20210313-tarde-exercicio.R

rstudio-user

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```
# ANÁLISE MULTIVARIADA
#
# EXERCÍCIOS
#
# ANÁLISE FATORIAL
#
# 1) Usando o arquivo "Exerc A fatorial.xlsx", realize a análise fatorial, seguindo todos
# os passos, desde a verificação da adequação da característica dos dados para
# essa análise até chegar na visualização gráfica do modelo e suas cargas
# fatoriais.

#
# Pacotes e libs necessários
#
require(psych)
```

```
## Loading required package: psych
```

```
library(readxl)
library(zoo)
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
library(data.table)

#
# PASSO 1 - Importar os dados
#
data <- read_excel(
  "Exerc_A_fatorial.xlsx",
  col_types = c(
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
```

```
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric",
    "numeric"
  )
)
#data

#
# PASSO 2 - Verificar se os dados são numéricos
#
str(table)
```

```
## function (..., exclude = if (useNA == "no") c(NA, NaN), useNA = c("no",
##     "ifany", "always"), dnn = list.names(...), deparse.level = 1)
```

```
#
# PASSO 3 - Verificar se há dados faltantes
#
#is.na(data)
sum(is.na(data))
```

```
## [1] 731
```

```
#
# PASSO 4 - Tratar os dados faltantes definindo a média da coluna
#           usando as libs zoo e data.table
#
data <- na.aggregate(data)
data
```

```
## # A tibble: 2,800 x 28
##       A1    A2    A3    A4    A5    C1    C2    C3    C4    C5    E1    E2    E3
##    <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
##  1     2     4     3     4     4     2     3     3     4     4     3     3  3
##  2     2     4     5     2     5     5     4     4     3     4     1     1  6
##  3     5     4     5     4     4     4     5     4     2     5     2     4  4
##  4     4     4     6     5     5     4     4     3     5     5     5     3  4
##  5     2     3     3     4     5     4     4     5     3     2     2     2  5
##  6     6     6     5     6     5     6     6     6     1     3     2     1  6
```

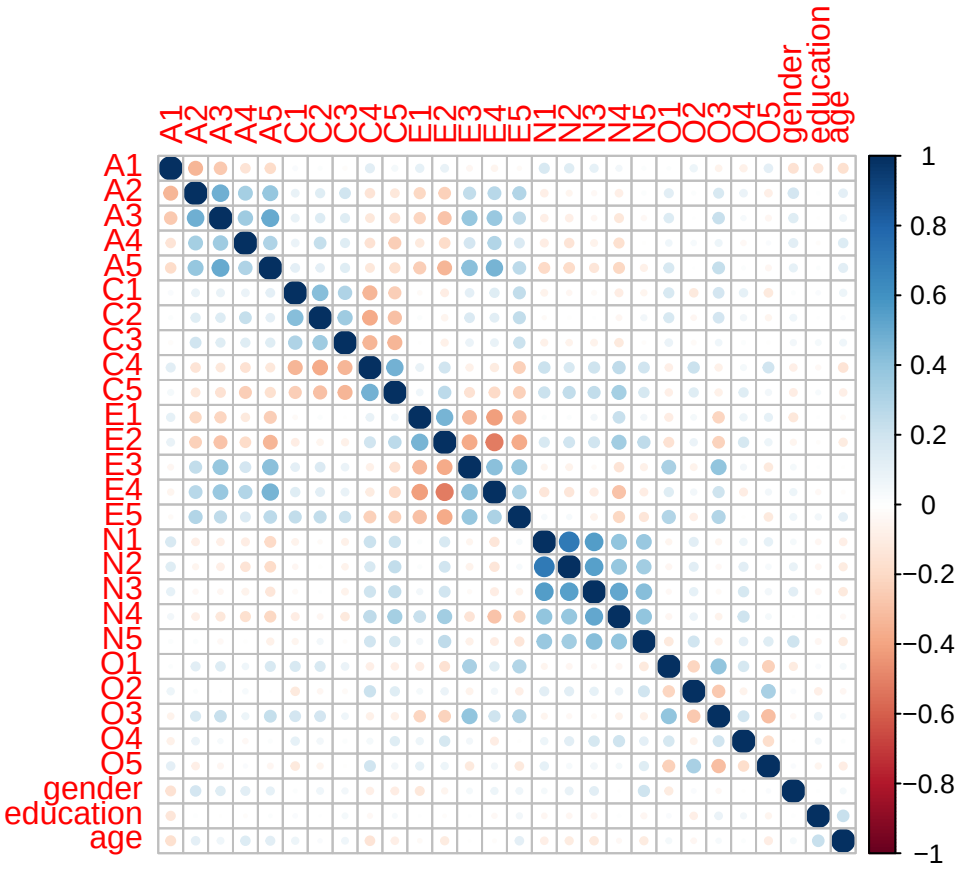
```
##  7     2     5     5     3     5     5     4     4     2     3     4     3  4
##  8     4     3     1     5     1     3     2     4     2     4     3     6  4
##  9     4     3     6     3     3     6     6     3     4     5     5     3  4.00
## 10     2     5     6     6     5     6     5     6     2     1     2     2  4
## # ... with 2,790 more rows, and 15 more variables: E4 <dbl>, E5 <dbl>,
## #   N1 <dbl>, N2 <dbl>, N3 <dbl>, N4 <dbl>, N5 <dbl>, O1 <dbl>, O2 <dbl>,
## #   O3 <dbl>, O4 <dbl>, O5 <dbl>, gender <dbl>, education <dbl>, age <dbl>
```

