	1534571	1271132	1430978	1529024	1563898	1604118
## 36	1516621	1511460	1585465	1887714	1227303	1840898	1880804	1573117
## 37	1256746	1853142	1673831	1822933	1674707	1900523	1956742	1307678
## 38	1482786	1862351	1103794	1935687	1905378	1522129	1509171	1893515
## 39	1274168	1571032	1433835	1483292	1290329	1475344	1931500	1668232
## 40	1151409	1993136	1983569	1781016	1909119	1531212	1990412	1611730
## 41	1250499	1864685	1345102	1116203	1532332	1591735	1188417	1110655
## 42	1171870	1852424	1554782	1647245	1811156	1147488	1302834	1136443
## 43	1826406	1326460	1231739	1469785	1849041	1560887	1349173	1162164
## 44	1785986	1827503	1447457	1978374	1882532	1698698	1646508	1705322
## 45	1939284	1915865	1619186	1288285	1108281	1123353	1801019	1729273
## 46	1123567	1618583	1326369	1792600	1714960	1146278	1282790	1565924
## 47	1803330	1590043	1516758	1171686	1262342	1647032	1706707	1850394
## 48	1545621	1555554	1179331	1150089	1775787	1273834	1387428	1377341
## 49	1238174	1539322	1539603	1872519	1462137	1683127	1204344	1198791
## 50	1980167	1901394	1648755	1940943	1729177	1510119	1701650	1846238
## 51	1587602	1504455	1282142	1881814	1673668	1994022	1204029	1853858

4. Menamakan semula pembolehubah.

```
mydata6 = rename(mydata, IndexXY=Index, USState=State)
mydata6
```

##	IndexXY	USState	Y2002	Y2003	Y2004	Y2005	Y2006	Y2007
## 1	A	Alabama	1296530	1317711	1118631	1492583	1107408	1440134
## 2	A	Alaska	1170302	1960378	1818085	1447852	1861639	1465841
## 3	A	Arizona	1742027	1968140	1377583	1782199	1102568	1109382
## 4	A	Arkansas	1485531	1994927	1119299	1947979	1669191	1801213
## 5	C	California	1685349	1675807	1889570	1480280	1735069	1812546
## 6	C	Colorado	1343824	1878473	1886149	1236697	1871471	1814218
## 7	C	Connecticut	1610512	1232844	1181949	1518933	1841266	1976976
## 8	D	Delaware	1330403	1268673	1706751	1403759	1441351	1300836
## 9	D	District of Columbia	1111437	1993741	1374643	1827949	1803852	1595981
## 10	F	Florida	1964626	1468852	1419738	1362787	1339608	1278550
## 11	G	Georgia	1929009	1541565	1810773	1779091	1326846	1223770
## 12	H	Hawaii	1461570	1200280	1213993	1245931	1459383	1430465
## 13	I	Idaho	1353210	1438538	1739154	1541015	1122387	1772050
## 14	I	Illinois	1508356	1527440	1493029	1261353	1540274	1747614
## 15	I	Indiana	1776918	1734104	1269927	1204117	1848073	1129546
## 16	I	Iowa	1499269	1444576	1576367	1388924	1554813	1452911
## 17	K	Kansas	1509054	1290700	1522230	1532094	1104256	1863278
## 18	K	Kentucky	1813878	1448846	1800760	1250524	1137913	1911227
## 19	L	Louisiana	1584734	1110625	1868456	1751920	1233709	1920301
## 20	M	Maine	1582720	1678622	1208496	1912040	1438549	1330014
## 21	M	Maryland	1579713	1404700	1849798	1397738	1310270	1789128
## 22	M	Massachusetts	1647582	1686259	1620601	1777250	1531641	1380529
## 23	M	Michigan	1295635	1149931	1601027	1340716	1729449	1567494
## 24	M	Minnesota	1729921	1675204	1903907	1561839	1985692	1148621
## 25	M	Mississippi	1983285	1292558	1631325	1943311	1354579	1731643
## 26	M	Missouri	1221316	1858368	1773451	1573967	1374863	1486197
## 27	M	Montana	1877154	1540099	1332722	1273327	1625721	1983568
## 28	N	Nebraska	1885081	1309769	1425527	1240465	1500594	1278272
## 29	N	Nevada	1426117	1114500	1119707	1758830	1694526	1765826
## 30	N	New Hampshire	1419776	1854370	1195119	1990062	1645430	1286967
## 31	N	New Jersey	1605532	1141514	1613550	1181452	1541327	1156804
## 32	N	New Mexico	1819239	1226057	1935991	1124400	1723493	1475985
## 33	N	New York	1395149	1611371	1170675	1446810	1426941	1463171
## 34	N	North Carolina	1616742	1292223	1482792	1532347	1158716	1827420
## 35	N	North Dakota	1618807	1510193	1876940	1443172	1425030	1868788
## 36	O	Ohio	1802132	1648498	1441386	1670280	1534888	1314824
## 37	O	Oklahoma	1173918	1334639	1663622	1798714	1312574	1708245
## 38	O	Oregon	1794912	1726665	1805445	1133510	1502242	1419251
## 39	P	Pennsylvania	1320191	1446723	1218591	1122030	1971479	1563062
## 40	R	Rhode Island	1501744	1942942	1266657	1961923	1835983	1234040
## 41	S	South Carolina	1631522	1803455	1425193	1458191	1538731	1825195
## 42	S	South Dakota	1159037	1150689	1660148	1417141	1418586	1279134
## 43	T	Tennessee	1811867	1485909	1974179	1157059	1786132	1399191
## 44	T	Texas	1520591	1310777	1957713	1907326	1873544	1655483
## 45	U	Utah	1771096	1195861	1979395	1241662	1437456	1859416
## 46	V	Vermont	1146902	1832249	1492704	1579265	1332048	1563537
## 47	V	Virginia	1134317	1163996	1891068	1853855	1708715	1197698

