R Notebook

This is an [R Markdown](http://rmarkdown.rstudio.com) Notebook. When you execute code within the notebook, the results appear beneath the code.

Try executing this chunk by clicking the *Run* button within the chunk or by placing your cursor inside it and pressing *Ctrl+Shift+Enter*.

#install necessary publishing packages   
  
tinytex::install\_tinytex()

## Warning in download.file(url, output, ..., method = method): URL 'http://  
## mirror.ctan.org/systems/texlive/tlnet/install-tl.zip': status was 'Couldn't  
## resolve proxy name'

## Warning in download.file(url, output, ..., method = method): URL 'https://  
## yihui.name/gh/tinytex/tools/pkgs-custom.txt': status was 'Couldn't resolve  
## proxy name'

## Warning in download.file(url, output, ..., method = method): URL 'https://  
## yihui.name/gh/tinytex/tools/tinytex.profile': status was 'Couldn't resolve  
## proxy name'

## Starting to install TinyTeX to C:\Users\PANUPIND\AppData\Roaming/TinyTeX. It will take a few minutes.

## Next you may see two error dialog boxes about the missing luatex.dll, and an error message like "Use of uninitialized value in bitwise or (|)..." in the end. These messages can be ignored.

## Warning in shell("install-tl-windows.bat -no-gui -profile=../  
## tinytex.profile", : 'install-tl-windows.bat -no-gui -profile=../  
## tinytex.profile' execution failed with error code 314

## Warning in file.remove("TinyTeX/install-tl.log"): cannot remove file  
## 'TinyTeX/install-tl.log', reason 'No such file or directory'

## Warning in system2(bin\_tlmgr, ...): '"bin/win32/tlmgr"' not found  
  
## Warning in system2(bin\_tlmgr, ...): '"bin/win32/tlmgr"' not found

## Warning in system2(bin, c("conf", "auxtrees", "add", r\_texmf\_path())):  
## '"bin/win32/tlmgr"' not found

## TinyTeX installed to C:\Users\PANUPIND\AppData\Roaming/TinyTeX

## Please quit and reopen your R session and IDE (if you are using one, such as RStudio or Emacs) and check if tinytex:::is\_tinytex() is TRUE.

library(tinytex)

library(readr)  
cerealDRO <- read\_csv("D:/Prasanna/Personal/Learning/Other Reads/GL/Course Material/Advanced Statistics/DataSets/cereal.csv")

## Parsed with column specification:  
## cols(  
## .default = col\_double(),  
## Cereals = col\_character()  
## )

## See spec(...) for full column specifications.

View(cerealDRO)  
summary(cerealDRO)

## Cereals Filling Natural Fibre   
## Length:235 Min. :1.000 Min. :1.000 Min. :1.000   
## Class :character 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:3.000   
## Mode :character Median :4.000 Median :4.000 Median :4.000   
## Mean :3.881 Mean :3.783 Mean :3.528   
## 3rd Qu.:4.500 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000   
## Sweet Easy Salt Satisfying   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :2.000   
## 1st Qu.:2.000 1st Qu.:4.000 1st Qu.:1.000 1st Qu.:3.000   
## Median :2.000 Median :5.000 Median :2.000 Median :4.000   
## Mean :2.506 Mean :4.532 Mean :1.991 Mean :4.004   
## 3rd Qu.:3.000 3rd Qu.:5.000 3rd Qu.:3.000 3rd Qu.:5.000   
## Max. :5.000 Max. :6.000 Max. :4.000 Max. :6.000   
## Energy Fun Kids Soggy   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.000 1st Qu.:3.000 1st Qu.:1.000   
## Median :4.000 Median :2.000 Median :4.000 Median :2.000   
## Mean :3.643 Mean :2.617 Mean :3.843 Mean :2.255   
## 3rd Qu.:4.000 3rd Qu.:3.000 3rd Qu.:5.000 3rd Qu.:3.000   
## Max. :5.000 Max. :5.000 Max. :6.000 Max. :5.000   
## Economical Health Family Calories   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.000   
## Median :3.000 Median :4.000 Median :4.000 Median :3.000   
## Mean :3.217 Mean :3.809 Mean :3.877 Mean :2.702   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:5.000 3rd Qu.:3.000   
## Max. :5.000 Max. :5.000 Max. :6.000 Max. :5.000   
## Plain Crisp Regular Sugar   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:1.000 1st Qu.:2.000 1st Qu.:2.000 1st Qu.:1.000   
## Median :2.000 Median :3.000 Median :3.000 Median :2.000   
## Mean :2.268 Mean :3.204 Mean :3.072 Mean :2.145   
## 3rd Qu.:3.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.000   
## Max. :5.000 Max. :6.000 Max. :5.000 Max. :5.000   
## Fruit Process Quality Treat   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.00   
## 1st Qu.:1.000 1st Qu.:2.000 1st Qu.:3.000 1st Qu.:2.00   
## Median :1.000 Median :3.000 Median :4.000 Median :3.00   
## Mean :1.694 Mean :2.936 Mean :3.694 Mean :2.63   
## 3rd Qu.:3.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.00   
## Max. :5.000 Max. :6.000 Max. :5.000 Max. :6.00   
## Boring Nutritious   
## Min. :1.00 Min. :1.000   
## 1st Qu.:1.00 1st Qu.:3.000   
## Median :2.00 Median :4.000   
## Mean :1.83 Mean :3.664   
## 3rd Qu.:2.00 3rd Qu.:4.000   
## Max. :5.00 Max. :5.000

head(cerealDRO)

## # A tibble: 6 x 26  
## Cereals Filling Natural Fibre Sweet Easy Salt Satisfying Energy Fun  
## <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 Weetab~ 5 5 5 1 2 1 5 4 1  
## 2 Specia~ 1 2 2 1 5 2 5 1 1  
## 3 Specia~ 5 4 5 5 5 3 5 5 5  
## 4 CMuesli 5 5 5 3 5 2 5 5 5  
## 5 CornFl~ 4 5 3 2 5 2 5 4 5  
## 6 RiceBu~ 4 4 4 2 5 2 5 4 5  
## # ... with 16 more variables: Kids <dbl>, Soggy <dbl>, Economical <dbl>,  
## # Health <dbl>, Family <dbl>, Calories <dbl>, Plain <dbl>, Crisp <dbl>,  
## # Regular <dbl>, Sugar <dbl>, Fruit <dbl>, Process <dbl>, Quality <dbl>,  
## # Treat <dbl>, Boring <dbl>, Nutritious <dbl>

tail(cerealDRO)

## # A tibble: 6 x 26  
## Cereals Filling Natural Fibre Sweet Easy Salt Satisfying Energy Fun  
## <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 PMuesli 4 4 4 3 4 2 4 3 2  
## 2 Weetab~ 3 4 4 1 4 2 3 3 2  
## 3 PMuesli 5 4 4 3 4 3 4 4 4  
## 4 Weetab~ 4 4 4 1 4 1 4 4 3  
## 5 Specia~ 3 3 3 3 4 2 3 3 2  
## 6 Weetab~ 4 4 4 1 4 1 4 3 2  
## # ... with 16 more variables: Kids <dbl>, Soggy <dbl>, Economical <dbl>,  
## # Health <dbl>, Family <dbl>, Calories <dbl>, Plain <dbl>, Crisp <dbl>,  
## # Regular <dbl>, Sugar <dbl>, Fruit <dbl>, Process <dbl>, Quality <dbl>,  
## # Treat <dbl>, Boring <dbl>, Nutritious <dbl>

# Some data transformations as likert scale exceeds 5 point scale and has a value of 6  
cerealDRO[cerealDRO==6]<- 5  
cerealDRO

## # A tibble: 235 x 26  
## Cereals Filling Natural Fibre Sweet Easy Salt Satisfying Energy Fun  
## <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 Weetab~ 5 5 5 1 2 1 5 4 1  
## 2 Specia~ 1 2 2 1 5 2 5 1 1  
## 3 Specia~ 5 4 5 5 5 3 5 5 5  
## 4 CMuesli 5 5 5 3 5 2 5 5 5  
## 5 CornFl~ 4 5 3 2 5 2 5 4 5  
## 6 RiceBu~ 4 4 4 2 5 2 5 4 5  
## 7 Specia~ 4 4 3 2 5 1 5 5 5  
## 8 Specia~ 4 3 3 2 5 1 5 4 4  
## 9 RiceBu~ 4 3 3 2 5 1 5 4 4  
## 10 CornFl~ 4 3 3 2 5 1 5 4 4  
## # ... with 225 more rows, and 16 more variables: Kids <dbl>, Soggy <dbl>,  
## # Economical <dbl>, Health <dbl>, Family <dbl>, Calories <dbl>,  
## # Plain <dbl>, Crisp <dbl>, Regular <dbl>, Sugar <dbl>, Fruit <dbl>,  
## # Process <dbl>, Quality <dbl>, Treat <dbl>, Boring <dbl>,  
## # Nutritious <dbl>

cerealDR<-cerealDRO[-1]  
  
  
attach(cerealDR)

# perform certain tests on the data to find if   
# \*\* Sample is adequate - using KMO test of sample adequecy  
# \*\* Dimensionality reduction possible - barlett test of Sphericity  
  
library(psych)

## Warning: package 'psych' was built under R version 3.6.1

cerealKMO <- KMO(cerealDR)  
cerealKMO

## Kaiser-Meyer-Olkin factor adequacy  
## Call: KMO(r = cerealDR)  
## Overall MSA = 0.85  
## MSA for each item =   
## Filling Natural Fibre Sweet Easy Salt   
## 0.89 0.90 0.88 0.78 0.83 0.82   
## Satisfying Energy Fun Kids Soggy Economical   
## 0.91 0.91 0.85 0.67 0.63 0.73   
## Health Family Calories Plain Crisp Regular   
## 0.92 0.73 0.86 0.82 0.83 0.87   
## Sugar Fruit Process Quality Treat Boring   
## 0.78 0.77 0.80 0.91 0.88 0.87   
## Nutritious   
## 0.92

cerealCor <- round(cor(cerealDR),2)  
cerealBartlett <- cortest.bartlett(cerealCor, n = nrow(cerealDRO))  
cerealBartlett

## $chisq  
## [1] 2878.65  
##   
## $p.value  
## [1] 0  
##   
## $df  
## [1] 300

library(corrplot)

## Warning: package 'corrplot' was built under R version 3.6.1

## corrplot 0.84 loaded

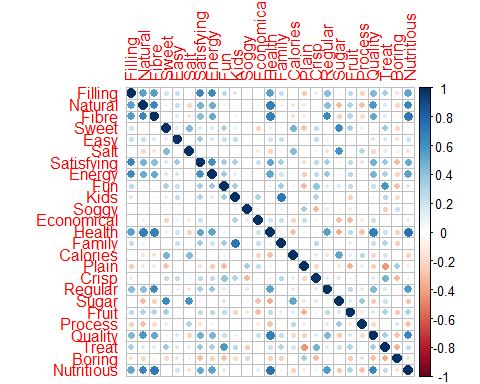
# Find out of pca can be applied based on the cor between variables and corrplot  
  
# decide number of fctors by using scree plot  
names(cerealDR)

## [1] "Filling" "Natural" "Fibre" "Sweet" "Easy"   
## [6] "Salt" "Satisfying" "Energy" "Fun" "Kids"   
## [11] "Soggy" "Economical" "Health" "Family" "Calories"   
## [16] "Plain" "Crisp" "Regular" "Sugar" "Fruit"   
## [21] "Process" "Quality" "Treat" "Boring" "Nutritious"

cor(cerealDR)

