Penentuan Faktor Pertumbuhan Anak

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```
#Library
library(readxl)
```

```
data <- read_excel("Tugas FA  - WiscsemData.xlsx")
head(data)
```

```
## # A tibble: 6 x 13
##   client agemate  info  comp arith simil vocab digit pictcomp parang block
##    <dbl>   <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>    <dbl>  <dbl> <dbl>
## 1      3       3     8     7    13     9    12     9        6     11    12
## 2      4       3     9     6     8     7    11    12        6      8     7
## 3      5       3    13    10    11    16    15     6       10      8    11
## 4      6       3     8    11     6    12     9     7       13      4     7
## 5      7       2    10     3     8     8     9    12        9      7    11
## 6      8       3    11     7    15    12    10    12        6     12    10
## # ... with 2 more variables: object <dbl>, coding <dbl>
```

```
str(data)
```

```
## tibble [175 x 13] (S3: tbl_df/tbl/data.frame)
##  $ client  : num [1:175] 3 4 5 6 7 8 9 10 12 13 ...
##  $ agemate : num [1:175] 3 3 3 3 2 3 3 2 3 3 ...
##  $ info    : num [1:175] 8 9 13 8 10 11 6 7 10 9 ...
##  $ comp    : num [1:175] 7 6 18 11 3 7 13 10 8 10 ...
##  $ arith   : num [1:175] 13 8 11 6 8 15 7 10 8 8 ...
##  $ simil   : num [1:175] 9 7 16 12 9 12 8 15 14 11 ...
##  $ vocab   : num [1:175] 12 11 15 9 12 10 11 10 9 9 ...
##  $ digit   : num [1:175] 9 12 6 7 9 12 6 7 9 11 ...
##  $ pictcomp: num [1:175] 6 6 18 13 7 6 14 8 10 10 ...
##  $ parang  : num [1:175] 11 8 8 4 7 12 9 14 11 12 ...
##  $ block   : num [1:175] 12 7 11 7 11 10 14 11 10 9 ...
##  $ object  : num [1:175] 7 12 12 12 4 5 14 10 9 13 ...
##  $ coding  : num [1:175] 9 14 9 11 10 10 10 12 6 13 ...
```

Matrix eigen vector

```
data_matriks <- as.matrix(data)
data_matriks_korelasi <- cor(data_matriks)
data_matriks_eigen <- eigen(data_matriks_korelasi)
data_matriks_vektor <- data_matriks_eigen$vectors
data_matriks_vektor_transpose <- t(data_matriks_vektor)
data_matriks_vektor %*% data_matriks_vektor_transpose
```

```
##               [,1]          [,2]          [,3]          [,4]          [,5]
##  [1,]  1.000000e+00  1.040834e-16 -1.457168e-16  1.370432e-16  2.151057e-16
##  [2,]  1.040834e-16  1.000000e+00  9.020562e-17  3.625572e-16 -3.989864e-17
##  [3,] -1.457168e-16  9.020562e-17  1.000000e+00 -1.110223e-16  0.000000e+00
##  [4,]  1.370432e-16  3.625572e-16 -1.110223e-16  1.000000e+00 -4.371503e-16
##  [5,]  2.151057e-16 -3.989864e-17  0.000000e+00 -4.371503e-16  1.000000e+00
##  [6,] -4.579670e-16 -3.755676e-16 -1.110223e-16 -2.706169e-16  3.053113e-16
##  [7,] -7.632783e-17  5.863365e-16 -2.220446e-16  2.220446e-16  1.110223e-16
##  [8,]  6.418477e-16 -2.059984e-16  2.671474e-16 -3.556183e-17  1.127570e-15
##  [9,]  3.248270e-16  8.131516e-17  1.908196e-17  2.649790e-16 -5.898060e-17
## [10,] -3.625572e-16 -1.011344e-15 -3.191891e-16 -5.221518e-16  1.873501e-16
## [11,]  1.092876e-16 -1.561251e-17  2.914335e-16 -1.422473e-16 -6.591949e-16
## [12,] -1.682682e-16  2.081668e-17  2.220446e-16 -2.602085e-16  7.910339e-16
## [13,]  2.428613e-16  4.510281e-16  1.387779e-17  1.700029e-16 -1.838807e-16
##               [,6]          [,7]          [,8]          [,9]         [,10]
##  [1,] -4.579670e-16 -7.632783e-17  6.418477e-16  3.248270e-16 -3.625572e-16
##  [2,] -3.755676e-16  5.863365e-16 -2.059984e-16  8.131516e-17 -1.011344e-15
##  [3,] -1.110223e-16 -2.220446e-16  2.671474e-16  1.908196e-17 -3.191891e-16
##  [4,] -2.706169e-16  2.220446e-16 -3.556183e-17  2.649790e-16 -5.221518e-16
##  [5,]  3.053113e-16  1.110223e-16  1.127570e-15 -5.898060e-17  1.873501e-16
##  [6,]  1.000000e+00  6.938894e-17 -1.873501e-16  5.854692e-17  3.972517e-16
##  [7,]  6.938894e-17  1.000000e+00  1.283695e-16 -6.938894e-17 -4.163336e-16
##  [8,] -1.873501e-16  1.283695e-16  1.000000e+00 -6.470519e-16  1.062518e-16
##  [9,]  5.854692e-17 -6.938894e-17 -6.470519e-16  1.000000e+00  1.229485e-16
## [10,]  3.972517e-16 -4.163336e-16  1.062518e-16  1.229485e-16  1.000000e+00
## [11,]  3.122502e-16 -1.249001e-16  3.018419e-16 -1.474515e-16 -3.313322e-16
## [12,] -6.487866e-16 -3.608225e-16 -4.128642e-16 -4.163336e-16 -2.168404e-16
## [13,]  1.422473e-16  1.387779e-17 -1.769418e-16  4.800847e-16 -7.042977e-16
##              [,11]         [,12]         [,13]
##  [1,]  1.092876e-16 -1.682682e-16  2.428613e-16
##  [2,] -1.561251e-17  2.081668e-17  4.510281e-16
##  [3,]  2.914335e-16  2.220446e-16  1.387779e-17
##  [4,] -1.422473e-16 -2.602085e-16  1.700029e-16
##  [5,] -6.591949e-16  7.910339e-16 -1.838807e-16
##  [6,]  3.122502e-16 -6.487866e-16  1.422473e-16
##  [7,] -1.249001e-16 -3.608225e-16  1.387779e-17
##  [8,]  3.018419e-16 -4.128642e-16 -1.769418e-16
##  [9,] -1.474515e-16 -4.163336e-16  4.800847e-16
## [10,] -3.313322e-16 -2.168404e-16 -7.042977e-16
## [11,]  1.000000e+00  7.979728e-16  1.006140e-16
## [12,]  7.979728e-16  1.000000e+00 -4.475587e-16
## [13,]  1.006140e-16 -4.475587e-16  1.000000e+00
```

3 Sampel eigen vektor

