The Procedure:

First, I went to the website where the data was stored. I obtained the data and from one of the links and put them all in a csv file where there are 9 variables: car name, mpg, cylinders, displacement, horsepower, weight, acceleration, model year and origin. Information of the csv file is given below.

```
> Cars.data<-read.csv("Cars.csv", header=TRUE)
> str(Cars.data)
'data.frame':   406 obs. of  9 variables:
 $ make        : Factor w/ 310 levels "amc.ambassador.brougham",..: 51 38 234 15 163 142 56 226 245 2 ...
 $ mpg         : Factor w/ 130 levels "10","11","12",..: 17 7 17 9 13 7 5 5 5 7 ...
 $ cylinders   : int  8 8 8 8 8 8 8 8 8 8 ...
 $ displacement: num  307 350 318 304 302 429 454 440 455 390 ...
 $ horsepower  : Factor w/ 94 levels "100","102","103",..: 16 34 28 28 23 41 46 45 47 39 ...
 $ weight      : int  3504 3693 3436 3433 3449 4341 4354 4312 4425 3850 ...
 $ acceleration: num  12 11.5 11 12 10.5 10 9 8.5 10 8.5 ...
 $ model.year  : int  70 70 70 70 70 70 70 70 70 70 ...
 $ origin      : int  1 1 1 1 1 1 1 1 1 1 ...
```

Findings:

The first factor I used to obtain information was origin because it was the least distinct with only three different countries (US, Europe and Japan). Organizing the data using origin as a factor allows us to see the different specs of cars of different origin.

