Variable Selection from Heart Disease Data

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```
# Load the data

heart.data <- read.csv("https://archive.ics.uci.edu/ml/machine-learning-
databases/heart-
disease/processed.cleveland.data",header=FALSE,sep=",",na.strings = '?')
names(heart.data) <- c( "age", "sex", "chest_pain_type",
"resting_blood_pressure", "cholesterol","fasting_blood_sugar", "rest_ecg",
                   "max_heart_rate_achieved","exercise_induced_angina",
"st_depression","st_slope", "num_major_vessels", "thalassemia", "target")

str(heart.data)
```

```
## 'data.frame':    303 obs. of  14 variables:
##  $ age                    : num  63 67 67 37 41 56 62 57 63 53 ...
##  $ sex                    : num  1 1 1 1 0 1 0 0 1 1 ...
##  $ chest_pain_type        : num  1 4 4 3 2 2 4 4 4 4 ...
##  $ resting_blood_pressure : num  145 160 120 130 130 120 140 120 130 140
...
##  $ cholesterol            : num  233 286 229 250 204 236 268 354 254 203
...
##  $ fasting_blood_sugar    : num  1 0 0 0 0 0 0 0 0 1 ...
##  $ rest_ecg               : num  2 2 2 0 2 0 2 0 2 2 ...
##  $ max_heart_rate_achieved: num  150 108 129 187 172 178 160 163 147 155
...
##  $ exercise_induced_angina: num  0 1 1 0 0 0 0 1 0 1 ...
##  $ st_depression          : num  2.3 1.5 2.6 3.5 1.4 0.8 3.6 0.6 1.4 3.1
...
##  $ st_slope               : num  3 2 2 3 1 1 3 1 2 3 ...
##  $ num_major_vessels      : num  0 3 2 0 0 0 2 0 1 0 ...
##  $ thalassemia            : num  6 3 7 3 3 3 3 3 7 7 ...
##  $ target                 : int  0 2 1 0 0 0 3 0 2 1 ...
```

```
summary(heart.data)
```

```
##       age             sex         chest_pain_type resting_blood_pressure
##  Min.   :29.00   Min.   :0.0000   Min.   :1.000   Min.   : 94.0
##  1st Qu.:48.00   1st Qu.:0.0000   1st Qu.:3.000   1st Qu.:120.0
##  Median :56.00   Median :1.0000   Median :3.000   Median :130.0
##  Mean   :54.44   Mean   :0.6799   Mean   :3.158   Mean   :131.7
##  3rd Qu.:61.00   3rd Qu.:1.0000   3rd Qu.:4.000   3rd Qu.:140.0
##  Max.   :77.00   Max.   :1.0000   Max.   :4.000   Max.   :200.0
##
```

```
##   cholesterol    fasting_blood_sugar    rest_ecg
##  Min.   :126.0   Min.   :0.0000      Min.   :0.0000
##  1st Qu.:211.0   1st Qu.:0.0000      1st Qu.:0.0000
##  Median :241.0   Median :0.0000      Median :1.0000
##  Mean   :246.7   Mean   :0.1485      Mean   :0.9901
##  3rd Qu.:275.0   3rd Qu.:0.0000      3rd Qu.:2.0000
##  Max.   :564.0   Max.   :1.0000      Max.   :2.0000
##
##  max_heart_rate_achieved exercise_induced_angina st_depression
##  Min.   : 71.0           Min.   :0.0000          Min.   :0.00
##  1st Qu.:133.5           1st Qu.:0.0000          1st Qu.:0.00
##  Median :153.0           Median :0.0000          Median :0.80
##  Mean   :149.6           Mean   :0.3267          Mean   :1.04
##  3rd Qu.:166.0           3rd Qu.:1.0000          3rd Qu.:1.60
##  Max.   :202.0           Max.   :1.0000          Max.   :6.20
##
##     st_slope     num_major_vessels  thalassemia        target
##  Min.   :1.000   Min.   :0.0000    Min.   :3.000   Min.   :0.0000
##  1st Qu.:1.000   1st Qu.:0.0000    1st Qu.:3.000   1st Qu.:0.0000
##  Median :2.000   Median :0.0000    Median :3.000   Median :0.0000
##  Mean   :1.601   Mean   :0.6722    Mean   :4.734   Mean   :0.9373
##  3rd Qu.:2.000   3rd Qu.:1.0000    3rd Qu.:7.000   3rd Qu.:2.0000
##  Max.   :3.000   Max.   :3.0000    Max.   :7.000   Max.   :4.0000
##                  NA's   :4         NA's   :2
```

```
heart.data <- na.omit(heart.data)
```

I'm also going to change the values of the categorical variables, to improve the interpretation later on,

```
heart.data$chest_pain_type <- factor(heart.data$chest_pain_type,
                    levels = c(1,2,3,4),
                    labels = c("typical angina", "atypical angina","non-
anginal pain","asymptomatic"))




heart.data$target[heart.data$target > 0] <- 1

heart.data$target <- factor(heart.data$target,
                    levels = c(0,1),
                    labels = c("No", "Yes"))
```

Check the data now ..

