

Exercise 1

- (a) better - a more flexible approach will fit the data closer and with the large sample size a better fit than an inflexible approach would be obtained
- (b) worse - a flexible method would over-fit the small number of observations
- (c) better - a more flexible approach will be able to better fit the non-linear relationship between the predictors and the response
- (d) worse - flexible method fit the noise as well which increase the variance

Exercise 2

- (a) regression problem, we are more interested in inference

n: 500 firms in the US p: profit, number of employees, industry

- (b) classification problem, we are more interested in prediction

n: 20 similar products that were previously launched p: price charged, marketing budget, competition price, and ten other variables

- (c) regression problem, we are more interested in prediction

n: 52 weeks of 2012 weekly data p: % change in the US market, % change in the British market, the % change in the German market

Exercise 3

- (b)

Training MSE reduced as more flexible methods introduced since more flexible methods tend to better reduce training MSE

Test MSE tend to reach minimum level before more flexible methods overfit the model

Bayes (or irreducible) error should be a straight line slightly lower than minimum point of Test MSE representing the error that cannot be reduced by choosing a different fitting method

Variance tend to increase as method become more and more flexible

Bias tend to decrease as method become more and more flexible

Exercise 4

- (a)

Decide whether to buy or sell a bond Decide whether to promote or not promote an employee Analyses whether a new album will hit the market well

- (b)

Predict stock price level Allocate marketing budget based on past performance Attribute portfolio return to factors

- (c)

Classify emails into relevant categories Classify baseball players type Understand DNA functionality

Exercise 5

The advantages for a very flexible approach for regression or classification are obtaining a better fit for non-linear models, decreasing bias

The disadvantages for a very flexible approach for regression or classification are requires estimating a greater number of parameters, follow the noise too closely, increasing variance

A more flexible approach would be preferred to a less flexible approach when we are interested in prediction and not the interpretability of the results

A less flexible approach would be preferred to a more flexible approach when we are interested in inference and the interpretability of the results

Exercise 6

A parametric approach reduces the problem of estimating f down to one of estimating a set of parameters because it assumes a form for f

A non-parametric approach does not assume a functional form for f and so requires a very large number of observations to accurately estimate f

The advantages of a parametric approach to regression or classification are the simplifying of modeling f to a few parameters and not as many observations are required compared to a non-parametric approach

The disadvantages of a parametric approach to regression or classification are a potential to inaccurately estimate f if the form of f assumed is wrong or to overfit the observations if more flexible models are used

Exercise 7

(a)

$$3 \cdot 2 \sqrt{10} = 3.2 \sqrt{5} = 2.2 \sqrt{2} = 1.4 \sqrt{3} = 1.7$$

(b) Green

(c) Red

(d) Small, a small K would be flexible for a non-linear decision boundary, whereas a large K would try to fit a more linear boundary because it takes more points into consideration

Exercise 8

(a) Use the `read.csv()` function to read the data into R. Call the loaded data `college`.

```
college <- read.csv("College.csv")
```

(b) Look at the data using the `fix()` function. Convert first column of university name to row name and remove it from the data set.

```
rownames(college) <- college[, 1]  
  
college <- college[,-1]
```

(c)

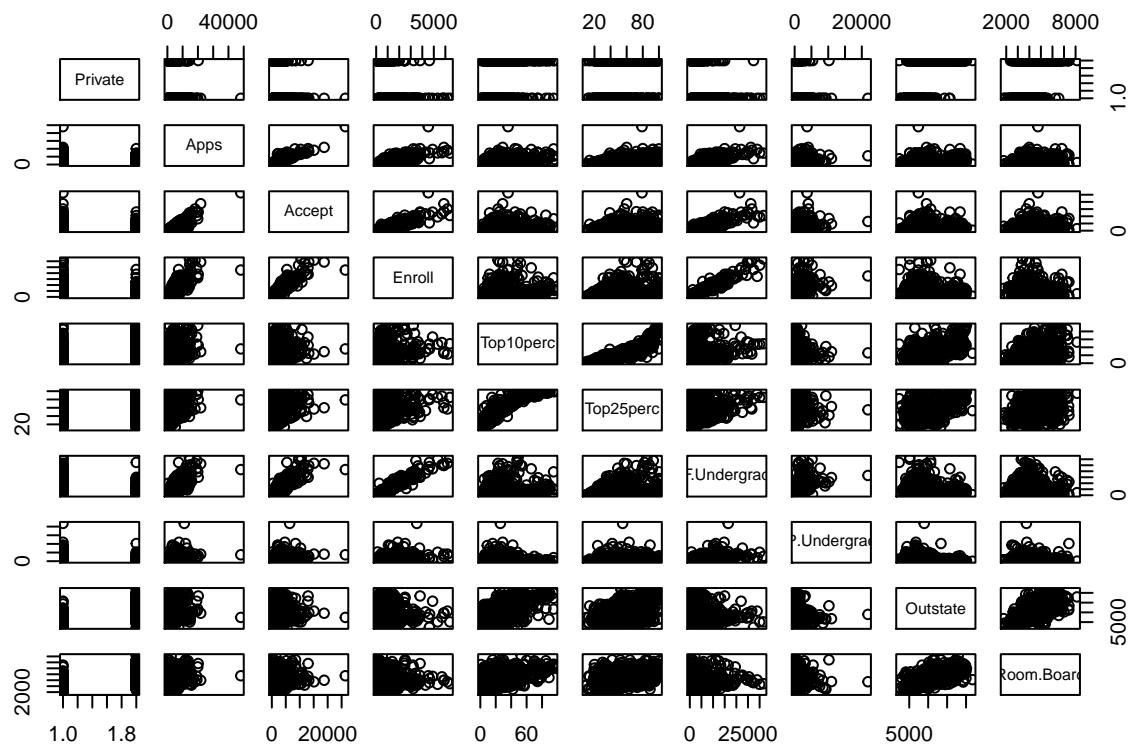
i. Use the `summary()` function to produce a numerical summary of the variables in the data set

```
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
```

