519095_individual

2023-10-22

##2.4

```
#a
library(MASS)
Boston

##        crim    zn indus chas    nox    rm   age     dis rad tax ptratio
black
## 1   0.00632  18.0  2.31    0 0.5380 6.575  65.2  4.0900   1 296    15.3
396.90
## 2   0.02731   0.0  7.07    0 0.4690 6.421  78.9  4.9671   2 242    17.8
396.90
## 3   0.02729   0.0  7.07    0 0.4690 7.185  61.1  4.9671   2 242    17.8
392.83
## 4   0.03237   0.0  2.18    0 0.4580 6.998  45.8  6.0622   3 222    18.7
394.63
## 5   0.06905   0.0  2.18    0 0.4580 7.147  54.2  6.0622   3 222    18.7
396.90
## 6   0.02985   0.0  2.18    0 0.4580 6.430  58.7  6.0622   3 222    18.7
394.12
## 7   0.08829  12.5  7.87    0 0.5240 6.012  66.6  5.5605   5 311    15.2
395.60
## 8   0.14455  12.5  7.87    0 0.5240 6.172  96.1  5.9505   5 311    15.2
396.90
## 9   0.21124  12.5  7.87    0 0.5240 5.631 100.0  6.0821   5 311    15.2
386.63
## 10  0.17004  12.5  7.87    0 0.5240 6.004  85.9  6.5921   5 311    15.2
386.71
## 11  0.22489  12.5  7.87    0 0.5240 6.377  94.3  6.3467   5 311    15.2
392.52
## 12  0.11747  12.5  7.87    0 0.5240 6.009  82.9  6.2267   5 311    15.2
396.90
## 13  0.09378  12.5  7.87    0 0.5240 5.889  39.0  5.4509   5 311    15.2
390.50
## 14  0.62976   0.0  8.14    0 0.5380 5.949  61.8  4.7075   4 307    21.0
396.90
## 15  0.63796   0.0  8.14    0 0.5380 6.096  84.5  4.4619   4 307    21.0
380.02
## 16  0.62739   0.0  8.14    0 0.5380 5.834  56.5  4.4986   4 307    21.0
395.62
## 17  1.05393   0.0  8.14    0 0.5380 5.935  29.3  4.4986   4 307    21.0
386.85
## 18  0.78420   0.0  8.14    0 0.5380 5.990  81.7  4.2579   4 307    21.0
386.75
```

```
## 19   0.80271   0.0  8.14    0 0.5380 5.456  36.6  3.7965   4 307    21.0
288.99
## 20   0.72580   0.0  8.14    0 0.5380 5.727  69.5  3.7965   4 307    21.0
390.95
## 21   1.25179   0.0  8.14    0 0.5380 5.570  98.1  3.7979   4 307    21.0
376.57
## 22   0.85204   0.0  8.14    0 0.5380 5.965  89.2  4.0123   4 307    21.0
392.53
## 23   1.23247   0.0  8.14    0 0.5380 6.142  91.7  3.9769   4 307    21.0
396.90
## 24   0.98843   0.0  8.14    0 0.5380 5.813 100.0  4.0952   4 307    21.0
394.54
## 25   0.75026   0.0  8.14    0 0.5380 5.924  94.1  4.3996   4 307    21.0
394.33
## 26   0.84054   0.0  8.14    0 0.5380 5.599  85.7  4.4546   4 307    21.0
303.42
## 27   0.67191   0.0  8.14    0 0.5380 5.813  90.3  4.6820   4 307    21.0
376.88
## 28   0.95577   0.0  8.14    0 0.5380 6.047  88.8  4.4534   4 307    21.0
306.38
## 29   0.77299   0.0  8.14    0 0.5380 6.495  94.4  4.4547   4 307    21.0
387.94
## 30   1.00245   0.0  8.14    0 0.5380 6.674  87.3  4.2390   4 307    21.0
380.23
## 31   1.13081   0.0  8.14    0 0.5380 5.713  94.1  4.2330   4 307    21.0
360.17
## 32   1.35472   0.0  8.14    0 0.5380 6.072 100.0  4.1750   4 307    21.0
376.73
## 33   1.38799   0.0  8.14    0 0.5380 5.950  82.0  3.9900   4 307    21.0
232.60
## 34   1.15172   0.0  8.14    0 0.5380 5.701  95.0  3.7872   4 307    21.0
358.77
## 35   1.61282   0.0  8.14    0 0.5380 6.096  96.9  3.7598   4 307    21.0
248.31
## 36   0.06417   0.0  5.96    0 0.4990 5.933  68.2  3.3603   5 279    19.2
396.90
## 37   0.09744   0.0  5.96    0 0.4990 5.841  61.4  3.3779   5 279    19.2
377.56
## 38   0.08014   0.0  5.96    0 0.4990 5.850  41.5  3.9342   5 279    19.2
396.90
## 39   0.17505   0.0  5.96    0 0.4990 5.966  30.2  3.8473   5 279    19.2
393.43
## 40   0.02763  75.0  2.95    0 0.4280 6.595  21.8  5.4011   3 252    18.3
395.63
## 41   0.03359  75.0  2.95    0 0.4280 7.024  15.8  5.4011   3 252    18.3
395.62
## 42   0.12744   0.0  6.91    0 0.4480 6.770   2.9  5.7209   3 233    17.9
385.41
## 43   0.14150   0.0  6.91    0 0.4480 6.169   6.6  5.7209   3 233    17.9
383.37
```

```
## 44   0.15936   0.0  6.91    0 0.4480 6.211   6.5  5.7209   3 233    17.9
394.46
## 45   0.12269   0.0  6.91    0 0.4480 6.069  40.0  5.7209   3 233    17.9
389.39
## 46   0.17142   0.0  6.91    0 0.4480 5.682  33.8  5.1004   3 233    17.9
396.90
## 47   0.18836   0.0  6.91    0 0.4480 5.786  33.3  5.1004   3 233    17.9
396.90
## 48   0.22927   0.0  6.91    0 0.4480 6.030  85.5  5.6894   3 233    17.9
392.74
## 49   0.25387   0.0  6.91    0 0.4480 5.399  95.3  5.8700   3 233    17.9
396.90
## 50   0.21977   0.0  6.91    0 0.4480 5.602  62.0  6.0877   3 233    17.9
396.90
## 51   0.08873  21.0  5.64    0 0.4390 5.963  45.7  6.8147   4 243    16.8
395.56
## 52   0.04337  21.0  5.64    0 0.4390 6.115  63.0  6.8147   4 243    16.8
393.97
## 53   0.05360  21.0  5.64    0 0.4390 6.511  21.1  6.8147   4 243    16.8
396.90
## 54   0.04981  21.0  5.64    0 0.4390 5.998  21.4  6.8147   4 243    16.8
396.90
## 55   0.01360  75.0  4.00    0 0.4100 5.888  47.6  7.3197   3 469    21.1
396.90
## 56   0.01311  90.0  1.22    0 0.4030 7.249  21.9  8.6966   5 226    17.9
395.93
## 57   0.02055  85.0  0.74    0 0.4100 6.383  35.7  9.1876   2 313    17.3
396.90
## 58   0.01432 100.0  1.32    0 0.4110 6.816  40.5  8.3248   5 256    15.1
392.90
## 59   0.15445  25.0  5.13    0 0.4530 6.145  29.2  7.8148   8 284    19.7
390.68
## 60   0.10328  25.0  5.13    0 0.4530 5.927  47.2  6.9320   8 284    19.7
396.90
## 61   0.14932  25.0  5.13    0 0.4530 5.741  66.2  7.2254   8 284    19.7
395.11
## 62   0.17171  25.0  5.13    0 0.4530 5.966  93.4  6.8185   8 284    19.7
378.08
## 63   0.11027  25.0  5.13    0 0.4530 6.456  67.8  7.2255   8 284    19.7
396.90
## 64   0.12650  25.0  5.13    0 0.4530 6.762  43.4  7.9809   8 284    19.7
395.58
## 65   0.01951  17.5  1.38    0 0.4161 7.104  59.5  9.2229   3 216    18.6
393.24
## 66   0.03584  80.0  3.37    0 0.3980 6.290  17.8  6.6115   4 337    16.1
396.90
## 67   0.04379  80.0  3.37    0 0.3980 5.787  31.1  6.6115   4 337    16.1
396.90
## 68   0.05789  12.5  6.07    0 0.4090 5.878  21.4  6.4980   4 345    18.9
396.21
```

```
## 69   0.13554  12.5  6.07    0 0.4090 5.594  36.8  6.4980   4 345    18.9
396.90
## 70   0.12816  12.5  6.07    0 0.4090 5.885  33.0  6.4980   4 345    18.9
396.90
## 71   0.08826   0.0 10.81    0 0.4130 6.417   6.6  5.2873   4 305    19.2
383.73
## 72   0.15876   0.0 10.81    0 0.4130 5.961  17.5  5.2873   4 305    19.2
376.94
## 73   0.09164   0.0 10.81    0 0.4130 6.065   7.8  5.2873   4 305    19.2
390.91
## 74   0.19539   0.0 10.81    0 0.4130 6.245   6.2  5.2873   4 305    19.2
377.17
## 75   0.07896   0.0 12.83    0 0.4370 6.273   6.0  4.2515   5 398    18.7
394.92
## 76   0.09512   0.0 12.83    0 0.4370 6.286  45.0  4.5026   5 398    18.7
383.23
## 77   0.10153   0.0 12.83    0 0.4370 6.279  74.5  4.0522   5 398    18.7
373.66
## 78   0.08707   0.0 12.83    0 0.4370 6.140  45.8  4.0905   5 398    18.7
386.96
## 79   0.05646   0.0 12.83    0 0.4370 6.232  53.7  5.0141   5 398    18.7
386.40
## 80   0.08387   0.0 12.83    0 0.4370 5.874  36.6  4.5026   5 398    18.7
396.06
## 81   0.04113  25.0  4.86    0 0.4260 6.727  33.5  5.4007   4 281    19.0
396.90
## 82   0.04462  25.0  4.86    0 0.4260 6.619  70.4  5.4007   4 281    19.0
395.63
## 83   0.03659  25.0  4.86    0 0.4260 6.302  32.2  5.4007   4 281    19.0
396.90
## 84   0.03551  25.0  4.86    0 0.4260 6.167  46.7  5.4007   4 281    19.0
390.64
## 85   0.05059   0.0  4.49    0 0.4490 6.389  48.0  4.7794   3 247    18.5
396.90
## 86   0.05735   0.0  4.49    0 0.4490 6.630  56.1  4.4377   3 247    18.5
392.30
## 87   0.05188   0.0  4.49    0 0.4490 6.015  45.1  4.4272   3 247    18.5
395.99
## 88   0.07151   0.0  4.49    0 0.4490 6.121  56.8  3.7476   3 247    18.5
395.15
## 89   0.05660   0.0  3.41    0 0.4890 7.007  86.3  3.4217   2 270    17.8
396.90
## 90   0.05302   0.0  3.41    0 0.4890 7.079  63.1  3.4145   2 270    17.8
396.06
## 91   0.04684   0.0  3.41    0 0.4890 6.417  66.1  3.0923   2 270    17.8
392.18
## 92   0.03932   0.0  3.41    0 0.4890 6.405  73.9  3.0921   2 270    17.8
393.55
## 93   0.04203  28.0 15.04    0 0.4640 6.442  53.6  3.6659   4 270    18.2
395.01
```

```
## 94   0.02875  28.0 15.04    0 0.4640 6.211  28.9  3.6659   4 270    18.2
396.33
## 95   0.04294  28.0 15.04    0 0.4640 6.249  77.3  3.6150   4 270    18.2
396.90
## 96   0.12204   0.0  2.89    0 0.4450 6.625  57.8  3.4952   2 276    18.0
357.98
## 97   0.11504   0.0  2.89    0 0.4450 6.163  69.6  3.4952   2 276    18.0
391.83
## 98   0.12083   0.0  2.89    0 0.4450 8.069  76.0  3.4952   2 276    18.0
396.90
## 99   0.08187   0.0  2.89    0 0.4450 7.820  36.9  3.4952   2 276    18.0
393.53
## 100  0.06860   0.0  2.89    0 0.4450 7.416  62.5  3.4952   2 276    18.0
396.90
## 101  0.14866   0.0  8.56    0 0.5200 6.727  79.9  2.7778   5 384    20.9
394.76
## 102  0.11432   0.0  8.56    0 0.5200 6.781  71.3  2.8561   5 384    20.9
395.58
## 103  0.22876   0.0  8.56    0 0.5200 6.405  85.4  2.7147   5 384    20.9
70.80
## 104  0.21161   0.0  8.56    0 0.5200 6.137  87.4  2.7147   5 384    20.9
394.47
## 105  0.13960   0.0  8.56    0 0.5200 6.167  90.0  2.4210   5 384    20.9
392.69
## 106  0.13262   0.0  8.56    0 0.5200 5.851  96.7  2.1069   5 384    20.9
394.05
## 107  0.17120   0.0  8.56    0 0.5200 5.836  91.9  2.2110   5 384    20.9
395.67
## 108  0.13117   0.0  8.56    0 0.5200 6.127  85.2  2.1224   5 384    20.9
387.69
## 109  0.12802   0.0  8.56    0 0.5200 6.474  97.1  2.4329   5 384    20.9
395.24
## 110  0.26363   0.0  8.56    0 0.5200 6.229  91.2  2.5451   5 384    20.9
391.23
## 111  0.10793   0.0  8.56    0 0.5200 6.195  54.4  2.7778   5 384    20.9
393.49
## 112  0.10084   0.0 10.01    0 0.5470 6.715  81.6  2.6775   6 432    17.8
395.59
## 113  0.12329   0.0 10.01    0 0.5470 5.913  92.9  2.3534   6 432    17.8
394.95
## 114  0.22212   0.0 10.01    0 0.5470 6.092  95.4  2.5480   6 432    17.8
396.90
## 115  0.14231   0.0 10.01    0 0.5470 6.254  84.2  2.2565   6 432    17.8
388.74
## 116  0.17134   0.0 10.01    0 0.5470 5.928  88.2  2.4631   6 432    17.8
344.91
## 117  0.13158   0.0 10.01    0 0.5470 6.176  72.5  2.7301   6 432    17.8
393.30
## 118  0.15098   0.0 10.01    0 0.5470 6.021  82.6  2.7474   6 432    17.8
394.51
```

```
## 119  0.13058   0.0 10.01    0 0.5470 5.872  73.1  2.4775   6 432    17.8
338.63
## 120  0.14476   0.0 10.01    0 0.5470 5.731  65.2  2.7592   6 432    17.8
391.50
## 121  0.06899   0.0 25.65    0 0.5810 5.870  69.7  2.2577   2 188    19.1
389.15
## 122  0.07165   0.0 25.65    0 0.5810 6.004  84.1  2.1974   2 188    19.1
377.67
## 123  0.09299   0.0 25.65    0 0.5810 5.961  92.9  2.0869   2 188    19.1
378.09
## 124  0.15038   0.0 25.65    0 0.5810 5.856  97.0  1.9444   2 188    19.1
370.31
## 125  0.09849   0.0 25.65    0 0.5810 5.879  95.8  2.0063   2 188    19.1
379.38
## 126  0.16902   0.0 25.65    0 0.5810 5.986  88.4  1.9929   2 188    19.1
385.02
## 127  0.38735   0.0 25.65    0 0.5810 5.613  95.6  1.7572   2 188    19.1
359.29
## 128  0.25915   0.0 21.89    0 0.6240 5.693  96.0  1.7883   4 437    21.2
392.11
## 129  0.32543   0.0 21.89    0 0.6240 6.431  98.8  1.8125   4 437    21.2
396.90
## 130  0.88125   0.0 21.89    0 0.6240 5.637  94.7  1.9799   4 437    21.2
396.90
## 131  0.34006   0.0 21.89    0 0.6240 6.458  98.9  2.1185   4 437    21.2
395.04
## 132  1.19294   0.0 21.89    0 0.6240 6.326  97.7  2.2710   4 437    21.2
396.90
## 133  0.59005   0.0 21.89    0 0.6240 6.372  97.9  2.3274   4 437    21.2
385.76
## 134  0.32982   0.0 21.89    0 0.6240 5.822  95.4  2.4699   4 437    21.2
388.69
## 135  0.97617   0.0 21.89    0 0.6240 5.757  98.4  2.3460   4 437    21.2
262.76
## 136  0.55778   0.0 21.89    0 0.6240 6.335  98.2  2.1107   4 437    21.2
394.67
## 137  0.32264   0.0 21.89    0 0.6240 5.942  93.5  1.9669   4 437    21.2
378.25
## 138  0.35233   0.0 21.89    0 0.6240 6.454  98.4  1.8498   4 437    21.2
394.08
## 139  0.24980   0.0 21.89    0 0.6240 5.857  98.2  1.6686   4 437    21.2
392.04
## 140  0.54452   0.0 21.89    0 0.6240 6.151  97.9  1.6687   4 437    21.2
396.90
## 141  0.29090   0.0 21.89    0 0.6240 6.174  93.6  1.6119   4 437    21.2
388.08
## 142  1.62864   0.0 21.89    0 0.6240 5.019 100.0  1.4394   4 437    21.2
396.90
## 143  3.32105   0.0 19.58    1 0.8710 5.403 100.0  1.3216   5 403    14.7
396.90
```

```
## 144  4.09740   0.0 19.58    0 0.8710 5.468 100.0  1.4118   5 403    14.7
396.90
## 145  2.77974   0.0 19.58    0 0.8710 4.903  97.8  1.3459   5 403    14.7
396.90
## 146  2.37934   0.0 19.58    0 0.8710 6.130 100.0  1.4191   5 403    14.7
172.91
## 147  2.15505   0.0 19.58    0 0.8710 5.628 100.0  1.5166   5 403    14.7
169.27
## 148  2.36862   0.0 19.58    0 0.8710 4.926  95.7  1.4608   5 403    14.7
391.71
## 149  2.33099   0.0 19.58    0 0.8710 5.186  93.8  1.5296   5 403    14.7
356.99
## 150  2.73397   0.0 19.58    0 0.8710 5.597  94.9  1.5257   5 403    14.7
351.85
## 151  1.65660   0.0 19.58    0 0.8710 6.122  97.3  1.6180   5 403    14.7
372.80
## 152  1.49632   0.0 19.58    0 0.8710 5.404 100.0  1.5916   5 403    14.7
341.60
## 153  1.12658   0.0 19.58    1 0.8710 5.012  88.0  1.6102   5 403    14.7
343.28
## 154  2.14918   0.0 19.58    0 0.8710 5.709  98.5  1.6232   5 403    14.7
261.95
## 155  1.41385   0.0 19.58    1 0.8710 6.129  96.0  1.7494   5 403    14.7
321.02
## 156  3.53501   0.0 19.58    1 0.8710 6.152  82.6  1.7455   5 403    14.7
88.01
## 157  2.44668   0.0 19.58    0 0.8710 5.272  94.0  1.7364   5 403    14.7
88.63
## 158  1.22358   0.0 19.58    0 0.6050 6.943  97.4  1.8773   5 403    14.7
363.43
## 159  1.34284   0.0 19.58    0 0.6050 6.066 100.0  1.7573   5 403    14.7
353.89
## 160  1.42502   0.0 19.58    0 0.8710 6.510 100.0  1.7659   5 403    14.7
364.31
## 161  1.27346   0.0 19.58    1 0.6050 6.250  92.6  1.7984   5 403    14.7
338.92
## 162  1.46336   0.0 19.58    0 0.6050 7.489  90.8  1.9709   5 403    14.7
374.43
## 163  1.83377   0.0 19.58    1 0.6050 7.802  98.2  2.0407   5 403    14.7
389.61
## 164  1.51902   0.0 19.58    1 0.6050 8.375  93.9  2.1620   5 403    14.7
388.45
## 165  2.24236   0.0 19.58    0 0.6050 5.854  91.8  2.4220   5 403    14.7
395.11
## 166  2.92400   0.0 19.58    0 0.6050 6.101  93.0  2.2834   5 403    14.7
240.16
## 167  2.01019   0.0 19.58    0 0.6050 7.929  96.2  2.0459   5 403    14.7
369.30
## 168  1.80028   0.0 19.58    0 0.6050 5.877  79.2  2.4259   5 403    14.7
227.61
```

```
## 169  2.30040   0.0 19.58    0 0.6050 6.319  96.1  2.1000   5 403    14.7
297.09
## 170  2.44953   0.0 19.58    0 0.6050 6.402  95.2  2.2625   5 403    14.7
330.04
## 171  1.20742   0.0 19.58    0 0.6050 5.875  94.6  2.4259   5 403    14.7
292.29
## 172  2.31390   0.0 19.58    0 0.6050 5.880  97.3  2.3887   5 403    14.7
348.13
## 173  0.13914   0.0  4.05    0 0.5100 5.572  88.5  2.5961   5 296    16.6
396.90
## 174  0.09178   0.0  4.05    0 0.5100 6.416  84.1  2.6463   5 296    16.6
395.50
## 175  0.08447   0.0  4.05    0 0.5100 5.859  68.7  2.7019   5 296    16.6
393.23
## 176  0.06664   0.0  4.05    0 0.5100 6.546  33.1  3.1323   5 296    16.6
390.96
## 177  0.07022   0.0  4.05    0 0.5100 6.020  47.2  3.5549   5 296    16.6
393.23
## 178  0.05425   0.0  4.05    0 0.5100 6.315  73.4  3.3175   5 296    16.6
395.60
## 179  0.06642   0.0  4.05    0 0.5100 6.860  74.4  2.9153   5 296    16.6
391.27
## 180  0.05780   0.0  2.46    0 0.4880 6.980  58.4  2.8290   3 193    17.8
396.90
## 181  0.06588   0.0  2.46    0 0.4880 7.765  83.3  2.7410   3 193    17.8
395.56
## 182  0.06888   0.0  2.46    0 0.4880 6.144  62.2  2.5979   3 193    17.8
396.90
## 183  0.09103   0.0  2.46    0 0.4880 7.155  92.2  2.7006   3 193    17.8
394.12
## 184  0.10008   0.0  2.46    0 0.4880 6.563  95.6  2.8470   3 193    17.8
396.90
## 185  0.08308   0.0  2.46    0 0.4880 5.604  89.8  2.9879   3 193    17.8
391.00
## 186  0.06047   0.0  2.46    0 0.4880 6.153  68.8  3.2797   3 193    17.8
387.11
## 187  0.05602   0.0  2.46    0 0.4880 7.831  53.6  3.1992   3 193    17.8
392.63
## 188  0.07875  45.0  3.44    0 0.4370 6.782  41.1  3.7886   5 398    15.2
393.87
## 189  0.12579  45.0  3.44    0 0.4370 6.556  29.1  4.5667   5 398    15.2
382.84
## 190  0.08370  45.0  3.44    0 0.4370 7.185  38.9  4.5667   5 398    15.2
396.90
## 191  0.09068  45.0  3.44    0 0.4370 6.951  21.5  6.4798   5 398    15.2
377.68
## 192  0.06911  45.0  3.44    0 0.4370 6.739  30.8  6.4798   5 398    15.2
389.71
## 193  0.08664  45.0  3.44    0 0.4370 7.178  26.3  6.4798   5 398    15.2
390.49
```

```
## 194  0.02187  60.0  2.93    0 0.4010 6.800   9.9  6.2196   1 265    15.6
393.37
## 195  0.01439  60.0  2.93    0 0.4010 6.604  18.8  6.2196   1 265    15.6
376.70
## 196  0.01381  80.0  0.46    0 0.4220 7.875  32.0  5.6484   4 255    14.4
394.23
## 197  0.04011  80.0  1.52    0 0.4040 7.287  34.1  7.3090   2 329    12.6
396.90
## 198  0.04666  80.0  1.52    0 0.4040 7.107  36.6  7.3090   2 329    12.6
354.31
