Homework 5: Boosting and AdaBoost.M1

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Goal: Understand and implement a random forest classifier.

1. Using the "vowel.train" data, develop a random forest (e.g., using the "randomForest" package) or gradient boosted classifier for the vowel data.

2. Fit a random forest or gradient boosted model to the "vowel.train" data using all of the 11 features using the default values of the tuning parameters.

3.Use 5-fold CV to tune the number of variables randomly sampled as candidates at each split if using random forest, or the ensemble size if using gradient boosting.

4. With the tuned model, make predictions using the majority vote method, and compute the misclassification rate using the 'vowel.test' data.

Libraries

```
library('magrittr')
```

```
## Warning: package 'magrittr' was built under R version 4.1.2
```

```
library('dplyr')
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library('rpart')
```

```
## Warning: package 'rpart' was built under R version 4.1.2
```

```
library('partykit')
```

```
## Loading required package: grid

## Loading required package: libcoin

## Loading required package: mvtnorm
```

```
library('utils')
library('manipulate')
library('randomForest')
```

```
## Warning: package 'randomForest' was built under R version 4.1.2

## randomForest 4.7-1

## Type rfNews() to see new features/changes/bug fixes.

##
## Attaching package: 'randomForest'

## The following object is masked from 'package:dplyr':
##
##     combine
```

```
library('xgboost')
```

```
## Warning: package 'xgboost' was built under R version 4.1.2

##
## Attaching package: 'xgboost'

## The following object is masked from 'package:dplyr':
##
##     slice
```

Import the training data

```
# Load the data from the URL
url <- "https://hastie.su.domains/ElemStatLearn/datasets/vowel.train"
train_vowel <- read.table(url, header = TRUE)

# Create a sample train_data frame
train_data <- train_vowel
# Split the comma-separated values into separate columns
train_data <- data.frame(do.call("rbind", strsplit(as.character(train_data[,1]), ",")))
```

```r
# Rename the columns
colnames(train_data) <- c("row.names", "y", "x.1", "x.2", "x.3", "x.4", "x.5", "x.6", "x.7", "x.8", "x.9

# Convert the columns to the appropriate train_data types
train_data$row.names <- as.numeric(train_data$row.names)
train_data$y <- as.numeric(train_data$y)
train_data$x.1 <- as.numeric(train_data$x.1)
train_data$x.2 <- as.numeric(train_data$x.2)
train_data$x.3 <- as.numeric(train_data$x.3)
train_data$x.4 <- as.numeric(train_data$x.4)
train_data$x.5 <- as.numeric(train_data$x.5)
train_data$x.6 <- as.numeric(train_data$x.6)
train_data$x.7 <- as.numeric(train_data$x.7)
train_data$x.8 <- as.numeric(train_data$x.8)
train_data$x.9 <- as.numeric(train_data$x.9)
train_data$x.10 <- as.numeric(train_data$x.10)

# View the resulting train_data frame
train_data
```

```
##     row.names  y    x.1   x.2    x.3   x.4    x.5   x.6    x.7    x.8    x.9
## 1           1  1 -3.639  0.418 -0.670  1.779 -0.168  1.627 -0.388  0.529 -0.874
## 2           2  2 -3.327  0.496 -0.694  1.365 -0.265  1.933 -0.363  0.510 -0.621
## 3           3  3 -2.120  0.894 -1.576  0.147 -0.707  1.559 -0.579  0.676 -0.809
## 4           4  4 -2.287  1.809 -1.498  1.012 -1.053  1.060 -0.567  0.235 -0.091
## 5           5  5 -2.598  1.938 -0.846  1.062 -1.633  0.764  0.394 -0.150  0.277
## 6           6  6 -2.852  1.914 -0.755  0.825 -1.588  0.855  0.217 -0.246  0.238
## 7           7  7 -3.482  2.524 -0.433  1.048 -1.995  0.902  0.322  0.450  0.377
## 8           8  8 -3.941  2.305  0.124  1.771 -1.815  0.593 -0.435  0.992  0.575
## 9           9  9 -3.860  2.116 -0.939  0.688 -0.675  1.679 -0.512  0.928 -0.167
## 10         10 10 -3.648  1.812 -1.378  1.578  0.065  1.577 -0.466  0.702  0.060
## 11         11 11 -3.032  1.739 -1.141  0.737 -0.834  1.386 -0.575  0.679 -0.018
## 12         12  1 -3.653  0.373 -0.600  1.705 -0.222  1.765 -0.353  0.537 -0.797
## 13         13  2 -3.237  0.436 -0.860  1.363 -0.251  1.915 -0.395  0.751 -0.774
## 14         14  3 -2.135  0.954 -1.632  0.121 -0.704  1.600 -0.628  0.713 -0.903
## 15         15  4 -2.304  1.784 -1.506  0.981 -0.961  0.806 -0.294 -0.002  0.119
## 16         16  5 -2.540  2.144 -1.024  0.933 -1.567  1.024  0.188 -0.047  0.309
## 17         17  6 -2.826  2.003 -0.738  0.801 -1.669  0.939  0.245 -0.257  0.256
## 18         18  7 -3.582  2.374 -0.358  1.162 -1.953  0.621  0.339  0.355  0.415
## 19         19  8 -3.951  2.250  0.127  1.772 -1.906  0.567 -0.432  1.045  0.598
## 20         20  9 -3.783  1.974 -1.200  0.606 -0.650  1.504 -0.134  0.528  0.392
## 21         21 10 -3.673  1.811 -1.405  1.621  0.044  1.572 -0.453  0.745 -0.066
## 22         22 11 -2.946  1.649 -1.167  0.788 -0.909  1.300 -0.562  0.902 -0.070
## 23         23  1 -3.665  0.337 -0.641  1.791 -0.194  1.686 -0.359  0.570 -0.676
## 24         24  2 -3.165  0.408 -0.971  1.207 -0.298  1.921 -0.215  0.723 -0.492
## 25         25  3 -2.105  1.035 -1.705  0.231 -0.558  1.554 -0.649  0.710 -0.855
## 26         26  4 -2.312  1.746 -1.510  1.019 -0.990  0.941 -0.488  0.208  0.033
## 27         27  5 -2.635  2.147 -1.129  0.911 -1.407  1.095 -0.071  0.118  0.139
## 28         28  6 -2.887  2.131 -0.830  0.682 -1.557  0.818  0.448 -0.382  0.207
## 29         29  7 -3.635  2.250 -0.394  1.012 -1.693  0.117  0.665  0.281  0.343
## 30         30  8 -3.986  2.325  0.102  1.633 -2.014  0.576 -0.344  1.003  0.566
## 31         31  9 -3.712  1.816 -1.171  0.647 -0.767  1.698 -0.347  0.920  0.159
## 32         32 10 -3.740  1.832 -1.384  1.587  0.049  1.642 -0.516  0.707 -0.169
```

```
## 33         33 11 -2.859  1.627 -1.140  0.769 -0.948  1.390 -0.608  0.956 -0.204
## 34         34  1 -3.624  0.305 -0.708  1.758 -0.194  1.675 -0.273  0.561 -0.577
## 35         35  2 -3.062  0.351 -1.071  1.061 -0.355  1.990 -0.210  0.796 -0.358
## 36         36  3 -2.081  1.050 -1.778  0.411 -0.518  1.460 -0.576  0.735 -0.866
## 37         37  4 -2.289  1.845 -1.616  0.987 -0.876  1.044 -0.549  0.196 -0.070
## 38         38  5 -2.724  2.067 -1.142  0.923 -1.157  1.170 -0.276  0.172 -0.008
## 39         39  6 -3.015  2.232 -0.899  0.574 -1.331  0.546  0.610 -0.452  0.035
## 40         40  7 -3.559  2.126 -0.445  1.053 -1.765  0.349  0.546  0.321  0.443
## 41         41  8 -4.074  2.281  0.152  1.556 -1.613 -0.047  0.222  0.252  0.775
## 42         42  9 -3.618  1.576 -1.140  0.699 -0.741  1.633 -0.387  1.086  0.235
## 43         43 10 -3.687  1.784 -1.593  1.603  0.123  1.424 -0.225  0.441  0.206
## 44         44 11 -2.690  1.652 -1.261  0.674 -0.964  1.449 -0.593  1.005 -0.303
## 45         45  1 -3.593  0.290 -0.782  1.707 -0.175  1.662 -0.137  0.493 -0.492
## 46         46  2 -3.046  0.387 -1.165  0.940 -0.386  1.978 -0.186  0.811 -0.394
## 47         47  3 -2.255  0.902 -1.723  0.454 -0.524  1.453 -0.614  0.761 -0.885
## 48         48  4 -2.299  1.848 -1.695  1.065 -0.861  1.047 -0.607  0.313 -0.253
## 49         49  5 -2.911  1.928 -1.131  0.899 -0.911  1.111 -0.208 -0.047 -0.029
## 50         50  6 -3.089  2.339 -0.973  0.463 -1.169  0.543  0.598 -0.450 -0.080
## 51         51  7 -3.459  2.086 -0.595  0.937 -1.841  0.600  0.457  0.400  0.473
## 52         52  8 -4.208  2.447  0.049  1.331 -2.088  0.585 -0.050  0.820  0.606
## 53         53  9 -3.543  1.391 -1.220  0.699 -0.769  1.579 -0.379  1.158  0.181
## 54         54 10 -3.684  1.774 -1.728  1.611  0.100  1.393 -0.193  0.554  0.245
## 55         55 11 -2.596  1.560 -1.249  0.656 -1.095  1.292 -0.550  1.006 -0.150
## 56         56  1 -3.604  0.235 -0.836  1.786 -0.153  1.642 -0.096  0.488 -0.524
## 57         57  2 -3.171  0.490 -1.128  0.911 -0.388  2.014 -0.212  0.707 -0.551
## 58         58  3 -2.302  0.850 -1.646  0.455 -0.488  1.491 -0.617  0.819 -0.887
## 59         59  4 -2.368  1.727 -1.556  1.162 -0.819  0.941 -0.572  0.345 -0.279
## 60         60  5 -3.141  1.873 -1.131  0.941 -0.759  1.224 -0.354  0.016 -0.218
## 61         61  6 -3.065  2.372 -1.002  0.496 -1.295  0.860  0.327 -0.404  0.067
## 62         62  7 -3.473  2.178 -0.820  0.706 -1.710  0.779  0.422  0.351  0.426
## 63         63  8 -4.238  2.437  0.036  1.158 -2.127  0.554  0.120  0.823  0.565
## 64         64  9 -3.546  1.258 -1.227  0.823 -0.702  1.734 -0.397  1.333 -0.277
## 65         65 10 -3.869  1.860 -1.646  1.612  0.044  1.531 -0.493  0.862 -0.106
## 66         66 11 -2.666  1.516 -1.198  0.741 -1.066  1.240 -0.574  0.965 -0.130
## 67         67  1 -4.102  0.209  0.414  0.423  0.985  1.434  0.663  0.036 -0.784
## 68         68  2 -1.372 -0.030 -1.003 -0.388 -0.471  1.141  0.654  0.823  0.558
## 69         69  3 -1.816  0.458 -0.947 -0.341  0.085  0.750  0.144  0.462 -0.240
## 70         70  4 -1.954  1.595 -1.593  0.370 -0.136  0.022  0.034  0.321 -0.190
## 71         71  5 -2.654  2.390 -0.008  0.070 -1.063  0.304 -0.105  0.281  0.488
## 72         72  6 -2.321  1.303  0.320 -0.085 -0.278  0.001 -0.094 -0.283  0.852
## 73         73  7 -3.141  3.314 -0.996 -0.394 -0.190 -0.312  0.137  0.631  0.547
## 74         74  8 -3.941  3.353  0.486 -0.506 -1.120  0.101  0.297  0.711 -0.078
## 75         75  9 -4.161  2.937  0.157  0.336 -0.968  0.641  0.088  0.237  0.565
## 76         76 10 -4.520  2.231 -0.088  0.513 -0.528  1.246  0.198  0.242  0.161
## 77         77 11 -3.088  1.389  0.048 -0.216 -0.329  0.910  0.045 -0.075  0.101
## 78         78  1 -4.275  0.162  0.728  0.662  0.940  1.269  0.711  0.073 -0.827
## 79         79  2 -1.657  0.056 -1.044 -0.320 -0.316  1.321  0.638  0.800  0.298
## 80         80  3 -1.709  0.486 -0.953 -0.346  0.020  0.786  0.145  0.564 -0.229
## 81         81  4 -1.952  1.469 -1.375  0.105 -0.154  0.170 -0.047  0.336 -0.098
## 82         82  5 -2.670  2.696 -0.231 -0.028 -1.014  0.486 -0.137  0.448  0.285
## 83         83  6 -2.441  1.415  0.386 -0.335 -0.187 -0.079  0.000 -0.175  0.792
## 84         84  7 -3.146  3.076 -0.683 -0.032 -0.693 -0.060 -0.267  0.476  0.982
## 85         85  8 -3.902  3.586  0.334 -0.669 -1.087  0.255  0.461  0.812 -0.185
## 86         86  9 -4.267  3.010  0.172  0.028 -0.827  0.532  0.099  0.326  0.340
```

```
##  87         87 10 -4.650  2.455  0.013  0.681 -0.800  1.434  0.126  0.036  0.382
##  88         88 11 -3.030  1.185  0.314 -0.121 -0.591  0.965  0.353 -0.137 -0.221
##  89         89  1 -4.473  0.373  0.858  0.919  0.778  1.272  0.653 -0.216 -0.891
##  90         90  2 -1.856  0.063 -1.011 -0.238 -0.152  1.461  0.572  0.775  0.154
##  91         91  3 -1.976  0.389 -0.947 -0.250 -0.065  0.949  0.127  0.478 -0.323
##  92         92  4 -1.914  1.473 -1.342 -0.013 -0.213  0.253  0.005  0.229 -0.009
##  93         93  5 -2.700  2.830 -0.389  0.032 -0.958  0.440 -0.168  0.519  0.169
##  94         94  6 -2.554  1.117  0.420 -0.022 -0.645  0.020  0.145 -0.327  0.660
##  95         95  7 -3.054  3.104 -0.513 -0.085 -0.952  0.299 -0.269  0.459  0.892
##  96         96  8 -3.840  3.745  0.121 -0.656 -1.066  0.329  0.734  0.875 -0.295
##  97         97  9 -4.323  2.853  0.385  0.209 -1.096  0.431  0.119  0.268  0.131
##  98         98 10 -4.676  2.537  0.075  0.730 -0.933  1.493  0.049  0.076  0.254
##  99         99 11 -2.922  1.516 -0.002 -0.353 -0.464  1.184  0.383 -0.175 -0.346
## 100        100  1 -4.477  0.246  1.087  1.108  0.682  1.057  0.424 -0.264 -1.195
## 101        101  2 -1.895 -0.012 -0.970 -0.152 -0.161  1.509  0.487  0.809  0.044
## 102        102  3 -1.945  0.352 -1.053 -0.228 -0.120  0.927  0.088  0.509 -0.279
## 103        103  4 -1.912  1.554 -1.455 -0.017 -0.118  0.270 -0.037  0.163 -0.027
## 104        104  5 -2.724  2.998 -0.560 -0.077 -0.944  0.548 -0.080  0.400  0.144
## 105        105  6 -2.385  1.241  0.272 -0.040 -0.692  0.160 -0.061 -0.189  0.744
## 106        106  7 -3.092  3.014 -0.307 -0.016 -0.956  0.195 -0.227  0.367  0.958
## 107        107  8 -3.917  3.496  0.409 -0.531 -1.150  0.017  0.605  0.977 -0.328
## 108        108  9 -4.232  3.035  0.428  0.497 -1.374  0.549  0.133  0.232  0.129
## 109        109 10 -4.759  2.696  0.104  0.697 -0.787  1.114  0.205 -0.066  0.369
## 110        110 11 -2.945  1.724 -0.312 -0.239 -0.447  1.360  0.014 -0.102  0.021
## 111        111  1 -4.314 -0.106  1.044  1.192  0.687  0.763  0.158 -0.193 -1.342
## 112        112  2 -2.050  0.065 -0.938 -0.037  0.082  1.561  0.393  0.835 -0.029
## 113        113  3 -1.804  0.431 -1.000 -0.427 -0.094  0.848  0.084  0.636 -0.275
## 114        114  4 -1.978  1.542 -1.487 -0.096 -0.025  0.320 -0.063  0.097 -0.073
## 115        115  5 -2.748  3.217 -0.976 -0.213 -0.792  0.771 -0.032  0.223  0.043
## 116        116  6 -2.351  1.530  0.086 -0.075 -0.426  0.125 -0.197  0.033  0.848
## 117        117  7 -3.105  2.916 -0.207  0.031 -0.897  0.021 -0.229  0.256  1.073
## 118        118  8 -3.985  3.614  0.584 -0.420 -1.105 -0.174  0.348  0.885 -0.165
## 119        119  9 -4.160  3.329  0.275  0.394 -1.287  0.693  0.483  0.121  0.286
## 120        120 10 -4.880  3.064  0.060  0.434 -0.575  0.897  0.250  0.085  0.093
## 121        121 11 -3.082  1.633 -0.118 -0.147 -0.484  1.176 -0.086 -0.072  0.086
## 122        122  1 -4.158 -0.342  0.900  1.090  0.560  0.955  0.395 -0.328 -1.520
## 123        123  2 -2.441  0.191 -0.814  0.255  0.411  1.636  0.395  0.761 -0.005
## 124        124  3 -1.672  0.328 -0.833 -0.577 -0.363  0.840  0.180  0.682 -0.124
## 125        125  4 -2.051  1.508 -1.641 -0.058 -0.102  0.346 -0.021  0.109 -0.147
## 126        126  5 -2.788  3.194 -1.142 -0.313 -0.580  0.357  0.281  0.082  0.109
## 127        127  6 -2.489  1.773 -0.180 -0.152 -0.353  0.133 -0.186  0.207  0.788
## 128        128  7 -3.065  3.139 -0.461 -0.221 -0.759 -0.045  0.068  0.274  0.999
## 129        129  8 -3.963  3.938  0.466 -0.564 -1.042 -0.064  0.241  0.888 -0.032
## 130        130  9 -4.136  3.582 -0.407 -0.038 -0.687  1.031  0.491  0.157  0.305
## 131        131 10 -4.944  3.325  0.015  0.079 -0.593  1.047  0.337  0.296 -0.453
## 132        132 11 -3.058  1.678 -0.351 -0.255  0.038  0.692 -0.173  0.226  0.202
## 133        133  1 -1.202 -0.253 -2.487  0.809 -0.367  2.169  0.320  1.034 -1.385
## 134        134  2 -1.077  0.511 -2.006  0.305 -0.584  1.962  0.089  1.406 -0.669
## 135        135  3 -1.768  0.786 -1.468  1.077 -0.347  1.704 -0.171  1.076 -0.691
## 136        136  4 -1.737  1.789 -1.046  1.071 -0.775  1.041 -0.025  0.925 -0.452
## 137        137  5 -2.432  2.126 -0.218  1.422 -1.169  0.410 -0.393  1.326 -0.067
## 138        138  6 -2.125  1.952 -0.415  1.458 -0.985  0.520 -0.344  1.249 -0.370
## 139        139  7 -2.607  2.406 -0.088  1.586 -1.477  0.164 -0.527  1.551  0.033
## 140        140  8 -3.813  3.705 -0.157  1.561 -1.503 -0.366 -0.581  1.412  0.290
```

```
## 141       141  9 -3.050  1.600 -0.686  1.543 -1.149 -0.043  0.297  0.727  0.598
## 142       142 10 -3.972  2.279 -0.620  0.954 -1.090  0.719  0.717  0.300  1.309
## 143       143 11 -2.979  1.795 -0.870  1.427 -0.930  1.323 -0.212  1.286 -0.135
## 144       144  1 -1.298 -0.295 -2.433  0.955 -0.278  2.252  0.285  0.915 -1.569
## 145       145  2 -1.012  0.516 -2.041  0.320 -0.634  1.969  0.041  1.414 -0.687
## 146       146  3 -1.501  0.847 -1.619  0.920 -0.488  1.616 -0.161  1.127 -0.613
## 147       147  4 -1.674  1.711 -1.040  1.136 -0.869  1.036 -0.157  0.946 -0.361
## 148       148  5 -2.308  2.023 -0.203  1.493 -1.223  0.379 -0.481  1.403 -0.045
## 149       149  6 -2.155  2.027 -0.393  1.354 -1.045  0.646 -0.246  1.279 -0.396
## 150       150  7 -2.652  2.156 -0.053  1.694 -1.258  0.062 -0.610  1.397  0.133
## 151       151  8 -3.834  3.749 -0.183  1.518 -1.585 -0.281 -0.334  1.191  0.425
## 152       152  9 -3.330  1.529 -0.552  2.023 -0.845  0.016  0.049  0.512  0.396
## 153       153 10 -4.170  2.232 -0.389  1.211 -1.011  0.570  0.543  0.218  1.206
## 154       154 11 -2.867  1.391 -0.817  1.595 -0.883  1.143 -0.427  1.159  0.170
## 155       155  1 -1.393 -0.305 -2.290  1.100 -0.254  2.327  0.363  0.795 -1.521
## 156       156  2 -0.941  0.539 -2.020  0.314 -0.679  1.897  0.028  1.504 -0.632
## 157       157  3 -1.332  0.848 -1.665  0.970 -0.463  1.522 -0.159  1.101 -0.541
## 158       158  4 -1.570  1.655 -1.040  1.160 -0.923  0.961 -0.231  0.955 -0.273
## 159       159  5 -2.227  1.993 -0.156  1.554 -1.190  0.332 -0.548  1.362 -0.013
## 160       160  6 -2.043  1.950 -0.435  1.341 -1.049  0.558 -0.237  1.237 -0.283
## 161       161  7 -2.679  1.731 -0.090  2.003 -1.009  0.038 -0.822  1.232  0.128
## 162       162  8 -3.836  3.699 -0.225  1.520 -1.729 -0.184  0.064  0.970  0.500
## 163       163  9 -3.478  1.703 -0.557  2.191 -1.043  0.339 -0.004  0.587  0.450
## 164       164 10 -4.333  2.438 -0.219  1.372 -0.761  0.306  0.594 -0.022  1.103
## 165       165 11 -2.704  1.285 -0.908  1.570 -0.840  1.044 -0.399  0.951  0.345
## 166       166  1 -1.417 -0.319 -2.254  1.072 -0.221  2.268  0.430  0.923 -1.486
## 167       167  2 -0.961  0.514 -1.951  0.364 -0.680  1.895  0.047  1.539 -0.630
## 168       168  3 -1.220  0.831 -1.674  0.940 -0.425  1.463 -0.063  1.135 -0.422
## 169       169  4 -1.501  1.611 -1.003  1.156 -0.883  0.901 -0.169  0.862 -0.151
## 170       170  5 -2.176  1.952 -0.144  1.659 -1.128  0.280 -0.658  1.346  0.008
## 171       171  6 -1.891  1.776 -0.518  1.461 -1.050  0.567 -0.307  1.152 -0.239
## 172       172  7 -2.624  1.653 -0.156  2.023 -1.052  0.086 -0.752  1.341  0.196
## 173       173  8 -3.763  3.252 -0.262  1.520 -1.684 -0.225  0.235  0.989  0.616
## 174       174  9 -3.549  1.905 -0.509  1.963 -1.200  0.847 -0.157  0.842  0.625
## 175       175 10 -4.373  2.463 -0.171  1.501 -0.639  0.292  0.518 -0.114  1.127
## 176       176 11 -2.562  1.361 -0.940  1.333 -1.047  1.208 -0.316  1.055  0.354
## 177       177  1 -1.384 -0.321 -2.266  0.937 -0.289  2.290  0.463  1.096 -1.436
## 178       178  2 -1.123  0.415 -1.954  0.563 -0.465  1.983  0.027  1.614 -0.568
## 179       179  3 -1.280  0.798 -1.647  0.968 -0.418  1.609 -0.031  1.224 -0.374
## 180       180  4 -1.475  1.557 -1.009  1.202 -0.846  0.883 -0.138  0.822 -0.165
## 181       181  5 -2.205  1.804 -0.199  1.773 -1.089  0.312 -0.621  1.247  0.137
## 182       182  6 -1.824  1.682 -0.669  1.483 -1.036  0.711 -0.249  1.193 -0.274
## 183       183  7 -2.574  1.814 -0.167  1.826 -1.156  0.120 -0.609  1.543  0.110
## 184       184  8 -3.693  3.067 -0.273  1.619 -1.905  0.045  0.006  1.347  0.346
## 185       185  9 -3.545  1.926 -0.512  1.732 -1.109  1.006  0.021  0.820  0.731
## 186       186 10 -4.386  2.271 -0.157  1.536 -0.614  0.230  0.570 -0.117  1.074
## 187       187 11 -2.530  1.492 -0.936  1.210 -1.154  1.316 -0.267  1.149  0.226
## 188       188  1 -1.215 -0.288 -2.423  0.834 -0.379  2.266  0.503  1.337 -1.360
## 189       189  2 -1.400  0.316 -1.894  0.830 -0.242  2.038  0.003  1.667 -0.515
## 190       190  3 -1.494  0.663 -1.580  1.191 -0.252  1.777 -0.072  1.189 -0.409
## 191       191  4 -1.512  1.492 -1.053  1.262 -0.809  0.941 -0.122  0.807 -0.206
## 192       192  5 -2.274  1.653 -0.226  1.857 -0.971  0.327 -0.605  1.121  0.121
## 193       193  6 -1.804  1.556 -0.803  1.388 -0.989  0.751 -0.029  0.963 -0.228
## 194       194  7 -2.447  1.914 -0.208  1.641 -1.159  0.104 -0.539  1.580  0.058
```

```
## 195       195  8 -3.675  3.132 -0.241  1.587 -1.750 -0.222  0.039  1.052  0.545
## 196       196  9 -3.425  1.724 -0.638  1.573 -1.041  1.204 -0.124  1.258  0.548
## 197       197 10 -4.376  2.216 -0.269  1.320 -0.660  0.159  0.719  0.008  1.058
## 198       198 11 -2.520  1.520 -0.959  1.296 -1.103  1.149 -0.268  1.249  0.092
## 199       199  1 -1.548 -0.400 -1.659  0.244 -0.101  1.562  0.551  1.248  0.129
## 200       200  2 -1.614  0.287 -1.195 -0.252 -0.257  1.251  0.281  0.898  0.188
## 201       201  3 -1.891  0.988 -1.060  0.119  0.590  0.263  0.372  0.390 -0.376
## 202       202  4 -2.030  1.764 -0.386 -0.249  0.180  0.117  0.096 -0.121  0.067
## 203       203  5 -2.550  2.629  0.084 -0.159 -0.882  0.093 -0.190  0.961  0.032
## 204       204  6 -2.464  1.968  0.026  0.078 -0.542  0.074  0.051  0.596  0.260
## 205       205  7 -3.193  2.026  0.830  0.813 -1.205  0.036 -0.950  0.786  1.045
## 206       206  8 -3.566  1.504  0.940  1.829 -1.224  0.178 -1.454  0.920  0.767
## 207       207  9 -3.299  1.730  0.187  0.121 -1.251  0.796 -0.366  1.091  0.493
## 208       208 10 -3.601  0.742 -0.238  0.332 -0.561  1.275 -0.014  0.844  0.558
## 209       209 11 -2.439  0.789  0.082  0.242 -0.693  0.595 -0.353  0.702  0.413
## 210       210  1 -1.507 -0.457 -1.728  0.256 -0.081  1.571  0.556  1.291  0.121
## 211       211  2 -1.425  0.256 -1.130 -0.284 -0.394  1.253  0.306  0.893  0.272
## 212       212  3 -1.814  0.923 -0.931  0.120  0.425  0.554  0.237  0.426 -0.184
## 213       213  4 -2.007  1.814 -0.581 -0.027  0.127  0.081  0.089 -0.016  0.115
## 214       214  5 -2.559  2.300  0.408 -0.001 -1.077  0.125 -0.254  0.975  0.070
## 215       215  6 -2.431  1.873  0.208  0.123 -0.634  0.178  0.040  0.612  0.446
## 216       216  7 -3.240  1.749  0.959  1.071 -1.188  0.018 -1.024  0.664  1.007
## 217       217  8 -3.565  1.363  0.958  1.976 -1.268  0.091 -1.363  0.720  0.738
## 218       218  9 -3.198  1.373  0.392  0.423 -1.203  0.656 -0.428  0.994  0.576
## 219       219 10 -3.772  0.904 -0.195  0.317 -0.473  1.310 -0.043  0.898  0.536
## 220       220 11 -2.434  0.870  0.127  0.224 -0.811  0.666 -0.233  0.705  0.408
## 221       221  1 -1.656 -0.496 -1.719  0.363 -0.002  1.637  0.535  1.319 -0.012
## 222       222  2 -1.388  0.215 -1.105 -0.295 -0.390  1.282  0.356  0.816  0.292
## 223       223  3 -1.764  0.888 -1.001  0.197  0.300  0.660  0.159  0.557 -0.301
## 224       224  4 -2.026  1.750 -0.526 -0.131  0.266 -0.055  0.084  0.063  0.047
## 225       225  5 -2.531  1.802  0.739  0.236 -1.169 -0.069 -0.349  0.903  0.123
## 226       226  6 -2.375  1.642  0.308  0.255 -0.820  0.225 -0.092  0.874  0.367
## 227       227  7 -3.179  1.346  0.988  1.320 -0.852 -0.008 -1.234  0.347  1.020
## 228       228  8 -3.570  1.366  0.970  1.957 -1.262  0.002 -1.275  0.585  0.754
## 229       229  9 -3.169  1.041  0.509  0.693 -1.185  0.673 -0.352  0.877  0.434
## 230       230 10 -4.066  1.050 -0.049  0.458 -0.357  1.331 -0.129  0.848  0.509
## 231       231 11 -2.483  0.810  0.185  0.284 -0.917  0.730 -0.111  0.613  0.373
## 232       232  1 -1.823 -0.578 -1.624  0.520  0.052  1.711  0.535  1.318 -0.115
## 233       233  2 -1.450  0.199 -1.127 -0.281 -0.372  1.287  0.369  0.855  0.303
## 234       234  3 -1.790  0.793 -1.041  0.214  0.215  0.694  0.121  0.583 -0.403
## 235       235  4 -2.089  1.695 -0.528 -0.232  0.385 -0.137  0.033  0.071  0.033
## 236       236  5 -2.475  1.498  0.864  0.397 -1.170 -0.234 -0.388  0.825  0.160
## 237       237  6 -2.314  1.494  0.294  0.245 -0.769  0.050 -0.068  0.819  0.618
## 238       238  7 -3.062  1.008  0.935  1.443 -0.579  0.068 -1.333  0.106  0.958
## 239       239  8 -3.576  1.357  0.912  1.878 -1.166  0.039 -1.537  0.658  0.843
## 240       240  9 -3.155  1.021  0.455  0.624 -1.306  0.842 -0.123  0.909  0.328
## 241       241 10 -4.316  1.147  0.088  0.593 -0.314  1.316 -0.255  0.761  0.492
## 242       242 11 -2.608  0.839  0.203  0.305 -0.851  0.780 -0.143  0.607  0.344
## 243       243  1 -1.953 -0.596 -1.543  0.619  0.056  1.742  0.592  1.289 -0.163
## 244       244  2 -1.495  0.117 -1.134 -0.249 -0.370  1.286  0.348  0.854  0.313
## 245       245  3 -1.921  0.719 -0.950  0.299  0.222  0.786  0.128  0.588 -0.462
## 246       246  4 -2.052  1.483 -0.488  0.041 -0.131  0.273 -0.112 -0.064  0.307
## 247       247  5 -2.507  1.528  0.852  0.331 -1.231 -0.259 -0.265  0.856  0.070
## 248       248  6 -2.291  1.146  0.352  0.354 -0.714  0.080 -0.181  0.787  0.709
```

```
## 249       249  7 -2.933  0.717  0.829  1.508 -0.517  0.069 -1.163  0.021  0.866
## 250       250  8 -3.530  1.268  0.903  1.887 -1.279  0.008 -1.441  0.657  0.873
## 251       251  9 -3.145  0.863  0.416  0.699 -1.378  0.892  0.020  0.890  0.221
## 252       252 10 -4.394  1.162  0.157  0.608 -0.409  1.352 -0.243  0.758  0.447
## 253       253 11 -2.704  0.917  0.267  0.314 -0.756  0.818 -0.114  0.673  0.261
## 254       254  1 -2.058 -0.610 -1.497  0.696  0.072  1.802  0.626  1.303 -0.192
## 255       255  2 -1.537  0.043 -1.125 -0.213 -0.378  1.265  0.330  0.870  0.293
## 256       256  3 -1.933  0.728 -1.015  0.270  0.199  0.780  0.192  0.706 -0.446
## 257       257  4 -2.076  1.413 -0.584  0.190 -0.350  0.518 -0.406  0.313  0.027
## 258       258  5 -2.554  1.532  0.812  0.367 -1.208 -0.352 -0.252  0.894  0.050
## 259       259  6 -2.343  0.788  0.373  0.492 -0.667  0.279 -0.240  0.827  0.589
## 260       260  7 -2.834  0.654  0.733  1.434 -0.716 -0.028 -0.841  0.239  0.920
## 261       261  8 -3.482  1.127  0.899  1.993 -1.385 -0.050 -1.273  0.647  0.844
## 262       262  9 -3.246  0.712  0.390  0.820 -1.352  1.074  0.197  0.857 -0.056
## 263       263 10 -4.521  1.430  0.162  0.580 -0.351  1.339 -0.259  0.810  0.431
## 264       264 11 -2.804  1.021  0.254  0.331 -0.654  0.854 -0.085  0.678  0.259
## 265       265  1 -3.034 -1.274  0.263  1.521  0.660  1.622 -0.361 -0.468 -0.740
## 266       266  2 -3.118  0.356  0.377  1.447  0.868  0.407 -0.915 -0.546 -0.637
## 267       267  3 -2.611  0.434  0.231  1.343  0.323 -0.378 -0.618 -0.219 -0.285
## 268       268  4 -1.566  0.930 -0.181 -0.155 -0.164 -0.277  0.144 -0.047 -0.694
## 269       269  5 -2.758  2.067 -0.310 -0.543 -0.687  0.091  0.881  0.172 -0.454
## 270       270  6 -2.497  1.607 -0.621 -0.446 -0.226 -0.152  1.160  0.122 -0.809
## 271       271  7 -3.533  2.319  1.085  0.247 -1.053 -0.429 -0.026  1.305 -0.243
## 272       272  8 -3.893  3.690  0.079 -0.151 -1.093 -0.518  0.198  1.583 -0.257
## 273       273  9 -4.079  2.663 -0.048 -0.315  0.234  0.861  0.335  0.435 -0.546
## 274       274 10 -4.160  2.814  0.557  0.604  0.584  0.477 -0.272  0.784 -0.999
## 275       275 11 -2.910  0.918 -0.138 -0.382  0.115  0.290  0.418  0.757 -0.898
## 276       276  1 -3.162 -1.137  0.300  1.440  0.688  1.645 -0.447 -0.518 -0.520
## 277       277  2 -3.224  0.487  0.822  1.324  0.753  0.352 -0.976 -0.562 -0.489
## 278       278  3 -2.681  0.531  0.252  1.239  0.469 -0.339 -0.652 -0.417 -0.246
## 279       279  4 -1.577  0.907 -0.291  0.007 -0.256 -0.233  0.187 -0.052 -0.627
## 280       280  5 -2.861  2.091 -0.411 -0.438 -0.643  0.317  0.817  0.104 -0.481
## 281       281  6 -2.445  1.503 -0.677 -0.460 -0.140 -0.002  1.014  0.061 -0.599
## 282       282  7 -3.406  2.403  1.025  0.108 -1.100 -0.316  0.099  1.541 -0.304
## 283       283  8 -3.958  3.922  0.150 -0.265 -1.201 -0.249  0.202  1.163 -0.049
## 284       284  9 -4.071  2.754 -0.232 -0.262  0.356  0.694  0.381  0.500 -0.721
## 285       285 10 -4.188  2.637  0.502  0.552  0.735  0.395 -0.026  0.803 -0.874
## 286       286 11 -2.923  0.919 -0.231 -0.307  0.075  0.265  0.403  0.691 -1.012
## 287       287  1 -3.390 -0.956  0.476  1.547  0.658  1.504 -0.650 -0.604 -0.295
## 288       288  2 -3.128  0.280  0.955  1.264  0.753  0.437 -0.841 -0.517 -0.473
## 289       289  3 -2.689  0.528  0.157  1.501  0.349 -0.412 -0.490 -0.512 -0.277
## 290       290  4 -1.693  0.807 -0.038 -0.051 -0.174 -0.372  0.117  0.053 -0.611
## 291       291  5 -2.927  2.202 -0.532 -0.486 -0.519  0.585  0.813 -0.133 -0.475
## 292       292  6 -2.555  1.421 -0.800 -0.233 -0.078  0.244  0.771 -0.112 -0.707
## 293       293  7 -3.439  2.711  1.067  0.029 -1.120 -0.212  0.062  1.440 -0.353
## 294       294  8 -4.067  3.908 -0.065 -0.378 -1.163  0.065  0.508  1.003  0.030
## 295       295  9 -4.068  2.566 -0.068 -0.152  0.126  0.548  0.453  0.577 -0.543
## 296       296 10 -4.314  2.322  0.580  0.279  0.702  0.532 -0.068  0.814 -0.917
## 297       297 11 -3.020  1.033 -0.238 -0.286  0.088  0.235  0.372  0.563 -1.027
## 298       298  1 -3.485 -0.860  0.582  1.501  0.578  1.480 -0.663 -0.602 -0.318
## 299       299  2 -3.049  0.084  0.981  1.193  0.761  0.495 -0.714 -0.466 -0.568
## 300       300  3 -2.837  0.528  0.241  1.629  0.230 -0.545 -0.643 -0.231 -0.186
## 301       301  4 -1.611  0.831 -0.056 -0.048 -0.044 -0.423  0.289 -0.092 -0.633
## 302       302  5 -2.939  2.157 -0.451 -0.209 -0.880  0.697  0.823 -0.035 -0.744
```