## Filling Natural Fibre Sweet Easy  
## Filling 1.00000000 0.53968982 0.552003065 0.19040004 0.237430844  
## Natural 0.53968982 1.00000000 0.652289828 -0.09094192 0.231200127  
## Fibre 0.55200307 0.65228983 1.000000000 -0.03739830 0.175859374  
## Sweet 0.19040004 -0.09094192 -0.037398300 1.00000000 0.124736166  
## Easy 0.23743084 0.23120013 0.175859374 0.12473617 1.000000000  
## Salt -0.03626646 -0.21687200 -0.174887993 0.44399118 0.013718595  
## Satisfying 0.65415162 0.46649207 0.414854460 0.17953203 0.351409453  
## Energy 0.63675882 0.49354159 0.503730689 0.18496133 0.181689577  
## Fun 0.26521397 0.08190321 0.062730827 0.32722313 0.239504083  
## Kids 0.16032166 0.05971495 -0.093404569 0.11908175 0.242728223  
## Soggy -0.05988555 0.06839973 -0.041667404 -0.08375192 -0.007683385  
## Economical 0.05194244 0.10316137 -0.033965332 -0.23981376 0.089328985  
## Health 0.54706871 0.68809770 0.683983690 -0.11562213 0.204213278  
## Family 0.23367398 0.10674234 -0.008412267 0.03853504 0.225122821  
## Calories 0.04721422 -0.16167366 -0.186542023 0.46731243 -0.022805607  
## Plain -0.25064803 -0.13851302 -0.122845902 -0.28955897 0.019140316  
## Crisp 0.12687526 0.02080611 0.050527459 0.25981733 0.240631080  
## Regular 0.42049880 0.41763842 0.648375681 -0.02518025 0.106329931  
## Sugar -0.07851945 -0.31680448 -0.225567250 0.64838267 -0.015639984  
## Fruit 0.26116604 0.30015027 0.293141065 0.34650542 0.035884483  
## Process -0.23419509 -0.30805266 -0.194892706 0.11450985 -0.066393291  
## Quality 0.44321697 0.57909956 0.513193764 -0.07754712 0.164648484  
## Treat 0.33983991 0.16989309 0.142593245 0.37467405 0.184731541  
## Boring -0.17785084 -0.21758679 -0.099258673 -0.20033406 -0.169705127  
## Nutritious 0.52621459 0.65072607 0.713064954 -0.04716005 0.204448721  
## Salt Satisfying Energy Fun Kids  
## Filling -0.03626646 0.654151625 0.63675882 0.265213973 0.160321662  
## Natural -0.21687200 0.466492067 0.49354159 0.081903207 0.059714946  
## Fibre -0.17488799 0.414854460 0.50373069 0.062730827 -0.093404569  
## Sweet 0.44399118 0.179532033 0.18496133 0.327223134 0.119081748  
## Easy 0.01371860 0.351409453 0.18168958 0.239504083 0.242728223  
## Salt 1.00000000 -0.012745988 -0.06713581 0.033474536 0.024483803  
## Satisfying -0.01274599 1.000000000 0.60343285 0.348331252 0.302769921  
## Energy -0.06713581 0.603432845 1.00000000 0.350327368 0.129792406  
## Fun 0.03347454 0.348331252 0.35032737 1.000000000 0.344943414  
## Kids 0.02448380 0.302769921 0.12979241 0.344943414 1.000000000  
## Soggy 0.02359707 -0.013261427 -0.04592438 -0.098754958 0.088859520  
## Economical -0.12590486 0.212175296 0.02641362 0.040700477 0.303934597  
## Health -0.22837678 0.522089653 0.52424330 0.100955593 -0.013620606  
## Family -0.08943424 0.345222020 0.19090292 0.347184634 0.724116120  
## Calories 0.43809745 0.005358204 0.03362541 0.113449859 0.009721636  
## Plain 0.02137203 -0.179957988 -0.25577344 -0.322275476 0.030241379  
## Crisp 0.09550574 0.264086144 0.24855721 0.398694869 0.293709966  
## Regular -0.16453021 0.331811073 0.38571918 0.136731512 -0.025734500  
## Sugar 0.59177089 -0.091413804 -0.08606954 0.165290744 -0.022348181  
## Fruit 0.02557426 0.254831721 0.27438372 0.251421273 -0.234295492  
## Process 0.29832766 -0.187033511 -0.10393584 -0.009329038 0.013964254  
## Quality -0.21785225 0.471768623 0.45703627 0.224503157 0.111778573  
## Treat 0.12062176 0.370353239 0.32363505 0.584648136 0.275914643  
## Boring 0.11223148 -0.319654672 -0.22338882 -0.298063613 -0.195340193  
## Nutritious -0.16009606 0.501680164 0.53577674 0.155230301 0.033247503  
## Soggy Economical Health Family Calories  
## Filling -0.059885555 0.05194244 0.547068708 0.233673983 0.047214217  
## Natural 0.068399728 0.10316137 0.688097695 0.106742337 -0.161673661  
## Fibre -0.041667404 -0.03396533 0.683983690 -0.008412267 -0.186542023  
## Sweet -0.083751919 -0.23981376 -0.115622126 0.038535041 0.467312428  
## Easy -0.007683385 0.08932898 0.204213278 0.225122821 -0.022805607  
## Salt 0.023597066 -0.12590486 -0.228376777 -0.089434239 0.438097454  
## Satisfying -0.013261427 0.21217530 0.522089653 0.345222020 0.005358204  
## Energy -0.045924383 0.02641362 0.524243298 0.190902922 0.033625413  
## Fun -0.098754958 0.04070048 0.100955593 0.347184634 0.113449859  
## Kids 0.088859520 0.30393460 -0.013620606 0.724116120 0.009721636  
## Soggy 1.000000000 0.11715122 0.006146656 0.082666210 -0.079664961  
## Economical 0.117151217 1.00000000 0.192658638 0.231987240 -0.210471442  
## Health 0.006146656 0.19265864 1.000000000 0.081719400 -0.307176155  
## Family 0.082666210 0.23198724 0.081719400 1.000000000 -0.066136936  
## Calories -0.079664961 -0.21047144 -0.307176155 -0.066136936 1.000000000  
## Plain 0.346129827 0.23120114 -0.099609317 -0.028206729 -0.076190855  
## Crisp -0.337141180 0.09084745 0.082185293 0.279076456 0.143389460  
## Regular -0.137300090 0.08029354 0.543222577 0.044234462 -0.164908655  
## Sugar -0.094456381 -0.29255416 -0.376892968 -0.061661312 0.525826174  
## Fruit -0.137035700 -0.33848391 0.266341061 -0.125689029 0.125937859  
## Process 0.059960688 -0.12910943 -0.292763907 -0.027407092 0.271275078  
## Quality -0.029808614 0.21549364 0.686304848 0.236893992 -0.201350145  
## Treat -0.256086894 -0.04241349 0.215207088 0.290905323 0.189949931  
## Boring 0.226885825 -0.02137835 -0.228589063 -0.249748195 -0.027015687  
## Nutritious 0.032786390 0.12902808 0.757614796 0.091035941 -0.226340067  
## Plain Crisp Regular Sugar Fruit  
## Filling -0.25064803 0.12687526 0.42049880 -0.078519448 0.26116604  
## Natural -0.13851302 0.02080611 0.41763842 -0.316804483 0.30015027  
## Fibre -0.12284590 0.05052746 0.64837568 -0.225567250 0.29314106  
## Sweet -0.28955897 0.25981733 -0.02518025 0.648382667 0.34650542  
## Easy 0.01914032 0.24063108 0.10632993 -0.015639984 0.03588448  
## Salt 0.02137203 0.09550574 -0.16453021 0.591770895 0.02557426  
## Satisfying -0.17995799 0.26408614 0.33181107 -0.091413804 0.25483172  
## Energy -0.25577344 0.24855721 0.38571918 -0.086069535 0.27438372  
## Fun -0.32227548 0.39869487 0.13673151 0.165290744 0.25142127  
## Kids 0.03024138 0.29370997 -0.02573450 -0.022348181 -0.23429549  
## Soggy 0.34612983 -0.33714118 -0.13730009 -0.094456381 -0.13703570  
## Economical 0.23120114 0.09084745 0.08029354 -0.292554157 -0.33848391  
## Health -0.09960932 0.08218529 0.54322258 -0.376892968 0.26634106  
## Family -0.02820673 0.27907646 0.04423446 -0.061661312 -0.12568903  
## Calories -0.07619086 0.14338946 -0.16490865 0.525826174 0.12593786  
## Plain 1.00000000 -0.21020347 -0.08026008 -0.146856923 -0.34308629  
## Crisp -0.21020347 1.00000000 0.13442586 0.163766199 0.08983357  
## Regular -0.08026008 0.13442586 1.00000000 -0.090571672 0.25474509  
## Sugar -0.14685692 0.16376620 -0.09057167 1.000000000 0.14533048  
## Fruit -0.34308629 0.08983357 0.25474509 0.145330476 1.00000000  
## Process 0.11507418 0.01001031 -0.15015168 0.365692112 -0.14246201  
## Quality -0.22690816 0.13014529 0.44147633 -0.263389434 0.16460384  
## Treat -0.43243767 0.46023136 0.16807989 0.212715048 0.31404638  
## Boring 0.33052554 -0.32640996 -0.09469787 -0.000921067 -0.26006170  
## Nutritious -0.14491592 0.10308733 0.56777612 -0.274637388 0.30605745  
## Process Quality Treat Boring Nutritious  
## Filling -0.234195089 0.44321697 0.33983991 -0.177850835 0.52621459  
## Natural -0.308052665 0.57909956 0.16989309 -0.217586787 0.65072607  
## Fibre -0.194892706 0.51319376 0.14259324 -0.099258673 0.71306495  
## Sweet 0.114509852 -0.07754712 0.37467405 -0.200334059 -0.04716005  
## Easy -0.066393291 0.16464848 0.18473154 -0.169705127 0.20444872  
## Salt 0.298327658 -0.21785225 0.12062176 0.112231476 -0.16009606  
## Satisfying -0.187033511 0.47176862 0.37035324 -0.319654672 0.50168016  
## Energy -0.103935835 0.45703627 0.32363505 -0.223388817 0.53577674  
## Fun -0.009329038 0.22450316 0.58464814 -0.298063613 0.15523030  
## Kids 0.013964254 0.11177857 0.27591464 -0.195340193 0.03324750  
## Soggy 0.059960688 -0.02980861 -0.25608689 0.226885825 0.03278639  
## Economical -0.129109427 0.21549364 -0.04241349 -0.021378353 0.12902808  
## Health -0.292763907 0.68630485 0.21520709 -0.228589063 0.75761480  
## Family -0.027407092 0.23689399 0.29090532 -0.249748195 0.09103594  
## Calories 0.271275078 -0.20135015 0.18994993 -0.027015687 -0.22634007  
## Plain 0.115074182 -0.22690816 -0.43243767 0.330525544 -0.14491592  
## Crisp 0.010010306 0.13014529 0.46023136 -0.326409963 0.10308733  
## Regular -0.150151681 0.44147633 0.16807989 -0.094697872 0.56777612  
## Sugar 0.365692112 -0.26338943 0.21271505 -0.000921067 -0.27463739  
## Fruit -0.142462009 0.16460384 0.31404638 -0.260061699 0.30605745  
## Process 1.000000000 -0.19001149 0.01515335 0.172489361 -0.28600488  
## Quality -0.190011494 1.00000000 0.33178455 -0.284256014 0.65983453  
## Treat 0.015153345 0.33178455 1.00000000 -0.362789133 0.24507215  
## Boring 0.172489361 -0.28425601 -0.36278913 1.000000000 -0.17027548  
## Nutritious -0.286004881 0.65983453 0.24507215 -0.170275481 1.00000000

corrplot(cor(cerealDR[,1:25]))



# determine the eigen vectors , eigen values for factanal   
  
  
ev\_cereal <- eigen(cor(cerealDR))  
ev\_cereal$values

## [1] 6.5104814 3.7921753 2.4942279 1.6821942 1.0856935 0.9450867 0.8532528  
## [8] 0.7910547 0.7326378 0.6977062 0.6481540 0.5507242 0.5314532 0.4874731  
## [15] 0.4168149 0.3869282 0.3640988 0.3608730 0.3061363 0.2755866 0.2628312  
## [22] 0.2428432 0.2183801 0.1986326 0.1645601

ev\_cereal$vectors

## [,1] [,2] [,3] [,4] [,5]  
## [1,] -0.29285459 -0.05139409 0.045409527 -0.175648940 0.106614756  
## [2,] -0.29384807 0.13150198 0.083040197 -0.100833688 0.138611833  
## [3,] -0.28676859 0.12325577 0.209966110 -0.138184774 -0.155324216  
## [4,] -0.03486923 -0.39831897 0.116796675 -0.143001498 0.154591053  
## [5,] -0.13603565 -0.07291661 -0.170910671 -0.121281672 -0.007026231  
## [6,] 0.08725627 -0.27991620 0.085980305 -0.373389879 -0.126813529  
## [7,] -0.29196256 -0.08223422 -0.107925154 -0.152312576 0.100997940  
## [8,] -0.28531936 -0.06952512 0.045003598 -0.131068073 0.028696506  
## [9,] -0.16114260 -0.27028143 -0.161871944 0.112617668 0.078372162  
## [10,] -0.08552043 -0.12885811 -0.497711494 -0.083795548 0.082365615  
## [11,] 0.04325508 0.14197831 -0.113098093 -0.445775202 0.479082529  
## [12,] -0.06284624 0.14661039 -0.365664977 -0.083323195 -0.236908886  
## [13,] -0.31835812 0.16118563 0.079395593 -0.067819269 -0.074382717  
## [14,] -0.12427041 -0.09916419 -0.459987956 -0.018756915 0.137393730  
## [15,] 0.06717069 -0.32372681 0.110174550 -0.216081155 0.008979861  
## [16,] 0.12908891 0.20761248 -0.157870081 -0.373618430 -0.143241202  
## [17,] -0.12114750 -0.25169679 -0.170565346 0.185222116 -0.401702990  
## [18,] -0.24298554 0.07468047 0.141557209 -0.069080151 -0.380912863  
## [19,] 0.09965488 -0.38370090 0.142313814 -0.201216417 -0.095145307  
## [20,] -0.15440271 -0.14759467 0.341705163 0.110951866 0.282132033  
## [21,] 0.13360770 -0.15469780 -0.003885401 -0.263300887 -0.338965585  
## [22,] -0.29457315 0.07984503 -0.023597039 0.009659106 -0.087750860  
## [23,] -0.19025098 -0.30172672 -0.059524060 0.150368084 -0.059429586  
## [24,] 0.16227646 0.15225240 0.083992978 -0.333826657 -0.157534280  
## [25,] -0.31615368 0.11601325 0.101720598 -0.113944917 -0.067841201  
## [,6] [,7] [,8] [,9] [,10]  
## [1,] 0.009038229 0.232001835 -0.40564065 -0.001396871 0.056356574  
## [2,] 0.056985629 0.012786365 0.05494239 -0.209887304 -0.076729074  
## [3,] -0.010400046 -0.147993546 -0.11939952 0.017489690 -0.177213252  
## [4,] 0.113867163 0.070455816 0.08503921 0.178174996 -0.129890292  
## [5,] 0.667213308 -0.478178111 -0.05484785 -0.162995363 0.248070462  
## [6,] 0.108633229 0.210054344 0.21956446 0.029372130 -0.030735229  
## [7,] 0.124262735 0.182044735 -0.10959549 -0.079050274 0.126774346  
## [8,] -0.128165682 0.111673347 -0.29720319 -0.103775264 0.231035177  
## [9,] -0.174510455 -0.229952078 0.07084376 0.353433117 0.389537622  
## [10,] -0.103296954 -0.025064069 -0.13874980 0.050557913 -0.298248970  
## [11,] -0.172960659 -0.173112172 0.31068692 0.103462609 0.074472606  
## [12,] 0.076357089 0.457954109 0.34927259 0.161852635 0.223018780  
## [13,] 0.008823887 0.023322155 0.19281379 -0.074569352 0.016116395  
## [14,] -0.199416918 -0.119621435 -0.17177050 0.001844428 -0.368886062  
## [15,] 0.043547250 0.279803207 -0.10075852 -0.258828064 -0.024494864  
## [16,] 0.232025764 -0.119899560 0.09664799 0.094374742 -0.173444809  
## [17,] 0.186209692 -0.032004580 0.02633833 0.061079255 0.002872429  
## [18,] -0.075781365 -0.141713807 -0.04687467 0.358736951 -0.344961429  
## [19,] -0.006543944 -0.005160841 0.11359068 0.113234835 -0.189833307  
## [20,] 0.051179676 -0.184820448 0.18880719 0.178366853 -0.069937477  
## [21,] -0.409388675 -0.364238642 0.04623460 -0.480055999 0.130693249  
## [22,] -0.225255220 0.042404947 0.30707676 -0.205996744 0.045922577  
## [23,] -0.190089601 -0.072889118 0.15493389 0.064487856 0.197801478  
## [24,] -0.153027200 -0.061898163 -0.36126905 0.418454372 0.358578334  
## [25,] -0.036577878 -0.033731016 0.16742866 0.066327818 -0.030076890  
## [,11] [,12] [,13] [,14] [,15]  
## [1,] -0.05274779 -0.10904935 -0.07981082 0.107921139 -0.110511682  
## [2,] -0.05393988 0.28142389 -0.11016453 -0.082539898 0.271528464  
## [3,] -0.04105435 0.03474143 0.01423228 -0.138980054 -0.019417744  
## [4,] -0.04978617 -0.22731081 0.08215589 -0.214245056 0.132180965  
## [5,] -0.22964067 -0.11373408 -0.18825845 -0.086219624 0.056329980  
## [6,] -0.35237234 0.15812470 0.28193888 0.305657728 -0.206209981  
## [7,] 0.12374771 -0.23178654 0.10795805 0.348172994 0.030770878  
## [8,] 0.28330069 -0.11704402 0.34711084 -0.159813549 -0.107341422  
## [9,] 0.16677061 -0.04922232 -0.16261506 -0.062665541 -0.311895622  
## [10,] -0.11592676 0.10768219 -0.02288115 0.037780033 0.132445514  
## [11,] 0.12136198 0.02962409 0.17063283 -0.348240239 0.033681191  
## [12,] 0.09787957 -0.26093674 -0.20459812 0.005331482 0.355604331  
## [13,] -0.04151516 0.03970035 0.09936475 0.095855733 -0.073244886  
## [14,] -0.08378184 0.05909883 -0.01238341 0.141353460 0.090141676  
## [15,] 0.31049900 0.34254251 -0.51960153 -0.232945713 0.010584958  
## [16,] 0.45760275 0.17898596 -0.05528350 0.261421299 -0.378469127  
## [17,] 0.26096107 0.35814023 0.46467864 -0.246859672 0.226728845  
## [18,] 0.10322994 -0.26230042 -0.24306934 -0.104406287 -0.037700979  
## [19,] -0.14794283 -0.21838844 -0.03673022 -0.140807670 0.009967933  
## [20,] 0.30171517 0.06723503 -0.04969529 0.462158730 0.426944399  
## [21,] 0.13218019 -0.23819214 0.02042100 0.172508960 0.226725534  
## [22,] -0.22482742 0.06357529 -0.15906582 -0.108669207 -0.102236370  
## [23,] -0.12404091 0.29969902 -0.17857493 0.190914125 -0.181140271  
## [24,] -0.22668556 0.29863269 -0.06020401 0.063226193 0.329862621  
## [25,] -0.10530462 0.15551916 0.07998859 -0.054759944 -0.010442231  
## [,16] [,17] [,18] [,19] [,20]  
## [1,] 0.0549156765 0.278004369 -0.18752287 -0.26833338 0.02234677  
## [2,] -0.3789771728 0.166998143 0.22277481 -0.43702867 0.01641254  
## [3,] -0.2134089769 0.196930812 -0.02526099 0.08115654 0.33927240  
## [4,] 0.2935698461 0.305706645 0.38065148 0.16940641 0.11953529  
## [5,] 0.0286110539 -0.091127738 -0.03185584 0.05670740 -0.19129165  
## [6,] -0.3792975263 -0.218119663 -0.07159137 0.01006288 -0.12096714  
## [7,] 0.1703554099 -0.136965724 -0.31276496 0.07833149 0.41239861  
## [8,] -0.0443221306 -0.157287631 0.31439929 0.06066031 -0.51904924  
## [9,] -0.3442405764 -0.171811904 0.18182374 -0.13526566 0.32355996  
## [10,] -0.1887294537 0.089323733 0.20312995 0.35579135 0.06470506  
## [11,] 0.0177569125 0.066105774 -0.41923787 -0.01484279 -0.07585444  
## [12,] -0.1323076977 0.101837893 0.05183278 -0.02052020 -0.11712867  
## [13,] 0.1238501475 0.108736364 0.08113743 0.00696172 -0.01580855  
## [14,] 0.1440253711 -0.242530192 -0.03114240 -0.21886778 -0.14337074  
## [15,] -0.0009608895 -0.200780992 -0.12146555 0.20315861 0.02120677  
## [16,] 0.2047159907 0.142681146 0.28313103 -0.13478606 0.02653506  
## [17,] 0.1057367068 -0.006965651 -0.21022232 -0.17405483 0.12575884  
## [18,] -0.0987462677 -0.117210123 -0.28316081 0.04828242 -0.26977868  
## [19,] 0.1180967899 -0.051180071 0.04527764 -0.39533193 0.01630266  
## [20,] 0.0063100759 -0.166446044 0.04920102 0.01064424 -0.12741578  
## [21,] -0.0714214070 0.137202946 0.01621678 0.04306877 0.07819036  
## [22,] 0.4245776412 -0.362041746 0.16040925 -0.15970197 0.08859079  
## [23,] 0.1627435939 0.511864797 -0.20380697 0.07567808 -0.31613690  
## [24,] 0.2177198432 -0.089731166 0.10051784 -0.03077240 0.04517495  
## [25,] 0.0431070287 -0.124845876 0.07173264 0.46109341 0.08817621  
## [,21] [,22] [,23] [,24] [,25]  
## [1,] 0.41627245 0.124199390 0.4133347821 -0.230175946 -0.0166428976  
## [2,] -0.33454436 0.051300742 0.0279861994 0.041962022 0.3153238019  
## [3,] 0.18317110 -0.276737402 -0.5033314993 -0.189387642 -0.3442383572  
## [4,] 0.10050868 0.227140773 -0.2133757141 -0.002960624 0.3306523009  
## [5,] 0.05437654 -0.004595285 -0.0062111685 -0.022078835 -0.0457984778  
## [6,] 0.12014933 0.158558136 -0.1307568246 -0.089564428 0.0677680369  
## [7,] -0.46461245 -0.037011569 -0.1501048736 0.079057100 0.0966579328  
## [8,] -0.14140263 -0.111960414 -0.1145541744 -0.055245417 -0.1162050638  
## [9,] 0.10479285 0.045881247 0.0365785242 0.102029851 0.0644997278  
## [10,] -0.22055131 0.245319111 0.2481025826 -0.082649032 -0.3938654500  
## [11,] 0.01168852 0.068732414 -0.0005031334 -0.041053358 -0.0647323760  
## [12,] 0.15980192 -0.178303380 -0.0900288161 -0.067245671 -0.0602348619  
## [13,] 0.19168086 0.226203386 0.0373840589 0.767312044 -0.2697536602  
## [14,] 0.30858129 -0.266562208 -0.2718887740 0.186007508 0.2483536524  
## [15,] 0.09371501 0.004658622 -0.0571477120 0.160238810 -0.0347055397  
## [16,] -0.04734456 -0.040896841 0.0273790324 -0.124913778 0.0319100995  
## [17,] 0.07621909 0.108183588 0.0976974182 -0.062029794 -0.0009366069  
## [18,] -0.17763245 0.304503661 0.0047256839 0.021922065 0.1879897244  
## [19,] -0.25212362 -0.421362540 0.2675135313 0.136316786 -0.3375407581  
## [20,] 0.14422123 0.024315949 0.0442349035 -0.159736110 -0.2174892455  
## [21,] 0.10190094 0.058846979 0.0911817408 -0.010438451 0.1175643915  
## [22,] -0.01903325 0.260649595 -0.0602238842 -0.379800169 -0.1355389183  
## [23,] -0.21071476 -0.151129847 -0.1492079883 -0.052485333 0.0057567216  
## [24,] -0.07720142 0.049527031 -0.0656175775 0.085900118 -0.0092214579  
## [25,] 0.08228211 -0.461216699 0.4525233284 -0.023638885 0.3320569301