## 199  0.03768  80.0  1.52    0 0.4040 7.274  38.3  7.3090   2 329    12.6
392.20
## 200  0.03150  95.0  1.47    0 0.4030 6.975  15.3  7.6534   3 402    17.0
396.90
## 201  0.01778  95.0  1.47    0 0.4030 7.135  13.9  7.6534   3 402    17.0
384.30
## 202  0.03445  82.5  2.03    0 0.4150 6.162  38.4  6.2700   2 348    14.7
393.77
## 203  0.02177  82.5  2.03    0 0.4150 7.610  15.7  6.2700   2 348    14.7
395.38
## 204  0.03510  95.0  2.68    0 0.4161 7.853  33.2  5.1180   4 224    14.7
392.78
## 205  0.02009  95.0  2.68    0 0.4161 8.034  31.9  5.1180   4 224    14.7
390.55
## 206  0.13642   0.0 10.59    0 0.4890 5.891  22.3  3.9454   4 277    18.6
396.90
## 207  0.22969   0.0 10.59    0 0.4890 6.326  52.5  4.3549   4 277    18.6
394.87
## 208  0.25199   0.0 10.59    0 0.4890 5.783  72.7  4.3549   4 277    18.6
389.43
## 209  0.13587   0.0 10.59    1 0.4890 6.064  59.1  4.2392   4 277    18.6
381.32
## 210  0.43571   0.0 10.59    1 0.4890 5.344 100.0  3.8750   4 277    18.6
396.90
## 211  0.17446   0.0 10.59    1 0.4890 5.960  92.1  3.8771   4 277    18.6
393.25
## 212  0.37578   0.0 10.59    1 0.4890 5.404  88.6  3.6650   4 277    18.6
395.24
## 213  0.21719   0.0 10.59    1 0.4890 5.807  53.8  3.6526   4 277    18.6
390.94
## 214  0.14052   0.0 10.59    0 0.4890 6.375  32.3  3.9454   4 277    18.6
385.81
## 215  0.28955   0.0 10.59    0 0.4890 5.412   9.8  3.5875   4 277    18.6
348.93
## 216  0.19802   0.0 10.59    0 0.4890 6.182  42.4  3.9454   4 277    18.6
393.63
## 217  0.04560   0.0 13.89    1 0.5500 5.888  56.0  3.1121   5 276    16.4
392.80
## 218  0.07013   0.0 13.89    0 0.5500 6.642  85.1  3.4211   5 276    16.4
392.78
```

```
## 219  0.11069   0.0 13.89    1 0.5500 5.951  93.8  2.8893   5 276    16.4
396.90
## 220  0.11425   0.0 13.89    1 0.5500 6.373  92.4  3.3633   5 276    16.4
393.74
## 221  0.35809   0.0  6.20    1 0.5070 6.951  88.5  2.8617   8 307    17.4
391.70
## 222  0.40771   0.0  6.20    1 0.5070 6.164  91.3  3.0480   8 307    17.4
395.24
## 223  0.62356   0.0  6.20    1 0.5070 6.879  77.7  3.2721   8 307    17.4
390.39
## 224  0.61470   0.0  6.20    0 0.5070 6.618  80.8  3.2721   8 307    17.4
396.90
## 225  0.31533   0.0  6.20    0 0.5040 8.266  78.3  2.8944   8 307    17.4
385.05
## 226  0.52693   0.0  6.20    0 0.5040 8.725  83.0  2.8944   8 307    17.4
382.00
## 227  0.38214   0.0  6.20    0 0.5040 8.040  86.5  3.2157   8 307    17.4
387.38
## 228  0.41238   0.0  6.20    0 0.5040 7.163  79.9  3.2157   8 307    17.4
372.08
## 229  0.29819   0.0  6.20    0 0.5040 7.686  17.0  3.3751   8 307    17.4
377.51
## 230  0.44178   0.0  6.20    0 0.5040 6.552  21.4  3.3751   8 307    17.4
380.34
## 231  0.53700   0.0  6.20    0 0.5040 5.981  68.1  3.6715   8 307    17.4
378.35
## 232  0.46296   0.0  6.20    0 0.5040 7.412  76.9  3.6715   8 307    17.4
376.14
## 233  0.57529   0.0  6.20    0 0.5070 8.337  73.3  3.8384   8 307    17.4
385.91
## 234  0.33147   0.0  6.20    0 0.5070 8.247  70.4  3.6519   8 307    17.4
378.95
## 235  0.44791   0.0  6.20    1 0.5070 6.726  66.5  3.6519   8 307    17.4
360.20
## 236  0.33045   0.0  6.20    0 0.5070 6.086  61.5  3.6519   8 307    17.4
376.75
## 237  0.52058   0.0  6.20    1 0.5070 6.631  76.5  4.1480   8 307    17.4
388.45
## 238  0.51183   0.0  6.20    0 0.5070 7.358  71.6  4.1480   8 307    17.4
390.07
## 239  0.08244  30.0  4.93    0 0.4280 6.481  18.5  6.1899   6 300    16.6
379.41
## 240  0.09252  30.0  4.93    0 0.4280 6.606  42.2  6.1899   6 300    16.6
383.78
## 241  0.11329  30.0  4.93    0 0.4280 6.897  54.3  6.3361   6 300    16.6
391.25
## 242  0.10612  30.0  4.93    0 0.4280 6.095  65.1  6.3361   6 300    16.6
394.62
## 243  0.10290  30.0  4.93    0 0.4280 6.358  52.9  7.0355   6 300    16.6
372.75
```

```
## 244  0.12757  30.0  4.93    0 0.4280 6.393   7.8  7.0355   6 300    16.6
374.71
## 245  0.20608  22.0  5.86    0 0.4310 5.593  76.5  7.9549   7 330    19.1
372.49
## 246  0.19133  22.0  5.86    0 0.4310 5.605  70.2  7.9549   7 330    19.1
389.13
## 247  0.33983  22.0  5.86    0 0.4310 6.108  34.9  8.0555   7 330    19.1
390.18
## 248  0.19657  22.0  5.86    0 0.4310 6.226  79.2  8.0555   7 330    19.1
376.14
## 249  0.16439  22.0  5.86    0 0.4310 6.433  49.1  7.8265   7 330    19.1
374.71
## 250  0.19073  22.0  5.86    0 0.4310 6.718  17.5  7.8265   7 330    19.1
393.74
## 251  0.14030  22.0  5.86    0 0.4310 6.487  13.0  7.3967   7 330    19.1
396.28
## 252  0.21409  22.0  5.86    0 0.4310 6.438   8.9  7.3967   7 330    19.1
377.07
## 253  0.08221  22.0  5.86    0 0.4310 6.957   6.8  8.9067   7 330    19.1
386.09
## 254  0.36894  22.0  5.86    0 0.4310 8.259   8.4  8.9067   7 330    19.1
396.90
## 255  0.04819  80.0  3.64    0 0.3920 6.108  32.0  9.2203   1 315    16.4
392.89
## 256  0.03548  80.0  3.64    0 0.3920 5.876  19.1  9.2203   1 315    16.4
395.18
## 257  0.01538  90.0  3.75    0 0.3940 7.454  34.2  6.3361   3 244    15.9
386.34
## 258  0.61154  20.0  3.97    0 0.6470 8.704  86.9  1.8010   5 264    13.0
389.70
## 259  0.66351  20.0  3.97    0 0.6470 7.333 100.0  1.8946   5 264    13.0
383.29
## 260  0.65665  20.0  3.97    0 0.6470 6.842 100.0  2.0107   5 264    13.0
391.93
## 261  0.54011  20.0  3.97    0 0.6470 7.203  81.8  2.1121   5 264    13.0
392.80
## 262  0.53412  20.0  3.97    0 0.6470 7.520  89.4  2.1398   5 264    13.0
388.37
## 263  0.52014  20.0  3.97    0 0.6470 8.398  91.5  2.2885   5 264    13.0
386.86
## 264  0.82526  20.0  3.97    0 0.6470 7.327  94.5  2.0788   5 264    13.0
393.42
## 265  0.55007  20.0  3.97    0 0.6470 7.206  91.6  1.9301   5 264    13.0
387.89
## 266  0.76162  20.0  3.97    0 0.6470 5.560  62.8  1.9865   5 264    13.0
392.40
## 267  0.78570  20.0  3.97    0 0.6470 7.014  84.6  2.1329   5 264    13.0
384.07
## 268  0.57834  20.0  3.97    0 0.5750 8.297  67.0  2.4216   5 264    13.0
384.54
```

```
## 269  0.54050  20.0  3.97    0 0.5750 7.470  52.6  2.8720   5 264    13.0
390.30
## 270  0.09065  20.0  6.96    1 0.4640 5.920  61.5  3.9175   3 223    18.6
391.34
## 271  0.29916  20.0  6.96    0 0.4640 5.856  42.1  4.4290   3 223    18.6
388.65
## 272  0.16211  20.0  6.96    0 0.4640 6.240  16.3  4.4290   3 223    18.6
396.90
## 273  0.11460  20.0  6.96    0 0.4640 6.538  58.7  3.9175   3 223    18.6
394.96
## 274  0.22188  20.0  6.96    1 0.4640 7.691  51.8  4.3665   3 223    18.6
390.77
## 275  0.05644  40.0  6.41    1 0.4470 6.758  32.9  4.0776   4 254    17.6
396.90
## 276  0.09604  40.0  6.41    0 0.4470 6.854  42.8  4.2673   4 254    17.6
396.90
## 277  0.10469  40.0  6.41    1 0.4470 7.267  49.0  4.7872   4 254    17.6
389.25
## 278  0.06127  40.0  6.41    1 0.4470 6.826  27.6  4.8628   4 254    17.6
393.45
## 279  0.07978  40.0  6.41    0 0.4470 6.482  32.1  4.1403   4 254    17.6
396.90
## 280  0.21038  20.0  3.33    0 0.4429 6.812  32.2  4.1007   5 216    14.9
396.90
## 281  0.03578  20.0  3.33    0 0.4429 7.820  64.5  4.6947   5 216    14.9
387.31
## 282  0.03705  20.0  3.33    0 0.4429 6.968  37.2  5.2447   5 216    14.9
392.23
## 283  0.06129  20.0  3.33    1 0.4429 7.645  49.7  5.2119   5 216    14.9
377.07
## 284  0.01501  90.0  1.21    1 0.4010 7.923  24.8  5.8850   1 198    13.6
395.52
## 285  0.00906  90.0  2.97    0 0.4000 7.088  20.8  7.3073   1 285    15.3
394.72
## 286  0.01096  55.0  2.25    0 0.3890 6.453  31.9  7.3073   1 300    15.3
394.72
## 287  0.01965  80.0  1.76    0 0.3850 6.230  31.5  9.0892   1 241    18.2
341.60
## 288  0.03871  52.5  5.32    0 0.4050 6.209  31.3  7.3172   6 293    16.6
396.90
## 289  0.04590  52.5  5.32    0 0.4050 6.315  45.6  7.3172   6 293    16.6
396.90
## 290  0.04297  52.5  5.32    0 0.4050 6.565  22.9  7.3172   6 293    16.6
371.72
## 291  0.03502  80.0  4.95    0 0.4110 6.861  27.9  5.1167   4 245    19.2
396.90
## 292  0.07886  80.0  4.95    0 0.4110 7.148  27.7  5.1167   4 245    19.2
396.90
## 293  0.03615  80.0  4.95    0 0.4110 6.630  23.4  5.1167   4 245    19.2
396.90
```

```
## 294  0.08265   0.0 13.92    0 0.4370 6.127  18.4  5.5027   4 289    16.0
396.90
## 295  0.08199   0.0 13.92    0 0.4370 6.009  42.3  5.5027   4 289    16.0
396.90
## 296  0.12932   0.0 13.92    0 0.4370 6.678  31.1  5.9604   4 289    16.0
396.90
## 297  0.05372   0.0 13.92    0 0.4370 6.549  51.0  5.9604   4 289    16.0
392.85
## 298  0.14103   0.0 13.92    0 0.4370 5.790  58.0  6.3200   4 289    16.0
396.90
## 299  0.06466  70.0  2.24    0 0.4000 6.345  20.1  7.8278   5 358    14.8
368.24
## 300  0.05561  70.0  2.24    0 0.4000 7.041  10.0  7.8278   5 358    14.8
371.58
## 301  0.04417  70.0  2.24    0 0.4000 6.871  47.4  7.8278   5 358    14.8
390.86
## 302  0.03537  34.0  6.09    0 0.4330 6.590  40.4  5.4917   7 329    16.1
395.75
## 303  0.09266  34.0  6.09    0 0.4330 6.495  18.4  5.4917   7 329    16.1
383.61
## 304  0.10000  34.0  6.09    0 0.4330 6.982  17.7  5.4917   7 329    16.1
390.43
## 305  0.05515  33.0  2.18    0 0.4720 7.236  41.1  4.0220   7 222    18.4
393.68
## 306  0.05479  33.0  2.18    0 0.4720 6.616  58.1  3.3700   7 222    18.4
393.36
## 307  0.07503  33.0  2.18    0 0.4720 7.420  71.9  3.0992   7 222    18.4
396.90
## 308  0.04932  33.0  2.18    0 0.4720 6.849  70.3  3.1827   7 222    18.4
396.90
## 309  0.49298   0.0  9.90    0 0.5440 6.635  82.5  3.3175   4 304    18.4
396.90
## 310  0.34940   0.0  9.90    0 0.5440 5.972  76.7  3.1025   4 304    18.4
396.24
## 311  2.63548   0.0  9.90    0 0.5440 4.973  37.8  2.5194   4 304    18.4
350.45
## 312  0.79041   0.0  9.90    0 0.5440 6.122  52.8  2.6403   4 304    18.4
396.90
## 313  0.26169   0.0  9.90    0 0.5440 6.023  90.4  2.8340   4 304    18.4
396.30
## 314  0.26938   0.0  9.90    0 0.5440 6.266  82.8  3.2628   4 304    18.4
393.39
## 315  0.36920   0.0  9.90    0 0.5440 6.567  87.3  3.6023   4 304    18.4
395.69
## 316  0.25356   0.0  9.90    0 0.5440 5.705  77.7  3.9450   4 304    18.4
396.42
## 317  0.31827   0.0  9.90    0 0.5440 5.914  83.2  3.9986   4 304    18.4
390.70
## 318  0.24522   0.0  9.90    0 0.5440 5.782  71.7  4.0317   4 304    18.4
396.90
```

```
## 319  0.40202   0.0  9.90    0 0.5440 6.382  67.2  3.5325   4 304    18.4
395.21
## 320  0.47547   0.0  9.90    0 0.5440 6.113  58.8  4.0019   4 304    18.4
396.23
## 321  0.16760   0.0  7.38    0 0.4930 6.426  52.3  4.5404   5 287    19.6
396.90
## 322  0.18159   0.0  7.38    0 0.4930 6.376  54.3  4.5404   5 287    19.6
396.90
## 323  0.35114   0.0  7.38    0 0.4930 6.041  49.9  4.7211   5 287    19.6
396.90
## 324  0.28392   0.0  7.38    0 0.4930 5.708  74.3  4.7211   5 287    19.6
391.13
## 325  0.34109   0.0  7.38    0 0.4930 6.415  40.1  4.7211   5 287    19.6
396.90
## 326  0.19186   0.0  7.38    0 0.4930 6.431  14.7  5.4159   5 287    19.6
393.68
## 327  0.30347   0.0  7.38    0 0.4930 6.312  28.9  5.4159   5 287    19.6
396.90
## 328  0.24103   0.0  7.38    0 0.4930 6.083  43.7  5.4159   5 287    19.6
396.90
## 329  0.06617   0.0  3.24    0 0.4600 5.868  25.8  5.2146   4 430    16.9
382.44
## 330  0.06724   0.0  3.24    0 0.4600 6.333  17.2  5.2146   4 430    16.9
375.21
## 331  0.04544   0.0  3.24    0 0.4600 6.144  32.2  5.8736   4 430    16.9
368.57
## 332  0.05023  35.0  6.06    0 0.4379 5.706  28.4  6.6407   1 304    16.9
394.02
## 333  0.03466  35.0  6.06    0 0.4379 6.031  23.3  6.6407   1 304    16.9
362.25
## 334  0.05083   0.0  5.19    0 0.5150 6.316  38.1  6.4584   5 224    20.2
389.71
## 335  0.03738   0.0  5.19    0 0.5150 6.310  38.5  6.4584   5 224    20.2
389.40
## 336  0.03961   0.0  5.19    0 0.5150 6.037  34.5  5.9853   5 224    20.2
396.90
## 337  0.03427   0.0  5.19    0 0.5150 5.869  46.3  5.2311   5 224    20.2
396.90
## 338  0.03041   0.0  5.19    0 0.5150 5.895  59.6  5.6150   5 224    20.2
394.81
## 339  0.03306   0.0  5.19    0 0.5150 6.059  37.3  4.8122   5 224    20.2
396.14
## 340  0.05497   0.0  5.19    0 0.5150 5.985  45.4  4.8122   5 224    20.2
396.90
## 341  0.06151   0.0  5.19    0 0.5150 5.968  58.5  4.8122   5 224    20.2
396.90
## 342  0.01301  35.0  1.52    0 0.4420 7.241  49.3  7.0379   1 284    15.5
394.74
## 343  0.02498   0.0  1.89    0 0.5180 6.540  59.7  6.2669   1 422    15.9
389.96
```

```
## 344  0.02543  55.0  3.78    0 0.4840 6.696  56.4  5.7321   5 370    17.6
396.90
## 345  0.03049  55.0  3.78    0 0.4840 6.874  28.1  6.4654   5 370    17.6
387.97
## 346  0.03113   0.0  4.39    0 0.4420 6.014  48.5  8.0136   3 352    18.8
385.64
## 347  0.06162   0.0  4.39    0 0.4420 5.898  52.3  8.0136   3 352    18.8
364.61
## 348  0.01870  85.0  4.15    0 0.4290 6.516  27.7  8.5353   4 351    17.9
392.43
## 349  0.01501  80.0  2.01    0 0.4350 6.635  29.7  8.3440   4 280    17.0
390.94
## 350  0.02899  40.0  1.25    0 0.4290 6.939  34.5  8.7921   1 335    19.7
389.85
## 351  0.06211  40.0  1.25    0 0.4290 6.490  44.4  8.7921   1 335    19.7
396.90
## 352  0.07950  60.0  1.69    0 0.4110 6.579  35.9 10.7103   4 411    18.3
370.78
## 353  0.07244  60.0  1.69    0 0.4110 5.884  18.5 10.7103   4 411    18.3
392.33
## 354  0.01709  90.0  2.02    0 0.4100 6.728  36.1 12.1265   5 187    17.0
384.46
## 355  0.04301  80.0  1.91    0 0.4130 5.663  21.9 10.5857   4 334    22.0
382.80
## 356  0.10659  80.0  1.91    0 0.4130 5.936  19.5 10.5857   4 334    22.0
376.04
## 357  8.98296   0.0 18.10    1 0.7700 6.212  97.4  2.1222  24 666    20.2
377.73
## 358  3.84970   0.0 18.10    1 0.7700 6.395  91.0  2.5052  24 666    20.2
391.34
## 359  5.20177   0.0 18.10    1 0.7700 6.127  83.4  2.7227  24 666    20.2
395.43
## 360  4.26131   0.0 18.10    0 0.7700 6.112  81.3  2.5091  24 666    20.2
390.74
## 361  4.54192   0.0 18.10    0 0.7700 6.398  88.0  2.5182  24 666    20.2
374.56
## 362  3.83684   0.0 18.10    0 0.7700 6.251  91.1  2.2955  24 666    20.2
350.65
## 363  3.67822   0.0 18.10    0 0.7700 5.362  96.2  2.1036  24 666    20.2
380.79
## 364  4.22239   0.0 18.10    1 0.7700 5.803  89.0  1.9047  24 666    20.2
353.04
## 365  3.47428   0.0 18.10    1 0.7180 8.780  82.9  1.9047  24 666    20.2
354.55
## 366  4.55587   0.0 18.10    0 0.7180 3.561  87.9  1.6132  24 666    20.2
354.70
## 367  3.69695   0.0 18.10    0 0.7180 4.963  91.4  1.7523  24 666    20.2
316.03
## 368 13.52220   0.0 18.10    0 0.6310 3.863 100.0  1.5106  24 666    20.2
131.42
```

```
## 369  4.89822   0.0 18.10    0 0.6310 4.970 100.0  1.3325  24 666    20.2
375.52
## 370  5.66998   0.0 18.10    1 0.6310 6.683  96.8  1.3567  24 666    20.2
375.33
## 371  6.53876   0.0 18.10    1 0.6310 7.016  97.5  1.2024  24 666    20.2
392.05
## 372  9.23230   0.0 18.10    0 0.6310 6.216 100.0  1.1691  24 666    20.2
366.15
## 373  8.26725   0.0 18.10    1 0.6680 5.875  89.6  1.1296  24 666    20.2
347.88
## 374 11.10810   0.0 18.10    0 0.6680 4.906 100.0  1.1742  24 666    20.2
396.90
## 375 18.49820   0.0 18.10    0 0.6680 4.138 100.0  1.1370  24 666    20.2
396.90
## 376 19.60910   0.0 18.10    0 0.6710 7.313  97.9  1.3163  24 666    20.2
396.90
## 377 15.28800   0.0 18.10    0 0.6710 6.649  93.3  1.3449  24 666    20.2
363.02
## 378  9.82349   0.0 18.10    0 0.6710 6.794  98.8  1.3580  24 666    20.2
396.90
## 379 23.64820   0.0 18.10    0 0.6710 6.380  96.2  1.3861  24 666    20.2
396.90
## 380 17.86670   0.0 18.10    0 0.6710 6.223 100.0  1.3861  24 666    20.2
393.74
## 381 88.97620   0.0 18.10    0 0.6710 6.968  91.9  1.4165  24 666    20.2
396.90
## 382 15.87440   0.0 18.10    0 0.6710 6.545  99.1  1.5192  24 666    20.2
396.90
## 383  9.18702   0.0 18.10    0 0.7000 5.536 100.0  1.5804  24 666    20.2
396.90
## 384  7.99248   0.0 18.10    0 0.7000 5.520 100.0  1.5331  24 666    20.2
396.90
## 385 20.08490   0.0 18.10    0 0.7000 4.368  91.2  1.4395  24 666    20.2
285.83
## 386 16.81180   0.0 18.10    0 0.7000 5.277  98.1  1.4261  24 666    20.2
396.90
## 387 24.39380   0.0 18.10    0 0.7000 4.652 100.0  1.4672  24 666    20.2
396.90
## 388 22.59710   0.0 18.10    0 0.7000 5.000  89.5  1.5184  24 666    20.2
396.90
## 389 14.33370   0.0 18.10    0 0.7000 4.880 100.0  1.5895  24 666    20.2
372.92
## 390  8.15174   0.0 18.10    0 0.7000 5.390  98.9  1.7281  24 666    20.2
396.90
## 391  6.96215   0.0 18.10    0 0.7000 5.713  97.0  1.9265  24 666    20.2
394.43
## 392  5.29305   0.0 18.10    0 0.7000 6.051  82.5  2.1678  24 666    20.2
378.38
## 393 11.57790   0.0 18.10    0 0.7000 5.036  97.0  1.7700  24 666    20.2
396.90
```

```
## 394  8.64476   0.0 18.10    0 0.6930 6.193  92.6  1.7912  24 666    20.2
396.90
## 395 13.35980   0.0 18.10    0 0.6930 5.887  94.7  1.7821  24 666    20.2
396.90
## 396  8.71675   0.0 18.10    0 0.6930 6.471  98.8  1.7257  24 666    20.2
391.98
## 397  5.87205   0.0 18.10    0 0.6930 6.405  96.0  1.6768  24 666    20.2
396.90
## 398  7.67202   0.0 18.10    0 0.6930 5.747  98.9  1.6334  24 666    20.2
393.10
