hw

```r
library(readxl)
data <- read_excel("C:\\Users\\10331\\OneDrive\\Desktop\\SeaWatch C data.xls")
data2 <- read_excel("C:\\Users\\10331\\OneDrive\\Desktop\\SeaWatch D data.xls")
```

```r
data[, 3:20] <- sapply(data[, 3:20], as.numeric)
```

```
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
```

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```

```r
data <- data[1:20]
data2[, 6:16] <- sapply(data2[, 6:16], as.numeric)
```

```
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
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```

```r
library(regclass)
```

```
## Loading required package: bestglm

## Loading required package: leaps

## Loading required package: VGAM

## Loading required package: stats4

## Loading required package: splines

## Loading required package: rpart

## Loading required package: randomForest

## randomForest 4.6-14

## Type rfNews() to see new features/changes/bug fixes.

## Important regclass change from 1.3:
## All functions that had a . in the name now have an _
## all.correlations -> all_correlations, cor.demo -> cor_demo, etc.
```

```r
str(data)
```

```
## tibble [396 x 20] (S3: tbl_df/tbl/data.frame)
##  $ CITY   : chr [1:396] "Acton" "Acton" "Acton" "Agawam" ...
##  $ AssoZIP: chr [1:396] "01720" "01720" "01720" "01001" ...
##  $ GROSS  : num [1:396] 6222 8641 10687 2423 2609 ...
##  $ CNVHRS : num [1:396] 238 294 351 160 134 81 39 187 201 297 ...
##  $ MOY    : num [1:396] 9 9 9 7 7 7 3 7 7 7 ...
##  $ YR     : num [1:396] 80 81 82 81 82 83 83 81 82 83 ...
##  $ MON    : num [1:396] 9 21 33 19 31 43 39 19 31 43 ...
##  $ VISIT  : num [1:396] 1 2 3 1 2 3 1 1 2 3 ...
##  $ LST    : num [1:396] 0 0 1 0 0 1 1 0 0 1 ...
##  $ CPI    : num [1:396] 249 276 293 271 291 ...
##  $ POP80  : num [1:396] 17544 17544 17544 10381 10381 ...
##  $ HHMEDI : num [1:396] 27323 27323 27323 19387 19387 ...
##  $ PERCAPI: num [1:396] 10522 10522 10522 7317 7317 ...
##  $ POVPR  : num [1:396] 3.8 3.8 3.8 6.3 6.3 6.3 10.1 25.4 25.4 25.4 ...
```

```
##  $ MFGPR  : num [1:396] 35.6 35.6 35.6 27.8 27.8 27.8 40.6 4.6 4.6 4.6 ...
##  $ COLLPR : num [1:396] 47.3 47.3 47.3 15.2 15.2 15.2 13.3 56.5 56.5 56.5 ...
##  $ MAGE   : num [1:396] 29.7 29.7 29.7 32.1 32.1 32.1 29.5 21.7 21.7 21.7 ...
##  $ CART   : num [1:396] 2663 2663 2663 4215 4215 ...
##  $ REAG   : num [1:396] 3667 3667 3667 4758 4758 ...
##  $ ANDR   : num [1:396] 2047 2047 2047 1685 1685 ...
```

```r
summary(data)
```

```
##     CITY             AssoZIP             GROSS          CNVHRS
##  Length:396        Length:396         Min.   :   43   Min.   :   3.0
##  Class :character  Class :character   1st Qu.: 1070   1st Qu.:  54.0
##  Mode  :character  Mode  :character   Median : 2420   Median : 114.0
##                                       Mean   : 3441   Mean   : 142.8
##                                       3rd Qu.: 4479   3rd Qu.: 188.0
##                                       Max.   :38256   Max.   :1204.0
##                                       NA's   :2       NA's   :3
##       MOY              YR             MON            VISIT
##  Min.   : 1.000   Min.   :80.00   Min.   : 3.00   Min.   :1.000
##  1st Qu.: 6.000   1st Qu.:81.00   1st Qu.:19.00   1st Qu.:1.000
##  Median : 7.000   Median :82.00   Median :31.00   Median :2.000
##  Mean   : 6.619   Mean   :81.79   Mean   :28.13   Mean   :2.003
##  3rd Qu.: 7.000   3rd Qu.:83.00   3rd Qu.:40.00   3rd Qu.:3.000
##  Max.   :12.000   Max.   :83.00   Max.   :44.00   Max.   :5.000
##
##       LST              CPI            POP80           HHMEDI
##  Min.   :0.0000   Min.   :236.4   Min.   :   688   Min.   :10108
##  1st Qu.:0.0000   1st Qu.:271.3   1st Qu.:  6345   1st Qu.:17182
##  Median :0.0000   Median :290.6   Median : 13212   Median :21304
##  Mean   :0.4066   Mean   :282.1   Mean   : 19179   Mean   :22643
##  3rd Qu.:1.0000   3rd Qu.:295.7   3rd Qu.: 24100   3rd Qu.:26702
##  Max.   :1.0000   Max.   :300.9   Max.   :161799   Max.   :47646
##                                   NA's   :9         NA's   :9
##     PERCAPI          POVPR           MFGPR           COLLPR
##  Min.   : 5188   Min.   : 0.400   Min.   : 3.00   Min.   : 8.20
##  1st Qu.: 6912   1st Qu.: 3.500   1st Qu.:17.20   1st Qu.:18.65
##  Median : 8060   Median : 5.100   Median :22.30   Median :25.90
##  Mean   : 8707   Mean   : 6.204   Mean   :23.89   Mean   :28.72
##  3rd Qu.:10008   3rd Qu.: 8.050   3rd Qu.:29.20   3rd Qu.:38.30
##  Max.   :17850   Max.   :26.100   Max.   :48.40   Max.   :61.70
##  NA's   :9       NA's   :9        NA's   :25      NA's   :25
##      MAGE            CART            REAG            ANDR
##  Min.   :21.70   Min.   :   97   Min.   :   84   Min.   :  63
##  1st Qu.:30.10   1st Qu.: 1089   1st Qu.: 1442   1st Qu.: 566
##  Median :32.10   Median : 2172   Median : 3067   Median :1105
##  Mean   :32.23   Mean   : 3784   Mean   : 3882   Mean   :1529
##  3rd Qu.:33.70   3rd Qu.: 4200   3rd Qu.: 5496   3rd Qu.:1995
##  Max.   :50.20   Max.   :31225   Max.   :23339   Max.   :8586
##  NA's   :9       NA's   :16      NA's   :16      NA's   :16
```

```r
library("psych")
```

```
##
## Attaching package: 'psych'
```

```
## The following object is masked from 'package:randomForest':
##
##     outlier


## The following objects are masked from 'package:VGAM':
##
##     fisherz, logistic, logit
```

```r
describe(data)
```

```
##            vars   n     mean       sd  median  trimmed      mad     min      max
## CITY*         1 396    79.65    46.65    78.5    79.43    59.30     1.0    161.0
## AssoZIP*      2 396    75.58    45.04    74.5    75.30    59.30     1.0    160.0
## GROSS         3 394  3441.30  4056.82  2419.5  2755.20  2227.61    43.0  38256.0
## CNVHRS        4 393   142.84   140.89   114.0   121.19    97.85     3.0   1204.0
## MOY           5 396     6.62     2.45     7.0     6.66     1.48     1.0     12.0
## YR            6 396    81.79     0.99    82.0    81.86     1.48    80.0     83.0
## MON           7 396    28.13    11.72    31.0    28.85    17.79     3.0     44.0
## VISIT         8 396     2.00     0.97     2.0     1.90     1.48     1.0      5.0
## LST           9 396     0.41     0.49     0.0     0.38     0.00     0.0      1.0
## CPI          10 396   282.14    16.85   290.6   284.31    13.34   236.4    300.9
## POP80        11 387 19179.16 22616.29 13212.0 14863.73 11421.95   688.0 161799.0
## HHMEDI       12 387 22643.48  6654.16 21304.0 21984.26  6862.96 10108.0  47646.0
## PERCAPI      13 387  8706.69  2236.39  8060.0  8429.94  1885.87  5188.0  17850.0
## POVPR        14 387     6.20     3.96     5.1     5.68     2.67     0.4     26.1
## MFGPR        15 371    23.89     9.65    22.3    23.41     8.60     3.0     48.4
## COLLPR       16 371    28.72    13.20    25.9    27.55    14.97     8.2     61.7
## MAGE         17 387    32.23     3.06    32.1    32.07     2.67    21.7     50.2
## CART         18 380  3784.08  5064.56  2171.5  2628.76  1965.19    97.0  31225.0
## REAG         19 380  3881.71  3430.15  3067.0  3359.21  2604.93    84.0  23339.0
## ANDR         20 380  1528.81  1463.64  1105.0  1262.62   919.21    63.0   8586.0
##              range  skew kurtosis      se
## CITY*        160.0  0.04    -1.21    2.34
## AssoZIP*     159.0  0.03    -1.20    2.26
## GROSS      38213.0  4.12    25.26  204.38
## CNVHRS      1201.0  3.11    15.47    7.11
## MOY           11.0 -0.24     0.52    0.12
## YR             3.0 -0.28    -1.03    0.05
## MON           41.0 -0.27    -1.06    0.59
## VISIT          4.0  0.67    -0.27    0.05
## LST            1.0  0.38    -1.86    0.02
## CPI           64.5 -0.85    -0.38    0.85
## POP80     161111.0  3.60    16.78 1149.65
## HHMEDI     37538.0  1.03     1.39  338.25
## PERCAPI    12662.0  1.30     1.94  113.68
## POVPR         25.7  2.00     6.23    0.20
## MFGPR         45.4  0.41    -0.16    0.50
## COLLPR        53.5  0.65    -0.47    0.69
## MAGE          28.5  1.33     7.57    0.16
## CART       31128.0  3.13    10.62  259.81
## REAG       23255.0  2.17     7.07  175.96
## ANDR        8523.0  2.28     6.40   75.08
```

```
data$COLLPR <- data$COLLPR * data$POP80
#data$MFGPR <- data$MFGPR * data$POP80
#data$POVPR <- data$POVPR * data$POP80
data$Voter <- data$CART +data$REAG +data$ANDR
data$CARTpr <- data$CART/data$POP80
data$REAGpr <- data$REAG/data$POP80
data$ANDRpr <- data$ANDR/data$POP80
```

```
attach(data)
```

```
name <- names(data[,3:24])
c = cor(data[,name],use="complete.obs")
c
```

```
GROSS   CNVHRS   MOY   YR   MON
GROSS   1.000000e+00   0.970312542 -0.019707185   3.816761e-05 -0.004045506
CNVHRS   9.703125e-01   1.000000000   0.008828027 -1.015354e-01 -0.101541861
MOY   -1.970718e-02   0.008828027   1.000000000 -1.882620e-01   0.015586180
YR   3.816761e-05 -0.101535423 -0.188261999   1.000000e+00   0.979065257
MON   -4.045506e-03 -0.101541861   0.015586180   9.790653e-01   1.000000000
VISIT   4.714549e-01   0.397322178 -0.064722937   5.782794e-01   0.575322431
LST   2.092043e-02 -0.043480533 -0.046289985   6.863727e-01   0.689190709
CPI   -1.933335e-02 -0.118142571   0.054205727   9.473316e-01   0.975696524
POP80   4.389496e-01   0.488901726 -0.062226439 -8.398052e-02 -0.098395728
HHMEDI   2.410117e-01   0.229749704 -0.144820038 -1.709204e-01 -0.204025434
PERCAPI   3.880198e-01   0.380973430 -0.147580529 -1.816646e-01 -0.215536130
POVPR   -4.915461e-02 -0.055945290   0.022908679   1.589712e-01   0.166593721
MFGPR   -3.003965e-01 -0.327243840   0.012482319   4.306026e-02   0.046425912
COLLPR   8.132564e-01   0.842700513 -0.060066494 -1.359970e-01 -0.150905136
MAGE   5.750895e-02   0.070473846   0.051021561   2.637948e-02   0.037430846
CART   4.872417e-01   0.528920517 -0.060546159 -6.485383e-02 -0.078574926
REAG   4.949702e-01   0.580720836 -0.031040707 -1.580719e-01 -0.167363573
ANDR   6.716217e-01   0.730813454 -0.040053417 -1.549636e-01 -0.166067011
Voter   5.392277e-01   0.601117012 -0.049516049 -1.146767e-01 -0.127012761
CARTpr   6.197288e-02   0.075385332   0.023108103   1.387689e-02   0.018917041
REAGpr   -5.989100e-02 -0.041457316 -0.011422674 -1.650621e-02 -0.019172074
ANDRpr   2.215403e-01   0.200282283 -0.041419152 -6.112452e-02 -0.070814059
VISIT   LST   CPI   POP80   HHMEDI
GROSS   0.47145490   0.0209204317 -0.01933335   0.438949555   0.241011657
CNVHRS   0.39732218 -0.0434805331 -0.11814257   0.488901726   0.229749704
MOY   -0.06472294 -0.0462899852   0.05420573 -0.062226439 -0.144820038
YR   0.57827938   0.6863727252   0.94733162 -0.083980519 -0.170920357
MON   0.57532243   0.6891907085   0.97569652 -0.098395728 -0.204025434
VISIT   1.00000000   0.4887824157   0.54527289   0.070194001   0.263152066
LST   0.48878242   1.0000000000   0.58221856   0.007507782 -0.127920449
CPI   0.54527289   0.5822185586   1.00000000 -0.106185650 -0.208713818
POP80   0.07019400   0.0075077818 -0.10618565   1.000000000 -0.213992474
HHMEDI   0.26315207 -0.1279204493 -0.20871382 -0.213992474   1.000000000
PERCAPI   0.31572352 -0.1133947945 -0.22967538 -0.106296100   0.897673269
POVPR   -0.12993370   0.0813155029   0.16722158   0.350877986 -0.699316429
MFGPR   -0.10244689 -0.0230735960   0.07458582 -0.070318776 -0.120390993
COLLPR   0.26263572 -0.0584354448 -0.16349634   0.775930819   0.045320398
MAGE   0.00675847   0.0680848352   0.01090359 -0.123361483   0.117411732
```
```
5
```