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## 303       303  6 -2.842  1.343 -0.713  0.003  0.126  0.411  0.538 -0.077 -0.995
## 304       304  7 -3.587  3.128  0.885 -0.188 -1.164 -0.215  0.051  1.344 -0.641
## 305       305  8 -4.222  3.886  0.016 -0.144 -1.132 -0.053  0.519  1.024  0.075
## 306       306  9 -4.087  2.555  0.123 -0.151  0.118  0.474  0.365  0.495 -0.473
## 307       307 10 -4.442  2.607  0.596  0.191  0.636  0.679 -0.140  0.774 -0.828
## 308       308 11 -2.976  1.033 -0.222 -0.099  0.081  0.052  0.479  0.517 -1.105
## 309       309  1 -3.689 -0.599  0.692  1.307  0.605  1.514 -0.752 -0.697 -0.355
## 310       310  2 -3.278  0.324  1.047  1.152  0.725  0.168 -0.839 -0.381 -0.687
## 311       311  3 -3.249  1.042  0.589  1.408  0.023 -0.821 -0.581  0.031  0.068
## 312       312  4 -1.596  0.885 -0.199  0.199 -0.115 -0.474  0.428 -0.113 -0.610
## 313       313  5 -2.986  2.072 -0.311 -0.083 -0.878  0.449  0.916  0.082 -0.905
## 314       314  6 -3.003  1.163 -0.450  0.328  0.097  0.574  0.427 -0.017 -1.146
## 315       315  7 -3.682  3.672  0.041 -0.508 -0.905  0.028  0.492  0.654 -0.722
## 316       316  8 -4.210  3.869  0.164 -0.047 -1.251 -0.102  0.276  0.919  0.091
## 317       317  9 -4.129  2.686  0.308 -0.125  0.117  0.393  0.199  0.308 -0.478
## 318       318 10 -4.497  3.018  0.609  0.115  0.673  0.709 -0.030  0.861 -0.704
## 319       319 11 -2.846  1.010 -0.219 -0.083  0.091  0.076  0.442  0.509 -1.181
## 320       320  1 -3.693 -0.568  0.727  1.236  0.612  1.502 -0.804 -0.763 -0.346
## 321       321  2 -3.543  0.624  0.674  1.413  0.653 -0.445 -0.803 -0.256 -0.650
## 322       322  3 -3.293  0.930  0.522  1.480  0.249 -0.661 -0.643 -0.094 -0.132
## 323       323  4 -1.708  0.944 -0.140  0.151 -0.092 -0.481  0.220  0.034 -0.692
## 324       324  5 -2.942  2.091 -0.353 -0.364 -0.610  0.401  0.864  0.191 -0.764
## 325       325  6 -3.253  1.025 -0.286  0.713 -0.036  0.539  0.476 -0.116 -0.945
## 326       326  7 -3.661  3.266 -0.117 -0.237 -0.755  0.092  0.686  0.381 -0.580
## 327       327  8 -4.216  3.638  0.192 -0.023 -1.231 -0.320  0.128  1.030  0.061
## 328       328  9 -4.077  2.542  0.039  0.082  0.218  0.393  0.324  0.399 -0.658
## 329       329 10 -4.544  3.046  1.028 -0.016  0.447  0.884 -0.094  0.885 -0.459
## 330       330 11 -2.711  0.971 -0.023  0.053  0.101 -0.148  0.382  0.476 -1.050
## 331       331  1 -3.322 -0.303 -0.500  0.963  0.921  0.981  1.059 -1.079 -1.004
## 332       332  2 -3.844  1.056 -0.190  1.685  0.617  1.245 -0.811 -0.506 -1.128
## 333       333  3 -2.665  0.772 -1.009  1.307  0.287  0.855 -0.466 -0.190 -0.721
## 334       334  4 -2.493  1.382 -0.929  0.465 -0.369  0.002  0.187 -0.696 -0.310
## 335       335  5 -2.905  2.311 -0.658  0.022 -1.121  0.250  0.467  0.484 -0.157
## 336       336  6 -2.685  1.971 -0.857  0.033 -0.638  0.484  0.143  0.159 -0.218
## 337       337  7 -3.389  2.762 -0.710 -0.026 -0.641  0.112  0.775  0.443 -0.110
## 338       338  8 -4.243  3.354 -0.415  0.898 -1.027 -0.281  0.576  0.480  0.564
## 339       339  9 -3.741  2.700 -1.593  0.782 -0.298  1.378  0.184  1.458 -0.134
## 340       340 10 -4.694  3.229 -1.153  0.702  0.452  0.298  0.454  0.001 -0.264
## 341       341 11 -3.012  1.628 -0.834  0.975 -0.299  0.926  0.174  0.836 -0.239
## 342       342  1 -3.268 -0.079 -0.693  0.763  1.043  1.194  0.892 -1.293 -1.033
## 343       343  2 -3.618  0.916 -0.400  1.771  0.666  1.535 -0.389 -0.342 -1.279
## 344       344  3 -2.693  0.771 -0.870  1.341  0.317  0.925 -0.328 -0.169 -0.936
## 345       345  4 -2.515  1.340 -0.840  0.511 -0.492  0.098  0.047 -0.680 -0.283
## 346       346  5 -2.882  2.165 -0.589  0.173 -1.165  0.014  0.571  0.502 -0.093
## 347       347  6 -2.591  1.809 -0.659 -0.016 -0.673  0.588  0.084  0.182 -0.094
## 348       348  7 -3.354  2.850 -0.887  0.010 -0.551  0.293  0.901  0.320 -0.302
## 349       349  8 -4.228  3.111 -0.380  1.160 -1.188 -0.362  0.516  0.507  0.669
## 350       350  9 -3.901  2.485 -0.950  0.702 -0.470  1.146 -0.109  1.597  0.146
## 351       351 10 -4.708  3.269 -1.121  0.701  0.437  0.176  0.552  0.004 -0.168
## 352       352 11 -3.000  1.524 -0.866  1.015 -0.400  0.861  0.174  0.938 -0.216
## 353       353  1 -3.347 -0.159 -0.414  0.922  0.973  0.978  0.929 -1.211 -1.268
## 354       354  2 -3.518  0.716 -0.365  1.788  0.584  1.678 -0.109 -0.016 -1.501
## 355       355  3 -2.875  0.868 -0.728  1.439  0.355  0.846 -0.378 -0.233 -1.072
## 356       356  4 -2.612  1.403 -0.870  0.470 -0.448  0.172 -0.060 -0.656 -0.334
```

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## 357       357  5 -2.859  2.255 -0.676  0.098 -1.086  0.041  0.732  0.305 -0.141
## 358       358  6 -2.497  1.692 -0.607  0.020 -0.710  0.612  0.093  0.272 -0.060
## 359       359  7 -3.236  2.745 -0.806 -0.200 -0.386  0.358  0.889  0.516 -0.297
## 360       360  8 -4.188  3.229 -0.456  1.077 -1.385 -0.104  0.459  0.558  0.701
## 361       361  9 -3.775  2.188 -1.017  0.687 -0.464  1.189 -0.157  1.673 -0.024
## 362       362 10 -4.744  3.385 -0.886  0.571  0.235  0.183  0.357  0.040  0.203
## 363       363 11 -3.046  1.462 -0.823  0.935 -0.440  0.849  0.085  0.865 -0.178
## 364       364  1 -3.594 -0.137 -0.028  1.018  1.069  0.723  0.695 -0.982 -1.433
## 365       365  2 -3.426  0.584 -0.469  1.776  0.566  1.686  0.070  0.081 -1.483
## 366       366  3 -3.086  1.010 -0.627  1.508  0.338  0.747 -0.479 -0.323 -1.087
## 367       367  4 -2.750  1.475 -0.848  0.364 -0.275  0.020 -0.003 -0.782 -0.291
## 368       368  5 -2.846  2.430 -0.780 -0.153 -0.905  0.240  0.746  0.140 -0.114
## 369       369  6 -2.511  1.511 -0.555  0.226 -0.735  0.631 -0.006  0.520 -0.138
## 370       370  7 -3.124  2.733 -0.857 -0.334 -0.312  0.587  0.849  0.475 -0.174
## 371       371  8 -4.175  3.320 -0.446  0.988 -1.480  0.133  0.507  0.605  0.691
## 372       372  9 -3.777  2.064 -0.983  0.846 -0.373  0.960 -0.040  1.331  0.247
## 373       373 10 -4.788  3.632 -0.710  0.300  0.366 -0.121  0.403 -0.016  0.124
## 374       374 11 -3.006  1.407 -0.875  0.945 -0.495  0.721  0.212  0.750 -0.037
## 375       375  1 -3.781 -0.011  0.102  1.115  1.036  0.651  0.615 -1.082 -1.272
## 376       376  2 -3.394  0.557 -0.573  1.704  0.608  1.644  0.109  0.200 -1.507
## 377       377  3 -3.091  0.935 -0.574  1.360  0.416  0.764 -0.480 -0.144 -1.295
## 378       378  4 -2.850  1.446 -0.792  0.482 -0.365  0.046 -0.029 -0.761 -0.251
## 379       379  5 -2.884  2.424 -0.764 -0.108 -1.015  0.361  0.712  0.133 -0.017
## 380       380  6 -2.656  1.263 -0.527  0.464 -0.612  0.668 -0.160  0.857 -0.416
## 381       381  7 -3.246  2.796 -0.867 -0.205 -0.316  0.808  0.824  0.062 -0.118
## 382       382  8 -4.172  3.188 -0.375  1.028 -1.410  0.008  0.513  0.635  0.802
## 383       383  9 -3.862  1.801 -0.717  1.133 -0.230  0.922 -0.223  1.264  0.194
## 384       384 10 -4.836  3.871 -0.684  0.182  0.349 -0.176  0.317  0.059 -0.024
## 385       385 11 -2.973  1.304 -0.849  0.984 -0.508  0.590  0.248  0.728  0.073
## 386       386  1 -3.858  0.115  0.050  1.170  0.975  0.703  0.585 -1.191 -1.172
## 387       387  2 -3.404  0.506 -0.591  1.627  0.660  1.456  0.068  0.381 -1.494
## 388       388  3 -2.952  0.777 -0.740  1.311  0.424  0.853 -0.319 -0.082 -1.456
## 389       389  4 -3.005  1.472 -0.716  0.535 -0.392  0.054 -0.054 -0.686 -0.290
## 390       390  5 -2.898  2.421 -0.810 -0.043 -1.164  0.448  0.690  0.218 -0.078
## 391       391  6 -2.906  1.102 -0.491  0.575 -0.386  0.771 -0.134  0.977 -0.540
## 392       392  7 -3.462  2.648 -0.447  0.000 -0.416  0.767  0.569 -0.072 -0.080
## 393       393  8 -4.076  3.336 -0.688  0.677 -1.472  0.461  0.682  0.724  0.717
## 394       394  9 -3.846  1.426 -0.607  1.434 -0.072  1.130 -0.535  1.159 -0.123
## 395       395 10 -4.885  3.967 -0.948  0.373  0.255 -0.121  0.430 -0.013  0.018
## 396       396 11 -2.980  1.290 -0.842  0.955 -0.491  0.572  0.267  0.692  0.084
## 397       397  1 -3.208 -0.608 -0.516  1.098  1.529  1.069  0.186 -0.947 -0.248
## 398       398  2 -2.569 -0.110 -0.841  0.732  1.112  0.961 -0.075  0.148 -0.893
## 399       399  3 -2.210  0.661 -0.581  1.139  0.238  0.074 -0.625 -0.366 -0.326
## 400       400  4 -1.885  2.214 -0.673  0.147 -0.148 -0.400  0.252 -0.098 -0.874
## 401       401  5 -2.488  2.822 -0.239 -0.330 -1.355  0.284  0.101  0.934 -0.966
## 402       402  6 -2.335  2.896 -0.295 -0.420 -0.645  0.351  0.120  0.447 -1.126
## 403       403  7 -2.715  2.325  0.701  0.239 -1.426 -0.218 -0.317  1.516 -0.162
## 404       404  8 -4.210  3.289 -0.106 -1.247 -0.683  0.539  0.579  0.832 -0.035
## 405       405  9 -3.984  2.290 -0.103 -0.707  0.297  0.317  0.857  1.403 -1.253
## 406       406 10 -4.964  2.780  0.474  0.047  0.417 -0.328  0.334  0.474 -1.260
## 407       407 11 -2.528  1.288 -0.144 -0.171 -0.077  0.260 -0.045  0.681 -1.399
## 408       408  1 -3.431 -0.500 -0.362  1.173  1.590  0.956  0.162 -0.853 -0.364
## 409       409  2 -2.659 -0.101 -0.687  0.697  1.081  1.045 -0.149  0.184 -0.927
## 410       410  3 -2.103  0.655 -0.840  1.195  0.377  0.135 -0.504 -0.549 -0.404
```

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## 411       411  4 -1.926  2.172 -0.571  0.257 -0.159 -0.493  0.270 -0.153 -0.673
## 412       412  5 -2.512  2.826 -0.171 -0.385 -1.495  0.381  0.067  0.899 -0.902
## 413       413  6 -2.353  2.897 -0.433 -0.193 -0.715  0.359  0.260  0.273 -1.206
## 414       414  7 -2.708  2.396  0.728  0.336 -1.437 -0.344 -0.411  1.469 -0.022
## 415       415  8 -4.341  3.514 -0.453 -1.047 -0.469  0.510  0.618  0.801 -0.399
## 416       416  9 -4.045  2.193  0.200 -0.745  0.215  0.387  0.625  1.477 -1.207
## 417       417 10 -5.020  2.551  0.562 -0.136  0.531 -0.064  0.373  0.631 -1.407
## 418       418 11 -2.665  1.633 -0.384 -0.111 -0.001  0.234  0.033  0.478 -1.558
## 419       419  1 -3.586 -0.380 -0.359  1.307  1.587  0.990  0.180 -0.831 -0.471
## 420       420  2 -2.889 -0.039 -0.494  0.719  1.104  1.003 -0.415  0.097 -0.855
## 421       421  3 -2.282  0.673 -0.798  1.286  0.308  0.010 -0.411 -0.610 -0.266
## 422       422  4 -1.985  2.161 -0.601  0.424 -0.295 -0.489  0.208 -0.216 -0.562
## 423       423  5 -2.563  2.829 -0.283 -0.368 -1.593  0.408  0.121  0.933 -0.946
## 424       424  6 -2.415  2.517 -0.285  0.085 -0.902  0.283  0.302  0.247 -1.207
## 425       425  7 -2.776  2.563  0.532  0.277 -1.470 -0.368 -0.278  1.479 -0.164
## 426       426  8 -4.384  3.721 -0.905 -0.965 -0.160  0.498  0.809  0.660 -0.613
## 427       427  9 -4.107  2.170  0.206 -0.811  0.334  0.633  0.402  1.097 -1.327
## 428       428 10 -5.069  2.119  0.826 -0.274  0.576  0.145  0.308  1.001 -1.412
## 429       429 11 -2.812  1.954 -0.661  0.109 -0.011  0.110  0.187  0.096 -1.538
## 430       430  1 -3.760 -0.320 -0.240  1.273  1.751  1.125  0.230 -0.723 -0.501
## 431       431  2 -3.152  0.086 -0.325  0.868  1.084  0.753 -0.522 -0.005 -0.821
## 432       432  3 -2.558  0.755 -0.660  1.366  0.038 -0.011 -0.443 -0.531 -0.062
## 433       433  4 -2.010  2.164 -0.626  0.389 -0.240 -0.441  0.103 -0.270 -0.647
## 434       434  5 -2.601  2.735 -0.322 -0.255 -1.670  0.229  0.202  1.010 -0.871
## 435       435  6 -2.521  2.271 -0.277  0.270 -0.909  0.274  0.348 -0.028 -1.177
## 436       436  7 -2.922  2.621  0.214  0.122 -1.477 -0.173  0.045  1.380 -0.635
## 437       437  8 -4.417  3.765 -1.225 -0.853  0.041  0.536  0.885  0.533 -0.757
## 438       438  9 -4.070  2.254 -0.280 -0.722  0.696  0.683  0.243  0.689 -1.450
## 439       439 10 -5.080  2.241  0.971 -0.374  0.501  0.226  0.144  0.851 -1.319
## 440       440 11 -2.930  2.014 -0.700  0.206 -0.088  0.153  0.142 -0.031 -1.437
## 441       441  1 -4.247 -0.034  0.248  1.372  1.831  1.167  0.087 -0.518 -0.316
## 442       442  2 -3.183  0.154 -0.413  0.923  1.091  0.582 -0.447 -0.085 -0.904
## 443       443  3 -2.514  0.558 -0.777  1.299  0.027  0.247 -0.487 -0.653 -0.028
## 444       444  4 -2.041  2.119 -0.585  0.549 -0.430 -0.291 -0.002 -0.234 -0.751
## 445       445  5 -2.640  2.704 -0.345 -0.230 -1.649  0.064  0.275  0.952 -0.651
## 446       446  6 -2.729  2.104 -0.505  0.138 -0.533  0.455  0.148 -0.407 -1.059
## 447       447  7 -3.025  2.711 -0.147 -0.034 -1.340  0.049  0.364  1.099 -1.020
## 448       448  8 -4.415  3.737 -1.313 -0.815  0.168  0.590  0.975  0.420 -0.825
## 449       449  9 -4.036  2.141 -0.355 -0.602  0.837  0.663 -0.013  0.507 -1.412
## 450       450 10 -5.158  2.488  1.064 -0.343  0.352  0.180 -0.050  0.817 -1.308
## 451       451 11 -2.907  1.992 -0.904  0.205  0.011  0.346 -0.031 -0.148 -1.262
## 452       452  1 -4.687  0.406  0.889  1.464  1.618  1.021 -0.121 -0.398 -0.307
## 453       453  2 -3.096  0.103 -0.452  0.879  1.067  0.497 -0.296 -0.067 -0.973
## 454       454  3 -2.452  0.279 -0.805  1.141  0.239  0.176 -0.104 -0.752 -0.334
## 455       455  4 -2.081  2.043 -0.521  0.578 -0.463 -0.246 -0.041 -0.162 -0.814
## 456       456  5 -2.658  2.739 -0.382 -0.310 -1.640  0.081  0.276  0.884 -0.535
## 457       457  6 -2.982  2.001 -0.915  0.188  0.035  0.467 -0.130 -0.689 -0.684
## 458       458  7 -3.098  2.525 -0.316 -0.322 -1.082  0.285  0.445  0.847 -0.951
## 459       459  8 -4.403  3.602 -0.945 -0.934  0.041  0.409  1.003  0.470 -0.477
## 460       460  9 -4.200  2.201 -0.310 -0.392  0.968  0.700 -0.328  0.129 -0.896
## 461       461 10 -5.211  2.544  0.820 -0.333  0.447  0.226  0.127  0.890 -1.389
## 462       462 11 -2.752  1.778 -0.718  0.057 -0.009  0.402  0.121  0.050 -1.435
## 463       463  1 -5.058  2.236  1.381  1.885 -0.259 -0.483 -0.562  0.123 -0.063
## 464       464  2 -4.181  1.646  0.736  1.286  0.724 -0.511 -1.126 -0.450 -0.648
```

```
## 465       465  3 -3.753  0.828 -0.042  1.406  0.209 -0.530 -0.520 -0.400 -0.386
## 466       466  4 -3.494  1.207 -0.607  0.242 -0.430  0.131  0.236  0.545 -0.593
## 467       467  5 -2.813  2.327 -1.246 -0.184 -0.755  0.491  1.202 -0.558 -0.669
## 468       468  6 -3.133  1.983 -1.398  0.254 -0.667  0.532  0.389 -0.178 -0.584
## 469       469  7 -3.749  3.018 -0.755 -0.452 -0.666  0.209  0.741  0.900 -1.613
## 470       470  8 -4.373  4.643 -0.792 -1.332 -0.202  0.597  0.192  1.133 -1.131
## 471       471  9 -4.468  4.121 -0.420 -1.197  0.338  0.600 -0.110  0.314 -1.248
## 472       472 10 -4.902  4.490 -0.564 -0.536 -0.164 -0.298  0.842 -0.158 -0.906
## 473       473 11 -4.125  2.300 -0.167 -0.270  0.103  0.320 -0.467 -0.254 -0.415
## 474       474  1 -5.124  2.319  1.413  1.804 -0.277 -0.330 -0.746  0.221  0.060
## 475       475  2 -4.393  2.137  0.570  1.397  0.293 -0.836 -0.966 -0.461 -0.277
## 476       476  3 -3.961  1.078  0.110  1.232  0.210 -0.670 -0.536 -0.330 -0.268
## 477       477  4 -3.654  1.222 -0.574  0.248 -0.299  0.158  0.154  0.553 -0.580
## 478       478  5 -3.001  2.263 -1.178 -0.116 -0.922  0.536  1.286 -0.506 -0.566
## 479       479  6 -3.417  1.984 -1.148  0.234 -0.778  0.411  0.494  0.130 -0.704
## 480       480  7 -3.887  3.172 -0.739 -0.690 -0.548  0.330  0.569  0.980 -1.609
## 481       481  8 -4.474  4.569 -1.069 -1.409  0.137  1.049  0.071  0.877 -1.355
## 482       482  9 -4.471  4.096 -0.809 -0.881  0.646  0.539  0.040  0.142 -1.555
## 483       483 10 -4.947  4.637 -0.444 -0.953 -0.119 -0.249  0.594  0.270 -0.783
## 484       484 11 -4.173  2.299 -0.298 -0.130  0.122  0.319 -0.388 -0.328 -0.480
## 485       485  1 -5.131  2.192  1.364  1.936 -0.591 -0.354 -0.677  0.150  0.178
## 486       486  2 -4.395  1.864  0.503  1.718  0.241 -0.817 -0.672 -0.687 -0.449
## 487       487  3 -4.058  1.072  0.157  1.136  0.385 -0.687 -0.583 -0.185 -0.300
## 488       488  4 -3.631  1.195 -0.719  0.130 -0.065  0.348 -0.061  0.555 -0.594
## 489       489  5 -3.434  2.260 -1.065 -0.122 -0.795  0.363  1.403 -0.507 -0.375
## 490       490  6 -3.765  1.970 -0.955  0.304 -0.735  0.410  0.380  0.146 -0.536
## 491       491  7 -3.975  3.066 -0.506 -0.827 -0.478  0.434  0.356  0.939 -1.309
## 492       492  8 -4.497  4.500 -1.446 -1.127  0.443  0.986  0.136  0.597 -1.087
## 493       493  9 -4.475  4.064 -0.927 -0.678  0.599  0.445  0.224  0.103 -1.336
## 494       494 10 -5.011  4.976 -0.868 -1.215  0.170 -0.018  0.543  0.154 -0.841
## 495       495 11 -4.151  2.069 -0.605  0.111  0.410  0.354 -0.284 -0.381 -0.507
## 496       496  1 -5.125  2.077  1.283  2.003 -0.734 -0.513 -0.557  0.055  0.295
## 497       497  2 -4.316  1.409  0.441  1.819  0.500 -0.617 -0.633 -0.621 -0.671
## 498       498  3 -4.149  1.129 -0.008  1.215  0.390 -0.474 -0.400 -0.343 -0.344
## 499       499  4 -3.581  1.188 -0.958  0.189 -0.077  0.451  0.049  0.449 -0.676
## 500       500  5 -3.828  2.367 -0.836 -0.343 -0.466  0.116  1.172 -0.175 -0.275
## 501       501  6 -3.820  1.705 -1.130  0.450 -0.471  0.665  0.298 -0.175 -0.473
## 502       502  7 -3.949  2.990 -0.643 -0.986 -0.175  0.768  0.249  0.803 -1.479
## 503       503  8 -4.471  4.461 -1.887 -0.799  0.719  0.938  0.239  0.342 -1.036
## 504       504  9 -4.580  4.116 -0.753 -0.849  0.516  0.498  0.117  0.181 -1.256
## 505       505 10 -5.049  4.846 -0.678 -0.877 -0.090  0.005  0.253 -0.078 -0.178
## 506       506 11 -4.115  1.856 -0.738  0.132  0.658  0.329 -0.252 -0.123 -0.530
## 507       507  1 -5.143  2.051  1.216  1.898 -0.555 -0.466 -0.842  0.011  0.461
## 508       508  2 -4.403  1.409  0.551  1.496  0.673 -0.616 -0.787 -0.382 -0.696
## 509       509  3 -4.316  1.272 -0.087  1.285  0.126 -0.128 -0.286 -0.463 -0.294
## 510       510  4 -3.622  1.111 -0.972  0.399 -0.402  0.527  0.271  0.373 -0.716
## 511       511  5 -3.850  2.280 -1.055 -0.335 -0.164  0.410  0.913 -0.391 -0.338
## 512       512  6 -3.962  1.724 -1.290  0.531 -0.170  0.528  0.282 -0.149 -0.603
## 513       513  7 -3.894  2.910 -0.968 -0.671 -0.131  0.519  0.591  0.708 -1.515
## 514       514  8 -4.469  4.348 -1.740 -0.886  0.447  0.883  0.374  0.577 -0.908
## 515       515  9 -4.661  4.235 -0.497 -1.021  0.295  0.457 -0.019  0.345 -1.355
## 516       516 10 -5.040  5.074 -1.721 -0.264  0.279  0.176  0.003 -0.609 -0.177
## 517       517 11 -4.169  1.799 -0.621  0.025  0.706  0.362 -0.343 -0.049 -0.339
## 518       518  1 -5.105  1.968  1.140  1.719 -0.443 -0.432 -0.969 -0.173  0.551
```

```
## 519       519  2 -4.544  1.672  0.643  1.281  0.504 -0.803 -0.709 -0.229 -0.546
## 520       520  3 -4.426  1.167  0.008  1.315  0.189 -0.297 -0.124 -0.244 -0.423
## 521       521  4 -3.622  0.988 -1.108  0.685 -0.693  0.754  0.442  0.166 -0.458
## 522       522  5 -3.597  2.146 -1.492 -0.142 -0.297  0.815  0.870 -0.490 -0.471
## 523       523  6 -4.122  1.735 -1.340  0.615  0.030  0.353  0.345 -0.104 -0.540
## 524       524  7 -4.065  2.876 -0.856 -0.221 -0.533  0.232  0.855  0.633 -1.452
## 525       525  8 -4.513  4.265 -1.477 -1.090  0.215  0.829  0.342  0.693 -0.601
## 526       526  9 -4.651  4.246 -0.823 -0.831  0.666  0.546 -0.300  0.094 -1.343
## 527       527 10 -5.034  4.993 -1.633 -0.285  0.398  0.181 -0.211 -0.508 -0.283
## 528       528 11 -4.261  1.827 -0.482 -0.194  0.731  0.354 -0.478  0.050 -0.112
##       x.10
## 1   -0.814
## 2   -0.488
## 3   -0.049
## 4   -0.795
## 5   -0.396
## 6   -0.365
## 7   -0.366
## 8   -0.301
## 9   -0.434
## 10  -0.836
## 11  -0.823
## 12  -0.813
## 13  -0.327
## 14  -0.027
## 15  -0.760
## 16  -0.633
## 17  -0.458
## 18  -0.259
## 19  -0.293
## 20  -0.580
## 21  -0.733
## 22  -0.842
## 23  -0.841
## 24  -0.425
## 25  -0.151
## 26  -0.847
## 27  -0.685
## 28  -0.402
## 29  -0.003
## 30  -0.245
## 31  -0.359
## 32  -0.522
## 33  -0.727
## 34  -0.843
## 35  -0.299
## 36  -0.172
## 37  -0.814
## 38  -0.649
## 39  -0.156
## 40  -0.118
## 41   0.125
## 42  -0.388
## 43  -0.714
```

```
## 44  -0.541
## 45  -0.926
## 46  -0.198
## 47  -0.118
## 48  -0.759
## 49  -0.539
## 50  -0.039
## 51  -0.211
## 52  -0.302
## 53  -0.178
## 54  -0.919
## 55  -0.553
## 56  -1.003
## 57  -0.187
## 58  -0.080
## 59  -0.736
## 60  -0.568
## 61  -0.155
## 62  -0.267
## 63  -0.293
## 64   0.013
## 65  -1.001
## 66  -0.711
## 67  -0.668
## 68   0.043
## 69  -0.266
## 70  -0.491
## 71  -0.382
## 72   0.022
## 73  -0.247
## 74   0.648
## 75   0.823
## 76   0.769
## 77  -0.134
## 78  -0.655
## 79  -0.159
## 80  -0.322
## 81  -0.410
## 82  -0.482
## 83  -0.026
## 84  -0.352
## 85   0.535
## 86   0.696
## 87   0.278
## 88   0.075
## 89  -0.627
## 90  -0.310
## 91  -0.345
## 92  -0.445
## 93  -0.525
## 94   0.073
## 95  -0.308
## 96   0.418
## 97   0.654
```

```
## 98   0.276
## 99  -0.033
## 100 -0.520
## 101 -0.264
## 102 -0.246
## 103 -0.474
## 104 -0.630
## 105  0.088
## 106 -0.092
## 107  0.447
## 108  0.487
## 109  0.306
## 110 -0.564
## 111 -0.447
## 112 -0.394
## 113 -0.214
## 114 -0.381
## 115 -0.825
## 116 -0.038
## 117 -0.065
## 118  0.650
## 119  0.153
## 120  0.445
## 121 -0.564
## 122 -0.498
## 123 -0.564
## 124 -0.109
## 125 -0.298
## 126 -0.858
## 127 -0.285
## 128 -0.331
## 129  0.798
## 130  0.028
## 131  0.371
## 132 -0.593
## 133 -0.706
## 134 -0.027
## 135 -0.060
## 136  0.007
## 137  0.225
## 138  0.145
## 139  0.522
## 140 -0.099
## 141  0.458
## 142  0.171
## 143 -0.496
## 144 -0.562
## 145  0.047
## 146 -0.051
## 147  0.020
## 148  0.402
## 149  0.177
## 150  0.602
## 151 -0.104
```

```
## 152  0.386
## 153  0.044
## 154 -0.456
## 155 -0.756
## 156  0.111
## 157 -0.050
## 158  0.065
## 159  0.369
## 160  0.306
## 161  0.720
## 162 -0.130
## 163  0.006
## 164  0.190
## 165 -0.695
## 166 -0.698
## 167  0.094
## 168  0.060
## 169  0.164
## 170  0.505
## 171  0.325
## 172  0.710
## 173  0.046
## 174 -0.586
## 175  0.332
## 176 -0.770
## 177 -0.701
## 178  0.007
## 179  0.044
## 180  0.198
## 181  0.406
## 182  0.224
## 183  0.750
## 184  0.360
## 185 -0.639
## 186  0.397
## 187 -0.770
## 188 -0.682
## 189 -0.087
## 190  0.090
## 191  0.145
## 192  0.291
## 193  0.297
## 194  0.786
## 195  0.233
## 196 -0.507
## 197  0.472
## 198 -0.682
## 199 -0.456
## 200 -0.423
## 201 -0.655
## 202 -0.552
## 203 -0.589
## 204 -0.437
## 205  0.210
```

```
## 206  1.059
## 207  0.436
## 208  0.659
## 209  0.098
## 210 -0.456
## 211 -0.378
## 212 -0.727
## 213 -0.719
## 214 -0.470
## 215 -0.562
## 216  0.443
## 217  1.145
## 218  0.865
## 219  0.503
## 220  0.136
## 221 -0.490
## 222 -0.376
## 223 -0.650
## 224 -0.691
## 225 -0.119
## 226 -0.525
## 227  0.771
## 228  0.993
## 229  1.009
## 230  0.317
## 231  0.184
## 232 -0.505
## 233 -0.385
## 234 -0.487
## 235 -0.744
## 236  0.057
## 237 -0.572
## 238  0.979
## 239  1.087
## 240  0.876
## 241  0.133
## 242  0.106
## 243 -0.523
## 244 -0.376
## 245 -0.491
## 246 -0.800
## 247  0.069
## 248 -0.409
## 249  1.066
## 250  1.042
## 251  0.834
## 252  0.096
## 253  0.056
## 254 -0.538
## 255 -0.393
## 256 -0.595
## 257 -0.724
## 258  0.084
## 259 -0.267
```

```
## 260  0.885
## 261  1.044
## 262  0.485
## 263 -0.102
## 264 -0.031
## 265  0.517
## 266  0.169
## 267  0.347
## 268  0.282
## 269 -0.093
## 270  0.495
## 271 -0.671
## 272 -0.169
## 273 -0.928
## 274 -0.781
## 275 -0.189
## 276  0.641
## 277  0.172
## 278  0.412
## 279  0.238
## 280 -0.252
## 281  0.175
## 282 -0.671
## 283 -0.039
## 284 -0.859
## 285 -0.913
## 286 -0.157
## 287  0.616
## 288  0.000
## 289  0.422
## 290  0.300
## 291 -0.349
## 292  0.165
## 293 -0.420
## 294 -0.187
## 295 -0.896
## 296 -1.109
## 297 -0.151
## 298  0.575
## 299 -0.149
## 300  0.450
## 301  0.221
## 302 -0.193
## 303  0.092
## 304 -0.253
## 305 -0.226
## 306 -0.886
## 307 -1.122
## 308 -0.125
## 309  0.702
## 310  0.013
## 311  0.325
## 312  0.131
## 313 -0.109
```

```
## 314 -0.060
## 315 -0.318
## 316 -0.159
## 317 -0.909
## 318 -1.038
## 319 -0.021
## 320  0.788
## 321  0.423
## 322  0.198
## 323  0.190
## 324 -0.235
## 325 -0.108
## 326 -0.687
## 327 -0.179
## 328 -0.964
## 329 -1.099
## 330 -0.256
## 331  0.112
## 332  0.076
## 333  0.407
## 334  0.348
## 335 -0.676
## 336 -0.343
## 337 -0.979
## 338 -0.085
## 339 -1.297
## 340 -1.399
## 341 -1.144
## 342  0.199
## 343 -0.109
## 344  0.399
## 345  0.168
## 346 -0.616
## 347 -0.372
## 348 -1.023
## 349 -0.074
## 350 -1.197
## 351 -1.484
## 352 -1.010
## 353  0.278
## 354  0.002
## 355  0.505
## 356  0.087
## 357 -0.636
## 358 -0.507
## 359 -1.075
## 360 -0.320
## 361 -1.144
## 362 -1.680
## 363 -0.954
## 364  0.249
## 365 -0.141
## 366  0.645
## 367  0.167
```

```
## 368 -0.746
## 369 -0.651
## 370 -0.899
## 371 -0.462
## 372 -1.090
## 373 -1.320
## 374 -1.054
## 375  0.050
## 376 -0.225
## 377  0.696
## 378  0.113
## 379 -0.847
## 380 -0.596
## 381 -0.749
## 382 -0.280
## 383 -0.935
## 384 -1.130
## 385 -1.107
## 386 -0.076
## 387 -0.453
## 388  0.616
## 389  0.153
## 390 -0.876
## 391 -0.604
## 392 -0.798
## 393 -0.409
## 394 -0.385
## 395 -1.518
## 396 -1.100
## 397 -0.059
## 398  0.314
## 399  0.557
## 400  0.245
## 401 -0.310
## 402  0.110
## 403 -0.703
## 404 -0.764
## 405 -0.298
## 406 -0.221
## 407 -0.066
## 408  0.084
## 409  0.327
## 410  0.602
## 411 -0.005
## 412 -0.412
## 413  0.360
## 414 -0.717
## 415 -0.777
## 416 -0.270
## 417 -0.267
## 418  0.219
## 419  0.198
## 420  0.356
## 421  0.584
```

```
## 422  0.079
## 423 -0.356
## 424  0.371
## 425 -0.797
## 426 -0.831
## 427 -0.040
## 428 -0.306
## 429  0.592
## 430  0.315
## 431  0.483
## 432  0.418
## 433  0.165
## 434 -0.461
## 435  0.432
## 436 -0.757
## 437 -0.789
## 438  0.190
## 439 -0.300
## 440  0.615
## 441  0.347
## 442  0.693
## 443  0.481
## 444  0.253
## 445 -0.571
## 446  0.625
## 447 -0.652
## 448 -0.748
## 449  0.210
## 450 -0.249
## 451  0.487
## 452  0.293
## 453  0.711
## 454  0.731
## 455  0.425
## 456 -0.548
## 457  0.664
## 458 -0.707
## 459 -0.621
## 460  0.150
## 461 -0.304
## 462  0.281
## 463  0.663
## 464  0.995
## 465  1.070
## 466  0.678
## 467  0.054
## 468  0.844
## 469  0.128
## 470 -0.280
## 471 -0.012
## 472  0.358
## 473  0.863
## 474  0.460
## 475  1.184
```

```
## 476  1.098
## 477  0.617
## 478 -0.102
## 479  0.764
## 480  0.283
## 481 -0.167
## 482 -0.023
## 483  0.265
## 484  0.990
## 485  0.380
## 486  1.396
## 487  1.177
## 488  0.806
## 489  0.015
## 490  0.738
## 491  0.204
## 492 -0.073
## 493 -0.192
## 494  0.707
## 495  0.737
## 496  0.269
## 497  1.193
## 498  0.886
## 499  0.919
## 500  0.117
## 501  0.848
## 502  0.168
## 503 -0.060
## 504 -0.119
## 505  0.131
## 506  0.456
## 507  0.193
## 508  1.139
## 509  0.691
## 510  0.943
## 511  0.260
## 512  1.139
## 513  0.121
## 514 -0.089
## 515  0.062
## 516  0.422
## 517  0.220
## 518  0.176
## 519  1.058
## 520  0.684
## 521  0.738
## 522  0.410
## 523  0.988
## 524  0.272
## 525 -0.056
## 526  0.185
## 527  0.304
## 528  0.321
```

Import the testing data

