Pertemuan 1

Aljabar Matriks dengan R

```
#Contoh
A <- matrix(c(3,5,2,6,4,8,7,9,5),3,3)
B <- matrix(c(1,3,2,5,7,5,8,3,4), nrow =3)

#Apakah A matriks
is.matrix(A)

## [1] TRUE

is.vector(A)

## [1] FALSE
```

Perkalian Matriks

```
#element-wise multiplication # A*B
A*B

##      [,1] [,2] [,3]
## [1,]    3   30   56
## [2,]   15   28   27
## [3,]    4   40   20

#matrix multiplication #A%*%B
A%*%B

##      [,1] [,2] [,3]
## [1,]   35   92   70
## [2,]   35   98   88
## [3,]   36   91   60
```

Transpose Matriks

```
#transpose of matrix
t(A)

##      [,1] [,2] [,3]
## [1,]    3    5    2
## [2,]    6    4    8
## [3,]    7    9    5

t(B)

##      [,1] [,2] [,3]
## [1,]    1    3    2
## [2,]    5    7    5
## [3,]    8    3    4
```

Invers Matriks

```
#inverse matrix
solve(A)
```

```
##            [,1]        [,2]       [,3]
## [1,] -2.0000000  1.00000000  1.0000000
## [2,] -0.2692308  0.03846154  0.3076923
## [3,]  1.2307692 -0.46153846 -0.6923077
```

```
solve(B)
```

```
##            [,1]       [,2]       [,3]
## [1,] -1.4444444 -2.2222222  4.5555556
## [2,]  0.6666667  1.3333333 -2.3333333
## [3,] -0.1111111 -0.5555556  0.8888889
```

Determinan Matriks

```
#Determinant matrix
det(A)
```

```
## [1] 26
```

```
det(B)
```

```
## [1] -9
```

Diagonal Matriks

```
#identify diagonal of matrix
diag(A)
```

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

```
diag(B)
```

```
## [1] 1 7 4
```

```
#create diagonal matrix
diag(diag(A))
```

```
##      [,1] [,2] [,3]
## [1,]    3    0    0
## [2,]    0    4    0
## [3,]    0    0    5
```

```
diag(2) #create identity matrix sized 2x2
```

```
##      [,1] [,2]
## [1,]    1    0
## [2,]    0    1
```

Eigen Value dan eigen vektor

```
#eigen value square matrix
C <- matrix(c(1,2,0,4),2,2)
eigen(C)
```

```
## eigen() decomposition
## $values
## [1] 4 1
##
## $vectors
##      [,1]       [,2]
## [1,]    0  0.8320503
## [2,]    1 -0.5547002
```

