Some Simple Reports in R

We will look at some of the summary methods in R. This document will be available as a markdown doc, so you can use this to create MSoffice, pdf or html report files on your own data.

Define datasets

```
data(mtcars)
df <- mtcars
dim(df)
```

```
## [1] 32 11
```

```
library(gmodels)
library(Hmisc)
library(ade4)
library(markdown)
```

```
## Error: there is no package called 'markdown'
```

```
library(knitr)
```

View data

```
View(df)
head(df)
```

```
##                    mpg cyl disp  hp drat    wt  qsec vs am gear carb
## Mazda RX4         21.0   6  160 110 3.90 2.620 16.46  0  1    4    4
## Mazda RX4 Wag     21.0   6  160 110 3.90 2.875 17.02  0  1    4    4
## Datsun 710        22.8   4  108  93 3.85 2.320 18.61  1  1    4    1
## Hornet 4 Drive    21.4   6  258 110 3.08 3.215 19.44  1  0    3    1
## Hornet Sportabout 18.7   8  360 175 3.15 3.440 17.02  0  0    3    2
## Valiant           18.1   6  225 105 2.76 3.460 20.22  1  0    3    1
```

```
tail(df)
```

```
##                 mpg cyl  disp  hp drat    wt qsec vs am gear carb
## Porsche 914-2  26.0   4 120.3  91 4.43 2.140 16.7  0  1    5    2
## Lotus Europa   30.4   4  95.1 113 3.77 1.513 16.9  1  1    5    2
## Ford Pantera L 15.8   8 351.0 264 4.22 3.170 14.5  0  1    5    4
## Ferrari Dino   19.7   6 145.0 175 3.62 2.770 15.5  0  1    5    6
## Maserati Bora  15.0   8 301.0 335 3.54 3.570 14.6  0  1    5    8
## Volvo 142E     21.4   4 121.0 109 4.11 2.780 18.6  1  1    4    2
```

```
str(df)
```

```
## 'data.frame':    32 obs. of  11 variables:
##  $ mpg : num  21 21 22.8 21.4 18.7 18.1 14.3 24.4 22.8 19.2 ...
```

```
##  $ cyl : num  6 6 4 6 8 6 8 4 4 6 ...
##  $ disp: num  160 160 108 258 360 ...
##  $ hp  : num  110 110 93 110 175 105 245 62 95 123 ...
##  $ drat: num  3.9 3.9 3.85 3.08 3.15 2.76 3.21 3.69 3.92 3.92 ...
##  $ wt  : num  2.62 2.88 2.32 3.21 3.44 ...
##  $ qsec: num  16.5 17 18.6 19.4 17 ...
##  $ vs  : num  0 0 1 1 0 1 0 1 1 1 ...
##  $ am  : num  1 1 1 0 0 0 0 0 0 0 ...
##  $ gear: num  4 4 4 3 3 3 3 4 4 4 ...
##  $ carb: num  4 4 1 1 2 1 4 2 2 4 ...
```

Basic Summary

```
summary(df)
```

```
##       mpg             cyl             disp             hp       
##  Min.   :10.4   Min.   :4.00   Min.   : 71.1   Min.   : 52.0  
##  1st Qu.:15.4   1st Qu.:4.00   1st Qu.:120.8   1st Qu.: 96.5  
##  Median :19.2   Median :6.00   Median :196.3   Median :123.0  
##  Mean   :20.1   Mean   :6.19   Mean   :230.7   Mean   :146.7  
##  3rd Qu.:22.8   3rd Qu.:8.00   3rd Qu.:326.0   3rd Qu.:180.0  
##  Max.   :33.9   Max.   :8.00   Max.   :472.0   Max.   :335.0  
##       drat             wt             qsec             vs        
##  Min.   :2.76   Min.   :1.51   Min.   :14.5   Min.   :0.000  
##  1st Qu.:3.08   1st Qu.:2.58   1st Qu.:16.9   1st Qu.:0.000  
##  Median :3.69   Median :3.33   Median :17.7   Median :0.000  
##  Mean   :3.60   Mean   :3.22   Mean   :17.8   Mean   :0.438  
##  3rd Qu.:3.92   3rd Qu.:3.61   3rd Qu.:18.9   3rd Qu.:1.000  
##  Max.   :4.93   Max.   :5.42   Max.   :22.9   Max.   :1.000  
##        am              gear            carb      
##  Min.   :0.000   Min.   :3.00   Min.   :1.00  
##  1st Qu.:0.000   1st Qu.:3.00   1st Qu.:2.00  
##  Median :0.000   Median :4.00   Median :2.00  
##  Mean   :0.406   Mean   :3.69   Mean   :2.81  
##  3rd Qu.:1.000   3rd Qu.:4.00   3rd Qu.:4.00  
##  Max.   :1.000   Max.   :5.00   Max.   :8.00
```

Using the describe function

```
library(Hmisc)
describe(df)
```

```
## df
##
##  11  Variables      32  Observations
## ---------------------------------------------------------------------------
-
## mpg
##       n missing  unique    Mean     .05     .10     .25     .50     .75
##      32       0      25   20.09   12.00   14.34   15.43   19.20   22.80
##     .90     .95
```

```
##   30.09   31.30
##
## lowest : 10.4 13.3 14.3 14.7 15.0, highest: 26.0 27.3 30.4 32.4 33.9
## ------------------------------------------------------------------------
-
## cyl
##       n missing  unique    Mean
##      32       0       3   6.188
##
## 4 (11, 34%), 6 (7, 22%), 8 (14, 44%)
## ------------------------------------------------------------------------
-
## disp
##       n missing  unique    Mean     .05     .10     .25     .50     .75
##      32       0      27   230.7   77.35   80.61  120.83  196.30  326.00
##     .90     .95
##  396.00  449.00
##
## lowest :  71.1  75.7  78.7  79.0  95.1
## highest: 360.0 400.0 440.0 460.0 472.0
## ------------------------------------------------------------------------
-
## hp
##       n missing  unique    Mean     .05     .10     .25     .50     .75
##      32       0      22   146.7   63.65   66.00   96.50  123.00  180.00
##     .90     .95
##  243.50  253.55
##
## lowest :  52  62  65  66  91, highest: 215 230 245 264 335
## ------------------------------------------------------------------------
-
## drat
##       n missing  unique    Mean     .05     .10     .25     .50     .75
##      32       0      22   3.597   2.853   3.007   3.080   3.695   3.920
##     .90     .95
##   4.209   4.314
##
## lowest : 2.76 2.93 3.00 3.07 3.08, highest: 4.08 4.11 4.22 4.43 4.93
## ------------------------------------------------------------------------
-
## wt
##       n missing  unique    Mean     .05     .10     .25     .50     .75
##      32       0      29   3.217   1.736   1.956   2.581   3.325   3.610
##     .90     .95
##   4.048   5.293
##
## lowest : 1.513 1.615 1.835 1.935 2.140
## highest: 3.845 4.070 5.250 5.345 5.424
## ------------------------------------------------------------------------
-
```

```
## qsec
##       n missing  unique    Mean     .05     .10     .25     .50     .75
##      32       0      30   17.85   15.05   15.53   16.89   17.71   18.90
##     .90     .95
##   19.99   20.10
##
## lowest : 14.50 14.60 15.41 15.50 15.84
## highest: 19.90 20.00 20.01 20.22 22.90
## ------------------------------------------------------------------------
-
## vs
##       n missing  unique     Sum    Mean
##      32       0       2      14  0.4375
## ------------------------------------------------------------------------
-
## am
##       n missing  unique     Sum    Mean
##      32       0       2      13  0.4062
## ------------------------------------------------------------------------
-
## gear
##       n missing  unique    Mean
##      32       0       3   3.688
##
## 3 (15, 47%), 4 (12, 38%), 5 (5, 16%)
## ------------------------------------------------------------------------
-
## carb
##       n missing  unique    Mean
##      32       0       6   2.812
##
##            1  2 3  4 6 8
## Frequency  7 10 3 10 1 1
## %         22 31 9 31 3 3
## ------------------------------------------------------------------------
-
```