## 399 38.35180   0.0 18.10    0 0.6930 5.453 100.0  1.4896  24 666    20.2
396.90
## 400  9.91655   0.0 18.10    0 0.6930 5.852  77.8  1.5004  24 666    20.2
338.16
## 401 25.04610   0.0 18.10    0 0.6930 5.987 100.0  1.5888  24 666    20.2
396.90
## 402 14.23620   0.0 18.10    0 0.6930 6.343 100.0  1.5741  24 666    20.2
396.90
## 403  9.59571   0.0 18.10    0 0.6930 6.404 100.0  1.6390  24 666    20.2
376.11
## 404 24.80170   0.0 18.10    0 0.6930 5.349  96.0  1.7028  24 666    20.2
396.90
## 405 41.52920   0.0 18.10    0 0.6930 5.531  85.4  1.6074  24 666    20.2
329.46
## 406 67.92080   0.0 18.10    0 0.6930 5.683 100.0  1.4254  24 666    20.2
384.97
## 407 20.71620   0.0 18.10    0 0.6590 4.138 100.0  1.1781  24 666    20.2
370.22
## 408 11.95110   0.0 18.10    0 0.6590 5.608 100.0  1.2852  24 666    20.2
332.09
## 409  7.40389   0.0 18.10    0 0.5970 5.617  97.9  1.4547  24 666    20.2
314.64
## 410 14.43830   0.0 18.10    0 0.5970 6.852 100.0  1.4655  24 666    20.2
179.36
## 411 51.13580   0.0 18.10    0 0.5970 5.757 100.0  1.4130  24 666    20.2
2.60
## 412 14.05070   0.0 18.10    0 0.5970 6.657 100.0  1.5275  24 666    20.2
35.05
## 413 18.81100   0.0 18.10    0 0.5970 4.628 100.0  1.5539  24 666    20.2
28.79
## 414 28.65580   0.0 18.10    0 0.5970 5.155 100.0  1.5894  24 666    20.2
210.97
## 415 45.74610   0.0 18.10    0 0.6930 4.519 100.0  1.6582  24 666    20.2
88.27
## 416 18.08460   0.0 18.10    0 0.6790 6.434 100.0  1.8347  24 666    20.2
27.25
## 417 10.83420   0.0 18.10    0 0.6790 6.782  90.8  1.8195  24 666    20.2
21.57
## 418 25.94060   0.0 18.10    0 0.6790 5.304  89.1  1.6475  24 666    20.2
127.36
```

```
## 419 73.53410   0.0 18.10    0 0.6790 5.957 100.0  1.8026  24 666    20.2
16.45
## 420 11.81230   0.0 18.10    0 0.7180 6.824  76.5  1.7940  24 666    20.2
48.45
## 421 11.08740   0.0 18.10    0 0.7180 6.411 100.0  1.8589  24 666    20.2
318.75
## 422  7.02259   0.0 18.10    0 0.7180 6.006  95.3  1.8746  24 666    20.2
319.98
## 423 12.04820   0.0 18.10    0 0.6140 5.648  87.6  1.9512  24 666    20.2
291.55
## 424  7.05042   0.0 18.10    0 0.6140 6.103  85.1  2.0218  24 666    20.2
2.52
## 425  8.79212   0.0 18.10    0 0.5840 5.565  70.6  2.0635  24 666    20.2
3.65
## 426 15.86030   0.0 18.10    0 0.6790 5.896  95.4  1.9096  24 666    20.2
7.68
## 427 12.24720   0.0 18.10    0 0.5840 5.837  59.7  1.9976  24 666    20.2
24.65
## 428 37.66190   0.0 18.10    0 0.6790 6.202  78.7  1.8629  24 666    20.2
18.82
## 429  7.36711   0.0 18.10    0 0.6790 6.193  78.1  1.9356  24 666    20.2
96.73
## 430  9.33889   0.0 18.10    0 0.6790 6.380  95.6  1.9682  24 666    20.2
60.72
## 431  8.49213   0.0 18.10    0 0.5840 6.348  86.1  2.0527  24 666    20.2
83.45
## 432 10.06230   0.0 18.10    0 0.5840 6.833  94.3  2.0882  24 666    20.2
81.33
## 433  6.44405   0.0 18.10    0 0.5840 6.425  74.8  2.2004  24 666    20.2
97.95
## 434  5.58107   0.0 18.10    0 0.7130 6.436  87.9  2.3158  24 666    20.2
100.19
## 435 13.91340   0.0 18.10    0 0.7130 6.208  95.0  2.2222  24 666    20.2
100.63
## 436 11.16040   0.0 18.10    0 0.7400 6.629  94.6  2.1247  24 666    20.2
109.85
## 437 14.42080   0.0 18.10    0 0.7400 6.461  93.3  2.0026  24 666    20.2
27.49
## 438 15.17720   0.0 18.10    0 0.7400 6.152 100.0  1.9142  24 666    20.2
9.32
## 439 13.67810   0.0 18.10    0 0.7400 5.935  87.9  1.8206  24 666    20.2
68.95
## 440  9.39063   0.0 18.10    0 0.7400 5.627  93.9  1.8172  24 666    20.2
396.90
## 441 22.05110   0.0 18.10    0 0.7400 5.818  92.4  1.8662  24 666    20.2
391.45
## 442  9.72418   0.0 18.10    0 0.7400 6.406  97.2  2.0651  24 666    20.2
385.96
## 443  5.66637   0.0 18.10    0 0.7400 6.219 100.0  2.0048  24 666    20.2
395.69
```

```
## 444  9.96654   0.0 18.10    0 0.7400 6.485 100.0  1.9784  24 666    20.2
386.73
## 445 12.80230   0.0 18.10    0 0.7400 5.854  96.6  1.8956  24 666    20.2
240.52
## 446 10.67180   0.0 18.10    0 0.7400 6.459  94.8  1.9879  24 666    20.2
43.06
## 447  6.28807   0.0 18.10    0 0.7400 6.341  96.4  2.0720  24 666    20.2
318.01
## 448  9.92485   0.0 18.10    0 0.7400 6.251  96.6  2.1980  24 666    20.2
388.52
## 449  9.32909   0.0 18.10    0 0.7130 6.185  98.7  2.2616  24 666    20.2
396.90
## 450  7.52601   0.0 18.10    0 0.7130 6.417  98.3  2.1850  24 666    20.2
304.21
## 451  6.71772   0.0 18.10    0 0.7130 6.749  92.6  2.3236  24 666    20.2
0.32
## 452  5.44114   0.0 18.10    0 0.7130 6.655  98.2  2.3552  24 666    20.2
355.29
## 453  5.09017   0.0 18.10    0 0.7130 6.297  91.8  2.3682  24 666    20.2
385.09
## 454  8.24809   0.0 18.10    0 0.7130 7.393  99.3  2.4527  24 666    20.2
375.87
## 455  9.51363   0.0 18.10    0 0.7130 6.728  94.1  2.4961  24 666    20.2
6.68
## 456  4.75237   0.0 18.10    0 0.7130 6.525  86.5  2.4358  24 666    20.2
50.92
## 457  4.66883   0.0 18.10    0 0.7130 5.976  87.9  2.5806  24 666    20.2
10.48
## 458  8.20058   0.0 18.10    0 0.7130 5.936  80.3  2.7792  24 666    20.2
3.50
## 459  7.75223   0.0 18.10    0 0.7130 6.301  83.7  2.7831  24 666    20.2
272.21
## 460  6.80117   0.0 18.10    0 0.7130 6.081  84.4  2.7175  24 666    20.2
396.90
## 461  4.81213   0.0 18.10    0 0.7130 6.701  90.0  2.5975  24 666    20.2
255.23
## 462  3.69311   0.0 18.10    0 0.7130 6.376  88.4  2.5671  24 666    20.2
391.43
## 463  6.65492   0.0 18.10    0 0.7130 6.317  83.0  2.7344  24 666    20.2
396.90
## 464  5.82115   0.0 18.10    0 0.7130 6.513  89.9  2.8016  24 666    20.2
393.82
## 465  7.83932   0.0 18.10    0 0.6550 6.209  65.4  2.9634  24 666    20.2
396.90
## 466  3.16360   0.0 18.10    0 0.6550 5.759  48.2  3.0665  24 666    20.2
334.40
## 467  3.77498   0.0 18.10    0 0.6550 5.952  84.7  2.8715  24 666    20.2
22.01
## 468  4.42228   0.0 18.10    0 0.5840 6.003  94.5  2.5403  24 666    20.2
331.29
```

```
## 469 15.57570   0.0 18.10    0 0.5800 5.926  71.0  2.9084  24 666    20.2
368.74
## 470 13.07510   0.0 18.10    0 0.5800 5.713  56.7  2.8237  24 666    20.2
396.90
## 471  4.34879   0.0 18.10    0 0.5800 6.167  84.0  3.0334  24 666    20.2
396.90
## 472  4.03841   0.0 18.10    0 0.5320 6.229  90.7  3.0993  24 666    20.2
395.33
## 473  3.56868   0.0 18.10    0 0.5800 6.437  75.0  2.8965  24 666    20.2
393.37
## 474  4.64689   0.0 18.10    0 0.6140 6.980  67.6  2.5329  24 666    20.2
374.68
## 475  8.05579   0.0 18.10    0 0.5840 5.427  95.4  2.4298  24 666    20.2
352.58
## 476  6.39312   0.0 18.10    0 0.5840 6.162  97.4  2.2060  24 666    20.2
302.76
## 477  4.87141   0.0 18.10    0 0.6140 6.484  93.6  2.3053  24 666    20.2
396.21
## 478 15.02340   0.0 18.10    0 0.6140 5.304  97.3  2.1007  24 666    20.2
349.48
## 479 10.23300   0.0 18.10    0 0.6140 6.185  96.7  2.1705  24 666    20.2
379.70
## 480 14.33370   0.0 18.10    0 0.6140 6.229  88.0  1.9512  24 666    20.2
383.32
## 481  5.82401   0.0 18.10    0 0.5320 6.242  64.7  3.4242  24 666    20.2
396.90
## 482  5.70818   0.0 18.10    0 0.5320 6.750  74.9  3.3317  24 666    20.2
393.07
## 483  5.73116   0.0 18.10    0 0.5320 7.061  77.0  3.4106  24 666    20.2
395.28
## 484  2.81838   0.0 18.10    0 0.5320 5.762  40.3  4.0983  24 666    20.2
392.92
## 485  2.37857   0.0 18.10    0 0.5830 5.871  41.9  3.7240  24 666    20.2
370.73
## 486  3.67367   0.0 18.10    0 0.5830 6.312  51.9  3.9917  24 666    20.2
388.62
## 487  5.69175   0.0 18.10    0 0.5830 6.114  79.8  3.5459  24 666    20.2
392.68
## 488  4.83567   0.0 18.10    0 0.5830 5.905  53.2  3.1523  24 666    20.2
388.22
## 489  0.15086   0.0 27.74    0 0.6090 5.454  92.7  1.8209   4 711    20.1
395.09
## 490  0.18337   0.0 27.74    0 0.6090 5.414  98.3  1.7554   4 711    20.1
344.05
## 491  0.20746   0.0 27.74    0 0.6090 5.093  98.0  1.8226   4 711    20.1
318.43
## 492  0.10574   0.0 27.74    0 0.6090 5.983  98.8  1.8681   4 711    20.1
390.11
## 493  0.11132   0.0 27.74    0 0.6090 5.983  83.5  2.1099   4 711    20.1
396.90
```

```
## 494  0.17331   0.0  9.69    0 0.5850 5.707  54.0  2.3817   6 391    19.2
396.90
## 495  0.27957   0.0  9.69    0 0.5850 5.926  42.6  2.3817   6 391    19.2
396.90
## 496  0.17899   0.0  9.69    0 0.5850 5.670  28.8  2.7986   6 391    19.2
393.29
## 497  0.28960   0.0  9.69    0 0.5850 5.390  72.9  2.7986   6 391    19.2
396.90
## 498  0.26838   0.0  9.69    0 0.5850 5.794  70.6  2.8927   6 391    19.2
396.90
## 499  0.23912   0.0  9.69    0 0.5850 6.019  65.3  2.4091   6 391    19.2
396.90
## 500  0.17783   0.0  9.69    0 0.5850 5.569  73.5  2.3999   6 391    19.2
395.77
## 501  0.22438   0.0  9.69    0 0.5850 6.027  79.7  2.4982   6 391    19.2
396.90
## 502  0.06263   0.0 11.93    0 0.5730 6.593  69.1  2.4786   1 273    21.0
391.99
## 503  0.04527   0.0 11.93    0 0.5730 6.120  76.7  2.2875   1 273    21.0
396.90
## 504  0.06076   0.0 11.93    0 0.5730 6.976  91.0  2.1675   1 273    21.0
396.90
## 505  0.10959   0.0 11.93    0 0.5730 6.794  89.3  2.3889   1 273    21.0
393.45
## 506  0.04741   0.0 11.93    0 0.5730 6.030  80.8  2.5050   1 273    21.0
396.90
##     lstat medv
## 1    4.98 24.0
## 2    9.14 21.6
## 3    4.03 34.7
## 4    2.94 33.4
## 5    5.33 36.2
## 6    5.21 28.7
## 7   12.43 22.9
## 8   19.15 27.1
## 9   29.93 16.5
## 10  17.10 18.9
## 11  20.45 15.0
## 12  13.27 18.9
## 13  15.71 21.7
## 14   8.26 20.4
## 15  10.26 18.2
## 16   8.47 19.9
## 17   6.58 23.1
## 18  14.67 17.5
## 19  11.69 20.2
## 20  11.28 18.2
## 21  21.02 13.6
## 22  13.83 19.6
## 23  18.72 15.2
```

```
## 24  19.88 14.5
## 25  16.30 15.6
## 26  16.51 13.9
## 27  14.81 16.6
## 28  17.28 14.8
## 29  12.80 18.4
## 30  11.98 21.0
## 31  22.60 12.7
## 32  13.04 14.5
## 33  27.71 13.2
## 34  18.35 13.1
## 35  20.34 13.5
## 36   9.68 18.9
## 37  11.41 20.0
## 38   8.77 21.0
## 39  10.13 24.7
## 40   4.32 30.8
## 41   1.98 34.9
## 42   4.84 26.6
## 43   5.81 25.3
## 44   7.44 24.7
## 45   9.55 21.2
## 46  10.21 19.3
## 47  14.15 20.0
## 48  18.80 16.6
## 49  30.81 14.4
## 50  16.20 19.4
## 51  13.45 19.7
## 52   9.43 20.5
## 53   5.28 25.0
## 54   8.43 23.4
## 55  14.80 18.9
## 56   4.81 35.4
## 57   5.77 24.7
## 58   3.95 31.6
## 59   6.86 23.3
## 60   9.22 19.6
## 61  13.15 18.7
## 62  14.44 16.0
## 63   6.73 22.2
## 64   9.50 25.0
## 65   8.05 33.0
## 66   4.67 23.5
## 67  10.24 19.4
## 68   8.10 22.0
## 69  13.09 17.4
## 70   8.79 20.9
## 71   6.72 24.2
## 72   9.88 21.7
## 73   5.52 22.8
```

```
## 74   7.54 23.4
## 75   6.78 24.1
## 76   8.94 21.4
## 77  11.97 20.0
## 78  10.27 20.8
## 79  12.34 21.2
## 80   9.10 20.3
## 81   5.29 28.0
## 82   7.22 23.9
## 83   6.72 24.8
## 84   7.51 22.9
## 85   9.62 23.9
## 86   6.53 26.6
## 87  12.86 22.5
## 88   8.44 22.2
## 89   5.50 23.6
## 90   5.70 28.7
## 91   8.81 22.6
## 92   8.20 22.0
## 93   8.16 22.9
## 94   6.21 25.0
## 95  10.59 20.6
## 96   6.65 28.4
## 97  11.34 21.4
## 98   4.21 38.7
## 99   3.57 43.8
## 100  6.19 33.2
## 101  9.42 27.5
## 102  7.67 26.5
## 103 10.63 18.6
## 104 13.44 19.3
## 105 12.33 20.1
## 106 16.47 19.5
## 107 18.66 19.5
## 108 14.09 20.4
## 109 12.27 19.8
## 110 15.55 19.4
## 111 13.00 21.7
## 112 10.16 22.8
## 113 16.21 18.8
## 114 17.09 18.7
## 115 10.45 18.5
## 116 15.76 18.3
## 117 12.04 21.2
## 118 10.30 19.2
## 119 15.37 20.4
## 120 13.61 19.3
## 121 14.37 22.0
## 122 14.27 20.3
## 123 17.93 20.5
```

```
## 124 25.41 17.3
## 125 17.58 18.8
## 126 14.81 21.4
## 127 27.26 15.7
## 128 17.19 16.2
## 129 15.39 18.0
## 130 18.34 14.3
## 131 12.60 19.2
## 132 12.26 19.6
## 133 11.12 23.0
## 134 15.03 18.4
## 135 17.31 15.6
## 136 16.96 18.1
## 137 16.90 17.4
## 138 14.59 17.1
## 139 21.32 13.3
## 140 18.46 17.8
## 141 24.16 14.0
## 142 34.41 14.4
## 143 26.82 13.4
## 144 26.42 15.6
## 145 29.29 11.8
## 146 27.80 13.8
## 147 16.65 15.6
## 148 29.53 14.6
## 149 28.32 17.8
## 150 21.45 15.4
## 151 14.10 21.5
## 152 13.28 19.6
## 153 12.12 15.3
## 154 15.79 19.4
## 155 15.12 17.0
## 156 15.02 15.6
## 157 16.14 13.1
## 158  4.59 41.3
## 159  6.43 24.3
## 160  7.39 23.3
## 161  5.50 27.0
## 162  1.73 50.0
## 163  1.92 50.0
## 164  3.32 50.0
## 165 11.64 22.7
## 166  9.81 25.0
## 167  3.70 50.0
## 168 12.14 23.8
## 169 11.10 23.8
## 170 11.32 22.3
## 171 14.43 17.4
## 172 12.03 19.1
## 173 14.69 23.1
```

```
## 174  9.04 23.6
## 175  9.64 22.6
## 176  5.33 29.4
## 177 10.11 23.2
## 178  6.29 24.6
## 179  6.92 29.9
## 180  5.04 37.2
## 181  7.56 39.8
## 182  9.45 36.2
## 183  4.82 37.9
## 184  5.68 32.5
## 185 13.98 26.4
## 186 13.15 29.6
## 187  4.45 50.0
## 188  6.68 32.0
## 189  4.56 29.8
## 190  5.39 34.9
## 191  5.10 37.0
## 192  4.69 30.5
## 193  2.87 36.4
## 194  5.03 31.1
## 195  4.38 29.1
## 196  2.97 50.0
## 197  4.08 33.3
## 198  8.61 30.3
## 199  6.62 34.6
## 200  4.56 34.9
## 201  4.45 32.9
## 202  7.43 24.1
## 203  3.11 42.3
## 204  3.81 48.5
## 205  2.88 50.0
## 206 10.87 22.6
## 207 10.97 24.4
## 208 18.06 22.5
## 209 14.66 24.4
## 210 23.09 20.0
## 211 17.27 21.7
## 212 23.98 19.3
## 213 16.03 22.4
## 214  9.38 28.1
## 215 29.55 23.7
## 216  9.47 25.0
## 217 13.51 23.3
## 218  9.69 28.7
## 219 17.92 21.5
## 220 10.50 23.0
## 221  9.71 26.7
## 222 21.46 21.7
## 223  9.93 27.5
```

```
## 224  7.60 30.1
## 225  4.14 44.8
## 226  4.63 50.0
## 227  3.13 37.6
## 228  6.36 31.6
## 229  3.92 46.7
## 230  3.76 31.5
## 231 11.65 24.3
## 232  5.25 31.7
## 233  2.47 41.7
## 234  3.95 48.3
## 235  8.05 29.0
## 236 10.88 24.0
## 237  9.54 25.1
## 238  4.73 31.5
## 239  6.36 23.7
## 240  7.37 23.3
## 241 11.38 22.0
## 242 12.40 20.1
## 243 11.22 22.2
## 244  5.19 23.7
## 245 12.50 17.6
## 246 18.46 18.5
## 247  9.16 24.3
## 248 10.15 20.5
## 249  9.52 24.5
## 250  6.56 26.2
## 251  5.90 24.4
## 252  3.59 24.8
## 253  3.53 29.6
## 254  3.54 42.8
## 255  6.57 21.9
## 256  9.25 20.9
## 257  3.11 44.0
## 258  5.12 50.0
## 259  7.79 36.0
## 260  6.90 30.1
## 261  9.59 33.8
## 262  7.26 43.1
## 263  5.91 48.8
## 264 11.25 31.0
## 265  8.10 36.5
## 266 10.45 22.8
## 267 14.79 30.7
## 268  7.44 50.0
## 269  3.16 43.5
## 270 13.65 20.7
## 271 13.00 21.1
## 272  6.59 25.2
## 273  7.73 24.4
```

```
## 274  6.58 35.2
## 275  3.53 32.4
## 276  2.98 32.0
## 277  6.05 33.2
## 278  4.16 33.1
## 279  7.19 29.1
## 280  4.85 35.1
## 281  3.76 45.4
## 282  4.59 35.4
## 283  3.01 46.0
## 284  3.16 50.0
## 285  7.85 32.2
## 286  8.23 22.0
## 287 12.93 20.1
## 288  7.14 23.2
## 289  7.60 22.3
## 290  9.51 24.8
## 291  3.33 28.5
## 292  3.56 37.3
## 293  4.70 27.9
## 294  8.58 23.9
## 295 10.40 21.7
## 296  6.27 28.6
## 297  7.39 27.1
## 298 15.84 20.3
## 299  4.97 22.5
## 300  4.74 29.0
## 301  6.07 24.8
## 302  9.50 22.0
## 303  8.67 26.4
## 304  4.86 33.1
## 305  6.93 36.1
## 306  8.93 28.4
## 307  6.47 33.4
## 308  7.53 28.2
## 309  4.54 22.8
## 310  9.97 20.3
## 311 12.64 16.1
## 312  5.98 22.1
## 313 11.72 19.4
## 314  7.90 21.6
## 315  9.28 23.8
## 316 11.50 16.2
## 317 18.33 17.8
## 318 15.94 19.8
## 319 10.36 23.1
## 320 12.73 21.0
## 321  7.20 23.8
## 322  6.87 23.1
## 323  7.70 20.4
```

```
## 324 11.74 18.5
## 325  6.12 25.0
## 326  5.08 24.6
## 327  6.15 23.0
## 328 12.79 22.2
## 329  9.97 19.3
## 330  7.34 22.6
## 331  9.09 19.8
## 332 12.43 17.1
## 333  7.83 19.4
## 334  5.68 22.2
## 335  6.75 20.7
## 336  8.01 21.1
## 337  9.80 19.5
## 338 10.56 18.5
## 339  8.51 20.6
## 340  9.74 19.0
## 341  9.29 18.7
## 342  5.49 32.7
## 343  8.65 16.5
## 344  7.18 23.9
## 345  4.61 31.2
## 346 10.53 17.5
## 347 12.67 17.2
## 348  6.36 23.1
## 349  5.99 24.5
## 350  5.89 26.6
## 351  5.98 22.9
## 352  5.49 24.1
## 353  7.79 18.6
## 354  4.50 30.1
## 355  8.05 18.2
## 356  5.57 20.6
## 357 17.60 17.8
## 358 13.27 21.7
## 359 11.48 22.7
## 360 12.67 22.6
## 361  7.79 25.0
## 362 14.19 19.9
## 363 10.19 20.8
## 364 14.64 16.8
## 365  5.29 21.9
## 366  7.12 27.5
## 367 14.00 21.9
## 368 13.33 23.1
## 369  3.26 50.0
## 370  3.73 50.0
## 371  2.96 50.0
## 372  9.53 50.0
## 373  8.88 50.0
```

```
## 374 34.77 13.8
## 375 37.97 13.8
## 376 13.44 15.0
## 377 23.24 13.9
## 378 21.24 13.3
## 379 23.69 13.1
## 380 21.78 10.2
## 381 17.21 10.4
## 382 21.08 10.9
## 383 23.60 11.3
## 384 24.56 12.3
## 385 30.63  8.8
## 386 30.81  7.2
## 387 28.28 10.5
## 388 31.99  7.4
## 389 30.62 10.2
## 390 20.85 11.5
## 391 17.11 15.1
## 392 18.76 23.2
## 393 25.68  9.7
## 394 15.17 13.8
## 395 16.35 12.7
## 396 17.12 13.1
## 397 19.37 12.5
## 398 19.92  8.5
## 399 30.59  5.0
## 400 29.97  6.3
## 401 26.77  5.6
## 402 20.32  7.2
## 403 20.31 12.1
## 404 19.77  8.3
## 405 27.38  8.5
## 406 22.98  5.0
## 407 23.34 11.9
## 408 12.13 27.9
## 409 26.40 17.2
## 410 19.78 27.5
## 411 10.11 15.0
## 412 21.22 17.2
## 413 34.37 17.9
## 414 20.08 16.3
## 415 36.98  7.0
## 416 29.05  7.2
## 417 25.79  7.5
## 418 26.64 10.4
## 419 20.62  8.8
## 420 22.74  8.4
## 421 15.02 16.7
## 422 15.70 14.2
## 423 14.10 20.8
```

