Statistical Learning - Homework 1

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Chapter 2 - Exercise 1

a) We have a lot of data points. Therefore, we can accurately model the true underlying population distribution of data points accurately. The book says, "The potential disadvantage of a parametric [inflexible] approach is that the model we choose will usually not match the true unknown form of f". So, since we have a lot of data points, we will most likely be able to accurately model the ground truth distribution with more parameters. The flexible model will work best in this situation.

b) The book states, "But non-parametric approaches do suffer from a major disadvantage: since they do not reduce the problem of estimating f to a small number of parameters, a very large number of observations (far more than is typically needed for a parametric approach) is required in order to obtain an accurate estimate for f." Since this problem has a small number of observations and a large number of predictors, these non-parametric models, which tend to represent flexible models, will not work. Therefore, we need an inflexible model.

c) Flexible model because the slides reference a linear line as low flexibility, low variance, and high bias. Therefore, if the relationship is non-linear, it will most likely fluctuate with the dataset, so we need a flexible model over an inflexible one. The book also states "if the true f is highly non-linear and we have an ample number of training observations, then we may do better using a highly flexible approach", so this proves my case.

d) If error term variance is high, then using a flexible model might increase the error even further due to addition of noise. Therefore, we should use the inflexible model.

Chapter 2 - Exercise 2

a) We need inference because we want the reasoning behind our decision, which is the salary. Prediction in this situation would just be determining the salary for a given CEO and company. This is also a regression problem since salary is continuous and nothing in the problem states the salary is split into discrete bins. n = 500. p = 3 (profit, # employees, industry). To change this into a classification problem, we could, as previously mentioned, place salaries into 10 bins. For example, the first bin, or class, are salaries from \$0-\$500k, second is \$500k-\$1M, . . . , \$5M+. Then, there are now 10 classes and we place each CEO's salary into one of the classes.

b) This is a classification problem since there are two output classes, *success* and *failure*. We are also more interested in prediction since we do not care why the product will be successful or a failure, but rather solely which class it will fit into. n = 20. p = 13 (price charged, marketing budget, competition price, ten other variables). If we want to modify this into a regression problem, we can predict the % success or % failure. Then, the response is a continuous percentage value.

c) We care about prediction more than inference, since the problem directly states "We are interested in predicting the % change in. . . ". This is a regression problem since percentages are continuous. n = 52 (number of weeks in 2012). p = 3 (% US market change, % British market change, % German market change). To change this into a classification problem, we can have five classes: "no change", "small change", "medium change", "strong change", "very strong change". Then, insteading of predicting percentages, fit the relation of the USD/Euro to the world stock markets into one of the above five classes.

Chapter 2 - Exercise 5

The positive of a very flexible model is that the a non-flexible, linear model may increase the error of the model's predictions. The flexible approach is useful since it reduces bias, or the error of the model's predictions.

On the other hand, very flexible models can lead to over-estimation of the model, caused by a greater number of model parameters, so the model overfits to noise, which in turn increases the model's error. In prediction, inference is not important, a more flexible model is useful since all relationships/dependencies of the predictors can be taken into account and interpretability of the model is not as important. When inference is more important than prediction, a less flexible model may have increased error, but can be easily interpreted due to decreased number of parameters, it is more robust to noise in the dataset, and overfitting is not as much of a concern.

Chapter 2 - Exercise 8

a)

```r
library(ISLR)

college = read.csv("College.csv")
```

b)

```r
rownames(college)=college[,1]
fix(college)

college = college[,-1]
fix(college)
```

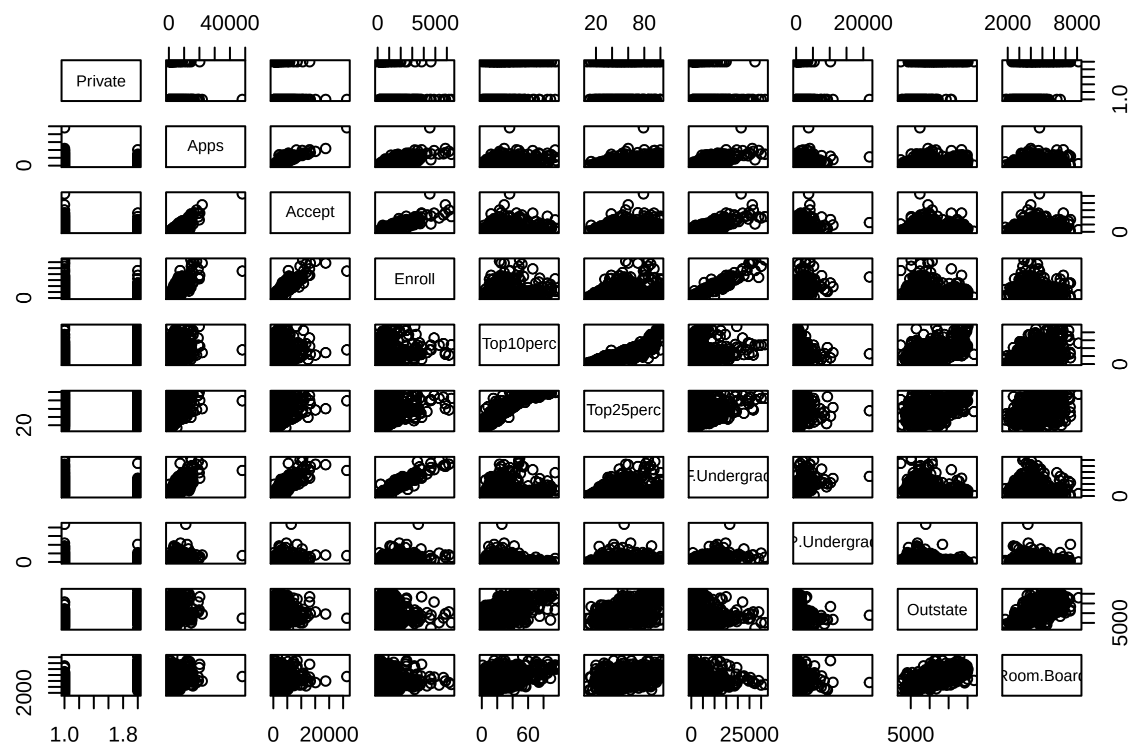
c)

```r
# i)
summary(college)
```

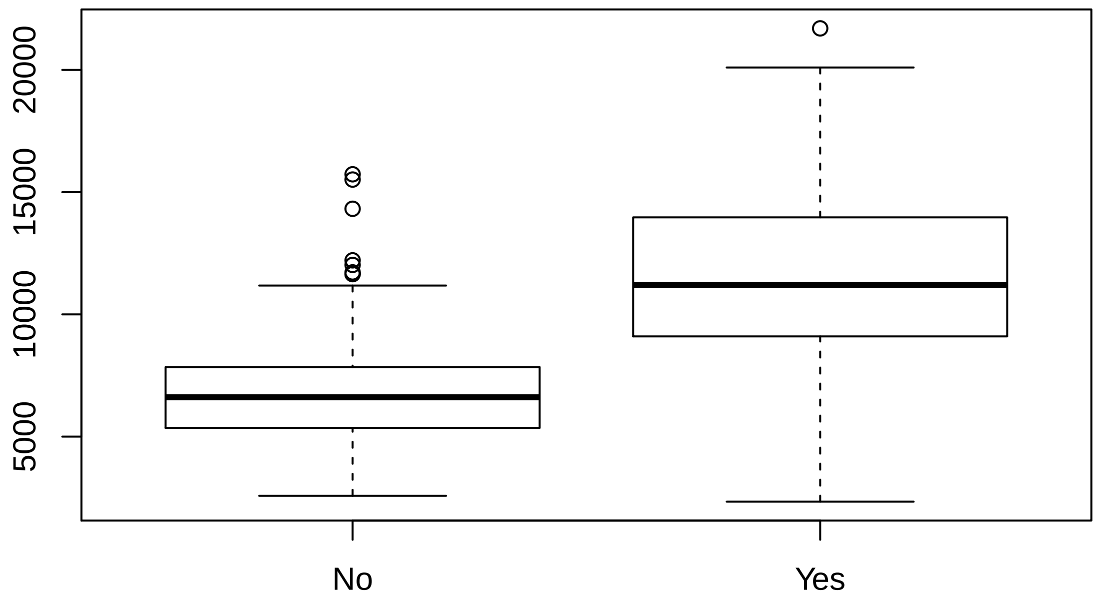
```
##  Private        Apps           Accept          Enroll       Top10perc
##  No :212   Min.   :   81   Min.   :   72   Min.   :  35   Min.   : 1.00
##  Yes:565   1st Qu.:  776   1st Qu.:  604   1st Qu.: 242   1st Qu.:15.00
##            Median : 1558   Median : 1110   Median : 434   Median :23.00
##            Mean   : 3002   Mean   : 2019   Mean   : 780   Mean   :27.56
##            3rd Qu.: 3624   3rd Qu.: 2424   3rd Qu.: 902   3rd Qu.:35.00
##            Max.   :48094   Max.   :26330   Max.   :6392   Max.   :96.00
##    Top25perc      F.Undergrad     P.Undergrad         Outstate
##  Min.   :  9.0   Min.   :  139   Min.   :    1.0   Min.   : 2340
##  1st Qu.: 41.0   1st Qu.:  992   1st Qu.:   95.0   1st Qu.: 7320
##  Median : 54.0   Median : 1707   Median :  353.0   Median : 9990
##  Mean   : 55.8   Mean   : 3700   Mean   :  855.3   Mean   :10441
##  3rd Qu.: 69.0   3rd Qu.: 4005   3rd Qu.:  967.0   3rd Qu.:12925
##  Max.   :100.0   Max.   :31643   Max.   :21836.0   Max.   :21700
##    Room.Board       Books           Personal         PhD
##  Min.   :1780   Min.   :  96.0   Min.   : 250   Min.   :  8.00
##  1st Qu.:3597   1st Qu.: 470.0   1st Qu.: 850   1st Qu.: 62.00
##  Median :4200   Median : 500.0   Median :1200   Median : 75.00
##  Mean   :4358   Mean   : 549.4   Mean   :1341   Mean   : 72.66
##  3rd Qu.:5050   3rd Qu.: 600.0   3rd Qu.:1700   3rd Qu.: 85.00
##  Max.   :8124   Max.   :2340.0   Max.   :6800   Max.   :103.00
```

```
##     Terminal       S.F.Ratio      perc.alumni        Expend     
##  Min.   : 24.0   Min.   : 2.50   Min.   : 0.00   Min.   : 3186  
##  1st Qu.: 71.0   1st Qu.:11.50   1st Qu.:13.00   1st Qu.: 6751  
##  Median : 82.0   Median :13.60   Median :21.00   Median : 8377  
##  Mean   : 79.7   Mean   :14.09   Mean   :22.74   Mean   : 9660  
##  3rd Qu.: 92.0   3rd Qu.:16.50   3rd Qu.:31.00   3rd Qu.:10830  
##  Max.   :100.0   Max.   :39.80   Max.   :64.00   Max.   :56233  
##    Grad.Rate     
##  Min.   : 10.00  
##  1st Qu.: 53.00  
##  Median : 65.00  
##  Mean   : 65.46  
##  3rd Qu.: 78.00  
##  Max.   :118.00
```

```
# ii)
pairs(college[,1:10])
```




```
# iii)
plot(college$Private, college$Outstate)
```

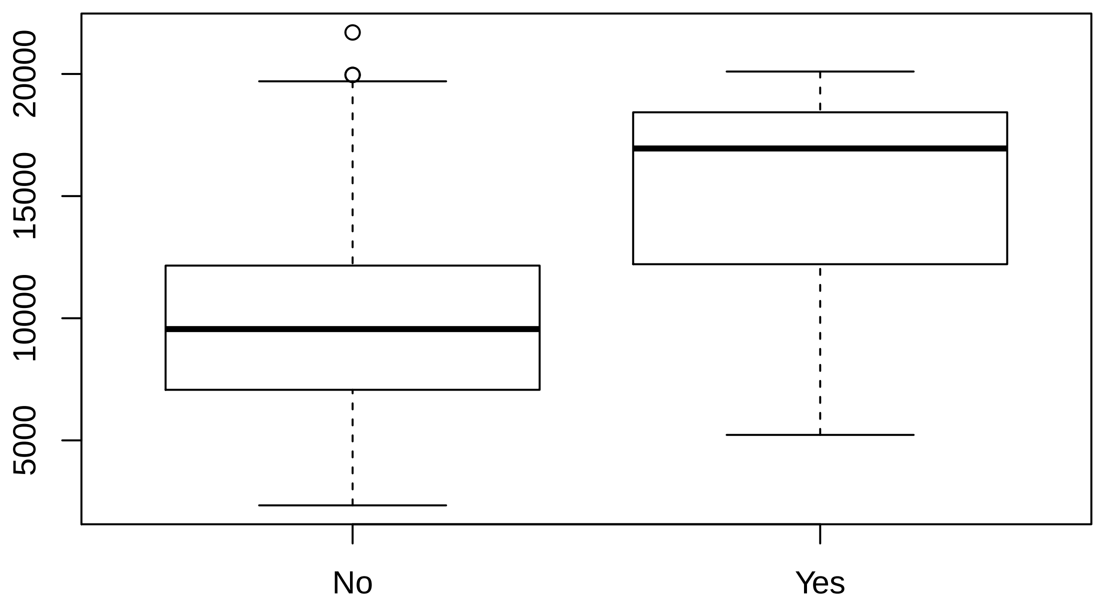



```r
# iv)
Elite = rep("No", nrow(college))
Elite[college$Top10perc > 50] = "Yes"
Elite = as.factor(Elite)
college = data.frame(college, Elite)
summary(college)
```