## 48	W	Washington	1977749	1687136	1199490	1163092	1334864	1621989
## 49	W	West Virginia	1677347	1380662	1176100	1888948	1922085	1740826
## 50	W	Wisconsin	1788920	1518578	1289663	1436888	1251678	1721874
## 51	W	Wyoming	1775190	1498098	1198212	1881688	1750527	1523124
##	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015
## 1	1945229	1944173	1237582	1440756	1186741	1852841	1558906	1916661
## 2	1551826	1436541	1629616	1230866	1512804	1985302	1580394	1979143
## 3	1752886	1554330	1300521	1130709	1907284	1363279	1525866	1647724
## 4	1188104	1628980	1669295	1928238	1216675	1591896	1360959	1329341
## 5	1487315	1663809	1624509	1639670	1921845	1156536	1388461	1644607
## 6	1875146	1752387	1913275	1665877	1491604	1178355	1383978	1330736
## 7	1764457	1972730	1968730	1945524	1228529	1582249	1503156	1718072
## 8	1762096	1553585	1370984	1318669	1984027	1671279	1803169	1627508
## 9	1193245	1739748	1707823	1353449	1979708	1912654	1782169	1410183
## 10	1756185	1818438	1198403	1497051	1131928	1107448	1407784	1170389
## 11	1773090	1630325	1145473	1851245	1850111	1887157	1259353	1725470
## 12	1919423	1928416	1330509	1902816	1695126	1517184	1948108	1150882
## 13	1335481	1748608	1436809	1456340	1643855	1312561	1713718	1757171
## 14	1871645	1658551	1422021	1751422	1696729	1915435	1645465	1583516
## 15	1139551	1883976	1999102	1559924	1905760	1129794	1988394	1467614
## 16	1317983	1150783	1751389	1992996	1501879	1173694	1431705	1641866
## 17	1949478	1561528	1550433	1465812	1882929	1410249	1930090	1385528
## 18	1301848	1956681	1350895	1512894	1916616	1878271	1722762	1913350
## 19	1185085	1124853	1498662	1210385	1234234	1287663	1908602	1403857
## 20	1295877	1969163	1627262	1706080	1437088	1318546	1116792	1529233
## 21	1112765	1967225	1486246	1872327	1175819	1314343	1979529	1569566
## 22	1978904	1567651	1761048	1658538	1482203	1731917	1669749	1963337
## 23	1990431	1575185	1267626	1274673	1709853	1815596	1965196	1646634
## 24	1328133	1890633	1995304	1575533	1910216	1972021	1515366	1864553
## 25	1428291	1568049	1383227	1629132	1988270	1907777	1649668	1991232
## 26	1735099	1800620	1164202	1425363	1800052	1698105	1767835	1996005
## 27	1251742	1592690	1350619	1520064	1185225	1465705	1110394	1125903
## 28	1140598	1270585	1128711	1187207	1569665	1690920	1459243	1802211
## 29	1903270	1231480	1526066	1143343	1980195	1283813	1225348	1903804
## 30	1762936	1763211	1265642	1704297	1131298	1197576	1242623	1963313
## 31	1568034	1357418	1443718	1390010	1202326	1100990	1850165	1183568
## 32	1237704	1820856	1801430	1653384	1475715	1623388	1533494	1868612
## 33	1732098	1426216	1604531	1683687	1500089	1718837	1619033	1367705
## 34	1267737	1116168	1791535	1553750	1472258	1104893	1596452	1229085
## 35	1720352	1671468	1534571	1271132	1430978	1529024	1563898	1604118
## 36	1516621	1511460	1585465	1887714	1227303	1840898	1880804	1573117
## 37	1256746	1853142	1673831	1822933	1674707	1900523	1956742	1307678
## 38	1482786	1862351	1103794	1935687	1905378	1522129	1509171	1893515
## 39	1274168	1571032	1433835	1483292	1290329	1475344	1931500	1668232
## 40	1151409	1993136	1983569	1781016	1909119	1531212	1990412	1611730
## 41	1250499	1864685	1345102	1116203	1532332	1591735	1188417	1110655
## 42	1171870	1852424	1554782	1647245	1811156	1147488	1302834	1136443
## 43	1826406	1326460	1231739	1469785	1849041	1560887	1349173	1162164
## 44	1785986	1827503	1447457	1978374	1882532	1698698	1646508	1705322
## 45	1939284	1915865	1619186	1288285	1108281	1123353	1801019	1729273
## 46	1123567	1618583	1326369	1792600	1714960	1146278	1282790	1565924
## 47	1803330	1590043	1516758	1171686	1262342	1647032	1706707	1850394
## 48	1545621	1555554	1179331	1150089	1775787	1273834	1387428	1377341
## 49	1238174	1539322	1539603	1872519	1462137	1683127	1204344	1198791

```
## 50 1980167 1901394 1648755 1940943 1729177 1510119 1701650 1846238
## 51 1587602 1504455 1282142 1881814 1673668 1994022 1204029 1853858
```

5. Menapis baris.

pilih subset data untuk index “A”

```
mydata7 = filter(mydata, Index=="A")
mydata7
```

```
##   Index   State  Y2002  Y2003  Y2004  Y2005  Y2006  Y2007  Y2008
## 1     A  Alabama 1296530 1317711 1118631 1492583 1107408 1440134 1945229
## 2     A   Alaska 1170302 1960378 1818085 1447852 1861639 1465841 1551826
## 3     A  Arizona 1742027 1968140 1377583 1782199 1102568 1109382 1752886
## 4     A Arkansas 1485531 1994927 1119299 1947979 1669191 1801213 1188104
##      Y2009  Y2010  Y2011  Y2012  Y2013  Y2014  Y2015
## 1 1944173 1237582 1440756 1186741 1852841 1558906 1916661
## 2 1436541 1629616 1230866 1512804 1985302 1580394 1979143
## 3 1554330 1300521 1130709 1907284 1363279 1525866 1647724
## 4 1628980 1669295 1928238 1216675 1591896 1360959 1329341
```

6. Pemililihan kriteria berganda.

```
mydata8 = filter(mydata, Index%in%c("A","C"))
mydata8
```

```
##   Index   State  Y2002  Y2003  Y2004  Y2005  Y2006  Y2007  Y2008
## 1     A  Alabama 1296530 1317711 1118631 1492583 1107408 1440134 1945229
## 2     A   Alaska 1170302 1960378 1818085 1447852 1861639 1465841 1551826
## 3     A  Arizona 1742027 1968140 1377583 1782199 1102568 1109382 1752886
## 4     A Arkansas 1485531 1994927 1119299 1947979 1669191 1801213 1188104
## 5     C California 1685349 1675807 1889570 1480280 1735069 1812546 1487315
## 6     C   Colorado 1343824 1878473 1886149 1236697 1871471 1814218 1875146
## 7     C Connecticut 1610512 1232844 1181949 1518933 1841266 1976976 1764457
##      Y2009  Y2010  Y2011  Y2012  Y2013  Y2014  Y2015
## 1 1944173 1237582 1440756 1186741 1852841 1558906 1916661
## 2 1436541 1629616 1230866 1512804 1985302 1580394 1979143
## 3 1554330 1300521 1130709 1907284 1363279 1525866 1647724
## 4 1628980 1669295 1928238 1216675 1591896 1360959 1329341
## 5 1663809 1624509 1639670 1921845 1156536 1388461 1644607
## 6 1752387 1913275 1665877 1491604 1178355 1383978 1330736
## 7 1972730 1968730 1945524 1228529 1582249 1503156 1718072
```