```
## CART      0.08851179  0.0002887727 -0.08470939  0.908312319 -0.165409857
## REAG      0.10215204 -0.0021585084 -0.18297991  0.918297549 -0.061571460
## ANDR      0.17445028 -0.0194490703 -0.18222905  0.920033266 -0.081690217
## Voter     0.11031462 -0.0035797348 -0.13832633  0.953061089 -0.122756610
## CARTpr    0.01467328 -0.0156585422  0.02357696  0.052771524  0.008482247
## REAGpr    0.02059688 -0.0068898220 -0.03354236 -0.407943948  0.556552655
## ANDRpr    0.17525144 -0.0391170442 -0.08919322 -0.314459040  0.483226675
##              PERCAPI       POVPR       MFGPR       COLLPR         MAGE
## GROSS      0.388019786 -0.04915461 -0.30039650  0.81325644  0.05750895
## CNVHRS     0.380973430 -0.05594529 -0.32724384  0.84270051  0.07047385
## MOY       -0.147580529  0.02290868  0.01248232 -0.06006649  0.05102156
## YR        -0.181664645  0.15897116  0.04306026 -0.13599697  0.02637948
## MON       -0.215536130  0.16659372  0.04642591 -0.15090514  0.03743085
## VISIT      0.315723522 -0.12993370 -0.10244689  0.26263572  0.00675847
## LST       -0.113394795  0.08131550 -0.02307360 -0.05843544  0.06808484
## CPI       -0.229675382  0.16722158  0.07458582 -0.16349634  0.01090359
## POP80     -0.106296100  0.35087799 -0.07031878  0.77593082 -0.12336148
## HHMEDI     0.897673269 -0.69931643 -0.12039099  0.04532040  0.11741173
## PERCAPI    1.000000000 -0.56439114 -0.29086075  0.20993512  0.33109676
## POVPR     -0.564391137  1.00000000 -0.12441804  0.19722814 -0.23878392
## MFGPR     -0.290860750 -0.12441804  1.00000000 -0.29099663 -0.33004859
## COLLPR     0.209935121  0.19722814 -0.29099663  1.00000000 -0.06864571
## MAGE       0.331096759 -0.23878392 -0.33004859 -0.06864571  1.00000000
## CART      -0.033185699  0.29958324 -0.11803612  0.78955659 -0.05455724
## REAG       0.043938178  0.12819133 -0.13219251  0.75370679  0.02891796
## ANDR       0.075762113  0.22533339 -0.21530117  0.91256231 -0.01596350
## Voter      0.009509042  0.24007480 -0.14302958  0.82974606 -0.02124129
## CARTpr     0.068492072 -0.01171989 -0.08587398  0.10470341  0.11653935
## REAGpr     0.530780934 -0.57707102 -0.20762578 -0.28377347  0.53568667
## ANDRpr     0.608645478 -0.29065091 -0.41257684 -0.01821835  0.44890163
##               CART         REAG         ANDR        Voter       CARTpr
## GROSS      0.4872417079  0.494970233  0.67162175  0.539227662  0.061972883
## CNVHRS     0.5289205165  0.580720836  0.73081345  0.601117012  0.075385332
## MOY       -0.0605461593 -0.031040707 -0.04005342 -0.049516049  0.023108103
## YR        -0.0648538277 -0.158071889 -0.15496363 -0.114676731  0.013876892
## MON       -0.0785749260 -0.167363573 -0.16606701 -0.127012761  0.018917041
## VISIT      0.0885117896  0.102152040  0.17445028  0.110314616  0.014673277
## LST        0.0002887727 -0.002158508 -0.01944907 -0.003579735 -0.015658542
## CPI       -0.0847093877 -0.182979910 -0.18222905 -0.138326331  0.023576956
## POP80      0.9083123185  0.918297549  0.92003327  0.953061089  0.052771524
## HHMEDI    -0.1654098570 -0.061571460 -0.08169022 -0.122756610  0.008482247
## PERCAPI   -0.0331856988  0.043938178  0.07576211  0.009509042  0.068492072
## POVPR      0.2995832425  0.128191333  0.22533339  0.240074805 -0.011719894
## MFGPR     -0.1180361210 -0.132192508 -0.21530117 -0.143029579 -0.085873981
## COLLPR     0.7895565860  0.753706789  0.91256231  0.829746056  0.104703411
## MAGE      -0.0545572399  0.028917962 -0.01596350 -0.021241286  0.116539350
## CART       1.0000000000  0.838442336  0.87614868  0.966825716  0.438248310
## REAG       0.8384423357  1.000000000  0.93678262  0.947472097  0.077870004
## ANDR       0.8761486838  0.936782624  1.00000000  0.954669326  0.088024811
## Voter      0.9668257157  0.947472097  0.95466933  1.000000000  0.275234893
## CARTpr     0.4382483102  0.077870004  0.08802481  0.275234893  1.000000000
## REAGpr    -0.3533039998 -0.175327843 -0.28944529 -0.295358227  0.024301842
## ANDRpr    -0.2439996394 -0.181976446 -0.08847272 -0.208743246  0.042950571
##              REAGpr       ANDRpr
```

```
## GROSS    -0.059890997  0.22154026
## CNVHRS   -0.041457316  0.20028228
## MOY      -0.011422674 -0.04141915
## YR       -0.016506213 -0.06112452
## MON      -0.019172074 -0.07081406
## VISIT     0.020596878  0.17525144
## LST      -0.006889822 -0.03911704
## CPI      -0.033542358 -0.08919322
## POP80    -0.407943948 -0.31445904
## HHMEDI    0.556552655  0.48322668
## PERCAPI   0.530780934  0.60864548
## POVPR    -0.577071020 -0.29065091
## MFGPR    -0.207625775 -0.41257684
## COLLPR   -0.283773473 -0.01821835
## MAGE      0.535686672  0.44890163
## CART     -0.353304000 -0.24399964
## REAG     -0.175327843 -0.18197645
## ANDR     -0.289445286 -0.08847272
## Voter    -0.295358227 -0.20874325
## CARTpr    0.024301842  0.04295057
## REAGpr    1.000000000  0.61488144
## ANDRpr    0.614881436  1.00000000
```
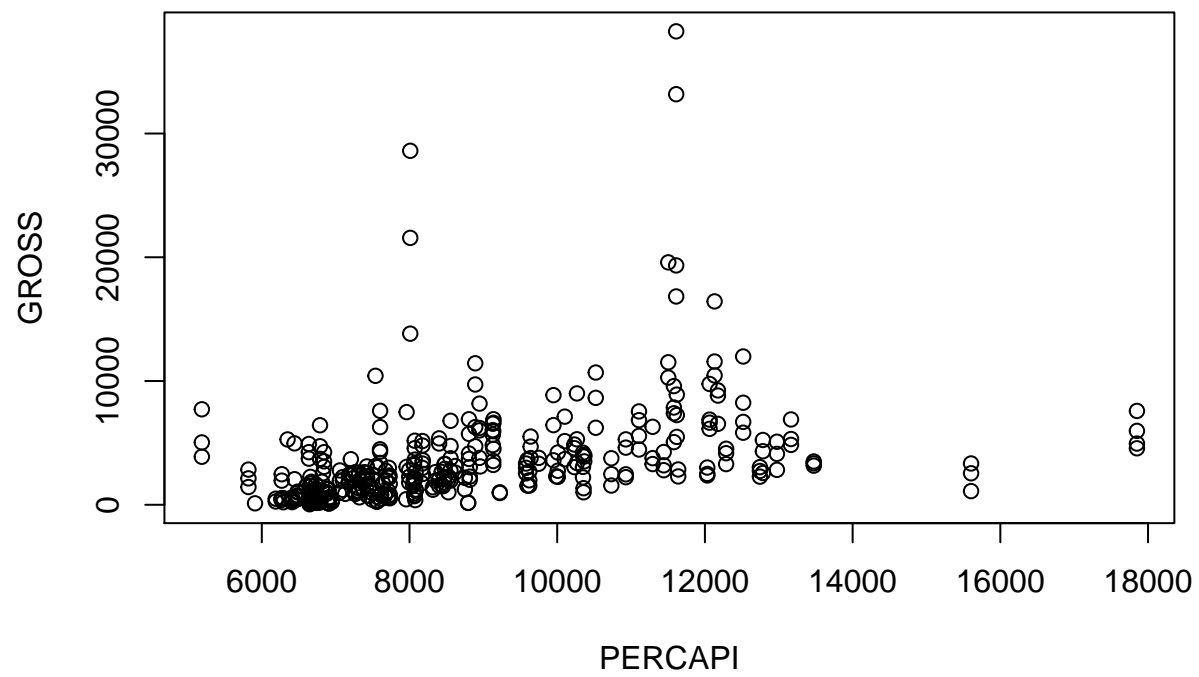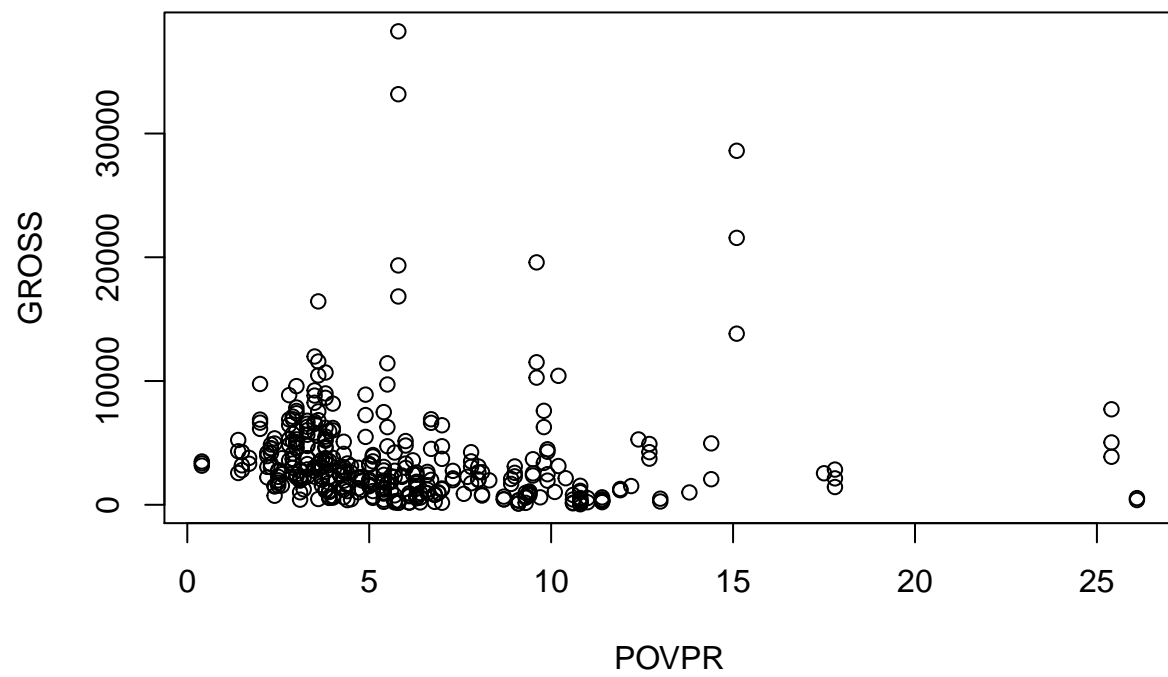
```r
heatmap(c)
```
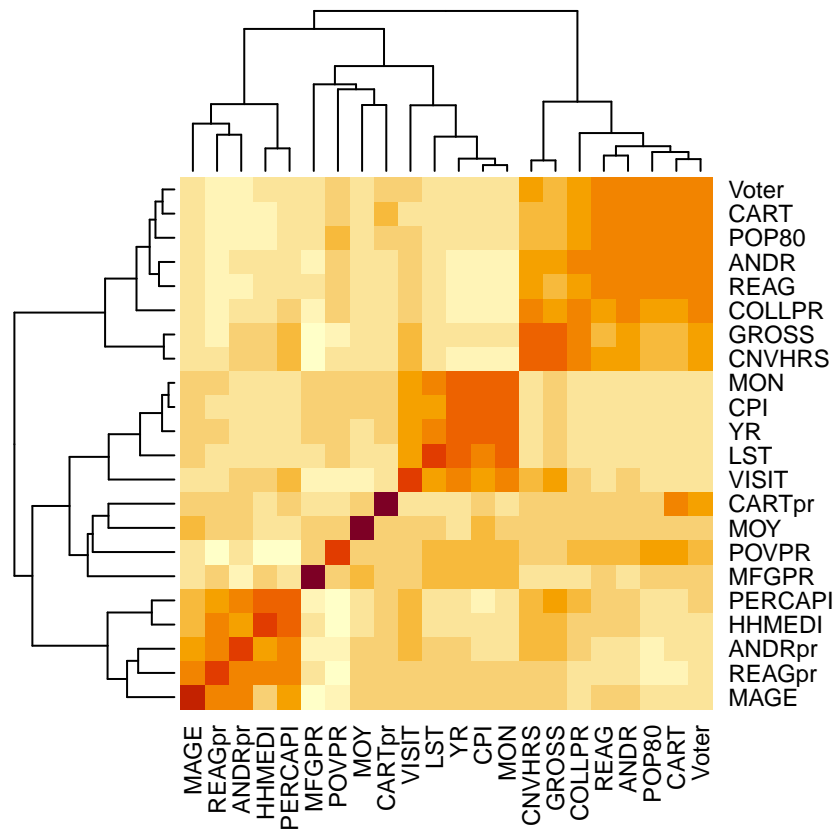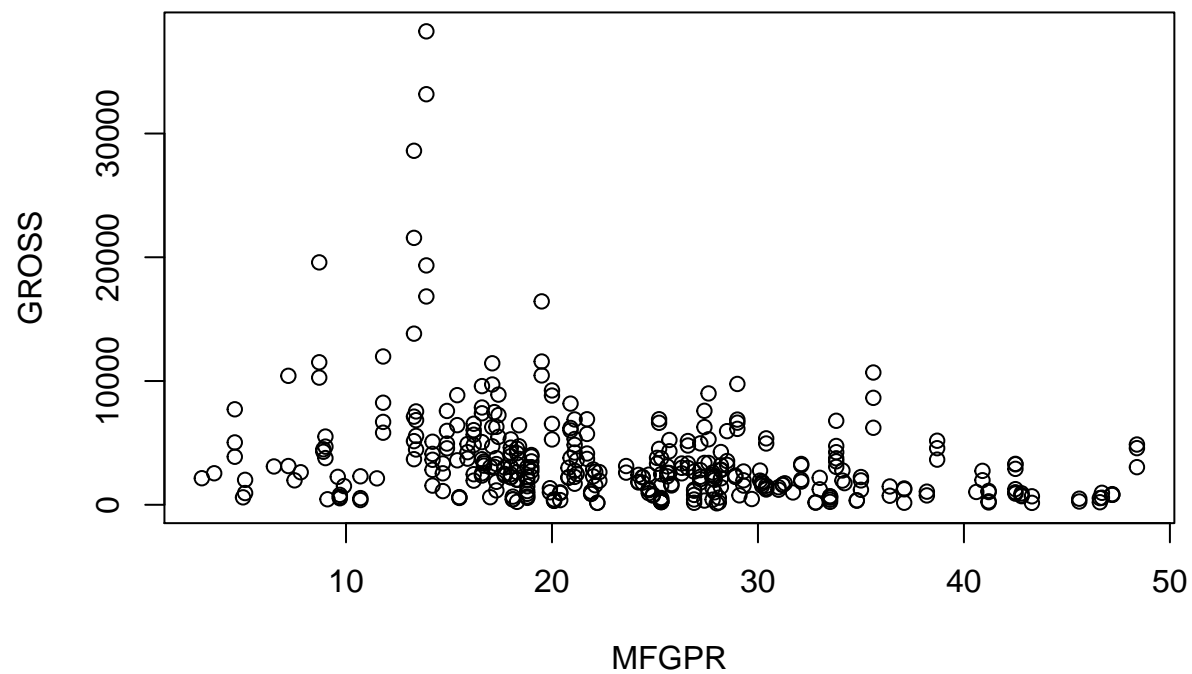
```
plot(POP80,GROSS)
```
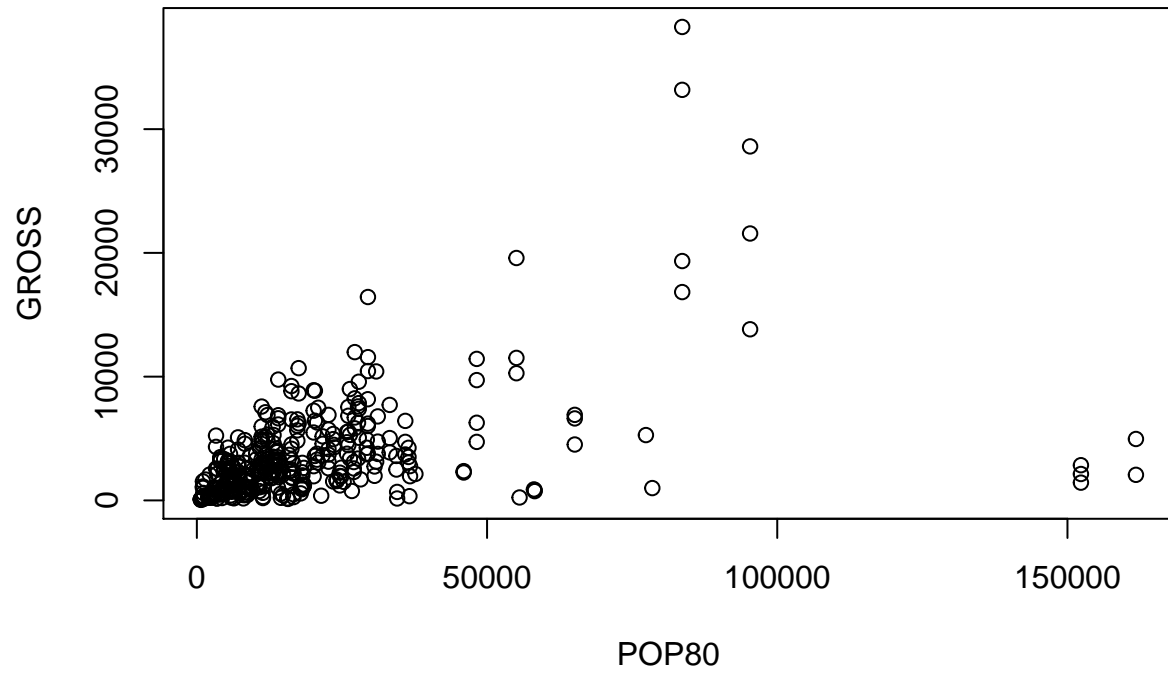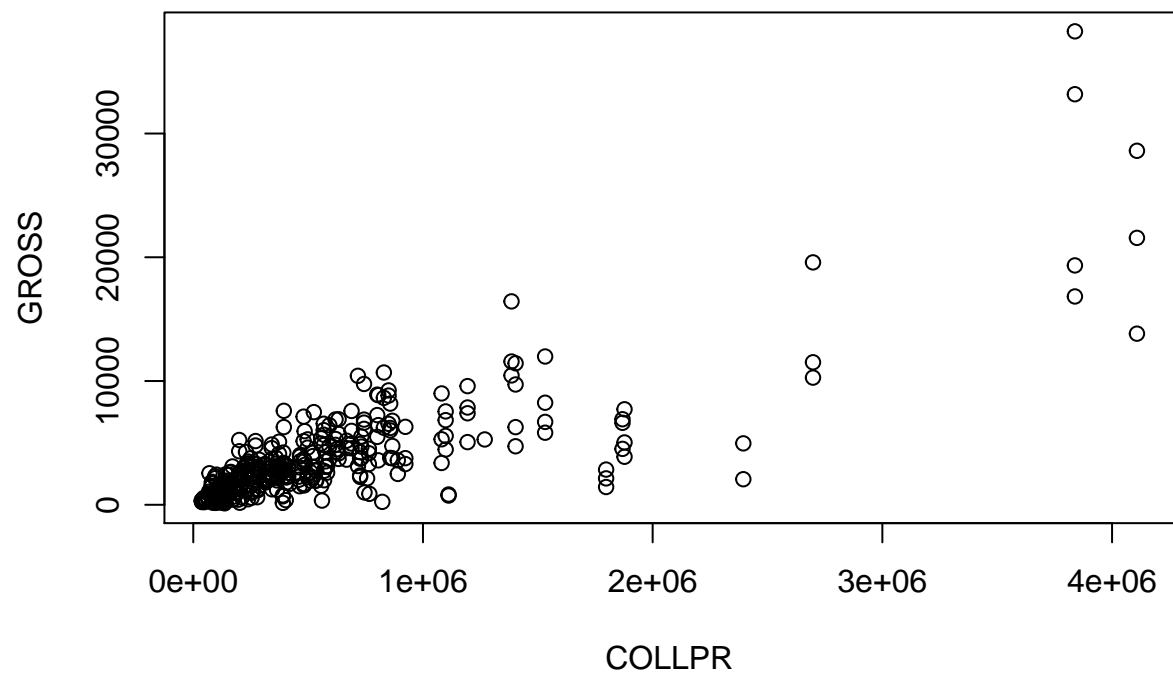


