personal assignment 2

```
#(a)
library(ISLR)
attach(Carseats)
?Carseats
na.omit(Carseats)
```

```
##     Sales CompPrice Income Advertising Population Price ShelveLoc Age
## 1    9.50       138     73           11        276   120       Bad  42
## 2   11.22       111     48           16        260    83      Good  65
## 3   10.06       113     35           10        269    80    Medium  59
## 4    7.40       117    100            4        466    97    Medium  55
## 5    4.15       141     64            3        340   128       Bad  38
## 6   10.81       124    113           13        501    72       Bad  78
## 7    6.63       115    105            0         45   108    Medium  71
## 8   11.85       136     81           15        425   120      Good  67
## 9    6.54       132    110            0        108   124    Medium  76
## 10   4.69       132    113            0        131   124    Medium  76
## 11   9.01       121     78            9        150   100       Bad  26
## 12  11.96       117     94            4        503    94      Good  50
## 13   3.98       122     35            2        393   136    Medium  62
## 14  10.96       115     28           11         29    86      Good  53
## 15  11.17       107    117           11        148   118      Good  52
## 16   8.71       149     95            5        400   144    Medium  76
## 17   7.58       118     32            0        284   110      Good  63
## 18  12.29       147     74           13        251   131      Good  52
## 19  13.91       110    110            0        408    68      Good  46
## 20   8.73       129     76           16         58   121    Medium  69
## 21   6.41       125     90            2        367   131    Medium  35
## 22  12.13       134     29           12        239   109      Good  62
## 23   5.08       128     46            6        497   138    Medium  42
## 24   5.87       121     31            0        292   109    Medium  79
## 25  10.14       145    119           16        294   113       Bad  42
## 26  14.90       139     32            0        176    82      Good  54
## 27   8.33       107    115           11        496   131      Good  50
## 28   5.27        98    118            0         19   107    Medium  64
## 29   2.99       103     74            0        359    97       Bad  55
## 30   7.81       104     99           15        226   102       Bad  58
## 31  13.55       125     94            0        447    89      Good  30
## 32   8.25       136     58           16        241   131    Medium  44
## 33   6.20       107     32           12        236   137      Good  64
## 34   8.77       114     38           13        317   128      Good  50
## 35   2.67       115     54            0        406   128    Medium  42
## 36  11.07       131     84           11         29    96    Medium  44
## 37   8.89       122     76            0        270   100      Good  60
## 38   4.95       121     41            5        412   110    Medium  54
## 39   6.59       109     73            0        454   102    Medium  65
## 40   3.24       130     60            0        144   138       Bad  38
## 41   2.07       119     98            0         18   126       Bad  73
## 42   7.96       157     53            0        403   124       Bad  58
## 43  10.43        77     69            0         25    24    Medium  50
## 44   4.12       123     42           11         16   134    Medium  59
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## 45   4.16        85     79          6        325    95    Medium  69
## 46   4.56       141     63          0        168   135       Bad  44
## 47  12.44       127     90         14         16    70    Medium  48
## 48   4.38       126     98          0        173   108       Bad  55
## 49   3.91       116     52          0        349    98       Bad  69
## 50  10.61       157     93          0         51   149      Good  32
## 51   1.42        99     32         18        341   108       Bad  80
## 52   4.42       121     90          0        150   108       Bad  75
## 53   7.91       153     40          3        112   129       Bad  39
## 54   6.92       109     64         13         39   119    Medium  61
## 55   4.90       134    103         13         25   144    Medium  76
## 56   6.85       143     81          5         60   154    Medium  61
## 57  11.91       133     82          0         54    84    Medium  50
## 58   0.91        93     91          0         22   117       Bad  75
## 59   5.42       103     93         15        188   103       Bad  74
## 60   5.21       118     71          4        148   114    Medium  80
## 61   8.32       122    102         19        469   123       Bad  29
## 62   7.32       105     32          0        358   107    Medium  26
## 63   1.82       139     45          0        146   133       Bad  77
## 64   8.47       119     88         10        170   101    Medium  61
## 65   7.80       100     67         12        184   104    Medium  32
## 66   4.90       122     26          0        197   128    Medium  55
## 67   8.85       127     92          0        508    91    Medium  56
## 68   9.01       126     61         14        152   115    Medium  47
## 69  13.39       149     69         20        366   134      Good  60
## 70   7.99       127     59          0        339    99    Medium  65
## 71   9.46        89     81         15        237    99      Good  74
## 72   6.50       148     51         16        148   150    Medium  58
## 73   5.52       115     45          0        432   116    Medium  25
## 74  12.61       118     90         10         54   104      Good  31
## 75   6.20       150     68          5        125   136    Medium  64
## 76   8.55        88    111         23        480    92       Bad  36
## 77  10.64       102     87         10        346    70    Medium  64
## 78   7.70       118     71         12         44    89    Medium  67
## 79   4.43       134     48          1        139   145    Medium  65
## 80   9.14       134     67          0        286    90       Bad  41
## 81   8.01       113    100         16        353    79       Bad  68
## 82   7.52       116     72          0        237   128      Good  70
## 83  11.62       151     83          4        325   139      Good  28
## 84   4.42       109     36          7        468    94       Bad  56
## 85   2.23       111     25          0         52   121       Bad  43
## 86   8.47       125    103          0        304   112    Medium  49
## 87   8.70       150     84          9        432   134    Medium  64
## 88  11.70       131     67          7        272   126      Good  54
## 89   6.56       117     42          7        144   111    Medium  62
## 90   7.95       128     66          3        493   119    Medium  45
## 91   5.33       115     22          0        491   103    Medium  64
## 92   4.81        97     46         11        267   107    Medium  80
## 93   4.53       114    113          0         97   125    Medium  29
## 94   8.86       145     30          0         67   104    Medium  55
## 95   8.39       115     97          5        134    84       Bad  55
## 96   5.58       134     25         10        237   148    Medium  59
## 97   9.48       147     42         10        407   132      Good  73
## 98   7.45       161     82          5        287   129       Bad  33
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## 99  12.49       122     77          24        382   127      Good  36