```
# Load the data from the URL
url <- "https://hastie.su.domains/ElemStatLearn/datasets/vowel.test"
test_vowel <- read.table(url, header = TRUE)

# Create a sample test_data frame
test_data <- test_vowel
# Split the comma-separated values into separate columns
test_data <- data.frame(do.call("rbind", strsplit(as.character(test_data[,1]), ",")))

# Rename the columns
colnames(test_data) <- c("row.names", "y", "x.1", "x.2", "x.3", "x.4", "x.5", "x.6", "x.7", "x.8", "x.9

# Convert the columns to the appropriate test_data types
test_data$row.names <- as.numeric(test_data$row.names)
test_data$y <- as.numeric(test_data$y)
test_data$x.1 <- as.numeric(test_data$x.1)
test_data$x.2 <- as.numeric(test_data$x.2)
test_data$x.3 <- as.numeric(test_data$x.3)
test_data$x.4 <- as.numeric(test_data$x.4)
test_data$x.5 <- as.numeric(test_data$x.5)
test_data$x.6 <- as.numeric(test_data$x.6)
test_data$x.7 <- as.numeric(test_data$x.7)
test_data$x.8 <- as.numeric(test_data$x.8)
test_data$x.9 <- as.numeric(test_data$x.9)
test_data$x.10 <- as.numeric(test_data$x.10)

# View the resulting test_data frame
test_data
```

```
##     row.names  y    x.1    x.2    x.3    x.4    x.5    x.6    x.7    x.8    x.9
## 1           1  1 -1.149 -0.904 -1.988  0.739 -0.060  1.206  0.864  1.196 -0.300
## 2           2  2 -2.613 -0.092 -0.540  0.484  0.389  1.741  0.198  0.257 -0.375
## 3           3  3 -2.505  0.632 -0.593  0.304  0.496  0.824 -0.162  0.181 -0.363
## 4           4  4 -1.768  1.769 -1.142 -0.739 -0.086  0.120 -0.230  0.217 -0.009
## 5           5  5 -2.671  3.155 -0.514  0.133 -0.964  0.234 -0.071  1.192  0.254
## 6           6  6 -2.509  1.326  0.354  0.663 -0.724  0.418 -0.496  0.713  0.638
## 7           7  7 -2.764  1.111  0.727  1.540 -0.855  0.261 -1.110  0.227  0.420
## 8           8  8 -3.816  3.426  0.224 -0.384 -1.733  0.434 -0.322  1.333  0.653
## 9           9  9 -3.839  1.248  0.830  0.982 -1.110  0.617 -0.751  0.084  0.309
## 10         10 10 -4.982  1.538  0.960  1.253 -0.640  0.588 -0.484 -0.310 -0.246
## 11         11 11 -2.895  0.682 -0.151  0.218 -0.689  1.118 -0.264  0.922  0.757
## 12         12  1 -1.093 -0.922 -2.091  0.844  0.009  1.247  0.891  1.453 -0.089
## 13         13  2 -2.499  0.119 -0.820  0.346  0.347  1.696  0.245  0.689 -0.084
## 14         14  3 -2.633  0.672 -0.372  0.439  0.437  0.907 -0.402 -0.040 -0.366
## 15         15  4 -1.707  1.652 -1.012 -0.622 -0.293  0.279 -0.276  0.477  0.050
## 16         16  5 -2.696  3.129 -0.520  0.294 -0.989  0.019 -0.066  1.106  0.361
## 17         17  6 -2.592  1.617  0.267  0.380 -0.777  0.487 -0.206  0.733  0.592
## 18         18  7 -2.733  1.088  0.761  1.694 -0.833  0.292 -1.069  0.266  0.369
## 19         19  8 -3.835  3.339  0.290 -0.126 -1.680  0.195 -0.368  1.328  0.523
## 20         20  9 -3.915  2.158  0.781  0.643 -1.023  0.598 -0.718  0.274  0.376
## 21         21 10 -4.848  1.115  0.932  1.615 -0.589  0.592 -0.446 -0.366 -0.447
```

```
## 22         22 11 -2.982  0.522 -0.100  0.362 -0.660  1.115 -0.305  0.859  0.637
## 23         23  1 -1.784 -1.074 -1.661  1.324  0.289  1.303  0.924  1.307 -0.346
## 24         24  2 -1.890  0.207 -1.161  0.027 -0.047  1.581  0.277  1.129  0.366
## 25         25  3 -2.677  0.486 -0.061  0.517  0.222  1.102 -0.425 -0.096 -0.373
## 26         26  4 -1.716  1.186 -0.809 -0.515 -0.350  0.290 -0.404  0.678  0.172
## 27         27  5 -2.769  2.906 -0.194  0.349 -0.958  0.089 -0.245  1.004  0.600
## 28         28  6 -2.625  1.551  0.298  0.324 -1.050  0.746  0.067  0.603  0.342
## 29         29  7 -2.632  0.881  0.710  1.800 -0.750  0.330 -1.128  0.177  0.339
## 30         30  8 -3.888  3.085  0.436  0.142 -1.526 -0.052 -0.503  1.085  0.511
## 31         31  9 -3.824  1.832  1.093  1.024 -1.090  0.560 -0.336  0.299  0.126
## 32         32 10 -4.813  1.042  0.887  1.661 -0.534  0.747 -0.513 -0.448 -0.412
## 33         33 11 -2.971  0.463 -0.195  0.323 -0.625  0.941 -0.327  0.780  0.552
## 34         34  1 -2.698 -1.027 -0.940  1.796  0.392  1.330  0.866  0.781 -0.838
## 35         35  2 -1.358  0.136 -1.082 -0.148 -0.609  1.464  0.144  1.149  0.481
## 36         36  3 -2.594  0.621 -0.292  0.521  0.260  1.204 -0.337  0.261 -0.332
## 37         37  4 -1.793  0.925 -0.739 -0.396 -0.211  0.329 -0.403  0.604  0.197
## 38         38  5 -2.920  2.697 -0.116  0.451 -0.859 -0.035 -0.307  0.874  0.622
## 39         39  6 -2.696  1.260  0.436  0.657 -1.161  0.805  0.062  0.575  0.182
## 40         40  7 -2.484  0.559  0.624  1.951 -0.646  0.381 -1.106  0.036  0.240
## 41         41  8 -3.989  3.049  0.304  0.209 -1.260 -0.205 -0.735  0.862  0.551
## 42         42  9 -3.776  1.752  0.920  0.722 -1.164  0.774 -0.010  0.657  0.248
## 43         43 10 -4.717  0.829  0.853  1.980 -0.546  0.688 -0.434 -0.424 -0.636
## 44         44 11 -3.108  0.926 -0.389  0.249 -0.461  0.816 -0.226  0.818  0.387
## 45         45  1 -3.366 -0.826 -0.405  1.643  0.603  1.226  0.524  0.293 -0.858
## 46         46  2 -1.530  0.029 -0.925  0.054 -0.565  1.593  0.123  1.117  0.338
## 47         47  3 -1.817  0.559 -0.801  0.234  0.011  1.215 -0.161  0.809  0.018
## 48         48  4 -1.969  0.835 -0.671 -0.270  0.028  0.400 -0.444  0.530  0.061
## 49         49  5 -3.038  2.475  0.024  0.508 -0.737 -0.102 -0.358  0.706  0.600
## 50         50  6 -2.889  1.418  0.409  0.610 -1.018  0.992  0.005  0.518 -0.027
## 51         51  7 -2.710  0.809  0.754  1.903 -0.764  0.378 -1.123  0.162  0.405
## 52         52  8 -3.992  3.342  0.167  0.086 -1.230 -0.216 -0.824  0.837  0.521
## 53         53  9 -3.810  1.910  0.527  0.478 -0.972  0.945 -0.280  0.719  0.482
## 54         54 10 -4.683  0.773  0.888  2.302 -0.562  0.395 -0.401 -0.289 -0.839
## 55         55 11 -3.375  1.779 -0.822  0.382 -0.019  0.845  0.123  0.767  0.223
## 56         56  1 -3.312 -0.776 -0.504  1.390  0.860  1.257  0.222  0.314 -0.715
## 57         57  2 -2.073  0.088 -0.730  0.296 -0.286  1.750  0.154  1.078  0.294
## 58         58  3 -1.222  0.491 -0.716  0.004 -0.323  1.108 -0.148  0.773  0.387
## 59         59  4 -2.295  0.883 -0.619 -0.041  0.143  0.378 -0.602  0.335 -0.114
## 60         60  5 -2.968  2.149  0.130  0.676 -0.790  0.112 -0.507  0.762  0.625
## 61         61  6 -2.784  1.430  0.145  0.309 -0.931  1.342  0.017  0.589 -0.044
## 62         62  7 -3.073  1.532  0.949  1.541 -1.058  0.272 -0.961  0.449  0.619
## 63         63  8 -3.958  4.132 -0.074 -0.190 -1.184 -0.110 -0.679  1.198  0.442
## 64         64  9 -3.947  2.102  0.305  0.462 -0.765  1.037 -0.618  0.741  0.345
## 65         65 10 -4.756  0.965  0.959  2.287 -0.527  0.454 -0.410 -0.362 -0.862
## 66         66 11 -3.366  1.952 -0.898  0.258  0.282  0.835  0.290  0.681  0.431
## 67         67  1 -3.137  0.077 -1.157  1.589  0.204  1.898  0.170  0.676 -1.033
## 68         68  2 -3.262  0.956 -0.791  1.528 -0.021  0.977 -0.121  0.499 -0.990
## 69         69  3 -2.045  0.819 -1.460  0.652 -0.701  0.352 -0.087  0.793 -0.567
## 70         70  4 -1.993  1.725 -1.130  0.556 -1.223  0.485  0.211 -0.040 -0.294
## 71         71  5 -2.765  2.817 -2.020  0.213 -0.772  0.852  0.252 -0.193 -0.202
## 72         72  6 -2.550  2.391 -1.137  0.090 -0.948  0.217  0.051  0.723 -0.558
## 73         73  7 -3.297  2.880 -0.859 -0.301 -1.020  0.798  0.288  0.855 -0.528
## 74         74  8 -4.047  3.899 -0.423  0.147 -1.273  0.203  0.317  0.531  0.584
## 75         75  9 -4.101  2.840 -0.802  0.062 -0.733  1.304 -0.145  0.443  0.049
```

```
## 76          76 10 -4.693  3.146 -0.136  0.587 -0.731  1.055 -0.104 -0.021  0.637
## 77          77 11 -3.730  1.872 -0.801  0.555 -0.427  0.791  0.196  0.650 -0.744
## 78          78  1 -3.019  0.058 -1.265  1.497  0.171  1.997  0.178  0.847 -1.160
## 79          79  2 -3.339  1.004 -0.747  1.505 -0.068  1.007 -0.017  0.377 -0.775
## 80          80  3 -2.008  0.785 -1.489  0.654 -0.685  0.313 -0.085  0.856 -0.516
## 81          81  4 -1.951  1.684 -1.039  0.586 -1.166  0.345  0.330 -0.108 -0.198
## 82          82  5 -2.785  2.792 -1.924  0.225 -0.985  1.076  0.070 -0.071 -0.257
## 83          83  6 -2.538  2.351 -1.029  0.146 -0.922  0.201 -0.058  0.835 -0.712
## 84          84  7 -3.231  3.003 -1.161 -0.315 -0.816  0.870  0.311  0.677 -0.565
## 85          85  8 -4.033  4.071 -0.586  0.127 -1.447  0.620  0.197  0.711  0.480
## 86          86  9 -4.130  3.105 -1.141  0.183 -0.498  1.324 -0.399  0.675 -0.339
## 87          87 10 -4.718  3.281 -0.203  0.651 -0.883  1.413 -0.663  0.583  0.237
## 88          88 11 -3.700  1.841 -0.675  0.441 -0.383  0.890  0.176  0.594 -0.677
## 89          89  1 -2.973  0.036 -1.273  1.519  0.195  1.980  0.131  0.832 -1.157
## 90          90  2 -3.485  1.092 -0.674  1.395 -0.027  1.039 -0.047  0.384 -0.761
## 91          91  3 -1.929  0.777 -1.415  0.598 -0.579  0.215 -0.061  0.733 -0.333
## 92          92  4 -1.928  1.578 -0.997  0.672 -1.287  0.381  0.249  0.006 -0.167
## 93          93  5 -2.823  2.743 -2.012  0.234 -0.919  1.103  0.091 -0.177 -0.143
## 94          94  6 -2.521  2.283 -0.954  0.232 -0.918  0.253 -0.094  0.833 -0.704
## 95          95  7 -3.173  3.166 -1.501 -0.370 -0.437  0.974  0.179  0.556 -0.794
## 96          96  8 -4.049  4.039 -0.558  0.064 -1.676  1.024  0.047  1.024 -0.091
## 97          97  9 -4.130  3.291 -1.424  0.359 -0.273  1.297 -0.454  0.620 -0.527
## 98          98 10 -4.753  3.421 -0.189  0.656 -0.984  1.443 -0.652  0.546  0.123
## 99          99 11 -3.725  1.904 -0.737  0.433 -0.369  1.047  0.120  0.425 -0.678
## 100        100  1 -3.000  0.042 -1.238  1.529  0.187  2.028  0.104  0.759 -1.180
## 101        101  2 -3.587  1.193 -0.617  1.340 -0.022  1.103 -0.072  0.368 -0.854
## 102        102  3 -1.895  0.755 -1.388  0.638 -0.614  0.246 -0.033  0.693 -0.270
## 103        103  4 -1.925  1.517 -0.999  0.634 -1.270  0.207  0.385  0.004 -0.141
## 104        104  5 -2.797  2.706 -1.936  0.147 -0.921  1.240 -0.082 -0.006 -0.214
## 105        105  6 -2.561  2.191 -0.955  0.214 -0.841  0.386 -0.083  0.740 -0.612
## 106        106  7 -3.152  3.176 -1.573 -0.204 -0.485  0.723  0.308  0.652 -0.872
## 107        107  8 -4.064  4.106 -0.545  0.030 -1.645  0.904  0.103  0.907  0.050
## 108        108  9 -4.139  3.363 -1.464  0.459 -0.066  1.045 -0.146  0.172 -0.124
## 109        109 10 -4.782  3.325 -0.071  0.663 -0.913  1.012 -0.033 -0.103  0.483
## 110        110 11 -3.731  1.927 -0.705  0.453 -0.372  1.149  0.046  0.323 -0.627
## 111        111  1 -3.055  0.088 -1.217  1.562  0.186  2.059  0.054  0.639 -1.121
## 112        112  2 -3.711  1.377 -0.584  1.428 -0.033  1.062 -0.127  0.328 -1.092
## 113        113  3 -1.926  0.689 -1.433  0.716 -0.588  0.269 -0.044  0.716 -0.245
## 114        114  4 -1.948  1.536 -1.012  0.537 -1.229  0.183  0.460 -0.002 -0.178
## 115        115  5 -2.800  2.609 -1.726  0.036 -0.941  1.039  0.191  0.044 -0.165
## 116        116  6 -2.691  2.111 -1.067  0.174 -0.649  0.431 -0.017  0.655 -0.498
## 117        117  7 -3.190  3.101 -1.659 -0.182 -0.436  0.828  0.272  0.502 -0.857
## 118        118  8 -4.074  4.187 -0.555  0.052 -1.603  0.730 -0.061  0.981  0.249
## 119        119  9 -4.174  3.540 -1.430  0.417  0.267  0.918 -0.118 -0.267 -0.162
## 120        120 10 -4.827  3.391 -0.099  0.599 -0.723  0.741  0.089 -0.214  0.518
## 121        121 11 -3.735  2.096 -0.818  0.463 -0.221  1.144  0.023  0.224 -0.745
## 122        122  1 -3.117  0.146 -1.228  1.635  0.223  2.026  0.036  0.569 -1.150
## 123        123  2 -3.871  1.694 -0.606  1.428  0.044  0.844 -0.013  0.126 -1.218
## 124        124  3 -2.029  0.698 -1.482  0.813 -0.681  0.422  0.016  0.751 -0.300
## 125        125  4 -1.998  1.497 -1.005  0.519 -1.236  0.398  0.273  0.151 -0.319
## 126        126  5 -2.914  2.541 -1.567  0.067 -1.051  1.207  0.006  0.289 -0.325
## 127        127  6 -2.937  2.183 -1.291  0.355 -0.372  0.570  0.045  0.452 -0.705
## 128        128  7 -3.239  2.916 -1.406 -0.455 -0.454  1.219  0.078  0.383 -0.776
## 129        129  8 -4.069  4.205 -0.614 -0.060 -1.462  0.476  0.381  0.589  0.405
```

```
## 130       130  9 -4.235  3.775 -1.593  0.814  0.288  0.805 -0.566 -0.247 -0.409
## 131       131 10 -4.884  3.630 -0.279  0.496 -0.670  0.792 -0.005 -0.137  0.532
## 132       132 11 -3.756  2.204 -0.716  0.529 -0.284  1.121  0.022  0.127 -0.782
## 133       133  1 -4.066  0.398 -0.382  1.679  0.121  1.617  0.504 -0.315 -0.226
## 134       134  2 -2.966  0.659 -1.057  1.360  0.152  1.435  0.197  0.926 -0.450
## 135       135  3 -2.695  1.119 -0.986  0.172  0.499  0.372  0.088  0.630 -0.721
## 136       136  4 -2.482  1.896 -1.289  0.112  0.285  0.096  0.022  0.832 -0.333
## 137       137  5 -2.742  2.729 -0.129 -0.490 -0.573  0.868  0.070  0.771  0.053
## 138       138  6 -2.434  2.903 -1.341 -0.411  0.372  0.843 -0.022  0.336  0.123
## 139       139  7 -2.973  3.557 -0.396 -0.719 -0.669  0.923  0.293  1.009  0.140
## 140       140  8 -4.103  3.812  0.255 -0.103 -0.994  0.097 -0.345  2.039  0.020
## 141       141  9 -3.863  3.245 -0.996  0.486 -0.348  0.190  0.558  1.342  0.176
## 142       142 10 -4.611  2.962 -0.856  1.161 -0.612  0.469  0.162  0.705  0.370
## 143       143 11 -3.548  1.611 -0.850  0.374  0.168  0.318  0.463  0.863 -1.131
## 144       144  1 -4.052  0.350 -0.314  1.734  0.127  1.667  0.512 -0.377 -0.358
## 145       145  2 -3.034  0.694 -1.007  1.453  0.155  1.480  0.179  1.005 -0.540
## 146       146  3 -2.667  1.132 -1.054  0.232  0.537  0.352  0.163  0.550 -0.688
## 147       147  4 -2.395  1.929 -1.496  0.372  0.065  0.009  0.149  0.813 -0.484
## 148       148  5 -2.758  2.839 -0.282 -0.449 -0.485  0.788  0.120  0.792  0.023
## 149       149  6 -2.464  2.755 -0.975 -0.651  0.158  1.047 -0.145  0.203  0.246
## 150       150  7 -3.045  3.312  0.171 -0.605 -1.027  0.924  0.353  0.897  0.365
## 151       151  8 -4.089  3.712  0.315 -0.050 -0.929  0.018 -0.350  1.770  0.244
## 152       152  9 -3.989  3.582 -1.100  0.374 -0.120  0.291  0.663  0.960  0.023
## 153       153 10 -4.602  3.043 -0.959  0.828 -0.298  0.315  0.423  0.570  0.387
## 154       154 11 -3.707  1.486 -0.494  0.402  0.183  0.186  0.234  1.029 -0.856
## 155       155  1 -3.894  0.117 -0.407  1.973  0.043  1.891  0.411 -0.095 -0.436
## 156       156  2 -3.053  0.716 -1.024  1.422  0.184  1.473  0.261  0.983 -0.431
## 157       157  3 -2.615  1.185 -1.162  0.395  0.459  0.345  0.298  0.456 -0.620
## 158       158  4 -2.303  1.954 -1.493  0.305  0.047  0.056  0.026  0.902 -0.522
## 159       159  5 -2.790  2.665  0.036 -0.440 -0.604  0.811  0.098  0.723  0.134
## 160       160  6 -2.445  2.678 -0.816 -0.743  0.076  1.117 -0.057  0.018  0.281
## 161       161  7 -3.024  3.260  0.350 -0.577 -1.183  0.872  0.556  0.762  0.395
## 162       162  8 -3.983  3.695  0.096 -0.333 -1.010  0.169 -0.108  1.674  0.262
## 163       163  9 -3.960  3.373 -1.235  0.152  0.031  0.664  0.558  0.841 -0.133
## 164       164 10 -4.617  3.033 -0.909  0.604 -0.341  0.636  0.294  0.527  0.480
## 165       165 11 -3.789  1.420 -0.372  0.568  0.123  0.185  0.078  1.006 -0.722
## 166       166  1 -3.676 -0.185 -0.563  2.377  0.096  1.854  0.303  0.296 -0.358
## 167       167  2 -3.033  0.700 -1.077  1.266  0.196  1.453  0.317  0.947 -0.324
## 168       168  3 -2.600  1.219 -1.315  0.589  0.311  0.364  0.451  0.350 -0.556
## 169       169  4 -2.316  2.007 -1.365  0.181  0.206  0.071  0.037  0.814 -0.332
## 170       170  5 -2.700  2.686 -0.043 -0.528 -0.626  0.917  0.167  0.652  0.100
## 171       171  6 -2.444  2.529 -0.487 -0.814 -0.151  1.285  0.077 -0.064  0.287
## 172       172  7 -2.969  3.128  0.504 -0.487 -1.371  0.704  0.660  0.676  0.469
## 173       173  8 -3.878  3.816 -0.155 -0.668 -1.207  0.541  0.022  1.972 -0.029
## 174       174  9 -3.896  2.768 -0.816 -0.014 -0.125  0.168  0.307  1.203  0.246
## 175       175 10 -4.717  3.059 -0.682  0.532 -0.480  0.731  0.174  0.493  0.635
## 176       176 11 -3.689  1.367 -0.389  0.376  0.136  0.343  0.156  1.010 -0.611
## 177       177  1 -3.644 -0.215 -0.579  2.307  0.046  1.945  0.280  0.272 -0.539
## 178       178  2 -3.034  0.452 -0.946  0.931  0.128  1.514  0.142  0.932 -0.104
## 179       179  3 -2.817  1.268 -1.127  0.707  0.399  0.406  0.289  0.319 -0.691
## 180       180  4 -2.382  1.984 -1.096 -0.103  0.369  0.204 -0.125  0.752 -0.136
## 181       181  5 -2.540  2.925 -0.377 -0.745 -0.562  0.981  0.303  0.539  0.127
## 182       182  6 -2.505  2.358 -0.184 -0.792 -0.316  1.363  0.302 -0.121  0.214
## 183       183  7 -2.951  2.640  0.832 -0.387 -1.502  0.272  0.756  0.538  0.616
```

```
## 184       184  8 -3.979  3.661  0.169 -0.598 -1.412  0.569  0.009  1.939  0.094
## 185       185  9 -4.083  2.315 -0.375  0.520 -0.019 -0.211 -0.172  1.054  0.387
## 186       186 10 -4.805  3.228 -0.501  0.602 -0.532  0.745  0.090  0.445  0.756
## 187       187 11 -3.661  1.292 -0.433  0.340  0.098  0.363  0.246  0.911 -0.415
## 188       188  1 -3.337 -0.347 -0.790  2.129 -0.058  2.079  0.295  0.246 -0.687
## 189       189  2 -3.000  0.217 -0.855  0.803 -0.008  1.795 -0.010  1.070 -0.061
## 190       190  3 -3.047  1.267 -0.799  0.507  0.524  0.507  0.044  0.302 -0.731
## 191       191  4 -2.450  1.993 -1.080 -0.090  0.367  0.324 -0.164  0.684 -0.181
## 192       192  5 -2.544  2.725 -0.067 -0.787 -0.903  0.970  0.524  0.320  0.283
## 193       193  6 -2.703  2.066  0.205 -0.630 -0.345  1.229  0.403 -0.032  0.247
## 194       194  7 -3.015  2.219  0.996 -0.455 -1.514  0.047  0.864  0.468  0.657
## 195       195  8 -4.122  3.177  0.529 -0.176 -1.307  0.132 -0.279  1.353  0.458
## 196       196  9 -4.047  2.626 -0.597  0.823 -0.266  0.048  0.049  0.882  0.359
## 197       197 10 -4.893  3.370 -0.464  0.538 -0.327  0.496  0.270  0.470  0.742
## 198       198 11 -3.664  1.119 -0.459  0.482  0.082  0.221  0.185  0.861 -0.237
## 199       199  1 -2.463 -0.197 -1.264  1.150  0.234  1.833  0.066  0.738 -1.382
## 200       200  2 -2.913  0.757 -0.819  1.245  0.419  1.170  0.051  0.328 -0.960
## 201       201  3 -2.012  1.134 -1.029  0.205  0.661  0.359  0.456  0.372 -0.939
## 202       202  4 -2.101  1.502 -0.322 -0.363  0.026  0.116  0.162 -0.074 -0.106
## 203       203  5 -2.565  1.871 -0.269  0.187 -0.656  0.267 -0.328  0.184  0.348
## 204       204  6 -2.346  1.604 -0.283  0.393 -0.416  0.268 -0.463  0.387  0.253
## 205       205  7 -3.008  2.882 -0.900  0.214 -0.565 -0.197  0.449  0.305  0.413
## 206       206  8 -3.823  3.536 -2.070  0.245 -0.442  1.125  0.730  0.538 -0.006
## 207       207  9 -4.019  3.520 -1.058 -0.200 -0.545  1.348  0.351  0.820 -0.868
## 208       208 10 -4.022  0.941 -0.623  1.461  0.020  1.904 -0.074  0.464 -0.541
## 209       209 11 -3.209  1.850 -0.394  0.555  0.425  0.313  0.067  0.077 -0.163
## 210       210  1 -2.377 -0.266 -1.371  1.090  0.240  1.843  0.107  0.702 -1.256
## 211       211  2 -2.961  0.766 -0.800  0.962  0.658  1.012  0.347 -0.015 -0.425
## 212       212  3 -2.207  1.090 -0.627  0.024  0.912  0.662  0.241  0.348 -0.702
## 213       213  4 -2.131  1.487 -0.302 -0.272  0.012  0.067  0.149  0.022 -0.133
## 214       214  5 -2.596  1.867 -0.208  0.208 -0.574  0.146 -0.214  0.116  0.395
## 215       215  6 -2.378  1.568 -0.243  0.407 -0.428  0.229 -0.293  0.297  0.372
## 216       216  7 -3.117  2.876 -0.746 -0.047 -0.427 -0.053  0.453  0.305  0.541
## 217       217  8 -3.911  3.703 -1.965  0.132 -0.209  0.929  0.811  0.495 -0.142
## 218       218  9 -4.135  3.651 -0.751 -0.066 -0.789  1.131  0.496  0.788 -0.883
## 219       219 10 -4.028  0.982 -0.648  1.478 -0.048  2.108 -0.146  0.467 -0.654
## 220       220 11 -3.265  1.933 -0.316  0.602  0.438  0.336  0.048  0.134 -0.160
## 221       221  1 -2.382 -0.294 -1.397  1.051  0.211  1.901  0.151  0.654 -1.286
## 222       222  2 -2.941  0.710 -0.855  0.902  0.635  0.924  0.466  0.010 -0.342
## 223       223  3 -2.306  1.086 -0.590  0.106  0.931  0.733  0.213  0.274 -0.684
## 224       224  4 -2.162  1.533 -0.267 -0.287 -0.026  0.122  0.168 -0.024 -0.268
## 225       225  5 -2.639  1.880 -0.389  0.204 -0.571  0.094 -0.233  0.279  0.426
## 226       226  6 -2.458  1.586 -0.359  0.376 -0.244  0.134 -0.163  0.298  0.444
## 227       227  7 -3.242  2.901 -0.632 -0.332 -0.421  0.226  0.536  0.142  0.623
## 228       228  8 -3.977  3.684 -1.242 -0.364 -0.217  0.594  0.759  0.600  0.069
## 229       229  9 -4.094  3.586 -0.845 -0.026 -0.538  0.964  0.666  0.647 -0.412
## 230       230 10 -4.138  1.128 -0.601  1.553 -0.019  2.039 -0.176  0.262 -0.551
## 231       231 11 -3.242  1.802 -0.482  0.699  0.424  0.337  0.115  0.272 -0.205
## 232       232  1 -2.453 -0.320 -1.368  1.040  0.174  1.985  0.158  0.590 -1.318
## 233       233  2 -2.957  0.596 -0.756  0.890  0.580  0.836  0.543  0.036 -0.232
## 234       234  3 -2.289  1.106 -0.816  0.228  0.867  0.616  0.338  0.298 -0.843
## 235       235  4 -2.175  1.631 -0.331 -0.203 -0.159  0.246  0.180 -0.093 -0.351
## 236       236  5 -2.723  1.975 -0.636  0.336 -0.677  0.156 -0.342  0.479  0.381
## 237       237  6 -2.580  1.608 -0.311  0.273 -0.148  0.262 -0.062  0.167  0.337
```

