BSc Population Health Dissertation (18/19)

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```r
###########################################   Package Library   ##########################################

library(data.table)
library(readr)
library(foreign)
library(haven)
library(grid)
library(gridExtra)
library(factoextra)
```

```
## Loading required package: ggplot2

## Welcome! Related Books: `Practical Guide To Cluster Analysis in R` at https://goo.gl/13EFCZ
```

```r
library(PerformanceAnalytics)
```

```
## Loading required package: xts

## Warning: package 'xts' was built under R version 3.4.4

## Loading required package: zoo

##
## Attaching package: 'zoo'

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

##
## Attaching package: 'xts'

## The following objects are masked from 'package:data.table':
##
##     first, last

##
## Attaching package: 'PerformanceAnalytics'

## The following object is masked from 'package:graphics':
##
##     legend
```

```r
library(factoextra)
library(ca)
library(highcharter)
```

```
## Highcharts (www.highcharts.com) is a Highsoft software product which is

## not free for commercial and Governmental use
```

```r
library(tidyverse)
```

```
## -- Attaching packages ------------------ tidyverse 1.2.1 --
```

```
## v tibble  1.4.2     v dplyr   0.7.4
## v tidyr   0.8.2     v stringr 1.2.0
## v purrr   0.2.4     v forcats 0.2.0

## Warning: package 'tidyr' was built under R version 3.4.4

## -- Conflicts --------------------- tidyverse_conflicts() --
## x dplyr::between()   masks data.table::between()
## x dplyr::combine()   masks gridExtra::combine()
## x dplyr::filter()    masks stats::filter()
## x dplyr::first()     masks xts::first(), data.table::first()
## x dplyr::lag()       masks stats::lag()
## x dplyr::last()      masks xts::last(), data.table::last()
## x purrr::transpose() masks data.table::transpose()
```

```r
library(rwars)
library(Matching)
```

```
## Loading required package: MASS

##
## Attaching package: 'MASS'

## The following object is masked from 'package:dplyr':
##
##     select

## ##
## ##  Matching (Version 4.9-2, Build Date: 2015-12-25)
## ##  See http://sekhon.berkeley.edu/matching for additional documentation.
## ##  Please cite software as:
## ##   Jasjeet S. Sekhon. 2011. ``Multivariate and Propensity Score Matching
## ##   Software with Automated Balance Optimization: The Matching package for R.''
## ##   Journal of Statistical Software, 42(7): 1-52.
## ##
```

```r
library(Hmisc)
```

```
## Loading required package: lattice

## Loading required package: survival

## Loading required package: Formula

##
## Attaching package: 'Hmisc'

## The following objects are masked from 'package:dplyr':
##
##     combine, src, summarize

## The following object is masked from 'package:gridExtra':
##
##     combine

## The following objects are masked from 'package:base':
##
##     format.pval, round.POSIXt, trunc.POSIXt, units
```

```r
library(dplyr)
```

```
#################################      Write in 2005-2015 datasets      ################################

hse05 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse05ai.dta")
write.csv(hse05, file = "hse05.csv")

hse06 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse06ai.dta")
write.csv(hse06, file = "hse06.csv")

hse07 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse07ai.dta")
write.csv(hse07, file = "hse07.csv")

hse08 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse08ai.dta")
write.csv(hse08, file = "hse08.csv")

hse09 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse09ai.dta")
write.csv(hse09, file = "hse09.csv")

hse10 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse10ai.dta")
write.csv(hse10, file = "hse10.csv")

hse11 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse2011ai.dta")
write.csv(hse11, file = "hse11.csv")

hse12 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse2012ai.dta")
write.csv(hse12, file = "hse12.csv")

hse13 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse2013ai.dta")
write.csv(hse13, file = "hse13.csv")

hse14 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse2014ai.dta")
write.csv(hse14, file = "hse14.csv")

hse15 = read_dta("/Users/vincentmay/Desktop/Dissertation/Codes/dataset/hse2015ai.dta")
write.csv(hse15, file = "hse15.csv")
```

```
#############################################     Load CSV files     ##################################

hse05 <-read.csv("hse05.csv")
hse06 <-read.csv("hse06.csv")
hse07 <-read.csv("hse07.csv")
hse08 <-read.csv("hse08.csv")
hse09 <-read.csv("hse09.csv")
hse10 <-read.csv("hse10.csv")
hse11 <-read.csv("hse11.csv")
hse12 <-read.csv("hse12.csv")
hse13 <-read.csv("hse13.csv")
hse14 <-read.csv("hse14.csv")
hse15 <-read.csv("hse15.csv")
```

Part 1/4: Data Preparation

```
################################      Data Preparation  --  Get variables needed      ###################

#         In this section, variables in interest are selected.
#         Children are filtered from the datasets by "ag215g2", which is further converted to three age

hse05.pc <- c("sys1om","dias1om","sex","tenureb","ag215g2","ethinda","hhsize","addnum","imd2004",
              "birthwt","porftvg","gor","sys2om","sys3om","dias2om","dias3om")
hse05.mk2 <- hse05[,hse05.pc]
colnames(hse05.mk2)[6] <- "origin"
colnames(hse05.mk2)[9] <- "imd"
hse05.mk2$year <- 05
hse05.mk2$aggr <- ifelse(hse05.mk2$ag215g2 > 4 , 3,
                         ifelse(hse05.mk2$ag215g2 > 3, 2,
                                ifelse(hse05.mk2$ag215g2 > 0, 1,0)))
hse05.mk2$porftvg <- ifelse(hse05.mk2$porftvg > 5, 6, hse05.mk2$porftvg)
hse05.2 <- -c(which(hse05.mk2$aggr == 0))
hse05.mk2 <- hse05.mk2[hse05.2,]
hse05.mk2$ag215g2 <- NULL


hse06.pc <- c("sys1om","dias1om","sex","tenureb","ag215g2","ethinda","hhsize","addnum","imd2004",
              "birthwt","porftvg","gor06","sys2om","sys3om","dias2om","dias3om")
hse06.mk2 <- hse06[,hse06.pc]
colnames(hse06.mk2)[6] <- "origin"
colnames(hse06.mk2)[9] <- "imd"
colnames(hse06.mk2)[12] <- "gor"
hse06.mk2$year <- 06
hse06.mk2$aggr <- ifelse(hse06.mk2$ag215g2 > 4 , 3,
                         ifelse(hse06.mk2$ag215g2 > 3, 2,
                                ifelse(hse06.mk2$ag215g2 > 0, 1,0)))
hse06.mk2$porftvg <- ifelse(hse06.mk2$porftvg > 5, 6, hse06.mk2$porftvg)
hse06.2 <- -c(which(hse06.mk2$aggr == 0))
hse06.mk2 <- hse06.mk2[hse06.2,]
hse06.mk2$ag215g2 <- NULL


hse07.pc <- c("sys1om","dias1om","sex","tenureb","ag215g2","ethinda","hhsized","addnum","imd2007",
              "birthwt","porftvg","gor07","sys2om","sys3om","dias2om","dias3om")
hse07.mk2 <- hse07[,hse07.pc]
colnames(hse07.mk2)[6] <- "origin"
colnames(hse07.mk2)[7] <- "hhsize"
colnames(hse07.mk2)[9] <- "imd"
colnames(hse07.mk2)[12] <- "gor"
hse07.mk2$year <- 07
hse07.mk2$aggr <- ifelse(hse07.mk2$ag215g2 > 4 , 3,
                         ifelse(hse07.mk2$ag215g2 > 3, 2,
                                ifelse(hse07.mk2$ag215g2 > 0, 1,0)))
hse07.mk2$porftvg <- ifelse(hse07.mk2$porftvg > 5, 6, hse07.mk2$porftvg)
hse07.2 <- -c(which(hse07.mk2$aggr == 0))
hse07.mk2 <- hse07.mk2[hse07.2,]
hse07.mk2$ag215g2 <- NULL
```

```
hse08.pc <- c("sys1om","dias1om","sex","tenureb","ag215g2","origin","hhsize","addnum","qimd",
              "birthwt","porftvg","GOR","sys2om","sys3om","dias2om","dias3om")
hse08.mk2 <- hse08[,hse08.pc]
colnames(hse08.mk2)[9] <- "imd"
colnames(hse08.mk2)[12] <- "gor"
hse08.mk2$year <- 08
hse08.mk2$aggr <- ifelse(hse08.mk2$ag215g2 > 4 , 3,
                         ifelse(hse08.mk2$ag215g2 > 3, 2,
                                ifelse(hse08.mk2$ag215g2 > 0, 1,0)))
hse08.mk2$porftvg <- ifelse(hse08.mk2$porftvg > 5, 6, hse08.mk2$porftvg)
hse08.2 <- -c(which(hse08.mk2$aggr == 0))
hse08.mk2 <- hse08.mk2[hse08.2,]
hse08.mk2$ag215g2 <- NULL


hse09.pc <- c("sys1om","dias1om","sex","tenureb","ag215g2","origin","hhsize","addnum","IMD2007",
              "birthwt","porftvg","GOR07","sys2om","sys3om","dias2om","dias3om")
hse09.mk2 <- hse09[,hse09.pc]
colnames(hse09.mk2)[9] <- "imd"
colnames(hse09.mk2)[12] <- "gor"
hse09.mk2$year <- 09
hse09.mk2$aggr <- ifelse(hse09.mk2$ag215g2 > 4 , 3,
                         ifelse(hse09.mk2$ag215g2 > 3, 2,
                                ifelse(hse09.mk2$ag215g2 > 0, 1,0)))
hse09.mk2$porftvg <- ifelse(hse09.mk2$porftvg > 5, 6, hse09.mk2$porftvg)
hse09.2 <- -c(which(hse09.mk2$aggr == 0))
hse09.mk2 <- hse09.mk2[hse09.2,]
hse09.mk2$ag215g2 <- NULL


hse10.pc <- c("sys1om","dias1om","sex","tenureb","ag215g2","origin","hhsize","addnum","imd2007",
              "birthwt","porftvg","gor1","sys2om","sys3om","dias2om","dias3om")
hse10.mk2 <- hse10[,hse10.pc]
colnames(hse10.mk2)[9] <- "imd"
colnames(hse10.mk2)[12] <- "gor"
hse10.mk2$year <- 10
hse10.mk2$aggr <- ifelse(hse10.mk2$ag215g2 > 4 , 3,
                         ifelse(hse10.mk2$ag215g2 > 3, 2,
                                ifelse(hse10.mk2$ag215g2 > 0, 1,0)))
hse10.mk2$porftvg <- ifelse(hse10.mk2$porftvg > 5, 6, hse10.mk2$porftvg)
hse10.2 <- -c(which(hse10.mk2$aggr == 0))
hse10.mk2 <- hse10.mk2[hse10.2,]
hse10.mk2$ag215g2 <- NULL


hse11.pc <- c("sys1om","dias1om","Sex","tenureb","ag215g2","Origin","HHSize","addnum","qimd",
              "BirthWt","porftvg","gor1","sys2om","sys3om","dias2om","dias3om")
hse11.mk2 <- hse11[,hse11.pc]
colnames(hse11.mk2)[3] <- "sex"
colnames(hse11.mk2)[6] <- "origin"
colnames(hse11.mk2)[7] <- "hhsize"
colnames(hse11.mk2)[9] <- "imd"
```

```r
colnames(hse11.mk2)[10] <- "birthwt"
colnames(hse11.mk2)[12] <- "gor"
hse11.mk2$year <- 11
hse11.mk2$aggr <- ifelse(hse11.mk2$ag215g2 > 4 , 3,
                         ifelse(hse11.mk2$ag215g2 > 3, 2,
                                ifelse(hse11.mk2$ag215g2 > 0, 1,0)))
hse11.mk2$porftvg <- ifelse(hse11.mk2$porftvg > 5, 6, hse11.mk2$porftvg)
hse11.2 <- -c(which(hse11.mk2$aggr == 0))
hse11.mk2 <- hse11.mk2[hse11.2,]
hse11.mk2$ag215g2 <- NULL


hse12.pc <- c("sys1om","dias1om","Sex","tenureb","ag215g2","Origin","HHSize","Addnum","qimd",
              "BirthWt",                 "gor1","sys2om","sys3om","dias2om","dias3om")
hse12.mk2 <- hse12[,hse12.pc]
colnames(hse12.mk2)[3] <- "sex"
colnames(hse12.mk2)[6] <- "origin"
colnames(hse12.mk2)[7] <- "hhsize"
colnames(hse12.mk2)[8] <- "addnum"
colnames(hse12.mk2)[9] <- "imd"
colnames(hse12.mk2)[10] <- "birthwt"
colnames(hse12.mk2)[11] <- "gor"
hse12.mk2$porftvg <- NA
hse12.mk2$year <- 12
hse12.mk2$aggr <- ifelse(hse12.mk2$ag215g2 > 4 , 3,
                         ifelse(hse12.mk2$ag215g2 > 3, 2,
                                ifelse(hse12.mk2$ag215g2 > 0, 1,0)))
hse12.mk2$porftvg <- ifelse(hse12.mk2$porftvg > 5, 6, hse12.mk2$porftvg)
hse12.2 <- -c(which(hse12.mk2$aggr == 0))
hse12.mk2 <- hse12.mk2[hse12.2,]
hse12.mk2$ag215g2 <- NULL


hse13.pc <- c("SYS1OM","DIAS1OM","Sex","tenureb","ag215g2","Origin","HHSize","Addnum","qimd",
              "BirthWt","porftvg","gor1","SYS2OM","SYS3OM","DIAS2OM","DIAS3OM")
hse13.mk2 <- hse13[,hse13.pc]
colnames(hse13.mk2)[1] <- "sys1om"
colnames(hse13.mk2)[2] <- "dias1om"
colnames(hse13.mk2)[3] <- "sex"
colnames(hse13.mk2)[6] <- "origin"
colnames(hse13.mk2)[7] <- "hhsize"
colnames(hse13.mk2)[8] <- "addnum"
colnames(hse13.mk2)[9] <- "imd"
colnames(hse13.mk2)[10] <- "birthwt"
colnames(hse13.mk2)[12] <- "gor"
colnames(hse13.mk2)[13] <- "sys2om"
colnames(hse13.mk2)[14] <- "sys3om"
colnames(hse13.mk2)[15] <- "dias2om"
colnames(hse13.mk2)[16] <- "dias3om"
hse13.mk2$year <- 13
hse13.mk2$aggr <- ifelse(hse13.mk2$ag215g2 > 4 , 3,
                         ifelse(hse13.mk2$ag215g2 > 3, 2,
                                ifelse(hse13.mk2$ag215g2 > 0, 1,0)))
```

```
hse13.mk2$porftvg <- ifelse(hse13.mk2$porftvg > 5, 6, hse13.mk2$porftvg)
hse13.2 <- -c(which(hse13.mk2$aggr == 0))
hse13.mk2 <- hse13.mk2[hse13.2,]
hse13.mk2$ag215g2 <- NULL


hse14.pc <- c("SYS1OM","DIAS1OM","Sex","tenureb","ag215g2","origin2","HHSize9","Addnum","qimd",
              "BirthWt","PorFV05","gor1","SYS2OM","SYS3OM","DIAS2OM","DIAS3OM")
hse14.mk2 <- hse14[,hse14.pc]
colnames(hse14.mk2)[1] <- "sys1om"
colnames(hse14.mk2)[2] <- "dias1om"
colnames(hse14.mk2)[3] <- "sex"
colnames(hse14.mk2)[6] <- "origin"
colnames(hse14.mk2)[7] <- "hhsize"
colnames(hse14.mk2)[8] <- "addnum"
colnames(hse14.mk2)[9] <- "imd"
colnames(hse14.mk2)[10] <- "birthwt"
colnames(hse14.mk2)[11] <- "porftvg"
colnames(hse14.mk2)[12] <- "gor"
colnames(hse14.mk2)[13] <- "sys2om"
colnames(hse14.mk2)[14] <- "sys3om"
colnames(hse14.mk2)[15] <- "dias2om"
colnames(hse14.mk2)[16] <- "dias3om"
hse14.mk2$year <- 14
hse14.mk2$aggr <- ifelse(hse14.mk2$ag215g2 > 4 , 3,
                         ifelse(hse14.mk2$ag215g2 > 3, 2,
                                ifelse(hse14.mk2$ag215g2 > 0, 1,0)))
hse14.2 <- -c(which(hse14.mk2$aggr == 0))
hse14.mk2 <- hse14.mk2[hse14.2,]
hse14.mk2$ag215g2 <- NULL


hse15.pc <- c("SYS1OM","DIAS1OM","Sex","tenureb","Ag015g4","origin2","HHSize6","addnum","qimd",
              "BirthWt","PorFV05b","Gor1","SYS2OM","SYS3OM","DIAS2OM","DIAS3OM")
hse15.mk2 <- hse15[,hse15.pc]
colnames(hse15.mk2)[1] <- "sys1om"
colnames(hse15.mk2)[2] <- "dias1om"
colnames(hse15.mk2)[3] <- "sex"
colnames(hse15.mk2)[6] <- "origin"
colnames(hse15.mk2)[7] <- "hhsize"
colnames(hse15.mk2)[9] <- "imd"
colnames(hse15.mk2)[10] <- "birthwt"
colnames(hse15.mk2)[11] <- "porftvg"
colnames(hse15.mk2)[12] <- "gor"
colnames(hse15.mk2)[13] <- "sys2om"
colnames(hse15.mk2)[14] <- "sys3om"
colnames(hse15.mk2)[15] <- "dias2om"
colnames(hse15.mk2)[16] <- "dias3om"
hse15.mk2$year <- 15
hse15.mk2$aggr <- ifelse(hse15.mk2$Ag015g4 > 4 , 3,
                         ifelse(hse15.mk2$Ag015g4 > 3, 2,
                                ifelse(hse15.mk2$Ag015g4 > 0, 1,0)))
hse15.2 <- -c(which(hse15.mk2$aggr == 0))
```

```r
hse15.mk2 <- hse15.mk2[hse15.2,]
hse15.mk2$Ag015g4 <- NULL
```

```r
################################      Data Preparation  --  Merge (Row bind) the datasets      #########

hse.mk20 <- rbind(hse05.mk2, hse06.mk2)
hse.mk20 <- rbind(hse.mk20, hse07.mk2)
hse.mk20 <- rbind(hse.mk20, hse08.mk2)
hse.mk20 <- rbind(hse.mk20, hse09.mk2)
hse.mk20 <- rbind(hse.mk20, hse10.mk2)
hse.mk20 <- rbind(hse.mk20, hse11.mk2)
hse.mk20 <- rbind(hse.mk20, hse12.mk2)
hse.mk20 <- rbind(hse.mk20, hse13.mk2)
hse.mk20 <- rbind(hse.mk20, hse14.mk2)
hse.mk20 <- rbind(hse.mk20, hse15.mk2)
```

```r
############      Data Preparation  --  Convert the inapplicable cases to NAs & Keep only the valid BP r

#       As some of the observations are recorded as negative number or huge number in inapplicable case
#       This step ensures those cases are marked as NAs rather than continuous number

colnames(hse.mk20)
```

```
##  [1] "sys1om"  "dias1om" "sex"     "tenureb" "origin"  "hhsize"  "addnum"
##  [8] "imd"     "birthwt" "porftvg" "gor"     "sys2om"  "sys3om"  "dias2om"
## [15] "dias3om" "year"    "aggr"
```

```r
range(hse.mk20$sex)
```

```
## [1] 1 2
```

```r
range(hse.mk20$tenureb)
```

```
## [1] -9  6
```

```r
range(hse.mk20$origin)
```

```
## [1] -9 18
```

```r
range(hse.mk20$hhsize)
```

```
## [1]  2 12
```

```r
range(hse.mk20$addnum)
```

```
## [1]  1 56
```

```r
range(hse.mk20$imd)
```

```
## [1] 1 5
```

```r
range(hse.mk20$birthwt, na.rm = T)
```

```
## [1] -1.00  7.14
```

```r
range(hse.mk20$porftvg, na.rm = T)
```

```
## [1] -9  6
```

```r
range(hse.mk20$gor)
```

```
## [1] 1 9
```

```r
range(hse.mk20$year)
```

```
## [1]  5 15
```

```r
range(hse.mk20$aggr)
```

```
## [1] 1 3
```

```r
range(hse.mk20$sys1om)
```

```
## [1]  -9 186
```

```r
range(hse.mk20$sys2om)
```

```
## [1]  -9 996
```

```r
range(hse.mk20$sys3om)
```

```
## [1]  -9 194
```

```r
range(hse.mk20$dias1om)
```

```
## [1]  -9 131
```

```r
range(hse.mk20$dias2om)
```

```
## [1]  -9 135
```

```r
range(hse.mk20$dias3om)
```

```
## [1]  -9 140
```

```r
# tenureb, origin, birthwt, porftvg, & six BP measurements has negative values (inapplicable cases)
# birthwt, porftvg has NA values originally which require to be imputed later.