```
#
# PASSO 5 - Criar tabela de correlação
#
tablecor <- cor(data)
round(tablecor, 2)
```

```
##              A1    A2    A3    A4    A5    C1    C2    C3    C4    C5    E1
## A1         1.00 -0.34 -0.26 -0.15 -0.18  0.03  0.02 -0.02  0.13  0.05  0.11
## A2        -0.34  1.00  0.48  0.33  0.39  0.09  0.13  0.19 -0.14 -0.12 -0.21
## A3        -0.26  0.48  1.00  0.36  0.50  0.10  0.14  0.13 -0.12 -0.16 -0.21
## A4        -0.15  0.33  0.36  1.00  0.31  0.09  0.23  0.13 -0.15 -0.24 -0.11
## A5        -0.18  0.39  0.50  0.31  1.00  0.12  0.11  0.13 -0.12 -0.17 -0.24
## C1         0.03  0.09  0.10  0.09  0.12  1.00  0.42  0.31 -0.34 -0.25 -0.02
## C2         0.02  0.13  0.14  0.23  0.11  0.42  1.00  0.35 -0.38 -0.30  0.02
## C3        -0.02  0.19  0.13  0.13  0.13  0.31  0.35  1.00 -0.33 -0.34  0.00
## C4         0.13 -0.14 -0.12 -0.15 -0.12 -0.34 -0.38 -0.33  1.00  0.47  0.09
## C5         0.05 -0.12 -0.16 -0.24 -0.17 -0.25 -0.30 -0.34  0.47  1.00  0.06
## E1         0.11 -0.21 -0.21 -0.11 -0.24 -0.02  0.02  0.00  0.09  0.06  1.00
## E2         0.09 -0.23 -0.28 -0.19 -0.33 -0.09 -0.06 -0.08  0.20  0.26  0.46
## E3        -0.05  0.25  0.39  0.19  0.41  0.12  0.15  0.09 -0.08 -0.16 -0.32
## E4        -0.06  0.28  0.38  0.30  0.47  0.14  0.12  0.09 -0.11 -0.20 -0.42
## E5        -0.02  0.29  0.25  0.16  0.27  0.25  0.24  0.21 -0.23 -0.23 -0.30
## N1         0.16 -0.09 -0.08 -0.10 -0.19 -0.07 -0.02 -0.07  0.22  0.21  0.02
## N2         0.14 -0.05 -0.09 -0.14 -0.19 -0.04 -0.01 -0.06  0.16  0.25  0.01
## N3         0.10 -0.04 -0.04 -0.07 -0.13 -0.03  0.00 -0.07  0.21  0.24  0.05
## N4         0.05 -0.09 -0.13 -0.17 -0.20 -0.10 -0.04 -0.11  0.26  0.34  0.23
## N5         0.02  0.02 -0.04 -0.01 -0.08 -0.05  0.05 -0.01  0.19  0.17  0.05
## O1         0.01  0.13  0.15  0.06  0.16  0.17  0.16  0.09 -0.09 -0.08 -0.10
## O2         0.08  0.02  0.00  0.04  0.00 -0.11 -0.04 -0.03  0.21  0.14  0.04
## O3        -0.06  0.16  0.22  0.07  0.24  0.19  0.19  0.06 -0.08 -0.08 -0.22
## O4        -0.08  0.09  0.04 -0.04  0.02  0.11  0.06  0.02  0.05  0.14  0.08
## O5         0.11 -0.09 -0.05  0.02 -0.05 -0.12 -0.05 -0.01  0.20  0.06  0.10
## gender    -0.16  0.18  0.14  0.13  0.10  0.01  0.07  0.05 -0.08 -0.09 -0.13
## education -0.13  0.01  0.00 -0.01  0.01  0.02  0.00  0.05 -0.03  0.03  0.00
## age       -0.16  0.11  0.07  0.14  0.13  0.08  0.02  0.07 -0.15 -0.09 -0.03
##              E2    E3    E4    E5    N1    N2    N3    N4    N5    O1    O2
## A1         0.09 -0.05 -0.06 -0.02  0.16  0.14  0.10  0.05  0.02  0.01  0.08
## A2        -0.23  0.25  0.28  0.29 -0.09 -0.05 -0.04 -0.09  0.02  0.13  0.02
## A3        -0.28  0.39  0.38  0.25 -0.08 -0.09 -0.04 -0.13 -0.04  0.15  0.00
## A4        -0.19  0.19  0.30  0.16 -0.10 -0.14 -0.07 -0.17 -0.01  0.06  0.04
## A5        -0.33  0.41  0.47  0.27 -0.19 -0.19 -0.13 -0.20 -0.08  0.16  0.00
## C1        -0.09  0.12  0.14  0.25 -0.07 -0.04 -0.03 -0.10 -0.05  0.17 -0.11
## C2        -0.06  0.15  0.12  0.24 -0.02 -0.01  0.00 -0.04  0.05  0.16 -0.04
## C3        -0.08  0.09  0.09  0.21 -0.07 -0.06 -0.07 -0.11 -0.01  0.09 -0.03
## C4         0.20 -0.08 -0.11 -0.23  0.22  0.16  0.21  0.26  0.19 -0.09  0.21
## C5         0.26 -0.16 -0.20 -0.23  0.21  0.25  0.24  0.34  0.17 -0.08  0.14
## E1         0.46 -0.32 -0.42 -0.30  0.02  0.01  0.05  0.23  0.05 -0.10  0.04
```