```
## 238       238  7 -3.311  2.946 -0.808 -0.300 -0.457  0.324  0.515  0.149  0.533
## 239       239  8 -4.052  3.747 -1.240 -0.299 -0.426  0.917  0.517  0.716 -0.210
## 240       240  9 -4.039  3.506 -0.964  0.041 -0.400  0.976  0.650  0.659 -0.216
## 241       241 10 -4.319  1.338 -0.549  1.678  0.027  1.922 -0.228  0.161 -0.470
## 242       242 11 -3.329  1.788 -0.517  0.597  0.503  0.278  0.121  0.176 -0.159
## 243       243  1 -2.460 -0.325 -1.404  0.928  0.122  2.049  0.274  0.532 -1.113
## 244       244  2 -2.904  0.458 -0.656  0.832  0.610  0.805  0.568  0.041 -0.114
## 245       245  3 -2.318  1.097 -0.832  0.260  0.821  0.588  0.402  0.327 -0.852
## 246       246  4 -2.147  1.655 -0.355 -0.082 -0.194  0.296  0.146 -0.083 -0.314
## 247       247  5 -2.733  2.026 -0.710  0.377 -0.774  0.284 -0.469  0.693  0.205
## 248       248  6 -2.729  1.595 -0.150  0.167  0.015  0.377  0.083 -0.038  0.166
## 249       249  7 -3.338  3.033 -1.189 -0.269 -0.364  0.544  0.491  0.148  0.365
## 250       250  8 -4.048  3.753 -1.150 -0.209 -0.530  0.871  0.445  0.716 -0.131
## 251       251  9 -4.142  3.454 -0.653  0.271 -0.598  0.793  0.563  0.520 -0.118
## 252       252 10 -4.457  1.512 -0.514  1.764  0.063  1.860 -0.332  0.189 -0.521
## 253       253 11 -3.407  1.821 -0.675  0.765  0.256  0.469 -0.090  0.322 -0.387
## 254       254  1 -2.391 -0.347 -1.474  0.843  0.089  2.021  0.417  0.502 -0.860
## 255       255  2 -2.919  0.463 -0.716  0.957  0.635  0.833  0.501  0.048 -0.134
## 256       256  3 -2.385  1.010 -0.754  0.370  0.785  0.471  0.415  0.318 -0.797
## 257       257  4 -2.104  1.600 -0.297 -0.071 -0.172  0.285  0.152 -0.089 -0.296
## 258       258  5 -2.706  2.070 -0.691  0.310 -0.745  0.266 -0.413  0.602  0.360
## 259       259  6 -2.855  1.587 -0.030  0.202  0.165  0.445  0.207 -0.067 -0.013
## 260       260  7 -3.339  3.011 -1.264 -0.343 -0.119  0.498  0.589  0.078  0.221
## 261       261  8 -4.039  3.689 -1.007 -0.139 -0.542  0.587  0.535  0.465  0.194
## 262       262  9 -4.172  3.070 -0.781  0.516 -0.627  1.006  0.531  0.441 -0.102
## 263       263 10 -4.494  1.535 -0.495  1.715  0.044  1.892 -0.367  0.362 -0.583
## 264       264 11 -3.285  1.547 -0.897  0.917  0.127  0.402 -0.011  0.502 -0.557
## 265       265  1 -3.415 -0.538  0.241  2.038  0.622  1.027 -0.701 -0.660 -0.418
## 266       266  2 -3.439  1.007  0.020  1.491  0.777  0.257 -0.777 -0.282 -0.707
## 267       267  3 -2.814  1.515 -0.088  0.597 -0.033 -0.290 -0.445  0.113 -0.136
## 268       268  4 -2.027  2.157 -0.297 -0.211 -0.266  0.086 -0.176 -0.179 -0.283
## 269       269  5 -2.263  3.344 -1.165 -0.625 -0.159  0.926  0.130 -0.330 -0.783
## 270       270  6 -2.594  2.584 -0.370 -0.524 -0.177  0.515 -0.137  0.095 -0.731
## 271       271  7 -2.702  3.596 -0.570 -1.041 -0.709  1.009  0.403  0.426 -1.013
## 272       272  8 -3.440  3.203 -0.698 -0.860 -0.542  1.503  0.922  0.467 -0.183
## 273       273  9 -3.961  4.144 -0.934 -0.089 -0.612  0.787  0.326  0.182 -0.487
## 274       274 10 -4.471  3.192 -0.161  0.117 -0.327  0.406 -0.201  0.919 -0.716
## 275       275 11 -3.012  2.252 -0.806  0.389 -0.110  0.649 -0.328  0.321 -0.559
## 276       276  1 -3.705 -0.204  0.274  1.569  0.883  1.366 -0.940 -0.691 -0.162
## 277       277  2 -3.303  0.702 -0.209  1.627  0.818  0.287 -0.541 -0.198 -0.717
## 278       278  3 -2.640  1.322 -0.111  0.861  0.026 -0.354 -0.425  0.083 -0.235
## 279       279  4 -1.948  2.143 -0.068 -0.211 -0.238  0.263 -0.270 -0.238 -0.342
## 280       280  5 -2.247  3.420 -0.887 -0.823 -0.297  0.774  0.185 -0.242 -0.790
## 281       281  6 -2.489  2.401 -0.440 -0.367 -0.069  0.533  0.011  0.118 -0.621
## 282       282  7 -2.776  3.557 -0.435 -1.044 -0.572  1.273  0.221  0.295 -0.986
## 283       283  8 -3.356  3.236 -0.653 -0.900 -0.661  1.430  0.901  0.395 -0.139
## 284       284  9 -3.909  3.674 -0.648  0.088 -0.365  0.199  0.424  0.336 -0.012
## 285       285 10 -4.386  3.055  0.075 -0.018 -0.436  0.566 -0.288  0.936 -0.577
## 286       286 11 -3.067  2.549 -0.851  0.505  0.044  0.574 -0.377  0.147 -0.606
## 287       287  1 -3.699 -0.251  0.268  1.585  0.850  1.381 -0.867 -0.710 -0.190
## 288       288  2 -3.266  0.577 -0.261  1.481  0.874  0.301 -0.496 -0.012 -0.623
## 289       289  3 -2.676  1.411 -0.098  1.047 -0.040 -0.131 -0.560 -0.030 -0.192
## 290       290  4 -1.899  2.135  0.092 -0.110 -0.145  0.081 -0.067 -0.104 -0.408
## 291       291  5 -2.305  3.625 -1.203 -0.665 -0.296  0.775  0.197 -0.282 -0.842
```

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## 292       292  6 -2.489  2.379 -0.523 -0.158 -0.178  0.406  0.198  0.059 -0.589
## 293       293  7 -2.898  3.393 -0.409 -0.993 -0.587  1.322  0.240  0.231 -1.068
## 294       294  8 -3.376  3.327 -0.797 -0.849 -0.681  1.198  0.838  0.244 -0.298
## 295       295  9 -3.828  3.188 -0.388  0.055 -0.185 -0.029  0.503  0.273  0.326
## 296       296 10 -4.283  2.829  0.296  0.086 -0.544  0.501 -0.317  0.995 -0.340
## 297       297 11 -3.189  2.620 -0.833  0.450  0.009  0.444 -0.348  0.126 -0.614
## 298       298  1 -3.490 -0.474  0.187  1.747  0.733  1.307 -0.816 -0.787 -0.222
## 299       299  2 -3.155  0.613 -0.285  1.287  0.882  0.337 -0.624  0.067 -0.516
## 300       300  3 -2.762  1.510 -0.145  1.157 -0.256  0.041 -0.647 -0.324 -0.128
## 301       301  4 -1.959  2.285 -0.089 -0.262 -0.013  0.019 -0.233 -0.068 -0.268
## 302       302  5 -2.364  3.743 -1.393 -0.361 -0.354  1.004  0.208 -0.376 -1.046
## 303       303  6 -2.577  2.449 -0.380  0.174 -0.410  0.383  0.190  0.097 -0.489
## 304       304  7 -2.919  3.480 -0.823 -0.751 -0.416  1.045  0.609  0.180 -1.172
## 305       305  8 -3.387  3.286 -0.747 -0.699 -0.900  0.891  0.875  0.460 -0.457
## 306       306  9 -3.818  3.159 -0.298 -0.058 -0.348  0.194  0.593  0.211  0.531
## 307       307 10 -4.299  2.775  0.244  0.177 -0.436  0.261 -0.308  1.175 -0.227
## 308       308 11 -3.269  2.489 -0.760  0.352 -0.092  0.432 -0.270  0.242 -0.523
## 309       309  1 -2.852 -0.805 -0.313  1.565  0.688  1.467 -0.664 -0.916 -0.279
## 310       310  2 -3.379  0.950 -0.060  1.470  0.538  0.051 -0.681 -0.098 -0.405
## 311       311  3 -2.836  1.561 -0.076  1.229 -0.291 -0.036 -0.369 -0.393 -0.181
## 312       312  4 -2.021  2.493 -0.416 -0.116  0.094 -0.033 -0.400 -0.080 -0.136
## 313       313  5 -2.411  3.850 -1.405 -0.302 -0.398  1.069  0.216 -0.291 -1.116
## 314       314  6 -2.708  2.560 -0.439  0.324 -0.348  0.429  0.091 -0.037 -0.434
## 315       315  7 -2.883  3.576 -1.198 -0.562 -0.162  0.974  0.764 -0.030 -1.023
## 316       316  8 -3.390  3.422 -0.718 -0.667 -0.871  0.788  0.959  0.555 -0.482
## 317       317  9 -3.972  3.240 -0.829  0.069 -0.617  0.977  0.532  0.498 -0.191
## 318       318 10 -4.513  3.080  0.068  0.050 -0.484  0.341 -0.257  1.302 -0.517
## 319       319 11 -3.292  2.595 -0.578  0.420 -0.233  0.391 -0.241  0.437 -0.541
## 320       320  1 -2.527 -0.926 -0.571  1.613  0.628  1.229 -0.687 -0.808 -0.354
## 321       321  2 -3.498  1.669  0.076  1.530  0.380 -0.135 -0.814 -0.208 -0.307
## 322       322  3 -2.851  1.412 -0.184  1.281  0.000 -0.146 -0.172 -0.419 -0.307
## 323       323  4 -2.026  2.433 -0.411  0.064  0.223 -0.027 -0.424 -0.009 -0.305
## 324       324  5 -2.460  3.706 -1.304 -0.339 -0.487  1.125  0.187 -0.211 -1.068
## 325       325  6 -2.879  2.662 -0.572  0.425 -0.248  0.213  0.176 -0.281 -0.404
## 326       326  7 -2.818  3.685 -1.413 -0.558  0.025  0.871  0.688 -0.144 -0.930
## 327       327  8 -3.396  3.867 -1.029 -0.603 -0.573  0.780  1.209  0.228 -0.673
## 328       328  9 -3.905  3.147 -1.259  0.304 -0.216  1.055  0.578  0.353 -0.517
## 329       329 10 -4.568  3.344 -0.005 -0.092 -0.546  0.479 -0.168  1.186 -0.565
## 330       330 11 -3.350  2.713 -0.472  0.400 -0.196  0.248 -0.224  0.530 -0.358
## 331       331  1 -4.711  1.166  1.244  1.746  0.311 -0.305 -0.691 -0.137 -0.288
## 332       332  2 -4.057  1.925  0.521  1.331  0.273 -0.167 -0.365 -0.665 -0.512
## 333       333  3 -3.097  1.385 -0.173  1.392 -0.613 -0.143 -0.014 -0.565 -0.065
## 334       334  4 -2.931  1.850 -0.896  0.685 -1.000  0.504  0.212 -0.276 -0.203
## 335       335  5 -2.942  2.642 -1.217  0.384 -0.994  1.467  0.134 -0.458 -0.465
## 336       336  6 -3.065  1.781 -0.915  0.698  0.175  0.662 -0.086 -0.361 -0.774
## 337       337  7 -3.318  3.395 -1.706  0.753 -0.214  1.431  0.000 -0.192 -1.330
## 338       338  8 -3.747  4.267 -1.847 -0.235  0.380  0.885 -0.049 -0.258 -0.772
## 339       339  9 -4.039  2.061 -0.727  0.888  0.302  0.413 -0.381 -0.194 -0.614
## 340       340 10 -4.080  2.242 -0.280  1.876  0.720 -0.292 -0.537 -0.540 -0.663
## 341       341 11 -3.483  2.628 -0.383  0.838  0.200  0.102 -0.162 -0.547 -0.791
## 342       342  1 -4.689  1.015  1.312  1.802  0.313 -0.405 -0.663  0.106 -0.325
## 343       343  2 -4.013  2.101  0.295  1.292  0.450 -0.024 -0.565 -0.588 -0.343
## 344       344  3 -2.972  1.151 -0.293  1.609 -0.724  0.123 -0.087 -0.801  0.040
## 345       345  4 -3.029  1.747 -0.899  0.674 -1.046  0.558  0.204 -0.155 -0.237
```

```
## 346       346  5 -2.926  2.673 -1.242  0.396 -1.029  1.548  0.050 -0.592 -0.331
## 347       347  6 -3.075  1.824 -0.905  0.727  0.155  0.608 -0.075 -0.377 -0.740
## 348       348  7 -3.400  3.441 -1.805  0.814 -0.162  1.445 -0.110 -0.499 -1.201
## 349       349  8 -3.797  4.314 -1.596 -0.476  0.044  0.903  0.129 -0.141 -0.646
## 350       350  9 -4.083  2.193 -0.492  0.695  0.251  0.423 -0.558 -0.123 -0.530
## 351       351 10 -4.045  2.377 -0.300  2.002  0.826 -0.180 -0.768 -0.408 -0.787
## 352       352 11 -3.455  2.561 -0.421  0.847  0.330  0.057 -0.177 -0.494 -0.786
## 353       353  1 -4.756  1.197  1.431  1.540  0.262 -0.277 -0.741  0.075 -0.260
## 354       354  2 -3.999  2.138  0.295  1.086  0.699 -0.127 -0.634 -0.400 -0.505
## 355       355  3 -2.964  1.154 -0.373  1.511 -0.583  0.152 -0.012 -0.949 -0.054
## 356       356  4 -3.053  1.518 -0.729  0.828 -1.211  0.499  0.326 -0.136 -0.263
## 357       357  5 -2.967  2.781 -1.277  0.354 -0.936  1.505 -0.004 -0.418 -0.560
## 358       358  6 -3.206  1.899 -0.933  0.733  0.261  0.565 -0.225 -0.339 -0.677
## 359       359  7 -3.492  3.446 -1.734  0.705 -0.230  1.339  0.092 -0.698 -1.143
## 360       360  8 -3.847  4.268 -1.521 -0.465 -0.230  1.067 -0.020  0.005 -0.577
## 361       361  9 -4.052  2.335 -0.415  0.732  0.234  0.426 -0.490 -0.218 -0.618
## 362       362 10 -4.001  2.284 -0.365  2.106  1.006 -0.028 -0.825 -0.390 -0.898
## 363       363 11 -3.446  2.440 -0.370  0.926  0.194  0.141 -0.098 -0.557 -0.889
## 364       364  1 -4.763  1.305  1.231  1.548  0.308 -0.152 -0.792 -0.124 -0.107
## 365       365  2 -3.990  2.008  0.503  0.845  0.774 -0.114 -0.641 -0.282 -0.734
## 366       366  3 -2.965  1.124 -0.349  1.581 -0.666  0.125 -0.025 -0.887 -0.130
## 367       367  4 -3.055  1.400 -0.686  0.964 -1.290  0.545  0.337 -0.299 -0.173
## 368       368  5 -2.964  2.811 -1.317  0.324 -0.781  1.369  0.127 -0.368 -0.677
## 369       369  6 -3.371  2.007 -0.919  0.843  0.221  0.541 -0.317 -0.370 -0.500
## 370       370  7 -3.554  3.386 -1.703  0.555 -0.072  1.073  0.237 -0.625 -1.067
## 371       371  8 -3.852  4.214 -1.556 -0.336 -0.305  1.133 -0.152  0.237 -0.915
## 372       372  9 -3.963  2.272 -0.534  0.977  0.329  0.514 -0.363 -0.425 -0.712
## 373       373 10 -3.985  2.192 -0.426  2.163  1.114  0.016 -0.846 -0.468 -0.858
## 374       374 11 -3.510  2.535 -0.260  0.946 -0.072  0.159 -0.112 -0.657 -0.789
## 375       375  1 -4.754  1.329  1.090  1.765  0.217 -0.198 -0.782 -0.154  0.023
## 376       376  2 -3.966  2.003  0.391  1.034  0.659 -0.191 -0.448 -0.397 -0.769
## 377       377  3 -2.959  1.061 -0.351  1.745 -0.851  0.344 -0.373 -0.729  0.048
## 378       378  4 -3.194  1.589 -0.774  0.814 -1.087  0.618  0.218 -0.450 -0.003
## 379       379  5 -2.928  2.830 -1.361  0.323 -0.739  1.431  0.002 -0.172 -0.939
## 380       380  6 -3.456  2.027 -0.862  0.887  0.281  0.435 -0.307 -0.387 -0.600
## 381       381  7 -3.520  3.318 -1.867  0.691  0.263  0.822  0.140 -0.620 -1.098
## 382       382  8 -3.838  4.252 -1.621 -0.219 -0.281  0.856  0.154  0.133 -0.920
## 383       383  9 -3.857  2.133 -0.580  0.996  0.502  0.650 -0.283 -0.468 -0.983
## 384       384 10 -4.062  2.358 -0.310  1.895  1.095  0.049 -0.870 -0.524 -0.980
## 385       385 11 -3.591  2.780 -0.301  0.812 -0.008 -0.019 -0.268 -0.564 -0.788
## 386       386  1 -4.687  1.152  1.089  1.915  0.201 -0.296 -0.692 -0.105 -0.143
## 387       387  2 -3.917  1.925  0.267  1.361  0.453 -0.190 -0.242 -0.633 -0.620
## 388       388  3 -3.004  1.090 -0.328  1.652 -0.679  0.287 -0.297 -0.695 -0.145
## 389       389  4 -3.341  1.714 -0.773  0.771 -0.976  0.625  0.078 -0.438 -0.084
## 390       390  5 -2.902  2.796 -1.199  0.234 -0.821  1.257  0.263 -0.075 -1.103
## 391       391  6 -3.567  2.081 -0.579  0.845  0.126  0.381 -0.179 -0.510 -0.846
## 392       392  7 -3.570  3.410 -1.576  0.563  0.002  0.759  0.285 -0.466 -1.409
## 393       393  8 -3.792  4.290 -1.531 -0.125 -0.312  0.624  0.324 -0.053 -0.942
## 394       394  9 -3.862  2.109 -0.650  0.990  0.724  0.641 -0.293 -0.519 -1.055
## 395       395 10 -4.118  2.542 -0.200  1.616  1.106 -0.060 -0.728 -0.544 -0.912
## 396       396 11 -3.636  2.719 -0.178  0.665  0.099 -0.084 -0.333 -0.362 -1.049
## 397       397  1 -4.047  0.913  0.734  1.479  0.258  0.206 -1.117 -0.423 -0.336
## 398       398  2 -3.811  2.123  0.278  1.552  0.754  0.492 -0.584 -0.433 -0.988
## 399       399  3 -3.441  1.975 -0.395  1.024 -0.052 -0.167 -0.445  0.168 -0.684
```

```
## 400       400  4 -2.584  2.091 -1.451  0.889 -0.464  0.285 -0.213 -0.245 -0.138
## 401       401  5 -3.119  3.135 -1.466 -0.352 -0.023  0.752  0.143 -0.231 -0.376
## 402       402  6 -2.871  3.130 -1.300  0.008 -0.288  0.483  0.258 -0.342 -0.614
## 403       403  7 -3.059  2.895 -0.847 -0.364 -0.484  1.025  0.502  0.506 -0.733
## 404       404  8 -3.642  3.582 -1.031 -0.761  0.046  1.255  0.841  0.512 -0.259
## 405       405  9 -3.977  2.976  0.309 -0.259  0.026  0.816 -0.317  0.492 -0.674
## 406       406 10 -4.008  2.141 -0.180  1.041  0.688  0.712 -0.879 -0.201 -1.066
## 407       407 11 -3.451  2.257 -0.845  0.432  0.486  0.266 -0.215  0.006 -1.082
## 408       408  1 -3.836  0.508  0.645  1.721  0.280  0.303 -0.911 -0.592 -0.631
## 409       409  2 -3.709  1.665  0.138  1.551  0.975  0.923 -0.396 -0.234 -1.154
## 410       410  3 -3.369  1.784 -0.603  1.303  0.007 -0.044 -0.459 -0.012 -0.591
## 411       411  4 -2.627  2.089 -1.434  0.937 -0.615  0.430 -0.311 -0.203  0.038
## 412       412  5 -3.074  3.062 -1.470 -0.379  0.233  0.789 -0.099 -0.135 -0.395
## 413       413  6 -2.902  2.988 -1.152  0.057 -0.477  0.622  0.338 -0.368 -0.689
## 414       414  7 -3.027  2.903 -0.799 -0.452 -0.503  1.044  0.679  0.483 -0.776
## 415       415  8 -3.634  3.589 -1.075 -0.709  0.058  1.051  0.878  0.627 -0.111
## 416       416  9 -3.924  2.726  0.414 -0.155 -0.020  0.893 -0.188  0.552 -0.507
## 417       417 10 -4.049  2.223 -0.076  0.928  0.692  0.731 -0.931 -0.141 -1.087
## 418       418 11 -3.432  2.235 -0.753  0.361  0.435  0.425 -0.193  0.012 -1.166
## 419       419  1 -3.661  0.300  0.530  1.816  0.333  0.444 -0.858 -0.732 -0.809
## 420       420  2 -3.674  1.513  0.038  1.604  0.907  1.045 -0.166 -0.295 -1.130
## 421       421  3 -3.242  1.615 -0.829  1.589  0.090  0.051 -0.504 -0.211 -0.513
## 422       422  4 -2.634  2.076 -1.320  0.833 -0.547  0.287 -0.173 -0.203 -0.001
## 423       423  5 -3.052  3.059 -1.668 -0.208  0.466  0.724 -0.237 -0.175 -0.315
## 424       424  6 -2.918  2.897 -1.069 -0.077 -0.261  0.550  0.317 -0.322 -0.776
## 425       425  7 -3.048  2.817 -0.703 -0.396 -0.639  0.920  0.674  0.686 -0.611
## 426       426  8 -3.660  3.618 -1.051 -0.748  0.080  1.022  0.914  0.613  0.023
## 427       427  9 -3.919  2.575  0.471 -0.064 -0.042  0.880 -0.128  0.612 -0.504
## 428       428 10 -4.094  2.499 -0.149  1.017  0.683  0.536 -1.023 -0.127 -1.142
## 429       429 11 -3.396  2.257 -0.602  0.407  0.204  0.366  0.067  0.044 -1.352
## 430       430  1 -3.572  0.228  0.520  1.791  0.382  0.573 -0.961 -0.740 -0.936
## 431       431  2 -3.584  1.252 -0.062  1.646  0.787  1.134  0.096 -0.292 -1.133
## 432       432  3 -3.232  1.551 -0.832  1.674 -0.042  0.296 -0.553 -0.443 -0.413
## 433       433  4 -2.643  2.021 -1.265  0.759 -0.442  0.159 -0.032 -0.145 -0.164
## 434       434  5 -3.050  3.055 -1.598 -0.120  0.144  0.757  0.119 -0.397 -0.396
## 435       435  6 -2.938  2.782 -1.111 -0.076  0.000  0.582  0.252 -0.400 -0.773
## 436       436  7 -3.095  2.851 -0.816 -0.396 -0.603  1.090  0.567  0.743 -0.677
## 437       437  8 -3.706  3.627 -0.889 -0.789 -0.093  1.223  0.814  0.563  0.062
## 438       438  9 -3.946  2.545  0.447 -0.001  0.043  0.788 -0.102  0.680 -0.637
## 439       439 10 -4.145  2.739 -0.115  0.907  0.669  0.478 -1.183 -0.240 -0.887
## 440       440 11 -3.325  2.141 -0.528  0.439  0.099  0.321  0.217  0.135 -1.388
## 441       441  1 -3.461  0.040  0.553  1.854  0.386  0.568 -1.003 -0.638 -1.040
## 442       442  2 -3.546  1.064 -0.006  1.455  0.847  1.117  0.073 -0.025 -1.318
## 443       443  3 -3.320  1.553 -0.586  1.688 -0.262  0.392 -0.478 -0.461 -0.522
## 444       444  4 -2.710  1.943 -1.247  0.772 -0.345  0.107 -0.062  0.040 -0.322
## 445       445  5 -3.018  3.014 -1.486 -0.105 -0.131  0.929  0.226 -0.463 -0.555
## 446       446  6 -2.904  2.741 -1.123  0.014  0.071  0.654  0.212 -0.454 -0.815
## 447       447  7 -3.176  2.997 -1.098 -0.371 -0.418  1.318  0.480  0.472 -0.814
## 448       448  8 -3.743  3.629 -0.874 -0.790 -0.312  1.759  0.679  0.565 -0.521
## 449       449  9 -3.952  2.489  0.287  0.012  0.141  0.892 -0.087  0.613 -0.685
## 450       450 10 -4.211  2.811  0.016  0.799  0.514  0.496 -1.219 -0.238 -0.798
## 451       451 11 -3.309  2.256 -0.615  0.365  0.251  0.439  0.011  0.119 -1.219
## 452       452  1 -3.500  0.068  0.533  1.876  0.363  0.542 -0.982 -0.671 -1.006
## 453       453  2 -3.620  1.066  0.158  1.393  0.879  1.020 -0.090  0.087 -1.333
```

```
## 454       454  3 -3.468  1.810 -0.390  1.550 -0.084 -0.008 -0.482 -0.231 -0.724
## 455       455  4 -2.795  1.957 -1.259  0.790 -0.274  0.078 -0.114  0.005 -0.309
## 456       456  5 -3.002  2.944 -1.379 -0.188 -0.131  0.957  0.346 -0.392 -0.711
## 457       457  6 -2.924  2.731 -1.138  0.066  0.100  0.683  0.162 -0.399 -0.882
## 458       458  7 -3.239  3.083 -1.427 -0.202 -0.282  1.421  0.576  0.068 -0.914
## 459       459  8 -3.753  3.605 -0.899 -0.747 -0.401  1.765  0.620  0.754 -0.835
## 460       460  9 -3.980  2.459  0.068  0.023  0.237  1.029 -0.189  0.521 -0.773
## 461       461 10 -4.264  2.925  0.065  0.794  0.323  0.515 -1.282 -0.140 -0.863
## 462       462 11 -3.291  2.324 -0.679  0.285  0.441  0.557 -0.227  0.115 -1.046
##       x.10
## 1   -0.467
## 2   -0.604
## 3   -0.764
## 4   -0.279
## 5   -0.471
## 6   -0.204
## 7    0.991
## 8    0.577
## 9    1.125
## 10   1.180
## 11   0.327
## 12  -0.400
## 13  -0.596
## 14  -0.741
## 15  -0.200
## 16  -0.396
## 17  -0.403
## 18   1.034
## 19   0.861
## 20   0.770
## 21   1.294
## 22   0.344
## 23  -0.521
## 24  -0.250
## 25  -0.484
## 26  -0.212
## 27  -0.336
## 28  -0.413
## 29   1.166
## 30   0.976
## 31   1.005
## 32   1.214
## 33   0.436
## 34  -0.663
## 35   0.119
## 36  -0.510
## 37  -0.251
## 38  -0.301
## 39  -0.334
## 40   1.291
## 41   1.114
## 42   1.055
## 43   1.245
## 44   0.303
```

```
## 45  -0.668
## 46   0.026
## 47  -0.382
## 48  -0.343
## 49  -0.209
## 50  -0.326
## 51   1.163
## 52   0.978
## 53   0.829
## 54   1.165
## 55  -0.337
## 56  -0.765
## 57  -0.174
## 58  -0.073
## 59  -0.391
## 60  -0.272
## 61  -0.273
## 62   0.969
## 63   0.563
## 64   0.269
## 65   1.088
## 66  -0.461
## 67  -0.635
## 68  -0.621
## 69  -0.013
## 70  -0.548
## 71  -0.093
## 72  -0.204
## 73  -0.662
## 74  -0.110
## 75  -0.611
## 76  -0.192
## 77  -0.372
## 78  -0.548
## 79  -0.899
## 80  -0.053
## 81  -0.609
## 82  -0.135
## 83  -0.074
## 84  -0.700
## 85  -0.306
## 86  -0.694
## 87  -0.307
## 88  -0.408
## 89  -0.547
## 90  -0.934
## 91  -0.235
## 92  -0.637
## 93  -0.090
## 94  -0.092
## 95  -0.549
## 96  -0.283
## 97  -0.709
## 98  -0.326
```

```
## 99  -0.391
## 100 -0.634
## 101 -0.767
## 102 -0.346
## 103 -0.624
## 104 -0.064
## 105 -0.196
## 106 -0.586
## 107 -0.322
## 108 -0.864
## 109 -0.202
## 110 -0.331
## 111 -0.757
## 112 -0.565
## 113 -0.285
## 114 -0.576
## 115 -0.234
## 116 -0.292
## 117 -0.516
## 118 -0.250
## 119 -0.710
## 120 -0.074
## 121 -0.325
## 122 -0.767
## 123 -0.553
## 124 -0.237
## 125 -0.490
## 126 -0.343
## 127 -0.263
## 128 -0.413
## 129 -0.259
## 130 -0.556
## 131 -0.184
## 132 -0.394
## 133 -0.873
## 134 -0.637
## 135 -0.256
## 136 -0.764
## 137 -0.939
## 138 -0.747
## 139 -1.098
## 140 -0.430
## 141 -0.318
## 142 -0.916
## 143 -0.334
## 144 -0.855
## 145 -0.563
## 146 -0.295
## 147 -0.672
## 148 -0.949
## 149 -0.745
## 150 -0.871
## 151 -0.301
## 152 -0.477
```

```
## 153 -0.617
## 154 -0.408
## 155 -1.015
## 156 -0.717
## 157 -0.307
## 158 -0.645
## 159 -0.910
## 160 -0.720
## 161 -0.665
## 162 -0.231
## 163 -0.317
## 164 -0.558
## 165 -0.391
## 166 -1.205
## 167 -0.828
## 168 -0.314
## 169 -0.753
## 170 -0.937
## 171 -0.638
## 172 -0.525
## 173 -0.290
## 174 -0.118
## 175 -0.473
## 176 -0.551
## 177 -1.226
## 178 -0.974
## 179 -0.379
## 180 -0.959
## 181 -0.959
## 182 -0.622
## 183 -0.399
## 184 -0.149
## 185  0.168
## 186 -0.420
## 187 -0.507
## 188 -1.241
## 189 -1.046
## 190 -0.431
## 191 -1.013
## 192 -0.822
## 193 -0.696
## 194 -0.343
## 195 -0.009
## 196 -0.203
## 197 -0.141
## 198 -0.413
## 199 -0.498
## 200 -0.614
## 201 -0.613
## 202 -0.397
## 203 -0.511
## 204 -0.504
## 205 -0.300
## 206 -0.640
```

```
## 207 -0.434
## 208 -0.211
## 209 -0.944
## 210 -0.620
## 211 -0.746
## 212 -0.912
## 213 -0.322
## 214 -0.541
## 215 -0.512
## 216 -0.489
## 217 -0.519
## 218 -0.351
## 219 -0.193
## 220 -0.991
## 221 -0.609
## 222 -0.588
## 223 -0.911
## 224 -0.270
## 225 -0.598
## 226 -0.711
## 227 -0.616
## 228 -0.250
## 229 -0.477
## 230 -0.362
## 231 -1.074
## 232 -0.587
## 233 -0.579
## 234 -0.832
## 235 -0.267
## 236 -0.729
## 237 -0.692
## 238 -0.718
## 239 -0.125
## 240 -0.327
## 241 -0.442
## 242 -0.980
## 243 -0.769
## 244 -0.615
## 245 -0.773
## 246 -0.308
## 247 -0.740
## 248 -0.672
## 249 -0.931
## 250  0.139
## 251 -0.330
## 252 -0.415
## 253 -0.968
## 254 -0.978
## 255 -0.638
## 256 -0.679
## 257 -0.370
## 258 -0.713
## 259 -0.712
## 260 -0.822
```

```
## 261  0.168
## 262 -0.456
## 263 -0.291
## 264 -0.715
## 265  0.781
## 266  0.746
## 267  0.662
## 268  0.292
## 269  0.310
## 270  0.072
## 271 -0.009
## 272 -0.919
## 273 -0.719
## 274 -0.933
## 275  0.234
## 276  0.598
## 277  0.768
## 278  0.781
## 279  0.147
## 280  0.046
## 281 -0.188
## 282 -0.040
## 283 -0.726
## 284 -0.252
## 285 -1.010
## 286  0.189
## 287  0.567
## 288  0.879
## 289  0.705
## 290 -0.099
## 291  0.188
## 292 -0.256
## 293 -0.094
## 294 -0.618
## 295  0.100
## 296 -1.113
## 297  0.081
## 298  0.410
## 299  0.891
## 300  0.806
## 301 -0.022
## 302  0.722
## 303 -0.084
## 304  0.123
## 305 -0.636
## 306 -0.014
## 307 -1.115
## 308  0.010
## 309  0.489
## 310  0.912
## 311  0.850
## 312  0.069
## 313  1.043
## 314  0.344
```

```
## 315  0.346
## 316 -0.724
## 317 -0.910
## 318 -1.057
## 319 -0.021
## 320  0.625
## 321  1.053
## 322  0.874
## 323  0.345
## 324  0.944
## 325  0.605
## 326  0.282
## 327 -0.562
## 328 -0.871
## 329 -1.025
## 330 -0.091
## 331  1.023
## 332  0.716
## 333  1.129
## 334  0.595
## 335  0.646
## 336  0.951
## 337  0.030
## 338 -0.110
## 339  0.410
## 340  0.238
## 341  1.018
## 342  0.838
## 343  0.695
## 344  1.070
## 345  0.655
## 346  0.595
## 347  0.852
## 348 -0.046
## 349 -0.318
## 350  0.376
## 351  0.156
## 352  0.951
## 353  0.876
## 354  0.856
## 355  1.160
## 356  0.750
## 357  0.725
## 358  0.765
## 359 -0.050
## 360 -0.509
## 361  0.340
## 362  0.099
## 363  0.985
## 364  0.885
## 365  0.877
## 366  1.110
## 367  0.690
## 368  0.493
```

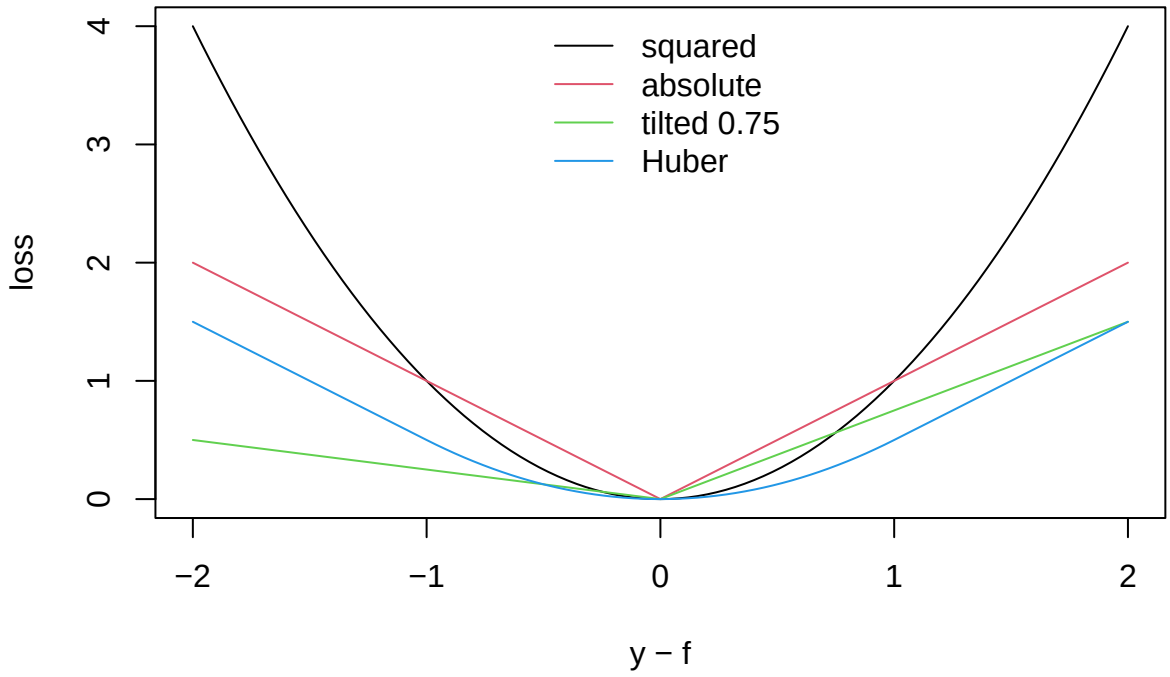
```
## 369  0.652
## 370 -0.176
## 371 -0.445
## 372  0.410
## 373  0.037
## 374  0.914
## 375  0.850
## 376  0.969
## 377  0.815
## 378  0.526
## 379  0.607
## 380  0.725
## 381  0.083
## 382 -0.454
## 383  0.613
## 384 -0.065
## 385  0.948
## 386  0.884
## 387  1.039
## 388  0.710
## 389  0.607
## 390  0.417
## 391  0.987
## 392  0.586
## 393 -0.301
## 394  0.653
## 395 -0.101
## 396  0.978
## 397  0.982
## 398  0.652
## 399  1.040
## 400  1.206
## 401  0.721
## 402  0.830
## 403  0.078
## 404 -0.447
## 405 -0.659
## 406 -0.549
## 407  0.759
## 408  1.023
## 409  0.736
## 410  1.047
## 411  0.933
## 412  0.572
## 413  0.793
## 414 -0.062
## 415 -0.437
## 416 -0.617
## 417 -0.584
## 418  0.794
## 419  0.995
## 420  0.594
## 421  1.005
## 422  0.802
```

```
## 423  0.411
## 424  0.790
## 425 -0.053
## 426 -0.448
## 427 -0.539
## 428 -0.421
## 429  0.871
## 430  1.007
## 431  0.472
## 432  0.960
## 433  0.860
## 434  0.477
## 435  0.838
## 436  0.052
## 437 -0.449
## 438 -0.545
## 439 -0.365
## 440  0.746
## 441  1.051
## 442  0.557
## 443  0.929
## 444  1.018
## 445  0.598
## 446  0.752
## 447  0.106
## 448 -0.485
## 449 -0.623
## 450 -0.392
## 451  0.695
## 452  1.101
## 453  0.585
## 454  0.967
## 455  1.142
## 456  0.617
## 457  0.827
## 458  0.147
## 459 -0.301
## 460 -0.500
## 461 -0.390
## 462  0.697
```

Loss functions

```
####################
## loss functions ##
####################

## Huber loss
loss_huber <- function(f, y, delta=1)
  ifelse(abs(y-f) <= delta,
    0.5*(y-f)^2, delta*(abs(y-f) - 0.5*delta))
```

```r
## squared error loss
loss_square <- function(f, y)
  (y-f)^2

## absolute error loss
loss_absolute <- function(f, y)
  abs(y-f)

## tilted absolute error loss
## tau - target quantile for prediction
loss_tilted <- function(f, y, tau=0.75)
  ifelse(y-f > 0, (y-f) * tau, (y-f) * (tau - 1))

## plot loss as functions of residual (y-f)
curve(loss_square(0, x), from=-2, to=2,
      xlab='y - f', ylab='loss')
curve(loss_absolute(0, x), from=-2, to=2, add=T, col=2)
curve(loss_tilted(0, x, 0.75), from=-2, to=2, add=T, col=3)
curve(loss_huber(0, x), from=-2, to=2, add=T, col=4)
legend('top', c('squared','absolute','tilted 0.75','Huber'),
       col=1:4, lty=1, bty='n')
```




```r
## constant prediction for given loss
## this applies decision theory predict the
## value 'f' that minimizes the sum of loss
```

```
## for loss=loss_square, this returns mean(y)
## for loss=loss_absolute, this returns quantile(y, probs=0.5)
## for loss=loss_huber, this returns some other value
const_pred <- function(y, loss=loss_huber,
                       limits=c(-1e10,1e10), ...) {
  sum_loss <- function(f) sum(loss(f, y, ...))
  optimize(sum_loss, interval=limits)$minimum
}

## const_pred examples
y1 <- rexp(1000) ## mean = 1.000, median = 0.693
mean(y1)
```

```
## [1] 1.047076
```

```
const_pred(y1, loss=loss_square)
```

```
## [1] 1.047076
```

```
median(y1)
```

```
## [1] 0.7124492
```

```
const_pred(y1, loss=loss_absolute)
```

```
## [1] 0.7122981
```

```
const_pred(y1, loss=loss_huber)
```

```
## [1] 0.8651944
```

```
################################
## weak learner for boosting ##
################################

## fit a stump (using squared error loss: method='anova')
stump <- function(dat, frm, maxdepth=1) {
  rpart(formula=frm, data=dat, method='anova',
        minsplit=2,minbucket=1,maxdepth=maxdepth,
        cp=0,maxcompete=0,maxsurrogate=0,
        usesurrogate=0,xval=0) %>%
    ## convert to constparty to make easier to
    ## manipulate predictions from this model
    as.constparty
}
```