```
eigen_vektor <- data_matriks_vektor[,1:3]
eigen_vektor
```

```
##              [,1]        [,2]        [,3]
##  [1,] -0.025014113  0.42834312  0.22273772
##  [2,] -0.06419603 -0.01594669 -0.40698838
##  [3,] -0.37470045 -0.27238702 -0.07085062
##  [4,] -0.38390549 -0.01532265 -0.03827933
##  [5,] -0.30796348 -0.23274052  0.09954685
##  [6,] -0.37938209 -0.09266052 -0.20195768
##  [7,] -0.37749189 -0.26472530 -0.04482546
##  [8,] -0.21465614 -0.29172059  0.30885079
##  [9,] -0.28611507  0.35313262 -0.17251921
## [10,] -0.23161635  0.30633302  0.11598853
## [11,] -0.29432550  0.34652084  0.10707086
## [12,] -0.23575765  0.42460452  0.05205189
## [13,] -0.04901539 -0.09548765  0.75682155
```

Diagonal matrix

```
matriks_diagonal <- data_matriks_eigen$values[1:3]
matriks_diagonal_value <- diag(matriks_diagonal, 3,3)
```

Loading factor

```
load_factor <- eigen_vektor %*% sqrt(matriks_diagonal_value)
load_factor
```

```
##              [,1]        [,2]        [,3]
##  [1,] -0.04903158  0.53452363  0.24115297
##  [2,] -0.12583420 -0.01989966 -0.44063689
##  [3,] -0.73447114 -0.33990810 -0.07670832
##  [4,] -0.75251444 -0.01912093 -0.04144414
##  [5,] -0.60365631 -0.29043376  0.10777707
##  [6,] -0.74364789 -0.11562982 -0.21865490
##  [7,] -0.73994280 -0.33034715 -0.04853149
##  [8,] -0.42075942 -0.36403421  0.33438560
##  [9,] -0.56083002  0.44066945 -0.18678255
## [10,] -0.45400407  0.38226885  0.12557809
## [11,] -0.57692374  0.42493138  0.11592314
## [12,] -0.46212165  0.52985827  0.05635538
## [13,] -0.09607778 -0.11915776  0.81939316
```

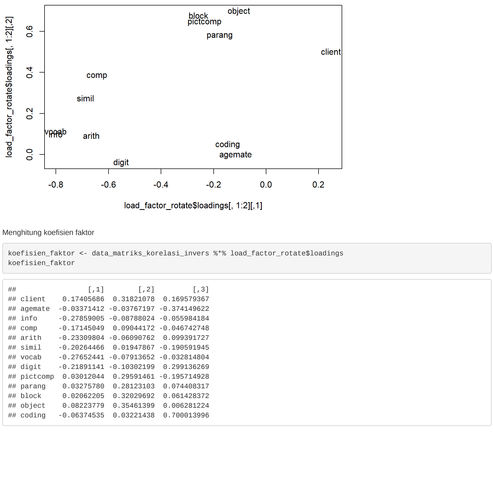
Matriks Invers