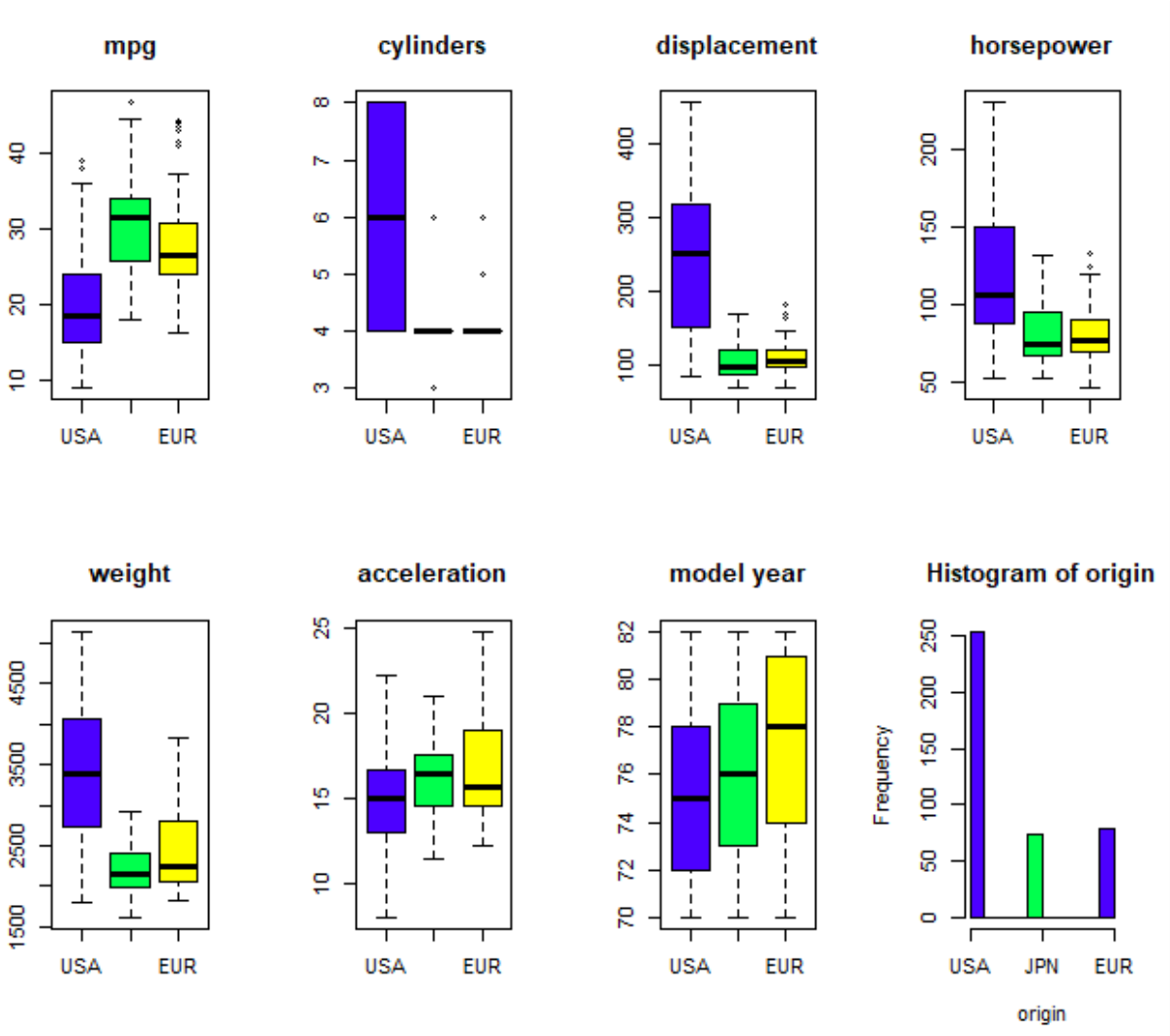
```
> summary(cars.USA)
      mpg          cylinders      displacement     horsepower        weight      acceleration     model.year
 Min.   : 9.00   Min.   :4.000   Min.   : 85.0   Min.   : 52.0   Min.   :1800   Min.   : 8.00   Min.   :70.0
 1st Qu.:15.00   1st Qu.:4.000   1st Qu.:151.0   1st Qu.: 88.0   1st Qu.:2721   1st Qu.:13.00   1st Qu.:72.0
 Median :18.50   Median :6.000   Median :250.0   Median :106.0   Median :3380   Median :15.00   Median :75.0
 Mean   :20.08   Mean   :6.283   Mean   :247.9   Mean   :119.9   Mean   :3373   Mean   :14.94   Mean   :75.5
 3rd Qu.:24.00   3rd Qu.:8.000   3rd Qu.:318.0   3rd Qu.:150.0   3rd Qu.:4055   3rd Qu.:16.70   3rd Qu.:78.0
 Max.   :39.00   Max.   :8.000   Max.   :455.0   Max.   :230.0   Max.   :5140   Max.   :22.20   Max.   :82.0
 NA's   :5                                       NA's   :4
> summary(cars.JPN)
      mpg          cylinders      displacement     horsepower        weight      acceleration     model.year
 Min.   :18.00   Min.   :3.000   Min.   : 70.0   Min.   : 52.00   Min.   :1613   Min.   :11.40   Min.   :70.00
 1st Qu.:25.70   1st Qu.:4.000   1st Qu.: 86.0   1st Qu.: 67.00   1st Qu.:1985   1st Qu.:14.60   1st Qu.:74.00
 Median :31.60   Median :4.000   Median : 97.0   Median : 75.00   Median :2155   Median :16.40   Median :78.00
 Mean   :30.45   Mean   :4.101   Mean   :102.7   Mean   : 79.84   Mean   :2221   Mean   :16.17   Mean   :77.44
 3rd Qu.:34.05   3rd Qu.:4.000   3rd Qu.:119.0   3rd Qu.: 95.00   3rd Qu.:2412   3rd Qu.:17.55   3rd Qu.:81.00
 Max.   :46.60   Max.   :6.000   Max.   :168.0   Max.   :132.00   Max.   :2930   Max.   :21.00   Max.   :82.00
> summary(cars.EUR)
      mpg          cylinders      displacement     horsepower        weight      acceleration     model.year
 Min.   :16.20   Min.   :4.000   Min.   : 68.0   Min.   : 46.0   Min.   :1825   Min.   :12.20   Min.   :70.00
 1st Qu.:24.00   1st Qu.:4.000   1st Qu.: 96.0   1st Qu.: 69.5   1st Qu.:2065   1st Qu.:14.50   1st Qu.:73.00
 Median :26.50   Median :4.000   Median :105.0   Median : 77.0   Median :2246   Median :15.70   Median :76.00
 Mean   :27.89   Mean   :4.151   Mean   :109.5   Mean   : 81.0   Mean   :2431   Mean   :16.82   Mean   :75.74
 3rd Qu.:30.65   3rd Qu.:4.000   3rd Qu.:121.0   3rd Qu.: 90.5   3rd Qu.:2800   3rd Qu.:19.00   3rd Qu.:79.00
 Max.   :44.30   Max.   :6.000   Max.   :183.0   Max.   :133.0   Max.   :3820   Max.   :24.80   Max.   :82.00
 NA's   :3                                       NA's   :2
```

From these summaries of US cars, European cars and Japan cars, we can see a lot of different things.

