PROYECTO ANALISIS MULTIVARIADO

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## PROYECTO DE ANÁLISIS MULTIVARIADO

Los resultados del test que se consignan en la data en Excel que se adjunta, se propone observar el Constructo “Perfil Sicológico del joven adulto” aplicado a **600 jóvenes de la ciudad de Guayaquil**.

Cargamos las librerias para el proyecto

#LIBRERIAS  
library(readxl)  
library(GPArotation)  
library(Matrix)  
library(nFactors)  
library(paran)  
library(descr)  
library(foreign)  
library(psych)  
library(haven)  
library(MVN)  
library(openxlsx)  
library(readxl)  
library(tidyverse)

# Cargar la base de Datos

getwd()

## [1] "C:/Users/santamarias/Desktop/CLASES PERU/2020 MULTIVARIADO/DEBER"

setwd("C:/Users/santamarias/Desktop/CLASES PERU/2020 MULTIVARIADO/DEBER")  
base <- read\_excel("C:/Users/santamarias/Desktop/CLASES PERU/2020 MULTIVARIADO/DEBER/DATA ANALISIS FACTORIAL.xlsx")  
dim(base)

## [1] 600 28

str(base)

## tibble [600 x 28] (S3: tbl\_df/tbl/data.frame)  
## $ Sujeto : num [1:600] 1 2 3 4 5 6 7 8 9 10 ...  
## $ HUMAN1 : num [1:600] 3 3 3 3 3 4 5 3 3 1 ...  
## $ COGNITIVO1: num [1:600] 4 2 3 4 3 3 5 5 3 3 ...  
## $ MATERIA1 : num [1:600] 2 3 3 3 3 2 1 3 3 2 ...  
## $ MATERIA2 : num [1:600] 2 2 4 3 3 2 1 1 2 1 ...  
## $ HUMAN2 : num [1:600] 2 3 2 3 3 2 1 3 2 2 ...  
## $ HUMAN3 : num [1:600] 4 3 4 4 4 3 5 3 5 5 ...  
## $ COGNITIVO2: num [1:600] 2 3 2 4 3 2 1 3 2 3 ...  
## $ MATERIA3 : num [1:600] 2 2 1 3 3 1 5 5 3 1 ...  
## $ HUMAN4 : num [1:600] 4 3 4 4 3 2 5 3 4 5 ...  
## $ COGNITIVO3: num [1:600] 3 2 3 4 3 2 1 3 4 1 ...  
## $ MATERIA4 : num [1:600] 2 3 3 3 3 2 5 3 4 4 ...  
## $ HUMAN5 : num [1:600] 2 3 2 4 2 3 1 3 2 4 ...  
## $ COGNITIVO4: num [1:600] 3 2 3 4 3 4 5 4 3 3 ...  
## $ MATERIA5 : num [1:600] 2 3 3 3 3 1 1 1 3 3 ...  
## $ HUMAN6 : num [1:600] 2 3 1 4 1 2 1 3 2 1 ...  
## $ MATERIA6 : num [1:600] 2 3 2 3 3 1 1 2 3 2 ...  
## $ HUMAN7 : num [1:600] 3 3 3 4 2 4 1 3 2 2 ...  
## $ COGNITIVO5: num [1:600] 3 3 4 4 3 1 5 3 2 2 ...  
## $ HUMAN8 : num [1:600] 3 3 3 3 2 4 1 3 3 1 ...  
## $ MATERIA8 : num [1:600] 1 5 1 3 3 1 5 4 3 1 ...  
## $ HUMAN9 : num [1:600] 3 3 3 3 4 2 1 3 4 5 ...  
## $ COGNITIVO6: num [1:600] 3 4 4 4 3 5 5 2 4 5 ...  
## $ MATERIA9 : num [1:600] 3 2 2 3 3 2 1 5 4 5 ...  
## $ COGEMOC1 : num [1:600] 3 3 3 4 3 2 5 4 2 2 ...  
## $ MATERIA7 : num [1:600] 3 1 1 3 3 1 5 1 2 1 ...  
## $ COGEMOC3 : num [1:600] 2 3 4 1 2 4 5 2 2 3 ...  
## $ COGEMOC2 : num [1:600] 3 3 4 4 3 3 5 2 3 3 ...

## Generar los 10 valores para tener la data con 610 registros y 27 variables

n <- 10  
muestramia<- sample(1:nrow(base),size=n,replace=FALSE)  
muestramia

## [1] 32 440 202 56 569 422 67 273 130 99

#Asignar los elementos de la muestra al data frame de datos  
muestramia<- base[muestramia, ]  
dim(muestramia)

## [1] 10 28

base <- rbind(base,muestramia)  
#PARA EL ANALISIS SOLO LAS 27 VARIABLES  
base <- base[2:28]  
dim(base)

## [1] 610 27

# GUARDAR LA DATA  
write.xlsx(base, file = "DATOS0K2.xlsx", sheetName="Sheet1", col.names=TRUE, row.names=FALSE , append=FALSE)

# Abrir el nuevo archivo para el analisis

base <- read\_excel("DATOS0K.xlsx")  
head(base , 5)

## # A tibble: 5 x 27  
## HUMAN1 COGNITIVO1 MATERIA1 MATERIA2 HUMAN2 HUMAN3 COGNITIVO2 MATERIA3 HUMAN4  
## <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 3 4 2 2 2 4 2 2 4  
## 2 3 2 3 2 3 3 3 2 3  
## 3 3 3 3 4 2 4 2 1 4  
## 4 3 4 3 3 3 4 4 3 4  
## 5 3 3 3 3 3 4 3 3 3  
## # ... with 18 more variables: COGNITIVO3 <dbl>, MATERIA4 <dbl>, HUMAN5 <dbl>,  
## # COGNITIVO4 <dbl>, MATERIA5 <dbl>, HUMAN6 <dbl>, MATERIA6 <dbl>,  
## # HUMAN7 <dbl>, COGNITIVO5 <dbl>, HUMAN8 <dbl>, MATERIA8 <dbl>, HUMAN9 <dbl>,  
## # COGNITIVO6 <dbl>, MATERIA9 <dbl>, COGEMOC1 <dbl>, MATERIA7 <dbl>,  
## # COGEMOC3 <dbl>, COGEMOC2 <dbl>

# TEMA Nro. 1

## 1° Determine con la matriz de correlaciones policóricas, la prueba de esfericidad de Bartlet y la prueba KMO si procede un análisis factorial. Expliqué porqué procede o no de acuerdo a cada uno de estos 3 criterios.

a.- Matriz de correlaciones policóricas

library(psych)  
r.poly=polychoric(base)  
#r.poly  
R=round(r.poly$rho,2) # La matriz de correlaciones polycórica  
R

## HUMAN1 COGNITIVO1 MATERIA1 MATERIA2 HUMAN2 HUMAN3 COGNITIVO2  
## HUMAN1 1.00 0.17 0.32 0.20 0.45 0.26 0.10  
## COGNITIVO1 0.17 1.00 -0.02 -0.08 0.03 0.19 0.43  
## MATERIA1 0.32 -0.02 1.00 0.41 0.65 0.17 0.23  
## MATERIA2 0.20 -0.08 0.41 1.00 0.32 -0.02 0.07  
## HUMAN2 0.45 0.03 0.65 0.32 1.00 0.25 0.20  
## HUMAN3 0.26 0.19 0.17 -0.02 0.25 1.00 0.16  
## COGNITIVO2 0.10 0.43 0.23 0.07 0.20 0.16 1.00  
## MATERIA3 0.31 0.00 0.64 0.36 0.51 0.20 0.22  
## HUMAN4 0.36 0.07 0.15 -0.01 0.28 0.39 0.06  
## COGNITIVO3 0.06 0.43 0.13 0.05 0.09 0.18 0.58  
## MATERIA4 0.34 0.03 0.59 0.34 0.46 0.23 0.28  
## HUMAN5 0.31 0.07 0.30 0.11 0.48 0.32 0.16  
## COGNITIVO4 0.10 0.53 0.14 0.00 0.12 0.22 0.43  
## MATERIA5 0.22 0.03 0.60 0.41 0.39 0.07 0.15  
## HUMAN6 0.25 0.06 0.36 0.17 0.53 0.25 0.13  
## MATERIA6 0.27 0.06 0.59 0.42 0.45 0.18 0.25  
## HUMAN7 0.31 0.06 0.30 0.14 0.52 0.29 0.12  
## COGNITIVO5 0.08 0.47 0.14 0.06 0.12 0.09 0.40  
## HUMAN8 0.28 0.04 0.23 0.06 0.42 0.27 0.04  
## MATERIA8 0.23 0.00 0.55 0.41 0.46 0.09 0.15  
## HUMAN9 0.26 0.08 0.27 0.20 0.37 0.27 0.13  
## COGNITIVO6 0.02 0.52 -0.06 -0.14 -0.10 0.12 0.29  
## MATERIA9 0.28 0.11 0.45 0.23 0.39 0.21 0.19  
## COGEMOC1 0.03 0.37 0.03 0.17 0.00 -0.05 0.34  
## MATERIA7 0.16 -0.15 0.45 0.46 0.35 -0.02 0.15  
## COGEMOC3 -0.13 0.11 -0.12 0.03 -0.19 -0.10 0.10  
## COGEMOC2 -0.02 0.24 -0.07 0.19 -0.02 -0.06 0.19  
## MATERIA3 HUMAN4 COGNITIVO3 MATERIA4 HUMAN5 COGNITIVO4 MATERIA5  
## HUMAN1 0.31 0.36 0.06 0.34 0.31 0.10 0.22  
## COGNITIVO1 0.00 0.07 0.43 0.03 0.07 0.53 0.03  
## MATERIA1 0.64 0.15 0.13 0.59 0.30 0.14 0.60  
## MATERIA2 0.36 -0.01 0.05 0.34 0.11 0.00 0.41  
## HUMAN2 0.51 0.28 0.09 0.46 0.48 0.12 0.39  
## HUMAN3 0.20 0.39 0.18 0.23 0.32 0.22 0.07  
## COGNITIVO2 0.22 0.06 0.58 0.28 0.16 0.43 0.15  
## MATERIA3 1.00 0.18 0.11 0.49 0.36 0.17 0.51  
## HUMAN4 0.18 1.00 0.06 0.10 0.42 0.09 0.08  
## COGNITIVO3 0.11 0.06 1.00 0.24 0.11 0.45 0.09  
## MATERIA4 0.49 0.10 0.24 1.00 0.28 0.14 0.45  
## HUMAN5 0.36 0.42 0.11 0.28 1.00 0.20 0.23  
## COGNITIVO4 0.17 0.09 0.45 0.14 0.20 1.00 0.18  
## MATERIA5 0.51 0.08 0.09 0.45 0.23 0.18 1.00  
## HUMAN6 0.50 0.27 0.07 0.20 0.61 0.18 0.43  
## MATERIA6 0.61 0.15 0.18 0.54 0.34 0.18 0.62  
## HUMAN7 0.24 0.32 0.09 0.19 0.50 0.18 0.28  
## COGNITIVO5 0.17 0.02 0.44 0.23 0.07 0.45 0.12  
## HUMAN8 0.21 0.31 0.07 0.13 0.37 0.12 0.12  
## MATERIA8 0.49 0.13 0.09 0.47 0.24 0.11 0.45  
## HUMAN9 0.21 0.34 0.10 0.14 0.47 0.15 0.29  
## COGNITIVO6 -0.04 0.02 0.37 0.03 0.02 0.52 0.01  
## MATERIA9 0.46 0.19 0.19 0.38 0.31 0.23 0.44  
## COGEMOC1 0.04 -0.09 0.27 0.06 -0.06 0.23 -0.03  
## MATERIA7 0.41 0.02 0.07 0.42 0.12 -0.01 0.34  
## COGEMOC3 -0.05 -0.11 0.06 -0.05 -0.08 0.09 0.04  
## COGEMOC2 -0.01 -0.02 0.25 -0.01 0.00 0.23 0.02  
## HUMAN6 MATERIA6 HUMAN7 COGNITIVO5 HUMAN8 MATERIA8 HUMAN9 COGNITIVO6  
## HUMAN1 0.25 0.27 0.31 0.08 0.28 0.23 0.26 0.02  
## COGNITIVO1 0.06 0.06 0.06 0.47 0.04 0.00 0.08 0.52  
## MATERIA1 0.36 0.59 0.30 0.14 0.23 0.55 0.27 -0.06  
## MATERIA2 0.17 0.42 0.14 0.06 0.06 0.41 0.20 -0.14  
## HUMAN2 0.53 0.45 0.52 0.12 0.42 0.46 0.37 -0.10  
## HUMAN3 0.25 0.18 0.29 0.09 0.27 0.09 0.27 0.12  
## COGNITIVO2 0.13 0.25 0.12 0.40 0.04 0.15 0.13 0.29  
## MATERIA3 0.50 0.61 0.24 0.17 0.21 0.49 0.21 -0.04  
## HUMAN4 0.27 0.15 0.32 0.02 0.31 0.13 0.34 0.02  
## COGNITIVO3 0.07 0.18 0.09 0.44 0.07 0.09 0.10 0.37  
## MATERIA4 0.20 0.54 0.19 0.23 0.13 0.47 0.14 0.03  
## HUMAN5 0.61 0.34 0.50 0.07 0.37 0.24 0.47 0.02  
## COGNITIVO4 0.18 0.18 0.18 0.45 0.12 0.11 0.15 0.52  
## MATERIA5 0.43 0.62 0.28 0.12 0.12 0.45 0.29 0.01  
## HUMAN6 1.00 0.42 0.56 0.10 0.37 0.29 0.40 -0.01  
## MATERIA6 0.42 1.00 0.33 0.23 0.18 0.52 0.28 0.02  
## HUMAN7 0.56 0.33 1.00 0.17 0.41 0.23 0.37 0.01  
## COGNITIVO5 0.10 0.23 0.17 1.00 0.07 0.20 0.10 0.27  
## HUMAN8 0.37 0.18 0.41 0.07 1.00 0.16 0.30 0.01  
## MATERIA8 0.29 0.52 0.23 0.20 0.16 1.00 0.31 -0.12  
## HUMAN9 0.40 0.28 0.37 0.10 0.30 0.31 1.00 -0.05  
## COGNITIVO6 -0.01 0.02 0.01 0.27 0.01 -0.12 -0.05 1.00  
## MATERIA9 0.27 0.54 0.24 0.12 0.20 0.39 0.21 0.20  
## COGEMOC1 -0.08 0.01 -0.09 0.36 -0.06 0.17 0.03 0.22  
## MATERIA7 0.09 0.43 0.05 0.12 0.07 0.51 0.13 -0.26  
## COGEMOC3 -0.04 0.01 -0.13 0.09 -0.23 -0.08 -0.06 0.08  
## COGEMOC2 -0.02 0.01 0.03 0.24 0.03 0.09 0.07 0.19  
## MATERIA9 COGEMOC1 MATERIA7 COGEMOC3 COGEMOC2  
## HUMAN1 0.28 0.03 0.16 -0.13 -0.02  
## COGNITIVO1 0.11 0.37 -0.15 0.11 0.24  
## MATERIA1 0.45 0.03 0.45 -0.12 -0.07  
## MATERIA2 0.23 0.17 0.46 0.03 0.19  
## HUMAN2 0.39 0.00 0.35 -0.19 -0.02  
## HUMAN3 0.21 -0.05 -0.02 -0.10 -0.06  
## COGNITIVO2 0.19 0.34 0.15 0.10 0.19  
## MATERIA3 0.46 0.04 0.41 -0.05 -0.01  
## HUMAN4 0.19 -0.09 0.02 -0.11 -0.02  
## COGNITIVO3 0.19 0.27 0.07 0.06 0.25  
## MATERIA4 0.38 0.06 0.42 -0.05 -0.01  
## HUMAN5 0.31 -0.06 0.12 -0.08 0.00  
## COGNITIVO4 0.23 0.23 -0.01 0.09 0.23  
## MATERIA5 0.44 -0.03 0.34 0.04 0.02  
## HUMAN6 0.27 -0.08 0.09 -0.04 -0.02  
## MATERIA6 0.54 0.01 0.43 0.01 0.01  
## HUMAN7 0.24 -0.09 0.05 -0.13 0.03  
## COGNITIVO5 0.12 0.36 0.12 0.09 0.24  
## HUMAN8 0.20 -0.06 0.07 -0.23 0.03  
## MATERIA8 0.39 0.17 0.51 -0.08 0.09  
## HUMAN9 0.21 0.03 0.13 -0.06 0.07  
## COGNITIVO6 0.20 0.22 -0.26 0.08 0.19  
## MATERIA9 1.00 0.06 0.22 -0.05 -0.12  
## COGEMOC1 0.06 1.00 0.17 0.18 0.33  
## MATERIA7 0.22 0.17 1.00 0.02 0.11  
## COGEMOC3 -0.05 0.18 0.02 1.00 0.08  
## COGEMOC2 -0.12 0.33 0.11 0.08 1.00