```
## E2         1.00 -0.38 -0.51 -0.37  0.17  0.19  0.20  0.34  0.25 -0.16  0.08
## E3        -0.38  1.00  0.42  0.38 -0.05 -0.07 -0.02 -0.14 -0.07  0.32 -0.07
## E4        -0.51  0.42  1.00  0.31 -0.13 -0.14 -0.10 -0.29 -0.09  0.14  0.06
## E5        -0.37  0.38  0.31  1.00  0.04  0.04 -0.06 -0.21 -0.13  0.30 -0.08
## N1         0.17 -0.05 -0.13  0.04  1.00  0.70  0.55  0.40  0.38 -0.05  0.13
## N2         0.19 -0.07 -0.14  0.04  0.70  1.00  0.55  0.39  0.35 -0.05  0.13
## N3         0.20 -0.02 -0.10 -0.06  0.55  0.55  1.00  0.52  0.43 -0.03  0.11
## N4         0.34 -0.14 -0.29 -0.21  0.40  0.39  0.52  1.00  0.39 -0.05  0.08
## N5         0.25 -0.07 -0.09 -0.13  0.38  0.35  0.43  0.39  1.00 -0.12  0.20
## O1        -0.16  0.32  0.14  0.30 -0.05 -0.05 -0.03 -0.05 -0.12  1.00 -0.21
## O2         0.08 -0.07  0.06 -0.08  0.13  0.13  0.11  0.08  0.20 -0.21  1.00
## O3        -0.23  0.39  0.21  0.29 -0.05 -0.03 -0.03 -0.06 -0.07  0.39 -0.26
## O4         0.17  0.05 -0.10  0.00  0.08  0.13  0.18  0.21  0.11  0.18 -0.07
## O5         0.08 -0.11  0.05 -0.11  0.11  0.04  0.06  0.04  0.13 -0.24  0.32
## gender    -0.05  0.04  0.08  0.07  0.04  0.10  0.12  0.00  0.21 -0.10  0.03
## education -0.01  0.00 -0.04  0.05 -0.04 -0.04 -0.05  0.01 -0.05  0.03 -0.08
## age       -0.10  0.00 -0.01  0.11 -0.09 -0.10 -0.11 -0.03 -0.10  0.05 -0.04
##                O3    O4    O5 gender education   age
## A1        -0.06 -0.08  0.11  -0.16     -0.13 -0.16
## A2         0.16  0.09 -0.09   0.18      0.01  0.11
## A3         0.22  0.04 -0.05   0.14      0.00  0.07
## A4         0.07 -0.04  0.02   0.13     -0.01  0.14
## A5         0.24  0.02 -0.05   0.10      0.01  0.13
## C1         0.19  0.11 -0.12   0.01      0.02  0.08
## C2         0.19  0.06 -0.05   0.07      0.00  0.02
## C3         0.06  0.02 -0.01   0.05      0.05  0.07
## C4        -0.08  0.05  0.20  -0.08     -0.03 -0.15
## C5        -0.08  0.14  0.06  -0.09      0.03 -0.09
## E1        -0.22  0.08  0.10  -0.13      0.00 -0.03
## E2        -0.23  0.17  0.08  -0.05     -0.01 -0.10
## E3         0.39  0.05 -0.11   0.04      0.00  0.00
## E4         0.21 -0.10  0.05   0.08     -0.04 -0.01
## E5         0.29  0.00 -0.11   0.07      0.05  0.11
## N1        -0.05  0.08  0.11   0.04     -0.04 -0.09
## N2        -0.03  0.13  0.04   0.10     -0.04 -0.10
## N3        -0.03  0.18  0.06   0.12     -0.05 -0.11
## N4        -0.06  0.21  0.04   0.00      0.01 -0.03
## N5        -0.07  0.11  0.13   0.21     -0.05 -0.10
## O1         0.39  0.18 -0.24  -0.10      0.03  0.05
## O2        -0.26 -0.07  0.32   0.03     -0.08 -0.04
## O3         1.00  0.19 -0.31  -0.04      0.09  0.04
## O4         0.19  1.00 -0.18   0.00      0.05  0.01
## O5        -0.31 -0.18  1.00   0.02     -0.05 -0.10
## gender    -0.04  0.00  0.02   1.00      0.01  0.05
## education  0.09  0.05 -0.05   0.01      1.00  0.23
## age        0.04  0.01 -0.10   0.05      0.23  1.00
```

```r
#
# PASSO 6 - Apresentar a matriz de correlação
#
corrplot::corrplot(tablecor, method = "circle")
```




```
#
# PASSO 7 - Realizar o teste de esfericidade (Bartlett)
#
cortest.bartlett(data)
```

```
## R was not square, finding R from data
```

```
## $chisq
## [1] 20886.2
##
## $p.value
## [1] 0
##
## $df
## [1] 378
```

```
#
# O teste indica que não é uma Matriz de Identidade, pois não atende: (p>0,05)
#


#
# PASSO 8 - Realizar o teste KMO
#
KMO(data)
```

```
## Kaiser-Meyer-Olkin factor adequacy
## Call: KMO(r = data)
## Overall MSA =  0.84
```

```
## MSA for each item =
##        A1        A2        A3        A4        A5        C1        C2        C3
##      0.76      0.85      0.87      0.86      0.90      0.83      0.78      0.84
##        C4        C5        E1        E2        E3        E4        E5        N1
##      0.83      0.86      0.84      0.88      0.89      0.87      0.89      0.78
##        N2        N3        N4        N5        O1        O2        O3        O4
##      0.78      0.86      0.88      0.85      0.85      0.77      0.84      0.77
##        O5    gender education       age
##      0.76      0.71      0.59      0.67
```