#       Covert the inapplicable cases to NAs

hse.mk20$tenureb <- ifelse(hse.mk20$tenureb < 0, NA, hse.mk20$tenureb)
hse.mk20$origin <- ifelse(hse.mk20$origin < 0, NA, hse.mk20$origin)
hse.mk20$birthwt <- ifelse(hse.mk20$birthwt < 0, NA, hse.mk20$birthwt)
hse.mk20$porftvg <- ifelse(hse.mk20$porftvg < 0, NA, hse.mk20$porftvg)

#      Keep only the valid measurements

hse.mk20.pc <- -c(which(hse.mk20$sys1om < 0 | hse.mk20$sys1om > 200 |
                        hse.mk20$sys2om < 0 | hse.mk20$sys2om > 200 |
                        hse.mk20$sys3om < 0 | hse.mk20$sys3om > 200 |
                        hse.mk20$dias1om < 0 | hse.mk20$dias1om > 200 |
                        hse.mk20$dias2om < 0 | hse.mk20$dias2om > 200 |
                        hse.mk20$dias3om < 0 | hse.mk20$dias3om > 200))
hse.mk20 <- hse.mk20[hse.mk20.pc,]

#     Last check

colnames(hse.mk20)
```

```
##  [1] "sys1om"  "dias1om" "sex"     "tenureb" "origin"  "hhsize"  "addnum"
##  [8] "imd"     "birthwt" "porftvg" "gor"     "sys2om"  "sys3om"  "dias2om"
```

```
## [15] "dias3om" "year"    "aggr"
range(hse.mk20$sex)
## [1] 1 2
range(hse.mk20$tenureb, na.rm = T)
## [1] 1 6
range(hse.mk20$origin, na.rm = T)
## [1]  1 18
range(hse.mk20$hhsize)
## [1]  2 11
range(hse.mk20$addnum)
## [1]  1 56
range(hse.mk20$imd)
## [1] 1 5
range(hse.mk20$birthwt, na.rm = T)
## [1] 0.91 6.75
range(hse.mk20$porftvg, na.rm = T)
## [1] 0 6
range(hse.mk20$gor)
## [1] 1 9
range(hse.mk20$year)
## [1]  5 15
range(hse.mk20$aggr)
## [1] 1 3
range(hse.mk20$sys1om, na.rm = T)
## [1]  51 183
range(hse.mk20$sys2om, na.rm = T)
## [1]  52 187
range(hse.mk20$sys3om, na.rm = T)
## [1]  53 194
range(hse.mk20$dias1om, na.rm = T)
## [1]  31 131
range(hse.mk20$dias2om, na.rm = T)
## [1]  31 135
```

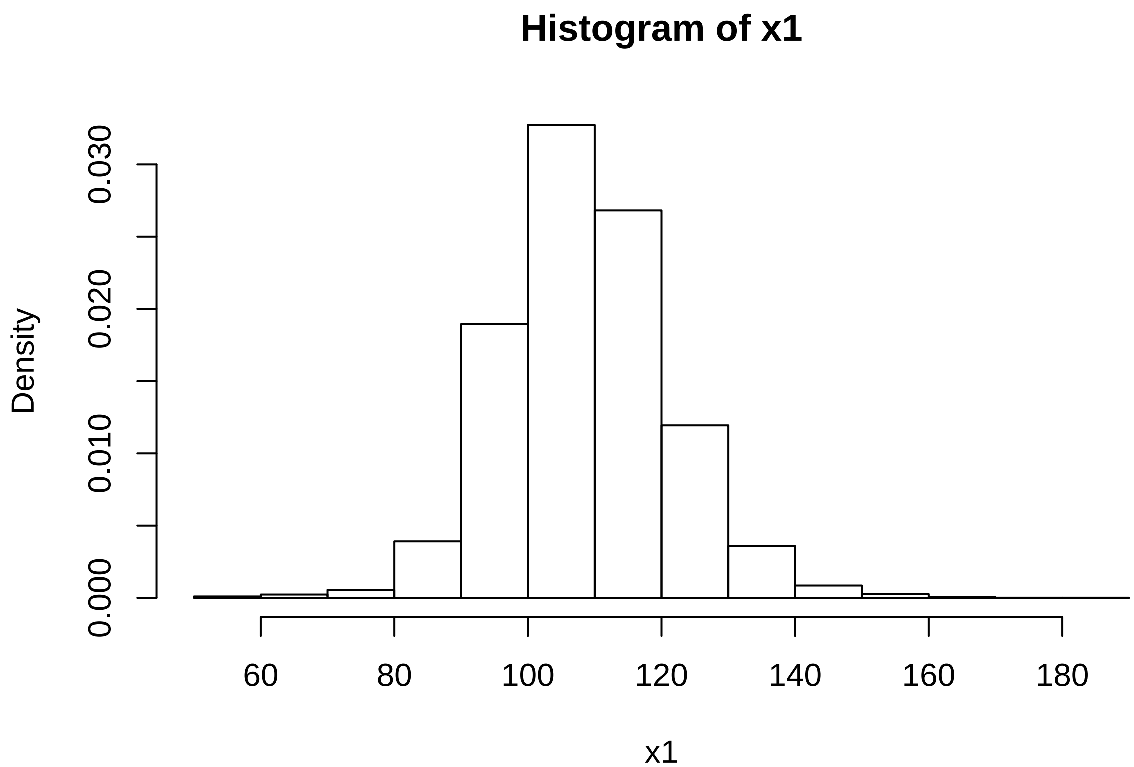
```r
range(hse.mk20$dias3om, na.rm = T)
```

```
## [1]  30 140
```

```r
################################      Data Preparation  --  Average the BP for each row      ############
#       Looking into the distribution of BP measurements

x1 <- hse.mk20$sys1om
range(hse.mk20$sys1om, na.rm = T)
```

```
## [1]  51 183
```

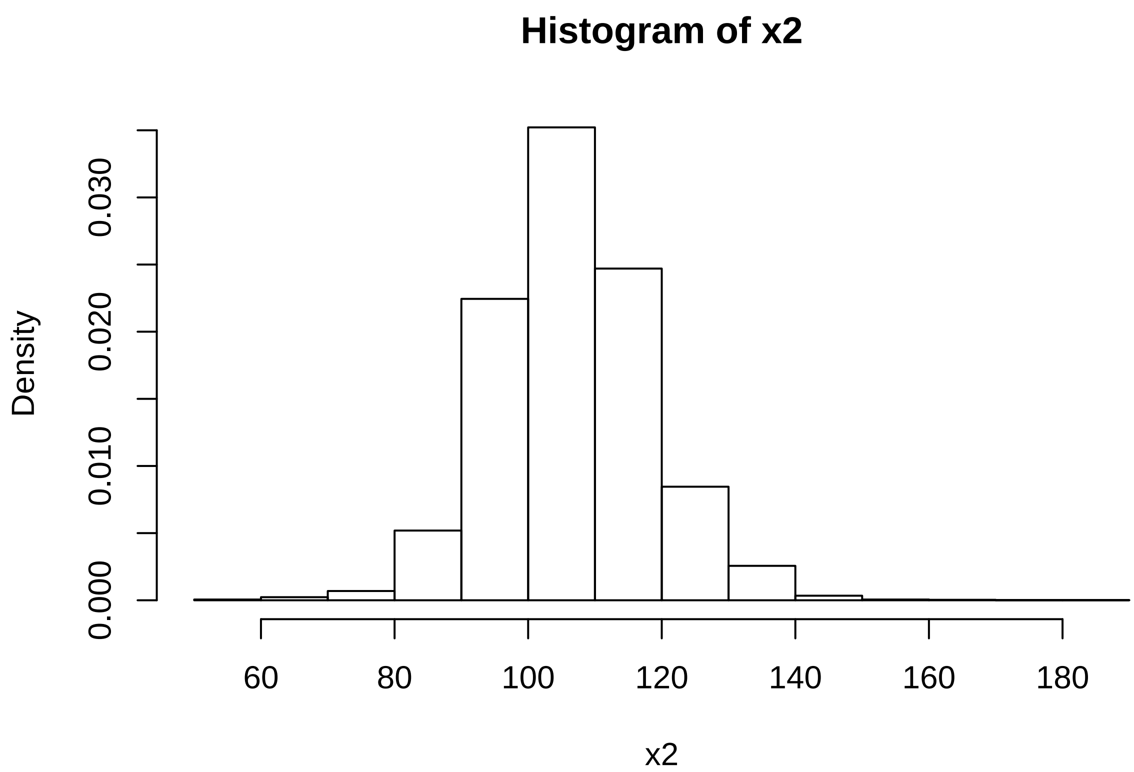
```r
hist(x1, freq = FALSE)
```




```r
x2 <- hse.mk20$sys2om
range(hse.mk20$sys2om, na.rm = T)
```

```
## [1]  52 187
```

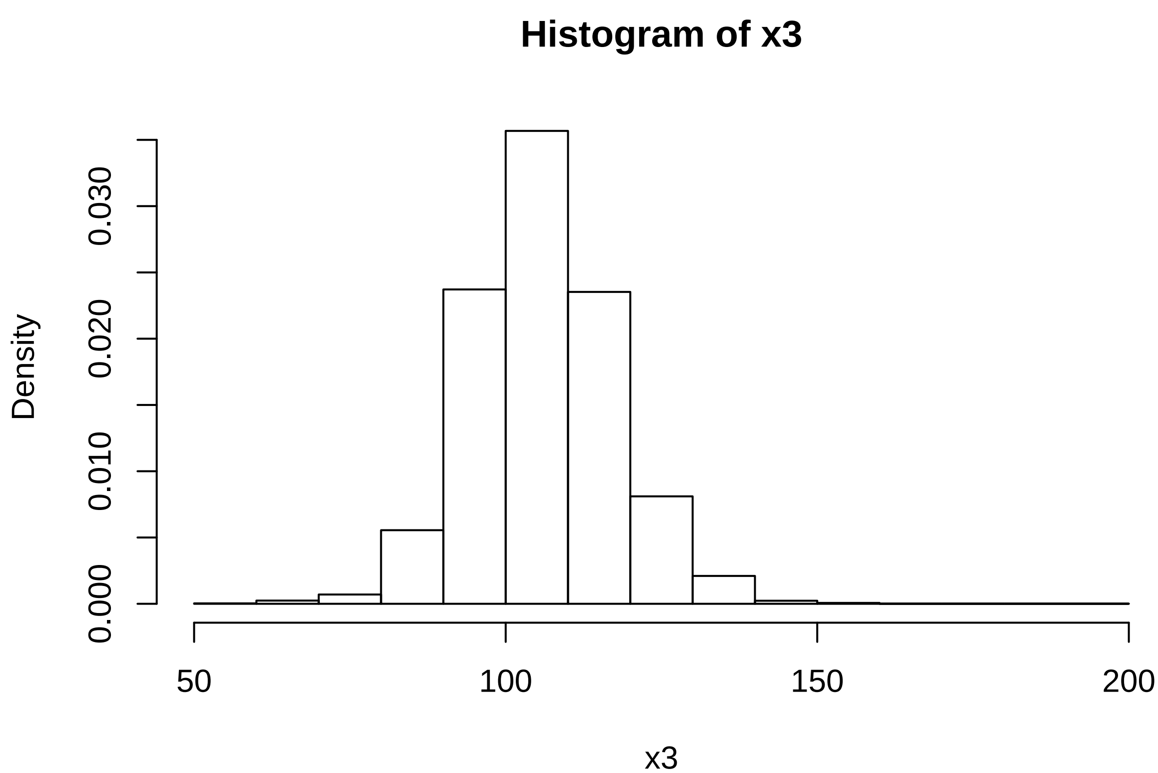
```r
hist(x2, freq = FALSE)
```




```
x3 <- hse.mk20$sys3om
range(hse.mk20$sys3om, na.rm = T)
```

```
## [1]  53 194
```

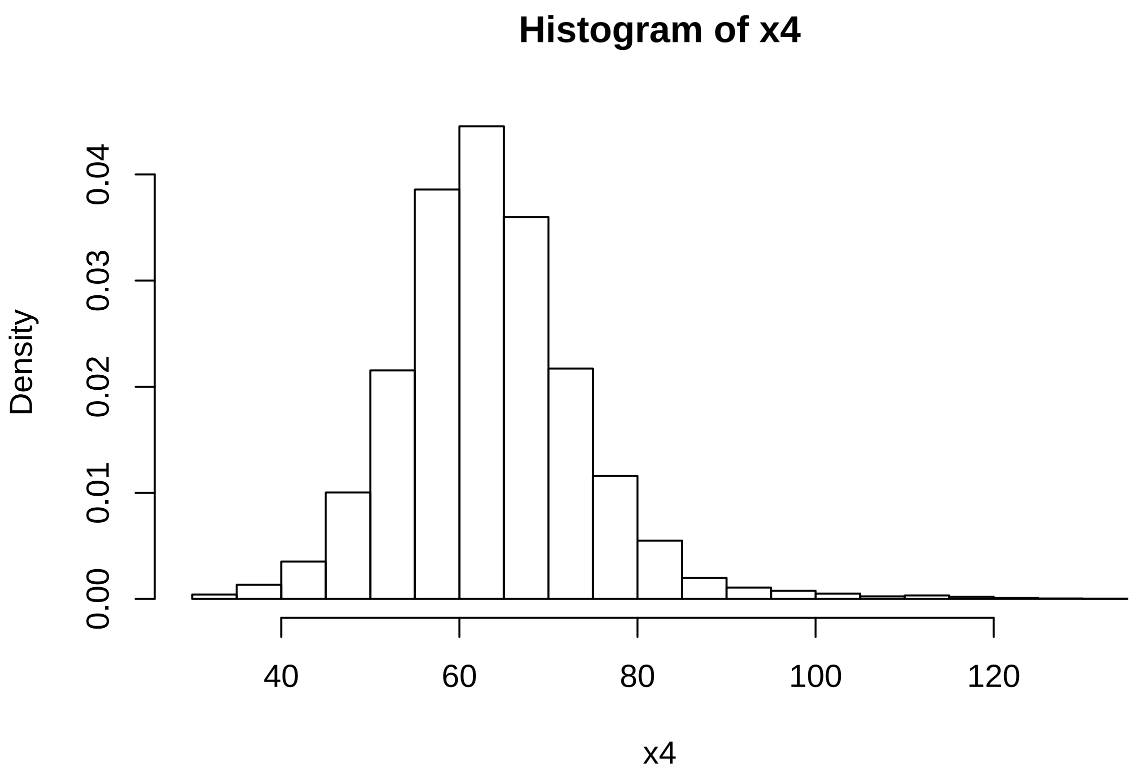
```
hist(x3, freq = FALSE)
```



```r
x4 <- hse.mk20$dias1om
range(hse.mk20$dias1om, na.rm = T)
```

```
## [1]  31 131
```

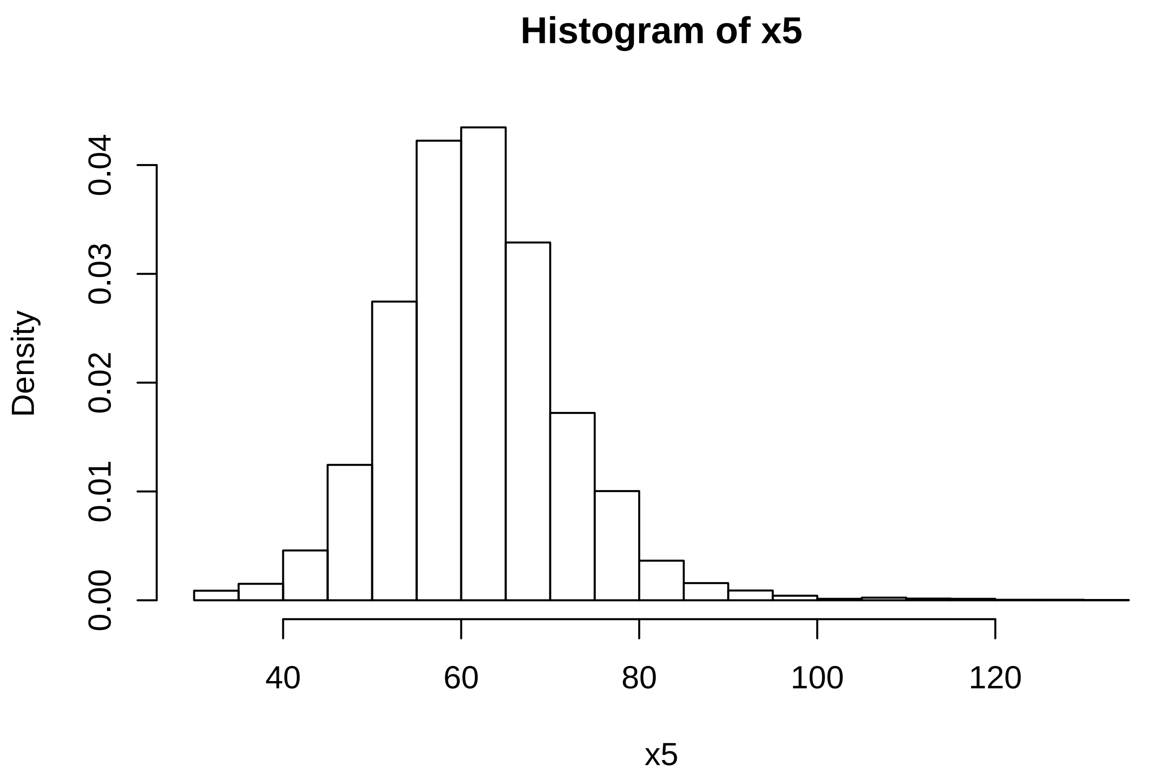
```r
hist(x4, freq = FALSE)
```




```r
x5 <- hse.mk20$dias2om
range(hse.mk20$dias2om, na.rm = T)
```

```
## [1]  31 135
```

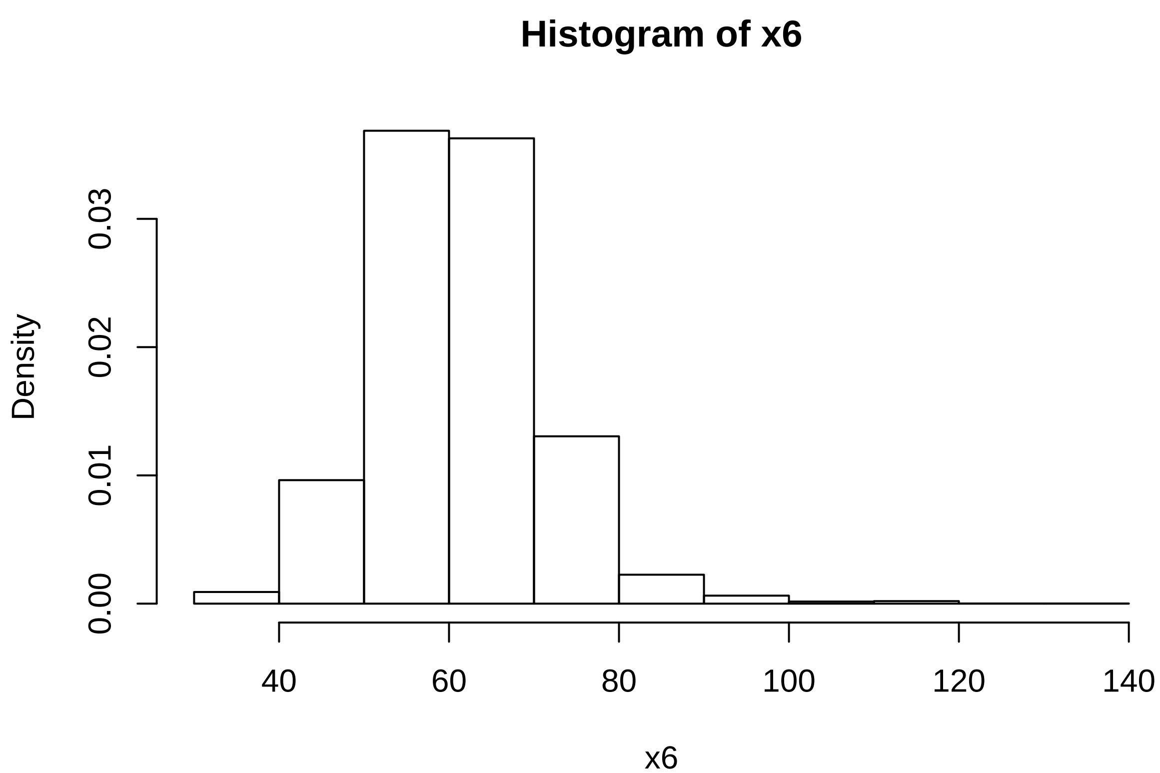
```r
hist(x5, freq = FALSE)
```