```
summary(heart.data)
```

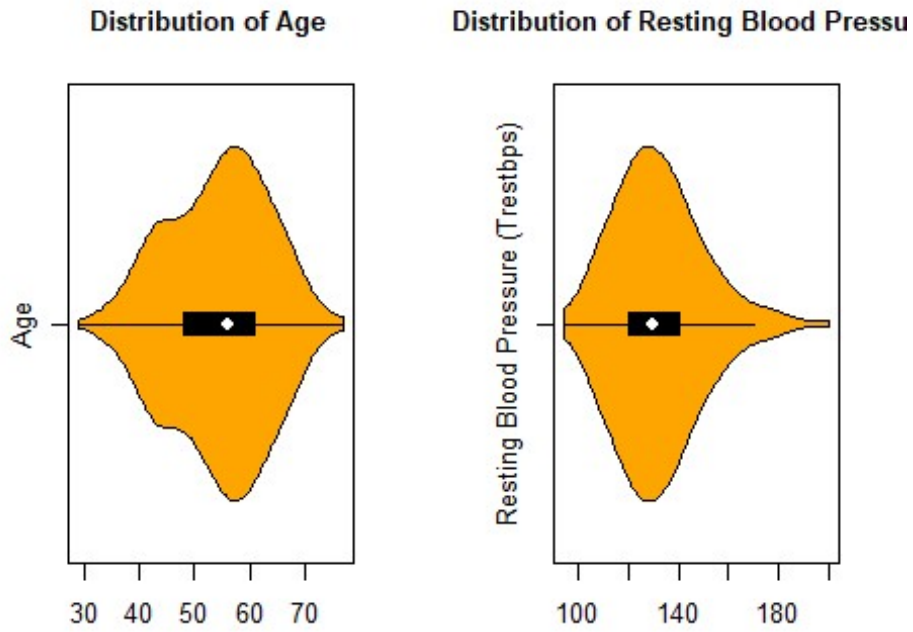
```
##       age             sex                 chest_pain_type
##  Min.   :29.00   Min.   :0.0000   typical angina  : 23
##  1st Qu.:48.00   1st Qu.:0.0000   atypical angina : 49
```

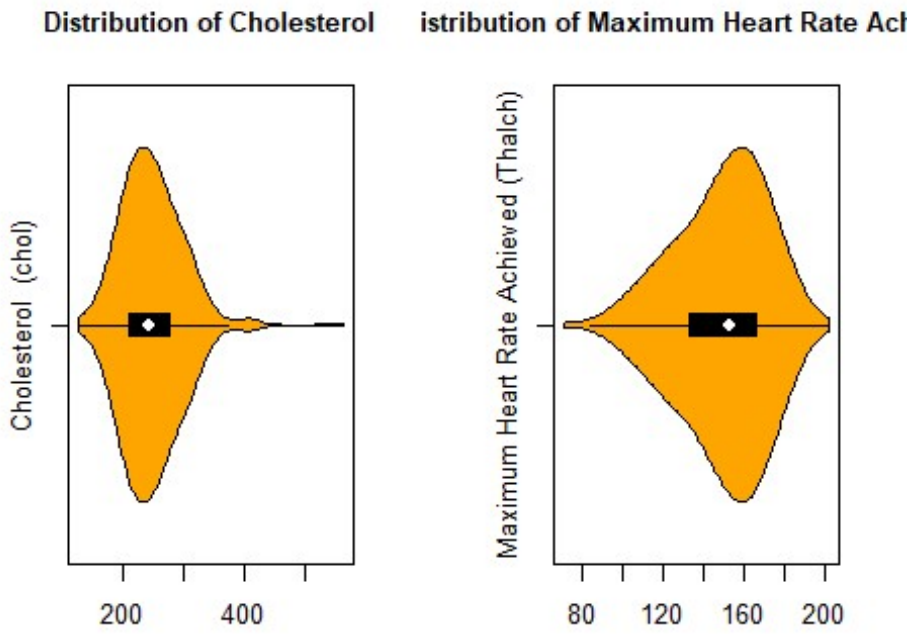
```
##  Median :56.00   Median :1.0000   non-anginal pain: 83
##  Mean   :54.54   Mean   :0.6768   asymptomatic    :142
##  3rd Qu.:61.00   3rd Qu.:1.0000
##  Max.   :77.00   Max.   :1.0000
##  resting_blood_pressure  cholesterol    fasting_blood_sugar
##  Min.   : 94.0          Min.   :126.0   Min.   :0.0000
##  1st Qu.:120.0          1st Qu.:211.0   1st Qu.:0.0000
##  Median :130.0          Median :243.0   Median :0.0000
##  Mean   :131.7          Mean   :247.4   Mean   :0.1448
##  3rd Qu.:140.0          3rd Qu.:276.0   3rd Qu.:0.0000
##  Max.   :200.0          Max.   :564.0   Max.   :1.0000
##     rest_ecg      max_heart_rate_achieved exercise_induced_angina
##  Min.   :0.0000   Min.   : 71.0           Min.   :0.0000
##  1st Qu.:0.0000   1st Qu.:133.0           1st Qu.:0.0000
##  Median :1.0000   Median :153.0           Median :0.0000
##  Mean   :0.9966   Mean   :149.6           Mean   :0.3266
##  3rd Qu.:2.0000   3rd Qu.:166.0           3rd Qu.:1.0000
##  Max.   :2.0000   Max.   :202.0           Max.   :1.0000
##  st_depression      st_slope     num_major_vessels  thalassemia
##  Min.   :0.000   Min.   :1.000   Min.   :0.0000    Min.   :3.000
##  1st Qu.:0.000   1st Qu.:1.000   1st Qu.:0.0000    1st Qu.:3.000
##  Median :0.800   Median :2.000   Median :0.0000    Median :3.000
##  Mean   :1.056   Mean   :1.603   Mean   :0.6768    Mean   :4.731
##  3rd Qu.:1.600   3rd Qu.:2.000   3rd Qu.:1.0000    3rd Qu.:7.000
##  Max.   :6.200   Max.   :3.000   Max.   :3.0000    Max.   :7.000
##  target
##  No :160
##  Yes:137
##
##
##
##
```

Producing violin plots for distribution of contineous features

```
library(vioplot)

## Loading required package: sm

## Package 'sm', version 2.2-5.6: type help(sm) for summary information

## Loading required package: zoo

##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric

par(mfrow = c(2,2))
with(heart.data,vioplot(age,names="Age",horizontal=TRUE, col = "orange", main
```

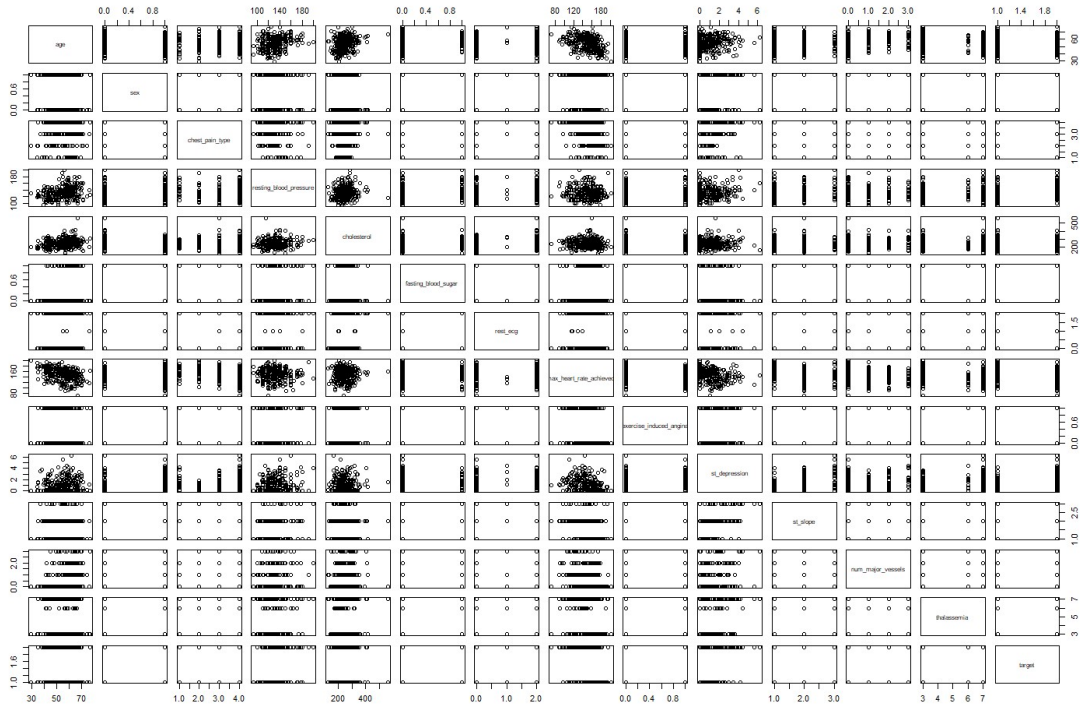
```
= "Distribution of Age"))
with(heart.data,vioplot(resting_blood_pressure  ,names="Resting Blood
Pressure (Trestbps)",horizontal=TRUE, col = "orange", main = "Distribution of
Resting Blood Pressure"))
with(heart.data,vioplot(cholesterol ,names="Cholesterol
(chol)",horizontal=TRUE, col = "orange", main = "Distribution of
Cholesterol"))
with(heart.data,vioplot(max_heart_rate_achieved  ,names="Maximum Heart Rate
Achieved (Thalch)",horizontal=TRUE, col = "orange", main = "Distribution of
Maximum Heart Rate Achieved"))
```





Creating a pair plot

```
plot(heart.data)
```



Checking the multicollinearity using VIF

```
round(diag(solve(cor(heart.data[,c(1,2,4,5,6,7,8,9,10,11)]))),2)
```

```
##                      age                      sex  resting_blood_pressure
##                     1.39                     1.10                    1.18
##              cholesterol     fasting_blood_sugar                rest_ecg
##                     1.13                     1.05                    1.08
## max_heart_rate_achieved exercise_induced_angina           st_depression
##                     1.57                     1.25                    1.64
##                 st_slope
##                     1.63
```