Geometri Sample

```
y1<-c(35,35,40,10,6,20,35,35,35,30)
y2<-c(3.5,4.9,30,2.8,2.7,2.8,4.6,10.9,8,1.6)
y3<-c(2.8,2.7,4.38,3.21,2.73,2.81,2.88,2.9,3.28,3.2)

Ydat<-matrix(c(y1,y2,y3),ncol=3) #convert data menjadi matrix
ybar <-colMeans(Ydat) #hitung mean setiap variabel
ybar
```

```
## [1] 28.100  7.180  3.089
```

```
d1<-y1-ybar[1]
d2<-y2-ybar[2]
d3<-y3-ybar[3]
dmat<-matrix(c(d1,d2,d3),ncol=3)
dmat
```

```
##        [,1]  [,2]   [,3]
##  [1,]   6.9 -3.68 -0.289
##  [2,]   6.9 -2.28 -0.389
##  [3,]  11.9 22.82  1.291
##  [4,] -18.1 -4.38  0.121
##  [5,] -22.1 -4.48 -0.359
##  [6,]  -8.1 -4.38 -0.279
##  [7,]   6.9 -2.58 -0.209
##  [8,]   6.9  3.72 -0.189
##  [9,]   6.9  0.82  0.191
## [10,]   1.9 -5.58  0.111
```

```
#Maka matriks kovarians Sn
Sn <-(1/10)*t(dmat)%*%dmat
print(dmat)
```

```
##        [,1]  [,2]   [,3]
##  [1,]   6.9 -3.68 -0.289
##  [2,]   6.9 -2.28 -0.389
##  [3,]  11.9 22.82  1.291
```

```
##  [4,] -18.1 -4.38  0.121
##  [5,] -22.1 -4.48 -0.359
##  [6,]  -8.1 -4.38 -0.279
##  [7,]   6.9 -2.58 -0.209
##  [8,]   6.9  3.72 -0.189
##  [9,]   6.9  0.82  0.191
## [10,]   1.9 -5.58  0.111

print(Sn)

##          [,1]     [,2]     [,3]
## [1,] 126.4900 44.71200 1.747100
## [2,]  44.7120 65.02360 3.308480
## [3,]   1.7471  3.30848 0.225109

S <- (10/9)*Sn
S

##            [,1]      [,2]      [,3]
## [1,] 140.544444 49.680000 1.9412222
## [2,]  49.680000 72.248444 3.6760889
## [3,]   1.941222  3.676089 0.2501211

#Dengan R
cov(Ydat)

##            [,1]      [,2]      [,3]
## [1,] 140.544444 49.680000 1.9412222
## [2,]  49.680000 72.248444 3.6760889
## [3,]   1.941222  3.676089 0.2501211
```

Mencari Matriks Korelasi (R) dari matriks S

```
#Mencari Matriks Korelasi
#manual dengan matriks S
#define Ds
Ds<-diag(c(sqrt(S[1,1]),sqrt(S[2,2]),sqrt(S[3,3])))
D <- diag(sqrt(diag(S)))
Ds

##          [,1]     [,2]      [,3]
## [1,] 11.85514 0.000000 0.0000000
## [2,]  0.00000 8.499908 0.0000000
## [3,]  0.00000 0.000000 0.5001211

D

##          [,1]     [,2]      [,3]
## [1,] 11.85514 0.000000 0.0000000
## [2,]  0.00000 8.499908 0.0000000
## [3,]  0.00000 0.000000 0.5001211
```

```r
#Invers matriks
invDs <- solve(Ds)

#Hitung matriks korelasi
Rmat<-invDs%*%S%*%invDs
print(Rmat)
```

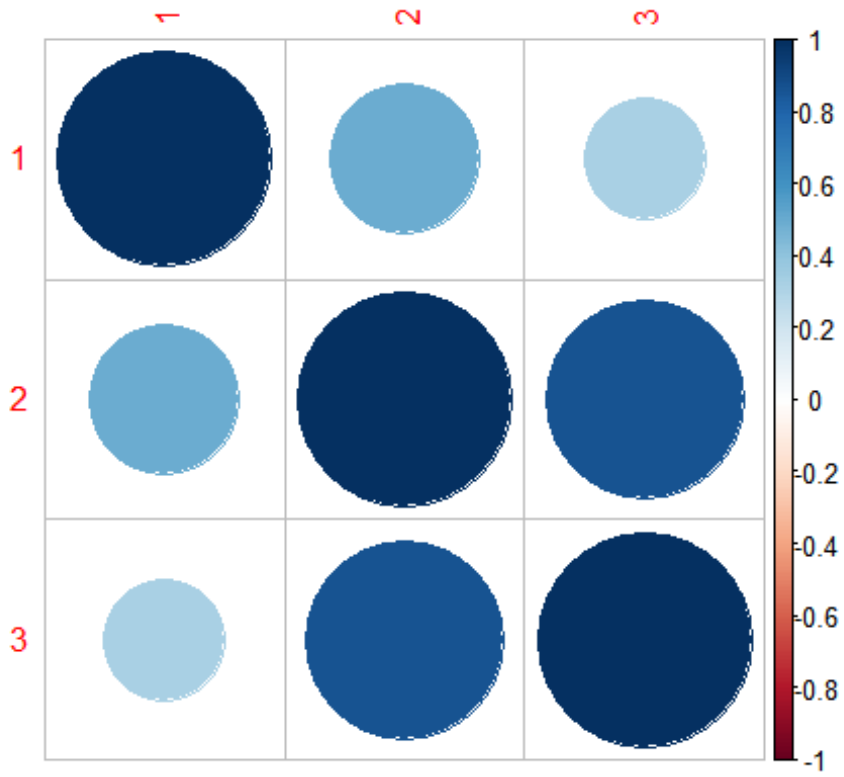
```
##           [,1]      [,2]     [,3]
## [1,] 1.0000000 0.4930154 0.327411
## [2,] 0.4930154 1.0000000 0.864762
## [3,] 0.3274110 0.8647620 1.000000
```

```r
#Dengan R
cor(Ydat)
```

```
##           [,1]      [,2]     [,3]
## [1,] 1.0000000 0.4930154 0.327411
## [2,] 0.4930154 1.0000000 0.864762
## [3,] 0.3274110 0.8647620 1.000000
```