The average mpg for USA cars is 20.08 whereas for Japan and European cars it is 30.45, and 27.89 respectively. Cars with a higher mpg are more gas efficient so on average we can see that Japanese cars are more gas efficient than the USA and European cars. Next, we can see the information about cylinders by factor of origin. The average of cylinders for American, Japanese and European cars are 6.283, 4.101 and 4.151 respectively. Since the cylinder of a car is a power unit of an engine we can say that American cars have more powerful cars, which we can see further through the horsepower variable where the American cars have a much higher average horsepower. Moreover, engines are measured by displacement, usually expressed in liters (L) or cubic centimeters (cc). Displacement is the total volume of all the cylinders in an engine. The displacement variable further shows that the American cars are

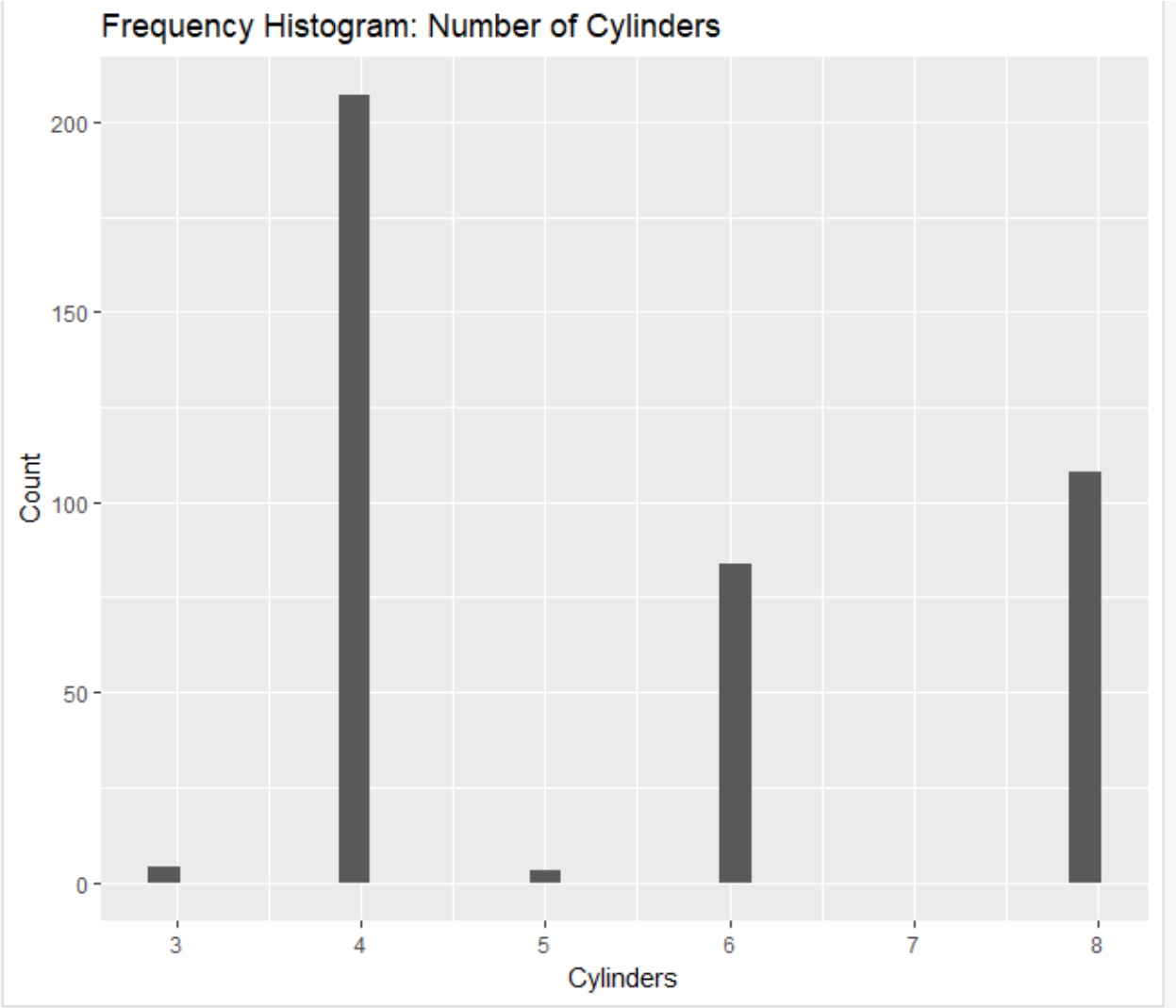
more powerful, and we can also say the more cylinders there are, the higher the displacement and therefore horsepower. In addition, we can see the relationships between origin and weight where we can see that average weight for American cars are heavier than the others. Then, the acceleration we can see that American cars have a lower acceleration than the other two. This could mean that there is a correlation between weight and acceleration but not necessarily horsepower. Lastly, we have the relationship between the origin and the model years.

