Assignment 3 Group 1 Question 2.2

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Q1: Import Pre-Processed Data and Splitting

The loans data has been preprocessed using Python. We first read in the CSV file which contains the data that has already been preprocessed (only contain the 8 columns).

Next, we split the data into:
* Training Set (20,000 records) * Validation Set (8,000 records) * Test Set (Remaining 10,697 records)

Q2: Classification Tree Using C50

```
##
## Charged Off   Fully Paid
##       5435        33262
```

The proportion of repaid loans in the dataset is 0.8595. We will now try to achieve an accuracy greater than this using classification tree.

```
##
## Call:
## C5.0.default(x = subset(train, select = -loan_status), y
##  = train$loan_status)
##
## Classification Tree
## Number of samples: 20000
## Number of predictors: 7
##
## Tree size: 1
##
## Non-standard options: attempt to group attributes

##
## Call:
## C5.0.default(x = subset(train, select = -loan_status), y
##  = train$loan_status)
##
##
## C5.0 [Release 2.07 GPL Edition]      Mon Feb 13 15:53:50 2017
## -------------------------------
##
## Class specified by attribute `outcome'
##
## Read 20000 cases (8 attributes) from undefined.data
##
## Decision tree:
##  Fully Paid (20000/2797)
##
##
## Evaluation on training data (20000 cases):
##
```

```
##      Decision Tree
##    ----------------
##    Size      Errors
##
##       1 2797(14.0%)   <<
##
##
##    (a)   (b)    <-classified as
##    ----  ----
##          2797   (a): class Charged Off
##         17203   (b): class Fully Paid
##
##
## Time: 0.2 secs
```

As observed, the classification tree classifies all training samples as "Fully Repaid" and its accuracy is simply the proportion of repaid loans in the training set.

We will now try to test this classification tree using validatin set.

```
##              predicted
## actual        Charged Off Fully Paid
##    Charged Off          0       1132
##    Fully Paid           0       6868
```

All the validation records are predicted to be "Fully Paid" as well. Its accuracy is hence the proportion of repaid loans in the validation set.

The number of repaid loans greatly outnumbers the number of charged-off loans. Consequently during the training phase, the algorithm discovers that doing a majority prediction using a single leaf node produces the best training accuracy. Thus, the trained classification tree simply predicts all loans as "Fully Repaid".

Q3: C50 Classification Tree with Costs Adjustments

We will need to train the classification tree with a cost matrix to correct the default behaviour of C50 in maximising the accuracy.

Granting a loan to a customer who is likely to default is much more costlier (i.e. False Negative) than denying loan to a customer who is likely able to pay back (i.e. False Positive). In the cost matrices, we set the cost of False Positive to 1 and test out different values of the cost of False Negative (from 2.8 to 5.2, in the increment of 0.1).

Table 1: Validation Performance Using Different Cost Matrices

weight	sens	prec	spec	acc
2.8	0.2031802	0.2784504	0.9132207	0.812750
2.9	0.2208481	0.2717391	0.9024461	0.806000
3.0	0.2579505	0.2649728	0.8820617	0.793750
3.1	0.2950530	0.2505626	0.8545428	0.775375
3.2	0.2950530	0.2613459	0.8625510	0.782250
3.3	0.3100707	0.2554585	0.8510483	0.774500
3.4	0.3321555	0.2575342	0.8421666	0.770000
3.5	0.3321555	0.2521797	0.8376529	0.766125
3.6	0.3418728	0.2511356	0.8319744	0.762625
3.7	0.3666078	0.2509069	0.8195981	0.755500
3.8	0.3825088	0.2478535	0.8086779	0.748375

weight	sens	prec	spec	acc
3.9	0.3992933	0.2495859	0.8021258	0.745125
4.0	0.4143110	0.2464530	0.7912056	0.737875
4.1	0.4478799	0.2416587	0.7683460	0.723000
4.2	0.4549470	0.2413308	0.7642691	0.720500
4.3	0.4628975	0.2395976	0.7578626	0.716125
4.4	0.4673145	0.2377528	0.7530577	0.712625
4.5	0.4664311	0.2370903	0.7526209	0.712125
4.6	0.4717314	0.2378619	0.7508736	0.711375
4.7	0.4805654	0.2366246	0.7444671	0.707125
4.8	0.4840989	0.2337884	0.7384974	0.702500
4.9	0.4867491	0.2328825	0.7357309	0.700500
5.0	0.4893993	0.2317992	0.7326733	0.698250
5.1	0.4911661	0.2304186	0.7296156	0.695875
5.2	0.5044170	0.2298712	0.7214619	0.690750

The target sensitivity levels that we are interested in are 25%, 40% and 50%.

25% Sensitivity

The costs matrix which achieves 25% sensitivity is:

```
## [1] "Costs Matrix: "

##               predicted
## actual        Charged Off Fully Paid
##    Charged Off          0          3
##    Fully Paid           1          0
```

From the earlier table, we can see that it achieves a sensitivity of 0.258 and precision of 0.265

40% Sensitivity

The costs matrix which achieves 40% sensitivity is:

```
## [1] "Costs Matrix: "

##               predicted
## actual        Charged Off Fully Paid
##    Charged Off          0        3.9
##    Fully Paid           1        0.0
```

From the earlier table, we can see that it achieves a sensitivity of 0.3993 and precision of 0.2496

50% Sensitivity

The costs matrix which achieves 50% sensitivity is:

```
## [1] "Costs Matrix: "

##               predicted
## actual        Charged Off Fully Paid
##    Charged Off          0        5.2
##    Fully Paid           1        0.0
```

From the earlier table, we can see that it achieves a sensitivity of 0.5044 and precision of 0.2299

Q4: Cost Parameter Matrix for Identifying Dubious Loan Applications

To lower the credit risk, we will need to identify as many dubious loan applicants as possible. However, we can see in the earlier section, the precision is very low. This means that out of all those applications that are highlighted as risky, only around 23% are indeed "Charged-Off" in the validation set. The drawback in reaching a sensitivity level of close to 50% is that the loan officers will need to manually cross-check large number of applications before 50% of the risky loans are identified.

Nevertheless, the cost of granting a loan to risky applicant still far outweighs this labour cost. Hence we pick the cost matrix which achieves close to 50% sensitivity.

Q5: Test Set Performance

Using the cost matrix we picked, we retrain the classification tree using training and validation data. The trained model is then tested against the test set. Below tabulates the test set performance and confusion matrix.

```
##
## Call:
## C5.0.default(x = subset(trainValid, select = -loan_status), y
##  = trainValid$loan_status, costs = costsMatList[[idx]])
##
##
## C5.0 [Release 2.07 GPL Edition]      Mon Feb 13 15:54:29 2017
## -------------------------------
##
## Class specified by attribute `outcome'
##
## Read 28000 cases (8 attributes) from undefined.data
## Read misclassification costs from undefined.costs
##
## Decision tree:
##
## gradeencoding > 5.3:
## :...purpose = small_business:
## :   :...gradeencoding <= 5.5:
## :   :   :...home_ownership in {NONE,OTHER,OWN}: Charged Off (10/7)
## :   :   :   home_ownership = RENT:
## :   :   :   :...emplen > 0: Charged Off (45/27)
## :   :   :   :   emplen <= 0:
## :   :   :   :   :...loan_amnt <= 1475: Charged Off (1)
## :   :   :   :       loan_amnt > 1475: Fully Paid (10)
## :   :   :   home_ownership = MORTGAGE:
## :   :   :   :...emplen > 7:
## :   :   :       :...verification_status = Not Verified: Charged Off (6/5)
## :   :   :       :   verification_status in {Source Verified,
## :   :   :       :                            Verified}: Fully Paid (21)
## :   :   :       emplen <= 7:
## :   :   :       :...term > 36: Charged Off (18/8)
## :   :   :           term <= 36:
## :   :   :           :...loan_amnt <= 7750: Fully Paid (8)
```

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```
## :    :    :                         loan_amnt > 7750: Charged Off (32/23)
## :    :    gradeencoding > 5.5:
## :    :    :...gradeencoding > 6.5: Fully Paid (27)
## :    :        gradeencoding <= 6.5:
## :    :        :...home_ownership in {NONE,OTHER}: Fully Paid (2)
## :    :            home_ownership = OWN:
## :    :            :...gradeencoding <= 6.3: Fully Paid (19)
## :    :            :   gradeencoding > 6.3: Charged Off (6/4)
## :    :            home_ownership = RENT:
## :    :            :...loan_amnt <= 15500: Charged Off (101/81)
## :    :            :   loan_amnt > 15500: Fully Paid (11)
## :    :            home_ownership = MORTGAGE:
## :    :            :...gradeencoding <= 5.6:
## :    :                :...emplen > 9: Charged Off (9/5)
## :    :                :   emplen <= 9:
## :    :                :   :...loan_amnt <= 13500: Fully Paid (13)
## :    :                :       loan_amnt > 13500: Charged Off (2/1)
## :    :                gradeencoding > 5.6:
## :    :                :...emplen > 7: Fully Paid (36/1)
## :    :                    emplen <= 7:
## :    :                    :...emplen <= 4: Fully Paid (54/5)
## :    :                        emplen > 4: Charged Off (20/15)
## :    purpose in {car,credit_card,debt_consolidation,educational,
## :    :              home_improvement,house,major_purchase,medical,moving,other,
## :    :              renewable_energy,vacation,wedding}:
## :    :...gradeencoding > 6.2: Fully Paid (4935/234)
## :        gradeencoding <= 6.2:
## :        :...home_ownership = NONE: Fully Paid (0)
## :            home_ownership = OTHER: Charged Off (20/15)
## :            home_ownership in {MORTGAGE,OWN,RENT}:
## :            :...purpose in {educational,medical,moving,vacation}:
## :                :...home_ownership = OWN: Charged Off (16/11)
## :                :   home_ownership = MORTGAGE:
## :                :   :...purpose = moving: Fully Paid (15)
## :                :   :   purpose = educational:
## :                :   :   :...loan_amnt <= 13000: Fully Paid (10)
## :                :   :   :   loan_amnt > 13000: Charged Off (3/2)
## :                :   :   purpose = vacation:
## :                :   :   :...loan_amnt <= 1750: Charged Off (3/2)
## :                :   :   :   loan_amnt > 1750: Fully Paid (21)
## :                :   :   purpose = medical:
## :                :   :   :...loan_amnt <= 6200: Charged Off (21/15)
## :                :   :       loan_amnt > 6200: [S1]
## :                :   home_ownership = RENT:
## :                :   :...loan_amnt <= 9150:
## :                :       :...purpose in {educational,
## :                :       :   :            vacation}: Charged Off (65/48)
## :                :       :   purpose = medical:
## :                :       :   :...loan_amnt > 5125: Charged Off (16/11)
## :                :       :   :   loan_amnt <= 5125:
## :                :       :   :   :...loan_amnt <= 1300: Charged Off (2/1)
## :                :       :   :       loan_amnt > 1300: Fully Paid (20)
## :                :       :   purpose = moving:
## :                :       :   :...gradeencoding > 5.5: Charged Off (38/27)
```