```
#
# Quando MSA maior que 0,5 na análise KMO, então indica que a análise
# fatorial é adequada para o conjunto de dados
#

#
# PASSO 9 - Realizar a análise de componentes principais
#
fit <- princomp(data, cor = TRUE)
fit
```

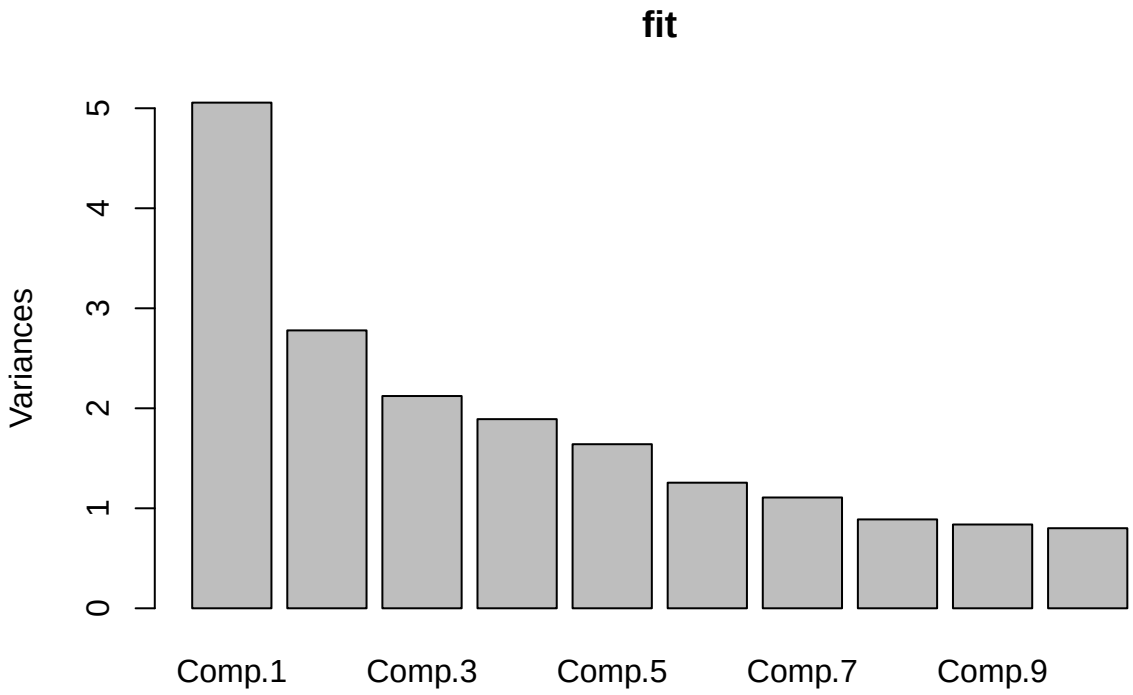
```
## Call:
## princomp(x = data, cor = TRUE)
##
## Standard deviations:
##    Comp.1    Comp.2    Comp.3    Comp.4    Comp.5    Comp.6    Comp.7    Comp.8
## 2.2486256 1.6669375 1.4568856 1.3752625 1.2808576 1.1206502 1.0525531 0.9426700
##    Comp.9   Comp.10   Comp.11   Comp.12   Comp.13   Comp.14   Comp.15   Comp.16
## 0.9152718 0.8948278 0.8698727 0.8391293 0.8283451 0.8196937 0.8074144 0.7933696
##   Comp.17   Comp.18   Comp.19   Comp.20   Comp.21   Comp.22   Comp.23   Comp.24
## 0.7605745 0.7415045 0.7314891 0.7234228 0.7079037 0.6955327 0.6688457 0.6568648
##   Comp.25   Comp.26   Comp.27   Comp.28
## 0.6418048 0.6295751 0.6202402 0.5254656
##
##  28  variables and  2800 observations.
```