1,2 and 3-way Cross Tabulations

```
table(df$cyl)
```

```
##
##  4  6  8
## 11  7 14
```

```
table(df$cyl, df$gear)
```

```
##
##      3  4  5
##   4  1  8  2
##   6  2  4  1
##   8 12  0  2
```

```
# Number of cyclinders, numbers of gear, transmission type
table(df$cyl, df$gear, df$am)
```

```
## , ,  = 0
##
##
##      3  4  5
##   4  1  2  0
##   6  2  2  0
##   8 12  0  0
##
## , ,  = 1
##
##
##      3  4  5
##   4  0  6  2
##   6  0  2  1
##   8  0  0  2
##
```

Crosstabulation using formula format

```
xtabs(cyl ~ gear, df)
```

```
## gear
##   3   4   5
## 112  56  30
```

```
xtabs(cyl ~ gear + am + vs, df)
```

```
## , , vs = 0
##
##     am
## gear  0  1
##    3 96  0
##    4  0 12
```

```
##    5  0 26
##
## , , vs = 1
##
##     am
## gear  0  1
##    3 16  0
##    4 20 24
##    5  0  4
##
```

Create Contingency Table

```
`?`(ftable)
ftable(df$cyl, df$vs, df$am, df$gear, row.vars = c(2, 4), dnn =
c("Cylinders",
    "V/S", "Transmission", "Gears"))
```

```
##           Cylinders     4     6     8
##           Transmission  0  1  0  1  0  1
## V/S Gears
## 0   3                   0  0  0  0 12  0
##     4                   0  0  0  2  0  0
##     5                   0  1  0  1  0  2
## 1   3                   1  0  2  0  0  0
##     4                   2  6  2  0  0  0
##     5                   0  1  0  0  0  0
```

```
ftable(df$cyl, df$vs, df$am, df$gear, row.vars = c(2, 3), dnn =
c("Cylinders",
    "V/S", "Transmission", "Gears"))
```

```
##                 Cylinders  4        6        8
##                 Gears      3  4  5  3  4  5  3  4  5
## V/S Transmission
## 0   0                      0  0  0  0  0  0 12  0  0
##     1                      0  0  1  0  2  1  0  0  2
## 1   0                      1  2  0  2  2  0  0  0  0
##     1                      0  6  1  0  0  0  0  0  0
```

2 way cross tabulation in SAS format

```
library(gmodels)
CrossTable(df$cyl, df$gear, format = "SAS")
```

```
##
##
##    Cell Contents
## |-------------------------|
## |                       N |
## | Chi-square contribution |
## |           N / Row Total |
## |           N / Col Total |
## |         N / Table Total |
## |-------------------------|
##
##
## Total Observations in Table:  32
##
##
##              | df$gear
##       df$cyl |         3 |         4 |         5 | Row Total |
## -------------|-----------|-----------|-----------|-----------|
##            4 |         1 |         8 |         2 |        11 |
##              |     3.350 |     3.640 |     0.046 |           |
##              |     0.091 |     0.727 |     0.182 |     0.344 |
##              |     0.067 |     0.667 |     0.400 |           |
##              |     0.031 |     0.250 |     0.062 |           |
## -------------|-----------|-----------|-----------|-----------|
##            6 |         2 |         4 |         1 |         7 |
##              |     0.500 |     0.720 |     0.008 |           |
##              |     0.286 |     0.571 |     0.143 |     0.219 |
##              |     0.133 |     0.333 |     0.200 |           |
##              |     0.062 |     0.125 |     0.031 |           |
## -------------|-----------|-----------|-----------|-----------|
##            8 |        12 |         0 |         2 |        14 |
##              |     4.505 |     5.250 |     0.016 |           |
##              |     0.857 |     0.000 |     0.143 |     0.438 |
##              |     0.800 |     0.000 |     0.400 |           |
##              |     0.375 |     0.000 |     0.062 |           |
## -------------|-----------|-----------|-----------|-----------|
## Column Total |        15 |        12 |         5 |        32 |
##              |     0.469 |     0.375 |     0.156 |           |
## -------------|-----------|-----------|-----------|-----------|
##
##
```

```
CrossTable(df$cyl, df$gear, expected = TRUE, format = "SAS")
```

```
## Warning: Chi-squared approximation may be incorrect
```

```
##
##
##    Cell Contents
## |-------------------------|
## |                       N |
## |              Expected N |
## | Chi-square contribution |
## |           N / Row Total |
## |           N / Col Total |
## |         N / Table Total |
## |-------------------------|
##
##
## Total Observations in Table:  32
##
##
##              | df$gear
##       df$cyl |         3 |         4 |         5 | Row Total |
## -------------|-----------|-----------|-----------|-----------|
##            4 |         1 |         8 |         2 |        11 |
##              |     5.156 |     4.125 |     1.719 |           |
##              |     3.350 |     3.640 |     0.046 |           |
##              |     0.091 |     0.727 |     0.182 |     0.344 |
##              |     0.067 |     0.667 |     0.400 |           |
##              |     0.031 |     0.250 |     0.062 |           |
## -------------|-----------|-----------|-----------|-----------|
##            6 |         2 |         4 |         1 |         7 |
##              |     3.281 |     2.625 |     1.094 |           |
##              |     0.500 |     0.720 |     0.008 |           |
##              |     0.286 |     0.571 |     0.143 |     0.219 |
##              |     0.133 |     0.333 |     0.200 |           |
##              |     0.062 |     0.125 |     0.031 |           |
## -------------|-----------|-----------|-----------|-----------|
##            8 |        12 |         0 |         2 |        14 |
##              |     6.562 |     5.250 |     2.188 |           |
##              |     4.505 |     5.250 |     0.016 |           |
##              |     0.857 |     0.000 |     0.143 |     0.438 |
##              |     0.800 |     0.000 |     0.400 |           |
##              |     0.375 |     0.000 |     0.062 |           |
## -------------|-----------|-----------|-----------|-----------|
## Column Total |        15 |        12 |         5 |        32 |
##              |     0.469 |     0.375 |     0.156 |           |
## -------------|-----------|-----------|-----------|-----------|
##
##
## Statistics for All Table Factors
```

```
##
##
## Pearson's Chi-squared test
## ------------------------------------------------------------
## Chi^2 =  18.04     d.f. =  4     p =  0.001214
##
##
##
```