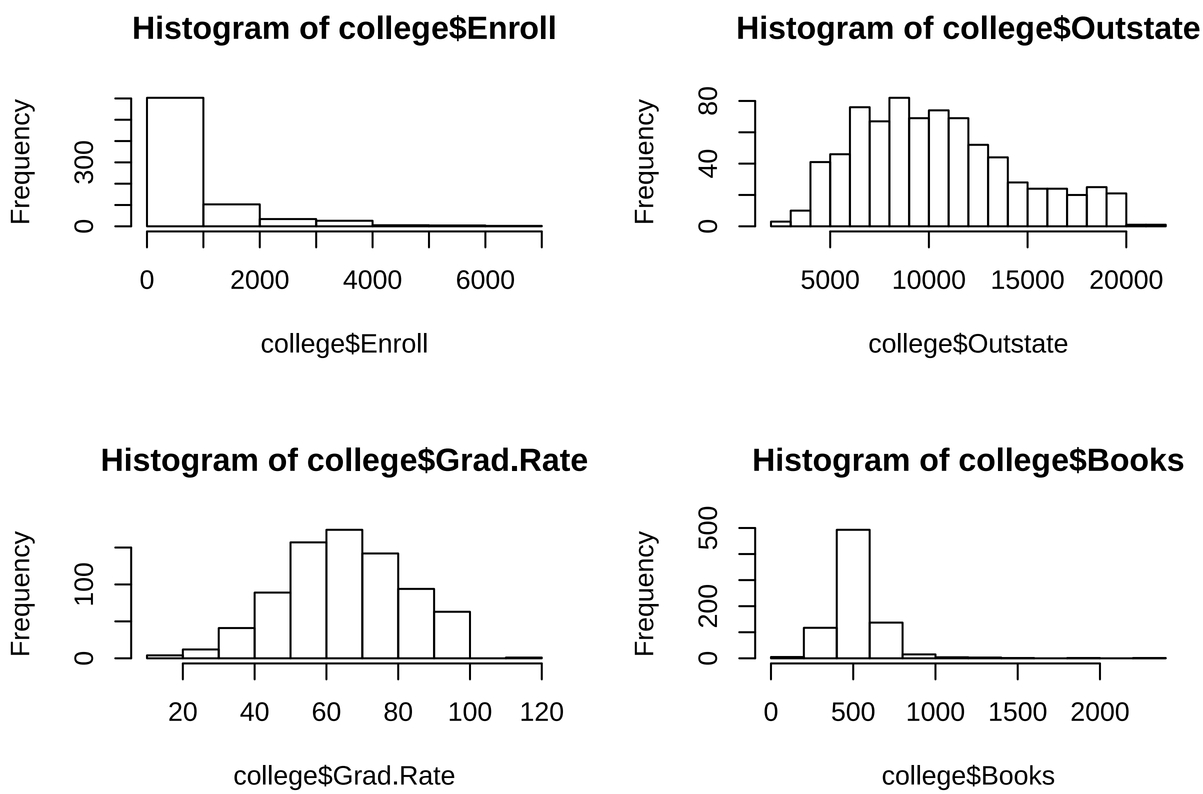
```
##  Private        Apps           Accept          Enroll       Top10perc
##  No :212   Min.   :   81   Min.   :   72   Min.   :  35   Min.   : 1.00
##  Yes:565   1st Qu.:  776   1st Qu.:  604   1st Qu.: 242   1st Qu.:15.00
##            Median : 1558   Median : 1110   Median : 434   Median :23.00
##            Mean   : 3002   Mean   : 2019   Mean   : 780   Mean   :27.56
##            3rd Qu.: 3624   3rd Qu.: 2424   3rd Qu.: 902   3rd Qu.:35.00
##            Max.   :48094   Max.   :26330   Max.   :6392   Max.   :96.00
##    Top25perc      F.Undergrad     P.Undergrad         Outstate
##  Min.   :  9.0   Min.   :  139   Min.   :    1.0   Min.   : 2340
##  1st Qu.: 41.0   1st Qu.:  992   1st Qu.:   95.0   1st Qu.: 7320
##  Median : 54.0   Median : 1707   Median :  353.0   Median : 9990
##  Mean   : 55.8   Mean   : 3700   Mean   :  855.3   Mean   :10441
##  3rd Qu.: 69.0   3rd Qu.: 4005   3rd Qu.:  967.0   3rd Qu.:12925
##  Max.   :100.0   Max.   :31643   Max.   :21836.0   Max.   :21700
##    Room.Board       Books           Personal         PhD
##  Min.   :1780   Min.   :  96.0   Min.   : 250   Min.   :  8.00
##  1st Qu.:3597   1st Qu.: 470.0   1st Qu.: 850   1st Qu.: 62.00
##  Median :4200   Median : 500.0   Median :1200   Median : 75.00
##  Mean   :4358   Mean   : 549.4   Mean   :1341   Mean   : 72.66
```

```
##  3rd Qu.:5050   3rd Qu.: 600.0   3rd Qu.:1700   3rd Qu.: 85.00
##  Max.   :8124   Max.   :2340.0   Max.   :6800   Max.   :103.00
##     Terminal       S.F.Ratio      perc.alumni        Expend
##  Min.   : 24.0   Min.   : 2.50   Min.   : 0.00   Min.   : 3186
##  1st Qu.: 71.0   1st Qu.:11.50   1st Qu.:13.00   1st Qu.: 6751
##  Median : 82.0   Median :13.60   Median :21.00   Median : 8377
##  Mean   : 79.7   Mean   :14.09   Mean   :22.74   Mean   : 9660
##  3rd Qu.: 92.0   3rd Qu.:16.50   3rd Qu.:31.00   3rd Qu.:10830
##  Max.   :100.0   Max.   :39.80   Max.   :64.00   Max.   :56233
##    Grad.Rate      Elite
##  Min.   : 10.00   No :699
##  1st Qu.: 53.00   Yes: 78
##  Median : 65.00
##  Mean   : 65.46
##  3rd Qu.: 78.00
##  Max.   :118.00
```

```r
plot(college$Elite, college$Outstate)
```




```r
# v)
par(mfrow=c(2,2))
hist(college$Enroll, breaks=5)
hist(college$Outstate, breaks=20)
hist(college$Grad.Rate)
hist(college$Books, breaks=15)
```




```r
# vi)
summary(college$Enroll)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
##      35     242     434     780     902    6392
```

```r
summary(college$Outstate)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
##    2340    7320    9990   10441   12925   21700
```

```r
summary(college$Grad.Rate)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
##   10.00   53.00   65.00   65.46   78.00  118.00
```

```r
summary(college$Books)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
##    96.0   470.0   500.0   549.4   600.0  2340.0
```

```r
oddGradRate = college[college$Grad.Rate > 100,]
nrow(oddGradRate)
```

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

```r
rownames(oddGradRate)
```

```
## [1] "Cazenovia College"
```

```r
enrollData = college[college$Enroll > 2000,]
nrow(enrollData)
```

```
## [1] 71
```

```r
rownames(enrollData)
```

```
##  [1] "Arizona State University Main campus"
##  [2] "Auburn University-Main Campus"
##  [3] "Baylor University"
##  [4] "Boston University"
##  [5] "Bowling Green State University"
##  [6] "Brigham Young University at Provo"
##  [7] "Clemson University"
##  [8] "Colorado State University"
##  [9] "East Carolina University"
## [10] "Florida State University"
## [11] "Georgia Institute of Technology"
## [12] "Illinois State University"
## [13] "Indiana State University"
## [14] "Indiana University at Bloomington"
## [15] "Iowa State University"
## [16] "James Madison University"
## [17] "Kansas State University"
## [18] "Louisiana State University at Baton Rouge"
## [19] "Marshall University"
## [20] "Miami University at Oxford"
## [21] "Michigan State University"
## [22] "New York University"
## [23] "North Carolina State University at Raleigh"
## [24] "Northeastern University"
## [25] "Northern Illinois University"
## [26] "Ohio University"
## [27] "Oklahoma State University"
## [28] "Pennsylvania State Univ. Main Campus"
## [29] "Purdue University at West Lafayette"
## [30] "Rutgers at New Brunswick"
## [31] "San Diego State University"
## [32] "Southwest Missouri State University"
## [33] "SUNY at Buffalo"
## [34] "Syracuse University"
## [35] "Texas A&M Univ. at College Station"
## [36] "Texas Southern University"
## [37] "University of Arkansas at Fayetteville"
## [38] "University of California at Berkeley"
## [39] "University of California at Irvine"
## [40] "University of Cincinnati"
## [41] "University of Connecticut at Storrs"
## [42] "University of Delaware"
## [43] "University of Florida"
## [44] "University of Georgia"
## [45] "University of Illinois - Urbana"
## [46] "University of Illinois at Chicago"
## [47] "University of Kansas"
## [48] "University of Maryland at College Park"
```

```
## [49] "University of Massachusetts at Amherst"
## [50] "University of Michigan at Ann Arbor"
## [51] "University of Minnesota Twin Cities"
## [52] "University of Missouri at Columbia"
## [53] "University of Nebraska at Lincoln"
## [54] "University of New Hampshire"
## [55] "University of North Carolina at Chapel Hill"
## [56] "University of North Texas"
## [57] "University of Oklahoma"
## [58] "University of Oregon"
## [59] "University of Pennsylvania"
## [60] "University of Pittsburgh-Main Campus"
## [61] "University of South Carolina at Columbia"
## [62] "University of Southern California"
## [63] "University of Tennessee at Knoxville"
## [64] "University of Texas at Austin"
## [65] "University of Utah"
## [66] "University of Virginia"
## [67] "University of Washington"
## [68] "University of Wisconsin at Madison"
## [69] "Virginia Tech"
## [70] "Washington State University"
## [71] "Western Michigan University"
```

There are two things to note here. First, enrollment across all universities is very close in size, except for a few 71 universities with a significant number of students, which were output above. These universities have more than 2000 new students enrolled, distinguishing these universities as behemoths in the academia world in terms of size. One can clearly see the histogram for enrollment is heavily skewed to the right.

Also, one discrepency appears in the graduation rates. Czenovia College is the only college with a graduation rate over 100%, coming out to be 118%.

The out-of-state tuition and books prices do not contain any surprising results or abnormally high or low values.

Chapter 2 - Exercise 9

a)

```r
library(ISLR)

auto = read.csv("Auto.csv", na.strings="?")
auto = auto[complete.cases(auto), ]
str(auto)
```

```
## 'data.frame':    392 obs. of  9 variables:
##  $ mpg         : num  18 15 18 16 17 15 14 14 14 15 ...
##  $ 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  : int  130 165 150 150 140 198 220 215 225 190 ...
##  $ 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 ...
##  $ year        : int  70 70 70 70 70 70 70 70 70 70 ...
##  $ origin      : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ name        : Factor w/ 304 levels "amc ambassador brougham",..: 49 36 231 14 161 141 54 223 241 2
```

```r
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
```

The quantitative variables are mpg, cylinders, displacement, horsepower, weight, acceleration, year, and origin. The only qualitative predictor is name.

b)

```r
range(auto$mpg)
```

```
## [1]  9.0 46.6
```

```r
range(auto$cylinders)
```

```
## [1] 3 8
```

```r
range(auto$displacement)
```

```
## [1]  68 455
```

```r
range(auto$horsepower)
```

```
## [1]  46 230
```

```r
range(auto$weight)
```

```
## [1] 1613 5140
```

```r
range(auto$acceleration)
```

```
## [1]  8.0 24.8
```

```r
range(auto$year)
```

```
## [1] 70 82
```

```r
range(auto$origin)
```

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

Range of mpg is 9.0 to 46.6 . Range of cylinders is 3 to 8. Range of displacement is 68 to 455. Range of horsepower is 46 to 230. Range of weight is 1613 to 5140. Range of acceleration is 8.0 to 24.8 . Range of year is 70 to 82. Range of origin is 1 to 3.

c)

```r
sapply(auto[, -c(0,9)], mean)
```

```
##          mpg    cylinders displacement   horsepower       weight
##    23.445918     5.471939   194.411990   104.469388  2977.584184
## acceleration         year       origin
##    15.541327    75.979592     1.576531
```

```r
sapply(auto[, -c(0,9)], sd)
```

```
##          mpg    cylinders displacement   horsepower       weight
##    7.8050075    1.7057832  104.6440039   38.4911599  849.4025600
## acceleration         year       origin
##    2.7588641    3.6837365    0.8055182
```

Mean and Std of mpg are 23.446 and 7.805 respectively. Mean and Std of cylinders are 5.472 and 1.706 respectively. Mean and Std of displacement are 194.412 and 104.644 respectively. Mean and Std of horsepower are 104.469 and 38.491 respectively. Mean and Std of weight are 2977.584 and 849.403 respectively. Mean and Std of acceleration are 15.541 and 2.759 respectively. Mean and Std of year are 75.980 and 3.684 respectively. Mean and Std of origin are 1.577 and 0.806 respectively.

d)

```r
autoNew = auto[-c(10:85), -c(0,9)]
sapply(autoNew, mean)
```

```
##          mpg    cylinders displacement   horsepower       weight
##    24.404430     5.373418   187.240506   100.721519  2935.971519
## acceleration         year       origin
##    15.726899    77.145570     1.601266
```

```r
sapply(autoNew, sd)
```

```
##          mpg    cylinders displacement   horsepower       weight
##     7.867283     1.654179    99.678367    35.708853   811.300208
## acceleration         year       origin
##     2.693721     3.106217     0.819910
```

```r
sapply(autoNew, 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
##      origin
## [1,]      1
## [2,]      3
```

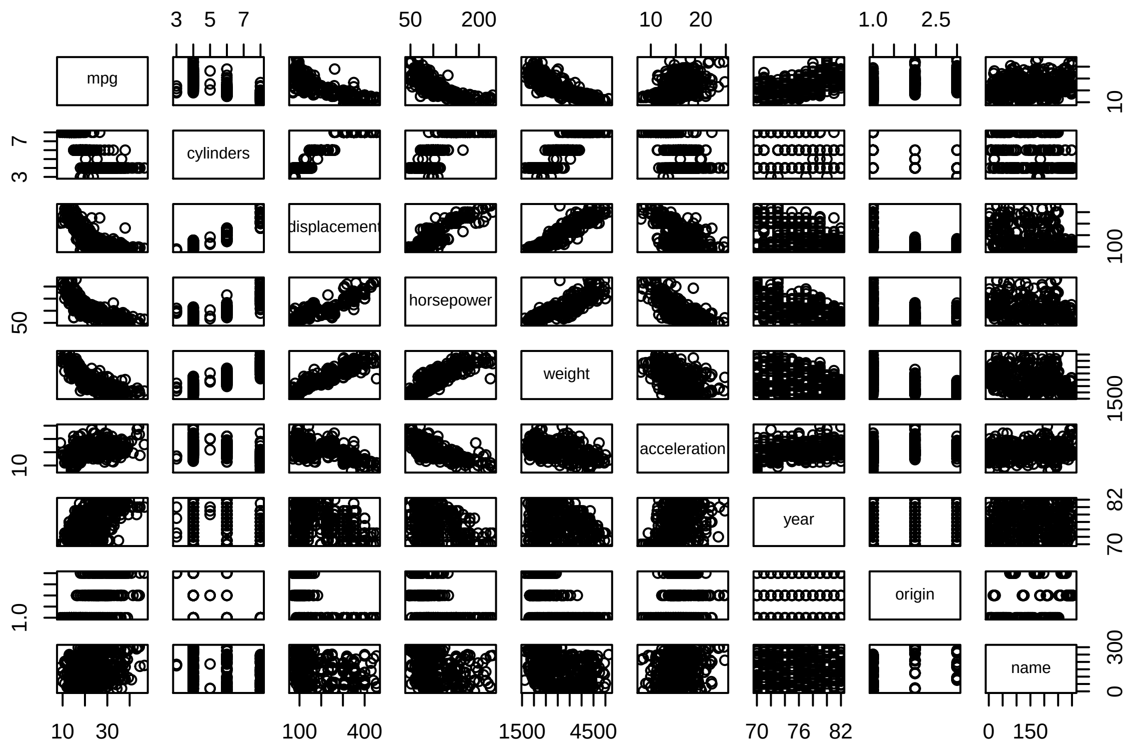
Mean and Std of mpg are 24.404 and 7.867 respectively. Mean and Std of cylinders are 5.373 and 1.654 respectively. Mean and Std of displacement are 187.241 and 99.678 respectively. Mean and Std of horsepower are 100.722 and 35.709 respectively. Mean and Std of weight are 2935.972 and 811.300 respectively. Mean and

Std of acceleration are 15.727 and 2.694 respectively. Mean and Std of year are 77.146 and 3.106 respectively. Mean and Std of origin are 1.601 and 0.820 respectively.