```
#
# Com o summary de fit, temos um entendimento maior da análise
#
summary(fit)
```

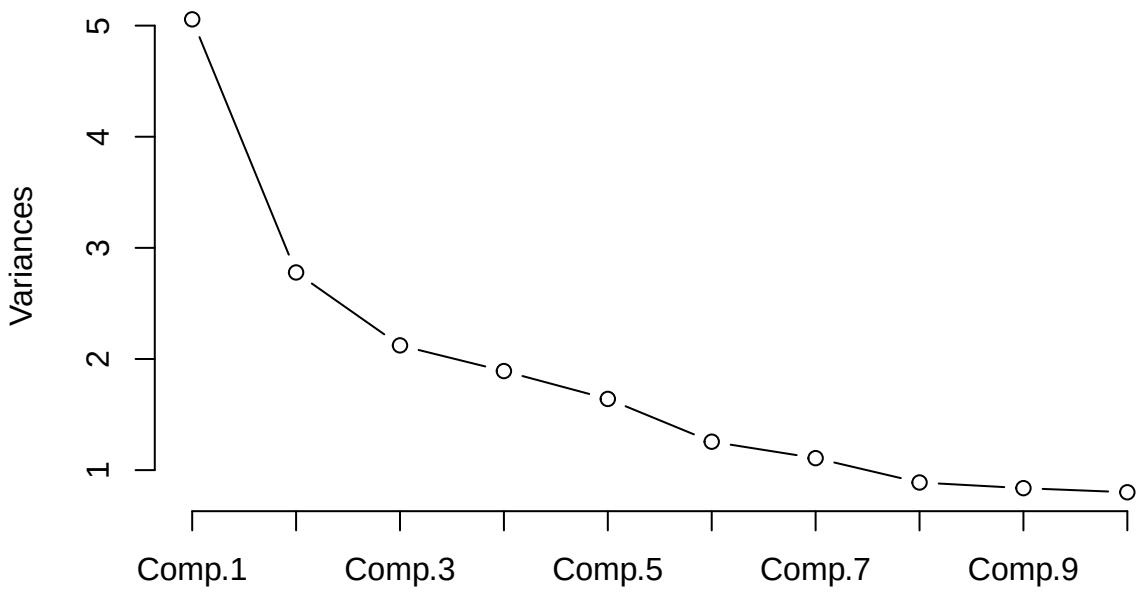
```
## Importance of components:
##                           Comp.1    Comp.2     Comp.3     Comp.4     Comp.5
## Standard deviation     2.2486256 1.6669375 1.45688565 1.37526252 1.28085761
## Proportion of Variance 0.1805828 0.0992386 0.07580414 0.06754811 0.05859272
## Cumulative Proportion  0.1805828 0.2798214 0.35562549 0.42317359 0.48176632
##                           Comp.6     Comp.7     Comp.8     Comp.9    Comp.10
## Standard deviation     1.12065024 1.05255314 0.94267003 0.91527179 0.89482782
## Proportion of Variance 0.04485203 0.03956672 0.03173667 0.02991866 0.02859703
## Cumulative Proportion  0.52661835 0.56618507 0.59792174 0.62784040 0.65643743
##                           Comp.11    Comp.12    Comp.13    Comp.14    Comp.15
## Standard deviation     0.86987267 0.83912935 0.82834510 0.81969370 0.80741440
## Proportion of Variance 0.02702423 0.02514779 0.02450556 0.02399635 0.02328279
## Cumulative Proportion  0.68346166 0.70860945 0.73311500 0.75711135 0.78039414
##                           Comp.16    Comp.17    Comp.18    Comp.19    Comp.20
## Standard deviation     0.79336961 0.76057447 0.74150445 0.73148913 0.72342282
```

```
## Proportion of Variance 0.02247983 0.02065977 0.01963674 0.01910987 0.01869073
## Cumulative Proportion  0.80287397 0.82353374 0.84317049 0.86228036 0.88097109
##                           Comp.21    Comp.22    Comp.23    Comp.24    Comp.25
## Standard deviation     0.70790372 0.69553266 0.66884569 0.65686475 0.64180482
## Proportion of Variance 0.01789742 0.01727735 0.01597695 0.01540969 0.01471119
## Cumulative Proportion  0.89886851 0.91614585 0.93212280 0.94753249 0.96224368
##                           Comp.26    Comp.27     Comp.28
## Standard deviation     0.62957506 0.62024022 0.525465642
## Proportion of Variance 0.01415588 0.01373921 0.009861219
## Cumulative Proportion  0.97639957 0.99013878 1.000000000
```

```r
#
# Apresentando o resultado através de gráfico de barras
# É possível verificar que 7 fatores possuem variância maior que 1
# e devem ser considerados
#
screeplot(fit)
```




```r
#
# Apresentando o resultado através de gráfico de linhas
#
plot(fit, type = "lines")
```




```
#
# Rodando a Análise de Componentes Principais (sem rotacionar)
#
pcdata <- principal(data, nfactors = 7, n.obs = 2800, rotate = "none", scores = TRUE)
pcdata
```