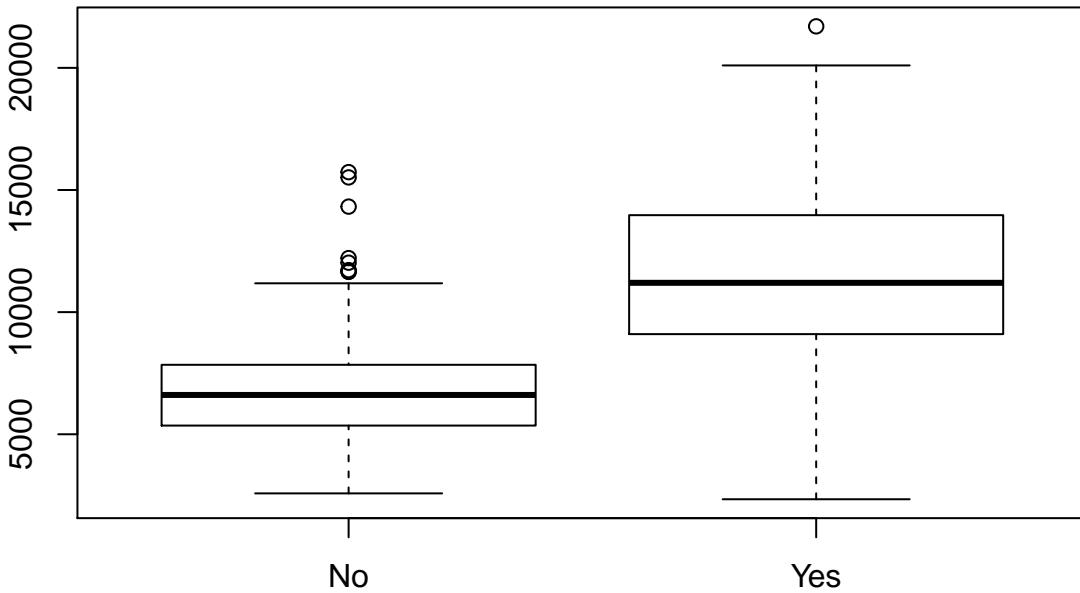
ii. Use the pairs() function to produce a scatterplot matrix of the first ten columns or variables of the data.

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



iii. Use the plot() function to produce side-by-side boxplots of Outstate versus Private.

```
college$Private <- as.factor(college$Private)
plot(x = college$Private, y = college$Outstate)
```