This can all be further visualized through boxplots and histograms. We can see all the relationships with origin as a factor which helps us obtain data about American, European and Japanese cars. The last histogram shows us the frequency of the origins and this shows us that the majority of the data retrieved is from USA cars;



With the data so far, we can answer a good amount of questions, such as: Which origin of cars has the most powerful ones, which one has the newest ones, which one is more gas efficient, which has a better acceleration, and which are more abundant in this data.

If we want to obtain data without factoring by origin, then we can use univariate plots to make general findings. For example, we can obtain a frequency histogram using the cylinders variable to see the number of cylinders that is most prevalent in this data.



We can do this on all variables but in my opinion, I think it would be better to find correlations between variables. Which is what we will see next

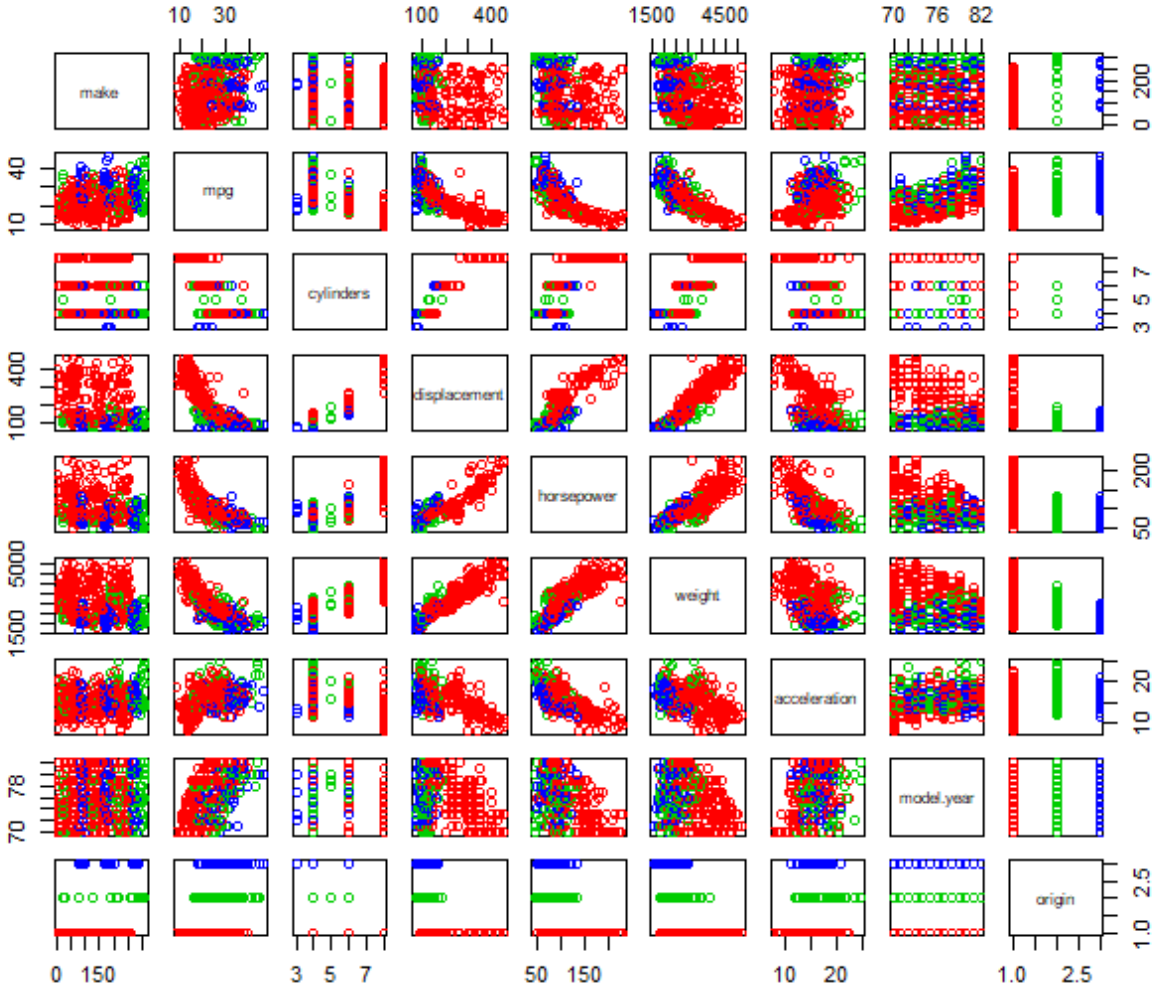
	weight	cylinders	displacement	horsepower	acceleration
weight	1.0000000	0.8966632	0.9326288	0.8665862	-0.4294799
cylinders	0.8966632	1.0000000	0.9518825	0.8441583	-0.5217933
displacement	0.9326288	0.9518825	1.0000000	0.8983263	-0.5581071
horsepower	0.8665862	0.8441583	0.8983263	1.0000000	-0.6971244
acceleration	-0.4294799	-0.5217933	-0.5581071	-0.6971244	1.0000000

