BSc Population Health Dissertation (18/19)

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```
##########################################   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
```

```
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
```

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

```
## Highcharts (www.highcharts.com) is a Highsoft software product which is
## not free for commercial and Governmental use
```

```
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","age","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$age > 10 & hse05.mk2$age < 16 , 3,
                         ifelse(hse05.mk2$age > 4 & hse05.mk2$age < 14 , 2,
                                ifelse(hse05.mk2$age > 1 & hse05.mk2$age < 5 , 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$age <- NULL


hse06.pc <- c("sys1om","dias1om","sex","tenureb","age","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$age > 10 & hse06.mk2$age < 16 , 3,
                         ifelse(hse06.mk2$age > 4 & hse06.mk2$age < 11 , 2,
                                ifelse(hse06.mk2$age > 1 & hse06.mk2$age < 5 , 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$age <- NULL


hse07.pc <- c("sys1om","dias1om","sex","tenureb","age","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$age > 10 & hse07.mk2$age < 16 , 3,
                         ifelse(hse07.mk2$age > 4 & hse07.mk2$age < 11 , 2,
                                ifelse(hse07.mk2$age > 1 & hse07.mk2$age < 5 , 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$age <- NULL
```

```r
hse08.pc <- c("sys1om","dias1om","sex","tenureb","age","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$age > 10 & hse08.mk2$age < 16 , 3,
                         ifelse(hse08.mk2$age > 4 & hse08.mk2$age < 11 , 2,
                                ifelse(hse08.mk2$age > 1 & hse08.mk2$age < 5 , 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$age <- NULL


hse09.pc <- c("sys1om","dias1om","sex","tenureb","age","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$age > 10 & hse09.mk2$age < 16 , 3,
                         ifelse(hse09.mk2$age > 4 & hse09.mk2$age < 11 , 2,
                                ifelse(hse09.mk2$age > 1 & hse09.mk2$age < 5 , 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$age <- NULL


hse10.pc <- c("sys1om","dias1om","sex","tenureb","age","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$age > 10 & hse10.mk2$age < 16 , 3,
                         ifelse(hse10.mk2$age > 4 & hse10.mk2$age < 11 , 2,
                                ifelse(hse10.mk2$age > 1 & hse10.mk2$age < 5 , 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$age <- NULL


hse11.pc <- c("sys1om","dias1om","Sex","tenureb","Age","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$Age > 10 & hse11.mk2$Age < 16 , 3,
                         ifelse(hse11.mk2$Age > 4 & hse11.mk2$Age < 11 , 2,
                                ifelse(hse11.mk2$Age > 1 & hse11.mk2$Age < 5 , 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$Age <- NULL


hse12.pc <- c("sys1om","dias1om","Sex","tenureb","Age","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$aggr <- ifelse(hse12.mk2$Age > 10 & hse12.mk2$Age < 16 , 3,
                         ifelse(hse12.mk2$Age > 4 & hse12.mk2$Age < 11 , 2,
                                ifelse(hse12.mk2$Age > 1 & hse12.mk2$Age < 5 , 1, 0)))
hse12.mk2$porftvg <- ifelse(hse12.mk2$porftvg > 5, 6, hse12.mk2$porftvg)
hse12.2 <- -c(which(hse12.mk2$aggr == 0))
hse12.mk2 <- hse12.mk2[hse12.2,]
hse12.mk2$Age <- NULL


hse13.pc <- c("SYS1OM","DIAS1OM","Sex","tenureb","Age","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$Age > 10 & hse13.mk2$Age < 16 , 3,
                         ifelse(hse13.mk2$Age > 4 & hse13.mk2$Age < 11 , 2,
                                ifelse(hse13.mk2$Age > 1 & hse13.mk2$Age < 5 , 1, 0)))
```

```r
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$Age <- NULL


hse14.pc <- c("SYS1OM","DIAS1OM","Sex","tenureb","Age90","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$Age90 > 10 & hse14.mk2$Age90 < 16 , 3,
                        ifelse(hse14.mk2$Age90 > 4 & hse14.mk2$Age90 < 11 , 2,
                               ifelse(hse14.mk2$Age90 > 1 & hse14.mk2$Age90 < 5 , 1, 0)))
hse14.2 <- -c(which(hse14.mk2$aggr == 0))
hse14.mk2 <- hse14.mk2[hse14.2,]
hse14.mk2$Age90 <- 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$Ag015g4 > 0, hse15.mk2$Ag015g4, 0)
hse15.2 <- -c(which(hse15.mk2$aggr == 0))
hse15.mk2 <- hse15.mk2[hse15.2,]
hse15.mk2$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 cases
#       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
#      Note: As children age from 2-4 does not have valid BP measurements, so they are dropped from the

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"
```

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

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

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

```
## [1] 1 6
```

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

```
## [1]  1 18
```

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

```
## [1]  2 11
```

```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] 0.91 6.75
```

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

```
## [1] 0 6
```

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

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

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

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

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

```
## [1] 2 3
```

```r
range(hse.mk20$sys1om, na.rm = T)
```

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

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

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

```r
range(hse.mk20$sys3om, na.rm = T)
```

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

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

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

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

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

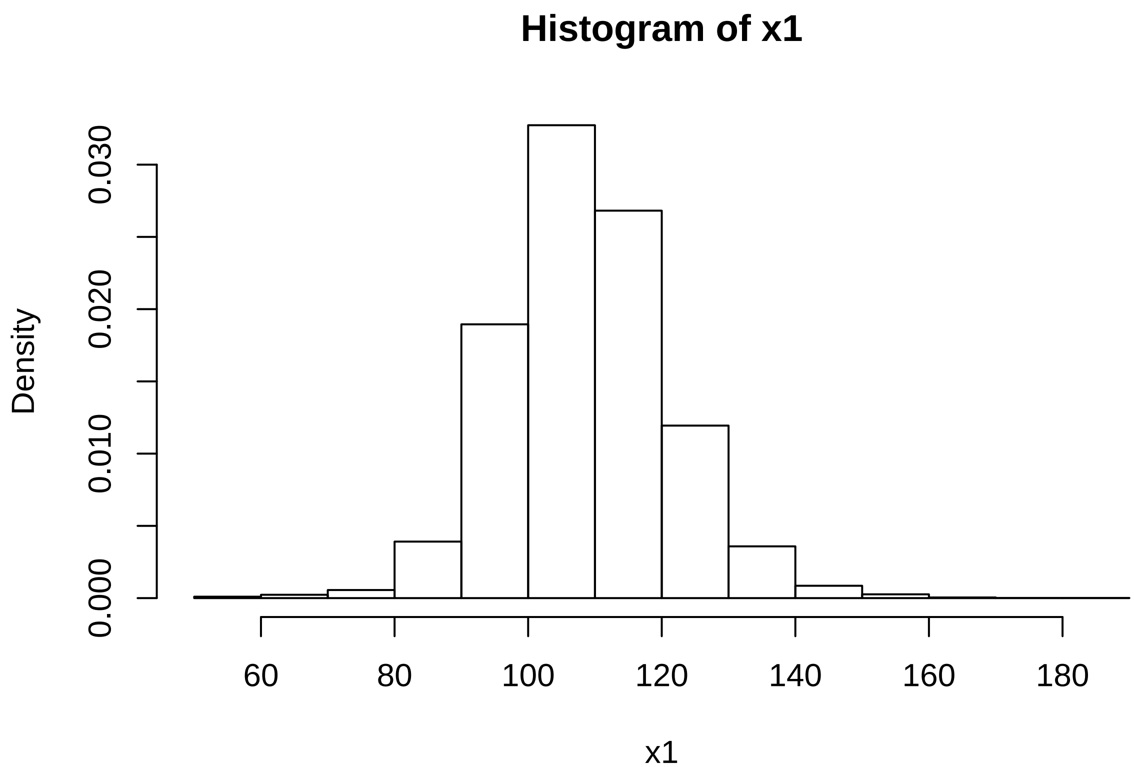
```r
range(hse.mk20$dias3om, na.rm = T)
```

```
## [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
```

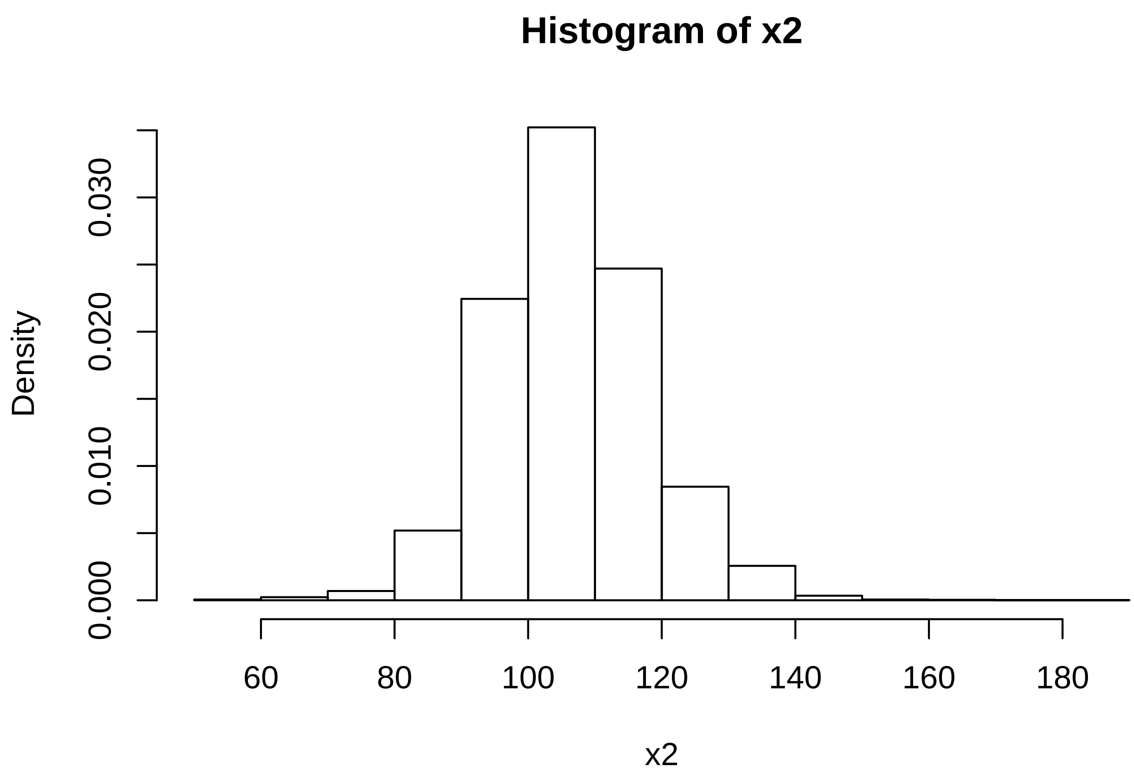
```r
hist(x1, freq = FALSE)
```




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

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

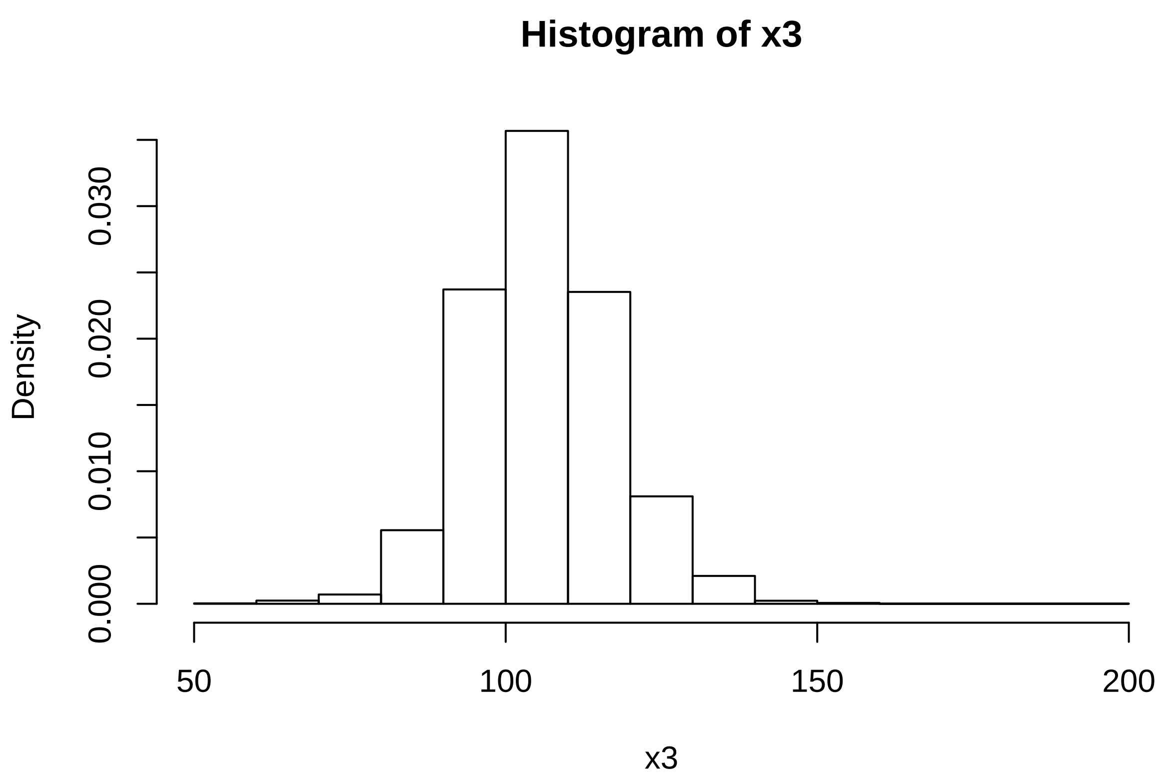
```r
hist(x2, freq = FALSE)
```




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

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

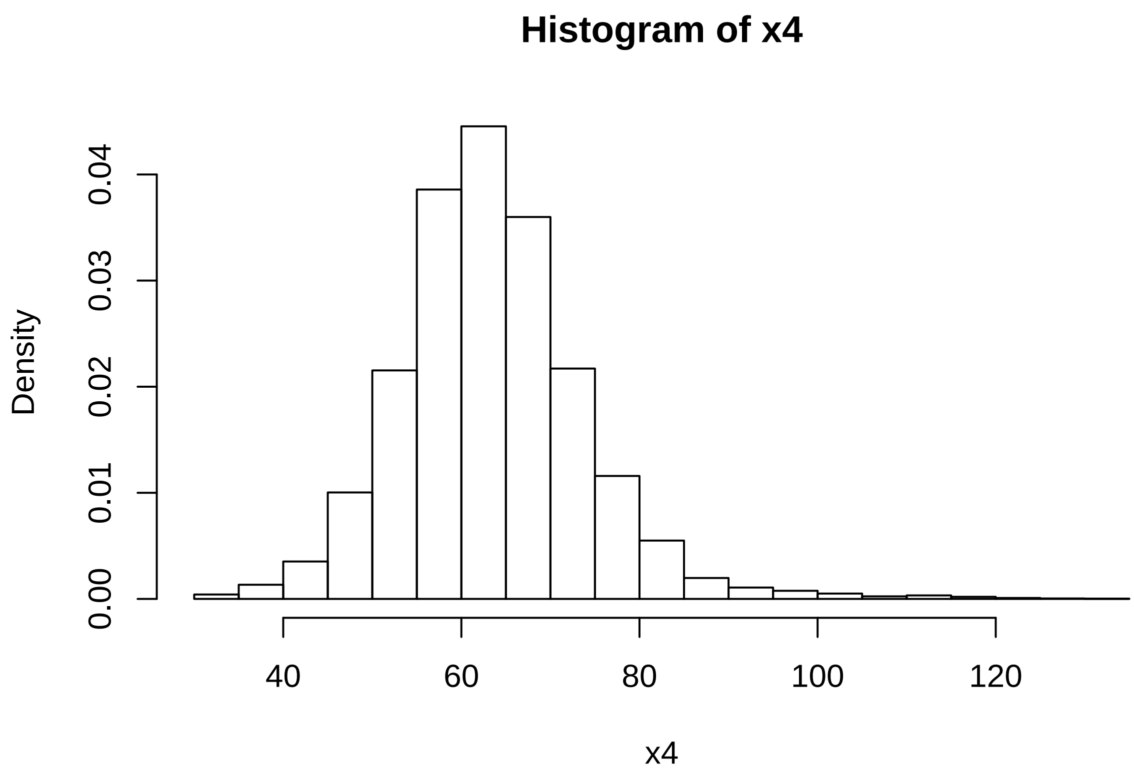
```r
hist(x3, freq = FALSE)
```



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

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

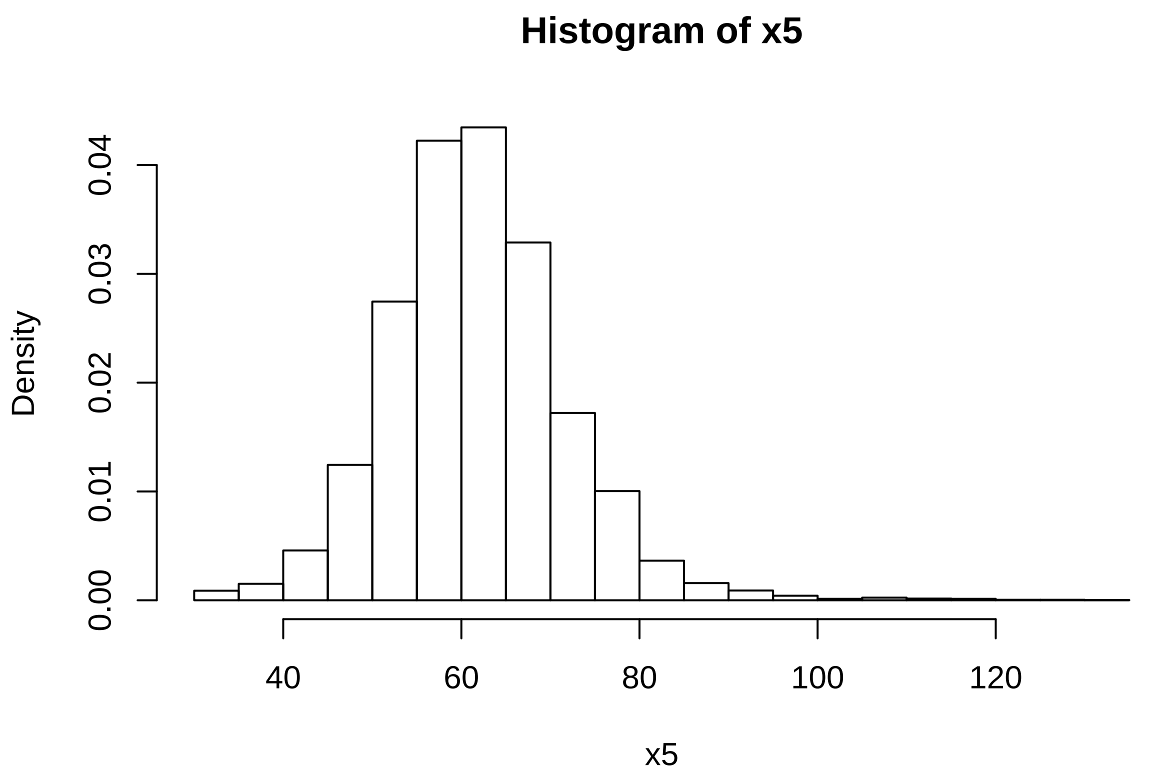
```r
hist(x4, freq = FALSE)
```




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

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

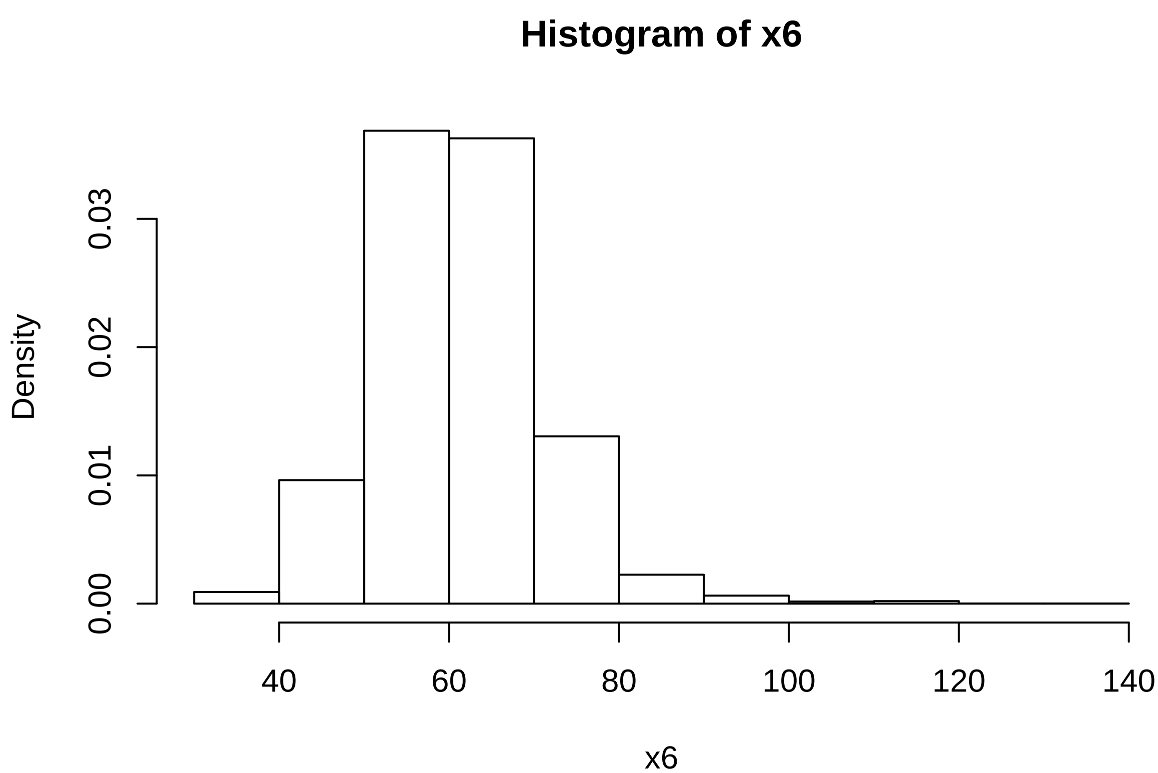
```r
hist(x5, freq = FALSE)
```