Hay correlaciones entre variables lo que implica que si se puede realizar el análisis de factores(Ver arhivo de excel )

b.- Esfericidad de Bartlet Se puede verificar que hay correlaciones Ho: La matriz de correlación es la identidad, H1: La matriz de correlaciones no es la identidad

n = nrow(base) # Tamaño de la muestra  
cortest.bartlett(R,n)

## $chisq  
## [1] 6933.608  
##   
## $p.value  
## [1] 0  
##   
## $df  
## [1] 351

El valor p es casi 0, por lo que se se rechaza la hipotesis Ho, es decir la matriz de corrleación no es la matriz de identidad, es decir sus correlciones no son 0.

c.- Kaiser-Meyer-Olkin (KMO)

KMO(R)

## Kaiser-Meyer-Olkin factor adequacy  
## Call: KMO(r = R)  
## Overall MSA = 0.87  
## MSA for each item =   
## HUMAN1 COGNITIVO1 MATERIA1 MATERIA2 HUMAN2 HUMAN3 COGNITIVO2   
## 0.88 0.82 0.90 0.90 0.90 0.86 0.86   
## MATERIA3 HUMAN4 COGNITIVO3 MATERIA4 HUMAN5 COGNITIVO4 MATERIA5   
## 0.90 0.85 0.85 0.88 0.87 0.87 0.87   
## HUMAN6 MATERIA6 HUMAN7 COGNITIVO5 HUMAN8 MATERIA8 HUMAN9   
## 0.82 0.93 0.88 0.85 0.92 0.93 0.89   
## COGNITIVO6 MATERIA9 COGEMOC1 MATERIA7 COGEMOC3 COGEMOC2   
## 0.78 0.87 0.76 0.88 0.76 0.70

El estadístico KMO nos informa sobre la idoneidad de una matriz de correlaciones para aplicar un análisis factorial, el índice KMO se utiliza para comparar las magnitudes de los coeficientes de correlación parcial, de forma que cuánto más cercano a 1 sea su valor, mayor será el valor de los coeficientes de correlación parciales.

El valor de KMO es 0.87 por lo que se considera aceptable para realizar un analisis de factores, tambien en los items son mayores a 0.70

## Realizamos un analisis exploratorio de las variables de estuido.

Con la función summary() podemos obtener los estadísticos descriptivos básicos para todas las variables (columnas) de nuestra matriz de datos.

summary(round(base),2)

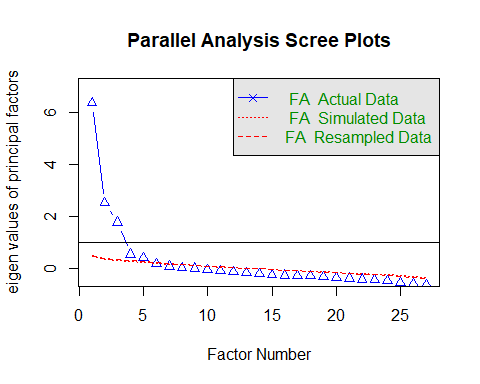
## HUMAN1 COGNITIVO1 MATERIA1 MATERIA2   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:2.000   
## Median :3.000 Median :3.000 Median :2.000 Median :3.000   
## Mean :3.118 Mean :3.282 Mean :2.515 Mean :2.641   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.000 3rd Qu.:3.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## HUMAN2 HUMAN3 COGNITIVO2 MATERIA3   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:2.000 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:2.000   
## Median :2.000 Median :4.000 Median :3.000 Median :3.000   
## Mean :2.548 Mean :3.528 Mean :2.789 Mean :2.587   
## 3rd Qu.:3.000 3rd Qu.:5.000 3rd Qu.:3.000 3rd Qu.:3.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## HUMAN4 COGNITIVO3 MATERIA4 HUMAN5   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:2.000 1st Qu.:2.000   
## Median :3.000 Median :3.000 Median :3.000 Median :3.000   
## Mean :3.364 Mean :2.913 Mean :2.644 Mean :2.966   
## 3rd Qu.:4.000 3rd Qu.:3.000 3rd Qu.:3.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## COGNITIVO4 MATERIA5 HUMAN6 MATERIA6 HUMAN7   
## Min. :1.000 Min. :1.000 Min. :1.0 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:2.0 1st Qu.:2.000 1st Qu.:2.000   
## Median :3.000 Median :3.000 Median :3.0 Median :3.000 Median :3.000   
## Mean :3.157 Mean :2.843 Mean :2.6 Mean :2.662 Mean :2.754   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.0 3rd Qu.:3.000 3rd Qu.:3.000   
## Max. :5.000 Max. :5.000 Max. :5.0 Max. :5.000 Max. :5.000   
## COGNITIVO5 HUMAN8 MATERIA8 HUMAN9   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:2.000 1st Qu.:2.000 1st Qu.:1.000 1st Qu.:3.000   
## Median :3.000 Median :3.000 Median :2.000 Median :3.000   
## Mean :2.702 Mean :2.992 Mean :2.393 Mean :3.367   
## 3rd Qu.:3.000 3rd Qu.:4.000 3rd Qu.:3.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## COGNITIVO6 MATERIA9 COGEMOC1 MATERIA7 COGEMOC3   
## Min. :1.000 Min. :1.0 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.0 1st Qu.:2.000 1st Qu.:1.000 1st Qu.:2.000   
## Median :4.000 Median :3.0 Median :3.000 Median :2.000 Median :2.000   
## Mean :3.611 Mean :3.2 Mean :2.872 Mean :2.141 Mean :2.539   
## 3rd Qu.:4.000 3rd Qu.:4.0 3rd Qu.:4.000 3rd Qu.:3.000 3rd Qu.:3.000   
## Max. :5.000 Max. :5.0 Max. :5.000 Max. :5.000 Max. :5.000   
## COGEMOC2   
## Min. :1.000   
## 1st Qu.:2.000   
## Median :3.000   
## Mean :3.008   
## 3rd Qu.:4.000   
## Max. :5.000

# TEMA Nro. 2

## 2° Con el Análisis Factorial confirme o no que el Test tiene 4 dimensiones o factores en el lugar de estudio.

Identificando el N° de factores

fap=fa.parallel(base,fa="fa",cor="poly")



## Parallel analysis suggests that the number of factors = 5 and the number of components = NA

fap

## Call: fa.parallel(x = base, fa = "fa", cor = "poly")  
## Parallel analysis suggests that the number of factors = 5 and the number of components = NA   
##   
## Eigen Values of   
##   
## eigen values of factors  
## [1] 6.35 2.52 1.78 0.56 0.43 0.19 0.09 0.03 0.02 -0.03 -0.07 -0.11  
## [13] -0.15 -0.20 -0.24 -0.25 -0.26 -0.26 -0.32 -0.34 -0.37 -0.40 -0.43 -0.46  
## [25] -0.53 -0.56 -0.62  
##   
## eigen values of simulated factors  
## [1] 0.46 0.36 0.33 0.28 0.25 0.22 0.18 0.15 0.13 0.10 0.07 0.05  
## [13] 0.02 0.00 -0.02 -0.05 -0.07 -0.09 -0.12 -0.14 -0.16 -0.18 -0.20 -0.23  
## [25] -0.25 -0.29 -0.33  
##   
## eigen values of components   
## [1] 6.98 3.43 2.54 1.36 1.17 0.99 0.91 0.79 0.74 0.69 0.68 0.63 0.62 0.56 0.53  
## [16] 0.50 0.49 0.46 0.41 0.40 0.38 0.37 0.35 0.29 0.26 0.25 0.19  
##   
## eigen values of simulated components  
## [1] NA

Un analisis de factor sugiere que son 3 factores, el modelo de estudio sugiere 4 factores, el modelo sugiere realizar un analisis con 5 factores tambien.

Corriendo el modelo con 3 Factores

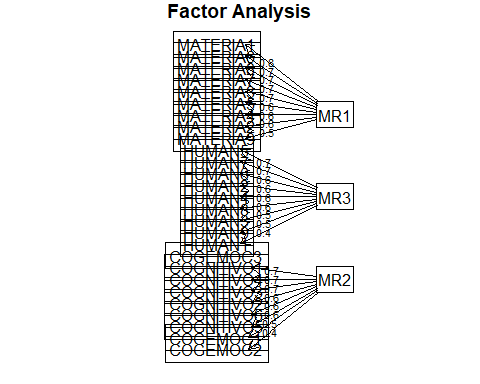
factorial3=fa.poly(base, nfactors=3, cor="poly",rotate="varimax")  
factorial3

## Factor Analysis using method = minres  
## Call: fa.poly(x = base, nfactors = 3, rotate = "varimax", cor = "poly")  
## Standardized loadings (pattern matrix) based upon correlation matrix  
## MR1 MR3 MR2 h2 u2 com  
## HUMAN1 0.26 0.43 0.06 0.258 0.74 1.7  
## COGNITIVO1 -0.12 0.13 0.75 0.591 0.41 1.1  
## MATERIA1 0.76 0.29 0.03 0.661 0.34 1.3  
## MATERIA2 0.60 -0.02 0.00 0.363 0.64 1.0  
## HUMAN2 0.54 0.57 -0.01 0.610 0.39 2.0  
## HUMAN3 0.02 0.50 0.15 0.270 0.73 1.2  
## COGNITIVO2 0.20 0.10 0.62 0.441 0.56 1.3  
## MATERIA3 0.67 0.31 0.06 0.551 0.45 1.4  
## HUMAN4 0.01 0.56 0.00 0.313 0.69 1.0  
## COGNITIVO3 0.10 0.09 0.66 0.450 0.55 1.1  
## MATERIA4 0.64 0.18 0.15 0.463 0.54 1.3  
## HUMAN5 0.20 0.70 0.04 0.528 0.47 1.2  
## COGNITIVO4 0.05 0.23 0.68 0.519 0.48 1.2  
## MATERIA5 0.64 0.21 0.07 0.465 0.54 1.2  
## HUMAN6 0.29 0.64 0.01 0.492 0.51 1.4  
## MATERIA6 0.71 0.28 0.13 0.605 0.40 1.4  
## HUMAN7 0.17 0.66 0.04 0.462 0.54 1.1  
## COGNITIVO5 0.17 0.05 0.61 0.402 0.60 1.2  
## HUMAN8 0.09 0.55 -0.01 0.313 0.69 1.1  
## MATERIA8 0.69 0.16 0.06 0.500 0.50 1.1  
## HUMAN9 0.22 0.50 0.06 0.296 0.70 1.4  
## COGNITIVO6 -0.18 0.07 0.61 0.416 0.58 1.2  
## MATERIA9 0.46 0.31 0.17 0.333 0.67 2.1  
## COGEMOC1 0.14 -0.19 0.49 0.298 0.70 1.5  
## MATERIA7 0.68 -0.08 -0.03 0.471 0.53 1.0  
## COGEMOC3 0.00 -0.22 0.19 0.082 0.92 1.9  
## COGEMOC2 0.05 -0.09 0.36 0.139 0.86 1.2  
##   
## MR1 MR3 MR2  
## SS loadings 4.59 3.59 3.11  
## Proportion Var 0.17 0.13 0.12  
## Cumulative Var 0.17 0.30 0.42  
## Proportion Explained 0.41 0.32 0.28  
## Cumulative Proportion 0.41 0.72 1.00  
##   
## Mean item complexity = 1.3  
## Test of the hypothesis that 3 factors are sufficient.  
##   
## The degrees of freedom for the null model are 351 and the objective function was 11.58 with Chi Square of 6936.65  
## The degrees of freedom for the model are 273 and the objective function was 2.18   
##   
## The root mean square of the residuals (RMSR) is 0.05   
## The df corrected root mean square of the residuals is 0.05   
##   
## The harmonic number of observations is 610 with the empirical chi square 960.21 with prob < 2.9e-77   
## The total number of observations was 610 with Likelihood Chi Square = 1302.23 with prob < 1.2e-133   
##   
## Tucker Lewis Index of factoring reliability = 0.798  
## RMSEA index = 0.079 and the 90 % confidence intervals are 0.074 0.083  
## BIC = -448.64  
## Fit based upon off diagonal values = 0.97  
## Measures of factor score adequacy   
## MR1 MR3 MR2  
## Correlation of (regression) scores with factors 0.94 0.91 0.92  
## Multiple R square of scores with factors 0.88 0.82 0.85  
## Minimum correlation of possible factor scores 0.75 0.65 0.70

El porcentaje de varianza acumulado de estos \*\* 3 factores es de 42%\*\*

Gráfica de segmentación de factores es el grafico como se asocia los factores y preguntas

fa.diagram(factorial3, e.size=.05,rsize=4.5)



## 2.2° Determine e interprete el porcentaje de varianza acumulado de estos 4 factores.

## coriendo el modelo para 4 factores

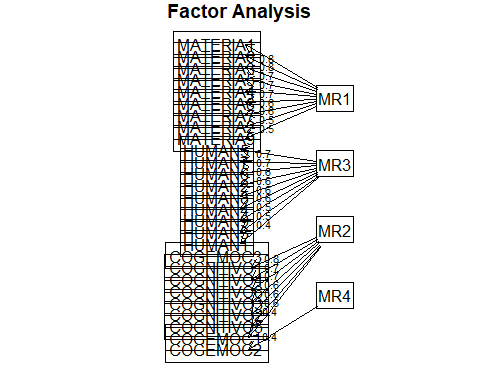
factorial4=fa.poly(base, nfactors=4, cor="poly",rotate="varimax")  
factorial4