```
x6 <- hse.mk20$dias3om
range(hse.mk20$dias3om, na.rm = T)
```

```
## [1]  30 140
```

```
hist(x6, freq = FALSE)
```



```r
#       Get the average of the diastolic and systolic measurements for each row

hse.mk20$sysavg <- NA
hse.mk20$diaavg <- NA

 for ( i in 1 : dim(hse.mk20)[1] ) {
      hse.mk20$sysavg[i] <- (hse.mk20$sys1om[i] + hse.mk20$sys2om[i] + hse.mk20$sys3om[i]) / 3
      hse.mk20$diaavg[i] <- (hse.mk20$dias1om[i] + hse.mk20$dias2om[i] + hse.mk20$dias3om[i]) / 3
 }
hse.mk20$sys1om <- NULL
hse.mk20$sys2om <- NULL
hse.mk20$sys3om <- NULL
hse.mk20$dias1om <- NULL
hse.mk20$dias2om <- NULL
hse.mk20$dias3om <- NULL
```

```r
#############################      Data Preparation  --  Get the hypertensive group      ##############

#   Calculate .95 quantiles of the systolic and diastolic bp for each of the three age groups,
#   if the child's systolic / diastolic bp is higher than .95 age group's threshold,
#   the child is classified as hypertensive


# systolic bp comparison for age group 1
hse.mk20$sys.hyper1 <- NA
hse.mk20$sys.hyper1 <- ifelse(hse.mk20$aggr == 1, hse.mk20$sysavg, NA)
range(hse.mk20$sys.hyper1, na.rm = T)
```

```
## [1]  66.33333 142.00000
```

```r
quantile(hse.mk20$sys.hyper1, .95, na.rm = T)
```

```
## 95%
## 120
```

```r
hse.mk20$sys.hyper1.mk <- NA
hse.mk20$sys.hyper1.mk <- ifelse(hse.mk20$sys.hyper1 >= quantile(hse.mk20$sys.hyper1, .95, na.rm = T)[1
length(which(hse.mk20$sys.hyper1.mk == 1 ))
```

```
## [1] 139
```

```r
#                               group 2
hse.mk20$sys.hyper2 <- NA
hse.mk20$sys.hyper2 <- ifelse(hse.mk20$aggr == 2, hse.mk20$sysavg, NA)
range(hse.mk20$sys.hyper2, na.rm = T)
```

```
## [1]  72.0000 148.3333
```

```r
quantile(hse.mk20$sys.hyper2, .95, na.rm = T)
```

```
## 95%
## 122
```

```r
hse.mk20$sys.hyper2.mk <- NA
hse.mk20$sys.hyper2.mk <- ifelse(hse.mk20$sys.hyper2 >= quantile(hse.mk20$sys.hyper2, .95, na.rm = T)[1
length(which(hse.mk20$sys.hyper2.mk == 1 ))
```

```
## [1] 78
```

```
#                                group 3
hse.mk20$sys.hyper3 <- NA
hse.mk20$sys.hyper3 <- ifelse(hse.mk20$aggr == 3, hse.mk20$sysavg, NA)
range(hse.mk20$sys.hyper3, na.rm = T)
```

```
## [1]  66 186
```

```
quantile(hse.mk20$sys.hyper3, .95, na.rm = T)
```

```
##      95%
## 128.6667
```

```
hse.mk20$sys.hyper3.mk <- NA
hse.mk20$sys.hyper3.mk <- ifelse(hse.mk20$sys.hyper3 >= quantile(hse.mk20$sys.hyper3, .95, na.rm = T)[1
length(which(hse.mk20$sys.hyper3.mk == 1 ))
```

```
## [1] 249
```

```
# diastolic bp comparison for age group 1
hse.mk20$dia.hyper1 <- NA
hse.mk20$dia.hyper1 <- ifelse(hse.mk20$aggr == 1, hse.mk20$diaavg, NA)
range(hse.mk20$dia.hyper1, na.rm = T)
```

```
## [1]  37 100
```

```
quantile(hse.mk20$dia.hyper1, .95, na.rm = T)
```

```
##      95%
## 76.66667
```

```
hse.mk20$dia.hyper1.mk <- NA
hse.mk20$dia.hyper1.mk <- ifelse(hse.mk20$dia.hyper1 >= quantile(hse.mk20$dia.hyper1, .95, na.rm = T)[1
length(which(hse.mk20$dia.hyper1.mk == 1 ))
```

```
## [1] 147
```

```
#                                group 2
hse.mk20$dia.hyper2 <- NA
hse.mk20$dia.hyper2 <- ifelse(hse.mk20$aggr == 2, hse.mk20$diaavg, NA)
range(hse.mk20$dia.hyper2, na.rm = T)
```

```
## [1] 34.66667 96.66667
```

```
quantile(hse.mk20$dia.hyper2, .95, na.rm = T)
```

```
##      95%
## 77.76667
```

```
hse.mk20$dia.hyper2.mk <- NA
hse.mk20$dia.hyper2.mk <- ifelse(hse.mk20$dia.hyper2 >= quantile(hse.mk20$dia.hyper2, .95, na.rm = T)[1
length(which(hse.mk20$dia.hyper2.mk == 1 ))
```

```
## [1] 75
```

```
#                                group 3
hse.mk20$dia.hyper3 <- NA
hse.mk20$dia.hyper3 <- ifelse(hse.mk20$aggr == 3, hse.mk20$diaavg, NA)
range(hse.mk20$dia.hyper3, na.rm = T)
```

```
## [1]  35.66667 114.33333
```

```r
quantile(hse.mk20$dia.hyper3, .95, na.rm = T)
```

```
##      95%
## 77.33333
```

```r
hse.mk20$dia.hyper3.mk <- NA
hse.mk20$dia.hyper3.mk <- ifelse(hse.mk20$dia.hyper3 >= quantile(hse.mk20$dia.hyper3, .95, na.rm = T)[1]
length(which(hse.mk20$dia.hyper3.mk == 1 ))
```

```
## [1] 256
```

```r
#       Get the hypertensive group
#   if the child is classified as hypertensive by one of the age groups'threshold
#   then the child is hypertensive

hse.mk20$sys.hyper1.mk <- ifelse(is.na(hse.mk20$sys.hyper1.mk), 0, hse.mk20$sys.hyper1.mk)
hse.mk20$sys.hyper2.mk <- ifelse(is.na(hse.mk20$sys.hyper2.mk), 0, hse.mk20$sys.hyper2.mk)
hse.mk20$sys.hyper3.mk <- ifelse(is.na(hse.mk20$sys.hyper3.mk), 0, hse.mk20$sys.hyper3.mk)
hse.mk20$dia.hyper1.mk <- ifelse(is.na(hse.mk20$dia.hyper1.mk), 0, hse.mk20$dia.hyper1.mk)
hse.mk20$dia.hyper2.mk <- ifelse(is.na(hse.mk20$dia.hyper2.mk), 0, hse.mk20$dia.hyper2.mk)
hse.mk20$dia.hyper3.mk <- ifelse(is.na(hse.mk20$dia.hyper3.mk), 0, hse.mk20$dia.hyper3.mk)

hse.mk20$hyper <- NA
hse.mk20$hyper <- ifelse(hse.mk20$sys.hyper1.mk == 1 | hse.mk20$sys.hyper2.mk == 1 | hse.mk20$sys.hyper3
                        | hse.mk20$dia.hyper1.mk == 1 | hse.mk20$dia.hyper2.mk == 1 | hse.mk20$dia.hyper3
length(which(hse.mk20$hyper == 1 ))
```

```
## [1] 790
```

```r
#       Delete used rows
hse.mk20$sys.hyper1 <- NULL
hse.mk20$sys.hyper1.mk <- NULL
hse.mk20$sys.hyper2 <- NULL
hse.mk20$sys.hyper2.mk <- NULL
hse.mk20$sys.hyper3 <- NULL
hse.mk20$sys.hyper3.mk <- NULL

hse.mk20$dia.hyper1 <- NULL
hse.mk20$dia.hyper1.mk <- NULL
hse.mk20$dia.hyper2 <- NULL
hse.mk20$dia.hyper2.mk <- NULL
hse.mk20$dia.hyper3 <- NULL
hse.mk20$dia.hyper3.mk <- NULL
```

```r
#############################      Data Preparation  --  Multiple Imputation     #######################

hse.mk50 <- hse.mk20

# Multiple imputation
set.seed(1)
hse.mk50.mi <- aregImpute(~ hyper + sex + tenureb + origin + hhsize + addnum + imd + birthwt +
                             porftvg + gor + aggr + year + sysavg + diaavg, data = hse.mk50, n.impute = 
```

```
## Iteration 1
Iteration 2
Iteration 3
```

```
Iteration 4
Iteration 5
Iteration 6
Iteration 7
Iteration 8
Iteration 9
Iteration 10
Iteration 11
Iteration 12
Iteration 13
Iteration 14
Iteration 15
Iteration 16
Iteration 17
Iteration 18
Iteration 19
Iteration 20
Iteration 21
Iteration 22
Iteration 23
Iteration 24
Iteration 25
Iteration 26
Iteration 27
Iteration 28
Iteration 29
Iteration 30
Iteration 31
Iteration 32
Iteration 33
Iteration 34
Iteration 35
Iteration 36
Iteration 37
Iteration 38
Iteration 39
Iteration 40
Iteration 41
Iteration 42
Iteration 43
Iteration 44
Iteration 45
Iteration 46
Iteration 47
Iteration 48
Iteration 49
Iteration 50
Iteration 51
Iteration 52
Iteration 53
```

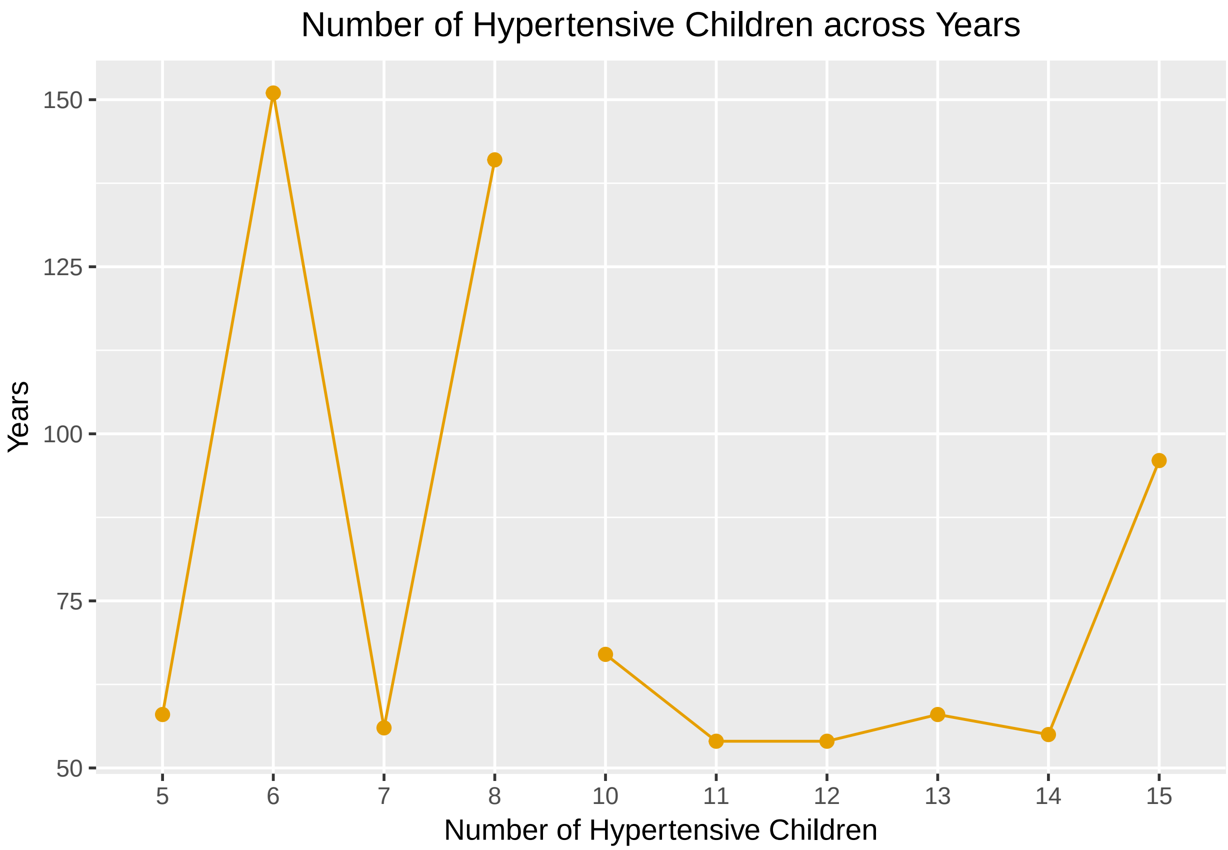
```
# Retrieve the imputed values
hse.mk50.mi.r <- impute.transcan(hse.mk50.mi, data = hse.mk50, imputation=1, list.out=TRUE, pr=FALSE, c
```

```r
# Arrange the columns accordingly
hse.mk60 <- hse.mk50
hse.mk60$tenureb <- hse.mk50.mi.r$tenureb
hse.mk60$origin <- hse.mk50.mi.r$origin
hse.mk60$birthwt <- hse.mk50.mi.r$birthwt
hse.mk60$porftvg <- hse.mk50.mi.r$porftvg
```

```r
####################   Data Preparation  --  Subset the hypertensive group for the clustering analysis

#       hse.mk60 is the dataset for all children with regardless of whether they are hypertensive or no
#       hse.mk85 contains only the hypertensive children

hse.mk60.pc <- -c(which(hse.mk60$hyper == 0))
hse.mk85 <- hse.mk60[hse.mk60.pc,]
hse.mk85$hyper <- NULL
hse.mk85$sysavg <- NULL
hse.mk85$diaavg <- NULL
hse.mk85$sysavg <- NULL
hse.mk85$diaavg <- NULL
```

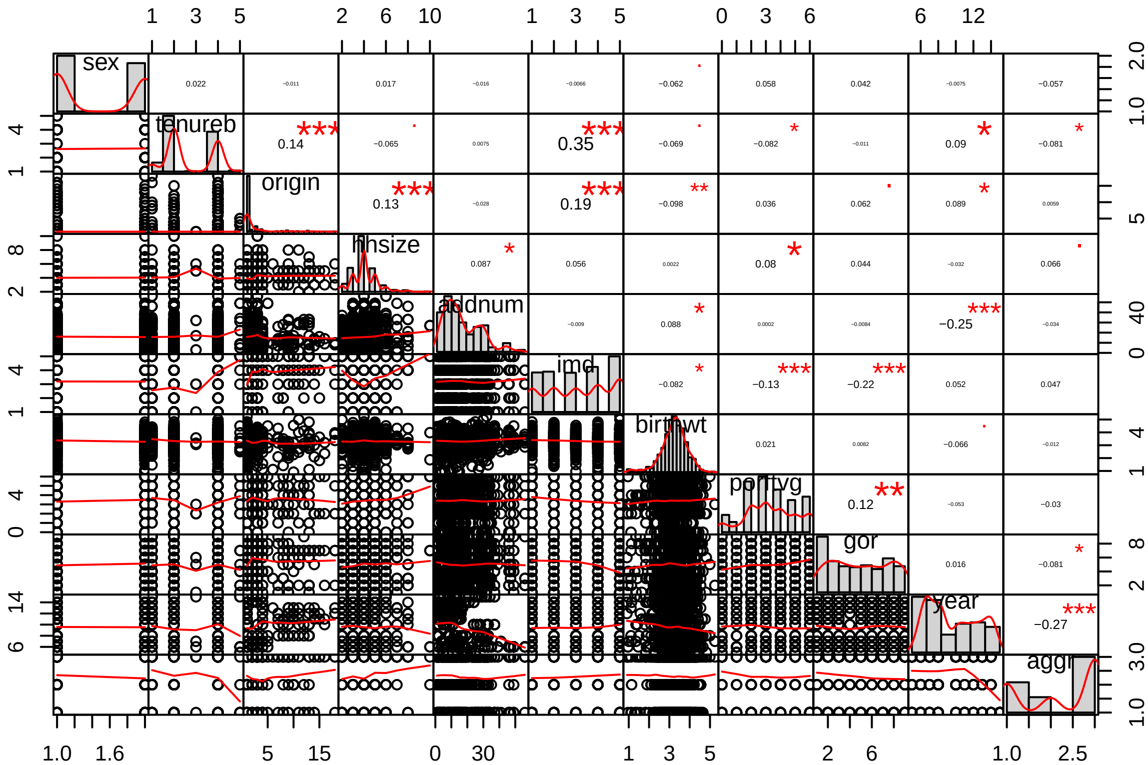
Part 2/4: Current Hypertension Phenomenon Plotting

```r
##################################       Current Hypertension Phenomenon Plotting       ###############

prop <- data.frame(table(hse.mk60$year[hse.mk60$hyper == 1]))
colnames(prop)[1] <- "year"
colnames(prop)[2] <- "number"

prop$group <- ifelse(prop$year %in% c(5:8), 1, 2)

ggplot(data = prop, mapping = aes(x = year, y = number, group = group)) +
  geom_line(color="#E69F00") +
  geom_point(color="#E69F00", size=2) +
  labs(x="Number of Hypertensive Children",y="Years",title = "Number of Hypertensive Children across Ye
  theme(plot.title = element_text(hjust = 0.5))
```



Part 3/4: Principal Components Analysis (PCA) & Correspondence analysis (CORA)

```
################################       Pairwise Correlations & Correlation Matrix       ################