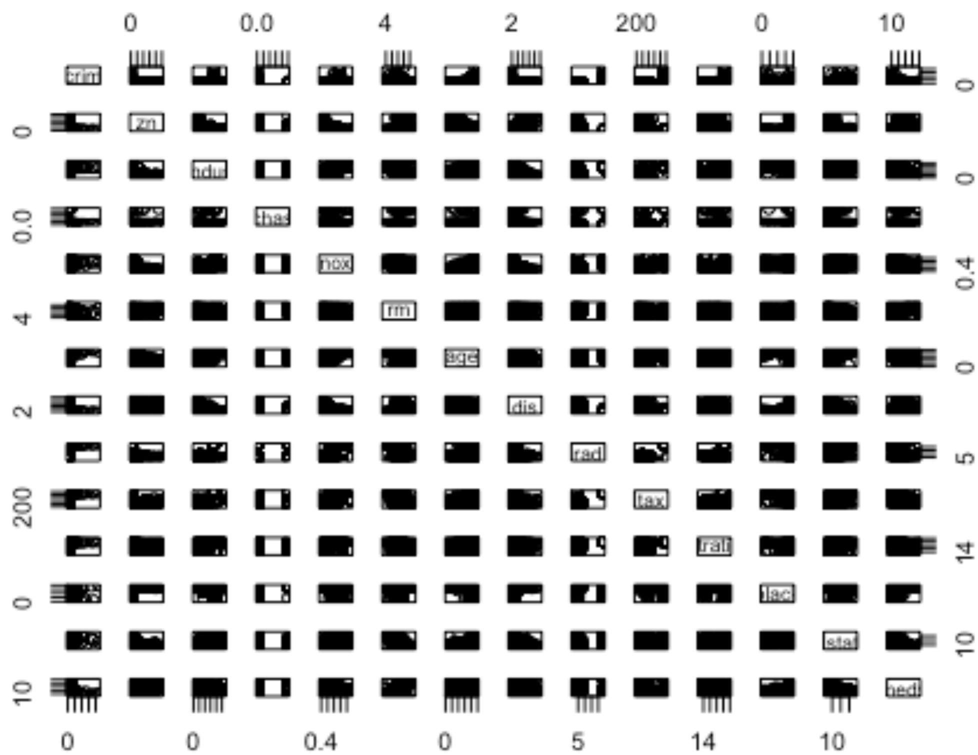
```
## 424 23.29 13.4
## 425 17.16 11.7
## 426 24.39  8.3
## 427 15.69 10.2
## 428 14.52 10.9
## 429 21.52 11.0
## 430 24.08  9.5
## 431 17.64 14.5
## 432 19.69 14.1
## 433 12.03 16.1
## 434 16.22 14.3
## 435 15.17 11.7
## 436 23.27 13.4
## 437 18.05  9.6
## 438 26.45  8.7
## 439 34.02  8.4
## 440 22.88 12.8
## 441 22.11 10.5
## 442 19.52 17.1
## 443 16.59 18.4
## 444 18.85 15.4
## 445 23.79 10.8
## 446 23.98 11.8
## 447 17.79 14.9
## 448 16.44 12.6
## 449 18.13 14.1
## 450 19.31 13.0
## 451 17.44 13.4
## 452 17.73 15.2
## 453 17.27 16.1
## 454 16.74 17.8
## 455 18.71 14.9
## 456 18.13 14.1
## 457 19.01 12.7
## 458 16.94 13.5
## 459 16.23 14.9
## 460 14.70 20.0
## 461 16.42 16.4
## 462 14.65 17.7
## 463 13.99 19.5
## 464 10.29 20.2
## 465 13.22 21.4
## 466 14.13 19.9
## 467 17.15 19.0
## 468 21.32 19.1
## 469 18.13 19.1
## 470 14.76 20.1
## 471 16.29 19.9
## 472 12.87 19.6
## 473 14.36 23.2
```

```
## 474 11.66 29.8
## 475 18.14 13.8
## 476 24.10 13.3
## 477 18.68 16.7
## 478 24.91 12.0
## 479 18.03 14.6
## 480 13.11 21.4
## 481 10.74 23.0
## 482  7.74 23.7
## 483  7.01 25.0
## 484 10.42 21.8
## 485 13.34 20.6
## 486 10.58 21.2
## 487 14.98 19.1
## 488 11.45 20.6
## 489 18.06 15.2
## 490 23.97  7.0
## 491 29.68  8.1
## 492 18.07 13.6
## 493 13.35 20.1
## 494 12.01 21.8
## 495 13.59 24.5
## 496 17.60 23.1
## 497 21.14 19.7
## 498 14.10 18.3
## 499 12.92 21.2
## 500 15.10 17.5
## 501 14.33 16.8
## 502  9.67 22.4
## 503  9.08 20.6
## 504  5.64 23.9
## 505  6.48 22.0
## 506  7.88 11.9
```

```
? Boston
dim(Boston)
```