## Factor Analysis using method = minres  
## Call: fa.poly(x = base, nfactors = 4, rotate = "varimax", cor = "poly")  
## Standardized loadings (pattern matrix) based upon correlation matrix  
## MR1 MR3 MR2 MR4 h2 u2 com  
## HUMAN1 0.27 0.42 0.07 0.00 0.258 0.74 1.8  
## COGNITIVO1 -0.09 0.10 0.75 0.04 0.583 0.42 1.1  
## MATERIA1 0.78 0.25 0.03 -0.03 0.681 0.32 1.2  
## MATERIA2 0.55 0.03 -0.06 0.34 0.415 0.58 1.7  
## HUMAN2 0.52 0.58 -0.01 0.09 0.621 0.38 2.0  
## HUMAN3 0.06 0.46 0.19 -0.16 0.275 0.73 1.6  
## COGNITIVO2 0.21 0.08 0.61 0.12 0.435 0.57 1.4  
## MATERIA3 0.70 0.27 0.07 -0.04 0.569 0.43 1.3  
## HUMAN4 0.02 0.56 0.03 -0.06 0.316 0.68 1.0  
## COGNITIVO3 0.12 0.06 0.65 0.08 0.443 0.56 1.1  
## MATERIA4 0.66 0.14 0.15 -0.01 0.482 0.52 1.2  
## HUMAN5 0.21 0.70 0.07 -0.02 0.536 0.46 1.2  
## COGNITIVO4 0.09 0.17 0.70 -0.04 0.528 0.47 1.2  
## MATERIA5 0.68 0.16 0.07 -0.07 0.501 0.50 1.2  
## HUMAN6 0.31 0.63 0.04 -0.05 0.491 0.51 1.5  
## MATERIA6 0.76 0.22 0.14 -0.07 0.647 0.35 1.3  
## HUMAN7 0.17 0.67 0.06 0.01 0.480 0.52 1.1  
## COGNITIVO5 0.15 0.05 0.58 0.21 0.411 0.59 1.4  
## HUMAN8 0.09 0.57 0.01 0.02 0.333 0.67 1.1  
## MATERIA8 0.65 0.19 0.02 0.24 0.516 0.48 1.5  
## HUMAN9 0.19 0.54 0.05 0.15 0.354 0.65 1.4  
## COGNITIVO6 -0.11 -0.02 0.67 -0.23 0.518 0.48 1.3  
## MATERIA9 0.54 0.23 0.20 -0.24 0.440 0.56 2.1  
## COGEMOC1 0.07 -0.15 0.45 0.43 0.412 0.59 2.3  
## MATERIA7 0.62 -0.02 -0.10 0.39 0.548 0.45 1.8  
## COGEMOC3 -0.01 -0.22 0.17 0.08 0.082 0.92 2.2  
## COGEMOC2 -0.03 -0.02 0.32 0.44 0.300 0.70 1.8  
##   
## MR1 MR3 MR2 MR4  
## SS loadings 4.65 3.43 3.13 0.97  
## Proportion Var 0.17 0.13 0.12 0.04  
## Cumulative Var 0.17 0.30 0.42 0.45  
## Proportion Explained 0.38 0.28 0.26 0.08  
## Cumulative Proportion 0.38 0.66 0.92 1.00  
##   
## Mean item complexity = 1.5  
## Test of the hypothesis that 4 factors are sufficient.  
##   
## The degrees of freedom for the null model are 351 and the objective function was 11.58 with Chi Square of 6936.65  
## The degrees of freedom for the model are 249 and the objective function was 1.7   
##   
## The root mean square of the residuals (RMSR) is 0.04   
## The df corrected root mean square of the residuals is 0.05   
##   
## The harmonic number of observations is 610 with the empirical chi square 615.76 with prob < 5e-33   
## The total number of observations was 610 with Likelihood Chi Square = 1016.07 with prob < 3.4e-93   
##   
## Tucker Lewis Index of factoring reliability = 0.835  
## RMSEA index = 0.071 and the 90 % confidence intervals are 0.067 0.076  
## BIC = -580.88  
## Fit based upon off diagonal values = 0.98  
## Measures of factor score adequacy   
## MR1 MR3 MR2 MR4  
## Correlation of (regression) scores with factors 0.94 0.90 0.92 0.78  
## Multiple R square of scores with factors 0.88 0.82 0.85 0.62  
## Minimum correlation of possible factor scores 0.76 0.63 0.71 0.23

El porcentaje de varianza acumulado de estos \*\* 4 factores es de 45%\*\*

# Gráfica de segmentación de factores es el grafico como se asocia los factores y preg

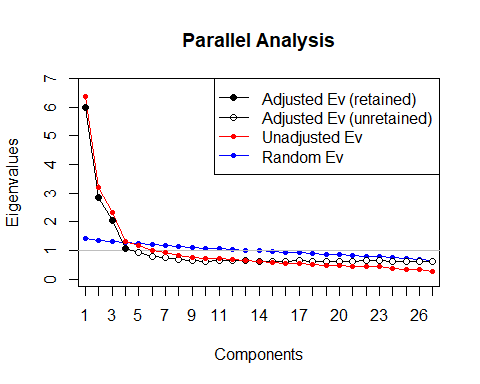
fa.diagram(factorial4, e.size=.05,rsize=4.5)



Realizar un analisis de factores exploratorio nos da el gráfico de sedimentación

paran(base, iterations=5000,graph=TRUE,color=TRUE, width=1000, height=1000)

##   
## Using eigendecomposition of correlation matrix.  
## Computing: 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%  
##   
##   
## Results of Horn's Parallel Analysis for component retention  
## 5000 iterations, using the mean estimate  
##   
## --------------------------------------------------   
## Component Adjusted Unadjusted Estimated   
## Eigenvalue Eigenvalue Bias   
## --------------------------------------------------   
## 1 5.983217 6.388813 0.405596  
## 2 2.854636 3.201250 0.346614  
## 3 2.036769 2.338806 0.302037  
## 4 1.059334 1.323061 0.263726  
## --------------------------------------------------   
##   
## Adjusted eigenvalues > 1 indicate dimensions to retain.  
## (4 components retained)



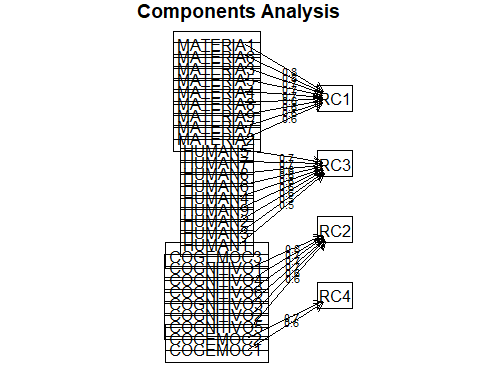
Gráficos y respuestas de 4 factores tambien exploratorio

fit\_1<-principal(cor(base),nfactors=4,rotate="varimax" )  
fit\_1$loadings

##   
## Loadings:  
## RC1 RC3 RC2 RC4   
## HUMAN1 0.271 0.463   
## COGNITIVO1 0.757   
## MATERIA1 0.785 0.225   
## MATERIA2 0.552 -0.115 0.448  
## HUMAN2 0.522 0.561   
## HUMAN3 0.493 0.225 -0.220  
## COGNITIVO2 0.211 0.640 0.139  
## MATERIA3 0.710 0.239   
## HUMAN4 0.622   
## COGNITIVO3 0.116 0.678 0.104  
## MATERIA4 0.699 0.106 0.143   
## HUMAN5 0.209 0.697   
## COGNITIVO4 0.145 0.726   
## MATERIA5 0.708 0.116   
## HUMAN6 0.304 0.627   
## MATERIA6 0.761 0.181 0.134   
## HUMAN7 0.156 0.689   
## COGNITIVO5 0.138 0.602 0.255  
## HUMAN8 0.633   
## MATERIA8 0.634 0.170 0.284  
## HUMAN9 0.157 0.587 0.226  
## COGNITIVO6 0.718 -0.195  
## MATERIA9 0.580 0.179 0.232 -0.279  
## COGEMOC1 -0.136 0.426 0.553  
## MATERIA7 0.579 -0.132 0.428  
## COGEMOC3 -0.271 0.194 0.108  
## COGEMOC2 0.281 0.673  
##   
## RC1 RC3 RC2 RC4  
## SS loadings 4.719 3.614 3.348 1.572  
## Proportion Var 0.175 0.134 0.124 0.058  
## Cumulative Var 0.175 0.309 0.433 0.491

Gráfica de segmentación de factores es el grafico como se asocia los factores y preguntas

fa.diagram(fit\_1, e.size=.05,rsize=4.5)



## 3° Valide el Modelo de Análisis Factorial Confirmatorio con 4 factores con las métricas correspondientes (Chi Cuadrado, SRMR, RMSEA, TLI, CFI, GFI, AGFI, significancia de coeficientes del modelo y covarianza de los factores)

Realizamos el modelo de Análisis Factorial Confirmatorio con los 4 factores

library(lavaan)  
modelo <- 'HUMAN = ~ HUMAN1 + HUMAN2 + HUMAN3 + HUMAN4 + HUMAN5 + HUMAN6 +  
HUMAN7 + HUMAN8 + HUMAN9  
MATERIA = ~ MATERIA1 + MATERIA2 + MATERIA3 + MATERIA4 + MATERIA5 + MATERIA6 +   
MATERIA7 + MATERIA8 + MATERIA9  
COGNITIVO = ~ COGNITIVO1 + COGNITIVO2 + COGNITIVO3 + COGNITIVO4 + COGNITIVO5 + COGNITIVO6   
COGEMOC = ~ COGEMOC1 + COGEMOC2 + COGEMOC3'

Obteniendo indicadores: Chi Cuadrado, SRMR, RMSEA, TLI, CFI, GFI, AGFI, significancia de coeficientes del modelo y covarianza de los 4 factores

fit <- cfa(modelo, data = base,ordered = TRUE)  
summary(fit, fit.measures = TRUE)