2 way cross tabulation in SPSS format

```
library(gmodels)
CrossTable(df$cyl, df$gear, format = "SPSS")
```

```
##
##    Cell Contents
## |-------------------------|
## |                   Count |
## | Chi-square contribution |
## |             Row Percent |
## |          Column Percent |
## |           Total Percent |
## |-------------------------|
##
## Total Observations in Table:  32
##
##              | df$gear
##       df$cyl |         3 |         4 |         5 | Row Total |
## -------------|-----------|-----------|-----------|-----------|
##            4 |         1 |         8 |         2 |        11 |
##              |     3.350 |     3.640 |     0.046 |           |
##              |     9.091% |    72.727% |    18.182% |    34.375% |
##              |     6.667% |    66.667% |    40.000% |           |
##              |     3.125% |    25.000% |     6.250% |           |
## -------------|-----------|-----------|-----------|-----------|
##            6 |         2 |         4 |         1 |         7 |
##              |     0.500 |     0.720 |     0.008 |           |
##              |    28.571% |    57.143% |    14.286% |    21.875% |
##              |    13.333% |    33.333% |    20.000% |           |
##              |     6.250% |    12.500% |     3.125% |           |
## -------------|-----------|-----------|-----------|-----------|
##            8 |        12 |         0 |         2 |        14 |
##              |     4.505 |     5.250 |     0.016 |           |
##              |    85.714% |     0.000% |    14.286% |    43.750% |
##              |    80.000% |     0.000% |    40.000% |           |
##              |    37.500% |     0.000% |     6.250% |           |
## -------------|-----------|-----------|-----------|-----------|
## Column Total |        15 |        12 |         5 |        32 |
##              |    46.875% |    37.500% |    15.625% |           |
## -------------|-----------|-----------|-----------|-----------|
##
##
```

```
CrossTable(df$cyl, df$gear, expected = TRUE, format = "SPSS")
```

```
## Warning: Chi-squared approximation may be incorrect
```

```
##
##    Cell Contents
## |-------------------------|
```

```
## |                   Count |
## |         Expected Values |
## | Chi-square contribution |
## |             Row Percent |
## |          Column Percent |
## |           Total Percent |
## |-------------------------|
##
## Total Observations in Table:  32
##
##              | df$gear
##       df$cyl |         3  |         4  |         5  | Row Total  |
## -------------|------------|------------|------------|------------|
##            4 |         1  |         8  |         2  |        11  |
##              |     5.156  |     4.125  |     1.719  |            |
##              |     3.350  |     3.640  |     0.046  |            |
##              |     9.091% |    72.727% |    18.182% |    34.375% |
##              |     6.667% |    66.667% |    40.000% |            |
##              |     3.125% |    25.000% |     6.250% |            |
## -------------|------------|------------|------------|------------|
##            6 |         2  |         4  |         1  |         7  |
##              |     3.281  |     2.625  |     1.094  |            |
##              |     0.500  |     0.720  |     0.008  |            |
##              |    28.571% |    57.143% |    14.286% |    21.875% |
##              |    13.333% |    33.333% |    20.000% |            |
##              |     6.250% |    12.500% |     3.125% |            |
## -------------|------------|------------|------------|------------|
##            8 |        12  |         0  |         2  |        14  |
##              |     6.562  |     5.250  |     2.188  |            |
##              |     4.505  |     5.250  |     0.016  |            |
##              |    85.714% |     0.000% |    14.286% |    43.750% |
##              |    80.000% |     0.000% |    40.000% |            |
##              |    37.500% |     0.000% |     6.250% |            |
## -------------|------------|------------|------------|------------|
## Column Total |        15  |        12  |         5  |        32  |
##              |    46.875% |    37.500% |    15.625% |            |
## -------------|------------|------------|------------|------------|
##
##
## Statistics for All Table Factors
##
##
## Pearson's Chi-squared test
## ------------------------------------------------------------
## Chi^2 =  18.04     d.f. =  4     p =  0.001214
##
##
##
##        Minimum expected frequency: 1.094
```

```
## Cells with Expected Frequency < 5: 6 of 9 (66.67%)
##
```