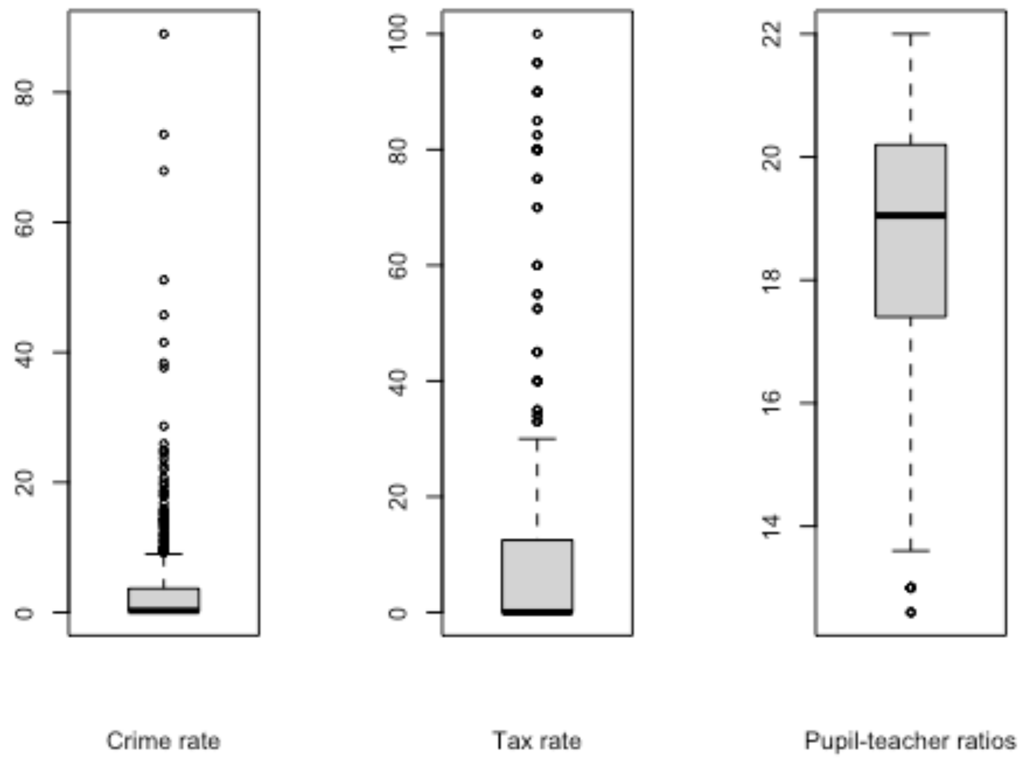
```
## [1] 506  14
```

```
# 506 rows & 14 columns
# rows = each observation
# columns = predictors

#b
pairs(Boston)
```



```
# nox is negatively correlated with rm, dis, but is positively correlated
with age, lstat

#c
correlation <- cor(Boston[, 1], Boston[, -1])
print( correlation )

##              zn     indus        chas       nox         rm       age
dis
## [1,] -0.2004692 0.4065834 -0.05589158 0.4209717 -0.2192467 0.3527343 -
0.3796701
##            rad       tax   ptratio      black     lstat       medv
## [1,] 0.6255051 0.5827643 0.2899456 -0.3850639 0.4556215 -0.3883046

#They all correlated with per capita crime rate.
#zn, chas, rm, dis, black, and medv are negatively corelated with per capita
crime rate
#indus, nox, age, rad, tax, ptratio, lstat are positively corelated with per
capita crime rate

#d
par(mfrow = c(1,3))
boxplot(Boston[,1], xlab= 'Crime rate')
```

```r
boxplot(Boston[,2], xlab = 'Tax rate')
boxplot(Boston[,11], xlab = 'Pupil-teacher ratios')
```




```r
summary(Boston[,1])
```