The range of mpg is 11.0 to 46.6 . The range of cylinders is 3 to 8. The range of displacement is 68 to 455. The range of horsepower is 46 to 230. The range of weight is 1649 to 4997. The range of acceleration is 8.5 to 24.8 . The range of year is 70 to 82. The range of origin is 1 to 3.

e)

```r
pairs(auto)
```



We can see several strong, linear relationships between several pairs of variables. For example, the pairs of (displacement, weight), (displacement, horsepower), (horsepower, weight), (displacement, weight), (horsepower, weight), and (displacement, horsepower). Now relationships are poor, or no relationship exists. Meanwhile, a lot of the relationships with mpg and other predictors is a negative linear relationship, kind of curved downward. The auto's name correlates with none of the other predictors.

f) Yes. In particular, displacement, horsepower, and weight would be somewhat accurate representations of predicting mpg. All three predictors represent negative, curved somewhat non-linear relationships. All data points are pretty bunched together, so it is very easy to fix a curve to that data without overfitting to a bunch of noise, such as in the (weight, acceleration) plot.

Chapter 2 - Exercise 10

a)

```r
library(MASS)
```

```
Boston
```

```
##          crim    zn indus chas    nox    rm   age     dis rad tax ptratio
## 1     0.00632  18.0  2.31    0 0.5380 6.575  65.2  4.0900   1 296    15.3
## 2     0.02731   0.0  7.07    0 0.4690 6.421  78.9  4.9671   2 242    17.8
## 3     0.02729   0.0  7.07    0 0.4690 7.185  61.1  4.9671   2 242    17.8
## 4     0.03237   0.0  2.18    0 0.4580 6.998  45.8  6.0622   3 222    18.7
## 5     0.06905   0.0  2.18    0 0.4580 7.147  54.2  6.0622   3 222    18.7
## 6     0.02985   0.0  2.18    0 0.4580 6.430  58.7  6.0622   3 222    18.7
## 7     0.08829  12.5  7.87    0 0.5240 6.012  66.6  5.5605   5 311    15.2
## 8     0.14455  12.5  7.87    0 0.5240 6.172  96.1  5.9505   5 311    15.2
## 9     0.21124  12.5  7.87    0 0.5240 5.631 100.0  6.0821   5 311    15.2
## 10    0.17004  12.5  7.87    0 0.5240 6.004  85.9  6.5921   5 311    15.2
## 11    0.22489  12.5  7.87    0 0.5240 6.377  94.3  6.3467   5 311    15.2
## 12    0.11747  12.5  7.87    0 0.5240 6.009  82.9  6.2267   5 311    15.2
## 13    0.09378  12.5  7.87    0 0.5240 5.889  39.0  5.4509   5 311    15.2
## 14    0.62976   0.0  8.14    0 0.5380 5.949  61.8  4.7075   4 307    21.0
## 15    0.63796   0.0  8.14    0 0.5380 6.096  84.5  4.4619   4 307    21.0
## 16    0.62739   0.0  8.14    0 0.5380 5.834  56.5  4.4986   4 307    21.0
## 17    1.05393   0.0  8.14    0 0.5380 5.935  29.3  4.4986   4 307    21.0
## 18    0.78420   0.0  8.14    0 0.5380 5.990  81.7  4.2579   4 307    21.0
## 19    0.80271   0.0  8.14    0 0.5380 5.456  36.6  3.7965   4 307    21.0
## 20    0.72580   0.0  8.14    0 0.5380 5.727  69.5  3.7965   4 307    21.0
## 21    1.25179   0.0  8.14    0 0.5380 5.570  98.1  3.7979   4 307    21.0
## 22    0.85204   0.0  8.14    0 0.5380 5.965  89.2  4.0123   4 307    21.0
## 23    1.23247   0.0  8.14    0 0.5380 6.142  91.7  3.9769   4 307    21.0
## 24    0.98843   0.0  8.14    0 0.5380 5.813 100.0  4.0952   4 307    21.0
## 25    0.75026   0.0  8.14    0 0.5380 5.924  94.1  4.3996   4 307    21.0
## 26    0.84054   0.0  8.14    0 0.5380 5.599  85.7  4.4546   4 307    21.0
## 27    0.67191   0.0  8.14    0 0.5380 5.813  90.3  4.6820   4 307    21.0
## 28    0.95577   0.0  8.14    0 0.5380 6.047  88.8  4.4534   4 307    21.0
## 29    0.77299   0.0  8.14    0 0.5380 6.495  94.4  4.4547   4 307    21.0
## 30    1.00245   0.0  8.14    0 0.5380 6.674  87.3  4.2390   4 307    21.0
## 31    1.13081   0.0  8.14    0 0.5380 5.713  94.1  4.2330   4 307    21.0
## 32    1.35472   0.0  8.14    0 0.5380 6.072 100.0  4.1750   4 307    21.0
## 33    1.38799   0.0  8.14    0 0.5380 5.950  82.0  3.9900   4 307    21.0
## 34    1.15172   0.0  8.14    0 0.5380 5.701  95.0  3.7872   4 307    21.0
## 35    1.61282   0.0  8.14    0 0.5380 6.096  96.9  3.7598   4 307    21.0
## 36    0.06417   0.0  5.96    0 0.4990 5.933  68.2  3.3603   5 279    19.2
## 37    0.09744   0.0  5.96    0 0.4990 5.841  61.4  3.3779   5 279    19.2
## 38    0.08014   0.0  5.96    0 0.4990 5.850  41.5  3.9342   5 279    19.2
## 39    0.17505   0.0  5.96    0 0.4990 5.966  30.2  3.8473   5 279    19.2
## 40    0.02763  75.0  2.95    0 0.4280 6.595  21.8  5.4011   3 252    18.3
## 41    0.03359  75.0  2.95    0 0.4280 7.024  15.8  5.4011   3 252    18.3
## 42    0.12744   0.0  6.91    0 0.4480 6.770   2.9  5.7209   3 233    17.9
## 43    0.14150   0.0  6.91    0 0.4480 6.169   6.6  5.7209   3 233    17.9
## 44    0.15936   0.0  6.91    0 0.4480 6.211   6.5  5.7209   3 233    17.9
## 45    0.12269   0.0  6.91    0 0.4480 6.069  40.0  5.7209   3 233    17.9
## 46    0.17142   0.0  6.91    0 0.4480 5.682  33.8  5.1004   3 233    17.9
## 47    0.18836   0.0  6.91    0 0.4480 5.786  33.3  5.1004   3 233    17.9
## 48    0.22927   0.0  6.91    0 0.4480 6.030  85.5  5.6894   3 233    17.9
## 49    0.25387   0.0  6.91    0 0.4480 5.399  95.3  5.8700   3 233    17.9
## 50    0.21977   0.0  6.91    0 0.4480 5.602  62.0  6.0877   3 233    17.9
## 51    0.08873  21.0  5.64    0 0.4390 5.963  45.7  6.8147   4 243    16.8
```

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## 52   0.04337  21.0  5.64    0 0.4390 6.115  63.0  6.8147   4 243     16.8
## 53   0.05360  21.0  5.64    0 0.4390 6.511  21.1  6.8147   4 243     16.8
## 54   0.04981  21.0  5.64    0 0.4390 5.998  21.4  6.8147   4 243     16.8
## 55   0.01360  75.0  4.00    0 0.4100 5.888  47.6  7.3197   3 469     21.1
## 56   0.01311  90.0  1.22    0 0.4030 7.249  21.9  8.6966   5 226     17.9
## 57   0.02055  85.0  0.74    0 0.4100 6.383  35.7  9.1876   2 313     17.3
## 58   0.01432 100.0  1.32    0 0.4110 6.816  40.5  8.3248   5 256     15.1
## 59   0.15445  25.0  5.13    0 0.4530 6.145  29.2  7.8148   8 284     19.7
## 60   0.10328  25.0  5.13    0 0.4530 5.927  47.2  6.9320   8 284     19.7
## 61   0.14932  25.0  5.13    0 0.4530 5.741  66.2  7.2254   8 284     19.7
## 62   0.17171  25.0  5.13    0 0.4530 5.966  93.4  6.8185   8 284     19.7
## 63   0.11027  25.0  5.13    0 0.4530 6.456  67.8  7.2255   8 284     19.7
## 64   0.12650  25.0  5.13    0 0.4530 6.762  43.4  7.9809   8 284     19.7
## 65   0.01951  17.5  1.38    0 0.4161 7.104  59.5  9.2229   3 216     18.6
## 66   0.03584  80.0  3.37    0 0.3980 6.290  17.8  6.6115   4 337     16.1
## 67   0.04379  80.0  3.37    0 0.3980 5.787  31.1  6.6115   4 337     16.1
## 68   0.05789  12.5  6.07    0 0.4090 5.878  21.4  6.4980   4 345     18.9
## 69   0.13554  12.5  6.07    0 0.4090 5.594  36.8  6.4980   4 345     18.9
## 70   0.12816  12.5  6.07    0 0.4090 5.885  33.0  6.4980   4 345     18.9
## 71   0.08826   0.0 10.81    0 0.4130 6.417   6.6  5.2873   4 305     19.2
## 72   0.15876   0.0 10.81    0 0.4130 5.961  17.5  5.2873   4 305     19.2
## 73   0.09164   0.0 10.81    0 0.4130 6.065   7.8  5.2873   4 305     19.2
## 74   0.19539   0.0 10.81    0 0.4130 6.245   6.2  5.2873   4 305     19.2
## 75   0.07896   0.0 12.83    0 0.4370 6.273   6.0  4.2515   5 398     18.7
## 76   0.09512   0.0 12.83    0 0.4370 6.286  45.0  4.5026   5 398     18.7
## 77   0.10153   0.0 12.83    0 0.4370 6.279  74.5  4.0522   5 398     18.7
## 78   0.08707   0.0 12.83    0 0.4370 6.140  45.8  4.0905   5 398     18.7
## 79   0.05646   0.0 12.83    0 0.4370 6.232  53.7  5.0141   5 398     18.7
## 80   0.08387   0.0 12.83    0 0.4370 5.874  36.6  4.5026   5 398     18.7
## 81   0.04113  25.0  4.86    0 0.4260 6.727  33.5  5.4007   4 281     19.0
## 82   0.04462  25.0  4.86    0 0.4260 6.619  70.4  5.4007   4 281     19.0
## 83   0.03659  25.0  4.86    0 0.4260 6.302  32.2  5.4007   4 281     19.0
## 84   0.03551  25.0  4.86    0 0.4260 6.167  46.7  5.4007   4 281     19.0
## 85   0.05059   0.0  4.49    0 0.4490 6.389  48.0  4.7794   3 247     18.5
## 86   0.05735   0.0  4.49    0 0.4490 6.630  56.1  4.4377   3 247     18.5
## 87   0.05188   0.0  4.49    0 0.4490 6.015  45.1  4.4272   3 247     18.5
## 88   0.07151   0.0  4.49    0 0.4490 6.121  56.8  3.7476   3 247     18.5
## 89   0.05660   0.0  3.41    0 0.4890 7.007  86.3  3.4217   2 270     17.8
## 90   0.05302   0.0  3.41    0 0.4890 7.079  63.1  3.4145   2 270     17.8
## 91   0.04684   0.0  3.41    0 0.4890 6.417  66.1  3.0923   2 270     17.8
## 92   0.03932   0.0  3.41    0 0.4890 6.405  73.9  3.0921   2 270     17.8
## 93   0.04203  28.0 15.04    0 0.4640 6.442  53.6  3.6659   4 270     18.2
## 94   0.02875  28.0 15.04    0 0.4640 6.211  28.9  3.6659   4 270     18.2
## 95   0.04294  28.0 15.04    0 0.4640 6.249  77.3  3.6150   4 270     18.2
## 96   0.12204   0.0  2.89    0 0.4450 6.625  57.8  3.4952   2 276     18.0
## 97   0.11504   0.0  2.89    0 0.4450 6.163  69.6  3.4952   2 276     18.0
## 98   0.12083   0.0  2.89    0 0.4450 8.069  76.0  3.4952   2 276     18.0
## 99   0.08187   0.0  2.89    0 0.4450 7.820  36.9  3.4952   2 276     18.0
## 100  0.06860   0.0  2.89    0 0.4450 7.416  62.5  3.4952   2 276     18.0
## 101  0.14866   0.0  8.56    0 0.5200 6.727  79.9  2.7778   5 384     20.9
## 102  0.11432   0.0  8.56    0 0.5200 6.781  71.3  2.8561   5 384     20.9
## 103  0.22876   0.0  8.56    0 0.5200 6.405  85.4  2.7147   5 384     20.9
## 104  0.21161   0.0  8.56    0 0.5200 6.137  87.4  2.7147   5 384     20.9
## 105  0.13960   0.0  8.56    0 0.5200 6.167  90.0  2.4210   5 384     20.9
```

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## 106  0.13262   0.0  8.56    0 0.5200 5.851  96.7  2.1069   5 384    20.9
## 107  0.17120   0.0  8.56    0 0.5200 5.836  91.9  2.2110   5 384    20.9
## 108  0.13117   0.0  8.56    0 0.5200 6.127  85.2  2.1224   5 384    20.9
## 109  0.12802   0.0  8.56    0 0.5200 6.474  97.1  2.4329   5 384    20.9
## 110  0.26363   0.0  8.56    0 0.5200 6.229  91.2  2.5451   5 384    20.9
## 111  0.10793   0.0  8.56    0 0.5200 6.195  54.4  2.7778   5 384    20.9
## 112  0.10084   0.0 10.01    0 0.5470 6.715  81.6  2.6775   6 432    17.8
## 113  0.12329   0.0 10.01    0 0.5470 5.913  92.9  2.3534   6 432    17.8
## 114  0.22212   0.0 10.01    0 0.5470 6.092  95.4  2.5480   6 432    17.8
## 115  0.14231   0.0 10.01    0 0.5470 6.254  84.2  2.2565   6 432    17.8
## 116  0.17134   0.0 10.01    0 0.5470 5.928  88.2  2.4631   6 432    17.8
## 117  0.13158   0.0 10.01    0 0.5470 6.176  72.5  2.7301   6 432    17.8
## 118  0.15098   0.0 10.01    0 0.5470 6.021  82.6  2.7474   6 432    17.8
## 119  0.13058   0.0 10.01    0 0.5470 5.872  73.1  2.4775   6 432    17.8
## 120  0.14476   0.0 10.01    0 0.5470 5.731  65.2  2.7592   6 432    17.8
## 121  0.06899   0.0 25.65    0 0.5810 5.870  69.7  2.2577   2 188    19.1
## 122  0.07165   0.0 25.65    0 0.5810 6.004  84.1  2.1974   2 188    19.1
## 123  0.09299   0.0 25.65    0 0.5810 5.961  92.9  2.0869   2 188    19.1
## 124  0.15038   0.0 25.65    0 0.5810 5.856  97.0  1.9444   2 188    19.1
## 125  0.09849   0.0 25.65    0 0.5810 5.879  95.8  2.0063   2 188    19.1
## 126  0.16902   0.0 25.65    0 0.5810 5.986  88.4  1.9929   2 188    19.1
## 127  0.38735   0.0 25.65    0 0.5810 5.613  95.6  1.7572   2 188    19.1
## 128  0.25915   0.0 21.89    0 0.6240 5.693  96.0  1.7883   4 437    21.2
## 129  0.32543   0.0 21.89    0 0.6240 6.431  98.8  1.8125   4 437    21.2
## 130  0.88125   0.0 21.89    0 0.6240 5.637  94.7  1.9799   4 437    21.2
## 131  0.34006   0.0 21.89    0 0.6240 6.458  98.9  2.1185   4 437    21.2
## 132  1.19294   0.0 21.89    0 0.6240 6.326  97.7  2.2710   4 437    21.2
## 133  0.59005   0.0 21.89    0 0.6240 6.372  97.9  2.3274   4 437    21.2
## 134  0.32982   0.0 21.89    0 0.6240 5.822  95.4  2.4699   4 437    21.2
## 135  0.97617   0.0 21.89    0 0.6240 5.757  98.4  2.3460   4 437    21.2
## 136  0.55778   0.0 21.89    0 0.6240 6.335  98.2  2.1107   4 437    21.2
## 137  0.32264   0.0 21.89    0 0.6240 5.942  93.5  1.9669   4 437    21.2
## 138  0.35233   0.0 21.89    0 0.6240 6.454  98.4  1.8498   4 437    21.2
## 139  0.24980   0.0 21.89    0 0.6240 5.857  98.2  1.6686   4 437    21.2
## 140  0.54452   0.0 21.89    0 0.6240 6.151  97.9  1.6687   4 437    21.2
## 141  0.29090   0.0 21.89    0 0.6240 6.174  93.6  1.6119   4 437    21.2
## 142  1.62864   0.0 21.89    0 0.6240 5.019 100.0  1.4394   4 437    21.2
## 143  3.32105   0.0 19.58    1 0.8710 5.403 100.0  1.3216   5 403    14.7
## 144  4.09740   0.0 19.58    0 0.8710 5.468 100.0  1.4118   5 403    14.7
## 145  2.77974   0.0 19.58    0 0.8710 4.903  97.8  1.3459   5 403    14.7
## 146  2.37934   0.0 19.58    0 0.8710 6.130 100.0  1.4191   5 403    14.7
## 147  2.15505   0.0 19.58    0 0.8710 5.628 100.0  1.5166   5 403    14.7
## 148  2.36862   0.0 19.58    0 0.8710 4.926  95.7  1.4608   5 403    14.7
## 149  2.33099   0.0 19.58    0 0.8710 5.186  93.8  1.5296   5 403    14.7
## 150  2.73397   0.0 19.58    0 0.8710 5.597  94.9  1.5257   5 403    14.7
## 151  1.65660   0.0 19.58    0 0.8710 6.122  97.3  1.6180   5 403    14.7
## 152  1.49632   0.0 19.58    0 0.8710 5.404 100.0  1.5916   5 403    14.7
## 153  1.12658   0.0 19.58    1 0.8710 5.012  88.0  1.6102   5 403    14.7
## 154  2.14918   0.0 19.58    0 0.8710 5.709  98.5  1.6232   5 403    14.7
## 155  1.41385   0.0 19.58    1 0.8710 6.129  96.0  1.7494   5 403    14.7
## 156  3.53501   0.0 19.58    1 0.8710 6.152  82.6  1.7455   5 403    14.7
## 157  2.44668   0.0 19.58    0 0.8710 5.272  94.0  1.7364   5 403    14.7
## 158  1.22358   0.0 19.58    0 0.6050 6.943  97.4  1.8773   5 403    14.7
## 159  1.34284   0.0 19.58    0 0.6050 6.066 100.0  1.7573   5 403    14.7
```