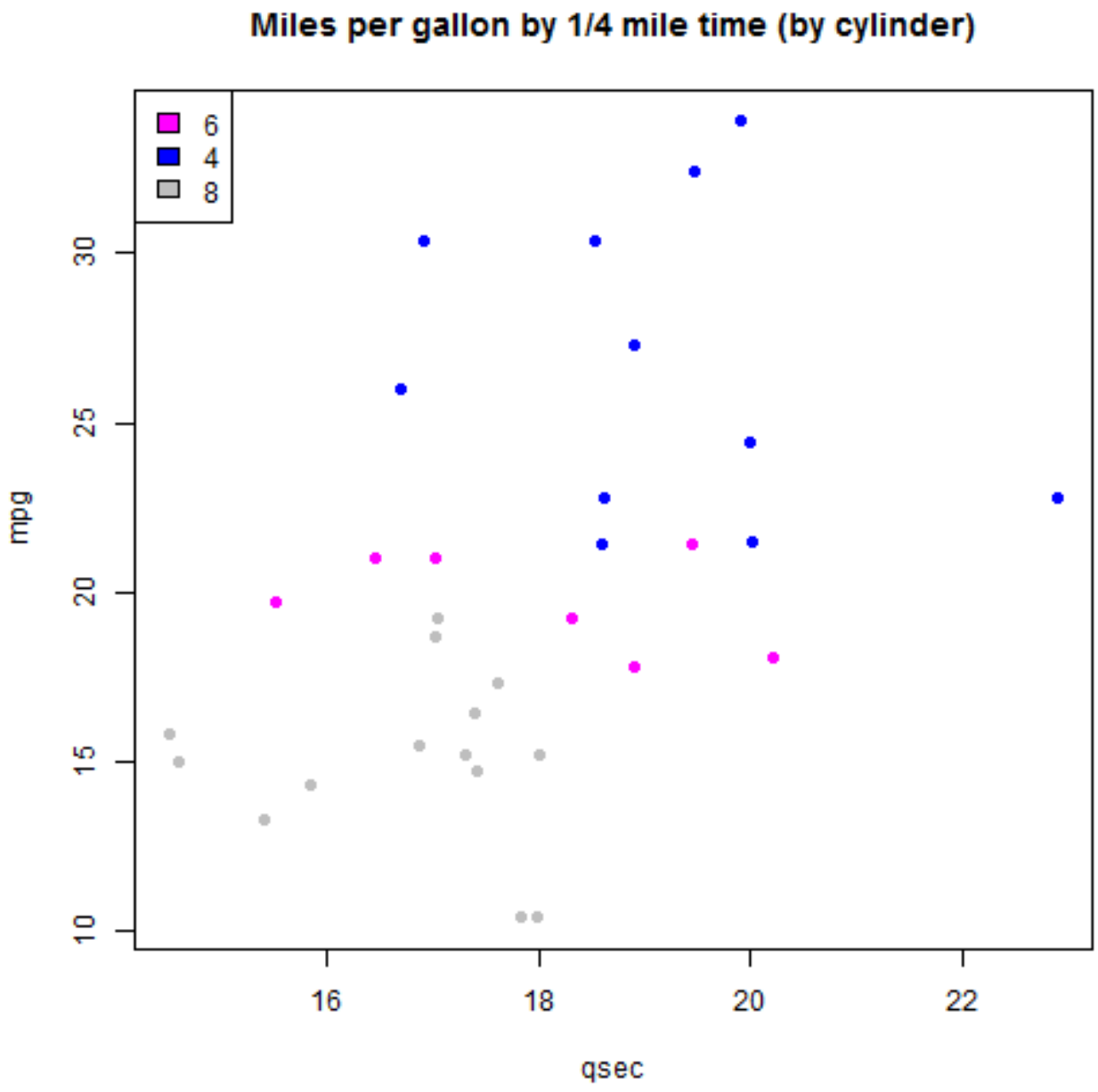
Categorical Data

The library *vcd* is very useful

Some Plots for Exploring Data

- scatterplot

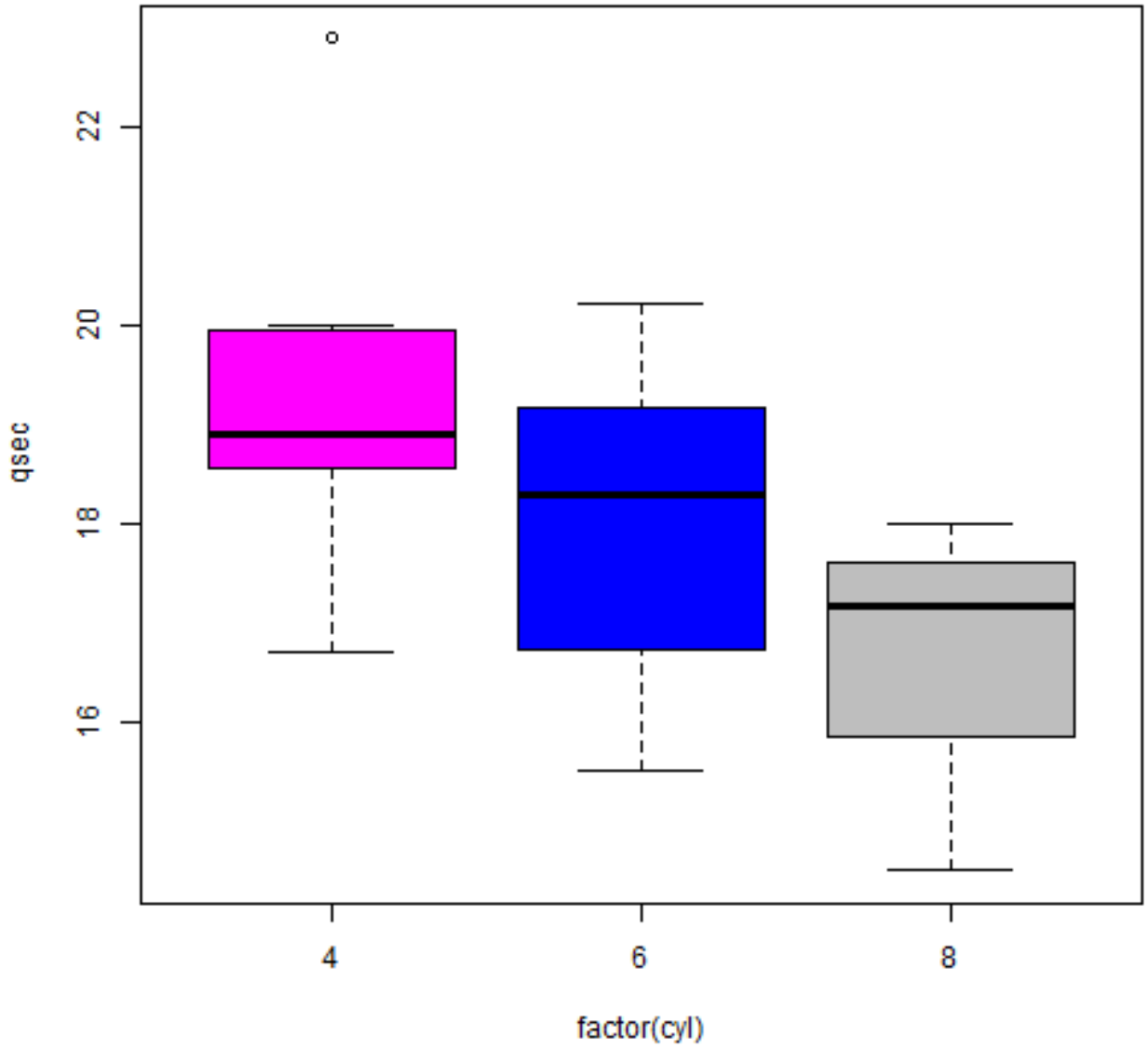
```
attach(df)

plot(qsec, mpg, col = cyl, pch = 19, main = "Miles per gallon by 1/4 mile
time (by cylinder)")
legend("topleft", legend = unique(cyl), fill = unique(cyl))
```



plot of chunk scatterplot

- boxplot

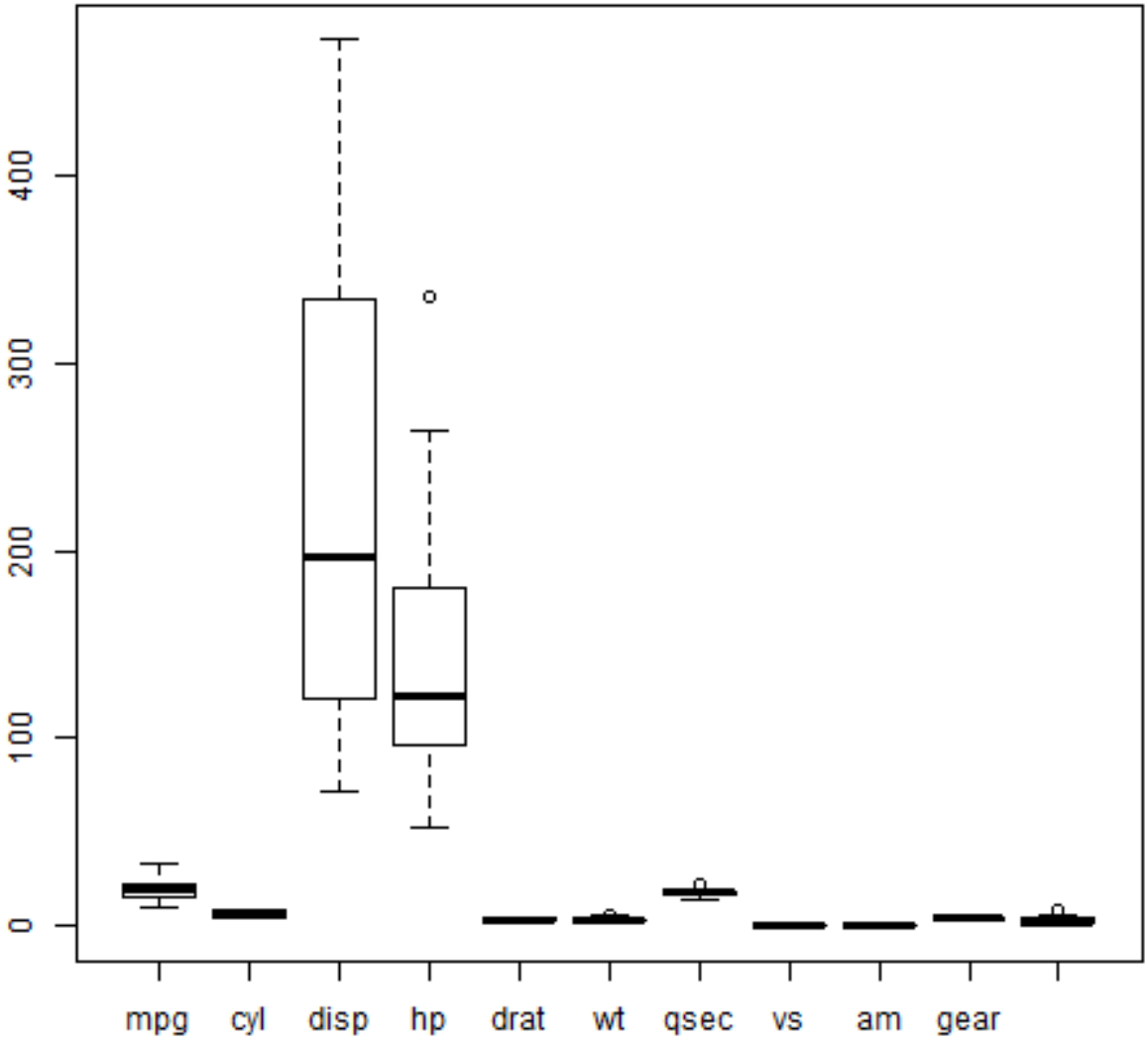
```
plot(qsec ~ factor(cyl), col = unique(cyl))
```