```
plot(HHMEDI,GROSS)
```
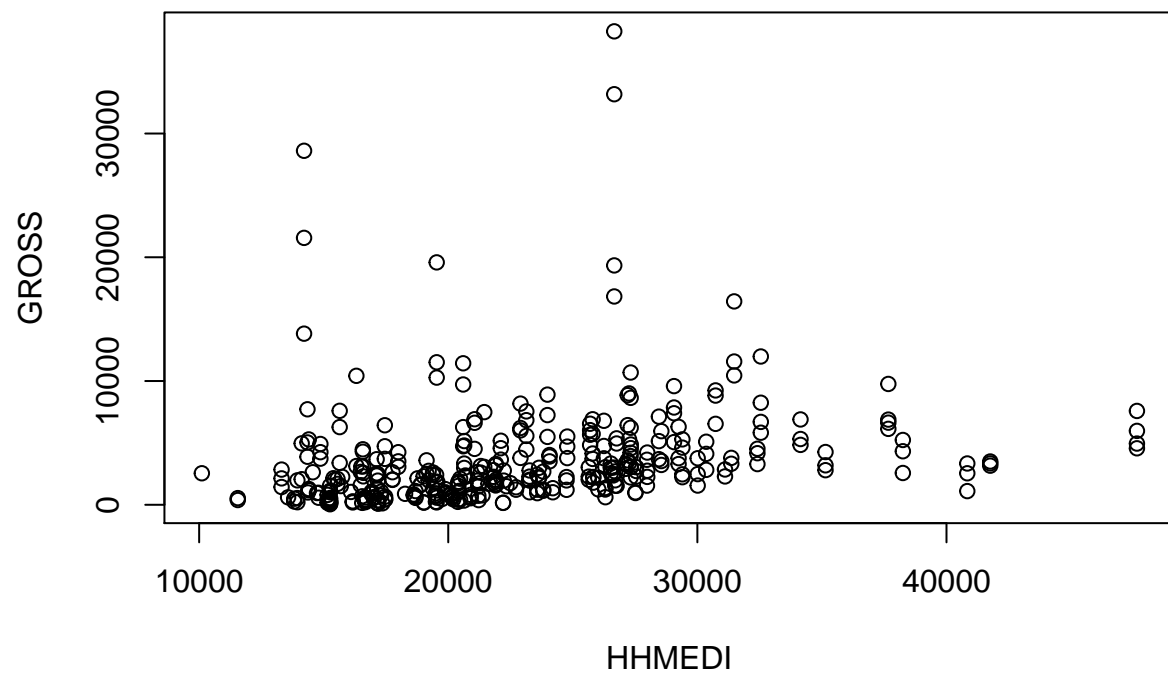
```
plot(PERCAPI,GROSS)
```
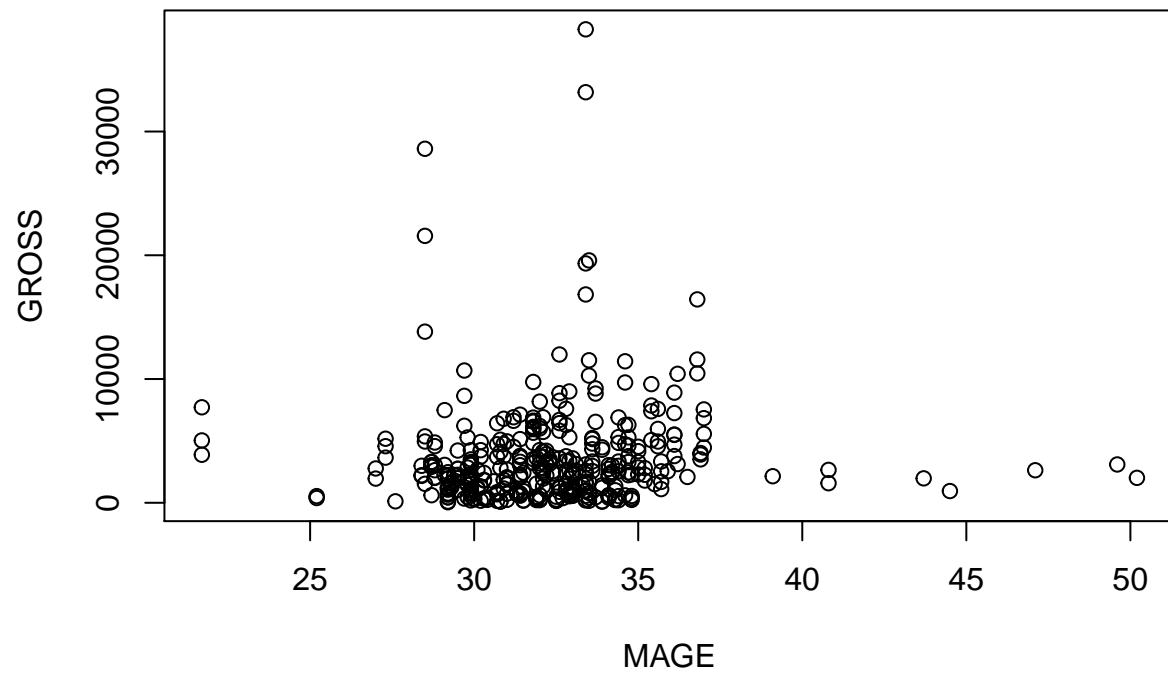
```
plot(POVPR,GROSS)
```
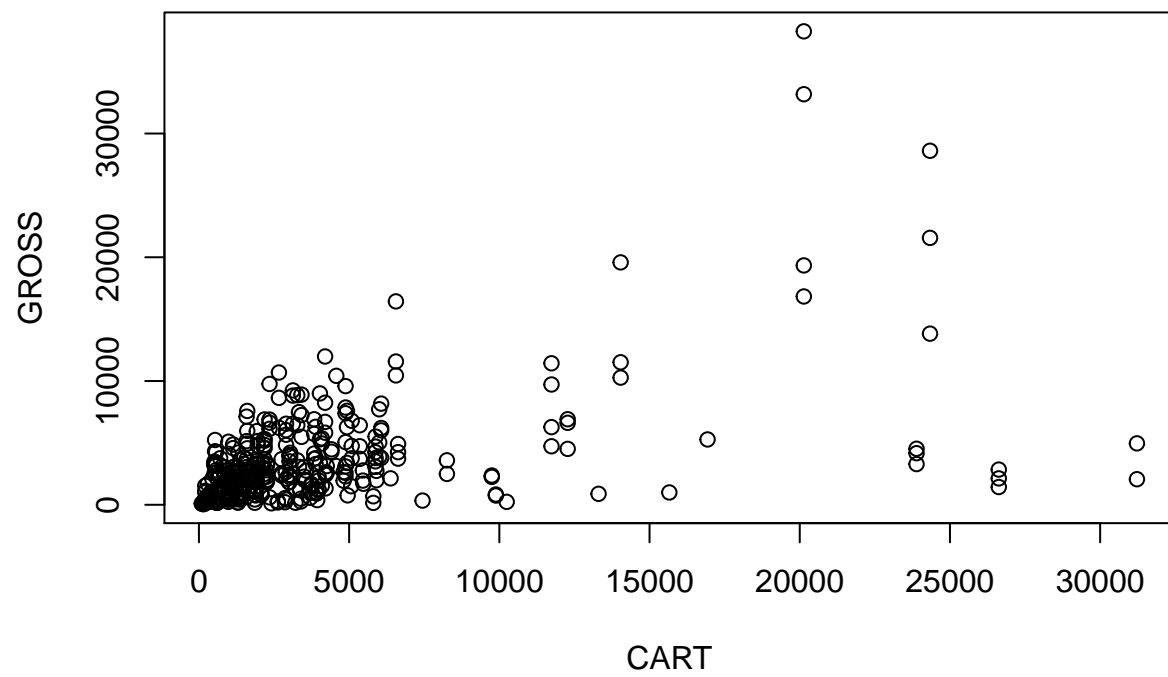
```
plot(MFGPR,GROSS)
```
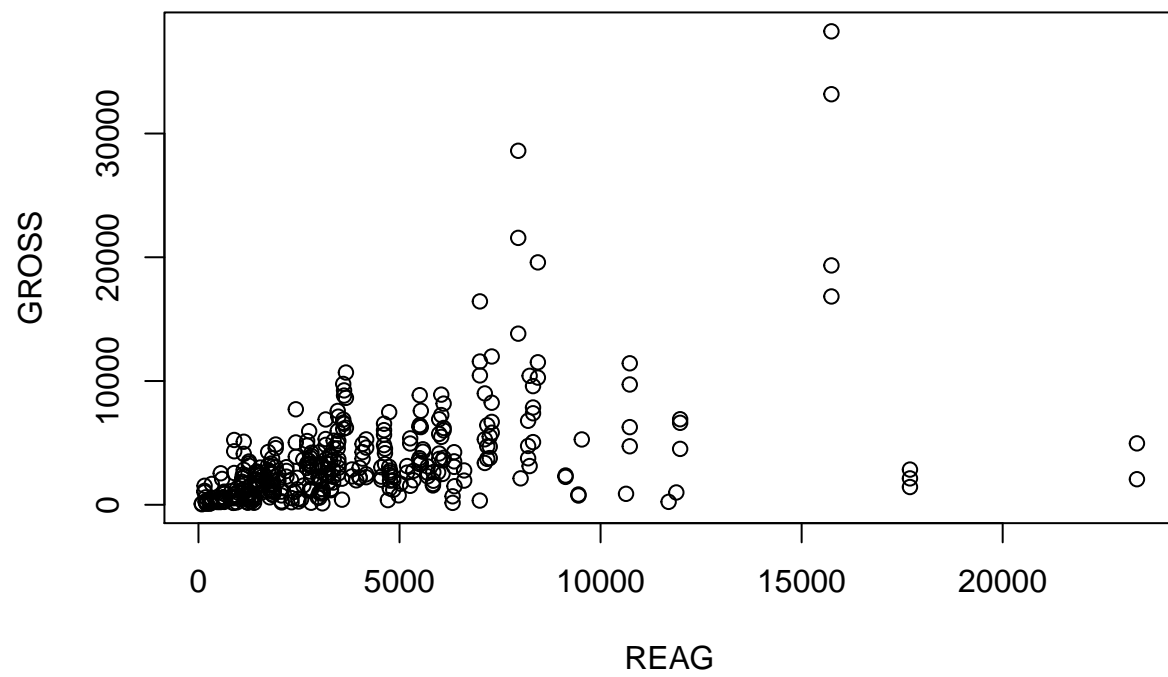
```
plot(COLLPR,GROSS)
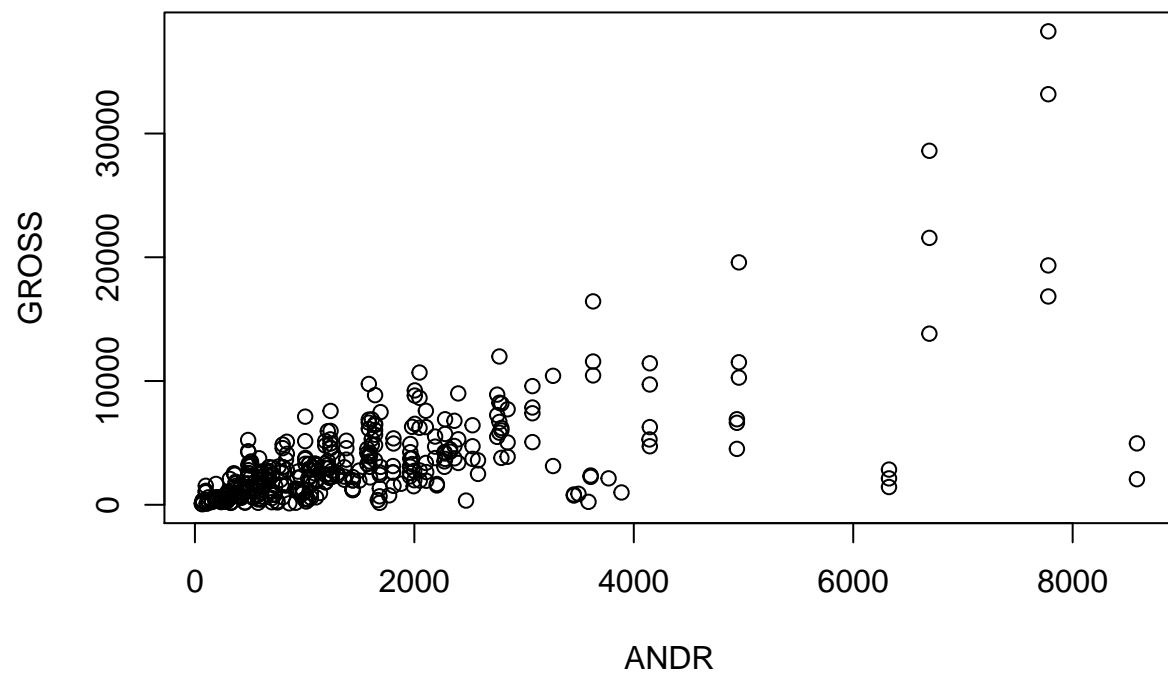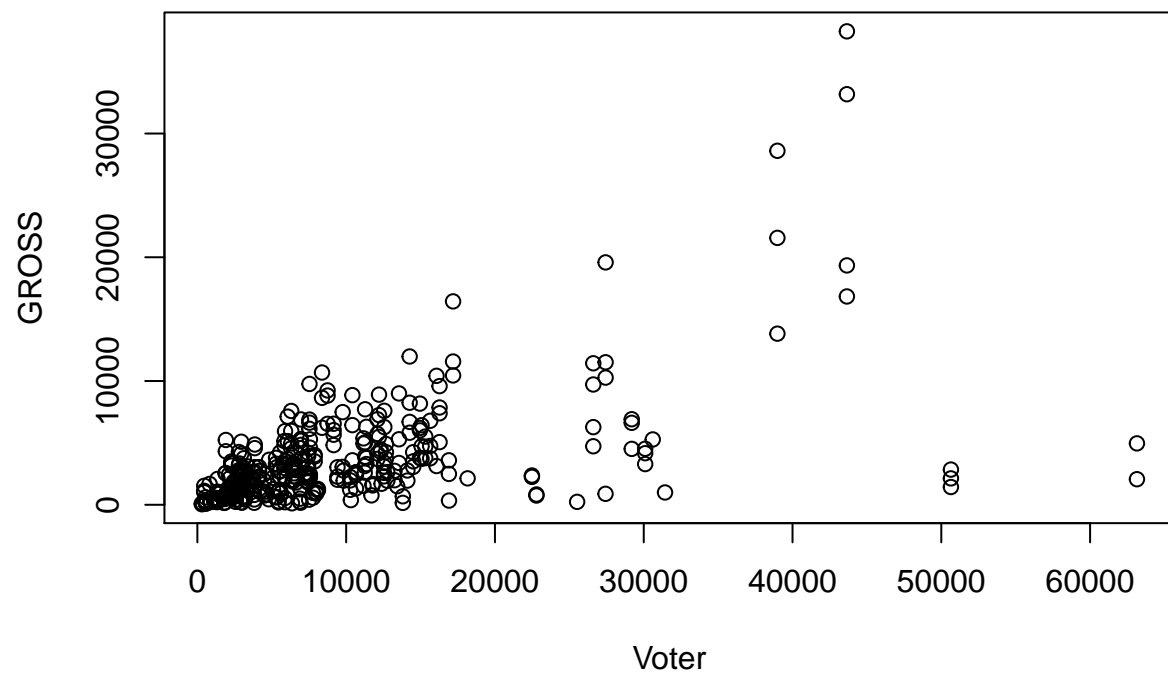```

```
plot(MAGE,GROSS)
```

```
plot(CART,GROSS)
```
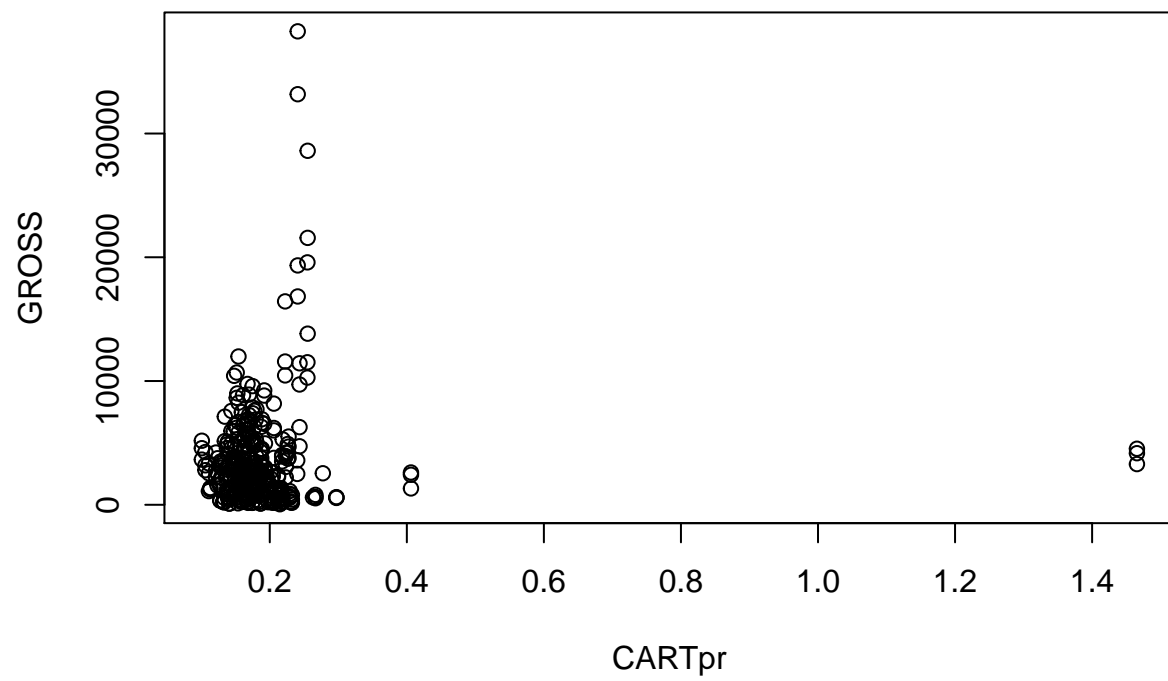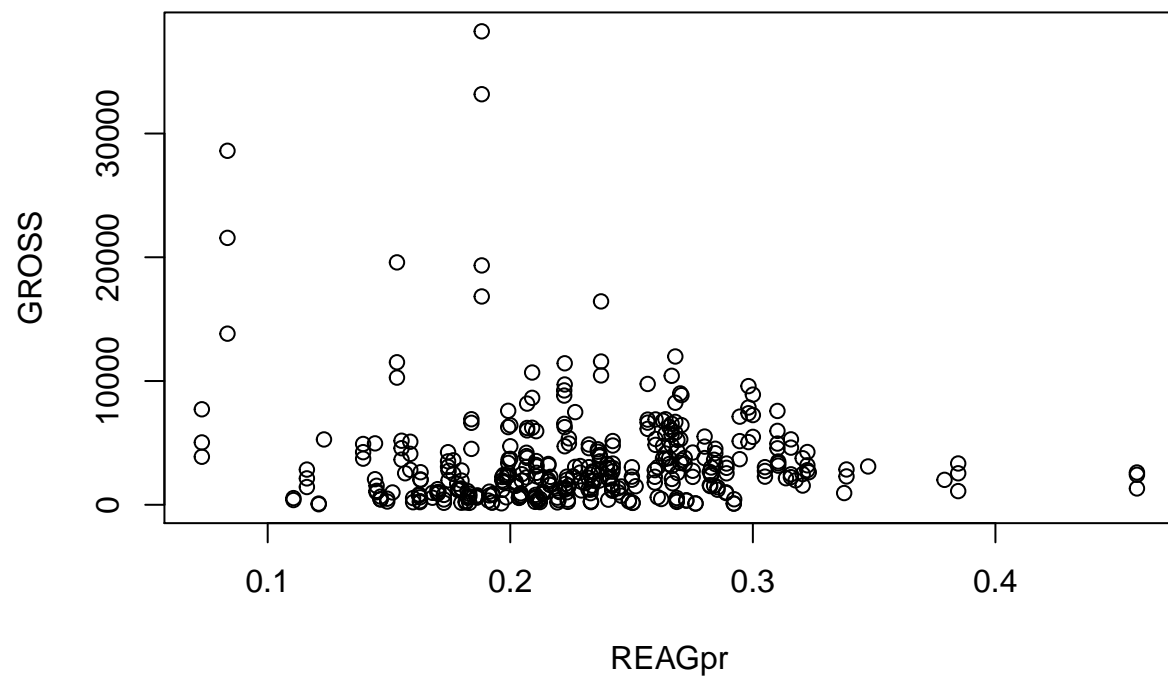
```
plot(REAG,GROSS)
```

```
plot(ANDR,GROSS)
```

```
plot(Voter,GROSS)
```

```
plot(CARTpr,GROSS)
```

```
plot(REAGpr,GROSS)
```

```
plot(ANDRpr,GROSS)
```
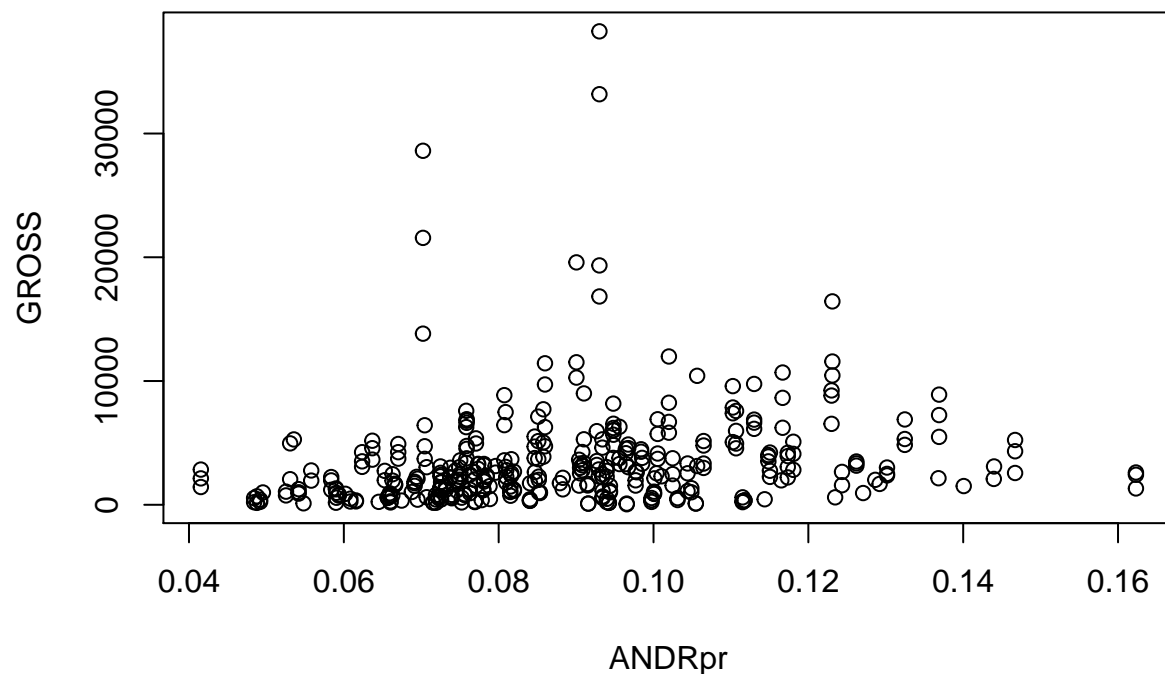
```
model <- lm (GROSS~COLLPR+POVPR+PERCAPI  +POP80 + factor(VISIT))
summary(model)
```

```
##
## Call:
## lm(formula = GROSS ~ COLLPR + POVPR + PERCAPI + POP80 + factor(VISIT))
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6418.3  -777.3   -86.3   722.6 11871.6
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.561e+03  6.305e+02   2.476 0.013755 *
## COLLPR         6.382e-03  2.654e-04  24.046  < 2e-16 ***
## POVPR         -1.083e+02  3.103e+01  -3.489 0.000545 ***
## PERCAPI       -2.614e-02  5.892e-02  -0.444 0.657536
## POP80         -6.173e-02  7.226e-03  -8.543 3.76e-16 ***
## factor(VISIT)2 1.951e+02  2.228e+02   0.876 0.381653
## factor(VISIT)3 9.921e+02  2.519e+02   3.938 9.88e-05 ***
## factor(VISIT)4 3.571e+03  4.487e+02   7.958 2.30e-14 ***
## factor(VISIT)5 6.423e+03  9.487e+02   6.770 5.23e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 1778 on 360 degrees of freedom
##   (27 observations deleted due to missingness)
## Multiple R-squared:  0.8193, Adjusted R-squared:  0.8153
## F-statistic: 204.1 on 8 and 360 DF,  p-value: < 2.2e-16
```

```
VIF(model)
```

```
##              GVIF Df GVIF^(1/(2*Df))
## COLLPR       3.589103  1        1.894493
## POVPR        1.742980  1        1.320220
## PERCAPI      2.037102  1        1.427271
## POP80        3.165940  1        1.779309
## factor(VISIT) 1.264601  4        1.029779
```

```
data$ERROR <- GROSS - predict(model,data)
name <- names(data[,3:25])
c = cor(data[,name],use="complete.obs")
c
```

```
##                  GROSS       CNVHRS         MOY          YR         MON
## GROSS     1.000000e+00  0.970312542 -0.019707185  3.816761e-05 -0.004045506
## CNVHRS    9.703125e-01  1.000000000  0.008828027 -1.015354e-01 -0.101541861
## MOY      -1.970718e-02  0.008828027  1.000000000 -1.882620e-01  0.015586180
## YR        3.816761e-05 -0.101535423 -0.188261999  1.000000e+00  0.979065257
## MON      -4.045506e-03 -0.101541861  0.015586180  9.790653e-01  1.000000000
## VISIT     4.714549e-01  0.397322178 -0.064722937  5.782794e-01  0.575322431
## LST       2.092043e-02 -0.043480533 -0.046289985  6.863727e-01  0.689190709
## CPI      -1.933335e-02 -0.118142571  0.054205727  9.473316e-01  0.975696524
## POP80     4.389496e-01  0.488901726 -0.062226439 -8.398052e-02 -0.098395728
## HHMEDI    2.410117e-01  0.229749704 -0.144820038 -1.709204e-01 -0.204025434
## PERCAPI   3.880198e-01  0.380973430 -0.147580529 -1.816646e-01 -0.215536130
## POVPR    -4.915461e-02 -0.055945290  0.022908679  1.589712e-01  0.166593721
## MFGPR    -3.003965e-01 -0.327243840  0.012482319  4.306026e-02  0.046425912
## COLLPR    8.132564e-01  0.842700513 -0.060066494 -1.359970e-01 -0.150905136
## MAGE      5.750895e-02  0.070473846  0.051021561  2.637948e-02  0.037430846
## CART      4.872417e-01  0.528920517 -0.060546159 -6.485383e-02 -0.078574926
## REAG      4.949702e-01  0.580720836 -0.031040707 -1.580719e-01 -0.167363573
## ANDR      6.716217e-01  0.730813454 -0.040053417 -1.549636e-01 -0.166067011
## Voter     5.392277e-01  0.601117012 -0.049516049 -1.146767e-01 -0.127012761
## CARTpr    6.197288e-02  0.075385332  0.023108103  1.387689e-02  0.018917041
## REAGpr   -5.989100e-02 -0.041457316 -0.011422674 -1.650621e-02 -0.019172074
## ANDRpr    2.215403e-01  0.200282283 -0.041419152 -6.112452e-02 -0.070814059
## ERROR     4.639896e-01  0.412669652  0.102858903  5.221710e-02  0.074479110
##              VISIT          LST          CPI        POP80       HHMEDI
## GROSS     0.47145490  0.0209204317 -0.01933335  0.438949555  0.241011657
## CNVHRS    0.39732218 -0.0434805331 -0.11814257  0.488901726  0.229749704
## MOY      -0.06472294 -0.0462899852  0.05420573 -0.062226439 -0.144820038
## YR        0.57827938  0.6863727252  0.94733162 -0.083980519 -0.170920357
## MON       0.57532243  0.6891907085  0.97569652 -0.098395728 -0.204025434
## VISIT     1.00000000  0.4887824157  0.54527289  0.070194001  0.263152066
## LST       0.48878242  1.0000000000  0.58221856  0.007507782 -0.127920449
## CPI       0.54527289  0.5822185586  1.00000000 -0.106185650 -0.208713818
## POP80     0.07019400  0.0075077818 -0.10618565  1.000000000 -0.213992474
```

```
## HHMEDI    0.26315207 -0.1279204493 -0.20871382 -0.213992474  1.000000000
## PERCAPI   0.31572352 -0.1133947945 -0.22967538 -0.106296100  0.897673269
## POVPR    -0.12993370  0.0813155029  0.16722158  0.350877986 -0.699316429
## MFGPR    -0.10244689 -0.0230735960  0.07458582 -0.070318776 -0.120390993
## COLLPR    0.26263572 -0.0584354448 -0.16349634  0.775930819  0.045320398
## MAGE      0.00675847  0.0680848352  0.01090359 -0.123361483  0.117411732
## CART      0.08851179  0.0002887727 -0.08470939  0.908312319 -0.165409857
## REAG      0.10215204 -0.0021585084 -0.18297991  0.918297549 -0.061571460
## ANDR      0.17445028 -0.0194490703 -0.18222905  0.920033266 -0.081690217
## Voter     0.11031462 -0.0035797348 -0.13832633  0.953061089 -0.122756610
## CARTpr    0.01467328 -0.0156585422  0.02357696  0.052771524  0.008482247
## REAGpr    0.02059688 -0.0068898220 -0.03354236 -0.407943948  0.556552655
## ANDRpr    0.17525144 -0.0391170442 -0.08919322 -0.314459040  0.483226675
## ERROR     0.04958479 -0.0148780458  0.08695215  0.013079470 -0.009811330
##               PERCAPI        POVPR        MFGPR       COLLPR         MAGE
## GROSS     0.388019786 -0.049154610 -0.30039650  0.81325644  0.05750895
## CNVHRS    0.380973430 -0.055945290 -0.32724384  0.84270051  0.07047385
## MOY      -0.147580529  0.022908679  0.01248232 -0.06006649  0.05102156
## YR       -0.181664645  0.158971159  0.04306026 -0.13599697  0.02637948
## MON      -0.215536130  0.166593721  0.04642591 -0.15090514  0.03743085
## VISIT     0.315723522 -0.129933704 -0.10244689  0.26263572  0.00675847
## LST      -0.113394795  0.081315503 -0.02307360 -0.05843544  0.06808484
## CPI      -0.229675382  0.167221579  0.07458582 -0.16349634  0.01090359
## POP80    -0.106296100  0.350877986 -0.07031878  0.77593082 -0.12336148
## HHMEDI    0.897673269 -0.699316429 -0.12039099  0.04532040  0.11741173
## PERCAPI   1.000000000 -0.564391137 -0.29086075  0.20993512  0.33109676
## POVPR    -0.564391137  1.000000000 -0.12441804  0.19722814 -0.23878392
## MFGPR    -0.290860750 -0.124418042  1.00000000 -0.29099663 -0.33004859
## COLLPR    0.209935121  0.197228144 -0.29099663  1.00000000 -0.06864571
## MAGE      0.331096759 -0.238783924 -0.33004859 -0.06864571  1.00000000
## CART     -0.033185699  0.299583243 -0.11803612  0.78955659 -0.05455724
## REAG      0.043938178  0.128191333 -0.13219251  0.75370679  0.02891796
## ANDR      0.075762113  0.225333393 -0.21530117  0.91256231 -0.01596350
## Voter     0.009509042  0.240074805 -0.14302958  0.82974606 -0.02124129
## CARTpr    0.068492072 -0.011719894 -0.08587398  0.10470341  0.11653935
## REAGpr    0.530780934 -0.577071020 -0.20762578 -0.28377347  0.53568667
## ANDRpr    0.608645478 -0.290650915 -0.41257684 -0.01821835  0.44890163
## ERROR     0.024338990 -0.008472752 -0.01838601  0.03440263  0.11591619
##                 CART         REAG         ANDR        Voter       CARTpr
## GROSS     0.4872417079  0.494970233  0.67162175  0.539227662  0.061972883
## CNVHRS    0.5289205165  0.580720836  0.73081345  0.601117012  0.075385332
## MOY      -0.0605461593 -0.031040707 -0.04005342 -0.049516049  0.023108103
## YR       -0.0648538277 -0.158071889 -0.15496363 -0.114676731  0.013876892
## MON      -0.0785749260 -0.167363573 -0.16606701 -0.127012761  0.018917041
## VISIT     0.0885117896  0.102152040  0.17445028  0.110314616  0.014673277
## LST       0.0002887727 -0.002158508 -0.01944907 -0.003579735 -0.015658542
## CPI      -0.0847093877 -0.182979910 -0.18222905 -0.138326331  0.023576956
## POP80     0.9083123185  0.918297549  0.92003327  0.953061089  0.052771524
## HHMEDI   -0.1654098570 -0.061571460 -0.08169022 -0.122756610  0.008482247
## PERCAPI  -0.0331856988  0.043938178  0.07576211  0.009509042  0.068492072
## POVPR     0.2995832425  0.128191333  0.22533339  0.240074805 -0.011719894
## MFGPR    -0.1180361210 -0.132192508 -0.21530117 -0.143029579 -0.085873981
## COLLPR    0.7895565860  0.753706789  0.91256231  0.829746056  0.104703411
## MAGE     -0.0545572399  0.028917962 -0.01596350 -0.021241286  0.116539350
```

