Intro to Data Science - Lab 9

Week 9 - Supervised Data Mining

```r
# Enter your name here: Taylor Huang
```

Please include nice comments.

Instructions:

Run the necessary code on your own instance of R-Studio.

Attribution statement: (choose only one and delete the rest)

Supervised data mining/machine learning is the most prevalent form of data mining as it allows for the prediction of new cases in the future. For example, when credit card companies are trying to detect fraud, they will create a supervised model by training it on fraud data that they already have. Then they will deploy the model into the field: As new input data arrives the model predicts whether it seems fraudulent and flags those transactions where that probability is high.

In these exercises we will work with a built-in data set called **GermanCredit**. This data set is in the ** caret ** package so we will need that and the ** kernlab ** package to be installed and libraried before running the following:

```
# 1. I did this lab assignment by myself, with help from the book and the professor.

```r
#install.packages(caret)
library("caret")
```

```
## Loading required package: ggplot2

## Loading required package: lattice
```

```r
#install.packages(kernlab)
library("kernlab")
```

```
##
## Attaching package: 'kernlab'

## The following object is masked from 'package:ggplot2':
##
##     alpha
```

```r
data("GermanCredit")
subCredit <- GermanCredit[,1:10]
str(subCredit)
```

```
## 'data.frame':    1000 obs. of  10 variables:
##  $ Duration                 : int  6 48 12 42 24 36 24 36 12 30 ...
##  $ Amount                   : int  1169 5951 2096 7882 4870 9055 2835 6948 3059 5234 ...
##  $ InstallmentRatePercentage: int  4 2 2 2 3 2 3 2 2 4 ...
##  $ ResidenceDuration        : int  4 2 3 4 4 4 4 2 4 2 ...
##  $ Age                      : int  67 22 49 45 53 35 53 35 61 28 ...
##  $ NumberExistingCredits    : int  2 1 1 1 2 1 1 1 1 2 ...
##  $ NumberPeopleMaintenance  : int  1 1 2 2 2 2 1 1 1 1 ...
##  $ Telephone                : num  0 1 1 1 1 0 1 0 1 1 ...
```
```

```
##  $ ForeignWorker            : num  1 1 1 1 1 1 1 1 1 1 ...
##  $ Class                    : Factor w/ 2 levels "Bad","Good": 2 1 2 2 1 2 2 2 2 1 ...
```

1. Examine the data structure that **str()** reveals. Also use the **help()** command to learn more about the **GermanCredit** data set. Summarize what you see in a comment.

```
help(GermanCredit)
#In subCredit, you see different entries related to individuals' credit data in Germany. subCredit also
```

2. Use the **createDataPartition()** function to generate a list of cases to include in the training data. This function is conveniently provided by caret and allows one to directly control the number of training cases. It also ensures that the training cases are balanced with respect to the outcome variable. Try this: `trainList <- createDataPartition(y=subCredit$Class,p=.40,list=FALSE)`

```
trainList <- createDataPartition(y=subCredit$Class,p=.40,list=FALSE)
trainList
```

```
##       Resample1
##   [1,]         1
##   [2,]         8
##   [3,]        18
##   [4,]        19
##   [5,]        20
##   [6,]        25
##   [7,]        26
##   [8,]        28
##   [9,]        29
##  [10,]        30
##  [11,]        35
##  [12,]        39
##  [13,]        41
##  [14,]        44
##  [15,]        46
##  [16,]        47
##  [17,]        48
##  [18,]        49
##  [19,]        53
##  [20,]        54
##  [21,]        56
##  [22,]        57
##  [23,]        61
##  [24,]        62
##  [25,]        63
##  [26,]        64
##  [27,]        65
##  [28,]        67
##  [29,]        73
##  [30,]        74
##  [31,]        75
##  [32,]        76
##  [33,]        79
##  [34,]        80
##  [35,]        82
##  [36,]        87
##  [37,]        89
##  [38,]        94
```

```
## [39,]     95
## [40,]    105
## [41,]    107
## [42,]    108
## [43,]    112
## [44,]    113
## [45,]    114
## [46,]    116
## [47,]    122
## [48,]    124
## [49,]    132
## [50,]    133
## [51,]    138
## [52,]    140
## [53,]    143
## [54,]    144
## [55,]    148
## [56,]    149
## [57,]    152
## [58,]    161
## [59,]    162
## [60,]    163
## [61,]    164
## [62,]    169
## [63,]    172
## [64,]    176
## [65,]    179
## [66,]    182
## [67,]    183
## [68,]    185
## [69,]    186
## [70,]    188
## [71,]    189
## [72,]    192
## [73,]    193
## [74,]    196
## [75,]    204
## [76,]    205
## [77,]    208
## [78,]    209
## [79,]    210
## [80,]    212
## [81,]    213
## [82,]    217
## [83,]    218
## [84,]    222
## [85,]    224
## [86,]    227
## [87,]    228
## [88,]    236
## [89,]    237
## [90,]    239
## [91,]    240
## [92,]    241
```

```
##  [93,]        243
##  [94,]        246
##  [95,]        248
##  [96,]        249
##  [97,]        250
##  [98,]        251
##  [99,]        252
## [100,]        257
## [101,]        258
## [102,]        266
## [103,]        268
## [104,]        270
## [105,]        271
## [106,]        275
## [107,]        277
## [108,]        281
## [109,]        282
## [110,]        283
## [111,]        284
## [112,]        285
## [113,]        287
## [114,]        288
## [115,]        293
## [116,]        298
## [117,]        303
## [118,]        304
## [119,]        305
## [120,]        309
## [121,]        310
## [122,]        311
## [123,]        312
## [124,]        313
## [125,]        314
## [126,]        316
## [127,]        320
## [128,]        321
## [129,]        324
## [130,]        325
## [131,]        326
## [132,]        329
## [133,]        333
## [134,]        336
## [135,]        340
## [136,]        341
## [137,]        342
## [138,]        343
## [139,]        346
## [140,]        350
## [141,]        352
## [142,]        353
## [143,]        356
## [144,]        357
## [145,]        358
## [146,]        359
```

```
## [147,]        363
## [148,]        364
## [149,]        367
## [150,]        369
## [151,]        376
## [152,]        380
## [153,]        381
## [154,]        382
## [155,]        383
## [156,]        384
## [157,]        386
## [158,]        387
## [159,]        390
## [160,]        391
## [161,]        396
## [162,]        402
## [163,]        404
## [164,]        412
## [165,]        420
## [166,]        421
## [167,]        426
## [168,]        427
## [169,]        428
## [170,]        429
## [171,]        432
## [172,]        433
## [173,]        434
## [174,]        437
## [175,]        438
## [176,]        440
## [177,]        442
## [178,]        443
## [179,]        444
## [180,]        446
## [181,]        447
## [182,]        448
## [183,]        454
## [184,]        457
## [185,]        459
## [186,]        462
## [187,]        463
## [188,]        465
## [189,]        467
## [190,]        468
## [191,]        469
## [192,]        470
## [193,]        474
## [194,]        479
## [195,]        481
## [196,]        483
## [197,]        486
## [198,]        488
## [199,]        491
## [200,]        492
```

```
## [201,]        493
## [202,]        497
## [203,]        499
## [204,]        501
## [205,]        502
## [206,]        503
## [207,]        506
## [208,]        508
## [209,]        514
## [210,]        525
## [211,]        526
## [212,]        527
## [213,]        533
## [214,]        535
## [215,]        537
## [216,]        539
## [217,]        540
## [218,]        543
## [219,]        545
## [220,]        549
## [221,]        555
## [222,]        556
## [223,]        557
## [224,]        560
## [225,]        561
## [226,]        562
## [227,]        563
## [228,]        564
## [229,]        568
## [230,]        569
## [231,]        573
## [232,]        576
## [233,]        578
## [234,]        579
## [235,]        581
## [236,]        582
## [237,]        583
## [238,]        586
## [239,]        591
## [240,]        592
## [241,]        593
## [242,]        594
## [243,]        595
## [244,]        597
## [245,]        599
## [246,]        600
## [247,]        603
## [248,]        604
## [249,]        608
## [250,]        609
## [251,]        612
## [252,]        613
## [253,]        614
## [254,]        615
```

```
## [255,]        616
## [256,]        622
## [257,]        623
## [258,]        633
## [259,]        635
## [260,]        637
## [261,]        641
## [262,]        643
## [263,]        645
## [264,]        648
## [265,]        651
## [266,]        655
## [267,]        657
## [268,]        659
## [269,]        660
## [270,]        664
## [271,]        665
## [272,]        672
## [273,]        677
## [274,]        679
## [275,]        680
## [276,]        681
## [277,]        683
## [278,]        684
## [279,]        685
## [280,]        686
## [281,]        689
## [282,]        690
## [283,]        692
## [284,]        698
## [285,]        700
## [286,]        701
## [287,]        705
## [288,]        708
## [289,]        714
## [290,]        715
## [291,]        716
## [292,]        717
## [293,]        721
## [294,]        723
## [295,]        726
## [296,]        728
## [297,]        729
## [298,]        730
## [299,]        732
## [300,]        735
## [301,]        737
## [302,]        740
## [303,]        742
## [304,]        743
## [305,]        745
## [306,]        746
## [307,]        747
## [308,]        750
```

```
## [309,]        763
## [310,]        764
## [311,]        765
## [312,]        770
## [313,]        772
## [314,]        774
## [315,]        776
## [316,]        778
## [317,]        787
## [318,]        794
## [319,]        795
## [320,]        796
## [321,]        797
## [322,]        798
## [323,]        799
## [324,]        800
## [325,]        802
## [326,]        803
## [327,]        804
## [328,]        806
## [329,]        812
## [330,]        815
## [331,]        816
## [332,]        820
## [333,]        821
## [334,]        822
## [335,]        823
## [336,]        824
## [337,]        828
## [338,]        829
## [339,]        830
## [340,]        832
## [341,]        834
## [342,]        835
## [343,]        837
## [344,]        839
## [345,]        840
## [346,]        841
## [347,]        842
## [348,]        844
## [349,]        846
## [350,]        852
## [351,]        853
## [352,]        855
## [353,]        865
## [354,]        866
## [355,]        867
## [356,]        871
## [357,]        872
## [358,]        873
## [359,]        874
## [360,]        876
## [361,]        878
## [362,]        881
```

```
## [363,]        882
## [364,]        894
## [365,]        903
## [366,]        908
## [367,]        913
## [368,]        915
## [369,]        916
## [370,]        917
## [371,]        920
## [372,]        921
## [373,]        925
## [374,]        928
## [375,]        929
## [376,]        932
## [377,]        933
## [378,]        938
## [379,]        941
## [380,]        945
## [381,]        946
## [382,]        947
## [383,]        949
## [384,]        951
## [385,]        952
## [386,]        955
## [387,]        956
## [388,]        957
## [389,]        958
## [390,]        959
## [391,]        963
## [392,]        965
## [393,]        969
## [394,]        971
## [395,]        973
## [396,]        983
## [397,]        987
## [398,]        993
## [399,]        996
## [400,]       1000
```

