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Tugas Pertemuan 9

Kerjakan penugasan pada modul "Analisis Faktor" dengan data survey Anxiety (SAQ8.sav) dan exercise 9.24 (census track data) pada buku Johnson & Wichern.

Data Survey Anxiety (SAQ8.sav)

```
penugasan9_1 <- as.data.frame(read_sav("SAQ8.sav"))
head(penugasan9_1)
```

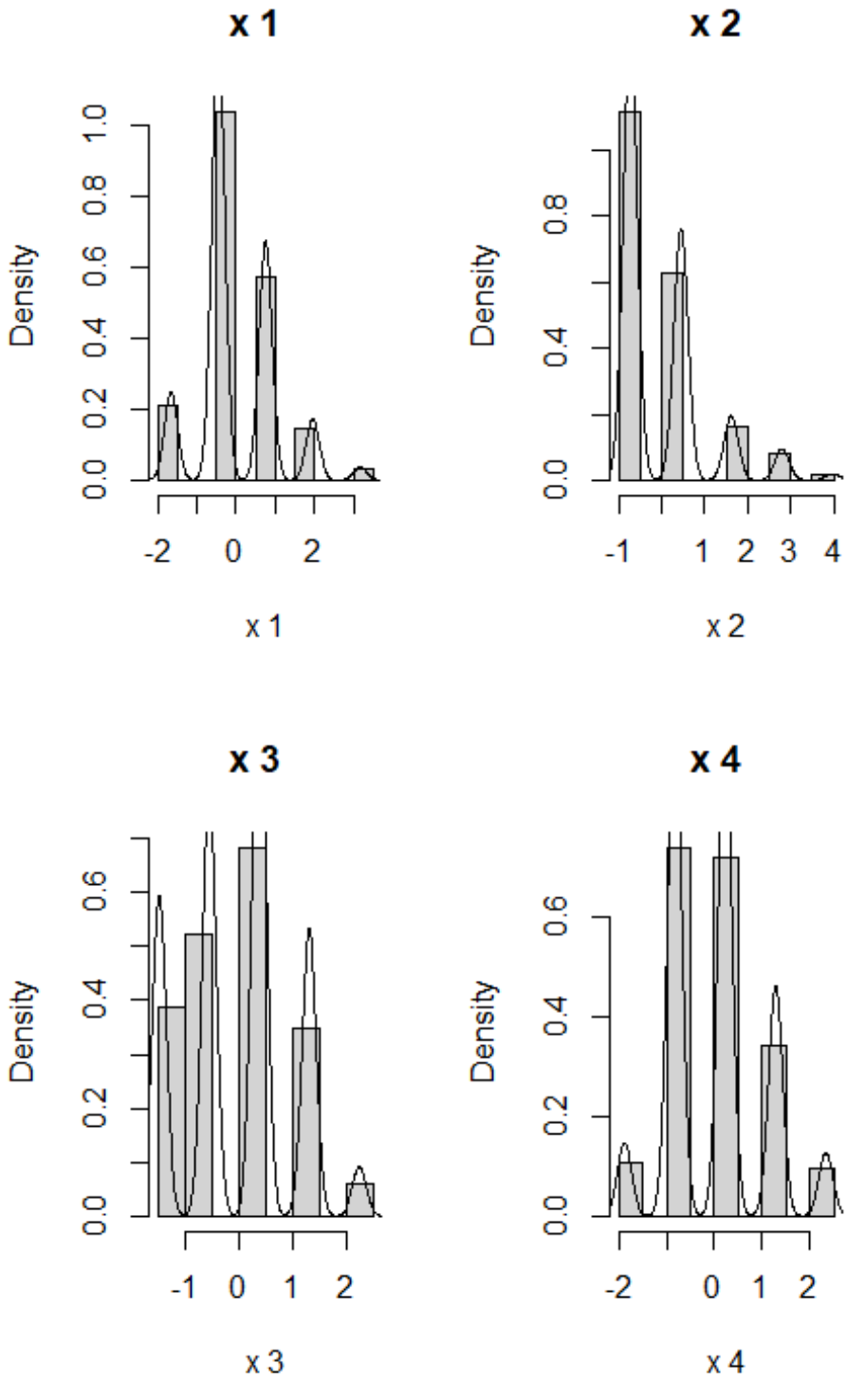
```
##   q01 q02 q03 q04 q05 q06 q07 q08
## 1   2   1   4   2   2   2   3   1
## 2   1   1   4   3   2   2   2   2
## 3   2   3   2   2   4   1   2   2
## 4   3   1   1   4   3   3   4   2
## 5   2   1   3   2   2   3   3   2
## 6   2   1   3   2   4   4   4   2
```