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

```r
summary(Boston[,2])
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    0.00    0.00    0.00   11.36   12.50  100.00
```

```r
summary(Boston[,11])
```

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

```r
# There are extremely high crime rates(e.g. 88.97) while the mean is 3.61,
and the range is 88.964
# There are extreme high Tax rates, and the range is 524
# There is an extremely low Pupil-teacher ratios here, where range is 9.4
```

```
#e
table(Boston$chas);

##
##   0   1
## 471  35

# 35 suburbs

#f
median_pt_ratio <- median(Boston$ptratio);
print(median_pt_ratio);

## [1] 19.05

#19.05

#g
summary(Boston[,14])

##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    5.00   17.02   21.20   22.53   25.00   50.00

subset <- Boston[Boston$medv == 5, ]
subset

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

summary(Boston)

##       crim                zn             indus            chas
##  Min.   : 0.00632   Min.   :  0.00   Min.   : 0.46   Min.   :0.00000
##  1st Qu.: 0.08205   1st Qu.:  0.00   1st Qu.: 5.19   1st Qu.:0.00000
##  Median : 0.25651   Median :  0.00   Median : 9.69   Median :0.00000
##  Mean   : 3.61352   Mean   : 11.36   Mean   :11.14   Mean   :0.06917
##  3rd Qu.: 3.67708   3rd Qu.: 12.50   3rd Qu.:18.10   3rd Qu.:0.00000
##  Max.   :88.97620   Max.   :100.00   Max.   :27.74   Max.   :1.00000
##       nox               rm             age              dis
##  Min.   :0.3850   Min.   :3.561   Min.   :  2.90   Min.   : 1.130
##  1st Qu.:0.4490   1st Qu.:5.886   1st Qu.: 45.02   1st Qu.: 2.100
##  Median :0.5380   Median :6.208   Median : 77.50   Median : 3.207
##  Mean   :0.5547   Mean   :6.285   Mean   : 68.57   Mean   : 3.795
##  3rd Qu.:0.6240   3rd Qu.:6.623   3rd Qu.: 94.08   3rd Qu.: 5.188
##  Max.   :0.8710   Max.   :8.780   Max.   :100.00   Max.   :12.127
```

```
##       rad              tax          ptratio          black
##  Min.   : 1.000   Min.   :187.0   Min.   :12.60   Min.   :  0.32
##  1st Qu.: 4.000   1st Qu.:279.0   1st Qu.:17.40   1st Qu.:375.38
##  Median : 5.000   Median :330.0   Median :19.05   Median :391.44
##  Mean   : 9.549   Mean   :408.2   Mean   :18.46   Mean   :356.67
##  3rd Qu.:24.000   3rd Qu.:666.0   3rd Qu.:20.20   3rd Qu.:396.23
##  Max.   :24.000   Max.   :711.0   Max.   :22.00   Max.   :396.90
##      lstat            medv
##  Min.   : 1.73   Min.   : 5.00
##  1st Qu.: 6.95   1st Qu.:17.02
##  Median :11.36   Median :21.20
##  Mean   :12.65   Mean   :22.53
##  3rd Qu.:16.95   3rd Qu.:25.00
##  Max.   :37.97   Max.   :50.00
```

```
#Obs.399, 406 have the lowest median value of owner-occupied homes
#Both have extremely high crime rates, age
#Both have relatively high indus, nox, rad, tax, ptratio, black, lstat
#Both have relatively low rm, dis

#h
more_than_7 <- sum(Boston$rm > 7)
print(more_than_7);
```

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

```
more_than_8 <- sum(Boston$rm > 8)
print(more_than_8);
```

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

```
# more than 7 rooms per dwelling = 64
# more than 8 rooms per dwelling = 13
```