```
## :                   :            :            gradeencoding <= 5.5: [S2]
## :                   :         loan_amnt > 9150:
## :                   :         :...purpose in {educational,
## :                   :         :              moving}: Fully Paid (19)
## :                   :            purpose in {medical,vacation}:
## :                   :            :...gradeencoding <= 5.4: Charged Off (4/2)
## :                   :               gradeencoding > 5.4:
## :                   :               :...purpose = medical: Fully Paid (14)
## :                   :                  purpose = vacation: Charged Off (5/4)
## :                purpose in {car,credit_card,debt_consolidation,
## :                :             home_improvement,house,major_purchase,other,
## :                :             renewable_energy,wedding}:
## :                :...term <= 36: Fully Paid (5096/418)
## :                   term > 36:
## :                   :...purpose in {house,renewable_energy,
## :                      :              wedding}: Fully Paid (30)
## :                      purpose in {car,credit_card,home_improvement,
## :                      :             major_purchase}:
## :                      :...purpose in {car,
## :                      :              major_purchase}: Fully Paid (196/16)
## :                      :  purpose = credit_card:
## :                      :...loan_amnt <= 11100: Charged Off (24/17)
## :                      :  loan_amnt > 11100:
## :                      :  :...emplen <= 0: Charged Off (7/5)
## :                      :     emplen > 0: Fully Paid (60/2)
## :                      :  purpose = home_improvement:
## :                      :...verification_status in {Not Verified,
## :                      :                            Source Verified}:
## :                      :...emplen <= 8: Fully Paid (51/3)
## :                      :  emplen > 8: Charged Off (22/16)
## :                      :  verification_status = Verified:
## :                      :...emplen <= 1: Charged Off (5/3)
## :                      :  emplen > 1: Fully Paid (46/1)
## :                   purpose in {debt_consolidation,other}:
## :                   :...home_ownership in {OWN,
## :                      :                    RENT}: Charged Off (198/158)
## :                      home_ownership = MORTGAGE:
## :                      :...verification_status = Not Verified:
## :                      :...emplen <= 2: Fully Paid (12)
## :                      :  emplen > 2:
## :                      :  :...loan_amnt <= 5300: Charged Off (10/5)
## :                      :     loan_amnt > 5300:
## :                      :     :...loan_amnt > 12650: Charged Off (26/21)
## :                      :        loan_amnt <= 12650:
## :                      :        :...emplen <= 3: Charged Off (4/3)
## :                      :           emplen > 3: Fully Paid (36)
## :                      verification_status = Source Verified:
## :                      :...emplen <= 3: Charged Off (25/17)
## :                      :  emplen > 3:
## :                      :  :...loan_amnt > 13100: Fully Paid (22)
## :                      :     loan_amnt <= 13100: [S3]
## :                      verification_status = Verified:
## :                      :...purpose = other:
## :                         :...gradeencoding <= 5.6: Fully Paid (14)
```

```
## :                                      :      gradeencoding > 5.6: Charged Off (2/1)
## :                                      purpose = debt_consolidation:
## :                                      :...loan_amnt > 32500: Fully Paid (10)
## :                                          loan_amnt <= 32500: [S4]
## gradeencoding <= 5.3:
## :...term > 36:
##     :...purpose in {car,home_improvement,moving,wedding}:
##     :   :...verification_status = Source Verified:
##     :   :   :...loan_amnt > 10100:
##     :   :   :   :...emplen <= 2:
##     :   :   :   :   :...loan_amnt <= 32500: Fully Paid (30)
##     :   :   :   :   :   loan_amnt > 32500: Charged Off (3/2)
##     :   :   :   :   emplen > 2:
##     :   :   :   :   :...gradeencoding <= 2.5: Charged Off (29/21)
##     :   :   :   :       gradeencoding > 2.5: Fully Paid (95/8)
##     :   :   :   loan_amnt <= 10100:
##     :   :   :   :...home_ownership in {NONE,OTHER,
##     :   :   :   :                       OWN}: Charged Off (18/11)
##     :   :   :       home_ownership in {MORTGAGE,RENT}:
##     :   :   :       :...purpose = moving: Charged Off (19/14)
##     :   :   :           purpose = car:
##     :   :   :           :...gradeencoding <= 5.2: Charged Off (58/46)
##     :   :   :           :   gradeencoding > 5.2: Fully Paid (7)
##     :   :   :           purpose = home_improvement:
##     :   :   :           :...loan_amnt <= 7600: Fully Paid (19)
##     :   :   :           :   loan_amnt > 7600: Charged Off (19/14)
##     :   :   :           purpose = wedding:
##     :   :   :           :...emplen <= 3: Charged Off (14/7)
##     :   :   :               emplen > 3: [S5]
##     :   :   verification_status = Not Verified:
##     :   :   :...gradeencoding > 4.4:
##     :   :   :   :...loan_amnt > 11125: Fully Paid (25)
##     :   :   :   :   loan_amnt <= 11125:
##     :   :   :   :   :...purpose = moving: Charged Off (3/2)
##     :   :   :   :       purpose = wedding: Fully Paid (4)
##     :   :   :   :       purpose = car:
##     :   :   :   :       :...loan_amnt <= 8000: Fully Paid (35)
##     :   :   :   :       :   loan_amnt > 8000: Charged Off (9/6)
##     :   :   :   :       purpose = home_improvement:
##     :   :   :   :       :...emplen <= 4: Fully Paid (10)
##     :   :   :   :           emplen > 4: Charged Off (11/7)
##     :   :   :   gradeencoding <= 4.4:
##     :   :   :   :...purpose = moving: Fully Paid (9)
##     :   :   :       purpose in {car,home_improvement,wedding}:
##     :   :   :       :...home_ownership in {NONE,OTHER}: Charged Off (0)
##     :   :   :           home_ownership = OWN:
##     :   :   :           :...emplen <= 5: Fully Paid (9)
##     :   :   :           :   emplen > 5: Charged Off (5/4)
##     :   :   :           home_ownership = MORTGAGE:
##     :   :   :           :...gradeencoding > 4.2: Charged Off (11/4)
##     :   :   :           :   gradeencoding <= 4.2:
##     :   :   :           :   :...purpose = car: Fully Paid (11)
##     :   :   :           :       purpose in {home_improvement,wedding}:
##     :   :   :           :       :...loan_amnt <= 7750: Fully Paid (12)
```

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```
##      :      :      :                     :                    loan_amnt > 7750: Charged Off (34/23)
##      :      :      :                     home_ownership = RENT:
##      :      :      :                     :...emplen <= 1: Charged Off (7/5)
##      :      :      :                         emplen > 1:
##      :      :      :                         :...gradeencoding <= 2.3: Charged Off (1)
##      :      :      :                             gradeencoding > 2.3:
##      :      :      :                             :...loan_amnt <= 2500: Charged Off (1)
##      :      :      :                                 loan_amnt > 2500: Fully Paid (23)
##      :      :   verification_status = Verified:
##      :      :   :...home_ownership in {NONE,OTHER}: Charged Off (0)
##      :      :       home_ownership = OWN:
##      :      :       :...loan_amnt <= 24500: Fully Paid (20)
##      :      :       :   loan_amnt > 24500: Charged Off (10/8)
##      :      :       home_ownership in {MORTGAGE,RENT}:
##      :      :       :...home_ownership = RENT:
##      :      :           :...gradeencoding <= 2.2: Fully Paid (13)
##      :      :           :   gradeencoding > 2.2:
##      :      :           :   :...purpose in {car,
##      :      :           :   :                 home_improvement}: Charged Off (27/17)
##      :      :           :       purpose = moving:
##      :      :           :       :...gradeencoding <= 3.6: Charged Off (2/1)
##      :      :           :       :   gradeencoding > 3.6: Fully Paid (6)
##      :      :           :       purpose = wedding:
##      :      :           :       :...gradeencoding <= 4.5: Charged Off (17/10)
##      :      :           :           gradeencoding > 4.5: Fully Paid (11)
##      :      :           home_ownership = MORTGAGE:
##      :      :           :...emplen <= 2:
##      :      :               :...purpose in {car,moving}: Fully Paid (8)
##      :      :               :   purpose in {home_improvement,
##      :      :               :                 wedding}: Charged Off (49/36)
##      :      :               emplen > 2:
##      :      :               :...emplen > 4: Charged Off (179/142)
##      :      :                   emplen <= 4:
##      :      :                   :...loan_amnt > 11850: Fully Paid (46/1)
##      :      :                       loan_amnt <= 11850:
##      :      :                       :...emplen <= 3: Charged Off (8/4)
##      :      :                           emplen > 3: Fully Paid (8)
##      :   purpose in {credit_card,debt_consolidation,educational,house,
##      :   :             major_purchase,medical,other,renewable_energy,
##      :   :             small_business,vacation}:
##      :   :...gradeencoding <= 3.6:
##      :       :...gradeencoding <= 1.3:
##      :       :   :...purpose in {house,medical,other,renewable_energy,
##      :       :   :   :             small_business}: Charged Off (69/40)
##      :       :   :   purpose in {educational,major_purchase,
##      :       :   :   :             vacation}: Fully Paid (10)
##      :       :   :   purpose = credit_card:
##      :       :   :   :...gradeencoding > 0.6: Charged Off (19/10)
##      :       :   :   :   gradeencoding <= 0.6: [S6]
##      :       :   :   purpose = debt_consolidation:
##      :       :   :   :...gradeencoding > 0.3: Charged Off (178/101)
##      :       :   :       gradeencoding <= 0.3:
##      :       :   :       :...home_ownership in {MORTGAGE,NONE,OTHER,
##      :       :   :       :                       OWN}: Fully Paid (10)
```