```
## Principal Components Analysis
## Call: principal(r = data, nfactors = 7, rotate = "none", n.obs = 2800,
##     scores = TRUE)
## Standardized loadings (pattern matrix) based upon correlation matrix
##             PC1   PC2   PC3   PC4   PC5   PC6   PC7   h2   u2 com
## A1        -0.26 -0.03  0.12  0.00 -0.66  0.15  0.18 0.57 0.43 1.7
## A2         0.49  0.33 -0.17  0.11  0.38  0.08 -0.07 0.56 0.44 3.3
## A3         0.55  0.33 -0.26  0.05  0.25  0.21 -0.03 0.59 0.41 3.0
## A4         0.44  0.15 -0.17  0.31  0.19  0.17  0.05 0.41 0.59 3.4
## A5         0.61  0.21 -0.28 -0.01  0.14  0.22  0.09 0.57 0.43 2.2
## C1         0.35  0.12  0.51  0.23 -0.14  0.09  0.09 0.49 0.51 2.8
## C2         0.35  0.21  0.47  0.40 -0.12  0.17  0.04 0.60 0.40 3.8
## C3         0.34  0.07  0.36  0.45 -0.04  0.05  0.11 0.47 0.53 3.1
## C4        -0.49  0.14 -0.42 -0.33  0.01  0.23  0.17 0.63 0.37 3.8
## C5        -0.52  0.18 -0.22 -0.39  0.15  0.09  0.14 0.55 0.45 3.0
## E1        -0.44 -0.21  0.32  0.21  0.21  0.38  0.14 0.59 0.41 4.7
## E2        -0.63 -0.03  0.28  0.13  0.26  0.28 -0.02 0.64 0.36 2.3
## E3         0.56  0.34 -0.12 -0.26 -0.18  0.14  0.05 0.56 0.44 2.7
## E4         0.60  0.20 -0.39  0.01 -0.25  0.06  0.05 0.62 0.38 2.4
## E5         0.55  0.30  0.10 -0.05 -0.25 -0.21  0.18 0.54 0.46 2.7
## N1        -0.43  0.64  0.04  0.05 -0.22 -0.24  0.07 0.71 0.29 2.4
## N2        -0.42  0.65  0.09  0.03 -0.17 -0.26  0.00 0.70 0.30 2.3
## N3        -0.41  0.68  0.06  0.04 -0.04 -0.07 -0.04 0.64 0.36 1.7
## N4        -0.54  0.46  0.15 -0.04  0.20  0.08  0.07 0.57 0.43 2.5
## N5        -0.36  0.53 -0.05  0.25  0.11  0.05 -0.12 0.51 0.49 2.5
## O1         0.36  0.20  0.32 -0.42 -0.10  0.22  0.11 0.52 0.48 4.3
```

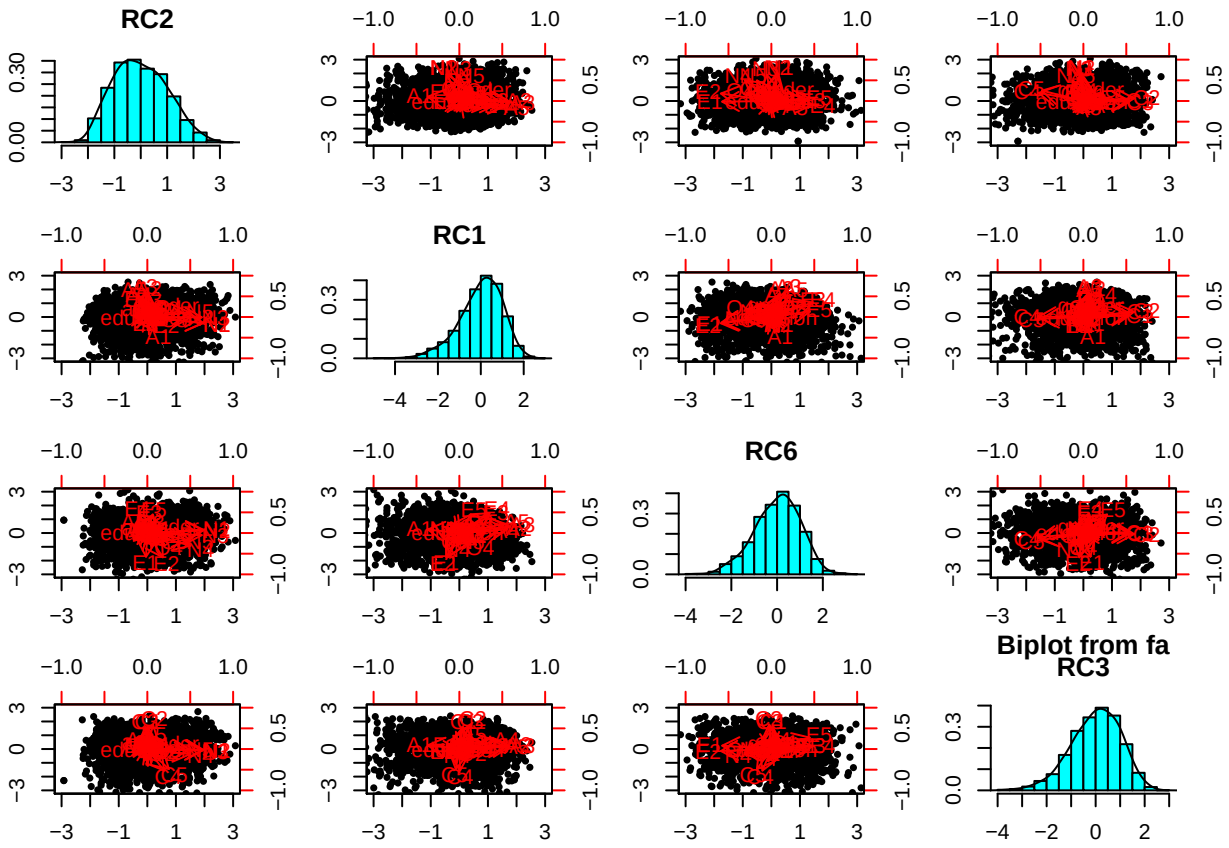
```
## O2        -0.22  0.14 -0.42  0.37 -0.08  0.20  0.32 0.53 0.47 4.3
## O3         0.43  0.28  0.26 -0.47 -0.03  0.10 -0.01 0.56 0.44 3.4
## O4        -0.06  0.31  0.33 -0.26  0.32  0.30 -0.02 0.48 0.52 4.9
## O5        -0.24 -0.02 -0.41  0.43 -0.19  0.16  0.31 0.56 0.44 4.2
## gender     0.10  0.26 -0.14  0.31  0.24 -0.34 -0.37 0.51 0.49 5.1
## education  0.07 -0.04  0.14 -0.13  0.34 -0.35  0.56 0.59 0.41 2.8
## age        0.21 -0.06  0.10  0.03  0.40 -0.36  0.49 0.59 0.41 3.4
##
##                        PC1  PC2  PC3  PC4  PC5  PC6  PC7
## SS loadings           5.06 2.78 2.12 1.89 1.64 1.26 1.11
## Proportion Var        0.18 0.10 0.08 0.07 0.06 0.04 0.04
## Cumulative Var        0.18 0.28 0.36 0.42 0.48 0.53 0.57
## Proportion Explained  0.32 0.18 0.13 0.12 0.10 0.08 0.07
## Cumulative Proportion 0.32 0.49 0.63 0.75 0.85 0.93 1.00
##
## Mean item complexity =  3.2
## Test of the hypothesis that 7 components are sufficient.
##
## The root mean square of the residuals (RMSR) is  0.05
##  with the empirical chi square  6091.66  with prob <  0
##
## Fit based upon off diagonal values = 0.92
```