## lavaan 0.6-7 ended normally after 46 iterations  
##   
## Estimator DWLS  
## Optimization method NLMINB  
## Number of free parameters 141  
##   
## Number of observations 610  
##   
## Model Test User Model:  
## Standard Robust  
## Test Statistic 1615.532 1483.582  
## Degrees of freedom 318 318  
## P-value (Chi-square) 0.000 0.000  
## Scaling correction factor 1.206  
## Shift parameter 143.627  
## simple second-order correction   
##   
## Model Test Baseline Model:  
##   
## Test statistic 28383.541 10293.889  
## Degrees of freedom 351 351  
## P-value 0.000 0.000  
## Scaling correction factor 2.819  
##   
## User Model versus Baseline Model:  
##   
## Comparative Fit Index (CFI) 0.954 0.883  
## Tucker-Lewis Index (TLI) 0.949 0.871  
##   
## Robust Comparative Fit Index (CFI) NA  
## Robust Tucker-Lewis Index (TLI) NA  
##   
## Root Mean Square Error of Approximation:  
##   
## RMSEA 0.082 0.078  
## 90 Percent confidence interval - lower 0.078 0.074  
## 90 Percent confidence interval - upper 0.086 0.082  
## P-value RMSEA <= 0.05 0.000 0.000  
##   
## Robust RMSEA NA  
## 90 Percent confidence interval - lower NA  
## 90 Percent confidence interval - upper NA  
##   
## Standardized Root Mean Square Residual:  
##   
## SRMR 0.075 0.075  
##   
## Parameter Estimates:  
##   
## Standard errors Robust.sem  
## Information Expected  
## Information saturated (h1) model Unstructured  
##   
## Latent Variables:  
## Estimate Std.Err z-value P(>|z|)  
## HUMAN =~   
## HUMAN1 1.000   
## HUMAN2 1.626 0.092 17.585 0.000  
## HUMAN3 0.794 0.073 10.835 0.000  
## HUMAN4 0.846 0.069 12.305 0.000  
## HUMAN5 1.309 0.082 15.879 0.000  
## HUMAN6 1.374 0.096 14.343 0.000  
## HUMAN7 1.207 0.081 14.990 0.000  
## HUMAN8 0.923 0.070 13.139 0.000  
## HUMAN9 1.039 0.075 13.814 0.000  
## MATERIA =~   
## MATERIA1 1.000   
## MATERIA2 0.598 0.035 16.997 0.000  
## MATERIA3 0.914 0.024 38.842 0.000  
## MATERIA4 0.812 0.027 29.681 0.000  
## MATERIA5 0.839 0.023 36.000 0.000  
## MATERIA6 0.949 0.022 43.478 0.000  
## MATERIA7 0.635 0.037 17.373 0.000  
## MATERIA8 0.811 0.028 29.463 0.000  
## MATERIA9 0.730 0.028 26.470 0.000  
## COGNITIVO =~   
## COGNITIVO1 1.000   
## COGNITIVO2 1.011 0.040 25.518 0.000  
## COGNITIVO3 0.997 0.044 22.713 0.000  
## COGNITIVO4 1.046 0.041 25.507 0.000  
## COGNITIVO5 0.933 0.042 22.076 0.000  
## COGNITIVO6 0.782 0.040 19.608 0.000  
## COGEMOC =~   
## COGEMOC1 1.000   
## COGEMOC2 0.701 0.063 11.056 0.000  
## COGEMOC3 0.344 0.070 4.898 0.000  
##   
## Covariances:  
## Estimate Std.Err z-value P(>|z|)  
## HUMAN ~~   
## MATERIA 0.288 0.022 13.079 0.000  
## COGNITIVO 0.084 0.016 5.239 0.000  
## COGEMOC -0.043 0.020 -2.203 0.028  
## MATERIA ~~   
## COGNITIVO 0.134 0.027 5.015 0.000  
## COGEMOC 0.056 0.033 1.681 0.093  
## COGNITIVO ~~   
## COGEMOC 0.315 0.027 11.567 0.000  
##   
## Intercepts:  
## Estimate Std.Err z-value P(>|z|)  
## .HUMAN1 0.000   
## .HUMAN2 0.000   
## .HUMAN3 0.000   
## .HUMAN4 0.000   
## .HUMAN5 0.000   
## .HUMAN6 0.000   
## .HUMAN7 0.000   
## .HUMAN8 0.000   
## .HUMAN9 0.000   
## .MATERIA1 0.000   
## .MATERIA2 0.000   
## .MATERIA3 0.000   
## .MATERIA4 0.000   
## .MATERIA5 0.000   
## .MATERIA6 0.000   
## .MATERIA7 0.000   
## .MATERIA8 0.000   
## .MATERIA9 0.000   
## .COGNITIVO1 0.000   
## .COGNITIVO2 0.000   
## .COGNITIVO3 0.000   
## .COGNITIVO4 0.000   
## .COGNITIVO5 0.000   
## .COGNITIVO6 0.000   
## .COGEMOC1 0.000   
## .COGEMOC2 0.000   
## .COGEMOC3 0.000   
## HUMAN 0.000   
## MATERIA 0.000   
## COGNITIVO 0.000   
## COGEMOC 0.000   
##   
## Thresholds:  
## Estimate Std.Err z-value P(>|z|)  
## HUMAN1|t1 -1.549 0.081 -19.243 0.000  
## HUMAN1|t2 -0.698 0.056 -12.564 0.000  
## HUMAN1|t3 0.455 0.053 8.625 0.000  
## HUMAN1|t4 1.300 0.070 18.595 0.000  
## HUMAN2|t1 -0.883 0.059 -15.052 0.000  
## HUMAN2|t2 0.021 0.051 0.405 0.686  
## HUMAN2|t3 0.908 0.059 15.342 0.000  
## HUMAN2|t4 1.536 0.080 19.236 0.000  
## HUMAN3|t1 -1.606 0.083 -19.241 0.000  
## HUMAN3|t2 -0.824 0.058 -14.313 0.000  
## HUMAN3|t3 -0.078 0.051 -1.537 0.124  
## HUMAN3|t4 0.657 0.055 11.943 0.000  
## HUMAN4|t1 -1.549 0.081 -19.243 0.000  
## HUMAN4|t2 -0.847 0.058 -14.611 0.000  
## HUMAN4|t3 0.058 0.051 1.133 0.257  
## HUMAN4|t4 1.054 0.062 16.867 0.000  
## HUMAN5|t1 -1.210 0.067 -18.087 0.000  
## HUMAN5|t2 -0.370 0.052 -7.103 0.000  
## HUMAN5|t3 0.414 0.052 7.905 0.000  
## HUMAN5|t4 1.310 0.070 18.641 0.000  
## HUMAN6|t1 -0.790 0.057 -13.863 0.000  
## HUMAN6|t2 -0.021 0.051 -0.405 0.686  
## HUMAN6|t3 0.746 0.056 13.255 0.000  
## HUMAN6|t4 1.414 0.074 19.027 0.000  
## HUMAN7|t1 -1.091 0.063 -17.191 0.000  
## HUMAN7|t2 -0.245 0.051 -4.769 0.000  
## HUMAN7|t3 0.724 0.056 12.949 0.000  
## HUMAN7|t4 1.549 0.081 19.243 0.000  
## HUMAN8|t1 -1.360 0.072 -18.851 0.000  
## HUMAN8|t2 -0.423 0.052 -8.065 0.000  
## HUMAN8|t3 0.496 0.053 9.342 0.000  
## HUMAN8|t4 1.254 0.068 18.352 0.000  
## HUMAN9|t1 -1.686 0.088 -19.148 0.000  
## HUMAN9|t2 -0.757 0.056 -13.408 0.000  
## HUMAN9|t3 0.041 0.051 0.809 0.418  
## HUMAN9|t4 1.019 0.062 16.533 0.000  
## MATERIA1|t1 -1.019 0.062 -16.533 0.000  
## MATERIA1|t2 0.082 0.051 1.618 0.106  
## MATERIA1|t3 1.005 0.061 16.397 0.000  
## MATERIA1|t4 1.703 0.089 19.114 0.000  
## MATERIA2|t1 -1.012 0.061 -16.465 0.000  
## MATERIA2|t2 -0.074 0.051 -1.456 0.145  
## MATERIA2|t3 0.796 0.057 13.938 0.000  
## MATERIA2|t4 1.606 0.083 19.241 0.000  
## MATERIA3|t1 -0.830 0.058 -14.388 0.000  
## MATERIA3|t2 -0.016 0.051 -0.324 0.746  
## MATERIA3|t3 0.830 0.058 14.388 0.000  
## MATERIA3|t4 1.403 0.074 18.995 0.000  
## MATERIA4|t1 -1.098 0.064 -17.254 0.000  
## MATERIA4|t2 -0.053 0.051 -1.052 0.293  
## MATERIA4|t3 0.824 0.058 14.313 0.000  
## MATERIA4|t4 1.606 0.083 19.241 0.000  
## MATERIA5|t1 -1.054 0.062 -16.867 0.000  
## MATERIA5|t2 -0.258 0.051 -5.011 0.000  
## MATERIA5|t3 0.515 0.053 9.660 0.000  
## MATERIA5|t4 1.381 0.073 18.926 0.000  
## MATERIA6|t1 -1.040 0.062 -16.734 0.000  
## MATERIA6|t2 -0.132 0.051 -2.588 0.010  
## MATERIA6|t3 0.853 0.058 14.685 0.000  
## MATERIA6|t4 1.536 0.080 19.236 0.000  
## MATERIA7|t1 -0.124 0.051 -2.427 0.015  
## MATERIA7|t2 0.365 0.052 7.023 0.000  
## MATERIA7|t3 0.992 0.061 16.260 0.000  
## MATERIA7|t4 1.448 0.076 19.112 0.000  
## MATERIA8|t1 -0.414 0.052 -7.905 0.000  
## MATERIA8|t2 0.078 0.051 1.537 0.124  
## MATERIA8|t3 0.883 0.059 15.052 0.000  
## MATERIA8|t4 1.437 0.075 19.085 0.000  
## MATERIA9|t1 -1.460 0.076 -19.136 0.000  
## MATERIA9|t2 -0.662 0.055 -12.021 0.000  
## MATERIA9|t3 0.270 0.051 5.253 0.000  
## MATERIA9|t4 1.113 0.064 17.380 0.000  
## COGNITIVO1|t1 -1.841 0.099 -18.685 0.000  
## COGNITIVO1|t2 -1.026 0.062 -16.601 0.000  
## COGNITIVO1|t3 0.296 0.052 5.736 0.000  
## COGNITIVO1|t4 1.381 0.073 18.926 0.000  
## COGNITIVO2|t1 -1.291 0.070 -18.549 0.000  
## COGNITIVO2|t2 -0.348 0.052 -6.702 0.000  
## COGNITIVO2|t3 0.847 0.058 14.611 0.000  
## COGNITIVO2|t4 1.621 0.084 19.231 0.000  
## COGNITIVO3|t1 -1.414 0.074 -19.027 0.000  
## COGNITIVO3|t2 -0.539 0.054 -10.057 0.000  
## COGNITIVO3|t3 0.708 0.056 12.718 0.000  
## COGNITIVO3|t4 1.669 0.087 19.176 0.000  
## COGNITIVO4|t1 -1.523 0.079 -19.226 0.000  
## COGNITIVO4|t2 -0.740 0.056 -13.179 0.000  
## COGNITIVO4|t3 0.326 0.052 6.300 0.000  
## COGNITIVO4|t4 1.414 0.074 19.027 0.000  
## COGNITIVO5|t1 -1.054 0.062 -16.867 0.000  
## COGNITIVO5|t2 -0.186 0.051 -3.639 0.000  
## COGNITIVO5|t3 0.740 0.056 13.179 0.000  
## COGNITIVO5|t4 1.703 0.089 19.114 0.000  
## COGNITIVO6|t1 -1.841 0.099 -18.685 0.000  
## COGNITIVO6|t2 -1.185 0.066 -17.919 0.000  
## COGNITIVO6|t3 -0.190 0.051 -3.720 0.000  
## COGNITIVO6|t4 0.889 0.059 15.125 0.000  
## COGEMOC1|t1 -1.371 0.073 -18.889 0.000  
## COGEMOC1|t2 -0.361 0.052 -6.943 0.000  
## COGEMOC1|t3 0.641 0.055 11.709 0.000  
## COGEMOC1|t4 1.592 0.083 19.247 0.000  
## COGEMOC2|t1 -1.392 0.073 -18.961 0.000  
## COGEMOC2|t2 -0.582 0.054 -10.768 0.000  
## COGEMOC2|t3 0.539 0.054 10.057 0.000  
## COGEMOC2|t4 1.437 0.075 19.085 0.000  
## COGEMOC3|t1 -0.939 0.060 -15.700 0.000  
## COGEMOC3|t2 0.128 0.051 2.508 0.012  
## COGEMOC3|t3 0.824 0.058 14.313 0.000  
## COGEMOC3|t4 1.563 0.081 19.248 0.000  
##   
## Variances:  
## Estimate Std.Err z-value P(>|z|)  
## .HUMAN1 0.715   
## .HUMAN2 0.247   
## .HUMAN3 0.821   
## .HUMAN4 0.796   
## .HUMAN5 0.512   
## .HUMAN6 0.463   
## .HUMAN7 0.585   
## .HUMAN8 0.757   
## .HUMAN9 0.693   
## .MATERIA1 0.297   
## .MATERIA2 0.749   
## .MATERIA3 0.412   
## .MATERIA4 0.537   
## .MATERIA5 0.505   
## .MATERIA6 0.367   
## .MATERIA7 0.717   
## .MATERIA8 0.538   
## .MATERIA9 0.626   
## .COGNITIVO1 0.518   
## .COGNITIVO2 0.507   
## .COGNITIVO3 0.521   
## .COGNITIVO4 0.472   
## .COGNITIVO5 0.580   
## .COGNITIVO6 0.705   
## .COGEMOC1 0.532   
## .COGEMOC2 0.770   
## .COGEMOC3 0.945   
## HUMAN 0.285 0.033 8.522 0.000  
## MATERIA 0.703 0.026 27.356 0.000  
## COGNITIVO 0.482 0.033 14.693 0.000  
## COGEMOC 0.468 0.048 9.670 0.000  
##   
## Scales y\*:  
## Estimate Std.Err z-value P(>|z|)  
## HUMAN1 1.000   
## HUMAN2 1.000   
## HUMAN3 1.000   
## HUMAN4 1.000   
## HUMAN5 1.000   
## HUMAN6 1.000   
## HUMAN7 1.000   
## HUMAN8 1.000   
## HUMAN9 1.000   
## MATERIA1 1.000   
## MATERIA2 1.000   
## MATERIA3 1.000   
## MATERIA4 1.000   
## MATERIA5 1.000   
## MATERIA6 1.000   
## MATERIA7 1.000   
## MATERIA8 1.000   
## MATERIA9 1.000   
## COGNITIVO1 1.000   
## COGNITIVO2 1.000   
## COGNITIVO3 1.000   
## COGNITIVO4 1.000   
## COGNITIVO5 1.000   
## COGNITIVO6 1.000   
## COGEMOC1 1.000   
## COGEMOC2 1.000   
## COGEMOC3 1.000

P-value (Chi-square) Se mantiene el modelo El valor p > 0,05; no se recomenda el analisi factorial Radio mayor q 3 no se recomienda el modelo RMR cuando más pequeño se ajusta al modelo, 0 es ajuste perfecto SRM menos igual q 0.08 el modelo se ajusta SRMR menor igual 0,06 el modelo se ajusta GFI/AGFI es mayor igual q 0,95 el modelo se ajusta NFI mayor a 0,95 el modelo se ajusta NNFI o TLI mayores 0,96 el modelo se ajusta RNI CFI mayor 0.95 el modelo se ajusta

Gráfico de senderos con el modelo

library(semPlot)

## Registered S3 methods overwritten by 'lme4':  
## method from  
## cooks.distance.influence.merMod car   
## influence.merMod car   
## dfbeta.influence.merMod car   
## dfbetas.influence.merMod car

## Registered S3 methods overwritten by 'huge':  
## method from   
## plot.sim BDgraph  
## print.sim BDgraph

library(semTools)

##

## ###############################################################################

## This is semTools 0.5-3

## All users of R (or SEM) are invited to submit functions or ideas for functions.

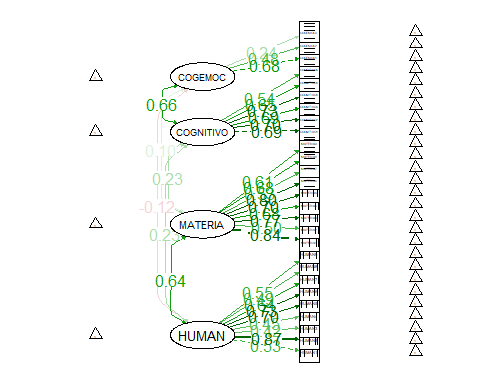
## ###############################################################################

##   
## Attaching package: 'semTools'

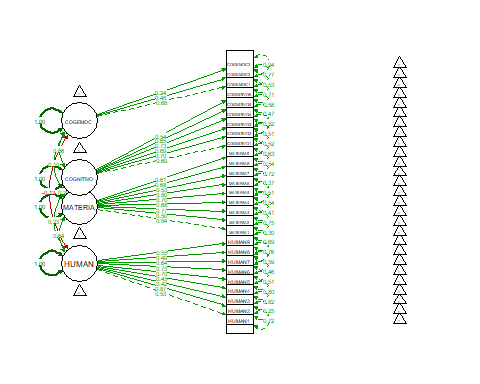
## The following object is masked from 'package:readr':  
##   
## clipboard

## The following object is masked from 'package:psych':  
##   
## skew

semPaths(fit, "std", rotation = 2, layout = "tree2", nCharNodes = 0,   
 sizeLat= 14, sizeLat2 = 6, sizeMan = 4.3,  
 mar=c(2,6,2,4), curvePivot = TRUE,  
 edge.label.cex=1.5,residuals = F)



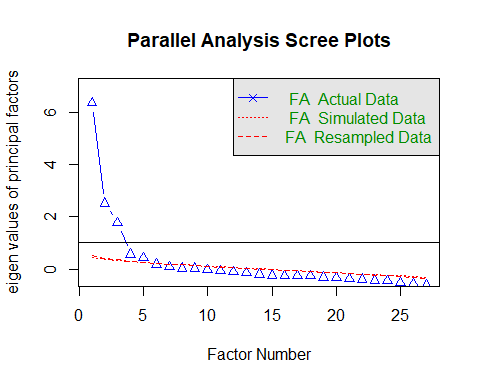
semPaths(fit, what="std",residuals = T, rotation = 2,nCharNodes = 0,fade=F,sizeMan = 6)



##4° Si el Modelo de Análisis Factorial con 4 factores o dimensiones, resultase explicar menos del 60% de la varianza y/o no cumple con todas o la mayoría de métricas, aplique un Análisis Factorial exploratorio con el código: Identificando el N° de factores fap=fa.parallel(Constructo,fa=“fa”,cor=“poly”) fap ## Donde Constructo es el nombre de la data, y que ustedes pueden darle otro nombre; este código se encuentra en los que les he alcanzado y hemos corrido. El constructo es base para este proyecto

Realizamos el analisis de factor

fap=fa.parallel(base,fa="fa",cor="poly")



## Parallel analysis suggests that the number of factors = 5 and the number of components = NA

fap

## Call: fa.parallel(x = base, fa = "fa", cor = "poly")  
## Parallel analysis suggests that the number of factors = 5 and the number of components = NA   
##   
## Eigen Values of   
##   
## eigen values of factors  
## [1] 6.35 2.52 1.78 0.56 0.43 0.19 0.09 0.03 0.02 -0.03 -0.07 -0.11  
## [13] -0.15 -0.20 -0.24 -0.25 -0.26 -0.26 -0.32 -0.34 -0.37 -0.40 -0.43 -0.46  
## [25] -0.53 -0.56 -0.62  
##   
## eigen values of simulated factors  
## [1] 0.46 0.35 0.32 0.28 0.25 0.21 0.18 0.16 0.14 0.11 0.08 0.05  
## [13] 0.03 0.01 -0.02 -0.04 -0.07 -0.09 -0.11 -0.14 -0.16 -0.19 -0.21 -0.24  
## [25] -0.26 -0.29 -0.34  
##   
## eigen values of components   
## [1] 6.98 3.43 2.54 1.36 1.17 0.99 0.91 0.79 0.74 0.69 0.68 0.63 0.62 0.56 0.53  
## [16] 0.50 0.49 0.46 0.41 0.40 0.38 0.37 0.35 0.29 0.26 0.25 0.19  
##   
## eigen values of simulated components  
## [1] NA