# Determine the factors , and choose appropriate as per scree plot , elbow and Kaizen rules  
library(nFactors)

## Warning: package 'nFactors' was built under R version 3.6.1

## Loading required package: MASS

## Loading required package: boot

##   
## Attaching package: 'boot'

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

## Loading required package: lattice

##   
## Attaching package: 'lattice'

## The following object is masked from 'package:boot':  
##   
## melanoma

##   
## Attaching package: 'nFactors'

## The following object is masked from 'package:lattice':  
##   
## parallel

library(lattice)  
library(latticeExtra)

## Warning: package 'latticeExtra' was built under R version 3.6.1

## Loading required package: RColorBrewer

?parallel

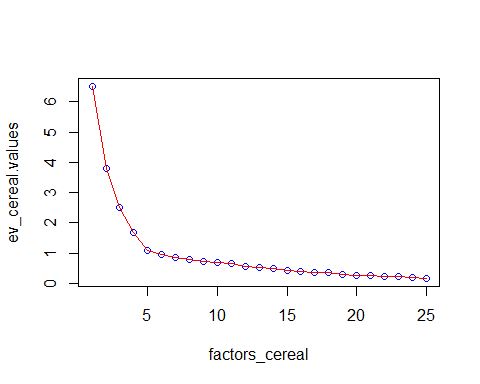
## starting httpd help server ...

## done

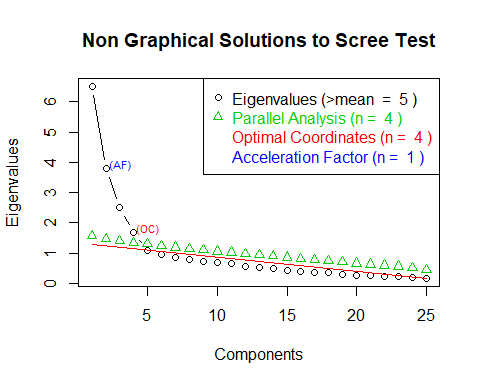
factors\_cereal <- c(1:25)  
scree\_cereal <- data.frame(factors\_cereal , ev\_cereal$values)   
scree\_cereal

## factors\_cereal ev\_cereal.values  
## 1 1 6.5104814  
## 2 2 3.7921753  
## 3 3 2.4942279  
## 4 4 1.6821942  
## 5 5 1.0856935  
## 6 6 0.9450867  
## 7 7 0.8532528  
## 8 8 0.7910547  
## 9 9 0.7326378  
## 10 10 0.6977062  
## 11 11 0.6481540  
## 12 12 0.5507242  
## 13 13 0.5314532  
## 14 14 0.4874731  
## 15 15 0.4168149  
## 16 16 0.3869282  
## 17 17 0.3640988  
## 18 18 0.3608730  
## 19 19 0.3061363  
## 20 20 0.2755866  
## 21 21 0.2628312  
## 22 22 0.2428432  
## 23 23 0.2183801  
## 24 24 0.1986326  
## 25 25 0.1645601

plot( scree\_cereal , col ="Blue")  
lines(scree\_cereal, col ="Red")



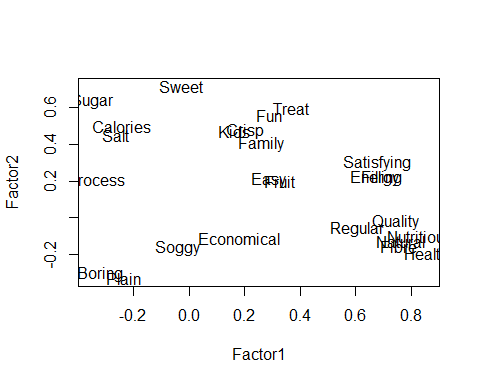
#parallel\_cereal <- fa.parallel(cerealDR , fm="ml",fa="fa")  
  
parallel\_cereal <- parallel(nrow(cerealDR), ncol(cerealDR), rep = 100 , cent = 0.05 )  
  
ns\_cereal <- nScree(x = ev\_cereal$values,aparallel = parallel\_cereal$eigen$qevpea )  
plotnScree(ns\_cereal)



# Performing Factor analysis using factanal function  
  
set.seed(100)  
library(nFactors)  
  
punrotate\_cereal <- factanal( x = cerealDR, factors = 4 , rotation = "none")  
  
print(punrotate\_cereal , digits = 3 , cutoff = 0.4 , sort = TRUE)

##   
## Call:  
## factanal(x = cerealDR, factors = 4, rotation = "none")  
##   
## Uniquenesses:  
## Filling Natural Fibre Sweet Easy Salt   
## 0.444 0.388 0.312 0.353 0.846 0.511   
## Satisfying Energy Fun Kids Soggy Economical   
## 0.432 0.486 0.528 0.230 0.773 0.724   
## Health Family Calories Plain Crisp Regular   
## 0.224 0.348 0.591 0.551 0.680 0.588   
## Sugar Fruit Process Quality Treat Boring   
## 0.261 0.564 0.795 0.436 0.419 0.669   
## Nutritious   
## 0.268   
##   
## Loadings:  
## Factor1 Factor2 Factor3 Factor4  
## Filling 0.697   
## Natural 0.765   
## Fibre 0.759   
## Satisfying 0.679   
## Energy 0.673   
## Health 0.855   
## Regular 0.609   
## Quality 0.748   
## Nutritious 0.834   
## Sweet 0.718   
## Fun 0.562   
## Sugar 0.642 0.403   
## Treat 0.598   
## Kids 0.473 -0.710   
## Family 0.404 -0.648   
## Easy   
## Salt 0.452   
## Soggy 0.409   
## Economical -0.464   
## Calories 0.498   
## Plain 0.469   
## Crisp 0.476   
## Fruit 0.491   
## Process   
## Boring   
##   
## Factor1 Factor2 Factor3 Factor4  
## SS loadings 6.016 3.318 2.112 1.132  
## Proportion Var 0.241 0.133 0.084 0.045  
## Cumulative Var 0.241 0.373 0.458 0.503  
##   
## Test of the hypothesis that 4 factors are sufficient.  
## The chi square statistic is 398.19 on 206 degrees of freedom.  
## The p-value is 2.3e-14

# plot the results of factor analysis to determine grouping of factors and name   
# current weightage of factors without rotation doesnt not help in identifying the names for the columns  
ucr\_load <- punrotate\_cereal$loadings[,1:2]  
plot(ucr\_load , type = "n" )   
text(ucr\_load , labels = row.names(ucr\_load))



# compute the factor scores using loadings without rotation  
library(psych)  
punrotate\_cereal$loadings

##   
## Loadings:  
## Factor1 Factor2 Factor3 Factor4  
## Filling 0.697 0.218 0.121   
## Natural 0.765 -0.127   
## Fibre 0.759 -0.156 0.254 0.149   
## Sweet 0.718 0.351   
## Easy 0.290 0.209 -0.139   
## Salt -0.260 0.452 0.274 0.376   
## Satisfying 0.679 0.303   
## Energy 0.673 0.221 0.100   
## Fun 0.289 0.562 -0.100 -0.248   
## Kids 0.165 0.473 -0.710 0.125   
## Soggy -0.161 -0.181 0.409   
## Economical 0.181 -0.112 -0.464 0.124   
## Health 0.855 -0.191   
## Family 0.261 0.404 -0.648   
## Calories -0.242 0.498 0.281 0.153   
## Plain -0.232 -0.332 -0.253 0.469   
## Crisp 0.202 0.476 -0.210   
## Regular 0.609 0.177   
## Sugar -0.349 0.642 0.403 0.205   
## Fruit 0.328 0.201 0.491 -0.215   
## Process -0.333 0.211 0.213   
## Quality 0.748   
## Treat 0.370 0.598 -0.293   
## Boring -0.320 -0.308 0.361   
## Nutritious 0.834 0.121 0.105   
##   
## Factor1 Factor2 Factor3 Factor4  
## SS loadings 6.016 3.318 2.112 1.132  
## Proportion Var 0.241 0.133 0.084 0.045  
## Cumulative Var 0.241 0.373 0.458 0.503

factorScores\_punrotate\_cereal <- factor.scores( cerealDR , f = punrotate\_cereal$loadings)  
factorScores\_punrotate\_cereal

## $scores  
## Factor1 Factor2 Factor3 Factor4  
## [1,] 1.42809657 -1.587370800 -0.859953716 1.412239931  
## [2,] -1.79324007 -0.325642052 -2.274802818 0.370559869  
## [3,] 1.59420267 1.593635359 0.075365107 0.528159175  
## [4,] 1.95481570 0.775600090 0.081872352 -0.544110179  
## [5,] 1.10558546 0.460079555 -0.723729548 -1.491704446  
## [6,] 0.86210348 1.058107480 -0.981304956 -1.167232535  
## [7,] 1.10575584 0.940723184 -1.105566967 -1.546581425  
## [8,] 0.24433843 0.052305376 -1.519203265 -0.953699377  
## [9,] 0.24433843 0.052305376 -1.519203265 -0.953699377  
## [10,] 0.24433843 0.052305376 -1.519203265 -0.953699377  
## [11,] 0.41421287 -1.549709709 -0.369508431 1.338763040  
## [12,] -0.07540467 -0.218235771 0.741912098 0.728383832  
## [13,] -0.62660691 1.804215748 0.992206953 1.251880515  
## [14,] -0.56618131 1.849693723 0.499153399 1.131988974  
## [15,] 0.38378856 2.355209505 0.045396744 0.852734778  
## [16,] 0.15222405 -0.663839412 1.140564428 -0.319778541  
## [17,] -1.43932428 0.956064247 -1.808482982 -1.746891554  
## [18,] 0.07681061 0.670565917 -0.619195923 1.362086767  
## [19,] 1.09199592 -0.752748593 -0.562698343 1.449441150  
## [20,] -0.90606043 0.957769192 3.129386645 1.143560790  
## [21,] -0.06355161 0.272601685 1.150260581 1.071899345  
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## [23,] 1.25228549 -0.638209020 1.936880761 -1.823602498  
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## [25,] 1.06774710 0.193236981 0.921636689 -0.417346082  
## [26,] -0.08200937 -0.462880739 -0.254538124 1.908778867  
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## [29,] -0.23958107 -1.307890685 0.788788360 -1.626548009  
## [30,] -0.39378685 0.160952350 -1.209773279 -0.639395750  
## [31,] -0.34185986 1.367278223 -0.472769530 -0.684391220  
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## [36,] -1.25665923 -0.133671117 -1.868596871 -0.422454166  
## [37,] -0.19341053 1.972628070 0.347195971 -0.328264707  
## [38,] -0.26413880 1.918196879 0.868017475 0.014055808  
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## [40,] -0.22373392 0.483119959 -1.101513865 1.906092398  
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## [193,] -0.61923395 0.298329101 -0.721682243 0.737961526  
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## [231,] 0.01118654 -1.145328615 -0.676833837 0.633011168  
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## [233,] 0.32030424 -0.881454048 -0.397396948 -0.333957516  
## [234,] -0.76995526 -0.690088393 0.352362777 -0.071166968  
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##   
## $weights  
## Factor1 Factor2 Factor3 Factor4  
## Filling 0.092319949 0.055202956 0.02997842 0.10457947  
## Natural 0.116057098 -0.036975605 0.02378575 0.08055350  
## Fibre 0.143028875 -0.056228599 0.12533980 0.18340463  
## Sweet -0.004599539 0.228591637 0.15291270 0.09681019  
## Easy 0.020167786 0.027829867 -0.02525053 0.03833452  
## Salt -0.029867162 0.099538720 0.08233443 0.28227671  
## Satisfying 0.092302029 0.078755995 -0.03061508 0.07881874  
## Energy 0.081369826 0.051206148 0.03164880 0.03608062  
## Fun 0.032181183 0.119763569 -0.02915500 -0.18030657  
## Kids 0.042310824 0.231670595 -0.47563360 0.20842688  
## Soggy -0.003029909 -0.023447343 -0.03595520 0.20297649  
## Economical 0.014712388 -0.017433571 -0.09851023 0.06601036  
## Health 0.224825137 -0.096064718 0.05620708 0.08946418  
## Family 0.044078527 0.130881751 -0.28677772 0.02594768  
## Calories -0.024058042 0.094937214 0.07313701 0.09975319  
## Plain -0.024781888 -0.067822532 -0.07069604 0.32701795  
## Crisp 0.017431521 0.078748626 -0.02141019 -0.11848091  
## Regular 0.060912513 -0.010858206 0.04634340 0.05635648  
## Sugar -0.078647833 0.276407152 0.23730176 0.30076623  
## Fruit 0.034209866 0.040018285 0.13385805 -0.14634899  
## Process -0.024626270 0.029828680 0.01322163 0.10296435  
## Quality 0.100928336 -0.004872182 -0.01389387 -0.05249647  
## Treat 0.051934758 0.160599926 0.01552934 -0.26857729  
## Boring -0.028112193 -0.051705510 0.01297790 0.20716685  
## Nutritious 0.182952657 -0.041885609 0.06926885 0.15075724  
##   
## $r.scores  
## Factor1 Factor2 Factor3 Factor4  
## Factor1 1.000000e+00 1.290634e-15 -2.428613e-16 -1.637579e-15  
## Factor2 1.249001e-15 1.000000e+00 1.955901e-15 2.407796e-15  
## Factor3 -2.532696e-16 1.879573e-15 1.000000e+00 -1.318390e-16  
## Factor4 -1.686151e-15 2.419072e-15 -1.405126e-16 1.000000e+00  
##   
## $missing  
## [1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [36] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [71] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [106] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [141] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [176] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [211] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
##   
## $R2  
## [1] 0.9710279 0.9453244 0.9260466 0.8262652