iv. Create a new qualitative variable, called Elite, by binning the Top10Perc variable.

```
Elite <- rep("No", nrow(college))
Elite[college$Top10perc > 50] <- "Yes"
Elite <- as.factor(Elite)
college <- data.frame(college, Elite)

summary(college)

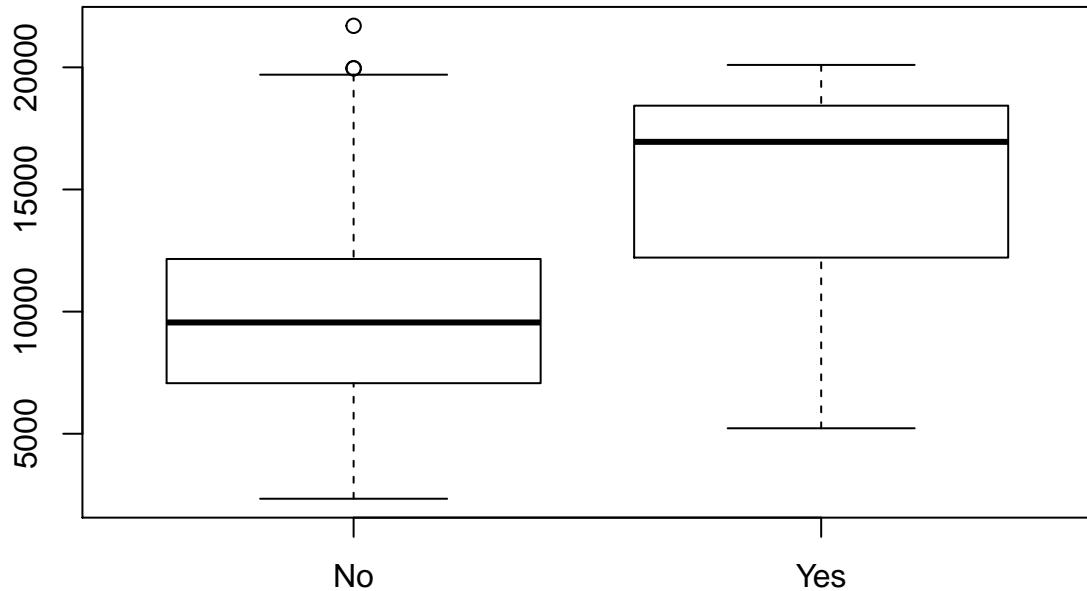
##   Private      Apps      Accept      Enroll   Top10perc
##   No :212    Min.   : 81   Min.   : 72   Min.   : 35   Min.   : 1.00
##   Yes:565   1st Qu.: 776  1st Qu.: 604  1st Qu.: 242  1st Qu.:15.00
##             Median :1558  Median :1110  Median :434  Median :23.00
##             Mean   :3002  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

plot(x = college$Elite, y = college$Outstate)

```



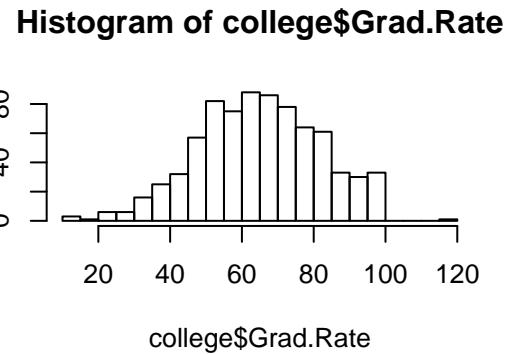
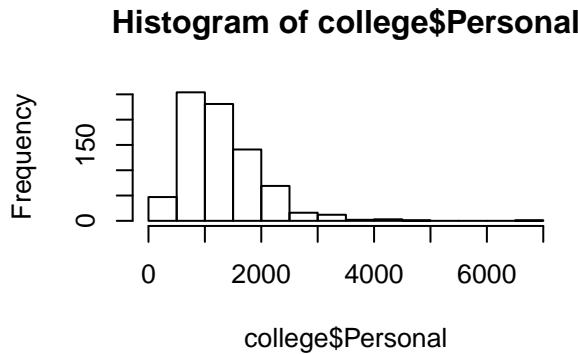
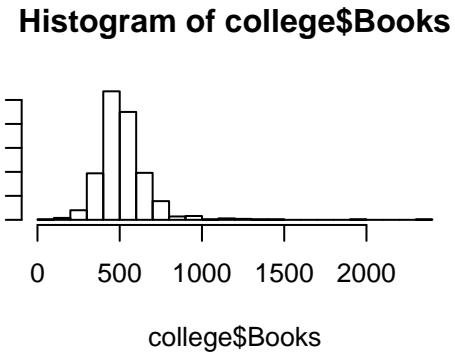
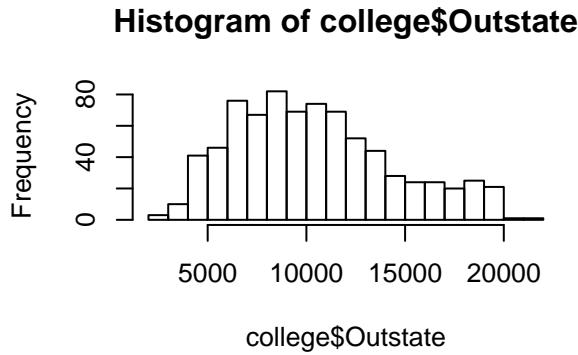
- v. Use the hist() function to produce some histograms with differing numbers of bins for a few of the quantitative variables. par(mfrow=c(2,2)) is useful to simultaneously plot several histograms

```

par(mfrow=c(2,2))
hist(college$Outstate,breaks = 20)
hist(college$Books,breaks = 20)
hist(college$Personal,breaks = 20)

