# Chapter 2 Problem 9

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**The exercise involves the `Auto` data set studied in the lab. Make sure that the missing values have been removed from the data.**

```
#Remove missing values from data
library(ISLR)
data=Auto
auto=na.omit(Auto)
```

### a. Which of the predictors are quantitative, and which are qualitative?

All predictors except name and origin are quantitative. It's clear as to why that is from the summary of the `Auto` data.

```
summary(auto)
```

```
##       mpg          cylinders      displacement     horsepower
##  Min.   : 9.00   Min.   :3.000   Min.   : 68.0   Min.   : 46.0
##  1st Qu.:17.00   1st Qu.:4.000   1st Qu.:105.0   1st Qu.: 75.0
##  Median :22.75   Median :4.000   Median :151.0   Median : 93.5
##  Mean   :23.45   Mean   :5.472   Mean   :194.4   Mean   :104.5
##  3rd Qu.:29.00   3rd Qu.:8.000   3rd Qu.:275.8   3rd Qu.:126.0
##  Max.   :46.60   Max.   :8.000   Max.   :455.0   Max.   :230.0
##
##      weight      acceleration        year           origin
##  Min.   :1613   Min.   : 8.00   Min.   :70.00   Min.   :1.000
##  1st Qu.:2225   1st Qu.:13.78   1st Qu.:73.00   1st Qu.:1.000
##  Median :2804   Median :15.50   Median :76.00   Median :1.000
##  Mean   :2978   Mean   :15.54   Mean   :75.98   Mean   :1.577
##  3rd Qu.:3615   3rd Qu.:17.02   3rd Qu.:79.00   3rd Qu.:2.000
##  Max.   :5140   Max.   :24.80   Max.   :82.00   Max.   :3.000
##
##                  name
##  amc matador       :  5
##  ford pinto        :  5
##  toyota corolla    :  5
##  amc gremlin       :  4
##  amc hornet        :  4
##  chevrolet chevette:  4
##  (Other)           :365
```

### b. What is the range of each quantitative predictor?

```
sapply(auto[,1:7], range) #range
```

```
##       mpg cylinders displacement horsepower weight acceleration year
## [1,]  9.0         3           68         46   1613          8.0   70
## [2,] 46.6         8          455        230   5140         24.8   82
```

### c. What is the mean and standard deviation of each quantitative predictor?

```
sapply(auto[,1:7], mean) #means
```

```
##          mpg    cylinders displacement   horsepower       weight
##    23.445918     5.471939   194.411990   104.469388  2977.584184
## acceleration         year
##    15.541327    75.979592
```

```
sapply(auto[,1:7], sd) #standard deviations
```

```
##          mpg    cylinders displacement   horsepower       weight
##     7.805007     1.705783   104.644004    38.491160   849.402560
## acceleration         year
##     2.758864     3.683737
```

**d. Now, remove the 10th through 85th observations. What is the range, mean, and standard deviation of each predictor in the subset of the data that remains?**

```
#Delete 10th to 85th observations
auto2=auto[-(10:85),]
sapply(auto2[,1:7], range) #range
```

```
##       mpg cylinders displacement horsepower weight acceleration year
## [1,] 11.0         3           68         46   1649          8.5   70
## [2,] 46.6         8          455        230   4997         24.8   82
```

```
sapply(auto2[,1:7], mean) #means
```

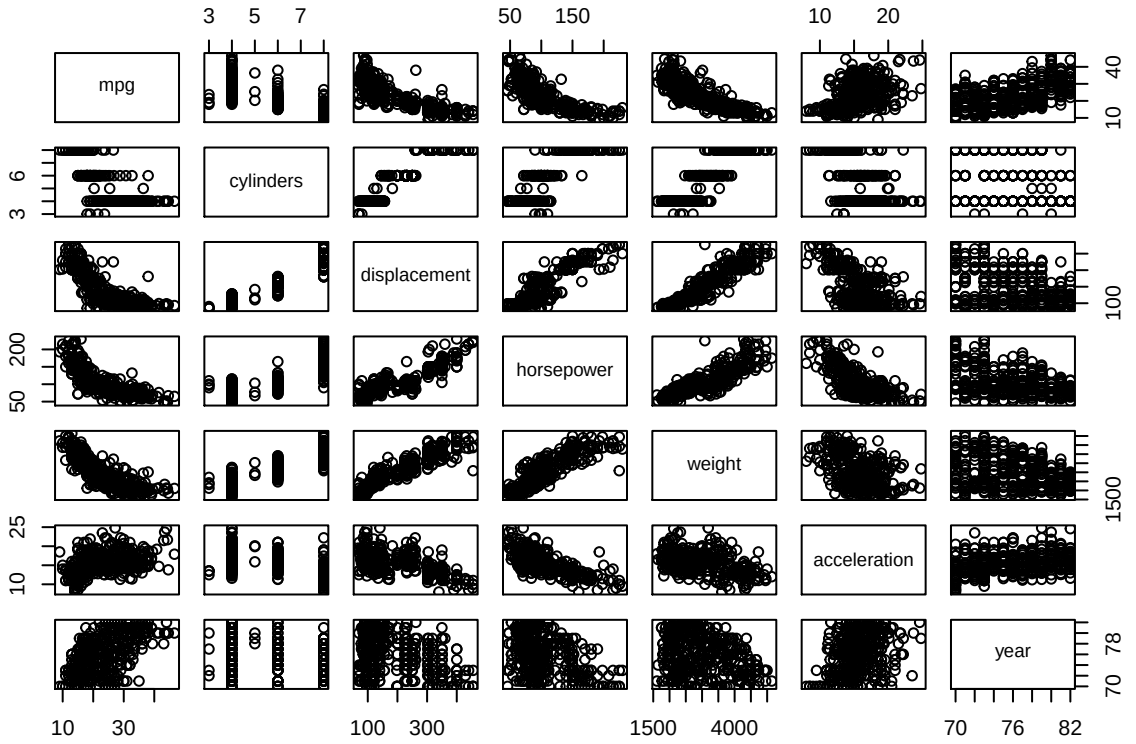
```
##          mpg    cylinders displacement   horsepower       weight
##    24.404430     5.373418   187.240506   100.721519  2935.971519
## acceleration         year
##    15.726899    77.145570
```

```
sapply(auto2[,1:7], sd) #standard deviations
```

```
##          mpg    cylinders displacement   horsepower       weight
##     7.867283     1.654179    99.678367    35.708853   811.300208
## acceleration         year
##     2.693721     3.106217
```

**e. Using the full data set, investigate predictors graphically using scatterplots or other tools of your choice. Create some plots highlighting the relationships among the predictors. Comment on your findings.**

```
pairs(auto[,1:7])
```




Positive correlations: mpg with years

Negative correlations: mpg with displacement, horsepower, weight

**f. Suppose that we wish to predict the gas mileage based on other variables. Do your plots suggest that any of the other variables might be useful in predicting mpg? Justify your answer.**

Yes, we were able to see relationships between mpg and other predictors (see above).