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```
## CART      1.0000000000  0.838442336  0.87614868  0.966825716  0.438248310
## REAG      0.8384423357  1.000000000  0.93678262  0.947472097  0.077870004
## ANDR      0.8761486838  0.936782624  1.00000000  0.954669326  0.088024811
## Voter     0.9668257157  0.947472097  0.95466933  1.000000000  0.275234893
## CARTpr    0.4382483102  0.077870004  0.08802481  0.275234893  1.000000000
## REAGpr   -0.3533039998 -0.175327843 -0.28944529 -0.295358227  0.024301842
## ANDRpr   -0.2439996394 -0.181976446 -0.08847272 -0.208743246  0.042950571
## ERROR     0.0014943615  0.054199129  0.07676560  0.031844242 -0.064782167
##                  REAGpr      ANDRpr       ERROR
## GROSS     -0.059890997  0.22154026  0.463989590
## CNVHRS    -0.041457316  0.20028228  0.412669652
## MOY       -0.011422674 -0.04141915  0.102858903
## YR        -0.016506213 -0.06112452  0.052217099
## MON       -0.019172074 -0.07081406  0.074479110
## VISIT      0.020596878  0.17525144  0.049584787
## LST       -0.006889822 -0.03911704 -0.014878046
## CPI       -0.033542358 -0.08919322  0.086952146
## POP80     -0.407943948 -0.31445904  0.013079470
## HHMEDI     0.556552655  0.48322668 -0.009811330
## PERCAPI    0.530780934  0.60864548  0.024338990
## POVPR     -0.577071020 -0.29065091 -0.008472752
## MFGPR     -0.207625775 -0.41257684 -0.018386010
## COLLPR    -0.283773473 -0.01821835  0.034402631
## MAGE       0.535686672  0.44890163  0.115916185
## CART      -0.353304000 -0.24399964  0.001494362
## REAG      -0.175327843 -0.18197645  0.054199129
## ANDR      -0.289445286 -0.08847272  0.076765601
## Voter     -0.295358227 -0.20874325  0.031844242
## CARTpr     0.024301842  0.04295057 -0.064782167
## REAGpr     1.000000000  0.61488144  0.061773512
## ANDRpr     0.614881436  1.00000000  0.148952577
## ERROR      0.061773512  0.14895258  1.000000000
```
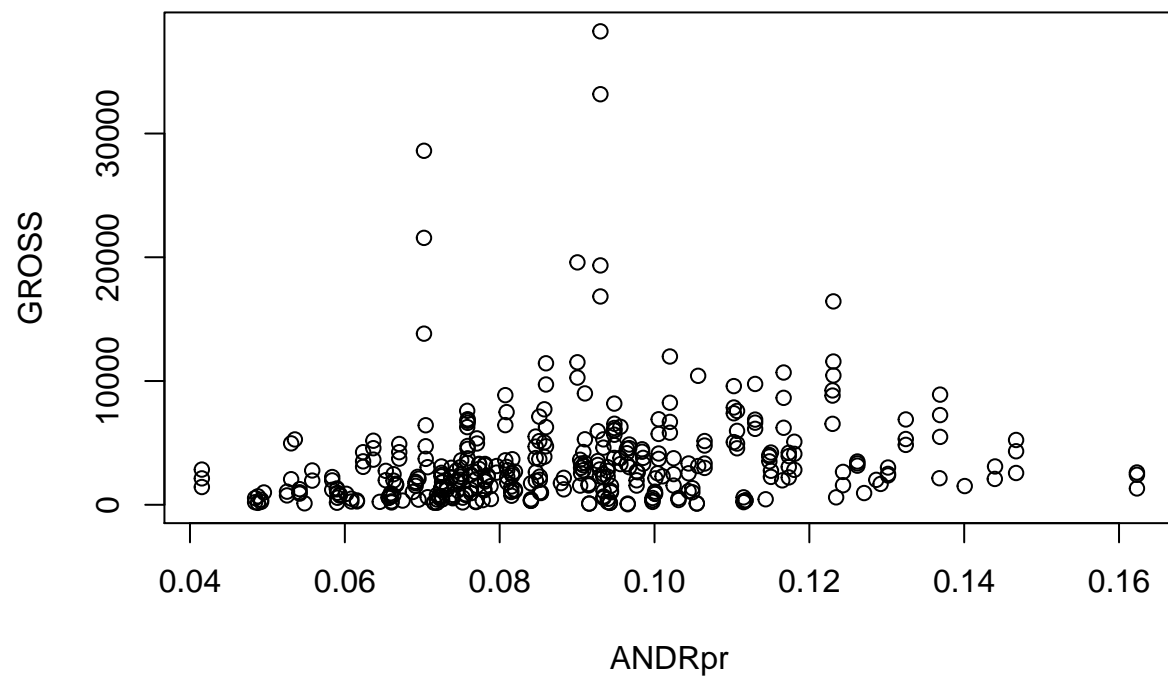
```r
plot(CARTpr,GROSS)
```