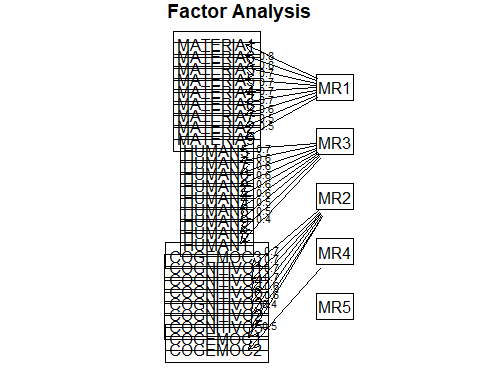
Corremos el Modelo de factores para 5 factores por que tambien suguiere el analisis de fcatores

factorial5=fa.poly(base, nfactors=5, cor="poly",rotate="varimax")  
factorial5

## Factor Analysis using method = minres  
## Call: fa.poly(x = base, nfactors = 5, rotate = "varimax", cor = "poly")  
## Standardized loadings (pattern matrix) based upon correlation matrix  
## MR1 MR3 MR2 MR4 MR5 h2 u2 com  
## HUMAN1 0.28 0.45 0.08 -0.03 -0.19 0.32 0.68 2.2  
## COGNITIVO1 -0.09 0.09 0.75 0.05 0.02 0.58 0.42 1.1  
## MATERIA1 0.79 0.25 0.04 -0.05 -0.06 0.69 0.31 1.2  
## MATERIA2 0.55 0.03 -0.07 0.33 0.06 0.42 0.58 1.7  
## HUMAN2 0.53 0.59 0.00 0.06 -0.06 0.63 0.37 2.0  
## HUMAN3 0.07 0.48 0.20 -0.19 -0.15 0.33 0.67 2.0  
## COGNITIVO2 0.21 0.08 0.61 0.13 -0.06 0.44 0.56 1.4  
## MATERIA3 0.70 0.26 0.07 -0.04 0.09 0.57 0.43 1.3  
## HUMAN4 0.03 0.57 0.04 -0.08 -0.12 0.35 0.65 1.1  
## COGNITIVO3 0.12 0.06 0.65 0.08 -0.08 0.46 0.54 1.2  
## MATERIA4 0.68 0.15 0.16 -0.05 -0.21 0.55 0.45 1.4  
## HUMAN5 0.21 0.68 0.07 -0.02 0.17 0.54 0.46 1.3  
## COGNITIVO4 0.08 0.15 0.70 -0.02 0.14 0.54 0.46 1.2  
## MATERIA5 0.69 0.12 0.07 -0.07 0.31 0.60 0.40 1.5  
## HUMAN6 0.30 0.62 0.02 -0.03 0.49 0.72 0.28 2.4  
## MATERIA6 0.76 0.20 0.14 -0.06 0.17 0.66 0.34 1.3  
## HUMAN7 0.17 0.65 0.06 0.01 0.20 0.50 0.50 1.4  
## COGNITIVO5 0.15 0.05 0.58 0.21 0.01 0.41 0.59 1.4  
## HUMAN8 0.09 0.57 0.02 0.01 -0.03 0.34 0.66 1.1  
## MATERIA8 0.65 0.19 0.03 0.23 -0.03 0.52 0.48 1.4  
## HUMAN9 0.19 0.53 0.05 0.15 0.11 0.35 0.65 1.6  
## COGNITIVO6 -0.12 -0.03 0.67 -0.21 0.08 0.52 0.48 1.3  
## MATERIA9 0.53 0.22 0.21 -0.24 0.02 0.44 0.56 2.1  
## COGEMOC1 0.07 -0.13 0.44 0.44 -0.07 0.41 0.59 2.3  
## MATERIA7 0.63 -0.01 -0.10 0.38 -0.15 0.57 0.43 1.8  
## COGEMOC3 -0.01 -0.24 0.16 0.10 0.20 0.13 0.87 3.2  
## COGEMOC2 -0.03 -0.02 0.31 0.46 0.08 0.32 0.68 1.8  
##   
## MR1 MR3 MR2 MR4 MR5  
## SS loadings 4.72 3.39 3.13 0.98 0.69  
## Proportion Var 0.17 0.13 0.12 0.04 0.03  
## Cumulative Var 0.17 0.30 0.42 0.45 0.48  
## Proportion Explained 0.37 0.26 0.24 0.08 0.05  
## Cumulative Proportion 0.37 0.63 0.87 0.95 1.00  
##   
## Mean item complexity = 1.6  
## Test of the hypothesis that 5 factors are sufficient.  
##   
## The degrees of freedom for the null model are 351 and the objective function was 11.58 with Chi Square of 6936.65  
## The degrees of freedom for the model are 226 and the objective function was 1.3   
##   
## The root mean square of the residuals (RMSR) is 0.03   
## The df corrected root mean square of the residuals is 0.04   
##   
## The harmonic number of observations is 610 with the empirical chi square 401.87 with prob < 5.4e-12   
## The total number of observations was 610 with Likelihood Chi Square = 774.9 with prob < 2.9e-61   
##   
## Tucker Lewis Index of factoring reliability = 0.87  
## RMSEA index = 0.063 and the 90 % confidence intervals are 0.058 0.068  
## BIC = -674.55  
## Fit based upon off diagonal values = 0.99  
## Measures of factor score adequacy   
## MR1 MR3 MR2 MR4 MR5  
## Correlation of (regression) scores with factors 0.94 0.91 0.92 0.79 0.78  
## Multiple R square of scores with factors 0.89 0.82 0.86 0.62 0.61  
## Minimum correlation of possible factor scores 0.78 0.64 0.71 0.24 0.23

Gráfica de segmentación de factores es el grafico como se asocia los factores y preg para los 5 factores

fa.diagram(factorial5, e.size=.05,rsize=4.5)



# Estimación por componentes principales para mostrar la gráfica

fit\_1<-principal(cor(base),nfactors=5,rotate="varimax" )  
fit\_1$loadings

##   
## Loadings:  
## RC1 RC2 RC3 RC4 RC5   
## HUMAN1 0.280 0.288 0.493  
## COGNITIVO1 0.759   
## MATERIA1 0.788 0.169 0.166  
## MATERIA2 0.552 -0.119 0.439   
## HUMAN2 0.526 0.476 0.312  
## HUMAN3 0.247 0.344 -0.209 0.425  
## COGNITIVO2 0.210 0.645 0.145   
## MATERIA3 0.709 0.239   
## HUMAN4 0.499 0.408  
## COGNITIVO3 0.116 0.685 0.115   
## MATERIA4 0.704 0.162 0.254  
## HUMAN5 0.207 0.719   
## COGNITIVO4 0.721 0.185   
## MATERIA5 0.701 0.235 -0.258  
## HUMAN6 0.297 0.746 -0.110 -0.151  
## MATERIA6 0.758 0.131 0.227   
## HUMAN7 0.154 0.713   
## COGNITIVO5 0.136 0.602 0.256   
## HUMAN8 0.526 0.378  
## MATERIA8 0.636 0.147 0.283   
## HUMAN9 0.155 0.627 0.196   
## COGNITIVO6 0.715 -0.196   
## MATERIA9 0.580 0.239 0.147 -0.282   
## COGEMOC1 0.426 -0.128 0.563   
## MATERIA7 0.584 -0.122 0.441 0.124  
## COGEMOC3 0.157 -0.631  
## COGEMOC2 0.271 0.663 -0.136  
##   
## RC1 RC2 RC3 RC4 RC5  
## SS loadings 4.725 3.355 3.244 1.571 1.519  
## Proportion Var 0.175 0.124 0.120 0.058 0.056  
## Cumulative Var 0.175 0.299 0.419 0.478 0.534

El porcentaje de varianza acumulado de estos \*\* 5 factores es de 53%\*\*

El nombre de los factores para los 5 factores sería:

F1 = HUMANISMO F2 = MATERIALISMO F3 = COGNITIVO F4 = COGNITIVO EMOCIONAL F5 = COGNITIVO EMOCIONAL - HUMANISTA

## TEMA 4.2.

## Analice solo el porcentaje de varianza explicado con 3 y 5 factores, si éste resultase menor al 60%, eliminar los ítems del Test que considere restan la validez del modelo y halle un nuevo modelo factorial sin considerar los ítems eliminados. Se recomienda eliminar los ítems que tengan una correlación ítem subtest (ítem factor) menor a 0.65; ya que el KMO de todos los ítems es mayor a 0.70 (datos que les adelanto sucederá).

Efectivamente el modelo explica: El porcentaje de varianza acumulado de estos \*\* 3 factores es de 42% **El porcentaje de varianza acumulado de estos**  4 factores es de 45% **El porcentaje de varianza acumulado de estos**  5 factores es de 53%\*\*

Realizamos el analisis de la matriz de correlación.

r.poly=polychoric(base)  
r.poly

## Call: polychoric(x = base)  
## Polychoric correlations   
## HUMAN1 COGNITIVO1 MATERIA1 MATERIA2 HUMAN2 HUMAN3 COGNITIVO2  
## HUMAN1 1.00   
## COGNITIVO1 0.17 1.00   
## MATERIA1 0.32 -0.02 1.00   
## MATERIA2 0.20 -0.08 0.41 1.00   
## HUMAN2 0.45 0.03 0.65 0.32 1.00   
## HUMAN3 0.26 0.19 0.17 -0.02 0.25 1.00   
## COGNITIVO2 0.10 0.43 0.23 0.07 0.20 0.16 1.00   
## MATERIA3 0.31 0.00 0.64 0.36 0.51 0.20 0.22   
## HUMAN4 0.36 0.07 0.15 -0.01 0.28 0.39 0.06   
## COGNITIVO3 0.06 0.43 0.13 0.05 0.09 0.18 0.58   
## MATERIA4 0.34 0.03 0.59 0.34 0.46 0.23 0.28   
## HUMAN5 0.31 0.07 0.30 0.11 0.48 0.32 0.16   
## COGNITIVO4 0.10 0.53 0.14 0.00 0.12 0.22 0.43   
## MATERIA5 0.22 0.03 0.60 0.41 0.39 0.07 0.15   
## HUMAN6 0.25 0.06 0.36 0.17 0.53 0.25 0.13   
## MATERIA6 0.27 0.06 0.59 0.42 0.45 0.18 0.25   
## HUMAN7 0.31 0.06 0.30 0.14 0.52 0.29 0.12   
## COGNITIVO5 0.08 0.47 0.14 0.06 0.12 0.09 0.40   
## HUMAN8 0.28 0.04 0.23 0.06 0.42 0.27 0.04   
## MATERIA8 0.23 0.00 0.55 0.41 0.46 0.09 0.15   
## HUMAN9 0.26 0.08 0.27 0.20 0.37 0.27 0.13   
## COGNITIVO6 0.02 0.52 -0.06 -0.14 -0.10 0.12 0.29   
## MATERIA9 0.28 0.11 0.45 0.23 0.39 0.21 0.19   
## COGEMOC1 0.03 0.37 0.03 0.17 0.00 -0.05 0.34   
## MATERIA7 0.16 -0.15 0.45 0.46 0.35 -0.02 0.15   
## COGEMOC3 -0.13 0.11 -0.12 0.03 -0.19 -0.10 0.10   
## COGEMOC2 -0.02 0.24 -0.07 0.19 -0.02 -0.06 0.19   
## MATERIA3 HUMAN4 COGNITIVO3 MATERIA4  
## HUMAN1   
## COGNITIVO1   
## MATERIA1   
## MATERIA2   
## HUMAN2   
## HUMAN3   
## COGNITIVO2   
## MATERIA3 1.00   
## HUMAN4 0.18 1.00   
## COGNITIVO3 0.11 0.06 1.00   
## MATERIA4 0.49 0.10 0.24 1.00   
## HUMAN5 0.36 0.42 0.11 0.28   
## COGNITIVO4 0.17 0.09 0.45 0.14   
## MATERIA5 0.51 0.08 0.09 0.45   
## HUMAN6 0.50 0.27 0.07 0.20   
## MATERIA6 0.61 0.15 0.18 0.54   
## HUMAN7 0.24 0.32 0.09 0.19   
## COGNITIVO5 0.17 0.02 0.44 0.23   
## HUMAN8 0.21 0.31 0.07 0.13   
## MATERIA8 0.49 0.13 0.09 0.47   
## HUMAN9 0.21 0.34 0.10 0.14   
## COGNITIVO6 -0.04 0.02 0.37 0.03   
## MATERIA9 0.46 0.19 0.19 0.38   
## COGEMOC1 0.04 -0.09 0.27 0.06   
## MATERIA7 0.41 0.02 0.07 0.42   
## COGEMOC3 -0.05 -0.11 0.06 -0.05   
## COGEMOC2 -0.01 -0.02 0.25 -0.01   
## HUMAN5 COGNITIVO4 MATERIA5 HUMAN6 MATERIA6 HUMAN7 COGNITIVO5 HUMAN8  
## HUMAN5 1.00   
## COGNITIVO4 0.20 1.00   
## MATERIA5 0.23 0.18 1.00   
## HUMAN6 0.61 0.18 0.43 1.00   
## MATERIA6 0.34 0.18 0.62 0.42 1.00   
## HUMAN7 0.50 0.18 0.28 0.56 0.33 1.00   
## COGNITIVO5 0.07 0.45 0.12 0.10 0.23 0.17 1.00   
## HUMAN8 0.37 0.12 0.12 0.37 0.18 0.41 0.07 1.00   
## MATERIA8 0.24 0.11 0.45 0.29 0.52 0.23 0.20 0.16   
## HUMAN9 0.47 0.15 0.29 0.40 0.28 0.37 0.10 0.30   
## COGNITIVO6 0.02 0.52 0.01 -0.01 0.02 0.01 0.27 0.01   
## MATERIA9 0.31 0.23 0.44 0.27 0.54 0.24 0.12 0.20   
## COGEMOC1 -0.06 0.23 -0.03 -0.08 0.01 -0.09 0.36 -0.06   
## MATERIA7 0.12 -0.01 0.34 0.09 0.43 0.05 0.12 0.07   
## COGEMOC3 -0.08 0.09 0.04 -0.04 0.01 -0.13 0.09 -0.23   
## COGEMOC2 0.00 0.23 0.02 -0.02 0.01 0.03 0.24 0.03   
## MATERIA8 HUMAN9 COGNITIVO6  
## HUMAN5   
## COGNITIVO4   
## MATERIA5   
## HUMAN6   
## MATERIA6   
## HUMAN7   
## COGNITIVO5   
## HUMAN8   
## MATERIA8 1.00   
## HUMAN9 0.31 1.00   
## COGNITIVO6 -0.12 -0.05 1.00   
## MATERIA9 0.39 0.21 0.20   
## COGEMOC1 0.17 0.03 0.22   
## MATERIA7 0.51 0.13 -0.26   
## COGEMOC3 -0.08 -0.06 0.08   
## COGEMOC2 0.09 0.07 0.19   
## MATERIA9 COGEMOC1 MATERIA7 COGEMOC3 COGEMOC2  
## MATERIA9 1.00   
## COGEMOC1 0.06 1.00   
## MATERIA7 0.22 0.17 1.00   
## COGEMOC3 -0.05 0.18 0.02 1.00   
## COGEMOC2 -0.12 0.33 0.11 0.08 1.00   
##   
## with tau of   
## 1 2 3 4  
## HUMAN1 -1.55 -0.698 0.455 1.30  
## COGNITIVO1 -1.84 -1.026 0.296 1.38  
## MATERIA1 -1.02 0.082 1.005 1.70  
## MATERIA2 -1.01 -0.074 0.796 1.61  
## HUMAN2 -0.88 0.021 0.908 1.54  
## HUMAN3 -1.61 -0.824 -0.078 0.66  
## COGNITIVO2 -1.29 -0.348 0.847 1.62  
## MATERIA3 -0.83 -0.016 0.830 1.40  
## HUMAN4 -1.55 -0.847 0.058 1.05  
## COGNITIVO3 -1.41 -0.539 0.708 1.67  
## MATERIA4 -1.10 -0.053 0.824 1.61  
## HUMAN5 -1.21 -0.370 0.414 1.31  
## COGNITIVO4 -1.52 -0.740 0.326 1.41  
## MATERIA5 -1.05 -0.258 0.515 1.38  
## HUMAN6 -0.79 -0.021 0.746 1.41  
## MATERIA6 -1.04 -0.132 0.853 1.54  
## HUMAN7 -1.09 -0.245 0.724 1.55  
## COGNITIVO5 -1.05 -0.186 0.740 1.70  
## HUMAN8 -1.36 -0.423 0.496 1.25  
## MATERIA8 -0.41 0.078 0.883 1.44  
## HUMAN9 -1.69 -0.757 0.041 1.02  
## COGNITIVO6 -1.84 -1.185 -0.190 0.89  
## MATERIA9 -1.46 -0.662 0.270 1.11  
## COGEMOC1 -1.37 -0.361 0.641 1.59  
## MATERIA7 -0.12 0.365 0.992 1.45  
## COGEMOC3 -0.94 0.128 0.824 1.56  
## COGEMOC2 -1.39 -0.582 0.539 1.44