```
heart.data
```

```
##     age sex  chest_pain_type resting_blood_pressure cholesterol
## 1    63   1   typical angina                   145         233
## 2    67   1     asymptomatic                   160         286
## 3    67   1     asymptomatic                   120         229
## 4    37   1 non-anginal pain                   130         250
## 5    41   0  atypical angina                   130         204
## 6    56   1  atypical angina                   120         236
## 7    62   0     asymptomatic                   140         268
## 8    57   0     asymptomatic                   120         354
## 9    63   1     asymptomatic                   130         254
## 10   53   1     asymptomatic                   140         203
## 11   57   1     asymptomatic                   140         192
## 12   56   0  atypical angina                   140         294
```

```
## 13   56   1 non-anginal pain                 130         256
## 14   44   1  atypical angina                 120         263
## 15   52   1 non-anginal pain                 172         199
## 16   57   1 non-anginal pain                 150         168
## 17   48   1  atypical angina                 110         229
## 18   54   1     asymptomatic                 140         239
## 19   48   0 non-anginal pain                 130         275
## 20   49   1  atypical angina                 130         266
## 21   64   1   typical angina                 110         211
## 22   58   0   typical angina                 150         283
## 23   58   1  atypical angina                 120         284
## 24   58   1 non-anginal pain                 132         224
## 25   60   1     asymptomatic                 130         206
## 26   50   0 non-anginal pain                 120         219
## 27   58   0 non-anginal pain                 120         340
## 28   66   0   typical angina                 150         226
## 29   43   1     asymptomatic                 150         247
## 30   40   1     asymptomatic                 110         167
## 31   69   0   typical angina                 140         239
## 32   60   1     asymptomatic                 117         230
## 33   64   1 non-anginal pain                 140         335
## 34   59   1     asymptomatic                 135         234
## 35   44   1 non-anginal pain                 130         233
## 36   42   1     asymptomatic                 140         226
## 37   43   1     asymptomatic                 120         177
## 38   57   1     asymptomatic                 150         276
## 39   55   1     asymptomatic                 132         353
## 40   61   1 non-anginal pain                 150         243
## 41   65   0     asymptomatic                 150         225
## 42   40   1   typical angina                 140         199
## 43   71   0  atypical angina                 160         302
## 44   59   1 non-anginal pain                 150         212
## 45   61   0     asymptomatic                 130         330
## 46   58   1 non-anginal pain                 112         230
## 47   51   1 non-anginal pain                 110         175
## 48   50   1     asymptomatic                 150         243
## 49   65   0 non-anginal pain                 140         417
## 50   53   1 non-anginal pain                 130         197
## 51   41   0  atypical angina                 105         198
## 52   65   1     asymptomatic                 120         177
## 53   44   1     asymptomatic                 112         290
## 54   44   1  atypical angina                 130         219
## 55   60   1     asymptomatic                 130         253
## 56   54   1     asymptomatic                 124         266
## 57   50   1 non-anginal pain                 140         233
## 58   41   1     asymptomatic                 110         172
## 59   54   1 non-anginal pain                 125         273
## 60   51   1   typical angina                 125         213
## 61   51   0     asymptomatic                 130         305
## 62   46   0 non-anginal pain                 142         177
```

```
## 63   58   1     asymptomatic                128         216
## 64   54   0 non-anginal pain                135         304
## 65   54   1     asymptomatic                120         188
## 66   60   1     asymptomatic                145         282
## 67   60   1 non-anginal pain                140         185
## 68   54   1 non-anginal pain                150         232
## 69   59   1     asymptomatic                170         326
## 70   46   1 non-anginal pain                150         231
## 71   65   0 non-anginal pain                155         269
## 72   67   1     asymptomatic                125         254
## 73   62   1     asymptomatic                120         267
## 74   65   1     asymptomatic                110         248
## 75   44   1     asymptomatic                110         197
## 76   65   0 non-anginal pain                160         360
## 77   60   1     asymptomatic                125         258
## 78   51   0 non-anginal pain                140         308
## 79   48   1  atypical angina                130         245
## 80   58   1     asymptomatic                150         270
## 81   45   1     asymptomatic                104         208
## 82   53   0     asymptomatic                130         264
## 83   39   1 non-anginal pain                140         321
## 84   68   1 non-anginal pain                180         274
## 85   52   1  atypical angina                120         325
## 86   44   1 non-anginal pain                140         235
## 87   47   1 non-anginal pain                138         257
## 89   53   0     asymptomatic                138         234
## 90   51   0 non-anginal pain                130         256
## 91   66   1     asymptomatic                120         302
## 92   62   0     asymptomatic                160         164
## 93   62   1 non-anginal pain                130         231
## 94   44   0 non-anginal pain                108         141
## 95   63   0 non-anginal pain                135         252
## 96   52   1     asymptomatic                128         255
## 97   59   1     asymptomatic                110         239
## 98   60   0     asymptomatic                150         258
## 99   52   1  atypical angina                134         201
## 100  48   1     asymptomatic                122         222
## 101  45   1     asymptomatic                115         260
## 102  34   1   typical angina                118         182
## 103  57   0     asymptomatic                128         303
## 104  71   0 non-anginal pain                110         265
## 105  49   1 non-anginal pain                120         188
## 106  54   1  atypical angina                108         309
## 107  59   1     asymptomatic                140         177
## 108  57   1 non-anginal pain                128         229
## 109  61   1     asymptomatic                120         260
## 110  39   1     asymptomatic                118         219
## 111  61   0     asymptomatic                145         307
## 112  56   1     asymptomatic                125         249
## 113  52   1   typical angina                118         186
```

```
## 114  43   0     asymptomatic                132          341
## 115  62   0 non-anginal pain                130          263
## 116  41   1  atypical angina                135          203
## 117  58   1 non-anginal pain                140          211
## 118  35   0     asymptomatic                138          183
## 119  63   1     asymptomatic                130          330
## 120  65   1     asymptomatic                135          254
## 121  48   1     asymptomatic                130          256
## 122  63   0     asymptomatic                150          407
## 123  51   1 non-anginal pain                100          222
## 124  55   1     asymptomatic                140          217
## 125  65   1   typical angina                138          282
## 126  45   0  atypical angina                130          234
## 127  56   0     asymptomatic                200          288
## 128  54   1     asymptomatic                110          239
## 129  44   1  atypical angina                120          220
## 130  62   0     asymptomatic                124          209
## 131  54   1 non-anginal pain                120          258
## 132  51   1 non-anginal pain                 94          227
## 133  29   1  atypical angina                130          204
## 134  51   1     asymptomatic                140          261
## 135  43   0 non-anginal pain                122          213
## 136  55   0  atypical angina                135          250
## 137  70   1     asymptomatic                145          174
## 138  62   1  atypical angina                120          281
## 139  35   1     asymptomatic                120          198
## 140  51   1 non-anginal pain                125          245
## 141  59   1  atypical angina                140          221
## 142  59   1   typical angina                170          288
## 143  52   1  atypical angina                128          205
## 144  64   1 non-anginal pain                125          309
## 145  58   1 non-anginal pain                105          240
## 146  47   1 non-anginal pain                108          243
## 147  57   1     asymptomatic                165          289
## 148  41   1 non-anginal pain                112          250
## 149  45   1  atypical angina                128          308
## 150  60   0 non-anginal pain                102          318
## 151  52   1   typical angina                152          298
## 152  42   0     asymptomatic                102          265
## 153  67   0 non-anginal pain                115          564
## 154  55   1     asymptomatic                160          289
## 155  64   1     asymptomatic                120          246
## 156  70   1     asymptomatic                130          322
## 157  51   1     asymptomatic                140          299
## 158  58   1     asymptomatic                125          300
## 159  60   1     asymptomatic                140          293
## 160  68   1 non-anginal pain                118          277
## 161  46   1  atypical angina                101          197
## 162  77   1     asymptomatic                125          304
## 163  54   0 non-anginal pain                110          214
```