Random Forest Model

```r
# Fit a random forest model
rf_model <- randomForest(y ~ ., data = train_data)

# View the model summary
rf_model
```

```
##
## Call:
##  randomForest(formula = y ~ ., data = train_data)
##                Type of random forest: regression
##                      Number of trees: 500
## No. of variables tried at each split: 3
##
##           Mean of squared residuals: 0.7813088
##                     % Var explained: 92.19
```

```r
library(randomForest)
library(caret)
```

```
## Warning: package 'caret' was built under R version 4.1.2
```

```
## Loading required package: ggplot2
```

```
##
## Attaching package: 'ggplot2'
```

```
## The following object is masked from 'package:randomForest':
##
##     margin
```

```
## Loading required package: lattice
```

```r
# Define the tuning grid
tuneGrid <- expand.grid(mtry = seq(1, ncol(train_data) - 1, by = 2))

# Set up the cross-validation
control <- trainControl(method = "cv", number = 5)

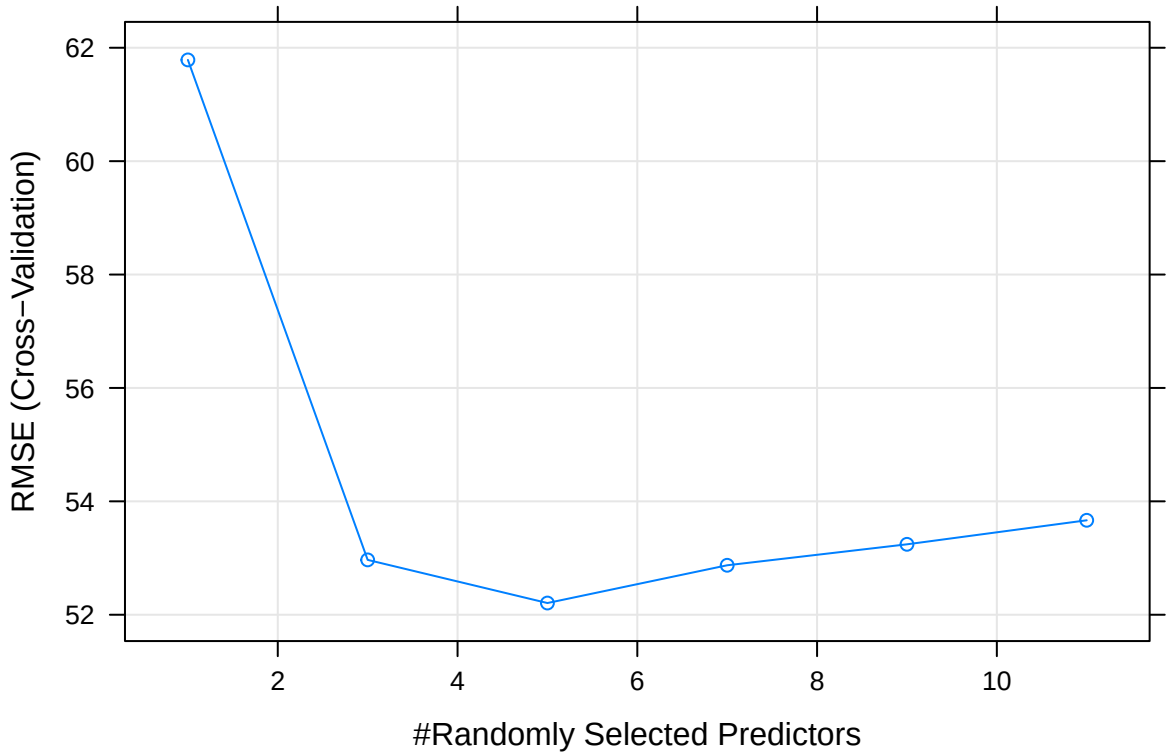
# Train the random forest with cross-validation
set.seed(123)
rf <- train(x = train_data[, -1], y = train_data[, 1],
            method = "rf", ntree = 500,
            tuneGrid = tuneGrid,
            trControl = control)

# Print the results
print(rf)
```

```
## Random Forest
##
```

```
## 528 samples
##  11 predictor
##
## No pre-processing
## Resampling: Cross-Validated (5 fold)
## Summary of sample sizes: 423, 424, 422, 421, 422
## Resampling results across tuning parameters:
##
##   mtry  RMSE      Rsquared   MAE
##    1    61.78593  0.8908508  49.25916
##    3    52.96732  0.9081346  40.62460
##    5    52.20642  0.9054763  38.87512
##    7    52.87233  0.8988020  38.61847
##    9    53.24198  0.8946419  38.18955
##   11    53.66567  0.8918767  38.18162
##
## RMSE was used to select the optimal model using the smallest value.
## The final value used for the model was mtry = 5.
```

```
# Plot the results
plot(rf)
```




```
library(randomForest)
library(caret)
```

```
# load the vowel.train data
train_data
```

```
##     row.names  y    x.1    x.2    x.3    x.4    x.5    x.6    x.7    x.8    x.9
## 1           1  1 -3.639  0.418 -0.670  1.779 -0.168  1.627 -0.388  0.529 -0.874
## 2           2  2 -3.327  0.496 -0.694  1.365 -0.265  1.933 -0.363  0.510 -0.621
## 3           3  3 -2.120  0.894 -1.576  0.147 -0.707  1.559 -0.579  0.676 -0.809
## 4           4  4 -2.287  1.809 -1.498  1.012 -1.053  1.060 -0.567  0.235 -0.091
## 5           5  5 -2.598  1.938 -0.846  1.062 -1.633  0.764  0.394 -0.150  0.277
## 6           6  6 -2.852  1.914 -0.755  0.825 -1.588  0.855  0.217 -0.246  0.238
## 7           7  7 -3.482  2.524 -0.433  1.048 -1.995  0.902  0.322  0.450  0.377
## 8           8  8 -3.941  2.305  0.124  1.771 -1.815  0.593 -0.435  0.992  0.575
## 9           9  9 -3.860  2.116 -0.939  0.688 -0.675  1.679 -0.512  0.928 -0.167
## 10         10 10 -3.648  1.812 -1.378  1.578  0.065  1.577 -0.466  0.702  0.060
## 11         11 11 -3.032  1.739 -1.141  0.737 -0.834  1.386 -0.575  0.679 -0.018
## 12         12  1 -3.653  0.373 -0.600  1.705 -0.222  1.765 -0.353  0.537 -0.797
## 13         13  2 -3.237  0.436 -0.860  1.363 -0.251  1.915 -0.395  0.751 -0.774
## 14         14  3 -2.135  0.954 -1.632  0.121 -0.704  1.600 -0.628  0.713 -0.903
## 15         15  4 -2.304  1.784 -1.506  0.981 -0.961  0.806 -0.294 -0.002  0.119
## 16         16  5 -2.540  2.144 -1.024  0.933 -1.567  1.024  0.188 -0.047  0.309
## 17         17  6 -2.826  2.003 -0.738  0.801 -1.669  0.939  0.245 -0.257  0.256
## 18         18  7 -3.582  2.374 -0.358  1.162 -1.953  0.621  0.339  0.355  0.415
## 19         19  8 -3.951  2.250  0.127  1.772 -1.906  0.567 -0.432  1.045  0.598
## 20         20  9 -3.783  1.974 -1.200  0.606 -0.650  1.504 -0.134  0.528  0.392
## 21         21 10 -3.673  1.811 -1.405  1.621  0.044  1.572 -0.453  0.745 -0.066
## 22         22 11 -2.946  1.649 -1.167  0.788 -0.909  1.300 -0.562  0.902 -0.070
## 23         23  1 -3.665  0.337 -0.641  1.791 -0.194  1.686 -0.359  0.570 -0.676
## 24         24  2 -3.165  0.408 -0.971  1.207 -0.298  1.921 -0.215  0.723 -0.492
## 25         25  3 -2.105  1.035 -1.705  0.231 -0.558  1.554 -0.649  0.710 -0.855
## 26         26  4 -2.312  1.746 -1.510  1.019 -0.990  0.941 -0.488  0.208  0.033
## 27         27  5 -2.635  2.147 -1.129  0.911 -1.407  1.095 -0.071  0.118  0.139
## 28         28  6 -2.887  2.131 -0.830  0.682 -1.557  0.818  0.448 -0.382  0.207
## 29         29  7 -3.635  2.250 -0.394  1.012 -1.693  0.117  0.665  0.281  0.343
## 30         30  8 -3.986  2.325  0.102  1.633 -2.014  0.576 -0.344  1.003  0.566
## 31         31  9 -3.712  1.816 -1.171  0.647 -0.767  1.698 -0.347  0.920  0.159
## 32         32 10 -3.740  1.832 -1.384  1.587  0.049  1.642 -0.516  0.707 -0.169
## 33         33 11 -2.859  1.627 -1.140  0.769 -0.948  1.390 -0.608  0.956 -0.204
## 34         34  1 -3.624  0.305 -0.708  1.758 -0.194  1.675 -0.273  0.561 -0.577
## 35         35  2 -3.062  0.351 -1.071  1.061 -0.355  1.990 -0.210  0.796 -0.358
## 36         36  3 -2.081  1.050 -1.778  0.411 -0.518  1.460 -0.576  0.735 -0.866
## 37         37  4 -2.289  1.845 -1.616  0.987 -0.876  1.044 -0.549  0.196 -0.070
## 38         38  5 -2.724  2.067 -1.142  0.923 -1.157  1.170 -0.276  0.172 -0.008
## 39         39  6 -3.015  2.232 -0.899  0.574 -1.331  0.546  0.610 -0.452  0.035
## 40         40  7 -3.559  2.126 -0.445  1.053 -1.765  0.349  0.546  0.321  0.443
## 41         41  8 -4.074  2.281  0.152  1.556 -1.613 -0.047  0.222  0.252  0.775
## 42         42  9 -3.618  1.576 -1.140  0.699 -0.741  1.633 -0.387  1.086  0.235
## 43         43 10 -3.687  1.784 -1.593  1.603  0.123  1.424 -0.225  0.441  0.206
## 44         44 11 -2.690  1.652 -1.261  0.674 -0.964  1.449 -0.593  1.005 -0.303
## 45         45  1 -3.593  0.290 -0.782  1.707 -0.175  1.662 -0.137  0.493 -0.492
## 46         46  2 -3.046  0.387 -1.165  0.940 -0.386  1.978 -0.186  0.811 -0.394
## 47         47  3 -2.255  0.902 -1.723  0.454 -0.524  1.453 -0.614  0.761 -0.885
## 48         48  4 -2.299  1.848 -1.695  1.065 -0.861  1.047 -0.607  0.313 -0.253
## 49         49  5 -2.911  1.928 -1.131  0.899 -0.911  1.111 -0.208 -0.047 -0.029
```

```
## 50         50  6 -3.089  2.339 -0.973  0.463 -1.169  0.543  0.598 -0.450 -0.080
## 51         51  7 -3.459  2.086 -0.595  0.937 -1.841  0.600  0.457  0.400  0.473
## 52         52  8 -4.208  2.447  0.049  1.331 -2.088  0.585 -0.050  0.820  0.606
## 53         53  9 -3.543  1.391 -1.220  0.699 -0.769  1.579 -0.379  1.158  0.181
## 54         54 10 -3.684  1.774 -1.728  1.611  0.100  1.393 -0.193  0.554  0.245
## 55         55 11 -2.596  1.560 -1.249  0.656 -1.095  1.292 -0.550  1.006 -0.150
## 56         56  1 -3.604  0.235 -0.836  1.786 -0.153  1.642 -0.096  0.488 -0.524
## 57         57  2 -3.171  0.490 -1.128  0.911 -0.388  2.014 -0.212  0.707 -0.551
## 58         58  3 -2.302  0.850 -1.646  0.455 -0.488  1.491 -0.617  0.819 -0.887
## 59         59  4 -2.368  1.727 -1.556  1.162 -0.819  0.941 -0.572  0.345 -0.279
## 60         60  5 -3.141  1.873 -1.131  0.941 -0.759  1.224 -0.354  0.016 -0.218
## 61         61  6 -3.065  2.372 -1.002  0.496 -1.295  0.860  0.327 -0.404  0.067
## 62         62  7 -3.473  2.178 -0.820  0.706 -1.710  0.779  0.422  0.351  0.426
## 63         63  8 -4.238  2.437  0.036  1.158 -2.127  0.554  0.120  0.823  0.565
## 64         64  9 -3.546  1.258 -1.227  0.823 -0.702  1.734 -0.397  1.333 -0.277
## 65         65 10 -3.869  1.860 -1.646  1.612  0.044  1.531 -0.493  0.862 -0.106
## 66         66 11 -2.666  1.516 -1.198  0.741 -1.066  1.240 -0.574  0.965 -0.130
## 67         67  1 -4.102  0.209  0.414  0.423  0.985  1.434  0.663  0.036 -0.784
## 68         68  2 -1.372 -0.030 -1.003 -0.388 -0.471  1.141  0.654  0.823  0.558
## 69         69  3 -1.816  0.458 -0.947 -0.341  0.085  0.750  0.144  0.462 -0.240
## 70         70  4 -1.954  1.595 -1.593  0.370 -0.136  0.022  0.034  0.321 -0.190
## 71         71  5 -2.654  2.390 -0.008  0.070 -1.063  0.304 -0.105  0.281  0.488
## 72         72  6 -2.321  1.303  0.320 -0.085 -0.278  0.001 -0.094 -0.283  0.852
## 73         73  7 -3.141  3.314 -0.996 -0.394 -0.190 -0.312  0.137  0.631  0.547
## 74         74  8 -3.941  3.353  0.486 -0.506 -1.120  0.101  0.297  0.711 -0.078
## 75         75  9 -4.161  2.937  0.157  0.336 -0.968  0.641  0.088  0.237  0.565
## 76         76 10 -4.520  2.231 -0.088  0.513 -0.528  1.246  0.198  0.242  0.161
## 77         77 11 -3.088  1.389  0.048 -0.216 -0.329  0.910  0.045 -0.075  0.101
## 78         78  1 -4.275  0.162  0.728  0.662  0.940  1.269  0.711  0.073 -0.827
## 79         79  2 -1.657  0.056 -1.044 -0.320 -0.316  1.321  0.638  0.800  0.298
## 80         80  3 -1.709  0.486 -0.953 -0.346  0.020  0.786  0.145  0.564 -0.229
## 81         81  4 -1.952  1.469 -1.375  0.105 -0.154  0.170 -0.047  0.336 -0.098
## 82         82  5 -2.670  2.696 -0.231 -0.028 -1.014  0.486 -0.137  0.448  0.285
## 83         83  6 -2.441  1.415  0.386 -0.335 -0.187 -0.079  0.000 -0.175  0.792
## 84         84  7 -3.146  3.076 -0.683 -0.032 -0.693 -0.060 -0.267  0.476  0.982
## 85         85  8 -3.902  3.586  0.334 -0.669 -1.087  0.255  0.461  0.812 -0.185
## 86         86  9 -4.267  3.010  0.172  0.028 -0.827  0.532  0.099  0.326  0.340
## 87         87 10 -4.650  2.455  0.013  0.681 -0.800  1.434  0.126  0.036  0.382
## 88         88 11 -3.030  1.185  0.314 -0.121 -0.591  0.965  0.353 -0.137 -0.221
## 89         89  1 -4.473  0.373  0.858  0.919  0.778  1.272  0.653 -0.216 -0.891
## 90         90  2 -1.856  0.063 -1.011 -0.238 -0.152  1.461  0.572  0.775  0.154
## 91         91  3 -1.976  0.389 -0.947 -0.250 -0.065  0.949  0.127  0.478 -0.323
## 92         92  4 -1.914  1.473 -1.342 -0.013 -0.213  0.253  0.005  0.229 -0.009
## 93         93  5 -2.700  2.830 -0.389  0.032 -0.958  0.440 -0.168  0.519  0.169
## 94         94  6 -2.554  1.117  0.420 -0.022 -0.645  0.020  0.145 -0.327  0.660
## 95         95  7 -3.054  3.104 -0.513 -0.085 -0.952  0.299 -0.269  0.459  0.892
## 96         96  8 -3.840  3.745  0.121 -0.656 -1.066  0.329  0.734  0.875 -0.295
## 97         97  9 -4.323  2.853  0.385  0.209 -1.096  0.431  0.119  0.268  0.131
## 98         98 10 -4.676  2.537  0.075  0.730 -0.933  1.493  0.049  0.076  0.254
## 99         99 11 -2.922  1.516 -0.002 -0.353 -0.464  1.184  0.383 -0.175 -0.346
## 100       100  1 -4.477  0.246  1.087  1.108  0.682  1.057  0.424 -0.264 -1.195
## 101       101  2 -1.895 -0.012 -0.970 -0.152 -0.161  1.509  0.487  0.809  0.044
## 102       102  3 -1.945  0.352 -1.053 -0.228 -0.120  0.927  0.088  0.509 -0.279
## 103       103  4 -1.912  1.554 -1.455 -0.017 -0.118  0.270 -0.037  0.163 -0.027
```

```
## 104       104  5 -2.724  2.998 -0.560 -0.077 -0.944  0.548 -0.080  0.400  0.144
## 105       105  6 -2.385  1.241  0.272 -0.040 -0.692  0.160 -0.061 -0.189  0.744
## 106       106  7 -3.092  3.014 -0.307 -0.016 -0.956  0.195 -0.227  0.367  0.958
## 107       107  8 -3.917  3.496  0.409 -0.531 -1.150  0.017  0.605  0.977 -0.328
## 108       108  9 -4.232  3.035  0.428  0.497 -1.374  0.549  0.133  0.232  0.129
## 109       109 10 -4.759  2.696  0.104  0.697 -0.787  1.114  0.205 -0.066  0.369
## 110       110 11 -2.945  1.724 -0.312 -0.239 -0.447  1.360  0.014 -0.102  0.021
## 111       111  1 -4.314 -0.106  1.044  1.192  0.687  0.763  0.158 -0.193 -1.342
## 112       112  2 -2.050  0.065 -0.938 -0.037  0.082  1.561  0.393  0.835 -0.029
## 113       113  3 -1.804  0.431 -1.000 -0.427 -0.094  0.848  0.084  0.636 -0.275
## 114       114  4 -1.978  1.542 -1.487 -0.096 -0.025  0.320 -0.063  0.097 -0.073
## 115       115  5 -2.748  3.217 -0.976 -0.213 -0.792  0.771 -0.032  0.223  0.043
## 116       116  6 -2.351  1.530  0.086 -0.075 -0.426  0.125 -0.197  0.033  0.848
## 117       117  7 -3.105  2.916 -0.207  0.031 -0.897  0.021 -0.229  0.256  1.073
## 118       118  8 -3.985  3.614  0.584 -0.420 -1.105 -0.174  0.348  0.885 -0.165
## 119       119  9 -4.160  3.329  0.275  0.394 -1.287  0.693  0.483  0.121  0.286
## 120       120 10 -4.880  3.064  0.060  0.434 -0.575  0.897  0.250  0.085  0.093
## 121       121 11 -3.082  1.633 -0.118 -0.147 -0.484  1.176 -0.086 -0.072  0.086
## 122       122  1 -4.158 -0.342  0.900  1.090  0.560  0.955  0.395 -0.328 -1.520
## 123       123  2 -2.441  0.191 -0.814  0.255  0.411  1.636  0.395  0.761 -0.005
## 124       124  3 -1.672  0.328 -0.833 -0.577 -0.363  0.840  0.180  0.682 -0.124
## 125       125  4 -2.051  1.508 -1.641 -0.058 -0.102  0.346 -0.021  0.109 -0.147
## 126       126  5 -2.788  3.194 -1.142 -0.313 -0.580  0.357  0.281  0.082  0.109
## 127       127  6 -2.489  1.773 -0.180 -0.152 -0.353  0.133 -0.186  0.207  0.788
## 128       128  7 -3.065  3.139 -0.461 -0.221 -0.759 -0.045  0.068  0.274  0.999
## 129       129  8 -3.963  3.938  0.466 -0.564 -1.042 -0.064  0.241  0.888 -0.032
## 130       130  9 -4.136  3.582 -0.407 -0.038 -0.687  1.031  0.491  0.157  0.305
## 131       131 10 -4.944  3.325  0.015  0.079 -0.593  1.047  0.337  0.296 -0.453
## 132       132 11 -3.058  1.678 -0.351 -0.255  0.038  0.692 -0.173  0.226  0.202
## 133       133  1 -1.202 -0.253 -2.487  0.809 -0.367  2.169  0.320  1.034 -1.385
## 134       134  2 -1.077  0.511 -2.006  0.305 -0.584  1.962  0.089  1.406 -0.669
## 135       135  3 -1.768  0.786 -1.468  1.077 -0.347  1.704 -0.171  1.076 -0.691
## 136       136  4 -1.737  1.789 -1.046  1.071 -0.775  1.041 -0.025  0.925 -0.452
## 137       137  5 -2.432  2.126 -0.218  1.422 -1.169  0.410 -0.393  1.326 -0.067
## 138       138  6 -2.125  1.952 -0.415  1.458 -0.985  0.520 -0.344  1.249 -0.370
## 139       139  7 -2.607  2.406 -0.088  1.586 -1.477  0.164 -0.527  1.551  0.033
## 140       140  8 -3.813  3.705 -0.157  1.561 -1.503 -0.366 -0.581  1.412  0.290
## 141       141  9 -3.050  1.600 -0.686  1.543 -1.149 -0.043  0.297  0.727  0.598
## 142       142 10 -3.972  2.279 -0.620  0.954 -1.090  0.719  0.717  0.300  1.309
## 143       143 11 -2.979  1.795 -0.870  1.427 -0.930  1.323 -0.212  1.286 -0.135
## 144       144  1 -1.298 -0.295 -2.433  0.955 -0.278  2.252  0.285  0.915 -1.569
## 145       145  2 -1.012  0.516 -2.041  0.320 -0.634  1.969  0.041  1.414 -0.687
## 146       146  3 -1.501  0.847 -1.619  0.920 -0.488  1.616 -0.161  1.127 -0.613
## 147       147  4 -1.674  1.711 -1.040  1.136 -0.869  1.036 -0.157  0.946 -0.361
## 148       148  5 -2.308  2.023 -0.203  1.493 -1.223  0.379 -0.481  1.403 -0.045
## 149       149  6 -2.155  2.027 -0.393  1.354 -1.045  0.646 -0.246  1.279 -0.396
## 150       150  7 -2.652  2.156 -0.053  1.694 -1.258  0.062 -0.610  1.397  0.133
## 151       151  8 -3.834  3.749 -0.183  1.518 -1.585 -0.281 -0.334  1.191  0.425
## 152       152  9 -3.330  1.529 -0.552  2.023 -0.845  0.016  0.049  0.512  0.396
## 153       153 10 -4.170  2.232 -0.389  1.211 -1.011  0.570  0.543  0.218  1.206
## 154       154 11 -2.867  1.391 -0.817  1.595 -0.883  1.143 -0.427  1.159  0.170
## 155       155  1 -1.393 -0.305 -2.290  1.100 -0.254  2.327  0.363  0.795 -1.521
## 156       156  2 -0.941  0.539 -2.020  0.314 -0.679  1.897  0.028  1.504 -0.632
## 157       157  3 -1.332  0.848 -1.665  0.970 -0.463  1.522 -0.159  1.101 -0.541
```

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## 158       158  4 -1.570  1.655 -1.040  1.160 -0.923  0.961 -0.231  0.955 -0.273
## 159       159  5 -2.227  1.993 -0.156  1.554 -1.190  0.332 -0.548  1.362 -0.013
## 160       160  6 -2.043  1.950 -0.435  1.341 -1.049  0.558 -0.237  1.237 -0.283
## 161       161  7 -2.679  1.731 -0.090  2.003 -1.009  0.038 -0.822  1.232  0.128
## 162       162  8 -3.836  3.699 -0.225  1.520 -1.729 -0.184  0.064  0.970  0.500
## 163       163  9 -3.478  1.703 -0.557  2.191 -1.043  0.339 -0.004  0.587  0.450
## 164       164 10 -4.333  2.438 -0.219  1.372 -0.761  0.306  0.594 -0.022  1.103
## 165       165 11 -2.704  1.285 -0.908  1.570 -0.840  1.044 -0.399  0.951  0.345
## 166       166  1 -1.417 -0.319 -2.254  1.072 -0.221  2.268  0.430  0.923 -1.486
## 167       167  2 -0.961  0.514 -1.951  0.364 -0.680  1.895  0.047  1.539 -0.630
## 168       168  3 -1.220  0.831 -1.674  0.940 -0.425  1.463 -0.063  1.135 -0.422
## 169       169  4 -1.501  1.611 -1.003  1.156 -0.883  0.901 -0.169  0.862 -0.151
## 170       170  5 -2.176  1.952 -0.144  1.659 -1.128  0.280 -0.658  1.346  0.008
## 171       171  6 -1.891  1.776 -0.518  1.461 -1.050  0.567 -0.307  1.152 -0.239
## 172       172  7 -2.624  1.653 -0.156  2.023 -1.052  0.086 -0.752  1.341  0.196
## 173       173  8 -3.763  3.252 -0.262  1.520 -1.684 -0.225  0.235  0.989  0.616
## 174       174  9 -3.549  1.905 -0.509  1.963 -1.200  0.847 -0.157  0.842  0.625
## 175       175 10 -4.373  2.463 -0.171  1.501 -0.639  0.292  0.518 -0.114  1.127
## 176       176 11 -2.562  1.361 -0.940  1.333 -1.047  1.208 -0.316  1.055  0.354
## 177       177  1 -1.384 -0.321 -2.266  0.937 -0.289  2.290  0.463  1.096 -1.436
## 178       178  2 -1.123  0.415 -1.954  0.563 -0.465  1.983  0.027  1.614 -0.568
## 179       179  3 -1.280  0.798 -1.647  0.968 -0.418  1.609 -0.031  1.224 -0.374
## 180       180  4 -1.475  1.557 -1.009  1.202 -0.846  0.883 -0.138  0.822 -0.165
## 181       181  5 -2.205  1.804 -0.199  1.773 -1.089  0.312 -0.621  1.247  0.137
## 182       182  6 -1.824  1.682 -0.669  1.483 -1.036  0.711 -0.249  1.193 -0.274
## 183       183  7 -2.574  1.814 -0.167  1.826 -1.156  0.120 -0.609  1.543  0.110
## 184       184  8 -3.693  3.067 -0.273  1.619 -1.905  0.045  0.006  1.347  0.346
## 185       185  9 -3.545  1.926 -0.512  1.732 -1.109  1.006  0.021  0.820  0.731
## 186       186 10 -4.386  2.271 -0.157  1.536 -0.614  0.230  0.570 -0.117  1.074
## 187       187 11 -2.530  1.492 -0.936  1.210 -1.154  1.316 -0.267  1.149  0.226
## 188       188  1 -1.215 -0.288 -2.423  0.834 -0.379  2.266  0.503  1.337 -1.360
## 189       189  2 -1.400  0.316 -1.894  0.830 -0.242  2.038  0.003  1.667 -0.515
## 190       190  3 -1.494  0.663 -1.580  1.191 -0.252  1.777 -0.072  1.189 -0.409
## 191       191  4 -1.512  1.492 -1.053  1.262 -0.809  0.941 -0.122  0.807 -0.206
## 192       192  5 -2.274  1.653 -0.226  1.857 -0.971  0.327 -0.605  1.121  0.121
## 193       193  6 -1.804  1.556 -0.803  1.388 -0.989  0.751 -0.029  0.963 -0.228
## 194       194  7 -2.447  1.914 -0.208  1.641 -1.159  0.104 -0.539  1.580  0.058
## 195       195  8 -3.675  3.132 -0.241  1.587 -1.750 -0.222  0.039  1.052  0.545
## 196       196  9 -3.425  1.724 -0.638  1.573 -1.041  1.204 -0.124  1.258  0.548
## 197       197 10 -4.376  2.216 -0.269  1.320 -0.660  0.159  0.719  0.008  1.058
## 198       198 11 -2.520  1.520 -0.959  1.296 -1.103  1.149 -0.268  1.249  0.092
## 199       199  1 -1.548 -0.400 -1.659  0.244 -0.101  1.562  0.551  1.248  0.129
## 200       200  2 -1.614  0.287 -1.195 -0.252 -0.257  1.251  0.281  0.898  0.188
## 201       201  3 -1.891  0.988 -1.060  0.119  0.590  0.263  0.372  0.390 -0.376
## 202       202  4 -2.030  1.764 -0.386 -0.249  0.180  0.117  0.096 -0.121  0.067
## 203       203  5 -2.550  2.629  0.084 -0.159 -0.882  0.093 -0.190  0.961  0.032
## 204       204  6 -2.464  1.968  0.026  0.078 -0.542  0.074  0.051  0.596  0.260
## 205       205  7 -3.193  2.026  0.830  0.813 -1.205  0.036 -0.950  0.786  1.045
## 206       206  8 -3.566  1.504  0.940  1.829 -1.224  0.178 -1.454  0.920  0.767
## 207       207  9 -3.299  1.730  0.187  0.121 -1.251  0.796 -0.366  1.091  0.493
## 208       208 10 -3.601  0.742 -0.238  0.332 -0.561  1.275 -0.014  0.844  0.558
## 209       209 11 -2.439  0.789  0.082  0.242 -0.693  0.595 -0.353  0.702  0.413
## 210       210  1 -1.507 -0.457 -1.728  0.256 -0.081  1.571  0.556  1.291  0.121
## 211       211  2 -1.425  0.256 -1.130 -0.284 -0.394  1.253  0.306  0.893  0.272
```

```
## 212       212  3 -1.814  0.923 -0.931  0.120  0.425  0.554  0.237  0.426 -0.184
## 213       213  4 -2.007  1.814 -0.581 -0.027  0.127  0.081  0.089 -0.016  0.115
## 214       214  5 -2.559  2.300  0.408 -0.001 -1.077  0.125 -0.254  0.975  0.070
## 215       215  6 -2.431  1.873  0.208  0.123 -0.634  0.178  0.040  0.612  0.446
## 216       216  7 -3.240  1.749  0.959  1.071 -1.188  0.018 -1.024  0.664  1.007
## 217       217  8 -3.565  1.363  0.958  1.976 -1.268  0.091 -1.363  0.720  0.738
## 218       218  9 -3.198  1.373  0.392  0.423 -1.203  0.656 -0.428  0.994  0.576
## 219       219 10 -3.772  0.904 -0.195  0.317 -0.473  1.310 -0.043  0.898  0.536
## 220       220 11 -2.434  0.870  0.127  0.224 -0.811  0.666 -0.233  0.705  0.408
## 221       221  1 -1.656 -0.496 -1.719  0.363 -0.002  1.637  0.535  1.319 -0.012
## 222       222  2 -1.388  0.215 -1.105 -0.295 -0.390  1.282  0.356  0.816  0.292
## 223       223  3 -1.764  0.888 -1.001  0.197  0.300  0.660  0.159  0.557 -0.301
## 224       224  4 -2.026  1.750 -0.526 -0.131  0.266 -0.055  0.084  0.063  0.047
## 225       225  5 -2.531  1.802  0.739  0.236 -1.169 -0.069 -0.349  0.903  0.123
## 226       226  6 -2.375  1.642  0.308  0.255 -0.820  0.225 -0.092  0.874  0.367
## 227       227  7 -3.179  1.346  0.988  1.320 -0.852 -0.008 -1.234  0.347  1.020
## 228       228  8 -3.570  1.366  0.970  1.957 -1.262  0.002 -1.275  0.585  0.754
## 229       229  9 -3.169  1.041  0.509  0.693 -1.185  0.673 -0.352  0.877  0.434
## 230       230 10 -4.066  1.050 -0.049  0.458 -0.357  1.331 -0.129  0.848  0.509
## 231       231 11 -2.483  0.810  0.185  0.284 -0.917  0.730 -0.111  0.613  0.373
## 232       232  1 -1.823 -0.578 -1.624  0.520  0.052  1.711  0.535  1.318 -0.115
## 233       233  2 -1.450  0.199 -1.127 -0.281 -0.372  1.287  0.369  0.855  0.303
## 234       234  3 -1.790  0.793 -1.041  0.214  0.215  0.694  0.121  0.583 -0.403
## 235       235  4 -2.089  1.695 -0.528 -0.232  0.385 -0.137  0.033  0.071  0.033
## 236       236  5 -2.475  1.498  0.864  0.397 -1.170 -0.234 -0.388  0.825  0.160
## 237       237  6 -2.314  1.494  0.294  0.245 -0.769  0.050 -0.068  0.819  0.618
## 238       238  7 -3.062  1.008  0.935  1.443 -0.579  0.068 -1.333  0.106  0.958
## 239       239  8 -3.576  1.357  0.912  1.878 -1.166  0.039 -1.537  0.658  0.843
## 240       240  9 -3.155  1.021  0.455  0.624 -1.306  0.842 -0.123  0.909  0.328
## 241       241 10 -4.316  1.147  0.088  0.593 -0.314  1.316 -0.255  0.761  0.492
## 242       242 11 -2.608  0.839  0.203  0.305 -0.851  0.780 -0.143  0.607  0.344
## 243       243  1 -1.953 -0.596 -1.543  0.619  0.056  1.742  0.592  1.289 -0.163
## 244       244  2 -1.495  0.117 -1.134 -0.249 -0.370  1.286  0.348  0.854  0.313
## 245       245  3 -1.921  0.719 -0.950  0.299  0.222  0.786  0.128  0.588 -0.462
## 246       246  4 -2.052  1.483 -0.488  0.041 -0.131  0.273 -0.112 -0.064  0.307
## 247       247  5 -2.507  1.528  0.852  0.331 -1.231 -0.259 -0.265  0.856  0.070
## 248       248  6 -2.291  1.146  0.352  0.354 -0.714  0.080 -0.181  0.787  0.709
## 249       249  7 -2.933  0.717  0.829  1.508 -0.517  0.069 -1.163  0.021  0.866
## 250       250  8 -3.530  1.268  0.903  1.887 -1.279  0.008 -1.441  0.657  0.873
## 251       251  9 -3.145  0.863  0.416  0.699 -1.378  0.892  0.020  0.890  0.221
## 252       252 10 -4.394  1.162  0.157  0.608 -0.409  1.352 -0.243  0.758  0.447
## 253       253 11 -2.704  0.917  0.267  0.314 -0.756  0.818 -0.114  0.673  0.261
## 254       254  1 -2.058 -0.610 -1.497  0.696  0.072  1.802  0.626  1.303 -0.192
## 255       255  2 -1.537  0.043 -1.125 -0.213 -0.378  1.265  0.330  0.870  0.293
## 256       256  3 -1.933  0.728 -1.015  0.270  0.199  0.780  0.192  0.706 -0.446
## 257       257  4 -2.076  1.413 -0.584  0.190 -0.350  0.518 -0.406  0.313  0.027
## 258       258  5 -2.554  1.532  0.812  0.367 -1.208 -0.352 -0.252  0.894  0.050
## 259       259  6 -2.343  0.788  0.373  0.492 -0.667  0.279 -0.240  0.827  0.589
## 260       260  7 -2.834  0.654  0.733  1.434 -0.716 -0.028 -0.841  0.239  0.920
## 261       261  8 -3.482  1.127  0.899  1.993 -1.385 -0.050 -1.273  0.647  0.844
## 262       262  9 -3.246  0.712  0.390  0.820 -1.352  1.074  0.197  0.857 -0.056
## 263       263 10 -4.521  1.430  0.162  0.580 -0.351  1.339 -0.259  0.810  0.431
## 264       264 11 -2.804  1.021  0.254  0.331 -0.654  0.854 -0.085  0.678  0.259
## 265       265  1 -3.034 -1.274  0.263  1.521  0.660  1.622 -0.361 -0.468 -0.740
```

```
## 266       266  2 -3.118  0.356  0.377  1.447  0.868  0.407 -0.915 -0.546 -0.637
## 267       267  3 -2.611  0.434  0.231  1.343  0.323 -0.378 -0.618 -0.219 -0.285
## 268       268  4 -1.566  0.930 -0.181 -0.155 -0.164 -0.277  0.144 -0.047 -0.694
## 269       269  5 -2.758  2.067 -0.310 -0.543 -0.687  0.091  0.881  0.172 -0.454
## 270       270  6 -2.497  1.607 -0.621 -0.446 -0.226 -0.152  1.160  0.122 -0.809
## 271       271  7 -3.533  2.319  1.085  0.247 -1.053 -0.429 -0.026  1.305 -0.243
## 272       272  8 -3.893  3.690  0.079 -0.151 -1.093 -0.518  0.198  1.583 -0.257
## 273       273  9 -4.079  2.663 -0.048 -0.315  0.234  0.861  0.335  0.435 -0.546
## 274       274 10 -4.160  2.814  0.557  0.604  0.584  0.477 -0.272  0.784 -0.999
## 275       275 11 -2.910  0.918 -0.138 -0.382  0.115  0.290  0.418  0.757 -0.898
## 276       276  1 -3.162 -1.137  0.300  1.440  0.688  1.645 -0.447 -0.518 -0.520
## 277       277  2 -3.224  0.487  0.822  1.324  0.753  0.352 -0.976 -0.562 -0.489
## 278       278  3 -2.681  0.531  0.252  1.239  0.469 -0.339 -0.652 -0.417 -0.246
## 279       279  4 -1.577  0.907 -0.291  0.007 -0.256 -0.233  0.187 -0.052 -0.627
## 280       280  5 -2.861  2.091 -0.411 -0.438 -0.643  0.317  0.817  0.104 -0.481
## 281       281  6 -2.445  1.503 -0.677 -0.460 -0.140 -0.002  1.014  0.061 -0.599
## 282       282  7 -3.406  2.403  1.025  0.108 -1.100 -0.316  0.099  1.541 -0.304
## 283       283  8 -3.958  3.922  0.150 -0.265 -1.201 -0.249  0.202  1.163 -0.049
## 284       284  9 -4.071  2.754 -0.232 -0.262  0.356  0.694  0.381  0.500 -0.721
## 285       285 10 -4.188  2.637  0.502  0.552  0.735  0.395 -0.026  0.803 -0.874
## 286       286 11 -2.923  0.919 -0.231 -0.307  0.075  0.265  0.403  0.691 -1.012
## 287       287  1 -3.390 -0.956  0.476  1.547  0.658  1.504 -0.650 -0.604 -0.295
## 288       288  2 -3.128  0.280  0.955  1.264  0.753  0.437 -0.841 -0.517 -0.473
## 289       289  3 -2.689  0.528  0.157  1.501  0.349 -0.412 -0.490 -0.512 -0.277
## 290       290  4 -1.693  0.807 -0.038 -0.051 -0.174 -0.372  0.117  0.053 -0.611
## 291       291  5 -2.927  2.202 -0.532 -0.486 -0.519  0.585  0.813 -0.133 -0.475
## 292       292  6 -2.555  1.421 -0.800 -0.233 -0.078  0.244  0.771 -0.112 -0.707
## 293       293  7 -3.439  2.711  1.067  0.029 -1.120 -0.212  0.062  1.440 -0.353
## 294       294  8 -4.067  3.908 -0.065 -0.378 -1.163  0.065  0.508  1.003  0.030
## 295       295  9 -4.068  2.566 -0.068 -0.152  0.126  0.548  0.453  0.577 -0.543
## 296       296 10 -4.314  2.322  0.580  0.279  0.702  0.532 -0.068  0.814 -0.917
## 297       297 11 -3.020  1.033 -0.238 -0.286  0.088  0.235  0.372  0.563 -1.027
## 298       298  1 -3.485 -0.860  0.582  1.501  0.578  1.480 -0.663 -0.602 -0.318
## 299       299  2 -3.049  0.084  0.981  1.193  0.761  0.495 -0.714 -0.466 -0.568
## 300       300  3 -2.837  0.528  0.241  1.629  0.230 -0.545 -0.643 -0.231 -0.186
## 301       301  4 -1.611  0.831 -0.056 -0.048 -0.044 -0.423  0.289 -0.092 -0.633
## 302       302  5 -2.939  2.157 -0.451 -0.209 -0.880  0.697  0.823 -0.035 -0.744
## 303       303  6 -2.842  1.343 -0.713  0.003  0.126  0.411  0.538 -0.077 -0.995
## 304       304  7 -3.587  3.128  0.885 -0.188 -1.164 -0.215  0.051  1.344 -0.641
## 305       305  8 -4.222  3.886  0.016 -0.144 -1.132 -0.053  0.519  1.024  0.075
## 306       306  9 -4.087  2.555  0.123 -0.151  0.118  0.474  0.365  0.495 -0.473
## 307       307 10 -4.442  2.607  0.596  0.191  0.636  0.679 -0.140  0.774 -0.828
## 308       308 11 -2.976  1.033 -0.222 -0.099  0.081  0.052  0.479  0.517 -1.105
## 309       309  1 -3.689 -0.599  0.692  1.307  0.605  1.514 -0.752 -0.697 -0.355
## 310       310  2 -3.278  0.324  1.047  1.152  0.725  0.168 -0.839 -0.381 -0.687
## 311       311  3 -3.249  1.042  0.589  1.408  0.023 -0.821 -0.581  0.031  0.068
## 312       312  4 -1.596  0.885 -0.199  0.199 -0.115 -0.474  0.428 -0.113 -0.610
## 313       313  5 -2.986  2.072 -0.311 -0.083 -0.878  0.449  0.916  0.082 -0.905
## 314       314  6 -3.003  1.163 -0.450  0.328  0.097  0.574  0.427 -0.017 -1.146
## 315       315  7 -3.682  3.672  0.041 -0.508 -0.905  0.028  0.492  0.654 -0.722
## 316       316  8 -4.210  3.869  0.164 -0.047 -1.251 -0.102  0.276  0.919  0.091
## 317       317  9 -4.129  2.686  0.308 -0.125  0.117  0.393  0.199  0.308 -0.478
## 318       318 10 -4.497  3.018  0.609  0.115  0.673  0.709 -0.030  0.861 -0.704
## 319       319 11 -2.846  1.010 -0.219 -0.083  0.091  0.076  0.442  0.509 -1.181
```