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```
##      :           :      :                    home_ownership = RENT: [S7]
##      :           :   gradeencoding > 1.3:
##      :           :   :...purpose in {educational,house,small_business,
##      :           :   :                  vacation}: Charged Off (249/157)
##      :           :       purpose = renewable_energy:
##      :           :       :...loan_amnt <= 16700: Fully Paid (5)
##      :           :       :   loan_amnt > 16700: Charged Off (2/1)
##      :           :       purpose = major_purchase:
##      :           :       :...home_ownership in {NONE,OTHER}: Charged Off (0)
##      :           :       :   home_ownership = MORTGAGE:
##      :           :       :   :...emplen <= 1: Fully Paid (9)
##      :           :       :   :   emplen > 1: Charged Off (36/26)
##      :           :       :   home_ownership = OWN:
##      :           :       :   :...gradeencoding <= 3.3: Fully Paid (10)
##      :           :       :   :   gradeencoding > 3.3: Charged Off (1)
##      :           :       :   home_ownership = RENT:
##      :           :       :   :...gradeencoding > 2.6: Charged Off (35/22)
##      :           :       :       gradeencoding <= 2.6: [S8]
##      :           :       purpose = medical:
##      :           :       :...loan_amnt > 18600: Fully Paid (8)
##      :           :       :   loan_amnt <= 18600:
##      :           :       :   :...loan_amnt > 11850: Charged Off (17/7)
##      :           :       :       loan_amnt <= 11850:
##      :           :       :       :...emplen <= 3: Charged Off (8/6)
##      :           :       :           emplen > 3: Fully Paid (11)
##      :           :       purpose = credit_card:
##      :           :       :...home_ownership in {NONE,OTHER,OWN,
##      :           :       :   :                    RENT}: Charged Off (166/119)
##      :           :       :   home_ownership = MORTGAGE:
##      :           :       :   :...loan_amnt <= 24925:
##      :           :       :       :...loan_amnt <= 9575: Fully Paid (17/1)
##      :           :       :       :   loan_amnt > 9575: Charged Off (107/73)
##      :           :       :       loan_amnt > 24925:
##      :           :       :       :...gradeencoding > 2.5: Fully Paid (16/1)
##      :           :       :           gradeencoding <= 2.5:
##      :           :       :           :...loan_amnt <= 29000: Fully Paid (15)
##      :           :       :               loan_amnt > 29000: Charged Off (15/11)
##      :           :       purpose = other:
##      :           :       :...home_ownership in {NONE,OTHER,
##      :           :       :   :                    RENT}: Charged Off (140/84)
##      :           :       :   home_ownership = OWN:
##      :           :       :   :...emplen <= 5: Fully Paid (13)
##      :           :       :   :   emplen > 5: Charged Off (11/7)
##      :           :       :   home_ownership = MORTGAGE:
##      :           :       :   :...emplen <= 9:
##      :           :       :       :...gradeencoding <= 2.4: Charged Off (24/15)
##      :           :       :       :   gradeencoding > 2.4:
##      :           :       :       :   :...loan_amnt <= 9200: Charged Off (15/12)
##      :           :       :       :       loan_amnt > 9200: Fully Paid (22)
##      :           :       :       emplen > 9:
##      :           :       :       :...gradeencoding > 2.2: Charged Off (32/17)
##      :           :       :           gradeencoding <= 2.2: [S9]
##      :           :       purpose = debt_consolidation:
##      :           :       :...gradeencoding > 3.3:
```

9

```
##      :         :                    :...emplen > 7: [S10]
##      :         :                    :   emplen <= 7:
##      :         :                    :   :...emplen <= 0: Charged Off (40/27)
##      :         :                    :       emplen > 0: [S11]
##      :         :                gradeencoding <= 3.3:
##      :         :                :...home_ownership in {NONE,OTHER,
##      :         :                :                      OWN}: Charged Off (91/63)
##      :         :                    home_ownership = MORTGAGE:
##      :         :                    :...emplen <= 7: Charged Off (349/238)
##      :         :                    :   emplen > 7: [S12]
##      :         :                    home_ownership = RENT: [S13]
##      :         gradeencoding > 3.6:
##      :         :...purpose = educational: Fully Paid (2)
##      :             purpose in {house,renewable_energy,
##      :             :            vacation}: Charged Off (45/32)
##      :             purpose = medical:
##      :             :...loan_amnt > 30000: Charged Off (1)
##      :             :   loan_amnt <= 30000:
##      :             :   :...home_ownership in {MORTGAGE,NONE,
##      :             :       :                  OTHER}: Fully Paid (16)
##      :             :       home_ownership in {OWN,RENT}: Charged Off (18/14)
##      :             purpose = major_purchase:
##      :             :...loan_amnt > 24750: Fully Paid (13)
##      :             :   loan_amnt <= 24750:
##      :             :   :...gradeencoding <= 4.6: Charged Off (70/50)
##      :             :       gradeencoding > 4.6:
##      :             :       :...loan_amnt <= 11600: Fully Paid (18)
##      :             :           loan_amnt > 11600: Charged Off (20/15)
##      :             purpose = credit_card:
##      :             :...gradeencoding <= 4.3: [S14]
##      :             :   gradeencoding > 4.3:
##      :             :   :...verification_status = Verified:
##      :             :       :...gradeencoding <= 5.2: Charged Off (100/79)
##      :             :       :   gradeencoding > 5.2: Fully Paid (20)
##      :             :       verification_status = Not Verified:
##      :             :       :...emplen <= 3: Fully Paid (14)
##      :             :       :   emplen > 3:
##      :             :       :   :...emplen <= 7: Charged Off (17/10)
##      :             :       :       emplen > 7:
##      :             :       :       :...gradeencoding <= 5.2: Fully Paid (17)
##      :             :       :           gradeencoding > 5.2: Charged Off (6/4)
##      :             :       verification_status = Source Verified:
##      :             :       :...emplen > 7: Fully Paid (14)
##      :             :           emplen <= 7:
##      :             :           :...emplen > 2: Charged Off (22/14)
##      :             :               emplen <= 2:
##      :             :               :...loan_amnt <= 4000: Charged Off (1)
##      :             :                   loan_amnt > 4000: Fully Paid (13)
##      :             purpose = other:
##      :             :...home_ownership in {NONE,OTHER,
##      :             :   :                  OWN}: Charged Off (17/10)
##      :             :   home_ownership = RENT: [S15]
##      :             :   home_ownership = MORTGAGE: [S16]
##      :             purpose = small_business:
```

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```
##       :                  :...verification_status = Not Verified: Charged Off (21/10)
##       :                  :   verification_status in {Source Verified,Verified}:
##       :                  :   :...home_ownership in {NONE,OTHER}: Charged Off (0)
##       :                  :       home_ownership = OWN:
##       :                  :       :...loan_amnt <= 21500: Fully Paid (6)
##       :                  :       :   loan_amnt > 21500: Charged Off (2/1)
##       :                  :       home_ownership = MORTGAGE:
##       :                  :       :...emplen > 7: Charged Off (36/22)
##       :                  :       :   emplen <= 7:
##       :                  :       :   :...gradeencoding > 5.2: Charged Off (10/6)
##       :                  :       :       gradeencoding <= 5.2:
##       :                  :       :       :...gradeencoding <= 4.4: Charged Off (4/3)
##       :                  :       :           gradeencoding > 4.4: Fully Paid (15)
##       :                  :       home_ownership = RENT:
##       :                  :       :...verification_status = Verified:
##       :                  :           :...loan_amnt <= 20050: Charged Off (10/5)
##       :                  :           :   loan_amnt > 20050: Fully Paid (16)
##       :                  :           verification_status = Source Verified:
##       :                  :           :...loan_amnt > 27000: Charged Off (2)
##       :                  :               loan_amnt <= 27000:
##       :                  :               :...gradeencoding <= 4.5: Charged Off (4/2)
##       :                  :                   gradeencoding > 4.5: Fully Paid (13)
##       :              purpose = debt_consolidation:
##       :              :...verification_status = Not Verified:
##       :                  :...loan_amnt <= 13500:
##       :                  :   :...gradeencoding > 4.6:
##       :                  :   :   :...loan_amnt <= 12550: Fully Paid (55)
##       :                  :   :   :   loan_amnt > 12550: Charged Off (4/3)
##       :                  :   :   gradeencoding <= 4.6:
##       :                  :   :   :...loan_amnt > 12100: Fully Paid (13)
##       :                  :   :       loan_amnt <= 12100:
##       :                  :   :       :...loan_amnt <= 4900: Fully Paid (13)
##       :                  :   :           loan_amnt > 4900:
##       :                  :   :           :...gradeencoding > 4.2: Charged Off (74/55)
##       :                  :   :               gradeencoding <= 4.2:
##       :                  :   :               :...loan_amnt <= 6500: Charged Off (2/1)
##       :                  :   :                   loan_amnt > 6500: Fully Paid (15)
##       :                  :   loan_amnt > 13500:
##       :                  :   :...home_ownership in {NONE,OTHER,OWN,
##       :                  :   :                      RENT}: Charged Off (50/38)
##       :                  :       home_ownership = MORTGAGE:
##       :                  :       :...emplen > 7:
##       :                  :       :...loan_amnt <= 14200: Charged Off (5/2)
##       :                  :       :   loan_amnt > 14200: Fully Paid (31/2)
##       :                  :           emplen <= 7:
##       :                  :       :...gradeencoding > 5.2: Charged Off (10/4)
##       :                  :           gradeencoding <= 5.2:
##       :                  :           :...gradeencoding <= 4.4: Charged Off (11/5)
##       :                  :               gradeencoding > 4.4:
##       :                  :               :...loan_amnt <= 17000: Fully Paid (12)
##       :                  :                   loan_amnt > 17000: Charged Off (4/2)
##       :              verification_status = Source Verified:
##       :              :...home_ownership in {MORTGAGE,NONE,OTHER,
##       :              :   :                  OWN}: Charged Off (194/154)
```