7. Syarat ‘AND’ dalam pemilihan kriteria.

```
mydata9 = filter(mydata, Index%in%c("A","C") & Y2002>=130000)
mydata9
```


##	Index	State	Y2002	Y2003	Y2004	Y2005	Y2006	Y2007	Y2008
## 1	A	Alabama	1296530	1317711	1118631	1492583	1107408	1440134	1945229
## 2	A	Alaska	1170302	1960378	1818085	1447852	1861639	1465841	1551826
## 3	A	Arizona	1742027	1968140	1377583	1782199	1102568	1109382	1752886
## 4	A	Arkansas	1485531	1994927	1119299	1947979	1669191	1801213	1188104
## 5	C	California	1685349	1675807	1889570	1480280	1735069	1812546	1487315
## 6	C	Colorado	1343824	1878473	1886149	1236697	1871471	1814218	1875146
## 7	C	Connecticut	1610512	1232844	1181949	1518933	1841266	1976976	1764457
##	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015		
## 1	1944173	1237582	1440756	1186741	1852841	1558906	1916661		
## 2	1436541	1629616	1230866	1512804	1985302	1580394	1979143		
## 3	1554330	1300521	1130709	1907284	1363279	1525866	1647724		
## 4	1628980	1669295	1928238	1216675	1591896	1360959	1329341		
## 5	1663809	1624509	1639670	1921845	1156536	1388461	1644607		
## 6	1752387	1913275	1665877	1491604	1178355	1383978	1330736		
## 7	1972730	1968730	1945524	1228529	1582249	1503156	1718072		

8. Syarat 'OR' dalam pemilihan kriteria.

```
mydata10 = filter(mydata, Index%in%c("A","C") | Y2002>=130000)
mydata10
```

##	Index	State	Y2002	Y2003	Y2004	Y2005	Y2006	Y2007
## 1	A	Alabama	1296530	1317711	1118631	1492583	1107408	1440134
## 2	A	Alaska	1170302	1960378	1818085	1447852	1861639	1465841
## 3	A	Arizona	1742027	1968140	1377583	1782199	1102568	1109382
## 4	A	Arkansas	1485531	1994927	1119299	1947979	1669191	1801213
## 5	C	California	1685349	1675807	1889570	1480280	1735069	1812546
## 6	C	Colorado	1343824	1878473	1886149	1236697	1871471	1814218
## 7	C	Connecticut	1610512	1232844	1181949	1518933	1841266	1976976
## 8	D	Delaware	1330403	1268673	1706751	1403759	1441351	1300836
## 9	D	District of Columbia	1111437	1993741	1374643	1827949	1803852	1595981
## 10	F	Florida	1964626	1468852	1419738	1362787	1339608	1278550
## 11	G	Georgia	1929009	1541565	1810773	1779091	1326846	1223770
## 12	H	Hawaii	1461570	1200280	1213993	1245931	1459383	1430465
## 13	I	Idaho	1353210	1438538	1739154	1541015	1122387	1772050
## 14	I	Illinois	1508356	1527440	1493029	1261353	1540274	1747614
## 15	I	Indiana	1776918	1734104	1269927	1204117	1848073	1129546
## 16	I	Iowa	1499269	1444576	1576367	1388924	1554813	1452911
## 17	K	Kansas	1509054	1290700	1522230	1532094	1104256	1863278
## 18	K	Kentucky	1813878	1448846	1800760	1250524	1137913	1911227
## 19	L	Louisiana	1584734	1110625	1868456	1751920	1233709	1920301
## 20	M	Maine	1582720	1678622	1208496	1912040	1438549	1330014
## 21	M	Maryland	1579713	1404700	1849798	1397738	1310270	1789128
## 22	M	Massachusetts	1647582	1686259	1620601	1777250	1531641	1380529
## 23	M	Michigan	1295635	1149931	1601027	1340716	1729449	1567494
## 24	M	Minnesota	1729921	1675204	1903907	1561839	1985692	1148621
## 25	M	Mississippi	1983285	1292558	1631325	1943311	1354579	1731643
## 26	M	Missouri	1221316	1858368	1773451	1573967	1374863	1486197
## 27	M	Montana	1877154	1540099	1332722	1273327	1625721	1983568
## 28	N	Nebraska	1885081	1309769	1425527	1240465	1500594	1278272
## 29	N	Nevada	1426117	1114500	1119707	1758830	1694526	1765826