```
#
# Rodando a Análise de Componentes Principais (com rotação varimax)
# Agora é possível verificar a relação de variáveis em relação aos fatores
#
pcdatavarimax <- principal(data, nfactors = 7, n.obs = 2800, rotate = "varimax", scores = TRUE)
pcdatavarimax
```

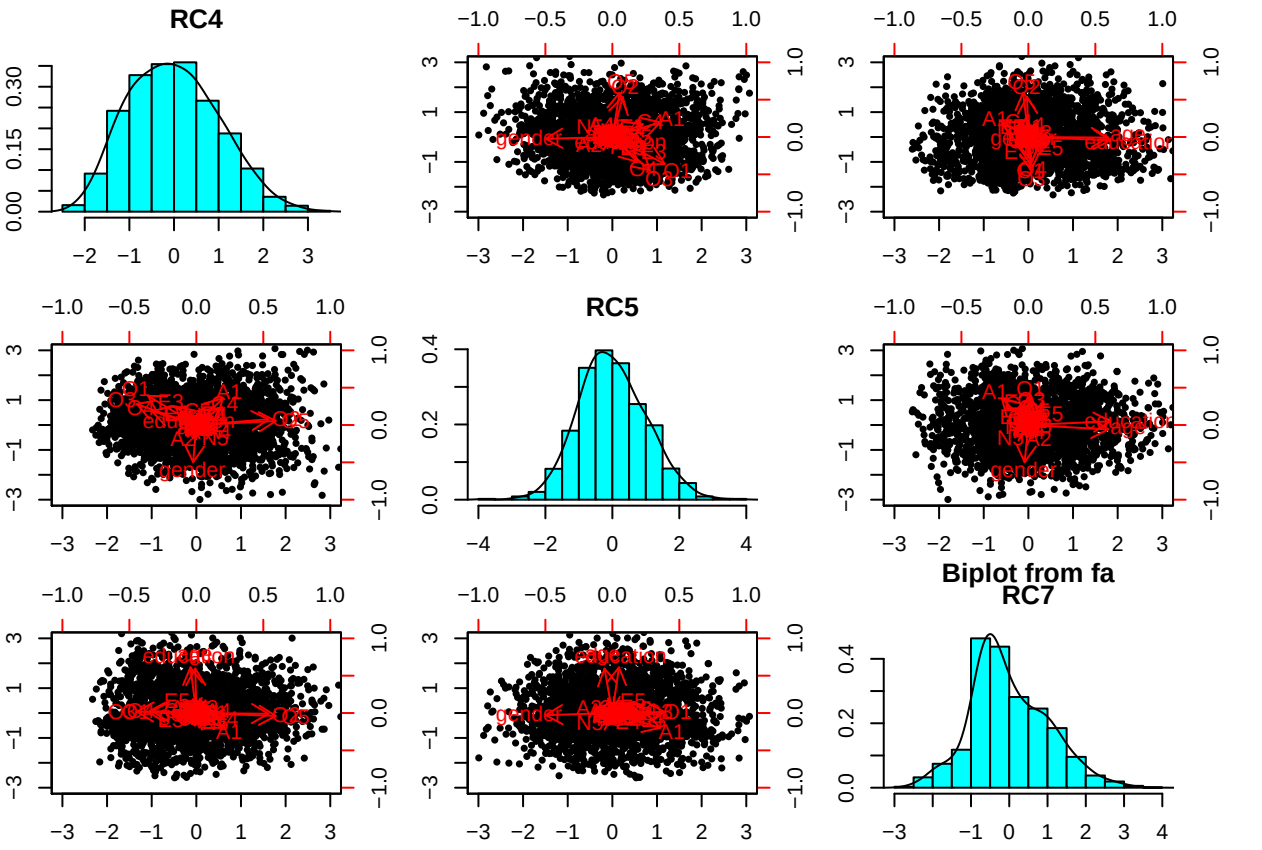
```
## Principal Components Analysis
## Call: principal(r = data, nfactors = 7, rotate = "varimax", n.obs = 2800,
##     scores = TRUE)
## Standardized loadings (pattern matrix) based upon correlation matrix
##              RC2   RC1   RC6   RC3   RC4   RC5   RC7   h2   u2 com
## A1         0.13 -0.46  0.11  0.12  0.25  0.45 -0.25 0.57 0.43 3.6
## A2         0.02  0.70  0.11  0.11 -0.10 -0.17  0.08 0.56 0.44 1.3
## A3        -0.03  0.74  0.20  0.08 -0.04 -0.01 -0.02 0.59 0.41 1.2
## A4        -0.10  0.55  0.08  0.24  0.17 -0.08  0.03 0.41 0.59 1.8
## A5        -0.15  0.67  0.28  0.07  0.00  0.11  0.03 0.57 0.43 1.6
## C1         0.01  0.05  0.03  0.66 -0.14  0.17  0.04 0.49 0.51 1.2
## C2         0.08  0.16 -0.03  0.74 -0.04  0.11 -0.05 0.60 0.40 1.2
## C3        -0.02  0.13 -0.02  0.67  0.06  0.00  0.08 0.47 0.53 1.1
## C4         0.24  0.01 -0.13 -0.65  0.21  0.28 -0.07 0.63 0.37 2.1
## C5         0.31 -0.05 -0.21 -0.60  0.01  0.20  0.06 0.55 0.45 2.1
## E1        -0.02 -0.15 -0.72  0.10  0.14  0.15  0.01 0.59 0.41 1.3
## E2         0.23 -0.19 -0.73 -0.06  0.05  0.02 -0.06 0.64 0.36 1.4
## E3         0.02  0.43  0.49  0.07 -0.19  0.31 -0.08 0.56 0.44 3.2
## E4        -0.12  0.44  0.60  0.08  0.14  0.12 -0.11 0.62 0.38 2.3
## E5         0.08  0.17  0.56  0.35 -0.14  0.16  0.17 0.54 0.46 2.5
## N1         0.81 -0.19  0.10 -0.03  0.10  0.01  0.01 0.71 0.29 1.2
## N2         0.81 -0.18  0.08 -0.02  0.01 -0.04  0.00 0.70 0.30 1.1
## N3         0.79 -0.01 -0.06 -0.05  0.00 -0.02 -0.07 0.64 0.36 1.0
## N4         0.62 -0.02 -0.39 -0.16 -0.04  0.08  0.05 0.57 0.43 1.9
## N5         0.62  0.14 -0.21 -0.02  0.14 -0.17 -0.13 0.51 0.49 1.7
```