## 100  4.88       121     47           3        220   107       Bad  56
## 101  4.11       113     69          11         94   106    Medium  76
## 102  6.20       128     93           0         89   118    Medium  34
## 103  5.30       113     22           0         57    97    Medium  65
## 104  5.07       123     91           0        334    96       Bad  78
## 105  4.62       121     96           0        472   138    Medium  51
## 106  5.55       104    100           8        398    97    Medium  61
## 107  0.16       102     33           0        217   139    Medium  70
## 108  8.55       134    107           0        104   108    Medium  60
## 109  3.47       107     79           2        488   103       Bad  65
## 110  8.98       115     65           0        217    90    Medium  60
## 111  9.00       128     62           7        125   116    Medium  43
## 112  6.62       132    118          12        272   151    Medium  43
## 113  6.67       116     99           5        298   125      Good  62
## 114  6.01       131     29          11        335   127       Bad  33
## 115  9.31       122     87           9         17   106    Medium  65
## 116  8.54       139     35           0         95   129    Medium  42
## 117  5.08       135     75           0        202   128    Medium  80
## 118  8.80       145     53           0        507   119    Medium  41
## 119  7.57       112     88           2        243    99    Medium  62
## 120  7.37       130     94           8        137   128    Medium  64
## 121  6.87       128    105          11        249   131    Medium  63
## 122 11.67       125     89          10        380    87       Bad  28
## 123  6.88       119    100           5         45   108    Medium  75
## 124  8.19       127    103           0        125   155      Good  29
## 125  8.87       131    113           0        181   120      Good  63
## 126  9.34        89     78           0        181    49    Medium  43
## 127 11.27       153     68           2         60   133      Good  59
## 128  6.52       125     48           3        192   116    Medium  51
## 129  4.96       133    100           3        350   126       Bad  55
## 130  4.47       143    120           7        279   147       Bad  40
## 131  8.41        94     84          13        497    77    Medium  51
## 132  6.50       108     69           3        208    94    Medium  77
## 133  9.54       125     87           9        232   136      Good  72
## 134  7.62       132     98           2        265    97       Bad  62
## 135  3.67       132     31           0        327   131    Medium  76
## 136  6.44        96     94          14        384   120    Medium  36
## 137  5.17       131     75           0         10   120       Bad  31
## 138  6.52       128     42           0        436   118    Medium  80
## 139 10.27       125    103          12        371   109    Medium  44
## 140 12.30       146     62          10        310    94    Medium  30
## 141  6.03       133     60          10        277   129    Medium  45
## 142  6.53       140     42           0        331   131       Bad  28
## 143  7.44       124     84           0        300   104    Medium  77
## 144  0.53       122     88           7         36   159       Bad  28
## 145  9.09       132     68           0        264   123      Good  34
## 146  8.77       144     63          11         27   117    Medium  47
## 147  3.90       114     83           0        412   131       Bad  39
## 148 10.51       140     54           9        402   119      Good  41
## 149  7.56       110    119           0        384    97    Medium  72
## 150 11.48       121    120          13        140    87    Medium  56
## 151 10.49       122     84           8        176   114      Good  57
## 152 10.77       111     58          17        407   103      Good  75
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## 153  7.64       128     78           0       341   128      Good  45
## 154  5.93       150     36           7       488   150    Medium  25
## 155  6.89       129     69          10       289   110    Medium  50
## 156  7.71        98     72           0        59    69    Medium  65
## 157  7.49       146     34           0       220   157      Good  51
## 158 10.21       121     58           8       249    90    Medium  48
## 159 12.53       142     90           1       189   112      Good  39
## 160  9.32       119     60           0       372    70       Bad  30
## 161  4.67       111     28           0       486   111    Medium  29
## 162  2.93       143     21           5        81   160    Medium  67
## 163  3.63       122     74           0       424   149    Medium  51
## 164  5.68       130     64           0        40   106       Bad  39
## 165  8.22       148     64           0        58   141    Medium  27
## 166  0.37       147     58           7       100   191       Bad  27
## 167  6.71       119     67          17       151   137    Medium  55
## 168  6.71       106     73           0       216    93    Medium  60
## 169  7.30       129     89           0       425   117    Medium  45
## 170 11.48       104     41          15       492    77      Good  73
## 171  8.01       128     39          12       356   118    Medium  71
## 172 12.49        93    106          12       416    55    Medium  75
## 173  9.03       104    102          13       123   110      Good  35
## 174  6.38       135     91           5       207   128    Medium  66
## 175  0.00       139     24           0       358   185    Medium  79
## 176  7.54       115     89           0        38   122    Medium  25
## 177  5.61       138    107           9       480   154    Medium  47
## 178 10.48       138     72           0       148    94    Medium  27
## 179 10.66       104     71          14        89    81    Medium  25
## 180  7.78       144     25           3        70   116    Medium  77
## 181  4.94       137    112          15       434   149       Bad  66
## 182  7.43       121     83           0        79    91    Medium  68
## 183  4.74       137     60           4       230   140       Bad  25
## 184  5.32       118     74           6       426   102    Medium  80
## 185  9.95       132     33           7        35    97    Medium  60
## 186 10.07       130    100          11       449   107    Medium  64
## 187  8.68       120     51           0        93    86    Medium  46
## 188  6.03       117     32           