plot of chunk boxplot

- boxplot all of the columns

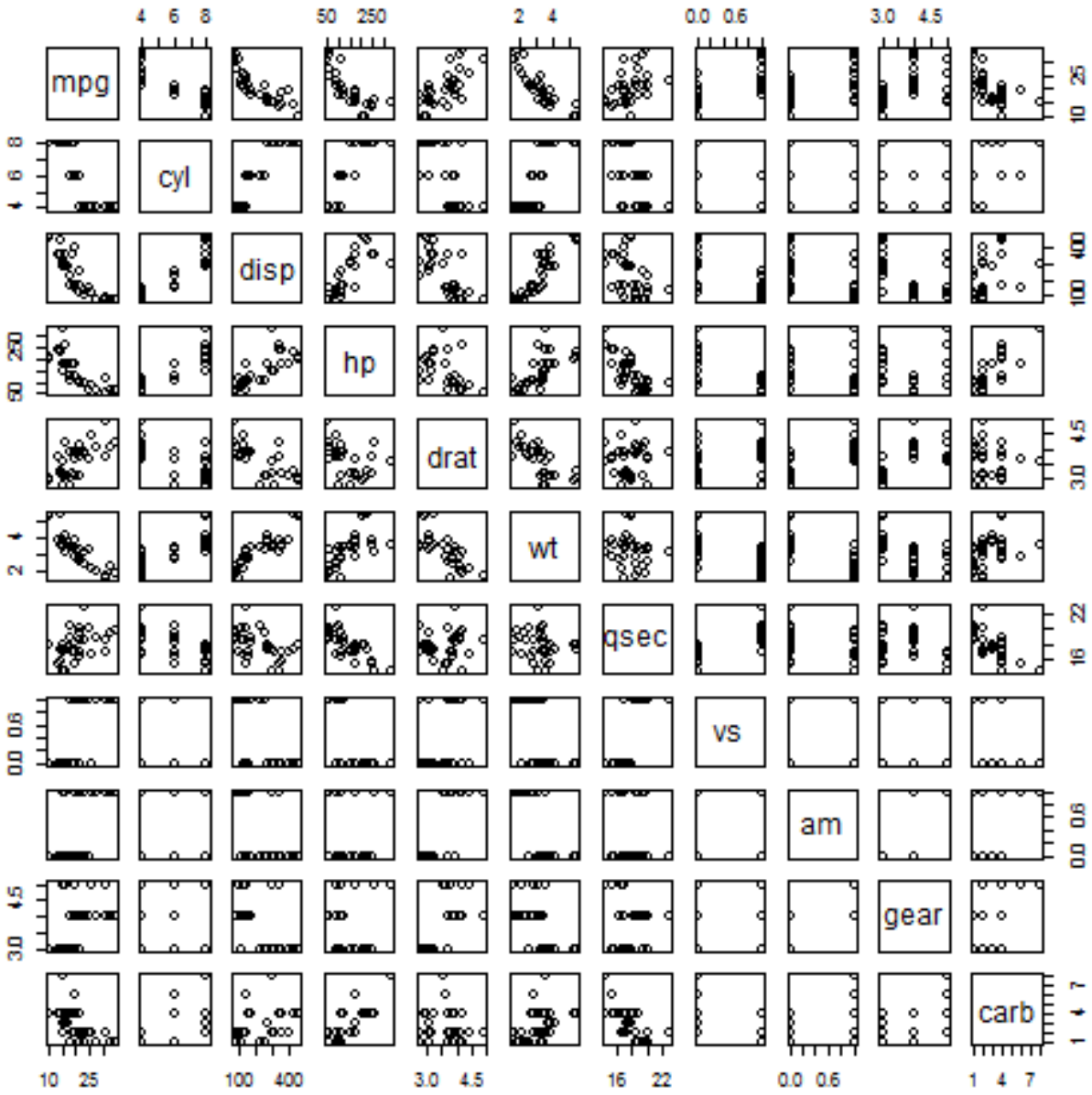
```
boxplot(df)
```



plot of chunk boxplotALL

- Correlation across

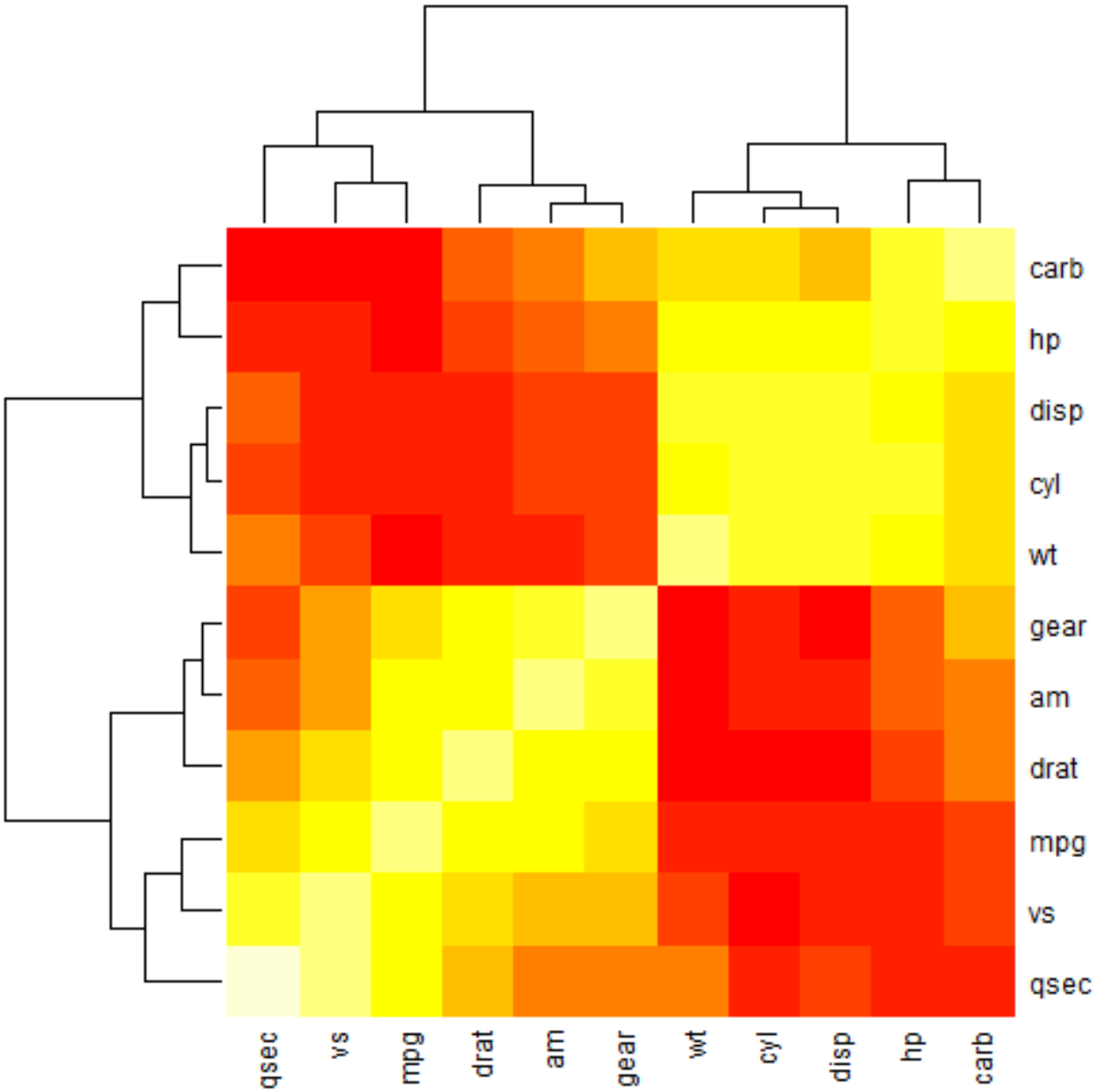
```
plot(df)
```



plot of chunk pairs