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```
##      :                      :       home_ownership = RENT:
##      :                      :       :...emplen <= 2: Charged Off (65/47)
##      :                      :           emplen > 2:
##      :                      :           :...emplen > 5: Charged Off (49/38)
##      :                      :               emplen <= 5:
##      :                      :               :...emplen > 4: Fully Paid (13)
##      :                      :                   emplen <= 4:
##      :                      :                   :...gradeencoding <= 4.3: Charged Off (6/4)
##      :                      :                       gradeencoding > 4.3: [S17]
##      :              verification_status = Verified:
##      :              :...home_ownership in {NONE,OTHER,OWN,
##      :              :                      RENT}: Charged Off (287/219)
##      :                  home_ownership = MORTGAGE:
##      :                  :...emplen > 9:
##      :                      :...loan_amnt <= 24100: Charged Off (104/71)
##      :                      :   loan_amnt > 24100:
##      :                      :   :...gradeencoding <= 4.3: Charged Off (4/2)
##      :                      :       gradeencoding > 4.3: Fully Paid (67/8)
##      :                      emplen <= 9:
##      :                      :...loan_amnt <= 18000:
##      :                          :...loan_amnt > 13900: Charged Off (38/24)
##      :                          :   loan_amnt <= 13900:
##      :                          :   :...gradeencoding <= 4.2: Charged Off (4/2)
##      :                          :       gradeencoding > 4.2: Fully Paid (44/4)
##      :                          loan_amnt > 18000:
##      :                          :...emplen > 8: Fully Paid (15)
##      :                              emplen <= 8:
##      :                              :...gradeencoding <= 4.3:
##      :                                  :...emplen <= 0: Charged Off (3/1)
##      :                                  :   emplen > 0: [S18]
##      :                                  gradeencoding > 4.3: [S19]
##      term <= 36:
##      :...purpose = small_business:
##          :...verification_status in {Not Verified,Verified}:
##          :   :...home_ownership in {NONE,OTHER,OWN}: Charged Off (19/10)
##          :   :   home_ownership = RENT:
##          :   :   :...verification_status = Verified: Charged Off (69/50)
##          :   :   :   verification_status = Not Verified:
##          :   :   :   :...loan_amnt <= 3650: Fully Paid (14)
##          :   :   :       loan_amnt > 3650: Charged Off (100/65)
##          :   :   home_ownership = MORTGAGE:
##          :   :   :...emplen <= 4: Charged Off (115/80)
##          :   :       emplen > 4:
##          :   :       :...loan_amnt <= 21725: Charged Off (69/53)
##          :   :           loan_amnt > 21725:
##          :   :           :...loan_amnt <= 28250: Fully Paid (17)
##          :   :               loan_amnt > 28250: Charged Off (4/3)
##          :   verification_status = Source Verified:
##          :   :...loan_amnt > 12250: Fully Paid (26)
##          :       loan_amnt <= 12250:
##          :       :...gradeencoding <= 3.4: Fully Paid (8)
##          :           gradeencoding > 3.4:
##          :           :...home_ownership in {NONE,OTHER,OWN,
##          :           :                      RENT}: Charged Off (28/18)
```

```
##          :                       home_ownership = MORTGAGE:
##          :                       :...gradeencoding <= 3.6: Charged Off (2/1)
##          :                           gradeencoding > 3.6:
##          :                           :...emplen <= 2: Charged Off (2/1)
##          :                               emplen > 2: Fully Paid (11)
##          purpose in {educational,home_improvement,house,medical,moving,other,
##          :               vacation}:
##          :...gradeencoding <= 3.5:
##          :   :...verification_status = Verified:
##          :   :   :...purpose in {educational,medical,
##          :   :   :   :              other}: Charged Off (79/62)
##          :   :   :   purpose in {house,moving,vacation}: Fully Paid (21)
##          :   :   :   purpose = home_improvement:
##          :   :   :   :...gradeencoding <= 2.5: Fully Paid (10)
##          :   :   :       gradeencoding > 2.5:
##          :   :   :       :...loan_amnt <= 7350: Fully Paid (8)
##          :   :   :           loan_amnt > 7350: Charged Off (25/19)
##          :   :   verification_status in {Not Verified,Source Verified}:
##          :   :   :...purpose in {educational,house,medical,
##          :   :   :              moving}: Charged Off (102/75)
##          :   :       purpose = vacation:
##          :   :       :...gradeencoding <= 3.4: Fully Paid (8)
##          :   :       :   gradeencoding > 3.4: Charged Off (2/1)
##          :   :       purpose = other:
##          :   :       :...loan_amnt > 3350: Charged Off (124/86)
##          :   :       :   loan_amnt <= 3350:
##          :   :       :   :...emplen <= 4: Charged Off (27/22)
##          :   :       :       emplen > 4: Fully Paid (20)
##          :   :       purpose = home_improvement:
##          :   :       :...home_ownership in {NONE,OTHER,
##          :   :       :                      RENT}: Charged Off (14/7)
##          :   :           home_ownership in {MORTGAGE,OWN}:
##          :   :           :...loan_amnt > 15125: Charged Off (11/5)
##          :   :               loan_amnt <= 15125:
##          :   :               :...loan_amnt <= 3250: Charged Off (12/6)
##          :   :                   loan_amnt > 3250: Fully Paid (42)
##          :   gradeencoding > 3.5:
##          :   :...gradeencoding > 4.6:
##          :       :...purpose in {educational,moving,
##          :       :   :              vacation}: Charged Off (103/78)
##          :       :   purpose in {home_improvement,house,medical,other}:
##          :       :   :...emplen > 2: Fully Paid (352/31)
##          :       :       emplen <= 2:
##          :       :       :...verification_status = Source Verified:
##          :       :       :   :...home_ownership in {MORTGAGE,NONE,OTHER,
##          :       :       :   :   :              RENT}: Fully Paid (32)
##          :       :       :   :   home_ownership = OWN: Charged Off (3/2)
##          :       :       :   verification_status in {Not Verified,Verified}:
##          :       :       :   :...purpose = medical: Charged Off (8/4)
##          :       :       :       purpose = house: Fully Paid (7)
##          :       :       :       purpose in {home_improvement,other}:
##          :       :       :       :...verification_status = Not Verified:
##          :       :       :           :...loan_amnt <= 10200: Charged Off (74/54)
##          :       :       :           :   loan_amnt > 10200: Fully Paid (21/1)
```