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## 160  1.42502   0.0 19.58    0 0.8710 6.510 100.0  1.7659   5 403    14.7
## 161  1.27346   0.0 19.58    1 0.6050 6.250  92.6  1.7984   5 403    14.7
## 162  1.46336   0.0 19.58    0 0.6050 7.489  90.8  1.9709   5 403    14.7
## 163  1.83377   0.0 19.58    1 0.6050 7.802  98.2  2.0407   5 403    14.7
## 164  1.51902   0.0 19.58    1 0.6050 8.375  93.9  2.1620   5 403    14.7
## 165  2.24236   0.0 19.58    0 0.6050 5.854  91.8  2.4220   5 403    14.7
## 166  2.92400   0.0 19.58    0 0.6050 6.101  93.0  2.2834   5 403    14.7
## 167  2.01019   0.0 19.58    0 0.6050 7.929  96.2  2.0459   5 403    14.7
## 168  1.80028   0.0 19.58    0 0.6050 5.877  79.2  2.4259   5 403    14.7
## 169  2.30040   0.0 19.58    0 0.6050 6.319  96.1  2.1000   5 403    14.7
## 170  2.44953   0.0 19.58    0 0.6050 6.402  95.2  2.2625   5 403    14.7
## 171  1.20742   0.0 19.58    0 0.6050 5.875  94.6  2.4259   5 403    14.7
## 172  2.31390   0.0 19.58    0 0.6050 5.880  97.3  2.3887   5 403    14.7
## 173  0.13914   0.0  4.05    0 0.5100 5.572  88.5  2.5961   5 296    16.6
## 174  0.09178   0.0  4.05    0 0.5100 6.416  84.1  2.6463   5 296    16.6
## 175  0.08447   0.0  4.05    0 0.5100 5.859  68.7  2.7019   5 296    16.6
## 176  0.06664   0.0  4.05    0 0.5100 6.546  33.1  3.1323   5 296    16.6
## 177  0.07022   0.0  4.05    0 0.5100 6.020  47.2  3.5549   5 296    16.6
## 178  0.05425   0.0  4.05    0 0.5100 6.315  73.4  3.3175   5 296    16.6
## 179  0.06642   0.0  4.05    0 0.5100 6.860  74.4  2.9153   5 296    16.6
## 180  0.05780   0.0  2.46    0 0.4880 6.980  58.4  2.8290   3 193    17.8
## 181  0.06588   0.0  2.46    0 0.4880 7.765  83.3  2.7410   3 193    17.8
## 182  0.06888   0.0  2.46    0 0.4880 6.144  62.2  2.5979   3 193    17.8
## 183  0.09103   0.0  2.46    0 0.4880 7.155  92.2  2.7006   3 193    17.8
## 184  0.10008   0.0  2.46    0 0.4880 6.563  95.6  2.8470   3 193    17.8
## 185  0.08308   0.0  2.46    0 0.4880 5.604  89.8  2.9879   3 193    17.8
## 186  0.06047   0.0  2.46    0 0.4880 6.153  68.8  3.2797   3 193    17.8
## 187  0.05602   0.0  2.46    0 0.4880 7.831  53.6  3.1992   3 193    17.8
## 188  0.07875  45.0  3.44    0 0.4370 6.782  41.1  3.7886   5 398    15.2
## 189  0.12579  45.0  3.44    0 0.4370 6.556  29.1  4.5667   5 398    15.2
## 190  0.08370  45.0  3.44    0 0.4370 7.185  38.9  4.5667   5 398    15.2
## 191  0.09068  45.0  3.44    0 0.4370 6.951  21.5  6.4798   5 398    15.2
## 192  0.06911  45.0  3.44    0 0.4370 6.739  30.8  6.4798   5 398    15.2
## 193  0.08664  45.0  3.44    0 0.4370 7.178  26.3  6.4798   5 398    15.2
## 194  0.02187  60.0  2.93    0 0.4010 6.800   9.9  6.2196   1 265    15.6
## 195  0.01439  60.0  2.93    0 0.4010 6.604  18.8  6.2196   1 265    15.6
## 196  0.01381  80.0  0.46    0 0.4220 7.875  32.0  5.6484   4 255    14.4
## 197  0.04011  80.0  1.52    0 0.4040 7.287  34.1  7.3090   2 329    12.6
## 198  0.04666  80.0  1.52    0 0.4040 7.107  36.6  7.3090   2 329    12.6
## 199  0.03768  80.0  1.52    0 0.4040 7.274  38.3  7.3090   2 329    12.6
## 200  0.03150  95.0  1.47    0 0.4030 6.975  15.3  7.6534   3 402    17.0
## 201  0.01778  95.0  1.47    0 0.4030 7.135  13.9  7.6534   3 402    17.0
## 202  0.03445  82.5  2.03    0 0.4150 6.162  38.4  6.2700   2 348    14.7
## 203  0.02177  82.5  2.03    0 0.4150 7.610  15.7  6.2700   2 348    14.7
## 204  0.03510  95.0  2.68    0 0.4161 7.853  33.2  5.1180   4 224    14.7
## 205  0.02009  95.0  2.68    0 0.4161 8.034  31.9  5.1180   4 224    14.7
## 206  0.13642   0.0 10.59    0 0.4890 5.891  22.3  3.9454   4 277    18.6
## 207  0.22969   0.0 10.59    0 0.4890 6.326  52.5  4.3549   4 277    18.6
## 208  0.25199   0.0 10.59    0 0.4890 5.783  72.7  4.3549   4 277    18.6
## 209  0.13587   0.0 10.59    1 0.4890 6.064  59.1  4.2392   4 277    18.6
## 210  0.43571   0.0 10.59    1 0.4890 5.344 100.0  3.8750   4 277    18.6
## 211  0.17446   0.0 10.59    1 0.4890 5.960  92.1  3.8771   4 277    18.6
## 212  0.37578   0.0 10.59    1 0.4890 5.404  88.6  3.6650   4 277    18.6
## 213  0.21719   0.0 10.59    1 0.4890 5.807  53.8  3.6526   4 277    18.6
```

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## 214 0.14052  0.0 10.59    0 0.4890 6.375  32.3 3.9454   4 277    18.6
## 215 0.28955  0.0 10.59    0 0.4890 5.412   9.8 3.5875   4 277    18.6
## 216 0.19802  0.0 10.59    0 0.4890 6.182  42.4 3.9454   4 277    18.6
## 217 0.04560  0.0 13.89    1 0.5500 5.888  56.0 3.1121   5 276    16.4
## 218 0.07013  0.0 13.89    0 0.5500 6.642  85.1 3.4211   5 276    16.4
## 219 0.11069  0.0 13.89    1 0.5500 5.951  93.8 2.8893   5 276    16.4
## 220 0.11425  0.0 13.89    1 0.5500 6.373  92.4 3.3633   5 276    16.4
## 221 0.35809  0.0  6.20    1 0.5070 6.951  88.5 2.8617   8 307    17.4
## 222 0.40771  0.0  6.20    1 0.5070 6.164  91.3 3.0480   8 307    17.4
## 223 0.62356  0.0  6.20    1 0.5070 6.879  77.7 3.2721   8 307    17.4
## 224 0.61470  0.0  6.20    0 0.5070 6.618  80.8 3.2721   8 307    17.4
## 225 0.31533  0.0  6.20    0 0.5040 8.266  78.3 2.8944   8 307    17.4
## 226 0.52693  0.0  6.20    0 0.5040 8.725  83.0 2.8944   8 307    17.4
## 227 0.38214  0.0  6.20    0 0.5040 8.040  86.5 3.2157   8 307    17.4
## 228 0.41238  0.0  6.20    0 0.5040 7.163  79.9 3.2157   8 307    17.4
## 229 0.29819  0.0  6.20    0 0.5040 7.686  17.0 3.3751   8 307    17.4
## 230 0.44178  0.0  6.20    0 0.5040 6.552  21.4 3.3751   8 307    17.4
## 231 0.53700  0.0  6.20    0 0.5040 5.981  68.1 3.6715   8 307    17.4
## 232 0.46296  0.0  6.20    0 0.5040 7.412  76.9 3.6715   8 307    17.4
## 233 0.57529  0.0  6.20    0 0.5070 8.337  73.3 3.8384   8 307    17.4
## 234 0.33147  0.0  6.20    0 0.5070 8.247  70.4 3.6519   8 307    17.4
## 235 0.44791  0.0  6.20    1 0.5070 6.726  66.5 3.6519   8 307    17.4
## 236 0.33045  0.0  6.20    0 0.5070 6.086  61.5 3.6519   8 307    17.4
## 237 0.52058  0.0  6.20    1 0.5070 6.631  76.5 4.1480   8 307    17.4
## 238 0.51183  0.0  6.20    0 0.5070 7.358  71.6 4.1480   8 307    17.4
## 239 0.08244 30.0  4.93    0 0.4280 6.481  18.5 6.1899   6 300    16.6
## 240 0.09252 30.0  4.93    0 0.4280 6.606  42.2 6.1899   6 300    16.6
## 241 0.11329 30.0  4.93    0 0.4280 6.897  54.3 6.3361   6 300    16.6
## 242 0.10612 30.0  4.93    0 0.4280 6.095  65.1 6.3361   6 300    16.6
## 243 0.10290 30.0  4.93    0 0.4280 6.358  52.9 7.0355   6 300    16.6
## 244 0.12757 30.0  4.93    0 0.4280 6.393   7.8 7.0355   6 300    16.6
## 245 0.20608 22.0  5.86    0 0.4310 5.593  76.5 7.9549   7 330    19.1
## 246 0.19133 22.0  5.86    0 0.4310 5.605  70.2 7.9549   7 330    19.1
## 247 0.33983 22.0  5.86    0 0.4310 6.108  34.9 8.0555   7 330    19.1
## 248 0.19657 22.0  5.86    0 0.4310 6.226  79.2 8.0555   7 330    19.1
## 249 0.16439 22.0  5.86    0 0.4310 6.433  49.1 7.8265   7 330    19.1
## 250 0.19073 22.0  5.86    0 0.4310 6.718  17.5 7.8265   7 330    19.1
## 251 0.14030 22.0  5.86    0 0.4310 6.487  13.0 7.3967   7 330    19.1
## 252 0.21409 22.0  5.86    0 0.4310 6.438   8.9 7.3967   7 330    19.1
## 253 0.08221 22.0  5.86    0 0.4310 6.957   6.8 8.9067   7 330    19.1
## 254 0.36894 22.0  5.86    0 0.4310 8.259   8.4 8.9067   7 330    19.1
## 255 0.04819 80.0  3.64    0 0.3920 6.108  32.0 9.2203   1 315    16.4
## 256 0.03548 80.0  3.64    0 0.3920 5.876  19.1 9.2203   1 315    16.4
## 257 0.01538 90.0  3.75    0 0.3940 7.454  34.2 6.3361   3 244    15.9
## 258 0.61154 20.0  3.97    0 0.6470 8.704  86.9 1.8010   5 264    13.0
## 259 0.66351 20.0  3.97    0 0.6470 7.333 100.0 1.8946   5 264    13.0
## 260 0.65665 20.0  3.97    0 0.6470 6.842 100.0 2.0107   5 264    13.0
## 261 0.54011 20.0  3.97    0 0.6470 7.203  81.8 2.1121   5 264    13.0
## 262 0.53412 20.0  3.97    0 0.6470 7.520  89.4 2.1398   5 264    13.0
## 263 0.52014 20.0  3.97    0 0.6470 8.398  91.5 2.2885   5 264    13.0
## 264 0.82526 20.0  3.97    0 0.6470 7.327  94.5 2.0788   5 264    13.0
## 265 0.55007 20.0  3.97    0 0.6470 7.206  91.6 1.9301   5 264    13.0
## 266 0.76162 20.0  3.97    0 0.6470 5.560  62.8 1.9865   5 264    13.0
## 267 0.78570 20.0  3.97    0 0.6470 7.014  84.6 2.1329   5 264    13.0
```