R=r.poly$rho # La matriz de correlaciones polycórica  
R

## HUMAN1 COGNITIVO1 MATERIA1 MATERIA2 HUMAN2  
## HUMAN1 1.00000000 0.167489183 0.32200991 0.204033875 0.44680996  
## COGNITIVO1 0.16748918 1.000000000 -0.02116059 -0.083263501 0.02737898  
## MATERIA1 0.32200991 -0.021160594 1.00000000 0.407669362 0.65466361  
## MATERIA2 0.20403388 -0.083263501 0.40766936 1.000000000 0.31860754  
## HUMAN2 0.44680996 0.027378978 0.65466361 0.318607538 1.00000000  
## HUMAN3 0.26382389 0.187510398 0.17389018 -0.022525624 0.25026488  
## COGNITIVO2 0.10098194 0.434963245 0.22635163 0.065362705 0.20163702  
## MATERIA3 0.30744919 -0.004662827 0.64112742 0.364804281 0.51397132  
## HUMAN4 0.35668977 0.073777553 0.14541702 -0.013930303 0.28338014  
## COGNITIVO3 0.05522505 0.426596331 0.13060415 0.045344166 0.09250001  
## MATERIA4 0.33900787 0.027075333 0.59465154 0.342480124 0.45996261  
## HUMAN5 0.31045484 0.071702726 0.29982493 0.112616994 0.48469159  
## COGNITIVO4 0.10158775 0.528042282 0.14317643 0.004082455 0.11937660  
## MATERIA5 0.22449324 0.028902850 0.59859514 0.407845912 0.38799384  
## HUMAN6 0.25102591 0.062932064 0.36264030 0.166351019 0.52985234  
## MATERIA6 0.27200170 0.057645120 0.59126773 0.423539517 0.44903231  
## HUMAN7 0.30997105 0.059420277 0.29701340 0.137232912 0.51561679  
## COGNITIVO5 0.07608395 0.468187186 0.14101831 0.055126366 0.11747381  
## HUMAN8 0.27767942 0.036164843 0.23450219 0.063568845 0.42161730  
## MATERIA8 0.23166667 0.002026177 0.54902331 0.405072540 0.45600962  
## HUMAN9 0.26497250 0.082028134 0.27271776 0.203560531 0.37079188  
## COGNITIVO6 0.02181991 0.524764125 -0.06193960 -0.137880285 -0.10486221  
## MATERIA9 0.28153074 0.107549772 0.45478493 0.228849254 0.38605278  
## COGEMOC1 0.03096369 0.370443149 0.03023081 0.173399464 0.00322006  
## MATERIA7 0.15750594 -0.146904072 0.45451787 0.463810217 0.34525779  
## COGEMOC3 -0.13072218 0.114374182 -0.11615725 0.033332461 -0.18807001  
## COGEMOC2 -0.01829528 0.242563620 -0.06803950 0.192780661 -0.01765609  
## HUMAN3 COGNITIVO2 MATERIA3 HUMAN4 COGNITIVO3  
## HUMAN1 0.26382389 0.10098194 0.307449192 0.35668977 0.05522505  
## COGNITIVO1 0.18751040 0.43496324 -0.004662827 0.07377755 0.42659633  
## MATERIA1 0.17389018 0.22635163 0.641127421 0.14541702 0.13060415  
## MATERIA2 -0.02252562 0.06536271 0.364804281 -0.01393030 0.04534417  
## HUMAN2 0.25026488 0.20163702 0.513971319 0.28338014 0.09250001  
## HUMAN3 1.00000000 0.15846953 0.197452603 0.38520355 0.18370249  
## COGNITIVO2 0.15846953 1.00000000 0.218161743 0.06274759 0.57751689  
## MATERIA3 0.19745260 0.21816174 1.000000000 0.18317371 0.11228413  
## HUMAN4 0.38520355 0.06274759 0.183173709 1.00000000 0.06223766  
## COGNITIVO3 0.18370249 0.57751689 0.112284132 0.06223766 1.00000000  
## MATERIA4 0.22680944 0.27509293 0.492901746 0.10204648 0.24287548  
## HUMAN5 0.31973358 0.16166274 0.355728117 0.41749039 0.11419992  
## COGNITIVO4 0.21800118 0.42660607 0.170422077 0.08557288 0.45044621  
## MATERIA5 0.07354922 0.14628331 0.505000489 0.07592648 0.09095985  
## HUMAN6 0.25412981 0.12569996 0.496149998 0.26720036 0.06538095  
## MATERIA6 0.17804051 0.24516487 0.610545311 0.15095283 0.18363614  
## HUMAN7 0.29398633 0.12303678 0.236263483 0.32292457 0.08917372  
## COGNITIVO5 0.09473921 0.40378835 0.165947010 0.02072766 0.43776794  
## HUMAN8 0.27203646 0.03848564 0.211336015 0.30553610 0.06565070  
## MATERIA8 0.09434266 0.15426963 0.493411849 0.13437706 0.08643808  
## HUMAN9 0.27151222 0.13205375 0.209136380 0.34496004 0.10403117  
## COGNITIVO6 0.12098013 0.29084588 -0.040157351 0.01661816 0.37182910  
## MATERIA9 0.21365268 0.19220221 0.456065740 0.18911823 0.19174661  
## COGEMOC1 -0.05030275 0.33539832 0.044870359 -0.09091606 0.27122023  
## MATERIA7 -0.01542868 0.14965244 0.406621087 0.01717791 0.07116272  
## COGEMOC3 -0.10258040 0.10435228 -0.045414674 -0.10589494 0.06066865  
## COGEMOC2 -0.06495553 0.19333321 -0.007380358 -0.02393128 0.24587272  
## MATERIA4 HUMAN5 COGNITIVO4 MATERIA5 HUMAN6  
## HUMAN1 0.339007869 0.310454839 0.101587755 0.224493240 0.25102591  
## COGNITIVO1 0.027075333 0.071702726 0.528042282 0.028902850 0.06293206  
## MATERIA1 0.594651544 0.299824927 0.143176431 0.598595144 0.36264030  
## MATERIA2 0.342480124 0.112616994 0.004082455 0.407845912 0.16635102  
## HUMAN2 0.459962607 0.484691587 0.119376597 0.387993840 0.52985234  
## HUMAN3 0.226809437 0.319733582 0.218001183 0.073549225 0.25412981  
## COGNITIVO2 0.275092930 0.161662741 0.426606069 0.146283314 0.12569996  
## MATERIA3 0.492901746 0.355728117 0.170422077 0.505000489 0.49615000  
## HUMAN4 0.102046477 0.417490389 0.085572883 0.075926480 0.26720036  
## COGNITIVO3 0.242875480 0.114199918 0.450446212 0.090959849 0.06538095  
## MATERIA4 1.000000000 0.277916735 0.143203792 0.454732417 0.19645215  
## HUMAN5 0.277916735 1.000000000 0.196676482 0.230041406 0.60778979  
## COGNITIVO4 0.143203792 0.196676482 1.000000000 0.181623955 0.18251206  
## MATERIA5 0.454732417 0.230041406 0.181623955 1.000000000 0.42593859  
## HUMAN6 0.196452154 0.607789794 0.182512064 0.425938586 1.00000000  
## MATERIA6 0.539121297 0.339596567 0.181071094 0.623455176 0.42208596  
## HUMAN7 0.187776564 0.497597224 0.183651566 0.280943397 0.55875212  
## COGNITIVO5 0.228908360 0.069174339 0.450053730 0.121409233 0.09874330  
## HUMAN8 0.133836178 0.369728028 0.124475249 0.116825920 0.36875454  
## MATERIA8 0.470914636 0.237806924 0.112988619 0.448383218 0.28890293  
## HUMAN9 0.144300429 0.467614811 0.154773096 0.289725980 0.39897249  
## COGNITIVO6 0.025692104 0.017957987 0.516919526 0.008858111 -0.01239094  
## MATERIA9 0.376635746 0.310088543 0.229996151 0.441353480 0.26630426  
## COGEMOC1 0.061215875 -0.062449433 0.234045804 -0.029487099 -0.07854363  
## MATERIA7 0.420184034 0.119716014 -0.014657231 0.344003982 0.09357768  
## COGEMOC3 -0.048150203 -0.083877986 0.092242805 0.043320552 -0.03546780  
## COGEMOC2 -0.007512356 -0.003717689 0.228929634 0.024447651 -0.02492291  
## MATERIA6 HUMAN7 COGNITIVO5 HUMAN8 MATERIA8  
## HUMAN1 0.272001696 0.30997105 0.07608395 0.277679424 0.231666671  
## COGNITIVO1 0.057645120 0.05942028 0.46818719 0.036164843 0.002026177  
## MATERIA1 0.591267731 0.29701340 0.14101831 0.234502195 0.549023314  
## MATERIA2 0.423539517 0.13723291 0.05512637 0.063568845 0.405072540  
## HUMAN2 0.449032314 0.51561679 0.11747381 0.421617299 0.456009615  
## HUMAN3 0.178040512 0.29398633 0.09473921 0.272036458 0.094342661  
## COGNITIVO2 0.245164873 0.12303678 0.40378835 0.038485643 0.154269634  
## MATERIA3 0.610545311 0.23626348 0.16594701 0.211336015 0.493411849  
## HUMAN4 0.150952835 0.32292457 0.02072766 0.305536100 0.134377060  
## COGNITIVO3 0.183636136 0.08917372 0.43776794 0.065650698 0.086438081  
## MATERIA4 0.539121297 0.18777656 0.22890836 0.133836178 0.470914636  
## HUMAN5 0.339596567 0.49759722 0.06917434 0.369728028 0.237806924  
## COGNITIVO4 0.181071094 0.18365157 0.45005373 0.124475249 0.112988619  
## MATERIA5 0.623455176 0.28094340 0.12140923 0.116825920 0.448383218  
## HUMAN6 0.422085962 0.55875212 0.09874330 0.368754535 0.288902926  
## MATERIA6 1.000000000 0.32511944 0.22637105 0.181596454 0.522081524  
## HUMAN7 0.325119438 1.00000000 0.17461349 0.414813738 0.225822558  
## COGNITIVO5 0.226371048 0.17461349 1.00000000 0.069732075 0.196975134  
## HUMAN8 0.181596454 0.41481374 0.06973208 1.000000000 0.162193817  
## MATERIA8 0.522081524 0.22582256 0.19697513 0.162193817 1.000000000  
## HUMAN9 0.278608297 0.36954003 0.09598608 0.297324100 0.314112271  
## COGNITIVO6 0.020817844 0.01190254 0.27210369 0.005132528 -0.121403119  
## MATERIA9 0.544949540 0.23586682 0.11985408 0.201174715 0.393836013  
## COGEMOC1 0.011258887 -0.09237033 0.36279032 -0.059466516 0.169150728  
## MATERIA7 0.426204826 0.05093745 0.12266959 0.065173708 0.512875558  
## COGEMOC3 0.007348125 -0.13343529 0.09127579 -0.230451469 -0.080531595  
## COGEMOC2 0.012677465 0.03076366 0.24155566 0.029806870 0.091357461  
## HUMAN9 COGNITIVO6 MATERIA9 COGEMOC1 MATERIA7  
## HUMAN1 0.26497250 0.021819906 0.28153074 0.03096369 0.15750594  
## COGNITIVO1 0.08202813 0.524764125 0.10754977 0.37044315 -0.14690407  
## MATERIA1 0.27271776 -0.061939599 0.45478493 0.03023081 0.45451787  
## MATERIA2 0.20356053 -0.137880285 0.22884925 0.17339946 0.46381022  
## HUMAN2 0.37079188 -0.104862214 0.38605278 0.00322006 0.34525779  
## HUMAN3 0.27151222 0.120980128 0.21365268 -0.05030275 -0.01542868  
## COGNITIVO2 0.13205375 0.290845876 0.19220221 0.33539832 0.14965244  
## MATERIA3 0.20913638 -0.040157351 0.45606574 0.04487036 0.40662109  
## HUMAN4 0.34496004 0.016618163 0.18911823 -0.09091606 0.01717791  
## COGNITIVO3 0.10403117 0.371829098 0.19174661 0.27122023 0.07116272  
## MATERIA4 0.14430043 0.025692104 0.37663575 0.06121588 0.42018403  
## HUMAN5 0.46761481 0.017957987 0.31008854 -0.06244943 0.11971601  
## COGNITIVO4 0.15477310 0.516919526 0.22999615 0.23404580 -0.01465723  
## MATERIA5 0.28972598 0.008858111 0.44135348 -0.02948710 0.34400398  
## HUMAN6 0.39897249 -0.012390942 0.26630426 -0.07854363 0.09357768  
## MATERIA6 0.27860830 0.020817844 0.54494954 0.01125889 0.42620483  
## HUMAN7 0.36954003 0.011902540 0.23586682 -0.09237033 0.05093745  
## COGNITIVO5 0.09598608 0.272103693 0.11985408 0.36279032 0.12266959  
## HUMAN8 0.29732410 0.005132528 0.20117471 -0.05946652 0.06517371  
## MATERIA8 0.31411227 -0.121403119 0.39383601 0.16915073 0.51287556  
## HUMAN9 1.00000000 -0.052702658 0.21269978 0.03160846 0.13044121  
## COGNITIVO6 -0.05270266 1.000000000 0.19528722 0.22142500 -0.26409743  
## MATERIA9 0.21269978 0.195287217 1.00000000 0.06361254 0.21570166  
## COGEMOC1 0.03160846 0.221425001 0.06361254 1.00000000 0.16629570  
## MATERIA7 0.13044121 -0.264097431 0.21570166 0.16629570 1.00000000  
## COGEMOC3 -0.06141956 0.081114482 -0.04823964 0.18473376 0.01574602  
## COGEMOC2 0.06930561 0.194303837 -0.11804250 0.32721739 0.11459135  
## COGEMOC3 COGEMOC2  
## HUMAN1 -0.130722182 -0.018295279  
## COGNITIVO1 0.114374182 0.242563620  
## MATERIA1 -0.116157249 -0.068039504  
## MATERIA2 0.033332461 0.192780661  
## HUMAN2 -0.188070013 -0.017656090  
## HUMAN3 -0.102580397 -0.064955526  
## COGNITIVO2 0.104352280 0.193333208  
## MATERIA3 -0.045414674 -0.007380358  
## HUMAN4 -0.105894941 -0.023931279  
## COGNITIVO3 0.060668646 0.245872716  
## MATERIA4 -0.048150203 -0.007512356  
## HUMAN5 -0.083877986 -0.003717689  
## COGNITIVO4 0.092242805 0.228929634  
## MATERIA5 0.043320552 0.024447651  
## HUMAN6 -0.035467802 -0.024922913  
## MATERIA6 0.007348125 0.012677465  
## HUMAN7 -0.133435293 0.030763663  
## COGNITIVO5 0.091275786 0.241555660  
## HUMAN8 -0.230451469 0.029806870  
## MATERIA8 -0.080531595 0.091357461  
## HUMAN9 -0.061419565 0.069305610  
## COGNITIVO6 0.081114482 0.194303837  
## MATERIA9 -0.048239639 -0.118042497  
## COGEMOC1 0.184733762 0.327217391  
## MATERIA7 0.015746018 0.114591349  
## COGEMOC3 1.000000000 0.078488124  
## COGEMOC2 0.078488124 1.000000000