```
## 164  58   0     asymptomatic                100         248
## 165  48   1 non-anginal pain                124         255
## 166  57   1     asymptomatic                132         207
## 168  54   0  atypical angina                132         288
## 169  35   1     asymptomatic                126         282
## 170  45   0  atypical angina                112         160
## 171  70   1 non-anginal pain                160         269
## 172  53   1     asymptomatic                142         226
## 173  59   0     asymptomatic                174         249
## 174  62   0     asymptomatic                140         394
## 175  64   1     asymptomatic                145         212
## 176  57   1     asymptomatic                152         274
## 177  52   1     asymptomatic                108         233
## 178  56   1     asymptomatic                132         184
## 179  43   1 non-anginal pain                130         315
## 180  53   1 non-anginal pain                130         246
## 181  48   1     asymptomatic                124         274
## 182  56   0     asymptomatic                134         409
## 183  42   1   typical angina                148         244
## 184  59   1   typical angina                178         270
## 185  60   0     asymptomatic                158         305
## 186  63   0  atypical angina                140         195
## 187  42   1 non-anginal pain                120         240
## 188  66   1  atypical angina                160         246
## 189  54   1  atypical angina                192         283
## 190  69   1 non-anginal pain                140         254
## 191  50   1 non-anginal pain                129         196
## 192  51   1     asymptomatic                140         298
## 194  62   0     asymptomatic                138         294
## 195  68   0 non-anginal pain                120         211
## 196  67   1     asymptomatic                100         299
## 197  69   1   typical angina                160         234
## 198  45   0     asymptomatic                138         236
## 199  50   0  atypical angina                120         244
## 200  59   1   typical angina                160         273
## 201  50   0     asymptomatic                110         254
## 202  64   0     asymptomatic                180         325
## 203  57   1 non-anginal pain                150         126
## 204  64   0 non-anginal pain                140         313
## 205  43   1     asymptomatic                110         211
## 206  45   1     asymptomatic                142         309
## 207  58   1     asymptomatic                128         259
## 208  50   1     asymptomatic                144         200
## 209  55   1  atypical angina                130         262
## 210  62   0     asymptomatic                150         244
## 211  37   0 non-anginal pain                120         215
## 212  38   1   typical angina                120         231
## 213  41   1 non-anginal pain                130         214
## 214  66   0     asymptomatic                178         228
## 215  52   1     asymptomatic                112         230
```

```
## 216  56   1   typical angina                  120         193
## 217  46   0  atypical angina                  105         204
## 218  46   0     asymptomatic                  138         243
## 219  64   0     asymptomatic                  130         303
## 220  59   1     asymptomatic                  138         271
## 221  41   0 non-anginal pain                  112         268
## 222  54   0 non-anginal pain                  108         267
## 223  39   0 non-anginal pain                   94         199
## 224  53   1     asymptomatic                  123         282
## 225  63   0     asymptomatic                  108         269
## 226  34   0  atypical angina                  118         210
## 227  47   1     asymptomatic                  112         204
## 228  67   0 non-anginal pain                  152         277
## 229  54   1     asymptomatic                  110         206
## 230  66   1     asymptomatic                  112         212
## 231  52   0 non-anginal pain                  136         196
## 232  55   0     asymptomatic                  180         327
## 233  49   1 non-anginal pain                  118         149
## 234  74   0  atypical angina                  120         269
## 235  54   0 non-anginal pain                  160         201
## 236  54   1     asymptomatic                  122         286
## 237  56   1     asymptomatic                  130         283
## 238  46   1     asymptomatic                  120         249
## 239  49   0  atypical angina                  134         271
## 240  42   1  atypical angina                  120         295
## 241  41   1  atypical angina                  110         235
## 242  41   0  atypical angina                  126         306
## 243  49   0     asymptomatic                  130         269
## 244  61   1   typical angina                  134         234
## 245  60   0 non-anginal pain                  120         178
## 246  67   1     asymptomatic                  120         237
## 247  58   1     asymptomatic                  100         234
## 248  47   1     asymptomatic                  110         275
## 249  52   1     asymptomatic                  125         212
## 250  62   1  atypical angina                  128         208
## 251  57   1     asymptomatic                  110         201
## 252  58   1     asymptomatic                  146         218
## 253  64   1     asymptomatic                  128         263
## 254  51   0 non-anginal pain                  120         295
## 255  43   1     asymptomatic                  115         303
## 256  42   0 non-anginal pain                  120         209
## 257  67   0     asymptomatic                  106         223
## 258  76   0 non-anginal pain                  140         197
## 259  70   1  atypical angina                  156         245
## 260  57   1  atypical angina                  124         261
## 261  44   0 non-anginal pain                  118         242
## 262  58   0  atypical angina                  136         319
## 263  60   0   typical angina                  150         240
## 264  44   1 non-anginal pain                  120         226
## 265  61   1     asymptomatic                  138         166
```

```
## 266  42   1     asymptomatic                    136          315
## 268  59   1 non-anginal pain                    126          218
## 269  40   1     asymptomatic                    152          223
## 270  42   1 non-anginal pain                    130          180
## 271  61   1     asymptomatic                    140          207
## 272  66   1     asymptomatic                    160          228
## 273  46   1     asymptomatic                    140          311
## 274  71   0     asymptomatic                    112          149
## 275  59   1   typical angina                    134          204
## 276  64   1   typical angina                    170          227
## 277  66   0 non-anginal pain                    146          278
## 278  39   0 non-anginal pain                    138          220
## 279  57   1  atypical angina                    154          232
## 280  58   0     asymptomatic                    130          197
## 281  57   1     asymptomatic                    110          335
## 282  47   1 non-anginal pain                    130          253
## 283  55   0     asymptomatic                    128          205
## 284  35   1  atypical angina                    122          192
## 285  61   1     asymptomatic                    148          203
## 286  58   1     asymptomatic                    114          318
## 287  58   0     asymptomatic                    170          225
## 289  56   1  atypical angina                    130          221
## 290  56   1  atypical angina                    120          240
## 291  67   1 non-anginal pain                    152          212
## 292  55   0  atypical angina                    132          342
## 293  44   1     asymptomatic                    120          169
## 294  63   1     asymptomatic                    140          187
## 295  63   0     asymptomatic                    124          197
## 296  41   1  atypical angina                    120          157
## 297  59   1     asymptomatic                    164          176
## 298  57   0     asymptomatic                    140          241
## 299  45   1   typical angina                    110          264
## 300  68   1     asymptomatic                    144          193
## 301  57   1     asymptomatic                    130          131
## 302  57   0  atypical angina                    130          236
##     fasting_blood_sugar rest_ecg max_heart_rate_achieved
## 1                     1        2                     150
## 2                     0        2                     108
## 3                     0        2                     129
## 4                     0        0                     187
## 5                     0        2                     172
## 6                     0        0                     178
## 7                     0        2                     160
## 8                     0        0                     163
## 9                     0        2                     147
## 10                    1        2                     155
## 11                    0        0                     148
## 12                    0        2                     153
## 13                    1        2                     142
## 14                    0        0                     173
```