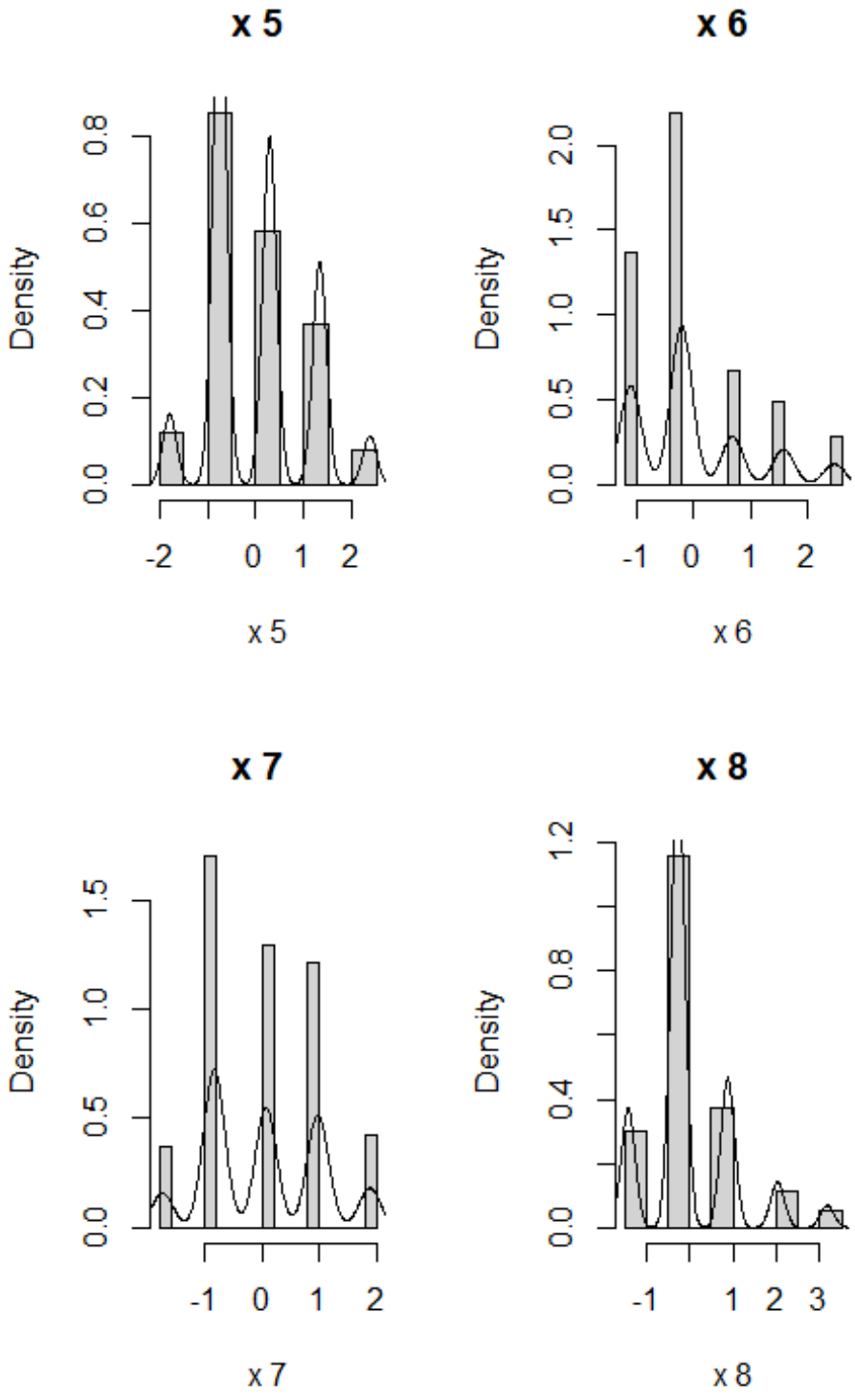
Standarisasi

```
zsurvei <- data.frame(scale(penugasan9_1))
```