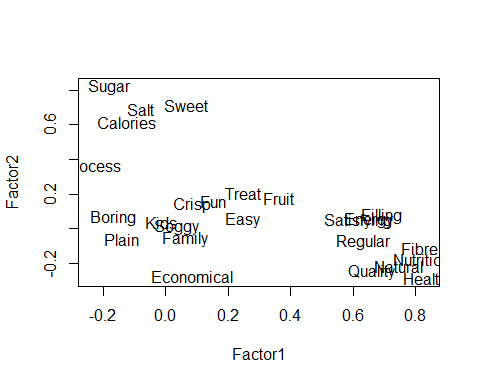
# rotate the factors and compute the factor scores to group and name the factors appropriately  
protate\_cereal <- factanal( x = cerealDR, factors = 4 , rotation = "varimax")  
protate\_cereal

##   
## Call:  
## factanal(x = cerealDR, factors = 4, rotation = "varimax")  
##   
## Uniquenesses:  
## Filling Natural Fibre Sweet Easy Salt   
## 0.444 0.388 0.312 0.353 0.846 0.511   
## Satisfying Energy Fun Kids Soggy Economical   
## 0.432 0.486 0.528 0.230 0.773 0.724   
## Health Family Calories Plain Crisp Regular   
## 0.224 0.348 0.591 0.551 0.680 0.588   
## Sugar Fruit Process Quality Treat Boring   
## 0.261 0.564 0.795 0.436 0.419 0.669   
## Nutritious   
## 0.268   
##   
## Loadings:  
## Factor1 Factor2 Factor3 Factor4  
## Filling 0.693 0.179 0.195   
## Natural 0.749 -0.215   
## Fibre 0.814 -0.114 -0.108   
## Sweet 0.715 0.358   
## Easy 0.248 0.290   
## Salt 0.691   
## Satisfying 0.618 0.213 0.370   
## Energy 0.652 0.239 0.167   
## Fun 0.152 0.160 0.534 0.371   
## Kids 0.876   
## Soggy -0.455 0.135   
## Economical -0.271 -0.205 0.391   
## Health 0.831 -0.287   
## Family 0.126 0.793   
## Calories -0.123 0.613 0.134   
## Plain -0.138 -0.647   
## Crisp 0.141 0.441 0.313   
## Regular 0.634   
## Sugar -0.181 0.821 0.166   
## Fruit 0.364 0.174 0.438 -0.284   
## Process -0.236 0.367 -0.122   
## Quality 0.663 -0.247 0.190 0.165   
## Treat 0.250 0.206 0.632 0.277   
## Boring -0.169 -0.509 -0.198   
## Nutritious 0.834 -0.174   
##   
## Factor1 Factor2 Factor3 Factor4  
## SS loadings 5.202 2.629 2.400 2.347  
## Proportion Var 0.208 0.105 0.096 0.094  
## Cumulative Var 0.208 0.313 0.409 0.503  
##   
## Test of the hypothesis that 4 factors are sufficient.  
## The chi square statistic is 398.19 on 206 degrees of freedom.  
## The p-value is 2.3e-14

print(protate\_cereal, digits = 3 , cutoff = 0.4 , sort = TRUE)

##   
## Call:  
## factanal(x = cerealDR, factors = 4, rotation = "varimax")  
##   
## Uniquenesses:  
## Filling Natural Fibre Sweet Easy Salt   
## 0.444 0.388 0.312 0.353 0.846 0.511   
## Satisfying Energy Fun Kids Soggy Economical   
## 0.432 0.486 0.528 0.230 0.773 0.724   
## Health Family Calories Plain Crisp Regular   
## 0.224 0.348 0.591 0.551 0.680 0.588   
## Sugar Fruit Process Quality Treat Boring   
## 0.261 0.564 0.795 0.436 0.419 0.669   
## Nutritious   
## 0.268   
##   
## Loadings:  
## Factor1 Factor2 Factor3 Factor4  
## Filling 0.693   
## Natural 0.749   
## Fibre 0.814   
## Satisfying 0.618   
## Energy 0.652   
## Health 0.831   
## Regular 0.634   
## Quality 0.663   
## Nutritious 0.834   
## Sweet 0.715   
## Salt 0.691   
## Calories 0.613   
## Sugar 0.821   
## Fun 0.534   
## Plain -0.647   
## Treat 0.632   
## Boring -0.509   
## Kids 0.876   
## Family 0.793   
## Easy   
## Soggy -0.455   
## Economical   
## Crisp 0.441   
## Fruit 0.438   
## Process   
##   
## Factor1 Factor2 Factor3 Factor4  
## SS loadings 5.202 2.629 2.400 2.347  
## Proportion Var 0.208 0.105 0.096 0.094  
## Cumulative Var 0.208 0.313 0.409 0.503  
##   
## Test of the hypothesis that 4 factors are sufficient.  
## The chi square statistic is 398.19 on 206 degrees of freedom.  
## The p-value is 2.3e-14

# Plot to name the factors  
cr\_load <- protate\_cereal$loadings[,1:2]  
plot(cr\_load , type = "n" )   
text(cr\_load , labels = row.names(cr\_load))



factorScores\_protate\_cereal <- factor.scores(cerealDR, protate\_cereal$loadings)  
factorScores\_protate\_cereal