```
##          :          :                        verification_status = Verified:
##          :          :                        :...loan_amnt <= 6875: Fully Paid (15)
##          :          :                            loan_amnt > 6875:
##          :          :                            :...loan_amnt <= 8750: Charged Off (2)
##          :          :                                loan_amnt > 8750: [S20]
##          :      gradeencoding <= 4.6:
##          :      :...purpose = educational: Fully Paid (71/8)
##          :          purpose = vacation: Charged Off (36/30)
##          :          purpose = house:
##          :          :...loan_amnt <= 11000: Charged Off (14/11)
##          :          :   loan_amnt > 11000: Fully Paid (10)
##          :          purpose = medical:
##          :          :...emplen <= 0: Fully Paid (11)
##          :          :   emplen > 0:
##          :          :   :...home_ownership in {MORTGAGE,NONE,
##          :          :   :                        OWN}: Charged Off (33/24)
##          :          :       home_ownership = OTHER: Fully Paid (1)
##          :          :       home_ownership = RENT:
##          :          :       :...gradeencoding <= 4.3: Fully Paid (14)
##          :          :           gradeencoding > 4.3: Charged Off (23/17)
##          :          purpose = moving:
##          :          :...gradeencoding <= 3.6: Fully Paid (11)
##          :          :   gradeencoding > 3.6:
##          :          :   :...loan_amnt <= 1400: Charged Off (5/2)
##          :          :       loan_amnt > 1400:
##          :          :       :...loan_amnt > 7625: Charged Off (5/3)
##          :          :           loan_amnt <= 7625:
##          :          :           :...gradeencoding > 4.2: Fully Paid (41)
##          :          :               gradeencoding <= 4.2:
##          :          :               :...emplen <= 1: Charged Off (6/3)
##          :          :                   emplen > 1: Fully Paid (9)
##          :          purpose = home_improvement:
##          :          :...home_ownership in {NONE,
##          :          :   :                    OTHER}: Charged Off (0)
##          :          :   home_ownership = OWN:
##          :          :   :...loan_amnt <= 4150: Fully Paid (9)
##          :          :   :   loan_amnt > 4150: Charged Off (24/17)
##          :          :   home_ownership = RENT:
##          :          :   :...emplen > 7: Charged Off (6/4)
##          :          :   :   emplen <= 7:
##          :          :   :   :...loan_amnt <= 2900: Charged Off (8/6)
##          :          :   :       loan_amnt > 2900: Fully Paid (18)
##          :          :   home_ownership = MORTGAGE:
##          :          :   :...loan_amnt > 12500:
##          :          :       :...gradeencoding <= 4.2: Charged Off (11/9)
##          :          :       :   gradeencoding > 4.2: Fully Paid (27)
##          :          :       loan_amnt <= 12500:
##          :          :       :...loan_amnt > 8700: Charged Off (34/21)
##          :          :           loan_amnt <= 8700:
##          :          :           :...emplen > 7:
##          :          :               :...loan_amnt <= 1950: Charged Off (1)
##          :          :               :   loan_amnt > 1950: Fully Paid (44/2)
##          :          :               emplen <= 7: [S21]
##          :      purpose = other:
```

```
##        :                   :...gradeencoding > 4.5:
##        :                       :...home_ownership in {NONE,
##        :                       :   :                   OTHER}: Charged Off (0)
##        :                       :   home_ownership = MORTGAGE:
##        :                       :   :...loan_amnt > 5125: Fully Paid (16)
##        :                       :   :   loan_amnt <= 5125:
##        :                       :   :   :...loan_amnt <= 4325: Fully Paid (12)
##        :                       :   :       loan_amnt > 4325: Charged Off (3)
##        :                       :   home_ownership in {OWN,RENT}:
##        :                       :   :...emplen <= 0: [S22]
##        :                       :       emplen > 0:
##        :                       :       :...loan_amnt > 3650: Charged Off (45/24)
##        :                       :           loan_amnt <= 3650:
##        :                       :           :...loan_amnt <= 1900: Charged Off (12/7)
##        :                       :               loan_amnt > 1900: Fully Paid (16)
##        :                   gradeencoding <= 4.5:
##        :                   :...home_ownership in {NONE,
##        :                       :                   OTHER}: Charged Off (4/3)
##        :                       home_ownership = OWN:
##        :                       :...loan_amnt > 18000: Charged Off (1)
##        :                       :   loan_amnt <= 18000:
##        :                       :   :...emplen > 2: Fully Paid (21)
##        :                       :       emplen <= 2:
##        :                       :       :...emplen <= 1: Fully Paid (10)
##        :                       :           emplen > 1: Charged Off (5/2)
##        :                       home_ownership = MORTGAGE:
##        :                       :...verification_status = Not Verified:
##        :                       :   :...gradeencoding <= 4.4: Charged Off (41/28)
##        :                       :   :   gradeencoding > 4.4:
##        :                       :   :   :...loan_amnt <= 8125: Fully Paid (14)
##        :                       :   :       loan_amnt > 8125: Charged Off (6/4)
##        :                       :   verification_status in {Source Verified,
##        :                       :   :                           Verified}:
##        :                       :   :...loan_amnt <= 1400: Charged Off (1)
##        :                       :       loan_amnt > 1400:
##        :                       :       :...loan_amnt <= 13125: Fully Paid (31)
##        :                       :           loan_amnt > 13125:
##        :                       :           :...loan_amnt <= 13800: Charged Off (1)
##        :                       :               loan_amnt > 13800: [S23]
##        :                       home_ownership = RENT:
##        :                       :...verification_status = Verified:
##        :                           :...gradeencoding > 3.6: Charged Off (38/26)
##        :                           :   gradeencoding <= 3.6:
##        :                           :   :...loan_amnt <= 21200: Fully Paid (11)
##        :                           :       loan_amnt > 21200: Charged Off (2/1)
##        :                           verification_status = Source Verified:
##        :                           :...emplen <= 1:
##        :                           :   :...gradeencoding <= 4.4: Fully Paid (12)
##        :                           :   :   gradeencoding > 4.4: Charged Off (5/4)
##        :                           :   emplen > 1:
##        :                           :   :...emplen <= 2: Charged Off (10/5)
##        :                           :       emplen > 2:
##        :                           :       :...emplen <= 3: Fully Paid (7)
##        :                           :           emplen > 3: [S24]
```