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## 268  0.57834  20.0  3.97    0 0.5750 8.297  67.0  2.4216   5 264    13.0
## 269  0.54050  20.0  3.97    0 0.5750 7.470  52.6  2.8720   5 264    13.0
## 270  0.09065  20.0  6.96    1 0.4640 5.920  61.5  3.9175   3 223    18.6
## 271  0.29916  20.0  6.96    0 0.4640 5.856  42.1  4.4290   3 223    18.6
## 272  0.16211  20.0  6.96    0 0.4640 6.240  16.3  4.4290   3 223    18.6
## 273  0.11460  20.0  6.96    0 0.4640 6.538  58.7  3.9175   3 223    18.6
## 274  0.22188  20.0  6.96    1 0.4640 7.691  51.8  4.3665   3 223    18.6
## 275  0.05644  40.0  6.41    1 0.4470 6.758  32.9  4.0776   4 254    17.6
## 276  0.09604  40.0  6.41    0 0.4470 6.854  42.8  4.2673   4 254    17.6
## 277  0.10469  40.0  6.41    1 0.4470 7.267  49.0  4.7872   4 254    17.6
## 278  0.06127  40.0  6.41    1 0.4470 6.826  27.6  4.8628   4 254    17.6
## 279  0.07978  40.0  6.41    0 0.4470 6.482  32.1  4.1403   4 254    17.6
## 280  0.21038  20.0  3.33    0 0.4429 6.812  32.2  4.1007   5 216    14.9
## 281  0.03578  20.0  3.33    0 0.4429 7.820  64.5  4.6947   5 216    14.9
## 282  0.03705  20.0  3.33    0 0.4429 6.968  37.2  5.2447   5 216    14.9
## 283  0.06129  20.0  3.33    1 0.4429 7.645  49.7  5.2119   5 216    14.9
## 284  0.01501  90.0  1.21    1 0.4010 7.923  24.8  5.8850   1 198    13.6
## 285  0.00906  90.0  2.97    0 0.4000 7.088  20.8  7.3073   1 285    15.3
## 286  0.01096  55.0  2.25    0 0.3890 6.453  31.9  7.3073   1 300    15.3
## 287  0.01965  80.0  1.76    0 0.3850 6.230  31.5  9.0892   1 241    18.2
## 288  0.03871  52.5  5.32    0 0.4050 6.209  31.3  7.3172   6 293    16.6
## 289  0.04590  52.5  5.32    0 0.4050 6.315  45.6  7.3172   6 293    16.6
## 290  0.04297  52.5  5.32    0 0.4050 6.565  22.9  7.3172   6 293    16.6
## 291  0.03502  80.0  4.95    0 0.4110 6.861  27.9  5.1167   4 245    19.2
## 292  0.07886  80.0  4.95    0 0.4110 7.148  27.7  5.1167   4 245    19.2
## 293  0.03615  80.0  4.95    0 0.4110 6.630  23.4  5.1167   4 245    19.2
## 294  0.08265   0.0 13.92    0 0.4370 6.127  18.4  5.5027   4 289    16.0
## 295  0.08199   0.0 13.92    0 0.4370 6.009  42.3  5.5027   4 289    16.0
## 296  0.12932   0.0 13.92    0 0.4370 6.678  31.1  5.9604   4 289    16.0
## 297  0.05372   0.0 13.92    0 0.4370 6.549  51.0  5.9604   4 289    16.0
## 298  0.14103   0.0 13.92    0 0.4370 5.790  58.0  6.3200   4 289    16.0
## 299  0.06466  70.0  2.24    0 0.4000 6.345  20.1  7.8278   5 358    14.8
## 300  0.05561  70.0  2.24    0 0.4000 7.041  10.0  7.8278   5 358    14.8
## 301  0.04417  70.0  2.24    0 0.4000 6.871  47.4  7.8278   5 358    14.8
## 302  0.03537  34.0  6.09    0 0.4330 6.590  40.4  5.4917   7 329    16.1
## 303  0.09266  34.0  6.09    0 0.4330 6.495  18.4  5.4917   7 329    16.1
## 304  0.10000  34.0  6.09    0 0.4330 6.982  17.7  5.4917   7 329    16.1
## 305  0.05515  33.0  2.18    0 0.4720 7.236  41.1  4.0220   7 222    18.4
## 306  0.05479  33.0  2.18    0 0.4720 6.616  58.1  3.3700   7 222    18.4
## 307  0.07503  33.0  2.18    0 0.4720 7.420  71.9  3.0992   7 222    18.4
## 308  0.04932  33.0  2.18    0 0.4720 6.849  70.3  3.1827   7 222    18.4
## 309  0.49298   0.0  9.90    0 0.5440 6.635  82.5  3.3175   4 304    18.4
## 310  0.34940   0.0  9.90    0 0.5440 5.972  76.7  3.1025   4 304    18.4
## 311  2.63548   0.0  9.90    0 0.5440 4.973  37.8  2.5194   4 304    18.4
## 312  0.79041   0.0  9.90    0 0.5440 6.122  52.8  2.6403   4 304    18.4
## 313  0.26169   0.0  9.90    0 0.5440 6.023  90.4  2.8340   4 304    18.4
## 314  0.26938   0.0  9.90    0 0.5440 6.266  82.8  3.2628   4 304    18.4
## 315  0.36920   0.0  9.90    0 0.5440 6.567  87.3  3.6023   4 304    18.4
## 316  0.25356   0.0  9.90    0 0.5440 5.705  77.7  3.9450   4 304    18.4
## 317  0.31827   0.0  9.90    0 0.5440 5.914  83.2  3.9986   4 304    18.4
## 318  0.24522   0.0  9.90    0 0.5440 5.782  71.7  4.0317   4 304    18.4
## 319  0.40202   0.0  9.90    0 0.5440 6.382  67.2  3.5325   4 304    18.4
## 320  0.47547   0.0  9.90    0 0.5440 6.113  58.8  4.0019   4 304    18.4
## 321  0.16760   0.0  7.38    0 0.4930 6.426  52.3  4.5404   5 287    19.6
```

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## 322  0.18159   0.0  7.38    0 0.4930 6.376  54.3  4.5404   5 287    19.6
## 323  0.35114   0.0  7.38    0 0.4930 6.041  49.9  4.7211   5 287    19.6
## 324  0.28392   0.0  7.38    0 0.4930 5.708  74.3  4.7211   5 287    19.6
## 325  0.34109   0.0  7.38    0 0.4930 6.415  40.1  4.7211   5 287    19.6
## 326  0.19186   0.0  7.38    0 0.4930 6.431  14.7  5.4159   5 287    19.6
## 327  0.30347   0.0  7.38    0 0.4930 6.312  28.9  5.4159   5 287    19.6
## 328  0.24103   0.0  7.38    0 0.4930 6.083  43.7  5.4159   5 287    19.6
## 329  0.06617   0.0  3.24    0 0.4600 5.868  25.8  5.2146   4 430    16.9
## 330  0.06724   0.0  3.24    0 0.4600 6.333  17.2  5.2146   4 430    16.9
## 331  0.04544   0.0  3.24    0 0.4600 6.144  32.2  5.8736   4 430    16.9
## 332  0.05023  35.0  6.06    0 0.4379 5.706  28.4  6.6407   1 304    16.9
## 333  0.03466  35.0  6.06    0 0.4379 6.031  23.3  6.6407   1 304    16.9
## 334  0.05083   0.0  5.19    0 0.5150 6.316  38.1  6.4584   5 224    20.2
## 335  0.03738   0.0  5.19    0 0.5150 6.310  38.5  6.4584   5 224    20.2
## 336  0.03961   0.0  5.19    0 0.5150 6.037  34.5  5.9853   5 224    20.2
## 337  0.03427   0.0  5.19    0 0.5150 5.869  46.3  5.2311   5 224    20.2
## 338  0.03041   0.0  5.19    0 0.5150 5.895  59.6  5.6150   5 224    20.2
## 339  0.03306   0.0  5.19    0 0.5150 6.059  37.3  4.8122   5 224    20.2
## 340  0.05497   0.0  5.19    0 0.5150 5.985  45.4  4.8122   5 224    20.2
## 341  0.06151   0.0  5.19    0 0.5150 5.968  58.5  4.8122   5 224    20.2
## 342  0.01301  35.0  1.52    0 0.4420 7.241  49.3  7.0379   1 284    15.5
## 343  0.02498   0.0  1.89    0 0.5180 6.540  59.7  6.2669   1 422    15.9
## 344  0.02543  55.0  3.78    0 0.4840 6.696  56.4  5.7321   5 370    17.6
## 345  0.03049  55.0  3.78    0 0.4840 6.874  28.1  6.4654   5 370    17.6
## 346  0.03113   0.0  4.39    0 0.4420 6.014  48.5  8.0136   3 352    18.8
## 347  0.06162   0.0  4.39    0 0.4420 5.898  52.3  8.0136   3 352    18.8
## 348  0.01870  85.0  4.15    0 0.4290 6.516  27.7  8.5353   4 351    17.9
## 349  0.01501  80.0  2.01    0 0.4350 6.635  29.7  8.3440   4 280    17.0
## 350  0.02899  40.0  1.25    0 0.4290 6.939  34.5  8.7921   1 335    19.7
## 351  0.06211  40.0  1.25    0 0.4290 6.490  44.4  8.7921   1 335    19.7
## 352  0.07950  60.0  1.69    0 0.4110 6.579  35.9 10.7103   4 411    18.3
## 353  0.07244  60.0  1.69    0 0.4110 5.884  18.5 10.7103   4 411    18.3
## 354  0.01709  90.0  2.02    0 0.4100 6.728  36.1 12.1265   5 187    17.0
## 355  0.04301  80.0  1.91    0 0.4130 5.663  21.9 10.5857   4 334    22.0
## 356  0.10659  80.0  1.91    0 0.4130 5.936  19.5 10.5857   4 334    22.0
## 357  8.98296   0.0 18.10    1 0.7700 6.212  97.4  2.1222  24 666    20.2
## 358  3.84970   0.0 18.10    1 0.7700 6.395  91.0  2.5052  24 666    20.2
## 359  5.20177   0.0 18.10    1 0.7700 6.127  83.4  2.7227  24 666    20.2
## 360  4.26131   0.0 18.10    0 0.7700 6.112  81.3  2.5091  24 666    20.2
## 361  4.54192   0.0 18.10    0 0.7700 6.398  88.0  2.5182  24 666    20.2
## 362  3.83684   0.0 18.10    0 0.7700 6.251  91.1  2.2955  24 666    20.2
## 363  3.67822   0.0 18.10    0 0.7700 5.362  96.2  2.1036  24 666    20.2
## 364  4.22239   0.0 18.10    1 0.7700 5.803  89.0  1.9047  24 666    20.2
## 365  3.47428   0.0 18.10    1 0.7180 8.780  82.9  1.9047  24 666    20.2
## 366  4.55587   0.0 18.10    0 0.7180 3.561  87.9  1.6132  24 666    20.2
## 367  3.69695   0.0 18.10    0 0.7180 4.963  91.4  1.7523  24 666    20.2
## 368 13.52220   0.0 18.10    0 0.6310 3.863 100.0  1.5106  24 666    20.2
## 369  4.89822   0.0 18.10    0 0.6310 4.970 100.0  1.3325  24 666    20.2
## 370  5.66998   0.0 18.10    1 0.6310 6.683  96.8  1.3567  24 666    20.2
## 371  6.53876   0.0 18.10    1 0.6310 7.016  97.5  1.2024  24 666    20.2
## 372  9.23230   0.0 18.10    0 0.6310 6.216 100.0  1.1691  24 666    20.2
## 373  8.26725   0.0 18.10    1 0.6680 5.875  89.6  1.1296  24 666    20.2
## 374 11.10810   0.0 18.10    0 0.6680 4.906 100.0  1.1742  24 666    20.2
## 375 18.49820   0.0 18.10    0 0.6680 4.138 100.0  1.1370  24 666    20.2
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## 376 19.60910   0.0 18.10    0 0.6710 7.313  97.9  1.3163  24 666    20.2
## 377 15.28800   0.0 18.10    0 0.6710 6.649  93.3  1.3449  24 666    20.2
## 378  9.82349   0.0 18.10    0 0.6710 6.794  98.8  1.3580  24 666    20.2
## 379 23.64820   0.0 18.10    0 0.6710 6.380  96.2  1.3861  24 666    20.2
## 380 17.86670   0.0 18.10    0 0.6710 6.223 100.0  1.3861  24 666    20.2
## 381 88.97620   0.0 18.10    0 0.6710 6.968  91.9  1.4165  24 666    20.2
## 382 15.87440   0.0 18.10    0 0.6710 6.545  99.1  1.5192  24 666    20.2
## 383  9.18702   0.0 18.10    0 0.7000 5.536 100.0  1.5804  24 666    20.2
## 384  7.99248   0.0 18.10    0 0.7000 5.520 100.0  1.5331  24 666    20.2
## 385 20.08490   0.0 18.10    0 0.7000 4.368  91.2  1.4395  24 666    20.2
## 386 16.81180   0.0 18.10    0 0.7000 5.277  98.1  1.4261  24 666    20.2
## 387 24.39380   0.0 18.10    0 0.7000 4.652 100.0  1.4672  24 666    20.2
## 388 22.59710   0.0 18.10    0 0.7000 5.000  89.5  1.5184  24 666    20.2
## 389 14.33370   0.0 18.10    0 0.7000 4.880 100.0  1.5895  24 666    20.2
## 390  8.15174   0.0 18.10    0 0.7000 5.390  98.9  1.7281  24 666    20.2
## 391  6.96215   0.0 18.10    0 0.7000 5.713  97.0  1.9265  24 666    20.2
## 392  5.29305   0.0 18.10    0 0.7000 6.051  82.5  2.1678  24 666    20.2
## 393 11.57790   0.0 18.10    0 0.7000 5.036  97.0  1.7700  24 666    20.2
## 394  8.64476   0.0 18.10    0 0.6930 6.193  92.6  1.7912  24 666    20.2
## 395 13.35980   0.0 18.10    0 0.6930 5.887  94.7  1.7821  24 666    20.2
## 396  8.71675   0.0 18.10    0 0.6930 6.471  98.8  1.7257  24 666    20.2
## 397  5.87205   0.0 18.10    0 0.6930 6.405  96.0  1.6768  24 666    20.2
## 398  7.67202   0.0 18.10    0 0.6930 5.747  98.9  1.6334  24 666    20.2
## 399 38.35180   0.0 18.10    0 0.6930 5.453 100.0  1.4896  24 666    20.2
## 400  9.91655   0.0 18.10    0 0.6930 5.852  77.8  1.5004  24 666    20.2
## 401 25.04610   0.0 18.10    0 0.6930 5.987 100.0  1.5888  24 666    20.2
## 402 14.23620   0.0 18.10    0 0.6930 6.343 100.0  1.5741  24 666    20.2
## 403  9.59571   0.0 18.10    0 0.6930 6.404 100.0  1.6390  24 666    20.2
## 404 24.80170   0.0 18.10    0 0.6930 5.349  96.0  1.7028  24 666    20.2
## 405 41.52920   0.0 18.10    0 0.6930 5.531  85.4  1.6074  24 666    20.2
## 406 67.92080   0.0 18.10    0 0.6930 5.683 100.0  1.4254  24 666    20.2
## 407 20.71620   0.0 18.10    0 0.6590 4.138 100.0  1.1781  24 666    20.2
## 408 11.95110   0.0 18.10    0 0.6590 5.608 100.0  1.2852  24 666    20.2
## 409  7.40389   0.0 18.10    0 0.5970 5.617  97.9  1.4547  24 666    20.2
## 410 14.43830   0.0 18.10    0 0.5970 6.852 100.0  1.4655  24 666    20.2
## 411 51.13580   0.0 18.10    0 0.5970 5.757 100.0  1.4130  24 666    20.2
## 412 14.05070   0.0 18.10    0 0.5970 6.657 100.0  1.5275  24 666    20.2
## 413 18.81100   0.0 18.10    0 0.5970 4.628 100.0  1.5539  24 666    20.2
## 414 28.65580   0.0 18.10    0 0.5970 5.155 100.0  1.5894  24 666    20.2
## 415 45.74610   0.0 18.10    0 0.6930 4.519 100.0  1.6582  24 666    20.2
## 416 18.08460   0.0 18.10    0 0.6790 6.434 100.0  1.8347  24 666    20.2
## 417 10.83420   0.0 18.10    0 0.6790 6.782  90.8  1.8195  24 666    20.2
## 418 25.94060   0.0 18.10    0 0.6790 5.304  89.1  1.6475  24 666    20.2
## 419 73.53410   0.0 18.10    0 0.6790 5.957 100.0  1.8026  24 666    20.2
## 420 11.81230   0.0 18.10    0 0.7180 6.824  76.5  1.7940  24 666    20.2
## 421 11.08740   0.0 18.10    0 0.7180 6.411 100.0  1.8589  24 666    20.2
## 422  7.02259   0.0 18.10    0 0.7180 6.006  95.3  1.8746  24 666    20.2
## 423 12.04820   0.0 18.10    0 0.6140 5.648  87.6  1.9512  24 666    20.2
## 424  7.05042   0.0 18.10    0 0.6140 6.103  85.1  2.0218  24 666    20.2
## 425  8.79212   0.0 18.10    0 0.5840 5.565  70.6  2.0635  24 666    20.2
## 426 15.86030   0.0 18.10    0 0.6790 5.896  95.4  1.9096  24 666    20.2
## 427 12.24720   0.0 18.10    0 0.5840 5.837  59.7  1.9976  24 666    20.2
## 428 37.66190   0.0 18.10    0 0.6790 6.202  78.7  1.8629  24 666    20.2
## 429  7.36711   0.0 18.10    0 0.6790 6.193  78.1  1.9356  24 666    20.2
```