```
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 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]  66.33333 148.33333
```

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

```
##      95%
## 120.6667
```

```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] 240
```

```r
#                                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
```

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

```
##      95%
## 129.6667
```

```r
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] 225
```

```r
# diastolic bp comparison for age  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 102.00000
```

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

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

```r
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] 247
```

```r
#                                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
```

```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] 229
```

```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$sys.hyper2.mk <- ifelse(is.na(hse.mk20$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$dia.hyper2.mk <- ifelse(is.na(hse.mk20$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$sys.hyper2.mk == 1 | hse.mk20$sys.hyper3.mk == 1
                       | hse.mk20$dia.hyper2.mk == 1 | hse.mk20$dia.hyper3.mk == 1 ,1, 0)
length(which(hse.mk20$hyper == 1 ))
```

```
## [1] 781
```

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

```r
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
```

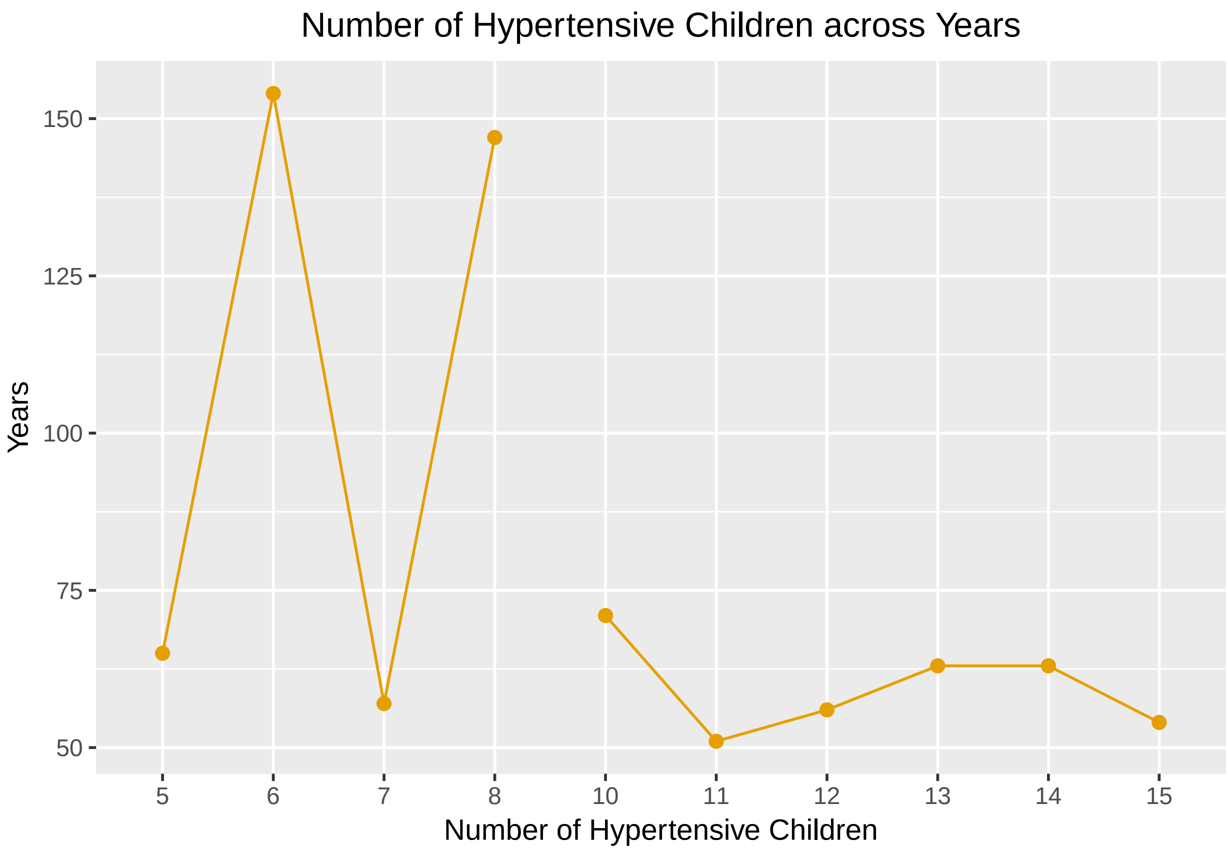
```
# Retrieve the imputed values
hse.mk50.mi.r <- impute.transcan(hse.mk50.mi, data = hse.mk50, imputation=1, list.out=TRUE, pr=FALSE, c

# 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
```

```
####################   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

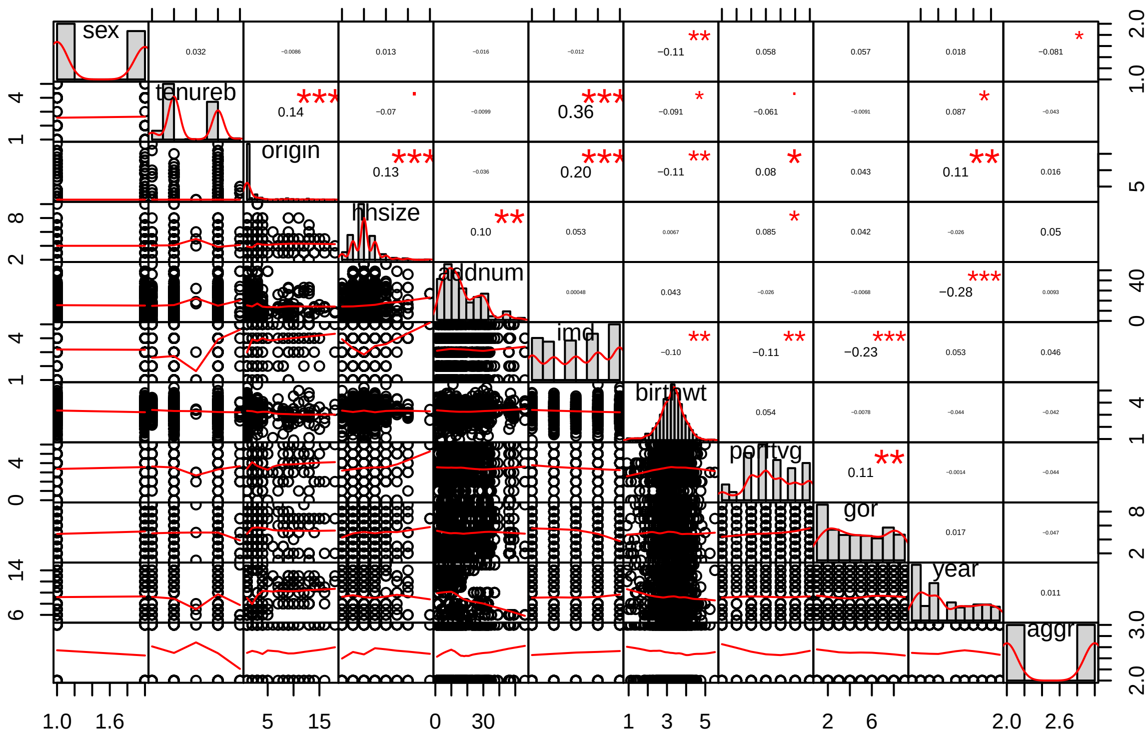
```
##################################       Current Hypertension Phenomenon Plotting       ###############

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 Yea
```

```r
  theme(plot.title = element_text(hjust = 0.5))
```