Visualisasi Matriks Korelasi

```r
library(corrplot)

## corrplot 0.92 loaded

corrplot(Rmat, method='circle')
```



Generalized Variance

```
GenVar<-det(S)
GenVar
```

```
## [1] 459.9555
```

Grafik Multivariate

Input Data

```
library(readxl)
data <- read_excel("C:/Users/ACER/Documents/Asprak APG/Bahan Pertemuan
1/Contoh Data.xlsx")
```

descriptive

```
colMeans(data[,c(5,6,7,8,9)])
```

```
##     UangSaku        Jajan        Pulsa  LamaBelajar LamaInternet
## 37085.714286 66857.142857 85400.000000     1.942857     7.457143
```

```
cov(data[,c(5,6,7,8,9)])
```

```
##                   UangSaku         Jajan         Pulsa   LamaBelajar
## UangSaku      1.925513e+08  6.115966e+07  1.526706e+08  -774.3697479
## Jajan         6.115966e+07  5.451597e+09 -2.067941e+08 -6728.9915966
## Pulsa         1.526706e+08 -2.067941e+08  1.679129e+09  4126.4705882
## LamaBelajar  -7.743697e+02 -6.728992e+03  4.126471e+03     0.5260504
## LamaInternet  1.119496e+04  6.589076e+04  2.319412e+04     0.3210084
##               LamaInternet
## UangSaku      1.119496e+04
## Jajan         6.589076e+04
## Pulsa         2.319412e+04
## LamaBelajar   3.210084e-01
## LamaInternet 1.449076e+01
```

```
cor(data[,c(5,6,7,8,9)])
```

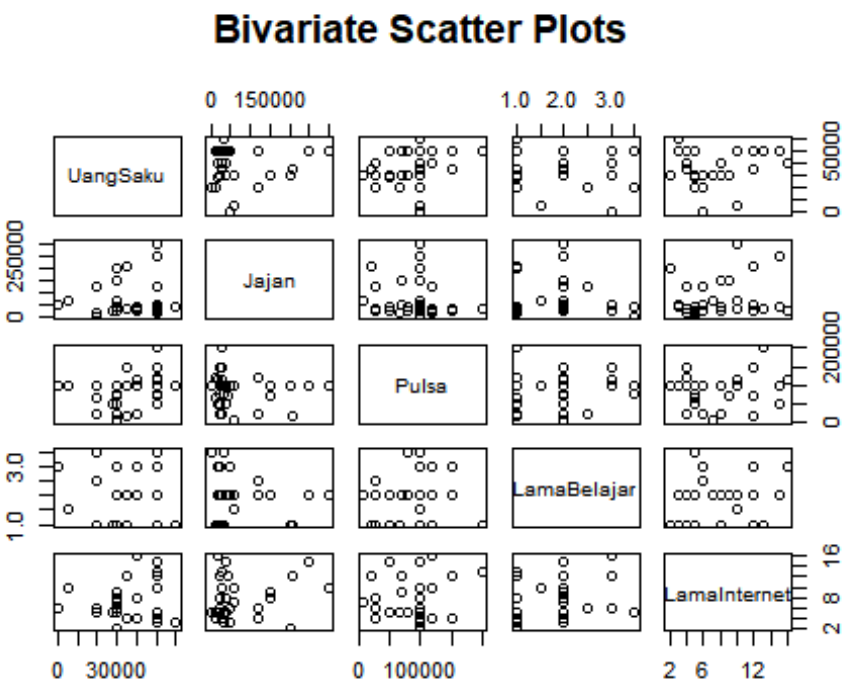
```
##                 UangSaku       Jajan       Pulsa LamaBelajar LamaInternet
## UangSaku      1.00000000  0.05969391  0.26849742 -0.07694165    0.2119355
## Jajan         0.05969391  1.00000000 -0.06834933 -0.12565346    0.2344321
## Pulsa         0.26849742 -0.06834933  1.00000000  0.13884268    0.1486929
## LamaBelajar  -0.07694165 -0.12565346  0.13884268  1.00000000    0.1162672
## LamaInternet  0.21193552  0.23443212  0.14869290  0.11626719    1.0000000
```