#guardo en formato excel la matriz coropólica  
write.xlsx(R, file = "correlacion\_policoricas.xlsx", sheetName="Sheet1",   
 col.names=TRUE, row.names=TRUE , append=FALSE)

Efectivamente los KMO de todos los items som mayores a 0.70

KMO(R)

## Kaiser-Meyer-Olkin factor adequacy  
## Call: KMO(r = R)  
## Overall MSA = 0.87  
## MSA for each item =   
## HUMAN1 COGNITIVO1 MATERIA1 MATERIA2 HUMAN2 HUMAN3 COGNITIVO2   
## 0.88 0.82 0.90 0.90 0.90 0.87 0.87   
## MATERIA3 HUMAN4 COGNITIVO3 MATERIA4 HUMAN5 COGNITIVO4 MATERIA5   
## 0.90 0.85 0.85 0.88 0.87 0.88 0.87   
## HUMAN6 MATERIA6 HUMAN7 COGNITIVO5 HUMAN8 MATERIA8 HUMAN9   
## 0.82 0.93 0.88 0.85 0.92 0.92 0.89   
## COGNITIVO6 MATERIA9 COGEMOC1 MATERIA7 COGEMOC3 COGEMOC2   
## 0.78 0.87 0.77 0.88 0.75 0.70

Eliminamos los ítems del Test que considere restan la validez del modelo y halle un nuevo modelo factorial sin considerar los ítems eliminados

Se recomienda eliminar los ítems que tengan una correlación ítem subtest (ítem factor) menor a 0.65

Porcedemos a Formar los factores

MATERIA <- base %>% select(c(3, 4, 8, 11, 14, 16 ,20, 23, 25))  
HUMAN<- base %>% select(c(1 ,5 ,6 ,9, 12, 15, 17, 19, 21))  
COGNITIVO <- base %>% select(c(2, 7, 10, 13, 18, 22))  
COGEMOC <- base %>% select(c(24, 26, 27))

Validación Subtest-Test, o Factor-Test

subtest1=rowSums(MATERIA)  
subtest2=rowSums(HUMAN)  
subtest3=rowSums(COGNITIVO)  
subtest4=rowSums(COGEMOC)  
subtest=data.frame(subtest1,subtest2,subtest3,subtest4)  
Sum.total =rowSums(base)  
Subtest.test=cor(subtest,Sum.total)  
Subtest.test

## [,1]  
## subtest1 0.8138651  
## subtest2 0.7630168  
## subtest3 0.5472376  
## subtest4 0.2472438

dim(subtest)

## [1] 610 4

dim(Subtest.test)

## [1] 4 1

Validación item-subtest o item-factor

item.subtest1=cor(subtest1,MATERIA)  
item.subtest1

## MATERIA1 MATERIA2 MATERIA3 MATERIA4 MATERIA5 MATERIA6 MATERIA8  
## [1,] 0.7820594 0.6030773 0.7326941 0.6925731 0.7104634 0.7763186 0.7070939  
## MATERIA9 MATERIA7  
## [1,] 0.6029217 0.6240176

item.subtest2=cor(subtest2,HUMAN)  
item.subtest2

## HUMAN1 HUMAN2 HUMAN3 HUMAN4 HUMAN5 HUMAN6 HUMAN7  
## [1,] 0.5549122 0.6969366 0.5433276 0.5904602 0.7271854 0.6953208 0.6909575  
## HUMAN8 HUMAN9  
## [1,] 0.6005453 0.6057547

item.subtest3=cor(subtest3,COGNITIVO)  
item.subtest3

## COGNITIVO1 COGNITIVO2 COGNITIVO3 COGNITIVO4 COGNITIVO5 COGNITIVO6  
## [1,] 0.7346343 0.6942557 0.7158422 0.7462683 0.6808217 0.6625172

item.subtest4=cor(subtest4,COGEMOC)  
item.subtest4

## COGEMOC1 COGEMOC3 COGEMOC2  
## [1,] 0.7081095 0.6368601 0.6637731

Eliminamos los ítems que tengan una correlación ítem subtest (ítem factor) menor a 0.65 La nueva base consta de 18 variables al eliminar los items que tienen una correlación item subtest (ítems factor)

base2 <- base %>% select(-c(26, 1, 6, 9, 19, 21, 4, 23, 25))  
head(base2)

## # A tibble: 6 x 18  
## COGNITIVO1 MATERIA1 HUMAN2 COGNITIVO2 MATERIA3 COGNITIVO3 MATERIA4 HUMAN5  
## <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 4 2 2 2 2 3 2 2  
## 2 2 3 3 3 2 2 3 3  
## 3 3 3 2 2 1 3 3 2  
## 4 4 3 3 4 3 4 3 4  
## 5 3 3 3 3 3 3 3 2  
## 6 3 2 2 2 1 2 2 3  
## # ... with 10 more variables: COGNITIVO4 <dbl>, MATERIA5 <dbl>, HUMAN6 <dbl>,  
## # MATERIA6 <dbl>, HUMAN7 <dbl>, COGNITIVO5 <dbl>, MATERIA8 <dbl>,  
## # COGNITIVO6 <dbl>, COGEMOC1 <dbl>, COGEMOC2 <dbl>

dim(base2)

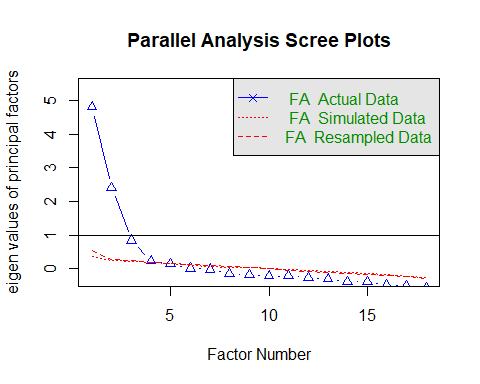
## [1] 610 18

str(base2)

## tibble [610 x 18] (S3: tbl\_df/tbl/data.frame)  
## $ COGNITIVO1: num [1:610] 4 2 3 4 3 3 5 5 3 3 ...  
## $ MATERIA1 : num [1:610] 2 3 3 3 3 2 1 3 3 2 ...  
## $ HUMAN2 : num [1:610] 2 3 2 3 3 2 1 3 2 2 ...  
## $ COGNITIVO2: num [1:610] 2 3 2 4 3 2 1 3 2 3 ...  
## $ MATERIA3 : num [1:610] 2 2 1 3 3 1 5 5 3 1 ...  
## $ COGNITIVO3: num [1:610] 3 2 3 4 3 2 1 3 4 1 ...  
## $ MATERIA4 : num [1:610] 2 3 3 3 3 2 5 3 4 4 ...  
## $ HUMAN5 : num [1:610] 2 3 2 4 2 3 1 3 2 4 ...  
## $ COGNITIVO4: num [1:610] 3 2 3 4 3 4 5 4 3 3 ...  
## $ MATERIA5 : num [1:610] 2 3 3 3 3 1 1 1 3 3 ...  
## $ HUMAN6 : num [1:610] 2 3 1 4 1 2 1 3 2 1 ...  
## $ MATERIA6 : num [1:610] 2 3 2 3 3 1 1 2 3 2 ...  
## $ HUMAN7 : num [1:610] 3 3 3 4 2 4 1 3 2 2 ...  
## $ COGNITIVO5: num [1:610] 3 3 4 4 3 1 5 3 2 2 ...  
## $ MATERIA8 : num [1:610] 1 5 1 3 3 1 5 4 3 1 ...  
## $ COGNITIVO6: num [1:610] 3 4 4 4 3 5 5 2 4 5 ...  
## $ COGEMOC1 : num [1:610] 3 3 3 4 3 2 5 4 2 2 ...  
## $ COGEMOC2 : num [1:610] 3 3 4 4 3 3 5 2 3 3 ...

Realizamos el Análisis Factorial para la base de 610 registros 18 variables (ítem).

fap=fa.parallel(base2,fa="fa",cor="poly")



## Parallel analysis suggests that the number of factors = 4 and the number of components = NA

fap

## Call: fa.parallel(x = base2, fa = "fa", cor = "poly")  
## Parallel analysis suggests that the number of factors = 4 and the number of components = NA   
##   
## Eigen Values of   
##   
## eigen values of factors  
## [1] 4.81 2.41 0.84 0.23 0.14 0.01 -0.01 -0.14 -0.17 -0.21 -0.22 -0.26  
## [13] -0.29 -0.38 -0.39 -0.47 -0.50 -0.58  
##   
## eigen values of simulated factors  
## [1] 0.37 0.26 0.22 0.18 0.15 0.11 0.08 0.05 0.03 0.00 -0.03 -0.06  
## [13] -0.09 -0.11 -0.14 -0.17 -0.21 -0.25  
##   
## eigen values of components   
## [1] 5.41 3.28 1.53 1.04 0.86 0.72 0.67 0.61 0.55 0.50 0.48 0.44 0.41 0.39 0.33  
## [16] 0.30 0.27 0.20  
##   
## eigen values of simulated components  
## [1] NA

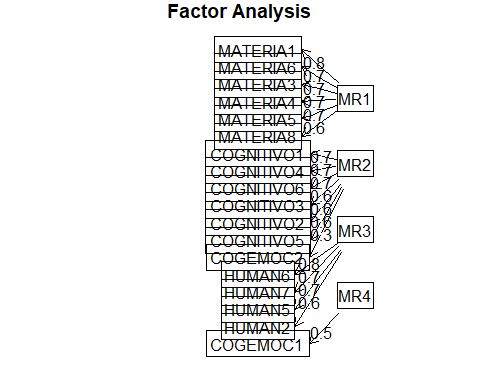
Corriendo el modelo para 4 factores

factorial4b=fa.poly(base2, nfactors=4, cor="poly",rotate="varimax")  
factorial4b

## Factor Analysis using method = minres  
## Call: fa.poly(x = base2, nfactors = 4, rotate = "varimax", cor = "poly")  
## Standardized loadings (pattern matrix) based upon correlation matrix  
## MR1 MR2 MR3 MR4 h2 u2 com  
## COGNITIVO1 -0.06 0.74 0.06 0.12 0.56 0.44 1.1  
## MATERIA1 0.82 0.01 0.21 0.02 0.71 0.29 1.1  
## HUMAN2 0.54 -0.02 0.55 0.14 0.61 0.39 2.1  
## COGNITIVO2 0.23 0.58 0.08 0.21 0.44 0.56 1.6  
## MATERIA3 0.70 0.05 0.27 0.01 0.57 0.43 1.3  
## COGNITIVO3 0.14 0.64 0.02 0.14 0.45 0.55 1.2  
## MATERIA4 0.69 0.12 0.08 0.06 0.50 0.50 1.1  
## HUMAN5 0.22 0.08 0.68 -0.03 0.52 0.48 1.2  
## COGNITIVO4 0.11 0.72 0.16 -0.04 0.56 0.44 1.2  
## MATERIA5 0.67 0.08 0.19 -0.15 0.52 0.48 1.3  
## HUMAN6 0.30 0.05 0.76 -0.10 0.67 0.33 1.4  
## MATERIA6 0.74 0.13 0.23 -0.07 0.62 0.38 1.3  
## HUMAN7 0.19 0.08 0.68 -0.01 0.50 0.50 1.2  
## COGNITIVO5 0.17 0.56 0.06 0.27 0.43 0.57 1.7  
## MATERIA8 0.65 -0.01 0.16 0.27 0.51 0.49 1.5  
## COGNITIVO6 -0.09 0.68 -0.04 -0.16 0.50 0.50 1.2  
## COGEMOC1 0.04 0.40 -0.13 0.52 0.45 0.55 2.0  
## COGEMOC2 -0.03 0.32 -0.01 0.29 0.19 0.81 2.0  
##   
## MR1 MR2 MR3 MR4  
## SS loadings 3.65 2.91 2.09 0.67  
## Proportion Var 0.20 0.16 0.12 0.04  
## Cumulative Var 0.20 0.36 0.48 0.52  
## Proportion Explained 0.39 0.31 0.22 0.07  
## Cumulative Proportion 0.39 0.70 0.93 1.00  
##   
## Mean item complexity = 1.4  
## Test of the hypothesis that 4 factors are sufficient.  
##   
## The degrees of freedom for the null model are 153 and the objective function was 7.93 with Chi Square of 4775.08  
## The degrees of freedom for the model are 87 and the objective function was 0.75   
##   
## The root mean square of the residuals (RMSR) is 0.03   
## The df corrected root mean square of the residuals is 0.04   
##   
## The harmonic number of observations is 610 with the empirical chi square 197.31 with prob < 1.5e-10   
## The total number of observations was 610 with Likelihood Chi Square = 448.77 with prob < 3.9e-50   
##   
## Tucker Lewis Index of factoring reliability = 0.862  
## RMSEA index = 0.083 and the 90 % confidence intervals are 0.075 0.09  
## BIC = -109.2  
## Fit based upon off diagonal values = 0.99  
## Measures of factor score adequacy   
## MR1 MR2 MR3 MR4  
## Correlation of (regression) scores with factors 0.93 0.92 0.88 0.72  
## Multiple R square of scores with factors 0.86 0.84 0.77 0.51  
## Minimum correlation of possible factor scores 0.72 0.68 0.54 0.03

ráfica de segmentación de factores es el grafico como se asocia los factores y preguntas

fa.diagram(factorial4b, e.size=.05,rsize=4.5)



Estimación por componentes principales de las componentes

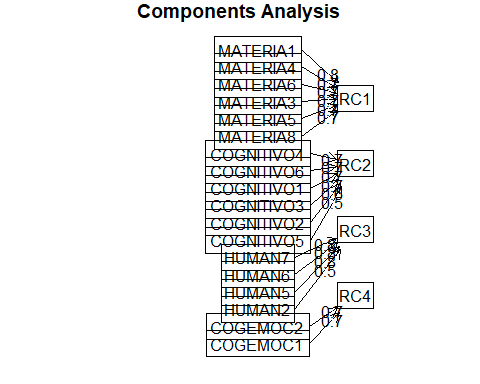
fit\_1<-principal(cor(base2),nfactors=4,rotate="varimax" )  
fit\_1$loadings