Or calculate correlation and view on heatmap

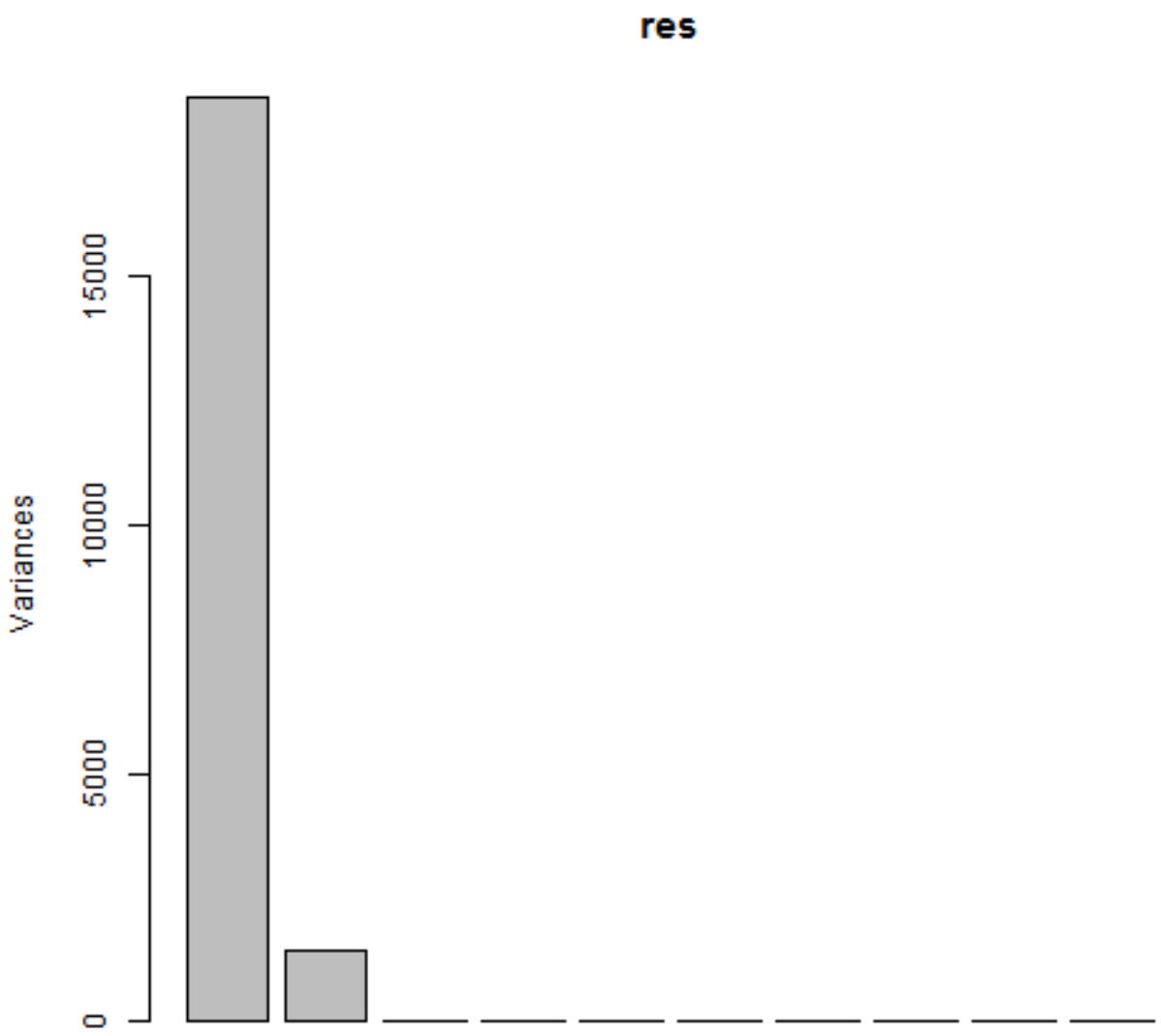
```
heatmap(cor(df))
```



plot of chunk heatmap

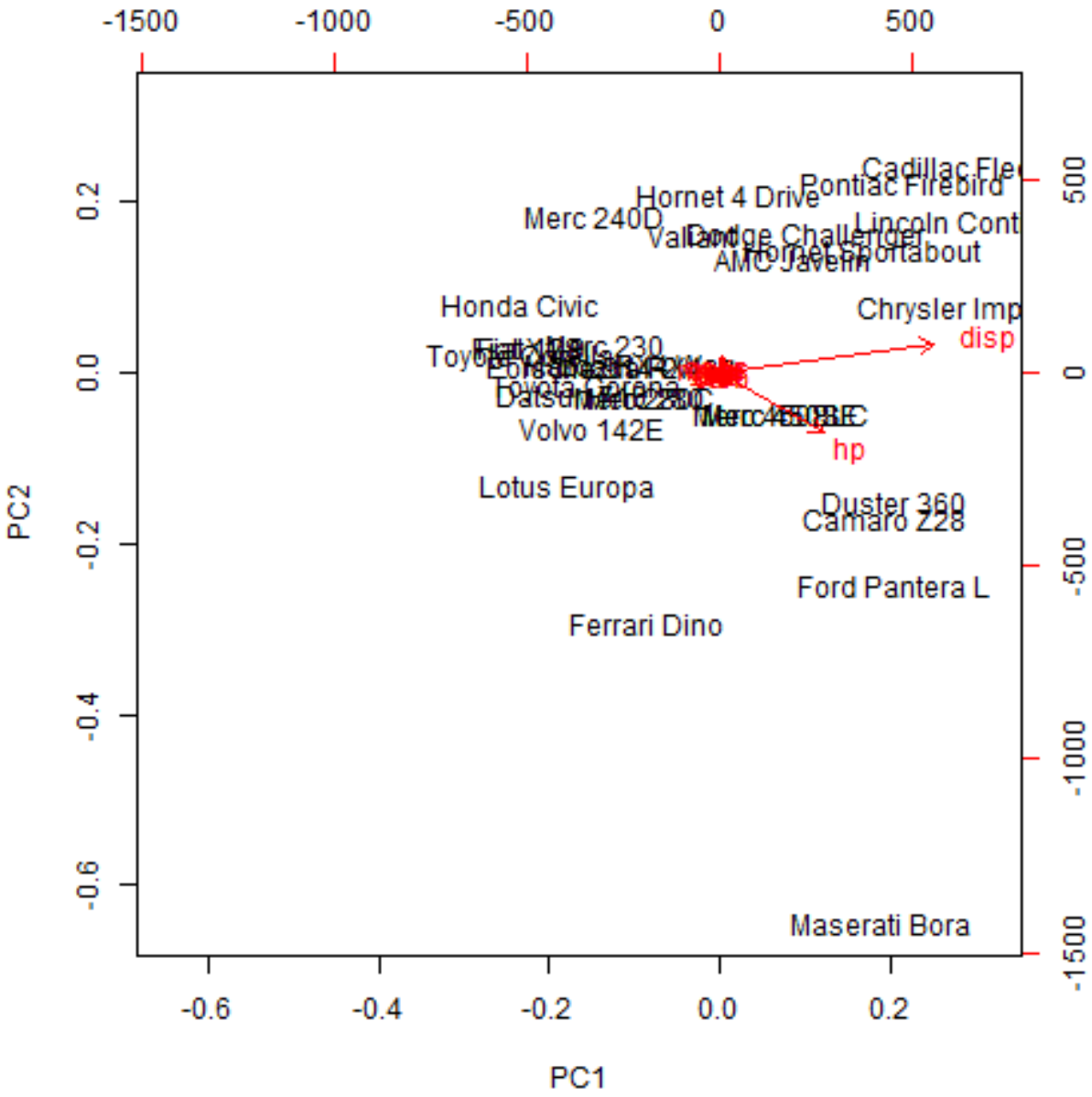
Basic principal component analysis

```
res <- prcomp(df)
screeplot(res)
```