Cek Histogram Dan Kurva Setiap Var

```
par(mfrow = c(1,2))
for (i in 1:8) {
  hist(zsurvei[,i],prob=T, main= paste("x",i,sept= " "),xlab = paste("x",i
,sep = " "))
  lines(density(zsurvei[,i]))
}
```


x 1
Density
0.0
0.2
0.4
0.6
0.8
1.0
-2
0
2
x 1
x 2
Density
0.0
0.4
0.8
-1
1
2
3
4
x 2
x 3
Density
0.0
0.2
0.4
0.6
-1
0
1
2
x 3
x 4
Density
0.0
0.2
0.4
0.6
-2
0
1
2
x 4



Normality Test

```
library(MVN)

## Warning: package 'MVN' was built under R version 4.2.2

result <- mvn(data =zsurvei,mvnTest = "mardia")
result
```

```
## $multivariateNormality
##              Test        Statistic p value Result
## 1 Mardia Skewness  2562.5608289646       0     NO
## 2 Mardia Kurtosis 27.5691604773384       0     NO
## 3             MVN             <NA>    <NA>     NO
##
## $univariateNormality
##               Test  Variable Statistic   p value Normality
## 1 Anderson-Darling    q01     187.8201  <0.001      NO
## 2 Anderson-Darling    q02     280.5486  <0.001      NO
## 3 Anderson-Darling    q03      99.8448  <0.001      NO
## 4 Anderson-Darling    q04     131.0783  <0.001      NO
## 5 Anderson-Darling    q05     148.3664  <0.001      NO
## 6 Anderson-Darling    q06     162.3253  <0.001      NO
## 7 Anderson-Darling    q07     107.5207  <0.001      NO
## 8 Anderson-Darling    q08     220.9863  <0.001      NO
##
## $Descriptives
##        n          Mean Std.Dev      Median        Min      Max       25
th
## q01 2571 -6.517004e-17       1 -0.45188825 -1.6595854 3.171203 -0.45188
82
## q02 2571  7.180628e-17       1 -0.73259120 -0.7325912 3.967326 -0.73259
12
## q03 2571  6.435299e-17       1  0.38569386 -1.4747544 2.246142 -0.54453
03
## q04 2571  1.034690e-17       1  0.22552837 -1.8829569 2.334014 -0.82871
43
## q05 2571 -1.543794e-16       1  0.28787780 -1.7853262 2.361082 -0.74872
42
## q06 2571  7.035456e-17       1 -0.20244965 -1.0937134 2.471342 -1.09371
34
## q07 2571 -1.223502e-17       1  0.06915611 -1.7451332 1.883445 -0.83798
85
## q08 2571  6.809732e-17       1 -0.27146555 -1.4175048 3.166652 -0.27146
55
##          75th       Skew   Kurtosis
## q01 0.7558089 0.65456004  0.6055246
## q02 0.4423882 1.48767803  2.0367054
## q03 0.3856939 0.08940993 -0.7801429
## q04 0.2255284 0.38517992 -0.2878337
## q05 0.2878778 0.45564247 -0.4418064
## q06 0.6888141 0.92666201  0.1507951
## q07 0.9763007 0.19958846 -0.8510760
## q08 0.8745737 1.05050718  1.4833814
```