Bivariate Scatter Plot

```
head(data)
```

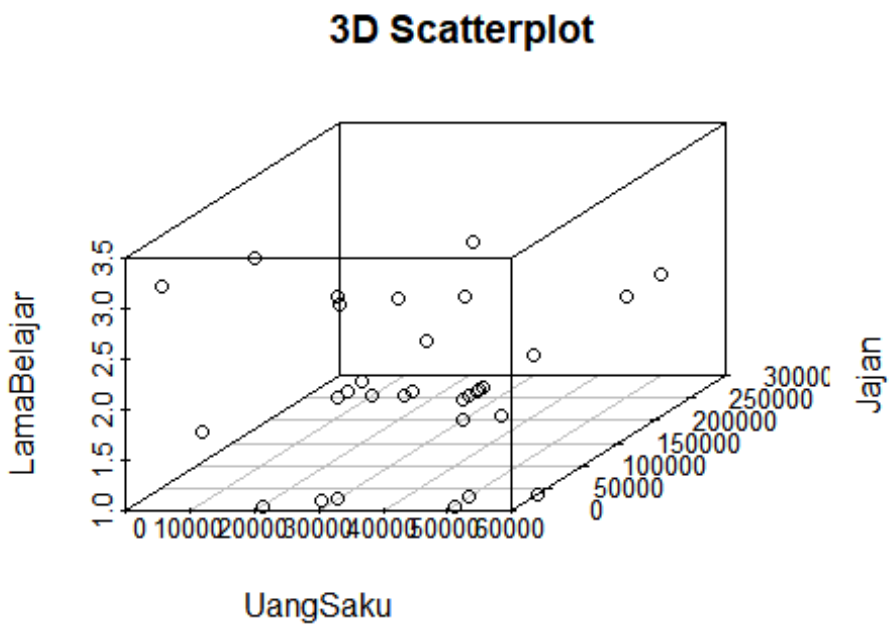
```
## # A tibble: 6 x 9
##      id    TB    BB JK        UangSaku  Jajan  Pulsa LamaBelajar
```

```
LamaInternet
##   <dbl> <dbl> <dbl> <chr>        <dbl>  <dbl>  <dbl>       <dbl>
<dbl>
## 1     1   167    73 Laki-laki    30000  25000  50000           1
5
## 2     2   168    59 Laki-laki    30000  25000  80000           2
5
## 3     3   156    56 Perempuan    60000  35000 100000           1
3
## 4     4   175    50 Laki-laki    30000 150000 100000           2
8
## 5     5   165    60 Laki-laki    30000  40000  50000           2
5
## 6     6   155    44 Perempuan    50000 250000 100000           2
15

pairs(~UangSaku+Jajan+Pulsa+LamaBelajar+LamaInternet,
data=data,main="Bivariate Scatter Plots")
```