3. Examine the contents of **trainList** to make sure that it is a list of case numbers. With **p=0.40**, it should have 400 case numbers in it.

```
# it is in a list of numbers with 400 cases
```

4. What is **trainList**? What do the elements in **trainList** represent? Which attribute is balanced in the **trainList** dataset?

```
# The elements of TrainList represents the people who have poor class, and the count of these people.
```

5. Use **trainList** and the square brackets notation to create a training data set called ** trainSet ** from the **subCredit** data frame. Look at the structure of trainSet to make sure it has all of the same variables as **subCredit**. The **trainSet** structure should be a data frame with **400 rows and 10 columns**.

```
trainSet <- subCredit[trainList,]
trainList
```

```
##         Resample1
##    [1,]         1
##    [2,]         8
##    [3,]        18
##    [4,]        19
##    [5,]        20
##    [6,]        25
##    [7,]        26
##    [8,]        28
##    [9,]        29
##   [10,]        30
##   [11,]        35
##   [12,]        39
##   [13,]        41
##   [14,]        44
##   [15,]        46
##   [16,]        47
##   [17,]        48
##   [18,]        49
##   [19,]        53
##   [20,]        54
##   [21,]        56
##   [22,]        57
##   [23,]        61
##   [24,]        62
##   [25,]        63
##   [26,]        64
##   [27,]        65
##   [28,]        67
##   [29,]        73
##   [30,]        74
##   [31,]        75
##   [32,]        76
##   [33,]        79
##   [34,]        80
##   [35,]        82
##   [36,]        87
##   [37,]        89
##   [38,]        94
##   [39,]        95
##   [40,]       105
##   [41,]       107
##   [42,]       108
##   [43,]       112
##   [44,]       113
##   [45,]       114
##   [46,]       116
##   [47,]       122
##   [48,]       124
##   [49,]       132
##   [50,]       133
##   [51,]       138
##   [52,]       140
##   [53,]       143
```

```
##  [54,]       144
##  [55,]       148
##  [56,]       149
##  [57,]       152
##  [58,]       161
##  [59,]       162
##  [60,]       163
##  [61,]       164
##  [62,]       169
##  [63,]       172
##  [64,]       176
##  [65,]       179
##  [66,]       182
##  [67,]       183
##  [68,]       185
##  [69,]       186
##  [70,]       188
##  [71,]       189
##  [72,]       192
##  [73,]       193
##  [74,]       196
##  [75,]       204
##  [76,]       205
##  [77,]       208
##  [78,]       209
##  [79,]       210
##  [80,]       212
##  [81,]       213
##  [82,]       217
##  [83,]       218
##  [84,]       222
##  [85,]       224
##  [86,]       227
##  [87,]       228
##  [88,]       236
##  [89,]       237
##  [90,]       239
##  [91,]       240
##  [92,]       241
##  [93,]       243
##  [94,]       246
##  [95,]       248
##  [96,]       249
##  [97,]       250
##  [98,]       251
##  [99,]       252
## [100,]       257
## [101,]       258
## [102,]       266
## [103,]       268
## [104,]       270
## [105,]       271
## [106,]       275
## [107,]       277
```

```
## [108,]         281
## [109,]         282
## [110,]         283
## [111,]         284
## [112,]         285
## [113,]         287
## [114,]         288
## [115,]         293
## [116,]         298
## [117,]         303
## [118,]         304
## [119,]         305
## [120,]         309
## [121,]         310
## [122,]         311
## [123,]         312
## [124,]         313
## [125,]         314
## [126,]         316
## [127,]         320
## [128,]         321
## [129,]         324
## [130,]         325
## [131,]         326
## [132,]         329
## [133,]         333
## [134,]         336
## [135,]         340
## [136,]         341
## [137,]         342
## [138,]         343
## [139,]         346
## [140,]         350
## [141,]         352
## [142,]         353
## [143,]         356
## [144,]         357
## [145,]         358
## [146,]         359
## [147,]         363
## [148,]         364
## [149,]         367
## [150,]         369
## [151,]         376
## [152,]         380
## [153,]         381
## [154,]         382
## [155,]         383
## [156,]         384
## [157,]         386
## [158,]         387
## [159,]         390
## [160,]         391
## [161,]         396
```

```
## [162,]        402
## [163,]        404
## [164,]        412
## [165,]        420
## [166,]        421
## [167,]        426
## [168,]        427
## [169,]        428
## [170,]        429
## [171,]        432
## [172,]        433
## [173,]        434
## [174,]        437
## [175,]        438
## [176,]        440
## [177,]        442
## [178,]        443
## [179,]        444
## [180,]        446
## [181,]        447
## [182,]        448
## [183,]        454
## [184,]        457
## [185,]        459
## [186,]        462
## [187,]        463
## [188,]        465
## [189,]        467
## [190,]        468
## [191,]        469
## [192,]        470
## [193,]        474
## [194,]        479
## [195,]        481
## [196,]        483
## [197,]        486
## [198,]        488
## [199,]        491
## [200,]        492
## [201,]        493
## [202,]        497
## [203,]        499
## [204,]        501
## [205,]        502
## [206,]        503
## [207,]        506
## [208,]        508
## [209,]        514
## [210,]        525
## [211,]        526
## [212,]        527
## [213,]        533
## [214,]        535
## [215,]        537
```

```
## [216,]        539
## [217,]        540
## [218,]        543
## [219,]        545
## [220,]        549
## [221,]        555
## [222,]        556
## [223,]        557
## [224,]        560
## [225,]        561
## [226,]        562
## [227,]        563
## [228,]        564
## [229,]        568
## [230,]        569
## [231,]        573
## [232,]        576
## [233,]        578
## [234,]        579
## [235,]        581
## [236,]        582
## [237,]        583
## [238,]        586
## [239,]        591
## [240,]        592
## [241,]        593
## [242,]        594
## [243,]        595
## [244,]        597
## [245,]        599
## [246,]        600
## [247,]        603
## [248,]        604
## [249,]        608
## [250,]        609
## [251,]        612
## [252,]        613
## [253,]        614
## [254,]        615
## [255,]        616
## [256,]        622
## [257,]        623
## [258,]        633
## [259,]        635
## [260,]        637
## [261,]        641
## [262,]        643
## [263,]        645
## [264,]        648
## [265,]        651
## [266,]        655
## [267,]        657
## [268,]        659
## [269,]        660
```

```
## [270,]        664
## [271,]        665
## [272,]        672
## [273,]        677
## [274,]        679
## [275,]        680
## [276,]        681
## [277,]        683
## [278,]        684
## [279,]        685
## [280,]        686
## [281,]        689
## [282,]        690
## [283,]        692
## [284,]        698
## [285,]        700
## [286,]        701
## [287,]        705
## [288,]        708
## [289,]        714
## [290,]        715
## [291,]        716
## [292,]        717
## [293,]        721
## [294,]        723
## [295,]        726
## [296,]        728
## [297,]        729
## [298,]        730
## [299,]        732
## [300,]        735
## [301,]        737
## [302,]        740
## [303,]        742
## [304,]        743
## [305,]        745
## [306,]        746
## [307,]        747
## [308,]        750
## [309,]        763
## [310,]        764
## [311,]        765
## [312,]        770
## [313,]        772
## [314,]        774
## [315,]        776
## [316,]        778
## [317,]        787
## [318,]        794
## [319,]        795
## [320,]        796
## [321,]        797
## [322,]        798
## [323,]        799
```

```
## [324,]         800
## [325,]         802
## [326,]         803
## [327,]         804
## [328,]         806
## [329,]         812
## [330,]         815
## [331,]         816
## [332,]         820
## [333,]         821
## [334,]         822
## [335,]         823
## [336,]         824
## [337,]         828
## [338,]         829
## [339,]         830
## [340,]         832
## [341,]         834
## [342,]         835
## [343,]         837
## [344,]         839
## [345,]         840
## [346,]         841
## [347,]         842
## [348,]         844
## [349,]         846
## [350,]         852
## [351,]         853
## [352,]         855
## [353,]         865
## [354,]         866
## [355,]         867
## [356,]         871
## [357,]         872
## [358,]         873
## [359,]         874
## [360,]         876
## [361,]         878
## [362,]         881
## [363,]         882
## [364,]         894
## [365,]         903
## [366,]         908
## [367,]         913
## [368,]         915
## [369,]         916
## [370,]         917
## [371,]         920
## [372,]         921
## [373,]         925
## [374,]         928
## [375,]         929
## [376,]         932
## [377,]         933
```

```
## [378,]       938
## [379,]       941
## [380,]       945
## [381,]       946
## [382,]       947
## [383,]       949
## [384,]       951
## [385,]       952
## [386,]       955
## [387,]       956
## [388,]       957
## [389,]       958
## [390,]       959
## [391,]       963
## [392,]       965
## [393,]       969
## [394,]       971
## [395,]       973
## [396,]       983
## [397,]       987
## [398,]       993
## [399,]       996
## [400,]      1000
```