## 30	N	New Hampshire	1419776	1854370	1195119	1990062	1645430	1286967
## 31	N	New Jersey	1605532	1141514	1613550	1181452	1541327	1156804
## 32	N	New Mexico	1819239	1226057	1935991	1124400	1723493	1475985
## 33	N	New York	1395149	1611371	1170675	1446810	1426941	1463171
## 34	N	North Carolina	1616742	1292223	1482792	1532347	1158716	1827420
## 35	N	North Dakota	1618807	1510193	1876940	1443172	1425030	1868788
## 36	O	Ohio	1802132	1648498	1441386	1670280	1534888	1314824
## 37	O	Oklahoma	1173918	1334639	1663622	1798714	1312574	1708245
## 38	O	Oregon	1794912	1726665	1805445	1133510	1502242	1419251
## 39	P	Pennsylvania	1320191	1446723	1218591	1122030	1971479	1563062
## 40	R	Rhode Island	1501744	1942942	1266657	1961923	1835983	1234040
## 41	S	South Carolina	1631522	1803455	1425193	1458191	1538731	1825195
## 42	S	South Dakota	1159037	1150689	1660148	1417141	1418586	1279134
## 43	T	Tennessee	1811867	1485909	1974179	1157059	1786132	1399191
## 44	T	Texas	1520591	1310777	1957713	1907326	1873544	1655483
## 45	U	Utah	1771096	1195861	1979395	1241662	1437456	1859416
## 46	V	Vermont	1146902	1832249	1492704	1579265	1332048	1563537
## 47	V	Virginia	1134317	1163996	1891068	1853855	1708715	1197698
## 48	W	Washington	1977749	1687136	1199490	1163092	1334864	1621989
## 49	W	West Virginia	1677347	1380662	1176100	1888948	1922085	1740826
## 50	W	Wisconsin	1788920	1518578	1289663	1436888	1251678	1721874
## 51	W	Wyoming	1775190	1498098	1198212	1881688	1750527	1523124
##	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015
## 1	1945229	1944173	1237582	1440756	1186741	1852841	1558906	1916661
## 2	1551826	1436541	1629616	1230866	1512804	1985302	1580394	1979143
## 3	1752886	1554330	1300521	1130709	1907284	1363279	1525866	1647724
## 4	1188104	1628980	1669295	1928238	1216675	1591896	1360959	1329341
## 5	1487315	1663809	1624509	1639670	1921845	1156536	1388461	1644607
## 6	1875146	1752387	1913275	1665877	1491604	1178355	1383978	1330736
## 7	1764457	1972730	1968730	1945524	1228529	1582249	1503156	1718072
## 8	1762096	1553585	1370984	1318669	1984027	1671279	1803169	1627508
## 9	1193245	1739748	1707823	1353449	1979708	1912654	1782169	1410183
## 10	1756185	1818438	1198403	1497051	1131928	1107448	1407784	1170389
## 11	1773090	1630325	1145473	1851245	1850111	1887157	1259353	1725470
## 12	1919423	1928416	1330509	1902816	1695126	1517184	1948108	1150882
## 13	1335481	1748608	1436809	1456340	1643855	1312561	1713718	1757171
## 14	1871645	1658551	1422021	1751422	1696729	1915435	1645465	1583516
## 15	1139551	1883976	1999102	1559924	1905760	1129794	1988394	1467614
## 16	1317983	1150783	1751389	1992996	1501879	1173694	1431705	1641866
## 17	1949478	1561528	1550433	1465812	1882929	1410249	1930090	1385528
## 18	1301848	1956681	1350895	1512894	1916616	1878271	1722762	1913350
## 19	1185085	1124853	1498662	1210385	1234234	1287663	1908602	1403857
## 20	1295877	1969163	1627262	1706080	1437088	1318546	1116792	1529233
## 21	1112765	1967225	1486246	1872327	1175819	1314343	1979529	1569566
## 22	1978904	1567651	1761048	1658538	1482203	1731917	1669749	1963337
## 23	1990431	1575185	1267626	1274673	1709853	1815596	1965196	1646634
## 24	1328133	1890633	1995304	1575533	1910216	1972021	1515366	1864553
## 25	1428291	1568049	1383227	1629132	1988270	1907777	1649668	1991232
## 26	1735099	1800620	1164202	1425363	1800052	1698105	1767835	1996005
## 27	1251742	1592690	1350619	1520064	1185225	1465705	1110394	1125903
## 28	1140598	1270585	1128711	1187207	1569665	1690920	1459243	1802211
## 29	1903270	1231480	1526066	1143343	1980195	1283813	1225348	1903804
## 30	1762936	1763211	1265642	1704297	1131298	1197576	1242623	1963313
## 31	1568034	1357418	1443718	1390010	1202326	1100990	1850165	1183568

```
## 32 1237704 1820856 1801430 1653384 1475715 1623388 1533494 1868612
## 33 1732098 1426216 1604531 1683687 1500089 1718837 1619033 1367705
## 34 1267737 1116168 1791535 1553750 1472258 1104893 1596452 1229085
## 35 1720352 1671468 1534571 1271132 1430978 1529024 1563898 1604118
## 36 1516621 1511460 1585465 1887714 1227303 1840898 1880804 1573117
## 37 1256746 1853142 1673831 1822933 1674707 1900523 1956742 1307678
## 38 1482786 1862351 1103794 1935687 1905378 1522129 1509171 1893515
## 39 1274168 1571032 1433835 1483292 1290329 1475344 1931500 1668232
## 40 1151409 1993136 1983569 1781016 1909119 1531212 1990412 1611730
## 41 1250499 1864685 1345102 1116203 1532332 1591735 1188417 1110655
## 42 1171870 1852424 1554782 1647245 1811156 1147488 1302834 1136443
## 43 1826406 1326460 1231739 1469785 1849041 1560887 1349173 1162164
## 44 1785986 1827503 1447457 1978374 1882532 1698698 1646508 1705322
## 45 1939284 1915865 1619186 1288285 1108281 1123353 1801019 1729273
## 46 1123567 1618583 1326369 1792600 1714960 1146278 1282790 1565924
## 47 1803330 1590043 1516758 1171686 1262342 1647032 1706707 1850394
## 48 1545621 1555554 1179331 1150089 1775787 1273834 1387428 1377341
## 49 1238174 1539322 1539603 1872519 1462137 1683127 1204344 1198791
## 50 1980167 1901394 1648755 1940943 1729177 1510119 1701650 1846238
## 51 1587602 1504455 1282142 1881814 1673668 1994022 1204029 1853858
```

9. Syarat NOT.

ambil data bukan Index A,C,M & N

```
mydata11 = filter(mydata, !Index%in%c("A","C","M","N"))
mydata11
```