Bartlett Test Dan KMO

```
bart_spher(zsurvei)

##  Bartlett's Test of Sphericity
##
## Call: bart_spher(x = zsurvei)
##
##      X2 = 4157.283
```

```
##      df = 28
## p-value < 2.22e-16

KMO(zsurvei)

## Kaiser-Meyer-Olkin factor adequacy
## Call: KMO(r = zsurvei)
## Overall MSA =  0.82
## MSA for each item =
##  q01  q02  q03  q04  q05  q06  q07  q08
## 0.84 0.68 0.82 0.85 0.87 0.75 0.78 0.88
```

Interpretasi:

Dikarenakan nilai p-value < alpha maka keputusannya tolak H0, yang artinya ada korelasi/hubungan antar variabelnya. artinya, data ini cocok untuk dilakukan analisis faktor KMO : karena nilai Overall MSA > 0.5 dan setiap nilai MSA tiap variabelnya tidak ada yang < 0.5 maka data ini cocok untuk dilakukan analisis factor

Analisis faktor

```
R <- cov(zsurvei)
R

##             q01         q02        q03        q04        q05         q0
6
## q01  1.00000000 -0.09872403 -0.3366489  0.4358602  0.4024399  0.2167339
9
## q02 -0.09872403  1.00000000  0.3183902 -0.1118597 -0.1193466 -0.0742096
8
## q03 -0.33664888  0.31839020  1.0000000 -0.3804602 -0.3103088 -0.2267404
8
## q04  0.43586018 -0.11185965 -0.3804602  1.0000000  0.4006722  0.2782015
4
## q05  0.40243992 -0.11934658 -0.3103088  0.4006722  1.0000000  0.2574601
4
## q06  0.21673399 -0.07420968 -0.2267405  0.2782015  0.2574601  1.0000000
0
## q07  0.30536514 -0.15917448 -0.3819533  0.4086150  0.3393918  0.5135804
8
## q08  0.33073761 -0.04962257 -0.2586342  0.3494294  0.2686270  0.2228317
5
##            q07         q08
## q01  0.3053651  0.33073761
## q02 -0.1591745 -0.04962257
## q03 -0.3819533 -0.25863421
## q04  0.4086150  0.34942939
## q05  0.3393918  0.26862697
## q06  0.5135805  0.22283175
## q07  1.0000000  0.29749696
## q08  0.2974970  1.00000000

eigen <- eigen(R)
eigen
```

```
## eigen() decomposition
## $values
## [1] 3.0565181 1.0669108 0.9583728 0.7364178 0.6215983 0.5707792 0.54300
07
## [8] 0.4464023
##
## $vectors
##            [,1]        [,2]        [,3]         [,4]       [,5]
[,6]
## [1,]  0.3770887 -0.13153453  0.40629889  0.186566596 -0.0807492  0.7522
2211
## [2,] -0.1713375 -0.83883879  0.02557898  0.107624897 -0.3681131 -0.2244
3355
## [3,] -0.3736902 -0.39564219 -0.08322941  0.074812976  0.5197953  0.3356
7005
## [4,]  0.4118076 -0.11509760  0.19572263  0.074679198 -0.3655488 -0.1179
5590
## [5,]  0.3715159 -0.09269101  0.21924373  0.536278728  0.5621253 -0.4312
7930
## [6,]  0.3270875 -0.17906337 -0.68970297  0.036278166  0.1351576  0.2328
6744
## [7,]  0.4105079 -0.04276093 -0.46269753 -0.007325367 -0.1147471 -0.0679
7019
## [8,]  0.3251009 -0.25842629  0.22624200 -0.808375645  0.3267107 -0.1111
5067
##              [,7]         [,8]
## [1,] -0.24044448  0.102199801
## [2,] -0.26243857 -0.001972779
## [3,]  0.51338883  0.211823375
## [4,]  0.76389623 -0.205440303
## [5,] -0.12452087 -0.015147512
## [6,] -0.07811714 -0.552581839
## [7,]  0.03384164  0.772385901
## [8,] -0.05877004 -0.017897849
```