# Plot the pairwise correlations
chart.Correlation(hse.mk85, histogram=TRUE, pch=19)
```




```r
# and the correlation matrix:
cor(hse.mk85)
```

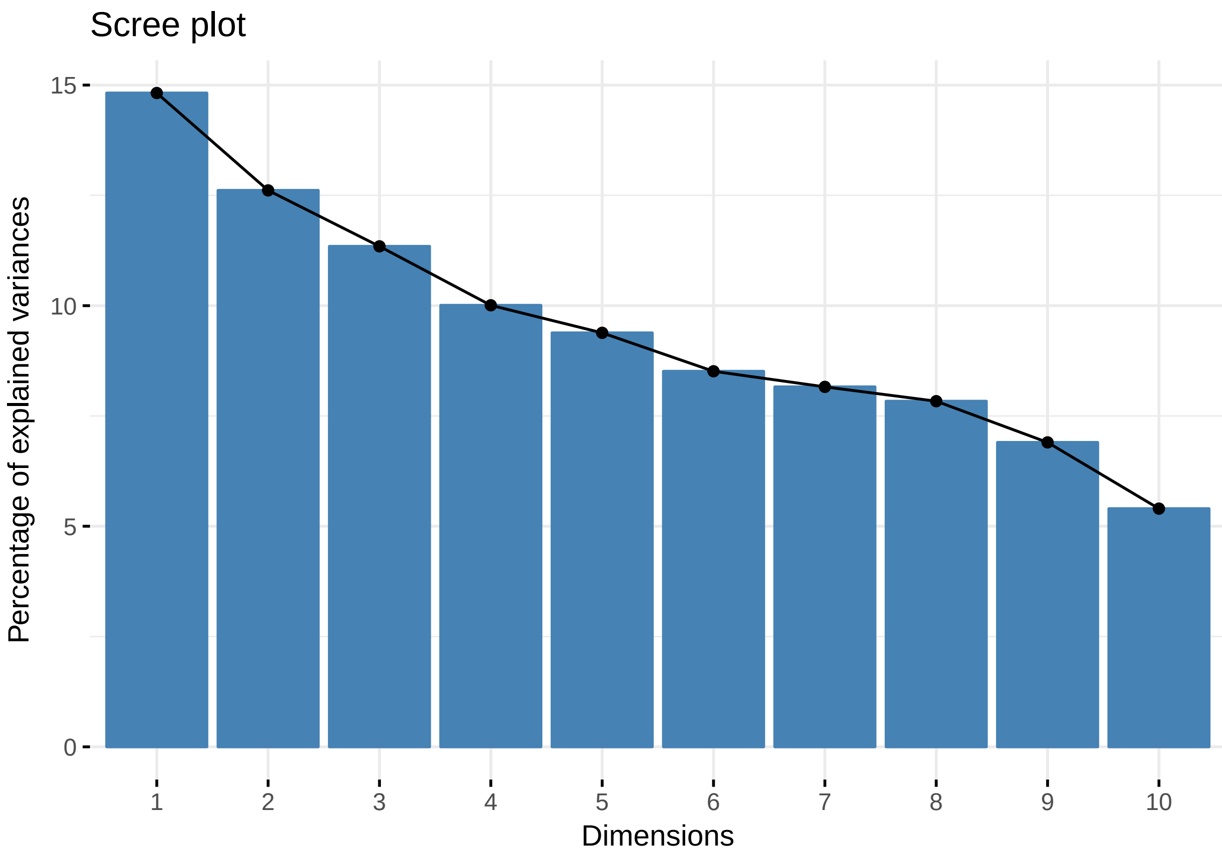
```
##                 sex      tenureb       origin       hhsize        addnum
## sex      1.000000000  0.022401245 -0.010981315  0.017433732 -0.0157067220
## tenureb  0.022401245  1.000000000  0.137419028 -0.064893358  0.0074513815
## origin  -0.010981315  0.137419028  1.000000000  0.125815929 -0.0283600609
## hhsize   0.017433732 -0.064893358  0.125815929  1.000000000  0.0870696057
## addnum  -0.015706722  0.007451381 -0.028360061  0.087069606  1.0000000000
## imd     -0.006643770  0.354130722  0.193494299  0.056279548 -0.0090115351
## birthwt -0.061968824 -0.068825715 -0.098254670  0.002160842  0.0876281527
## porftvg  0.058088669 -0.081536737  0.035613758  0.079937727  0.0001979402
## gor      0.041528345 -0.011329562  0.061850871  0.043838809 -0.0084113914
## year    -0.007504394  0.089886690  0.089293395 -0.032443799 -0.2482750382
## aggr    -0.057230601 -0.080929572  0.005944462  0.066272084 -0.0344165989
##                 imd      birthwt      porftvg          gor         year
## sex     -0.006643770 -0.061968824  0.0580886691  0.041528345 -0.007504394
## tenureb  0.354130722 -0.068825715 -0.0815367371 -0.011329562  0.089886690
## origin   0.193494299 -0.098254670  0.0356137579  0.061850871  0.089293395
## hhsize   0.056279548  0.002160842  0.0799377267  0.043838809 -0.032443799
## addnum  -0.009011535  0.087628153  0.0001979402 -0.008411391 -0.248275038
## imd      1.000000000 -0.081649001 -0.1341024472 -0.222205379  0.051630554
## birthwt -0.081649001  1.000000000  0.0207074576  0.008245878 -0.065737992
## porftvg -0.134102447  0.020707458  1.0000000000  0.116031330 -0.052598247
## gor     -0.222205379  0.008245878  0.1160313305  1.000000000  0.015703590
## year     0.051630554 -0.065737992 -0.0525982473  0.015703590  1.000000000
## aggr     0.047075509 -0.011654642 -0.0297928429 -0.080563604 -0.265687234
##                aggr
## sex     -0.057230601
## tenureb -0.080929572
```

```
## origin   0.005944462
## hhsize   0.066272084
## addnum  -0.034416599
## imd      0.047075509
## birthwt -0.011654642
## porftvg -0.029792843
## gor     -0.080563604
## year    -0.265687234
## aggr     1.000000000
```

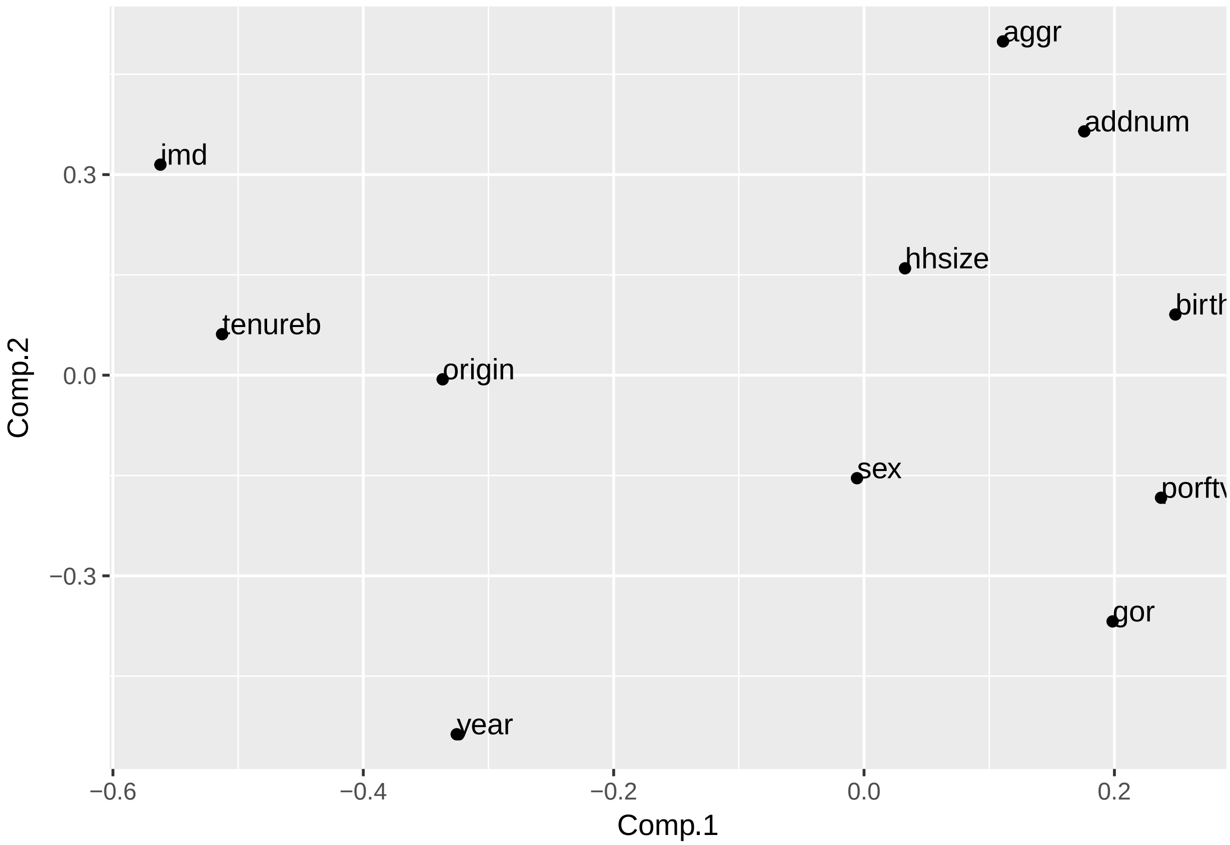
```
##################################       Principal Components Analysis (PCA)       ####################

# The eigen values (explained variances) and the scree plot:
pca <-  princomp(na.omit(hse.mk85), cor = T, scores = TRUE)
summary(pca)
```

```
## Importance of components:
##                           Comp.1    Comp.2    Comp.3    Comp.4    Comp.5
## Standard deviation     1.2768085 1.1779134 1.1171060 1.0492488 1.0159959
## Proportion of Variance 0.1482036 0.1261345 0.1134478 0.1000839 0.0938407
## Cumulative Proportion  0.1482036 0.2743382 0.3877860 0.4878699 0.5817106
##                            Comp.6     Comp.7    Comp.8     Comp.9
## Standard deviation     0.96769218 0.94739078 0.9283487 0.87126141
## Proportion of Variance 0.08512983 0.08159539 0.0783483 0.06900877
## Cumulative Proportion  0.66684041 0.74843580 0.8267841 0.89579287
##                           Comp.10    Comp.11
## Standard deviation     0.77066231 0.74320792
## Proportion of Variance 0.05399276 0.05021436
## Cumulative Proportion  0.94978564 1.00000000
```

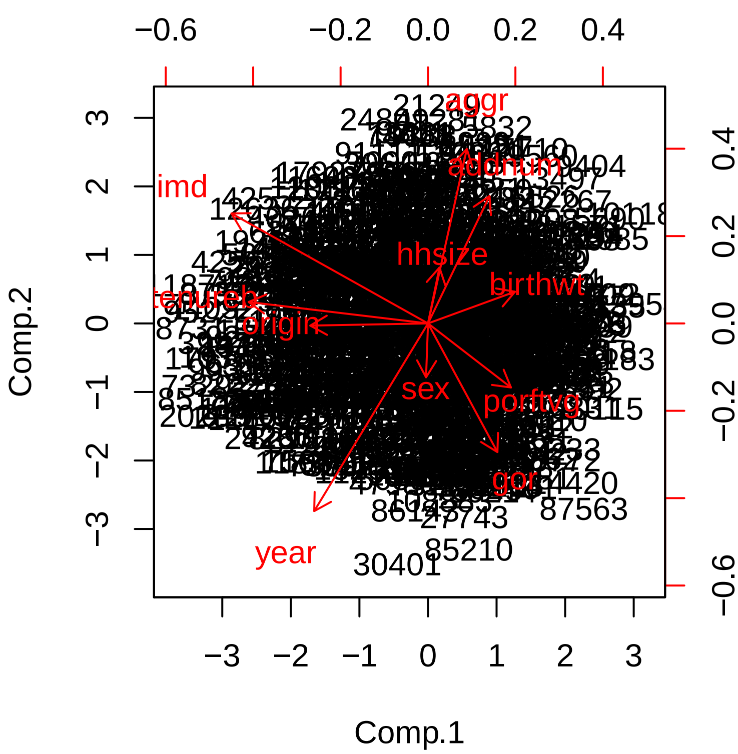
```
fviz_eig(pca)
```



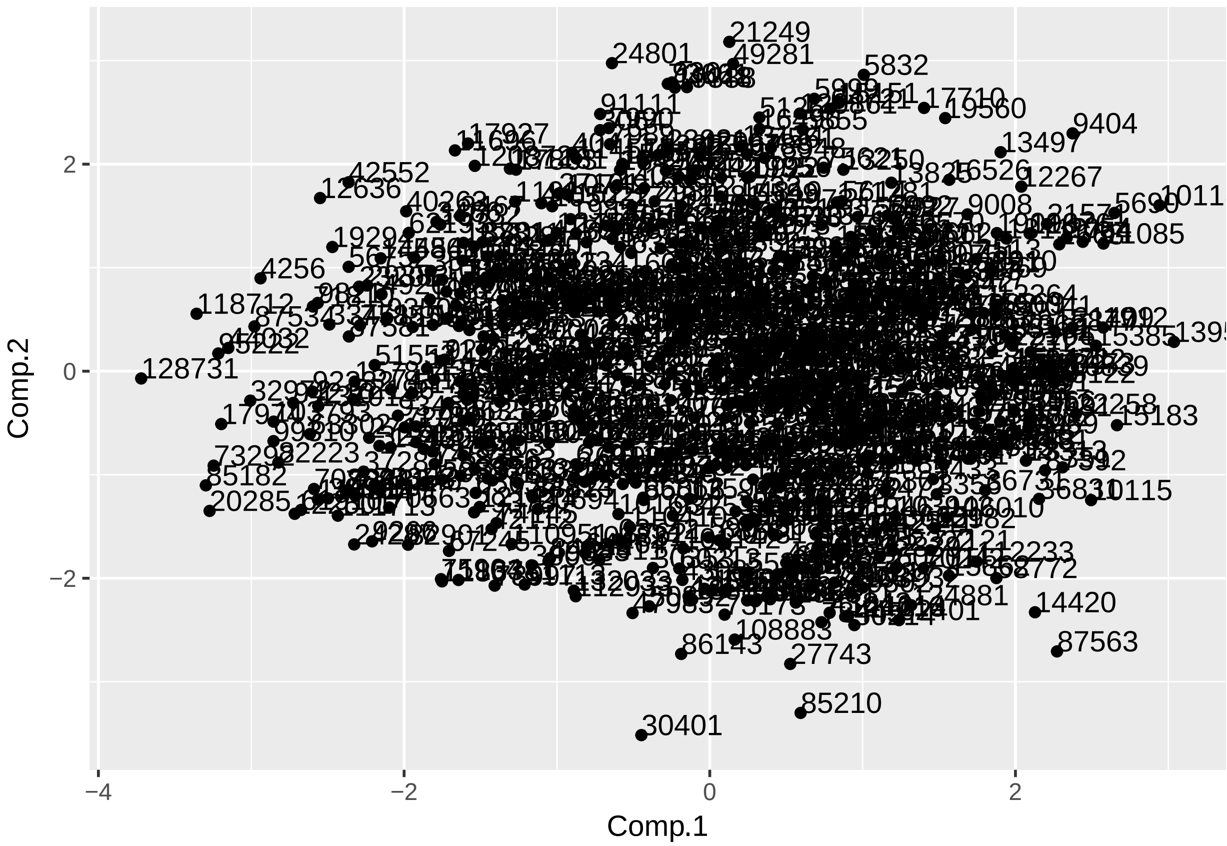

```
# Overall, it seems that we'll need two or three components to account for the variation in the data.

# Variables' contribution to the principal components
pca.df <- data.frame(pca$loadings[,1:2])
ggplot(pca.df,aes(x = Comp.1, y = Comp.2)) + geom_point() + geom_text(aes(label=rownames(pca.df)),hjust=
```




```r
# Dimension Reduction
biplot(pca, scale = 0)
```



```
prediction <- data.frame(predict(pca))
ggplot(prediction,aes(x = Comp.1, y = Comp.2)) + geom_point() + geom_text(aes(label=rownames(prediction)
```




```
####################################      Correspondence Analysis (CORA)     ##########################

cora <- ca(na.omit(hse.mk85))
summary(cora)
```

```
##
## Principal inertias (eigenvalues):
##
##  dim    value      %   cum%   scree plot
##  1      0.112515  44.0  44.0  ***********
##  2      0.054679  21.4  65.3  *****
##  3      0.027229  10.6  76.0  ***
##  4      0.018140   7.1  83.0  **
##  5      0.015779   6.2  89.2  **
##  6      0.009395   3.7  92.9  *
##  7      0.006139   2.4  95.3  *
##  8      0.005368   2.1  97.4  *
##  9      0.003640   1.4  98.8
##  10     0.003090   1.2 100.0
##         -------- -----
##  Total: 0.255974 100.0
##
##
## Rows:
```