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

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

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




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

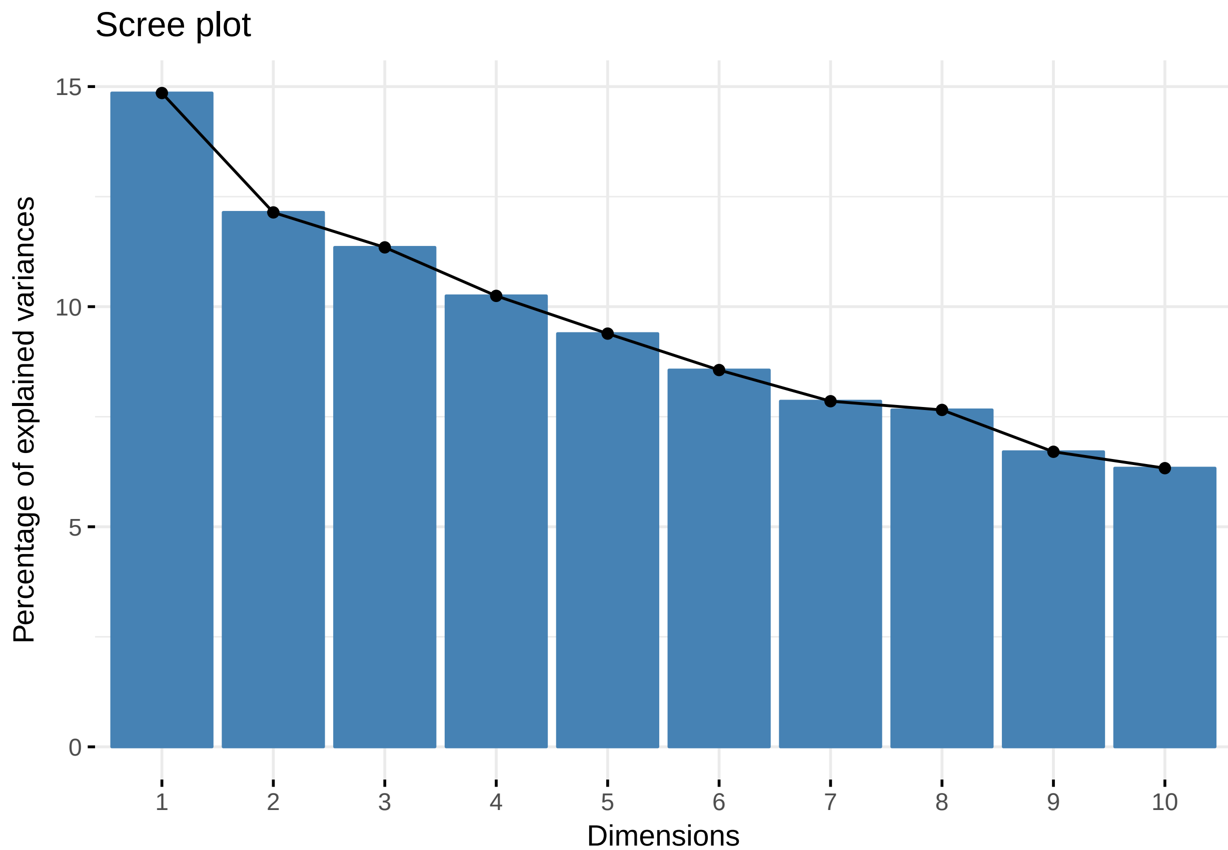
```
##                  sex      tenureb       origin       hhsize        addnum
## sex      1.000000000  0.032417927 -0.008604396  0.013400676 -0.0162555127
## tenureb  0.032417927  1.000000000  0.138691314 -0.070010414 -0.0099494051
## origin  -0.008604396  0.138691314  1.000000000  0.125300694 -0.0356240083
## hhsize   0.013400676 -0.070010414  0.125300694  1.000000000  0.1019075663
## addnum  -0.016255513 -0.009949405 -0.035624008  0.101907566  1.0000000000
## imd     -0.011701401  0.360434975  0.199830386  0.053353413  0.0004755454
## birthwt -0.110554645 -0.090559327 -0.110419365  0.006704787  0.0425466873
## porftvg  0.057974983 -0.060507403  0.080352101  0.085146930 -0.0257302882
## gor      0.057357270 -0.009123849  0.042795023  0.041744105 -0.0067576125
## year     0.017830535  0.086812986  0.112924233 -0.025591251 -0.2809383590
## aggr    -0.080776257 -0.043188987  0.015528203  0.050358235  0.0093275242
##                  imd      birthwt      porftvg          gor         year
## sex     -0.0117014008 -0.110554645  0.057974983  0.057357270  0.017830535
## tenureb  0.3604349751 -0.090559327 -0.060507403 -0.009123849  0.086812986
## origin   0.1998303857 -0.110419365  0.080352101  0.042795023  0.112924233
## hhsize   0.0533534132  0.006704787  0.085146930  0.041744105 -0.025591251
## addnum   0.0004755454  0.042546687 -0.025730288 -0.006757613 -0.280938359
## imd      1.0000000000 -0.103795819 -0.109717956 -0.234176752  0.053088789
## birthwt -0.1037958194  1.000000000  0.054341549 -0.007760230 -0.043703547
## porftvg -0.1097179565  0.054341549  1.000000000  0.107895548 -0.001402858
## gor     -0.2341767523 -0.007760230  0.107895548  1.000000000  0.016672702
## year     0.0530887892 -0.043703547 -0.001402858  0.016672702  1.000000000
## aggr     0.0456080353 -0.041830433 -0.044178573 -0.046981949  0.011454565
##                 aggr
## sex     -0.080776257
## tenureb -0.043188987
```

```
## origin   0.015528203
## hhsize   0.050358235
## addnum   0.009327524
## imd      0.045608035
## birthwt -0.041830433
## porftvg -0.044178573
## gor     -0.046981949
## year     0.011454565
## aggr     1.000000000
```

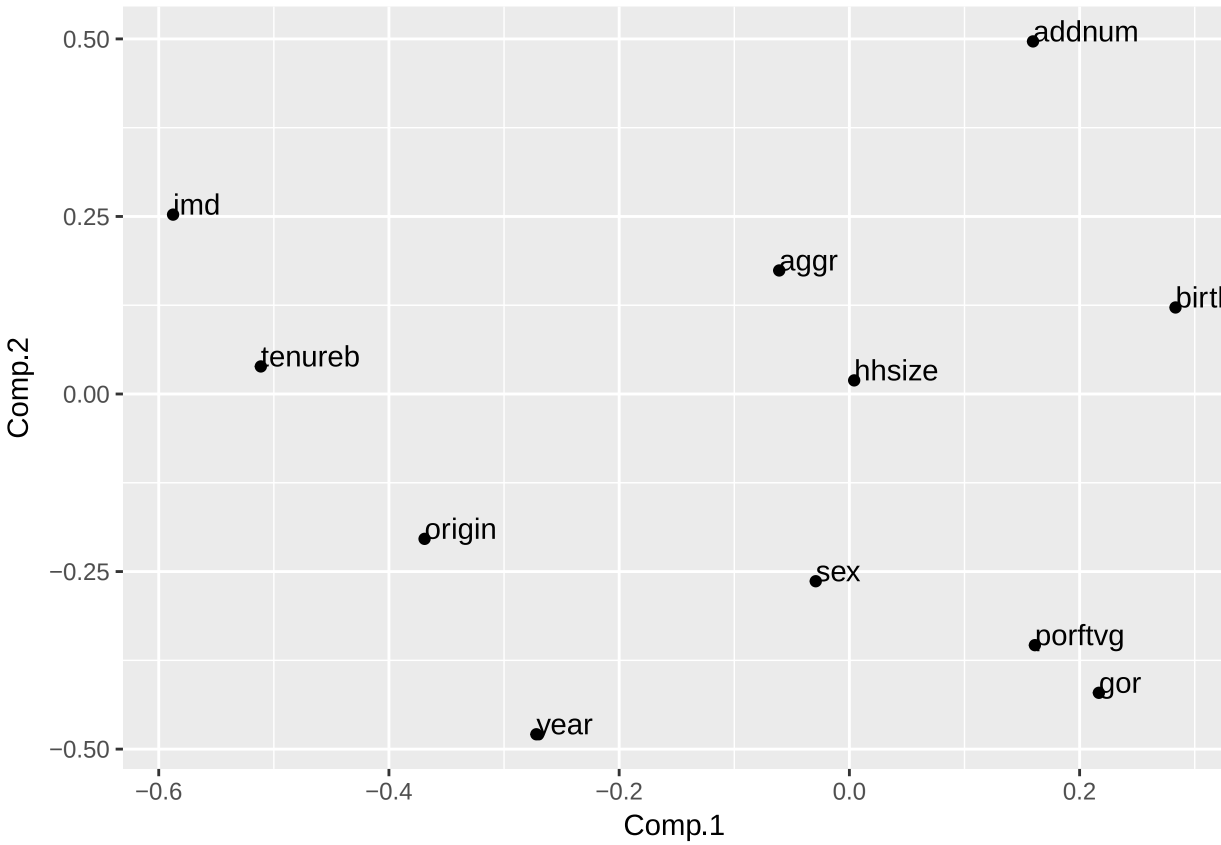
```
##################################       Principal Components Analysis (PCA)       ####################

# 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     1.2782534 1.1556594 1.1172116 1.0615910 1.01619180
## Proportion of Variance 0.1485392 0.1214135 0.1134693 0.1024523 0.09387689
## Cumulative Proportion  0.1485392 0.2699528 0.3834220 0.4858743 0.57975120
##                            Comp.6     Comp.7     Comp.8    Comp.9
## Standard deviation     0.97038590 0.92937644 0.91757061 0.8587035
## Proportion of Variance 0.08560444 0.07852187 0.07653962 0.0670338
## Cumulative Proportion  0.66535564 0.74387751 0.82041713 0.8874509
##                           Comp.10    Comp.11
## Standard deviation     0.83451462 0.73595187
## Proportion of Variance 0.06331042 0.04923865
## Cumulative Proportion  0.95076135 1.00000000
```

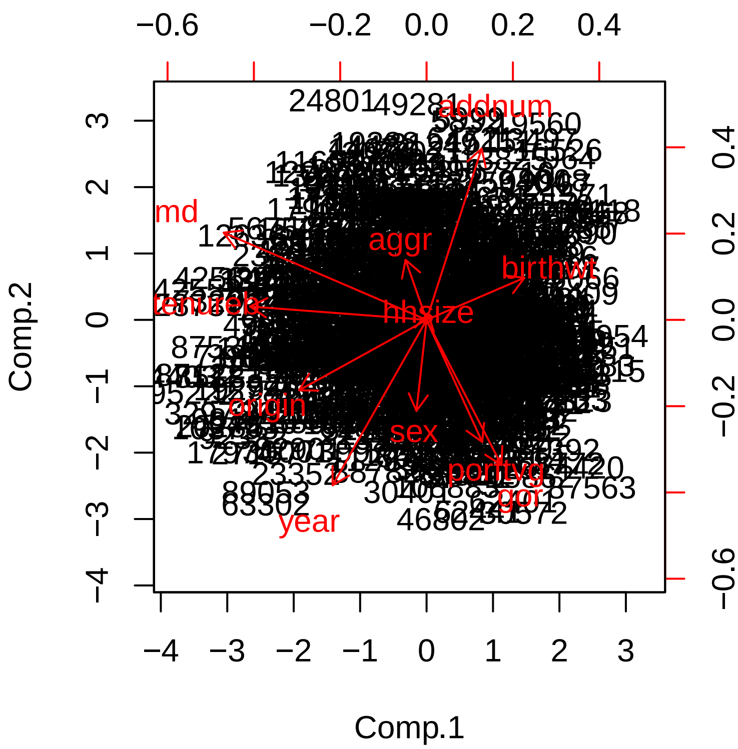
```
fviz_eig(pca)
```



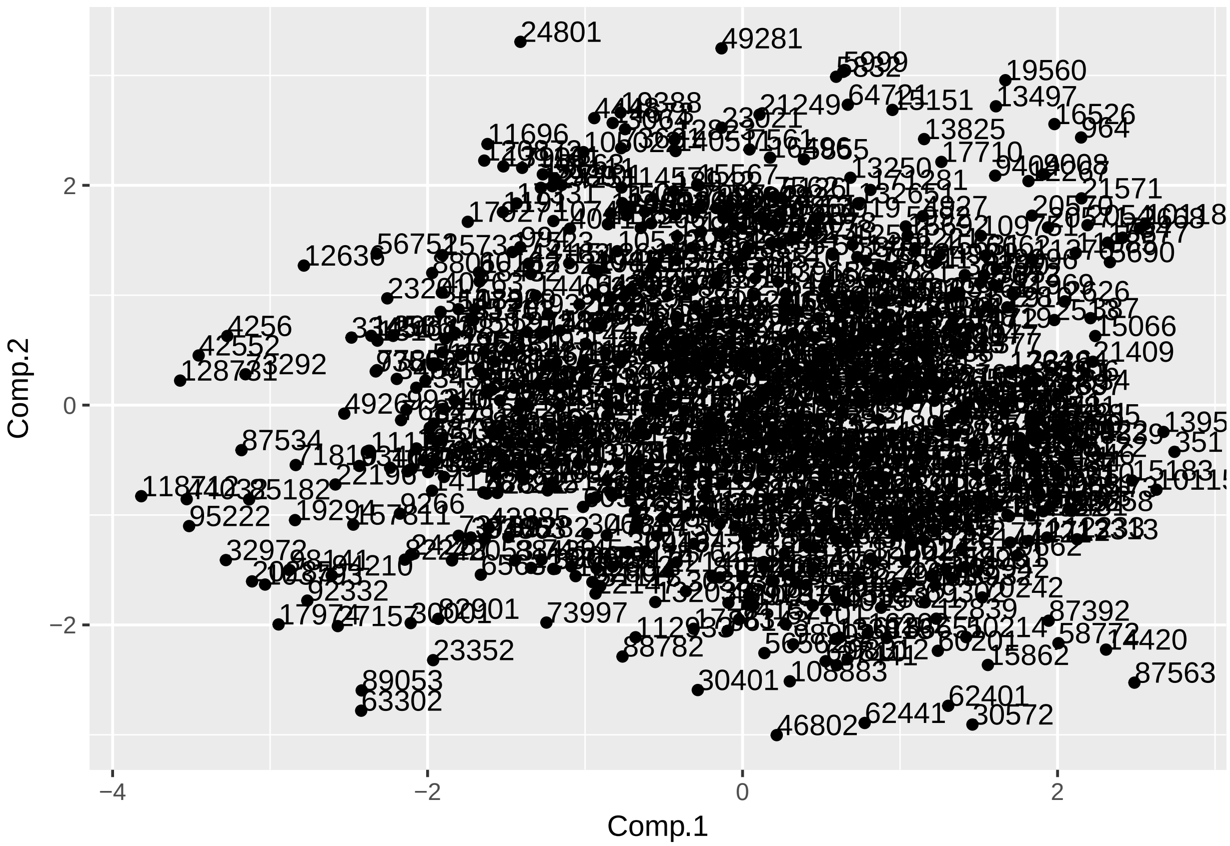

```
# Overall, it seems that we'll need two or three components to account for the variation in the data.

# 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)
```