6. Use **trainList** and the square brackets notation to create a testing data set called ** testSet ** from the subCredit data frame. The **testSet** structure should be a data frame with **600 rows and 10 columns** and should be a completely different set of cases than **trainSet**.

```
testSet <- subCredit[-trainList,]
testSet
```

```
##     Duration Amount InstallmentRatePercentage ResidenceDuration Age
## 2         48   5951                         2                 2  22
## 3         12   2096                         2                 3  49
## 4         42   7882                         2                 4  45
## 5         24   4870                         3                 4  53
## 6         36   9055                         2                 4  35
## 7         24   2835                         3                 4  53
## 9         12   3059                         2                 4  61
## 10        30   5234                         4                 2  28
## 11        12   1295                         3                 1  25
## 12        48   4308                         3                 4  24
## 13        12   1567                         1                 1  22
## 14        24   1199                         4                 4  60
## 15        15   1403                         2                 4  28
## 16        24   1282                         4                 2  32
## 17        24   2424                         4                 4  53
## 21         9   2134                         4                 4  48
## 22         6   2647                         2                 3  44
## 23        10   2241                         1                 3  48
## 24        12   1804                         3                 4  44
## 27         6    426                         4                 4  39
## 31        18   1913                         3                 3  36
## 32        24   4020                         2                 2  27
## 33        18   5866                         2                 2  30
```

```
## 34           12   1264                                4                 4  57
## 36           45   4746                                4                 2  25
## 37           48   6110                                1                 3  31
## 38           18   2100                                4                 2  37
## 40            9    458                                4                 3  24
## 42           12   1158                                3                 1  26
## 43           18   6204                                2                 4  44
## 45           48   6143                                4                 4  58
## 50           12   2073                                4                 2  28
## 51           24   2333                                4                 2  29
## 52           27   5965                                1                 2  30
## 55           36   2225                                4                 4  57
## 58           36   9566                                2                 2  31
## 59           18   1961                                3                 2  23
## 60           36   6229                                4                 4  23
## 66           27   5190                                4                 4  48
## 68           12   1007                                4                 1  22
## 69           36   1819                                4                 4  37
## 70           36   2394                                4                 4  25
## 71           36   8133                                1                 2  30
## 72            7    730                                4                 2  46
## 77           42   3965                                4                 3  34
## 78           11   4771                                2                 4  51
## 81           24   5943                                1                 1  44
## 83           18   1568                                3                 4  24
## 84           24   1755                                4                 4  58
## 85           10   2315                                3                 4  52
## 86           12   1412                                4                 2  29
## 88           36  12612                                1                 4  47
## 90           12   1108                                4                 3  28
## 91           12    618                                4                 4  56
## 92           12   1409                                4                 3  54
## 93           12    797                                4                 3  33
## 96           54  15945                                3                 4  58
## 97           12   2012                                4                 2  61
## 98           18   2622                                4                 4  34
## 99           36   2337                                4                 4  36
## 100          20   7057                                3                 4  36
## 101          24   1469                                4                 4  41
## 102          36   2323                                4                 4  24
## 103           6    932                                3                 2  24
## 104           9   1919                                4                 3  35
## 106          24  11938                                2                 3  39
## 109          24   7721                                1                 2  30
## 110          14   1410                                1                 2  35
## 111           6   1449                                1                 2  31
## 115          12   1680                                3                 1  35
## 117          42   7174                                4                 3  30
## 118          10   2132                                2                 3  27
## 119          33   4281                                1                 4  23
## 120          12   2366                                3                 3  36
## 121          21   1835                                3                 2  25
## 123          12   1768                                3                 2  24
## 125          18   1924                                4                 3  27
```

```
## 126       12   2121                         4                 2  30
## 127       12    701                         4                 2  40
## 128       12    639                         4                 2  30
## 129       12   1860                         4                 2  34
## 130       12   3499                         3                 2  29
## 131       48   8487                         1                 2  24
## 134       18   1984                         4                 4  47
## 135       60  10144                         2                 4  21
## 136       12   1240                         4                 2  38
## 137       27   8613                         2                 2  27
## 139       15   2728                         4                 2  35
## 141        6    709                         2                 2  27
## 142       36   4795                         4                 1  30
## 145       21   2288                         4                 4  23
## 146       48   3566                         4                 2  30
## 147        6    860                         1                 4  39
## 150       18   1582                         4                 4  46
## 151        6   1346                         2                 4  42
## 153       36   5848                         4                 1  24
## 154       24   7758                         2                 4  29
## 155       24   6967                         4                 4  36
## 156       12   1282                         2                 4  20
## 157        9   1288                         3                 4  48
## 158       12    339                         4                 1  45
## 159       24   3512                         2                 3  38
## 160        6   1898                         1                 2  34
## 165       36    909                         4                 4  36
## 166        6   2978                         1                 2  32
## 167       18   1131                         4                 2  33
## 168       11   1577                         4                 1  20
## 170       24   1935                         4                 4  31
## 171       15    950                         4                 3  33
## 173       24   2064                         3                 2  34
## 174        8   1414                         4                 2  33
## 175       21   3414                         2                 1  26
## 177       12   2577                         2                 1  42
## 178        6    338                         4                 4  52
## 180       21    571                         4                 4  65
## 181       36   9572                         1                 1  28
## 184       24   3777                         4                 4  50
## 187        9   5129                         2                 4  74
## 190       18   3244                         1                 4  33
## 191       24   4591                         2                 3  54
## 194        6   2108                         2                 2  29
## 195       45   3031                         4                 4  21
## 197        6   1382                         1                 1  28
## 198       12    951                         4                 4  27
## 199       24   2760                         4                 4  36
## 200       18   4297                         4                 3  40
## 201        9    936                         4                 2  52
## 202       12   1168                         4                 3  27
## 203       27   5117                         3                 4  26
## 206       30  10623                         3                 4  38
## 207       12   1935                         4                 4  43
```

```
## 211          9    3074                        1                 2  33
## 214         30    1908                        4                 4  66
## 215         36    3342                        4                 2  51
## 216          6     932                        1                 3  39
## 219         24    3021                        2                 2  24
## 220         10    1364                        2                 4  64
## 221         12     625                        4                 1  26
## 223         12     707                        4                 2  30
## 225         15    4657                        3                 2  30
## 226         36    2613                        4                 2  27
## 229          9    1478                        4                 2  22
## 230         24    3149                        4                 1  22
## 231         36    4210                        4                 2  26
## 232          9    2507                        2                 4  51
## 233         12    2141                        3                 1  35
## 234         18     866                        4                 2  25
## 235          4    1544                        2                 1  42
## 238         21    2767                        4                 2  61
## 242          6    1595                        3                 2  51
## 244         12    1185                        3                 2  27
## 245         12    3447                        4                 3  35
## 247         12     717                        4                 4  52
## 253         30    2150                        4                 2  24
## 254         24    4151                        2                 3  35
## 255          9    2030                        2                 1  24
## 256         60    7418                        1                 1  27
## 259         15    3812                        1                 4  23
## 260         11    1154                        4                 4  57
## 261         12    1657                        2                 2  27
## 262         24    1603                        4                 4  55
## 263         18    5302                        2                 4  36
## 264         12    2748                        2                 4  57
## 265         10    1231                        3                 4  32
## 267         36    6304                        4                 4  36
## 269         14    8978                        1                 4  45
## 272         12    1402                        3                 4  37
## 273         48   12169                        4                 4  36
## 274         48    3060                        4                 4  28
## 276          9    2697                        1                 2  32
## 278         12    1262                        2                 4  49
## 279          6    4611                        1                 4  32
## 280         24    1901                        4                 4  29
## 286         47   10722                        1                 1  35
## 289         12    1092                        4                 4  49
## 290         24    1024                        4                 4  48
## 291         12    1076                        2                 2  26
## 292         36    9398                        1                 4  28
## 294         42    4796                        4                 4  56
## 295         48    7629                        4                 2  46
## 296         48    9960                        1                 2  26
## 297         12    4675                        1                 4  20
## 299         18    2515                        3                 4  43
## 300         21    2745                        3                 2  32
## 301          6     672                        1                 4  54
```

```
## 302          36   3804                              4                 1  42
## 306           6   1543                              4                 2  33
## 307          30   4811                              2                 4  24
## 308          12    727                              4                 3  33
## 315           4   1494                              1                 2  29
## 317          12    708                              2                 3  38
## 318          24   4351                              1                 4  48
## 319          12    701                              4                 2  32
## 322          24   1938                              4                 3  32
## 323          24   2910                              2                 1  34
## 327          12   5801                              2                 4  49
## 328          24   1525                              4                 3  34
## 330           6   1068                              4                 4  28
## 331          24   6615                              2                 4  75
## 332          18   1864                              4                 2  30
## 334          48  11590                              2                 4  24
## 335          24   4110                              3                 4  23
## 337          13   2101                              2                 4  23
## 338          15   1275                              4                 2  24
## 339          24   4169                              4                 4  28
## 344          18   4439                              1                 1  33
## 345          10   3949                              1                 1  37
## 347          13    882                              4                 4  23
## 348          24   3758                              1                 4  23
## 349           6   1743                              1                 2  34
## 351           9   1236                              1                 4  23
## 354          12   6199                              4                 2  28
## 355          10    727                              4                 4  46
## 360          30   2406                              4                 4  23
## 361          18   1239                              4                 4  61
## 362          12   3399                              2                 3  37
## 365          18   2473                              4                 1  25
## 366          12   1542                              2                 4  36
## 368          18   3650                              1                 4  22
## 370          18   3001                              2                 4  40
## 371          36   3079                              4                 4  36
## 372          18   6070                              3                 4  33
## 373          10   2146                              1                 3  23
## 374          60  13756                              2                 4  63
## 375          60  14782                              3                 4  60
## 377          18   2320                              2                 3  34
## 378           7    846                              3                 4  36
## 379          36  14318                              4                 2  57
## 385          30   4272                              2                 2  26
## 388          18   7374                              4                 4  40
## 389          15   2326                              2                 4  27
## 392          12    983                              1                 4  19
## 393          36   3249                              2                 4  39
## 394           6   1957                              1                 4  31
## 395           9   2406                              2                 3  31
## 397          12   2578                              3                 4  55
## 398          36   2348                              3                 2  46
## 399          12   1223                              1                 1  46
## 400          24   1516                              4                 1  43
```

```
## 401          18    1473                               3                 4   39
## 403          24    8648                               2                 2   27
## 405          18    2899                               4                 4   43
## 406          24    2039                               1                 1   22
## 407          24    2197                               4                 4   43
## 408          15    1053                               4                 2   27
## 409          24    3235                               3                 2   26
## 410          12     939                               4                 2   28
## 411          24    1967                               4                 4   20
## 413          12    2292                               4                 2   42
## 414          10    1597                               3                 2   40
## 415          24    1381                               4                 2   35
## 416          36    5842                               2                 2   35
## 417          12    2579                               4                 1   33
## 418          18    8471                               1                 2   23
## 419          21    2782                               1                 2   31
## 422          12    2028                               4                 2   30
## 423          12     958                               2                 3   47
## 424          21    1591                               4                 3   34
## 425          12    2762                               1                 2   25
## 430          18    1190                               2                 4   55
## 431           5    3448                               1                 4   74
## 435           9    2136                               3                 2   25
## 436          12    1484                               2                 1   25
## 439          42    3394                               4                 4   65
## 441          12    1884                               4                 4   39
## 445          48    5096                               2                 3   30
## 449          12    1424                               3                 4   55
## 450          15    1512                               3                 3   61
## 451          36   11054                               4                 2   30
## 452           6     518                               3                 1   29
## 453          12    2759                               2                 4   34
## 455          24    4817                               2                 3   31
## 456          24    2679                               4                 1   29
## 458          12    3386                               3                 4   35
## 460          18    4594                               3                 2   32
## 461          36    3620                               1                 2   37
## 464          12     754                               4                 4   38
## 466          24    2924                               3                 4   63
## 471          24    3092                               3                 2   22
## 472           6     448                               4                 4   23
## 473           9     654                               4                 3   28
## 475          18    1245                               4                 2   33
## 476          18    3114                               1                 4   26
## 477          39    2569                               4                 4   24
## 478          24    5152                               4                 2   25
## 480          15    1478                               4                 4   44
## 482          24    1201                               4                 1   26
## 484          15     960                               3                 2   30
## 485          12    1163                               4                 4   44
## 487          12    3077                               2                 4   52
## 489          10    1418                               3                 2   35
## 490           6    3518                               2                 3   26
## 494           6     368                               4                 4   38
```

```
## 495          12   2122                                          3                2  39
## 496          24   2996                                          2                4  20
## 498          24   1585                                          4                3  40
## 500           6   1323                                          2                4  28
## 504          24   1216                                          4                4  38
## 505          24   1207                                          4                4  24
## 507          15   2360                                          2                2  36
## 509          24   1413                                          4                2  28
## 510          39   8588                                          4                2  45
## 511          12    759                                          4                2  26
## 512          36   4686                                          2                2  32
## 513          15   2687                                          2                4  26
## 515          24   2255                                          4                1  54
## 516           6    609                                          4                3  37
## 517           6   1361                                          2                4  40
## 518          36   7127                                          2                4  23
## 519           6   1203                                          3                2  43
## 520           6    700                                          4                4  36
## 521          24   5507                                          3                4  44
## 522          18   3190                                          2                2  24
## 523          48   7119                                          3                4  53
## 524          24   3488                                          3                4  23
## 528           4   1503                                          2                1  42
## 529          36   2302                                          4                4  31
## 530           6    662                                          3                4  41
## 531          36   2273                                          3                1  32
## 532          15   2631                                          2                4  28
## 534          24   1311                                          4                3  26
## 536          21   2319                                          2                1  33
## 538          18   3612                                          3                4  37
## 541          12   1534                                          1                1  23
## 542          24   2032                                          4                4  60
## 544          18   2864                                          2                1  34
## 546          24   1333                                          4                2  43
## 547          24   2022                                          4                4  37
## 548          24   1552                                          3                1  32
## 550          48   8858                                          2                1  35
## 551          12    996                                          4                4  23
## 552           6   1750                                          2                4  45
## 553          48   6999                                          1                1  34
## 554          12   1995                                          4                1  27
## 558          21   5003                                          1                4  29
## 559          24   3552                                          3                4  27
## 565          24   4712                                          4                2  37
## 566          24   1553                                          3                2  23
## 567          12   1372                                          2                3  36
## 570          48   6758                                          3                2  31
## 571          24   3234                                          4                4  23
## 572          30   5954                                          3                2  38
## 574          15    806                                          4                4  22
## 575           9   1082                                          4                4  27
## 577          12   2930                                          2                1  27
## 580          24    937                                          4                3  27
## 584          36   2384                                          4                1  33
```