```
plot(REAGpr,GROSS)
```
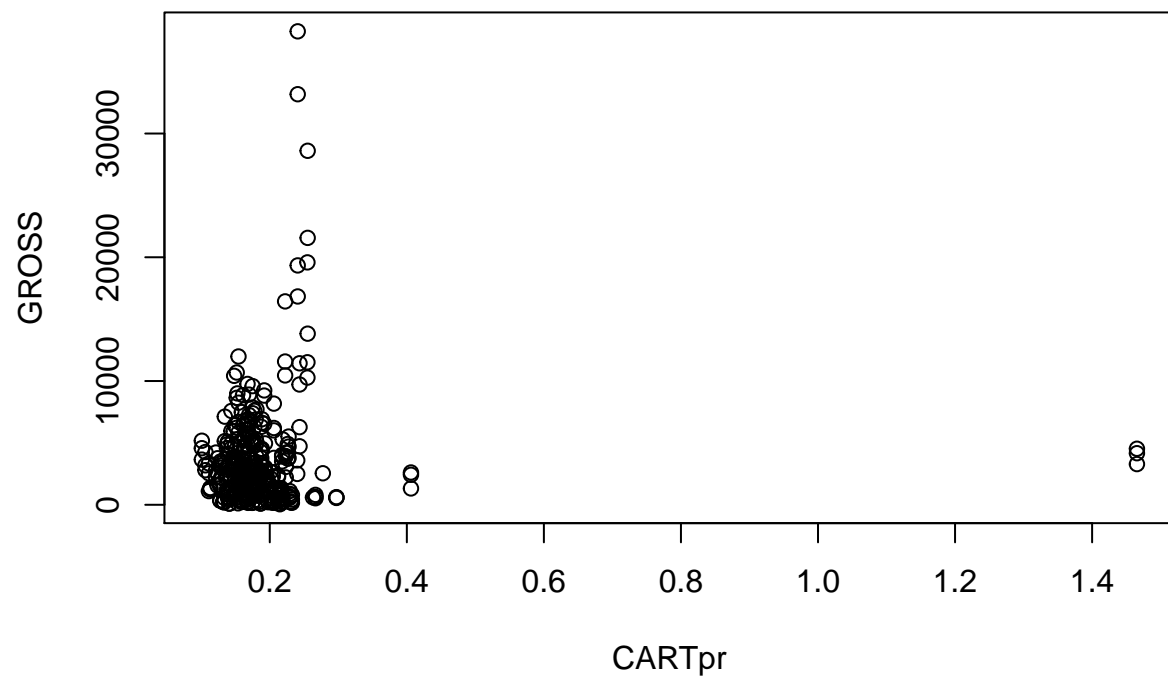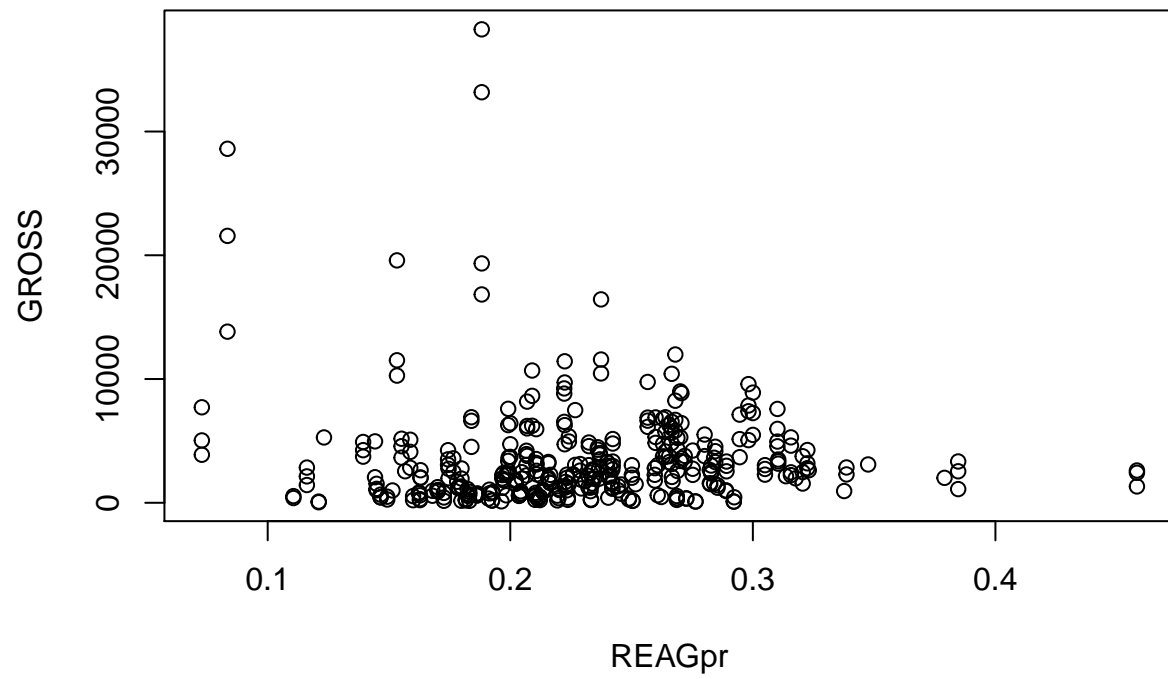
```
plot(ANDRpr,GROSS)
```