FA Analisis

```
fa.parallel(R, fa = "fa")

## In smc, smcs < 0 were set to .0
## In smc, smcs < 0 were set to .0
## In smc, smcs < 0 were set to .0

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead
```

```
## In smc, smcs < 0 were set to .0
## In smc, smcs < 0 were set to .0

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

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## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

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e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

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e is  used

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d instead

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e is  used

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d instead

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## I was unable to calculate the factor score weights, factor loadings use
d instead
```

```
## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
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## In smc, smcs < 0 were set to .0
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## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.stats, the correlation matrix is singular, an approximation i
s used

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.stats, the correlation matrix is singular, an approximation i
s used

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used
```

```
## I was unable to calculate the factor score weights, factor loadings use
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## In smc, smcs < 0 were set to .0

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e is  used

## I was unable to calculate the factor score weights, factor loadings use
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## In smc, smcs < 0 were set to .0
## In smc, smcs < 0 were set to .0

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d instead

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In smc, smcs < 0 were set to .0
## In smc, smcs < 0 were set to .0
```

```
## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.stats, the correlation matrix is singular, an approximation i
s used

## In factor.stats: The factor scoring weights matrix is probably singular
-- Factor score estimate results are likely incorrect.
##  Try a different factor score estimation method

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In smc, smcs < 0 were set to .0
## In smc, smcs < 0 were set to .0

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
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## I was unable to calculate the factor score weights, factor loadings use
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## In factor.scores, the correlation matrix is singular, the pseudo invers
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## I was unable to calculate the factor score weights, factor loadings use
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## In factor.scores, the correlation matrix is singular, the pseudo invers
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## I was unable to calculate the factor score weights, factor loadings use
d instead
```

```
## In smc, smcs < 0 were set to .0
## In smc, smcs < 0 were set to .0

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
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## I was unable to calculate the factor score weights, factor loadings use
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## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
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e is  used

## I was unable to calculate the factor score weights, factor loadings use
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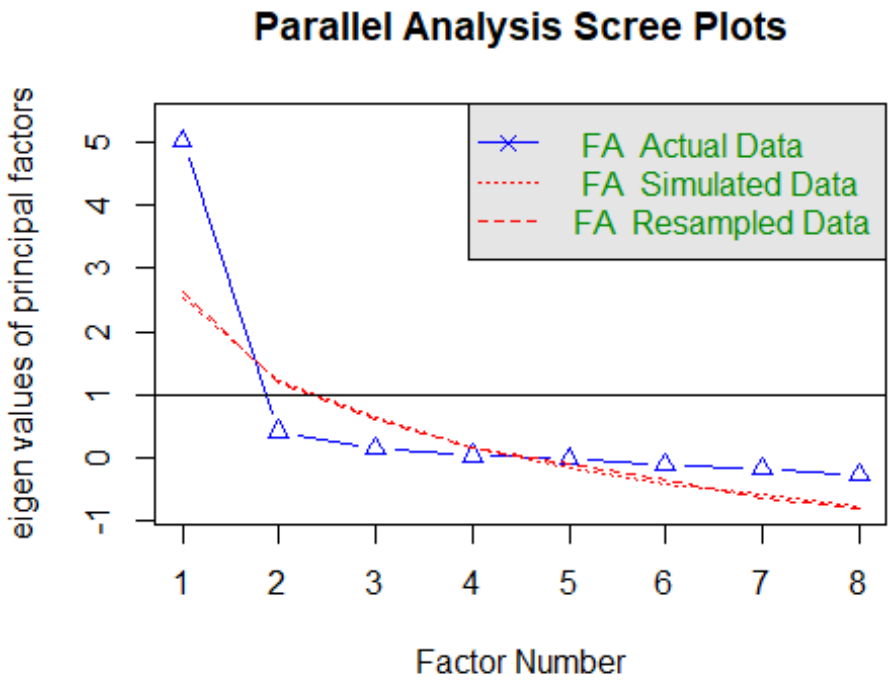
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead
```




```
## Parallel analysis suggests that the number of factors =  1  and the num
ber of components =  NA
```

Interpretasi:

Dari gambar diatas, elbo terdapat pada faktor kedua, yang artinya hanya dipakai 2 faktor saja.