## $scores  
## Factor1 Factor2 Factor3 Factor4  
## [1,] 1.542033783 -1.174834975 -1.816593232 0.484800476  
## [2,] -2.135678381 -0.617665792 -1.267986992 1.443388710  
## [3,] 1.585876602 1.019213365 0.749753953 1.117969747  
## [4,] 1.646080038 -0.169402225 1.271851914 0.608058370  
## [5,] 0.395532252 -1.002334740 1.546028145 0.794754865  
## [6,] 0.174669185 -0.475516836 1.493580253 1.304146272  
## [7,] 0.264141255 -0.860013233 1.768617427 1.335832153  
## [8,] -0.442706009 -1.168311649 0.570664077 1.180406697  
## [9,] -0.442706009 -1.168311649 0.570664077 1.180406697  
## [10,] -0.442706009 -1.168311649 0.570664077 1.180406697  
## [11,] 0.713315985 -0.711282555 -1.863251030 -0.124693534  
## [12,] 0.336979188 0.551454407 -0.581289438 -0.615414442  
## [13,] -0.026168060 2.486287929 -0.030488007 0.127546829  
## [14,] -0.134896759 2.224482140 0.012112461 0.553006919  
## [15,] 0.527199554 2.005254118 0.617860583 1.320146884  
## [16,] 0.371658119 -0.153590465 0.157650281 -1.296312869  
## [17,] -2.324955471 -0.624512899 1.267609610 1.380465722  
## [18,] 0.269129693 0.842497476 -0.852272418 1.088871621  
## [19,] 1.292520335 -0.349744213 -1.432130244 0.576773558  
## [20,] 0.274036635 2.860134351 -0.046718378 -2.140423365  
## [21,] 0.535176573 1.245550168 -0.527700880 -0.658893536  
## [22,] -0.005553968 0.782883618 -1.926999912 -1.992733900  
## [23,] 1.171644973 -0.788223574 1.767376391 -1.983657025  
## [24,] 0.465932544 -0.586044312 1.748199857 0.465690171  
## [25,] 1.102895305 0.077907007 0.834072816 -0.531875278  
## [26,] 0.409684026 0.510575950 -1.846840313 0.299770898  
## [27,] 0.409598739 -1.150831519 0.766684886 -1.303353960  
## [28,] -1.238821930 -1.383586643 0.169991223 -1.187007974  
## [29,] -0.427943920 -1.305543950 0.733253512 -1.615729222  
## [30,] -0.865559512 -0.640304355 0.293822232 0.898797874  
## [31,] -0.677313176 0.506961345 1.100328841 0.867025820  
## [32,] 1.803560702 -0.152540410 -0.925679308 -1.490969369  
## [33,] 0.094158955 0.289997105 1.596061632 1.344443269  
## [34,] 0.794048412 -0.944071351 0.715613218 0.855873866  
## [35,] 0.837327225 -1.156315061 -0.064443774 0.059685789  
## [36,] -1.763511366 -0.821417020 -0.338674940 1.169522638  
## [37,] -0.245464383 1.437966541 1.307694821 0.564717286  
## [38,] -0.076128532 1.816925918 1.083540138 0.147735926  
## [39,] -0.398490978 1.762311632 1.135581117 -0.655991453  
## [40,] 0.024611256 0.834937420 -1.541685974 1.433687879  
## [41,] 1.939198010 2.018187725 0.936396285 0.720131860  
## [42,] 1.070723143 0.428341213 0.637125573 -0.269059391  
## [43,] 0.695621927 0.055111473 -0.967878550 -0.299956590  
## [44,] 1.373818557 -0.130616654 0.249026182 1.019674715  
## [45,] 1.392514452 -1.080868708 1.403532748 1.124199538  
## [46,] 1.530607295 -0.651645072 -0.734603434 -0.099496013  
## [47,] 0.019608960 -0.662586474 0.264229266 -1.644353770  
## [48,] 0.238182549 -0.147369342 0.078839355 -1.549923579  
## [49,] -0.211305248 0.455092308 -0.213009154 -1.305317192  
## [50,] -0.191957869 -1.069060939 1.150184886 -2.683491359  
## [51,] 0.089706434 -0.494537635 0.494280287 -2.569622473  
## [52,] -1.717359082 -1.341070169 -0.338131499 1.095309229  
## [53,] -3.874172976 -1.039266702 2.327762333 0.329655825  
## [54,] 0.707756978 -1.028205546 -0.706993275 0.203637666  
## [55,] -0.527863001 1.184993562 0.169452852 0.112966011  
## [56,] 0.725215369 -0.536444854 -0.863554475 1.132438918  
## [57,] 0.171547416 -0.269714887 1.547277397 -1.361419739  
## [58,] 1.568496474 -0.030090806 1.344131651 0.900583681  
## [59,] -1.173211999 -1.104679917 0.082578342 0.421524343  
## [60,] 0.590742151 0.161991490 1.345917549 0.194096708  
## [61,] 0.030380979 -0.302225990 -0.482411179 0.339623426  
## [62,] 0.005674706 0.292229107 0.314952687 0.217148140  
## [63,] 0.962400424 -1.016502902 0.624125776 -2.025606835  
## [64,] 1.437918896 1.462295913 1.556239947 -0.579946976  
## [65,] -0.212624428 -1.201380170 -0.597987632 0.709655483  
## [66,] -1.009722750 -0.771375828 -1.035544439 -0.165525293  
## [67,] 1.428331503 -1.152365032 -0.766552154 1.332540468  
## [68,] 0.158563836 -1.178513207 1.943360774 1.432753034  
## [69,] -0.850844372 1.022183291 1.239203863 0.813817315  
## [70,] -1.661150697 -1.571932692 0.800298950 1.046251137  
## [71,] 0.613717269 -1.222801434 -0.109805407 0.989371702  
## [72,] 0.398127445 -0.645168507 0.075438754 1.190694651  
## [73,] -0.497930794 0.620966781 -1.923003447 1.040796209  
## [74,] 1.801996577 0.736428178 -0.368286447 -2.188130371  
## [75,] -0.005525948 -0.470146282 0.034005211 -2.245301134  
## [76,] -2.728174379 -1.209667229 0.567724103 -2.344635571  
## [77,] 0.788579704 1.303848524 -0.741785447 -0.884002282  
## [78,] -0.692057423 0.884781573 -0.278058560 -1.247743789  
## [79,] 1.765130518 -0.175632809 -1.322339340 1.143760627  
## [80,] -2.455356987 0.466855718 -0.008381127 0.071931300  
## [81,] 0.347019216 -1.215847745 0.756972645 -0.793623683  
## [82,] -1.144163088 -1.583111663 0.380338796 -2.487424430  
## [83,] -0.486409657 0.051849361 -0.422097356 -0.904538525  
## [84,] -0.865980669 1.860133941 -0.698838456 -1.103690396  
## [85,] -2.033049478 3.447244720 -1.410949755 -0.999041672  
## [86,] 1.205994671 -1.228085057 -0.307983476 -0.852795811  
## [87,] 0.179509858 1.139470276 1.441027911 1.484545751  
## [88,] 1.120866018 1.320056091 -0.884240638 -0.303259076  
## [89,] 0.320088094 -0.541738518 -1.081053289 -0.316436526  
## [90,] -0.419014189 -1.446460644 1.419681374 -0.776486990  
## [91,] -1.763707296 1.303942295 1.313475500 0.134462081  
## [92,] 0.646613791 0.050476818 -1.981655426 0.381384185  
## [93,] 0.706010625 -0.215928272 -0.447988063 -1.225663400  
## [94,] 0.271081005 -0.707535510 0.142364532 0.487435905  
## [95,] 0.284036180 0.151121344 -0.475842561 -0.149158116  
## [96,] -1.619334069 -1.630276029 0.871751987 0.060809025  
## [97,] 0.231155730 -0.245389940 0.448176116 -0.111953852  
## [98,] 0.455088048 0.017541205 0.339192656 -0.679681912  
## [99,] -0.217705071 -1.503908862 -0.530633611 -0.847885118  
## [100,] 0.402741716 1.542794067 1.626508735 0.333022445  
## [101,] 0.245448508 1.528632180 1.768350468 0.665951114  
## [102,] 0.073007010 -1.373361519 -0.527094150 -0.532967111  
## [103,] 0.073007010 -1.373361519 -0.527094150 -0.532967111  
## [104,] 0.699537841 0.778243596 0.747349191 -0.688245860  
## [105,] 0.639079191 -0.153446292 -1.438988434 -0.678324439  
## [106,] -0.856080845 -0.147703741 -1.029753015 -0.156086532  
## [107,] -0.903594236 0.064963321 -1.405877813 -0.105420818  
## [108,] -0.786527443 0.853685987 1.043557230 0.621249800  
## [109,] -0.640895471 -0.344489716 -2.235849971 -0.443667268  
## [110,] 0.069685399 -0.725009151 -1.363483084 -0.503178291  
## [111,] -0.082450581 -0.134643906 0.290922401 -1.719185030  
## [112,] 0.082643566 -0.968885218 -0.813087532 -0.241972304  
## [113,] -0.144780558 0.373611784 0.848574153 -1.343773544  
## [114,] -0.784722041 1.940023740 0.787458575 1.171320732  
## [115,] 0.688139266 0.998226618 0.669988108 -1.745916647  
## [116,] 0.227745168 0.093946946 -0.613843638 -1.531865398  
## [117,] 0.718984641 1.096339020 -1.059950233 -1.272207078  
## [118,] -0.428303035 0.710353291 0.122291647 -0.634346877  
## [119,] -0.175150106 -0.440343354 -1.350659669 0.135601474  
## [120,] -0.831169770 -0.451760630 -0.913430044 1.140150455  
## [121,] -0.418482316 1.514650188 1.490360736 -1.187802922  
## [122,] 0.654501833 -0.129952989 0.808665106 -0.096067722  
## [123,] -0.472536125 -0.579938568 -0.286516619 1.107033877  
## [124,] 0.159054382 -0.720150440 -0.589360034 1.149176225  
## [125,] 0.608335123 -0.912053354 0.428066633 -0.024928362  
## [126,] -1.792028702 1.972839950 0.342652125 0.236268105  
## [127,] 1.218668748 0.975875789 2.081258280 -1.925730644  
## [128,] 0.085625538 -0.652574441 -0.967360267 -0.263016695  
## [129,] -1.475418010 -1.197070073 0.082790604 0.787987882  
## [130,] -2.137902317 -1.235382763 0.013030154 0.146710171  
## [131,] 0.448746530 0.185286822 -0.803782549 0.826298839  
## [132,] 0.718959495 0.981824225 0.434059367 0.123251423  
## [133,] 0.122553831 -1.064666221 -0.489228362 0.675837888  
## [134,] 0.196356670 -0.967106280 0.424552884 -0.184393391  
## [135,] 0.246069426 0.254590970 -0.427736236 0.823608028  
## [136,] -2.028852176 1.490482546 0.012027358 0.772404387  
## [137,] 0.278657594 1.816842692 -1.160277155 1.208908641  
## [138,] -0.562659653 1.428018809 -0.714168576 1.094648995  
## [139,] -0.305453826 -0.044645518 -0.823758403 1.050779094  
## [140,] -1.350598692 -0.317715951 -0.415915498 0.060996415  
## [141,] -0.791809257 -0.565911107 0.773507814 0.341086515  
## [142,] 0.043192344 0.647534815 0.722666411 -0.308009588  
## [143,] -1.915021704 -1.750777671 0.060092418 -0.895531051  
## [144,] -0.538513205 -0.058293112 0.019683142 -0.032716285  
## [145,] 0.604516779 -0.783129035 0.633293708 0.844862430  
## [146,] -0.734133167 -1.641426929 0.653677079 0.986420681  
## [147,] 0.601786262 -1.023712919 -0.862311000 0.737383853  
## [148,] -0.188907347 -0.598113635 0.223455743 0.015093479  
## [149,] 1.253241940 0.363538810 -1.261564947 0.299802890  
## [150,] -0.096712048 0.849380368 0.742618957 0.835577649  
## [151,] -0.439934196 0.436740118 0.758106917 1.236719982  
## [152,] 0.680950226 -0.835436738 -0.496525930 -2.523787283  
## [153,] 0.529597454 1.985946761 0.414304852 0.225503660  
## [154,] 1.879529371 -0.017601863 -1.504787861 1.353969391  
## [155,] 0.334636778 0.196554969 0.524561064 1.336556490  
## [156,] -0.701454957 0.387068121 -0.221180266 0.007174508  
## [157,] -0.050184927 -0.381684536 -0.505670699 0.715761618  
## [158,] -1.120552574 0.638586524 -0.041276800 0.620783806  
## [159,] 1.931785977 1.245199570 -2.019691861 -0.062865506  
## [160,] 1.245261954 1.853465872 -0.956105443 -1.964893579  
## [161,] 0.284750505 -0.030368647 0.846939323 -0.482908585  
## [162,] 0.110528331 0.008027284 1.327583557 -0.784922538  
## [163,] 1.456973866 -0.244744309 -0.112095119 0.805240724  
## [164,] 1.445736775 -0.894147954 2.220831664 0.729425462  
## [165,] 0.522080086 1.244971006 0.904026450 1.521219603  
## [166,] -0.376211980 0.439643687 -0.220187018 0.148425403  
## [167,] -0.869618708 0.595520758 0.189409022 0.318637063  
## [168,] -0.379999973 -0.206106595 -0.169496844 -1.584525194  
## [169,] 0.579974822 0.192383377 -0.790740123 -0.610327020  
## [170,] 1.525168711 0.048890267 -1.246255048 1.235909895  
## [171,] 0.767909677 1.114447321 -1.712334361 1.240671897  
## [172,] -0.542579214 0.712080087 -1.148097893 -0.025286603  
## [173,] -0.705777146 0.955927044 -1.257083442 -0.166559691  
## [174,] -1.649958208 0.866499958 0.294071260 -0.075788840  
## [175,] -1.060051391 -0.353377418 -0.975774666 -1.586620702  
## [176,] -0.988031770 -0.162267429 -0.701133532 -0.880064458  
## [177,] -0.379792999 -0.701936243 -1.011382027 -0.011712777  
## [178,] 1.145821010 -0.014922337 0.779907220 -0.190423459  
## [179,] 1.099180407 -0.186286857 0.758789422 -0.104887794  
## [180,] 0.591309825 -0.695516262 0.738879425 0.664703768  
## [181,] 0.653160568 0.158089923 -0.766066459 -0.248967271  
## [182,] -2.143724866 2.072808170 -1.614983116 -1.673743416  
## [183,] -0.170721190 -0.370338291 -0.197629126 0.264983339  
## [184,] 0.762953321 1.028609278 -0.209618301 0.978631982  
## [185,] 0.336349440 -0.577560141 1.694078948 0.708431081  
## [186,] 0.644803075 0.176987974 1.388594443 0.142634790  
## [187,] -0.164478712 1.126710206 -0.183256546 0.891811589  
## [188,] 0.229221452 0.094389740 -0.148301683 -1.597081842  
## [189,] 0.287181452 -1.672665627 0.222085006 0.723608131  
## [190,] 0.364801572 -0.604389831 1.548315988 0.721236288  
## [191,] -0.312963952 -0.226558344 -1.632108260 1.204746391  
## [192,] 0.521194310 1.166901278 -1.526315817 1.158675265  
## [193,] -0.562942942 0.403186882 -0.707006985 0.747355414  
## [194,] -0.713758708 -1.049171194 -1.414944580 0.803902738  
## [195,] -1.876211556 0.019232469 0.442469905 0.874529173  
## [196,] 0.218383349 -0.706785290 1.321185886 -1.510950368  
## [197,] 0.282344105 -0.659598153 -0.791601600 1.236365387  
## [198,] 0.086919499 -1.024298809 -0.064275474 -0.439449148  
## [199,] 0.086919499 -1.024298809 -0.064275474 -0.439449148  
## [200,] 0.445931124 -1.124603032 -0.953644413 0.213597331  
## [201,] 0.296503145 0.181924369 0.688805376 0.482361094  
## [202,] 1.055550448 -0.931789507 -0.752792844 -0.468763618  
## [203,] -1.999596412 2.150826464 0.853071202 1.096555343  
## [204,] 0.378834080 -0.582649380 -1.407877376 1.185227264  
## [205,] -1.486188424 0.283905306 -1.247039168 0.147147431  
## [206,] 1.475520538 -0.078406315 -1.347205533 0.663110399  
## [207,] 1.430010287 1.158004508 0.473053658 0.695105633  
## [208,] -0.552145154 -1.686633247 0.001047928 0.172811066  
## [209,] 1.489604079 -0.772351357 1.289078652 -1.337629949  
## [210,] 0.677219605 -0.579335415 1.269576941 -1.821797424  
## [211,] -0.713290762 0.006020205 1.191946568 0.793798717  
## [212,] 0.622209348 0.817884634 1.492533448 -0.938472694  
## [213,] -0.593635114 -0.193264883 0.670020161 0.133788502  
## [214,] 0.589384967 -0.169038265 -1.642660652 0.904539316  
## [215,] -1.425419932 0.198424233 -0.239361235 1.264274000  
## [216,] -0.183249847 -1.086085157 -0.615670091 0.004668552  
## [217,] -0.841135438 1.484531920 1.148210401 0.282549749  
## [218,] -1.451599301 0.909456806 -0.984065393 -0.163040889  
## [219,] -1.451599301 0.909456806 -0.984065393 -0.163040889  
## [220,] 1.611899558 0.406526583 1.263018720 1.167776128  
## [221,] 1.550123363 0.019212202 0.813176416 0.768093351  
## [222,] 1.550123363 0.019212202 0.813176416 0.768093351  
## [223,] -0.039773854 0.550953439 0.016533334 -1.286322319  
## [224,] -1.635739497 0.641010533 -0.815296544 -0.431322405  
## [225,] -0.090294580 -0.949001063 -1.268866499 -0.279915737  
## [226,] -0.090294580 -0.949001063 -1.268866499 -0.279915737  
## [227,] -0.332985892 -0.395572803 -0.281086683 -0.762373695  
## [228,] -1.310074983 -0.012676000 -0.290447188 -0.472192892  
## [229,] -2.157339557 1.086774404 0.524388282 -0.615999689  
## [230,] 0.497489095 0.213387987 -0.402946494 -0.926131964  
## [231,] 0.049036361 -0.806215638 -1.225913889 0.124325679  
## [232,] 0.547060306 0.804883192 1.412311264 -0.208556330  
## [233,] 0.126818671 -1.043755595 -0.190512690 -0.084877544  
## [234,] -0.614966848 -0.172520261 -0.398162211 -0.794856434  
## [235,] 0.155340294 -1.239984554 -0.723754411 0.068970392  
##   
## $weights  
## Factor1 Factor2 Factor3 Factor4  
## Filling 0.120591482 0.080346361 -0.030864160 0.0381506348  
## Natural 0.137185214 -0.005242536 -0.055169420 -0.0003770006  
## Fibre 0.218248191 0.069957697 -0.123858463 -0.0714070560  
## Sweet 0.055439612 0.278316222 0.067025213 -0.0019873752  
## Easy 0.021836499 0.022043606 -0.016964181 0.0451423208  
## Salt 0.070071243 0.252324635 -0.167993906 0.0214347468  
## Satisfying 0.096662949 0.057354624 -0.009012448 0.0956940234  
## Energy 0.091802447 0.047593801 0.020431123 0.0208874546  
## Fun -0.032637876 -0.024362051 0.209170401 0.0576924243  
## Kids -0.034776590 0.042284660 -0.127272756 0.5531137298  
## Soggy 0.045626141 0.067119460 -0.183492223 0.0528680389  
## Economical 0.006888436 -0.027833558 -0.077373458 0.0881657988  
## Health 0.250504889 -0.055381332 -0.063804925 -0.0323571995  
## Family -0.031580620 -0.034012364 0.003292687 0.3159472630  
## Calories 0.021857693 0.154477254 -0.023250702 -0.0031638857  
## Plain 0.052803912 0.086166437 -0.317739788 0.0773383782  
## Crisp -0.025466048 -0.016049916 0.136269082 0.0390633356  
## Regular 0.084550726 0.025291686 -0.029691261 -0.0219529755  
## Sugar 0.064994414 0.467840233 -0.073400682 -0.0295368860  
## Fruit 0.024172374 0.008175189 0.170916477 -0.1106535218  
## Process 0.008700011 0.083379158 -0.070641676 0.0159578293  
## Quality 0.074874137 -0.060502651 0.058848719 0.0207197389  
## Treat -0.028877998 -0.023518727 0.314070803 0.0289299209  
## Boring 0.037433852 0.077329450 -0.197821634 -0.0059789061  
## Nutritious 0.230724934 0.029127732 -0.091867414 -0.0151642666  
##   
## $r.scores  
## Factor1 Factor2 Factor3 Factor4  
## Factor1 1.000000e+00 -1.769418e-16 3.400058e-15 1.346145e-15  
## Factor2 -2.081668e-16 1.000000e+00 -1.502271e-15 -1.576430e-15  
## Factor3 3.379241e-15 -1.495548e-15 1.000000e+00 -9.847808e-16  
## Factor4 1.363493e-15 -1.561251e-15 -1.027390e-15 1.000000e+00  
##   
## $missing  
## [1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [36] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [71] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [106] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [141] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [176] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [211] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
##   
## $R2  
## [1] 0.9564660 0.9147540 0.8680029 0.9294413

#Naming the dimensions  
Dimension1 <- colnames(cerealDR[,c(1,2,3,7,8,13,18,22,25)])  
Dimension1

## [1] "Filling" "Natural" "Fibre" "Satisfying" "Energy"   
## [6] "Health" "Regular" "Quality" "Nutritious"

# based on the   
Dimension2 <- colnames(cerealDR[,c(4,6,19,21)])  
Dimension2

## [1] "Sweet" "Salt" "Sugar" "Process"

Dimension3 <- colnames(cerealDR[,c(10,12,14)])  
Dimension3

## [1] "Kids" "Economical" "Family"

Dimension4 <- colnames(cerealDR[,c(5,9,11,16,17,20,23,24)])  
Dimension4

## [1] "Easy" "Fun" "Soggy" "Plain" "Crisp" "Fruit" "Treat" "Boring"

remove(newcerealDR)

## Warning in remove(newcerealDR): object 'newcerealDR' not found

newcerealDR <- cerealDR  
  
cerealDR[,Dimension1]

## # A tibble: 235 x 9  
## Filling Natural Fibre Satisfying Energy Health Regular Quality  
## <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 5 5 5 5 4 5 4 5  
## 2 1 2 2 5 1 2 1 2  
## 3 5 4 5 5 5 5 4 5  
## 4 5 5 5 5 5 5 4 5  
## 5 4 5 3 5 4 5 3 5  
## 6 4 4 4 5 4 4 3 5  
## 7 4 4 3 5 5 5 3 5  
## 8 4 3 3 5 4 4 4 4  
## 9 4 3 3 5 4 4 4 4  
## 10 4 3 3 5 4 4 4 4  
## # ... with 225 more rows, and 1 more variable: Nutritious <dbl>

aggDim1 <- apply(newcerealDR[,Dimension1],1, mean)  
aggDim2 <- apply(newcerealDR[,Dimension2],1, mean)  
aggDim3 <- apply(newcerealDR[,Dimension3],1, mean)  
aggDim4 <- apply(newcerealDR[,Dimension4],1, mean)  
  
aggDim1

## [1] 4.777778 2.111111 4.777778 4.888889 4.222222 4.111111 4.222222  
## [8] 3.777778 3.777778 3.777778 4.111111 3.777778 3.333333 3.333333  
## [15] 4.000000 3.888889 2.333333 3.777778 4.555556 3.555556 3.888889  
## [22] 3.333333 4.555556 4.333333 4.555556 3.777778 3.888889 2.888889  
## [29] 3.333333 3.333333 3.444444 4.888889 4.222222 4.444444 4.333333  
## [36] 2.555556 3.444444 3.555556 3.222222 3.555556 4.888889 4.333333  
## [43] 3.888889 4.777778 5.000000 4.777778 3.666667 3.777778 3.333333  
## [50] 3.444444 3.555556 2.666667 1.444444 4.222222 3.333333 4.222222  
## [57] 3.888889 4.888889 2.888889 4.333333 3.666667 3.555556 4.333333  
## [64] 4.555556 3.555556 2.777778 4.888889 4.222222 3.222222 2.888889  
## [71] 4.222222 4.111111 3.333333 4.666667 3.444444 1.777778 3.888889  
## [78] 3.000000 5.000000 2.000000 3.777778 2.666667 3.333333 2.777778  
## [85] 1.888889 4.777778 4.111111 4.111111 3.777778 3.555556 2.666667  
## [92] 3.888889 4.222222 4.111111 3.888889 2.777778 3.888889 4.000000  
## [99] 3.555556 4.111111 3.777778 3.777778 3.777778 4.222222 4.111111  
## [106] 3.000000 2.888889 3.222222 3.000000 3.555556 3.444444 3.777778  
## [113] 3.555556 3.222222 3.888889 3.666667 4.000000 3.333333 3.444444  
## [120] 3.111111 3.444444 4.333333 3.333333 3.888889 4.222222 2.222222  
## [127] 4.444444 3.666667 2.888889 2.333333 3.888889 4.111111 3.888889  
## [134] 4.000000 3.777778 2.111111 3.666667 3.222222 3.444444 2.777778  
## [141] 3.333333 3.777778 2.444444 3.444444 4.222222 3.333333 4.111111  
## [148] 3.555556 4.444444 3.555556 3.555556 4.000000 4.111111 5.000000  
## [155] 4.000000 3.111111 3.777778 2.777778 4.555556 4.111111 4.000000  
## [162] 3.777778 4.666667 5.000000 4.000000 3.555556 3.111111 3.333333  
## [169] 4.000000 4.555556 3.888889 3.111111 2.888889 2.333333 2.777778  
## [176] 2.888889 3.222222 4.333333 4.444444 4.222222 4.111111 1.555556  
## [183] 3.666667 4.333333 4.222222 4.222222 3.444444 3.777778 4.222222  
## [190] 4.222222 3.333333 3.777778 3.222222 3.111111 2.555556 3.888889  
## [197] 3.777778 3.777778 3.777778 4.111111 4.000000 4.333333 2.333333  
## [204] 4.111111 2.666667 4.444444 4.444444 3.333333 4.777778 4.111111  
## [211] 3.333333 4.000000 3.222222 4.111111 2.777778 3.555556 3.222222  
## [218] 2.444444 2.444444 5.000000 4.777778 4.777778 3.333333 2.333333  
## [225] 3.555556 3.555556 3.333333 2.666667 2.111111 3.888889 3.666667  
## [232] 4.111111 3.888889 3.111111 3.888889

mean(aggDim1)