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




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

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

```
##
## Principal inertias (eigenvalues):
##
##  dim    value      %   cum%   scree plot
##  1      0.115351  45.5  45.5  ***********
##  2      0.055700  22.0  67.4  *****
##  3      0.027461  10.8  78.3  ***
##  4      0.016668   6.6  84.8  **
##  5      0.015196   6.0  90.8  *
##  6      0.007862   3.1  93.9  *
##  7      0.006129   2.4  96.3  *
##  8      0.003720   1.5  97.8
##  9      0.003405   1.3  99.1
##  10     0.002193   0.9 100.0
##         -------- -----
##  Total: 0.253686 100.0
##
##
## Rows:
```

```
##          name   mass  qlt  inr    k=1 cor ctr    k=2 cor ctr
## 1    |    152 |     1  389    1 | -312 301   1 | -169  88   0 |
## 2    |    303 |     1  125    1 |   99  65   0 |  -95  60   0 |
## 3    |    609 |     1   72    1 |   40  10   0 |  -98  62   0 |
## 4    |    754 |     1  641    1 |  339 632   1 |  -39   8   0 |
## 5    |    994 |     1   50    1 | -132  47   0 |  -37   4   0 |
## 6    |   1082 |     2  410    1 |  217 368   1 |  -74  43   0 |
## 7    |   1507 |     1  459    1 |  244 448   1 |  -39  11   0 |
## 8    |   1567 |     1  389    1 |  210 381   0 |  -30   8   0 |
## 9    |   1702 |     1  313    0 |  176 305   0 |  -30   9   0 |
## 10   |   2004 |     1  463    0 |  208 448   0 |  -38  15   0 |
## 11   |   2545 |     1  130    1 |  -89  55   0 | -104  75   0 |
## 12   |   2752 |     1  401    1 |  235 386   1 |  -46  15   0 |
## 13   |   2910 |     1  142    1 | -133  90   0 | -102  53   0 |
## 14   |   2944 |     1  671    1 |  377 670   1 |   15   1   0 |
## 15   |   2984 |     2  467    1 |  220 449   1 |  -44  18   0 |
## 16   |   3064 |     1  168    1 |  167 160   0 |  -36   8   0 |
## 17   |   3212 |     1  291    0 |   74  79   0 |  120 211   0 |
## 18   |   3303 |     1  106    1 |  116  91   0 |  -48  15   0 |
## 19   |   3594 |     1  493    1 |  140 159   0 |  203 334   1 |
## 20   |   4022 |     1  155    1 |  163 150   0 |  -30   5   0 |
## 21   |   4062 |     1  524    1 |  254 523   1 |    6   0   0 |
## 22   |   4268 |     1  187    1 | -196 140   0 | -113  46   0 |
## 23   |   4388 |     1  544    2 | -533 480   2 | -196  65   0 |
## 24   |   4446 |     1   63    1 |  118  59   0 |  -28   3   0 |
## 25   |   4573 |     1  534    1 |  256 530   1 |  -25   5   0 |
## 26   |   4887 |     1  272    0 |  159 232   0 |  -67  41   0 |
## 27   |   4927 |     1  486    0 |  227 478   0 |  -30   8   0 |
## 28   |   5614 |     1  703    1 |  310 701   1 |  -15   2   0 |
## 29   |   5709 |     1  150    1 |  -96  42   0 | -154 108   0 |
## 30   |   5818 |     1  631    2 | -539 562   2 | -189  69   1 |
## 31   |   5855 |     1  321    1 |  221 321   0 |   -8   0   0 |
## 32   |   5992 |     1  768    1 |  325 764   1 |  -25   4   0 |
## 33   |   6128 |     1  644    1 |  336 641   1 |  -21   3   0 |
## 34   |   6634 |     1  343    1 |  211 308   0 |  -72  35   0 |
## 35   |   6821 |     1  273    1 |  152 221   0 |  -74  52   0 |
## 36   |   7012 |     1  352    1 |  185 300   0 |  -77  52   0 |
## 37   |   7073 |     1  634    0 |  242 621   1 |  -36  14   0 |
## 38   |   7615 |     1  451    1 | -309 378   1 | -136  73   0 |
## 39   |   8065 |     1  523    2 | -556 441   2 | -240  82   1 |
## 40   |   8715 |     1  316    1 | -190 201   0 | -144 115   0 |
## 41   |   8730 |     1  783    1 |  305 779   1 |  -24   5   0 |
## 42   |   9048 |     1  578    1 |  328 578   1 |    6   0   0 |
## 43   |   9138 |     1  452    1 |  254 437   1 |  -47  15   0 |
## 44   |   9483 |     1  294    1 |  171 276   0 |  -44  18   0 |
## 45   |   9543 |     1  270    0 |  146 242   0 |  -50  29   0 |
## 46   |   9662 |     1  386    2 | -351 282   1 | -213 104   1 |
## 47   |   9764 |     1   90    1 |   75  47   0 |  -71  43   0 |
## 48   |   9788 |     1  258    1 |  193 255   0 |  -21   3   0 |
## 49   |   9958 |     1  156    1 |  -91  44   0 | -145 112   0 |
## 50   |   1030 |     1  276    1 |  165 237   0 |  -67  38   0 |
## 51   |   1080 |     1  310    0 |  171 290   0 |  -45  20   0 |
## 52   |  11376 |     1  652    1 |  375 652   2 |   -6   0   0 |
## 53   |  11377 |     1  763    1 |  409 763   2 |    9   0   0 |
```

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## 54  |   1141 |    1 461    2 | -412 458    2 |   32   3    0 |
## 55  |   1169 |    1 349    1 |  283 347    1 |   20   2    0 |
## 56  |  11946 |    1 270    1 | -213 162    0 | -173 107    1 |
## 57  |   1201 |    1 303    1 | -283 256    1 | -120  47    0 |
## 58  |  12034 |    1 250    1 | -206 158    0 | -157  92    0 |
## 59  |  12264 |    1 282    1 | -205 185    0 | -149  98    0 |
## 60  |   1232 |    1 408    0 |  210 407    0 |   -9   1    0 |
## 61  |   1251 |    1 748    0 |  258 748    1 |   -6   0    0 |
## 62  |   1264 |    1 545    2 | -541 456    2 | -239  89    1 |
## 63  |   1286 |    1 641    2 | -544 561    2 | -206  80    1 |
## 64  |   1297 |    2 434    1 |  194 319    0 |  117 115    0 |
## 65  |   1312 |    1 210    1 |  156 201    0 |  -34   9    0 |
## 66  |    146 |    2 915    3 |  565 880    6 |  112  35    1 |
## 67  |    274 |    1 126    1 |  -28   6    0 | -120 119    0 |
## 68  |    328 |    1 124    1 |  -18   2    0 | -130 122    0 |
## 69  |    351 |    2 744    2 |  442 738    3 |  -38   5    0 |
## 70  |    387 |    2 890    3 |  591 890    6 |    6   0    0 |
## 71  |   6221 |    2 919    3 |  588 917    6 |   29   2    0 |
## 72  |   6512 |    1 614    1 | -418 610    1 |  -33   4    0 |
## 73  |   7241 |    1 802    1 |  307 801    1 |  -11   1    0 |
## 74  |    825 |    2 752    1 |  330 749    2 |  -21   3    0 |
## 75  |    920 |    1 159    0 |  -16   3    0 | -119 156    0 |
## 76  |    964 |    2 971    3 |  674 967    7 |   47   5    0 |
## 77  |   1078 |    1 360    1 | -456 341    1 | -109  19    0 |
## 78  |   1179 |    1 165    1 |  -80  42    0 | -137 122    0 |
## 79  |   1424 |    1 103    1 |    1   0    0 | -111 103    0 |
## 80  |   1463 |    2 884    2 |  415 814    3 |  121  69    0 |
## 81  |   1749 |    1  74    1 |  -27   4    0 |  112  70    0 |
## 82  |   1867 |    1 110    1 |   30   7    0 | -121 104    0 |
## 83  |   1912 |    2 560    1 |  326 509    1 |  104  51    0 |
## 84  |   1935 |    2 185    1 |  145 157    0 |   62  28    0 |
## 85  |   1936 |    2 189    1 |  152 158    0 |   68  31    0 |
## 86  |   1946 |    2 771    1 |  335 708    2 |  100  63    0 |
## 87  |   2054 |    2 784    2 |  488 783    3 |  -10   0    0 |
## 88  |   2138 |    1 679    1 |  295 675    1 |  -23   4    0 |
## 89  |   2302 |    2 881    2 |  469 880    3 |   18   1    0 |
## 90  |   2480 |    2 896    4 |  662 887    7 |   68   9    0 |
## 91  |   2506 |    2 781    1 |  374 775    2 |  -34   6    0 |
## 92  |   2513 |    2 712    1 |  349 655    2 |  103  57    0 |
## 93  |   2626 |    2 871    3 |  549 871    5 |   -1   0    0 |
## 94  |   2668 |    2 927    3 |  600 914    6 |   72  13    0 |
## 95  |   2729 |    1 343    1 | -294 254    1 | -174  89    1 |
## 96  |   2738 |    1 107    0 |   -5   0    0 |  -99 107    0 |
## 97  |   2751 |    1 693    0 |  252 682    1 |  -31  10    0 |
## 98  |   2784 |    1 630    1 |  348 625    1 |  -29   4    0 |
## 99  |   2796 |    1 424    1 | -194 278    0 | -141 146    0 |
## 100 |   2819 |    1 158    0 |   90  91    0 |  -77  67    0 |
## 101 |   3091 |    1 631    2 | -500 521    2 | -230 110    1 |
## 102 |   3259 |    1 124    0 |  -24   8    0 |  -92 116    0 |
## 103 |   3492 |    2 785    2 |  449 785    3 |   12   1    0 |
## 104 |   3519 |    1 466    1 | -304 372    1 | -152  94    0 |
## 105 |   3812 |    1 461    1 | -329 334    1 | -203 127    1 |
## 106 |   4020 |    1 298    1 |  155 236    0 |  -80  62    0 |
## 107 |   4206 |    2 906    2 |  482 859    4 |  112  46    0 |
```

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## 108 |    4233 |     1  455     1 | -318 333    1 | -192 122    1 |
## 109 |    4234 |     1  319     1 | -277 241    1 | -157  78    0 |
## 110 |    4341 |     1  552     2 | -502 462    2 | -221  89    1 |
## 111 |    4448 |     1  215     1 |  225 213    0 |   18   1    0 |
## 112 |    4928 |     2  966     4 |  701 958    9 |   65   8    0 |
## 113 |    4942 |     1  660     1 | -359 573    1 | -140  86    0 |
## 114 |    5126 |     2  690     1 |  306 612    1 |  109  78    0 |
## 115 |    5411 |     1  132     1 |  -68  43    0 |  -98  89    0 |
## 116 |    5690 |     2  931     3 |  617 931    6 |   19   1    0 |
## 117 |    5832 |     2  961     3 |  637 954    6 |   56   7    0 |
## 118 |    5936 |     1  882     1 |  422 881    2 |   15   1    0 |
## 119 |    5999 |     2  977     4 |  692 971    9 |   54   6    0 |
## 120 |    6103 |     1   67     1 |   16   2    0 |  -87  65    0 |
## 121 |    6157 |     1  274     0 |   79 136    0 |  -80 138    0 |
## 122 |    6430 |     2  846     1 |  405 846    2 |   -2   0    0 |
## 123 |    6662 |     1  856     1 |  469 856    3 |    6   0    0 |
## 124 |    7001 |     1   52     1 |   54  19    0 |  -71  33    0 |
## 125 |    7366 |     2  922     2 |  495 872    5 |  118  50    1 |
## 126 |    7561 |     2  952     3 |  642 947    7 |   48   5    0 |
## 127 |    7562 |     2  953     3 |  613 950    6 |   38   4    0 |
## 128 |    7989 |     1  495     1 |  241 493    1 |  -16   2    0 |
## 129 |    7990 |     1  496     1 |  259 496    1 |   -7   0    0 |
## 130 |    7992 |     1  653     1 |  337 653    1 |   -7   0    0 |
## 131 |    7997 |     1  841     1 |  432 838    2 |   25   3    0 |
## 132 |    8051 |     1  427     1 | -389 384    1 | -130  43    0 |
## 133 |    8198 |     1  417     1 | -239 346    0 | -108  71    0 |
## 134 |    8801 |     2  704     1 |  293 457    1 |  216 248    1 |
## 135 |    8819 |     1  100     1 |  114  69    0 |  -76  31    0 |
## 136 |    8936 |     1  377     1 | -344 314    1 | -154  63    0 |
## 137 |    8990 |     1  521     1 | -363 474    1 | -114  47    0 |
## 138 |    9008 |     1  901     2 |  509 899    3 |   23   2    0 |
## 139 |    9111 |     2  714     1 |  368 714    2 |    2   0    0 |
## 140 |    9404 |     2  900     3 |  624 896    6 |   44   4    0 |
## 141 |    9718 |     1  500     2 | -522 500    2 |   17   0    0 |
## 142 |    9802 |     1  309     0 | -109 142    0 | -118 166    0 |
## 143 |   10056 |     2  729     1 |  385 716    2 |   52  13    0 |
## 144 |   10118 |     2  925     5 |  747 920   10 |   59   6    0 |
## 145 |    1063 |     1  785     2 |  471 782    3 |   26   2    0 |
## 146 |    1066 |     1  162     0 |  -66  52    0 |   96 110    0 |
## 147 |    1108 |     2  872     3 |  570 872    5 |    4   0    0 |
## 148 |    1136 |     1  617     1 | -394 517    1 | -173 100    0 |
## 149 |    1145 |     2  750     1 |  313 666    1 |  111  84    0 |
## 150 |   12086 |     1  100     1 |  -76  25    0 |  131  75    0 |
## 151 |   12267 |     2  906     3 |  643 902    6 |   44   4    0 |
## 152 |   12425 |     1  509     1 |  314 507    1 |   20   2    0 |
## 153 |    1271 |     1  482     2 | -413 370    1 | -227 112    1 |
## 154 |   13113 |     1    8     1 |  -40   6    0 |  -23   2    0 |
## 155 |   13119 |     1   29     1 |   48  13    0 |  -52  16    0 |
## 156 |    1332 |     1  512     2 | -490 480    2 | -127  32    0 |
## 157 |    1344 |     1  652     1 |  351 649    1 |   23   3    0 |
## 158 |   13497 |     2  937     4 |  721 930    8 |   62   7    0 |
## 159 |    1376 |     2  851     2 |  476 846    3 |   35   5    0 |
## 160 |    1382 |     2  955     4 |  770 943    9 |   88  12    0 |
## 161 |    1391 |     1  132     0 |  106 118    0 |  -36  14    0 |
```