```
##         :                          verification_status = Not Verified:
##         :                          :...gradeencoding > 4.3:
##         :                          :    :...emplen > 9: Charged Off (6/4)
##         :                          :    :   emplen <= 9:
##         :                          :    :   :...loan_amnt <= 3100: Fully Paid (19)
##         :                          :    :       loan_amnt > 3100: [S25]
##         :                          :    gradeencoding <= 4.3:
##         :                          :    :...emplen <= 0: Charged Off (21/14)
##         :                          :        emplen > 0:
##         :                          :        :...gradeencoding <= 3.6: [S26]
##         :                          :            gradeencoding > 3.6:
##         :                          :            :...emplen <= 2: Fully Paid (18/1)
##         :                          :                emplen > 2: [S27]
##         purpose in {car,credit_card,debt_consolidation,major_purchase,
##         :             renewable_energy,wedding}:
##         :...gradeencoding > 4.4:
##             :...gradeencoding > 4.6:
##             :   :...purpose = credit_card: Fully Paid (404/41)
##             :   :   purpose = renewable_energy:
##             :   :   :...gradeencoding <= 5.2: Charged Off (3/2)
##             :   :   :   gradeencoding > 5.2: Fully Paid (6)
##             :   :   purpose = wedding: [S28]
##             :   :   purpose = car:
##             :   :   :...home_ownership in {NONE,OTHER}: Fully Paid (0)
##             :   :   :   home_ownership = OWN: Charged Off (4/2)
##             :   :   :   home_ownership in {MORTGAGE,RENT}:
##             :   :   :   :...emplen <= 2:
##             :   :   :   :   :...loan_amnt <= 11000: Fully Paid (26)
##             :   :   :   :   :   loan_amnt > 11000: Charged Off (4/3)
##             :   :   :   :       emplen > 2: [S29]
##             :   :   purpose = debt_consolidation:
##             :   :   :...loan_amnt > 5225: Fully Paid (1049/90)
##             :   :   :   loan_amnt <= 5225:
##             :   :   :   :...emplen > 5: Charged Off (90/69)
##             :   :   :       emplen <= 5:
##             :   :   :       :...loan_amnt <= 1600: Charged Off (8/4)
##             :   :   :           loan_amnt > 1600:
##             :   :   :           :...loan_amnt <= 5100: Fully Paid (155/12)
##             :   :   :               loan_amnt > 5100: Charged Off (6/3)
##             :   :   purpose = major_purchase:
##             :   :   :...gradeencoding <= 5.2:
##             :   :       :...emplen <= 9: Fully Paid (45)
##             :   :       :   emplen > 9: [S30]
##             :   :       gradeencoding > 5.2:
##             :   :       :...emplen > 6: Fully Paid (15)
##             :   :           emplen <= 6:
##             :   :           :...loan_amnt > 11300: Charged Off (6/4)
##             :   :               loan_amnt <= 11300: [S31]
##             :   gradeencoding <= 4.6:
##             :   :...purpose = credit_card: Fully Paid (304/28)
##             :       purpose = renewable_energy: Charged Off (5/4)
##             :       purpose = major_purchase: [S32]
##             :       purpose = car:
##             :       :...home_ownership = NONE: Charged Off (0)
```

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```
##               :           :      home_ownership = MORTGAGE: Fully Paid (12)
##               :           :      home_ownership in {OTHER,OWN,RENT}:
##               :           :      :...gradeencoding <= 4.5: Charged Off (15/9)
##               :           :          gradeencoding > 4.5:
##               :           :          :...home_ownership = OTHER: Charged Off (1)
##               :           :              home_ownership in {OWN,
##               :           :                                 RENT}: Fully Paid (13)
##               :       purpose = wedding:
##               :       :...emplen <= 1: Fully Paid (18)
##               :       :   emplen > 1:
##               :       :   :...loan_amnt <= 2900: Charged Off (3)
##               :       :       loan_amnt > 2900:
##               :       :       :...emplen <= 6: Charged Off (24/20)
##               :       :           emplen > 6: Fully Paid (14)
##               :       purpose = debt_consolidation:
##               :       :...loan_amnt <= 3950: Fully Paid (94/5)
##               :           loan_amnt > 3950:
##               :           :...home_ownership in {NONE,
##               :           :                      OTHER}: Fully Paid (3)
##               :           home_ownership = RENT:
##               :           :...emplen <= 6: [S33]
##               :           :   emplen > 6:
##               :           :   :...loan_amnt > 8250: Charged Off (66/44)
##               :           :       loan_amnt <= 8250:
##               :           :       :...loan_amnt <= 4650: Charged Off (8/6)
##               :           :           loan_amnt > 4650: Fully Paid (42/2)
##               :           home_ownership = OWN:
##               :           :...emplen > 9: Fully Paid (11)
##               :           :   emplen <= 9:
##               :           :   :...loan_amnt > 9800: Charged Off (14/7)
##               :           :       loan_amnt <= 9800:
##               :           :       :...gradeencoding <= 4.5: Fully Paid (15)
##               :           :           gradeencoding > 4.5:
##               :           :           :...loan_amnt <= 6625: Charged Off (4/2)
##               :           :               loan_amnt > 6625: Fully Paid (7)
##               :           home_ownership = MORTGAGE:
##               :           :...emplen > 9:
##               :               :...loan_amnt <= 24100: Fully Paid (71/3)
##               :               :   loan_amnt > 24100: Charged Off (6/5)
##               :               emplen <= 9:
##               :               :...loan_amnt <= 8200: Charged Off (73/61)
##               :                   loan_amnt > 8200: [S34]
##           gradeencoding <= 4.4:
##           :...gradeencoding <= 2.2:
##               :...home_ownership in {MORTGAGE,NONE,
##               :   :                  OTHER}: Charged Off (60/39)
##               :   home_ownership = OWN:
##               :   :...loan_amnt <= 17525: Fully Paid (7)
##               :   :   loan_amnt > 17525: Charged Off (6/1)
##               :   home_ownership = RENT: [S35]
##               gradeencoding > 2.2:
##               :...purpose in {car,credit_card,major_purchase,
##                   :            renewable_energy,wedding}:
##                   :...emplen <= 1:
```

```
##                                 :     :...gradeencoding <= 2.6: Fully Paid (19)
##                                 :     :   gradeencoding > 2.6: [S36]
##                                 :     emplen > 1:
##                                 :     :...purpose = renewable_energy: Fully Paid (4)
##                                 :         purpose = credit_card:
##                                 :         :...home_ownership in {MORTGAGE,NONE,OTHER,
##                                 :         :   :                   RENT}: Fully Paid (453/49)
##                                 :         :   home_ownership = OWN: [S37]
##                                 :         purpose = car:
##                                 :         :...gradeencoding <= 2.6: Fully Paid (9)
##                                 :         :   gradeencoding > 2.6:
##                                 :         :   :...emplen <= 8: Charged Off (46/38)
##                                 :         :       emplen > 8: [S38]
##                                 :         purpose = major_purchase:
##                                 :         :...loan_amnt <= 2450: Fully Paid (18)
##                                 :         :   loan_amnt > 2450:
##                                 :         :   :...gradeencoding <= 3.6: [S39]
##                                 :         :       gradeencoding > 3.6:
##                                 :         :       :...loan_amnt > 9800: Charged Off (14/10)
##                                 :         :           loan_amnt <= 9800: [S40]
##                                 :         purpose = wedding:
##                                 :         :...emplen > 9: Charged Off (5/2)
##                                 :             emplen <= 9:
##                                 :             :...loan_amnt <= 5550: Fully Paid (20)
##                                 :                 loan_amnt > 5550:
##                                 :                 :...loan_amnt > 17000: Charged Off (15/10)
##                                 :                     loan_amnt <= 17000: [S41]
##                     purpose = debt_consolidation:
##                     :...loan_amnt > 16500:
##                         :...emplen <= 0:
##                         :   :...loan_amnt <= 31500: Fully Paid (52)
##                         :   :   loan_amnt > 31500: Charged Off (3/2)
##                         :   emplen > 0:
##                         :   :...gradeencoding > 2.6: Fully Paid (360/35)
##                         :       gradeencoding <= 2.6: [S42]
##                         loan_amnt <= 16500:
##                         :...gradeencoding > 3.6:
##                             :...verification_status in {Not Verified,Verified}:
##                             :   :...verification_status = Not Verified:
##                             :   :   :...emplen <= 4:
##                             :   :   :   :...gradeencoding > 4.2: [S43]
##                             :   :   :   :   gradeencoding <= 4.2: [S44]
##                             :   :   :   emplen > 4:
##                             :   :   :   :...emplen <= 6: Fully Paid (51/2)
##                             :   :   :       emplen > 6: [S45]
##                             :   :   verification_status = Verified:
##                             :   :   :...gradeencoding > 4.3: Fully Paid (81/7)
##                             :   :       gradeencoding <= 4.3:
##                             :   :       :...gradeencoding > 4.2: [S46]
##                             :   :           gradeencoding <= 4.2:
##                             :   :           :...emplen > 8: Fully Paid (11)
##                             :   :               emplen <= 8: [S47]
##                             :   verification_status = Source Verified:
##                             :   :...gradeencoding <= 4.3: Fully Paid (120/8)
```