```
##          name   mass  qlt  inr    k=1 cor ctr    k=2 cor ctr
## 1    |    152 |    1  365    1 | -317 286    1 | -166  79    0 |
## 2    |    232 |    1  405    1 |  259 403    1 |  -20   2    0 |
## 3    |    303 |    1  105    1 |  101  60    0 |  -88  45    0 |
## 4    |    609 |    1   52    1 |   25   4    0 |  -88  48    0 |
## 5    |    754 |    1  603    1 |  328 597    1 |  -35   7    0 |
## 6    |    994 |    1   45    1 | -132  44    0 |  -28   2    0 |
## 7    |   1082 |    1  367    1 |  206 325    1 |  -74  42    0 |
## 8    |   1507 |    1  409    1 |  230 400    1 |  -35   9    0 |
## 9    |   1567 |    1  313    1 |  189 297    0 |  -44  16    0 |
## 10   |   1702 |    1  287    0 |  169 274    0 |  -36  13    0 |
## 11   |   2004 |    1  421    0 |  197 405    0 |  -39  16    0 |
## 12   |   2545 |    1  125    1 | -100  64    0 |  -97  61    0 |
## 13   |   2752 |    1  346    1 |  210 330    1 |  -47  16    0 |
## 14   |   2910 |    1  137    1 | -139  88    0 | -104  49    0 |
## 15   |   2944 |    1  655    1 |  369 655    1 |    7   0    0 |
## 16   |   2984 |    1  419    1 |  209 399    1 |  -47  20    0 |
## 17   |   3064 |    1  136    1 |  152 131    0 |  -30   5    0 |
## 18   |   3212 |    1  226    0 |   53  40    0 |  116 187    0 |
## 19   |   3594 |    1  455    1 |  129 128    0 |  207 327    1 |
## 20   |   4062 |    1  498    1 |  261 498    1 |    7   0    0 |
## 21   |   4268 |    1  186    1 | -201 137    0 | -120  48    0 |
## 22   |   4388 |    1  523    2 | -540 465    2 | -191  58    0 |
## 23   |   4573 |    1  503    1 |  245 496    1 |  -29   7    0 |
## 24   |   4887 |    1  246    0 |  152 205    0 |  -68  41    0 |
## 25   |   4927 |    1  419    0 |  214 413    0 |  -26   6    0 |
## 26   |   5614 |    1  657    1 |  300 653    1 |  -21   3    0 |
## 27   |   5709 |    1  136    1 | -107  49    0 | -142  87    0 |
## 28   |   5818 |    1  613    2 | -548 551    2 | -184  62    0 |
## 29   |   5855 |    1  285    1 |  211 283    0 |  -15   1    0 |
## 30   |   5981 |    1  272    1 |  169 248    0 |  -52  24    0 |
## 31   |   5992 |    1  717    1 |  312 713    1 |  -23   4    0 |
## 32   |   6128 |    1  615    1 |  324 613    1 |  -16   1    0 |
## 33   |   6821 |    1  223    1 |  152 191    0 |  -63  33    0 |
## 34   |   7012 |    1  302    1 |  187 265    0 |  -70  37    0 |
## 35   |   7073 |    1  589    0 |  247 583    1 |  -26   6    0 |
## 36   |   7615 |    1  404    1 | -311 345    1 | -128  59    0 |
## 37   |   8715 |    1  294    1 | -197 195    0 | -141 100    0 |
## 38   |   9048 |    1  558    1 |  320 558    1 |   -2   0    0 |
## 39   |   9138 |    1  430    1 |  247 414    1 |  -49  16    0 |
## 40   |   9483 |    1  237    1 |  150 210    0 |  -54  27    0 |
## 41   |   9662 |    1  370    2 | -359 280    1 | -204  90    1 |
## 42   |   9764 |    1   81    1 |   66  36    0 |  -74  45    0 |
## 43   |   9788 |    1  227    1 |  184 221    0 |  -30   6    0 |
## 44   |   1030 |    1  248    1 |  172 217    0 |  -64  30    0 |
## 45   |   1080 |    1  280    0 |  162 261    0 |  -44  20    0 |
## 46   |   1095 |    1  516    1 |  312 506    1 |  -44  10    0 |
## 47   |  11376 |    1  624    1 |  368 623    1 |  -15   1    0 |
## 48   |  11377 |    1  749    1 |  419 749    2 |    9   0    0 |
## 49   |   1141 |    1  452    2 | -418 448    2 |   41   4    0 |
## 50   |   1169 |    1  328    1 |  272 327    1 |   14   1    0 |
## 51   |  11946 |    1  228    1 | -215 150    0 | -156  78    0 |
## 52   |   1201 |    1  266    1 | -279 227    0 | -117  40    0 |
## 53   |  12034 |    1  242    1 | -220 173    0 | -140  70    0 |
```

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## 54   |  12264 |    1 269    1 | -212 180   0 | -149  88   0 |
## 55   |   1264 |    1 532    2 | -554 462   2 | -215  70   1 |
## 56   |   1286 |    1 606    2 | -557 546   2 | -185  61   0 |
## 57   |   1297 |    1 385    1 |  186 283   0 |  112 102   0 |
## 58   |   1312 |    1 177    1 |  145 165   0 |  -39  12   0 |
## 59   |     93 |    1 497    2 | -537 486   2 |   81  11   0 |
## 60   |    146 |    2 906    3 |  551 873   6 |  107  33   0 |
## 61   |    274 |    1  75    1 |  -26   5   0 | -101  70   0 |
## 62   |    328 |    1 112    1 |  -35   8   0 | -124 104   0 |
## 63   |    351 |    2 713    2 |  457 710   3 |  -30   3   0 |
## 64   |    387 |    2 874    3 |  595 874   6 |    8   0   0 |
## 65   |   6221 |    2 918    3 |  572 918   5 |   16   1   0 |
## 66   |   6512 |    1 590    1 | -424 590   1 |   -1   0   0 |
## 67   |   7241 |    1 750    1 |  298 748   1 |  -15   2   0 |
## 68   |    825 |    2 717    1 |  315 711   1 |  -29   6   0 |
## 69   |    920 |    1 125    0 |  -21   4   0 | -111 121   0 |
## 70   |    964 |    2 981    3 |  698 975   7 |   56   6   0 |
## 71   |   1078 |    1 361    1 | -468 347   1 |  -97  15   0 |
## 72   |   1179 |    1 173    1 |  -96  60   0 | -132 113   0 |
## 73   |   1424 |    1  80    1 |   -7   0   0 |  -99  80   0 |
## 74   |   1463 |    2 850    2 |  416 777   3 |  127  73   1 |
## 75   |   1749 |    1  94    1 |  -38   8   0 |  128  86   0 |
## 76   |   1867 |    1 104    1 |   16   2   0 | -120 102   0 |
## 77   |   1912 |    2 524    1 |  299 478   1 |   92  46   0 |
## 78   |   1935 |    2 167    1 |  147 134   0 |   73  33   0 |
## 79   |   1936 |    2 154    1 |  130 129   0 |   57  24   0 |
## 80   |   1946 |    2 741    1 |  328 679   2 |   98  61   0 |
## 81   |   2054 |    2 756    2 |  470 755   3 |   -8   0   0 |
## 82   |   2302 |    2 881    2 |  469 880   3 |   17   1   0 |
## 83   |   2480 |    2 884    3 |  626 878   6 |   52   6   0 |
## 84   |   2506 |    2 757    1 |  367 750   2 |  -34   6   0 |
## 85   |   2513 |    2 711    1 |  353 643   2 |  115  68   0 |
## 86   |   2626 |    2 849    3 |  566 849   5 |    7   0   0 |
## 87   |   2668 |    2 927    3 |  603 913   6 |   76  14   0 |
## 88   |   2729 |    1 343    1 | -304 255   1 | -178  88   1 |
## 89   |   2738 |    1  84    0 |   -1   0   0 |  -91  84   0 |
## 90   |   2751 |    1 574    1 |  250 564   1 |  -33  10   0 |
## 91   |   2784 |    1 579    1 |  325 575   1 |  -29   5   0 |
## 92   |   2796 |    1 427    1 | -216 291   0 | -148 136   0 |
## 93   |   2819 |    1 132    0 |   68  51   0 |  -87  81   0 |
## 94   |   3091 |    1 612    2 | -510 516   2 | -220  96   1 |
## 95   |   3492 |    1 766    2 |  460 766   3 |    8   0   0 |
## 96   |   3519 |    1 483    1 | -318 393   1 | -152  90   0 |
## 97   |   3812 |    1 457    1 | -340 348   1 | -190 109   1 |
## 98   |   4206 |    2 900    2 |  469 857   4 |  105  43   0 |
## 99   |   4233 |    1 448    1 | -329 338   1 | -187 109   1 |
## 100  |   4234 |    1 324    1 | -292 264   1 | -140  60   0 |
## 101  |   4341 |    1 530    2 | -519 466   2 | -191  63   1 |
## 102  |   4365 |    1 509    1 | -279 420   1 | -129  90   0 |
## 103  |   4448 |    1 146    1 |  188 146   0 |   -2   0   0 |
## 104  |   4928 |    2 964    4 |  691 958   9 |   54   6   0 |
## 105  |   4942 |    1 581    1 | -369 504   1 | -144  77   0 |
## 106  |   5126 |    2 660    1 |  302 580   1 |  113  81   0 |
## 107  |   5411 |    1  89    1 |  -63  30   0 |  -87  59   0 |
```

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## 108 |    5690 |     2  921     3 |  583 921    6 |     7    0     0 |
## 109 |    5832 |     2  952     3 |  620 947    6 |    43    5     0 |
## 110 |    5936 |     1  857     1 |  403 857    2 |     2    0     0 |
## 111 |    5999 |     2  978     4 |  688 973    9 |    47    5     0 |
## 112 |    6103 |     1   73     1 |    7   0    0 |   -95   73     0 |
## 113 |    6157 |     1  209     0 |   70  96    0 |   -76  113     0 |
## 114 |    6430 |     2  833     1 |  394 832    2 |    -6    0     0 |
## 115 |    6662 |     1  847     1 |  471 847    3 |     9    0     0 |
## 116 |    7001 |     1   53     1 |   64  24    0 |   -71   29     0 |
## 117 |    7366 |     2  915     2 |  478 865    4 |   114   49     1 |
## 118 |    7433 |     1  113     1 |   80  41    0 |  -106   72     0 |
## 119 |    7473 |     2  960     2 |  545 958    4 |    21    1     0 |
## 120 |    7561 |     2  945     3 |  626 941    7 |    40    4     0 |
## 121 |    7562 |     2  950     3 |  595 948    6 |    27    2     0 |
## 122 |    7989 |     1  429     1 |  220 422    1 |   -27    6     0 |
## 123 |    7990 |     1  411     1 |  230 408    1 |   -21    3     0 |
## 124 |    7992 |     1  642     1 |  341 642    1 |    -6    0     0 |
## 125 |    8051 |     1  390     1 | -391 362    1 |  -109   28     0 |
## 126 |    8198 |     1  409     0 | -239 354    0 |   -94   55     0 |
## 127 |    8362 |     1   91     1 |    3   0    0 |  -104   91     0 |
## 128 |    8801 |     2  651     1 |  284 425    1 |   207  226     1 |
## 129 |    8819 |     1   71     1 |   88  43    0 |   -72   29     0 |
## 130 |    8936 |     1  362     1 | -357 317    1 |  -135   45     0 |
## 131 |    8990 |     1  524     1 | -375 478    1 |  -116   46     0 |
## 132 |    9008 |     1  915     1 |  511 913    3 |    24    2     0 |
## 133 |    9111 |     2  679     1 |  350 678    2 |    -5    0     0 |
## 134 |    9301 |     2  940     3 |  629 935    7 |    47    5     0 |
## 135 |    9404 |     2  889     3 |  602 888    6 |    24    1     0 |
## 136 |    9718 |     1  492     2 | -526 492    2 |    14    0     0 |
## 137 |    9802 |     1  268     0 | -127 140    0 |  -122  128     0 |
## 138 |   10056 |     2  716     1 |  371 702    2 |    52   14     0 |
## 139 |   10118 |     2  926     5 |  739 922   10 |    46    4     0 |
## 140 |    1063 |     1  771     1 |  440 770    2 |    17    1     0 |
## 141 |    1066 |     1  196     0 |  -83  87    0 |    93  109     0 |
## 142 |    1108 |     2  859     3 |  549 859    5 |    -2    0     0 |
## 143 |    1136 |     1  596     1 | -404 512    1 |  -163   84     0 |
## 144 |    1145 |     2  728     1 |  309 633    1 |   120   95     0 |
## 145 |   12086 |     1   97     1 |  -89  33    0 |   124   64     0 |
## 146 |   12267 |     2  905     3 |  638 903    6 |    32    2     0 |
## 147 |   12425 |     1  497     1 |  323 494    1 |    23    3     0 |
## 148 |    1271 |     1  467     2 | -422 372    2 |  -214   96     1 |
## 149 |   13113 |     1   13     1 |  -56  11    0 |   -27    2     0 |
## 150 |   13119 |     1   33     1 |   28   4    0 |   -75   29     0 |
## 151 |   13497 |     2  924     4 |  699 918    7 |    54    5     0 |
## 152 |    1376 |     1  840     1 |  466 837    3 |    26    3     0 |
## 153 |    1382 |     2  953     4 |  755 944    9 |    76   10     0 |
## 154 |    1391 |     1  167     0 |  121 164    0 |   -17    3     0 |
## 155 |    1395 |     2  591     1 |  354 577    2 |   -55   14     0 |
## 156 |    1399 |     2  843     3 |  595 841    6 |    30    2     0 |
## 157 |   14251 |     1  383     1 | -361 362    1 |   -88   21     0 |
## 158 |   14410 |     1   35     1 |  -12   1    0 |   -76   34     0 |
## 159 |   14411 |     1   69     0 |   -4   0    0 |   -74   68     0 |
## 160 |    1447 |     1   51     0 |    7   1    0 |   -63   51     0 |
## 161 |   14537 |     1  221     0 | -101 127    0 |   -87   94     0 |
```

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## 162 |   14538 |     1  279    0 | -128 163    0 | -108 116    0 |
## 163 |    1472 |     1  384    1 |  207 336    1 |  -79  48    0 |
## 164 |    1481 |     1   47    0 |  -22   7    0 |   54  40    0 |
## 165 |    1482 |     1   63    0 |  -24  10    0 |   54  53    0 |
## 166 |    1505 |     1   75    1 |   28   4    0 | -114  71    0 |
## 167 |    1506 |     1  691    2 |  444 690    3 |  -18   1    0 |
## 168 |    1515 |     2  973    4 |  670 918    8 |  164  55    1 |
## 169 |    1538 |     2  700    1 |  379 690    2 |  -45  10    0 |
## 170 |   15569 |     2  770    2 |  429 764    3 |  -35   5    0 |
## 171 |   15733 |     1  194    0 |   53  30    0 |  125 164    0 |
## 172 |    1587 |     2  942    3 |  643 940    6 |   28   2    0 |
## 173 |    1649 |     2  896    1 |  433 896    3 |   -8   0    0 |
## 174 |    1652 |     1  875    2 |  561 871    4 |   37   4    0 |
## 175 |    1667 |     1  212    0 | -135 176    0 |  -61  36    0 |
## 176 |    1692 |     1  411    1 | -310 306    1 | -182 106    1 |
## 177 |    1701 |     1  465    1 | -288 397    1 | -120  68    0 |
## 178 |    1715 |     1  502    1 | -296 405    1 | -144  96    0 |
## 179 |   17331 |     1   38    1 |   86  37    0 |   -4   0    0 |
## 180 |    1745 |     1  102    0 |  -48  26    0 |  -83  77    0 |
## 181 |   17522 |     2  882    3 |  478 707    4 |  237 174    2 |
## 182 |   17523 |     2  905    3 |  472 729    4 |  232 176    2 |
## 183 |    1765 |     1  111    0 |   57  44    0 |  -70  67    0 |
## 184 |    1771 |     2  946    3 |  584 945    6 |   25   2    0 |
## 185 |    1781 |     1  276    1 | -210 215    0 | -112  61    0 |
## 186 |    1786 |     1  157    1 |  150 157    0 |  -11   1    0 |
## 187 |    1795 |     2  897    2 |  515 897    5 |    3   0    0 |
## 188 |    1803 |     1  215    1 | -184 215    0 |   -4   0    0 |
## 189 |    1806 |     1  341    1 | -253 306    0 |  -86  35    0 |
## 190 |    1838 |     1  403    2 | -491 381    2 | -118  22    0 |
## 191 |   18948 |     1  744    1 |  433 743    2 |   15   1    0 |
## 192 |    1903 |     1  139    1 |  -67  25    0 | -142 114    0 |
## 193 |    1909 |     1  691    1 |  404 691    2 |   -2   0    0 |
## 194 |    1931 |     1  107    1 |  -50  13    0 |  135  94    0 |
## 195 |    1938 |     2  946    2 |  547 945    5 |   22   2    0 |
## 196 |    1942 |     1  552    0 | -257 456    0 | -118  96    0 |
## 197 |    1943 |     1  126    1 |  109  87    0 |  -73  39    0 |
## 198 |   19560 |     2  970    5 |  771 962   10 |   72   8    0 |
## 199 |   19567 |     1  539    1 | -377 532    1 |   44   7    0 |
## 200 |    1985 |     1  306    2 | -377 286    1 |  -99  20    0 |
## 201 |    2009 |     1   98    1 |   42  14    0 | -102  84    0 |
## 202 |    2016 |     1  360    2 | -400 316    1 | -148  43    0 |
## 203 |    2042 |     1  331    1 | -117  91    0 |  190 240    1 |
## 204 |    2052 |     2  573    1 |  271 555    1 |  -49  18    0 |
## 205 |    2053 |     2  861    3 |  538 861    5 |    5   0    0 |
## 206 |    2057 |     1  879    2 |  502 878    3 |   19   1    0 |
## 207 |    2112 |     1  425    1 | -342 343    1 | -168  83    1 |
## 208 |    2123 |     1  392    1 | -210 321    0 |   99  72    0 |
## 209 |    2124 |     2  854    3 |  512 791    5 |  145  63    1 |
## 210 |     233 |     1  284    1 |  177 198    0 |  117  86    0 |
## 211 |    4926 |     1  514    1 | -440 513    2 |  -14   0    0 |
## 212 |    8851 |     1  465    0 |  202 435    0 |  -52  29    0 |
## 213 |    1085 |     1  420    1 | -182 262    0 | -141 158    0 |
## 214 |   12823 |     1  729    1 |  424 728    2 |   15   1    0 |
## 215 |    1635 |     1   53    0 |  -62  27    0 |  -60  25    0 |
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## 216 |    1719 |     2  838     2 |  446 819    3 |   68  19    0 |
## 217 |    1731 |     1  188     1 | -168 129    0 | -113  59    0 |
## 218 |    2484 |     1  505     1 | -270 384    1 |  151 121    1 |
## 219 |    2632 |     2  786     1 |  409 786    2 |  -12   1    0 |
## 220 |    3196 |     1  530     1 | -444 518    2 |  -65  11    0 |
## 221 |    4416 |     1  546     1 |  236 535    1 |  -34  11    0 |
## 222 |    4563 |     1  745     0 |  264 735    1 |  -31  10    0 |
## 223 |    4600 |     1  127     0 |   50  34    0 |  -84  93    0 |
## 224 |    4626 |     1  723     1 | -404 632    1 | -153  91    0 |
## 225 |    4698 |     1  204     0 |  -25  14    0 |   92 190    0 |
## 226 |    4857 |     1  156     1 | -112  93    0 |  -93  64    0 |
## 227 |    4976 |     1  818     1 |  361 818    2 |   -5   0    0 |
## 228 |    5163 |     1  851     0 |  236 824    1 |  -43  28    0 |
## 229 |    5184 |     1  188     0 |   85  90    0 |  -89  98    0 |
## 230 |    5274 |     1  251     1 | -181 149    0 | -149 102    0 |
## 231 |    5473 |     1  381     1 | -207 236    0 | -162 144    1 |
## 232 |    5599 |     1  577     1 |  279 569    1 |  -33   8    0 |
## 233 |    5672 |     1  401     1 | -309 368    1 |   93  33    0 |
## 234 |    5894 |     1  667     1 | -278 376    1 |  245 291    1 |
## 235 |    6248 |     1  346     1 |  178 296    0 |  -73  50    0 |
## 236 |    6358 |     1  507     2 | -435 423    2 | -194  84    1 |
## 237 |    6472 |     2  739     1 |  396 738    2 |   -2   0    0 |
## 238 |    6801 |     1  293     1 | -188 175    0 | -155 119    0 |
## 239 |    6878 |     2  936     1 |  396 935    2 |  -15   1    0 |
## 240 |    7039 |     1  102     0 |   42  21    0 |  -82  81    0 |
## 241 |    7185 |     1  216     1 | -144  97    0 | -158 118    1 |
## 242 |    7411 |     1  110     1 | -140  95    0 |  -56  15    0 |
## 243 |    7534 |     1  582     1 | -420 513    1 | -154  69    0 |
## 244 |    7655 |     1  439     1 |  199 402    0 |  -60  36    0 |
## 245 |    7656 |     1  422     0 |  185 372    0 |  -68  50    0 |
## 246 |    7659 |     1  856     1 |  296 846    1 |  -33  10    0 |
## 247 |    7952 |     1   41     1 |    7   0    0 |  -85  41    0 |
## 248 |    8310 |     1  440     1 |  291 425    1 |  -54  14    0 |
## 249 |    8316 |     2  637     1 |  360 628    2 |  -45  10    0 |
## 250 |   95021 |     1  156     0 |  -58  40    0 | -100 116    0 |
## 251 |    9754 |     1  647     1 |  320 632    1 |  -49  15    0 |
## 252 |    1051 |     1   33     1 |   21   3    0 |  -72  31    0 |
## 253 |    1067 |     1  320     0 | -170 250    0 |   90  70    0 |
## 254 |   10749 |     1  538     1 |  335 538    1 |   -4   0    0 |
## 255 |    1097 |     1  697     1 |  366 697    1 |    8   0    0 |
## 256 |   11984 |     1  262     1 | -164 131    0 | -164 131    1 |
## 257 |   12037 |     1  575     1 | -293 437    1 |  164 138    1 |
## 258 |    1272 |     1  525     1 | -408 473    1 | -135  52    0 |
## 259 |    1292 |     1  847     1 |  300 816    1 |   59  32    0 |
## 260 |    1325 |     1  761     2 |  481 760    3 |   19   1    0 |
## 261 |    1331 |     1  490     2 | -447 467    2 |  -98  22    0 |
## 262 |   13473 |     1  198     1 | -117  78    0 | -145 120    0 |
## 263 |    1389 |     1  188     1 | -203 142    0 | -115  45    0 |
## 264 |   14053 |     1   63     1 |  102  59    0 |  -26   4    0 |
## 265 |    1432 |     1  365     2 | -394 335    1 | -118  30    0 |
## 266 |    5433 |     1  152     0 |   14   2    0 | -114 149    0 |
## 267 |     111 |     1  816     2 | -603 708    3 |  235 108    1 |
## 268 |    4185 |     1  107     1 | -174  98    0 |  -51   8    0 |
## 269 |     533 |     1  547     2 | -524 489    2 | -181  58    1 |
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## 270 |    585 |    2  744    1 |  343 726    2 |  -53  18    0 |
## 271 |   1060 |    1  381    1 | -237 256    0 | -166 126    0 |
## 272 |   1440 |    1  526    1 | -103  74    0 |  255 452    1 |
## 273 |   1444 |    2  876    2 |  106  29    0 |  567 846    9 |
## 274 |  15732 |    1   14    1 |  -36   5    0 |  -44   8    0 |
## 275 |   1625 |    2  532    1 |  211 532    1 |   -6   0    0 |
## 276 |   1994 |    2  643    1 |  286 627    1 |  -46  16    0 |
## 277 |   2596 |    1  324    1 |  223 301    1 |  -61  23    0 |
## 278 |   2710 |    1  817    1 |  409 816    2 |    8   0    0 |
## 279 |   2711 |    2  844    1 |  390 844    2 |   -3   0    0 |
## 280 |   2914 |    2  580    1 |  283 563    1 |  -49  17    0 |
## 281 |   3046 |    1  379    1 | -245 259    1 | -167 120    1 |
## 282 |   3391 |    1  237    1 | -161 149    0 | -124  88    0 |
## 283 |   3466 |    2  973    3 |   32   2    0 |  670 971   16 |
## 284 |   3467 |    2  975    3 |   30   2    0 |  665 973   16 |
## 285 |   3513 |    2  897    1 |  397 896    2 |   -9   1    0 |
## 286 |   3839 |    1  786    1 |  406 786    2 |    4   0    0 |
## 287 |   3932 |    1  132    0 |   72  73    0 |  -66  60    0 |
## 288 |   4196 |    1  917    2 | -180  92    0 |  539 825    8 |
## 289 |   4715 |    2  861    1 |  329 847    2 |  -43  14    0 |
## 290 |   4781 |    1  751    2 | -562 738    3 |   74  13    0 |
## 291 |   5191 |    1  631    2 | -531 542    2 | -215  89    1 |
## 292 |   5469 |    1   74    0 |   40  19    0 |  -67  55    0 |
## 293 |  55311 |    1  849    2 | -207 109    0 |  539 740    6 |
## 294 |   6110 |    1  136    0 |   39  26    0 |  -79 110    0 |
## 295 |   6363 |    1  205    1 | -191 156    0 | -107  49    0 |
## 296 |   6394 |    1   88    0 |  -48  25    0 |  -77  63    0 |
## 297 |   6456 |    1  345    1 | -152 170    0 | -155 176    1 |
## 298 |   6561 |    1   53    1 |  -18   2    0 |  -97  51    0 |
## 299 |  66012 |    2  687    0 |  203 625    1 |  -64  62    0 |
## 300 |   6769 |    1  143    1 |  149 138    0 |  -27   5    0 |
## 301 |   6830 |    1  727    1 |  344 721    1 |  -31   6    0 |
## 302 |   6856 |    1  761    1 |  331 760    1 |  -15   1    0 |
## 303 |   6974 |    1  520    1 |  136  94    0 |  290 426    2 |
## 304 |   7024 |    1  184    1 | -161 167    0 |   51  17    0 |
## 305 |  72653 |    1  800    1 |  301 784    1 |  -43  16    0 |
## 306 |   7495 |    1  489    1 | -276 357    1 | -168 132    1 |
## 307 |   7712 |    1  345    1 | -203 210    0 | -162 135    0 |
## 308 |  77851 |    1  182    0 |  -46  42    0 |  -84 141    0 |
## 309 |   8044 |    1  132    1 | -161  96    0 |  -98  36    0 |
## 310 |   8071 |    1  725    1 |  367 722    2 |  -23   3    0 |
## 311 |   8330 |    1  171    0 |   44  38    0 |  -82 133    0 |
## 312 |   8571 |    1  683    1 |  280 676    1 |  -29   7    0 |
## 313 |   9273 |    2  713    1 |  367 703    2 |  -42   9    0 |
## 314 |   9407 |    1  105    0 |  -40  19    0 |  -84  86    0 |
## 315 |   9581 |    2  846    1 |  396 846    2 |   -8   0    0 |
## 316 |   9585 |    1  897    1 |  470 897    3 |    2   0    0 |
## 317 |   9821 |    2  939    5 | -228  69    1 |  812 870   19 |
## 318 |   9984 |    1  196    0 |  -69  56    0 | -109 140    0 |
## 319 |  10003 |    1  292    1 | -223 206    0 | -144  86    0 |
## 320 |  10004 |    1  347    1 | -228 245    0 | -147 102    0 |
## 321 |  10115 |    2  606    1 |  328 584    2 |  -64  22    0 |
## 322 |   1081 |    1  484    0 | -209 353    0 | -128 131    0 |
## 323 |  10823 |    1  786    2 | -165  87    0 |  470 699    6 |
```