0       142    96       Bad  62
## 189  8.07       116     37           0       426    90    Medium  76
## 190 12.11       118    117          18       509   104    Medium  26
## 191  8.79       130     37          13       297   101    Medium  37
## 192  6.67       156     42          13       170   173      Good  74
## 193  7.56       108     26           0       408    93    Medium  56
## 194 13.28       139     70           7        71    96      Good  61
## 195  7.23       112     98          18       481   128    Medium  45
## 196  4.19       117     93           4       420   112       Bad  66
## 197  4.10       130     28           6       410   133       Bad  72
## 198  2.52       124     61           0       333   138    Medium  76
## 199  3.62       112     80           5       500   128    Medium  69
## 200  6.42       122     88           5       335   126    Medium  64
## 201  5.56       144     92           0       349   146    Medium  62
## 202  5.94       138     83           0       139   134    Medium  54
## 203  4.10       121     78           4       413   130       Bad  46
## 204  2.05       131     82           0       132   157       Bad  25
## 205  8.74       155     80           0       237   124    Medium  37
## 206  5.68       113     22           1       317   132    Medium  28
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## 207  4.97       162     67           0         27   160    Medium  77
## 208  8.19       111    105           0        466    97       Bad  61
## 209  7.78        86     54           0        497    64       Bad  33
## 210  3.02        98     21          11        326    90       Bad  76
## 211  4.36       125     41           2        357   123       Bad  47
## 212  9.39       117    118          14        445   120    Medium  32
## 213 12.04       145     69          19        501   105    Medium  45
## 214  8.23       149     84           5        220   139    Medium  33
## 215  4.83       115    115           3         48   107    Medium  73
## 216  2.34       116     83          15        170   144       Bad  71
## 217  5.73       141     33           0        243   144    Medium  34
## 218  4.34       106     44           0        481   111    Medium  70
## 219  9.70       138     61          12        156   120    Medium  25
## 220 10.62       116     79          19        359   116      Good  58
## 221 10.59       131    120          15        262   124    Medium  30
## 222  6.43       124     44           0        125   107    Medium  80
## 223  7.49       136    119           6        178   145    Medium  35
## 224  3.45       110     45           9        276   125    Medium  62
## 225  4.10       134     82           0        464   141    Medium  48
## 226  6.68       107     25           0        412    82       Bad  36
## 227  7.80       119     33           0        245   122      Good  56
## 228  8.69       113     64          10         68   101    Medium  57
## 229  5.40       149     73          13        381   163       Bad  26
## 230 11.19        98    104           0        404    72    Medium  27
## 231  5.16       115     60           0        119   114       Bad  38
## 232  8.09       132     69           0        123   122    Medium  27
## 233 13.14       137     80          10         24   105      Good  61
## 234  8.65       123     76          18        218   120    Medium  29
## 235  9.43       115     62          11        289   129      Good  56
## 236  5.53       126     32           8         95   132    Medium  50
## 237  9.32       141     34          16        361   108    Medium  69
## 238  9.62       151     28           8        499   135    Medium  48
## 239  7.36       121     24           0        200   133      Good  73
## 240  3.89       123    105           0        149   118       Bad  62
## 241 10.31       159     80           0        362   121    Medium  26
## 242 12.01       136     63           0        160    94    Medium  38
## 243  4.68       124     46           0        199   135    Medium  52
## 244  7.82       124     25          13         87   110    Medium  57
## 245  8.78       130     30           0        391   100    Medium  26
## 246 10.00       114     43           0        199    88      Good  57
## 247  6.90       120     56          20        266    90       Bad  78
## 248  5.04       123    114           0        298   151       Bad  34
## 249  5.36       111     52           0         12   101    Medium  61
## 250  5.05       125     67           0         86   117       Bad  65
## 251  9.16       137    105          10        435   156      Good  72
## 252  3.72       139    111           5        310   132       Bad  62
## 253  8.31       133     97           0         70   117    Medium  32
## 254  5.64       124     24           5        288   122    Medium  57
## 255  9.58       108    104          23        353   129      Good  37
## 256  7.71       123     81           8        198    81       Bad  80
## 257  4.20       147     40           0        277   144    Medium  73
## 258  8.67       125     62          14        477   112    Medium  80
## 259  3.47       108     38           0        251    81       Bad  72
## 260  5.12       123     36          10        467   100       Bad  74
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## 261  7.67       129    117           8        400   101       Bad  36
## 262  5.71       121     42           4        188   118    Medium  54
## 263  6.37       120     77          15         86   132    Medium  48
## 264  7.77       116     26           6        434   115    Medium  25
## 265  6.95       128     29           5        324   159      Good  31
## 266  5.31       130     35          10        402   129       Bad  39
## 267  9.10       128     93          12        343   112      Good  73
## 268  5.83       134     82           7        473   112       Bad  51
## 269  6.53       123     57           0         66   105    Medium  39
## 270  5.01       159     69           0        438   166    Medium  46
## 271 11.99       119     26           0        284    89      Good  26
## 272  4.55       111     56           0        504   110    Medium  62
## 273 12.98       113     33           0         14    63      Good  38
## 274 10.04       116    106           8        244    86    Medium  58
## 275  7.22       135     93           2         67   119    Medium  34
## 276  6.67       107    119          11        210   132    Medium  53
## 277  6.93       135     69          14        296   130    Medium  73
## 278  7.80       136     48          12        326   125    Medium  36
## 279  7.22       114    113           2        129   151      Good  40
## 280  3.42       141     57          13        376   158    Medium  64
## 281  2.86       121     86          10        496   145       Bad  51
## 282 11.19       122     69           7        303   105      Good  45
## 