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## 162 |    1395 |    2  618    1 |  366 605    2 |  -56  14    0 |
## 163 |    1399 |    2  852    3 |  610 850    6 |   31   2    0 |
## 164 |   14251 |    1  409    1 | -354 376    1 | -104  32    0 |
## 165 |   14410 |    1   64    1 |  -16   2    0 |  -85  61    0 |
## 166 |   14411 |    1   69    0 |    5   0    0 |  -73  69    0 |
## 167 |    1447 |    1   57    0 |   21   6    0 |  -63  51    0 |
## 168 |   14537 |    1  218    0 |  -87 107    0 |  -88 111    0 |
## 169 |   14538 |    1  240    0 | -108 130    0 |  -99 110    0 |
## 170 |    1467 |    2  925    3 |  632 916    6 |   61   8    0 |
## 171 |    1472 |    1  414    1 |  236 379    1 |  -71  35    0 |
## 172 |    1481 |    1   37    0 |  -15   3    0 |   48  34    0 |
## 173 |    1482 |    1   58    0 |  -18   6    0 |   51  52    0 |
## 174 |    1505 |    1   87    1 |   33   6    0 | -120  81    0 |
## 175 |    1506 |    2  718    2 |  444 716    3 |  -27   3    0 |
## 176 |    1515 |    2  977    4 |  668 922    8 |  164  55    1 |
## 177 |    1538 |    2  721    1 |  393 714    2 |  -39   7    0 |
## 178 |   15569 |    2  784    2 |  461 781    3 |  -27   3    0 |
## 179 |   15733 |    1  215    0 |   63  47    0 |  118 167    0 |
## 180 |    1575 |    1  513    1 | -366 409    1 | -184 104    0 |
## 181 |    1587 |    2  954    3 |  645 952    7 |   30   2    0 |
## 182 |    1649 |    2  913    2 |  444 913    3 |   -7   0    0 |
## 183 |    1652 |    1  843    2 |  553 840    4 |   32   3    0 |
## 184 |    1667 |    1  238    0 | -138 186    0 |  -73  52    0 |
## 185 |    1692 |    1  435    1 | -303 302    1 | -201 133    1 |
## 186 |    1715 |    1  526    1 | -283 405    1 | -155 121    0 |
## 187 |   17331 |    1   38    1 |   83  38    0 |  -12   1    0 |
## 188 |    1745 |    1   93    0 |  -33  14    0 |  -80  79    0 |
## 189 |   17522 |    2  906    3 |  471 726    4 |  234 179    2 |
## 190 |   17523 |    2  929    3 |  483 743    4 |  241 186    2 |
## 191 |    1765 |    1  137    0 |   51  45    0 |  -73  92    0 |
## 192 |    1771 |    2  950    3 |  606 946    6 |   39   4    0 |
## 193 |    1781 |    1  318    1 | -211 231    0 | -129  87    0 |
## 194 |    1786 |    1  183    1 |  157 182    0 |  -14   1    0 |
## 195 |    1795 |    2  902    3 |  533 901    5 |   16   1    0 |
## 196 |    1803 |    1  208    1 | -175 207    0 |  -14   1    0 |
## 197 |    1806 |    1  469    1 | -251 395    0 | -109  74    0 |
## 198 |    1838 |    1  404    2 | -476 378    1 | -125  26    0 |
## 199 |   18948 |    1  797    2 |  470 791    3 |   39   5    0 |
## 200 |   19031 |    1  160    1 |  -57  20    0 | -153 140    0 |
## 201 |   19035 |    1   96    1 |   34   7    0 | -119  89    0 |
## 202 |    1909 |    1  713    1 |  412 713    2 |    8   0    0 |
## 203 |    1919 |    1  313    1 | -284 260    1 | -129  54    0 |
## 204 |    1931 |    1  126    1 |  -45  11    0 |  143 115    0 |
## 205 |    1938 |    2  952    3 |  567 949    6 |   32   3    0 |
## 206 |    1942 |    1  559    0 | -250 454    0 | -121 106    0 |
## 207 |   19560 |    2  970    5 |  770 961   10 |   76   9    0 |
## 208 |   19567 |    1  554    1 | -370 549    1 |   37   5    0 |
## 209 |    1985 |    1  304    2 | -362 277    1 | -112  26    0 |
## 210 |    2009 |    1  120    1 |   60  28    0 | -107  92    0 |
## 211 |    2016 |    1  362    2 | -396 321    1 | -142  41    0 |
## 212 |    2042 |    1  322    1 | -111  92    0 |  175 230    1 |
## 213 |    2052 |    2  592    1 |  302 581    1 |  -41  11    0 |
## 214 |   20570 |    1  917    1 |  483 917    3 |    8   0    0 |
## 215 |   20571 |    1  924    2 |  514 923    3 |   20   1    0 |
```

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## 216 |   21120 |     1  461     1 | -332 346    1 | -191 115    1 |
## 217 |   21121 |     1  430     1 | -327 329    1 | -181 101    1 |
## 218 |    2123 |     1  374     1 | -198 295    0 |  102  78    0 |
## 219 |    2124 |     2  869     3 |  533 805    5 |  151  65    1 |
## 220 |     233 |     1  288     1 |  175 214    0 |  102  73    0 |
## 221 |     436 |     1  166     1 |  140 136    0 |   67  30    0 |
## 222 |    4926 |     1  513     1 | -430 512    2 |  -19   1    0 |
## 223 |    8851 |     1  503     0 |  209 479    1 |  -46  23    0 |
## 224 |   10851 |     1  442     1 | -174 265    0 | -142 177    0 |
## 225 |    1282 |     2  758     2 |  438 757    3 |   16   1    0 |
## 226 |    1635 |     1   68     0 |  -69  35    0 |  -67  33    0 |
## 227 |    1731 |     1  189     1 | -153 112    0 | -128  77    0 |
## 228 |    2484 |     1  509     1 | -263 392    1 |  144 117    0 |
## 229 |    2632 |     2  811     1 |  403 810    2 |   -9   0    0 |
## 230 |    3196 |     1  551     1 | -438 538    2 |  -69  13    0 |
## 231 |    4416 |     1  594     1 |  248 584    1 |  -33  11    0 |
## 232 |    4563 |     1  755     1 |  273 748    1 |  -26   7    0 |
## 233 |    4600 |     1  166     0 |   61  52    0 |  -90 114    0 |
## 234 |    4626 |     1  731     1 | -396 634    1 | -155  97    0 |
## 235 |    4698 |     1  214     0 |  -16   7    0 |   88 207    0 |
## 236 |    4857 |     1  150     1 | -103  85    0 |  -91  66    0 |
## 237 |    4976 |     1  846     1 |  372 846    2 |    1   0    0 |
## 238 |    5163 |     1  870     0 |  247 845    1 |  -42  25    0 |
## 239 |    5184 |     1  218     0 |   95 111    0 |  -93 107    0 |
## 240 |    5274 |     1  264     1 | -169 135    0 | -165 129    1 |
## 241 |    5473 |     1  404     1 | -201 245    0 | -162 159    1 |
## 242 |    5894 |     1  666     1 | -272 381    1 |  236 285    1 |
## 243 |    6248 |     1  405     1 |  176 341    0 |  -76  64    0 |
## 244 |    6358 |     1  555     2 | -427 451    2 | -205 103    1 |
## 245 |    6467 |     1  662     1 |  293 662    1 |   -4   0    0 |
## 246 |    6472 |     2  757     1 |  406 757    2 |    6   0    0 |
## 247 |    6801 |     1  351     1 | -185 192    0 | -168 158    1 |
## 248 |    6878 |     2  957     1 |  407 956    2 |  -11   1    0 |
## 249 |    7039 |     1  158     0 |   48  37    0 |  -88 122    0 |
## 250 |    7185 |     1  230     1 | -135  90    0 | -167 140    1 |
## 251 |    7411 |     1  123     1 | -139 102    0 |  -63  21    0 |
## 252 |    7534 |     1  630     1 | -413 544    1 | -164  86    0 |
## 253 |    7655 |     1  482     1 |  207 452    1 |  -53  30    0 |
## 254 |    7656 |     1  466     0 |  193 423    0 |  -61  43    0 |
## 255 |    7659 |     1  896     1 |  305 889    1 |  -28   8    0 |
## 256 |    7952 |     1   64     1 |   11   1    0 | -100  63    0 |
## 257 |    8310 |     1  488     1 |  317 474    1 |  -54  14    0 |
## 258 |    8316 |     2  666     1 |  372 655    2 |  -49  11    0 |
## 259 |   95021 |     1  153     0 |  -52  34    0 |  -98 119    0 |
## 260 |    9748 |     1  598     1 |  291 571    1 |  -62  26    0 |
## 261 |    9754 |     1  665     1 |  331 649    1 |  -52  16    0 |
## 262 |   10510 |     1   30     1 |   29   5    0 |  -64  25    0 |
## 263 |    1067 |     1  375     0 | -162 295    0 |   85  80    0 |
## 264 |   10749 |     1  559     1 |  343 559    1 |    6   0    0 |
## 265 |    1097 |     1  705     1 |  375 704    1 |   15   1    0 |
## 266 |   11984 |     1  277     1 | -156 126    0 | -171 151    1 |
## 267 |   12037 |     1  554     1 | -282 432    1 |  150 122    0 |
## 268 |    1272 |     1  519     1 | -399 465    1 | -137  54    0 |
## 269 |    1292 |     1  902     1 |  323 862    1 |   70  40    0 |
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## 270 |   1296 |    1  238    0 |   56   66    0 |  -90  173    0 |
## 271 |   1325 |    1  775    2 |  491  773    3 |   26    2    0 |
## 272 |   1331 |    1  494    2 | -439  463    2 | -112   30    0 |
## 273 |  13473 |    1  188    1 | -104   68    0 | -138  119    0 |
## 274 |   1389 |    1  181    1 | -198  141    0 | -105   40    0 |
## 275 |  14053 |    1   81    1 |  116   77    0 |  -26    4    0 |
## 276 |   1432 |    1  388    1 | -389  353    1 | -122   35    0 |
## 277 |   5433 |    1  217    0 |   14    3    0 | -124  215    0 |
## 278 |    111 |    1  810    2 | -596  716    3 |  216   94    1 |
## 279 |   4185 |    1   94    1 | -161   86    0 |  -51    9    0 |
## 280 |    533 |    1  544    2 | -510  473    2 | -198   71    1 |
## 281 |    585 |    2  764    1 |  352  748    2 |  -51   16    0 |
## 282 |   1060 |    1  442    1 | -234  273    0 | -184  169    1 |
## 283 |   1252 |    1  373    0 |  119  253    0 |  -82  120    0 |
## 284 |   1440 |    1  520    1 |  -98   68    0 |  253  452    1 |
## 285 |   1444 |    2  899    2 |  107   31    0 |  568  868    9 |
## 286 |  15732 |    1   11    1 |  -24    2    0 |  -44    9    0 |
## 287 |   1625 |    2  561    1 |  221  561    1 |   -5    0    0 |
## 288 |   1994 |    2  679    1 |  299  661    1 |  -49   18    0 |
## 289 |   2596 |    1  372    1 |  250  348    1 |  -65   24    0 |
## 290 |   2710 |    2  832    1 |  420  831    2 |   14    1    0 |
## 291 |   2711 |    2  843    1 |  399  843    2 |    4    0    0 |
## 292 |   3046 |    1  379    1 | -227  236    0 | -177  143    1 |
## 293 |   3466 |    2  971    3 |   36    3    0 |  662  968   15 |
## 294 |   3467 |    2  969    4 |   40    3    0 |  669  965   16 |
## 295 |   3513 |    2  913    1 |  409  913    2 |   -5    0    0 |
## 296 |   3839 |    1  792    1 |  398  792    2 |    2    0    0 |
## 297 |   3932 |    1  134    0 |   79   88    0 |  -57   46    0 |
## 298 |   4196 |    1  925    2 | -171   83    0 |  546  843    8 |
## 299 |   4715 |    2  862    1 |  339  850    2 |  -40   12    0 |
## 300 |   4781 |    1  746    2 | -556  736    3 |   66   10    0 |
## 301 |   5108 |    1  698    1 | -501  610    2 | -190   88    1 |
## 302 |   5191 |    1  627    2 | -518  520    2 | -235  107    1 |
## 303 |   5469 |    1   90    0 |   52   34    0 |  -66   55    0 |
## 304 |  55311 |    1  866    2 | -203  108    0 |  537  757    6 |
## 305 |   5636 |    1  934    5 | -723  414    5 |  811  521   13 |
## 306 |   6110 |    1  187    0 |   36   29    0 |  -83  158    0 |
## 307 |   6363 |    1  200    1 | -185  156    0 |  -98   44    0 |
## 308 |   6394 |    1   82    0 |  -36   15    0 |  -76   67    0 |
## 309 |   6456 |    1  360    1 | -143  160    0 | -160  200    1 |
## 310 |   6561 |    1   45    1 |  -15    1    0 |  -86   44    0 |
## 311 |  66012 |    2  712    0 |  225  664    1 |  -61   48    0 |
## 312 |   6746 |    1  616    2 | -511  562    2 | -158   54    0 |
## 313 |   6830 |    1  762    1 |  340  753    1 |  -38   10    0 |
## 314 |   6856 |    1  818    1 |  354  818    1 |    0    0    0 |
## 315 |   6974 |    1  538    1 |  142  104    0 |  290  434    2 |
## 316 |   7024 |    1  207    1 | -161  198    0 |   34    9    0 |
## 317 |  72653 |    1  804    1 |  309  792    1 |  -38   12    0 |
## 318 |   7495 |    1  510    1 | -268  363    1 | -171  147    1 |
## 319 |   7712 |    1  408    1 | -200  227    0 | -179  182    1 |
## 320 |   7875 |    1  323    0 |  -63   84    0 | -105  239    0 |
## 321 |   8044 |    1  130    1 | -149   88    0 | -103   42    0 |
## 322 |   8071 |    1  742    1 |  375  741    2 |  -12    1    0 |
## 323 |   8464 |    1  151    0 |  -19    4    0 | -111  147    0 |
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## 324 |   8571 |     1  722     1 |  292 716    1 |  -26   6    0 |
## 325 |   9273 |     2  740     1 |  391 732    2 |  -40   8    0 |
## 326 |   9407 |     1  102     0 |  -31  13    0 |  -81  88    0 |
## 327 |   9581 |     2  844     1 |  404 844    2 |    0   0    0 |
## 328 |   9585 |     2  910     1 |  462 910    3 |    5   0    0 |
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## 330 |   9984 |     1  202     0 |  -63  53    0 | -105 148    0 |
## 331 |  10003 |     1  296     1 | -209 187    0 | -160 109    0 |
## 332 |  10004 |     1  353     1 | -214 226    0 | -161 127    0 |
## 333 |  10115 |     2  643     1 |  324 618    2 |  -66  26    0 |
## 334 |   1081 |     1  497     0 | -197 337    0 | -135 160    0 |
## 335 |  10823 |     1  821     2 | -169 101    0 |  450 719    5 |
## 336 |   1106 |     1  616     0 | -211 413    0 | -148 203    0 |
## 337 |  11988 |     2  775     1 |  361 770    2 |  -31   6    0 |
## 338 |  12087 |     1  584     1 |  378 583    2 |   16   1    0 |
## 339 |  12092 |     2  816     1 |  410 815    2 |    7   0    0 |
## 340 |   1225 |     2  876     1 |  393 876    2 |   -7   0    0 |
## 341 |  12420 |     1  411     1 | -130 174    0 | -152 237    1 |
## 342 |   1245 |     2  879     3 |   66  12    0 |  555 866   11 |
## 343 |   1248 |     2  860     3 |   61   8    0 |  613 851   13 |
## 344 |   1260 |     1   39     1 |    2   0    0 |  -76  39    0 |
## 345 |   1284 |     1  156     1 |  -50  21    0 | -126 135    0 |
## 346 |   1287 |     2  884     5 |   39   2    0 |  810 882   20 |
## 347 |  13106 |     2  728     2 |  431 725    2 |  -27   3    0 |
## 348 |   1315 |     2  928     3 |  111  30    0 |  609 898   13 |
## 349 |   1317 |     2  657     1 |  364 646    2 |  -47  11    0 |
## 350 |   1318 |     1  159     1 |   14   2    0 | -136 157    0 |
## 351 |   1326 |     1  742     1 |  387 740    2 |  -16   1    0 |
## 352 |   1339 |     1  857     1 |  301 841    1 |  -42  16    0 |
## 353 |  13476 |     1  432     1 | -211 323    0 | -123 109    0 |
## 354 |  13490 |     2  779     1 |  293 772    1 |  -28   7    0 |
## 355 |  13781 |     1  922     6 | -446 191    2 |  873 731   19 |
## 356 |  13782 |     1  929     6 | -446 183    2 |  902 746   20 |
## 357 |   1396 |     1   84     1 |   98  68    0 |  -48  16    0 |
## 358 |   1401 |     1  629     2 | -528 519    2 | -242 109    1 |
## 359 |   1420 |     1  562     0 | -206 392    0 | -136 170    0 |
## 360 |  14254 |     1  551     1 | -218 352    0 | -163 199    0 |
## 361 |   1428 |     2  918     2 |  128  73    0 |  434 845    7 |
## 362 |   1437 |     1  814     2 |  579 804    4 |   65  10    0 |
## 363 |   1442 |     1  639     2 | -574 510    3 | -288 128    1 |
## 364 |   1461 |     1  778     3 | -390 238    1 |  588 540    7 |
## 365 |   1465 |     1  720     2 | -573 608    3 | -246 112    1 |
## 366 |   1471 |     2  941     1 |  423 940    2 |  -14   1    0 |
## 367 |   1474 |     1  700     2 | -527 573    2 | -248 127    1 |
## 368 |   1483 |     1  406     0 | -106 173    0 | -123 233    0 |
## 369 |   1512 |     1   38     1 |   56  23    0 |  -44  15    0 |
## 370 |   1519 |     1  346     1 | -189 263    0 | -106  83    0 |
## 371 |   1530 |     2  777     1 |  324 756    2 |  -54  21    0 |
## 372 |   1554 |     1  238     0 |   90  91    0 | -113 146    0 |
## 373 |  15567 |     1  622     1 |  290 621    1 |  -11   1    0 |
## 374 |   1569 |     1  841     1 |  368 841    2 |   -6   0    0 |
## 375 |   1571 |     1  142     0 |   57  38    0 |  -96 105    0 |
## 376 |   1578 |     2  915     2 | -185  86    0 |  573 828    9 |
## 377 |   1581 |     1  593     1 |  285 575    1 |  -51  18    0 |
```