##	Index	State	Y2002	Y2003	Y2004	Y2005	Y2006	Y2007
## 1	D	Delaware	1330403	1268673	1706751	1403759	1441351	1300836
## 2	D	District of Columbia	1111437	1993741	1374643	1827949	1803852	1595981
## 3	F	Florida	1964626	1468852	1419738	1362787	1339608	1278550
## 4	G	Georgia	1929009	1541565	1810773	1779091	1326846	1223770
## 5	H	Hawaii	1461570	1200280	1213993	1245931	1459383	1430465
## 6	I	Idaho	1353210	1438538	1739154	1541015	1122387	1772050
## 7	I	Illinois	1508356	1527440	1493029	1261353	1540274	1747614
## 8	I	Indiana	1776918	1734104	1269927	1204117	1848073	1129546
## 9	I	Iowa	1499269	1444576	1576367	1388924	1554813	1452911
## 10	K	Kansas	1509054	1290700	1522230	1532094	1104256	1863278
## 11	K	Kentucky	1813878	1448846	1800760	1250524	1137913	1911227
## 12	L	Louisiana	1584734	1110625	1868456	1751920	1233709	1920301
## 13	O	Ohio	1802132	1648498	1441386	1670280	1534888	1314824
## 14	O	Oklahoma	1173918	1334639	1663622	1798714	1312574	1708245
## 15	O	Oregon	1794912	1726665	1805445	1133510	1502242	1419251
## 16	P	Pennsylvania	1320191	1446723	1218591	1122030	1971479	1563062
## 17	R	Rhode Island	1501744	1942942	1266657	1961923	1835983	1234040
## 18	S	South Carolina	1631522	1803455	1425193	1458191	1538731	1825195
## 19	S	South Dakota	1159037	1150689	1660148	1417141	1418586	1279134
## 20	T	Tennessee	1811867	1485909	1974179	1157059	1786132	1399191
## 21	T	Texas	1520591	1310777	1957713	1907326	1873544	1655483
## 22	U	Utah	1771096	1195861	1979395	1241662	1437456	1859416
## 23	V	Vermont	1146902	1832249	1492704	1579265	1332048	1563537

```
## 24      V      Virginia 1134317 1163996 1891068 1853855 1708715 1197698
## 25      W      Washington 1977749 1687136 1199490 1163092 1334864 1621989
## 26      W      West Virginia 1677347 1380662 1176100 1888948 1922085 1740826
## 27      W      Wisconsin 1788920 1518578 1289663 1436888 1251678 1721874
## 28      W      Wyoming 1775190 1498098 1198212 1881688 1750527 1523124
##      Y2008      Y2009      Y2010      Y2011      Y2012      Y2013      Y2014      Y2015
## 1 1762096 1553585 1370984 1318669 1984027 1671279 1803169 1627508
## 2 1193245 1739748 1707823 1353449 1979708 1912654 1782169 1410183
## 3 1756185 1818438 1198403 1497051 1131928 1107448 1407784 1170389
## 4 1773090 1630325 1145473 1851245 1850111 1887157 1259353 1725470
## 5 1919423 1928416 1330509 1902816 1695126 1517184 1948108 1150882
## 6 1335481 1748608 1436809 1456340 1643855 1312561 1713718 1757171
## 7 1871645 1658551 1422021 1751422 1696729 1915435 1645465 1583516
## 8 1139551 1883976 1999102 1559924 1905760 1129794 1988394 1467614
## 9 1317983 1150783 1751389 1992996 1501879 1173694 1431705 1641866
## 10 1949478 1561528 1550433 1465812 1882929 1410249 1930090 1385528
## 11 1301848 1956681 1350895 1512894 1916616 1878271 1722762 1913350
## 12 1185085 1124853 1498662 1210385 1234234 1287663 1908602 1403857
## 13 1516621 1511460 1585465 1887714 1227303 1840898 1880804 1573117
## 14 1256746 1853142 1673831 1822933 1674707 1900523 1956742 1307678
## 15 1482786 1862351 1103794 1935687 1905378 1522129 1509171 1893515
## 16 1274168 1571032 1433835 1483292 1290329 1475344 1931500 1668232
## 17 1151409 1993136 1983569 1781016 1909119 1531212 1990412 1611730
## 18 1250499 1864685 1345102 1116203 1532332 1591735 1188417 1110655
## 19 1171870 1852424 1554782 1647245 1811156 1147488 1302834 1136443
## 20 1826406 1326460 1231739 1469785 1849041 1560887 1349173 1162164
## 21 1785986 1827503 1447457 1978374 1882532 1698698 1646508 1705322
## 22 1939284 1915865 1619186 1288285 1108281 1123353 1801019 1729273
## 23 1123567 1618583 1326369 1792600 1714960 1146278 1282790 1565924
## 24 1803330 1590043 1516758 1171686 1262342 1647032 1706707 1850394
## 25 1545621 1555554 1179331 1150089 1775787 1273834 1387428 1377341
## 26 1238174 1539322 1539603 1872519 1462137 1683127 1204344 1198791
## 27 1980167 1901394 1648755 1940943 1729177 1510119 1701650 1846238
## 28 1587602 1504455 1282142 1881814 1673668 1994022 1204029 1853858
```

10. Syarat CONTAINS.

teknik digunakan untuk cari padanan data / pattern matching

dapatkan data dengan syarat p/ubah untuk State yang ada pattern nama Ar

```
mydata12 = filter(mydata, grepl("Ar", State))
mydata12
```

```
##      Index      State      Y2002      Y2003      Y2004      Y2005      Y2006      Y2007      Y2008
## 1      A      Arizona 1742027 1968140 1377583 1782199 1102568 1109382 1752886
## 2      A      Arkansas 1485531 1994927 1119299 1947979 1669191 1801213 1188104
##      Y2009      Y2010      Y2011      Y2012      Y2013      Y2014      Y2015
## 1 1554330 1300521 1130709 1907284 1363279 1525866 1647724
## 2 1628980 1669295 1928238 1216675 1591896 1360959 1329341
```

11. Memperlihatkan pemboleh ubah terpilih.

hitung min & median by p/ubah 2015

```
summarise(mydata, Y2015_mean=mean(Y2015), Y2015_median=median(Y2015))
```

```
##   Y2015_mean Y2015_median
## 1    1588297    1627508
```

12. Memperlihatkan pemboleh ubah berganda.

```
summarise_at(mydata, vars(Y2005,Y2006), list(means=mean, medians=median))
```

```
##   Y2005_means Y2006_means Y2005_medians Y2006_medians
## 1    1522064    1530969    1480280    1531641
```

13. Memperlihatkan data berdasarkan fungsi tersuai (Custom functions).

```
summarise_at(mydata, vars(Y2005,Y2006), function(x) log(sd(x-mean(x))))
```

```
##   Y2005    Y2006
## 1 12.49566 12.43145
```

14. Memperlihatkan semua pemboleh ubah berangka.

```
summarise_if(mydata, is.numeric, list(means=mean, medians=median))
```

```
##   Y2002_means Y2003_means Y2004_means Y2005_means Y2006_means Y2007_means
## 1    1566034    1509193    1540555    1522064    1530969    1553219
##   Y2008_means Y2009_means Y2010_means Y2011_means Y2012_means Y2013_means
## 1    1538398    1658519    1504108    1574968    1591135    1530078
##   Y2014_means Y2015_means Y2002_medians Y2003_medians Y2004_medians
## 1    1583360    1588297    1584734    1485909    1522230
##   Y2005_medians Y2006_medians Y2007_medians Y2008_medians Y2009_medians
## 1    1480280    1531641    1563062    1545621    1658551
##   Y2010_medians Y2011_medians Y2012_medians Y2013_medians Y2014_medians
## 1    1498662    1575533    1643855    1531212    1580394
##   Y2015_medians
## 1    1627508
```