283  7.74       150     96           0         80   154      Good  61
## 284  5.36       135    110           0        112   117    Medium  80
## 285  6.97       106     46          11        414    96       Bad  79
## 286  7.60       146     26          11        261   131    Medium  39
## 287  7.53       117    118          11        429   113    Medium  67
## 288  6.88        95     44           4        208    72       Bad  44
## 289  6.98       116     40           0         74    97    Medium  76
## 290  8.75       143     77          25        448   156    Medium  43
## 291  9.49       107    111          14        400   103    Medium  41
## 292  6.64       118     70           0        106    89       Bad  39
## 293 11.82       113     66          16        322    74      Good  76
## 294 11.28       123     84           0         74    89      Good  59
## 295 12.66       148     76           3        126    99      Good  60
## 296  4.21       118     35          14        502   137    Medium  79
## 297  8.21       127     44          13        160   123      Good  63
## 298  3.07       118     83          13        276   104       Bad  75
## 299 10.98       148     63           0        312   130      Good  63
## 300  9.40       135     40          17        497    96    Medium  54
## 301  8.57       116     78           1        158    99    Medium  45
## 302  7.41        99     93           0        198    87    Medium  57
## 303  5.28       108     77          13        388   110       Bad  74
## 304 10.01       133     52          16        290    99    Medium  43
## 305 11.93       123     98          12        408   134      Good  29
## 306  8.03       115     29          26        394   132    Medium  33
## 307  4.78       131     32           1         85   133    Medium  48
## 308  5.90       138     92           0         13   120       Bad  61
## 309  9.24       126     80          19        436   126    Medium  52
## 310 11.18       131    111          13         33    80       Bad  68
## 311  9.53       175     65          29        419   166    Medium  53
## 312  6.15       146     68          12        328   132       Bad  51
## 313  6.80       137    117           5        337   135       Bad  38
## 314  9.33       103     81           3        491    54    Medium  66
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## 315  7.72       133     33          10        333   129      Good  71
## 316  6.39       131     21           8        220   171      Good  29
## 317 15.63       122     36           5        369    72      Good  35
## 318  6.41       142     30           0        472   136      Good  80
## 319 10.08       116     72          10        456   130      Good  41
## 320  6.97       127     45          19        459   129    Medium  57
## 321  5.86       136     70          12        171   152    Medium  44
## 322  7.52       123     39           5        499    98    Medium  34
## 323  9.16       140     50          10        300   139      Good  60
## 324 10.36       107    105          18        428   103    Medium  34
## 325  2.66       136     65           4        133   150       Bad  53
## 326 11.70       144     69          11        131   104    Medium  47
## 327  4.69       133     30           0        152   122    Medium  53
## 328  6.23       112     38          17        316   104    Medium  80
## 329  3.15       117     66           1         65   111       Bad  55
## 330 11.27       100     54           9        433    89      Good  45
## 331  4.99       122     59           0        501   112       Bad  32
## 332 10.10       135     63          15        213   134    Medium  32
## 333  5.74       106     33          20        354   104    Medium  61
## 334  5.87       136     60           7        303   147    Medium  41
## 335  7.63        93    117           9        489    83       Bad  42
## 336  6.18       120     70          15        464   110    Medium  72
## 337  5.17       138     35           6         60   143       Bad  28
## 338  8.61       130     38           0        283   102    Medium  80
## 339  5.97       112     24           0        164   101    Medium  45
## 340 11.54       134     44           4        219   126      Good  44
## 341  7.50       140     29           0        105    91       Bad  43
## 342  7.38        98    120           0        268    93    Medium  72
## 343  7.81       137    102          13        422   118    Medium  71
## 344  5.99       117     42          10        371   121       Bad  26
## 345  8.43       138     80           0        108   126      Good  70
## 346  4.81       121     68           0        279   149      Good  79
## 347  8.97       132    107           0        144   125    Medium  33
## 348  6.88        96     39           0        161   112      Good  27
## 349 12.57       132    102          20        459   107      Good  49
## 350  9.32       134     27          18        467    96    Medium  49
## 351  8.64       111    101          17        266    91    Medium  63
## 352 10.44       124    115          16        458   105    Medium  62
## 353 13.44       133    103          14        288   122      Good  61
## 354  9.45       107     67          12        430    92    Medium  35
## 355  5.30       133     31           1         80   145    Medium  42
## 356  7.02       130    100           0        306   146      Good  42
## 357  3.58       142    109           0        111   164      Good  72
## 358 13.36       103     73           3        276    72    Medium  34
## 359  4.17       123     96          10         71   118       Bad  69
## 360  3.13       130     62          11        396   130       Bad  66
## 361  8.77       118     86           7        265   114      Good  52
## 362  8.68       131     25          10        183   104    Medium  56
## 363  5.25       131     55           0         26   110       Bad  79
## 364 10.26       111     75           1        377   108      Good  25
## 365 10.50       122     21          16        488   131      Good  30
## 366  6.53       154     30           0        122   162    Medium  57
## 367  5.98       124     56          11        447   134    Medium  53
## 368 14.37        95    106           0        256    53      Good  52
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```