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## 378 |    1586 |    1 645    2 | -583 530    3 | -272 115    1 |
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## 380 |    1650 |    2 792    1 |  345 780    2 |  -43  12    0 |
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## 382 |    1681 |    1 853    2 | -156  86    0 |  465 767    6 |
## 383 |    1683 |    2 514    1 |  212 429    1 |  -94  85    0 |
## 384 |    1687 |    1 837    1 |  349 832    2 |  -29   6    0 |
## 385 |    1707 |    1 157    0 |    3   0    0 |  -98 157    0 |
## 386 |    1710 |    1 827    2 | -565 712    3 | -228 116    1 |
## 387 |    1712 |    2 764    1 |  406 763    2 |  -14   1    0 |
## 388 |   17332 |    1 370    0 |  148 308    0 |  -66  62    0 |
## 389 |    1736 |    2 668    1 |  395 666    2 |  -18   1    0 |
## 390 |    1753 |    1 197    1 |   97  85    0 | -111 112    0 |
## 391 |    1788 |    1 885    1 |  333 879    1 |  -26   5    0 |
## 392 |    1792 |    2 669    1 |  355 669    2 |    7   0    0 |
## 393 |   18154 |    1 784    1 |  353 783    1 |    9   1    0 |
## 394 |   18155 |    1 793    1 |  338 793    1 |    3   0    0 |
## 395 |    1817 |    1 304    0 |  115 178    0 |  -97 126    0 |
## 396 |    1880 |    1 311    1 | -236 217    1 | -155  94    0 |
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## 405 |    2081 |    1 825    1 | -509 707    2 | -208 118    1 |
## 406 |    2095 |    2 780    1 |  352 770    2 |  -39  10    0 |
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## 408 |    2136 |    2 845    1 |  283 760    1 |   95  85    0 |
## 409 |    2140 |    2 704    1 |  327 678    2 |  -64  26    0 |
## 410 |    2157 |    1 818    2 |  497 817    3 |   14   1    0 |
## 411 |    2161 |    1  39    1 |  -21   4    0 |  -66  35    0 |
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## 415 |    2187 |    1 832    3 | -239 102    1 |  639 730   10 |
## 416 |    2196 |    1 738    2 |  451 738    3 |    5   0    0 |
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## 421 |    2216 |    2 765    1 |  384 755    2 |  -43  10    0 |
## 422 |    2225 |    2 424    1 |  214 353    1 |  -96  70    0 |
## 423 |    2254 |    1 551    2 | -507 506    2 | -151  45    0 |
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## 425 |    2904 |    2 650    1 |  307 591    1 |   97  59    0 |
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## 431 |    1191 |    1 575    1 |  359 574    2 |   19   2    0 |
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## 432 |    1417 |    1 950    8 | -509 186    3 | 1032 765   28 |
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## 437 |    2270 |    1 548    2 | -525 488    2 | -184  60    1 |
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## 449 |    4323 |    1 446    1 | -311 381    1 | -128  65    0 |
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## 452 |    5778 |    1 817    1 |  445 817    3 |   -1   0    0 |
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## 458 |    6024 |    1 673    1 | -269 435    1 | -199 238    1 |
## 459 |    6256 |    2 893    1 |  387 890    2 |  -21   3    0 |
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## 463 |    7217 |    1 604    1 | -348 504    1 | -155 100    0 |
## 464 |    7512 |    1 400    1 | -290 289    1 | -180 111    1 |
## 465 |    7513 |    1 451    1 | -275 325    1 | -171 126    1 |
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## 472 |   93502 |    1 345    1 | -329 307    1 | -116  38    0 |
## 473 |    9583 |    1 670    0 |  222 645    1 |  -44  25    0 |
## 474 |    1021 |    1 634    1 |  290 622    1 |  -39  11    0 |
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## 476 |   10394 |    1 819    2 | -591 678    3 | -270 141    1 |
## 477 |   10502 |    2 760    2 |  475 759    3 |   15   1    0 |
## 478 |   10829 |    1 679    1 | -411 569    2 |  181 110    1 |
## 479 |  108882 |    2 844    0 |  236 789    1 |  -63  56    0 |
## 480 |    1122 |    2 541    1 |  254 491    1 |  -81  50    0 |
## 481 |    1148 |    1 355    1 | -134 152    0 | -155 203    0 |
## 482 |   11943 |    1 638    1 | -368 517    1 | -178 121    1 |
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## 485 |    1241 |    1 524    1 |  270 519    1 |  -27   5    0 |
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## 491 |   13334 |     1 355     1 | -302 295     1 | -137  61     0 |
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## 494 |   14051 |     2 752     2 |  439 751     3 |   12   1     0 |
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## 496 |    4481 |     1 421     0 | -107 163     0 | -134 258     0 |
## 497 |    6981 |     1 504     1 | -240 301     1 | -197 203     1 |
## 498 |    1187 |     2 963     7 | -371 119     2 |  987 844    28 |
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## 504 |    2534 |     1 571     1 | -293 409     1 | -184 162     1 |
## 505 |    2938 |     1 268     1 | -282 240     1 |  -96  28     0 |
## 506 |    3133 |     1 534     1 | -304 419     1 | -159 115     0 |
## 507 |    3187 |     1 809     2 | -436 421     2 |  419 388     4 |
## 508 |    3297 |     2 945     5 | -344 137     2 |  834 808    20 |
## 509 |    3547 |     1 597     2 | -483 536     2 | -163  61     0 |
## 510 |    4129 |     1 780     1 | -484 645     2 | -221 134     1 |
## 511 |   42053 |     1 953     4 | -385 237     2 |  670 716    12 |
## 512 |    4238 |     1 881     1 | -391 731     1 | -177 150     1 |
## 513 |    4379 |     1 451     1 | -216 320     0 | -137 130     0 |
## 514 |    4957 |     1 566     1 | -334 397     1 | -218 169     1 |
## 515 |    4980 |     1 233     0 |  -53  51     0 | -100 183     0 |
## 516 |    5164 |     1  70     0 |  -11   1     0 |  -81  69     0 |
## 517 |    5367 |     1 615     1 | -336 510     1 | -153 105     0 |
## 518 |    5656 |     1 758     2 | -254 148     1 |  515 610     7 |
## 519 |    5889 |     1 599     1 | -367 503     1 | -160  96     0 |
## 520 |    5893 |     1 572     1 | -286 457     1 | -144 116     0 |
## 521 |    6006 |     1  56     1 |   52  21     0 |  -66  34     0 |
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## 523 |    6791 |     2 407     0 | -160 337     0 |   73  70     0 |
## 524 |    7146 |     1 796     1 | -326 604     1 | -184 192     1 |
## 525 |    7544 |     1 636     2 | -604 552     3 | -236  84     1 |
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## 528 |    8127 |     1 777     1 | -322 540     1 | -213 237     1 |
## 529 |    8170 |     1 159     1 | -163 118     0 |  -97  41     0 |
## 530 |    8290 |     2 895     2 | -238 171     1 |  490 724     6 |
## 531 |    8333 |     1 378     0 | -105 126     0 | -148 252     0 |
## 532 |    8756 |     1 714     2 | -594 573     3 | -295 141     2 |
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## 534 |    9019 |     1 254     0 |  -29  19     0 | -104 235     0 |
## 535 |    9254 |     1 231     1 | -176 156     0 | -122  75     0 |
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## 537 |    9326 |     1 221     1 | -234 183     0 | -107  38     0 |
## 538 |   95023 |     1 449     1 | -340 373     1 | -153  76     0 |
## 539 |    9522 |     2 960     7 | -443 182     3 |  916 779    23 |
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## 540 |    9546 |     1  167     1 | -137 110    0 |  -98   57    0 |
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## 542 |    1002 |     1  801     2 | -281 264    1 |  401 537    4 |
## 543 |    1020 |     1  953     4 | -570 436    4 |  620 517    9 |
## 544 |   10393 |     1  566     1 | -264 359    1 | -201 208    1 |
## 545 |   10452 |     1  538     1 | -261 333    1 | -205 205    1 |
## 546 |     277 |     1  140     1 |  -15   2    0 | -121 138    0 |
## 547 |    7231 |     1  569     1 | -346 452    1 | -176 118    1 |
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## 549 |    9421 |     2  867     3 | -334 202    2 |  606 665   11 |
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## 552 |    1589 |     1  572     1 | -196 306    0 | -183 266    1 |
## 553 |    1620 |     1  787     2 | -605 643    3 | -287 144    2 |
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## 556 |    2128 |     1  809     1 | -296 574    1 | -189 235    1 |
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## 570 |    4987 |     1  435     1 | -178 287    0 | -128 148    0 |
## 571 |    5021 |     1  800     2 | -602 652    3 | -286 148    1 |
## 572 |    5151 |     1  716     2 | -503 629    2 | -186  86    1 |
## 573 |    5517 |     1  331     1 |  -92  81    0 | -162 250    1 |
## 574 |    5545 |     1  664     0 | -168 381    0 | -145 284    1 |
## 575 |    5546 |     1  459     0 | -146 250    0 | -133 209    0 |
## 576 |    5622 |     1  623     2 | -606 574    3 | -176  48    0 |
## 577 |    5710 |     1  801     2 | -602 655    3 | -284 146    1 |
## 578 |    6042 |     1  249     0 | -122 124    0 | -122 125    0 |
## 579 |    6219 |     1  305     1 | -165 198    0 | -121 107    0 |
## 580 |    6265 |     1  360     0 | -104 148    0 | -125 212    0 |
## 581 |    6330 |     2  956     9 | -579 239    5 | 1003 717   30 |
## 582 |    6439 |     1  117     1 |  -92  46    0 | -115  71    0 |
## 583 |    7624 |     1  332     1 | -166 213    0 | -124 118    0 |
## 584 |    7632 |     1  134     1 |  -59  28    0 | -114 106    0 |
## 585 |    7972 |     1  738     1 | -293 330    1 |  326 408    3 |
## 586 |    7973 |     1  651     1 | -206 353    1 | -189 297    1 |
## 587 |    8039 |     1  787     1 | -443 663    2 | -192 124    1 |
## 588 |    8165 |     1  195     0 | -119 119    0 |  -95  76    0 |
## 589 |    8222 |     1  897     4 | -646 428    4 |  675 468    9 |
## 590 |    8334 |     1  557     0 | -131 240    0 | -150 317    1 |
## 591 |    8601 |     1  507     1 | -205 352    0 | -136 155    0 |
## 592 |    8669 |     1  446     1 | -353 372    1 | -157  74    0 |
## 593 |    8878 |     2  922     6 | -317 123    1 |  809 799   20 |
```

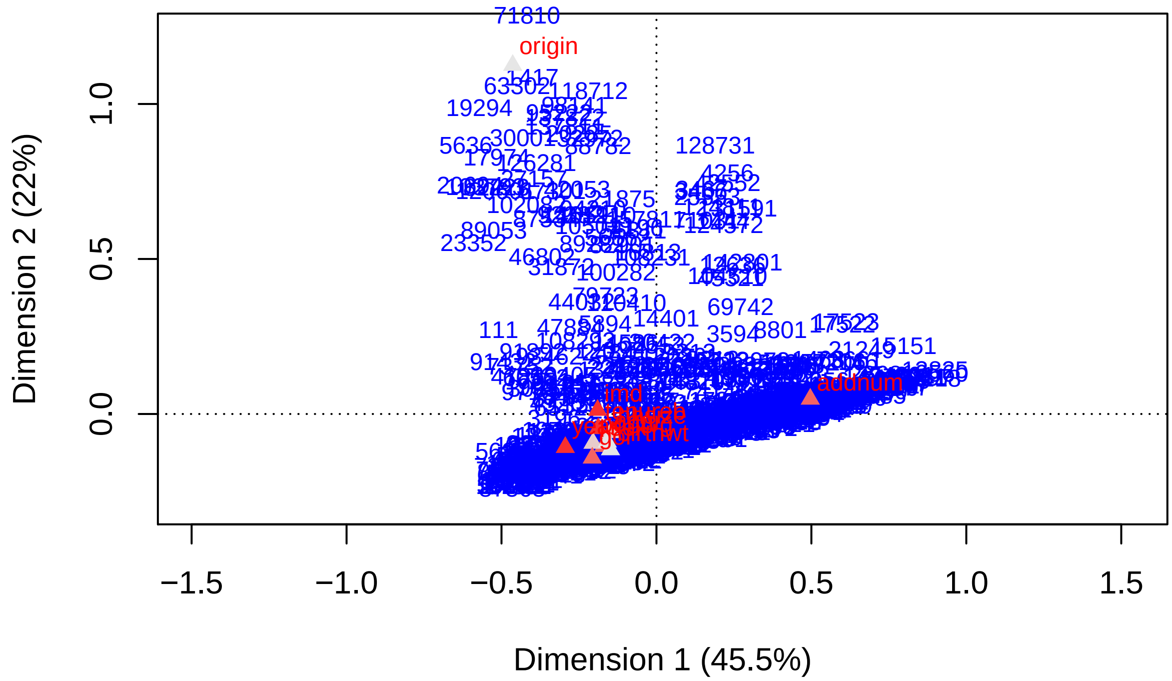
```
## 594 |    8896 |     1  309    1 | -235 225   0 | -143  83    0 |
## 595 |   90481 |     1  703    1 | -402 561   1 | -203 142    1 |
## 596 |    9233 |     1  922    3 | -407 299   2 |  587 623    9 |
## 597 |    9346 |     1  686    2 | -476 639   2 |  130  48    0 |
## 598 |    9811 |     1  319    1 | -228 246   0 | -124  72    0 |
## 599 |    9871 |     1  627    1 | -405 504   1 | -200 123    1 |
## 600 |    1003 |     1   78    1 |  -68  23   0 | -103  55    0 |
## 601 |    1027 |     1  724    1 | -447 598   2 | -205 126    1 |
## 602 |    6038 |     1  196    0 |   -8   1   0 | -116 195    0 |
## 603 |    6761 |     1  455    0 |  -74  87   0 | -151 368    1 |
## 604 |    6931 |     1  178    1 | -136 101   0 | -119  77    0 |
## 605 |    7181 |     1  966   11 | -547 159   4 | 1230 807   40 |
## 606 |   10501 |     1  889    3 | -349 255   1 |  551 634    8 |
## 607 |   10511 |     1  892    3 | -344 229   1 |  586 663    8 |
## 608 |    1055 |     1  233    1 | -149 144   0 | -116  88    0 |
## 609 |    1089 |     1  439    2 | -545 405   2 | -157  34    0 |
## 610 |    1524 |     1  808    1 | -242 524   1 | -178 284    1 |
## 611 |   15675 |     1  800    1 | -469 629   2 | -245 172    1 |
## 612 |    1705 |     1  652    1 | -353 465   1 | -223 186    1 |
## 613 |    1780 |     1  187    1 |  -95  85   0 | -104 101    0 |
## 614 |    2028 |     2  958    6 | -379 159   2 |  849 799   20 |
## 615 |    2335 |     1  954    4 | -719 646   6 |  497 308    6 |
## 616 |    2514 |     1  532    1 | -369 410   1 | -202 122    1 |
## 617 |    2601 |     1  195    0 |   -1   0   0 | -136 195    0 |
## 618 |    2715 |     2  961    5 | -524 343   4 |  703 618   14 |
## 619 |    3345 |     1  318    2 | -398 284   1 | -137  34    0 |
## 620 |    3783 |     1  392    1 | -278 313   1 | -140  80    0 |
## 621 |    4026 |     1  190    1 | -211 146   0 | -116  44    0 |
## 622 |    4403 |     1  742    2 | -370 441   2 |  306 301    2 |
## 623 |    4680 |     1  800    3 | -498 440   3 |  451 360    5 |
## 624 |    4908 |     1  723    2 | -554 637   2 | -204  86    1 |
## 625 |    5086 |     1  266    1 | -139 136   0 | -136 130    0 |
## 626 |   55312 |     1  625    0 | -150 296   0 | -158 329    1 |
## 627 |    6056 |     1  782    2 | -518 772   3 |   61  11    0 |
## 628 |    6070 |     1  875    2 | -560 726   3 | -253 149    1 |
## 629 |    6124 |     1  434    2 | -374 369   1 | -156  65    0 |
## 630 |    6159 |     1  163    1 | -157 100   0 | -124  62    0 |
## 631 |    6240 |     1  797    2 | -562 637   3 | -282 160    1 |
## 632 |    6244 |     1  709    2 | -474 551   2 | -254 158    1 |
## 633 |    6280 |     1  571    0 | -150 280   0 | -153 291    1 |
## 634 |    6552 |     1  684    2 | -464 530   2 | -250 154    1 |
## 635 |    6653 |     1  743    2 | -555 654   2 | -205  89    1 |
## 636 |    6730 |     1  915    4 | -464 300   2 |  664 615   10 |
## 637 |    6930 |     1  718    1 | -373 539   1 | -215 179    1 |
## 638 |    7173 |     1  409    1 | -311 332   1 | -149  76    0 |
## 639 |   72654 |     1  712    2 | -610 627   3 | -224  85    1 |
## 640 |    7285 |     1  755    1 | -365 584   1 | -198 171    1 |
## 641 |    7375 |     1  801    2 | -570 777   3 |   99  23    0 |
## 642 |    7603 |     1  651    1 | -447 541   2 | -201 109    1 |
## 643 |    7626 |     1  763    1 | -426 588   2 | -232 175    1 |
## 644 |    7785 |     1  470    2 | -409 405   1 | -164  65    0 |
## 645 |    7918 |     1  492    1 | -214 291   0 | -178 201    1 |
## 646 |    8346 |     1  239    1 | -194 172   0 | -121  67    0 |
## 647 |    8355 |     1   66    1 |   80  37   0 |  -70  29    0 |
```