Trivariate Scatter Plot

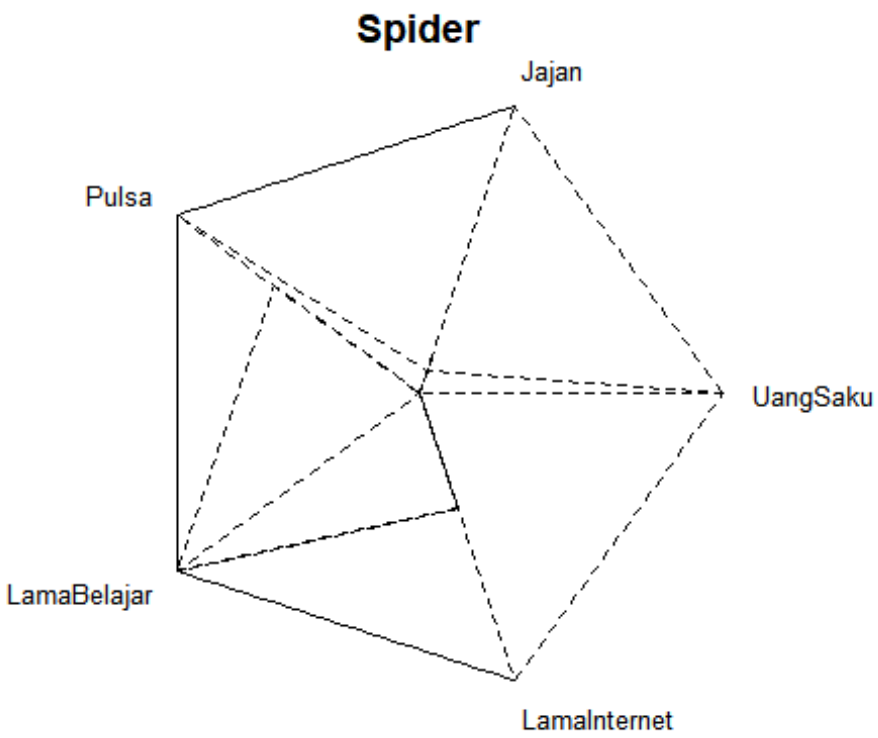
```
library(scatterplot3d)
attach(data)
scatterplot3d(UangSaku,Jajan,LamaBelajar, main="3D Scatterplot")
```




```
per <- data$JK

#Scatterplot 3d interactive
library(shiny)
library(crosstalk)

##
## Attaching package: 'crosstalk'

## The following object is masked from 'package:shiny':
##
##     getDefaultReactiveDomain

library(rgl)
library(plot3D)
library(plot3Drgl)
scatter3Drgl(UangSaku,Jajan,Pulsa,LamaBelajar,LamaInternet)
```

Spider/Star

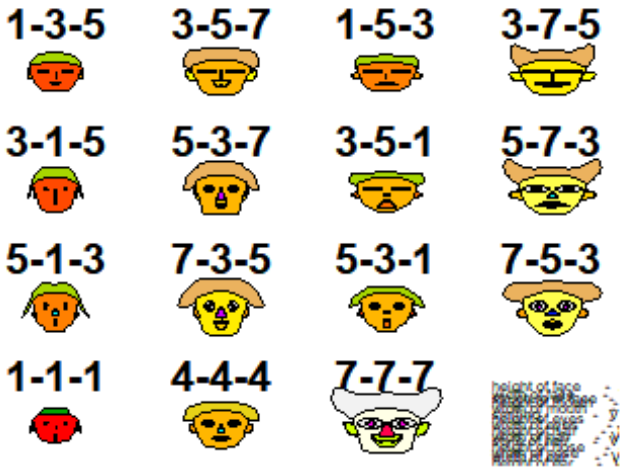
```
stars(data[1:5, 5:9], locations = c(0, 0), radius = FALSE,
      key.loc = c(0, 0), main = "Spider", lty = 2)
```



