

Tugas 4

1. Janakan data mtcars dalam R

```
data = mtcars  
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
```

2. Skalikan data tersebut.

```
mtcars_scaled = scale(mtcars)  
head(mtcars_scaled,10)
```

```
##           mpg      cyl      disp      hp      drat  
## Mazda RX4      0.1508848 -0.1049878 -0.57061982 -0.5350928 0.5675137  
## Mazda RX4 Wag  0.1508848 -0.1049878 -0.57061982 -0.5350928 0.5675137  
## Datsun 710     0.4495434 -1.2248578 -0.99018209 -0.7830405 0.4739996  
## Hornet 4 Drive  0.2172534 -0.1049878  0.22009369 -0.5350928 -0.9661175  
## Hornet Sportabout -0.2307345  1.0148821  1.04308123  0.4129422 -0.8351978  
## Valiant        -0.3302874 -0.1049878 -0.04616698 -0.6080186 -1.5646078  
## Duster 360     -0.9607889  1.0148821  1.04308123  1.4339030 -0.7229809  
## Merc 240D      0.7150178 -1.2248578 -0.67793094 -1.2351802 0.1747545  
## Merc 230       0.4495434 -1.2248578 -0.72553512 -0.7538702 0.6049193  
## Merc 280      -0.1477738 -0.1049878 -0.50929918 -0.3454858 0.6049193  
##           wt      qsec      vs      am      gear  
## Mazda RX4     -0.610399567 -0.7771651 -0.8680278  1.1899014 0.4235542  
## Mazda RX4 Wag -0.349785269 -0.4637808 -0.8680278  1.1899014 0.4235542  
## Datsun 710     -0.917004624  0.4260068  1.1160357  1.1899014 0.4235542  
## Hornet 4 Drive -0.002299538  0.8904872  1.1160357 -0.8141431 -0.9318192  
## Hornet Sportabout 0.227654255 -0.4637808 -0.8680278 -0.8141431 -0.9318192  
## Valiant        0.248094592  1.3269868  1.1160357 -0.8141431 -0.9318192  
## Duster 360     0.360516446 -1.1241264 -0.8680278 -0.8141431 -0.9318192  
## Merc 240D      -0.027849959  1.2038715  1.1160357 -0.8141431 0.4235542  
## Merc 230       -0.068730634  2.8267546  1.1160357 -0.8141431 0.4235542  
## Merc 280       0.227654255  0.2525262  1.1160357 -0.8141431 0.4235542
```

```
## carb
## Mazda RX4 0.7352031
## Mazda RX4 Wag 0.7352031
## Datsun 710 -1.1221521
## Hornet 4 Drive -1.1221521
## Hornet Sportabout -0.5030337
## Valiant -1.1221521
## Duster 360 0.7352031
## Merc 240D -0.5030337
## Merc 230 -0.5030337
## Merc 280 0.7352031
```

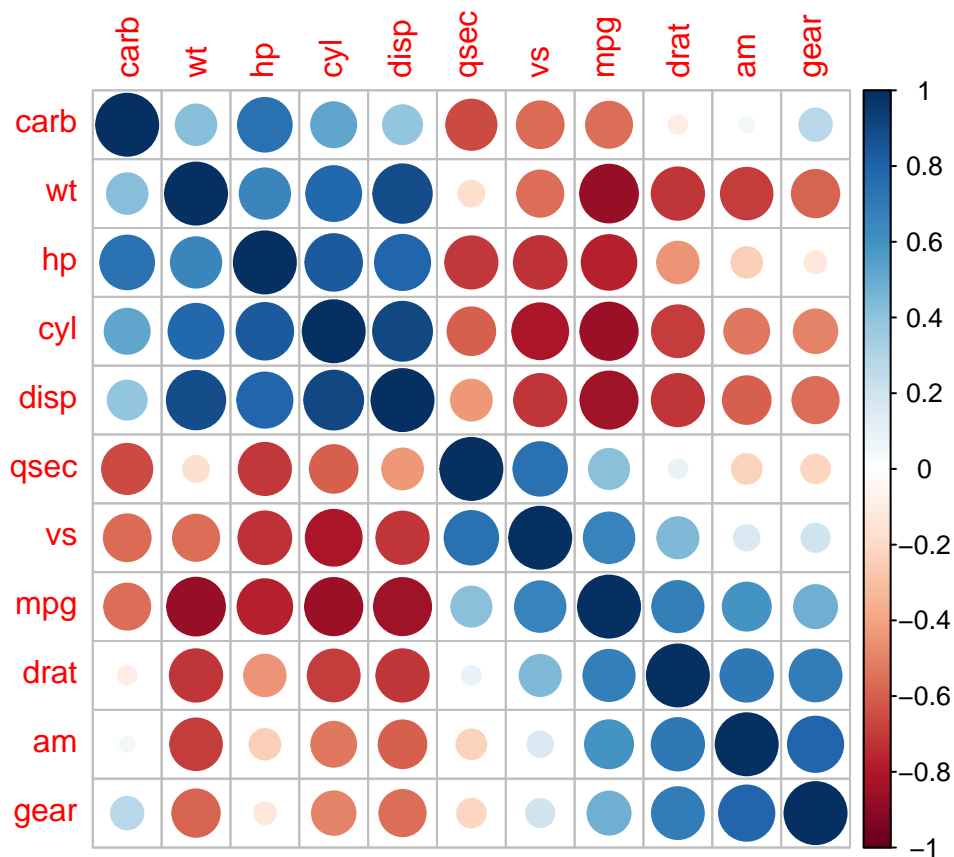
3. Jalankan analisis faktor untuk menurunkan dimensi data mtcars.

```
library(corrplot)
```

```
## Warning: package 'corrplot' was built under R version 4.4.2
```

```
## corrplot 0.95 loaded
```

```
corrplot(cor(mtcars_scaled), order='hclust')
```