```

```
hist(college$Grad.Rate, breaks = 20)
```



Exercise 9

- (a) Which of the predictors are quantitative, and which are qualitative?

```
auto <- read.csv("Auto.csv")
auto$origin <- as.factor(auto$origin)
auto$horsepower <- as.numeric(auto$horsepower)
summary(auto)
```

```
##      mpg      cylinders      displacement      horsepower
##  Min.   : 9.00   Min.   :3.000   Min.   :68.0   Min.   : 1.00
##  1st Qu.:17.50  1st Qu.:4.000  1st Qu.:104.0  1st Qu.:26.00
##  Median :23.00  Median :4.000  Median :146.0  Median :61.00
##  Mean   :23.52  Mean   :5.458  Mean   :193.5  Mean   :51.52
##  3rd Qu.:29.00  3rd Qu.:8.000  3rd Qu.:262.0  3rd Qu.:79.00
##  Max.   :46.60  Max.   :8.000  Max.   :455.0  Max.   :94.00
##
##      weight      acceleration      year      origin
##  Min.   :1613   Min.   : 8.00   Min.   :70.00  1:248
##  1st Qu.:2223  1st Qu.:13.80  1st Qu.:73.00  2: 70
##  Median :2800   Median :15.50  Median :76.00  3: 79
##  Mean   :2970   Mean   :15.56  Mean   :75.99
##  3rd Qu.:3609  3rd Qu.:17.10  3rd Qu.:79.00
##  Max.   :5140   Max.   :24.80  Max.   :82.00
```

```

##          name
##  ford pinto    : 6
##  amc matador   : 5
##  ford maverick : 5
##  toyota corolla: 5
##  amc gremlin    : 4
##  amc hornet     : 4
##  (Other)        :368

```

- (b) What is the range of each quantitative predictor?

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

```

##      mpg cylinders displacement horsepower weight acceleration year
## [1,] 9.0         3           68          1    1613       8.0     70
## [2,] 46.6        8           455         94    5140      24.8     82

```

- (c) What is the mean and standard deviation of each quantitative predictor

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

```

##      mpg      cylinders displacement horsepower      weight
##  23.515869    5.458438    193.532746    51.516373  2970.261965
##  acceleration      year
##  15.555668    75.994962

```

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

```

##      mpg      cylinders displacement horsepower      weight
##  7.825804    1.701577    104.379583    29.862697  847.904119
##  acceleration      year
##  2.749995    3.690005

```

- (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?

```
sapply(auto[-c(10:85),1:7],range)
```

```

##      mpg cylinders displacement horsepower weight acceleration year
## [1,] 11.0         3           68          1    1649       8.5     70
## [2,] 46.6         8           455         94    4997      24.8     82

```

```
sapply(auto[-c(10:85),1:7],mean)
```

```

##      mpg      cylinders displacement horsepower      weight
##  24.438629    5.370717    187.049844    50.996885  2933.962617
##  acceleration      year
##  15.723053    77.152648

```

```
sapply(auto[-c(10:85),1:7],sd)
```

```

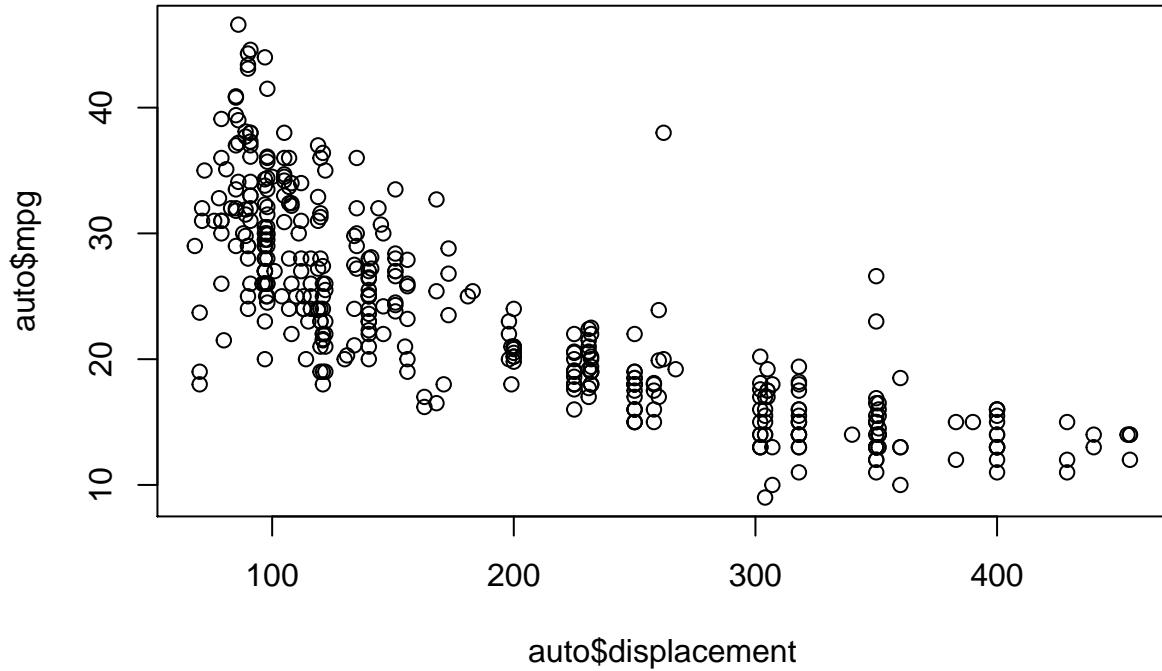
##      mpg      cylinders displacement horsepower      weight
##  7.908184    1.653486    99.635385    30.076725  810.642938
##  acceleration      year
##  2.680514    3.111230