```
## 585          12   2133                          4                4  52
## 587           9   2799                          2                2  36
## 588          12   1289                          4                1  21
## 589          18   1217                          4                3  47
## 590          12   2246                          3                3  60
## 596           6    931                          1                1  32
## 598          24   4241                          1                4  36
## 601           7   2329                          1                1  45
## 602           9    918                          4                1  30
## 605          10   1275                          4                2  23
## 606          24   2828                          4                4  22
## 607          24   4526                          3                2  74
## 610          15   1300                          4                4  45
## 611          12    741                          4                3  22
## 617          60   9157                          2                2  27
## 618           6   3676                          1                3  37
## 619          30   3441                          2                4  21
## 620          12    640                          4                2  49
## 621          21   3652                          2                3  27
## 624          12   1858                          4                1  22
## 625          18   2600                          4                4  65
## 626          15   1979                          4                2  35
## 627           6   2116                          2                2  41
## 628           9   1437                          2                3  29
## 629          42   4042                          4                4  36
## 630           9   3832                          1                4  64
## 631          24   3660                          2                4  28
## 632          18   1553                          4                3  44
## 634           9   1980                          2                2  19
## 636          12   1393                          4                4  47
## 638          60  15653                          2                4  21
## 639          12   1493                          4                3  34
## 640          42   4370                          3                2  26
## 642          15   1308                          4                4  38
## 644          24   1851                          4                2  33
## 646          36   7980                          4                4  27
## 647          30   4583                          2                2  32
## 649          24    947                          4                3  38
## 650          12    684                          4                4  40
## 652          12   1922                          4                2  37
## 653          24   2303                          4                1  45
## 654          36   8086                          2                4  42
## 656          14   3973                          1                4  22
## 658          48  10222                          4                3  37
## 661          12   1297                          3                4  23
## 662          12    900                          4                2  23
## 663          21   2241                          4                2  50
## 666          24   6314                          4                2  27
## 667          30   3496                          4                2  34
## 668          48   3609                          1                1  27
## 669          12   4843                          3                4  43
## 670          30   3017                          4                4  47
## 671          24   4139                          3                3  27
## 673          60  10366                          2                4  42
```

```
## 674          6   2080                         1                   2  24
## 675         21   2580                         4                   2  41
## 676         30   4530                         4                   4  26
## 678         72   5595                         2                   2  24
## 682         12   2279                         4                   4  37
## 687         10   1347                         4                   2  27
## 688         36   2862                         4                   3  30
## 691         15    975                         2                   3  25
## 693         24   2896                         2                   1  29
## 694          6   4716                         1                   3  44
## 695         24   2284                         4                   2  28
## 696          6   1236                         2                   4  50
## 697         12   1103                         4                   3  29
## 699         18   1800                         4                   2  24
## 702         48   6331                         4                   4  46
## 703         24   1377                         4                   2  47
## 704         30   2503                         4                   2  41
## 706         15   5324                         1                   4  35
## 707         48   6560                         3                   2  24
## 709          9   1206                         4                   4  25
## 710          9   2118                         2                   2  37
## 711         18    629                         4                   3  32
## 712          6   1198                         4                   4  35
## 713         21   2476                         4                   4  46
## 718         18   1505                         4                   2  32
## 719         24   3148                         3                   2  31
## 720         20   6148                         3                   4  31
## 722          6    433                         4                   2  24
## 724          9    790                         4                   3  66
## 725         27   2570                         3                   3  21
## 727         15   1316                         2                   2  47
## 731         24   6403                         1                   2  33
## 733          8    760                         4                   2  44
## 734         24   2603                         2                   4  28
## 736         36   3990                         3                   2  29
## 738         18   4380                         3                   4  35
## 739          6   6761                         1                   3  45
## 741         24   2325                         2                   3  32
## 744         24   2483                         4                   4  22
## 748         12   1274                         3                   1  37
## 749         21   5248                         1                   3  26
## 751          6    428                         2                   1  49
## 752         18    976                         1                   2  23
## 753         12    841                         2                   4  23
## 754         30   5771                         4                   2  25
## 755         12   1555                         4                   4  55
## 756         24   1285                         4                   4  32
## 757          6   1299                         1                   1  74
## 758         15   1271                         3                   4  39
## 759         24   1393                         2                   2  31
## 760         12    691                         4                   3  35
## 761         15   5045                         1                   4  59
## 762         18   2124                         4                   4  24
## 766         12   1155                         3                   3  40
```

```
## 767          30   3108                          2                  4  31
## 768          10   2901                          1                  4  31
## 769          12   3617                          1                  4  28
## 771          24   2812                          2                  4  26
## 773          21   3275                          1                  4  36
## 775          12   1480                          2                  4  66
## 777          36   3535                          4                  4  37
## 779          36   5711                          4                  2  38
## 780          18   3872                          2                  4  67
## 781          39   4933                          2                  2  25
## 782          24   1940                          4                  4  60
## 783          12   1410                          2                  2  31
## 784          12    836                          4                  2  23
## 785          20   6468                          1                  4  60
## 786          18   1941                          4                  2  35
## 788          48   2751                          4                  3  38
## 789          48   6224                          4                  4  50
## 790          40   5998                          4                  3  27
## 791          21   1188                          2                  4  39
## 792          24   6313                          3                  4  41
## 793           6   1221                          1                  2  27
## 801          24   1597                          4                  4  54
## 805          12   7472                          1                  2  24
## 807           6    590                          3                  3  26
## 808          12    930                          4                  4  65
## 809          42   9283                          1                  2  55
## 810          15   1778                          2                  1  26
## 811           8    907                          3                  2  26
## 813          36   9629                          4                  4  24
## 814          48   3051                          3                  4  54
## 817           6   1338                          1                  4  62
## 818           6   1554                          1                  2  24
## 819          36  15857                          2                  3  43
## 825          18   3780                          3                  2  35
## 826          21   1602                          4                  3  30
## 827          18   3966                          1                  4  33
## 831          24   2375                          4                  2  44
## 833          45  11816                          2                  4  29
## 836          12   1082                          4                  4  48
## 838           4    601                          1                  3  23
## 843          18   1943                          4                  4  23
## 845          18   3422                          4                  4  47
## 847          18   6761                          2                  4  68
## 848          24   1249                          4                  2  28
## 849           9   1364                          3                  4  59
## 850          12    709                          4                  4  57
## 851          20   2235                          4                  2  33
## 854          18   1442                          4                  4  32
## 856          24   1474                          4                  3  33
## 857          10    894                          4                  3  40
## 858          15   3343                          4                  2  28
## 859          15   3959                          3                  2  29
## 860           9   3577                          1                  2  26
## 861          24   5804                          4                  2  27
```

```
## 862           18    2169                                 4                    2  28
## 863           24    2439                                 4                    4  35
## 864           27    4526                                 4                    2  32
## 868           12    3331                                 2                    4  42
## 869           36    7409                                 3                    2  37
## 870           12     652                                 4                    4  24
## 875           12    3590                                 2                    2  29
## 877           18    1940                                 3                    4  36
## 879            9    1422                                 3                    2  27
## 880           30    6742                                 2                    3  36
## 883           30    2181                                 4                    4  36
## 884           18    1098                                 4                    4  65
## 885           24    4057                                 3                    3  43
## 886           12     795                                 4                    4  53
## 887           24    2825                                 4                    3  34
## 888           48   15672                                 2                    2  23
## 889           36    6614                                 4                    4  34
## 890           28    7824                                 3                    4  40
## 891           27    2442                                 4                    4  43
## 892           15    1829                                 4                    4  46
## 893           12    2171                                 4                    4  38
## 895           18    1169                                 4                    3  29
## 896           36    8947                                 3                    2  31
## 897           21    2606                                 4                    4  28
## 898           12    1592                                 3                    2  35
## 899           15    2186                                 1                    4  33
## 900           18    4153                                 2                    3  42
## 901           16    2625                                 2                    4  43
## 902           20    3485                                 2                    4  44
## 904           15    1386                                 4                    2  40
## 905           24    1278                                 4                    1  36
## 906           12    1107                                 2                    2  20
## 907           21    3763                                 2                    2  24
## 909           15    3594                                 1                    2  46
## 910            9    3195                                 1                    2  33
## 911           36    4454                                 4                    4  34
## 912           24    4736                                 2                    4  25
## 914           11    2142                                 1                    2  28
## 918            6   14896                                 1                    4  68
## 919           24    2359                                 1                    1  33
## 922           48   12749                                 4                    1  37
## 923            9    1366                                 3                    4  22
## 924           12    2002                                 3                    4  30
## 926           12     697                                 4                    2  46
## 927           18    1049                                 4                    4  21
## 930           12    1344                                 4                    2  43
## 931           24    1747                                 4                    1  24
## 934           12     522                                 4                    4  42
## 935           12    1498                                 4                    1  23
## 936           30    1919                                 4                    3  30
## 937            9     745                                 3                    2  28
## 939           60    6288                                 4                    4  42
## 940           24    6842                                 2                    4  46
## 942           10    1546                                 3                    2  31
```

```
## 943       24   929                        4                  2  31
## 944        4  1455                        2                  1  42
## 948       12  2859                        4                  4  38
## 950       24  3621                        2                  4  31
## 953       24  4113                        3                  4  28
## 954       36 10974                        4                  2  26
## 960       24  3069                        4                  4  30
## 961        6  1740                        2                  2  30
## 962       21  2353                        1                  4  47
## 964       24  2397                        3                  2  35
## 966       30  1715                        4                  1  26
## 967       27  2520                        4                  2  23
## 968       15  3568                        4                  2  54
## 970       11  3939                        1                  2  40
## 972       24  7393                        1                  4  43
## 974       60  7297                        4                  4  36
## 975       30  2831                        4                  2  33
## 976       24  1258                        3                  3  57
## 977        6   753                        2                  3  64
## 978       18  2427                        4                  2  42
## 979       24  2538                        4                  4  47
## 980       15  1264                        2                  2  25
## 981       30  8386                        2                  2  49
## 982       48  4844                        3                  2  33
## 984       36  8229                        2                  2  26
## 985       24  2028                        2                  2  30
## 986       15  1433                        4                  3  25
## 988       13  1409                        2                  4  64
## 989       24  6579                        4                  2  29
## 990       24  1743                        4                  2  48
## 991       12  3565                        2                  1  37
## 992       15  1569                        4                  4  34
## 994       36  3959                        4                  3  30
## 995       12  2390                        4                  3  50
## 997       30  3857                        4                  4  40
## 998       12   804                        4                  4  38
## 999       45  1845                        4                  4  23
##     NumberExistingCredits NumberPeopleMaintenance Telephone ForeignWorker Class
## 2                       1                       1         1             1   Bad
## 3                       1                       2         1             1  Good
## 4                       1                       2         1             1  Good
## 5                       2                       2         1             1   Bad
## 6                       1                       2         0             1  Good
## 7                       1                       1         1             1  Good
## 9                       1                       1         1             1  Good
## 10                      2                       1         1             1   Bad
## 11                      1                       1         1             1   Bad
## 12                      1                       1         1             1   Bad
## 13                      1                       1         0             1  Good
## 14                      2                       1         1             1   Bad
## 15                      1                       1         1             1  Good
## 16                      1                       1         1             1   Bad
## 17                      2                       1         1             1  Good
## 21                      3                       1         0             1  Good
```

```
## 22                       1                        2         1             1  Good
## 23                       2                        2         1             0  Good
## 24                       1                        1         1             1  Good
## 27                       1                        1         1             1  Good
## 31                       1                        1         0             1  Good
## 32                       1                        1         1             1  Good
## 33                       2                        1         0             1  Good
## 34                       1                        1         1             1  Good
## 36                       2                        1         1             1   Bad
## 37                       1                        1         0             1  Good
## 38                       1                        1         1             1   Bad
## 40                       1                        1         1             1  Good
## 42                       1                        1         0             1  Good
## 43                       1                        2         0             1  Good
## 45                       2                        1         1             1   Bad
## 50                       1                        1         1             1  Good
## 51                       1                        1         1             1  Good
## 52                       2                        1         0             1  Good
## 55                       2                        1         0             1   Bad
## 58                       2                        1         1             1  Good
## 59                       1                        1         1             1  Good
## 60                       2                        1         0             1   Bad
## 66                       4                        2         0             1  Good
## 68                       1                        1         1             1  Good
## 69                       1                        1         0             1   Bad
## 70                       1                        1         1             1  Good
## 71                       1                        1         1             1  Good
## 72                       2                        1         0             1  Good
## 77                       1                        1         1             1   Bad
## 78                       1                        1         1             1  Good
## 81                       2                        1         0             1   Bad
## 83                       1                        1         1             1  Good
## 84                       1                        1         0             1  Good
## 85                       1                        1         1             1  Good
## 86                       2                        1         0             1  Good
## 88                       1                        2         0             1   Bad
## 90                       2                        1         1             1   Bad
## 91                       1                        1         1             1  Good
## 92                       1                        1         1             1  Good
## 93                       1                        2         1             1   Bad
## 96                       1                        1         0             1   Bad
## 97                       1                        1         1             1  Good
## 98                       1                        1         1             1  Good
## 99                       1                        1         1             1  Good
## 100                      2                        2         0             1  Good
## 101                      1                        1         1             1  Good
## 102                      1                        1         1             1  Good
## 103                      1                        1         1             1  Good
## 104                      1                        1         0             1  Good
## 106                      2                        2         0             1   Bad
## 109                      1                        1         0             0  Good
## 110                      1                        1         0             1  Good
## 111                      2                        2         1             1  Good
## 115                      1                        1         1             1  Good
```

```