```
plot(CARTpr,POP80)
```
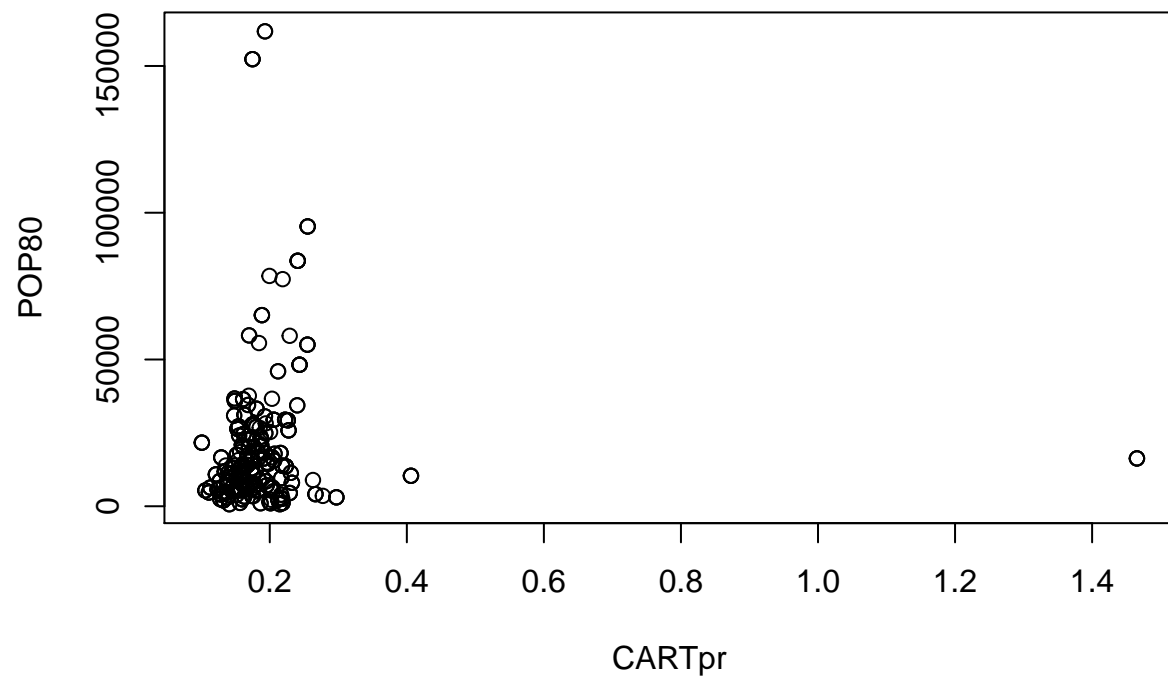
```
plot(REAGpr,POP80)
```
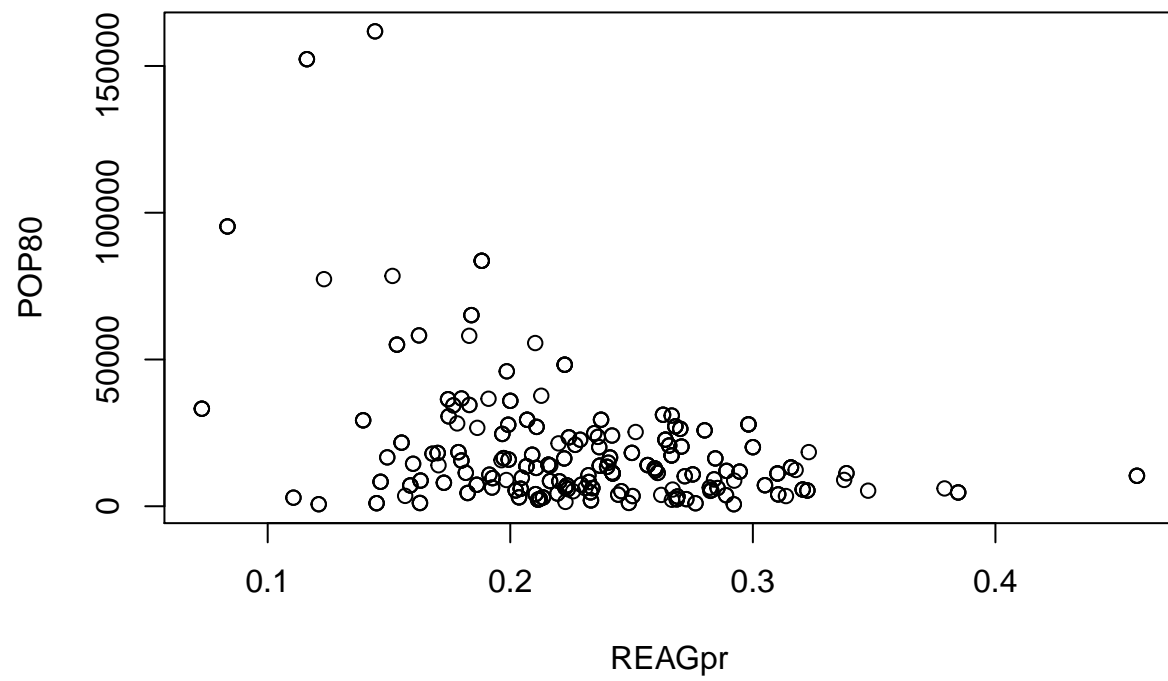
```
plot(ANDRpr,POP80)
```
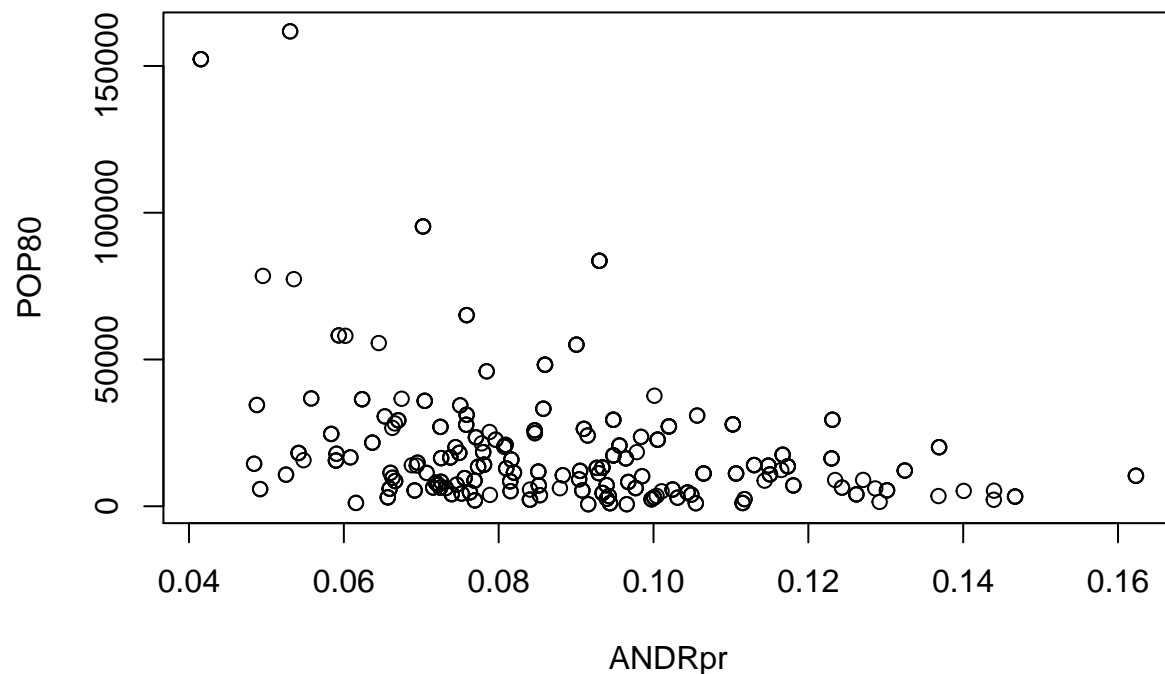
```
model2 <- lm (GROSS ~ COLLPR+POVPR+PERCAPI+ CART +REAG + ANDR + factor(VISIT))
summary(model2)
```