```

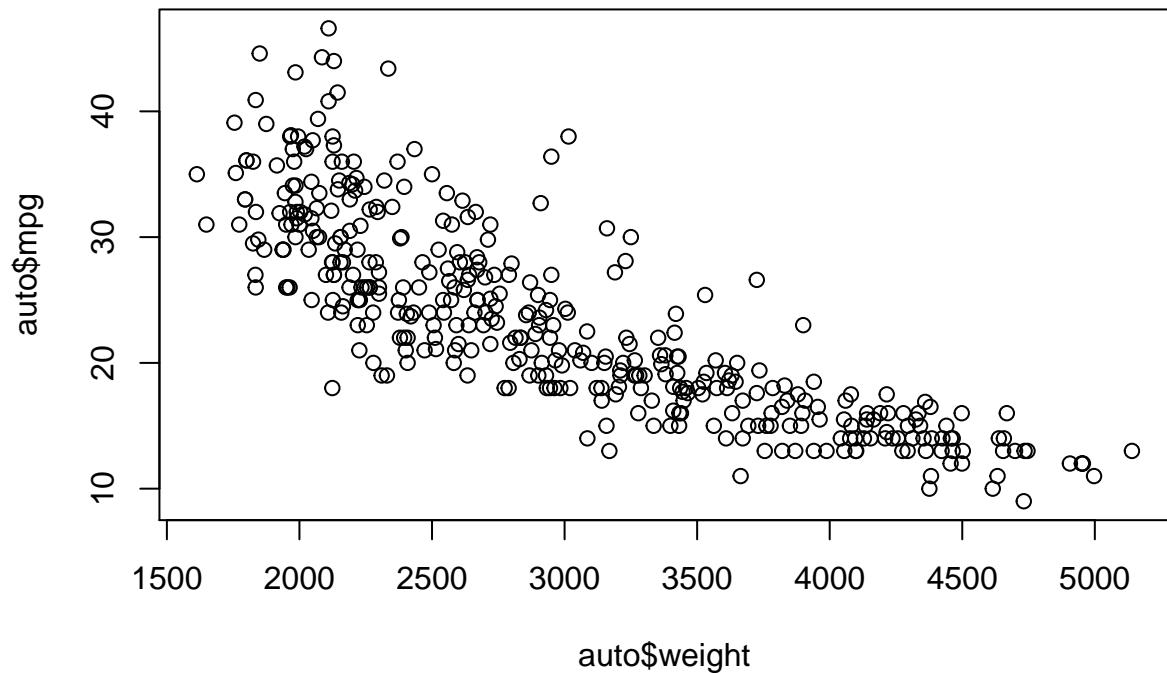
- (e) Using the full data set, investigate the predictors graphically, create some plots highlighting the relationships among the predictors.

(f) Suppose that we wish to predict gas mileage on the basis of the other variables. Do your plots suggest that any of the other variables might be useful in predicting mpg?

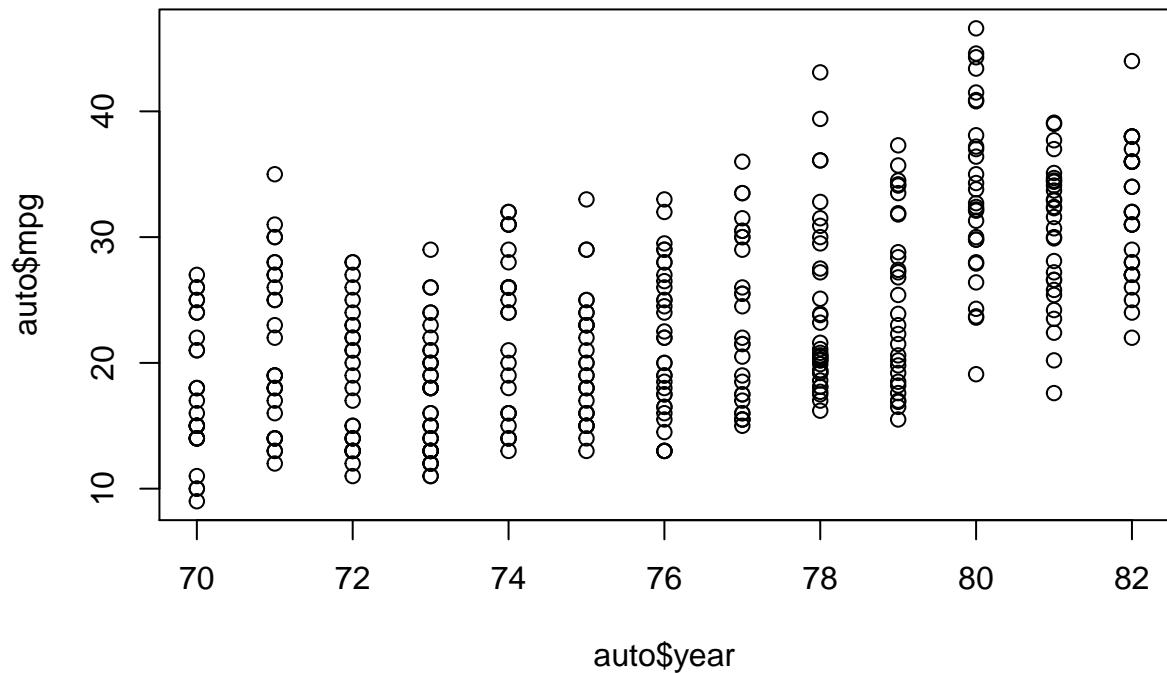
```
plot(auto$displacement, auto$mpg)
```