extract faktor

Tanpa Rotasi

```
survei_fac <- factanal(factors = 2,covmat = R, rotation = "none")
survei_fac

##
## Call:
## factanal(factors = 2, covmat = R, rotation = "none")
##
## Uniquenesses:
##   q01   q02   q03   q04   q05   q06   q07   q08
## 0.565 0.951 0.690 0.538 0.651 0.697 0.112 0.759
##
## Loadings:
##     Factor1 Factor2
## q01  0.423   0.506
## q02 -0.193  -0.106
## q03 -0.468  -0.301
## q04  0.522   0.435
## q05  0.441   0.393
## q06  0.550
## q07  0.927  -0.173
## q08  0.380   0.311
```

```
##
##                Factor1 Factor2
## SS loadings      2.207   0.829
## Proportion Var   0.276   0.104
## Cumulative Var   0.276   0.380
##
## The degrees of freedom for the model is 13 and the fit was 0.0774
```

Interpretasi:

Dari analisis faktor tanpa rotasi ini, dengan menggunakan 2 faktor, hanya dapat menjelaskan 38% dari data keseluruhan.

Menggunakan Rotation

```
survei_factor <- factanal(factors = 2, covmat = R, rotation = "varimax")
survei_factor
```

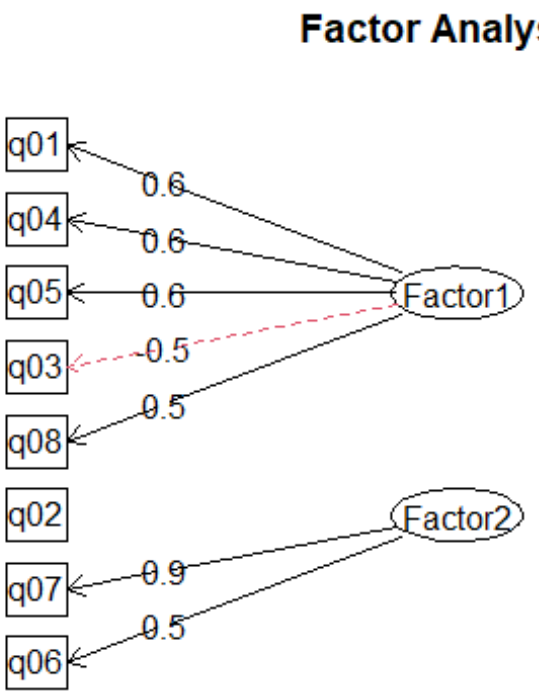
```
##
## Call:
## factanal(factors = 2, covmat = R, rotation = "varimax")
##
## Uniquenesses:
##   q01   q02   q03   q04   q05   q06   q07   q08
## 0.565 0.951 0.690 0.538 0.651 0.697 0.112 0.759
##
## Loadings:
##     Factor1 Factor2
## q01  0.644   0.143
## q02 -0.183  -0.123
## q03 -0.483  -0.277
## q04  0.626   0.264
## q05  0.552   0.211
## q06  0.236   0.497
## q07  0.273   0.902
## q08  0.451   0.194
##
##                Factor1 Factor2
## SS loadings      1.711   1.326
## Proportion Var   0.214   0.166
## Cumulative Var   0.214   0.380
##
## The degrees of freedom for the model is 13 and the fit was 0.0774
```

Interpretasi:

Dari analisis faktor tanpa rotasi ini, dengan menggunakan 2 faktor, hanya dapat menjelaskan 38% dari data keseluruhan.

gambar faktor analisis

```
loads <- survei_factor$loadings
fa.diagram(loads)
```



Interpretasi:

Dari grafik diatas dapat dilihat bahwa q01, q04, q05, q03, dan q08 lebih dominan berkontribusi dalam menjelaskan faktor 1 daripada menjelaskan faktor 2 Dari grafik diatas dapat dilihat bahwa q07 dan q06 lebih dominan berkontribusi dalam menjelaskan faktor 2 daripada menjelaskan faktor 1 kontribusi q02 tidak dominan pada kedua faktor sehingga tidak masuk kedalam faktor pertama ataupun kedua.