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## 324 |     1106 |     1  588     0 | -221 418     0 | -141 170     0 |
## 325 |    11988 |     2  762     1 |  348 756     2 |  -29   5     0 |
## 326 |    12087 |     1  559     1 |  366 558     2 |   12   1     0 |
## 327 |    12092 |     2  799     1 |  399 799     2 |   -1   0     0 |
## 328 |    12252 |     2  861     1 |  383 860     2 |  -12   1     0 |
## 329 |    12420 |     1  391     1 | -140 186     0 | -147 205     1 |
## 330 |     1245 |     2  869     3 |   64  11     0 |  559 857    11 |
## 331 |    12481 |     2  860     3 |   65   9     0 |  635 851    13 |
## 332 |     1260 |     1   35     1 |   10   1     0 |  -75  34     0 |
## 333 |     1284 |     1  160     1 |  -54  24     0 | -130 136     0 |
## 334 |     1287 |     2  898     5 |   42   2     0 |  842 896    21 |
## 335 |    13106 |     2  699     1 |  404 695     2 |  -28   3     0 |
## 336 |     1315 |     2  920     3 |  115  30     0 |  627 890    14 |
## 337 |     1317 |     2  646     1 |  355 633     2 |  -50  13     0 |
## 338 |     1318 |     1  135     1 |    5   0     0 | -128 135     0 |
## 339 |     1326 |     1  713     1 |  374 712     2 |  -14   1     0 |
## 340 |     1339 |     1  795     1 |  304 783     1 |  -37  12     0 |
## 341 |    13476 |     1  377     1 | -214 293     0 | -115  85     0 |
## 342 |    13490 |     2  750     1 |  282 740     1 |  -33  10     0 |
## 343 |     1378 |     1  907     6 | -443 183     2 |  882 724    20 |
## 344 |     1396 |     1   78     1 |   91  56     0 |  -58  22     0 |
## 345 |     1420 |     1  541     0 | -215 387     0 | -136 154     0 |
## 346 |    14254 |     1  469     1 | -219 320     0 | -150 149     0 |
## 347 |     1428 |     2  900     2 |  123  67     0 |  435 833     7 |
## 348 |     1442 |     1  591     3 | -582 485     3 | -272 106     1 |
## 349 |     1461 |     1  795     3 | -392 221     1 |  631 574     8 |
## 350 |     1465 |     1  711     2 | -585 615     3 | -231  96     1 |
## 351 |     1471 |     2  913     1 |  428 912     2 |  -13   1     0 |
## 352 |     1474 |     1  650     2 | -537 548     2 | -231 102     1 |
## 353 |     1483 |     1  378     0 | -114 178     0 | -121 200     0 |
## 354 |     1512 |     1   38     1 |   60  24     0 |  -46  14     0 |
## 355 |     1519 |     1  356     1 | -197 273     0 | -109  83     0 |
## 356 |     1527 |     1  856     1 |  315 853     1 |  -21   4     0 |
## 357 |     1530 |     2  751     1 |  313 731     1 |  -52  20     0 |
## 358 |     1554 |     1  199     0 |   80  70     0 | -109 130     0 |
## 359 |    15567 |     1  590     1 |  279 588     1 |  -18   3     0 |
## 360 |     1569 |     1  795     1 |  343 793     1 |  -16   2     0 |
## 361 |     1571 |     1  125     0 |   40  17     0 | -100 108     0 |
## 362 |     1578 |     2  924     2 | -189  88     0 |  584 836    10 |
## 363 |     1581 |     1  581     1 |  265 560     1 |  -51  21     0 |
## 364 |     1586 |     1  629     2 | -587 525     3 | -261 104     1 |
## 365 |     1640 |     1  702     2 | -577 618     2 | -213  84     1 |
## 366 |     1650 |     2  764     1 |  332 753     2 |  -41  11     0 |
## 367 |     1669 |     2  467     1 |  222 432     1 |  -64  35     0 |
## 368 |     1681 |     1  873     2 | -163  90     0 |  479 783     6 |
## 369 |     1683 |     2  474     1 |  202 393     1 |  -92  81     0 |
## 370 |     1687 |     1  797     1 |  355 792     2 |  -29   5     0 |
## 371 |     1707 |     1  133     0 |   -6   1     0 |  -95 133     0 |
## 372 |     1710 |     1  814     2 | -575 711     3 | -219 103     1 |
## 373 |     1712 |     2  737     1 |  393 737     2 |  -12   1     0 |
## 374 |    17332 |     1  348     0 |  156 303     0 |  -60  46     0 |
## 375 |     1736 |     2  664     1 |  389 660     2 |  -29   4     0 |
## 376 |     1788 |     1  858     1 |  323 851     1 |  -30   7     0 |
## 377 |     1792 |     2  631     1 |  330 631     1 |   -4   0     0 |
```

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## 378 |   18154 |     1  779     1 |  342 779    1 |     2   0    0 |
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## 383 |   18977 |     1  168     0 |  -69  49    0 | -109 120    0 |
## 384 |   18978 |     1   83     0 |  -40  14    0 |  -88  69    0 |
## 385 |    1900 |     1  647     1 |  371 642    2 |  -32   5    0 |
## 386 |    1929 |     1  922     7 | -694 334    5 |  921 588   20 |
## 387 |    2037 |     1  732     1 |  361 732    1 |     4   0    0 |
## 388 |    2040 |     2  887     1 |  306 871    1 |  -42  16    0 |
## 389 |    2074 |     1  164     0 |  127 137    0 |  -57  28    0 |
## 390 |    2081 |     1  793     1 | -515 687    2 | -203 107    1 |
## 391 |    2133 |     2  717     1 |  389 716    2 |  -14   1    0 |
## 392 |    2136 |     2  818     1 |  274 734    1 |   93  84    0 |
## 393 |    2140 |     2  680     1 |  317 654    2 |  -63  26    0 |
## 394 |    2157 |     1  810     2 |  487 810    3 |     7   0    0 |
## 395 |    2161 |     1   48     1 |  -28   6    0 |  -73  42    0 |
## 396 |   21718 |     1  574     1 | -504 514    2 | -172  60    0 |
## 397 |   21719 |     1  631     1 | -502 576    2 | -156  55    0 |
## 398 |    2173 |     1   75     0 |   71  49    0 |  -51  25    0 |
## 399 |    2187 |     1  808     3 | -239  99    1 |  640 708   10 |
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## 401 |   22127 |     1  634     0 | -248 541    1 |  103  93    0 |
## 402 |   22128 |     1  636     0 | -255 566    1 |   90  70    0 |
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## 405 |    2216 |     2  746     1 |  373 736    2 |  -43  10    0 |
## 406 |    2225 |     2  391     1 |  205 322    1 |  -95  69    0 |
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## 408 |    2904 |     2  634     1 |  286 574    1 |   93  60    0 |
## 409 |    4081 |     1  356     1 | -168 230    0 | -124 125    0 |
## 410 |    4761 |     2  577     1 |  208 498    1 |   83  78    0 |
## 411 |    4771 |     2  563     1 |  212 484    1 |   85  79    0 |
## 412 |    4946 |     2  668     1 |  328 647    2 |  -58  20    0 |
## 413 |   10451 |     2  856     1 |   74  30    0 |  390 826    5 |
## 414 |    1191 |     1  556     1 |  349 555    1 |     9   0    0 |
## 415 |    1417 |     1  960     8 | -509 181    3 | 1054 779   30 |
## 416 |    1458 |     1  609     1 | -238 388    1 |  180 222    1 |
## 417 |    1518 |     1  291     1 |  156 199    0 | -106  92    0 |
## 418 |    2062 |     2  826     1 |  333 811    2 |  -44  14    0 |
## 419 |    2069 |     1  915     4 | -734 465    4 |  723 451    9 |
## 420 |    2270 |     1  562     2 | -537 509    2 | -172  53    0 |
## 421 |    2555 |     2  910     3 |   32   2    0 |  655 908   14 |
## 422 |    2593 |     1  682     1 | -378 537    1 | -197 145    1 |
## 423 |    2691 |     1  594     2 | -552 527    2 | -197  67    1 |
## 424 |    3290 |     1  389     1 | -316 343    1 | -115  46    0 |
## 425 |    3673 |     2  760     1 |  399 752    2 |  -42   8    0 |
## 426 |    4041 |     2  727     1 |  389 726    2 |   -9   0    0 |
## 427 |    4255 |     2  966     4 |   86  16    0 |  670 950   16 |
## 428 |    4256 |     2  941     4 |  118  24    0 |  726 917   18 |
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## 431 |    5770 |     1  265     0 | -108 115    0 | -123 150    0 |
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## 432 |   5778 |    1 813    1 |  435 812   2 |   -6   0    0 |
## 433 |   5877 |    1 568    1 | -371 413   1 | -227 155    1 |
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## 436 |   6020 |    1 660    1 | -414 509   2 | -226 151    1 |
## 437 |   6023 |    1 553    1 | -243 382   1 | -162 171    1 |
## 438 |   6024 |    1 647    1 | -277 433   1 | -195 214    1 |
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## 440 |   6524 |    1 544    1 |  265 528   1 |  -46  16    0 |
## 441 |   6865 |    1 850    1 | -546 729   2 | -222 121    1 |
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## 446 |   7539 |    1 302    0 | -118 138   0 | -129 163    0 |
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## 448 |   7718 |    2 721    1 |  332 707   2 |  -48  14    0 |
## 449 |   8031 |    1 766    1 | -327 638   1 | -146 128    0 |
## 450 |   8615 |    1 771    2 | -536 672   2 | -206  99    1 |
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## 456 |  10394 |    1 811    2 | -597 683   3 | -258 128    1 |
## 457 |  10502 |    2 750    2 |  463 749   3 |   12   1    0 |
## 458 |  10829 |    1 682    1 | -417 565   2 |  190 117    1 |
## 459 | 108882 |    2 825    0 |  226 765   1 |  -63  60    0 |
## 460 |   1122 |    2 503    1 |  257 461   1 |  -77  41    0 |
## 461 |   1148 |    1 346    1 | -143 166   0 | -149 180    0 |
## 462 |  11943 |    1 581    1 | -372 479   1 | -171 101    1 |
## 463 |  12060 |    1 968    4 | -670 477   4 |  680 491    8 |
## 464 |  12098 |    1 459    1 |  249 455   1 |  -23   4    0 |
## 465 |  12416 |    1 512    1 |  263 502   1 |  -37  10    0 |
## 466 |   1262 |    1 871    4 | -539 289   3 |  764 581   11 |
## 467 |   1263 |    2 783    1 |  113  52   0 |  424 731    5 |
## 468 | 132032 |    1 689    1 | -412 556   2 | -201 133    1 |
## 469 |  13333 |    1 353    1 | -305 288   1 | -144  65    0 |
## 470 |  13334 |    1 374    1 | -310 301   1 | -153  73    0 |
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## 473 |  14051 |    2 735    2 |  442 735   3 |    8   0    0 |
## 474 |   2721 |    1 768    2 | -551 647   2 | -238 121    1 |
## 475 |  44811 |    1 424    0 | -117 191   0 | -129 232    0 |
## 476 |   6981 |    1 499    1 | -246 310   1 | -192 189    1 |
## 477 |   1187 |    2 948    7 | -366 113   2 |  995 835   29 |
## 478 |  12061 |    1 789    1 | -333 582   1 | -199 208    1 |
## 479 |   1207 |    1 820    1 | -324 614   1 | -188 206    1 |
## 480 |   1393 |    1 889    1 | -314 669   1 | -180 220    1 |
## 481 |   2298 |    1 370    1 | -206 236   0 | -156 134    0 |
## 482 |   2369 |    1 276    0 |  -62  61   0 | -115 214    0 |
## 483 |   2534 |    1 566    1 | -302 425   1 | -174 141    1 |
## 484 |   2938 |    1 288    1 | -294 255   1 | -107  34    0 |
## 485 |   3133 |    1 531    1 | -309 417   1 | -162 114    0 |
```