## 369 10.71       109     22          10        348    79      Good  74
## 370 10.26       135    100          22        463   122    Medium  36
## 371  7.68       126     41          22        403   119       Bad  42
## 372  9.08       152     81           0        191   126    Medium  54
## 373  7.80       121     50           0        508    98    Medium  65
## 374  5.58       137     71           0        402   116    Medium  78
## 375  9.44       131     47           7         90   118    Medium  47
## 376  7.90       132     46           4        206   124    Medium  73
## 377 16.27       141     60          19        319    92      Good  44
## 378  6.81       132     61           0        263   125    Medium  41
## 379  6.11       133     88           3        105   119    Medium  79
## 380  5.81       125    111           0        404   107       Bad  54
## 381  9.64       106     64          10         17    89    Medium  68
## 382  3.90       124     65          21        496   151       Bad  77
## 383  4.95       121     28          19        315   121    Medium  66
## 384  9.35        98    117           0         76    68    Medium  63
## 385 12.85       123     37          15        348   112      Good  28
## 386  5.87       131     73          13        455   132    Medium  62
## 387  5.32       152    116           0        170   160    Medium  39
## 388  8.67       142     73          14        238   115    Medium  73
## 389  8.14       135     89          11        245    78       Bad  79
## 390  8.44       128     42           8        328   107    Medium  35
## 391  5.47       108     75           9         61   111    Medium  67
## 392  6.10       153     63           0         49   124       Bad  56
## 393  4.53       129     42          13        315   130       Bad  34
## 394  5.57       109     51          10         26   120    Medium  30
## 395  5.35       130     58          19        366   139       Bad  33
## 396 12.57       138    108          17        203   128      Good  33
## 397  6.14       139     23           3         37   120    Medium  55
## 398  7.41       162     26          12        368   159    Medium  40
## 399  5.94       100     79           7        284    95       Bad  50
## 400  9.71       134     37           0         27   120      Good  49
##     Education Urban  US
## 1          17   Yes Yes
## 2          10   Yes Yes
## 3          12   Yes Yes
## 4          14   Yes Yes
## 5          13   Yes  No
## 6          16    No Yes
## 7          15   Yes  No
## 8          10   Yes Yes
## 9          10    No  No
## 10         17    No Yes
## 11         10    No Yes
## 12         13   Yes Yes
## 13         18   Yes  No
## 14         18   Yes Yes
## 15         18   Yes Yes
## 16         18    No  No
## 17         13   Yes  No
## 18         10   Yes Yes
## 19         17    No Yes
## 20         12   Yes Yes
## 21         18   Yes Yes
```

```
## 22         18    No Yes
## 23         13   Yes  No
## 24         10   Yes  No
## 25         12   Yes Yes
## 26         11    No  No
## 27         11    No Yes
## 28         17   Yes  No
## 29         11   Yes Yes
## 30         17   Yes Yes
## 31         12   Yes  No
## 32         18   Yes Yes
## 33         10    No Yes
## 34         16   Yes Yes
## 35         17   Yes Yes
## 36         17    No Yes
## 37         18    No  No
## 38         10   Yes Yes
## 39         15   Yes  No
## 40         10    No  No
## 41         17    No  No
## 42         16   Yes  No
## 43         18   Yes  No
## 44         13   Yes Yes
## 45         13   Yes Yes
## 46         12   Yes Yes
## 47         15    No Yes
## 48         16   Yes  No
## 49         18   Yes  No
## 50         17   Yes  No
## 51         16   Yes Yes
## 52         16   Yes  No
## 53         18   Yes Yes
## 54         17   Yes Yes
## 55         17    No Yes
## 56         18   Yes Yes
## 57         17   Yes  No
## 58         11   Yes  No
## 59         16   Yes Yes
## 60         13   Yes  No
## 61         13   Yes Yes
## 62         13    No  No
## 63         17   Yes Yes
## 64         13   Yes Yes
## 65         16    No Yes
## 66         13    No  No
## 67         18   Yes  No
## 68         16   Yes Yes
## 69         13   Yes Yes
## 70         12   Yes  No
## 71         12   Yes Yes
## 72         17    No Yes
## 73         15   Yes  No
## 74         11    No Yes
## 75         13    No Yes
```

```
## 76         16    No Yes
## 77         15   Yes Yes
## 78         18    No Yes
## 79         12   Yes Yes
## 80         13   Yes  No
## 81         11   Yes Yes
## 82         13   Yes  No
## 83         17   Yes Yes
## 84         11   Yes Yes
## 85         18    No  No
## 86         13    No  No
## 87         15   Yes  No
## 88         16    No Yes
## 89         10   Yes Yes
## 90         16    No  No
## 91         11    No  No
## 92         15   Yes Yes
## 93         12   Yes  No
## 94         17   Yes  No
## 95         11   Yes Yes
## 96         13   Yes Yes
## 97         16    No Yes
## 98         16   Yes Yes
## 99         16    No Yes
## 100        16    No Yes
## 101        12    No Yes
## 102        18   Yes  No
## 103        16    No  No
## 104        17   Yes Yes
## 105        12   Yes  No
## 106        11   Yes Yes
## 107        18    No  No
## 108        12   Yes  No
## 109        16   Yes  No
## 110        17    No  No
## 111        14   Yes Yes
## 112        14   Yes Yes
## 113        12   Yes Yes
## 114        12   Yes Yes
## 115        13   Yes Yes
## 116        13   Yes  No
## 117        10    No  No
## 118        12   Yes  No
## 119        11   Yes Yes
## 120        12   Yes Yes
## 121        13   Yes Yes
## 122        10   Yes Yes
## 123        10   Yes Yes
## 124        15    No Yes
## 125        14   Yes  No
## 126        15    No  No
## 127        16   Yes Yes
## 128        14   Yes Yes
## 129        13   Yes Yes
```

```
## 130        10    No Yes
## 131        12   Yes Yes
## 132        16   Yes  No
## 133        10   Yes Yes
## 134        12   Yes Yes
## 135        16   Yes  No
## 136        18    No Yes
## 137        18    No  No
## 138        11   Yes  No
## 139        10   Yes Yes
## 140        13    No Yes
## 141        18   Yes Yes
## 142        15   Yes  No
## 143        15   Yes  No
## 144        17   Yes Yes
## 145        11    No  No
## 146        17   Yes Yes
## 147        14   Yes  No
## 148        16    No Yes
## 149        14    No Yes
## 150        11   Yes Yes
## 151        10    No Yes
## 152        17    No Yes
## 153        13    No  No
## 154        17    No Yes
## 155        16    No Yes
## 156        16   Yes  No
## 157        16   Yes  No
## 158        13    No Yes
## 159        10    No Yes
## 160        18    No  No
## 161        12    No  No
## 162        12    No Yes
## 163        13   Yes  No
## 164        17    No  No
## 165        13    No Yes
## 166        15   Yes Yes
## 167        11   Yes Yes
## 168        13   Yes  No
## 169        10   Yes  No
## 170        18   Yes Yes
## 171        10   Yes Yes
## 172        15   Yes Yes
## 173        16   Yes Yes
## 174        18   Yes Yes
## 175        15    No  No
## 176        12   Yes  No
## 177        11    No Yes
## 178        17   Yes Yes
## 179        14    No Yes
## 180        18   Yes Yes
## 181        13   Yes Yes
## 182        11   Yes  No
## 183        13   Yes  No
```

```