Using the correlation function we can see the pairwise correlations between these variables. We can see that weight & cylinders, weight & displacement, and weight & horsepower are all correlated with more than 80% correlation. We can do the same with all the variables to find the pairwise correlations and we the lowest of them comes from acceleration. Therefore, we can say all these variables are highly correlated with each other except for acceleration, which further proves what we were able to see in the boxplots and summaries.

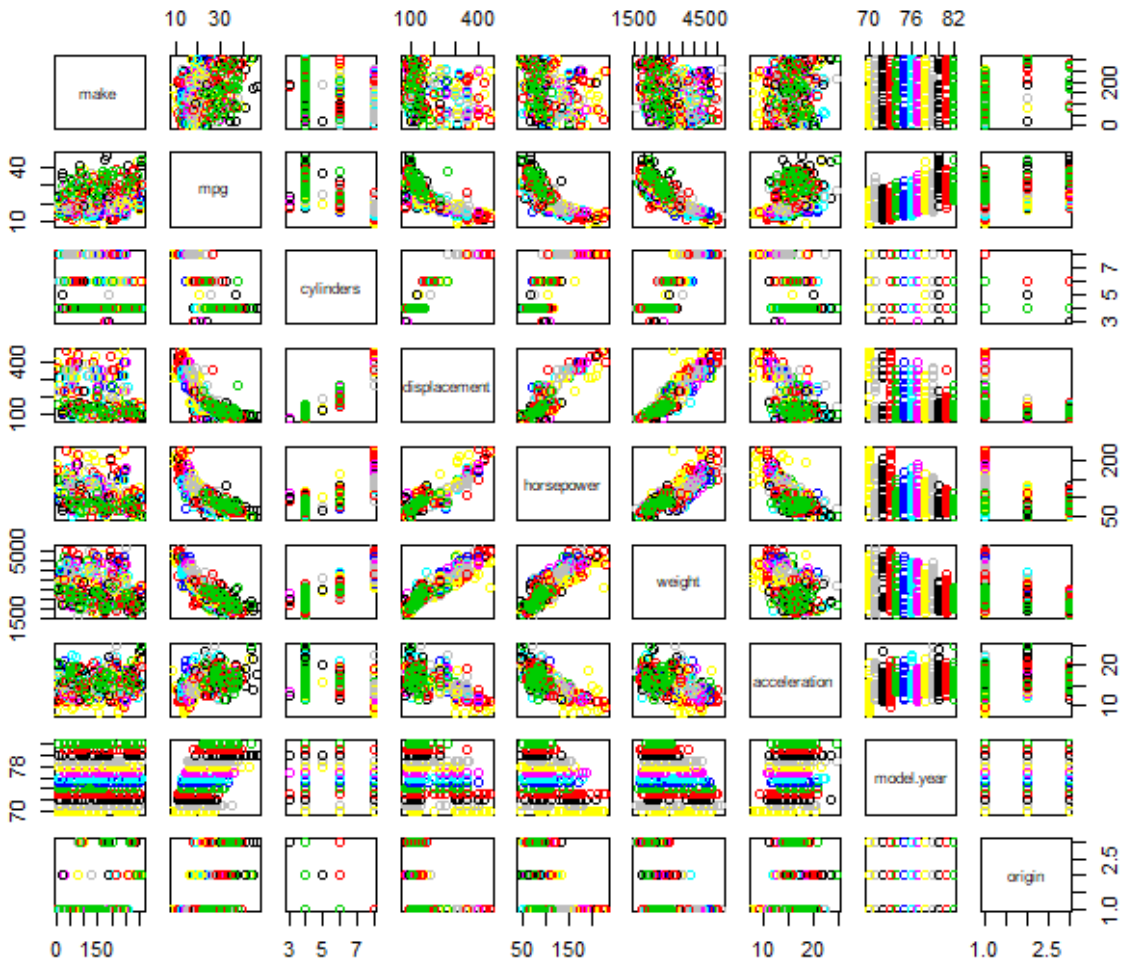
Next, we can see the correlation with the remaining variables: weight and mpg. From the boxplots we were able to see that they were correlated. Using the correlation function we see that

```
            weight        mpg
weight  1.0000000 -0.8317409
mpg    -0.8317409  1.0000000
```