15. Menyusun data menerusi pemboleh ubah berganda.

15.1 Susunan menaik

```
arrange(mydata, Index, Y2011)
```

##	Index	State	Y2002	Y2003	Y2004	Y2005	Y2006	Y2007
## 1	A	Arizona	1742027	1968140	1377583	1782199	1102568	1109382
## 2	A	Alaska	1170302	1960378	1818085	1447852	1861639	1465841
## 3	A	Alabama	1296530	1317711	1118631	1492583	1107408	1440134
## 4	A	Arkansas	1485531	1994927	1119299	1947979	1669191	1801213
## 5	C	California	1685349	1675807	1889570	1480280	1735069	1812546
## 6	C	Colorado	1343824	1878473	1886149	1236697	1871471	1814218
## 7	C	Connecticut	1610512	1232844	1181949	1518933	1841266	1976976
## 8	D	Delaware	1330403	1268673	1706751	1403759	1441351	1300836
## 9	D	District of Columbia	1111437	1993741	1374643	1827949	1803852	1595981
## 10	F	Florida	1964626	1468852	1419738	1362787	1339608	1278550
## 11	G	Georgia	1929009	1541565	1810773	1779091	1326846	1223770
## 12	H	Hawaii	1461570	1200280	1213993	1245931	1459383	1430465
## 13	I	Idaho	1353210	1438538	1739154	1541015	1122387	1772050
## 14	I	Indiana	1776918	1734104	1269927	1204117	1848073	1129546
## 15	I	Illinois	1508356	1527440	1493029	1261353	1540274	1747614
## 16	I	Iowa	1499269	1444576	1576367	1388924	1554813	1452911
## 17	K	Kansas	1509054	1290700	1522230	1532094	1104256	1863278
## 18	K	Kentucky	1813878	1448846	1800760	1250524	1137913	1911227
## 19	L	Louisiana	1584734	1110625	1868456	1751920	1233709	1920301
## 20	M	Michigan	1295635	1149931	1601027	1340716	1729449	1567494
## 21	M	Missouri	1221316	1858368	1773451	1573967	1374863	1486197
## 22	M	Montana	1877154	1540099	1332722	1273327	1625721	1983568
## 23	M	Minnesota	1729921	1675204	1903907	1561839	1985692	1148621
## 24	M	Mississippi	1983285	1292558	1631325	1943311	1354579	1731643
## 25	M	Massachusetts	1647582	1686259	1620601	1777250	1531641	1380529
## 26	M	Maine	1582720	1678622	1208496	1912040	1438549	1330014
## 27	M	Maryland	1579713	1404700	1849798	1397738	1310270	1789128
## 28	N	Nevada	1426117	1114500	1119707	1758830	1694526	1765826
## 29	N	Nebraska	1885081	1309769	1425527	1240465	1500594	1728272
## 30	N	North Dakota	1618807	1510193	1876940	1443172	1425030	1868788
## 31	N	New Jersey	1605532	1141514	1613550	1181452	1541327	1156804
## 32	N	North Carolina	1616742	1292223	1482792	1532347	1158716	1827420
## 33	N	New Mexico	1819239	1226057	1935991	1124400	1723493	1475985
## 34	N	New York	1395149	1611371	1170675	1446810	1426941	1463171
## 35	N	New Hampshire	1419776	1854370	1195119	1990062	1645430	1286967
## 36	O	Oklahoma	1173918	1334639	1663622	1798714	1312574	1708245
## 37	O	Ohio	1802132	1648498	1441386	1670280	1534888	1314824
## 38	O	Oregon	1794912	1726665	1805445	1133510	1502242	1419251
## 39	P	Pennsylvania	1320191	1446723	1218591	1122030	1971479	1563062
## 40	R	Rhode Island	1501744	1942942	1266657	1961923	1835983	1234040
## 41	S	South Carolina	1631522	1803455	1425193	1458191	1538731	1825195
## 42	S	South Dakota	1159037	1150689	1660148	1417141	1418586	1279134
## 43	T	Tennessee	1811867	1485909	1974179	1157059	1786132	1399191
## 44	T	Texas	1520591	1310777	1957713	1907326	1873544	1655483
## 45	U	Utah	1771096	1195861	1979395	1241662	1437456	1859416
## 46	V	Virginia	1134317	1163996	1891068	1853855	1708715	1197698
## 47	V	Vermont	1146902	1832249	1492704	1579265	1332048	1563537
## 48	W	Washington	1977749	1687136	1199490	1163092	1334864	1621989
## 49	W	West Virginia	1677347	1380662	1176100	1888948	1922085	1740826
## 50	W	Wyoming	1775190	1498098	1198212	1881688	1750527	1523124

## 51	W	Wisconsin 1788920 1518578 1289663 1436888 1251678 1721874						
##	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015
## 1	1752886	1554330	1300521	1130709	1907284	1363279	1525866	1647724
## 2	1551826	1436541	1629616	1230866	1512804	1985302	1580394	1979143
## 3	1945229	1944173	1237582	1440756	1186741	1852841	1558906	1916661
## 4	1188104	1628980	1669295	1928238	1216675	1591896	1360959	1329341
## 5	1487315	1663809	1624509	1639670	1921845	1156536	1388461	1644607
## 6	1875146	1752387	1913275	1665877	1491604	1178355	1383978	1330736
## 7	1764457	1972730	1968730	1945524	1228529	1582249	1503156	1718072
## 8	1762096	1553585	1370984	1318669	1984027	1671279	1803169	1627508
## 9	1193245	1739748	1707823	1353449	1979708	1912654	1782169	1410183
## 10	1756185	1818438	1198403	1497051	1131928	1107448	1407784	1170389
## 11	1773090	1630325	1145473	1851245	1850111	1887157	1259353	1725470
## 12	1919423	1928416	1330509	1902816	1695126	1517184	1948108	1150882
## 13	1335481	1748608	1436809	1456340	1643855	1312561	1713718	1757171
## 14	1139551	1883976	1999102	1559924	1905760	1129794	1988394	1467614
## 15	1871645	1658551	1422021	1751422	1696729	1915435	1645465	1583516
## 16	1317983	1150783	1751389	1992996	1501879	1173694	1431705	1641866
## 17	1949478	1561528	1550433	1465812	1882929	1410249	1930090	1385528
## 18	1301848	1956681	1350895	1512894	1916616	1878271	1722762	1913350
## 19	1185085	1124853	1498662	1210385	1234234	1287663	1908602	1403857
## 20	1990431	1575185	1267626	1274673	1709853	1815596	1965196	1646634
## 21	1735099	1800620	1164202	1425363	1800052	1698105	1767835	1996005
## 22	1251742	1592690	1350619	1520064	1185225	1465705	1110394	1125903
## 23	1328133	1890633	1995304	1575533	1910216	1972021	1515366	1864553
## 24	1428291	1568049	1383227	1629132	1988270	1907777	1649668	1991232
## 25	1978904	1567651	1761048	1658538	1482203	1731917	1669749	1963337
## 26	1295877	1969163	1627262	1706080	1437088	1318546	1116792	1529233
## 27	1112765	1967225	1486246	1872327	1175819	1314343	1979529	1569566
## 28	1903270	1231480	1526066	1143343	1980195	1283813	1225348	1903804
## 29	1140598	1270585	1128711	1187207	1569665	1690920	1459243	1802211
## 30	1720352	1671468	1534571	1271132	1430978	1529024	1563898	1604118
## 31	1568034	1357418	1443718	1390010	1202326	1100990	1850165	1183568
## 32	1267737	1116168	1791535	1553750	1472258	1104893	1596452	1229085
## 33	1237704	1820856	1801430	1653384	1475715	1623388	1533494	1868612
## 34	1732098	1426216	1604531	1683687	1500089	1718837	1619033	1367705
## 35	1762936	1763211	1265642	1704297	1131298	1197576	1242623	1963313
## 36	1256746	1853142	1673831	1822933	1674707	1900523	1956742	1307678
## 37	1516621	1511460	1585465	1887714	1227303	1840898	1880804	1573117
## 38	1482786	1862351	1103794	1935687	1905378	1522129	1509171	1893515
## 39	1274168	1571032	1433835	1483292	1290329	1475344	1931500	1668232
## 40	1151409	1993136	1983569	1781016	1909119	1531212	1990412	1611730
## 41	1250499	1864685	1345102	1116203	1532332	1591735	1188417	1110655
## 42	1171870	1852424	1554782	1647245	1811156	1147488	1302834	1136443
## 43	1826406	1326460	1231739	1469785	1849041	1560887	1349173	1162164
## 44	1785986	1827503	1447457	1978374	1882532	1698698	1646508	1705322
## 45	1939284	1915865	1619186	1288285	1108281	1123353	1801019	1729273
## 46	1803330	1590043	1516758	1171686	1262342	1647032	1706707	1850394
## 47	1123567	1618583	1326369	1792600	1714960	1146278	1282790	1565924
## 48	1545621	1555554	1179331	1150089	1775787	1273834	1387428	1377341
## 49	1238174	1539322	1539603	1872519	1462137	1683127	1204344	1198791
## 50	1587602	1504455	1282142	1881814	1673668	1994022	1204029	1853858
## 51	1980167	1901394	1648755	1940943	1729177	1510119	1701650	1846238