##   
## Loadings:  
## RC1 RC2 RC3 RC4   
## COGNITIVO1 0.739 0.189  
## MATERIA1 0.820 0.180   
## HUMAN2 0.542 0.550   
## COGNITIVO2 0.242 0.629 0.191  
## MATERIA3 0.721 0.245   
## COGNITIVO3 0.143 0.685 0.147  
## MATERIA4 0.749 0.142   
## HUMAN5 0.192 0.756   
## COGNITIVO4 0.745 0.172   
## MATERIA5 0.694 0.165   
## HUMAN6 0.274 0.778   
## MATERIA6 0.747 0.136 0.202   
## HUMAN7 0.132 0.788   
## COGNITIVO5 0.169 0.549 0.361  
## MATERIA8 0.668 0.127 0.339  
## COGNITIVO6 -0.114 0.745   
## COGEMOC1 0.285 -0.148 0.714  
## COGEMOC2 0.170 0.730  
##   
## RC1 RC2 RC3 RC4  
## SS loadings 3.804 3.004 2.341 1.411  
## Proportion Var 0.211 0.167 0.130 0.078  
## Cumulative Var 0.211 0.378 0.508 0.587

El modelo explica el 58,6% de la variabilidad de los datos

Mostramos el grafico de las componentes y sus items con sus respectivos factores.

fa.diagram(fit\_1, e.size=.05,rsize=4.5)



Realizamos el analisis Confirmatorio con la base de 18 items.

modelo2 <- 'HUMAN = ~ HUMAN2 + HUMAN5 + HUMAN6 + HUMAN7   
MATERIA = ~ MATERIA1 + MATERIA3 + MATERIA4 + MATERIA5 + MATERIA6 + MATERIA8   
COGNITIVO = ~ COGNITIVO1 + COGNITIVO2 + COGNITIVO3 + COGNITIVO4 + COGNITIVO5 + COGNITIVO6   
COGEMOC = ~ COGEMOC1 + COGEMOC2'

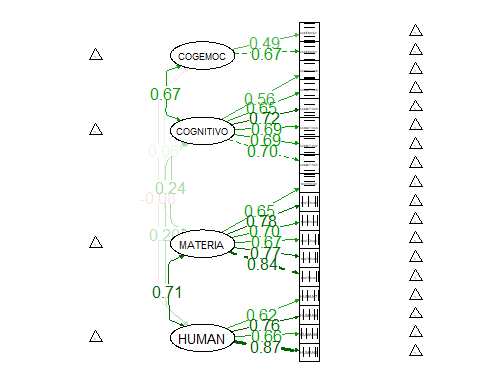
Obteniendo indicadores

fit <- cfa(modelo2, data = base2 ,ordered = TRUE)  
summary(fit, fit.measures = TRUE)

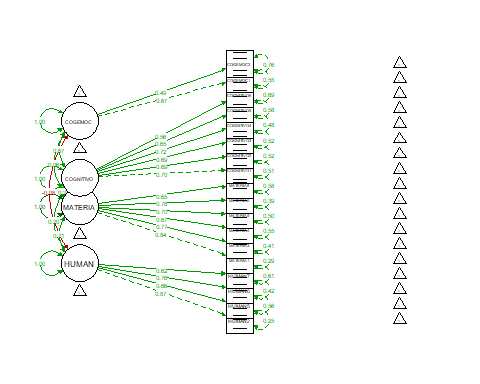
## lavaan 0.6-7 ended normally after 36 iterations  
##   
## Estimator DWLS  
## Optimization method NLMINB  
## Number of free parameters 96  
##   
## Number of observations 610  
##   
## Model Test User Model:  
## Standard Robust  
## Test Statistic 649.092 737.205  
## Degrees of freedom 129 129  
## P-value (Chi-square) 0.000 0.000  
## Scaling correction factor 0.940  
## Shift parameter 46.810  
## simple second-order correction   
##   
## Model Test Baseline Model:  
##   
## Test statistic 18711.046 7842.665  
## Degrees of freedom 153 153  
## P-value 0.000 0.000  
## Scaling correction factor 2.413  
##   
## User Model versus Baseline Model:  
##   
## Comparative Fit Index (CFI) 0.972 0.921  
## Tucker-Lewis Index (TLI) 0.967 0.906  
##   
## Robust Comparative Fit Index (CFI) NA  
## Robust Tucker-Lewis Index (TLI) NA  
##   
## Root Mean Square Error of Approximation:  
##   
## RMSEA 0.081 0.088  
## 90 Percent confidence interval - lower 0.075 0.082  
## 90 Percent confidence interval - upper 0.088 0.094  
## P-value RMSEA <= 0.05 0.000 0.000  
##   
## Robust RMSEA NA  
## 90 Percent confidence interval - lower NA  
## 90 Percent confidence interval - upper NA  
##   
## Standardized Root Mean Square Residual:  
##   
## SRMR 0.068 0.068  
##   
## Parameter Estimates:  
##   
## Standard errors Robust.sem  
## Information Expected  
## Information saturated (h1) model Unstructured  
##   
## Latent Variables:  
## Estimate Std.Err z-value P(>|z|)  
## HUMAN =~   
## HUMAN2 1.000   
## HUMAN5 0.763 0.035 21.900 0.000  
## HUMAN6 0.880 0.036 24.246 0.000  
## HUMAN7 0.720 0.036 20.111 0.000  
## MATERIA =~   
## MATERIA1 1.000   
## MATERIA3 0.909 0.024 38.560 0.000  
## MATERIA4 0.799 0.027 29.449 0.000  
## MATERIA5 0.835 0.023 36.138 0.000  
## MATERIA6 0.929 0.022 43.168 0.000  
## MATERIA8 0.769 0.028 27.624 0.000  
## COGNITIVO =~   
## COGNITIVO1 1.000   
## COGNITIVO2 0.992 0.038 25.864 0.000  
## COGNITIVO3 0.987 0.042 23.432 0.000  
## COGNITIVO4 1.029 0.039 26.284 0.000  
## COGNITIVO5 0.925 0.039 23.517 0.000  
## COGNITIVO6 0.798 0.039 20.705 0.000  
## COGEMOC =~   
## COGEMOC1 1.000   
## COGEMOC2 0.730 0.066 11.020 0.000  
##   
## Covariances:  
## Estimate Std.Err z-value P(>|z|)  
## HUMAN ~~   
## MATERIA 0.516 0.023 22.516 0.000  
## COGNITIVO 0.122 0.026 4.731 0.000  
## COGEMOC -0.046 0.033 -1.405 0.160  
## MATERIA ~~   
## COGNITIVO 0.143 0.027 5.341 0.000  
## COGEMOC 0.037 0.033 1.108 0.268  
## COGNITIVO ~~   
## COGEMOC 0.316 0.027 11.569 0.000  
##   
## Intercepts:  
## Estimate Std.Err z-value P(>|z|)  
## .HUMAN2 0.000   
## .HUMAN5 0.000   
## .HUMAN6 0.000   
## .HUMAN7 0.000   
## .MATERIA1 0.000   
## .MATERIA3 0.000   
## .MATERIA4 0.000   
## .MATERIA5 0.000   
## .MATERIA6 0.000   
## .MATERIA8 0.000   
## .COGNITIVO1 0.000   
## .COGNITIVO2 0.000   
## .COGNITIVO3 0.000   
## .COGNITIVO4 0.000   
## .COGNITIVO5 0.000   
## .COGNITIVO6 0.000   
## .COGEMOC1 0.000   
## .COGEMOC2 0.000   
## HUMAN 0.000   
## MATERIA 0.000   
## COGNITIVO 0.000   
## COGEMOC 0.000   
##   
## Thresholds:  
## Estimate Std.Err z-value P(>|z|)  
## HUMAN2|t1 -0.883 0.059 -15.052 0.000  
## HUMAN2|t2 0.021 0.051 0.405 0.686  
## HUMAN2|t3 0.908 0.059 15.342 0.000  
## HUMAN2|t4 1.536 0.080 19.236 0.000  
## HUMAN5|t1 -1.210 0.067 -18.087 0.000  
## HUMAN5|t2 -0.370 0.052 -7.103 0.000  
## HUMAN5|t3 0.414 0.052 7.905 0.000  
## HUMAN5|t4 1.310 0.070 18.641 0.000  
## HUMAN6|t1 -0.790 0.057 -13.863 0.000  
## HUMAN6|t2 -0.021 0.051 -0.405 0.686  
## HUMAN6|t3 0.746 0.056 13.255 0.000  
## HUMAN6|t4 1.414 0.074 19.027 0.000  
## HUMAN7|t1 -1.091 0.063 -17.191 0.000  
## HUMAN7|t2 -0.245 0.051 -4.769 0.000  
## HUMAN7|t3 0.724 0.056 12.949 0.000  
## HUMAN7|t4 1.549 0.081 19.243 0.000  
## MATERIA1|t1 -1.019 0.062 -16.533 0.000  
## MATERIA1|t2 0.082 0.051 1.618 0.106  
## MATERIA1|t3 1.005 0.061 16.397 0.000  
## MATERIA1|t4 1.703 0.089 19.114 0.000  
## MATERIA3|t1 -0.830 0.058 -14.388 0.000  
## MATERIA3|t2 -0.016 0.051 -0.324 0.746  
## MATERIA3|t3 0.830 0.058 14.388 0.000  
## MATERIA3|t4 1.403 0.074 18.995 0.000  
## MATERIA4|t1 -1.098 0.064 -17.254 0.000  
## MATERIA4|t2 -0.053 0.051 -1.052 0.293  
## MATERIA4|t3 0.824 0.058 14.313 0.000  
## MATERIA4|t4 1.606 0.083 19.241 0.000  
## MATERIA5|t1 -1.054 0.062 -16.867 0.000  
## MATERIA5|t2 -0.258 0.051 -5.011 0.000  
## MATERIA5|t3 0.515 0.053 9.660 0.000  
## MATERIA5|t4 1.381 0.073 18.926 0.000  
## MATERIA6|t1 -1.040 0.062 -16.734 0.000  
## MATERIA6|t2 -0.132 0.051 -2.588 0.010  
## MATERIA6|t3 0.853 0.058 14.685 0.000  
## MATERIA6|t4 1.536 0.080 19.236 0.000  
## MATERIA8|t1 -0.414 0.052 -7.905 0.000  
## MATERIA8|t2 0.078 0.051 1.537 0.124  
## MATERIA8|t3 0.883 0.059 15.052 0.000  
## MATERIA8|t4 1.437 0.075 19.085 0.000  
## COGNITIVO1|t1 -1.841 0.099 -18.685 0.000  
## COGNITIVO1|t2 -1.026 0.062 -16.601 0.000  
## COGNITIVO1|t3 0.296 0.052 5.736 0.000  
## COGNITIVO1|t4 1.381 0.073 18.926 0.000  
## COGNITIVO2|t1 -1.291 0.070 -18.549 0.000  
## COGNITIVO2|t2 -0.348 0.052 -6.702 0.000  
## COGNITIVO2|t3 0.847 0.058 14.611 0.000  
## COGNITIVO2|t4 1.621 0.084 19.231 0.000  
## COGNITIVO3|t1 -1.414 0.074 -19.027 0.000  
## COGNITIVO3|t2 -0.539 0.054 -10.057 0.000  
## COGNITIVO3|t3 0.708 0.056 12.718 0.000  
## COGNITIVO3|t4 1.669 0.087 19.176 0.000  
## COGNITIVO4|t1 -1.523 0.079 -19.226 0.000  
## COGNITIVO4|t2 -0.740 0.056 -13.179 0.000  
## COGNITIVO4|t3 0.326 0.052 6.300 0.000  
## COGNITIVO4|t4 1.414 0.074 19.027 0.000  
## COGNITIVO5|t1 -1.054 0.062 -16.867 0.000  
## COGNITIVO5|t2 -0.186 0.051 -3.639 0.000  
## COGNITIVO5|t3 0.740 0.056 13.179 0.000  
## COGNITIVO5|t4 1.703 0.089 19.114 0.000  
## COGNITIVO6|t1 -1.841 0.099 -18.685 0.000  
## COGNITIVO6|t2 -1.185 0.066 -17.919 0.000  
## COGNITIVO6|t3 -0.190 0.051 -3.720 0.000  
## COGNITIVO6|t4 0.889 0.059 15.125 0.000  
## COGEMOC1|t1 -1.371 0.073 -18.889 0.000  
## COGEMOC1|t2 -0.361 0.052 -6.943 0.000  
## COGEMOC1|t3 0.641 0.055 11.709 0.000  
## COGEMOC1|t4 1.592 0.083 19.247 0.000  
## COGEMOC2|t1 -1.392 0.073 -18.961 0.000  
## COGEMOC2|t2 -0.582 0.054 -10.768 0.000  
## COGEMOC2|t3 0.539 0.054 10.057 0.000  
## COGEMOC2|t4 1.437 0.075 19.085 0.000  
##   
## Variances:  
## Estimate Std.Err z-value P(>|z|)  
## .HUMAN2 0.250   
## .HUMAN5 0.563   
## .HUMAN6 0.419   
## .HUMAN7 0.611   
## .MATERIA1 0.289   
## .MATERIA3 0.412   
## .MATERIA4 0.546   
## .MATERIA5 0.504   
## .MATERIA6 0.387   
## .MATERIA8 0.579   
## .COGNITIVO1 0.510   
## .COGNITIVO2 0.517   
## .COGNITIVO3 0.523   
## .COGNITIVO4 0.481   
## .COGNITIVO5 0.581   
## .COGNITIVO6 0.688   
## .COGEMOC1 0.551   
## .COGEMOC2 0.761   
## HUMAN 0.750 0.040 18.760 0.000  
## MATERIA 0.711 0.025 28.118 0.000  
## COGNITIVO 0.490 0.033 15.077 0.000  
## COGEMOC 0.449 0.050 9.048 0.000  
##   
## Scales y\*:  
## Estimate Std.Err z-value P(>|z|)  
## HUMAN2 1.000   
## HUMAN5 1.000   
## HUMAN6 1.000   
## HUMAN7 1.000   
## MATERIA1 1.000   
## MATERIA3 1.000   
## MATERIA4 1.000   
## MATERIA5 1.000   
## MATERIA6 1.000   
## MATERIA8 1.000   
## COGNITIVO1 1.000   
## COGNITIVO2 1.000   
## COGNITIVO3 1.000   
## COGNITIVO4 1.000   
## COGNITIVO5 1.000   
## COGNITIVO6 1.000   
## COGEMOC1 1.000   
## COGEMOC2 1.000

Gráfico de senderos

library(semPlot)  
library(semTools)  
  
semPaths(fit, "std", rotation = 2, layout = "tree2", nCharNodes = 0,   
 sizeLat= 14, sizeLat2 = 6, sizeMan = 4.3,  
 mar=c(2,6,2,4), curvePivot = TRUE,  
 edge.label.cex=1.5,residuals = F)



semPaths(fit, what="std",residuals = T, rotation = 2,nCharNodes = 0,fade=F,sizeMan = 6)



## 5° Escriba con sus coeficientes, el mejor modelo factorial que han encontrado.

El mejor modelo es con 4 factores y 18 variables por que tienen explica el 58,6% de la variabilidad de los datos que es mejor al de los anteriores.

HUMAN = 1HUMAN2 + 0,763HUMAN5 + 0.880 HUMAN6 + 0.720HUMAN7

MATERIA = 1MATERIA1 + 0.909MATERIA3 + 0.799MATERIA4 + 0.835MATERIA5 + 0.929MATERIA6 + 0.769MATERIA8

COGNITIVO = 1COGNITIVO1 + 0.992COGNITIVO2 + 0.987COGNITIVO3 + 1.029COGNITIVO4 + 0.925COGNITIVO5 + 0.798COGNITIVO6

COGEMOC = 1COGEMOC1 + 0.730COGEMOC1