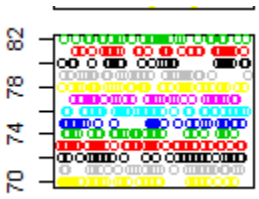
Weight and mpg are inversely correlated which makes sense since heavier cars would need more fuel, so the higher the weight, the less the mpg.



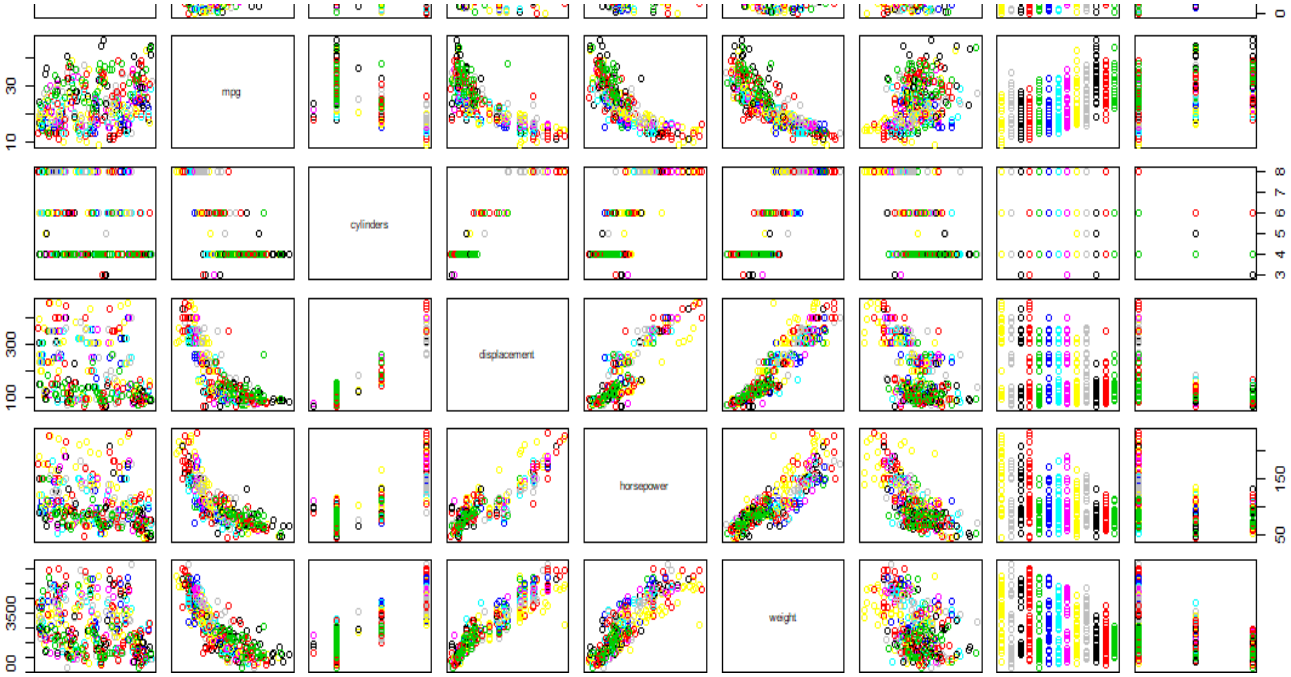
We can also see relationships between origins and other variables by using scatterplots where red is USA, green is European, and blue is Japanese. Moreover, we can use the same visual techniques and this time factor by model year, so we can see the evolution of specs as time increases.