```
## 648 |   8382 |    1 770    1 | -406 596   2 | -219 173   1 |
## 649 |   8386 |    1 582    1 | -302 413   1 | -193 169   1 |
## 650 |   8415 |    1 108    0 |   -1   0   0 |  -90 108   0 |
## 651 |   8753 |    1 893    3 | -485 371   3 |  575 522   8 |
## 652 |   8905 |    1 945    4 | -654 564   5 |  538 381   7 |
## 653 |   8928 |    2 946    2 | -335 298   2 |  493 647   7 |
## 654 |   8999 |    1 380    1 | -148 208   0 | -134 172   0 |
## 655 |   9000 |    1 298    1 | -145 164   0 | -131 133   0 |
## 656 |   9112 |    1 313    1 | -223 185   1 | -186 128   1 |
## 657 |   9203 |    1 109    1 |  -59  20   0 | -123  88   0 |
## 658 |   9642 |    1 535    1 | -203 305   0 | -176 230   1 |
## 659 |  10057 |    1 462    1 | -238 336   1 | -146 126   0 |
## 660 |   1016 |    1 543    1 | -258 373   1 | -175 171   1 |
## 661 |   1025 |    1 355    1 | -187 199   0 |  165 156   1 |
## 662 |   1037 |    1 932    5 | -702 482   6 |  678 449  11 |
## 663 | 107492 |    1 148    1 | -156  93   0 | -120  55   0 |
## 664 |   1091 |    1 865    2 | -473 682   2 | -244 182   1 |
## 665 |   1255 |    1 163    1 |   41  15   0 | -130 148   0 |
## 666 | 108513 |    1 281    0 |  -19   6   0 | -133 276   0 |
## 667 |   1142 |    2 119    0 |  -48  71   0 |  -40  48   0 |
## 668 |   1283 |    1 646    1 | -383 489   1 | -217 157   1 |
## 669 |   1338 |    1 447    1 | -275 406   1 |   87  40   0 |
## 670 |   1689 |    1 271    1 |  -90  69   0 | -155 202   1 |
## 671 |   1793 |    1 648    2 | -510 642   2 |   50   6   0 |
## 672 |   1853 |    1 446    1 | -315 444   1 |   18   1   0 |
## 673 |   2073 |    1 146    1 |   32   9   0 | -122 136   0 |
## 674 |   2219 |    1 387    1 | -238 374   1 |  -44  13   0 |
## 675 |   2320 |    1 374    2 | -370 322   1 | -148  52   0 |
## 676 |   2552 |    1 516    1 | -254 328   1 | -193 188   1 |
## 677 |   3057 |    1 495    1 | -240 277   1 | -213 218   1 |
## 678 |  30913 |    2 154    0 |  -17  13   0 |  -56 141   0 |
## 679 |   3503 |    1 663    1 | -282 659   1 |  -21   4   0 |
## 680 |   3552 |    1 418    0 | -127 179   0 | -148 239   1 |
## 681 |   3734 |    1 652    1 | -424 652   2 |   -4   0   0 |
## 682 |   3940 |    1 856    1 | -427 834   2 |   69  22   0 |
## 683 |   4134 |    1 107    1 |   40  18   0 |   90  90   0 |
## 684 |  42054 |    1 120    1 |   77  58   0 |  -79  62   0 |
## 685 |   4214 |    1 781    2 | -514 649   2 | -232 132   1 |
## 686 |   4231 |    1 455    2 | -510 403   2 | -184  52   1 |
## 687 |   4288 |    1 280    1 | -180 279   0 |    9   1   0 |
## 688 |   4407 |    1 370    1 | -206 230   0 | -161 140   1 |
## 689 |   4524 |    1 499    2 | -389 418   1 | -171  80   1 |
## 690 |   5059 |    1  45    1 |   47  15   0 |  -65  30   0 |
## 691 |   5155 |    1 397    2 | -372 347   1 | -143  51   0 |
## 692 |   5170 |    1 127    1 | -107  65   0 | -105  62   0 |
## 693 |   5415 |    1 550    1 | -217 329   1 | -178 221   1 |
## 694 |   5416 |    1 536    1 | -222 321   1 | -181 215   1 |
## 695 |   5675 |    1  61    1 |  -98  35   0 |  -85  26   0 |
## 696 |   5731 |    1 476    1 | -290 358   1 | -167 118   1 |
## 697 |   5816 |    1 382    1 | -201 382   0 |    2   0   0 |
## 698 |   5824 |    1 620    1 | -299 433   1 | -197 187   1 |
## 699 |   5891 |    1 300    1 |  180 263   0 |  -67  36   0 |
## 700 |   5943 |    1 153    0 |  -24   7   0 | -110 146   0 |
## 701 |   6563 |    1 743    1 | -372 565   1 | -208 177   1 |
```

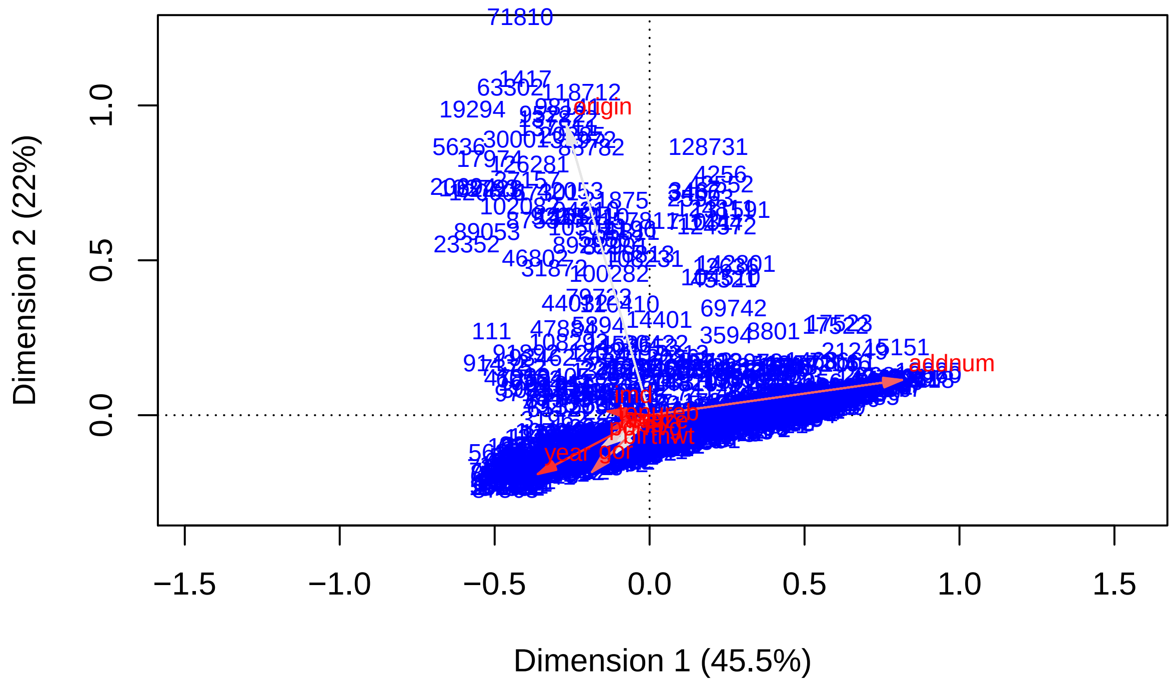
```
## 702 |   7023 |    1  135    1 |  104  76    0 |  -91  59    0 |
## 703 |   7081 |    1  786    2 | -568 648    3 | -262 138    1 |
## 704 |   7164 |    1  243    1 |  -62  38    0 | -146 206    1 |
## 705 |   7165 |    1  373    0 |  -88  88    0 | -158 285    1 |
## 706 |  72954 |    1  154    0 |   48  28    0 | -101 125    0 |
## 707 |   7347 |    1  763    1 | -435 763    2 |    3   0    0 |
## 708 |   8241 |    2  133    1 |   95  68    0 |   92  65    0 |
## 709 |   8552 |    1  399    0 |  -93 106    0 | -155 293    1 |
## 710 |   8553 |    1  456    0 |  -79 101    0 | -148 355    1 |
## 711 |   8762 |    2  510    0 |  -53  65    0 | -139 445    1 |
## 712 |   8843 |    2  203    0 |  -93 154    0 |   52  48    0 |
## 713 |   8978 |    1  442    1 | -205 438    0 |   20   4    0 |
## 714 |   9143 |    1  720    2 | -624 697    3 |  113  23    0 |
## 715 |   9189 |    1  749    2 | -528 697    2 |  145  52    0 |
## 716 |   9324 |    1  280    0 |  -31  13    0 | -140 267    1 |
## 717 |  93253 |    1  145    1 |   -6   0    0 | -126 145    0 |
## 718 |  93504 |    2  178    0 |   29  14    0 |  101 164    0 |
## 719 |   9428 |    2   26    0 |    3   0    0 |  -38  26    0 |
## 720 |   9437 |    1  533    0 | -145 234    0 | -164 299    1 |
## 721 |   9632 |    1  188    1 |  -92  62    0 | -131 126    0 |
## 722 |   9635 |    1  277    0 |  -81  86    0 | -121 192    0 |
## 723 |   9831 |    1  753    1 | -381 540    2 | -239 213    1 |
## 724 |   9880 |    1  525    1 | -261 522    1 |   21   3    0 |
## 725 |   9881 |    1  647    1 | -270 646    1 |   11   1    0 |
## 726 |   9890 |    1  777    2 | -568 636    3 | -267 141    1 |
## 727 |   1001 |    1  394    1 | -306 323    1 | -143  70    0 |
## 728 |   9266 |    1  780    1 | -452 647    2 | -205 133    1 |
## 729 |   7810 |    2  603    1 |  267 581    1 |  -52  22    0 |
## 730 |   6021 |    1  587    1 | -195 324    0 | -176 264    1 |
## 731 |  66015 |    2  526    1 |  240 470    1 |   83  56    0 |
## 732 |   9931 |    1  589    2 | -470 586    2 |   33   3    0 |
## 733 |   1117 |    1  292    1 | -155 173    0 | -129 119    0 |
## 734 |   1214 |    1  348    0 | -111 143    0 | -133 206    0 |
## 735 |  13101 |    2  476    1 |  188 446    1 |   49  30    0 |
## 736 |   1963 |    2  356    1 |  233 311    1 |  -88  44    0 |
## 737 |   2425 |    2  577    1 |  318 568    2 |  -38   8    0 |
## 738 |   2428 |    1  766    1 | -447 637    2 | -201 129    1 |
## 739 |  30002 |    2  686    0 | -156 331    0 | -162 355    1 |
## 740 |   3035 |    1  862    2 | -502 859    3 |   28   3    0 |
## 741 |   3040 |    1  658    2 | -538 527    3 | -268 131    1 |
## 742 |   3195 |    1  498    0 | -118 175    0 | -161 323    1 |
## 743 |   3232 |    2  582    1 |  294 562    1 |   55  20    0 |
## 744 |   3271 |    2  406    1 |  187 363    1 |  -64  43    0 |
## 745 |   3728 |    1  607    1 | -329 484    1 | -166 123    1 |
## 746 |   4308 |    1  636    1 | -190 336    0 | -180 299    1 |
## 747 |   4411 |    1  216    1 | -126  93    0 | -145 122    0 |
## 748 |   4521 |    2  679    1 |  293 636    1 |  -76  43    0 |
## 749 |   5111 |    1  870    2 | -569 733    3 | -246 137    1 |
## 750 |   5875 |    2  656    1 |  315 646    2 |  -39  10    0 |
## 751 |   5974 |    2  452    1 |  287 444    1 |  -39   8    0 |
## 752 |   6446 |    1  717    2 | -531 611    3 | -221 106    1 |
## 753 |   6586 |    2  363    1 |  222 321    1 |  -80  41    0 |
## 754 |   6724 |    1  502    1 | -173 284    0 | -152 219    1 |
## 755 |   7066 |    1  606    2 | -518 531    2 | -196  76    1 |
```