##3.7

```
library(ISLR)
?Carseats
attach(Carseats)

#a
model <- lm(Sales ~ Price + Urban + US, data = Carseats)
summary(model)
```

```
##
## Call:
## lm(formula = Sales ~ Price + Urban + US, data = Carseats)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.9206 -1.6220 -0.0564  1.5786  7.0581
```

```
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 13.043469   0.651012  20.036  < 2e-16 ***
## Price       -0.054459   0.005242 -10.389  < 2e-16 ***
## UrbanYes    -0.021916   0.271650  -0.081    0.936
## USYes        1.200573   0.259042   4.635 4.86e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.472 on 396 degrees of freedom
## Multiple R-squared:  0.2393, Adjusted R-squared:  0.2335
## F-statistic: 41.52 on 3 and 396 DF,  p-value: < 2.2e-16
```

```r
contrasts(Urban)
```

```
##     Yes
## No    0
## Yes   1
```

```r
contrasts(US)
```

```
##     Yes
## No    0
## Yes   1
```

```r
#b
# The expected Sales would be 13.04, hold other vaibales = 0.
# Hold other vaiables constant, when the Price increases by 1 unit, the Sales
would decrease by 0.05.
# Hold other vaiables constant, if the store is in urban area, the Sales
would decrease by 0.02.
# Hold other vaiables constant, if the store is in the US, the Sales would
increase by 1.20.

#c
# Sales = B0 + B1*Price + B2*Urban + B3*US
# Urban, US are dummy variables

#d
summary(model)
```

```
##
## Call:
## lm(formula = Sales ~ Price + Urban + US, data = Carseats)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.9206 -1.6220 -0.0564  1.5786  7.0581
##
## Coefficients:
```

```
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 13.043469   0.651012  20.036  < 2e-16 ***
## Price       -0.054459   0.005242 -10.389  < 2e-16 ***
## UrbanYes    -0.021916   0.271650  -0.081    0.936
## USYes        1.200573   0.259042   4.635 4.86e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.472 on 396 degrees of freedom
## Multiple R-squared:  0.2393, Adjusted R-squared:  0.2335
## F-statistic: 41.52 on 3 and 396 DF,  p-value: < 2.2e-16
```

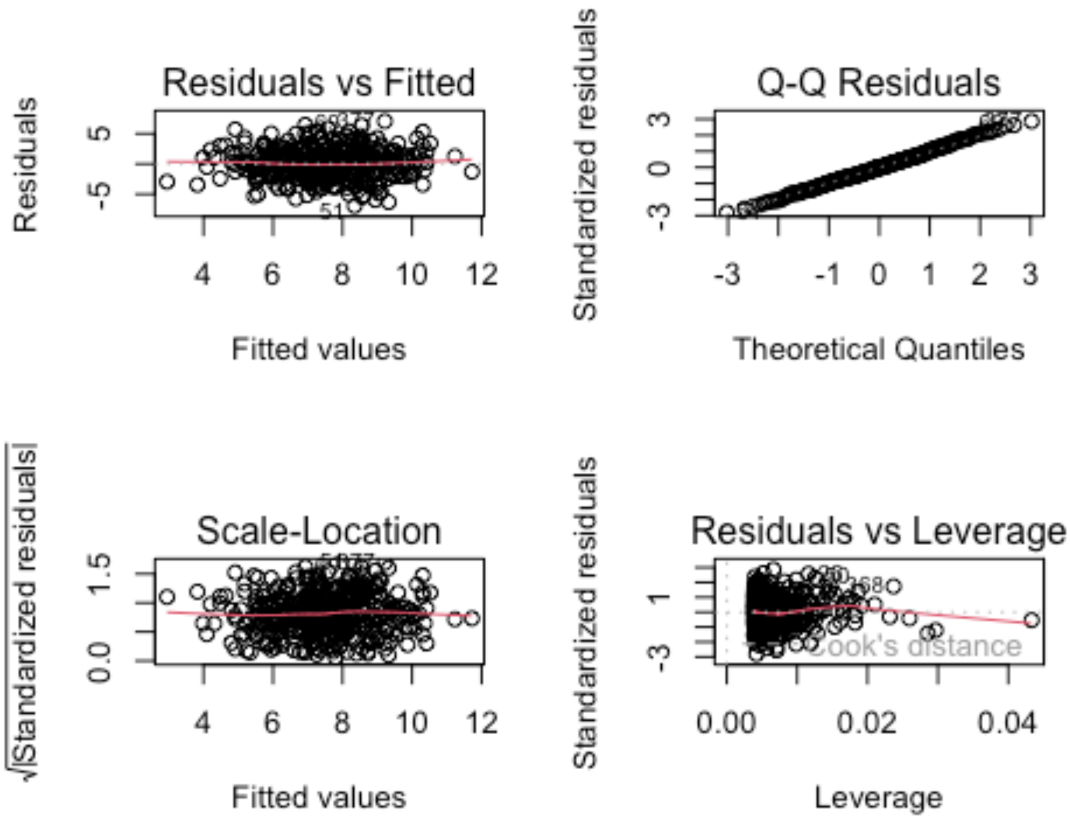
```
# Reject the null hypothesis which UrbanYes is not 0 because the P-value is
way lower than 0.05

#e
model2 = lm(Sales ~ Price + US, Carseats)
summary(model2)
```

```
##
## Call:
## lm(formula = Sales ~ Price + US, data = Carseats)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.9269 -1.6286 -0.0574  1.5766  7.0515
##
## Coefficients:
##            Estimate Std. Error t value Pr(>|t|)
## (Intercept) 13.03079    0.63098  20.652  < 2e-16 ***
## Price       -0.05448    0.00523 -10.416  < 2e-16 ***
## USYes        1.19964    0.25846   4.641 4.71e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.469 on 397 degrees of freedom
## Multiple R-squared:  0.2393, Adjusted R-squared:  0.2354
## F-statistic: 62.43 on 2 and 397 DF,  p-value: < 2.2e-16
```

```
#f
#Both models' Adj R-Squared is about 23~24%, which means both of them can
explain about a quarter of data

#g
confint(model2)
```

```
##                   2.5 %      97.5 %
## (Intercept) 11.79032020 14.27126531
## Price       -0.06475984 -0.04419543
## USYes        0.69151957  1.70776632
```

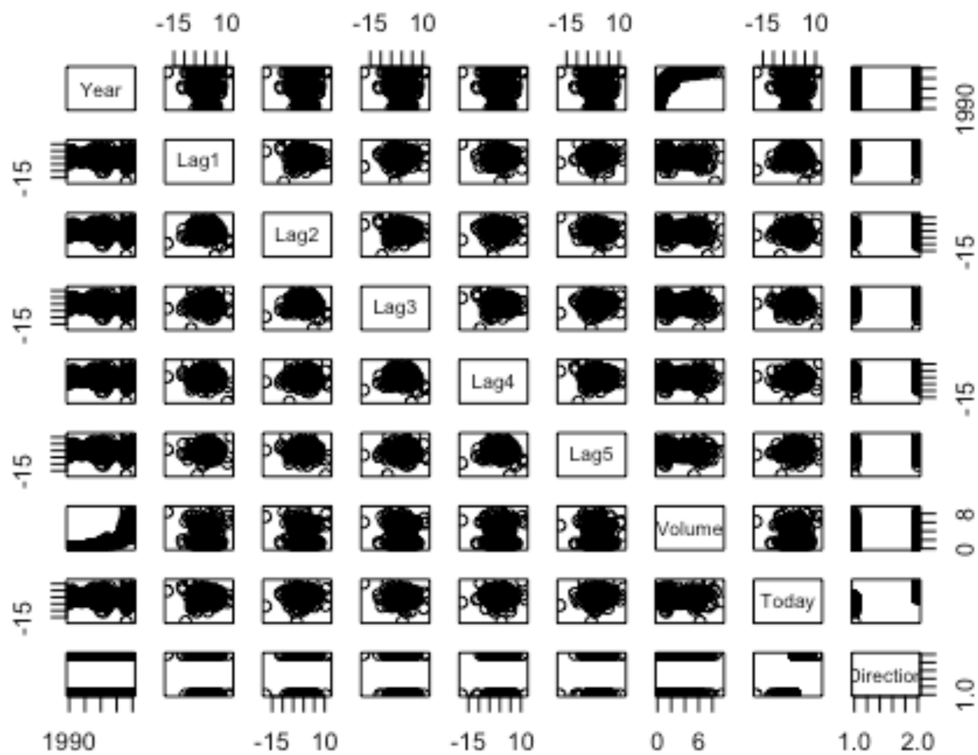
```
# 95% confidence intervals for the coefficient of Price = -0.06 ~ -0.04
# 95% confidence intervals for the coefficient of Price = 0.69 ~ 1.71

#h
par(mfrow = c(2,2))
plot(model2)
```




```
# There is an outlier and a high leverage point.
# Based on the Residuals vs Leverage graph, the point on the right side of
the graph.
```

4.7

```
library(ISLR)
?Weekly
dim(Weekly)

## [1] 1089    9

attach(Weekly)

#a
pairs(Weekly)
```




```
summary(Weekly)
```

```
##       Year           Lag1               Lag2               Lag3
##  Min.   :1990   Min.   :-18.1950   Min.   :-18.1950   Min.   :-18.1950
##  1st Qu.:1995   1st Qu.: -1.1540   1st Qu.: -1.1540   1st Qu.: -1.1580
##  Median :2000   Median :  0.2410   Median :  0.2410   Median :  0.2410
##  Mean   :2000   Mean   :  0.1506   Mean   :  0.1511   Mean   :  0.1472
##  3rd Qu.:2005   3rd Qu.:  1.4050   3rd Qu.:  1.4090   3rd Qu.:  1.4090
##  Max.   :2010   Max.   : 12.0260   Max.   : 12.0260   Max.   : 12.0260
##       Lag4               Lag5              Volume            Today
##  Min.   :-18.1950   Min.   :-18.1950   Min.   :0.08747   Min.   :-18.1950
##  1st Qu.: -1.1580   1st Qu.: -1.1660   1st Qu.:0.33202   1st Qu.: -1.1540
##  Median :  0.2380   Median :  0.2340   Median :1.00268   Median :  0.2410
##  Mean   :  0.1458   Mean   :  0.1399   Mean   :1.57462   Mean   :  0.1499
##  3rd Qu.:  1.4090   3rd Qu.:  1.4050   3rd Qu.:2.05373   3rd Qu.:  1.4050
##  Max.   : 12.0260   Max.   : 12.0260   Max.   :9.32821   Max.   : 12.0260
##  Direction
##  Down:484
##  Up  :605
##
##
##
##
```

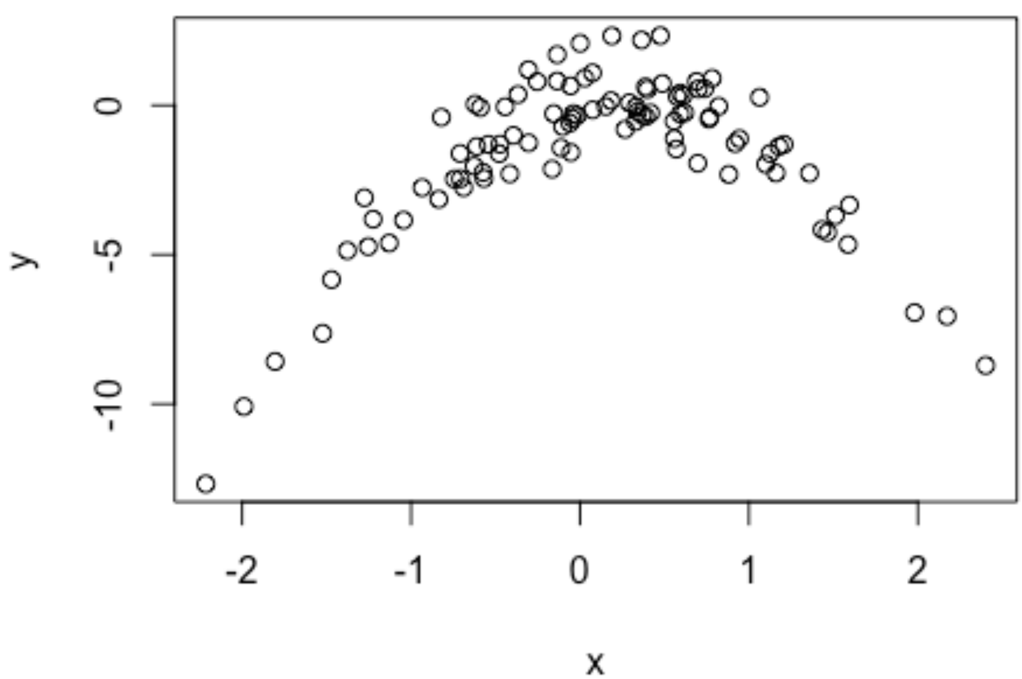
```r
# Year and Volumn have postive relation
# Other variables have no obvious pattern

#b
logistic= glm(Direction~ Lag1 + Lag2 + Lag3 + Lag4 + Lag5 + Volume, Weekly,
family=binomial)
summary(logistic)

##
## Call:
## glm(formula = Direction ~ Lag1 + Lag2 + Lag3 + Lag4 + Lag5 +
##     Volume, family = binomial, data = Weekly)
##
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.26686    0.08593   3.106   0.0019 **
## Lag1        -0.04127    0.02641  -1.563   0.1181
## Lag2         0.05844    0.02686   2.175   0.0296 *
## Lag3        -0.01606    0.02666  -0.602   0.5469
## Lag4        -0.02779    0.02646  -1.050   0.2937
## Lag5        -0.01447    0.02638  -0.549   0.5833
## Volume      -0.02274    0.03690  -0.616   0.5377
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 1496.2  on 1088  degrees of freedom
## Residual deviance: 1486.4  on 1082  degrees of freedom
## AIC: 1500.4
##
## Number of Fisher Scoring iterations: 4

# Lag2 is the only significant predictor with a p-value lower than 0.05.

#c
probs = predict(logistic, type= 'response')
contrasts(Direction)

##      Up
## Down  0
## Up    1

pred = rep('Down', 1089)
pred[probs > 0.5] ='Up'
table(pred, Direction)

##       Direction
## pred   Down  Up
##   Down   54  48
##   Up    430 557
```

```r
mean(pred == Direction)

## [1] 0.5610652

# The total accuracy is roughly 56%.
# But the accuracy of Down is only has 11%(54/54+430) accuracy.

#d
training = (Year < 2009)
dim(Weekly[!training,])

## [1] 104   9

logistic2 = glm(Direction~Lag2, data=Weekly, family = binomial, subset =
training)
probs2 = predict(logistic2, Weekly[!training,], type= 'response')
pred2 = rep('Down', 104)
pred2[probs2>0.5] ='Up'
table(pred2, Direction[!training])

##
## pred2  Down Up
##   Down    9  5
##   Up     34 56

mean(pred2==Direction[!training])

## [1] 0.625

# The total accuracy is roughly 62.5%.
# But the accuracy of Down is only has 21%(9/9+34) accuracy.
```