15.2 Susunan menurun (index)

```
arrange(mydata, desc(Index), Y2011)
```

##	Index	State	Y2002	Y2003	Y2004	Y2005	Y2006	Y2007
## 1	W	Washington	1977749	1687136	1199490	1163092	1334864	1621989
## 2	W	West Virginia	1677347	1380662	1176100	1888948	1922085	1740826
## 3	W	Wyoming	1775190	1498098	1198212	1881688	1750527	1523124
## 4	W	Wisconsin	1788920	1518578	1289663	1436888	1251678	1721874
## 5	V	Virginia	1134317	1163996	1891068	1853855	1708715	1197698
## 6	V	Vermont	1146902	1832249	1492704	1579265	1332048	1563537
## 7	U	Utah	1771096	1195861	1979395	1241662	1437456	1859416
## 8	T	Tennessee	1811867	1485909	1974179	1157059	1786132	1399191
## 9	T	Texas	1520591	1310777	1957713	1907326	1873544	1655483
## 10	S	South Carolina	1631522	1803455	1425193	1458191	1538731	1825195
## 11	S	South Dakota	1159037	1150689	1660148	1417141	1418586	1279134
## 12	R	Rhode Island	1501744	1942942	1266657	1961923	1835983	1234040
## 13	P	Pennsylvania	1320191	1446723	1218591	1122030	1971479	1563062
## 14	O	Oklahoma	1173918	1334639	1663622	1798714	1312574	1708245
## 15	O	Ohio	1802132	1648498	1441386	1670280	1534888	1314824
## 16	O	Oregon	1794912	1726665	1805445	1133510	1502242	1419251
## 17	N	Nevada	1426117	1114500	1119707	1758830	1694526	1765826
## 18	N	Nebraska	1885081	1309769	1425527	1240465	1500594	1278272
## 19	N	North Dakota	1618807	1510193	1876940	1443172	1425030	1868788
## 20	N	New Jersey	1605532	1141514	1613550	1181452	1541327	1156804
## 21	N	North Carolina	1616742	1292223	1482792	1532347	1158716	1827420
## 22	N	New Mexico	1819239	1226057	1935991	1124400	1723493	1475985
## 23	N	New York	1395149	1611371	1170675	1446810	1426941	1463171
## 24	N	New Hampshire	1419776	1854370	1195119	1990062	1645430	1286967
## 25	M	Michigan	1295635	1149931	1601027	1340716	1729449	1567494
## 26	M	Missouri	1221316	1858368	1773451	1573967	1374863	1486197
## 27	M	Montana	1877154	1540099	1332722	1273327	1625721	1983568
## 28	M	Minnesota	1729921	1675204	1903907	1561839	1985692	1148621
## 29	M	Mississippi	1983285	1292558	1631325	1943311	1354579	1731643
## 30	M	Massachusetts	1647582	1686259	1620601	1777250	1531641	1380529
## 31	M	Maine	1582720	1678622	1208496	1912040	1438549	1330014
## 32	M	Maryland	1579713	1404700	1849798	1397738	1310270	1789128
## 33	L	Louisiana	1584734	1110625	1868456	1751920	1233709	1920301
## 34	K	Kansas	1509054	1290700	1522230	1532094	1104256	1863278
## 35	K	Kentucky	1813878	1448846	1800760	1250524	1137913	1911227
## 36	I	Idaho	1353210	1438538	1739154	1541015	1122387	1772050
## 37	I	Indiana	1776918	1734104	1269927	1204117	1848073	1129546
## 38	I	Illinois	1508356	1527440	1493029	1261353	1540274	1747614
## 39	I	Iowa	1499269	1444576	1576367	1388924	1554813	1452911
## 40	H	Hawaii	1461570	1200280	1213993	1245931	1459383	1430465
## 41	G	Georgia	1929009	1541565	1810773	1779091	1326846	1223770
## 42	F	Florida	1964626	1468852	1419738	1362787	1339608	1278550
## 43	D	Delaware	1330403	1268673	1706751	1403759	1441351	1300836
## 44	D	District of Columbia	1111437	1993741	1374643	1827949	1803852	1595981
## 45	C	California	1685349	1675807	1889570	1480280	1735069	1812546
## 46	C	Colorado	1343824	1878473	1886149	1236697	1871471	1814218
## 47	C	Connecticut	1610512	1232844	1181949	1518933	1841266	1976976
## 48	A	Arizona	1742027	1968140	1377583	1782199	1102568	1109382