```
## 756 |   72955 |    1   87    1 |   -4    0    0 |  -93   86    0 |
## 757 |    7317 |    2  224    1 |  126  124    0 | -113  100    0 |
## 758 |    7329 |    1   56    1 |  -67   22    0 |  -84   34    0 |
## 759 |    7399 |    1  700    0 | -239  697    1 |  -15    3    0 |
## 760 |    7414 |    2  141    0 |   63  130    0 |   18   11    0 |
## 761 |    7535 |    1  363    1 | -281  289    1 | -143   74    0 |
## 762 |    7559 |    2  284    1 |  149  212    0 |  -87   73    0 |
## 763 |    7684 |    1  411    1 | -180  309    0 |  104  102    0 |
## 764 |    7844 |    1  544    1 | -322  368    1 | -222  176    1 |
## 765 |    8518 |    1  444    1 | -329  436    1 |   43    8    0 |
## 766 |    8614 |    1  729    2 | -571  608    3 | -255  121    1 |
## 767 |    9251 |    2  399    1 |  159  279    0 | -105  120    0 |
## 768 |    9602 |    2  530    1 |  279  503    1 |  -64   26    0 |
## 769 |   10114 |    1  529    1 | -300  389    1 | -180  140    1 |
## 770 |    1041 |    1  208    1 |  203  201    1 |  -39    7    0 |
## 771 |  108883 |    2  387    1 | -182  382    0 |  -19    4    0 |
## 772 |    1129 |    1  809    1 | -320  565    1 | -210  244    1 |
## 773 |   11632 |    2  361    1 |  253  329    1 |  -79   32    0 |
## 774 |   11638 |    1  695    1 | -357  517    1 | -209  177    1 |
## 775 |    1235 |    2  486    1 |  233  450    1 |  -66   36    0 |
## 776 |    1300 |    2  355    1 |  176  269    0 | -100   87    0 |
## 777 |    1301 |    2  262    1 |  155  231    0 |   56   30    0 |
## 778 |  132033 |    1  650    1 | -371  647    2 |  -26    3    0 |
## 779 |    1322 |    2  571    1 |  281  556    1 |  -46   15    0 |
## 780 |    1343 |    1   84    1 |  -10    1    0 |  -95   83    0 |
## 781 |    1359 |    1  156    1 | -107   66    0 | -125   90    0 |
##
## Columns:
##      name   mass  qlt  inr    k=1 cor ctr    k=2 cor ctr
## 1  |  sex |   27  236   18 | -171 172   7 | -104  64   5 |
## 2  | tnrb |   50  194   38 | -188 182  15 |  -47  11   2 |
## 3  | orgn |   38  994  226 | -464 144  72 | 1125 850 873 |
## 4  | hhsz |   76  249   30 | -147 214  14 |  -60  35   5 |
## 5  | addn |  311  998  305 |  496 988 664 |   48   9  13 |
## 6  |  imd |   59  146   57 | -190 146  18 |   12   1   0 |
## 7  | brth |   61  376   22 | -148 235  12 | -115 141  14 |
## 8  | prft |   64  185   69 | -205 153  23 |  -94  32  10 |
## 9  |  gor |   93  219  105 | -207 149  35 | -142  70  34 |
## 10 | year |  174  606  111 | -294 534 130 | -108  72  36 |
## 11 | aggr |   47  357   17 | -159 270  10 |  -90  87   7 |
```

```r
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

```r
############################################      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
```

```r
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...  0.018598
## SE.........  0.0075139
## T-stat.....  2.4751
## p.val......  0.013319
##
## Original number of observations..............  3927
## Original number of treated obs...............  2097
## Matched number of observations...............  2097
## Matched number of observations  (unweighted).  2097
```

```r
#    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             1.4649
## std mean diff.........    -2.5123             3.6254
##
## mean raw eQQ diff.....   0.012568           0.018121
## med  raw eQQ diff.....          0                  0
```

```
## max  raw eQQ diff.....          1                  1
##
## mean eCDF diff........  0.0062787          0.0090606
## med  eCDF diff........  0.0062787          0.0090606
## max  eCDF diff........   0.012557           0.018121
##
## var ratio (Tr/Co).....    0.99886             1.0038
## T-test p-value........    0.43243               0.24
##
##
## ***** (V2) tenureb *****
##                        Before Matching        After Matching
## mean treatment........     2.1497             2.1497
## mean control..........     3.1869             2.0482
## std mean diff.........    -128.24             12.559
##
## mean raw eQQ diff.....     1.0377            0.14354
## med  raw eQQ diff.....          1                  0
## max  raw eQQ diff.....          2                  2
##
## mean eCDF diff........    0.17286           0.028708
## med  eCDF diff........   0.031363          0.0090606
## max  eCDF diff........    0.49059            0.11683
##
## var ratio (Tr/Co).....     0.5675              0.816
## T-test p-value........ < 2.22e-16         5.8512e-08
## KS Bootstrap p-value.. < 2.22e-16         < 2.22e-16
## KS Naive p-value...... < 2.22e-16         7.4074e-13
## KS Statistic..........    0.49059            0.11683
##
##
## ***** (V3) origin *****
##                        Before Matching        After Matching
## mean treatment........     1.5131             1.5131
## mean control..........     2.8087             1.7787
## std mean diff.........    -67.155            -13.767
##
## mean raw eQQ diff.....     1.2984            0.28755
## med  raw eQQ diff.....          0                  0
## max  raw eQQ diff.....          9                  2
##
## mean eCDF diff........   0.076049           0.016859
## med  eCDF diff........   0.079276           0.003815
## max  eCDF diff........    0.21319            0.12732
##
## var ratio (Tr/Co).....    0.28059            0.87491
## T-test p-value........ < 2.22e-16         2.3668e-06
## KS Bootstrap p-value.. < 2.22e-16         < 2.22e-16
## KS Naive p-value...... < 2.22e-16         3.4417e-15
## KS Statistic..........    0.21319            0.12732
##
##
## ***** (V4) hhsize *****
##                        Before Matching        After Matching
```

```
## mean treatment........     4.0877             4.0877
## mean control..........     4.1743             4.1149
## std mean diff.........    -9.7108             -3.049
##
## mean raw eQQ diff.....    0.40546            0.19504
## med  raw eQQ diff.....          0                  0
## max  raw eQQ diff.....          2                  3
##
## mean eCDF diff........   0.040475           0.021671
## med  eCDF diff........   0.028262           0.015737
## max  eCDF diff........    0.10353           0.065808
##
## var ratio (Tr/Co).....    0.45237            0.55952
## T-test p-value........   0.018052            0.40808
## KS Bootstrap p-value.. < 2.22e-16         < 2.22e-16
## KS Naive p-value...... 1.5955e-09         0.00022749
## KS Statistic..........    0.10353           0.065808
##
##
## ***** (V5) addnum *****
##                        Before Matching        After Matching
## mean treatment........     16.147             16.147
## mean control..........     16.685             16.417
## std mean diff.........    -4.5391              -2.28
##
## mean raw eQQ diff.....    0.62459            0.79542
## med  raw eQQ diff.....          0                  1
## max  raw eQQ diff.....          5                  8
##
## mean eCDF diff........   0.014179           0.015794
## med  eCDF diff........   0.013992           0.015498
## max  eCDF diff........   0.037979           0.044826
##
## var ratio (Tr/Co).....    0.97447             1.0978
## T-test p-value........    0.15888            0.45047
## KS Bootstrap p-value..      0.064              0.028
## KS Naive p-value......    0.11931           0.029585
## KS Statistic..........   0.037979           0.044826
##
##
## ***** (V6) birthwt *****
##                        Before Matching        After Matching
## mean treatment........     3.4064             3.4064
## mean control..........     3.2368             3.3824
## std mean diff.........      28.26             4.0128
##
## mean raw eQQ diff.....    0.16895           0.076757
## med  raw eQQ diff.....       0.17               0.06
## max  raw eQQ diff.....       0.61                0.7
##
## mean eCDF diff........   0.055606           0.022989
## med  eCDF diff........   0.051557           0.018121
## max  eCDF diff........     0.1313           0.073915
##
```

```
## var ratio (Tr/Co).....    0.92313           0.98438
## T-test p-value........ < 2.22e-16           0.19158
## KS Bootstrap p-value.. < 2.22e-16        < 2.22e-16
## KS Naive p-value...... 4.6629e-15        2.1154e-05
## KS Statistic..........     0.1313          0.073915
##
##
## ***** (V7) porftvg *****
##                       Before Matching        After Matching
## mean treatment........     3.7492            3.7492
## mean control..........     3.2437            3.6371
## std mean diff.........     31.067             6.888
##
## mean raw eQQ diff.....    0.50437           0.11874
## med  raw eQQ diff.....          0                 0
## max  raw eQQ diff.....          2                 1
##
## mean eCDF diff........   0.072207          0.016963
## med  eCDF diff........   0.064757           0.01526
## max  eCDF diff........      0.116          0.047687
##
## var ratio (Tr/Co).....    0.87716            1.0186
## T-test p-value........ < 2.22e-16          0.020721
## KS Bootstrap p-value.. < 2.22e-16             0.002
## KS Naive p-value...... 7.5787e-12          0.016983
## KS Statistic..........      0.116          0.047687
##
##
## ***** (V8) gor *****
##                       Before Matching        After Matching
## mean treatment........      5.825             5.825
## mean control..........     4.0792            5.7129
## std mean diff.........     69.839            4.4831
##
## mean raw eQQ diff.....     1.7443           0.23891
## med  raw eQQ diff.....          2                 0
## max  raw eQQ diff.....          3                 1
##
## mean eCDF diff........    0.19397          0.026546
## med  eCDF diff........    0.22449          0.019075
## max  eCDF diff........    0.30776           0.07773
##
## var ratio (Tr/Co).....     1.0481             1.031
## T-test p-value........ < 2.22e-16          0.057349
## 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........     2.4902            2.4902
## mean control..........     2.4672            2.4912
## std mean diff.........      4.602          -0.19074
```

```
##
## mean raw eQQ diff.....   0.022951         0.00095374
## med  raw eQQ diff.....          0                  0
## max  raw eQQ diff.....          1                  1
##
## mean eCDF diff........   0.011506         0.00047687
## med  eCDF diff........   0.011506         0.00047687
## max  eCDF diff........   0.023011         0.00095374
##
## var ratio (Tr/Co).....     1.0039            0.99993
## T-test p-value........    0.14993            0.95084
##
##
## ***** (V10) year *****
##                        Before Matching        After Matching
## mean treatment........     9.5031             9.5031
## mean control..........     9.7022              9.609
## std mean diff.........    -6.1378            -3.2638
##
## mean raw eQQ diff.....    0.20164            0.38817
## med  raw eQQ diff.....          0                  0
## max  raw eQQ diff.....          2                  2
##
## mean eCDF diff........   0.018896           0.034812
## med  eCDF diff........   0.018954           0.028135
## max  eCDF diff........   0.037739           0.086314
##
## var ratio (Tr/Co).....    0.95043            0.86366
## T-test p-value........   0.058498            0.31015
## KS Bootstrap p-value..      0.038         < 2.22e-16
## KS Naive p-value......     0.1236          3.282e-07
## KS Statistic..........   0.037739           0.086314
##
##
## 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 birthwt gor year  Number(s): 2 3 4 6 8 10
```

```
#  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
## -0.10792 -0.09750 -0.05755 -0.05542  0.94458
##
## Coefficients:
```

```
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.057547   0.008316   6.920  5.2e-12 ***
## factor(imd)2 -0.002123   0.012474  -0.170  0.86489
## factor(imd)3  0.036792   0.012703   2.896  0.00379 **
## factor(imd)4  0.039950   0.012874   3.103  0.00193 **
## factor(imd)5  0.050376   0.013011   3.872  0.00011 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2707 on 4189 degrees of freedom
## Multiple R-squared:  0.006513,   Adjusted R-squared:  0.005564
## F-statistic: 6.865 on 4 and 4189 DF,  p-value: 1.666e-05
```

```r
#    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
## -0.41181 -0.13351 -0.03614  0.05144  0.83970
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.432e+00  5.506e-02 -26.010  < 2e-16 ***
## factor(imd)2 -2.460e-02  1.040e-02  -2.365 0.018081 *
## factor(imd)3  1.336e-03  1.074e-02   0.124 0.900989
## factor(imd)4 -6.004e-03  1.119e-02  -0.536 0.591788
## factor(imd)5  8.137e-03  1.239e-02   0.657 0.511508
## sex           1.750e-04  7.143e-03   0.025 0.980450
## tenureb       1.720e-03  3.806e-03   0.452 0.651372
## origin       -7.315e-03  2.168e-03  -3.374 0.000747 ***
## hhsize        8.516e-03  3.218e-03   2.646 0.008172 **
## addnum       -1.688e-04  2.538e-04  -0.665 0.506088
## birthwt      -3.886e-03  6.123e-03  -0.635 0.525656
## porftvg      -1.573e-05  2.054e-03  -0.008 0.993892
## gor          -2.821e-03  1.400e-03  -2.015 0.043981 *
## aggr         -4.012e-02  7.773e-03  -5.162 2.55e-07 ***
## year         -2.003e-03  3.448e-03  -0.581 0.561307
## sysavg        8.847e-03  4.251e-04  20.812  < 2e-16 ***
## diaavg        1.081e-02  5.097e-04  21.204  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.223 on 4177 degrees of freedom
## Multiple R-squared:  0.3278, Adjusted R-squared:  0.3252
## F-statistic: 127.3 on 16 and 4177 DF,  p-value: < 2.2e-16
```

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