```
## 320       320  1 -3.693 -0.568  0.727  1.236  0.612  1.502 -0.804 -0.763 -0.346
## 321       321  2 -3.543  0.624  0.674  1.413  0.653 -0.445 -0.803 -0.256 -0.650
## 322       322  3 -3.293  0.930  0.522  1.480  0.249 -0.661 -0.643 -0.094 -0.132
## 323       323  4 -1.708  0.944 -0.140  0.151 -0.092 -0.481  0.220  0.034 -0.692
## 324       324  5 -2.942  2.091 -0.353 -0.364 -0.610  0.401  0.864  0.191 -0.764
## 325       325  6 -3.253  1.025 -0.286  0.713 -0.036  0.539  0.476 -0.116 -0.945
## 326       326  7 -3.661  3.266 -0.117 -0.237 -0.755  0.092  0.686  0.381 -0.580
## 327       327  8 -4.216  3.638  0.192 -0.023 -1.231 -0.320  0.128  1.030  0.061
## 328       328  9 -4.077  2.542  0.039  0.082  0.218  0.393  0.324  0.399 -0.658
## 329       329 10 -4.544  3.046  1.028 -0.016  0.447  0.884 -0.094  0.885 -0.459
## 330       330 11 -2.711  0.971 -0.023  0.053  0.101 -0.148  0.382  0.476 -1.050
## 331       331  1 -3.322 -0.303 -0.500  0.963  0.921  0.981  1.059 -1.079 -1.004
## 332       332  2 -3.844  1.056 -0.190  1.685  0.617  1.245 -0.811 -0.506 -1.128
## 333       333  3 -2.665  0.772 -1.009  1.307  0.287  0.855 -0.466 -0.190 -0.721
## 334       334  4 -2.493  1.382 -0.929  0.465 -0.369  0.002  0.187 -0.696 -0.310
## 335       335  5 -2.905  2.311 -0.658  0.022 -1.121  0.250  0.467  0.484 -0.157
## 336       336  6 -2.685  1.971 -0.857  0.033 -0.638  0.484  0.143  0.159 -0.218
## 337       337  7 -3.389  2.762 -0.710 -0.026 -0.641  0.112  0.775  0.443 -0.110
## 338       338  8 -4.243  3.354 -0.415  0.898 -1.027 -0.281  0.576  0.480  0.564
## 339       339  9 -3.741  2.700 -1.593  0.782 -0.298  1.378  0.184  1.458 -0.134
## 340       340 10 -4.694  3.229 -1.153  0.702  0.452  0.298  0.454  0.001 -0.264
## 341       341 11 -3.012  1.628 -0.834  0.975 -0.299  0.926  0.174  0.836 -0.239
## 342       342  1 -3.268 -0.079 -0.693  0.763  1.043  1.194  0.892 -1.293 -1.033
## 343       343  2 -3.618  0.916 -0.400  1.771  0.666  1.535 -0.389 -0.342 -1.279
## 344       344  3 -2.693  0.771 -0.870  1.341  0.317  0.925 -0.328 -0.169 -0.936
## 345       345  4 -2.515  1.340 -0.840  0.511 -0.492  0.098  0.047 -0.680 -0.283
## 346       346  5 -2.882  2.165 -0.589  0.173 -1.165  0.014  0.571  0.502 -0.093
## 347       347  6 -2.591  1.809 -0.659 -0.016 -0.673  0.588  0.084  0.182 -0.094
## 348       348  7 -3.354  2.850 -0.887  0.010 -0.551  0.293  0.901  0.320 -0.302
## 349       349  8 -4.228  3.111 -0.380  1.160 -1.188 -0.362  0.516  0.507  0.669
## 350       350  9 -3.901  2.485 -0.950  0.702 -0.470  1.146 -0.109  1.597  0.146
## 351       351 10 -4.708  3.269 -1.121  0.701  0.437  0.176  0.552  0.004 -0.168
## 352       352 11 -3.000  1.524 -0.866  1.015 -0.400  0.861  0.174  0.938 -0.216
## 353       353  1 -3.347 -0.159 -0.414  0.922  0.973  0.978  0.929 -1.211 -1.268
## 354       354  2 -3.518  0.716 -0.365  1.788  0.584  1.678 -0.109 -0.016 -1.501
## 355       355  3 -2.875  0.868 -0.728  1.439  0.355  0.846 -0.378 -0.233 -1.072
## 356       356  4 -2.612  1.403 -0.870  0.470 -0.448  0.172 -0.060 -0.656 -0.334
## 357       357  5 -2.859  2.255 -0.676  0.098 -1.086  0.041  0.732  0.305 -0.141
## 358       358  6 -2.497  1.692 -0.607  0.020 -0.710  0.612  0.093  0.272 -0.060
## 359       359  7 -3.236  2.745 -0.806 -0.200 -0.386  0.358  0.889  0.516 -0.297
## 360       360  8 -4.188  3.229 -0.456  1.077 -1.385 -0.104  0.459  0.558  0.701
## 361       361  9 -3.775  2.188 -1.017  0.687 -0.464  1.189 -0.157  1.673 -0.024
## 362       362 10 -4.744  3.385 -0.886  0.571  0.235  0.183  0.357  0.040  0.203
## 363       363 11 -3.046  1.462 -0.823  0.935 -0.440  0.849  0.085  0.865 -0.178
## 364       364  1 -3.594 -0.137 -0.028  1.018  1.069  0.723  0.695 -0.982 -1.433
## 365       365  2 -3.426  0.584 -0.469  1.776  0.566  1.686  0.070  0.081 -1.483
## 366       366  3 -3.086  1.010 -0.627  1.508  0.338  0.747 -0.479 -0.323 -1.087
## 367       367  4 -2.750  1.475 -0.848  0.364 -0.275  0.020 -0.003 -0.782 -0.291
## 368       368  5 -2.846  2.430 -0.780 -0.153 -0.905  0.240  0.746  0.140 -0.114
## 369       369  6 -2.511  1.511 -0.555  0.226 -0.735  0.631 -0.006  0.520 -0.138
## 370       370  7 -3.124  2.733 -0.857 -0.334 -0.312  0.587  0.849  0.475 -0.174
## 371       371  8 -4.175  3.320 -0.446  0.988 -1.480  0.133  0.507  0.605  0.691
## 372       372  9 -3.777  2.064 -0.983  0.846 -0.373  0.960 -0.040  1.331  0.247
## 373       373 10 -4.788  3.632 -0.710  0.300  0.366 -0.121  0.403 -0.016  0.124
```

```
## 374       374 11 -3.006  1.407 -0.875  0.945 -0.495  0.721  0.212  0.750 -0.037
## 375       375  1 -3.781 -0.011  0.102  1.115  1.036  0.651  0.615 -1.082 -1.272
## 376       376  2 -3.394  0.557 -0.573  1.704  0.608  1.644  0.109  0.200 -1.507
## 377       377  3 -3.091  0.935 -0.574  1.360  0.416  0.764 -0.480 -0.144 -1.295
## 378       378  4 -2.850  1.446 -0.792  0.482 -0.365  0.046 -0.029 -0.761 -0.251
## 379       379  5 -2.884  2.424 -0.764 -0.108 -1.015  0.361  0.712  0.133 -0.017
## 380       380  6 -2.656  1.263 -0.527  0.464 -0.612  0.668 -0.160  0.857 -0.416
## 381       381  7 -3.246  2.796 -0.867 -0.205 -0.316  0.808  0.824  0.062 -0.118
## 382       382  8 -4.172  3.188 -0.375  1.028 -1.410  0.008  0.513  0.635  0.802
## 383       383  9 -3.862  1.801 -0.717  1.133 -0.230  0.922 -0.223  1.264  0.194
## 384       384 10 -4.836  3.871 -0.684  0.182  0.349 -0.176  0.317  0.059 -0.024
## 385       385 11 -2.973  1.304 -0.849  0.984 -0.508  0.590  0.248  0.728  0.073
## 386       386  1 -3.858  0.115  0.050  1.170  0.975  0.703  0.585 -1.191 -1.172
## 387       387  2 -3.404  0.506 -0.591  1.627  0.660  1.456  0.068  0.381 -1.494
## 388       388  3 -2.952  0.777 -0.740  1.311  0.424  0.853 -0.319 -0.082 -1.456
## 389       389  4 -3.005  1.472 -0.716  0.535 -0.392  0.054 -0.054 -0.686 -0.290
## 390       390  5 -2.898  2.421 -0.810 -0.043 -1.164  0.448  0.690  0.218 -0.078
## 391       391  6 -2.906  1.102 -0.491  0.575 -0.386  0.771 -0.134  0.977 -0.540
## 392       392  7 -3.462  2.648 -0.447  0.000 -0.416  0.767  0.569 -0.072 -0.080
## 393       393  8 -4.076  3.336 -0.688  0.677 -1.472  0.461  0.682  0.724  0.717
## 394       394  9 -3.846  1.426 -0.607  1.434 -0.072  1.130 -0.535  1.159 -0.123
## 395       395 10 -4.885  3.967 -0.948  0.373  0.255 -0.121  0.430 -0.013  0.018
## 396       396 11 -2.980  1.290 -0.842  0.955 -0.491  0.572  0.267  0.692  0.084
## 397       397  1 -3.208 -0.608 -0.516  1.098  1.529  1.069  0.186 -0.947 -0.248
## 398       398  2 -2.569 -0.110 -0.841  0.732  1.112  0.961 -0.075  0.148 -0.893
## 399       399  3 -2.210  0.661 -0.581  1.139  0.238  0.074 -0.625 -0.366 -0.326
## 400       400  4 -1.885  2.214 -0.673  0.147 -0.148 -0.400  0.252 -0.098 -0.874
## 401       401  5 -2.488  2.822 -0.239 -0.330 -1.355  0.284  0.101  0.934 -0.966
## 402       402  6 -2.335  2.896 -0.295 -0.420 -0.645  0.351  0.120  0.447 -1.126
## 403       403  7 -2.715  2.325  0.701  0.239 -1.426 -0.218 -0.317  1.516 -0.162
## 404       404  8 -4.210  3.289 -0.106 -1.247 -0.683  0.539  0.579  0.832 -0.035
## 405       405  9 -3.984  2.290 -0.103 -0.707  0.297  0.317  0.857  1.403 -1.253
## 406       406 10 -4.964  2.780  0.474  0.047  0.417 -0.328  0.334  0.474 -1.260
## 407       407 11 -2.528  1.288 -0.144 -0.171 -0.077  0.260 -0.045  0.681 -1.399
## 408       408  1 -3.431 -0.500 -0.362  1.173  1.590  0.956  0.162 -0.853 -0.364
## 409       409  2 -2.659 -0.101 -0.687  0.697  1.081  1.045 -0.149  0.184 -0.927
## 410       410  3 -2.103  0.655 -0.840  1.195  0.377  0.135 -0.504 -0.549 -0.404
## 411       411  4 -1.926  2.172 -0.571  0.257 -0.159 -0.493  0.270 -0.153 -0.673
## 412       412  5 -2.512  2.826 -0.171 -0.385 -1.495  0.381  0.067  0.899 -0.902
## 413       413  6 -2.353  2.897 -0.433 -0.193 -0.715  0.359  0.260  0.273 -1.206
## 414       414  7 -2.708  2.396  0.728  0.336 -1.437 -0.344 -0.411  1.469 -0.022
## 415       415  8 -4.341  3.514 -0.453 -1.047 -0.469  0.510  0.618  0.801 -0.399
## 416       416  9 -4.045  2.193  0.200 -0.745  0.215  0.387  0.625  1.477 -1.207
## 417       417 10 -5.020  2.551  0.562 -0.136  0.531 -0.064  0.373  0.631 -1.407
## 418       418 11 -2.665  1.633 -0.384 -0.111 -0.001  0.234  0.033  0.478 -1.558
## 419       419  1 -3.586 -0.380 -0.359  1.307  1.587  0.990  0.180 -0.831 -0.471
## 420       420  2 -2.889 -0.039 -0.494  0.719  1.104  1.003 -0.415  0.097 -0.855
## 421       421  3 -2.282  0.673 -0.798  1.286  0.308  0.010 -0.411 -0.610 -0.266
## 422       422  4 -1.985  2.161 -0.601  0.424 -0.295 -0.489  0.208 -0.216 -0.562
## 423       423  5 -2.563  2.829 -0.283 -0.368 -1.593  0.408  0.121  0.933 -0.946
## 424       424  6 -2.415  2.517 -0.285  0.085 -0.902  0.283  0.302  0.247 -1.207
## 425       425  7 -2.776  2.563  0.532  0.277 -1.470 -0.368 -0.278  1.479 -0.164
## 426       426  8 -4.384  3.721 -0.905 -0.965 -0.160  0.498  0.809  0.660 -0.613
## 427       427  9 -4.107  2.170  0.206 -0.811  0.334  0.633  0.402  1.097 -1.327
```

```
## 428       428 10 -5.069  2.119  0.826 -0.274  0.576  0.145  0.308  1.001 -1.412
## 429       429 11 -2.812  1.954 -0.661  0.109 -0.011  0.110  0.187  0.096 -1.538
## 430       430  1 -3.760 -0.320 -0.240  1.273  1.751  1.125  0.230 -0.723 -0.501
## 431       431  2 -3.152  0.086 -0.325  0.868  1.084  0.753 -0.522 -0.005 -0.821
## 432       432  3 -2.558  0.755 -0.660  1.366  0.038 -0.011 -0.443 -0.531 -0.062
## 433       433  4 -2.010  2.164 -0.626  0.389 -0.240 -0.441  0.103 -0.270 -0.647
## 434       434  5 -2.601  2.735 -0.322 -0.255 -1.670  0.229  0.202  1.010 -0.871
## 435       435  6 -2.521  2.271 -0.277  0.270 -0.909  0.274  0.348 -0.028 -1.177
## 436       436  7 -2.922  2.621  0.214  0.122 -1.477 -0.173  0.045  1.380 -0.635
## 437       437  8 -4.417  3.765 -1.225 -0.853  0.041  0.536  0.885  0.533 -0.757
## 438       438  9 -4.070  2.254 -0.280 -0.722  0.696  0.683  0.243  0.689 -1.450
## 439       439 10 -5.080  2.241  0.971 -0.374  0.501  0.226  0.144  0.851 -1.319
## 440       440 11 -2.930  2.014 -0.700  0.206 -0.088  0.153  0.142 -0.031 -1.437
## 441       441  1 -4.247 -0.034  0.248  1.372  1.831  1.167  0.087 -0.518 -0.316
## 442       442  2 -3.183  0.154 -0.413  0.923  1.091  0.582 -0.447 -0.085 -0.904
## 443       443  3 -2.514  0.558 -0.777  1.299  0.027  0.247 -0.487 -0.653 -0.028
## 444       444  4 -2.041  2.119 -0.585  0.549 -0.430 -0.291 -0.002 -0.234 -0.751
## 445       445  5 -2.640  2.704 -0.345 -0.230 -1.649  0.064  0.275  0.952 -0.651
## 446       446  6 -2.729  2.104 -0.505  0.138 -0.533  0.455  0.148 -0.407 -1.059
## 447       447  7 -3.025  2.711 -0.147 -0.034 -1.340  0.049  0.364  1.099 -1.020
## 448       448  8 -4.415  3.737 -1.313 -0.815  0.168  0.590  0.975  0.420 -0.825
## 449       449  9 -4.036  2.141 -0.355 -0.602  0.837  0.663 -0.013  0.507 -1.412
## 450       450 10 -5.158  2.488  1.064 -0.343  0.352  0.180 -0.050  0.817 -1.308
## 451       451 11 -2.907  1.992 -0.904  0.205  0.011  0.346 -0.031 -0.148 -1.262
## 452       452  1 -4.687  0.406  0.889  1.464  1.618  1.021 -0.121 -0.398 -0.307
## 453       453  2 -3.096  0.103 -0.452  0.879  1.067  0.497 -0.296 -0.067 -0.973
## 454       454  3 -2.452  0.279 -0.805  1.141  0.239  0.176 -0.104 -0.752 -0.334
## 455       455  4 -2.081  2.043 -0.521  0.578 -0.463 -0.246 -0.041 -0.162 -0.814
## 456       456  5 -2.658  2.739 -0.382 -0.310 -1.640  0.081  0.276  0.884 -0.535
## 457       457  6 -2.982  2.001 -0.915  0.188  0.035  0.467 -0.130 -0.689 -0.684
## 458       458  7 -3.098  2.525 -0.316 -0.322 -1.082  0.285  0.445  0.847 -0.951
## 459       459  8 -4.403  3.602 -0.945 -0.934  0.041  0.409  1.003  0.470 -0.477
## 460       460  9 -4.200  2.201 -0.310 -0.392  0.968  0.700 -0.328  0.129 -0.896
## 461       461 10 -5.211  2.544  0.820 -0.333  0.447  0.226  0.127  0.890 -1.389
## 462       462 11 -2.752  1.778 -0.718  0.057 -0.009  0.402  0.121  0.050 -1.435
## 463       463  1 -5.058  2.236  1.381  1.885 -0.259 -0.483 -0.562  0.123 -0.063
## 464       464  2 -4.181  1.646  0.736  1.286  0.724 -0.511 -1.126 -0.450 -0.648
## 465       465  3 -3.753  0.828 -0.042  1.406  0.209 -0.530 -0.520 -0.400 -0.386
## 466       466  4 -3.494  1.207 -0.607  0.242 -0.430  0.131  0.236  0.545 -0.593
## 467       467  5 -2.813  2.327 -1.246 -0.184 -0.755  0.491  1.202 -0.558 -0.669
## 468       468  6 -3.133  1.983 -1.398  0.254 -0.667  0.532  0.389 -0.178 -0.584
## 469       469  7 -3.749  3.018 -0.755 -0.452 -0.666  0.209  0.741  0.900 -1.613
## 470       470  8 -4.373  4.643 -0.792 -1.332 -0.202  0.597  0.192  1.133 -1.131
## 471       471  9 -4.468  4.121 -0.420 -1.197  0.338  0.600 -0.110  0.314 -1.248
## 472       472 10 -4.902  4.490 -0.564 -0.536 -0.164 -0.298  0.842 -0.158 -0.906
## 473       473 11 -4.125  2.300 -0.167 -0.270  0.103  0.320 -0.467 -0.254 -0.415
## 474       474  1 -5.124  2.319  1.413  1.804 -0.277 -0.330 -0.746  0.221  0.060
## 475       475  2 -4.393  2.137  0.570  1.397  0.293 -0.836 -0.966 -0.461 -0.277
## 476       476  3 -3.961  1.078  0.110  1.232  0.210 -0.670 -0.536 -0.330 -0.268
## 477       477  4 -3.654  1.222 -0.574  0.248 -0.299  0.158  0.154  0.553 -0.580
## 478       478  5 -3.001  2.263 -1.178 -0.116 -0.922  0.536  1.286 -0.506 -0.566
## 479       479  6 -3.417  1.984 -1.148  0.234 -0.778  0.411  0.494  0.130 -0.704
## 480       480  7 -3.887  3.172 -0.739 -0.690 -0.548  0.330  0.569  0.980 -1.609
## 481       481  8 -4.474  4.569 -1.069 -1.409  0.137  1.049  0.071  0.877 -1.355
```

```
## 482       482  9 -4.471  4.096 -0.809 -0.881  0.646  0.539  0.040  0.142 -1.555
## 483       483 10 -4.947  4.637 -0.444 -0.953 -0.119 -0.249  0.594  0.270 -0.783
## 484       484 11 -4.173  2.299 -0.298 -0.130  0.122  0.319 -0.388 -0.328 -0.480
## 485       485  1 -5.131  2.192  1.364  1.936 -0.591 -0.354 -0.677  0.150  0.178
## 486       486  2 -4.395  1.864  0.503  1.718  0.241 -0.817 -0.672 -0.687 -0.449
## 487       487  3 -4.058  1.072  0.157  1.136  0.385 -0.687 -0.583 -0.185 -0.300
## 488       488  4 -3.631  1.195 -0.719  0.130 -0.065  0.348 -0.061  0.555 -0.594
## 489       489  5 -3.434  2.260 -1.065 -0.122 -0.795  0.363  1.403 -0.507 -0.375
## 490       490  6 -3.765  1.970 -0.955  0.304 -0.735  0.410  0.380  0.146 -0.536
## 491       491  7 -3.975  3.066 -0.506 -0.827 -0.478  0.434  0.356  0.939 -1.309
## 492       492  8 -4.497  4.500 -1.446 -1.127  0.443  0.986  0.136  0.597 -1.087
## 493       493  9 -4.475  4.064 -0.927 -0.678  0.599  0.445  0.224  0.103 -1.336
## 494       494 10 -5.011  4.976 -0.868 -1.215  0.170 -0.018  0.543  0.154 -0.841
## 495       495 11 -4.151  2.069 -0.605  0.111  0.410  0.354 -0.284 -0.381 -0.507
## 496       496  1 -5.125  2.077  1.283  2.003 -0.734 -0.513 -0.557  0.055  0.295
## 497       497  2 -4.316  1.409  0.441  1.819  0.500 -0.617 -0.633 -0.621 -0.671
## 498       498  3 -4.149  1.129 -0.008  1.215  0.390 -0.474 -0.400 -0.343 -0.344
## 499       499  4 -3.581  1.188 -0.958  0.189 -0.077  0.451  0.049  0.449 -0.676
## 500       500  5 -3.828  2.367 -0.836 -0.343 -0.466  0.116  1.172 -0.175 -0.275
## 501       501  6 -3.820  1.705 -1.130  0.450 -0.471  0.665  0.298 -0.175 -0.473
## 502       502  7 -3.949  2.990 -0.643 -0.986 -0.175  0.768  0.249  0.803 -1.479
## 503       503  8 -4.471  4.461 -1.887 -0.799  0.719  0.938  0.239  0.342 -1.036
## 504       504  9 -4.580  4.116 -0.753 -0.849  0.516  0.498  0.117  0.181 -1.256
## 505       505 10 -5.049  4.846 -0.678 -0.877 -0.090  0.005  0.253 -0.078 -0.178
## 506       506 11 -4.115  1.856 -0.738  0.132  0.658  0.329 -0.252 -0.123 -0.530
## 507       507  1 -5.143  2.051  1.216  1.898 -0.555 -0.466 -0.842  0.011  0.461
## 508       508  2 -4.403  1.409  0.551  1.496  0.673 -0.616 -0.787 -0.382 -0.696
## 509       509  3 -4.316  1.272 -0.087  1.285  0.126 -0.128 -0.286 -0.463 -0.294
## 510       510  4 -3.622  1.111 -0.972  0.399 -0.402  0.527  0.271  0.373 -0.716
## 511       511  5 -3.850  2.280 -1.055 -0.335 -0.164  0.410  0.913 -0.391 -0.338
## 512       512  6 -3.962  1.724 -1.290  0.531 -0.170  0.528  0.282 -0.149 -0.603
## 513       513  7 -3.894  2.910 -0.968 -0.671 -0.131  0.519  0.591  0.708 -1.515
## 514       514  8 -4.469  4.348 -1.740 -0.886  0.447  0.883  0.374  0.577 -0.908
## 515       515  9 -4.661  4.235 -0.497 -1.021  0.295  0.457 -0.019  0.345 -1.355
## 516       516 10 -5.040  5.074 -1.721 -0.264  0.279  0.176  0.003 -0.609 -0.177
## 517       517 11 -4.169  1.799 -0.621  0.025  0.706  0.362 -0.343 -0.049 -0.339
## 518       518  1 -5.105  1.968  1.140  1.719 -0.443 -0.432 -0.969 -0.173  0.551
## 519       519  2 -4.544  1.672  0.643  1.281  0.504 -0.803 -0.709 -0.229 -0.546
## 520       520  3 -4.426  1.167  0.008  1.315  0.189 -0.297 -0.124 -0.244 -0.423
## 521       521  4 -3.622  0.988 -1.108  0.685 -0.693  0.754  0.442  0.166 -0.458
## 522       522  5 -3.597  2.146 -1.492 -0.142 -0.297  0.815  0.870 -0.490 -0.471
## 523       523  6 -4.122  1.735 -1.340  0.615  0.030  0.353  0.345 -0.104 -0.540
## 524       524  7 -4.065  2.876 -0.856 -0.221 -0.533  0.232  0.855  0.633 -1.452
## 525       525  8 -4.513  4.265 -1.477 -1.090  0.215  0.829  0.342  0.693 -0.601
## 526       526  9 -4.651  4.246 -0.823 -0.831  0.666  0.546 -0.300  0.094 -1.343
## 527       527 10 -5.034  4.993 -1.633 -0.285  0.398  0.181 -0.211 -0.508 -0.283
## 528       528 11 -4.261  1.827 -0.482 -0.194  0.731  0.354 -0.478  0.050 -0.112
##      x.10
## 1  -0.814
## 2  -0.488
## 3  -0.049
## 4  -0.795
## 5  -0.396
## 6  -0.365
```

```
## 7   -0.366
## 8   -0.301
## 9   -0.434
## 10  -0.836
## 11  -0.823
## 12  -0.813
## 13  -0.327
## 14  -0.027
## 15  -0.760
## 16  -0.633
## 17  -0.458
## 18  -0.259
## 19  -0.293
## 20  -0.580
## 21  -0.733
## 22  -0.842
## 23  -0.841
## 24  -0.425
## 25  -0.151
## 26  -0.847
## 27  -0.685
## 28  -0.402
## 29  -0.003
## 30  -0.245
## 31  -0.359
## 32  -0.522
## 33  -0.727
## 34  -0.843
## 35  -0.299
## 36  -0.172
## 37  -0.814
## 38  -0.649
## 39  -0.156
## 40  -0.118
## 41   0.125
## 42  -0.388
## 43  -0.714
## 44  -0.541
## 45  -0.926
## 46  -0.198
## 47  -0.118
## 48  -0.759
## 49  -0.539
## 50  -0.039
## 51  -0.211
## 52  -0.302
## 53  -0.178
## 54  -0.919
## 55  -0.553
## 56  -1.003
## 57  -0.187
## 58  -0.080
## 59  -0.736
## 60  -0.568
```

```
## 61  -0.155
## 62  -0.267
## 63  -0.293
## 64   0.013
## 65  -1.001
## 66  -0.711
## 67  -0.668
## 68   0.043
## 69  -0.266
## 70  -0.491
## 71  -0.382
## 72   0.022
## 73  -0.247
## 74   0.648
## 75   0.823
## 76   0.769
## 77  -0.134
## 78  -0.655
## 79  -0.159
## 80  -0.322
## 81  -0.410
## 82  -0.482
## 83  -0.026
## 84  -0.352
## 85   0.535
## 86   0.696
## 87   0.278
## 88   0.075
## 89  -0.627
## 90  -0.310
## 91  -0.345
## 92  -0.445
## 93  -0.525
## 94   0.073
## 95  -0.308
## 96   0.418
## 97   0.654
## 98   0.276
## 99  -0.033
## 100 -0.520
## 101 -0.264
## 102 -0.246
## 103 -0.474
## 104 -0.630
## 105  0.088
## 106 -0.092
## 107  0.447
## 108  0.487
## 109  0.306
## 110 -0.564
## 111 -0.447
## 112 -0.394
## 113 -0.214
## 114 -0.381
```

```
## 115 -0.825
## 116 -0.038
## 117 -0.065
## 118  0.650
## 119  0.153
## 120  0.445
## 121 -0.564
## 122 -0.498
## 123 -0.564
## 124 -0.109
## 125 -0.298
## 126 -0.858
## 127 -0.285
## 128 -0.331
## 129  0.798
## 130  0.028
## 131  0.371
## 132 -0.593
## 133 -0.706
## 134 -0.027
## 135 -0.060
## 136  0.007
## 137  0.225
## 138  0.145
## 139  0.522
## 140 -0.099
## 141  0.458
## 142  0.171
## 143 -0.496
## 144 -0.562
## 145  0.047
## 146 -0.051
## 147  0.020
## 148  0.402
## 149  0.177
## 150  0.602
## 151 -0.104
## 152  0.386
## 153  0.044
## 154 -0.456
## 155 -0.756
## 156  0.111
## 157 -0.050
## 158  0.065
## 159  0.369
## 160  0.306
## 161  0.720
## 162 -0.130
## 163  0.006
## 164  0.190
## 165 -0.695
## 166 -0.698
## 167  0.094
## 168  0.060
```

```
## 169  0.164
## 170  0.505
## 171  0.325
## 172  0.710
## 173  0.046
## 174 -0.586
## 175  0.332
## 176 -0.770
## 177 -0.701
## 178  0.007
## 179  0.044
## 180  0.198
## 181  0.406
## 182  0.224
## 183  0.750
## 184  0.360
## 185 -0.639
## 186  0.397
## 187 -0.770
## 188 -0.682
## 189 -0.087
## 190  0.090
## 191  0.145
## 192  0.291
## 193  0.297
## 194  0.786
## 195  0.233
## 196 -0.507
## 197  0.472
## 198 -0.682
## 199 -0.456
## 200 -0.423
## 201 -0.655
## 202 -0.552
## 203 -0.589
## 204 -0.437
## 205  0.210
## 206  1.059
## 207  0.436
## 208  0.659
## 209  0.098
## 210 -0.456
## 211 -0.378
## 212 -0.727
## 213 -0.719
## 214 -0.470
## 215 -0.562
## 216  0.443
## 217  1.145
## 218  0.865
## 219  0.503
## 220  0.136
## 221 -0.490
## 222 -0.376
```

```
## 223 -0.650
## 224 -0.691
## 225 -0.119
## 226 -0.525
## 227  0.771
## 228  0.993
## 229  1.009
## 230  0.317
## 231  0.184
## 232 -0.505
## 233 -0.385
## 234 -0.487
## 235 -0.744
## 236  0.057
## 237 -0.572
## 238  0.979
## 239  1.087
## 240  0.876
## 241  0.133
## 242  0.106
## 243 -0.523
## 244 -0.376
## 245 -0.491
## 246 -0.800
## 247  0.069
## 248 -0.409
## 249  1.066
## 250  1.042
## 251  0.834
## 252  0.096
## 253  0.056
## 254 -0.538
## 255 -0.393
## 256 -0.595
## 257 -0.724
## 258  0.084
## 259 -0.267
## 260  0.885
## 261  1.044
## 262  0.485
## 263 -0.102
## 264 -0.031
## 265  0.517
## 266  0.169
## 267  0.347
## 268  0.282
## 269 -0.093
## 270  0.495
## 271 -0.671
## 272 -0.169
## 273 -0.928
## 274 -0.781
## 275 -0.189
## 276  0.641
```

```
## 277  0.172
## 278  0.412
## 279  0.238
## 280 -0.252
## 281  0.175
## 282 -0.671
## 283 -0.039
## 284 -0.859
## 285 -0.913
## 286 -0.157
## 287  0.616
## 288  0.000
## 289  0.422
## 290  0.300
## 291 -0.349
## 292  0.165
## 293 -0.420
## 294 -0.187
## 295 -0.896
## 296 -1.109
## 297 -0.151
## 298  0.575
## 299 -0.149
## 300  0.450
## 301  0.221
## 302 -0.193
## 303  0.092
## 304 -0.253
## 305 -0.226
## 306 -0.886
## 307 -1.122
## 308 -0.125
## 309  0.702
## 310  0.013
## 311  0.325
## 312  0.131
## 313 -0.109
## 314 -0.060
## 315 -0.318
## 316 -0.159
## 317 -0.909
## 318 -1.038
## 319 -0.021
## 320  0.788
## 321  0.423
## 322  0.198
## 323  0.190
## 324 -0.235
## 325 -0.108
## 326 -0.687
## 327 -0.179
## 328 -0.964
## 329 -1.099
## 330 -0.256
```

```
## 331  0.112
## 332  0.076
## 333  0.407
## 334  0.348
## 335 -0.676
## 336 -0.343
## 337 -0.979
## 338 -0.085
## 339 -1.297
## 340 -1.399
## 341 -1.144
## 342  0.199
## 343 -0.109
## 344  0.399
## 345  0.168
## 346 -0.616
## 347 -0.372
## 348 -1.023
## 349 -0.074
## 350 -1.197
## 351 -1.484
## 352 -1.010
## 353  0.278
## 354  0.002
## 355  0.505
## 356  0.087
## 357 -0.636
## 358 -0.507
## 359 -1.075
## 360 -0.320
## 361 -1.144
## 362 -1.680
## 363 -0.954
## 364  0.249
## 365 -0.141
## 366  0.645
## 367  0.167
## 368 -0.746
## 369 -0.651
## 370 -0.899
## 371 -0.462
## 372 -1.090
## 373 -1.320
## 374 -1.054
## 375  0.050
## 376 -0.225
## 377  0.696
## 378  0.113
## 379 -0.847
## 380 -0.596
## 381 -0.749
## 382 -0.280
## 383 -0.935
## 384 -1.130
```

```
## 385 -1.107
## 386 -0.076
## 387 -0.453
## 388  0.616
## 389  0.153
## 390 -0.876
## 391 -0.604
## 392 -0.798
## 393 -0.409
## 394 -0.385
## 395 -1.518
## 396 -1.100
## 397 -0.059
## 398  0.314
## 399  0.557
## 400  0.245
## 401 -0.310
## 402  0.110
## 403 -0.703
## 404 -0.764
## 405 -0.298
## 406 -0.221
## 407 -0.066
## 408  0.084
## 409  0.327
## 410  0.602
## 411 -0.005
## 412 -0.412
## 413  0.360
## 414 -0.717
## 415 -0.777
## 416 -0.270
## 417 -0.267
## 418  0.219
## 419  0.198
## 420  0.356
## 421  0.584
## 422  0.079
## 423 -0.356
## 424  0.371
## 425 -0.797
## 426 -0.831
## 427 -0.040
## 428 -0.306
## 429  0.592
## 430  0.315
## 431  0.483
## 432  0.418
## 433  0.165
## 434 -0.461
## 435  0.432
## 436 -0.757
## 437 -0.789
## 438  0.190
```

```
## 439 -0.300
## 440  0.615
## 441  0.347
## 442  0.693
## 443  0.481
## 444  0.253
## 445 -0.571
## 446  0.625
## 447 -0.652
## 448 -0.748
## 449  0.210
## 450 -0.249
## 451  0.487
## 452  0.293
## 453  0.711
## 454  0.731
## 455  0.425
## 456 -0.548
## 457  0.664
## 458 -0.707
## 459 -0.621
## 460  0.150
## 461 -0.304
## 462  0.281
## 463  0.663
## 464  0.995
## 465  1.070
## 466  0.678
## 467  0.054
## 468  0.844
## 469  0.128
## 470 -0.280
## 471 -0.012
## 472  0.358
## 473  0.863
## 474  0.460
## 475  1.184
## 476  1.098
## 477  0.617
## 478 -0.102
## 479  0.764
## 480  0.283
## 481 -0.167
## 482 -0.023
## 483  0.265
## 484  0.990
## 485  0.380
## 486  1.396
## 487  1.177
## 488  0.806
## 489  0.015
## 490  0.738
## 491  0.204
## 492 -0.073
```

```
## 493 -0.192
## 494  0.707
## 495  0.737
## 496  0.269
## 497  1.193
## 498  0.886
## 499  0.919
## 500  0.117
## 501  0.848
## 502  0.168
## 503 -0.060
## 504 -0.119
## 505  0.131
## 506  0.456
## 507  0.193
## 508  1.139
## 509  0.691
## 510  0.943
## 511  0.260
## 512  1.139
## 513  0.121
## 514 -0.089
## 515  0.062
## 516  0.422
## 517  0.220
## 518  0.176
## 519  1.058
## 520  0.684
## 521  0.738
## 522  0.410
## 523  0.988
## 524  0.272
## 525 -0.056
## 526  0.185
## 527  0.304
## 528  0.321
```

```r
# 1. develop a random forest for the vowel data
rf_vowel <- randomForest(formula = y ~ ., data = train_data)

# 2. fit a random forest model using all features with default tuning parameters
rf_default <- randomForest(formula = y ~ ., data = train_data)

# 3. use 5-fold CV to tune the number of variables randomly sampled as candidates at each split
tuneGrid <- expand.grid(mtry = seq(1, ncol(train_data) - 1, by = 2))
control <- trainControl(method = "cv", number = 5)
set.seed(123)
rf_tuned <- train(x = train_data[, -1], y = train_data[, 1],
                  method = "rf", ntree = 500, tuneGrid = tuneGrid,
                  trControl = control)

# 4. make predictions using the majority vote method, and compute the misclassification rate
# load the vowel.test data
test_data
```