```
##
## Call:
## lm(formula = GROSS ~ COLLPR + POVPR + PERCAPI + CART + REAG +
##     ANDR + factor(VISIT))
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6794.8  -775.4   -65.7   727.1 10508.1
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.445e+03  6.531e+02   2.212 0.027599 *
## COLLPR         4.342e-03  5.504e-04   7.889 3.91e-14 ***
## POVPR         -1.742e+02  3.296e+01  -5.284 2.23e-07 ***
## PERCAPI        3.443e-02  5.856e-02   0.588 0.557018
## CART          -1.578e-01  4.011e-02  -3.934 0.000101 ***
## REAG          -5.725e-01  1.223e-01  -4.680 4.11e-06 ***
## ANDR           1.773e+00  4.597e-01   3.857 0.000136 ***
## factor(VISIT)2 2.164e+02  2.234e+02   0.969 0.333293
## factor(VISIT)3 1.035e+03  2.536e+02   4.080 5.58e-05 ***
## factor(VISIT)4 3.566e+03  4.597e+02   7.758 9.48e-14 ***
## factor(VISIT)5 8.745e+03  1.098e+03   7.966 2.31e-14 ***
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1771 on 351 degrees of freedom
##   (34 observations deleted due to missingness)
## Multiple R-squared:  0.8242, Adjusted R-squared:  0.8192
## F-statistic: 164.5 on 10 and 351 DF,  p-value: < 2.2e-16
```

```
VIF(model2)
```

```
##                     GVIF Df GVIF^(1/(2*Df))
## COLLPR        15.440568  1        3.929449
## POVPR          1.969582  1        1.403418
## PERCAPI        2.004958  1        1.415966
## CART           4.870202  1        2.206853
## REAG          20.166837  1        4.490750
## ANDR          52.300659  1        7.231919
## factor(VISIT)  1.321771  4        1.035487
```

```
data$ERROR <- GROSS - predict(model2,data)
name <- names(data[,3:22])
c = cor(data[,name],use="complete.obs")
c
```

```
##                  GROSS        CNVHRS          MOY          YR          MON
## GROSS    1.000000e+00  0.970312542 -0.019707185  3.816761e-05 -0.004045506
## CNVHRS   9.703125e-01  1.000000000  0.008828027 -1.015354e-01 -0.101541861
## MOY     -1.970718e-02  0.008828027  1.000000000 -1.882620e-01  0.015586180
## YR       3.816761e-05 -0.101535423 -0.188261999  1.000000e+00  0.979065257
## MON     -4.045506e-03 -0.101541861  0.015586180  9.790653e-01  1.000000000
## VISIT    4.714549e-01  0.397322178 -0.064722937  5.782794e-01  0.575322431
## LST      2.092043e-02 -0.043480533 -0.046289985  6.863727e-01  0.689190709
## CPI     -1.933335e-02 -0.118142571  0.054205727  9.473316e-01  0.975696524
## POP80    4.389496e-01  0.488901726 -0.062226439 -8.398052e-02 -0.098395728
## HHMEDI   2.410117e-01  0.229749704 -0.144820038 -1.709204e-01 -0.204025434
## PERCAPI  3.880198e-01  0.380973430 -0.147580529 -1.816646e-01 -0.215536130
## POVPR   -4.915461e-02 -0.055945290  0.022908679  1.589712e-01  0.166593721
## MFGPR   -3.003965e-01 -0.327243840  0.012482319  4.306026e-02  0.046425912
## COLLPR   8.132564e-01  0.842700513 -0.060066494 -1.359970e-01 -0.150905136
## MAGE     5.750895e-02  0.070473846  0.051021561  2.637948e-02  0.037430846
## CART     4.872417e-01  0.528920517 -0.060546159 -6.485383e-02 -0.078574926
## REAG     4.949702e-01  0.580720836 -0.031040707 -1.580719e-01 -0.167363573
## ANDR     6.716217e-01  0.730813454 -0.040053417 -1.549636e-01 -0.166067011
## Voter    5.392277e-01  0.601117012 -0.049516049 -1.146767e-01 -0.127012761
## CARTpr   6.197288e-02  0.075385332  0.023108103  1.387689e-02  0.018917041
##                VISIT           LST          CPI        POP80       HHMEDI
## GROSS     0.47145490  0.0209204317 -0.01933335  0.438949555  0.241011657
## CNVHRS    0.39732218 -0.0434805331 -0.11814257  0.488901726  0.229749704
## MOY      -0.06472294 -0.0462899852  0.05420573 -0.062226439 -0.144820038
## YR        0.57827938  0.6863727252  0.94733162 -0.083980519 -0.170920357
## MON       0.57532243  0.6891907085  0.97569652 -0.098395728 -0.204025434
## VISIT     1.00000000  0.4887824157  0.54527289  0.070194001  0.263152066
## LST       0.48878242  1.0000000000  0.58221856  0.007507782 -0.127920449
```

```
## CPI        0.54527289   0.5822185586   1.00000000  -0.106185650  -0.208713818
## POP80      0.07019400   0.0075077818  -0.10618565   1.000000000  -0.213992474
## HHMEDI     0.26315207  -0.1279204493  -0.20871382  -0.213992474   1.000000000
## PERCAPI    0.31572352  -0.1133947945  -0.22967538  -0.106296100   0.897673269
## POVPR     -0.12993370   0.0813155029   0.16722158   0.350877986  -0.699316429
## MFGPR     -0.10244689  -0.0230735960   0.07458582  -0.070318776  -0.120390993
## COLLPR     0.26263572  -0.0584354448  -0.16349634   0.775930819   0.045320398
## MAGE       0.00675847   0.0680848352   0.01090359  -0.123361483   0.117411732
## CART       0.08851179   0.0002887727  -0.08470939   0.908312319  -0.165409857
## REAG       0.10215204  -0.0021585084  -0.18297991   0.918297549  -0.061571460
## ANDR       0.17445028  -0.0194490703  -0.18222905   0.920033266  -0.081690217
## Voter      0.11031462  -0.0035797348  -0.13832633   0.953061089  -0.122756610
## CARTpr     0.01467328  -0.0156585422   0.02357696   0.052771524   0.008482247
##               PERCAPI        POVPR        MFGPR        COLLPR         MAGE
## GROSS      0.388019786  -0.04915461  -0.30039650   0.81325644   0.05750895
## CNVHRS     0.380973430  -0.05594529  -0.32724384   0.84270051   0.07047385
## MOY       -0.147580529   0.02290868   0.01248232  -0.06006649   0.05102156
## YR        -0.181664645   0.15897116   0.04306026  -0.13599697   0.02637948
## MON       -0.215536130   0.16659372   0.04642591  -0.15090514   0.03743085
## VISIT      0.315723522  -0.12993370  -0.10244689   0.26263572   0.00675847
## LST       -0.113394795   0.08131550  -0.02307360  -0.05843544   0.06808484
## CPI       -0.229675382   0.16722158   0.07458582  -0.16349634   0.01090359
## POP80     -0.106296100   0.35087799  -0.07031878   0.77593082  -0.12336148
## HHMEDI     0.897673269  -0.69931643  -0.12039099   0.04532040   0.11741173
## PERCAPI    1.000000000  -0.56439114  -0.29086075   0.20993512   0.33109676
## POVPR     -0.564391137   1.00000000  -0.12441804   0.19722814  -0.23878392
## MFGPR     -0.290860750  -0.12441804   1.00000000  -0.29099663  -0.33004859
## COLLPR     0.209935121   0.19722814  -0.29099663   1.00000000  -0.06864571
## MAGE       0.331096759  -0.23878392  -0.33004859  -0.06864571   1.00000000
## CART      -0.033185699   0.29958324  -0.11803612   0.78955659  -0.05455724
## REAG       0.043938178   0.12819133  -0.13219251   0.75370679   0.02891796
## ANDR       0.075762113   0.22533339  -0.21530117   0.91256231  -0.01596350
## Voter      0.009509042   0.24007480  -0.14302958   0.82974606  -0.02124129
## CARTpr     0.068492072  -0.01171989  -0.08587398   0.10470341   0.11653935
##                  CART         REAG         ANDR         Voter        CARTpr
## GROSS      0.4872417079   0.494970233   0.67162175   0.539227662   0.061972883
## CNVHRS     0.5289205165   0.580720836   0.73081345   0.601117012   0.075385332
## MOY       -0.0605461593  -0.031040707  -0.04005342  -0.049516049   0.023108103
## YR        -0.0648538277  -0.158071889  -0.15496363  -0.114676731   0.013876892
## MON       -0.0785749260  -0.167363573  -0.16606701  -0.127012761   0.018917041
## VISIT      0.0885117896   0.102152040   0.17445028   0.110314616   0.014673277
## LST        0.0002887727  -0.002158508  -0.01944907  -0.003579735  -0.015658542
## CPI       -0.0847093877  -0.182979910  -0.18222905  -0.138326331   0.023576956
## POP80      0.9083123185   0.918297549   0.92003327   0.953061089   0.052771524
## HHMEDI    -0.1654098570  -0.061571460  -0.08169022  -0.122756610   0.008482247
## PERCAPI   -0.0331856988   0.043938178   0.07576211   0.009509042   0.068492072
## POVPR      0.2995832425   0.128191333   0.22533339   0.240074805  -0.011719894
## MFGPR     -0.1180361210  -0.132192508  -0.21530117  -0.143029579  -0.085873981
## COLLPR     0.7895565860   0.753706789   0.91256231   0.829746056   0.104703411
## MAGE      -0.0545572399   0.028917962  -0.01596350  -0.021241286   0.116539350
## CART       1.0000000000   0.838442336   0.87614868   0.966825716   0.438248310
## REAG       0.8384423357   1.000000000   0.93678262   0.947472097   0.077870004
## ANDR       0.8761486838   0.936782624   1.00000000   0.954669326   0.088024811
## Voter      0.9668257157   0.947472097   0.95466933   1.000000000   0.275234893
```

```
## CARTpr    0.4382483102  0.077870004  0.08802481  0.275234893  1.000000000
```

```
model3 <- lm (GROSS~COLLPR+POVPR+PERCAPI+ REAGpr + CARTpr + ANDRpr+ POP80+ factor(VISIT))
summary(model3)
```