In the second last row we can distinguish the colours with the model years by using the legend. The newest cars are green.



In the mpg row and weight column you can see that smaller/lighter cars with a higher mpg are becoming more prevalent as time goes on (since green are the newer cars)



Also, since the car names are available to us, we can find the top 3 cars for certain categories. The ones that seem important to me are mpg, horsepower, and acceleration.

```
> mpg_sorted <- Cars.data[order(Cars.data$mpg),]
> View(mpg_sorted)
> View(mpg_sorted)
> mpg_sorted <- Cars.data[order(-Cars.data$mpg),]
> head((mpg_sorted),3)
                    make  mpg cylinders displacement horsepower weight acceleration model.year origin
330            mazda.glc 46.6         4           86         65   2110         17.9         80      3
337  honda.civic.1500.gl 44.6         4           91         67   1850         13.8         80      3
333 vw.rabbit.c.(diesel) 44.3         4           90         48   2085         21.7         80      2
> horsepowe_sortedr<-Cars.data[order(-Cars.data$horsepower),]
> horsepower_sorted<-Cars.data[order(-Cars.data$horsepower),]
> head((horsepower_sorted),3)
                     make mpg cylinders displacement horsepower weight acceleration model.year origin
124      pontiac.grand.prix  16         8          400        230   4278          9.5         73      1
9          pontiac.catalina  14         8          455        225   4425         10.0         70      1
20  buick.estate.wagon.(sw)  14         8          455        225   3086         10.0         70      1
> acceleration_sorted<-Cars.data[order(-Cars.data$acceleration),]
> head((acceleration_sorted),3)
                   make  mpg cylinders displacement horsepower weight acceleration model.year origin
307        peugeot.504 27.2         4          141         71   3190         24.8         79      2
403          vw.pickup 44.0         4           97         52   2130         24.6         82      2
334 vw.dasher.(diesel) 43.4         4           90         48   2335         23.7         80      2
```

These are the top 3 for each of those categories. It's funny to see how each origin dominates a certain one of those categories as if each country focuses on a certain aspect of a car. As we can see Japanese cars excel in gas efficiency, with the Mazda GLC having the highest mpg at 46.6. The Americans excel at making the most powerful cars with the Pontiac Grand Prix having the highest horsepower at 230. And the Europeans excel at making the car with the highest acceleration with the Peugeot 504 having the highest acceleration at 24.8 (m/s?)

Lastly, we can see the summary data of the entire data set.

To try and obtain more generalized information.

```
> summary(Cars.data)
           make          mpg          cylinders      displacement     horsepower        weight      acceleration    model.year    origin
 ford.pinto    :  6   Min.   : 9.00   Min.   :3.000   Min.   : 68.0   Min.   : 46.00   Min.   :1613   Min.   : 8.00   Min.   :70.00   1:254
 amc.matador   :  5   1st Qu.:17.50   1st Qu.:4.000   1st Qu.:105.0   1st Qu.: 75.75   1st Qu.:2226   1st Qu.:13.70   1st Qu.:73.00   2: 73
 ford.maverick :  5   Median :23.00   Median :4.000   Median :151.0   Median : 95.00   Median :2822   Median :15.50   Median :76.00   3: 79
 toyota.corolla:  5   Mean   :23.51   Mean   :5.475   Mean   :194.8   Mean   :105.08   Mean   :2979   Mean   :15.52   Mean   :75.92
 amc.gremlin   :  4   3rd Qu.:29.00   3rd Qu.:8.000   3rd Qu.:302.0   3rd Qu.:130.00   3rd Qu.:3618   3rd Qu.:17.18   3rd Qu.:79.00
 amc.hornet    :  4   Max.   :46.60   Max.   :8.000   Max.   :455.0   Max.   :230.00   Max.   :5140   Max.   :24.80   Max.   :82.00
 (Other)       :377   NA's   :8                                       NA's   :6
```

For example the car that was in the dataset the most was Ford Pinto.