Exercise 9.24 (Census Track Data)

```
xbar <- c(4.47, 3.96, 71.42, 26.91, 1.64)
Sn <- matrix(c(3.397, -1.102, 4.306, -2.078, 0.027, -1.102, 9.673, -1.513,
10.953, 1.203, 4.306, -1.513, 55.626, -28.937, -0.044, -2.078, 10.953, -28
.937, 89.067, 0.957, 0.027, 1.203, -0.044, 0.957, 0.319), ncol = 5)
Sn
```

```
##        [,1]   [,2]    [,3]    [,4]   [,5]
## [1,]  3.397 -1.102   4.306  -2.078  0.027
## [2,] -1.102  9.673  -1.513  10.953  1.203
## [3,]  4.306 -1.513  55.626 -28.937 -0.044
## [4,] -2.078 10.953 -28.937  89.067  0.957
## [5,]  0.027  1.203  -0.044   0.957  0.319
```

```
eigen1 <- eigen(Sn)
eigen1
```

```
## eigen() decomposition
## $values
## [1] 107.0151014  39.6727660   8.3711315   2.8679027   0.1550985
```

```
##
## $vectors
##              [,1]        [,2]        [,3]        [,4]         [,5]
## [1,]  0.038886851 -0.07115908 -0.18787889  0.97714020 -0.057643285
## [2,] -0.105319293 -0.12975150  0.96099825  0.17134428 -0.138549268
## [3,]  0.492359797 -0.86438932 -0.04579616 -0.09105437  0.004974019
## [4,] -0.863072581 -0.48032809 -0.15318063 -0.02968953  0.006698212
## [5,] -0.009121921 -0.01472929  0.12498918  0.08164434  0.988641363
```

FA Analisis

```
fa.parallel(Sn, fa = "fa")

## In factor.stats, the correlation matrix is singular, an approximation i
s used

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In smc, smcs < 0 were set to .0
## In smc, smcs < 0 were set to .0

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In smc, smcs < 0 were set to .0
## In smc, smcs < 0 were set to .0

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In smc, smcs < 0 were set to .0
## In smc, smcs < 0 were set to .0

## In factor.stats, the correlation matrix is singular, an approximation i
s used

## In factor.scores, the correlation matrix is singular, the pseudo invers
e is  used

## I was unable to calculate the factor score weights, factor loadings use
d instead

## In factor.scores, the correlation matrix is singular, the pseudo invers
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## In factor.stats: The factor scoring weights matrix is probably singular
-- Factor score estimate results are likely incorrect.
##  Try a different factor score estimation method

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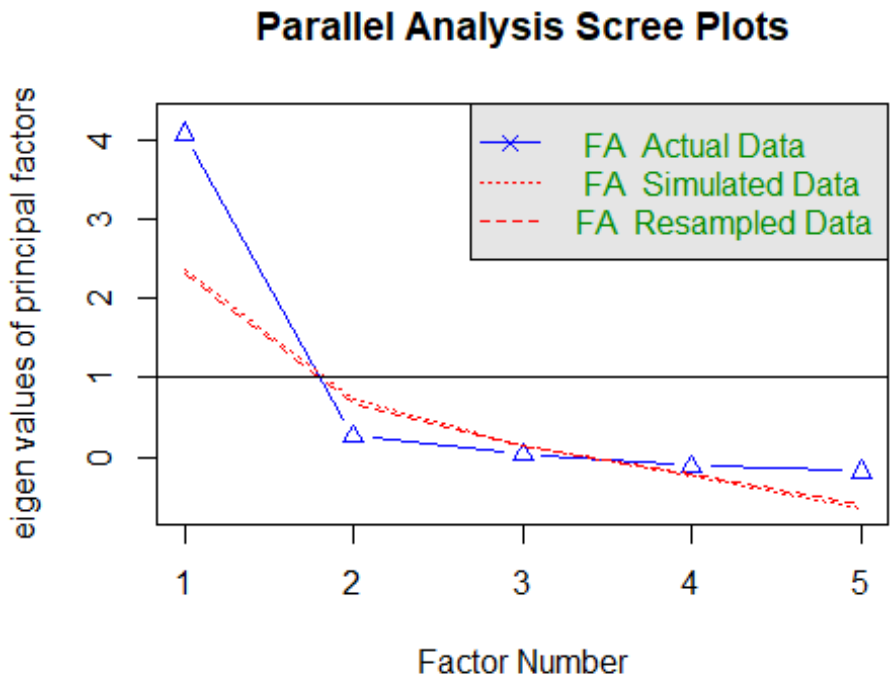