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## 430  9.33889   0.0 18.10    0 0.6790 6.380  95.6  1.9682  24 666    20.2
## 431  8.49213   0.0 18.10    0 0.5840 6.348  86.1  2.0527  24 666    20.2
## 432 10.06230   0.0 18.10    0 0.5840 6.833  94.3  2.0882  24 666    20.2
## 433  6.44405   0.0 18.10    0 0.5840 6.425  74.8  2.2004  24 666    20.2
## 434  5.58107   0.0 18.10    0 0.7130 6.436  87.9  2.3158  24 666    20.2
## 435 13.91340   0.0 18.10    0 0.7130 6.208  95.0  2.2222  24 666    20.2
## 436 11.16040   0.0 18.10    0 0.7400 6.629  94.6  2.1247  24 666    20.2
## 437 14.42080   0.0 18.10    0 0.7400 6.461  93.3  2.0026  24 666    20.2
## 438 15.17720   0.0 18.10    0 0.7400 6.152 100.0  1.9142  24 666    20.2
## 439 13.67810   0.0 18.10    0 0.7400 5.935  87.9  1.8206  24 666    20.2
## 440  9.39063   0.0 18.10    0 0.7400 5.627  93.9  1.8172  24 666    20.2
## 441 22.05110   0.0 18.10    0 0.7400 5.818  92.4  1.8662  24 666    20.2
## 442  9.72418   0.0 18.10    0 0.7400 6.406  97.2  2.0651  24 666    20.2
## 443  5.66637   0.0 18.10    0 0.7400 6.219 100.0  2.0048  24 666    20.2
## 444  9.96654   0.0 18.10    0 0.7400 6.485 100.0  1.9784  24 666    20.2
## 445 12.80230   0.0 18.10    0 0.7400 5.854  96.6  1.8956  24 666    20.2
## 446 10.67180   0.0 18.10    0 0.7400 6.459  94.8  1.9879  24 666    20.2
## 447  6.28807   0.0 18.10    0 0.7400 6.341  96.4  2.0720  24 666    20.2
## 448  9.92485   0.0 18.10    0 0.7400 6.251  96.6  2.1980  24 666    20.2
## 449  9.32909   0.0 18.10    0 0.7130 6.185  98.7  2.2616  24 666    20.2
## 450  7.52601   0.0 18.10    0 0.7130 6.417  98.3  2.1850  24 666    20.2
## 451  6.71772   0.0 18.10    0 0.7130 6.749  92.6  2.3236  24 666    20.2
## 452  5.44114   0.0 18.10    0 0.7130 6.655  98.2  2.3552  24 666    20.2
## 453  5.09017   0.0 18.10    0 0.7130 6.297  91.8  2.3682  24 666    20.2
## 454  8.24809   0.0 18.10    0 0.7130 7.393  99.3  2.4527  24 666    20.2
## 455  9.51363   0.0 18.10    0 0.7130 6.728  94.1  2.4961  24 666    20.2
## 456  4.75237   0.0 18.10    0 0.7130 6.525  86.5  2.4358  24 666    20.2
## 457  4.66883   0.0 18.10    0 0.7130 5.976  87.9  2.5806  24 666    20.2
## 458  8.20058   0.0 18.10    0 0.7130 5.936  80.3  2.7792  24 666    20.2
## 459  7.75223   0.0 18.10    0 0.7130 6.301  83.7  2.7831  24 666    20.2
## 460  6.80117   0.0 18.10    0 0.7130 6.081  84.4  2.7175  24 666    20.2
## 461  4.81213   0.0 18.10    0 0.7130 6.701  90.0  2.5975  24 666    20.2
## 462  3.69311   0.0 18.10    0 0.7130 6.376  88.4  2.5671  24 666    20.2
## 463  6.65492   0.0 18.10    0 0.7130 6.317  83.0  2.7344  24 666    20.2
## 464  5.82115   0.0 18.10    0 0.7130 6.513  89.9  2.8016  24 666    20.2
## 465  7.83932   0.0 18.10    0 0.6550 6.209  65.4  2.9634  24 666    20.2
## 466  3.16360   0.0 18.10    0 0.6550 5.759  48.2  3.0665  24 666    20.2
## 467  3.77498   0.0 18.10    0 0.6550 5.952  84.7  2.8715  24 666    20.2
## 468  4.42228   0.0 18.10    0 0.5840 6.003  94.5  2.5403  24 666    20.2
## 469 15.57570   0.0 18.10    0 0.5800 5.926  71.0  2.9084  24 666    20.2
## 470 13.07510   0.0 18.10    0 0.5800 5.713  56.7  2.8237  24 666    20.2
## 471  4.34879   0.0 18.10    0 0.5800 6.167  84.0  3.0334  24 666    20.2
## 472  4.03841   0.0 18.10    0 0.5320 6.229  90.7  3.0993  24 666    20.2
## 473  3.56868   0.0 18.10    0 0.5800 6.437  75.0  2.8965  24 666    20.2
## 474  4.64689   0.0 18.10    0 0.6140 6.980  67.6  2.5329  24 666    20.2
## 475  8.05579   0.0 18.10    0 0.5840 5.427  95.4  2.4298  24 666    20.2
## 476  6.39312   0.0 18.10    0 0.5840 6.162  97.4  2.2060  24 666    20.2
## 477  4.87141   0.0 18.10    0 0.6140 6.484  93.6  2.3053  24 666    20.2
## 478 15.02340   0.0 18.10    0 0.6140 5.304  97.3  2.1007  24 666    20.2
## 479 10.23300   0.0 18.10    0 0.6140 6.185  96.7  2.1705  24 666    20.2
## 480 14.33370   0.0 18.10    0 0.6140 6.229  88.0  1.9512  24 666    20.2
## 481  5.82401   0.0 18.10    0 0.5320 6.242  64.7  3.4242  24 666    20.2
## 482  5.70818   0.0 18.10    0 0.5320 6.750  74.9  3.3317  24 666    20.2
## 483  5.73116   0.0 18.10    0 0.5320 7.061  77.0  3.4106  24 666    20.2
```

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## 484  2.81838   0.0 18.10    0 0.5320 5.762  40.3  4.0983  24 666    20.2
## 485  2.37857   0.0 18.10    0 0.5830 5.871  41.9  3.7240  24 666    20.2
## 486  3.67367   0.0 18.10    0 0.5830 6.312  51.9  3.9917  24 666    20.2
## 487  5.69175   0.0 18.10    0 0.5830 6.114  79.8  3.5459  24 666    20.2
## 488  4.83567   0.0 18.10    0 0.5830 5.905  53.2  3.1523  24 666    20.2
## 489  0.15086   0.0 27.74    0 0.6090 5.454  92.7  1.8209   4 711    20.1
## 490  0.18337   0.0 27.74    0 0.6090 5.414  98.3  1.7554   4 711    20.1
## 491  0.20746   0.0 27.74    0 0.6090 5.093  98.0  1.8226   4 711    20.1
## 492  0.10574   0.0 27.74    0 0.6090 5.983  98.8  1.8681   4 711    20.1
## 493  0.11132   0.0 27.74    0 0.6090 5.983  83.5  2.1099   4 711    20.1
## 494  0.17331   0.0  9.69    0 0.5850 5.707  54.0  2.3817   6 391    19.2
## 495  0.27957   0.0  9.69    0 0.5850 5.926  42.6  2.3817   6 391    19.2
## 496  0.17899   0.0  9.69    0 0.5850 5.670  28.8  2.7986   6 391    19.2
## 497  0.28960   0.0  9.69    0 0.5850 5.390  72.9  2.7986   6 391    19.2
## 498  0.26838   0.0  9.69    0 0.5850 5.794  70.6  2.8927   6 391    19.2
## 499  0.23912   0.0  9.69    0 0.5850 6.019  65.3  2.4091   6 391    19.2
## 500  0.17783   0.0  9.69    0 0.5850 5.569  73.5  2.3999   6 391    19.2
## 501  0.22438   0.0  9.69    0 0.5850 6.027  79.7  2.4982   6 391    19.2
## 502  0.06263   0.0 11.93    0 0.5730 6.593  69.1  2.4786   1 273    21.0
## 503  0.04527   0.0 11.93    0 0.5730 6.120  76.7  2.2875   1 273    21.0
## 504  0.06076   0.0 11.93    0 0.5730 6.976  91.0  2.1675   1 273    21.0
## 505  0.10959   0.0 11.93    0 0.5730 6.794  89.3  2.3889   1 273    21.0
## 506  0.04741   0.0 11.93    0 0.5730 6.030  80.8  2.5050   1 273    21.0
##      black lstat medv
## 1   396.90  4.98 24.0
## 2   396.90  9.14 21.6
## 3   392.83  4.03 34.7
## 4   394.63  2.94 33.4
## 5   396.90  5.33 36.2
## 6   394.12  5.21 28.7
## 7   395.60 12.43 22.9
## 8   396.90 19.15 27.1
## 9   386.63 29.93 16.5
## 10  386.71 17.10 18.9
## 11  392.52 20.45 15.0
## 12  396.90 13.27 18.9
## 13  390.50 15.71 21.7
## 14  396.90  8.26 20.4
## 15  380.02 10.26 18.2
## 16  395.62  8.47 19.9
## 17  386.85  6.58 23.1
## 18  386.75 14.67 17.5
## 19  288.99 11.69 20.2
## 20  390.95 11.28 18.2
## 21  376.57 21.02 13.6
## 22  392.53 13.83 19.6
## 23  396.90 18.72 15.2
## 24  394.54 19.88 14.5
## 25  394.33 16.30 15.6
## 26  303.42 16.51 13.9
## 27  376.88 14.81 16.6
## 28  306.38 17.28 14.8
## 29  387.94 12.80 18.4
## 30  380.23 11.98 21.0
```