## [1] 3.674704

class(aggDim1)

## [1] "numeric"

newcerealDR[,26] <- round(aggDim1 , digits = 3)  
newcerealDR[,27] <- round(aggDim2 , digits = 3)  
newcerealDR[,28] <- round(aggDim3, digits = 2)  
newcerealDR[,29] <- round(aggDim4 , digits = 2)  
  
ncol(newcerealDR)

## [1] 29

colnames(newcerealDR)[26:29] <- c("Health", "Taste", "Family", "Experience")  
  
names(newcerealDR)

## [1] "Filling" "Natural" "Fibre" "Sweet" "Easy"   
## [6] "Salt" "Satisfying" "Energy" "Fun" "Kids"   
## [11] "Soggy" "Economical" "Health" "Family" "Calories"   
## [16] "Plain" "Crisp" "Regular" "Sugar" "Fruit"   
## [21] "Process" "Quality" "Treat" "Boring" "Nutritious"  
## [26] "Health" "Taste" "Family" "Experience"

mean(newcerealDR$Health)

## [1] 3.808511

print(newcerealDR)

## # A tibble: 235 x 29  
## Filling Natural Fibre Sweet Easy Salt Satisfying Energy Fun Kids  
## <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 5 5 5 1 2 1 5 4 1 4  
## 2 1 2 2 1 5 2 5 1 1 5  
## 3 5 4 5 5 5 3 5 5 5 5  
## 4 5 5 5 3 5 2 5 5 5 5  
## 5 4 5 3 2 5 2 5 4 5 5  
## 6 4 4 4 2 5 2 5 4 5 5  
## 7 4 4 3 2 5 1 5 5 5 5  
## 8 4 3 3 2 5 1 5 4 4 5  
## 9 4 3 3 2 5 1 5 4 4 5  
## 10 4 3 3 2 5 1 5 4 4 5  
## # ... with 225 more rows, and 19 more variables: Soggy <dbl>,  
## # Economical <dbl>, Health <dbl>, Family <dbl>, Calories <dbl>,  
## # Plain <dbl>, Crisp <dbl>, Regular <dbl>, Sugar <dbl>, Fruit <dbl>,  
## # Process <dbl>, Quality <dbl>, Treat <dbl>, Boring <dbl>,  
## # Nutritious <dbl>, Health <dbl>, Taste <dbl>, Family <dbl>,  
## # Experience <dbl>

Dimension 1 ==> Signifies Health related parameters Dimension 2 ==> Signifies Taste related parameters Dimension 3 ==> Signifies Family related parameters Dimension 4 ==> Signifies Experience related parameters Next step is to add these 4 new Dimensions as columns to the dataset

aggregate(x= newcerealDR[,27:29], by = list(cerealDRO$Cereals) , FUN = mean)

## Group.1 Taste Family Experience  
## 1 AllBran 2.233333 2.976667 2.299333  
## 2 CMuesli 2.711538 3.512308 2.759231  
## 3 CornFlakes 2.583333 4.123704 2.597037  
## 4 JustRight 2.687500 3.166875 2.665000  
## 5 Komplete 2.464286 2.642857 2.722143  
## 6 NutriGrain 3.031250 3.972083 2.724167  
## 7 PMuesli 2.763889 3.203333 2.895000  
## 8 RiceBubbles 2.130952 4.190476 2.720000  
## 9 SpecialK 2.347826 3.709565 2.558261  
## 10 Sustain 2.125000 3.278333 2.918333  
## 11 Vitabrit 1.830000 3.933200 2.540800  
## 12 Weetabix 2.000000 3.803333 2.374815

## Re-computing the whole exercise using principal function than using factanal function  
  
# Please note input of first argument to principal function i.e. "x" can be either a  
# correlation matrrix of the dataframe of original data or the data frame with original data of input variables.  
# If original data frame of input variables is given , correlation is computed.  
# However , if cor(x) is used in the principal function , pCAresult$scores will yield a result of NULL  
  
#factors without rotation  
  
library(psych)  
unrotate\_cereal <- principal( cerealDR , nfactors = 4 , rotate = "none")   
unrotate\_cereal

## Principal Components Analysis  
## Call: principal(r = cerealDR, nfactors = 4, rotate = "none")  
## Standardized loadings (pattern matrix) based upon correlation matrix  
## PC1 PC2 PC3 PC4 h2 u2 com  
## Filling 0.75 0.10 -0.07 0.23 0.63 0.37 1.2  
## Natural 0.75 -0.26 -0.13 0.13 0.66 0.34 1.4  
## Fibre 0.73 -0.24 -0.33 0.18 0.74 0.26 1.8  
## Sweet 0.09 0.78 -0.18 0.19 0.68 0.32 1.3  
## Easy 0.35 0.14 0.27 0.16 0.24 0.76 2.7  
## Salt -0.22 0.55 -0.14 0.48 0.60 0.40 2.5  
## Satisfying 0.74 0.16 0.17 0.20 0.65 0.35 1.4  
## Energy 0.73 0.14 -0.07 0.17 0.58 0.42 1.2  
## Fun 0.41 0.53 0.26 -0.15 0.53 0.47 2.6  
## Kids 0.22 0.25 0.79 0.11 0.74 0.26 1.4  
## Soggy -0.11 -0.28 0.18 0.58 0.45 0.55 1.7  
## Economical 0.16 -0.29 0.58 0.11 0.45 0.55 1.7  
## Health 0.81 -0.31 -0.13 0.09 0.78 0.22 1.4  
## Family 0.32 0.19 0.73 0.02 0.67 0.33 1.5  
## Calories -0.17 0.63 -0.17 0.28 0.54 0.46 1.7  
## Plain -0.33 -0.40 0.25 0.48 0.57 0.43 3.3  
## Crisp 0.31 0.49 0.27 -0.24 0.47 0.53 2.9  
## Regular 0.62 -0.15 -0.22 0.09 0.46 0.54 1.4  
## Sugar -0.25 0.75 -0.22 0.26 0.74 0.26 1.7  
## Fruit 0.39 0.29 -0.54 -0.14 0.55 0.45 2.6  
## Process -0.34 0.30 0.01 0.34 0.32 0.68 3.0  
## Quality 0.75 -0.16 0.04 -0.01 0.59 0.41 1.1  
## Treat 0.49 0.59 0.09 -0.20 0.63 0.37 2.2  
## Boring -0.41 -0.30 -0.13 0.43 0.46 0.54 3.0  
## Nutritious 0.81 -0.23 -0.16 0.15 0.75 0.25 1.3  
##   
## PC1 PC2 PC3 PC4  
## SS loadings 6.51 3.79 2.49 1.68  
## Proportion Var 0.26 0.15 0.10 0.07  
## Cumulative Var 0.26 0.41 0.51 0.58  
## Proportion Explained 0.45 0.26 0.17 0.12  
## Cumulative Proportion 0.45 0.71 0.88 1.00  
##   
## Mean item complexity = 1.9  
## Test of the hypothesis that 4 components are sufficient.  
##   
## The root mean square of the residuals (RMSR) is 0.06   
## with the empirical chi square 428.91 with prob < 9e-18   
##   
## Fit based upon off diagonal values = 0.96

print(unrotate\_cereal$loadings, sort = TRUE)

##   
## Loadings:  
## PC1 PC2 PC3 PC4   
## Filling 0.747 0.100 0.228  
## Natural 0.750 -0.256 -0.131 0.131  
## Fibre 0.732 -0.240 -0.332 0.179  
## Satisfying 0.745 0.160 0.170 0.198  
## Energy 0.728 0.135 0.170  
## Health 0.812 -0.314 -0.125   
## Regular 0.620 -0.145 -0.224   
## Quality 0.752 -0.155   
## Nutritious 0.807 -0.226 -0.161 0.148  
## Sweet 0.776 -0.184 0.185  
## Salt -0.223 0.545 -0.136 0.484  
## Fun 0.411 0.526 0.256 -0.146  
## Calories -0.171 0.630 -0.174 0.280  
## Sugar -0.254 0.747 -0.225 0.261  
## Treat 0.485 0.588 -0.195  
## Kids 0.218 0.251 0.786 0.109  
## Economical 0.160 -0.286 0.577 0.108  
## Family 0.317 0.193 0.726   
## Fruit 0.394 0.287 -0.540 -0.144  
## Soggy -0.110 -0.276 0.179 0.578  
## Easy 0.347 0.142 0.270 0.157  
## Plain -0.329 -0.404 0.249 0.485  
## Crisp 0.309 0.490 0.269 -0.240  
## Process -0.341 0.301 0.341  
## Boring -0.414 -0.296 -0.133 0.433  
##   
## PC1 PC2 PC3 PC4  
## SS loadings 6.51 3.792 2.494 1.682  
## Proportion Var 0.26 0.152 0.100 0.067  
## Cumulative Var 0.26 0.412 0.512 0.579

factor.scores(cerealDR, unrotate\_cereal$loadings)

## $scores  
## PC1 PC2 PC3 PC4  
## [1,] 0.96209119 -2.338502319 0.324581717 1.072995402  
## [2,] -1.84293973 -0.443295563 2.594085050 -0.203341763  
## [3,] 1.74526247 1.053766874 0.528690482 0.475915537  
## [4,] 2.05523869 0.227041812 -0.375300355 -0.062641403  
## [5,] 1.19654810 0.464342116 1.043671867 -1.061647938  
## [6,] 1.08552822 0.853718019 1.468299266 -0.928293574  
## [7,] 1.28319066 0.688392835 1.577060734 -1.207858040  
## [8,] 0.40497911 -0.179360526 1.369323059 -1.128603864  
## [9,] 0.40497911 -0.179360526 1.369323059 -1.128603864  
## [10,] 0.40497911 -0.179360526 1.369323059 -1.128603864  
## [11,] 0.13365951 -1.757851712 0.089546367 1.427612178  
## [12,] -0.11306489 -0.231186280 -0.502722747 0.615105982  
## [13,] -0.41333084 1.961445282 -0.791748645 1.117509876  
## [14,] -0.35465771 1.841680265 -0.453156455 0.775925581  
## [15,] 0.62739540 2.208511080 0.789515499 1.363730642  
## [16,] 0.05670838 -0.397952171 -1.180041635 -0.396697997  
## [17,] -1.07696887 0.838642402 2.244583196 -1.772869379  
## [18,] 0.13239233 0.250827803 1.042101380 0.380346662  
## [19,] 0.83624946 -1.179272609 0.349882098 1.428620747  
## [20,] -0.62387004 1.714908290 -2.330860426 1.915606247  
## [21,] 0.08919468 0.199318915 -0.770537594 1.023490548  
## [22,] -1.16573641 -0.987715471 -1.405525495 1.299619219  
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## [24,] 1.30694325 0.709792472 -0.072066508 -1.138153284  
## [25,] 1.22409782 0.062424359 -0.934110217 -0.205968298  
## [26,] -0.25805575 -0.821809991 0.207671993 2.034059271  
## [27,] 0.41929651 -0.535529358 -0.890404951 -0.810427046  
## [28,] -1.01671958 -0.947109202 -0.132116108 -1.094195616  
## [29,] -0.31967271 -0.717480526 -0.960623542 -1.312065975  
## [30,] -0.26902349 -0.009624716 1.075764214 -0.995404689  
## [31,] -0.06676070 1.357843789 0.620946109 -0.472016677  
## [32,] 1.00896099 -1.154104924 -1.285800026 1.021780489  
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## [34,] 1.42943931 -0.384203335 0.669179040 -1.050915428  
## [35,] 1.08255364 -1.123271997 0.345028487 -0.097438200  
## [36,] -1.25564444 -0.040803180 1.692995036 0.139861819  
## [37,] 0.11030655 2.121443524 0.058957960 -0.506849376  
## [38,] 0.07135509 2.110490554 -0.621907161 0.271598822  
## [39,] -0.45602786 1.972541682 -1.171247231 0.382879279  
## [40,] -0.24461482 -0.182016007 1.332220829 2.009597438  
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## [43,] 0.09093744 -0.594565401 0.012050611 1.122787154  
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## [47,] -0.21410591 -0.762756412 -1.446227672 -0.882115749  
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## [61,] -0.04303307 -0.410101000 0.700354123 0.288558458  
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## [70,] -0.56191423 -0.276678615 1.717490256 -1.809189775  
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## [77,] 0.08125614 0.270188622 -0.736056459 1.950997645  
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## [83,] -0.80522356 -0.333108214 -0.715787719 -0.050909783  
## [84,] -1.63198205 0.891490724 -1.125396646 1.036146299  
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## [91,] -1.21845461 1.772097669 -0.299439573 -1.120857613  
## [92,] -0.05636651 -1.176794095 0.343187654 1.483276718  
## [93,] 0.34888906 -0.960361863 -1.147321103 -0.332097729  
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## [97,] 0.39583876 0.111326170 -0.260124047 -0.450879855  
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## [99,] -0.25528892 -1.712048732 -0.339727815 -0.875120341  
## [100,] 0.83321833 2.004028007 -0.522046044 -0.504897151  
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## [104,] 0.59083855 0.843925620 -1.304614094 -0.119338491  
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## [107,] -1.40387551 -0.668239548 -0.135150993 0.691052778  
## [108,] -0.35366925 1.540366014 -0.075702514 -0.434864380  
## [109,] -1.28725384 -1.462818560 0.199668731 1.189999013  
## [110,] -0.42430203 -1.319574530 -0.061355572 0.641338261  
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## [125,] 0.78684600 -0.398522532 0.201638891 -0.804606887  
## [126,] -1.78679404 2.068672694 0.246013835 -0.210221469  
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## [128,] -0.20830262 -0.831520723 0.184094791 0.307448817  
## [129,] -0.70951858 -0.472846807 1.408567663 -1.500262911  
## [130,] -1.47291301 -0.592283112 1.109057091 -1.746426850  
## [131,] 0.24869597 -0.196699688 0.915600636 1.484310322  
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## [140,] -1.42660413 -0.242353334 0.320887842 -0.255269656  
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## [161,] 0.35623119 0.394210815 -1.233244170 -1.014333045  
## [162,] 0.38774390 0.779977592 -1.005560805 -1.064450093  
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## [166,] -0.30432662 0.248499819 0.120968916 0.018526251  
## [167,] -0.67956805 0.712333875 0.518167264 -0.208573399  
## [168,] -0.62136200 -0.603189011 -0.874247846 -0.119696452  
## [169,] 0.10027255 -0.581108517 -0.556848059 0.743378098  
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## [173,] -1.29861354 0.013611999 -0.135086855 0.882929486  
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## [176,] -1.38868125 -0.552229784 -0.574926127 -0.070317073  
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## [215,] -0.90835610 0.257012916 1.671999798 -0.124048644  
## [216,] -0.34195225 -1.249504916 0.043193236 -0.257129325  
## [217,] -0.50503161 1.915426320 0.133651466 -0.045080972  
## [218,] -1.82948598 0.342174247 0.190401762 0.523524833  
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## [222,] 1.80914090 0.239507767 0.048953696 0.054078993  
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## [228,] -1.40819062 -0.196975456 0.082193156 -0.508258201  
## [229,] -2.07236231 1.218448327 -0.201370789 -0.715761079  
## [230,] 0.01933376 -0.386110425 -1.169518392 0.365665933  
## [231,] -0.27838561 -1.178322968 0.371207195 0.436412064  
## [232,] 0.81590859 1.336811500 -0.914997235 -0.544006981  
## [233,] 0.20506715 -0.907228287 0.135126533 -0.394353964  
## [234,] -0.92957092 -0.491339191 -0.424630852 -0.275176306  
## [235,] 0.09351029 -1.501259115 0.227931930 -0.095697921  
##   
## $weights  
## PC1 PC2 PC3 PC4  
## Filling 0.11477452 0.02639180 -0.028752718 0.13542769  
## Natural 0.11516388 -0.06752865 -0.052579966 0.07774413  
## Fibre 0.11238932 -0.06329408 -0.132947793 0.10654231  
## Sweet 0.01366582 0.20454402 -0.073954126 0.11025607  
## Easy 0.05331460 0.03744400 0.108218400 0.09350980  
## Salt -0.03419716 0.14374205 -0.054441604 0.28788861  
## Satisfying 0.11442492 0.04222876 0.068336795 0.11743504  
## Energy 0.11182134 0.03570241 -0.028495689 0.10105524  
## Fun 0.06315443 0.13879442 0.102495197 -0.08682973  
## Kids 0.03351686 0.06617098 0.315144404 0.06460749  
## Soggy -0.01695238 -0.07290844 0.071612232 0.34369866  
## Economical 0.02463047 -0.07528710 0.231534278 0.06424330  
## Health 0.12476977 -0.08277174 -0.050272250 0.05228957  
## Family 0.04870361 0.05092261 0.291258353 0.01446183  
## Calories -0.02632530 0.16623959 -0.069761083 0.16660147  
## Plain -0.05059206 -0.10661278 0.099961269 0.28806482  
## Crisp 0.04747969 0.12925087 0.107999744 -0.14280874  
## Regular 0.09523002 -0.03834978 -0.089632172 0.05326172  
## Sugar -0.03905638 0.19703737 -0.090111244 0.15514056  
## Fruit 0.06051295 0.07579254 -0.216363237 -0.08554538  
## Process -0.05236305 0.07944013 0.002460185 0.20300852  
## Quality 0.11544805 -0.04100187 0.014941336 -0.00744730  
## Treat 0.07456248 0.15494214 0.037689856 -0.11593581  
## Boring -0.06359881 -0.07818437 -0.053183254 0.25738483  
## Nutritious 0.12390581 -0.05957491 -0.064408151 0.08785306  
##   
## $r.scores  
## PC1 PC2 PC3 PC4  
## PC1 1.000000e+00 1.387779e-17 -2.844947e-16 -6.52256e-16  
## PC2 3.469447e-18 1.000000e+00 -2.579534e-15 4.14252e-15  
## PC3 -3.712308e-16 -2.596881e-15 1.000000e+00 1.16053e-15  
## PC4 -6.245005e-16 4.211909e-15 1.235123e-15 1.00000e+00  
##   
## $missing  
## [1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [36] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [71] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [106] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [141] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [176] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [211] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
##   
## $R2  
## [1] 1 1 1 1