```
## 15                    1         0                   162
## 16                    0         0                   174
## 17                    0         0                   168
## 18                    0         0                   160
## 19                    0         0                   139
## 20                    0         0                   171
## 21                    0         2                   144
## 22                    1         2                   162
## 23                    0         2                   160
## 24                    0         2                   173
## 25                    0         2                   132
## 26                    0         0                   158
## 27                    0         0                   172
## 28                    0         0                   114
## 29                    0         0                   171
## 30                    0         2                   114
## 31                    0         0                   151
## 32                    1         0                   160
## 33                    0         0                   158
## 34                    0         0                   161
## 35                    0         0                   179
## 36                    0         0                   178
## 37                    0         2                   120
## 38                    0         2                   112
## 39                    0         0                   132
## 40                    1         0                   137
## 41                    0         2                   114
## 42                    0         0                   178
## 43                    0         0                   162
## 44                    1         0                   157
## 45                    0         2                   169
## 46                    0         2                   165
## 47                    0         0                   123
## 48                    0         2                   128
## 49                    1         2                   157
## 50                    1         2                   152
## 51                    0         0                   168
## 52                    0         0                   140
## 53                    0         2                   153
## 54                    0         2                   188
## 55                    0         0                   144
## 56                    0         2                   109
## 57                    0         0                   163
## 58                    0         2                   158
## 59                    0         2                   152
## 60                    0         2                   125
## 61                    0         0                   142
## 62                    0         2                   160
## 63                    0         2                   131
## 64                    1         0                   170
```

```
## 65                    0        0                    113
## 66                    0        2                    142
## 67                    0        2                    155
## 68                    0        2                    165
## 69                    0        2                    140
## 70                    0        0                    147
## 71                    0        0                    148
## 72                    1        0                    163
## 73                    0        0                     99
## 74                    0        2                    158
## 75                    0        2                    177
## 76                    0        2                    151
## 77                    0        2                    141
## 78                    0        2                    142
## 79                    0        2                    180
## 80                    0        2                    111
## 81                    0        2                    148
## 82                    0        2                    143
## 83                    0        2                    182
## 84                    1        2                    150
## 85                    0        0                    172
## 86                    0        2                    180
## 87                    0        2                    156
## 89                    0        2                    160
## 90                    0        2                    149
## 91                    0        2                    151
## 92                    0        2                    145
## 93                    0        0                    146
## 94                    0        0                    175
## 95                    0        2                    172
## 96                    0        0                    161
## 97                    0        2                    142
## 98                    0        2                    157
## 99                    0        0                    158
## 100                   0        2                    186
## 101                   0        2                    185
## 102                   0        2                    174
## 103                   0        2                    159
## 104                   1        2                    130
## 105                   0        0                    139
## 106                   0        0                    156
## 107                   0        0                    162
## 108                   0        2                    150
## 109                   0        0                    140
## 110                   0        0                    140
## 111                   0        2                    146
## 112                   1        2                    144
## 113                   0        2                    190
## 114                   1        2                    136
## 115                   0        0                     97
```

```
## 116                  0        0                  132
## 117                  1        2                  165
## 118                  0        0                  182
## 119                  1        2                  132
## 120                  0        2                  127
## 121                  1        2                  150
## 122                  0        2                  154
## 123                  0        0                  143
## 124                  0        0                  111
## 125                  1        2                  174
## 126                  0        2                  175
## 127                  1        2                  133
## 128                  0        0                  126
## 129                  0        0                  170
## 130                  0        0                  163
## 131                  0        2                  147
## 132                  0        0                  154
## 133                  0        2                  202
## 134                  0        2                  186
## 135                  0        0                  165
## 136                  0        2                  161
## 137                  0        0                  125
## 138                  0        2                  103
## 139                  0        0                  130
## 140                  1        2                  166
## 141                  0        0                  164
## 142                  0        2                  159
## 143                  1        0                  184
## 144                  0        0                  131
## 145                  0        2                  154
## 146                  0        0                  152
## 147                  1        2                  124
## 148                  0        0                  179
## 149                  0        2                  170
## 150                  0        0                  160
## 151                  1        0                  178
## 152                  0        2                  122
## 153                  0        2                  160
## 154                  0        2                  145
## 155                  0        2                   96
## 156                  0        2                  109
## 157                  0        0                  173
## 158                  0        2                  171
## 159                  0        2                  170
## 160                  0        0                  151
## 161                  1        0                  156
## 162                  0        2                  162
## 163                  0        0                  158
## 164                  0        2                  122
## 165                  1        0                  175
```

```
## 166                  0        0                  168
## 168                  1        2                  159
## 169                  0        2                  156
## 170                  0        0                  138
## 171                  0        0                  112
## 172                  0        2                  111
## 173                  0        0                  143
## 174                  0        2                  157
## 175                  0        2                  132
## 176                  0        0                   88
## 177                  1        0                  147
## 178                  0        2                  105
## 179                  0        0                  162
## 180                  1        2                  173
## 181                  0        2                  166
## 182                  0        2                  150
## 183                  0        2                  178
## 184                  0        2                  145
## 185                  0        2                  161
## 186                  0        0                  179
## 187                  1        0                  194
## 188                  0        0                  120
## 189                  0        2                  195
## 190                  0        2                  146
## 191                  0        0                  163
## 192                  0        0                  122
## 194                  1        0                  106
## 195                  0        2                  115
## 196                  0        2                  125
## 197                  1        2                  131
## 198                  0        2                  152
## 199                  0        0                  162
## 200                  0        2                  125
## 201                  0        2                  159
## 202                  0        0                  154
## 203                  1        0                  173
## 204                  0        0                  133
## 205                  0        0                  161
## 206                  0        2                  147
## 207                  0        2                  130
## 208                  0        2                  126
## 209                  0        0                  155
## 210                  0        0                  154
## 211                  0        0                  170
## 212                  0        0                  182
## 213                  0        2                  168
## 214                  1        0                  165
## 215                  0        0                  160
## 216                  0        2                  162
## 217                  0        0                  172
```

```
## 218                   0        2                   152
## 219                   0        0                   122
## 220                   0        2                   182
## 221                   0        2                   172
## 222                   0        2                   167
## 223                   0        0                   179
## 224                   0        0                    95
## 225                   0        0                   169
## 226                   0        0                   192
## 227                   0        0                   143
## 228                   0        0                   172
## 229                   0        2                   108
## 230                   0        2                   132
## 231                   0        2                   169
## 232                   0        1                   117
## 233                   0        2                   126
## 234                   0        2                   121
## 235                   0        0                   163
## 236                   0        2                   116
## 237                   1        2                   103
## 238                   0        2                   144
## 239                   0        0                   162
## 240                   0        0                   162
## 241                   0        0                   153
## 242                   0        0                   163
## 243                   0        0                   163
## 244                   0        0                   145
## 245                   1        0                    96
## 246                   0        0                    71
## 247                   0        0                   156
## 248                   0        2                   118
## 249                   0        0                   168
## 250                   1        2                   140
## 251                   0        0                   126
## 252                   0        0                   105
## 253                   0        0                   105
## 254                   0        2                   157
## 255                   0        0                   181
## 256                   0        0                   173
## 257                   0        0                   142
## 258                   0        1                   116
## 259                   0        2                   143
## 260                   0        0                   141
## 261                   0        0                   149
## 262                   1        2                   152
## 263                   0        0                   171
## 264                   0        0                   169
## 265                   0        2                   125
## 266                   0        0                   125
## 268                   1        0                   134
```

```
## 269                    0        0                    181
## 270                    0        0                    150
## 271                    0        2                    138
## 272                    0        2                    138
## 273                    0        0                    120
## 274                    0        0                    125
## 275                    0        0                    162
## 276                    0        2                    155
## 277                    0        2                    152
## 278                    0        0                    152
## 279                    0        2                    164
## 280                    0        0                    131
## 281                    0        0                    143
## 282                    0        0                    179
## 283                    0        1                    130
## 284                    0        0                    174
## 285                    0        0                    161
## 286                    0        1                    140
## 287                    1        2                    146
## 289                    0        2                    163
## 290                    0        0                    169
## 291                    0        2                    150
## 292                    0        0                    166
## 293                    0        0                    144
## 294                    0        2                    144
## 295                    0        0                    136
## 296                    0        0                    182
## 297                    1        2                     90
## 298                    0        0                    123
## 299                    0        0                    132
## 300                    1        0                    141
## 301                    0        0                    115
## 302                    0        2                    174
##     exercise_induced_angina st_depression st_slope num_major_vessels
## 1                         0           2.3        3                 0
## 2                         1           1.5        2                 3
## 3                         1           2.6        2                 2
## 4                         0           3.5        3                 0
## 5                         0           1.4        1                 0
## 6                         0           0.8        1                 0
## 7                         0           3.6        3                 2
## 8                         1           0.6        1                 0
## 9                         0           1.4        2                 1
## 10                        1           3.1        3                 0
## 11                        0           0.4        2                 0
## 12                        0           1.3        2                 0
## 13                        1           0.6        2                 1
## 14                        0           0.0        1                 0
## 15                        0           0.5        1                 0
## 16                        0           1.6        1                 0
```