## 117                    1                      1         0             1   Bad
## 118                    2                      1         1             0  Good
## 119                    2                      1         1             1   Bad
## 120                    1                      1         0             1  Good
## 121                    2                      1         0             1   Bad
## 123                    1                      1         1             1  Good
## 125                    1                      1         1             1   Bad
## 126                    2                      1         1             1  Good
## 127                    1                      1         1             1  Good
## 128                    1                      1         1             1   Bad
## 129                    2                      1         0             1  Good
## 130                    2                      1         1             1   Bad
## 131                    1                      1         1             1  Good
## 134                    2                      1         1             1  Good
## 135                    1                      1         0             1  Good
## 136                    2                      1         0             1  Good
## 137                    2                      1         1             1  Good
## 139                    3                      1         0             1  Good
## 141                    1                      1         1             0  Good
## 142                    1                      1         0             1  Good
## 145                    1                      1         0             1  Good
## 146                    1                      1         1             1  Good
## 147                    2                      1         0             1  Good
## 150                    2                      1         1             1  Good
## 151                    1                      2         0             1  Good
## 153                    1                      1         1             1  Good
## 154                    1                      1         1             1  Good
## 155                    1                      1         0             1  Good
## 156                    1                      1         1             1   Bad
## 157                    2                      2         1             0  Good
## 158                    1                      1         1             1  Good
## 159                    2                      1         0             1  Good
## 160                    2                      2         1             1  Good
## 165                    1                      1         1             1  Good
## 166                    1                      1         0             1  Good
## 167                    1                      1         1             1   Bad
## 168                    1                      1         1             1  Good
## 170                    2                      1         0             1   Bad
## 171                    2                      2         1             1   Bad
## 173                    1                      1         0             1   Bad
## 174                    1                      1         1             0  Good
## 175                    2                      1         1             1   Bad
## 177                    1                      1         1             1  Good
## 178                    2                      1         1             1  Good
## 180                    2                      1         1             1  Good
## 181                    2                      1         1             1   Bad
## 184                    1                      1         0             1  Good
## 187                    1                      2         0             1   Bad
## 190                    2                      1         0             1  Good
## 191                    3                      1         0             1   Bad
## 194                    1                      1         1             1  Good
## 195                    1                      1         1             1   Bad
## 197                    2                      1         0             1  Good
## 198                    4                      1         1             1   Bad
```

```
## 199                 1                      1         0             1  Good
## 200                 1                      1         0             1   Bad
## 201                 2                      1         0             1  Good
## 202                 1                      1         1             1  Good
## 203                 2                      1         1             1  Good
## 206                 3                      2         0             1  Good
## 207                 3                      1         0             1  Good
## 211                 2                      2         1             1  Good
## 214                 1                      1         0             1   Bad
## 215                 1                      1         0             1  Good
## 216                 2                      1         1             1  Good
## 219                 1                      1         1             1  Good
## 220                 1                      1         0             1  Good
## 221                 1                      1         1             1  Good
## 223                 2                      1         1             1  Good
## 225                 1                      1         0             1  Good
## 226                 2                      1         1             1  Good
## 229                 1                      1         1             1   Bad
## 230                 1                      1         1             1  Good
## 231                 1                      1         1             1   Bad
## 232                 1                      1         1             1  Good
## 233                 1                      1         1             1  Good
## 234                 1                      1         1             1  Good
## 235                 3                      2         1             1  Good
## 238                 2                      1         1             1   Bad
## 242                 1                      2         1             1  Good
## 244                 2                      1         1             1  Good
## 245                 1                      2         1             1  Good
## 247                 3                      1         1             1  Good
## 253                 1                      1         1             1   Bad
## 254                 2                      1         1             1  Good
## 255                 1                      1         0             1  Good
## 256                 1                      1         1             1  Good
## 259                 1                      1         0             1  Good
## 260                 3                      1         1             1  Good
## 261                 1                      1         1             1  Good
## 262                 1                      1         1             1  Good
## 263                 3                      1         0             1  Good
## 264                 3                      1         1             1  Good
## 265                 2                      2         1             0  Good
## 267                 2                      1         1             1  Good
## 269                 1                      1         0             0   Bad
## 272                 1                      1         0             1  Good
## 273                 1                      1         0             1  Good
## 274                 2                      1         1             1   Bad
## 276                 1                      2         1             1  Good
## 278                 1                      1         0             1  Good
## 279                 1                      1         1             1   Bad
## 280                 1                      1         0             1  Good
## 286                 1                      1         0             1  Good
## 289                 2                      1         0             1  Good
## 290                 1                      1         1             1   Bad
## 291                 1                      1         0             0  Good
## 292                 1                      1         0             1   Bad
```

```
## 294                    1                 1       1          1  Good
## 295                    2                 2       1          1  Good
## 296                    1                 1       0          1   Bad
## 297                    1                 1       1          1  Good
## 299                    1                 1       0          1  Good
## 300                    2                 1       0          1  Good
## 301                    1                 1       0          1  Good
## 302                    1                 1       0          1   Bad
## 306                    1                 1       1          1  Good
## 307                    1                 1       1          1  Good
## 308                    1                 1       0          1   Bad
## 315                    1                 2       1          0  Good
## 317                    1                 2       1          1  Good
## 318                    1                 1       0          1  Good
## 319                    2                 1       1          1  Good
## 322                    1                 1       1          1   Bad
## 323                    1                 1       0          1  Good
## 327                    1                 1       0          1  Good
## 328                    1                 2       0          1  Good
## 330                    1                 2       1          1  Good
## 331                    2                 1       0          1  Good
## 332                    2                 1       1          1   Bad
## 334                    2                 1       1          1   Bad
## 335                    2                 2       1          1   Bad
## 337                    1                 1       1          1  Good
## 338                    1                 1       1          1   Bad
## 339                    1                 1       1          1  Good
## 344                    1                 1       0          1  Good
## 345                    1                 2       1          1  Good
## 347                    2                 1       1          1  Good
## 348                    1                 1       1          1  Good
## 349                    2                 1       1          1  Good
## 351                    1                 1       0          1  Good
## 354                    2                 1       0          1   Bad
## 355                    1                 1       0          1  Good
## 360                    1                 1       1          1   Bad
## 361                    1                 1       1          1  Good
## 362                    1                 1       1          1  Good
## 365                    1                 1       1          1   Bad
## 366                    1                 1       0          1  Good
## 368                    1                 1       1          1  Good
## 370                    1                 1       1          1  Good
## 371                    1                 1       1          1  Good
## 372                    2                 1       0          1  Good
## 373                    2                 1       1          1  Good
## 374                    1                 1       0          1  Good
## 375                    2                 1       0          1   Bad
## 377                    2                 1       1          1  Good
## 378                    1                 1       1          1  Good
## 379                    1                 1       0          1   Bad
## 385                    2                 1       1          1  Good
## 388                    2                 1       0          1  Good
## 389                    1                 1       1          1  Good
## 392                    1                 1       1          1  Good
```

```
## 393                    1                 2      0          1  Good
## 394                    1                 1      1          1  Good
## 395                    1                 1      1          1  Good
## 397                    1                 1      1          1  Good
## 398                    2                 1      0          1  Good
## 399                    2                 1      1          1   Bad
## 400                    2                 1      1          1  Good
## 401                    1                 1      0          1  Good
## 403                    2                 1      0          1   Bad
## 405                    1                 2      1          1  Good
## 406                    1                 1      0          1   Bad
## 407                    2                 2      0          1  Good
## 408                    1                 1      1          0  Good
## 409                    1                 1      0          1  Good
## 410                    3                 1      0          1   Bad
## 411                    1                 1      0          1  Good
## 413                    2                 1      0          1   Bad
## 414                    1                 2      1          0  Good
## 415                    1                 1      1          1   Bad
## 416                    2                 2      0          1  Good
## 417                    1                 2      1          1   Bad
## 418                    2                 1      0          1  Good
## 419                    1                 1      1          1  Good
## 422                    1                 1      1          1  Good
## 423                    2                 2      1          1  Good
## 424                    2                 1      1          1  Good
## 425                    1                 1      0          1   Bad
## 430                    3                 2      1          1   Bad
## 431                    1                 1      1          1  Good
## 435                    1                 1      1          1  Good
## 436                    1                 1      0          1   Bad
## 439                    2                 1      1          1  Good
## 441                    1                 1      0          1  Good
## 445                    1                 1      0          1   Bad
## 449                    1                 1      0          1  Good
## 450                    2                 1      1          1   Bad
## 451                    1                 1      0          1  Good
## 452                    1                 1      1          1  Good
## 453                    2                 1      1          1  Good
## 455                    1                 1      0          1   Bad
## 456                    1                 1      0          1  Good
## 458                    1                 1      0          1   Bad
## 460                    1                 1      0          1  Good
## 461                    1                 2      1          1  Good
## 464                    2                 1      1          1  Good
## 466                    1                 2      0          1  Good
## 471                    1                 1      0          1   Bad
## 472                    1                 1      1          1   Bad
## 473                    1                 1      1          1   Bad
## 475                    1                 1      1          1   Bad
## 476                    1                 1      1          1   Bad
## 477                    1                 1      1          1  Good
## 478                    1                 1      1          1  Good
## 480                    2                 2      0          1  Good
```

```
## 482                     1                       1         1             1 Good
## 484                     2                       1         1             1 Good
## 485                     1                       1         0             1 Good
## 487                     1                       1         0             1 Good
## 489                     1                       1         1             0 Good
## 490                     1                       1         1             1 Good
## 494                     1                       1         1             1 Good
## 495                     2                       2         1             0 Good
## 496                     1                       1         1             1  Bad
## 498                     2                       1         1             1 Good
## 500                     2                       2         0             1 Good
## 504                     2                       2         1             1  Bad
## 505                     1                       1         1             1  Bad
## 507                     1                       1         0             1 Good
## 509                     1                       1         1             1 Good
## 510                     1                       1         0             1 Good
## 511                     1                       1         1             1  Bad
## 512                     1                       1         0             1 Good
## 513                     1                       1         0             1 Good
## 515                     1                       1         1             1 Good
## 516                     2                       1         1             0 Good
## 517                     1                       2         1             0 Good
## 518                     2                       1         0             1  Bad
## 519                     1                       1         0             1 Good
## 520                     2                       1         1             1 Good
## 521                     2                       1         1             1 Good
## 522                     1                       1         1             1  Bad
## 523                     2                       2         1             1  Bad
## 524                     1                       1         1             1 Good
## 528                     2                       2         1             1 Good
## 529                     1                       1         1             1  Bad
## 530                     1                       2         0             1 Good
## 531                     2                       2         1             1 Good
## 532                     2                       1         0             1  Bad
## 534                     1                       1         0             1 Good
## 536                     1                       1         1             1  Bad
## 538                     1                       1         0             1 Good
## 541                     1                       1         1             1  Bad
## 542                     2                       1         0             1 Good
## 544                     1                       2         1             1  Bad
## 546                     2                       2         1             1  Bad
## 547                     1                       1         0             1 Good
## 548                     1                       2         1             1 Good
## 550                     2                       1         0             1 Good
## 551                     2                       1         1             1 Good
## 552                     1                       2         1             1 Good
## 553                     2                       1         0             1  Bad
## 554                     1                       1         1             1 Good
## 558                     2                       1         0             1  Bad
## 559                     1                       1         1             1  Bad
## 565                     2                       1         0             1 Good
## 566                     2                       1         0             1 Good
## 567                     1                       1         1             1  Bad
## 570                     1                       1         0             1  Bad
```

```
## 571                    1                      1         0             1   Bad
## 572                    1                      1         1             1  Good
## 574                    1                      1         1             1  Good
## 575                    2                      1         1             1  Good
## 577                    1                      1         1             1  Good
## 580                    2                      1         1             1  Good
## 584                    1                      1         1             1   Bad
## 585                    1                      1         0             1  Good
## 587                    2                      2         1             1  Good
## 588                    1                      1         1             1  Good
## 589                    1                      1         0             1   Bad
## 590                    2                      1         1             1   Bad
## 596                    1                      1         1             1   Bad
## 598                    3                      1         0             1   Bad
## 601                    1                      1         1             1  Good
## 602                    1                      1         1             1   Bad
## 605                    1                      1         1             1  Good
## 606                    1                      1         0             1  Good
## 607                    1                      1         0             1  Good
## 610                    1                      2         1             1  Good
## 611                    1                      1         1             1   Bad
## 617                    1                      1         1             1  Good
## 618                    3                      2         1             1  Good
## 619                    1                      1         1             1   Bad
## 620                    1                      1         1             1  Good
## 621                    2                      1         1             1  Good
## 624                    1                      1         1             1  Good
## 625                    2                      1         1             1   Bad
## 626                    1                      1         1             1  Good
## 627                    1                      1         0             1  Good
## 628                    1                      1         1             1   Bad
## 629                    2                      1         0             1  Good
## 630                    1                      1         1             1  Good
## 631                    1                      1         1             1  Good
## 632                    1                      1         1             1   Bad
## 634                    2                      1         1             1   Bad
## 636                    3                      2         0             1  Good
## 638                    2                      1         0             1  Good
## 639                    1                      2         1             1  Good
## 640                    2                      2         0             1   Bad
## 642                    2                      1         1             1  Good
## 644                    2                      1         0             1  Good
## 646                    2                      1         0             1   Bad
## 647                    2                      1         1             1  Good
## 649                    1                      2         1             1   Bad
## 650                    1                      2         1             1   Bad
## 652                    1                      1         1             1   Bad
## 653                    1                      1         1             1   Bad
## 654                    4                      1         0             1   Bad
## 656                    1                      1         1             1  Good
## 658                    1                      1         0             1  Good
## 661                    1                      1         1             1  Good
## 662                    1                      1         1             1   Bad
## 663                    2                      1         1             1  Good
```

```
## 666                    2                      1         0             1  Good
## 667                    1                      2         0             1  Good
## 668                    1                      1         1             1  Good
## 669                    2                      1         0             1   Bad
## 670                    1                      1         1             1  Good
## 671                    2                      1         0             1  Good
## 673                    1                      1         0             1  Good
## 674                    1                      1         1             1  Good
## 675                    1                      2         1             1   Bad
## 676                    1                      1         0             1  Good
## 678                    1                      1         1             1   Bad
## 682                    1                      1         0             1  Good
## 687                    2                      1         0             1  Good
## 688                    1                      1         1             1  Good
## 691                    2                      1         1             1  Good
## 693                    1                      1         1             1  Good
## 694                    2                      2         1             1  Good
## 695                    1                      1         0             1  Good
## 696                    1                      1         1             1  Good
## 697                    2                      1         1             0  Good
## 699                    2                      1         1             1  Good
## 702                    2                      1         0             1   Bad
## 703                    1                      1         0             1  Good
## 704                    2                      1         1             1  Good
## 706                    1                      1         1             1  Good
## 707                    1                      1         1             1   Bad
## 709                    1                      1         1             1  Good
## 710                    1                      2         1             1  Good
## 711                    2                      1         0             1  Good
## 712                    1                      1         1             1   Bad
## 713                    1                      1         0             1  Good
## 718                    1                      1         0             1  Good
## 719                    2                      1         0             1  Good
## 720                    2                      1         0             1  Good
## 722                    1                      2         1             1   Bad
## 724                    1                      1         1             1  Good
## 725                    1                      1         1             1   Bad
## 727                    2                      1         1             1  Good
## 731                    1                      1         1             1  Good
## 733                    1                      1         1             1  Good
## 734                    1                      1         0             1  Good
## 736                    1                      1         1             1  Good
## 738                    1                      2         0             1  Good
## 739                    2                      2         0             1  Good
## 741                    1                      1         1             1  Good
## 744                    1                      1         0             1  Good
## 748                    1                      1         1             1   Bad
## 749                    1                      1         1             1  Good
## 751                    1                      1         0             1  Good
## 752                    1                      1         1             1   Bad
## 753                    1                      1         1             1  Good
## 754                    2                      1         1             1  Good
## 755                    2                      2         1             1   Bad
## 756                    1                      1         1             1   Bad
```