## 184        18   Yes Yes
## 185        11    No Yes
## 186        10   Yes Yes
## 187        17    No  No
## 188        17   Yes  No
## 189        15   Yes  No
## 190        15    No Yes
## 191        13    No Yes
## 192        14   Yes Yes
## 193        14    No  No
## 194        10   Yes Yes
## 195        11   Yes Yes
## 196        11   Yes Yes
## 197        16   Yes Yes
## 198        16   Yes  No
## 199        10   Yes Yes
## 200        14   Yes Yes
## 201        12    No  No
## 202        18   Yes  No
## 203        10    No Yes
## 204        14   Yes  No
## 205        14   Yes  No
## 206        12   Yes  No
## 207        17   Yes Yes
## 208        10    No  No
## 209        12   Yes  No
## 210        11    No Yes
## 211        14    No Yes
## 212        15   Yes Yes
## 213        11   Yes Yes
## 214        10   Yes Yes
## 215        18   Yes Yes
## 216        11   Yes Yes
## 217        17   Yes  No
## 218        14    No  No
## 219        14   Yes Yes
## 220        17   Yes Yes
## 221        10   Yes Yes
## 222        11   Yes  No
## 223        13   Yes Yes
## 224        14   Yes Yes
## 225        13    No  No
## 226        14   Yes  No
## 227        14   Yes  No
## 228        16   Yes Yes
## 229        11    No Yes
## 230        18    No  No
## 231        14    No  No
## 232        11    No  No
## 233        15   Yes Yes
## 234        14    No Yes
## 235        16    No Yes
## 236        17   Yes Yes
## 237        10   Yes Yes
```

```
## 238        10   Yes Yes
## 239        13   Yes  No
## 240        16   Yes Yes
## 241        18   Yes  No
## 242        12   Yes  No
## 243        14    No  No
## 244        10   Yes Yes
## 245        18   Yes  No
## 246        10    No Yes
## 247        18   Yes Yes
## 248        16   Yes  No
## 249        11   Yes Yes
## 250        11   Yes  No
## 251        14   Yes Yes
## 252        13   Yes Yes
## 253        16   Yes  No
## 254        12    No Yes
## 255        17   Yes Yes
## 256        15   Yes Yes
## 257        10   Yes  No
## 258        13   Yes Yes
## 259        14    No  No
## 260        11    No Yes
## 261        10   Yes Yes
## 262        15   Yes Yes
## 263        18   Yes Yes
## 264        17   Yes Yes
## 265        15   Yes Yes
## 266        17   Yes Yes
## 267        17    No Yes
## 268        12    No Yes
## 269        11   Yes  No
## 270        17   Yes  No
## 271        10   Yes  No
## 272        16   Yes  No
## 273        12   Yes  No
## 274        12   Yes Yes
## 275        11   Yes Yes
## 276        11   Yes Yes
## 277        15   Yes Yes
## 278        16   Yes Yes
## 279        15    No Yes
## 280        18   Yes Yes
## 281        10   Yes Yes
## 282        16    No Yes
## 283        11   Yes  No
## 284        16    No  No
## 285        17    No  No
## 286        10   Yes Yes
## 287        18    No Yes
## 288        17   Yes Yes
## 289        15    No  No
## 290        17   Yes Yes
## 291        11    No Yes
```

```
## 292        17   Yes  No
## 293        15   Yes Yes
## 294        10   Yes  No
## 295        11   Yes Yes
## 296        10    No Yes
## 297        18   Yes Yes
## 298        10   Yes Yes
## 299        15   Yes  No
## 300        17    No Yes
## 301        11   Yes Yes
## 302        16   Yes Yes
## 303        14   Yes Yes
## 304        11   Yes Yes
## 305        10   Yes Yes
## 306        13   Yes Yes
## 307        12   Yes Yes
## 308        12   Yes  No
## 309        10   Yes Yes
## 310        18   Yes Yes
## 311        12   Yes Yes
## 312        14   Yes Yes
## 313        10   Yes Yes
## 314        13   Yes  No
## 315        14   Yes Yes
## 316        14   Yes Yes
## 317        10   Yes Yes
## 318        15    No  No
## 319        14    No Yes
## 320        11    No Yes
## 321        18   Yes Yes
## 322        15   Yes  No
## 323        15   Yes Yes
## 324        12   Yes Yes
## 325        13   Yes Yes
## 326        11   Yes Yes
## 327        17   Yes  No
## 328        16   Yes Yes
## 329        11   Yes Yes
## 330        12   Yes Yes
## 331        14    No  No
## 332        10   Yes Yes
## 333        12   Yes Yes
## 334        10   Yes Yes
## 335        13   Yes Yes
## 336        15   Yes Yes
## 337        18   Yes  No
## 338        15   Yes  No
## 339        11   Yes  No
## 340        15   Yes Yes
## 341        16   Yes  No
## 342        10    No  No
## 343        10    No Yes
## 344        14   Yes Yes
## 345        13    No Yes
```

```
## 346        12   Yes  No
## 347        13    No  No
## 348        14    No  No
## 349        11   Yes Yes
## 350        14    No Yes
## 351        17    No Yes
## 352        16    No Yes
## 353        17   Yes Yes
## 354        12    No Yes
## 355        18   Yes Yes
## 356        11   Yes  No
## 357        12   Yes  No
## 358        15   Yes Yes
## 359        11   Yes Yes
## 360        14   Yes Yes
## 361        15    No Yes
## 362        15    No Yes
## 363        12   Yes Yes
## 364        12   Yes  No
## 365        14   Yes Yes
## 366        17    No  No
## 367        12    No Yes
## 368        17   Yes  No
## 369        14    No Yes
## 370        14   Yes Yes
## 371        12   Yes Yes
## 372        16   Yes  No
## 373        11    No  No
## 374        17   Yes  No
## 375        12   Yes Yes
## 376        11   Yes  No
## 377        11   Yes Yes
## 378        12    No  No
## 379        12   Yes Yes
## 380        15   Yes  No
## 381        17   Yes Yes
## 382        13   Yes Yes
## 383        14   Yes Yes
## 384        10   Yes  No
## 385        12   Yes Yes
## 386        17   Yes Yes
## 387        16   Yes  No
## 388        14    No Yes
## 389        16   Yes Yes
## 390        12   Yes Yes
## 391        12   Yes Yes
## 392        16   Yes  No
## 393        13   Yes Yes
## 394        17    No Yes
## 395        16   Yes Yes
## 396        14   Yes Yes
## 397        11    No Yes
## 398        18   Yes Yes
## 399        12   Yes Yes
```

```
## 400        16   Yes Yes
```

```
lm.fit=lm(Sales~Price+Urban+US)
# As above, lm.fit is a multiple regression model of sales and three predictors.
```

```
#(b)
summary(lm.fit)
```

```
##
## Call:
## lm(formula = Sales ~ Price + Urban + US)
##
## 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
```

```
contrasts(US)
```

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

```
contrasts(Urban)
```

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

```
#According to the results, the coefficient for price is -0.054459,and the
#p-value is smaller than the significance level we chose to prove it is
#statistically significant. The number means that when the prices increase
#an unit, the sales of the carseats for chirldren will decrease 0.054459.
#And the coefficients for the two qualitative predictors,which are Urban and US,
#are -0.021916 and 1.200573 repectively. R automatically make these
#two qualitative predictors as dummy variables, which we can know by contrasts() function.
#Therefore, the sales will decrease if the store is in
#the urban area. And the sale of stores in rural area is the baseline.
#However, this correlation is not significant according to the p-value.
#Similarly, the sales will increase if the stores are in the US,
#and the sales outside the US are the baseline. This correlation is
#significant from the results.