```
## Parallel analysis suggests that the number of factors =  1  and the num
ber of components =  NA
```

Interpretasi:

Dari grafik diatas dapat dilihat bahwa elbow yang terbentuk ada pada faktor kedua, yang artinya cukup 2 faktor saja yang diambil.

extract faktor

Tanpa Rotasi

```
no_fac <- factanal(factors = 2,covmat = Sn, rotation = "none")
no_fac
```

```
##
## Call:
## factanal(factors = 2, covmat = Sn, rotation = "none")
##
## Uniquenesses:
## [1] 0.872 0.005 0.005 0.710 0.528
##
## Loadings:
##      Factor1 Factor2
## [1,] -0.345
## [2,]  0.738   0.671
## [3,] -0.718   0.692
## [4,]  0.538
## [5,]  0.484   0.488
##
##                Factor1 Factor2
## SS loadings      1.703   1.178
```

```
## Proportion Var   0.341   0.236
## Cumulative Var   0.341   0.576
##
## The degrees of freedom for the model is 1 and the fit was 0.0724
```

Interpretasi:

Dari perhitungan tanpa rotasi diatas didapat bahwa tanpa rotasi hanya dapat menjelaskan data sebesar 57.6%.

Menggunakan Rotasi

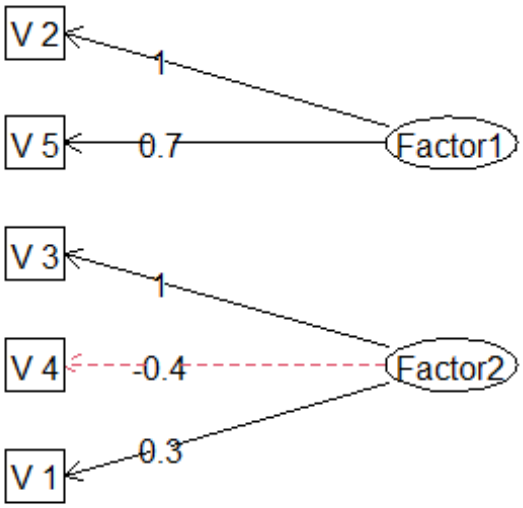
```
no_factor <- factanal(factors = 2,covmat = Sn, rotation = "varimax")
no_factor
```

```
##
## Call:
## factanal(factors = 2, covmat = Sn, rotation = "varimax")
##
## Uniquenesses:
## [1] 0.872 0.005 0.005 0.710 0.528
##
## Loadings:
##      Factor1 Factor2
## [1,] -0.135   0.331
## [2,]  0.982  -0.176
## [3,]  0.111   0.991
## [4,]  0.299  -0.448
## [5,]  0.682
##
##                Factor1 Factor2
## SS loadings      1.549   1.332
## Proportion Var   0.310   0.266
## Cumulative Var   0.310   0.576
##
## The degrees of freedom for the model is 1 and the fit was 0.0724
```

Dari perhitungan dengan rotasi diatas didapat bahwa dengan rotasi hanya dapat menjelaskan data sebesar 57.6%

```
loads1 <- no_factor$loadings
fa.diagram(loads1)
```

Factor Analysis



Interpretasi:

Dari grafik diatas dapat dilihat bahwa V2 dan V5 lebih dominan berkontribusi dalam menjelaskan faktor 1 daripada menjelaskan faktor 2 Dari grafik diatas dapat dilihat bahwa V3,V4, dan V1 lebih dominan berkontribusi dalam menjelaskan faktor 2 daripada menjelaskan faktor 1.