plot of chunk prcomp

```
biplot(res)
```

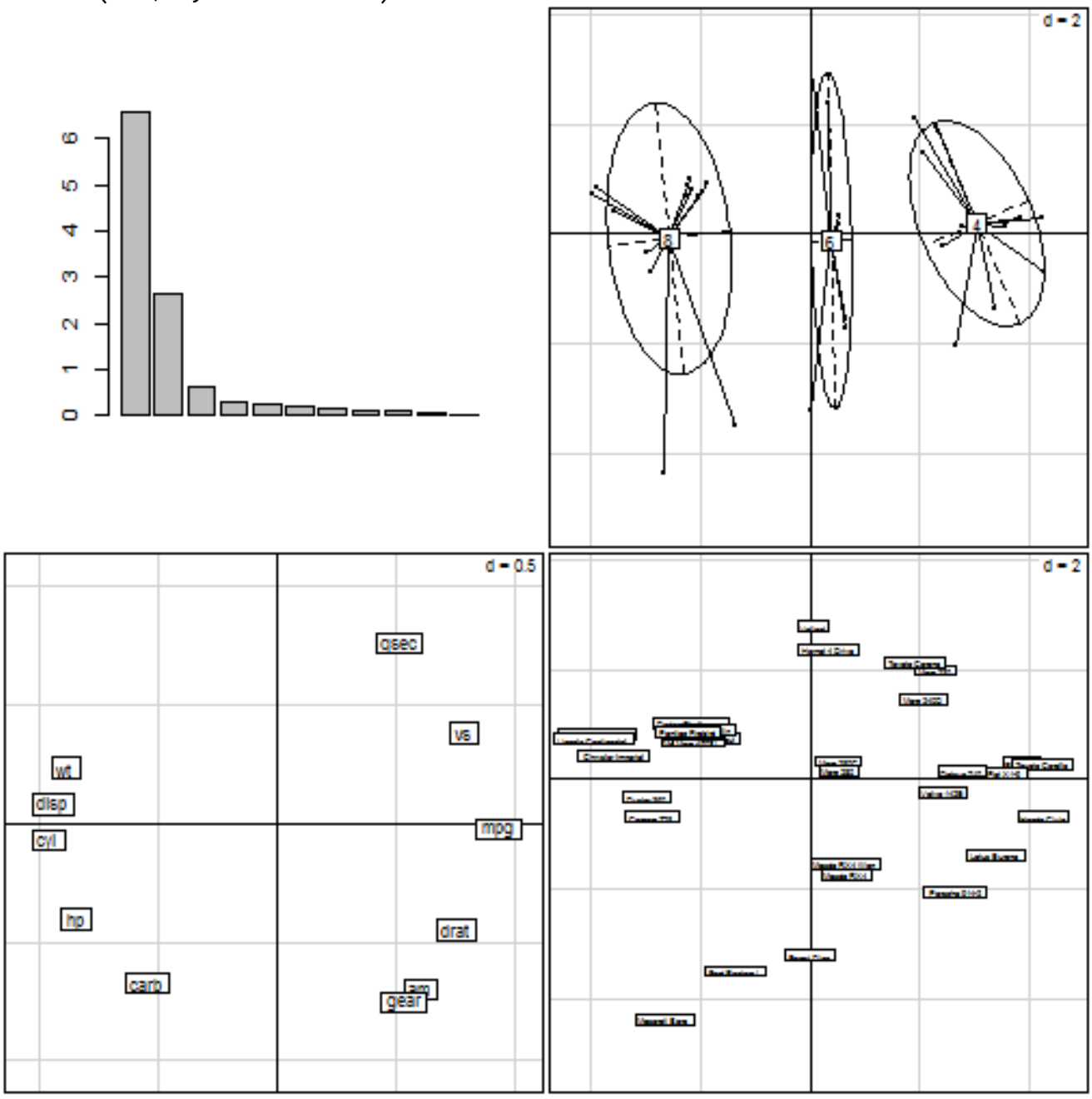


plot of chunk prcomp

Or using fast.prcomp (optimized for big wide datasets)

```
res <- fast.prcomp(df)
```

```
library(ade4)
res <- dudi.pca(df, scan = FALSE)
par(mfrow = c(2, 2))
barplot(res$eig)

s.class(res$li, factor(cyl))
s.label(res$co)
s.label(res$li, clabel = 0.5)
```



plot of chunk dudi.pca

Missing Data

```
df[sample(1:nrow(df), 2), sample(1:ncol(df), 2)] <- NA
summary(df)
```

```
##       mpg             cyl             disp             hp       
##  Min.   :10.4   Min.   :4.00   Min.   : 71.1   Min.   : 52.0  
##  1st Qu.:15.3   1st Qu.:4.00   1st Qu.:125.4   1st Qu.: 96.5  
##  Median :18.9   Median :6.00   Median :196.3   Median :123.0  
##  Mean   :20.1   Mean   :6.19   Mean   :228.7   Mean   :146.7  
##  3rd Qu.:22.8   3rd Qu.:8.00   3rd Qu.:314.5   3rd Qu.:180.0  
##  Max.   :33.9   Max.   :8.00   Max.   :472.0   Max.   :335.0  
##  NA's   :2                     NA's   :2                      
##       drat             wt             qsec             vs        
##  Min.   :2.76   Min.   :1.51   Min.   :14.5   Min.   :0.000  
##  1st Qu.:3.08   1st Qu.:2.58   1st Qu.:16.9   1st Qu.:0.000  
##  Median :3.69   Median :3.33   Median :17.7   Median :0.000  
##  Mean   :3.60   Mean   :3.22   Mean   :17.8   Mean   :0.438  
##  3rd Qu.:3.92   3rd Qu.:3.61   3rd Qu.:18.9   3rd Qu.:1.000  
##  Max.   :4.93   Max.   :5.42   Max.   :22.9   Max.   :1.000  
##                                                             
##        am              gear            carb      
##  Min.   :0.000   Min.   :3.00   Min.   :1.00  
##  1st Qu.:0.000   1st Qu.:3.00   1st Qu.:2.00  
##  Median :0.000   Median :4.00   Median :2.00  
##  Mean   :0.406   Mean   :3.69   Mean   :2.81  
##  3rd Qu.:1.000   3rd Qu.:4.00   3rd Qu.:4.00  
##  Max.   :1.000   Max.   :5.00   Max.   :8.00  
##                                               
```

Analyzing >1 Dataset

Often we have 2 or more tables either reflecting different time points of the same sample population or different measuments on the same population.

Merge Data There are several function for manipulating data, see the plyr library for functions. Also see the function reshape and stack which make it easier to convert a "wide" table into a narrow one.

```
x1 <- data.frame(Case = sample(letters, 10), A1 = rnorm(10), B1 = 1:10,
    C1 = rep(1:5, 2))
x1
```

```
##    Case      A1 B1 C1
## 1     f -0.4227  1  1
## 2     w  1.1173  2  2
## 3     c  0.2895  3  3
## 4     u  0.2005  4  4
## 5     l -0.2262  5  5
## 6     x  1.1932  6  1
## 7     g -0.4561  7  2
## 8     e -0.6621  8  3
## 9     o  0.2095  9  4
## 10    h  0.2013 10  5
```

```
x2 <- data.frame(A1 = seq(1, 10, 2), Case = sample(letters, 10),
    D1 = rnorm(10, 4), E1 = rep(1:5, 2), B1 = c(rep(c("Non-Smoker",
"Smoker"),
        each = 4), NA, NA))
x2
```

```
##    A1 Case    D1 E1         B1
## 1   1    z 4.567  1 Non-Smoker
## 2   3    f 4.649  2 Non-Smoker
## 3   5    y 4.286  3 Non-Smoker
## 4   7    d 3.085  4 Non-Smoker
## 5   9    r 3.391  5     Smoker
## 6   1    c 4.558  1     Smoker
## 7   3    j 2.966  2     Smoker
## 8   5    b 5.230  3     Smoker
## 9   7    q 2.708  4       <NA>
## 10  9    w 2.815  5       <NA>
```

```
merge(x1, x2, "Case")
```

```
##   Case    A1.x B1.x C1 A1.y    D1 E1       B1.y
## 1    c  0.2895    3  3    1 4.558  1     Smoker
## 2    f -0.4227    1  1    3 4.649  2 Non-Smoker
## 3    w  1.1173    2  2    9 2.815  5       <NA>
```