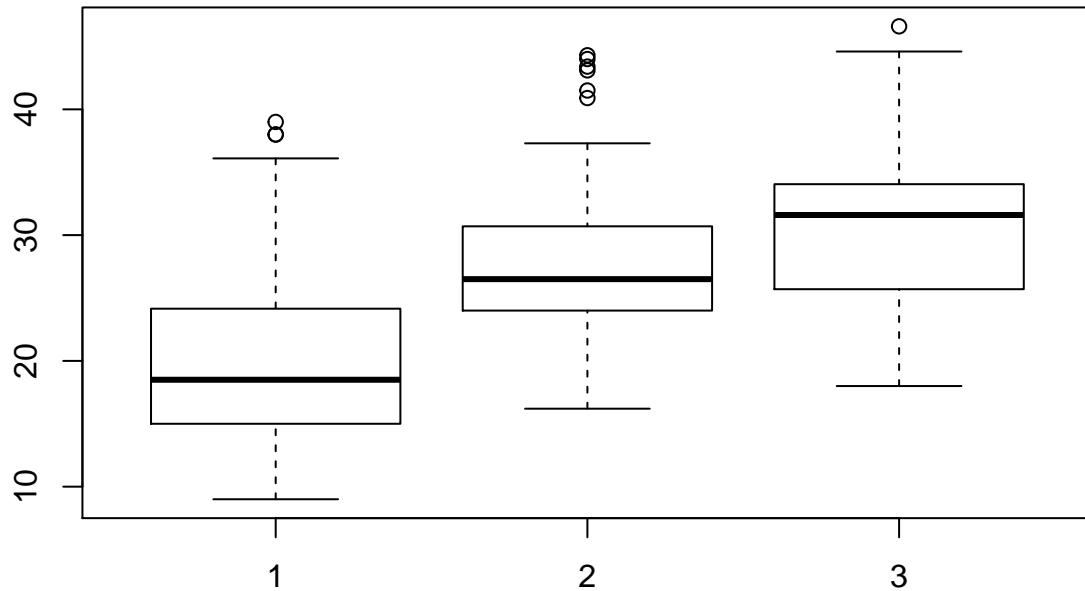
```
plot(auto$weight, auto$mpg)
```



```
plot(auto$year, auto$mpg)
```



```
plot(auto$origin, auto$mpg)
```



mpg is negatively correlated with displacement and weight. It is positively correlated with years and origin.

Exercise 10

- (a) To begin, load in the Boston data set. The Boston data set is part of the MASS library in 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
## 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
## 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
## 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
## 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
## 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
## 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
## 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
## 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
## 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

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## 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
## 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

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## 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
## 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

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## 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
## 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
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## 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
## 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
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## 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
## 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
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## 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
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## 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
```