```
## 17                    0          1.0        3                  0
## 18                    0          1.2        1                  0
## 19                    0          0.2        1                  0
## 20                    0          0.6        1                  0
## 21                    1          1.8        2                  0
## 22                    0          1.0        1                  0
## 23                    0          1.8        2                  0
## 24                    0          3.2        1                  2
## 25                    1          2.4        2                  2
## 26                    0          1.6        2                  0
## 27                    0          0.0        1                  0
## 28                    0          2.6        3                  0
## 29                    0          1.5        1                  0
## 30                    1          2.0        2                  0
## 31                    0          1.8        1                  2
## 32                    1          1.4        1                  2
## 33                    0          0.0        1                  0
## 34                    0          0.5        2                  0
## 35                    1          0.4        1                  0
## 36                    0          0.0        1                  0
## 37                    1          2.5        2                  0
## 38                    1          0.6        2                  1
## 39                    1          1.2        2                  1
## 40                    1          1.0        2                  0
## 41                    0          1.0        2                  3
## 42                    1          1.4        1                  0
## 43                    0          0.4        1                  2
## 44                    0          1.6        1                  0
## 45                    0          0.0        1                  0
## 46                    0          2.5        2                  1
## 47                    0          0.6        1                  0
## 48                    0          2.6        2                  0
## 49                    0          0.8        1                  1
## 50                    0          1.2        3                  0
## 51                    0          0.0        1                  1
## 52                    0          0.4        1                  0
## 53                    0          0.0        1                  1
## 54                    0          0.0        1                  0
## 55                    1          1.4        1                  1
## 56                    1          2.2        2                  1
## 57                    0          0.6        2                  1
## 58                    0          0.0        1                  0
## 59                    0          0.5        3                  1
## 60                    1          1.4        1                  1
## 61                    1          1.2        2                  0
## 62                    1          1.4        3                  0
## 63                    1          2.2        2                  3
## 64                    0          0.0        1                  0
## 65                    0          1.4        2                  1
## 66                    1          2.8        2                  2
```

```
## 67                      0           3.0         2                   0
## 68                      0           1.6         1                   0
## 69                      1           3.4         3                   0
## 70                      0           3.6         2                   0
## 71                      0           0.8         1                   0
## 72                      0           0.2         2                   2
## 73                      1           1.8         2                   2
## 74                      0           0.6         1                   2
## 75                      0           0.0         1                   1
## 76                      0           0.8         1                   0
## 77                      1           2.8         2                   1
## 78                      0           1.5         1                   1
## 79                      0           0.2         2                   0
## 80                      1           0.8         1                   0
## 81                      1           3.0         2                   0
## 82                      0           0.4         2                   0
## 83                      0           0.0         1                   0
## 84                      1           1.6         2                   0
## 85                      0           0.2         1                   0
## 86                      0           0.0         1                   0
## 87                      0           0.0         1                   0
## 89                      0           0.0         1                   0
## 90                      0           0.5         1                   0
## 91                      0           0.4         2                   0
## 92                      0           6.2         3                   3
## 93                      0           1.8         2                   3
## 94                      0           0.6         2                   0
## 95                      0           0.0         1                   0
## 96                      1           0.0         1                   1
## 97                      1           1.2         2                   1
## 98                      0           2.6         2                   2
## 99                      0           0.8         1                   1
## 100                     0           0.0         1                   0
## 101                     0           0.0         1                   0
## 102                     0           0.0         1                   0
## 103                     0           0.0         1                   1
## 104                     0           0.0         1                   1
## 105                     0           2.0         2                   3
## 106                     0           0.0         1                   0
## 107                     1           0.0         1                   1
## 108                     0           0.4         2                   1
## 109                     1           3.6         2                   1
## 110                     0           1.2         2                   0
## 111                     1           1.0         2                   0
## 112                     1           1.2         2                   1
## 113                     0           0.0         2                   0
## 114                     1           3.0         2                   0
## 115                     0           1.2         2                   1
## 116                     0           0.0         2                   0
## 117                     0           0.0         1                   0
```

```
## 118                    0          1.4        1                    0
## 119                    1          1.8        1                    3
## 120                    0          2.8        2                    1
## 121                    1          0.0        1                    2
## 122                    0          4.0        2                    3
## 123                    1          1.2        2                    0
## 124                    1          5.6        3                    0
## 125                    0          1.4        2                    1
## 126                    0          0.6        2                    0
## 127                    1          4.0        3                    2
## 128                    1          2.8        2                    1
## 129                    0          0.0        1                    0
## 130                    0          0.0        1                    0
## 131                    0          0.4        2                    0
## 132                    1          0.0        1                    1
## 133                    0          0.0        1                    0
## 134                    1          0.0        1                    0
## 135                    0          0.2        2                    0
## 136                    0          1.4        2                    0
## 137                    1          2.6        3                    0
## 138                    0          1.4        2                    1
## 139                    1          1.6        2                    0
## 140                    0          2.4        2                    0
## 141                    1          0.0        1                    0
## 142                    0          0.2        2                    0
## 143                    0          0.0        1                    0
## 144                    1          1.8        2                    0
## 145                    1          0.6        2                    0
## 146                    0          0.0        1                    0
## 147                    0          1.0        2                    3
## 148                    0          0.0        1                    0
## 149                    0          0.0        1                    0
## 150                    0          0.0        1                    1
## 151                    0          1.2        2                    0
## 152                    0          0.6        2                    0
## 153                    0          1.6        2                    0
## 154                    1          0.8        2                    1
## 155                    1          2.2        3                    1
## 156                    0          2.4        2                    3
## 157                    1          1.6        1                    0
## 158                    0          0.0        1                    2
## 159                    0          1.2        2                    2
## 160                    0          1.0        1                    1
## 161                    0          0.0        1                    0
## 162                    1          0.0        1                    3
## 163                    0          1.6        2                    0
## 164                    0          1.0        2                    0
## 165                    0          0.0        1                    2
## 166                    1          0.0        1                    0
## 168                    1          0.0        1                    1
```

```
## 169                    1          0.0        1                    0
## 170                    0          0.0        2                    0
## 171                    1          2.9        2                    1
## 172                    1          0.0        1                    0
## 173                    1          0.0        2                    0
## 174                    0          1.2        2                    0
## 175                    0          2.0        2                    2
## 176                    1          1.2        2                    1
## 177                    0          0.1        1                    3
## 178                    1          2.1        2                    1
## 179                    0          1.9        1                    1
## 180                    0          0.0        1                    3
## 181                    0          0.5        2                    0
## 182                    1          1.9        2                    2
## 183                    0          0.8        1                    2
## 184                    0          4.2        3                    0
## 185                    0          0.0        1                    0
## 186                    0          0.0        1                    2
## 187                    0          0.8        3                    0
## 188                    1          0.0        2                    3
## 189                    0          0.0        1                    1
## 190                    0          2.0        2                    3
## 191                    0          0.0        1                    0
## 192                    1          4.2        2                    3
## 194                    0          1.9        2                    3
## 195                    0          1.5        2                    0
## 196                    1          0.9        2                    2
## 197                    0          0.1        2                    1
## 198                    1          0.2        2                    0
## 199                    0          1.1        1                    0
## 200                    0          0.0        1                    0
## 201                    0          0.0        1                    0
## 202                    1          0.0        1                    0
## 203                    0          0.2        1                    1
## 204                    0          0.2        1                    0
## 205                    0          0.0        1                    0
## 206                    1          0.0        2                    3
## 207                    1          3.0        2                    2
## 208                    1          0.9        2                    0
## 209                    0          0.0        1                    0
## 210                    1          1.4        2                    0
## 211                    0          0.0        1                    0
## 212                    1          3.8        2                    0
## 213                    0          2.0        2                    0
## 214                    1          1.0        2                    2
## 215                    0          0.0        1                    1
## 216                    0          1.9        2                    0
## 217                    0          0.0        1                    0
## 218                    1          0.0        2                    0
## 219                    0          2.0        2                    2
```