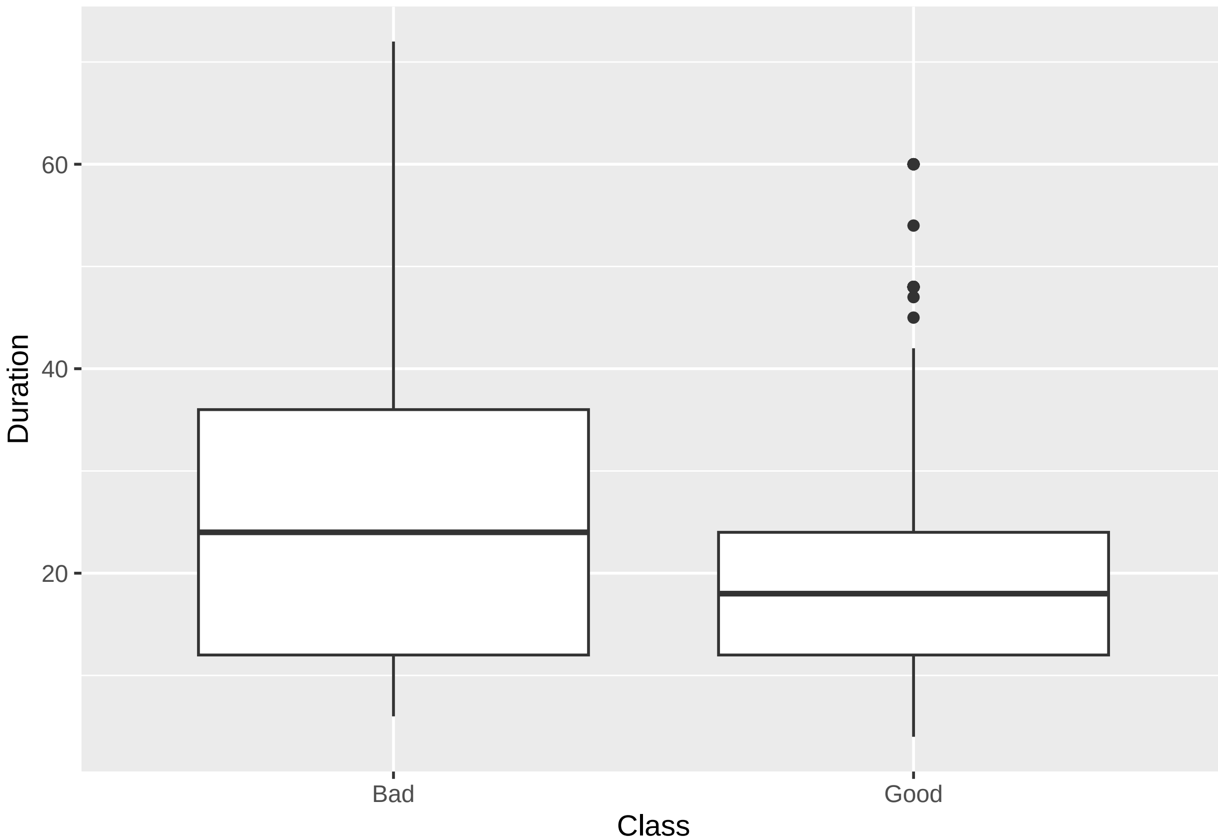
```
## 757                        3                         2          1              0  Good
## 758                        2                         1          0              1   Bad
## 759                        1                         1          0              1  Good
## 760                        2                         1          1              1   Bad
## 761                        1                         1          0              1  Good
## 762                        2                         1          1              1   Bad
## 766                        2                         1          1              1  Good
## 767                        1                         1          1              1   Bad
## 768                        1                         1          1              1  Good
## 769                        3                         1          0              1  Good
## 771                        1                         1          1              1  Good
## 773                        1                         1          0              1  Good
## 775                        3                         1          1              1  Good
## 777                        2                         1          0              1  Good
## 779                        2                         1          0              1  Good
## 780                        1                         1          0              1  Good
## 781                        2                         1          1              1   Bad
## 782                        1                         1          0              1  Good
## 783                        1                         1          0              1  Good
## 784                        1                         1          1              1   Bad
## 785                        1                         1          0              1  Good
## 786                        1                         1          0              1  Good
## 788                        2                         2          0              1  Good
## 789                        1                         1          1              1   Bad
## 790                        1                         1          0              1   Bad
## 791                        1                         2          1              1   Bad
## 792                        1                         2          0              1  Good
## 793                        2                         1          1              1  Good
## 801                        2                         2          1              1  Good
## 805                        1                         1          1              1  Good
## 807                        1                         1          1              0  Good
## 808                        4                         1          1              1  Good
## 809                        1                         1          0              1  Good
## 810                        2                         1          1              1   Bad
## 811                        1                         1          0              1  Good
## 813                        2                         1          0              1   Bad
## 814                        1                         1          1              1   Bad
## 817                        1                         1          1              1  Good
## 818                        2                         1          0              1  Good
## 819                        1                         1          1              1  Good
## 825                        2                         1          0              1  Good
## 826                        2                         1          0              1  Good
## 827                        3                         1          0              1   Bad
## 831                        2                         2          0              1  Good
## 833                        2                         1          1              1   Bad
## 836                        2                         1          1              1   Bad
## 838                        1                         2          1              1  Good
## 843                        1                         1          1              1   Bad
## 845                        3                         2          0              1  Good
## 847                        2                         1          1              1   Bad
## 848                        1                         1          1              1  Good
## 849                        1                         1          1              1  Good
## 850                        1                         1          1              1   Bad
## 851                        2                         1          1              0   Bad
```

```
## 854    2    2    1    1   Bad
## 856    1    1    0    1  Good
## 857    1    1    0    1  Good
## 858    1    1    0    1  Good
## 859    1    1    0    1   Bad
## 860    1    2    1    0  Good
## 861    2    1    1    1  Good
## 862    1    1    0    1   Bad
## 863    1    1    0    1   Bad
## 864    2    2    0    1  Good
## 868    1    1    1    1  Good
## 869    2    1    1    1  Good
## 870    1    1    1    1  Good
## 875    1    2    1    1  Good
## 877    1    1    0    1  Good
## 879    1    1    0    1   Bad
## 880    2    1    1    1  Good
## 883    2    1    1    1  Good
## 884    2    1    1    1  Good
## 885    1    1    0    1   Bad
## 886    1    1    1    1   Bad
## 887    2    2    0    1  Good
## 888    1    1    0    1   Bad
## 889    2    1    0    1  Good
## 890    2    2    0    1  Good
## 891    4    2    0    1  Good
## 892    2    1    0    1  Good
## 893    2    1    1    0  Good
## 895    2    1    0    1  Good
## 896    1    2    0    1  Good
## 897    1    1    0    1  Good
## 898    1    1    1    0  Good
## 899    1    1    1    1  Good
## 900    1    1    1    1   Bad
## 901    1    1    0    1   Bad
## 902    2    1    0    1  Good
## 904    1    1    0    1  Good
## 905    1    1    0    1  Good
## 906    1    2    0    1  Good
## 907    1    1    1    0  Good
## 909    2    1    1    1  Good
## 910    1    1    1    1  Good
## 911    2    1    1    1  Good
## 912    1    1    1    1   Bad
## 914    1    1    0    1  Good
## 918    1    1    0    1   Bad
## 919    1    1    1    1   Bad
## 922    1    1    0    1  Good
## 923    1    1    1    1   Bad
## 924    1    2    0    1  Good
## 926    2    1    0    1   Bad
## 927    1    1    1    1  Good
## 930    2    2    1    1  Good
## 931    1    1    1    0  Good
```