```

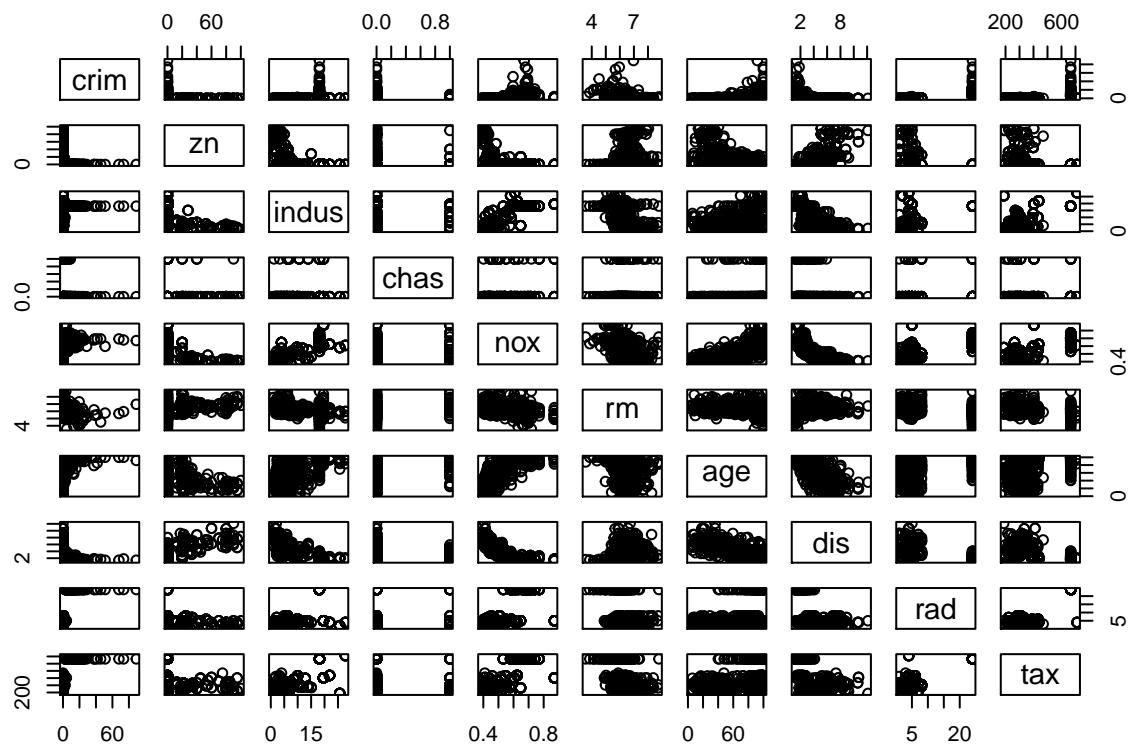
## 428 18.82 14.52 10.9
## 429 96.73 21.52 11.0
## 430 60.72 24.08 9.5
## 431 83.45 17.64 14.5
## 432 81.33 19.69 14.1
## 433 97.95 12.03 16.1
## 434 100.19 16.22 14.3
## 435 100.63 15.17 11.7
## 436 109.85 23.27 13.4
## 437 27.49 18.05 9.6
## 438 9.32 26.45 8.7
## 439 68.95 34.02 8.4
## 440 396.90 22.88 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
```

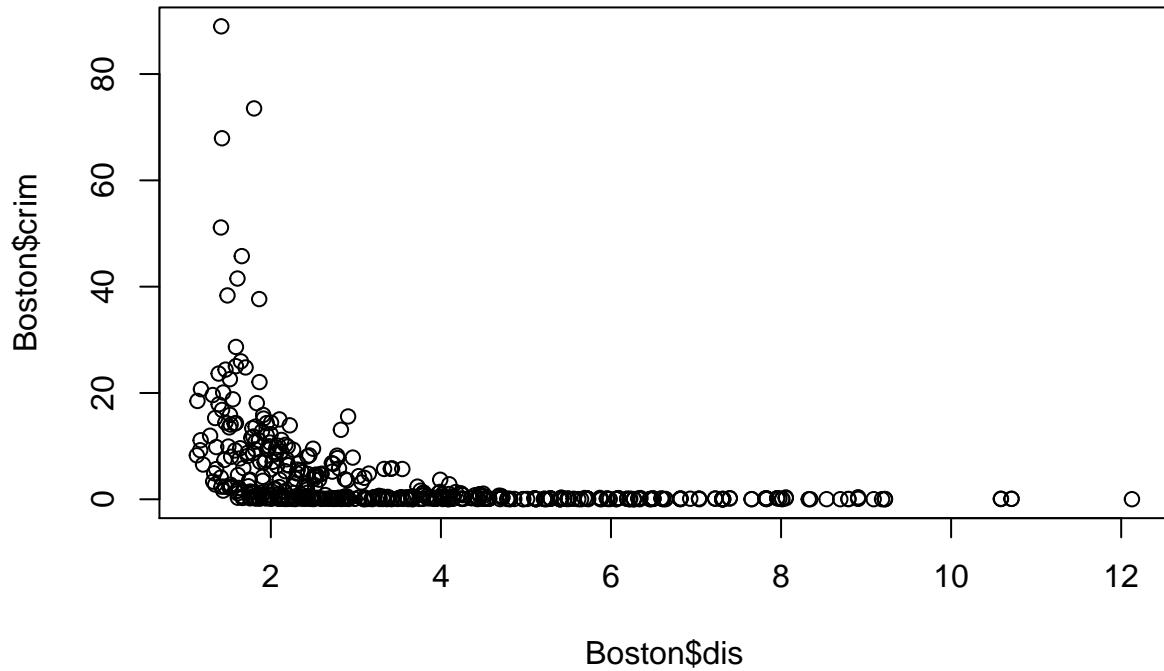
(b) Make some pairwise scatterplots of the predictors (columns) in this data set. Describe your findings.