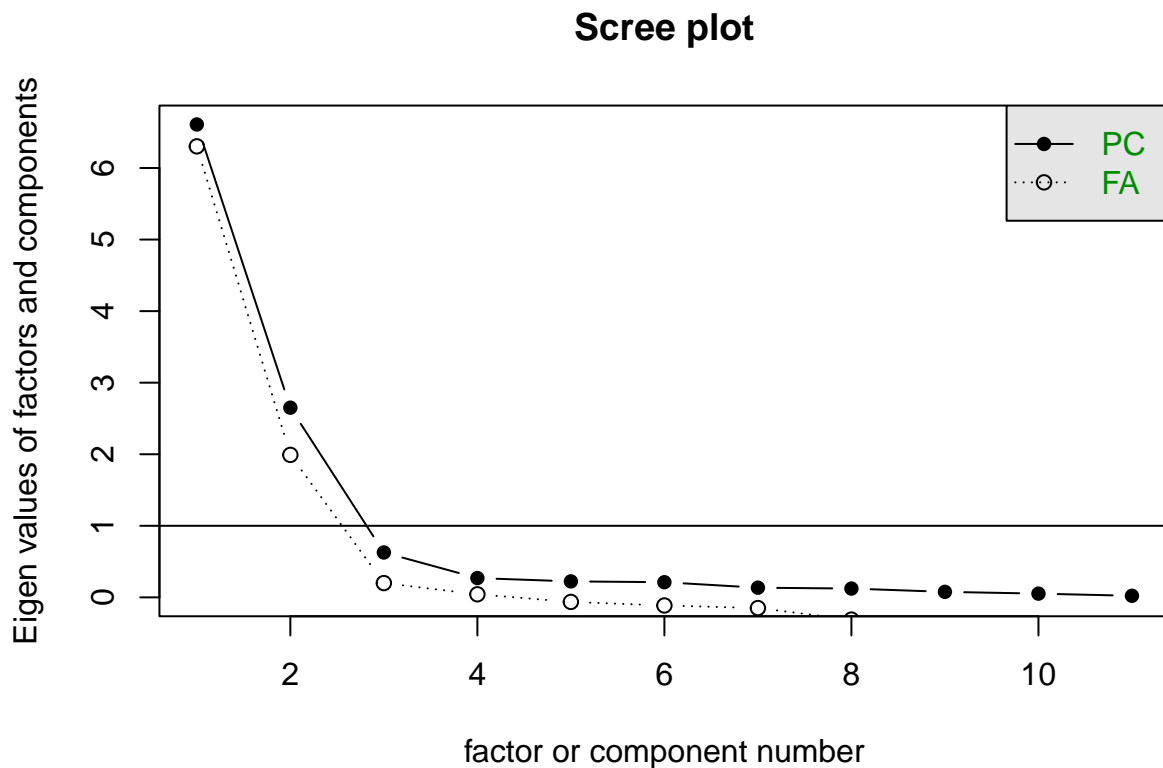


```
library(psych)
```

```
## Warning: package 'psych' was built under R version 4.4.2
```

```
scree(mtcars_scaled)
```

```
## Warning in fa.stats(r = r, f = f, phi = phi, n.obs = n.obs, np.obs = np.obs, :  
## The estimated weights for the factor scores are probably incorrect. Try a  
## different factor score estimation method.
```