Multivariate methods for exploring covariance across studies

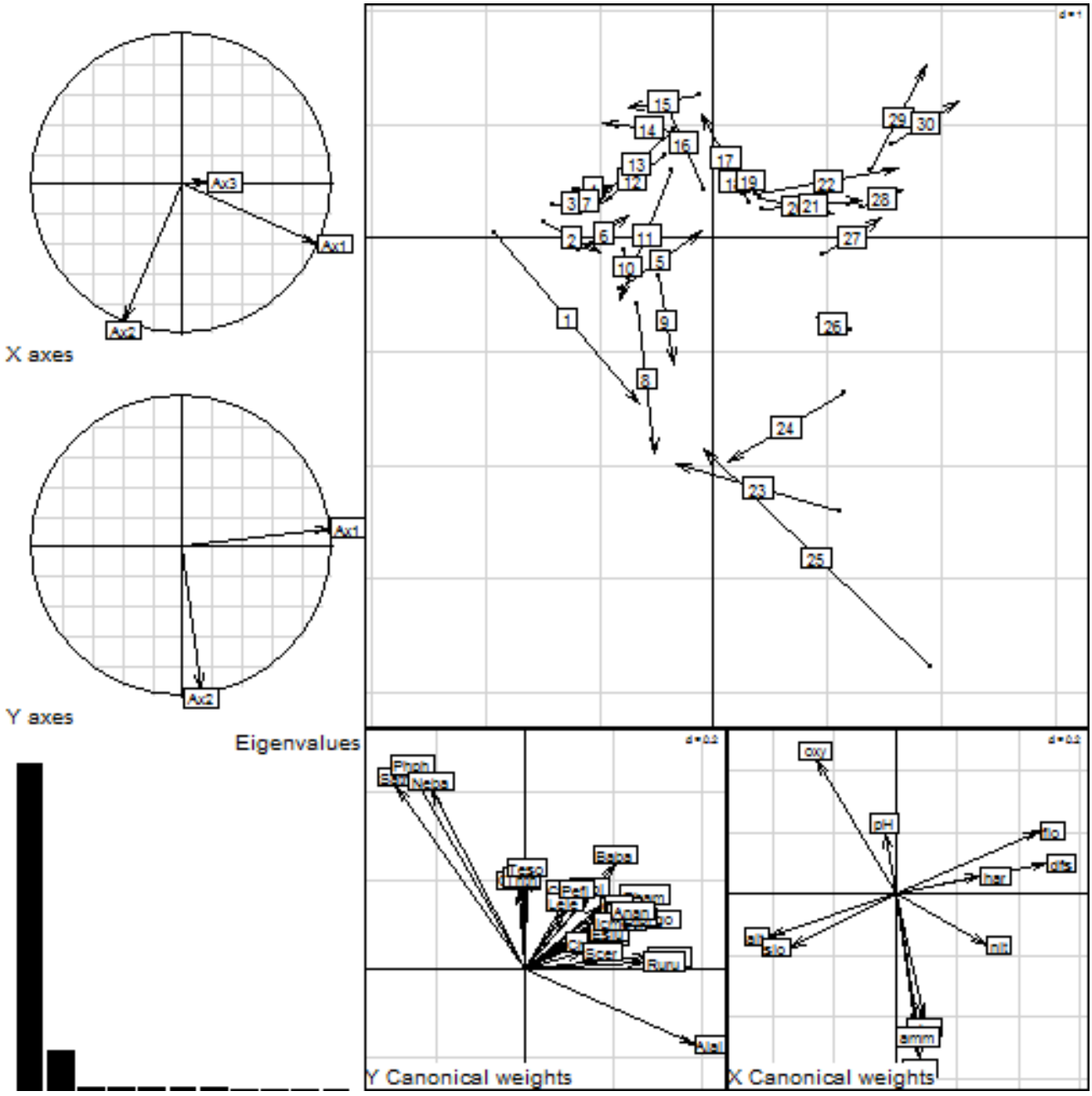
Lets look at the doubs data in the ade4 package. This data set gives environmental variables, fish species and spatial coordinates for 30 sites

```
require(ade4)
data(doubs)
lapply(doubs, head)
```

```
## $env
##   dfs alt   slo flo pH har pho nit amm oxy bdo
## 1   3 934 6.176  84 79  45   1  20   0 122  27
## 2  22 932 3.434 100 80  40   2  20  10 103  19
## 3 102 914 3.638 180 83  52   5  22   5 105  35
## 4 185 854 3.497 253 80  72  10  21   0 110  13
## 5 215 849 3.178 264 81  84  38  52  20  80  62
## 6 324 846 3.497 286 79  60  20  15   0 102  53
##
## $fish
##   Cogo Satr Phph Neba Thth Teso Chna Chto Lele Lece Baba Spbi Gogo Eslu
## 1    0    3    0    0    0    0    0    0    0    0    0    0    0    0
## 2    0    5    4    3    0    0    0    0    0    0    0    0    0    0
## 3    0    5    5    5    0    0    0    0    0    0    0    0    0    1
## 4    0    4    5    5    0    0    0    0    0    1    0    0    1    2
## 5    0    2    3    2    0    0    0    0    5    2    0    0    2    4
## 6    0    3    4    5    0    0    0    0    1    2    0    0    1    1
##   Pefl Rham Legi Scer Cyca Titi Abbr Icme Acce Ruru Blbj Alal Anan
## 1    0    0    0    0    0    0    0    0    0    0    0    0    0
## 2    0    0    0    0    0    0    0    0    0    0    0    0    0
## 3    0    0    0    0    0    0    0    0    0    0    0    0    0
## 4    2    0    0    0    0    1    0    0    0    0    0    0    0
## 5    4    0    0    2    0    3    0    0    0    5    0    0    0
## 6    1    0    0    0    0    2    0    0    0    1    0    0    0
##
## $xy
##     x  y
## 1  88  7
## 2  94 14
## 3 102 18
## 4 100 28
## 5 106 39
## 6 112 51
##
## $species
##                 Scientific        French           English code
## 1             Cottus gobio        chabot european bullhead Cogo
## 2       Salmo trutta fario  truite fario       brown trout Satr
## 3        Phoxinus phoxinus        vairon            minnow Phph
## 4   Nemacheilus barbatulus loche franche       stone loach Neba
## 5      Thymallus thymallus         ombre          grayling Thth
```

```
## 6 Telestes soufia agassizi       blageon           blageon Teso
##
```

```
dudi1 <- dudi.pca(doubs$env, scale = TRUE, scannf = FALSE, nf = 3)
dudi2 <- dudi.pca(doubs$fish, scale = FALSE, scannf = FALSE, nf = 2)
coin1 <- coinertia(dudi1, dudi2, scan = FALSE, nf = 2)
plot(coin1)
```



plot of chunk coinertia

```
# s.arrow(coin1$l1, clab = 0.7)
```

How to Process this document

```
require(knitr)
dir(pattern="Rmd")
knit("Reports.Rmd")
knit2html("Reports.Rmd")
knit2pdf("Reports.Rmd")
purl("Reports.Rmd")
```

Or use pandoc to convert markdown file {} `system("pandoc -s Reports.md  -o Reports.pdf") system("pandoc -s Reports.md  -o Reports.docx") system("pandoc -s Reports.md  -o Reports.html") dir()`