```
##     row.names  y    x.1    x.2    x.3    x.4    x.5    x.6    x.7    x.8    x.9
## 1           1  1 -1.149 -0.904 -1.988  0.739 -0.060  1.206  0.864  1.196 -0.300
## 2           2  2 -2.613 -0.092 -0.540  0.484  0.389  1.741  0.198  0.257 -0.375
## 3           3  3 -2.505  0.632 -0.593  0.304  0.496  0.824 -0.162  0.181 -0.363
## 4           4  4 -1.768  1.769 -1.142 -0.739 -0.086  0.120 -0.230  0.217 -0.009
## 5           5  5 -2.671  3.155 -0.514  0.133 -0.964  0.234 -0.071  1.192  0.254
## 6           6  6 -2.509  1.326  0.354  0.663 -0.724  0.418 -0.496  0.713  0.638
## 7           7  7 -2.764  1.111  0.727  1.540 -0.855  0.261 -1.110  0.227  0.420
## 8           8  8 -3.816  3.426  0.224 -0.384 -1.733  0.434 -0.322  1.333  0.653
## 9           9  9 -3.839  1.248  0.830  0.982 -1.110  0.617 -0.751  0.084  0.309
## 10         10 10 -4.982  1.538  0.960  1.253 -0.640  0.588 -0.484 -0.310 -0.246
## 11         11 11 -2.895  0.682 -0.151  0.218 -0.689  1.118 -0.264  0.922  0.757
## 12         12  1 -1.093 -0.922 -2.091  0.844  0.009  1.247  0.891  1.453 -0.089
## 13         13  2 -2.499  0.119 -0.820  0.346  0.347  1.696  0.245  0.689 -0.084
## 14         14  3 -2.633  0.672 -0.372  0.439  0.437  0.907 -0.402 -0.040 -0.366
## 15         15  4 -1.707  1.652 -1.012 -0.622 -0.293  0.279 -0.276  0.477  0.050
## 16         16  5 -2.696  3.129 -0.520  0.294 -0.989  0.019 -0.066  1.106  0.361
## 17         17  6 -2.592  1.617  0.267  0.380 -0.777  0.487 -0.206  0.733  0.592
## 18         18  7 -2.733  1.088  0.761  1.694 -0.833  0.292 -1.069  0.266  0.369
## 19         19  8 -3.835  3.339  0.290 -0.126 -1.680  0.195 -0.368  1.328  0.523
## 20         20  9 -3.915  2.158  0.781  0.643 -1.023  0.598 -0.718  0.274  0.376
## 21         21 10 -4.848  1.115  0.932  1.615 -0.589  0.592 -0.446 -0.366 -0.447
## 22         22 11 -2.982  0.522 -0.100  0.362 -0.660  1.115 -0.305  0.859  0.637
## 23         23  1 -1.784 -1.074 -1.661  1.324  0.289  1.303  0.924  1.307 -0.346
## 24         24  2 -1.890  0.207 -1.161  0.027 -0.047  1.581  0.277  1.129  0.366
## 25         25  3 -2.677  0.486 -0.061  0.517  0.222  1.102 -0.425 -0.096 -0.373
## 26         26  4 -1.716  1.186 -0.809 -0.515 -0.350  0.290 -0.404  0.678  0.172
## 27         27  5 -2.769  2.906 -0.194  0.349 -0.958  0.089 -0.245  1.004  0.600
## 28         28  6 -2.625  1.551  0.298  0.324 -1.050  0.746  0.067  0.603  0.342
## 29         29  7 -2.632  0.881  0.710  1.800 -0.750  0.330 -1.128  0.177  0.339
## 30         30  8 -3.888  3.085  0.436  0.142 -1.526 -0.052 -0.503  1.085  0.511
## 31         31  9 -3.824  1.832  1.093  1.024 -1.090  0.560 -0.336  0.299  0.126
## 32         32 10 -4.813  1.042  0.887  1.661 -0.534  0.747 -0.513 -0.448 -0.412
## 33         33 11 -2.971  0.463 -0.195  0.323 -0.625  0.941 -0.327  0.780  0.552
## 34         34  1 -2.698 -1.027 -0.940  1.796  0.392  1.330  0.866  0.781 -0.838
## 35         35  2 -1.358  0.136 -1.082 -0.148 -0.609  1.464  0.144  1.149  0.481
## 36         36  3 -2.594  0.621 -0.292  0.521  0.260  1.204 -0.337  0.261 -0.332
## 37         37  4 -1.793  0.925 -0.739 -0.396 -0.211  0.329 -0.403  0.604  0.197
## 38         38  5 -2.920  2.697 -0.116  0.451 -0.859 -0.035 -0.307  0.874  0.622
## 39         39  6 -2.696  1.260  0.436  0.657 -1.161  0.805  0.062  0.575  0.182
## 40         40  7 -2.484  0.559  0.624  1.951 -0.646  0.381 -1.106  0.036  0.240
## 41         41  8 -3.989  3.049  0.304  0.209 -1.260 -0.205 -0.735  0.862  0.551
## 42         42  9 -3.776  1.752  0.920  0.722 -1.164  0.774 -0.010  0.657  0.248
## 43         43 10 -4.717  0.829  0.853  1.980 -0.546  0.688 -0.434 -0.424 -0.636
## 44         44 11 -3.108  0.926 -0.389  0.249 -0.461  0.816 -0.226  0.818  0.387
## 45         45  1 -3.366 -0.826 -0.405  1.643  0.603  1.226  0.524  0.293 -0.858
## 46         46  2 -1.530  0.029 -0.925  0.054 -0.565  1.593  0.123  1.117  0.338
## 47         47  3 -1.817  0.559 -0.801  0.234  0.011  1.215 -0.161  0.809  0.018
## 48         48  4 -1.969  0.835 -0.671 -0.270  0.028  0.400 -0.444  0.530  0.061
## 49         49  5 -3.038  2.475  0.024  0.508 -0.737 -0.102 -0.358  0.706  0.600
## 50         50  6 -2.889  1.418  0.409  0.610 -1.018  0.992  0.005  0.518 -0.027
## 51         51  7 -2.710  0.809  0.754  1.903 -0.764  0.378 -1.123  0.162  0.405
## 52         52  8 -3.992  3.342  0.167  0.086 -1.230 -0.216 -0.824  0.837  0.521
## 53         53  9 -3.810  1.910  0.527  0.478 -0.972  0.945 -0.280  0.719  0.482
```

```
## 54         54 10 -4.683  0.773  0.888  2.302 -0.562  0.395 -0.401 -0.289 -0.839
## 55         55 11 -3.375  1.779 -0.822  0.382 -0.019  0.845  0.123  0.767  0.223
## 56         56  1 -3.312 -0.776 -0.504  1.390  0.860  1.257  0.222  0.314 -0.715
## 57         57  2 -2.073  0.088 -0.730  0.296 -0.286  1.750  0.154  1.078  0.294
## 58         58  3 -1.222  0.491 -0.716  0.004 -0.323  1.108 -0.148  0.773  0.387
## 59         59  4 -2.295  0.883 -0.619 -0.041  0.143  0.378 -0.602  0.335 -0.114
## 60         60  5 -2.968  2.149  0.130  0.676 -0.790  0.112 -0.507  0.762  0.625
## 61         61  6 -2.784  1.430  0.145  0.309 -0.931  1.342  0.017  0.589 -0.044
## 62         62  7 -3.073  1.532  0.949  1.541 -1.058  0.272 -0.961  0.449  0.619
## 63         63  8 -3.958  4.132 -0.074 -0.190 -1.184 -0.110 -0.679  1.198  0.442
## 64         64  9 -3.947  2.102  0.305  0.462 -0.765  1.037 -0.618  0.741  0.345
## 65         65 10 -4.756  0.965  0.959  2.287 -0.527  0.454 -0.410 -0.362 -0.862
## 66         66 11 -3.366  1.952 -0.898  0.258  0.282  0.835  0.290  0.681  0.431
## 67         67  1 -3.137  0.077 -1.157  1.589  0.204  1.898  0.170  0.676 -1.033
## 68         68  2 -3.262  0.956 -0.791  1.528 -0.021  0.977 -0.121  0.499 -0.990
## 69         69  3 -2.045  0.819 -1.460  0.652 -0.701  0.352 -0.087  0.793 -0.567
## 70         70  4 -1.993  1.725 -1.130  0.556 -1.223  0.485  0.211 -0.040 -0.294
## 71         71  5 -2.765  2.817 -2.020  0.213 -0.772  0.852  0.252 -0.193 -0.202
## 72         72  6 -2.550  2.391 -1.137  0.090 -0.948  0.217  0.051  0.723 -0.558
## 73         73  7 -3.297  2.880 -0.859 -0.301 -1.020  0.798  0.288  0.855 -0.528
## 74         74  8 -4.047  3.899 -0.423  0.147 -1.273  0.203  0.317  0.531  0.584
## 75         75  9 -4.101  2.840 -0.802  0.062 -0.733  1.304 -0.145  0.443  0.049
## 76         76 10 -4.693  3.146 -0.136  0.587 -0.731  1.055 -0.104 -0.021  0.637
## 77         77 11 -3.730  1.872 -0.801  0.555 -0.427  0.791  0.196  0.650 -0.744
## 78         78  1 -3.019  0.058 -1.265  1.497  0.171  1.997  0.178  0.847 -1.160
## 79         79  2 -3.339  1.004 -0.747  1.505 -0.068  1.007 -0.017  0.377 -0.775
## 80         80  3 -2.008  0.785 -1.489  0.654 -0.685  0.313 -0.085  0.856 -0.516
## 81         81  4 -1.951  1.684 -1.039  0.586 -1.166  0.345  0.330 -0.108 -0.198
## 82         82  5 -2.785  2.792 -1.924  0.225 -0.985  1.076  0.070 -0.071 -0.257
## 83         83  6 -2.538  2.351 -1.029  0.146 -0.922  0.201 -0.058  0.835 -0.712
## 84         84  7 -3.231  3.003 -1.161 -0.315 -0.816  0.870  0.311  0.677 -0.565
## 85         85  8 -4.033  4.071 -0.586  0.127 -1.447  0.620  0.197  0.711  0.480
## 86         86  9 -4.130  3.105 -1.141  0.183 -0.498  1.324 -0.399  0.675 -0.339
## 87         87 10 -4.718  3.281 -0.203  0.651 -0.883  1.413 -0.663  0.583  0.237
## 88         88 11 -3.700  1.841 -0.675  0.441 -0.383  0.890  0.176  0.594 -0.677
## 89         89  1 -2.973  0.036 -1.273  1.519  0.195  1.980  0.131  0.832 -1.157
## 90         90  2 -3.485  1.092 -0.674  1.395 -0.027  1.039 -0.047  0.384 -0.761
## 91         91  3 -1.929  0.777 -1.415  0.598 -0.579  0.215 -0.061  0.733 -0.333
## 92         92  4 -1.928  1.578 -0.997  0.672 -1.287  0.381  0.249  0.006 -0.167
## 93         93  5 -2.823  2.743 -2.012  0.234 -0.919  1.103  0.091 -0.177 -0.143
## 94         94  6 -2.521  2.283 -0.954  0.232 -0.918  0.253 -0.094  0.833 -0.704
## 95         95  7 -3.173  3.166 -1.501 -0.370 -0.437  0.974  0.179  0.556 -0.794
## 96         96  8 -4.049  4.039 -0.558  0.064 -1.676  1.024  0.047  1.024 -0.091
## 97         97  9 -4.130  3.291 -1.424  0.359 -0.273  1.297 -0.454  0.620 -0.527
## 98         98 10 -4.753  3.421 -0.189  0.656 -0.984  1.443 -0.652  0.546  0.123
## 99         99 11 -3.725  1.904 -0.737  0.433 -0.369  1.047  0.120  0.425 -0.678
## 100       100  1 -3.000  0.042 -1.238  1.529  0.187  2.028  0.104  0.759 -1.180
## 101       101  2 -3.587  1.193 -0.617  1.340 -0.022  1.103 -0.072  0.368 -0.854
## 102       102  3 -1.895  0.755 -1.388  0.638 -0.614  0.246 -0.033  0.693 -0.270
## 103       103  4 -1.925  1.517 -0.999  0.634 -1.270  0.207  0.385  0.004 -0.141
## 104       104  5 -2.797  2.706 -1.936  0.147 -0.921  1.240 -0.082 -0.006 -0.214
## 105       105  6 -2.561  2.191 -0.955  0.214 -0.841  0.386 -0.083  0.740 -0.612
## 106       106  7 -3.152  3.176 -1.573 -0.204 -0.485  0.723  0.308  0.652 -0.872
## 107       107  8 -4.064  4.106 -0.545  0.030 -1.645  0.904  0.103  0.907  0.050
```

```
## 108       108  9 -4.139  3.363 -1.464  0.459 -0.066  1.045 -0.146  0.172 -0.124
## 109       109 10 -4.782  3.325 -0.071  0.663 -0.913  1.012 -0.033 -0.103  0.483
## 110       110 11 -3.731  1.927 -0.705  0.453 -0.372  1.149  0.046  0.323 -0.627
## 111       111  1 -3.055  0.088 -1.217  1.562  0.186  2.059  0.054  0.639 -1.121
## 112       112  2 -3.711  1.377 -0.584  1.428 -0.033  1.062 -0.127  0.328 -1.092
## 113       113  3 -1.926  0.689 -1.433  0.716 -0.588  0.269 -0.044  0.716 -0.245
## 114       114  4 -1.948  1.536 -1.012  0.537 -1.229  0.183  0.460 -0.002 -0.178
## 115       115  5 -2.800  2.609 -1.726  0.036 -0.941  1.039  0.191  0.044 -0.165
## 116       116  6 -2.691  2.111 -1.067  0.174 -0.649  0.431 -0.017  0.655 -0.498
## 117       117  7 -3.190  3.101 -1.659 -0.182 -0.436  0.828  0.272  0.502 -0.857
## 118       118  8 -4.074  4.187 -0.555  0.052 -1.603  0.730 -0.061  0.981  0.249
## 119       119  9 -4.174  3.540 -1.430  0.417  0.267  0.918 -0.118 -0.267 -0.162
## 120       120 10 -4.827  3.391 -0.099  0.599 -0.723  0.741  0.089 -0.214  0.518
## 121       121 11 -3.735  2.096 -0.818  0.463 -0.221  1.144  0.023  0.224 -0.745
## 122       122  1 -3.117  0.146 -1.228  1.635  0.223  2.026  0.036  0.569 -1.150
## 123       123  2 -3.871  1.694 -0.606  1.428  0.044  0.844 -0.013  0.126 -1.218
## 124       124  3 -2.029  0.698 -1.482  0.813 -0.681  0.422  0.016  0.751 -0.300
## 125       125  4 -1.998  1.497 -1.005  0.519 -1.236  0.398  0.273  0.151 -0.319
## 126       126  5 -2.914  2.541 -1.567  0.067 -1.051  1.207  0.006  0.289 -0.325
## 127       127  6 -2.937  2.183 -1.291  0.355 -0.372  0.570  0.045  0.452 -0.705
## 128       128  7 -3.239  2.916 -1.406 -0.455 -0.454  1.219  0.078  0.383 -0.776
## 129       129  8 -4.069  4.205 -0.614 -0.060 -1.462  0.476  0.381  0.589  0.405
## 130       130  9 -4.235  3.775 -1.593  0.814  0.288  0.805 -0.566 -0.247 -0.409
## 131       131 10 -4.884  3.630 -0.279  0.496 -0.670  0.792 -0.005 -0.137  0.532
## 132       132 11 -3.756  2.204 -0.716  0.529 -0.284  1.121  0.022  0.127 -0.782
## 133       133  1 -4.066  0.398 -0.382  1.679  0.121  1.617  0.504 -0.315 -0.226
## 134       134  2 -2.966  0.659 -1.057  1.360  0.152  1.435  0.197  0.926 -0.450
## 135       135  3 -2.695  1.119 -0.986  0.172  0.499  0.372  0.088  0.630 -0.721
## 136       136  4 -2.482  1.896 -1.289  0.112  0.285  0.096  0.022  0.832 -0.333
## 137       137  5 -2.742  2.729 -0.129 -0.490 -0.573  0.868  0.070  0.771  0.053
## 138       138  6 -2.434  2.903 -1.341 -0.411  0.372  0.843 -0.022  0.336  0.123
## 139       139  7 -2.973  3.557 -0.396 -0.719 -0.669  0.923  0.293  1.009  0.140
## 140       140  8 -4.103  3.812  0.255 -0.103 -0.994  0.097 -0.345  2.039  0.020
## 141       141  9 -3.863  3.245 -0.996  0.486 -0.348  0.190  0.558  1.342  0.176
## 142       142 10 -4.611  2.962 -0.856  1.161 -0.612  0.469  0.162  0.705  0.370
## 143       143 11 -3.548  1.611 -0.850  0.374  0.168  0.318  0.463  0.863 -1.131
## 144       144  1 -4.052  0.350 -0.314  1.734  0.127  1.667  0.512 -0.377 -0.358
## 145       145  2 -3.034  0.694 -1.007  1.453  0.155  1.480  0.179  1.005 -0.540
## 146       146  3 -2.667  1.132 -1.054  0.232  0.537  0.352  0.163  0.550 -0.688
## 147       147  4 -2.395  1.929 -1.496  0.372  0.065  0.009  0.149  0.813 -0.484
## 148       148  5 -2.758  2.839 -0.282 -0.449 -0.485  0.788  0.120  0.792  0.023
## 149       149  6 -2.464  2.755 -0.975 -0.651  0.158  1.047 -0.145  0.203  0.246
## 150       150  7 -3.045  3.312  0.171 -0.605 -1.027  0.924  0.353  0.897  0.365
## 151       151  8 -4.089  3.712  0.315 -0.050 -0.929  0.018 -0.350  1.770  0.244
## 152       152  9 -3.989  3.582 -1.100  0.374 -0.120  0.291  0.663  0.960  0.023
## 153       153 10 -4.602  3.043 -0.959  0.828 -0.298  0.315  0.423  0.570  0.387
## 154       154 11 -3.707  1.486 -0.494  0.402  0.183  0.186  0.234  1.029 -0.856
## 155       155  1 -3.894  0.117 -0.407  1.973  0.043  1.891  0.411 -0.095 -0.436
## 156       156  2 -3.053  0.716 -1.024  1.422  0.184  1.473  0.261  0.983 -0.431
## 157       157  3 -2.615  1.185 -1.162  0.395  0.459  0.345  0.298  0.456 -0.620
## 158       158  4 -2.303  1.954 -1.493  0.305  0.047  0.056  0.026  0.902 -0.522
## 159       159  5 -2.790  2.665  0.036 -0.440 -0.604  0.811  0.098  0.723  0.134
## 160       160  6 -2.445  2.678 -0.816 -0.743  0.076  1.117 -0.057  0.018  0.281
## 161       161  7 -3.024  3.260  0.350 -0.577 -1.183  0.872  0.556  0.762  0.395
```