# factors after rotation  
  
rotate\_cereal <- principal( cerealDR , nfactors = 4 , rotate = "varimax")   
rotate\_cereal

## Principal Components Analysis  
## Call: principal(r = cerealDR, nfactors = 4, rotate = "varimax")  
## Standardized loadings (pattern matrix) based upon correlation matrix  
## RC1 RC2 RC4 RC3 h2 u2 com  
## Filling 0.75 0.11 0.14 0.20 0.63 0.37 1.3  
## Natural 0.79 -0.20 0.02 0.04 0.66 0.34 1.1  
## Fibre 0.84 -0.11 0.01 -0.13 0.74 0.26 1.1  
## Sweet 0.08 0.74 0.34 0.06 0.68 0.32 1.4  
## Easy 0.26 0.08 0.04 0.40 0.24 0.76 1.9  
## Salt -0.09 0.76 -0.12 0.01 0.60 0.40 1.1  
## Satisfying 0.66 0.09 0.17 0.43 0.65 0.35 1.9  
## Energy 0.70 0.11 0.19 0.19 0.58 0.42 1.4  
## Fun 0.17 0.21 0.51 0.45 0.53 0.47 2.6  
## Kids -0.03 0.03 0.04 0.86 0.74 0.26 1.0  
## Soggy 0.08 0.07 -0.65 0.16 0.45 0.55 1.2  
## Economical 0.06 -0.33 -0.25 0.53 0.45 0.55 2.2  
## Health 0.84 -0.28 0.04 0.05 0.78 0.22 1.2  
## Family 0.06 -0.06 0.11 0.80 0.67 0.33 1.1  
## Calories -0.11 0.72 0.10 -0.02 0.54 0.46 1.1  
## Plain -0.15 -0.06 -0.73 0.12 0.57 0.43 1.2  
## Crisp 0.05 0.14 0.53 0.41 0.47 0.53 2.1  
## Regular 0.67 -0.10 0.08 -0.06 0.46 0.54 1.1  
## Sugar -0.19 0.82 0.16 -0.06 0.74 0.26 1.2  
## Fruit 0.41 0.22 0.46 -0.35 0.55 0.45 3.4  
## Process -0.24 0.47 -0.20 0.03 0.32 0.68 1.9  
## Quality 0.68 -0.25 0.16 0.20 0.59 0.41 1.6  
## Treat 0.26 0.26 0.62 0.32 0.63 0.37 2.3  
## Boring -0.15 0.10 -0.61 -0.24 0.46 0.54 1.5  
## Nutritious 0.85 -0.17 0.04 0.04 0.75 0.25 1.1  
##   
## RC1 RC2 RC4 RC3  
## SS loadings 5.65 3.13 2.87 2.84  
## Proportion Var 0.23 0.13 0.11 0.11  
## Cumulative Var 0.23 0.35 0.47 0.58  
## Proportion Explained 0.39 0.22 0.20 0.20  
## Cumulative Proportion 0.39 0.61 0.80 1.00  
##   
## Mean item complexity = 1.6  
## Test of the hypothesis that 4 components are sufficient.  
##   
## The root mean square of the residuals (RMSR) is 0.06   
## with the empirical chi square 428.91 with prob < 9e-18   
##   
## Fit based upon off diagonal values = 0.96

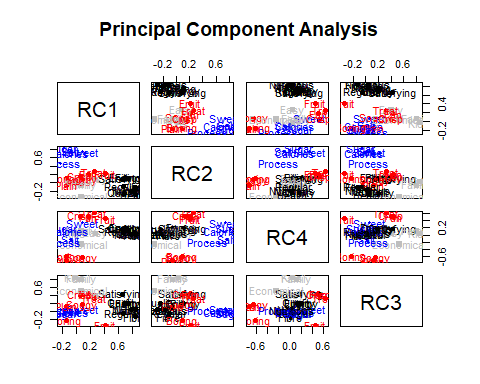
print(rotate\_cereal$loadings , sort = TRUE)

##   
## Loadings:  
## RC1 RC2 RC4 RC3   
## Filling 0.746 0.114 0.136 0.195  
## Natural 0.786 -0.205   
## Fibre 0.839 -0.114 -0.134  
## Satisfying 0.657 0.166 0.427  
## Energy 0.705 0.112 0.193 0.190  
## Health 0.835 -0.284   
## Regular 0.667   
## Quality 0.680 -0.246 0.165 0.201  
## Nutritious 0.846 -0.173   
## Sweet 0.743 0.342   
## Salt 0.760 -0.120   
## Calories -0.108 0.716 0.103   
## Sugar -0.191 0.822 0.161   
## Fun 0.171 0.210 0.511 0.446  
## Soggy -0.646 0.160  
## Plain -0.150 -0.726 0.122  
## Crisp 0.141 0.527 0.408  
## Treat 0.258 0.260 0.624 0.323  
## Boring -0.151 -0.613 -0.236  
## Kids 0.858  
## Economical -0.329 -0.251 0.527  
## Family 0.114 0.804  
## Easy 0.264 0.400  
## Fruit 0.415 0.221 0.457 -0.347  
## Process -0.242 0.472 -0.202   
##   
## RC1 RC2 RC4 RC3  
## SS loadings 5.645 3.129 2.866 2.840  
## Proportion Var 0.226 0.125 0.115 0.114  
## Cumulative Var 0.226 0.351 0.466 0.579

factor.scores(cerealDR , rotate\_cereal$loadings)