```
##                                    :         gradeencoding > 4.3: [S48]
##                                 gradeencoding <= 3.6:
##                                 :...loan_amnt <= 10150: [S49]
##                                     loan_amnt > 10150:
##                                     :...loan_amnt <= 11200: Fully Paid (40/1)
##                                         loan_amnt > 11200:
##                                         :...emplen > 7: [S50]
##                                             emplen <= 7:
##                                             :...emplen > 3: [S51]
##                                                 emplen <= 3: [S52]
##
## SubTree [S1]
##
## verification_status = Not Verified: Charged Off (12/10)
## verification_status in {Source Verified,Verified}: Fully Paid (17)
##
## SubTree [S2]
##
## verification_status = Not Verified: Fully Paid (14)
## verification_status in {Source Verified,Verified}: Charged Off (22/18)
##
## SubTree [S3]
##
## purpose = debt_consolidation: Charged Off (26/20)
## purpose = other:
## :...loan_amnt <= 9500: Fully Paid (9)
##     loan_amnt > 9500: Charged Off (3/2)
##
## SubTree [S4]
##
## gradeencoding > 5.5: Fully Paid (24/1)
## gradeencoding <= 5.5:
## :...gradeencoding <= 5.4: Charged Off (59/48)
##     gradeencoding > 5.4:
##     :...loan_amnt <= 18400: Charged Off (13/10)
##         loan_amnt > 18400: Fully Paid (23/1)
##
## SubTree [S5]
##
## home_ownership = MORTGAGE: Charged Off (3/2)
## home_ownership = RENT: Fully Paid (14)
##
## SubTree [S6]
##
## verification_status in {Not Verified,Source Verified}: Charged Off (5/3)
## verification_status = Verified: Fully Paid (15)
##
## SubTree [S7]
##
## verification_status in {Not Verified,Source Verified}: Fully Paid (7)
## verification_status = Verified: Charged Off (8/4)
##
## SubTree [S8]
##
```

```
## verification_status in {Not Verified,Verified}: Charged Off (22/18)
## verification_status = Source Verified: Fully Paid (10)
##
## SubTree [S9]
##
## verification_status = Not Verified: Charged Off (1)
## verification_status in {Source Verified,Verified}: Fully Paid (8)
##
## SubTree [S10]
##
## home_ownership in {MORTGAGE,NONE,OTHER,RENT}: Charged Off (122/83)
## home_ownership = OWN: Fully Paid (7)
##
## SubTree [S11]
##
## home_ownership in {NONE,OTHER,OWN}: Charged Off (9/6)
## home_ownership = RENT:
## :...emplen <= 3:
## :   :...loan_amnt <= 3050: Charged Off (3/1)
## :   :   loan_amnt > 3050: Fully Paid (64/5)
## :   emplen > 3:
## :   :...verification_status = Source Verified: Charged Off (21/13)
## :       verification_status = Not Verified:
## :       :...emplen <= 5: Fully Paid (9)
## :       :   emplen > 5: Charged Off (6/4)
## :       verification_status = Verified:
## :       :...emplen <= 4: Charged Off (13/7)
## :           emplen > 4: Fully Paid (23/2)
## home_ownership = MORTGAGE:
## :...verification_status = Source Verified:
##     :...emplen <= 3: Fully Paid (12)
##     :   emplen > 3: Charged Off (16/13)
##     verification_status = Verified:
##     :...emplen <= 4: Charged Off (23/18)
##     :   emplen > 4: Fully Paid (12)
##     verification_status = Not Verified:
##     :...gradeencoding <= 3.4: Charged Off (11/9)
##         gradeencoding > 3.4:
##         :...emplen > 6: Charged Off (4/2)
##             emplen <= 6:
##             :...loan_amnt <= 17500: Fully Paid (9)
##                 loan_amnt > 17500: Charged Off (1)
##
## SubTree [S12]
##
## verification_status = Not Verified: Charged Off (38/27)
## verification_status = Source Verified:
## :...loan_amnt <= 11000: Fully Paid (11)
## :   loan_amnt > 11000:
## :   :...loan_amnt <= 12200: Charged Off (7/2)
## :       loan_amnt > 12200:
## :       :...loan_amnt > 21500: Charged Off (25/14)
## :           loan_amnt <= 21500:
## :           :...gradeencoding <= 2.4: Fully Paid (15)
```

```
## :                 gradeencoding > 2.4: Charged Off (16/12)
## verification_status = Verified:
## :...gradeencoding <= 1.6:
##     :...emplen <= 9: Fully Paid (8)
##     :   emplen > 9: Charged Off (40/26)
##     gradeencoding > 1.6:
##     :...gradeencoding > 2.4: Charged Off (110/85)
##         gradeencoding <= 2.4:
##         :...emplen <= 9: Charged Off (9/7)
##             emplen > 9:
##             :...loan_amnt <= 24750: Charged Off (22/18)
##                 loan_amnt > 24750: Fully Paid (30)
##
## SubTree [S13]
##
## verification_status in {Not Verified,Source Verified}: Charged Off (312/213)
## verification_status = Verified:
## :...emplen > 3: Charged Off (220/146)
##     emplen <= 3:
##     :...emplen <= 1: Charged Off (63/44)
##         emplen > 1:
##         :...gradeencoding <= 2.3: Charged Off (28/20)
##             gradeencoding > 2.3:
##             :...loan_amnt > 29000: Charged Off (3/1)
##                 loan_amnt <= 29000:
##                 :...emplen <= 2:
##                     :...loan_amnt <= 19750: Fully Paid (13)
##                     :   loan_amnt > 19750: Charged Off (7/5)
##                     emplen > 2:
##                     :...loan_amnt <= 8125: Charged Off (2/1)
##                         loan_amnt > 8125: Fully Paid (15)
##
## SubTree [S14]
##
## verification_status in {Source Verified,Verified}: Charged Off (32/20)
## verification_status = Not Verified:
## :...gradeencoding <= 4.2: Charged Off (8/5)
##     gradeencoding > 4.2: Fully Paid (10)
##
## SubTree [S15]
##
## verification_status = Not Verified: Charged Off (35/20)
## verification_status in {Source Verified,Verified}:
## :...emplen <= 5: Charged Off (47/34)
##     emplen > 5: Fully Paid (20)
##
## SubTree [S16]
##
## verification_status = Source Verified: Charged Off (20/15)
## verification_status = Verified:
## :...emplen > 9: Charged Off (14/10)
## :   emplen <= 9:
## :   :...loan_amnt <= 5500: Charged Off (2/1)
## :       loan_amnt > 5500: Fully Paid (20)
```

```
## verification_status = Not Verified:
## :...gradeencoding > 4.6: Fully Paid (8)
##     gradeencoding <= 4.6:
##     :...gradeencoding <= 4.3: Charged Off (2)
##         gradeencoding > 4.3:
##         :...emplen <= 8: Charged Off (11/7)
##             emplen > 8: Fully Paid (9)
##
## SubTree [S17]
##
## gradeencoding <= 5.2: Fully Paid (17)
## gradeencoding > 5.2: Charged Off (3/2)
##
## SubTree [S18]
##
## loan_amnt > 29000: Charged Off (5/3)
## loan_amnt <= 29000:
## :...loan_amnt <= 20500: Charged Off (6/5)
##     loan_amnt > 20500: Fully Paid (12)
##
## SubTree [S19]
##
## gradeencoding <= 4.4: Fully Paid (17)
## gradeencoding > 4.4:
## :...emplen > 5: Charged Off (25/20)
##     emplen <= 5:
##     :...emplen > 3: Fully Paid (36)
##         emplen <= 3:
##         :...loan_amnt <= 22200: Charged Off (18/14)
##             loan_amnt > 22200: Fully Paid (33/1)
##
## SubTree [S20]
##
## gradeencoding <= 5.2: Charged Off (9/7)
## gradeencoding > 5.2: Fully Paid (8)
##
## SubTree [S21]
##
## verification_status in {Not Verified,Verified}: Charged Off (59/47)
## verification_status = Source Verified:
## :...gradeencoding <= 4.3: Charged Off (6/4)
##     gradeencoding > 4.3: Fully Paid (11)
##
## SubTree [S22]
##
## verification_status = Not Verified: Fully Paid (12)
## verification_status in {Source Verified,Verified}: Charged Off (6/4)
##
## SubTree [S23]
##
## gradeencoding <= 3.6: Charged Off (3/2)
## gradeencoding > 3.6: Fully Paid (8)
##
## SubTree [S24]
```

```
## 
## gradeencoding > 4.4: Charged Off (5/2)
## gradeencoding <= 4.4:
## :...emplen <= 9: Charged Off (15/12)
##      emplen > 9: Fully Paid (9)
## 
## SubTree [S25]
## 
## loan_amnt <= 3750: Charged Off (3/1)
## loan_amnt > 3750: Fully Paid (33/1)
## 
## SubTree [S26]
## 
## loan_amnt <= 5200: Charged Off (14/11)
## loan_amnt > 5200: Fully Paid (10)
## 
## SubTree [S27]
## 
## gradeencoding <= 4.2: Charged Off (17/12)
## gradeencoding > 4.2:
## :...loan_amnt > 8750: Charged Off (3/1)
##      loan_amnt <= 8750:
##      :...loan_amnt <= 1350: Charged Off (1)
##           loan_amnt > 1350: Fully Paid (14)
## 
## SubTree [S28]
## 
## verification_status in {Not Verified,Source Verified}: Fully Paid (57/2)
## verification_status = Verified: Charged Off (11/8)
## 
## SubTree [S29]
## 
## verification_status in {Not Verified,Verified}: Charged Off (26/20)
## verification_status = Source Verified: Fully Paid (11)
## 
## SubTree [S30]
## 
## verification_status in {Not Verified,Source Verified}: Fully Paid (7)
## verification_status = Verified: Charged Off (7/4)
## 
## SubTree [S31]
## 
## verification_status = Verified: Fully Paid (9)
## verification_status = Not Verified:
## :...emplen <= 2: Fully Paid (9)
## :   emplen > 2: Charged Off (12/7)
## verification_status = Source Verified:
## :...loan_amnt <= 1750: Charged Off (2/1)
##      loan_amnt > 1750: Fully Paid (14)
## 
## SubTree [S32]
## 
## verification_status = Not Verified: Charged Off (50/41)
## verification_status = Source Verified:
```

```
## :...home_ownership in {MORTGAGE,OWN}: Charged Off (10/8)
## :   home_ownership in {NONE,OTHER,RENT}: Fully Paid (16)
## verification_status = Verified:
## :...gradeencoding <= 4.5: Charged Off (9/7)
##     gradeencoding > 4.5: Fully Paid (8)
##
## SubTree [S33]
##
## verification_status = Not Verified: Fully Paid (194/17)
## verification_status = Source Verified:
## :...emplen <= 0: Charged Off (23/17)
## :   emplen > 0: Fully Paid (74/7)
## verification_status = Verified:
## :...loan_amnt <= 9000: Charged Off (41/31)
##     loan_amnt > 9000: Fully Paid (62/3)
##
## SubTree [S34]
##
## verification_status in {Not Verified,Source Verified}: Fully Paid (91/7)
## verification_status = Verified:
## :...emplen <= 1: Charged Off (14/9)
##     emplen > 1:
##     :...emplen <= 3: Fully Paid (21)
##         emplen > 3:
##         :...loan_amnt > 18600: Charged Off (14/10)
##             loan_amnt <= 18600:
##             :...loan_amnt <= 9700: Charged Off (2/1)
##                 loan_amnt > 9700: Fully Paid (16)
##
## SubTree [S35]
##
## verification_status in {Not Verified,Verified}: Charged Off (71/54)
## verification_status = Source Verified:
## :...loan_amnt <= 3900: Charged Off (1)
##     loan_amnt > 3900: Fully Paid (12)
##
## SubTree [S36]
##
## purpose = renewable_energy: Charged Off (3/2)
## purpose = car: Fully Paid (24)
## purpose = credit_card:
## :...verification_status in {Not Verified,Verified}: Fully Paid (97/7)
## :   verification_status = Source Verified: Charged Off (27/20)
## purpose = wedding:
## :...loan_amnt <= 2200: Charged Off (3/1)
## :   loan_amnt > 2200: Fully Paid (22)
## purpose = major_purchase:
## :...emplen <= 0: Fully Paid (29)
##     emplen > 0:
##     :...loan_amnt > 8075: Fully Paid (12)
##         loan_amnt <= 8075:
##         :...loan_amnt <= 4000: Fully Paid (9)
##             loan_amnt > 4000: Charged Off (5/2)
##
```