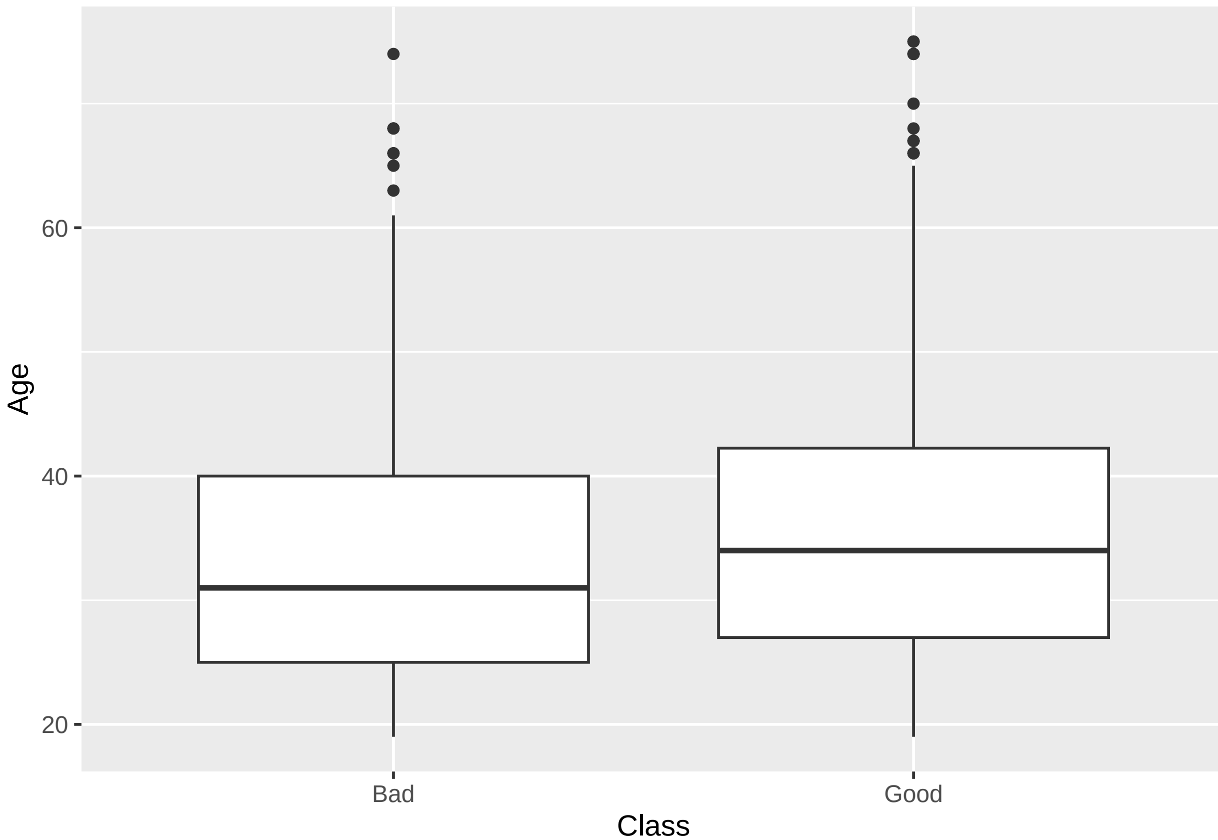
```
## 934                         2                         2          0              1  Good
## 935                         1                         1          1              1  Good
## 936                         2                         1          1              1   Bad
## 937                         1                         1          1              1   Bad
## 939                         1                         1          1              1   Bad
## 940                         2                         2          0              1  Good
## 942                         1                         2          1              0  Good
## 943                         1                         1          0              1  Good
## 944                         3                         2          1              1  Good
## 948                         1                         1          0              1  Good
## 950                         2                         1          1              1   Bad
## 953                         1                         1          1              1   Bad
## 954                         2                         1          0              1   Bad
## 960                         1                         1          1              1  Good
## 961                         2                         1          1              1  Good
## 962                         2                         1          1              1  Good
## 964                         2                         1          0              1   Bad
## 966                         1                         1          1              1  Good
## 967                         2                         1          1              1   Bad
## 968                         1                         1          0              1  Good
## 970                         2                         2          1              1  Good
## 972                         1                         2          1              1  Good
## 974                         1                         1          1              1   Bad
## 975                         1                         1          0              1  Good
## 976                         1                         1          1              1  Good
## 977                         1                         1          1              1  Good
## 978                         2                         1          1              1  Good
## 979                         2                         2          1              1   Bad
## 980                         1                         1          1              1   Bad
## 981                         1                         1          1              1   Bad
## 982                         1                         1          0              1   Bad
## 984                         1                         2          1              1   Bad
## 985                         2                         1          1              1  Good
## 986                         2                         1          1              1  Good
## 988                         1                         1          1              1  Good
## 989                         1                         1          0              1  Good
## 990                         2                         1          1              1  Good
## 991                         2                         2          1              1  Good
## 992                         1                         2          1              1  Good
## 994                         1                         1          0              1  Good
## 995                         1                         1          0              1  Good
## 997                         1                         1          0              1  Good
## 998                         1                         1          1              1  Good
## 999                         1                         1          0              1   Bad
```