```

```
#(C)
#Sales=13.043469 - 0.054459*Price - 0.021916*Urban + 1.200537*US
```

```r
#(The urban=1 if the stores are in the urban areas,otherwise it equals to 0;
#The US=1 if the stores are in the US, otherwise it equals to 0)
```

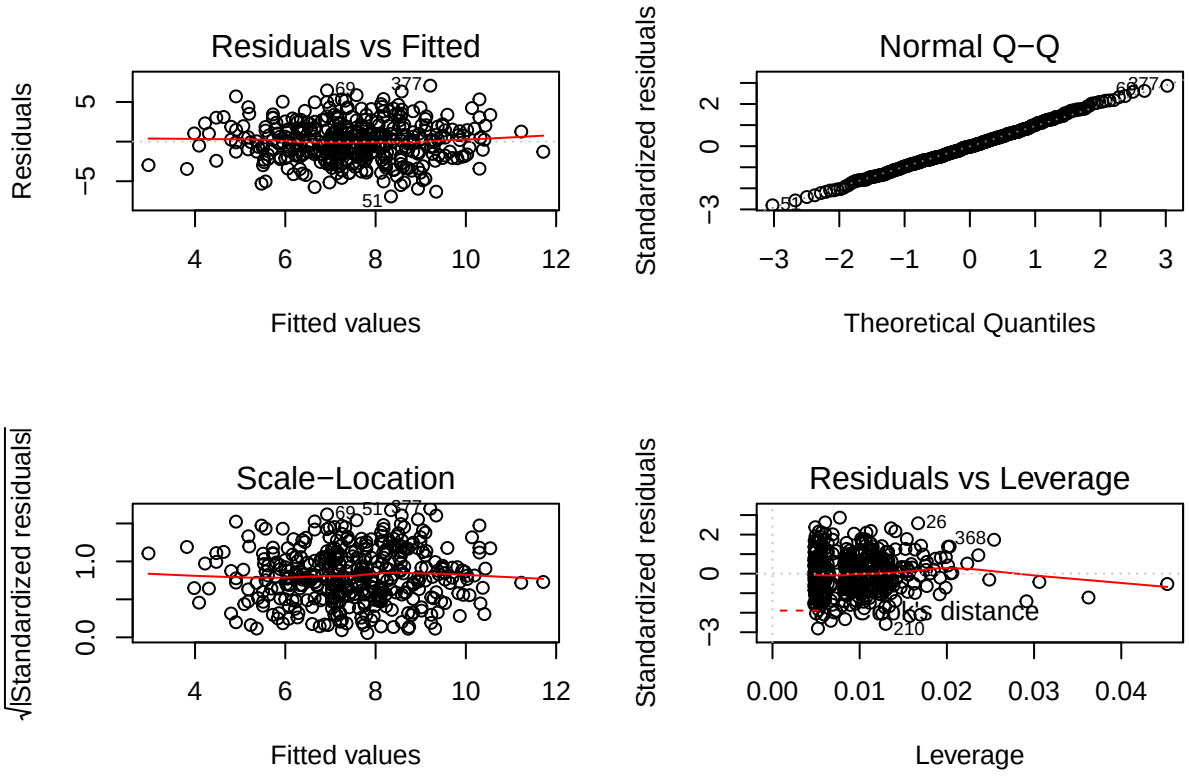
```r
#(d)
summary(lm.fit)
```

```
##
## Call:
## lm(formula = Sales ~ Price + Urban + US)
##
## 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
```

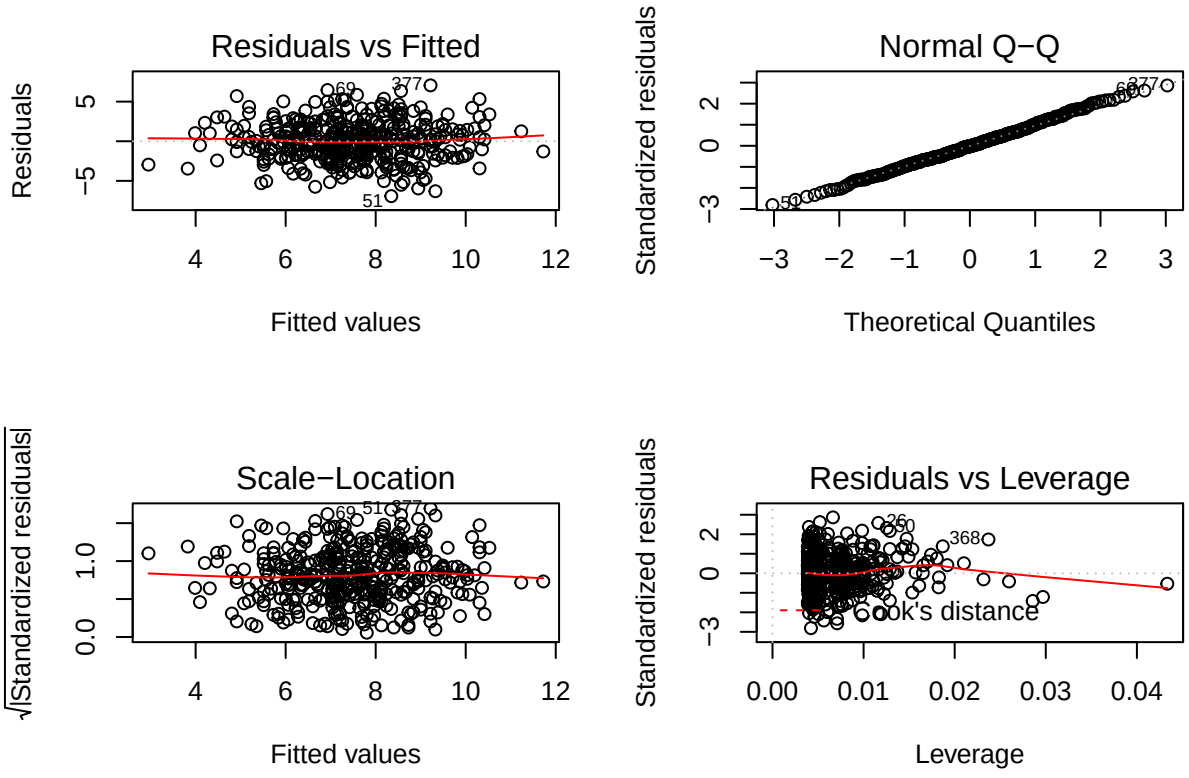
```r
# According to the results, price and us are statistically significant.
#Because the p-values and t-value are smaller than the signifance level,
#so we can deny the null hypothesis and accept the alternative hypothesis.
```

```r
#(e)
lm.fit2=lm(Sales~Price+US,data=Carseats)
#the lim.fit2 is the new smaller model, which only uses the
#significant predictors.