```
pairs(Boston[, 1:10])
```



(c) Are any of the predictors associated with per capita crime rate? If so explain the relationship.

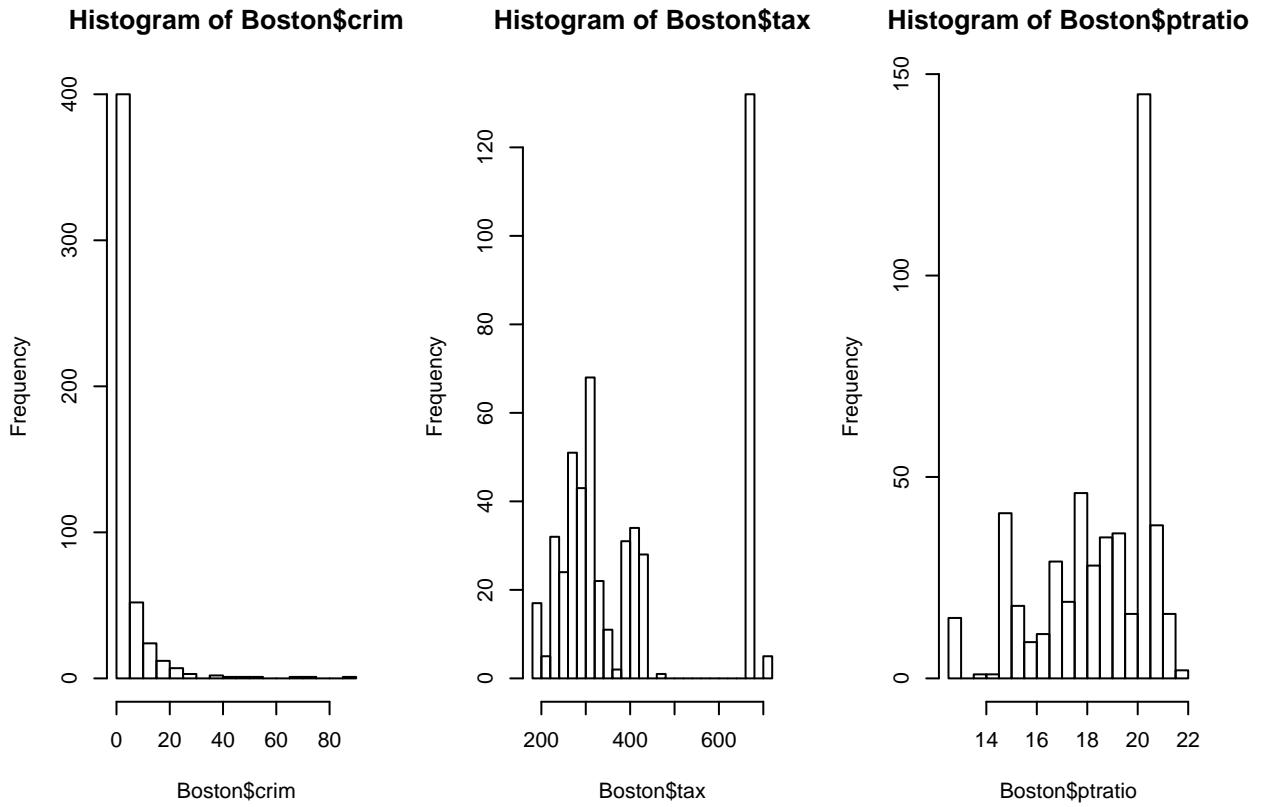
```
plot(Boston$dis, Boston$crim)
```



Distance seems to be a huge correlation factor. the closer it is to one of the five Boston employment centres, the higher the crime rate.

- (d) Does any of the suburbs of Boston appear to have particularly high crime rates? Tax rates? Pupil-teacher ratios?

```
par(mfrow=c(1,3))
hist(Boston$crim, breaks = 25)
hist(Boston$tax, breaks = 25)
hist(Boston$ptratio, breaks = 25)
```



(e) How many of the suburbs in this data set bound the Charles river

```
dim(subset(Boston, chas == 1))
```

```
## [1] 35 14
```

(f) What is the median pupil-teacher ratio among the towns in this data set?

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

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

(g) Which suburb of Boston has lowest median value of owner-occupied homes?

```
t(subset(Boston, medv == min(Boston$medv)))
```

```
##          399      406
## crim    38.3518 67.9208
## zn      0.0000  0.0000
## indus   18.1000 18.1000
## chas    0.0000  0.0000
## nox     0.6930  0.6930
## rm      5.4530  5.6830
## age     100.0000 100.0000
## dis     1.4896  1.4254
## rad     24.0000 24.0000
## tax     666.0000 666.0000
## ptratio 20.2000 20.2000
## black   396.9000 384.9700
```

```

## lstat    30.5900 22.9800
## medv     5.0000  5.0000

(h) In this data set, how many of the suburbs average more than seven rooms per dwelling? More than
eight rooms per dwelling?

dim(subset(Boston, rm > 7))

## [1] 64 14

subset(Boston, rm > 8)

##          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

```