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## 486 |     3187 |     1  829     2 | -441 418     2 |  438 411    4 |
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## 488 |     3547 |     1  604     2 | -492 545     2 | -162  59    0 |
## 489 |    42053 |     1  935     4 | -384 217     2 |  698 718   12 |
## 490 |     4238 |     1  902     1 | -400 761     1 | -172 142    0 |
## 491 |     4379 |     1  459     1 | -225 337     1 | -135 122    0 |
## 492 |     4583 |     1  636     1 | -363 529     1 | -164 108    0 |
## 493 |     4957 |     1  558     1 | -344 415     1 | -202 143    1 |
## 494 |     4980 |     1  251     0 |  -61  66     0 | -103 186    0 |
## 495 |     5164 |     1   79     0 |  -19   4     0 |  -83  75    0 |
## 496 |     5367 |     1  622     1 | -348 518     1 | -156 104    0 |
## 497 |     5656 |     1  742     3 | -249 131     1 |  540 612    7 |
## 498 |     5889 |     1  552     1 | -369 465     1 | -160  87    0 |
## 499 |     5893 |     1  593     1 | -293 475     1 | -146 118    0 |
## 500 |     6006 |     1   60     1 |   46  16     0 |  -75  44    0 |
## 501 |     6127 |     1   63     0 |  -22   5     0 |  -75  58    0 |
## 502 |     6339 |     1  536     1 | -216 315     1 | -182 221    1 |
## 503 |     6444 |     1  624     2 | -594 569     3 | -186  56    1 |
## 504 |     6791 |     2  346     1 | -161 274     0 |   83  72    0 |
## 505 |     7146 |     1  787     1 | -335 615     1 | -177 172    1 |
## 506 |     7544 |     1  618     2 | -604 535     3 | -238  83    1 |
## 507 |     7694 |     1  381     1 | -155 170     0 | -172 210    1 |
## 508 |     8126 |     1  644     1 | -318 473     1 | -192 171    1 |
## 509 |     8127 |     1  759     1 | -331 549     1 | -205 210    1 |
## 510 |     8170 |     1  171     1 | -172 129     0 |  -98  42    0 |
## 511 |     8290 |     1  881     2 | -237 154     1 |  515 727    7 |
## 512 |     8333 |     1  371     0 | -113 143     0 | -143 228    0 |
## 513 |     8595 |     1  666     0 | -229 455     0 | -156 210    0 |
## 514 |     8756 |     1  666     2 | -601 545     3 | -284 121    1 |
## 515 |     8833 |     1  921     2 | -605 800     3 | -236 121    1 |
## 516 |     9019 |     1  186     0 |  -31  17     0 |  -97 169    0 |
## 517 |     9254 |     1  238     1 | -180 159     0 | -127  79    0 |
## 518 |    93252 |     1  361     1 | -254 300     1 | -115  61    0 |
## 519 |     9326 |     1  234     1 | -246 197     1 | -105  36    0 |
## 520 |    95023 |     1  473     1 | -357 403     1 | -149  70    0 |
## 521 |     9522 |     2  972     7 | -444 178     3 |  937 794   24 |
## 522 |     9546 |     1  178     1 | -148 127     0 |  -94  51    0 |
## 523 |     9658 |     1  787     1 | -493 654     2 | -223 134    1 |
## 524 |    10028 |     1  804     2 | -285 260     1 |  411 543    4 |
## 525 |     1020 |     1  960     4 | -571 428     4 |  637 532    9 |
## 526 |    10393 |     1  497     1 | -268 331     1 | -190 166    1 |
## 527 |    10452 |     1  529     1 | -271 348     1 | -195 181    1 |
## 528 |      277 |     1  125     0 |   26   8     0 |  -98 117    0 |
## 529 |     2850 |     1  129     0 |   38  19     0 |  -92 110    0 |
## 530 |    12828 |     1  551     1 | -238 381     1 | -158 170    0 |
## 531 |     6191 |     2  973     9 | -516 208     4 |  989 764   31 |
## 532 |     7231 |     1  419     1 | -336 346     1 | -154  72    0 |
## 533 |    72410 |     1  568     1 | -358 448     1 | -185 120    1 |
## 534 |     9421 |     1  868     4 | -324 169     1 |  659 699   12 |
## 535 |     1104 |     1  695     1 | -244 236     1 |  340 458    3 |
## 536 |     1582 |     1  753     2 | -563 647     2 | -228 107    1 |
## 537 |     1589 |     1  574     1 | -196 319     0 | -175 255    1 |
## 538 |     1620 |     1  752     2 | -616 641     3 | -256 111    1 |
## 539 |     1778 |     1  724     1 | -395 568     2 | -207 156    1 |
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## 540 |   1797 |   1 962   6 | -648 361   5 |  837 602  18 |
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## 546 |   3356 |   1 289   0 |  -66  46   0 | -151 243   1 |
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## 548 |   3683 |   1 312   1 | -145 125   0 | -177 187   1 |
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## 557 |   5517 |   1 343   0 |  -82  80   0 | -148 263   1 |
## 558 |   5545 |   1 460   0 | -155 274   0 | -128 186   0 |
## 559 |   5546 |   1 620   0 | -164 366   0 | -136 253   0 |
## 560 |   5710 |   1 832   2 | -606 691   3 | -274 141   1 |
## 561 |   6042 |   1 325   1 | -159 177   0 | -145 147   0 |
## 562 |   6219 |   1 115   1 | -130  77   0 |  -91  38   0 |
## 563 |   6265 |   1 427   0 | -121 193   0 | -133 234   0 |
## 564 |   6330 |   2 964  10 | -574 203   5 | 1113 761  35 |
## 565 |   6439 |   1 106   1 |  -65  30   0 | -103  76   0 |
## 566 |   7624 |   1 381   1 | -180 244   0 | -135 137   0 |
## 567 |   7632 |   1 110   1 |  -53  21   0 | -109  89   0 |
## 568 |   7972 |   1 802   1 | -311 413   1 |  302 389   2 |
## 569 |   7973 |   1 648   1 | -214 369   1 | -186 279   1 |
## 570 |   8222 |   1 838   5 | -652 324   4 |  821 514  12 |
## 571 |   8334 |   1 429   0 | -107 177   0 | -128 252   0 |
## 572 |  86015 |   1 525   1 | -213 371   0 | -137 154   0 |
## 573 |   8878 |   2 910   5 | -319 123   2 |  806 787  20 |
## 574 |   8896 |   1 313   1 | -238 225   0 | -148  87   0 |
## 575 |  90481 |   1 829   1 | -429 654   2 | -222 175   1 |
## 576 |   9233 |   1 910   3 | -404 262   2 |  635 648  10 |
## 577 |   9346 |   1 826   1 | -489 779   2 |  120  47   0 |
## 578 |   9811 |   1 296   1 | -227 231   0 | -120  65   0 |
## 579 |   9871 |   1 709   1 | -398 579   1 | -188 129   1 |
## 580 |   1023 |   1 768   2 | -565 650   3 | -241 118   1 |
## 581 |   1027 |   1 688   1 | -443 585   2 | -186 103   1 |
## 582 |   6038 |   1 223   0 |  -15   4   0 | -119 219   0 |
## 583 |   6761 |   1 460   0 |  -84 114   0 | -146 346   1 |
## 584 |   6931 |   1 218   1 | -147 118   0 | -134 100   0 |
## 585 |   7181 |   1 963  11 | -542 153   4 | 1247 810  41 |
## 586 |  10501 |   1 881   3 | -351 251   1 |  557 630   8 |
## 587 |   1055 |   1 255   1 | -158 163   0 | -119  93   0 |
## 588 |   1089 |   1 452   2 | -556 419   2 | -155  33   0 |
## 589 |   1524 |   1 815   1 | -250 546   1 | -175 268   1 |
## 590 |  15675 |   1 812   1 | -478 656   2 | -234 157   1 |
## 591 |   1705 |   1 654   1 | -363 487   1 | -212 166   1 |
## 592 |   1780 |   1 166   1 |  -95  77   0 | -103  89   0 |
## 593 |   2028 |   2 958   6 | -376 147   2 |  884 811  21 |
```

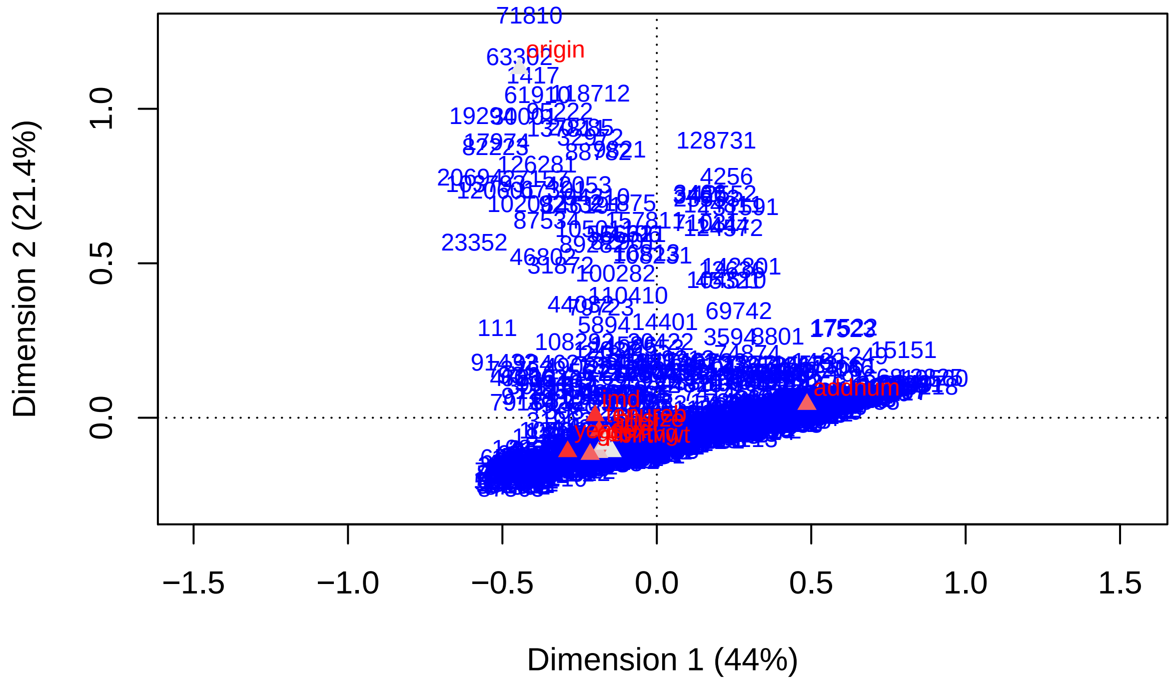
```
## 594 |   2335 |    1 951    4 | -720 632    6 |  511 319    6 |
## 595 |   2715 |    2 957    5 | -522 332    4 |  717 625   15 |
## 596 |   3203 |    1 242    1 | -148 141    0 | -125 101    0 |
## 597 |   3345 |    1 329    2 | -407 296    1 | -136  33    0 |
## 598 |   3783 |    1 368    1 | -279 294    1 | -140  74    0 |
## 599 |   4026 |    1 223    1 | -229 175    1 | -119  48    0 |
## 600 |   4403 |    1 745    2 | -376 442    2 |  311 303    2 |
## 601 |   4680 |    1 797    3 | -498 426    3 |  465 371    5 |
## 602 |  49082 |    1 726    2 | -559 640    2 | -205  86    1 |
## 603 |   5086 |    1 239    1 | -135 117    0 | -138 122    0 |
## 604 |  55312 |    1 516    0 | -151 251    0 | -155 265    1 |
## 605 |   6056 |    1 802    2 | -527 786    3 |   74  15    0 |
## 606 |   6070 |    1 872    2 | -567 736    3 | -244 136    1 |
## 607 |   6124 |    1 459    2 | -380 384    1 | -167  74    1 |
## 608 |   6159 |    1 173    1 | -163 107    0 | -128  66    0 |
## 609 |   6240 |    1 796    2 | -567 647    3 | -272 149    1 |
## 610 |   6552 |    1 683    2 | -474 548    2 | -235 135    1 |
## 611 |   6730 |    1 921    4 | -464 291    2 |  683 630   11 |
## 612 |   6930 |    1 665    1 | -376 509    1 | -208 156    1 |
## 613 |   7173 |    1 416    1 | -315 332    1 | -159  84    1 |
## 614 |  72654 |    1 715    2 | -612 628    3 | -228  87    1 |
## 615 |   7285 |    1 764    1 | -376 610    2 | -189 154    1 |
## 616 |   7375 |    1 792    2 | -572 768    3 |  100  24    0 |
## 617 |   7603 |    1 656    1 | -453 552    2 | -197 104    1 |
## 618 |   7626 |    1 762    1 | -435 606    2 | -221 156    1 |
## 619 |  77855 |    1 485    2 | -420 425    2 | -158  60    0 |
## 620 |  79183 |    1 432    1 | -215 261    0 | -174 171    1 |
## 621 |   8346 |    1 256    1 | -201 183    0 | -127  74    0 |
## 622 |   8355 |    1  67    1 |   73  32    0 |  -77  35    0 |
## 623 |   8382 |    1 719    1 | -415 578    2 | -205 141    1 |
## 624 |   8386 |    1 588    1 | -313 437    1 | -184 151    1 |
## 625 |   8415 |    1 138    0 |  -20   6    0 |  -96 133    0 |
## 626 |   8753 |    1 891    3 | -486 365    3 |  584 527    8 |
## 627 |   8928 |    2 959    2 | -337 296    2 |  505 664    7 |
## 628 |   8999 |    1 404    1 | -156 225    0 | -139 179    1 |
## 629 |   9000 |    1 325    1 | -152 179    0 | -137 146    0 |
## 630 |   9112 |    1 313    1 | -235 205    1 | -171 109    1 |
## 631 |   9203 |    1 107    1 |  -72  30    0 | -114  77    0 |
## 632 |   9642 |    1 534    1 | -211 316    1 | -175 218    1 |
## 633 |  10022 |    1 631    1 | -195 365    0 | -167 266    1 |
## 634 |  10057 |    1 474    1 | -243 341    1 | -152 133    1 |
## 635 |   1016 |    1 565    1 | -265 401    1 | -169 164    1 |
## 636 |   1025 |    1 372    1 | -192 207    0 |  171 165    1 |
## 637 |   1037 |    1 948    5 | -705 476    6 |  702 472   12 |
## 638 | 107492 |    1 157    1 | -165 104    0 | -118  53    0 |
## 639 |   1091 |    1 864    1 | -482 698    2 | -235 166    1 |
## 640 |   1255 |    1 156    1 |   32   9    0 | -127 147    0 |
## 641 |   1142 |    2 154    0 |  -57 102    0 |  -41  52    0 |
## 642 |   1283 |    1 657    1 | -386 499    1 | -218 158    1 |
## 643 |   1338 |    1 402    1 | -276 345    1 |  113  58    0 |
## 644 |   1689 |    1 274    1 | -100  85    0 | -148 188    1 |
## 645 |   1853 |    1 436    1 | -316 436    1 |   13   1    0 |
## 646 |   2073 |    1 143    1 |   23   5    0 | -119 138    0 |
## 647 |   2219 |    1 403    1 | -244 389    1 |  -46  14    0 |
```

```
## 648 |    2320 |     1  390     2 | -380 340    1 | -145  50    0 |
## 649 |    2552 |     1  526     1 | -266 358    1 | -182 168    1 |
## 650 |   30913 |     2  200     0 |  -24  32    0 |  -56 168    0 |
## 651 |    3386 |     1  511     0 |  -84 128    0 | -145 383    1 |
## 652 |    3552 |     1  359     1 | -130 168    0 | -139 191    0 |
## 653 |    3940 |     1  902     1 | -434 880    2 |   69  23    0 |
## 654 |    4134 |     1   83     0 |   25   8    0 |   78  75    0 |
## 655 |   42054 |     1  120     0 |   68  49    0 |  -83  71    0 |
## 656 |    4214 |     1  754     2 | -522 640    2 | -220 114    1 |
## 657 |    4231 |     1  460     2 | -513 406    2 | -187  54    1 |
## 658 |    4288 |     1  317     1 | -190 313    0 |   20   3    0 |
## 659 |    4407 |     1  385     1 | -212 243    0 | -162 142    1 |
## 660 |    5155 |     1  418     2 | -378 364    1 | -146  54    0 |
## 661 |    5170 |     1  119     1 | -107  61    0 | -105  58    0 |
## 662 |    5364 |     2  314     0 |  112 184    0 |  -95 131    0 |
## 663 |    5390 |     1  167     1 | -123  91    0 | -112  76    0 |
## 664 |    5415 |     1  559     1 | -223 343    1 | -177 216    1 |
## 665 |    5416 |     1  539     1 | -227 328    1 | -182 211    1 |
## 666 |    5675 |     1   70     1 | -108  43    0 |  -87  28    0 |
## 667 |    5731 |     1  490     1 | -295 366    1 | -171 123    1 |
## 668 |    5816 |     1  342     1 | -202 340    0 |   15   2    0 |
## 669 |    5824 |     1  564     1 | -302 400    1 | -193 164    1 |
## 670 |    5891 |     1  299     1 |  186 262    0 |  -70  38    0 |
## 671 |    6563 |     1  753     1 | -382 591    2 | -200 162    1 |
## 672 |    7023 |     1  146     1 |  100  73    0 | -100  74    0 |
## 673 |    7081 |     1  791     2 | -575 659    3 | -257 132    1 |
## 674 |    7164 |     1  249     1 |  -71  50    0 | -141 198    0 |
## 675 |    7165 |     1  442     0 | -101 125    0 | -161 318    1 |
## 676 |    7284 |     1  585     1 | -279 438    1 | -161 147    1 |
## 677 |   72954 |     1  176     0 |   42  24    0 | -107 152    0 |
## 678 |    8241 |     2  113     1 |   90  62    0 |   82  51    0 |
## 679 |    8553 |     1  507     0 |  -88 133    0 | -146 374    1 |
## 680 |    8762 |     1  389     0 |  -53  52    0 | -136 338    0 |
## 681 |    8843 |     2  181     0 |  -95 129    0 |   61  52    0 |
## 682 |    8978 |     1  547     0 | -219 543    1 |   18   4    0 |
## 683 |    9143 |     1  717     2 | -624 690    3 |  124  27    0 |
## 684 |   93253 |     1  112     1 |   -9   1    0 | -115 111    0 |
## 685 |   93504 |     2  202     0 |   21   7    0 |  107 195    0 |
## 686 |    9428 |     2   40     0 |   -7   1    0 |  -45  39    0 |
## 687 |    9437 |     1  544     0 | -151 247    0 | -166 297    1 |
## 688 |    9632 |     1  222     1 | -108  88    0 | -134 134    0 |
## 689 |    9635 |     1  320     0 |  -89 109    0 | -123 211    0 |
## 690 |    9831 |     1  746     1 | -387 547    2 | -233 198    1 |
## 691 |    9880 |     1  559     1 | -270 554    1 |   26   5    0 |
## 692 |    9881 |     1  667     1 | -277 666    1 |   13   2    0 |
## 693 |    9890 |     1  791     2 | -577 664    3 | -252 127    1 |
## 694 |    1001 |     1  408     1 | -311 331    1 | -150  77    0 |
## 695 |    9266 |     1  712     2 | -457 599    2 | -198 113    1 |
## 696 |    7810 |     2  577     1 |  268 555    1 |  -52  21    0 |
## 697 |    2491 |     2  575     2 |  412 574    3 |  -14   1    0 |
## 698 |    2901 |     2  415     1 |  229 385    1 |  -64  30    0 |
## 699 |    6021 |     1  518     1 | -198 298    0 | -170 220    1 |
## 700 |   66015 |     2  499     1 |  252 446    1 |   86  52    0 |
## 701 |    8521 |     1  693     2 | -463 535    2 | -252 158    1 |
```

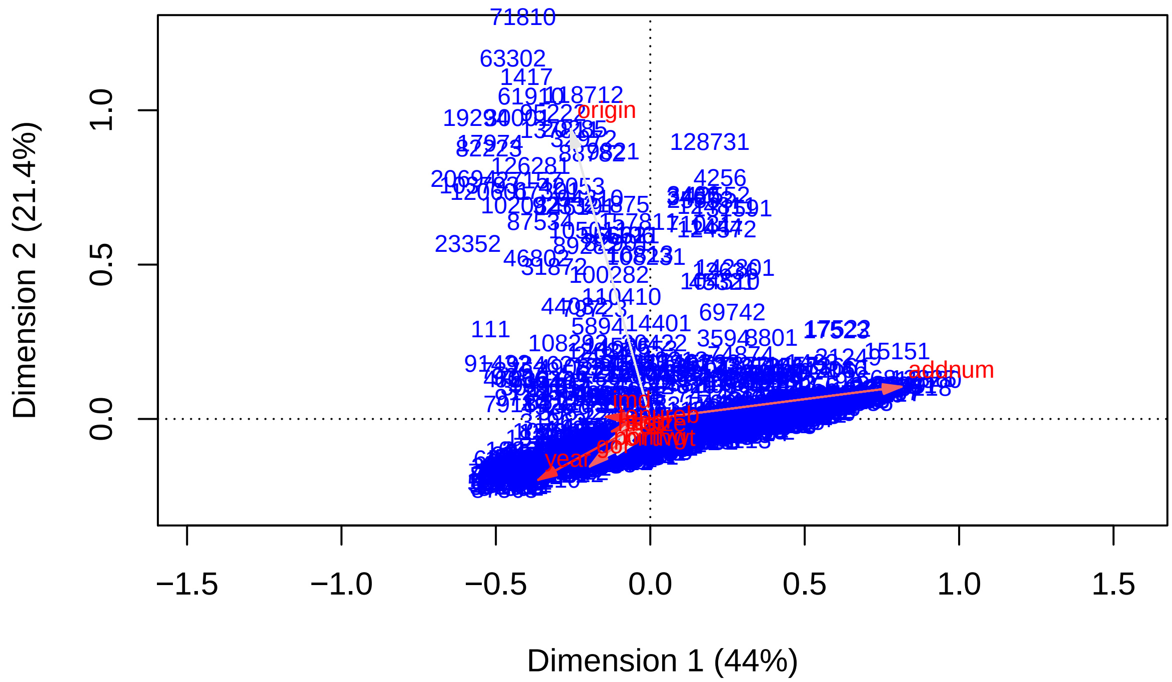
```
## 702 |   86016 |    2 448    1 |  228 447    1 |    7   0    0 |
## 703 |    9931 |    1 562    2 | -476 555    2 |   55   7    0 |
## 704 |    1117 |    1 242    1 | -150 146    0 | -121  95    0 |
## 705 |    1214 |    1 308    0 | -112 131    0 | -130 177    0 |
## 706 |   13101 |    2 421    1 |  197 383    1 |   62  38    0 |
## 707 |    1341 |    1 582    2 | -446 470    2 | -218 112    1 |
## 708 |    1410 |    2 285    1 |  168 209    0 | -101  76    0 |
## 709 |    1963 |    2 339    1 |  245 309    1 |  -76  30    0 |
## 710 |    2318 |    1 376    1 | -177 251    0 |  125 125    0 |
## 711 |    2425 |    2 571    1 |  334 563    2 |  -40   8    0 |
## 712 |    2428 |    1 733    1 | -454 619    2 | -194 113    1 |
## 713 |    2774 |    1 569    2 | -442 449    2 | -228 120    1 |
## 714 |    2937 |    1  84    1 |  -68  26    0 | -102  58    0 |
## 715 |   30002 |    1 502    1 | -153 244    0 | -157 258    1 |
## 716 |    3035 |    1 779    2 | -507 772    3 |   48   7    0 |
## 717 |    3040 |    1 614    2 | -549 509    3 | -249 105    1 |
## 718 |    3195 |    1 373    0 | -114 138    0 | -150 236    1 |
## 719 |    3232 |    2 571    1 |  297 548    1 |   60  23    0 |
## 720 |    3271 |    2 373    1 |  186 335    1 |  -63  38    0 |
## 721 |    3728 |    1 576    1 | -334 466    1 | -162 110    1 |
## 722 |    4211 |    1 394    1 | -291 296    1 | -167  98    1 |
## 723 |    4308 |    1 507    1 | -190 285    0 | -167 222    1 |
## 724 |    4384 |    1 371    1 | -194 201    0 | -179 170    1 |
## 725 |    4411 |    1 173    1 | -118  76    0 | -134  97    0 |
## 726 |   44814 |    2 113    0 |   79 102    0 |  -26  11    0 |
## 727 |    4521 |    2 632    1 |  304 599    2 |  -72  33    0 |
## 728 |    4798 |    1 772    1 | -458 624    2 | -223 147    1 |
## 729 |    4824 |    1 573    2 | -576 510    3 | -203  63    1 |
## 730 |   49083 |    1 689    1 | -388 637    2 |  111  52    0 |
## 731 |    5089 |    1 653    1 | -386 648    2 |  -33   5    0 |
## 732 |    5111 |    1 837    2 | -577 716    3 | -237 120    1 |
## 733 |    5847 |    1 216    1 |  182 182    0 |  -78  34    0 |
## 734 |    5875 |    2 639    1 |  317 628    2 |  -42  11    0 |
## 735 |    5904 |    2 241    1 |  101 116    0 | -104 125    0 |
## 736 |    5974 |    2 450    1 |  292 439    1 |  -47  11    0 |
## 737 |    6354 |    2 365    1 |  217 331    1 |   70  34    0 |
## 738 |    6446 |    1 682    2 | -536 582    3 | -222 100    1 |
## 739 |    6475 |    1 294    1 |  200 256    0 |  -78  39    0 |
## 740 |    6586 |    2 329    1 |  219 298    1 |  -71  32    0 |
## 741 |    6724 |    1 405    1 | -169 237    0 | -143 169    0 |
## 742 |    6787 |    2 294    1 |  153 183    0 |  119 111    0 |
## 743 |    7066 |    1 573    2 | -524 506    2 | -191  67    1 |
## 744 |    7080 |    1  29    1 |  -37   5    0 |  -78  24    0 |
## 745 |   72955 |    1  71    1 |    5   0    0 |  -92  71    0 |
## 746 |    7317 |    2 205    1 |  128 120    0 | -108  85    0 |
## 747 |    7329 |    1  43    1 |  -59  15    0 |  -78  27    0 |
## 748 |    7386 |    1 301    1 |  256 293    1 |  -41   7    0 |
## 749 |    7399 |    1 600    1 | -241 599    1 |   -6   0    0 |
## 750 |    7414 |    2 112    0 |   61  96    0 |   25  16    0 |
## 751 |    7487 |    2 406    1 |  164 217    0 |  153 189    1 |
## 752 |    7535 |    1 344    1 | -281 272    1 | -144  72    0 |
## 753 |    7559 |    2 279    1 |  154 206    0 |  -91  72    0 |
## 754 |    7590 |    1 463    1 | -246 420    1 |  -79  43    0 |
## 755 |    7684 |    1 376    1 | -177 250    0 |  126 126    0 |
```