7. Create and interpret boxplots of all the predictor variables in relation to the outcome variable (**Class**).

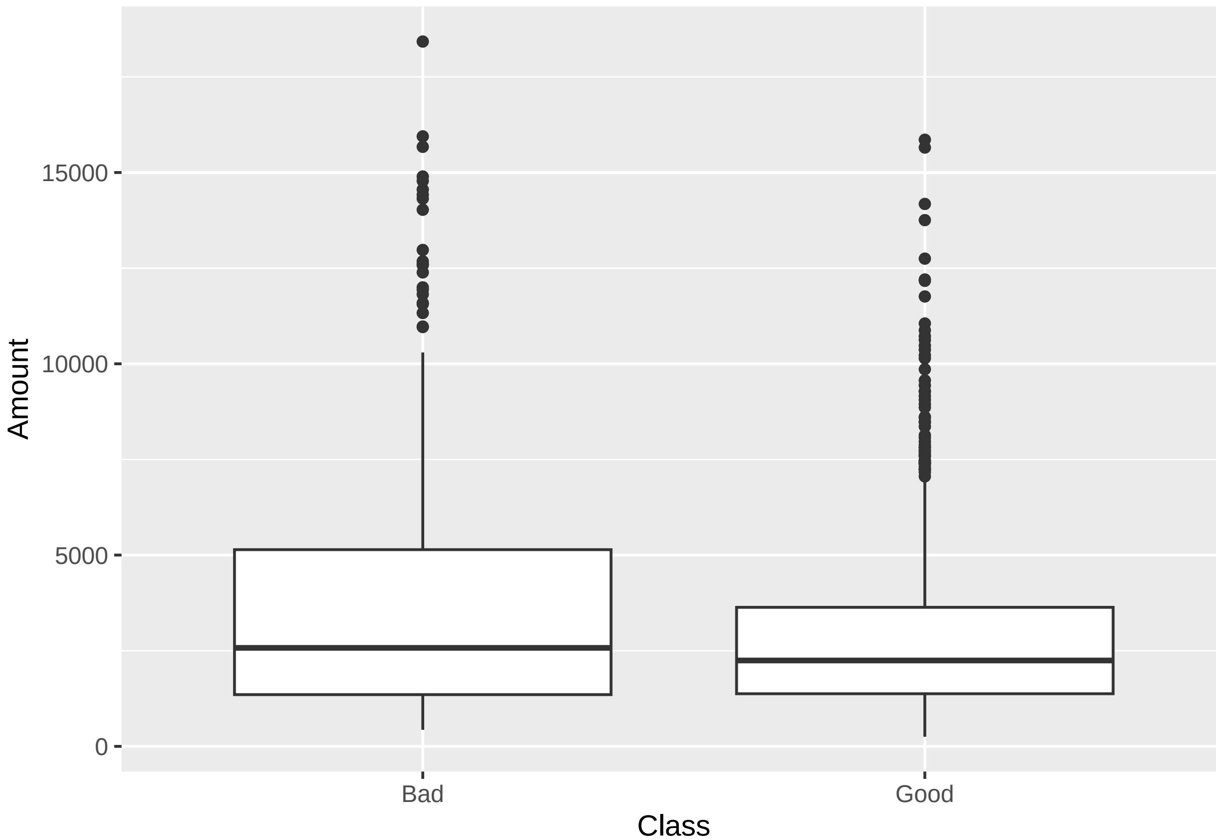
```
ggplot(subCredit, aes(Class,Duration)) + geom_boxplot()
```




```
ggplot(subCredit, aes(Class,Age)) + geom_boxplot()
```




```
ggplot(subCredit, aes(Class,Amount)) + geom_boxplot()
```



8. Train a support vector machine with the **ksvm()** function from the **kernlab** package. Make sure that you have installed and libraried the **kernlab** package. Have the **cost** be 5, and have **ksvm** do 3 **cross validations** (Hint: try `prob.model = TRUE`)

```
svm <- ksvm(data=subCredit, Class ~.,C=5, CV=3,prob.model=TRUE)
svm
```

```
## Support Vector Machine object of class "ksvm"
##
## SV type: C-svc  (classification)
##  parameter : cost C = 5
##
## Gaussian Radial Basis kernel function.
##  Hyperparameter : sigma =  0.092244004453622
##
## Number of Support Vectors : 634
##
## Objective Function Value : -2483.01
## Training error : 0.224
## Probability model included.
```

9. Examine the ksvm output object. In particular, look at the **cross-validation error** for an initial indication of model quality. Add a comment that gives your opinion on whether this is a good model.

```
# 0.219 is the error, and it is good because it is a low number
```

10. Predict the training cases using the **predict()** command

```
predicted <- predict(svm, testSet)
predicted
```

```
##   [1] Good Good Good Bad  Good Good Good Good Good Bad  Good Good Good Good Good
##  [16] Good Good Good Good Good Good Good Good Good Bad  Good Good Good Good Good
##  [31] Bad  Good Good Good Good Good Good Bad  Good Good Good Good Good Good Bad
##  [46] Good Bad  Good Good Good Good Bad  Good Good Good Bad  Bad  Good Good Good
##  [61] Good Good Bad  Good Good Bad  Good Good Good Good Bad  Good Good Good Good
##  [76] Good Good Good Good Good Good Good Good Good Good Good Good Good Good Good
##  [91] Good Bad  Good Good Good Good Good Good Good Good Good Good Good Good Good
## [106] Good Good Good Bad  Good Good Good Good Good Good Good Good Bad  Good Good
## [121] Good Bad  Good Bad  Good Good Good Good Good Good Good Good Good Good Good
## [136] Good Good Good Good Good Good Good Good Good Good Good Good Good Good Good
## [151] Good Good Good Good Good Good Good Good Good Good Good Good Good Good Good
## [166] Bad  Good Good Bad  Good Good Good Good Good Good Good Good Good Bad  Good
## [181] Bad  Good Good Good Good Good Good Good Good Good Good Good Good Good Good
## [196] Good Good Good Good Good Bad  Bad  Good Good Good Good Good Good Good Good
## [211] Good Good Good Good Good Good Good Good Good Good Good Good Good Good Bad
## [226] Good Good Bad  Good Good Good Good Good Good Good Good Good Good Good Good
## [241] Bad  Good Good Good Good Good Good Good Good Good Good Good Bad  Good Good
## [256] Good Good Good Good Bad  Good Good Good Bad  Good Good Good Good Bad  Good
## [271] Good Good Good Good Good Good Good Good Good Good Good Good Good Bad  Good
## [286] Good Good Good Good Good Good Good Good Good Good Good Good Bad  Good Good
## [301] Good Good Good Good Good Good Good Good Bad  Good Good Good Good Bad  Good
## [316] Good Good Good Good Good Good Good Good Good Good Good Bad  Good Bad  Bad
## [331] Good Good Bad  Good Good Good Good Good Good Bad  Good Good Good Good Good
## [346] Good Good Good Good Good Good Good Good Bad  Good Good Good Good Good Bad
## [361] Good Bad  Good Good Good Good Good Good Good Good Good Good Good Good Good
## [376] Good Good Good Bad  Good Good Good Bad  Good Bad  Bad  Good Good Bad  Good
## [391] Good Good Good Good Good Good Good Good Good Good Good Good Bad  Good Bad
## [406] Good Good Good Good Good Good Good Good Good Good Good Good Good Good Bad
## [421] Good Good Good Good Good Good Good Good Bad  Good Good Good Good Good Good
## [436] Good Good Good Good Good Good Good Good Good Good Good Bad  Good Good Good
## [451] Good Good Good Good Good Good Good Good Good Good Good Good Good Good Good
## [466] Good Good Good Good Good Good Bad  Bad  Good Good Good Bad  Good Good Good
## [481] Good Good Good Bad  Bad  Good Good Good Good Good Good Good Bad  Good Good
## [496] Good Good Good Good Good Good Good Bad  Good Good Good Good Good Good Good
## [511] Good Good Good Good Good Good Good Good Good Good Good Good Good Good Bad
## [526] Good Good Good Good Good Good Good Good Good Good Good Good Good Good Good
## [541] Good Good Good Good Good Good Good Bad  Good Good Good Good Good Good Bad
## [556] Good Good Good Good Good Bad  Good Good Good Good Good Good Good Bad  Good
## [571] Good Good Good Good Good Good Good Good Bad  Good Good Good Good Bad  Good
## [586] Good Bad  Good Good Good Good Good Good Good Bad  Good Good Good Good Bad
## Levels: Bad Good
```

11. Examine the predicted out object with **str( )**. Then, calculate a **confusion matrix** using the **table()** function.

```
str(predicted)
```

```
##  Factor w/ 2 levels "Bad","Good": 2 2 2 1 2 2 2 2 2 1 ...
```

```
CCM <- table(predicted, testSet$Class)
CCM
```

```
##
## predicted Bad Good
##      Bad   56   14
##      Good 124  406
```

12. Interpret the confusion matrix and in particular calculate the overall **accuracy** of the model. The **diag( )** command can be applied to the results of the table command you ran in the previous step. You can also use **sum( )** to get the total of all four cells.

```
(sum(CCM)- sum(diag(CCM)))/sum(CCM)
```

```
## [1] 0.23
```

13. Check you calculation with the **confusionMatrix()** function in the **caret** package.

```
1-0.2183333
```

```
## [1] 0.7816667
```