```
##
## Call:
## lm(formula = GROSS ~ COLLPR + POVPR + PERCAPI + REAGpr + CARTpr +
##     ANDRpr + POP80 + factor(VISIT))
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6236.5  -757.3   -98.2   782.4  9884.4
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.225e+03  7.266e+02   1.686 0.092733 .
## COLLPR         6.304e-03  2.692e-04  23.417  < 2e-16 ***
## POVPR         -1.394e+02  3.331e+01  -4.184 3.62e-05 ***
## PERCAPI       -1.684e-01  6.820e-02  -2.469 0.014016 *
## REAGpr        -1.764e+02  2.500e+03  -0.071 0.943778
## CARTpr        -9.822e+02  7.377e+02  -1.331 0.183918
## ANDRpr         2.118e+04  6.365e+03   3.327 0.000969 ***
## POP80         -5.340e-02  7.398e-03  -7.219 3.28e-12 ***
## factor(VISIT)2 2.621e+02  2.173e+02   1.206 0.228624
## factor(VISIT)3 1.067e+03  2.466e+02   4.327 1.97e-05 ***
## factor(VISIT)4 3.637e+03  4.469e+02   8.137 7.17e-15 ***
## factor(VISIT)5 8.480e+03  1.062e+03   7.984 2.05e-14 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1720 on 350 degrees of freedom
##   (34 observations deleted due to missingness)
## Multiple R-squared:  0.8347, Adjusted R-squared:  0.8296
## F-statistic: 160.7 on 11 and 350 DF,  p-value: < 2.2e-16
```

```
VIF(model3)
```

```
##                   GVIF Df GVIF^(1/(2*Df))
## COLLPR        3.918729  1        1.979578
## POVPR         2.134023  1        1.460830
## PERCAPI       2.884769  1        1.698461
## REAGpr        2.546972  1        1.595924
## CARTpr        1.019079  1        1.009495
## ANDRpr        2.440642  1        1.562255
## POP80         3.542470  1        1.882145
## factor(VISIT) 1.316201  4        1.034940
```

```
data$ERROR <- GROSS - predict(model3,data)
name <- names(data[,3:25])
c = cor(data[,name],use="complete.obs")
c
```

```
##                  GROSS        CNVHRS           MOY            YR           MON
## GROSS     1.000000e+00   0.970312542  -0.019707185   3.816761e-05  -0.004045506
## CNVHRS    9.703125e-01   1.000000000   0.008828027  -1.015354e-01  -0.101541861
## MOY      -1.970718e-02   0.008828027   1.000000000  -1.882620e-01   0.015586180
## YR        3.816761e-05  -0.101535423  -0.188261999   1.000000e+00   0.979065257
## MON      -4.045506e-03  -0.101541861   0.015586180   9.790653e-01   1.000000000
## VISIT     4.714549e-01   0.397322178  -0.064722937   5.782794e-01   0.575322431
## LST       2.092043e-02  -0.043480533  -0.046289985   6.863727e-01   0.689190709
## CPI      -1.933335e-02  -0.118142571   0.054205727   9.473316e-01   0.975696524
## POP80     4.389496e-01   0.488901726  -0.062226439  -8.398052e-02  -0.098395728
## HHMEDI    2.410117e-01   0.229749704  -0.144820038  -1.709204e-01  -0.204025434
## PERCAPI   3.880198e-01   0.380973430  -0.147580529  -1.816646e-01  -0.215536130
## POVPR    -4.915461e-02  -0.055945290   0.022908679   1.589712e-01   0.166593721
## MFGPR    -3.003965e-01  -0.327243840   0.012482319   4.306026e-02   0.046425912
## COLLPR    8.132564e-01   0.842700513  -0.060066494  -1.359970e-01  -0.150905136
## MAGE      5.750895e-02   0.070473846   0.051021561   2.637948e-02   0.037430846
## CART      4.872417e-01   0.528920517  -0.060546159  -6.485383e-02  -0.078574926
## REAG      4.949702e-01   0.580720836  -0.031040707  -1.580719e-01  -0.167363573
## ANDR      6.716217e-01   0.730813454  -0.040053417  -1.549636e-01  -0.166067011
## Voter     5.392277e-01   0.601117012  -0.049516049  -1.146767e-01  -0.127012761
## CARTpr    6.197288e-02   0.075385332   0.023108103   1.387689e-02   0.018917041
## REAGpr   -5.989100e-02  -0.041457316  -0.011422674  -1.650621e-02  -0.019172074
## ANDRpr    2.215403e-01   0.200282283  -0.041419152  -6.112452e-02  -0.070814059
## ERROR     4.209706e-01   0.375493781   0.099038214   3.132009e-02   0.052412376
##                  VISIT           LST           CPI         POP80        HHMEDI
## GROSS       0.471454897   0.0209204317  -0.01933335   0.438949555   0.241011657
## CNVHRS      0.397322178  -0.0434805331  -0.11814257   0.488901726   0.229749704
## MOY        -0.064722937  -0.0462899852   0.05420573  -0.062226439  -0.144820038
## YR          0.578279379   0.6863727252   0.94733162  -0.083980519  -0.170920357
## MON         0.575322431   0.6891907085   0.97569652  -0.098395728  -0.204025434
## VISIT       1.000000000   0.4887824157   0.54527289   0.070194001   0.263152066
## LST         0.488782416   1.0000000000   0.58221856   0.007507782  -0.127920449
## CPI         0.545272885   0.5822185586   1.00000000  -0.106185650  -0.208713818
## POP80       0.070194001   0.0075077818  -0.10618565   1.000000000  -0.213992474
## HHMEDI      0.263152066  -0.1279204493  -0.20871382  -0.213992474   1.000000000
## PERCAPI     0.315723522  -0.1133947945  -0.22967538  -0.106296100   0.897673269
## POVPR      -0.129933704   0.0813155029   0.16722158   0.350877986  -0.699316429
## MFGPR      -0.102446890  -0.0230735960   0.07458582  -0.070318776  -0.120390993
## COLLPR      0.262635724  -0.0584354448  -0.16349634   0.775930819   0.045320398
## MAGE        0.006758470   0.0680848352   0.01090359  -0.123361483   0.117411732
## CART        0.088511790   0.0002887727  -0.08470939   0.908312319  -0.165409857
## REAG        0.102152040  -0.0021585084  -0.18297991   0.918297549  -0.061571460
## ANDR        0.174450284  -0.0194490703  -0.18222905   0.920033266  -0.081690217
## Voter       0.110314616  -0.0035797348  -0.13832633   0.953061089  -0.122756610
## CARTpr      0.014673277  -0.0156585422   0.02357696   0.052771524   0.008482247
## REAGpr      0.020596878  -0.0068898220  -0.03354236  -0.407943948   0.556552655
## ANDRpr      0.175251445  -0.0391170442  -0.08919322  -0.314459040   0.483226675
## ERROR       0.005798637  -0.0430668529   0.07060944   0.008494537  -0.017809635
##                PERCAPI         POVPR         MFGPR        COLLPR          MAGE
## GROSS       0.388019786  -0.049154610  -0.30039650   0.81325644   0.05750895
## CNVHRS      0.380973430  -0.055945290  -0.32724384   0.84270051   0.07047385
## MOY        -0.147580529   0.022908679   0.01248232  -0.06006649   0.05102156
## YR         -0.181664645   0.158971159   0.04306026  -0.13599697   0.02637948
## MON        -0.215536130   0.166593721   0.04642591  -0.15090514   0.03743085
```

```
## VISIT    0.315723522 -0.129933704 -0.10244689  0.26263572  0.00675847
## LST     -0.113394795  0.081315503 -0.02307360 -0.05843544  0.06808484
## CPI     -0.229675382  0.167221579  0.07458582 -0.16349634  0.01090359
## POP80   -0.106296100  0.350877986 -0.07031878  0.77593082 -0.12336148
## HHMEDI   0.897673269 -0.699316429 -0.12039099  0.04532040  0.11741173
## PERCAPI  1.000000000 -0.564391137 -0.29086075  0.20993512  0.33109676
## POVPR   -0.564391137  1.000000000 -0.12441804  0.19722814 -0.23878392
## MFGPR   -0.290860750 -0.124418042  1.00000000 -0.29099663 -0.33004859
## COLLPR   0.209935121  0.197228144 -0.29099663  1.00000000 -0.06864571
## MAGE     0.331096759 -0.238783924 -0.33004859 -0.06864571  1.00000000
## CART    -0.033185699  0.299583243 -0.11803612  0.78955659 -0.05455724
## REAG     0.043938178  0.128191333 -0.13219251  0.75370679  0.02891796
## ANDR     0.075762113  0.225333393 -0.21530117  0.91256231 -0.01596350
## Voter    0.009509042  0.240074805 -0.14302958  0.82974606 -0.02124129
## CARTpr   0.068492072 -0.011719894 -0.08587398  0.10470341  0.11653935
## REAGpr   0.530780934 -0.577071020 -0.20762578 -0.28377347  0.53568667
## ANDRpr   0.608645478 -0.290650915 -0.41257684 -0.01821835  0.44890163
## ERROR    0.003941863  0.006819194  0.03447646  0.01773562  0.05871706
##                  CART         REAG         ANDR        Voter       CARTpr
## GROSS    0.4872417079  0.494970233  0.67162175  0.539227662  0.061972883
## CNVHRS   0.5289205165  0.580720836  0.73081345  0.601117012  0.075385332
## MOY     -0.0605461593 -0.031040707 -0.04005342 -0.049516049  0.023108103
## YR      -0.0648538277 -0.158071889 -0.15496363 -0.114676731  0.013876892
## MON     -0.0785749260 -0.167363573 -0.16606701 -0.127012761  0.018917041
## VISIT    0.0885117896  0.102152040  0.17445028  0.110314616  0.014673277
## LST      0.0002887727 -0.002158508 -0.01944907 -0.003579735 -0.015658542
## CPI     -0.0847093877 -0.182979910 -0.18222905 -0.138326331  0.023576956
## POP80    0.9083123185  0.918297549  0.92003327  0.953061089  0.052771524
## HHMEDI  -0.1654098570 -0.061571460 -0.08169022 -0.122756610  0.008482247
## PERCAPI -0.0331856988  0.043938178  0.07576211  0.009509042  0.068492072
## POVPR    0.2995832425  0.128191333  0.22533339  0.240074805 -0.011719894
## MFGPR   -0.1180361210 -0.132192508 -0.21530117 -0.143029579 -0.085873981
## COLLPR   0.7895565860  0.753706789  0.91256231  0.829746056  0.104703411
## MAGE    -0.0545572399  0.028917962 -0.01596350 -0.021241286  0.116539350
## CART     1.0000000000  0.838442336  0.87614868  0.966825716  0.438248310
## REAG     0.8384423357  1.000000000  0.93678262  0.947472097  0.077870004
## ANDR     0.8761486838  0.936782624  1.00000000  0.954669326  0.088024811
## Voter    0.9668257157  0.947472097  0.95466933  1.000000000  0.275234893
## CARTpr   0.4382483102  0.077870004  0.08802481  0.275234893  1.000000000
## REAGpr  -0.3533039998 -0.175327843 -0.28944529 -0.295358227  0.024301842
## ANDRpr  -0.2439996394 -0.181976446 -0.08847272 -0.208743246  0.042950571
## ERROR    0.0256077323  0.032801599  0.04469942  0.032195665  0.003718071
##                REAGpr       ANDRpr        ERROR
## GROSS    -0.059890997  0.22154026  0.420970633
## CNVHRS   -0.041457316  0.20028228  0.375493781
## MOY      -0.011422674 -0.04141915  0.099038214
## YR       -0.016506213 -0.06112452  0.031320093
## MON      -0.019172074 -0.07081406  0.052412376
## VISIT     0.020596878  0.17525144  0.005798637
## LST      -0.006889822 -0.03911704 -0.043066853
## CPI      -0.033542358 -0.08919322  0.070609443
## POP80    -0.407943948 -0.31445904  0.008494537
## HHMEDI    0.556552655  0.48322668 -0.017809635
## PERCAPI   0.530780934  0.60864548  0.003941863
```

```
## POVPR   -0.577071020 -0.29065091  0.006819194
## MFGPR   -0.207625775 -0.41257684  0.034476458
## COLLPR  -0.283773473 -0.01821835  0.017735619
## MAGE     0.535686672  0.44890163  0.058717060
## CART    -0.353304000 -0.24399964  0.025607732
## REAG    -0.175327843 -0.18197645  0.032801599
## ANDR    -0.289445286 -0.08847272  0.044699418
## Voter   -0.295358227 -0.20874325  0.032195665
## CARTpr   0.024301842  0.04295057  0.003718071
## REAGpr   1.000000000  0.61488144 -0.007965893
## ANDRpr   0.614881436  1.00000000  0.002519900
## ERROR   -0.007965893  0.00251990  1.000000000
```

```r
detach(data)
attach(data2)
```

```r
data2$COLLPR <- data2$COLLPR * data2$POP80
#data2$MFGPR <- data2$MFGPR * data2$POP80
#data2$POVPR <- data2$POVPR * data2$POP80
data2$Voter <- data2$CART +data2$REAG +data2$ANDR
data2$CARTpr <- data2$CART/data2$POP80
data2$REAGpr <- data2$REAG/data2$POP80
data2$ANDRpr <- data2$ANDR/data2$POP80
```

```r
data2$Predict <- predict(model3,data2)
summary(data2$Predict)
```

```
##    Min. 1st Qu.  Median   Mean 3rd Qu.    Max.    NA's
## -8576.0   266.9  1122.0  1952.2  2237.9 57289.5      87
```

```r
describe(data2$Predict)
```

```
##    vars   n    mean      sd median trimmed     mad      min      max     range
## X1    1 318 1952.16 4678.73 1122.05 1284.65 1370.48 -8576.03 57289.52 65865.54
##    skew kurtosis      se
## X1 7.17    70.07  262.37
```