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## 31  360.17 22.60 12.7
## 32  376.73 13.04 14.5
## 33  232.60 27.71 13.2
## 34  358.77 18.35 13.1
## 35  248.31 20.34 13.5
## 36  396.90  9.68 18.9
## 37  377.56 11.41 20.0
## 38  396.90  8.77 21.0
## 39  393.43 10.13 24.7
## 40  395.63  4.32 30.8
## 41  395.62  1.98 34.9
## 42  385.41  4.84 26.6
## 43  383.37  5.81 25.3
## 44  394.46  7.44 24.7
## 45  389.39  9.55 21.2
## 46  396.90 10.21 19.3
## 47  396.90 14.15 20.0
## 48  392.74 18.80 16.6
## 49  396.90 30.81 14.4
## 50  396.90 16.20 19.4
## 51  395.56 13.45 19.7
## 52  393.97  9.43 20.5
## 53  396.90  5.28 25.0
## 54  396.90  8.43 23.4
## 55  396.90 14.80 18.9
## 56  395.93  4.81 35.4
## 57  396.90  5.77 24.7
## 58  392.90  3.95 31.6
## 59  390.68  6.86 23.3
## 60  396.90  9.22 19.6
## 61  395.11 13.15 18.7
## 62  378.08 14.44 16.0
## 63  396.90  6.73 22.2
## 64  395.58  9.50 25.0
## 65  393.24  8.05 33.0
## 66  396.90  4.67 23.5
## 67  396.90 10.24 19.4
## 68  396.21  8.10 22.0
## 69  396.90 13.09 17.4
## 70  396.90  8.79 20.9
## 71  383.73  6.72 24.2
## 72  376.94  9.88 21.7
## 73  390.91  5.52 22.8
## 74  377.17  7.54 23.4
## 75  394.92  6.78 24.1
## 76  383.23  8.94 21.4
## 77  373.66 11.97 20.0
## 78  386.96 10.27 20.8
## 79  386.40 12.34 21.2
## 80  396.06  9.10 20.3
## 81  396.90  5.29 28.0
## 82  395.63  7.22 23.9
## 83  396.90  6.72 24.8
## 84  390.64  7.51 22.9
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## 85  396.90  9.62 23.9
## 86  392.30  6.53 26.6
## 87  395.99 12.86 22.5
## 88  395.15  8.44 22.2
## 89  396.90  5.50 23.6
## 90  396.06  5.70 28.7
## 91  392.18  8.81 22.6
## 92  393.55  8.20 22.0
## 93  395.01  8.16 22.9
## 94  396.33  6.21 25.0
## 95  396.90 10.59 20.6
## 96  357.98  6.65 28.4
## 97  391.83 11.34 21.4
## 98  396.90  4.21 38.7
## 99  393.53  3.57 43.8
## 100 396.90  6.19 33.2
## 101 394.76  9.42 27.5
## 102 395.58  7.67 26.5
## 103  70.80 10.63 18.6
## 104 394.47 13.44 19.3
## 105 392.69 12.33 20.1
## 106 394.05 16.47 19.5
## 107 395.67 18.66 19.5
## 108 387.69 14.09 20.4
## 109 395.24 12.27 19.8
## 110 391.23 15.55 19.4
## 111 393.49 13.00 21.7
## 112 395.59 10.16 22.8
## 113 394.95 16.21 18.8
## 114 396.90 17.09 18.7
## 115 388.74 10.45 18.5
## 116 344.91 15.76 18.3
## 117 393.30 12.04 21.2
## 118 394.51 10.30 19.2
## 119 338.63 15.37 20.4
## 120 391.50 13.61 19.3
## 121 389.15 14.37 22.0
## 122 377.67 14.27 20.3
## 123 378.09 17.93 20.5
## 124 370.31 25.41 17.3
## 125 379.38 17.58 18.8
## 126 385.02 14.81 21.4
## 127 359.29 27.26 15.7
## 128 392.11 17.19 16.2
## 129 396.90 15.39 18.0
## 130 396.90 18.34 14.3
## 131 395.04 12.60 19.2
## 132 396.90 12.26 19.6
## 133 385.76 11.12 23.0
## 134 388.69 15.03 18.4
## 135 262.76 17.31 15.6
## 136 394.67 16.96 18.1
## 137 378.25 16.90 17.4
## 138 394.08 14.59 17.1
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## 139 392.04 21.32 13.3
## 140 396.90 18.46 17.8
## 141 388.08 24.16 14.0
## 142 396.90 34.41 14.4
## 143 396.90 26.82 13.4
## 144 396.90 26.42 15.6
## 145 396.90 29.29 11.8
## 146 172.91 27.80 13.8
## 147 169.27 16.65 15.6
## 148 391.71 29.53 14.6
## 149 356.99 28.32 17.8
## 150 351.85 21.45 15.4
## 151 372.80 14.10 21.5
## 152 341.60 13.28 19.6
## 153 343.28 12.12 15.3
## 154 261.95 15.79 19.4
## 155 321.02 15.12 17.0
## 156  88.01 15.02 15.6
## 157  88.63 16.14 13.1
## 158 363.43  4.59 41.3
## 159 353.89  6.43 24.3
## 160 364.31  7.39 23.3
## 161 338.92  5.50 27.0
## 162 374.43  1.73 50.0
## 163 389.61  1.92 50.0
## 164 388.45  3.32 50.0
## 165 395.11 11.64 22.7
## 166 240.16  9.81 25.0
## 167 369.30  3.70 50.0
## 168 227.61 12.14 23.8
## 169 297.09 11.10 23.8
## 170 330.04 11.32 22.3
## 171 292.29 14.43 17.4
## 172 348.13 12.03 19.1
## 173 396.90 14.69 23.1
## 174 395.50  9.04 23.6
## 175 393.23  9.64 22.6
## 176 390.96  5.33 29.4
## 177 393.23 10.11 23.2
## 178 395.60  6.29 24.6
## 179 391.27  6.92 29.9
## 180 396.90  5.04 37.2
## 181 395.56  7.56 39.8
## 182 396.90  9.45 36.2
## 183 394.12  4.82 37.9
## 184 396.90  5.68 32.5
## 185 391.00 13.98 26.4
## 186 387.11 13.15 29.6
## 187 392.63  4.45 50.0
## 188 393.87  6.68 32.0
## 189 382.84  4.56 29.8
## 190 396.90  5.39 34.9
## 191 377.68  5.10 37.0
## 192 389.71  4.69 30.5
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## 193 390.49  2.87 36.4
## 194 393.37  5.03 31.1
## 195 376.70  4.38 29.1
## 196 394.23  2.97 50.0
## 197 396.90  4.08 33.3
## 198 354.31  8.61 30.3
## 199 392.20  6.62 34.6
## 200 396.90  4.56 34.9
## 201 384.30  4.45 32.9
## 202 393.77  7.43 24.1
## 203 395.38  3.11 42.3
## 204 392.78  3.81 48.5
## 205 390.55  2.88 50.0
## 206 396.90 10.87 22.6
## 207 394.87 10.97 24.4
## 208 389.43 18.06 22.5
## 209 381.32 14.66 24.4
## 210 396.90 23.09 20.0
## 211 393.25 17.27 21.7
## 212 395.24 23.98 19.3
## 213 390.94 16.03 22.4
## 214 385.81  9.38 28.1
## 215 348.93 29.55 23.7
## 216 393.63  9.47 25.0
## 217 392.80 13.51 23.3
## 218 392.78  9.69 28.7
## 219 396.90 17.92 21.5
## 220 393.74 10.50 23.0
## 221 391.70  9.71 26.7
## 222 395.24 21.46 21.7
## 223 390.39  9.93 27.5
## 224 396.90  7.60 30.1
## 225 385.05  4.14 44.8
## 226 382.00  4.63 50.0
## 227 387.38  3.13 37.6
## 228 372.08  6.36 31.6
## 229 377.51  3.92 46.7
## 230 380.34  3.76 31.5
## 231 378.35 11.65 24.3
## 232 376.14  5.25 31.7
## 233 385.91  2.47 41.7
## 234 378.95  3.95 48.3
## 235 360.20  8.05 29.0
## 236 376.75 10.88 24.0
## 237 388.45  9.54 25.1
## 238 390.07  4.73 31.5
## 239 379.41  6.36 23.7
## 240 383.78  7.37 23.3
## 241 391.25 11.38 22.0
## 242 394.62 12.40 20.1
## 243 372.75 11.22 22.2
## 244 374.71  5.19 23.7
## 245 372.49 12.50 17.6
## 246 389.13 18.46 18.5
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## 247 390.18  9.16 24.3
## 248 376.14 10.15 20.5
## 249 374.71  9.52 24.5
## 250 393.74  6.56 26.2
## 251 396.28  5.90 24.4
## 252 377.07  3.59 24.8
## 253 386.09  3.53 29.6
## 254 396.90  3.54 42.8
## 255 392.89  6.57 21.9
## 256 395.18  9.25 20.9
## 257 386.34  3.11 44.0
## 258 389.70  5.12 50.0
## 259 383.29  7.79 36.0
## 260 391.93  6.90 30.1
## 261 392.80  9.59 33.8
## 262 388.37  7.26 43.1
## 263 386.86  5.91 48.8
## 264 393.42 11.25 31.0
## 265 387.89  8.10 36.5
## 266 392.40 10.45 22.8
## 267 384.07 14.79 30.7
## 268 384.54  7.44 50.0
## 269 390.30  3.16 43.5
## 270 391.34 13.65 20.7
## 271 388.65 13.00 21.1
## 272 396.90  6.59 25.2
## 273 394.96  7.73 24.4
## 274 390.77  6.58 35.2
## 275 396.90  3.53 32.4
## 276 396.90  2.98 32.0
## 277 389.25  6.05 33.2
## 278 393.45  4.16 33.1
## 279 396.90  7.19 29.1
## 280 396.90  4.85 35.1
## 281 387.31  3.76 45.4
## 282 392.23  4.59 35.4
## 283 377.07  3.01 46.0
## 284 395.52  3.16 50.0
## 285 394.72  7.85 32.2
## 286 394.72  8.23 22.0
## 287 341.60 12.93 20.1
## 288 396.90  7.14 23.2
## 289 396.90  7.60 22.3
## 290 371.72  9.51 24.8
## 291 396.90  3.33 28.5
## 292 396.90  3.56 37.3
## 293 396.90  4.70 27.9
## 294 396.90  8.58 23.9
## 295 396.90 10.40 21.7
## 296 396.90  6.27 28.6
## 297 392.85  7.39 27.1
## 298 396.90 15.84 20.3
## 299 368.24  4.97 22.5
## 300 371.58  4.74 29.0
```

```
## 301 390.86  6.07 24.8
## 302 395.75  9.50 22.0
## 303 383.61  8.67 26.4
## 304 390.43  4.86 33.1
## 305 393.68  6.93 36.1
## 306 393.36  8.93 28.4
## 307 396.90  6.47 33.4
## 308 396.90  7.53 28.2
## 309 396.90  4.54 22.8
## 310 396.24  9.97 20.3
## 311 350.45 12.64 16.1
## 312 396.90  5.98 22.1
## 313 396.30 11.72 19.4
## 314 393.39  7.90 21.6
## 315 395.69  9.28 23.8
## 316 396.42 11.50 16.2
## 317 390.70 18.33 17.8
## 318 396.90 15.94 19.8
## 319 395.21 10.36 23.1
## 320 396.23 12.73 21.0
## 321 396.90  7.20 23.8
## 322 396.90  6.87 23.1
## 323 396.90  7.70 20.4
## 324 391.13 11.74 18.5
## 325 396.90  6.12 25.0
## 326 393.68  5.08 24.6
## 327 396.90  6.15 23.0
## 328 396.90 12.79 22.2
## 329 382.44  9.97 19.3
## 330 375.21  7.34 22.6
## 331 368.57  9.09 19.8
## 332 394.02 12.43 17.1
## 333 362.25  7.83 19.4
## 334 389.71  5.68 22.2
## 335 389.40  6.75 20.7
## 336 396.90  8.01 21.1
## 337 396.90  9.80 19.5
## 338 394.81 10.56 18.5
## 339 396.14  8.51 20.6
## 340 396.90  9.74 19.0
## 341 396.90  9.29 18.7
## 342 394.74  5.49 32.7
## 343 389.96  8.65 16.5
## 344 396.90  7.18 23.9
## 345 387.97  4.61 31.2
## 346 385.64 10.53 17.5
## 347 364.61 12.67 17.2
## 348 392.43  6.36 23.1
## 349 390.94  5.99 24.5
## 350 389.85  5.89 26.6
## 351 396.90  5.98 22.9
## 352 370.78  5.49 24.1
## 353 392.33  7.79 18.6
## 354 384.46  4.50 30.1
```

```
## 355 382.80  8.05 18.2
## 356 376.04  5.57 20.6
## 357 377.73 17.60 17.8
## 358 391.34 13.27 21.7
## 359 395.43 11.48 22.7
## 360 390.74 12.67 22.6
## 361 374.56  7.79 25.0
## 362 350.65 14.19 19.9
## 363 380.79 10.19 20.8
## 364 353.04 14.64 16.8
## 365 354.55  5.29 21.9
## 366 354.70  7.12 27.5
## 367 316.03 14.00 21.9
## 368 131.42 13.33 23.1
## 369 375.52  3.26 50.0
## 370 375.33  3.73 50.0
## 371 392.05  2.96 50.0
## 372 366.15  9.53 50.0
## 373 347.88  8.88 50.0
## 374 396.90 34.77 13.8
## 375 396.90 37.97 13.8
## 376 396.90 13.44 15.0
## 377 363.02 23.24 13.9
## 378 396.90 21.24 13.3
## 379 396.90 23.69 13.1
## 380 393.74 21.78 10.2
## 381 396.90 17.21 10.4
## 382 396.90 21.08 10.9
## 383 396.90 23.60 11.3
## 384 396.90 24.56 12.3
## 385 285.83 30.63  8.8
## 386 396.90 30.81  7.2
## 387 396.90 28.28 10.5
## 388 396.90 31.99  7.4
## 389 372.92 30.62 10.2
## 390 396.90 20.85 11.5
## 391 394.43 17.11 15.1
## 392 378.38 18.76 23.2
## 393 396.90 25.68  9.7
## 394 396.90 15.17 13.8
## 395 396.90 16.35 12.7
## 396 391.98 17.12 13.1
## 397 396.90 19.37 12.5
## 398 393.10 19.92  8.5
## 399 396.90 30.59  5.0
## 400 338.16 29.97  6.3
## 401 396.90 26.77  5.6
## 402 396.90 20.32  7.2
## 403 376.11 20.31 12.1
## 404 396.90 19.77  8.3
## 405 329.46 27.38  8.5
## 406 384.97 22.98  5.0
## 407 370.22 23.34 11.9
## 408 332.09 12.13 27.9
```