```
## O1          0.00  0.17  0.16  0.15 -0.45  0.49  0.02 0.52 0.48 2.7
## O2          0.18  0.16 -0.06 -0.10  0.67  0.10 -0.01 0.53 0.47 1.4
## O3          0.04  0.24  0.25  0.09 -0.56  0.35  0.02 0.56 0.44 2.7
## O4          0.25  0.25 -0.36  0.00 -0.41  0.23  0.03 0.48 0.52 4.1
## O5          0.07  0.01 -0.03 -0.04  0.74  0.07 -0.05 0.56 0.44 1.1
## gender      0.22  0.22  0.11  0.09 -0.03 -0.62 -0.04 0.51 0.49 1.7
## education -0.01 -0.02  0.00 -0.01 -0.06  0.06  0.76 0.59 0.41 1.0
## age       -0.09  0.10  0.02  0.09 -0.01 -0.07  0.75 0.59 0.41 1.1
##
##                        RC2  RC1  RC6  RC3  RC4  RC5  RC7
## SS loadings           3.16 2.81 2.62 2.54 1.99 1.42 1.31
## Proportion Var        0.11 0.10 0.09 0.09 0.07 0.05 0.05
## Cumulative Var        0.11 0.21 0.31 0.40 0.47 0.52 0.57
## Proportion Explained  0.20 0.18 0.17 0.16 0.13 0.09 0.08
## Cumulative Proportion 0.20 0.38 0.54 0.70 0.83 0.92 1.00
##
## Mean item complexity =  1.8
## Test of the hypothesis that 7 components are sufficient.
##
## The root mean square of the residuals (RMSR) is  0.05
##  with the empirical chi square  6091.66  with prob <  0
##
## Fit based upon off diagonal values = 0.92
```

```
#
# PASSO 10 - Interpretação dos fatores e análise dos componentes
#
biplot(pcdatavarimax, choose=c(1,2,3,4))
```

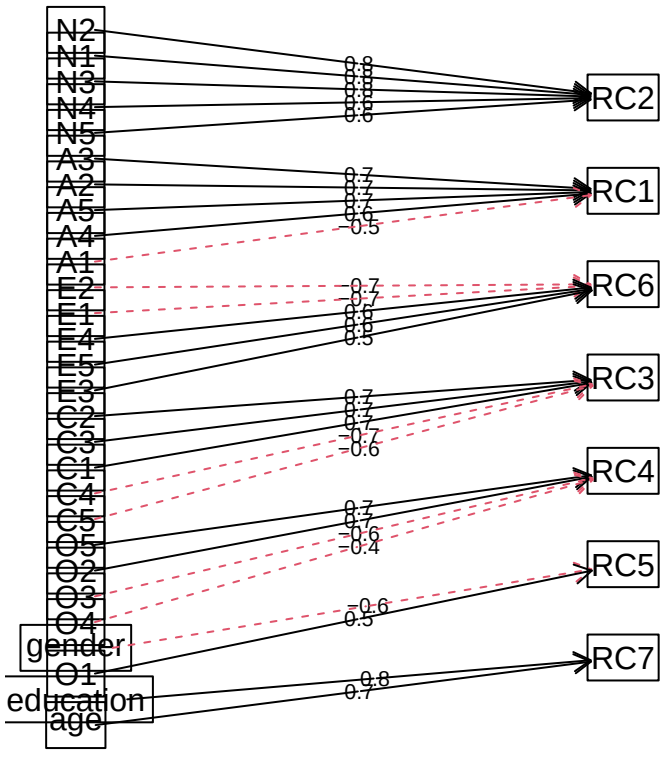



```
biplot(pcdatavarimax, choose=c(5,6,7))
```




```
fa.diagram(pcdatavarimax)
```

Components Analysis



```
#
# Relações identificadas (Fator x Variáveis)
# RC2 - N2, N1, N3, N4, N5
# RC1 - A3, A2, A5, A4, A1
# RC6 - E2, E1, E4, E5, E3
# RC3 - C2, C3, C1, C4, C5
# RC4 - O5, O2, O3, O4
# RC5 - gender, O1
# RC7 - education, age
#
```