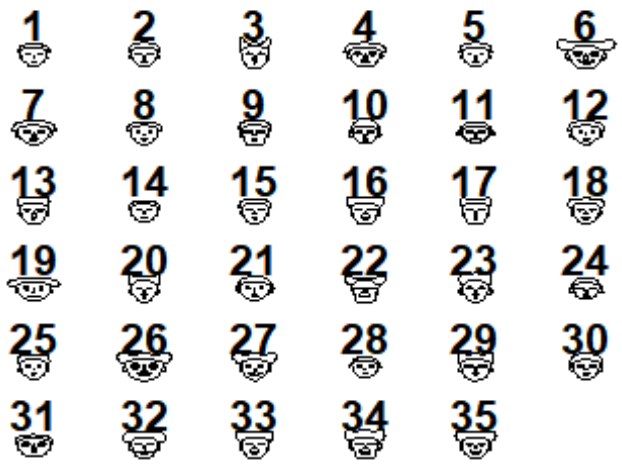
Chernoff Face

```
library(aplpack)
faces()

## effect of variables:
##  modified item       Var
##  "height of face   " "Var1"
##  "width of face    " "Var2"
##  "structure of face" "Var3"
##  "height of mouth  " "Var1"
##  "width of mouth   " "Var2"
##  "smiling          " "Var3"
##  "height of eyes   " "Var1"
##  "width of eyes    " "Var2"
##  "height of hair   " "Var3"
##  "width of hair    "  "Var1"
##  "style of hair    "  "Var2"
##  "height of nose   "  "Var3"
##  "width of nose    "  "Var1"
##  "width of ear     "  "Var2"
##  "height of ear    "  "Var3"

faces(face.type=1)

## effect of variables:
##  modified item       Var
##  "height of face   " "Var1"
```

```
##  "width of face    " "Var2"
##  "structure of face" "Var3"
##  "height of mouth  " "Var1"
##  "width of mouth   " "Var2"
##  "smiling          " "Var3"
##  "height of eyes   " "Var1"
##  "width of eyes    " "Var2"
##  "height of hair   " "Var3"
##  "width of hair   "  "Var1"
##  "style of hair   "  "Var2"
##  "height of nose  "  "Var3"
##  "width of nose   "  "Var1"
##  "width of ear    "  "Var2"
##  "height of ear   "  "Var3"
```




```
data(data)

## Warning in data(data): data set 'data' not found

faces(data[,5:9],face.type=0)
```




```
## effect of variables:
##  modified item       Var
##  "height of face   " "UangSaku"
##  "width of face    " "Jajan"
##  "structure of face" "Pulsa"
##  "height of mouth  " "LamaBelajar"
##  "width of mouth   " "LamaInternet"
##  "smiling          " "UangSaku"
##  "height of eyes   " "Jajan"
##  "width of eyes    " "Pulsa"
##  "height of hair   " "LamaBelajar"
##  "width of hair    "  "LamaInternet"
##  "style of hair    "  "UangSaku"
##  "height of nose   "  "Jajan"
##  "width of nose    "  "Pulsa"
##  "width of ear     "  "LamaBelajar"
##  "height of ear    "  "LamaInternet"

faces(data[,5:9],face.type=1)
```


```
## effect of variables:
##  modified item       Var
##  "height of face   " "UangSaku"
##  "width of face    " "Jajan"
##  "structure of face" "Pulsa"
##  "height of mouth  " "LamaBelajar"
##  "width of mouth   " "LamaInternet"
##  "smiling          " "UangSaku"
##  "height of eyes   " "Jajan"
##  "width of eyes    " "Pulsa"
##  "height of hair   " "LamaBelajar"
##  "width of hair    "  "LamaInternet"
##  "style of hair    "  "UangSaku"
##  "height of nose   "  "Jajan"
##  "width of nose    "  "Pulsa"
##  "width of ear     "  "LamaBelajar"
##  "height of ear    "  "LamaInternet"
```