```
data_matriks_korelasi_invers <- solve(data_matriks_korelasi)
data_matriks_korelasi_invers
```

```
##                client      agemate         info         comp         arith
## client    1.11061815  0.033654880 -0.04779109 -0.05051364 -0.012529317
## agemate   0.03365488  1.036379515 -0.05782591  0.01538460  0.011816983
## info     -0.04799109 -0.057825914  2.06256825 -0.13888007 -0.506027749
## comp     -0.05051364  0.015384597 -0.13888007  1.81581017 -0.256468796
## arith    -0.01252932  0.011816983 -0.50062775 -0.25646880  1.506064158
## simil     0.15909067 -0.063735367 -0.27956549 -0.34849833 -0.141032555
## vocab     0.22568064  0.038691491 -0.83140230 -0.41154421 -0.005449071
## digit    -0.04879022 -0.042478757 -0.24954960 -0.06732920 -0.097396599
## pictcomp -0.18023639  0.001520763  0.06500115 -0.29077069  0.068105065
## parang   -0.17879538 -0.064812381 -0.05429335  0.11742479 -0.133489923
## block    -0.03720763 -0.100065981  0.09221296 -0.18470174 -0.228235914
## object   -0.05830429  0.080941802 -0.12746812 -0.21853625  0.259111792
## coding    0.00823179  0.103951906  0.15193022 -0.04044767 -0.083482090
##                simil       vocab       digit    pictcomp      parang
## client    0.15909067  0.225680643 -0.04879022 -0.18023639 -0.17879538
## agemate  -0.06373537  0.038691491 -0.04247876  0.001520763 -0.06481238
## info     -0.27956549 -0.831402302 -0.24954960  0.065001152 -0.05429335
## comp     -0.34849833 -0.411544210 -0.06732920 -0.290770690  0.11742479
## arith    -0.14103256 -0.005449071 -0.09729651  0.068105065 -0.13348992
## simil     1.84790615 -0.439275722 -0.10014671 -0.248798889 -0.29431818
## vocab    -0.43927572  2.108659658 -0.09843701 -0.109561047  0.15640940
## digit    -0.10014671 -0.098437013  1.22332358  0.020981826 -0.09186433
## pictcomp -0.24879089 -0.109561047  0.02898183  1.455805030 -0.07418153
## parang   -0.29431818  0.156409400 -0.09186433 -0.074181533  1.29774233
## block     0.11672229 -0.218588037  0.10174713 -0.268406504 -0.30705327
## object   -0.15088013  0.088675668  0.06250029 -0.225588135 -0.12708186
## coding    0.15622600 -0.170348609 -0.20409833  0.153818469 -0.02847740
##                block      object      coding
## client   -0.03720763 -0.05830429  0.00823179
## agemate  -0.10006598  0.08094180  0.10395191
## info      0.09221296 -0.12746812  0.15193022
## comp     -0.18470174 -0.21853625 -0.04044767
## arith    -0.22823591  0.25911179 -0.08348209
## simil     0.11672229 -0.15088013  0.15622600
## vocab    -0.21858804  0.08867567 -0.17034861
## digit     0.10174713  0.06250029 -0.20409833
## pictcomp -0.26840650 -0.22558813  0.15381847
## parang   -0.30705327 -0.12708186 -0.02847740
## block     1.51702930 -0.36357129 -0.11991989
## object   -0.36357129  1.37606961 -0.07337641
## coding   -0.11991989 -0.07337641  1.10607065
```

Plot

```
load_factor_rotate <- varimax(load_factor)
plot(load_factor_rotate$loadings[,1:2], type = "n")
text(load_factor_rotate$loadings[,1:2], labels=names(data), cex = 1)
```



Menghitung koefisien faktor

```
koefisien_faktor <- data_matriks_korelasi_invers %*% load_factor_rotate$loadings
koefisien_faktor
```

```
##                [,1]        [,2]        [,3]
## client    0.17405686  0.31821078  0.169579367
## agemate  -0.03371412 -0.03767197 -0.374149622
## info     -0.27859005 -0.08788024 -0.055984184
## comp     -0.17145949  0.09044172 -0.046742748
## arith    -0.23309804 -0.06090782  0.099391727
## simil    -0.20264466  0.01947867 -0.190591945
## vocab    -0.27652441 -0.07913652 -0.032814804
## digit    -0.21891141 -0.10302199  0.299136269
## pictcomp  0.03012044  0.29591461 -0.195714928
## parang    0.03275780  0.28123103  0.074408317
## block     0.02062205  0.32029692  0.061428372
## object    0.08223779  0.35461399  0.006281224
## coding   -0.06374535  0.03221438  0.700013996
```