## 49	A	Alaska	1170302	1960378	1818085	1447852	1861639	1465841
## 50	A	Alabama	1296530	1317711	1118631	1492583	1107408	1440134
## 51	A	Arkansas	1485531	1994927	1119299	1947979	1669191	1801213
##	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015
## 1	1545621	1555554	1179331	1150089	1775787	1273834	1387428	1377341
## 2	1238174	1539322	1539603	1872519	1462137	1683127	1204344	1198791
## 3	1587602	1504455	1282142	1881814	1673668	1994022	1204029	1853858
## 4	1980167	1901394	1648755	1940943	1729177	1510119	1701650	1846238
## 5	1803330	1590043	1516758	1171686	1262342	1647032	1706707	1850394
## 6	1123567	1618583	1326369	1792600	1714960	1146278	1282790	1565924
## 7	1939284	1915865	1619186	1288285	1108281	1123353	1801019	1729273
## 8	1826406	1326460	1231739	1469785	1849041	1560887	1349173	1162164
## 9	1785986	1827503	1447457	1978374	1882532	1698698	1646508	1705322
## 10	1250499	1864685	1345102	1116203	1532332	1591735	1188417	1110655
## 11	1171870	1852424	1554782	1647245	1811156	1147488	1302834	1136443
## 12	1151409	1993136	1983569	1781016	1909119	1531212	1990412	1611730
## 13	1274168	1571032	1433835	1483292	1290329	1475344	1931500	1668232
## 14	1256746	1853142	1673831	1822933	1674707	1900523	1956742	1307678
## 15	1516621	1511460	1585465	1887714	1227303	1840898	1880804	1573117
## 16	1482786	1862351	1103794	1935687	1905378	1522129	1509171	1893515
## 17	1903270	1231480	1526066	1143343	1980195	1283813	1225348	1903804
## 18	1140598	1270585	1128711	1187207	1569665	1690920	1459243	1802211
## 19	1720352	1671468	1534571	1271132	1430978	1529024	1563898	1604118
## 20	1568034	1357418	1443718	1390010	1202326	1100990	1850165	1183568
## 21	1267737	1116168	1791535	1553750	1472258	1104893	1596452	1229085
## 22	1237704	1820856	1801430	1653384	1475715	1623388	1533494	1868612
## 23	1732098	1426216	1604531	1683687	1500089	1718837	1619033	1367705
## 24	1762936	1763211	1265642	1704297	1131298	1197576	1242623	1963313
## 25	1990431	1575185	1267626	1274673	1709853	1815596	1965196	1646634
## 26	1735099	1800620	1164202	1425363	1800052	1698105	1767835	1996005
## 27	1251742	1592690	1350619	1520064	1185225	1465705	1110394	1125903
## 28	1328133	1890633	1995304	1575533	1910216	1972021	1515366	1864553
## 29	1428291	1568049	1383227	1629132	1988270	1907777	1649668	1991232
## 30	1978904	1567651	1761048	1658538	1482203	1731917	1669749	1963337
## 31	1295877	1969163	1627262	1706080	1437088	1318546	1116792	1529233
## 32	1112765	1967225	1486246	1872327	1175819	1314343	1979529	1569566
## 33	1185085	1124853	1498662	1210385	1234234	1287663	1908602	1403857
## 34	1949478	1561528	1550433	1465812	1882929	1410249	1930090	1385528
## 35	1301848	1956681	1350895	1512894	1916616	1878271	1722762	1913350
## 36	1335481	1748608	1436809	1456340	1643855	1312561	1713718	1757171
## 37	1139551	1883976	1999102	1559924	1905760	1129794	1988394	1467614
## 38	1871645	1658551	1422021	1751422	1696729	1915435	1645465	1583516
## 39	1317983	1150783	1751389	1992996	1501879	1173694	1431705	1641866
## 40	1919423	1928416	1330509	1902816	1695126	1517184	1948108	1150882
## 41	1773090	1630325	1145473	1851245	1850111	1887157	1259353	1725470
## 42	1756185	1818438	1198403	1497051	1131928	1107448	1407784	1170389
## 43	1762096	1553585	1370984	1318669	1984027	1671279	1803169	1627508
## 44	1193245	1739748	1707823	1353449	1979708	1912654	1782169	1410183
## 45	1487315	1663809	1624509	1639670	1921845	1156536	1388461	1644607
## 46	1875146	1752387	1913275	1665877	1491604	1178355	1383978	1330736
## 47	1764457	1972730	1968730	1945524	1228529	1582249	1503156	1718072
## 48	1752886	1554330	1300521	1130709	1907284	1363279	1525866	1647724
## 49	1551826	1436541	1629616	1230866	1512804	1985302	1580394	1979143
## 50	1945229	1944173	1237582	1440756	1186741	1852841	1558906	1916661

```
## 51 1188104 1628980 1669295 1928238 1216675 1591896 1360959 1329341
```

16. Operator Pipe %>%.

berguna untuk tulis sub-queries, gabungkan beberapa fungsi secara serentak

```
dt2 = mydata%>%select(Index,State,Y2002)%>% sample_n(10)
dt2
```

```
##      Index      State  Y2002
## 1      I      Indiana 1776918
## 2      C      Colorado 1343824
## 3      N North Carolina 1616742
## 4      M      Maryland 1579713
## 5      N New Hampshire 1419776
## 6      G      Georgia 1929009
## 7      N      New Mexico 1819239
## 8      M      Maine 1582720
## 9      K      Kentucky 1813878
## 10     I      Illinois 1508356
```

17. Memperlihatkan data menerusi pemboleh ubah berkategori. #hitung min p/ubah Y2011 & Y2012 mengikut kumpulan p/ubah index

```
tdata = mydata%>%
  group_by(Index)%>%
  summarise_at(vars(Y2011,Y2012),list(means=mean,variances=var))
tdata
```

```
## # A tibble: 19 x 5
##   Index Y2011_means Y2012_means Y2011_variances Y2012_variances
##   <chr>      <dbl>      <dbl>      <dbl>      <dbl>
## 1 A      1432642.    1455876    125852774292.  112220248758
## 2 C      1750357      1547326    28739320129    122500474927
## 3 D      1336059      1981868.    604824200      9326880.
## 4 F      1497051      1131928      NA              NA
## 5 G      1851245      1850111      NA              NA
## 6 H      1902816      1695126      NA              NA
## 7 I      1690170.    1687056.    55698627732.   28027284758.
## 8 K      1489353      1899772.    1108357362      567406984.
## 9 L      1210385      1234234      NA              NA
## 10 M     1582714.    1586091.    32946279081.   98558940046.
## 11 N     1448351.    1470316.    52867883306.   65580784743.
## 12 O     1882111.    1602463.    3201908534.    118860859180.
## 13 P     1483292      1290329      NA              NA
## 14 R     1781016      1909119      NA              NA
## 15 S     1381724      1671744    141002802882    38871411488
## 16 T     1724080.    1865786.    129331385460.   560823540.
## 17 U     1288285      1108281      NA              NA
## 18 V     1482143      1488651    192767097698    102431526962
## 19 W     1711341.    1660192.    140920092440.   19176173284.
```

18. Penapisan data dalam pemboleh ubah berkategori.

```
tdata2 = mydata%>%  
  select(Index,Y2015)%>%  
  filter(Index%in%c("A","C","I"))%>%  
  group_by(Index)%>%  
  do(arrange(.,desc(Y2015)))%>%  
  slice(1) #to select nth number of row tdata2
```

20. Memperihalkan, mengkumpulkan dan menyusun data secara bersama.
21. Memilih kumpulan yang menjana nilai tertinggi antara beberapa pembolehubah tertentu.
22. Menghitung nilai kumulatif bagi pemboleh ubah.
23. Operasi ROW WISE.
24. Menghitung nilai-nilai persentil.
25. Dan banyak lagi