## $scores  
## RC1 RC2 RC4 RC3  
## [1,] 1.45578300 -1.4598510950 -1.83416904 0.190366957  
## [2,] -2.37231455 -0.8283466309 -0.97977943 1.757714629  
## [3,] 1.40744906 0.7080257244 0.74213641 1.276477655  
## [4,] 1.88766900 -0.0611209623 0.88784170 0.255020486  
## [5,] 0.36951637 -0.6493991115 1.33860489 1.230269755  
## [6,] 0.13652933 -0.3582859910 1.37238535 1.701289811  
## [7,] 0.21786014 -0.6972884587 1.54417441 1.774360652  
## [8,] -0.35523734 -1.1566090712 0.73556983 1.157570524  
## [9,] -0.35523734 -1.1566090712 0.73556983 1.157570524  
## [10,] -0.35523734 -1.1566090712 0.73556983 1.157570524  
## [11,] 0.80899969 -0.6319115926 -2.02388955 -0.063881976  
## [12,] 0.27008865 0.2973381401 -0.57556662 -0.452417416  
## [13,] -0.08036370 2.4079619640 0.20069274 -0.220878909  
## [14,] -0.21406444 2.0343125934 0.37415176 0.027179401  
## [15,] 0.44864331 2.2008724019 0.32109989 1.614316226  
## [16,] 0.31327772 -0.2506149739 0.22477775 -1.224734055  
## [17,] -2.27990692 -0.7141135715 1.20887301 1.695610471  
## [18,] -0.08923139 0.1326782900 -0.21749953 1.112748566  
## [19,] 1.27873240 -0.3426059130 -1.50034999 0.499786246  
## [20,] 0.45351547 3.0616924891 -0.44060812 -1.630585539  
## [21,] 0.59254650 0.8965945637 -0.54847440 -0.482832766  
## [22,] -0.08754949 0.4543181964 -1.76055543 -1.638722031  
## [23,] 1.34079098 -0.3065847616 1.46790258 -1.698650950  
## [24,] 0.71998354 -0.2422500802 1.69091663 0.276101518  
## [25,] 1.28022450 -0.0128174719 0.69296304 -0.545857386  
## [26,] 0.48136612 0.4643556271 -2.10106165 0.246352748  
## [27,] 0.44440183 -0.7098954643 0.54764070 -0.954389508  
## [28,] -1.08062149 -1.1675663743 -0.02047024 -0.783632680  
## [29,] -0.32926821 -1.0056520787 0.59058733 -1.338931143  
## [30,] -0.85769292 -0.7810394484 0.54088166 0.763120355  
## [31,] -0.58437991 0.6621531673 1.02389186 0.792634420  
## [32,] 1.75759469 -0.1723328222 -0.94438841 -1.018120998  
## [33,] 0.25422776 0.5400750668 1.34594644 1.650175979  
## [34,] 0.81102590 -1.2509136110 0.97449137 0.755613296  
## [35,] 1.00507237 -1.1750859425 -0.23573450 0.340048587  
## [36,] -1.54520275 -0.1877064717 -0.72400388 1.231679550  
## [37,] -0.39255853 1.3536147704 1.59512510 0.492202463  
## [38,] 0.01324643 1.9466576321 1.06269534 -0.028697858  
## [39,] -0.24820606 2.1102474296 0.78889924 -0.692954724  
## [40,] 0.07628009 0.6756808774 -1.84400587 1.429524223  
## [41,] 1.99729069 2.1142550065 0.61766710 0.546851103  
## [42,] 1.20500127 0.7311792502 0.23144900 0.001439029  
## [43,] 0.52371709 0.1372328049 -1.15073675 0.072569566  
## [44,] 1.19996330 -0.2675672193 0.39405071 1.346548730  
## [45,] 1.41160254 -1.0592039007 1.36569913 1.339588413  
## [46,] 1.59156911 -0.6938471027 -0.80015550 -0.290949450  
## [47,] 0.04485622 -0.7004043575 0.32820083 -1.702071452  
## [48,] 0.31853660 -0.1580722806 0.25130880 -1.785954254  
## [49,] -0.32353402 0.1129681624 -0.07502502 -1.129407008  
## [50,] -0.26015845 -1.1771038565 1.20141838 -2.398650369  
## [51,] 0.06743707 -0.6159066432 0.48551384 -2.261756537  
## [52,] -1.58338311 -1.0571747488 -0.53676415 1.038221322  
## [53,] -3.74074190 -0.7682796114 2.19793624 0.354926908  
## [54,] 0.61255524 -0.9688199803 -0.61441967 0.254616291  
## [55,] -0.55269000 1.1081583900 0.15879225 0.217293517  
## [56,] 0.60078079 -1.0294860824 -0.66696350 1.118300744  
## [57,] 0.46793992 0.1425833197 1.41939987 -1.261091640  
## [58,] 1.49682669 -0.2906408818 1.42551969 0.952594405  
## [59,] -1.14635941 -0.9613390306 -0.06440322 0.625915047  
## [60,] 0.80005427 0.0451640018 1.16891828 0.326399106  
## [61,] -0.08203616 -0.3274072274 -0.53689738 0.584476121  
## [62,] -0.26112287 0.3101770279 0.33835545 0.698185538  
## [63,] 0.66687053 -1.4800860882 0.97086798 -1.498632340  
## [64,] 1.38726210 1.7191824665 1.35141787 -0.235478421  
## [65,] -0.26205299 -1.3171056736 -0.31477412 0.635426426  
## [66,] -1.11483450 -0.8360750380 -0.93924390 -0.371027108  
## [67,] 1.66466080 -1.0589421881 -1.35726998 1.380614960  
## [68,] 0.19689175 -1.0729295513 1.65525224 1.870072578  
## [69,] -0.88753514 0.9079677537 1.23675377 0.620649889  
## [70,] -1.51925346 -1.5541697545 0.84058490 1.088614440  
## [71,] 0.58187057 -1.2358487859 -0.16360271 0.949624432  
## [72,] 0.40131515 -0.8211588930 -0.01245547 1.308875412  
## [73,] -0.37761276 0.8130269787 -2.12832800 0.670394118  
## [74,] 1.86453376 0.6757871852 -0.41806455 -2.569366968  
## [75,] -0.14573387 -0.5572253707 0.10188585 -2.198967110  
## [76,] -2.74183606 -1.1815260841 0.69657536 -2.387350430  
## [77,] 0.86120861 1.4566734389 -1.21560417 -0.294115799  
## [78,] -0.60875708 0.8517928522 -0.41261002 -1.443746706  
## [79,] 1.76633828 0.1102114960 -1.57748684 1.004988977  
## [80,] -2.44398030 0.7112959294 -0.25157315 0.082540467  
## [81,] 0.24723175 -1.1515709610 0.93435278 -0.879592223  
## [82,] -1.30482461 -1.6385429327 0.58427211 -2.430458641  
## [83,] -0.48599877 0.0018145361 -0.33300243 -0.962912883  
## [84,] -0.94374196 1.7813267481 -0.69714851 -1.117339681  
## [85,] -1.92039081 3.4278418934 -1.60076948 -1.207982873  
## [86,] 1.18694554 -1.2873507485 -0.32264630 -1.174892740  
## [87,] 0.27043339 1.2783497647 1.16111497 1.907431609  
## [88,] 0.97238696 1.3339345764 -0.63775490 -0.474095349  
## [89,] 0.24583353 -0.5490487102 -1.00398486 -0.294401377  
## [90,] -0.30727820 -1.3150340428 1.38979703 -1.008122456  
## [91,] -1.62356839 1.0200931445 1.46782834 -0.373982987  
## [92,] 0.50026123 -0.1801529377 -1.83183222 0.259968208  
## [93,] 0.66869463 -0.7061365614 -0.04542716 -1.234021118  
## [94,] 0.26897639 -0.6207267618 0.35356348 0.583756084  
## [95,] 0.25935853 0.0605178270 -0.50420867 -0.029514251  
## [96,] -1.48984544 -1.4152212125 0.49508900 0.381022628  
## [97,] 0.26622110 -0.1549683731 0.56046263 -0.176158380  
## [98,] 0.59769605 0.2754524712 0.29337865 -0.809499651  
## [99,] -0.15955016 -1.7055743414 -0.34036111 -0.909531814  
## [100,] 0.43389901 1.3004316588 1.82823611 0.126475713  
## [101,] 0.04670404 1.3143220204 1.94197190 0.525163209  
## [102,] 0.13364868 -1.3189885822 -0.66771864 -0.614392543  
## [103,] 0.13364868 -1.3189885822 -0.66771864 -0.614392543  
## [104,] 0.73062478 0.8297331947 0.89623169 -0.867213509  
## [105,] 0.63940421 -0.2076583965 -1.32554982 -1.135082611  
## [106,] -0.79527935 -0.2090273008 -0.96356868 -0.651997609  
## [107,] -0.89729650 0.0927726860 -1.33935107 -0.552830182  
## [108,] -0.66066808 1.0374910222 1.07953462 0.119926483  
## [109,] -0.61051931 -0.3536946882 -2.15733987 -0.317610993  
## [110,] 0.03734871 -0.6047249155 -1.35218094 -0.375377117  
## [111,] 0.07031866 0.1303831899 -0.07063216 -1.682863284  
## [112,] -0.07473873 -1.4481290303 -0.42304167 -0.340440498  
## [113,] -0.08473082 0.3218471059 0.97990108 -1.386146044  
## [114,] -0.89850372 1.7014312958 0.92116570 1.344837784  
## [115,] 0.80676175 1.2665487172 0.45609282 -1.697432737  
## [116,] 0.34326165 0.4307028520 -0.75094999 -1.284443485  
## [117,] 0.71029945 0.9595781521 -0.80475753 -1.898318588  
## [118,] -0.53051097 0.7179082858 0.25829234 -0.730313228  
## [119,] -0.19930957 -0.3795552606 -1.25263051 0.012727473  
## [120,] -0.67289292 -0.2066279085 -1.16915977 0.965973669  
## [121,] -0.11991764 1.5567889318 1.31222648 -0.952927641  
## [122,] 0.86756524 -0.0070407658 0.89386303 -0.363741548  
## [123,] -0.58642860 -0.7435350718 -0.14750204 1.054552522  
## [124,] 0.27190221 -0.6339569150 -0.76465501 1.032467394  
## [125,] 0.44858028 -0.9192549621 0.62103006 0.184567152  
## [126,] -2.03730504 1.7037319812 0.70007592 0.182578081  
## [127,] 1.32789586 1.2477518377 1.68197079 -1.216940322  
## [128,] -0.01691971 -0.4973965433 -0.78399105 -0.030013382  
## [129,] -1.43712527 -1.4407221723 0.48328758 0.766339392  
## [130,] -2.09613150 -1.4869015584 0.38517979 0.217438244  
## [131,] 0.46825433 0.4050485832 -1.24864641 1.095261513  
## [132,] 0.89836659 1.1219583312 0.25842100 -0.151298092  
## [133,] 0.15368502 -0.9409022432 -0.50897122 0.531209642  
## [134,] 0.26783567 -1.1331484453 0.60336620 -0.371267216  
## [135,] 0.09730686 0.4110330786 -0.46050113 0.958732537  
## [136,] -2.24810142 1.4414761575 0.13379077 0.774436639  
## [137,] -0.01425725 1.4696826316 -0.89911552 1.246936881  
## [138,] -0.70224413 1.1667840504 -0.49299970 1.112017334  
## [139,] -0.35987368 0.0026907802 -0.81142054 0.869188462  
## [140,] -1.40999430 -0.2036505392 -0.44454713 -0.186779156  
## [141,] -0.76150072 -0.5756885573 0.93417457 0.350514484  
## [142,] 0.09713737 0.3254882661 1.07078700 -0.722953568  
## [143,] -1.99921967 -1.9978202774 0.59948405 -0.864806141  
## [144,] -0.50101728 -0.1757106357 0.33823634 -0.022262003  
## [145,] 0.42233171 -0.5405845000 0.90820999 0.720114788  
## [146,] -0.88928579 -1.4975122114 0.85387509 1.061164709  
## [147,] 0.53313842 -0.7783679409 -1.08247348 1.040697043  
## [148,] -0.16206937 -0.3678090820 0.02043755 -0.347634535  
## [149,] 1.14286865 0.0128521447 -1.05899995 0.303615805  
## [150,] -0.30214572 0.7531499009 0.83377757 1.077433335  
## [151,] -0.51381713 0.2598439963 0.85440754 1.458522856  
## [152,] 0.51082043 -0.8590152086 -0.37024703 -2.059548018  
## [153,] 0.57330246 1.9412885130 0.65095214 0.060331610  
## [154,] 1.88092869 0.1700855822 -1.59830515 1.404834379  
## [155,] 0.31752560 0.6647002826 0.42315232 1.491072686  
## [156,] -0.66384991 0.4985398302 -0.29151252 0.062649765  
## [157,] -0.05785222 -0.6374803687 -0.24636316 0.219763146  
## [158,] -1.09767052 0.7089049561 -0.16873892 0.318939358  
## [159,] 1.62757402 1.3046129511 -1.65480410 0.116186874  
## [160,] 1.18016345 1.8978331881 -0.92536994 -1.924255048  
## [161,] 0.28189287 -0.0003977858 1.23663668 -1.106043180  
## [162,] 0.17339665 0.2142480832 1.47506359 -0.806929790  
## [163,] 1.38938779 -0.1850013236 -0.14419373 0.412692199  
## [164,] 1.56981246 -0.8890002711 2.08796434 0.642901743  
## [165,] 0.47623174 1.2189538249 0.39776566 2.098802790  
## [166,] -0.33648925 0.2193991960 0.01171135 0.088574119  
## [167,] -0.92379917 0.4148132494 0.27560986 0.424024437  
## [168,] -0.25947665 -0.2357037755 -0.35416531 -1.131479911  
## [169,] 0.56836063 0.0761835588 -0.79173883 -0.504722040  
## [170,] 1.50776834 0.0921068510 -1.46374555 1.310413968  
## [171,] 0.65127938 0.9368368517 -1.79774153 1.215699409  
## [172,] -0.57147901 0.7931037510 -1.09038090 -0.115203244  
## [173,] -0.84264526 0.7181541322 -1.06961119 -0.338424090  
## [174,] -1.68556613 0.6721443514 0.15286062 -0.160484018  
## [175,] -1.11060615 -0.2038416879 -0.99516431 -1.496785814  
## [176,] -1.02054604 -0.1310344178 -0.64693906 -1.044827018  
## [177,] -0.38837299 -0.7014962652 -1.07901018 -0.025607540  
## [178,] 1.04872837 0.0811421305 0.96420197 -0.364333894  
## [179,] 0.98876756 -0.1160917022 1.07024539 -0.181435162  
## [180,] 0.58944953 -0.8122401588 0.87763816 0.159736201  
## [181,] 0.73957679 0.2175714282 -0.99986091 -0.224747663  
## [182,] -2.16913802 2.0259634692 -1.91276876 -1.303233402  
## [183,] -0.18715473 -0.2736726067 -0.23329631 0.432646018  
## [184,] 0.75308088 1.0981723263 -0.08086473 0.676369589  
## [185,] 0.59359996 -0.1191696550 1.50573649 0.339234299  
## [186,] 0.62032778 0.1645168771 1.58801712 -0.293322198  
## [187,] -0.33591885 0.8932289371 -0.06776737 0.864066289  
## [188,] 0.15176631 -0.2920481797 0.14283935 -1.267916909  
## [189,] 0.34745701 -1.9512786945 0.45034804 0.631205404  
## [190,] 0.54435839 -0.2251326733 1.48978624 0.498586408  
## [191,] -0.27873003 0.2810319773 -1.88564605 1.202776880  
## [192,] 0.46309799 1.2417022523 -1.74258683 1.164576215  
## [193,] -0.38423663 0.6884774612 -1.18448914 0.902247322  
## [194,] -0.59129749 -1.0623387681 -1.42529341 0.464832366  
## [195,] -1.60433788 0.5259389236 -0.21476744 1.228227750  
## [196,] 0.53972934 -0.3739006544 0.93516839 -1.294889434  
## [197,] 0.28148757 -0.7209341783 -1.06102417 1.285209255  
## [198,] 0.12654601 -0.9113347702 0.10983178 -0.865559960  
## [199,] 0.12654601 -0.9113347702 0.10983178 -0.865559960  
## [200,] 0.45620797 -1.3322791731 -0.72159565 0.139784424  
## [201,] 0.29599897 -0.0569540813 0.72302903 0.283310717  
## [202,] 1.04048735 -0.9198186335 -0.84456299 -0.410025740  
## [203,] -1.95218183 2.0134997117 0.61113008 1.066045389  
## [204,] 0.65910695 -0.3402975674 -1.77587843 1.294707589  
## [205,] -1.31829916 0.3562812211 -1.06009938 -0.349531499  
## [206,] 1.25650579 -0.3140870550 -1.36819216 0.811495841  
## [207,] 1.32968871 1.3996716030 0.19710199 0.513577333  
## [208,] -0.71454114 -1.9084854792 0.22407523 0.153020690  
## [209,] 1.48553900 -1.0689679887 1.29509304 -0.878411882  
## [210,] 0.81707546 -0.6755665726 1.12237377 -1.688479993  
## [211,] -0.75279294 0.3404236535 1.23004810 0.892994867  
## [212,] 0.74184627 1.1714633790 1.25524983 -0.616760579  
## [213,] -0.68785984 -0.1163519863 0.69121241 0.221567448  
## [214,] 0.52748914 -0.4787771729 -1.49642645 0.873489719  
## [215,] -1.35718634 -0.1447309380 -0.24268647 1.334293564  
## [216,] -0.21529788 -1.0829805913 -0.61917738 -0.378938329  
## [217,] -0.78549997 1.5173259039 0.92196592 0.417732766  
## [218,] -1.57115696 0.7744600944 -0.82439254 -0.162749963  
## [219,] -1.57115696 0.7744600944 -0.82439254 -0.162749963  
## [220,] 1.51377211 0.3910879378 1.26775293 1.415805084  
## [221,] 1.58440305 -0.0551853451 0.67985038 0.600083982  
## [222,] 1.58440305 -0.0551853451 0.67985038 0.600083982  
## [223,] -0.11183716 0.5848250969 0.13750533 -1.544838362  
## [224,] -1.62159501 0.6099978487 -0.94914622 -0.500250739  
## [225,] -0.21065914 -1.0467344902 -1.03718519 -0.456398084  
## [226,] -0.21065914 -1.0467344902 -1.03718519 -0.456398084  
## [227,] -0.46388894 -0.4842675140 -0.18578483 -0.766600896  
## [228,] -1.41409347 -0.2519556398 -0.19620276 -0.430400699  
## [229,] -2.20298325 0.9086102301 0.56296941 -0.580106616  
## [230,] 0.51838039 0.1821528692 -0.35760522 -1.105061317  
## [231,] -0.03963678 -0.7338381080 -1.11804553 0.063863739  
## [232,] 0.61441670 0.8542024064 1.52292001 -0.399349930  
## [233,] 0.15337602 -0.9916480693 -0.15561440 -0.088226905  
## [234,] -0.72681960 -0.2992750915 -0.32433642 -0.799076486  
## [235,] 0.21061433 -1.2992894889 -0.75893277 -0.123059506  
##   
## $weights  
## RC1 RC2 RC4 RC3  
## Filling 0.149892346 0.0859037398 -0.046815976 0.0315941751  
## Natural 0.152365653 -0.0138070922 -0.052902857 -0.0206639952  
## Fibre 0.180955080 0.0254546005 -0.064438292 -0.0901049851  
## Sweet 0.037918879 0.2373508458 0.043323924 -0.0006312356  
## Easy 0.041628165 0.0468131658 -0.044055270 0.1372390642  
## Salt 0.055327169 0.2898174901 -0.142490672 0.0177790720  
## Satisfying 0.114315475 0.0647062771 -0.035093532 0.1218636549  
## Energy 0.134844459 0.0746016190 -0.016668475 0.0278670597  
## Fun -0.020453914 0.0267617658 0.152455005 0.1300767385  
## Kids -0.047462811 0.0056528839 -0.035244520 0.3247541406  
## Soggy 0.085190781 0.1174107403 -0.313499929 0.0976480837  
## Economical -0.011238284 -0.0837533447 -0.107636472 0.2127994334  
## Health 0.154429427 -0.0417555355 -0.039288032 -0.0233373800  
## Family -0.040953407 -0.0303242643 0.001690921 0.2956452699  
## Calories 0.024642102 0.2431452652 -0.034126962 -0.0077316757  
## Plain 0.034424818 0.0582012751 -0.304391406 0.0983506655  
## Crisp -0.052447335 -0.0106964842 0.183666382 0.1200829308  
## Regular 0.132820564 0.0074993579 -0.020642106 -0.0573285333  
## Sugar 0.010769210 0.2677840168 -0.010255805 -0.0246641336  
## Fruit 0.076182635 0.0564084744 0.150232969 -0.1788343762  
## Process 0.005572601 0.1812633644 -0.126402440 0.0374979285  
## Quality 0.102622989 -0.0565631996 0.018944450 0.0346171359  
## Treat -0.003780590 0.0375643587 0.194229436 0.0726486125  
## Boring 0.051712551 0.1028857038 -0.252953714 -0.0445844829  
## Nutritious 0.165539072 -0.0003603661 -0.051949391 -0.0258135067  
##   
## $r.scores  
## RC1 RC2 RC4 RC3  
## RC1 1.000000e+00 9.111635e-16 3.663736e-15 1.484923e-15  
## RC2 9.124645e-16 1.000000e+00 -1.670539e-15 -1.099815e-15  
## RC4 3.653328e-15 -1.731169e-15 1.000000e+00 -2.246901e-15  
## RC3 1.493597e-15 -1.127882e-15 -2.280294e-15 1.000000e+00  
##   
## $missing  
## [1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [36] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [71] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [106] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [141] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [176] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
## [211] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
##   
## $R2  
## [1] 1 1 1 1

plot(rotate\_cereal , row.names(rotate\_cereal$loadings))



rotate\_cereal$fit

## [1] 0.9077224

rotate\_cereal$fit.off

## [1] 0.9615832

(rotate\_cereal$STATISTIC- rotate\_cereal$dof)/(rotate\_cereal$chi- rotate\_cereal$null.dof)

## [1] 2.258929

rotate\_cereal$dof

## [1] 206

rotate\_cereal$null.dof

## [1] 300

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The preview shows you a rendered HTML copy of the contents of the editor. Consequently, unlike *Knit*, *Preview* does not run any R code chunks. Instead, the output of the chunk when it was last run in the editor is displayed.