4. Kenalpasti faktor pendam yang sesuai yang boleh menerangkan data asal.

```
F.A = factanal(mtcars_scaled, factors=3, scores = 'regression',rotation='varimax')  
F.A
```

```
##  
## Call:  
## factanal(x = mtcars_scaled, factors = 3, scores = "regression",      rotation = "varimax")  
##  
## Uniquenesses:  
##   mpg   cyl  disp    hp  drat    wt  qsec    vs  am  gear  carb  
## 0.135 0.055 0.090 0.127 0.290 0.060 0.051 0.223 0.208 0.125 0.158  
##
```

```
## Loadings:
##      Factor1 Factor2 Factor3
## mpg    0.643  -0.478  -0.473
## cyl   -0.618   0.703   0.261
## disp  -0.719   0.537   0.323
## hp    -0.291   0.725   0.513
## drat   0.804  -0.241
## wt    -0.778   0.248   0.524
## qsec  -0.177  -0.946  -0.151
## vs     0.295  -0.805  -0.204
## am     0.880
## gear   0.908           0.224
## carb   0.114   0.559   0.719
##
##              Factor1 Factor2 Factor3
## SS loadings      4.380   3.520   1.578
## Proportion Var    0.398   0.320   0.143
## Cumulative Var    0.398   0.718   0.862
##
## Test of the hypothesis that 3 factors are sufficient.
## The chi square statistic is 30.53 on 25 degrees of freedom.
## The p-value is 0.205
```

```
head(F.A$scores,20)
```

```
##              Factor1      Factor2      Factor3
## Mazda RX4      0.84659011  0.672117481 -0.27829936
## Mazda RX4 Wag  0.72212550  0.383521909  0.02456662
## Datsun 710      0.68627400 -0.592149628 -0.56444514
## Hornet 4 Drive -0.86578979 -0.673352726 -0.76659243
## Hornet Sportabout -0.89251543  0.862106905 -1.01495860
## Valiant        -1.06151049 -1.068850264 -0.38290802
## Duster 360     -0.55880772  1.244212537 -0.19899809
## Merc 240D       0.07740501 -1.500123830  0.40929935
## Merc 230       -0.24200520 -2.610411470  1.22842059
## Merc 280        0.18320755 -0.591355337  0.91024316
## Merc 280C       0.09100657 -0.829974474  1.08883341
## Merc 450SE     -0.89214656  0.445887398 -0.10542097
## Merc 450SL     -0.84060251  0.465272798 -0.32537080
## Merc 450SLC    -0.92381859  0.288204107 -0.13479952
## Cadillac Fleetwood -1.43625243 -0.017745759  1.38774949
## Lincoln Continental -1.41670671 -0.005943498  1.51793494
## Chrysler Imperial -1.23182157  0.177238534  1.32548587
## Fiat 128        0.75376560 -0.908814970 -0.80869775
## Honda Civic     1.20771953 -0.470502250 -0.97181997
## Toyota Corolla  0.81876601 -0.981070416 -0.99396734
```

5. Berikan tafsiran yang bersesuaian bagi setiap faktor pendam terhadap data asal.

Factor 1: seems to be related to performance vehicle

- High positive loadings:

- Rear axle ratio (0.804)
- Transmission (0.880)
- Number of forward gears (0.908)
- Moderate negative loadings:
 - Miles/(US) gallon (-0.643)
 - Displacement (-0.719)
 - Weight (-0.778)

Factor 2: reflects engine characteristics and power

- High positive loadings:
 - Number of cylinders (0.703)
 - Gross horsepower (0.725)
 - 1/4 mile time (-0.946)
- Moderate negative loadings:
 - Engine Shape (-0.805)

Factor 3: seems to reflect heavier, less fuel-efficient vehicles

- High positive loadings:
 - Weight (0.524)
 - Number of carburetors (0.719)
- Moderate negative loadings:
 - Miles (-0.473)
 - Gross horsepower (0.513)

Summary of Factors:

1. **Factor 1** seems to be related to **performance** vehicles, with manual transmissions, higher gear ratios, and larger engine sizes that are less fuel-efficient.
2. **Factor 2** reflects **engine characteristics and power**, including high horsepower and large engine displacement, likely representing powerful vehicles with a focus on engine strength rather than fuel efficiency or acceleration speed.
3. **Factor 3** seems to reflect **heavier, less fuel-efficient vehicles** with potentially more complex carburetor systems and greater emphasis on weight and engine characteristics rather than speed or fuel economy.