##5.4

```r
#a
set.seed(1)
x =rnorm(100)
y = x-2*x^2 + rnorm(100)
print( y )

##   [1]  -2.03170924   0.15830946  -3.14310062  -3.33653210  -0.54222762
##   [6]  -0.39951785   0.72896237   0.55825219   0.29691838   1.19026356
##  [11]  -3.69491989  -0.37575699   0.03916194 -12.67518742  -1.61338897
##  [16]  -0.44177960  -0.33670738  -1.11693068  -0.03339898  -0.28886672
##  [21]  -1.27601891   0.90170074  -0.15113430 -10.08394857  -0.24873291
##  [26]   0.65023670  -0.27790439  -5.83461170  -1.61706548  -0.25567901
##  [31]  -2.27318026  -0.71281285   0.61858925  -1.57798909  -4.86308774
##  [36]  -2.29588536  -1.00619522  -0.59462946  -1.97218105  -0.45859548
##  [41]  -2.13301905   0.79483735  -1.93952495  -0.52661504  -2.75344461
##  [46]  -2.45941295   2.18590849  -0.39535717  -1.42389009  -2.31219946
##  [51]   0.53131640  -1.37973884  -0.20967397  -4.60964725  -4.16155047
##  [56]  -6.93875991   0.36310410  -3.84583556  -1.46386813   1.69775653
```

```
## [61] -8.70881760 -0.28096666  0.79674163  0.91285657 -2.46742638
## [66]  2.32360970 -8.57573696 -4.25464189 -0.03811944 -7.06033293
## [71]  2.33126930 -1.61219193  0.32175180 -2.75632734 -4.73082765
## [76]  0.08683839 -0.04866764  2.07634792  1.09068050 -0.07668244
## [81] -2.44676041  0.81217044 -1.37776614 -7.63332842  0.40942478
## [86] -0.04751613  0.26732462 -1.25532164 -0.33402078 -0.80169423
## [91] -1.30827996 -1.30800969 -2.26441402  0.54998851 -4.65733016
## [96] -1.11331216 -3.09480984 -2.24637935 -3.81199002 -1.30269301

# n is 100
# p is x
# y = x-2*x^2 + random error.
# mean should be nearly 0, and var should be nearly 1

#b
plot(x,y)
```




```
# It's a downward symmetric curve, and most of the xs cluster near 0

#c
set.seed(100)
library(boot)
test.data = data.frame(x, y)
```

```
cv.error= rep (0, 9)
for (i in 1:9){
  model3 = glm(y~poly(x,i), data=test.data)
  cv.error[i] = cv.glm(test.data, model3)$delta[1]
}
cv.error

## [1] 7.2881616 0.9374236 0.9566218 0.9539049 0.9247836 0.9569199 0.9998317
## [8] 1.1839802 1.9465417

# Regardless how many times we re-run the code, the average of MSE is
constant.
# The second model has the smallest LOOCV error,indicating a better
predictive performance.

#d
set.seed(10)
library(boot)
test.data = data.frame(x, y)
cv.error= rep (0, 9)
for (i in 1:9){
  model3 = glm(y~poly(x,i), data=test.data)
  cv.error[i] = cv.glm(test.data, model3)$delta[1]
}
cv.error

## [1] 7.2881616 0.9374236 0.9566218 0.9539049 0.9247836 0.9569199 0.9998317
## [8] 1.1839802 1.9465417

# Same as (c)
# It means the model is stable, and it will not be affect by random seeds

#e
glm.fit.1 = glm(y~poly(x,1), data=test.data)
glm.fit.2 = glm(y~poly(x,2), data=test.data)
glm.fit.3 = glm(y~poly(x,3), data=test.data)
glm.fit.4 = glm(y~poly(x,4), data=test.data)
summary(glm.fit.1)

##
## Call:
## glm(formula = y ~ poly(x, 1), data = test.data)
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -1.550      0.260  -5.961 3.95e-08 ***
## poly(x, 1)     6.189      2.600   2.380   0.0192 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 6.760719)
```

```
##
##     Null deviance: 700.85  on 99  degrees of freedom
## Residual deviance: 662.55  on 98  degrees of freedom
## AIC: 478.88
##
## Number of Fisher Scoring iterations: 2
```

```r
summary(glm.fit.2)
```

```
##
## Call:
## glm(formula = y ~ poly(x, 2), data = test.data)
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.5500     0.0958  -16.18  < 2e-16 ***
## poly(x, 2)1   6.1888     0.9580    6.46 4.18e-09 ***
## poly(x, 2)2 -23.9483     0.9580  -25.00  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.9178258)
##
##     Null deviance: 700.852  on 99  degrees of freedom
## Residual deviance:  89.029  on 97  degrees of freedom
## AIC: 280.17
##
## Number of Fisher Scoring iterations: 2
```

```r
summary(glm.fit.3)
```

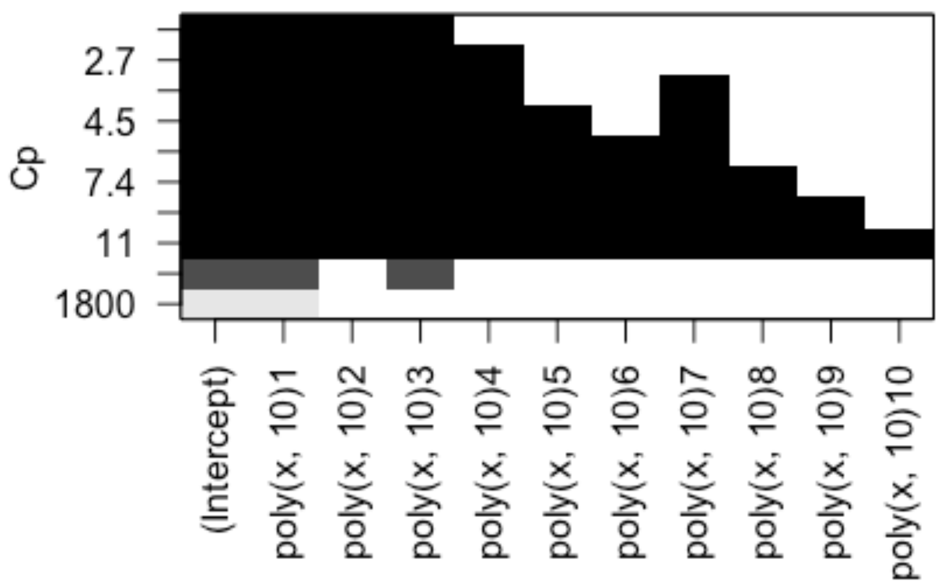
```
##
## Call:
## glm(formula = y ~ poly(x, 3), data = test.data)
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.55002    0.09626 -16.102  < 2e-16 ***
## poly(x, 3)1   6.18883    0.96263   6.429 4.97e-09 ***
## poly(x, 3)2 -23.94830    0.96263 -24.878  < 2e-16 ***
## poly(x, 3)3   0.26411    0.96263   0.274    0.784
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.9266599)
##
##     Null deviance: 700.852  on 99  degrees of freedom
## Residual deviance:  88.959  on 96  degrees of freedom
## AIC: 282.09
##
## Number of Fisher Scoring iterations: 2
```

```r
summary(glm.fit.4)

##
## Call:
## glm(formula = y ~ poly(x, 4), data = test.data)
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.55002    0.09591 -16.162  < 2e-16 ***
## poly(x, 4)1   6.18883    0.95905   6.453 4.59e-09 ***
## poly(x, 4)2 -23.94830    0.95905 -24.971  < 2e-16 ***
## poly(x, 4)3   0.26411    0.95905   0.275    0.784
## poly(x, 4)4   1.25710    0.95905   1.311    0.193
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for gaussian family taken to be 0.9197797)
##
##     Null deviance: 700.852  on 99  degrees of freedom
## Residual deviance:  87.379  on 95  degrees of freedom
## AIC: 282.3
##
## Number of Fisher Scoring iterations: 2

# Tables show that the coefficients of xs with 2 degrees is the highest.
# It's same with (c), (d) that the 2-dimension model is the best
```

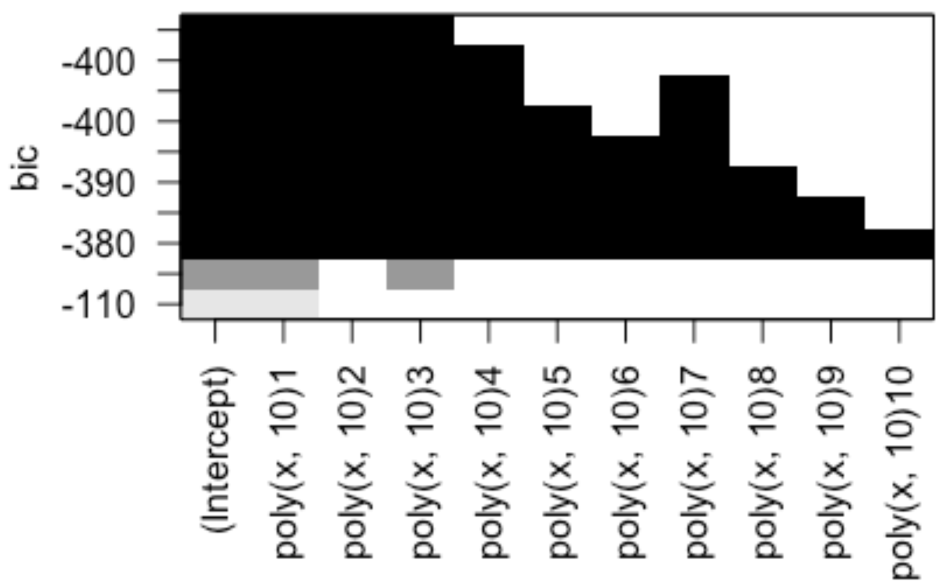
6.8

```r
#a
x = rnorm(100)
noise = rnorm(100)

#b
y = 5 + x + 2 * x^2 + 3 * x^3 + noise

#c
library(leaps)
test.data.2 = data.frame(x,y)
best = regsubsets(y~ poly(x,10),test.data.2,nvmax=10)

best_cp <- which.min(summary(best)$cp)
best_bic <- which.min(summary(best)$bic)
best_adj_r2 <- which.max(summary(best)$adjr2)

best_cp

## [1] 3

best_bic
```

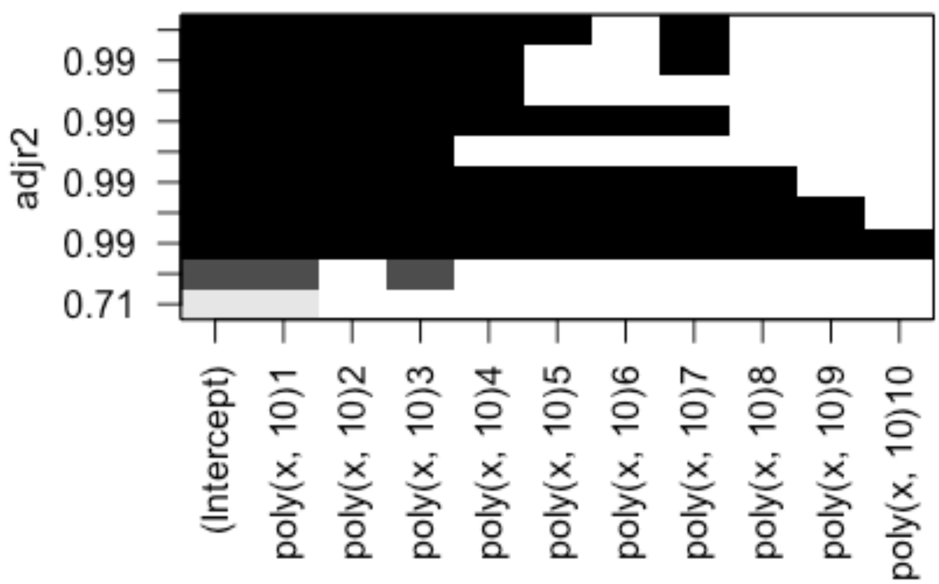
```
## [1] 3
best_adj_r2
## [1] 6
plot(best, scale = "Cp")
```




```
plot(best, scale = "bic")
```




```
plot(best, scale = "adjr2")
```




```
# It's better to have 6 predictors according to cp, ADJ R^2
# It's better to have 4 predictors according to bic

#d

#FORWARD
forward <- regsubsets(y ~ poly(x, 10), test.data.2, method = "forward", nvmax
= 10)

best_cp_forward <- which.min(summary(forward)$cp)
best_bic_forward <- which.min(summary(forward)$bic)
best_adj_r2_forward <- which.max(summary(forward)$adjr2)

best_cp_forward

## [1] 3

best_bic_forward

## [1] 3

best_adj_r2_forward

## [1] 6
```

```r
# It's better to have 6 predictors according to cp, ADJ R^2
# It's better to have 4 predictors according to bic

#BACKWARD
backward <- regsubsets(y ~ poly(x, 10), test.data.2, method = "backward",
nvmax = 10)

best_cp_backward <- which.min(summary(backward)$cp)
best_bic_backward <- which.min(summary(backward)$bic)
best_adj_r2_backward <- which.max(summary(backward)$adjr2)

best_cp_backward

## [1] 3

best_bic_backward

## [1] 3

best_adj_r2_backward

## [1] 6

# It's better to have 6 predictors according to cp, ADJ R^2
# It's better to have 4 predictors according to bic

# No matter using which methods, the results are the same.
# Which means the model is stable.
```