```
## 409 314.64 26.40 17.2
## 410 179.36 19.78 27.5
## 411   2.60 10.11 15.0
## 412  35.05 21.22 17.2
## 413  28.79 34.37 17.9
## 414 210.97 20.08 16.3
## 415  88.27 36.98  7.0
## 416  27.25 29.05  7.2
## 417  21.57 25.79  7.5
## 418 127.36 26.64 10.4
## 419  16.45 20.62  8.8
## 420  48.45 22.74  8.4
## 421 318.75 15.02 16.7
## 422 319.98 15.70 14.2
## 423 291.55 14.10 20.8
## 424   2.52 23.29 13.4
## 425   3.65 17.16 11.7
## 426   7.68 24.39  8.3
## 427  24.65 15.69 10.2
## 428  18.82 14.52 10.9
## 429  96.73 21.52 11.0
## 430  60.72 24.08  9.5
## 431  83.45 17.64 14.5
## 432  81.33 19.69 14.1
## 433  97.95 12.03 16.1
## 434 100.19 16.22 14.3
## 435 100.63 15.17 11.7
## 436 109.85 23.27 13.4
## 437  27.49 18.05  9.6
## 438   9.32 26.45  8.7
## 439  68.95 34.02  8.4
## 440 396.90 22.88 12.8
## 441 391.45 22.11 10.5
## 442 385.96 19.52 17.1
## 443 395.69 16.59 18.4
## 444 386.73 18.85 15.4
## 445 240.52 23.79 10.8
## 446  43.06 23.98 11.8
## 447 318.01 17.79 14.9
## 448 388.52 16.44 12.6
## 449 396.90 18.13 14.1
## 450 304.21 19.31 13.0
## 451   0.32 17.44 13.4
## 452 355.29 17.73 15.2
## 453 385.09 17.27 16.1
## 454 375.87 16.74 17.8
## 455   6.68 18.71 14.9
## 456  50.92 18.13 14.1
## 457  10.48 19.01 12.7
## 458   3.50 16.94 13.5
## 459 272.21 16.23 14.9
## 460 396.90 14.70 20.0
## 461 255.23 16.42 16.4
## 462 391.43 14.65 17.7
```

```
## 463 396.90 13.99 19.5
## 464 393.82 10.29 20.2
## 465 396.90 13.22 21.4
## 466 334.40 14.13 19.9
## 467  22.01 17.15 19.0
## 468 331.29 21.32 19.1
## 469 368.74 18.13 19.1
## 470 396.90 14.76 20.1
## 471 396.90 16.29 19.9
## 472 395.33 12.87 19.6
## 473 393.37 14.36 23.2
## 474 374.68 11.66 29.8
## 475 352.58 18.14 13.8
## 476 302.76 24.10 13.3
## 477 396.21 18.68 16.7
## 478 349.48 24.91 12.0
## 479 379.70 18.03 14.6
## 480 383.32 13.11 21.4
## 481 396.90 10.74 23.0
## 482 393.07  7.74 23.7
## 483 395.28  7.01 25.0
## 484 392.92 10.42 21.8
## 485 370.73 13.34 20.6
## 486 388.62 10.58 21.2
## 487 392.68 14.98 19.1
## 488 388.22 11.45 20.6
## 489 395.09 18.06 15.2
## 490 344.05 23.97  7.0
## 491 318.43 29.68  8.1
## 492 390.11 18.07 13.6
## 493 396.90 13.35 20.1
## 494 396.90 12.01 21.8
## 495 396.90 13.59 24.5
## 496 393.29 17.60 23.1
## 497 396.90 21.14 19.7
## 498 396.90 14.10 18.3
## 499 396.90 12.92 21.2
## 500 395.77 15.10 17.5
## 501 396.90 14.33 16.8
## 502 391.99  9.67 22.4
## 503 396.90  9.08 20.6
## 504 396.90  5.64 23.9
## 505 393.45  6.48 22.0
## 506 396.90  7.88 11.9
```

```r
?Boston
```

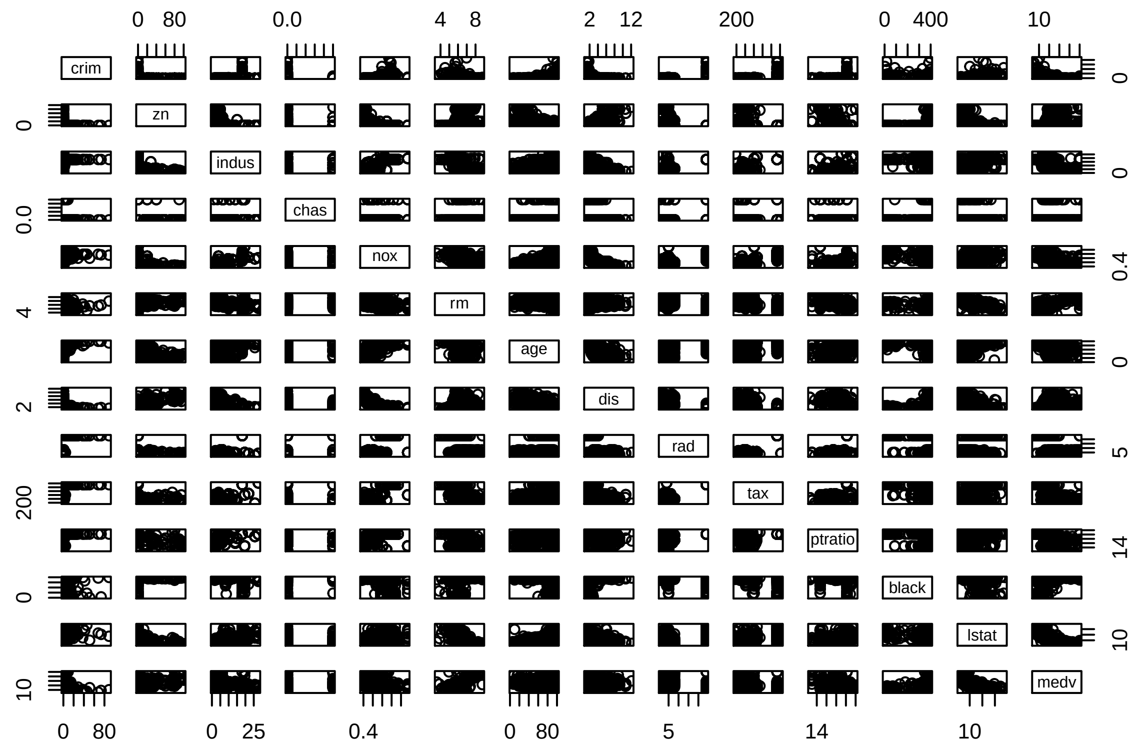
```
## starting httpd help server ... done
```

There are 506 rows and 14 columns. The crim column represents per capita crime rate by town. The zn column represents the proportion of residential land zoned for lots over 25,000 sq. ft. The indus column represents proportion of non-retail business acres per town. The chas column is the Charles River dummy variable (1 if tract bounds river; 0 otherwise). The nox column is nitrogen oxides concentration. The rm column is the average number of rooms per dwelling. The age column is the proportion of owner-occupied units built prior to 1940. The dis column is the weighted mean of distances to five Boston employment centres. The rad column is the index of accessibility to radial highways. The tax column is the full-value property-tax rate per $10,000. The ptratio column is the pupil-teacher ratio by town. The black column is the proportion of blacks by town. The lstat column is the lower status of the population. Finally, the medv column is the median value of owner-occupied homes.

The columns are a representation of characteristics of Boston suburbs. Each row is data from one suburb.

b)

```r
pairs(Boston)
```



Not many of the variables are correlated. From investigation, (rm, lstat), (rm, medv), (lstat, medv), and (age, lstat) all have somewhat strong relationships, while (black, dis) and (ptratio, lstat) have somewhat weak relationships, but it still exists.

c) In general, not many variables are closely related to per capita crime rate. But, age has a weak positive relationship, distance has a weak negative relationship, and medv has a weak negative relationship.

d)

```r
summary(Boston$crim)
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
##  0.00632  0.08204  0.25651  3.61352  3.67708 88.97620
```

```r
oddCrim = Boston[Boston$crim > 5.392, ]
nrow(oddCrim)
```

```
## [1] 103
```

```r
summary(Boston$tax)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   187.0   279.0   330.0   408.2   666.0   711.0
```

```r
oddTax = Boston[Boston$tax > 580.5, ]
nrow(oddTax)
```

```
## [1] 137
```

```r
summary(Boston$ptratio)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   12.60   17.40   19.05   18.46   20.20   22.00
```

```r
oddPt = Boston[Boston$ptratio > 4.2, ]
nrow(oddPt)
```

```
## [1] 506
```

Crime rates range from 0.006 to 88.976, a gap of 88.970. Since 1.5*IQR = 5.392, the crime rates were checked to see if any were significantly above the interquartile range. There were 103 suburbs with very high crime rates.

Tax rates range from $187 to $711, a gap of 524. The same procedure was performed for tax rates. Outliers held values that were 1.5*IQR = 580.5 or higher. There were 137 suburbs with very high tax rates.

Finally, pupil-teacher ratios range from 12.6 to 12.0, a gap of 9.4 . The same procedure was carried out again. A high pupil-teacher ratio is considered to be 1.5*IQR = 4.2 or higher. There were 506 suburbs with abnormally high ratios, which is almost the entire dataset.

e)

```r
boundCharles = Boston[Boston$chas == 1, ]
nrow(boundCharles)
```

```
## [1] 35
```

There are 35 suburbs that bound the Charles river.

f)

```r
median(Boston$ptratio)
```

```
## [1] 19.05
```

The median pupil-teacher ratio is 19.05 .

g)

```r
lowestMedv = Boston[Boston$medv == min(Boston$medv), ]
print(lowestMedv)
```

```
##        crim zn indus chas   nox    rm age    dis rad tax ptratio  black
## 399 38.3518  0  18.1    0 0.693 5.453 100 1.4896  24 666    20.2 396.90
## 406 67.9208  0  18.1    0 0.693 5.683 100 1.4254  24 666    20.2 384.97
##     lstat medv
## 399 30.59    5
## 406 22.98    5
```

```r
sapply(Boston, range)
```

```
##         crim  zn indus chas   nox    rm   age     dis rad tax ptratio
```

```
## [1,]  0.00632   0  0.46    0 0.385 3.561   2.9  1.1296   1 187    12.6
## [2,] 88.97620 100 27.74    1 0.871 8.780 100.0 12.1265  24 711    22.0
##       black lstat medv
## [1,]   0.32  1.73    5
## [2,] 396.90 37.97   50
```

There are actually two suburbs sharing the lowest median value of owner-occupied homes. Unfortunately, we are not given suburb names, but they are on row 399 and 406.

For the row 399 suburb, crime rate is on the lower end, none of the residential land is zoned for lots over 25,000 sq ft, it is generally on the higher end in terms of non-retail businesses per acre, it does not border the Charles River, the nitrogen oxide concentration is very high, the average number of rooms is very high, every single house is built prior to 1940, the houses are very close to employment centres, houses are right next to the highway, they have high property tax rates, it has one of the highest pupil-teacher ratios among suburbs, the suburb is the blackest in Boston, and it has one of the highest percentages of lower status civilians.

For the row 406 suburb, there are many of the same characteristics. Crime rate is high, none of the residential land is zoned for lots over 25,000 sq ft, there is a relatively high industrial content, it is not bordering the Charles River, the nitrogen oxide concentration is high, the number of rooms per dwelling is abnormally high, all of the homes were built prior to 1940, the houses are very close to Boston's employment centers, the suburb is right next to the highways, property tax rate is high, it has one of the highest pupil-teacher ratios, is one of the blackest suburbs in Boston, and in the middle in terms of lower-status population percentage.

From what I see, these two suburbs generally have a lot of pollution, both noise and chemicals, crime rate is relatively high, there are a lot of lower status people living there, a lot of rooms are crammed in as possible, employment centers are nearby, and property tax rates are high. Therefore, they do not have access to many resources and suffer due to that. These are predominantly poorer neighborhoods.

h)

```r
bostonRooms = Boston[Boston$rm > 7, ]
nrow(bostonRooms)
```

```
## [1] 64
```

```r
bostonRooms = Boston[Boston$rm > 8, ]
nrow(bostonRooms)
```

```
## [1] 13
```

```r
print(bostonRooms)
```

```
##        crim zn indus chas    nox    rm  age    dis rad tax ptratio  black
## 98  0.12083  0  2.89    0 0.4450 8.069 76.0 3.4952   2 276    18.0 396.90
## 164 1.51902  0 19.58    1 0.6050 8.375 93.9 2.1620   5 403    14.7 388.45
## 205 0.02009 95  2.68    0 0.4161 8.034 31.9 5.1180   4 224    14.7 390.55
## 225 0.31533  0  6.20    0 0.5040 8.266 78.3 2.8944   8 307    17.4 385.05
## 226 0.52693  0  6.20    0 0.5040 8.725 83.0 2.8944   8 307    17.4 382.00
## 227 0.38214  0  6.20    0 0.5040 8.040 86.5 3.2157   8 307    17.4 387.38
## 233 0.57529  0  6.20    0 0.5070 8.337 73.3 3.8384   8 307    17.4 385.91
## 234 0.33147  0  6.20    0 0.5070 8.247 70.4 3.6519   8 307    17.4 378.95
## 254 0.36894 22  5.86    0 0.4310 8.259  8.4 8.9067   7 330    19.1 396.90
## 258 0.61154 20  3.97    0 0.6470 8.704 86.9 1.8010   5 264    13.0 389.70
## 263 0.52014 20  3.97    0 0.6470 8.398 91.5 2.2885   5 264    13.0 386.86
## 268 0.57834 20  3.97    0 0.5750 8.297 67.0 2.4216   5 264    13.0 384.54
## 365 3.47428  0 18.10    1 0.7180 8.780 82.9 1.9047  24 666    20.2 354.55
##     lstat medv
## 98   4.21 38.7
## 164  3.32 50.0
```

```
## 205  2.88 50.0
## 225  4.14 44.8
## 226  4.63 50.0
## 227  3.13 37.6
## 233  2.47 41.7
## 234  3.95 48.3
## 254  3.54 42.8
## 258  5.12 50.0
## 263  5.91 48.8
## 268  7.44 50.0
## 365  5.29 21.9
```

There are 64 Boston suburbs averaging more than 7 rooms per dwelling.

There are 13 Boston suburbs averaging more than 8 rooms per dwelling.

In general, suburbs averaging more than 8 rooms per house have a large proportion of homes built prior to 1940, they have a relatively high proportion of blacks, not much of the population is of lower status, there is almost no crime, and the homes are on the pricier side of Boston. Also, nearly all of the Suburbs do not border the Charles River. Therefore, we can conclude many of these suburbs are historically black, old, and middle class.