```

```r
#(f)
par(mfrow=c(2,2))
plot(lm.fit)
```




```
plot(lm.fit2)
```




```
anova(lm.fit,lm.fit2)
```

```
## Analysis of Variance Table
```

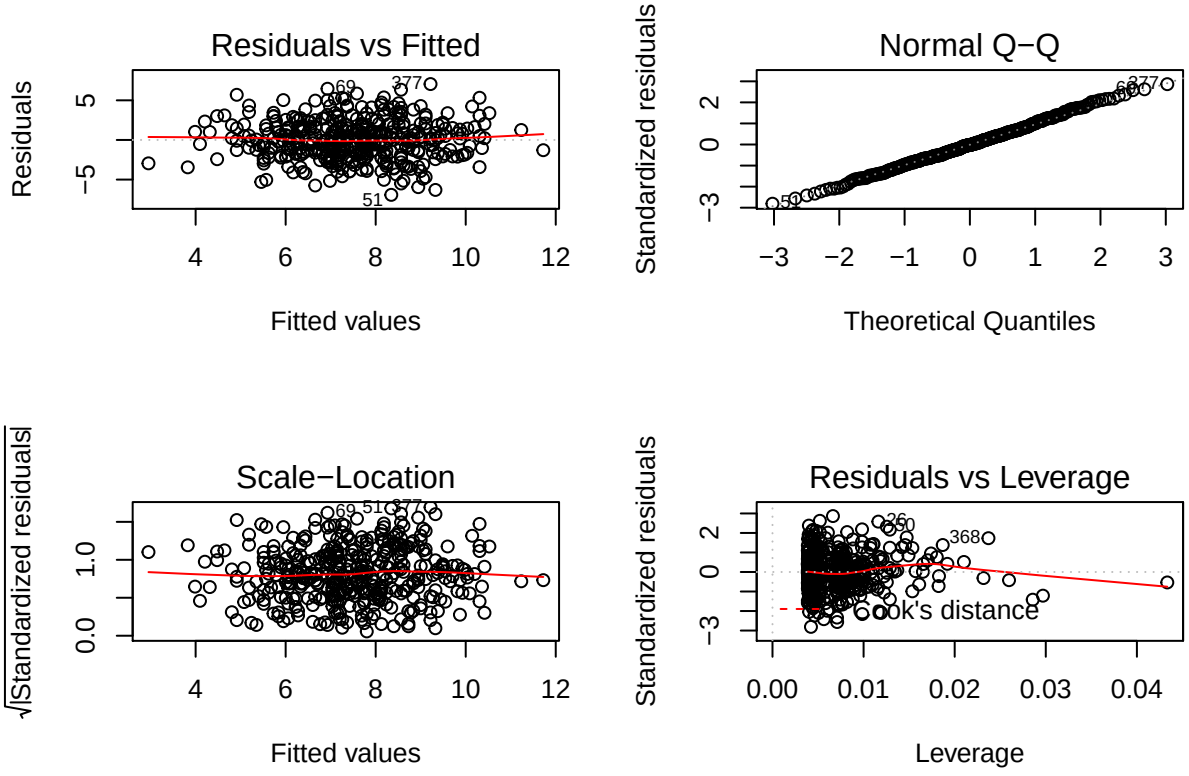
```
##
## Model 1: Sales ~ Price + Urban + US
## Model 2: Sales ~ Price + US
##   Res.Df    RSS Df Sum of Sq      F Pr(>F)
## 1    396 2420.8
## 2    397 2420.9 -1  -0.03979 0.0065 0.9357
```

```
#According to the results above, we can conclude that, generally,
#both of these two models fit well, but have high-leverage and outlier problem
#according to the plots.
#And compared between these two models, the difference is small but the
#latter one might fit better because the R-squre is a little bigger,so
#as anova function shows.
```

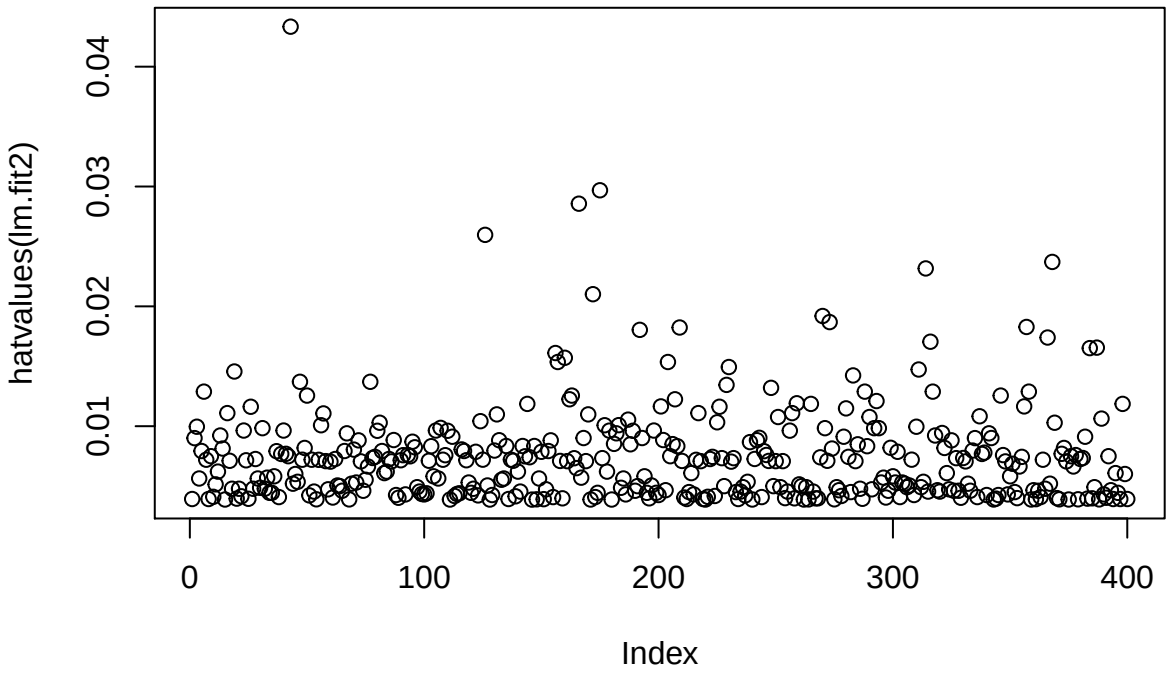
```
#(g)
confint(lm.fit2)
```

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

```
#(h)
par(mfrow=c(2,2))
plot(lm.fit2)
```




```
par(mfrow=c(1,1))
plot(hatvalues(lm.fit2))
```




```
#According to the plots, we can see that these are outliers and high-leverage
#problems in the model lm.fit2.
#In the Residuals vs Leverage plot we can see the high-leverage point 368
#which has a extremely big x value. Also, in the hatvalue plots,and
#Residuals vs fitted plots we can see the points with very big Y value,
#including 69, 377, 51 , are outliers.
```