```
## 756 |   7787 |     2  460     1 |  191 412    1 |   65   48    0 |
## 757 |   7844 |     1  483     1 | -323 345    1 | -205 138    1 |
## 758 |  79184 |     1  780     2 | -562 780    3 |   -6    0    0 |
## 759 |   8439 |     2  359     1 |  188 303    1 |  -81   57    0 |
## 760 |   8518 |     1  421     1 | -331 411    1 |   50    9    0 |
## 761 |   8614 |     1  694     2 | -582 591    3 | -242 103    1 |
## 762 |   8658 |     1  206     1 | -152 103    0 | -152 102    0 |
## 763 |   8758 |     2  469     2 |  346 469    2 |  -10    0    0 |
## 764 |   9251 |     2  338     1 |  166 254    0 |  -96   84    0 |
## 765 |   9602 |     2  502     1 |  278 481    1 |  -58   21    0 |
## 766 |   1007 |     2  637     2 |  381 633    2 |  -29    4    0 |
## 767 |  10114 |     1  484     1 | -299 367    1 | -168 116    1 |
## 768 |   1041 |     1  202     1 |  204 196    1 |  -38    7    0 |
## 769 |   1048 |     1  785     2 | -533 667    3 | -224 118    1 |
## 770 |   1070 |     1  141     1 |    8   1    0 | -125 141    0 |
## 771 | 108883 |     1  327     1 | -183 325    0 |  -11    1    0 |
## 772 |   1109 |     1  755     2 | -581 660    3 | -220   94    1 |
## 773 |   1129 |     1  740     1 | -326 536    1 | -201 204    1 |
## 774 |  11632 |     2  346     1 |  255 320    1 |  -71   25    0 |
## 775 |  11638 |     1  647     1 | -363 498    1 | -199 149    1 |
## 776 |   1172 |     1  495     1 | -256 490    1 |   24    4    0 |
## 777 |   1183 |     1  563     2 | -460 465    2 | -211   98    1 |
## 778 |  12250 |     1  614     2 | -481 612    2 |   32    3    0 |
## 779 |   1235 |     2  473     1 |  236 438    1 |  -67   35    0 |
## 780 |  12411 |     2  288     1 |  112 129    0 | -124 159    0 |
## 781 |  12488 |     1  236     1 | -155 112    0 | -163 124    1 |
## 782 |   1249 |     1  417     1 | -302 389    1 |  -81   28    0 |
## 783 |   1300 |     2  329     1 |  189 261    1 |  -96   68    0 |
## 784 |   1301 |     2  260     1 |  158 224    0 |   63   36    0 |
## 785 | 132033 |     1  617     1 | -376 617    2 |   -8    0    0 |
## 786 |   1322 |     2  548     1 |  282 534    1 |  -45   14    0 |
## 787 |   1330 |     2  301     1 |  225 283    1 |  -56   17    0 |
## 788 |   1343 |     1   70     1 |    0   0    0 |  -95   70    0 |
## 789 |   1359 |     1  127     1 |  -97  52    0 | -118   76    0 |
## 790 |   1360 |     2  429     1 |  299 426    1 |  -26    3    0 |
##
## Columns:
##      name   mass  qlt  inr    k=1 cor ctr    k=2 cor ctr
## 1  |  sex |   27  234   18 | -173 174   7 | -101  60   5 |
## 2  | tnrb |   50  192   37 | -187 183  16 |  -42   9   2 |
## 3  | orgn |   38  996  219 | -445 134  66 | 1130 862 882 |
## 4  | hhsz |   76  263   31 | -156 232  16 |  -57  31   5 |
## 5  | addn |  315  998  294 |  486 990 662 |   43   8  11 |
## 6  |  imd |   59  162   56 | -200 162  21 |    7   0   0 |
## 7  | brth |   61  365   21 | -145 233  11 | -109 132  13 |
## 8  | prft |   62  167   70 | -188 123  20 | -112  44  14 |
## 9  |  gor |   93  215  102 | -216 165  38 | -118  50  24 |
## 10 | year |  178  580  114 | -289 507 132 | -109  73  39 |
## 11 | aggr |   42  156   37 | -167 124  10 |  -85  32   6 |
```

```
plot(cora, contrib = "absolute")
```




```r
plot(cora, mass = TRUE, contrib = "absolute", map = "rowgreen", arrows = c(FALSE, TRUE))
```




```r
# The first dimension explains 44% of the inertia.
# The 2nd dimension explains a further 21.4%.
# The first two dimensions seem to explain much of the data.
```

Part 4/4: The Effect of Urban Deprivation – Propensity Analysis

```
############################################      Propensity Analysis      ###########################

# Covert the ordinal scale of treatment variable (imd) to binary scale for computing the propensity sco
hse.mk90 <- hse.mk60

hse.mk90$imd <- ifelse(hse.mk90$imd == 1, 1,
                       ifelse(hse.mk90$imd == 5, 0, NA))
table(hse.mk90$imd)
```

```
##
##    0    1
## 1830 2097
```

```
hse.mk90 <- hse.mk90[complete.cases(hse.mk90), ]

# Compute the Propensity scores
reg <- glm(imd ~ sex + tenureb + origin + hhsize + addnum + birthwt + porftvg + gor + aggr + year + hype
                                                family=binomial, data=hse.mk90)
hse.mk90$fit.value <- fitted.values(reg)



# Propensity Scores Matching & Average Treatment Effect on Treated
set.seed(11)
matching.vars <- cbind(hse.mk90$fit.value)
psm <- Match(Y=hse.mk90$hyper, Tr=hse.mk90$imd, X=matching.vars, Weight = 2, ties = F)
summary.Match(psm)
```

```
##
## Estimate...  0.010968
## SE.........  0.0073992
## T-stat.....  1.4823
## p.val......  0.13825
##
## Original number of observations..............  3927
## Original number of treated obs...............  2097
## Matched number of observations...............  2097
## Matched number of observations  (unweighted).  2097
```

```
#    1  --   Estimate effect of deprivation on hypertention (insignificant)
# Balance test
MatchBalance(imd ~ sex + tenureb + origin + hhsize + addnum + birthwt + porftvg + gor + aggr + year,
             match.out=psm, data=hse.mk90)
```

```
##
## ***** (V1) sex *****
##                       Before Matching        After Matching
## mean treatment........     1.4831            1.4831
## mean control..........     1.4956            1.4654
## std mean diff.........    -2.5123              3.53
##
## mean raw eQQ diff.....   0.012568          0.017644
## med  raw eQQ diff.....          0                 0
```

```
## max  raw eQQ diff.....          1               1
##
## mean eCDF diff........  0.0062787        0.0088221
## med  eCDF diff........  0.0062787        0.0088221
## max  eCDF diff........   0.012557         0.017644
##
## var ratio (Tr/Co).....    0.99886           1.0037
## T-test p-value........    0.43243          0.26218
##
##
## ***** (V2) tenureb *****
##                        Before Matching        After Matching
## mean treatment........     2.1497           2.1497
## mean control..........      3.188           2.0858
## std mean diff.........    -128.37           7.9011
##
## mean raw eQQ diff.....     1.0388          0.17072
## med  raw eQQ diff.....          1               0
## max  raw eQQ diff.....          2               2
##
## mean eCDF diff........    0.17304         0.034144
## med  eCDF diff........   0.031363         0.026228
## max  eCDF diff........    0.49114          0.11111
##
## var ratio (Tr/Co).....     0.5677          0.76482
## T-test p-value........ < 2.22e-16        0.0010861
## KS Bootstrap p-value.. < 2.22e-16       < 2.22e-16
## KS Naive p-value...... < 2.22e-16       1.1419e-11
## KS Statistic..........    0.49114          0.11111
##
##
## ***** (V3) origin *****
##                        Before Matching        After Matching
## mean treatment........     1.5131           1.5131
## mean control..........     2.8087           1.6328
## std mean diff.........    -67.155           -6.204
##
## mean raw eQQ diff.....     1.2984          0.25513
## med  raw eQQ diff.....          0               0
## max  raw eQQ diff.....          9               3
##
## mean eCDF diff........   0.076049         0.014979
## med  eCDF diff........   0.079276        0.0061993
## max  eCDF diff........    0.21319          0.10587
##
## var ratio (Tr/Co).....    0.28059           1.3031
## T-test p-value........ < 2.22e-16         0.019849
## KS Bootstrap p-value.. < 2.22e-16       < 2.22e-16
## KS Naive p-value...... < 2.22e-16       1.2422e-10
## KS Statistic..........    0.21319          0.10587
##
##
## ***** (V4) hhsize *****
##                        Before Matching        After Matching
```

```
## mean treatment........     4.0877             4.0877
## mean control..........     4.1743             4.0544
## std mean diff.........    -9.7108             3.7444
##
## mean raw eQQ diff.....    0.40546            0.22031
## med  raw eQQ diff.....          0                  0
## max  raw eQQ diff.....          2                  2
##
## mean eCDF diff........   0.040475           0.024479
## med  eCDF diff........   0.028262          0.0052456
## max  eCDF diff........    0.10353           0.098712
##
## var ratio (Tr/Co).....    0.45237             0.5725
## T-test p-value........   0.018052            0.30097
## KS Bootstrap p-value.. < 2.22e-16         < 2.22e-16
## KS Naive p-value...... 1.5955e-09         2.6723e-09
## KS Statistic..........    0.10353           0.098712
##
##
## ***** (V5) addnum *****
##                        Before Matching        After Matching
## mean treatment........     16.147             16.147
## mean control..........     16.685              16.48
## std mean diff.........    -4.5391            -2.8117
##
## mean raw eQQ diff.....    0.62459              1.175
## med  raw eQQ diff.....          0                  1
## max  raw eQQ diff.....          5                  8
##
## mean eCDF diff........   0.014179           0.024502
## med  eCDF diff........   0.013992            0.01979
## max  eCDF diff........   0.037979           0.060563
##
## var ratio (Tr/Co).....    0.97447             1.0657
## T-test p-value........    0.15888            0.34792
## KS Bootstrap p-value..      0.092         < 2.22e-16
## KS Naive p-value......    0.11931         0.00091342
## KS Statistic..........   0.037979           0.060563
##
##
## ***** (V6) birthwt *****
##                        Before Matching        After Matching
## mean treatment........     3.3987             3.3987
## mean control..........     3.2459             3.3586
## std mean diff.........     25.555             6.7016
##
## mean raw eQQ diff.....    0.15504           0.071025
## med  raw eQQ diff.....       0.14               0.06
## max  raw eQQ diff.....        0.7                0.4
##
## mean eCDF diff........   0.049164           0.021642
## med  eCDF diff........   0.048823           0.012637
## max  eCDF diff........    0.11914           0.066285
##
```

```
## var ratio (Tr/Co).....    0.85865           0.96479
## T-test p-value........ 2.3537e-14          0.030954
## KS Bootstrap p-value.. < 2.22e-16        < 2.22e-16
## KS Naive p-value...... 1.7919e-12        0.00019934
## KS Statistic..........    0.11914          0.066285
##
##
## ***** (V7) porftvg *****
##                       Before Matching        After Matching
## mean treatment........     3.7744            3.7744
## mean control..........     3.2383            3.8035
## std mean diff.........     32.944           -1.7873
##
## mean raw eQQ diff.....    0.53443          0.059609
## med  raw eQQ diff.....          1                 0
## max  raw eQQ diff.....          2                 1
##
## mean eCDF diff........   0.076598         0.0085156
## med  eCDF diff........   0.074304         0.0057225
## max  eCDF diff........    0.11845          0.026705
##
## var ratio (Tr/Co).....    0.89456            0.9352
## T-test p-value........ < 2.22e-16           0.54511
## KS Bootstrap p-value.. < 2.22e-16             0.172
## KS Naive p-value...... 2.4618e-12           0.44324
## KS Statistic..........    0.11845          0.026705
##
##
## ***** (V8) gor *****
##                       Before Matching        After Matching
## mean treatment........      5.825             5.825
## mean control..........     4.0792            5.6676
## std mean diff.........     69.839            6.2955
##
## mean raw eQQ diff.....     1.7443           0.21745
## med  raw eQQ diff.....          2                 0
## max  raw eQQ diff.....          3                 1
##
## mean eCDF diff........    0.19397          0.024162
## med  eCDF diff........    0.22449          0.013829
## max  eCDF diff........    0.30776           0.07773
##
## var ratio (Tr/Co).....     1.0481            1.0446
## T-test p-value........ < 2.22e-16         0.0089714
## KS Bootstrap p-value.. < 2.22e-16        < 2.22e-16
## KS Naive p-value...... < 2.22e-16        6.2881e-06
## KS Statistic..........    0.30776           0.07773
##
##
## ***** (V9) aggr *****
##                       Before Matching        After Matching
## mean treatment........     2.2556            2.2556
## mean control..........     2.1754            2.2446
## std mean diff.........       9.17            1.2542
```

```
##
## mean raw eQQ diff.....   0.079781          0.055794
## med  raw eQQ diff.....          0                 0
## max  raw eQQ diff.....          1                 1
##
## mean eCDF diff........   0.026731          0.018598
## med  eCDF diff........   0.031751          0.022413
## max  eCDF diff........   0.048442          0.033381
##
## var ratio (Tr/Co).....     0.9371           0.92578
## T-test p-value........  0.0048794           0.69511
## KS Bootstrap p-value..      0.002              0.03
## KS Naive p-value......    0.02038           0.19312
## KS Statistic..........   0.048442          0.033381
##
##
## ***** (V10) year *****
##                        Before Matching        After Matching
## mean treatment........     9.5031            9.5031
## mean control..........     9.7022            9.6595
## std mean diff.........    -6.1378           -4.8222
##
## mean raw eQQ diff.....    0.20164           0.29948
## med  raw eQQ diff.....          0                 0
## max  raw eQQ diff.....          2                 2
##
## mean eCDF diff........   0.018896          0.028374
## med  eCDF diff........   0.018954          0.030758
## max  eCDF diff........   0.037739          0.043872
##
## var ratio (Tr/Co).....    0.95043           0.99125
## T-test p-value........   0.058498            0.1142
## KS Bootstrap p-value..      0.038             0.012
## KS Naive p-value......     0.1236          0.035327
## KS Statistic..........   0.037739          0.043872
##
##
## Before Matching Minimum p.value: < 2.22e-16
## Variable Name(s): tenureb origin hhsize birthwt porftvg gor  Number(s): 2 3 4 6 7 8
##
## After Matching Minimum p.value: < 2.22e-16
## Variable Name(s): tenureb origin hhsize addnum birthwt gor  Number(s): 2 3 4 5 6 8
```

```
#  Regression with a matched dataset  --  this time using ordinal scale of treatment (imd)
#  Create a new dataset after matching
hse.mk.FX <- rbind(hse.mk60[psm$index.control,],hse.mk60[psm$index.treated,])

summary(lm(hyper ~ factor(imd),data=hse.mk.FX))
```

```
##
## Call:
## lm(formula = hyper ~ factor(imd), data = hse.mk.FX)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -0.09898 -0.09580 -0.09041 -0.04576  0.95424
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.045764   0.008249   5.548 3.07e-08 ***
## factor(imd)2  0.014236   0.012466   1.142 0.253535
## factor(imd)3  0.044650   0.012007   3.719 0.000203 ***
## factor(imd)4  0.050036   0.012639   3.959 7.66e-05 ***
## factor(imd)5  0.053217   0.013030   4.084 4.50e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2644 on 4189 degrees of freedom
## Multiple R-squared:  0.006772,   Adjusted R-squared:  0.005824
## F-statistic:  7.14 on 4 and 4189 DF,  p-value: 1.001e-05
```

```
#    2  --   Balance our datasets for more accurate measure & conduct factor regression analysis
#            Estimating deprivation on a ordinal scales (significant)
#       This shows that regression with a matched dataset is a good alternative to matching

summary(lm(hyper ~ factor(imd) + sex + tenureb + origin + hhsize + addnum + birthwt + porftvg + gor + ag
           ,data=hse.mk.FX))
```

```
##
## Call:
## lm(formula = hyper ~ factor(imd) + sex + tenureb + origin + hhsize +
##     addnum + birthwt + porftvg + gor + aggr + year + sysavg +
##     diaavg, data = hse.mk.FX)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.41630 -0.12942 -0.03592  0.04907  0.91141
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.509e+00  5.495e-02 -27.466  < 2e-16 ***
## factor(imd)2  7.758e-04  1.043e-02   0.074  0.94073
## factor(imd)3  1.289e-02  1.013e-02   1.273  0.20325
## factor(imd)4  6.573e-03  1.104e-02   0.595  0.55177
## factor(imd)5  1.972e-02  1.224e-02   1.611  0.10729
## sex          -3.911e-03  6.993e-03  -0.559  0.57601
## tenureb       1.010e-02  3.698e-03   2.732  0.00632 **
## origin        7.934e-03  2.420e-03   3.279  0.00105 **
## hhsize        4.463e-03  3.151e-03   1.416  0.15675
## addnum       -1.603e-04  2.530e-04  -0.634  0.52633
## birthwt       4.382e-03  5.752e-03   0.762  0.44627
## porftvg      -5.928e-05  1.963e-03  -0.030  0.97591
## gor           1.767e-03  1.377e-03   1.283  0.19955
## aggr         -1.942e-02  4.516e-03  -4.300 1.75e-05 ***
## year         -2.259e-03  3.471e-03  -0.651  0.51532
## sysavg        8.708e-03  4.107e-04  21.205  < 2e-16 ***
## diaavg        9.988e-03  4.881e-04  20.466  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 0.2193 on 4177 degrees of freedom
## Multiple R-squared:  0.3183, Adjusted R-squared:  0.3157
## F-statistic: 121.9 on 16 and 4177 DF,  p-value: < 2.2e-16
```

```
#    3  --   However, if we control other variables, deprivation is not significant predictors
```