```
## 220                    0          0.0        1                    0
## 221                    1          0.0        1                    0
## 222                    0          0.0        1                    0
## 223                    0          0.0        1                    0
## 224                    1          2.0        2                    2
## 225                    1          1.8        2                    2
## 226                    0          0.7        1                    0
## 227                    0          0.1        1                    0
## 228                    0          0.0        1                    1
## 229                    1          0.0        2                    1
## 230                    1          0.1        1                    1
## 231                    0          0.1        2                    0
## 232                    1          3.4        2                    0
## 233                    0          0.8        1                    3
## 234                    1          0.2        1                    1
## 235                    0          0.0        1                    1
## 236                    1          3.2        2                    2
## 237                    1          1.6        3                    0
## 238                    0          0.8        1                    0
## 239                    0          0.0        2                    0
## 240                    0          0.0        1                    0
## 241                    0          0.0        1                    0
## 242                    0          0.0        1                    0
## 243                    0          0.0        1                    0
## 244                    0          2.6        2                    2
## 245                    0          0.0        1                    0
## 246                    0          1.0        2                    0
## 247                    0          0.1        1                    1
## 248                    1          1.0        2                    1
## 249                    0          1.0        1                    2
## 250                    0          0.0        1                    0
## 251                    1          1.5        2                    0
## 252                    0          2.0        2                    1
## 253                    1          0.2        2                    1
## 254                    0          0.6        1                    0
## 255                    0          1.2        2                    0
## 256                    0          0.0        2                    0
## 257                    0          0.3        1                    2
## 258                    0          1.1        2                    0
## 259                    0          0.0        1                    0
## 260                    0          0.3        1                    0
## 261                    0          0.3        2                    1
## 262                    0          0.0        1                    2
## 263                    0          0.9        1                    0
## 264                    0          0.0        1                    0
## 265                    1          3.6        2                    1
## 266                    1          1.8        2                    0
## 268                    0          2.2        2                    1
## 269                    0          0.0        1                    0
## 270                    0          0.0        1                    0
```

```
## 271                      1          1.9        1                    1
## 272                      0          2.3        1                    0
## 273                      1          1.8        2                    2
## 274                      0          1.6        2                    0
## 275                      0          0.8        1                    2
## 276                      0          0.6        2                    0
## 277                      0          0.0        2                    1
## 278                      0          0.0        2                    0
## 279                      0          0.0        1                    1
## 280                      0          0.6        2                    0
## 281                      1          3.0        2                    1
## 282                      0          0.0        1                    0
## 283                      1          2.0        2                    1
## 284                      0          0.0        1                    0
## 285                      0          0.0        1                    1
## 286                      0          4.4        3                    3
## 287                      1          2.8        2                    2
## 289                      0          0.0        1                    0
## 290                      0          0.0        3                    0
## 291                      0          0.8        2                    0
## 292                      0          1.2        1                    0
## 293                      1          2.8        3                    0
## 294                      1          4.0        1                    2
## 295                      1          0.0        2                    0
## 296                      0          0.0        1                    0
## 297                      0          1.0        2                    2
## 298                      1          0.2        2                    0
## 299                      0          1.2        2                    0
## 300                      0          3.4        2                    2
## 301                      1          1.2        2                    1
## 302                      0          0.0        2                    1
##     thalassemia target
## 1             6     No
## 2             3    Yes
## 3             7    Yes
## 4             3     No
## 5             3     No
## 6             3     No
## 7             3    Yes
## 8             3     No
## 9             7    Yes
## 10            7    Yes
## 11            6     No
## 12            3     No
## 13            6    Yes
## 14            7     No
## 15            7     No
## 16            3     No
## 17            7    Yes
## 18            3     No
```

```
## 19              3     No
## 20              3     No
## 21              3     No
## 22              3     No
## 23              3    Yes
## 24              7    Yes
## 25              7    Yes
## 26              3     No
## 27              3     No
## 28              3     No
## 29              3     No
## 30              7    Yes
## 31              3     No
## 32              7    Yes
## 33              3    Yes
## 34              7     No
## 35              3     No
## 36              3     No
## 37              7    Yes
## 38              6    Yes
## 39              7    Yes
## 40              3     No
## 41              7    Yes
## 42              7     No
## 43              3     No
## 44              3     No
## 45              3    Yes
## 46              7    Yes
## 47              3     No
## 48              7    Yes
## 49              3     No
## 50              3     No
## 51              3     No
## 52              7     No
## 53              3    Yes
## 54              3     No
## 55              7    Yes
## 56              7    Yes
## 57              7    Yes
## 58              7    Yes
## 59              3     No
## 60              3     No
## 61              7    Yes
## 62              3     No
## 63              7    Yes
## 64              3     No
## 65              7    Yes
## 66              7    Yes
## 67              3    Yes
## 68              7     No
```

```
## 69            7    Yes
## 70            3    Yes
## 71            3     No
## 72            7    Yes
## 73            7    Yes
## 74            6    Yes
## 75            3    Yes
## 76            3     No
## 77            7    Yes
## 78            3     No
## 79            3     No
## 80            7    Yes
## 81            3     No
## 82            3     No
## 83            3     No
## 84            7    Yes
## 85            3     No
## 86            3     No
## 87            3     No
## 89            3     No
## 90            3     No
## 91            3     No
## 92            7    Yes
## 93            7     No
## 94            3     No
## 95            3     No
## 96            7    Yes
## 97            7    Yes
## 98            7    Yes
## 99            3     No
## 100           3     No
## 101           3     No
## 102           3     No
## 103           3     No
## 104           3     No
## 105           7    Yes
## 106           7     No
## 107           7    Yes
## 108           7    Yes
## 109           7    Yes
## 110           7    Yes
## 111           7    Yes
## 112           3    Yes
## 113           6     No
## 114           7    Yes
## 115           7    Yes
## 116           6     No
## 117           3     No
## 118           3     No
## 119           7    Yes
```

```
## 120           7    Yes
## 121           7    Yes
## 122           7    Yes
## 123           3     No
## 124           7    Yes
## 125           3    Yes
## 126           3     No
## 127           7    Yes
## 128           7    Yes
## 129           3     No
## 130           3     No
## 131           7     No
## 132           7     No
## 133           3     No
## 134           3     No
## 135           3     No
## 136           3     No
## 137           7    Yes
## 138           7    Yes
## 139           7    Yes
## 140           3     No
## 141           3     No
## 142           7    Yes
## 143           3     No
## 144           7    Yes
## 145           7     No
## 146           3    Yes
## 147           7    Yes
## 148           3     No
## 149           3     No
## 150           3     No
## 151           7     No
## 152           3     No
## 153           7     No
## 154           7    Yes
## 155           3    Yes
## 156           3    Yes
## 157           7    Yes
## 158           7    Yes
## 159           7    Yes
## 160           7     No
## 161           7     No
## 162           3    Yes
## 163           3     No
## 164           3     No
## 165           3     No
## 166           7     No
## 168           3     No
## 169           7    Yes
## 170           3     No
```