```
## SubTree [S37]
##
## verification_status = Not Verified: Fully Paid (8)
## verification_status in {Source Verified,Verified}: Charged Off (17/10)
##
## SubTree [S38]
##
## verification_status in {Not Verified,Source Verified}: Fully Paid (16)
## verification_status = Verified: Charged Off (5/4)
##
## SubTree [S39]
##
## verification_status = Source Verified: Charged Off (22/18)
## verification_status = Not Verified:
## :...gradeencoding <= 3.4: Fully Paid (16)
## :   gradeencoding > 3.4: Charged Off (21/10)
## verification_status = Verified:
## :...gradeencoding <= 3.4: Charged Off (11/7)
##     gradeencoding > 3.4: Fully Paid (8)
##
## SubTree [S40]
##
## home_ownership in {MORTGAGE,NONE,OTHER,RENT}: Fully Paid (46)
## home_ownership = OWN: Charged Off (5/4)
##
## SubTree [S41]
##
## verification_status = Verified: Fully Paid (18)
## verification_status in {Not Verified,Source Verified}:
## :...emplen <= 2: Fully Paid (8)
##     emplen > 2:
##     :...emplen <= 5: Charged Off (16/11)
##         emplen > 5: Fully Paid (8)
##
## SubTree [S42]
##
## home_ownership in {MORTGAGE,NONE}: Charged Off (41/34)
## home_ownership in {OTHER,OWN}: Fully Paid (4)
## home_ownership = RENT:
## :...loan_amnt > 30000: Charged Off (2)
##     loan_amnt <= 30000:
##     :...verification_status in {Not Verified,
##         :                      Source Verified}: Charged Off (12/9)
##         verification_status = Verified:
##         :...gradeencoding <= 2.5: Fully Paid (20)
##             gradeencoding > 2.5: Charged Off (7/5)
##
## SubTree [S43]
##
## home_ownership in {MORTGAGE,NONE,RENT}: Charged Off (168/135)
## home_ownership in {OTHER,OWN}: Fully Paid (14)
##
## SubTree [S44]
##
```

```
## home_ownership in {MORTGAGE,NONE,OTHER,OWN}: Charged Off (20/12)
## home_ownership = RENT:
## :...emplen <= 0: Charged Off (17/10)
##     emplen > 0:
##     :...emplen <= 2: Fully Paid (32/2)
##         emplen > 2: Charged Off (21/15)
##
## SubTree [S45]
##
## loan_amnt <= 7750: Charged Off (57/40)
## loan_amnt > 7750:
## :...emplen <= 9:
##     :...loan_amnt <= 11100: Fully Paid (14)
##     :   loan_amnt > 11100: Charged Off (14/8)
##     emplen > 9:
##     :...loan_amnt > 15500: Charged Off (2/1)
##         loan_amnt <= 15500:
##         :...home_ownership in {MORTGAGE,NONE,OTHER,RENT}: Fully Paid (35)
##             home_ownership = OWN: Charged Off (6/5)
##
## SubTree [S46]
##
## home_ownership in {MORTGAGE,NONE,OTHER}: Charged Off (23/18)
## home_ownership = OWN: Fully Paid (2)
## home_ownership = RENT:
## :...loan_amnt <= 5100: Charged Off (8/3)
##     loan_amnt > 5100:
##     :...emplen <= 4: Fully Paid (15)
##         emplen > 4: Charged Off (10/6)
##
## SubTree [S47]
##
## home_ownership in {NONE,OTHER,OWN,RENT}: Charged Off (26/21)
## home_ownership = MORTGAGE:
## :...emplen > 7: Charged Off (1)
##     emplen <= 7:
##     :...loan_amnt <= 4100: Charged Off (2/1)
##         loan_amnt > 4100: Fully Paid (13)
##
## SubTree [S48]
##
## home_ownership in {NONE,OTHER,OWN}: Fully Paid (9)
## home_ownership in {MORTGAGE,RENT}:
## :...loan_amnt > 14300: Charged Off (10/5)
##     loan_amnt <= 14300:
##     :...home_ownership = MORTGAGE:
##         :...loan_amnt <= 8800: Charged Off (6/5)
##         :   loan_amnt > 8800: Fully Paid (14)
##         home_ownership = RENT:
##         :...loan_amnt <= 2750: Fully Paid (8)
##             loan_amnt > 2750:
##             :...loan_amnt <= 3800: Charged Off (6/3)
##                 loan_amnt > 3800:
##                 :...loan_amnt <= 7500: Fully Paid (11)
```

```
##                         loan_amnt > 7500: Charged Off (21/17)
##
## SubTree [S49]
##
## home_ownership = NONE: Charged Off (0)
## home_ownership = OTHER: Fully Paid (3)
## home_ownership = OWN:
## :...loan_amnt > 8750: Fully Paid (13)
## :   loan_amnt <= 8750:
## :   :...emplen <= 0: Charged Off (9/4)
## :       emplen > 0:
## :       :...loan_amnt <= 3625: Fully Paid (8)
## :           loan_amnt > 3625: Charged Off (38/29)
## home_ownership = MORTGAGE:
## :...emplen > 4: Charged Off (112/76)
## :   emplen <= 4:
## :   :...verification_status = Verified:
## :       :...emplen <= 2: Fully Paid (6)
## :       :   emplen > 2: Charged Off (13/10)
## :       verification_status = Source Verified:
## :       :...loan_amnt <= 4075: Charged Off (4/1)
## :       :   loan_amnt > 4075:
## :       :   :...emplen <= 3: Fully Paid (15)
## :       :       emplen > 3: Charged Off (3/1)
## :       verification_status = Not Verified:
## :       :...emplen <= 1: Charged Off (11/8)
## :           emplen > 1:
## :           :...gradeencoding > 3.4: Fully Paid (22)
## :               gradeencoding <= 3.4:
## :               :...emplen <= 2: Fully Paid (8)
## :                   emplen > 2: Charged Off (13/9)
## home_ownership = RENT:
## :...verification_status = Verified:
##     :...emplen <= 0: Charged Off (10/5)
##     :   emplen > 0:
##     :   :...gradeencoding <= 2.6: Charged Off (11/8)
##     :       gradeencoding > 2.6: Fully Paid (63/7)
##     verification_status = Source Verified:
##     :...emplen <= 0:
##     :   :...gradeencoding <= 3.3: Charged Off (10/8)
##     :   :   gradeencoding > 3.3: Fully Paid (16)
##     :   emplen > 0:
##     :   :...emplen <= 7: Charged Off (88/58)
##     :       emplen > 7:
##     :       :...loan_amnt <= 6800: Charged Off (4/3)
##     :           loan_amnt > 6800: Fully Paid (9)
##     verification_status = Not Verified:
##     :...loan_amnt <= 2750: Charged Off (26/16)
##         loan_amnt > 2750:
##         :...gradeencoding > 3.2: Charged Off (197/156)
##             gradeencoding <= 3.2:
##             :...gradeencoding <= 2.5:
##                 :...gradeencoding <= 2.4: Fully Paid (9)
##                 :   gradeencoding > 2.4: Charged Off (13/9)
```

```
##                  gradeencoding > 2.5:
##                  :...loan_amnt <= 9800: Fully Paid (27)
##                      loan_amnt > 9800: Charged Off (6/5)
##
## SubTree [S50]
##
## verification_status = Not Verified:
## :...home_ownership in {NONE,OTHER}: Fully Paid (0)
## :   home_ownership = OWN: Charged Off (2/1)
## :   home_ownership = MORTGAGE:
## :   :...gradeencoding <= 3.4: Fully Paid (14)
## :   :   gradeencoding > 3.4: Charged Off (2)
## :   home_ownership = RENT:
## :   :...gradeencoding <= 3.2: Charged Off (4/3)
## :       gradeencoding > 3.2: Fully Paid (14)
## verification_status in {Source Verified,Verified}:
## :...loan_amnt > 14200: Charged Off (42/26)
##     loan_amnt <= 14200:
##     :...home_ownership in {MORTGAGE,NONE,OTHER,OWN}: Fully Paid (9)
##         home_ownership = RENT: Charged Off (11/9)
##
## SubTree [S51]
##
## loan_amnt <= 13800: Fully Paid (42)
## loan_amnt > 13800:
## :...loan_amnt <= 15900: Charged Off (40/33)
##     loan_amnt > 15900: Fully Paid (10)
##
## SubTree [S52]
##
## gradeencoding <= 2.6: Fully Paid (42/3)
## gradeencoding > 2.6:
## :...home_ownership in {MORTGAGE,NONE,OTHER}: Charged Off (23/15)
##     home_ownership = OWN:
##     :...gradeencoding <= 3.3: Charged Off (2/1)
##     :   gradeencoding > 3.3: Fully Paid (5)
##     home_ownership = RENT:
##     :...verification_status = Not Verified:
##         :...emplen <= 0: Fully Paid (8)
##         :   emplen > 0: Charged Off (36/27)
##         verification_status = Source Verified:
##         :...gradeencoding <= 3.4: Charged Off (5/4)
##         :   gradeencoding > 3.4: Fully Paid (9)
##         verification_status = Verified:
##         :...loan_amnt > 15500: Charged Off (4/2)
##             loan_amnt <= 15500:
##             :...loan_amnt <= 13125: Charged Off (10/8)
##                 loan_amnt > 13125: Fully Paid (10)
##
##
## Evaluation on training data (28000 cases):
##
##          Decision Tree
##      ----------------------
```

```
##     Size      Errors    Cost
##
##      591 7710(27.5%)   0.44    <<
##
##
##      (a)    (b)      <-classified as
##      ----   ----
##     2832   1097     (a): class Charged Off
##     6613  17458     (b): class Fully Paid
##
##
##   Attribute usage:
##
##   100.00% gradeencoding
##   100.00% purpose
##    79.70% term
##    58.09% home_ownership
##    33.78% loan_amnt
##    33.74% emplen
##    32.73% verification_status
##
##
## Time: 0.4 secs

## [1] "Costs Matrix: "

##               predicted
## actual         Charged Off Fully Paid
##    Charged Off           0        5.2
##    Fully Paid            1        0.0

## [1] "Confusion Matrix (Test Performance): "

##               predicted
## actual         Charged Off Fully Paid
##    Charged Off         778        728
##    Fully Paid         2907       6284

##
##
##    Cell Contents
## |-------------------------|
## |                       N |
## |         N / Table Total |
## |-------------------------|
##
##
## Total Observations in Table:  10697
##
##
##                | Predicted Status
## Actual Status | Charged Off |  Fully Paid |  Row Total |
## --------------|-------------|-------------|-------------|
##    Charged Off |         778 |         728 |        1506 |
##                |       0.073 |       0.068 |             |
## --------------|-------------|-------------|-------------|
```

```
##     Fully Paid |           2907 |           6284 |           9191 |
##                |          0.272 |          0.587 |                |
## --------------|--------------|--------------|--------------|
##   Column Total |           3685 |           7012 |          10697 |
## --------------|--------------|--------------|--------------|
##
##
## [1] "Test Set Performance: "

##              weight      sens      prec      spec       acc
## Charged Off     5.2 0.5166003 0.2111262 0.6837123 0.6601851
```