```
## 171           7    Yes
## 172           7     No
## 173           3    Yes
## 174           3     No
## 175           6    Yes
## 176           7    Yes
## 177           7     No
## 178           6    Yes
## 179           3     No
## 180           3     No
## 181           7    Yes
## 182           7    Yes
## 183           3     No
## 184           7     No
## 185           3    Yes
## 186           3     No
## 187           7     No
## 188           6    Yes
## 189           7    Yes
## 190           7    Yes
## 191           3     No
## 192           7    Yes
## 194           3    Yes
## 195           3     No
## 196           3    Yes
## 197           3     No
## 198           3     No
## 199           3     No
## 200           3    Yes
## 201           3     No
## 202           3     No
## 203           7     No
## 204           7     No
## 205           7     No
## 206           7    Yes
## 207           7    Yes
## 208           7    Yes
## 209           3     No
## 210           3    Yes
## 211           3     No
## 212           7    Yes
## 213           3     No
## 214           7    Yes
## 215           3    Yes
## 216           7     No
## 217           3     No
## 218           3     No
## 219           3     No
## 220           3     No
## 221           3     No
```

```
## 222           3     No
## 223           3     No
## 224           7    Yes
## 225           3    Yes
## 226           3     No
## 227           3     No
## 228           3     No
## 229           3    Yes
## 230           3    Yes
## 231           3     No
## 232           3    Yes
## 233           3    Yes
## 234           3     No
## 235           3     No
## 236           3    Yes
## 237           7    Yes
## 238           7    Yes
## 239           3     No
## 240           3     No
## 241           3     No
## 242           3     No
## 243           3     No
## 244           3    Yes
## 245           3     No
## 246           3    Yes
## 247           7    Yes
## 248           3    Yes
## 249           7    Yes
## 250           3     No
## 251           6     No
## 252           7    Yes
## 253           7     No
## 254           3     No
## 255           3     No
## 256           3     No
## 257           3     No
## 258           3     No
## 259           3     No
## 260           7    Yes
## 261           3     No
## 262           3    Yes
## 263           3     No
## 264           3     No
## 265           3    Yes
## 266           6    Yes
## 268           6    Yes
## 269           7    Yes
## 270           3     No
## 271           7    Yes
## 272           6     No
```

```
## 273           7    Yes
## 274           3     No
## 275           3    Yes
## 276           7     No
## 277           3     No
## 278           3     No
## 279           3    Yes
## 280           3     No
## 281           7    Yes
## 282           3     No
## 283           7    Yes
## 284           3     No
## 285           7    Yes
## 286           6    Yes
## 287           6    Yes
## 289           7     No
## 290           3     No
## 291           7    Yes
## 292           3     No
## 293           6    Yes
## 294           7    Yes
## 295           3    Yes
## 296           3     No
## 297           6    Yes
## 298           7    Yes
## 299           7    Yes
## 300           7    Yes
## 301           7    Yes
## 302           3    Yes
```

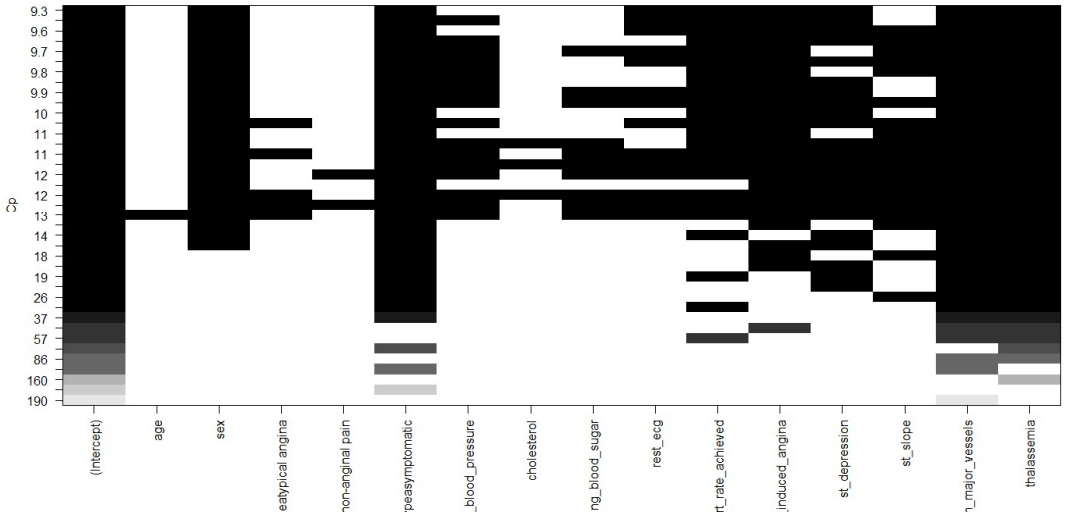
Producing AIC , BIC and RSS values for various feature subset selection.

```
library(leaps)
subsets.out<-regsubsets(target~.,data=heart.data)
sso<-summary(subsets.out)

dim(heart.data)

## [1] 297  14

ic<-sso$bic-log(297)*13 + 2*13
round(ic,2)

## [1] -133.11 -181.83 -215.87 -223.03 -226.31 -227.46 -226.92 -224.28

my.table<-cbind(sso$outmat,round(sso$rss,2),round(ic,2),round(sso$bic,2))



colnames(my.table)[14:15]<-c("Cp","BIC")
print.table( my.table)
```

```
##          age sex chest_pain_typeatypical angina
## 1  ( 1 )
## 2  ( 1 )
## 3  ( 1 )
## 4  ( 1 )
## 5  ( 1 )
## 6  ( 1 )     *
## 7  ( 1 )     *
## 8  ( 1 )     *
##          chest_pain_typenon-anginal pain chest_pain_typeasymptomatic
## 1  ( 1 )
## 2  ( 1 )                                 *
## 3  ( 1 )                                 *
## 4  ( 1 )                                 *
## 5  ( 1 )                                 *
## 6  ( 1 )                                 *
## 7  ( 1 )                                 *
## 8  ( 1 )                                 *
##          resting_blood_pressure cholesterol fasting_blood_sugar rest_ecg
## 1  ( 1 )
## 2  ( 1 )
## 3  ( 1 )
## 4  ( 1 )
## 5  ( 1 )
## 6  ( 1 )
## 7  ( 1 )
## 8  ( 1 )                                                          *
##          max_heart_rate_achieved exercise_induced_angina st_depression
## 1  ( 1 )
## 2  ( 1 )
## 3  ( 1 )
## 4  ( 1 )                                                 *
## 5  ( 1 )                         *
## 6  ( 1 )                         *
## 7  ( 1 ) *                       *                       *
## 8  ( 1 ) *                       *                       *
##          st_slope Cp BIC
## 1  ( 1 )             *   53.34 -133.11 -85.09
## 2  ( 1 )             *   44.41 -181.83 -133.81
## 3  ( 1 )          *  *   38.85 -215.87 -167.85
## 4  ( 1 )          *  *   37.2  -223.03 -175.01
## 5  ( 1 ) *        *  *   36.09 -226.31 -178.29
## 6  ( 1 ) *        *  *   35.27 -227.46 -179.44
## 7  ( 1 )          *  *   34.66 -226.92 -178.91
## 8  ( 1 )          *  *   34.31 -224.28 -176.26
```

Producing BIC and CP plots.

```
subsets2.out<-regsubsets(target~.,data=heart.data,nbest=3, nvmax = 13)
plot(subsets2.out,scale="Cp")
```




```r
plot(subsets2.out,scale="bic")
```