```
## 162       162  8 -3.983  3.695  0.096 -0.333 -1.010  0.169 -0.108  1.674  0.262
## 163       163  9 -3.960  3.373 -1.235  0.152  0.031  0.664  0.558  0.841 -0.133
## 164       164 10 -4.617  3.033 -0.909  0.604 -0.341  0.636  0.294  0.527  0.480
## 165       165 11 -3.789  1.420 -0.372  0.568  0.123  0.185  0.078  1.006 -0.722
## 166       166  1 -3.676 -0.185 -0.563  2.377  0.096  1.854  0.303  0.296 -0.358
## 167       167  2 -3.033  0.700 -1.077  1.266  0.196  1.453  0.317  0.947 -0.324
## 168       168  3 -2.600  1.219 -1.315  0.589  0.311  0.364  0.451  0.350 -0.556
## 169       169  4 -2.316  2.007 -1.365  0.181  0.206  0.071  0.037  0.814 -0.332
## 170       170  5 -2.700  2.686 -0.043 -0.528 -0.626  0.917  0.167  0.652  0.100
## 171       171  6 -2.444  2.529 -0.487 -0.814 -0.151  1.285  0.077 -0.064  0.287
## 172       172  7 -2.969  3.128  0.504 -0.487 -1.371  0.704  0.660  0.676  0.469
## 173       173  8 -3.878  3.816 -0.155 -0.668 -1.207  0.541  0.022  1.972 -0.029
## 174       174  9 -3.896  2.768 -0.816 -0.014 -0.125  0.168  0.307  1.203  0.246
## 175       175 10 -4.717  3.059 -0.682  0.532 -0.480  0.731  0.174  0.493  0.635
## 176       176 11 -3.689  1.367 -0.389  0.376  0.136  0.343  0.156  1.010 -0.611
## 177       177  1 -3.644 -0.215 -0.579  2.307  0.046  1.945  0.280  0.272 -0.539
## 178       178  2 -3.034  0.452 -0.946  0.931  0.128  1.514  0.142  0.932 -0.104
## 179       179  3 -2.817  1.268 -1.127  0.707  0.399  0.406  0.289  0.319 -0.691
## 180       180  4 -2.382  1.984 -1.096 -0.103  0.369  0.204 -0.125  0.752 -0.136
## 181       181  5 -2.540  2.925 -0.377 -0.745 -0.562  0.981  0.303  0.539  0.127
## 182       182  6 -2.505  2.358 -0.184 -0.792 -0.316  1.363  0.302 -0.121  0.214
## 183       183  7 -2.951  2.640  0.832 -0.387 -1.502  0.272  0.756  0.538  0.616
## 184       184  8 -3.979  3.661  0.169 -0.598 -1.412  0.569  0.009  1.939  0.094
## 185       185  9 -4.083  2.315 -0.375  0.520 -0.019 -0.211 -0.172  1.054  0.387
## 186       186 10 -4.805  3.228 -0.501  0.602 -0.532  0.745  0.090  0.445  0.756
## 187       187 11 -3.661  1.292 -0.433  0.340  0.098  0.363  0.246  0.911 -0.415
## 188       188  1 -3.337 -0.347 -0.790  2.129 -0.058  2.079  0.295  0.246 -0.687
## 189       189  2 -3.000  0.217 -0.855  0.803 -0.008  1.795 -0.010  1.070 -0.061
## 190       190  3 -3.047  1.267 -0.799  0.507  0.524  0.507  0.044  0.302 -0.731
## 191       191  4 -2.450  1.993 -1.080 -0.090  0.367  0.324 -0.164  0.684 -0.181
## 192       192  5 -2.544  2.725 -0.067 -0.787 -0.903  0.970  0.524  0.320  0.283
## 193       193  6 -2.703  2.066  0.205 -0.630 -0.345  1.229  0.403 -0.032  0.247
## 194       194  7 -3.015  2.219  0.996 -0.455 -1.514  0.047  0.864  0.468  0.657
## 195       195  8 -4.122  3.177  0.529 -0.176 -1.307  0.132 -0.279  1.353  0.458
## 196       196  9 -4.047  2.626 -0.597  0.823 -0.266  0.048  0.049  0.882  0.359
## 197       197 10 -4.893  3.370 -0.464  0.538 -0.327  0.496  0.270  0.470  0.742
## 198       198 11 -3.664  1.119 -0.459  0.482  0.082  0.221  0.185  0.861 -0.237
## 199       199  1 -2.463 -0.197 -1.264  1.150  0.234  1.833  0.066  0.738 -1.382
## 200       200  2 -2.913  0.757 -0.819  1.245  0.419  1.170  0.051  0.328 -0.960
## 201       201  3 -2.012  1.134 -1.029  0.205  0.661  0.359  0.456  0.372 -0.939
## 202       202  4 -2.101  1.502 -0.322 -0.363  0.026  0.116  0.162 -0.074 -0.106
## 203       203  5 -2.565  1.871 -0.269  0.187 -0.656  0.267 -0.328  0.184  0.348
## 204       204  6 -2.346  1.604 -0.283  0.393 -0.416  0.268 -0.463  0.387  0.253
## 205       205  7 -3.008  2.882 -0.900  0.214 -0.565 -0.197  0.449  0.305  0.413
## 206       206  8 -3.823  3.536 -2.070  0.245 -0.442  1.125  0.730  0.538 -0.006
## 207       207  9 -4.019  3.520 -1.058 -0.200 -0.545  1.348  0.351  0.820 -0.868
## 208       208 10 -4.022  0.941 -0.623  1.461  0.020  1.904 -0.074  0.464 -0.541
## 209       209 11 -3.209  1.850 -0.394  0.555  0.425  0.313  0.067  0.077 -0.163
## 210       210  1 -2.377 -0.266 -1.371  1.090  0.240  1.843  0.107  0.702 -1.256
## 211       211  2 -2.961  0.766 -0.800  0.962  0.658  1.012  0.347 -0.015 -0.425
## 212       212  3 -2.207  1.090 -0.627  0.024  0.912  0.662  0.241  0.348 -0.702
## 213       213  4 -2.131  1.487 -0.302 -0.272  0.012  0.067  0.149  0.022 -0.133
## 214       214  5 -2.596  1.867 -0.208  0.208 -0.574  0.146 -0.214  0.116  0.395
## 215       215  6 -2.378  1.568 -0.243  0.407 -0.428  0.229 -0.293  0.297  0.372
```

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## 216       216  7 -3.117  2.876 -0.746 -0.047 -0.427 -0.053  0.453  0.305  0.541
## 217       217  8 -3.911  3.703 -1.965  0.132 -0.209  0.929  0.811  0.495 -0.142
## 218       218  9 -4.135  3.651 -0.751 -0.066 -0.789  1.131  0.496  0.788 -0.883
## 219       219 10 -4.028  0.982 -0.648  1.478 -0.048  2.108 -0.146  0.467 -0.654
## 220       220 11 -3.265  1.933 -0.316  0.602  0.438  0.336  0.048  0.134 -0.160
## 221       221  1 -2.382 -0.294 -1.397  1.051  0.211  1.901  0.151  0.654 -1.286
## 222       222  2 -2.941  0.710 -0.855  0.902  0.635  0.924  0.466  0.010 -0.342
## 223       223  3 -2.306  1.086 -0.590  0.106  0.931  0.733  0.213  0.274 -0.684
## 224       224  4 -2.162  1.533 -0.267 -0.287 -0.026  0.122  0.168 -0.024 -0.268
## 225       225  5 -2.639  1.880 -0.389  0.204 -0.571  0.094 -0.233  0.279  0.426
## 226       226  6 -2.458  1.586 -0.359  0.376 -0.244  0.134 -0.163  0.298  0.444
## 227       227  7 -3.242  2.901 -0.632 -0.332 -0.421  0.226  0.536  0.142  0.623
## 228       228  8 -3.977  3.684 -1.242 -0.364 -0.217  0.594  0.759  0.600  0.069
## 229       229  9 -4.094  3.586 -0.845 -0.026 -0.538  0.964  0.666  0.647 -0.412
## 230       230 10 -4.138  1.128 -0.601  1.553 -0.019  2.039 -0.176  0.262 -0.551
## 231       231 11 -3.242  1.802 -0.482  0.699  0.424  0.337  0.115  0.272 -0.205
## 232       232  1 -2.453 -0.320 -1.368  1.040  0.174  1.985  0.158  0.590 -1.318
## 233       233  2 -2.957  0.596 -0.756  0.890  0.580  0.836  0.543  0.036 -0.232
## 234       234  3 -2.289  1.106 -0.816  0.228  0.867  0.616  0.338  0.298 -0.843
## 235       235  4 -2.175  1.631 -0.331 -0.203 -0.159  0.246  0.180 -0.093 -0.351
## 236       236  5 -2.723  1.975 -0.636  0.336 -0.677  0.156 -0.342  0.479  0.381
## 237       237  6 -2.580  1.608 -0.311  0.273 -0.148  0.262 -0.062  0.167  0.337
## 238       238  7 -3.311  2.946 -0.808 -0.300 -0.457  0.324  0.515  0.149  0.533
## 239       239  8 -4.052  3.747 -1.240 -0.299 -0.426  0.917  0.517  0.716 -0.210
## 240       240  9 -4.039  3.506 -0.964  0.041 -0.400  0.976  0.650  0.659 -0.216
## 241       241 10 -4.319  1.338 -0.549  1.678  0.027  1.922 -0.228  0.161 -0.470
## 242       242 11 -3.329  1.788 -0.517  0.597  0.503  0.278  0.121  0.176 -0.159
## 243       243  1 -2.460 -0.325 -1.404  0.928  0.122  2.049  0.274  0.532 -1.113
## 244       244  2 -2.904  0.458 -0.656  0.832  0.610  0.805  0.568  0.041 -0.114
## 245       245  3 -2.318  1.097 -0.832  0.260  0.821  0.588  0.402  0.327 -0.852
## 246       246  4 -2.147  1.655 -0.355 -0.082 -0.194  0.296  0.146 -0.083 -0.314
## 247       247  5 -2.733  2.026 -0.710  0.377 -0.774  0.284 -0.469  0.693  0.205
## 248       248  6 -2.729  1.595 -0.150  0.167  0.015  0.377  0.083 -0.038  0.166
## 249       249  7 -3.338  3.033 -1.189 -0.269 -0.364  0.544  0.491  0.148  0.365
## 250       250  8 -4.048  3.753 -1.150 -0.209 -0.530  0.871  0.445  0.716 -0.131
## 251       251  9 -4.142  3.454 -0.653  0.271 -0.598  0.793  0.563  0.520 -0.118
## 252       252 10 -4.457  1.512 -0.514  1.764  0.063  1.860 -0.332  0.189 -0.521
## 253       253 11 -3.407  1.821 -0.675  0.765  0.256  0.469 -0.090  0.322 -0.387
## 254       254  1 -2.391 -0.347 -1.474  0.843  0.089  2.021  0.417  0.502 -0.860
## 255       255  2 -2.919  0.463 -0.716  0.957  0.635  0.833  0.501  0.048 -0.134
## 256       256  3 -2.385  1.010 -0.754  0.370  0.785  0.471  0.415  0.318 -0.797
## 257       257  4 -2.104  1.600 -0.297 -0.071 -0.172  0.285  0.152 -0.089 -0.296
## 258       258  5 -2.706  2.070 -0.691  0.310 -0.745  0.266 -0.413  0.602  0.360
## 259       259  6 -2.855  1.587 -0.030  0.202  0.165  0.445  0.207 -0.067 -0.013
## 260       260  7 -3.339  3.011 -1.264 -0.343 -0.119  0.498  0.589  0.078  0.221
## 261       261  8 -4.039  3.689 -1.007 -0.139 -0.542  0.587  0.535  0.465  0.194
## 262       262  9 -4.172  3.070 -0.781  0.516 -0.627  1.006  0.531  0.441 -0.102
## 263       263 10 -4.494  1.535 -0.495  1.715  0.044  1.892 -0.367  0.362 -0.583
## 264       264 11 -3.285  1.547 -0.897  0.917  0.127  0.402 -0.011  0.502 -0.557
## 265       265  1 -3.415 -0.538  0.241  2.038  0.622  1.027 -0.701 -0.660 -0.418
## 266       266  2 -3.439  1.007  0.020  1.491  0.777  0.257 -0.777 -0.282 -0.707
## 267       267  3 -2.814  1.515 -0.088  0.597 -0.033 -0.290 -0.445  0.113 -0.136
## 268       268  4 -2.027  2.157 -0.297 -0.211 -0.266  0.086 -0.176 -0.179 -0.283
## 269       269  5 -2.263  3.344 -1.165 -0.625 -0.159  0.926  0.130 -0.330 -0.783
```

```
## 270       270  6 -2.594  2.584 -0.370 -0.524 -0.177  0.515 -0.137  0.095 -0.731
## 271       271  7 -2.702  3.596 -0.570 -1.041 -0.709  1.009  0.403  0.426 -1.013
## 272       272  8 -3.440  3.203 -0.698 -0.860 -0.542  1.503  0.922  0.467 -0.183
## 273       273  9 -3.961  4.144 -0.934 -0.089 -0.612  0.787  0.326  0.182 -0.487
## 274       274 10 -4.471  3.192 -0.161  0.117 -0.327  0.406 -0.201  0.919 -0.716
## 275       275 11 -3.012  2.252 -0.806  0.389 -0.110  0.649 -0.328  0.321 -0.559
## 276       276  1 -3.705 -0.204  0.274  1.569  0.883  1.366 -0.940 -0.691 -0.162
## 277       277  2 -3.303  0.702 -0.209  1.627  0.818  0.287 -0.541 -0.198 -0.717
## 278       278  3 -2.640  1.322 -0.111  0.861  0.026 -0.354 -0.425  0.083 -0.235
## 279       279  4 -1.948  2.143 -0.068 -0.211 -0.238  0.263 -0.270 -0.238 -0.342
## 280       280  5 -2.247  3.420 -0.887 -0.823 -0.297  0.774  0.185 -0.242 -0.790
## 281       281  6 -2.489  2.401 -0.440 -0.367 -0.069  0.533  0.011  0.118 -0.621
## 282       282  7 -2.776  3.557 -0.435 -1.044 -0.572  1.273  0.221  0.295 -0.986
## 283       283  8 -3.356  3.236 -0.653 -0.900 -0.661  1.430  0.901  0.395 -0.139
## 284       284  9 -3.909  3.674 -0.648  0.088 -0.365  0.199  0.424  0.336 -0.012
## 285       285 10 -4.386  3.055  0.075 -0.018 -0.436  0.566 -0.288  0.936 -0.577
## 286       286 11 -3.067  2.549 -0.851  0.505  0.044  0.574 -0.377  0.147 -0.606
## 287       287  1 -3.699 -0.251  0.268  1.585  0.850  1.381 -0.867 -0.710 -0.190
## 288       288  2 -3.266  0.577 -0.261  1.481  0.874  0.301 -0.496 -0.012 -0.623
## 289       289  3 -2.676  1.411 -0.098  1.047 -0.040 -0.131 -0.560 -0.030 -0.192
## 290       290  4 -1.899  2.135  0.092 -0.110 -0.145  0.081 -0.067 -0.104 -0.408
## 291       291  5 -2.305  3.625 -1.203 -0.665 -0.296  0.775  0.197 -0.282 -0.842
## 292       292  6 -2.489  2.379 -0.523 -0.158 -0.178  0.406  0.198  0.059 -0.589
## 293       293  7 -2.898  3.393 -0.409 -0.993 -0.587  1.322  0.240  0.231 -1.068
## 294       294  8 -3.376  3.327 -0.797 -0.849 -0.681  1.198  0.838  0.244 -0.298
## 295       295  9 -3.828  3.188 -0.388  0.055 -0.185 -0.029  0.503  0.273  0.326
## 296       296 10 -4.283  2.829  0.296  0.086 -0.544  0.501 -0.317  0.995 -0.340
## 297       297 11 -3.189  2.620 -0.833  0.450  0.009  0.444 -0.348  0.126 -0.614
## 298       298  1 -3.490 -0.474  0.187  1.747  0.733  1.307 -0.816 -0.787 -0.222
## 299       299  2 -3.155  0.613 -0.285  1.287  0.882  0.337 -0.624  0.067 -0.516
## 300       300  3 -2.762  1.510 -0.145  1.157 -0.256  0.041 -0.647 -0.324 -0.128
## 301       301  4 -1.959  2.285 -0.089 -0.262 -0.013  0.019 -0.233 -0.068 -0.268
## 302       302  5 -2.364  3.743 -1.393 -0.361 -0.354  1.004  0.208 -0.376 -1.046
## 303       303  6 -2.577  2.449 -0.380  0.174 -0.410  0.383  0.190  0.097 -0.489
## 304       304  7 -2.919  3.480 -0.823 -0.751 -0.416  1.045  0.609  0.180 -1.172
## 305       305  8 -3.387  3.286 -0.747 -0.699 -0.900  0.891  0.875  0.460 -0.457
## 306       306  9 -3.818  3.159 -0.298 -0.058 -0.348  0.194  0.593  0.211  0.531
## 307       307 10 -4.299  2.775  0.244  0.177 -0.436  0.261 -0.308  1.175 -0.227
## 308       308 11 -3.269  2.489 -0.760  0.352 -0.092  0.432 -0.270  0.242 -0.523
## 309       309  1 -2.852 -0.805 -0.313  1.565  0.688  1.467 -0.664 -0.916 -0.279
## 310       310  2 -3.379  0.950 -0.060  1.470  0.538  0.051 -0.681 -0.098 -0.405
## 311       311  3 -2.836  1.561 -0.076  1.229 -0.291 -0.036 -0.369 -0.393 -0.181
## 312       312  4 -2.021  2.493 -0.416 -0.116  0.094 -0.033 -0.400 -0.080 -0.136
## 313       313  5 -2.411  3.850 -1.405 -0.302 -0.398  1.069  0.216 -0.291 -1.116
## 314       314  6 -2.708  2.560 -0.439  0.324 -0.348  0.429  0.091 -0.037 -0.434
## 315       315  7 -2.883  3.576 -1.198 -0.562 -0.162  0.974  0.764 -0.030 -1.023
## 316       316  8 -3.390  3.422 -0.718 -0.667 -0.871  0.788  0.959  0.555 -0.482
## 317       317  9 -3.972  3.240 -0.829  0.069 -0.617  0.977  0.532  0.498 -0.191
## 318       318 10 -4.513  3.080  0.068  0.050 -0.484  0.341 -0.257  1.302 -0.517
## 319       319 11 -3.292  2.595 -0.578  0.420 -0.233  0.391 -0.241  0.437 -0.541
## 320       320  1 -2.527 -0.926 -0.571  1.613  0.628  1.229 -0.687 -0.808 -0.354
## 321       321  2 -3.498  1.669  0.076  1.530  0.380 -0.135 -0.814 -0.208 -0.307
## 322       322  3 -2.851  1.412 -0.184  1.281  0.000 -0.146 -0.172 -0.419 -0.307
## 323       323  4 -2.026  2.433 -0.411  0.064  0.223 -0.027 -0.424 -0.009 -0.305
```

```
## 324       324  5 -2.460  3.706 -1.304 -0.339 -0.487  1.125  0.187 -0.211 -1.068
## 325       325  6 -2.879  2.662 -0.572  0.425 -0.248  0.213  0.176 -0.281 -0.404
## 326       326  7 -2.818  3.685 -1.413 -0.558  0.025  0.871  0.688 -0.144 -0.930
## 327       327  8 -3.396  3.867 -1.029 -0.603 -0.573  0.780  1.209  0.228 -0.673
## 328       328  9 -3.905  3.147 -1.259  0.304 -0.216  1.055  0.578  0.353 -0.517
## 329       329 10 -4.568  3.344 -0.005 -0.092 -0.546  0.479 -0.168  1.186 -0.565
## 330       330 11 -3.350  2.713 -0.472  0.400 -0.196  0.248 -0.224  0.530 -0.358
## 331       331  1 -4.711  1.166  1.244  1.746  0.311 -0.305 -0.691 -0.137 -0.288
## 332       332  2 -4.057  1.925  0.521  1.331  0.273 -0.167 -0.365 -0.665 -0.512
## 333       333  3 -3.097  1.385 -0.173  1.392 -0.613 -0.143 -0.014 -0.565 -0.065
## 334       334  4 -2.931  1.850 -0.896  0.685 -1.000  0.504  0.212 -0.276 -0.203
## 335       335  5 -2.942  2.642 -1.217  0.384 -0.994  1.467  0.134 -0.458 -0.465
## 336       336  6 -3.065  1.781 -0.915  0.698  0.175  0.662 -0.086 -0.361 -0.774
## 337       337  7 -3.318  3.395 -1.706  0.753 -0.214  1.431  0.000 -0.192 -1.330
## 338       338  8 -3.747  4.267 -1.847 -0.235  0.380  0.885 -0.049 -0.258 -0.772
## 339       339  9 -4.039  2.061 -0.727  0.888  0.302  0.413 -0.381 -0.194 -0.614
## 340       340 10 -4.080  2.242 -0.280  1.876  0.720 -0.292 -0.537 -0.540 -0.663
## 341       341 11 -3.483  2.628 -0.383  0.838  0.200  0.102 -0.162 -0.547 -0.791
## 342       342  1 -4.689  1.015  1.312  1.802  0.313 -0.405 -0.663  0.106 -0.325
## 343       343  2 -4.013  2.101  0.295  1.292  0.450 -0.024 -0.565 -0.588 -0.343
## 344       344  3 -2.972  1.151 -0.293  1.609 -0.724  0.123 -0.087 -0.801  0.040
## 345       345  4 -3.029  1.747 -0.899  0.674 -1.046  0.558  0.204 -0.155 -0.237
## 346       346  5 -2.926  2.673 -1.242  0.396 -1.029  1.548  0.050 -0.592 -0.331
## 347       347  6 -3.075  1.824 -0.905  0.727  0.155  0.608 -0.075 -0.377 -0.740
## 348       348  7 -3.400  3.441 -1.805  0.814 -0.162  1.445 -0.110 -0.499 -1.201
## 349       349  8 -3.797  4.314 -1.596 -0.476  0.044  0.903  0.129 -0.141 -0.646
## 350       350  9 -4.083  2.193 -0.492  0.695  0.251  0.423 -0.558 -0.123 -0.530
## 351       351 10 -4.045  2.377 -0.300  2.002  0.826 -0.180 -0.768 -0.408 -0.787
## 352       352 11 -3.455  2.561 -0.421  0.847  0.330  0.057 -0.177 -0.494 -0.786
## 353       353  1 -4.756  1.197  1.431  1.540  0.262 -0.277 -0.741  0.075 -0.260
## 354       354  2 -3.999  2.138  0.295  1.086  0.699 -0.127 -0.634 -0.400 -0.505
## 355       355  3 -2.964  1.154 -0.373  1.511 -0.583  0.152 -0.012 -0.949 -0.054
## 356       356  4 -3.053  1.518 -0.729  0.828 -1.211  0.499  0.326 -0.136 -0.263
## 357       357  5 -2.967  2.781 -1.277  0.354 -0.936  1.505 -0.004 -0.418 -0.560
## 358       358  6 -3.206  1.899 -0.933  0.733  0.261  0.565 -0.225 -0.339 -0.677
## 359       359  7 -3.492  3.446 -1.734  0.705 -0.230  1.339  0.092 -0.698 -1.143
## 360       360  8 -3.847  4.268 -1.521 -0.465 -0.230  1.067 -0.020  0.005 -0.577
## 361       361  9 -4.052  2.335 -0.415  0.732  0.234  0.426 -0.490 -0.218 -0.618
## 362       362 10 -4.001  2.284 -0.365  2.106  1.006 -0.028 -0.825 -0.390 -0.898
## 363       363 11 -3.446  2.440 -0.370  0.926  0.194  0.141 -0.098 -0.557 -0.889
## 364       364  1 -4.763  1.305  1.231  1.548  0.308 -0.152 -0.792 -0.124 -0.107
## 365       365  2 -3.990  2.008  0.503  0.845  0.774 -0.114 -0.641 -0.282 -0.734
## 366       366  3 -2.965  1.124 -0.349  1.581 -0.666  0.125 -0.025 -0.887 -0.130
## 367       367  4 -3.055  1.400 -0.686  0.964 -1.290  0.545  0.337 -0.299 -0.173
## 368       368  5 -2.964  2.811 -1.317  0.324 -0.781  1.369  0.127 -0.368 -0.677
## 369       369  6 -3.371  2.007 -0.919  0.843  0.221  0.541 -0.317 -0.370 -0.500
## 370       370  7 -3.554  3.386 -1.703  0.555 -0.072  1.073  0.237 -0.625 -1.067
## 371       371  8 -3.852  4.214 -1.556 -0.336 -0.305  1.133 -0.152  0.237 -0.915
## 372       372  9 -3.963  2.272 -0.534  0.977  0.329  0.514 -0.363 -0.425 -0.712
## 373       373 10 -3.985  2.192 -0.426  2.163  1.114  0.016 -0.846 -0.468 -0.858
## 374       374 11 -3.510  2.535 -0.260  0.946 -0.072  0.159 -0.112 -0.657 -0.789
## 375       375  1 -4.754  1.329  1.090  1.765  0.217 -0.198 -0.782 -0.154  0.023
## 376       376  2 -3.966  2.003  0.391  1.034  0.659 -0.191 -0.448 -0.397 -0.769
## 377       377  3 -2.959  1.061 -0.351  1.745 -0.851  0.344 -0.373 -0.729  0.048
```

```
## 378       378  4 -3.194  1.589 -0.774  0.814 -1.087  0.618  0.218 -0.450 -0.003
## 379       379  5 -2.928  2.830 -1.361  0.323 -0.739  1.431  0.002 -0.172 -0.939
## 380       380  6 -3.456  2.027 -0.862  0.887  0.281  0.435 -0.307 -0.387 -0.600
## 381       381  7 -3.520  3.318 -1.867  0.691  0.263  0.822  0.140 -0.620 -1.098
## 382       382  8 -3.838  4.252 -1.621 -0.219 -0.281  0.856  0.154  0.133 -0.920
## 383       383  9 -3.857  2.133 -0.580  0.996  0.502  0.650 -0.283 -0.468 -0.983
## 384       384 10 -4.062  2.358 -0.310  1.895  1.095  0.049 -0.870 -0.524 -0.980
## 385       385 11 -3.591  2.780 -0.301  0.812 -0.008 -0.019 -0.268 -0.564 -0.788
## 386       386  1 -4.687  1.152  1.089  1.915  0.201 -0.296 -0.692 -0.105 -0.143
## 387       387  2 -3.917  1.925  0.267  1.361  0.453 -0.190 -0.242 -0.633 -0.620
## 388       388  3 -3.004  1.090 -0.328  1.652 -0.679  0.287 -0.297 -0.695 -0.145
## 389       389  4 -3.341  1.714 -0.773  0.771 -0.976  0.625  0.078 -0.438 -0.084
## 390       390  5 -2.902  2.796 -1.199  0.234 -0.821  1.257  0.263 -0.075 -1.103
## 391       391  6 -3.567  2.081 -0.579  0.845  0.126  0.381 -0.179 -0.510 -0.846
## 392       392  7 -3.570  3.410 -1.576  0.563  0.002  0.759  0.285 -0.466 -1.409
## 393       393  8 -3.792  4.290 -1.531 -0.125 -0.312  0.624  0.324 -0.053 -0.942
## 394       394  9 -3.862  2.109 -0.650  0.990  0.724  0.641 -0.293 -0.519 -1.055
## 395       395 10 -4.118  2.542 -0.200  1.616  1.106 -0.060 -0.728 -0.544 -0.912
## 396       396 11 -3.636  2.719 -0.178  0.665  0.099 -0.084 -0.333 -0.362 -1.049
## 397       397  1 -4.047  0.913  0.734  1.479  0.258  0.206 -1.117 -0.423 -0.336
## 398       398  2 -3.811  2.123  0.278  1.552  0.754  0.492 -0.584 -0.433 -0.988
## 399       399  3 -3.441  1.975 -0.395  1.024 -0.052 -0.167 -0.445  0.168 -0.684
## 400       400  4 -2.584  2.091 -1.451  0.889 -0.464  0.285 -0.213 -0.245 -0.138
## 401       401  5 -3.119  3.135 -1.466 -0.352 -0.023  0.752  0.143 -0.231 -0.376
## 402       402  6 -2.871  3.130 -1.300  0.008 -0.288  0.483  0.258 -0.342 -0.614
## 403       403  7 -3.059  2.895 -0.847 -0.364 -0.484  1.025  0.502  0.506 -0.733
## 404       404  8 -3.642  3.582 -1.031 -0.761  0.046  1.255  0.841  0.512 -0.259
## 405       405  9 -3.977  2.976  0.309 -0.259  0.026  0.816 -0.317  0.492 -0.674
## 406       406 10 -4.008  2.141 -0.180  1.041  0.688  0.712 -0.879 -0.201 -1.066
## 407       407 11 -3.451  2.257 -0.845  0.432  0.486  0.266 -0.215  0.006 -1.082
## 408       408  1 -3.836  0.508  0.645  1.721  0.280  0.303 -0.911 -0.592 -0.631
## 409       409  2 -3.709  1.665  0.138  1.551  0.975  0.923 -0.396 -0.234 -1.154
## 410       410  3 -3.369  1.784 -0.603  1.303  0.007 -0.044 -0.459 -0.012 -0.591
## 411       411  4 -2.627  2.089 -1.434  0.937 -0.615  0.430 -0.311 -0.203  0.038
## 412       412  5 -3.074  3.062 -1.470 -0.379  0.233  0.789 -0.099 -0.135 -0.395
## 413       413  6 -2.902  2.988 -1.152  0.057 -0.477  0.622  0.338 -0.368 -0.689
## 414       414  7 -3.027  2.903 -0.799 -0.452 -0.503  1.044  0.679  0.483 -0.776
## 415       415  8 -3.634  3.589 -1.075 -0.709  0.058  1.051  0.878  0.627 -0.111
## 416       416  9 -3.924  2.726  0.414 -0.155 -0.020  0.893 -0.188  0.552 -0.507
## 417       417 10 -4.049  2.223 -0.076  0.928  0.692  0.731 -0.931 -0.141 -1.087
## 418       418 11 -3.432  2.235 -0.753  0.361  0.435  0.425 -0.193  0.012 -1.166
## 419       419  1 -3.661  0.300  0.530  1.816  0.333  0.444 -0.858 -0.732 -0.809
## 420       420  2 -3.674  1.513  0.038  1.604  0.907  1.045 -0.166 -0.295 -1.130
## 421       421  3 -3.242  1.615 -0.829  1.589  0.090  0.051 -0.504 -0.211 -0.513
## 422       422  4 -2.634  2.076 -1.320  0.833 -0.547  0.287 -0.173 -0.203 -0.001
## 423       423  5 -3.052  3.059 -1.668 -0.208  0.466  0.724 -0.237 -0.175 -0.315
## 424       424  6 -2.918  2.897 -1.069 -0.077 -0.261  0.550  0.317 -0.322 -0.776
## 425       425  7 -3.048  2.817 -0.703 -0.396 -0.639  0.920  0.674  0.686 -0.611
## 426       426  8 -3.660  3.618 -1.051 -0.748  0.080  1.022  0.914  0.613  0.023
## 427       427  9 -3.919  2.575  0.471 -0.064 -0.042  0.880 -0.128  0.612 -0.504
## 428       428 10 -4.094  2.499 -0.149  1.017  0.683  0.536 -1.023 -0.127 -1.142
## 429       429 11 -3.396  2.257 -0.602  0.407  0.204  0.366  0.067  0.044 -1.352
## 430       430  1 -3.572  0.228  0.520  1.791  0.382  0.573 -0.961 -0.740 -0.936
## 431       431  2 -3.584  1.252 -0.062  1.646  0.787  1.134  0.096 -0.292 -1.133
```

```
## 432       432  3 -3.232  1.551 -0.832  1.674 -0.042  0.296 -0.553 -0.443 -0.413
## 433       433  4 -2.643  2.021 -1.265  0.759 -0.442  0.159 -0.032 -0.145 -0.164
## 434       434  5 -3.050  3.055 -1.598 -0.120  0.144  0.757  0.119 -0.397 -0.396
## 435       435  6 -2.938  2.782 -1.111 -0.076  0.000  0.582  0.252 -0.400 -0.773
## 436       436  7 -3.095  2.851 -0.816 -0.396 -0.603  1.090  0.567  0.743 -0.677
## 437       437  8 -3.706  3.627 -0.889 -0.789 -0.093  1.223  0.814  0.563  0.062
## 438       438  9 -3.946  2.545  0.447 -0.001  0.043  0.788 -0.102  0.680 -0.637
## 439       439 10 -4.145  2.739 -0.115  0.907  0.669  0.478 -1.183 -0.240 -0.887
## 440       440 11 -3.325  2.141 -0.528  0.439  0.099  0.321  0.217  0.135 -1.388
## 441       441  1 -3.461  0.040  0.553  1.854  0.386  0.568 -1.003 -0.638 -1.040
## 442       442  2 -3.546  1.064 -0.006  1.455  0.847  1.117  0.073 -0.025 -1.318
## 443       443  3 -3.320  1.553 -0.586  1.688 -0.262  0.392 -0.478 -0.461 -0.522
## 444       444  4 -2.710  1.943 -1.247  0.772 -0.345  0.107 -0.062  0.040 -0.322
## 445       445  5 -3.018  3.014 -1.486 -0.105 -0.131  0.929  0.226 -0.463 -0.555
## 446       446  6 -2.904  2.741 -1.123  0.014  0.071  0.654  0.212 -0.454 -0.815
## 447       447  7 -3.176  2.997 -1.098 -0.371 -0.418  1.318  0.480  0.472 -0.814
## 448       448  8 -3.743  3.629 -0.874 -0.790 -0.312  1.759  0.679  0.565 -0.521
## 449       449  9 -3.952  2.489  0.287  0.012  0.141  0.892 -0.087  0.613 -0.685
## 450       450 10 -4.211  2.811  0.016  0.799  0.514  0.496 -1.219 -0.238 -0.798
## 451       451 11 -3.309  2.256 -0.615  0.365  0.251  0.439  0.011  0.119 -1.219
## 452       452  1 -3.500  0.068  0.533  1.876  0.363  0.542 -0.982 -0.671 -1.006
## 453       453  2 -3.620  1.066  0.158  1.393  0.879  1.020 -0.090  0.087 -1.333
## 454       454  3 -3.468  1.810 -0.390  1.550 -0.084 -0.008 -0.482 -0.231 -0.724
## 455       455  4 -2.795  1.957 -1.259  0.790 -0.274  0.078 -0.114  0.005 -0.309
## 456       456  5 -3.002  2.944 -1.379 -0.188 -0.131  0.957  0.346 -0.392 -0.711
## 457       457  6 -2.924  2.731 -1.138  0.066  0.100  0.683  0.162 -0.399 -0.882
## 458       458  7 -3.239  3.083 -1.427 -0.202 -0.282  1.421  0.576  0.068 -0.914
## 459       459  8 -3.753  3.605 -0.899 -0.747 -0.401  1.765  0.620  0.754 -0.835
## 460       460  9 -3.980  2.459  0.068  0.023  0.237  1.029 -0.189  0.521 -0.773
## 461       461 10 -4.264  2.925  0.065  0.794  0.323  0.515 -1.282 -0.140 -0.863
## 462       462 11 -3.291  2.324 -0.679  0.285  0.441  0.557 -0.227  0.115 -1.046
##       x.10
## 1   -0.467
## 2   -0.604
## 3   -0.764
## 4   -0.279
## 5   -0.471
## 6   -0.204
## 7    0.991
## 8    0.577
## 9    1.125
## 10   1.180
## 11   0.327
## 12  -0.400
## 13  -0.596
## 14  -0.741
## 15  -0.200
## 16  -0.396
## 17  -0.403
## 18   1.034
## 19   0.861
## 20   0.770
## 21   1.294
## 22   0.344
```

```
## 23  -0.521
## 24  -0.250
## 25  -0.484
## 26  -0.212
## 27  -0.336
## 28  -0.413
## 29   1.166
## 30   0.976
## 31   1.005
## 32   1.214
## 33   0.436
## 34  -0.663
## 35   0.119
## 36  -0.510
## 37  -0.251
## 38  -0.301
## 39  -0.334
## 40   1.291
## 41   1.114
## 42   1.055
## 43   1.245
## 44   0.303
## 45  -0.668
## 46   0.026
## 47  -0.382
## 48  -0.343
## 49  -0.209
## 50  -0.326
## 51   1.163
## 52   0.978
## 53   0.829
## 54   1.165
## 55  -0.337
## 56  -0.765
## 57  -0.174
## 58  -0.073
## 59  -0.391
## 60  -0.272
## 61  -0.273
## 62   0.969
## 63   0.563
## 64   0.269
## 65   1.088
## 66  -0.461
## 67  -0.635
## 68  -0.621
## 69  -0.013
## 70  -0.548
## 71  -0.093
## 72  -0.204
## 73  -0.662
## 74  -0.110
## 75  -0.611
## 76  -0.192
```

```
## 77  -0.372
## 78  -0.548
## 79  -0.899
## 80  -0.053
## 81  -0.609
## 82  -0.135
## 83  -0.074
## 84  -0.700
## 85  -0.306
## 86  -0.694
## 87  -0.307
## 88  -0.408
## 89  -0.547
## 90  -0.934
## 91  -0.235
## 92  -0.637
## 93  -0.090
## 94  -0.092
## 95  -0.549
## 96  -0.283
## 97  -0.709
## 98  -0.326
## 99  -0.391
## 100 -0.634
## 101 -0.767
## 102 -0.346
## 103 -0.624
## 104 -0.064
## 105 -0.196
## 106 -0.586
## 107 -0.322
## 108 -0.864
## 109 -0.202
## 110 -0.331
## 111 -0.757
## 112 -0.565
## 113 -0.285
## 114 -0.576
## 115 -0.234
## 116 -0.292
## 117 -0.516
## 118 -0.250
## 119 -0.710
## 120 -0.074
## 121 -0.325
## 122 -0.767
## 123 -0.553
## 124 -0.237
## 125 -0.490
## 126 -0.343
## 127 -0.263
## 128 -0.413
## 129 -0.259
## 130 -0.556
```

```
## 131 -0.184
## 132 -0.394
## 133 -0.873
## 134 -0.637
## 135 -0.256
## 136 -0.764
## 137 -0.939
## 138 -0.747
## 139 -1.098
## 140 -0.430
## 141 -0.318
## 142 -0.916
## 143 -0.334
## 144 -0.855
## 145 -0.563
## 146 -0.295
## 147 -0.672
## 148 -0.949
## 149 -0.745
## 150 -0.871
## 151 -0.301
## 152 -0.477
## 153 -0.617
## 154 -0.408
## 155 -1.015
## 156 -0.717
## 157 -0.307
## 158 -0.645
## 159 -0.910
## 160 -0.720
## 161 -0.665
## 162 -0.231
## 163 -0.317
## 164 -0.558
## 165 -0.391
## 166 -1.205
## 167 -0.828
## 168 -0.314
## 169 -0.753
## 170 -0.937
## 171 -0.638
## 172 -0.525
## 173 -0.290
## 174 -0.118
## 175 -0.473
## 176 -0.551
## 177 -1.226
## 178 -0.974
## 179 -0.379
## 180 -0.959
## 181 -0.959
## 182 -0.622
## 183 -0.399
## 184 -0.149
```

```
## 185  0.168
## 186 -0.420
## 187 -0.507
## 188 -1.241
## 189 -1.046
## 190 -0.431
## 191 -1.013
## 192 -0.822
## 193 -0.696
## 194 -0.343
## 195 -0.009
## 196 -0.203
## 197 -0.141
## 198 -0.413
## 199 -0.498
## 200 -0.614
## 201 -0.613
## 202 -0.397
## 203 -0.511
## 204 -0.504
## 205 -0.300
## 206 -0.640
## 207 -0.434
## 208 -0.211
## 209 -0.944
## 210 -0.620
## 211 -0.746
## 212 -0.912
## 213 -0.322
## 214 -0.541
## 215 -0.512
## 216 -0.489
## 217 -0.519
## 218 -0.351
## 219 -0.193
## 220 -0.991
## 221 -0.609
## 222 -0.588
## 223 -0.911
## 224 -0.270
## 225 -0.598
## 226 -0.711
## 227 -0.616
## 228 -0.250
## 229 -0.477
## 230 -0.362
## 231 -1.074
## 232 -0.587
## 233 -0.579
## 234 -0.832
## 235 -0.267
## 236 -0.729
## 237 -0.692
## 238 -0.718
```

```
## 239 -0.125
## 240 -0.327
## 241 -0.442
## 242 -0.980
## 243 -0.769
## 244 -0.615
## 245 -0.773
## 246 -0.308
## 247 -0.740
## 248 -0.672
## 249 -0.931
## 250  0.139
## 251 -0.330
## 252 -0.415
## 253 -0.968
## 254 -0.978
## 255 -0.638
## 256 -0.679
## 257 -0.370
## 258 -0.713
## 259 -0.712
## 260 -0.822
## 261  0.168
## 262 -0.456
## 263 -0.291
## 264 -0.715
## 265  0.781
## 266  0.746
## 267  0.662
## 268  0.292
## 269  0.310
## 270  0.072
## 271 -0.009
## 272 -0.919
## 273 -0.719
## 274 -0.933
## 275  0.234
## 276  0.598
## 277  0.768
## 278  0.781
## 279  0.147
## 280  0.046
## 281 -0.188
## 282 -0.040
## 283 -0.726
## 284 -0.252
## 285 -1.010
## 286  0.189
## 287  0.567
## 288  0.879
## 289  0.705
## 290 -0.099
## 291  0.188
## 292 -0.256
```

```
## 293 -0.094
## 294 -0.618
## 295  0.100
## 296 -1.113
## 297  0.081
## 298  0.410
## 299  0.891
## 300  0.806
## 301 -0.022
## 302  0.722
## 303 -0.084
## 304  0.123
## 305 -0.636
## 306 -0.014
## 307 -1.115
## 308  0.010
## 309  0.489
## 310  0.912
## 311  0.850
## 312  0.069
## 313  1.043
## 314  0.344
## 315  0.346
## 316 -0.724
## 317 -0.910
## 318 -1.057
## 319 -0.021
## 320  0.625
## 321  1.053
## 322  0.874
## 323  0.345
## 324  0.944
## 325  0.605
## 326  0.282
## 327 -0.562
## 328 -0.871
## 329 -1.025
## 330 -0.091
## 331  1.023
## 332  0.716
## 333  1.129
## 334  0.595
## 335  0.646
## 336  0.951
## 337  0.030
## 338 -0.110
## 339  0.410
## 340  0.238
## 341  1.018
## 342  0.838
## 343  0.695
## 344  1.070
## 345  0.655
## 346  0.595
```

```
## 347  0.852
## 348 -0.046
## 349 -0.318
## 350  0.376
## 351  0.156
## 352  0.951
## 353  0.876
## 354  0.856
## 355  1.160
## 356  0.750
## 357  0.725
## 358  0.765
## 359 -0.050
## 360 -0.509
## 361  0.340
## 362  0.099
## 363  0.985
## 364  0.885
## 365  0.877
## 366  1.110
## 367  0.690
## 368  0.493
## 369  0.652
## 370 -0.176
## 371 -0.445
## 372  0.410
## 373  0.037
## 374  0.914
## 375  0.850
## 376  0.969
## 377  0.815
## 378  0.526
## 379  0.607
## 380  0.725
## 381  0.083
## 382 -0.454
## 383  0.613
## 384 -0.065
## 385  0.948
## 386  0.884
## 387  1.039
## 388  0.710
## 389  0.607
## 390  0.417
## 391  0.987
## 392  0.586
## 393 -0.301
## 394  0.653
## 395 -0.101
## 396  0.978
## 397  0.982
## 398  0.652
## 399  1.040
## 400  1.206
```

```
## 401  0.721
## 402  0.830
## 403  0.078
## 404 -0.447
## 405 -0.659
## 406 -0.549
## 407  0.759
## 408  1.023
## 409  0.736
## 410  1.047
## 411  0.933
## 412  0.572
## 413  0.793
## 414 -0.062
## 415 -0.437
## 416 -0.617
## 417 -0.584
## 418  0.794
## 419  0.995
## 420  0.594
## 421  1.005
## 422  0.802
## 423  0.411
## 424  0.790
## 425 -0.053
## 426 -0.448
## 427 -0.539
## 428 -0.421
## 429  0.871
## 430  1.007
## 431  0.472
## 432  0.960
## 433  0.860
## 434  0.477
## 435  0.838
## 436  0.052
## 437 -0.449
## 438 -0.545
## 439 -0.365
## 440  0.746
## 441  1.051
## 442  0.557
## 443  0.929
## 444  1.018
## 445  0.598
## 446  0.752
## 447  0.106
## 448 -0.485
## 449 -0.623
## 450 -0.392
## 451  0.695
## 452  1.101
## 453  0.585
## 454  0.967
```

```
## 455  1.142
## 456  0.617
## 457  0.827
## 458  0.147
## 459 -0.301
## 460 -0.500
## 461 -0.390
## 462  0.697
```

```r
# predict the class for the vowel.test data using the tuned random forest model
y_pred <- predict(rf_tuned, newdata = test_data[, -1], type = "raw")

# compute the misclassification rate
misclassification_rate <- mean(y_pred != test_data[, 1])
misclassification_rate
```

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

XGboost model

```r
# Split the data into features and target
train_X <- train_data[, 3:12]
train_y <- train_data$y

# Fit a gradient boosted model with default tuning parameters
model <- xgboost(data = as.matrix(train_X), label = train_y, nrounds = 50)
```

```
## [1]  train-rmse:4.599697
## [2]  train-rmse:3.350324
## [3]  train-rmse:2.485207
## [4]  train-rmse:1.888163
## [5]  train-rmse:1.430851
## [6]  train-rmse:1.134093
## [7]  train-rmse:0.914695
## [8]  train-rmse:0.711988
## [9]  train-rmse:0.617216
## [10] train-rmse:0.531064
## [11] train-rmse:0.483871
## [12] train-rmse:0.407501
## [13] train-rmse:0.374300
## [14] train-rmse:0.348659
## [15] train-rmse:0.320308
## [16] train-rmse:0.297381
## [17] train-rmse:0.278422
## [18] train-rmse:0.259181
## [19] train-rmse:0.249042
## [20] train-rmse:0.236537
## [21] train-rmse:0.222837
```

```
## [22] train-rmse:0.209632
## [23] train-rmse:0.200539
## [24] train-rmse:0.191716
## [25] train-rmse:0.186439
## [26] train-rmse:0.176411
## [27] train-rmse:0.159349
## [28] train-rmse:0.153721
## [29] train-rmse:0.144252
## [30] train-rmse:0.135729
## [31] train-rmse:0.133394
## [32] train-rmse:0.130287
## [33] train-rmse:0.121986
## [34] train-rmse:0.112076
## [35] train-rmse:0.105059
## [36] train-rmse:0.102912
## [37] train-rmse:0.095745
## [38] train-rmse:0.091892
## [39] train-rmse:0.089761
## [40] train-rmse:0.086291
## [41] train-rmse:0.084972
## [42] train-rmse:0.081172
## [43] train-rmse:0.078768
## [44] train-rmse:0.075385
## [45] train-rmse:0.073123
## [46] train-rmse:0.067656
## [47] train-rmse:0.065573
## [48] train-rmse:0.062659
## [49] train-rmse:0.060158
## [50] train-rmse:0.058029
```

```
library(caret)
library(xgboost)

# Split the data into features and target
train_X <- train_data[, 3:12]
train_y <- train_data$y

# Define the tuning parameter grid
tune_grid <- expand.grid(nrounds = c(50, 100),
                         max_depth = c(3, 4),
                         eta = c(0.01, 0.05),
                         gamma = c(0, 0.1),
                         colsample_bytree = c(0.5, 0.8),
                         min_child_weight = c(1, 5),
                         subsample = seq(0.5, 1, by = 0.1))

# Set up the cross-validation control
cv_ctrl <- trainControl(method = "cv", number = 5)

# Perform the tuning using cross-validation
model_tune <- train(x = as.matrix(train_X),
                    y = train_y,
                    method = "xgbTree",
                    tuneGrid = tune_grid,
```

```
                      trControl = cv_ctrl)
```

```
## [17:50:02] WARNING: src/c_api/c_api.cc:935: ‘ntree_limit‘ is deprecated, use ‘iteration_range‘ instea
## [17:50:02] WARNING: src/c_api/c_api.cc:935: ‘ntree_limit‘ is deprecated, use ‘iteration_range‘ instea
## [17:50:02] WARNING: src/c_api/c_api.cc:935: ‘ntree_limit‘ is deprecated, use ‘iteration_range‘ instea
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```

```
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## [17:50:43] WARNING: src/c_api/c_api.cc:935: ‘ntree_limit‘ is deprecated, use ‘iteration_range‘ instea
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```

```r
# Print the optimal tuning parameter
print(model_tune$bestTune)
```

```
##     nrounds max_depth  eta gamma colsample_bytree min_child_weight subsample
## 320     100         4 0.05     0              0.8                1       0.8
```

```
model_tune
```

```
## eXtreme Gradient Boosting
##
## 528 samples
##  10 predictor
##
## No pre-processing
## Resampling: Cross-Validated (5 fold)
## Summary of sample sizes: 423, 422, 423, 421, 423
## Resampling results across tuning parameters:
##
##   eta   max_depth  gamma  colsample_bytree  min_child_weight  subsample
##   0.01  3          0.0    0.5               1                 0.5
##   0.01  3          0.0    0.5               1                 0.5
##   0.01  3          0.0    0.5               1                 0.6
##   0.01  3          0.0    0.5               1                 0.6
##   0.01  3          0.0    0.5               1                 0.7
##   0.01  3          0.0    0.5               1                 0.7
##   0.01  3          0.0    0.5               1                 0.8
##   0.01  3          0.0    0.5               1                 0.8
##   0.01  3          0.0    0.5               1                 0.9
##   0.01  3          0.0    0.5               1                 0.9
##   0.01  3          0.0    0.5               1                 1.0
##   0.01  3          0.0    0.5               1                 1.0
##   0.01  3          0.0    0.5               5                 0.5
##   0.01  3          0.0    0.5               5                 0.5
##   0.01  3          0.0    0.5               5                 0.6
##   0.01  3          0.0    0.5               5                 0.6
##   0.01  3          0.0    0.5               5                 0.7
##   0.01  3          0.0    0.5               5                 0.7
##   0.01  3          0.0    0.5               5                 0.8
##   0.01  3          0.0    0.5               5                 0.8
##   0.01  3          0.0    0.5               5                 0.9
##   0.01  3          0.0    0.5               5                 0.9
##   0.01  3          0.0    0.5               5                 1.0
##   0.01  3          0.0    0.5               5                 1.0
##   0.01  3          0.0    0.8               1                 0.5
##   0.01  3          0.0    0.8               1                 0.5
##   0.01  3          0.0    0.8               1                 0.6
##   0.01  3          0.0    0.8               1                 0.6
##   0.01  3          0.0    0.8               1                 0.7
##   0.01  3          0.0    0.8               1                 0.7
##   0.01  3          0.0    0.8               1                 0.8
##   0.01  3          0.0    0.8               1                 0.8
##   0.01  3          0.0    0.8               1                 0.9
##   0.01  3          0.0    0.8               1                 0.9
##   0.01  3          0.0    0.8               1                 1.0
##   0.01  3          0.0    0.8               1                 1.0
##   0.01  3          0.0    0.8               5                 0.5
##   0.01  3          0.0    0.8               5                 0.5
##   0.01  3          0.0    0.8               5                 0.6
##   0.01  3          0.0    0.8               5                 0.6
```

```
##   0.01  3          0.0    0.8               5                 0.7
##   0.01  3          0.0    0.8               5                 0.7
##   0.01  3          0.0    0.8               5                 0.8
##   0.01  3          0.0    0.8               5                 0.8
##   0.01  3          0.0    0.8               5                 0.9
##   0.01  3          0.0    0.8               5                 0.9
##   0.01  3          0.0    0.8               5                 1.0
##   0.01  3          0.0    0.8               5                 1.0
##   0.01  3          0.1    0.5               1                 0.5
##   0.01  3          0.1    0.5               1                 0.5
##   0.01  3          0.1    0.5               1                 0.6
##   0.01  3          0.1    0.5               1                 0.6
##   0.01  3          0.1    0.5               1                 0.7
##   0.01  3          0.1    0.5               1                 0.7
##   0.01  3          0.1    0.5               1                 0.8
##   0.01  3          0.1    0.5               1                 0.8
##   0.01  3          0.1    0.5               1                 0.9
##   0.01  3          0.1    0.5               1                 0.9
##   0.01  3          0.1    0.5               1                 1.0
##   0.01  3          0.1    0.5               1                 1.0
##   0.01  3          0.1    0.5               5                 0.5
##   0.01  3          0.1    0.5               5                 0.5
##   0.01  3          0.1    0.5               5                 0.6
##   0.01  3          0.1    0.5               5                 0.6
##   0.01  3          0.1    0.5               5                 0.7
##   0.01  3          0.1    0.5               5                 0.7
##   0.01  3          0.1    0.5               5                 0.8
##   0.01  3          0.1    0.5               5                 0.8
##   0.01  3          0.1    0.5               5                 0.9
##   0.01  3          0.1    0.5               5                 0.9
##   0.01  3          0.1    0.5               5                 1.0
##   0.01  3          0.1    0.5               5                 1.0
##   0.01  3          0.1    0.8               1                 0.5
##   0.01  3          0.1    0.8               1                 0.5
##   0.01  3          0.1    0.8               1                 0.6
##   0.01  3          0.1    0.8               1                 0.6
##   0.01  3          0.1    0.8               1                 0.7
##   0.01  3          0.1    0.8               1                 0.7
##   0.01  3          0.1    0.8               1                 0.8
##   0.01  3          0.1    0.8               1                 0.8
##   0.01  3          0.1    0.8               1                 0.9
##   0.01  3          0.1    0.8               1                 0.9
##   0.01  3          0.1    0.8               1                 1.0
##   0.01  3          0.1    0.8               1                 1.0
##   0.01  3          0.1    0.8               5                 0.5
##   0.01  3          0.1    0.8               5                 0.5
##   0.01  3          0.1    0.8               5                 0.6
##   0.01  3          0.1    0.8               5                 0.6
##   0.01  3          0.1    0.8               5                 0.7
##   0.01  3          0.1    0.8               5                 0.7
##   0.01  3          0.1    0.8               5                 0.8
##   0.01  3          0.1    0.8               5                 0.8
##   0.01  3          0.1    0.8               5                 0.9
##   0.01  3          0.1    0.8               5                 0.9
```

```
##   0.01  3          0.1    0.8              5                1.0
##   0.01  3          0.1    0.8              5                1.0
##   0.01  4          0.0    0.5              1                0.5
##   0.01  4          0.0    0.5              1                0.5
##   0.01  4          0.0    0.5              1                0.6
##   0.01  4          0.0    0.5              1                0.6
##   0.01  4          0.0    0.5              1                0.7
##   0.01  4          0.0    0.5              1                0.7
##   0.01  4          0.0    0.5              1                0.8
##   0.01  4          0.0    0.5              1                0.8
##   0.01  4          0.0    0.5              1                0.9
##   0.01  4          0.0    0.5              1                0.9
##   0.01  4          0.0    0.5              1                1.0
##   0.01  4          0.0    0.5              1                1.0
##   0.01  4          0.0    0.5              5                0.5
##   0.01  4          0.0    0.5              5                0.5
##   0.01  4          0.0    0.5              5                0.6
##   0.01  4          0.0    0.5              5                0.6
##   0.01  4          0.0    0.5              5                0.7
##   0.01  4          0.0    0.5              5                0.7
##   0.01  4          0.0    0.5              5                0.8
##   0.01  4          0.0    0.5              5                0.8
##   0.01  4          0.0    0.5              5                0.9
##   0.01  4          0.0    0.5              5                0.9
##   0.01  4          0.0    0.5              5                1.0
##   0.01  4          0.0    0.5              5                1.0
##   0.01  4          0.0    0.8              1                0.5
##   0.01  4          0.0    0.8              1                0.5
##   0.01  4          0.0    0.8              1                0.6
##   0.01  4          0.0    0.8              1                0.6
##   0.01  4          0.0    0.8              1                0.7
##   0.01  4          0.0    0.8              1                0.7
##   0.01  4          0.0    0.8              1                0.8
##   0.01  4          0.0    0.8              1                0.8
##   0.01  4          0.0    0.8              1                0.9
##   0.01  4          0.0    0.8              1                0.9
##   0.01  4          0.0    0.8              1                1.0
##   0.01  4          0.0    0.8              1                1.0
##   0.01  4          0.0    0.8              5                0.5
##   0.01  4          0.0    0.8              5                0.5
##   0.01  4          0.0    0.8              5                0.6
##   0.01  4          0.0    0.8              5                0.6
##   0.01  4          0.0    0.8              5                0.7
##   0.01  4          0.0    0.8              5                0.7
##   0.01  4          0.0    0.8              5                0.8
##   0.01  4          0.0    0.8              5                0.8
##   0.01  4          0.0    0.8              5                0.9
##   0.01  4          0.0    0.8              5                0.9
##   0.01  4          0.0    0.8              5                1.0
##   0.01  4          0.0    0.8              5                1.0
##   0.01  4          0.1    0.5              1                0.5
##   0.01  4          0.1    0.5              1                0.5
##   0.01  4          0.1    0.5              1                0.6
##   0.01  4          0.1    0.5              1                0.6
```

```
##   0.01  4          0.1    0.5              1                0.7
##   0.01  4          0.1    0.5              1                0.7
##   0.01  4          0.1    0.5              1                0.8
##   0.01  4          0.1    0.5              1                0.8
##   0.01  4          0.1    0.5              1                0.9
##   0.01  4          0.1    0.5              1                0.9
##   0.01  4          0.1    0.5              1                1.0
##   0.01  4          0.1    0.5              1                1.0
##   0.01  4          0.1    0.5              5                0.5
##   0.01  4          0.1    0.5              5                0.5
##   0.01  4          0.1    0.5              5                0.6
##   0.01  4          0.1    0.5              5                0.6
##   0.01  4          0.1    0.5              5                0.7
##   0.01  4          0.1    0.5              5                0.7
##   0.01  4          0.1    0.5              5                0.8
##   0.01  4          0.1    0.5              5                0.8
##   0.01  4          0.1    0.5              5                0.9
##   0.01  4          0.1    0.5              5                0.9
##   0.01  4          0.1    0.5              5                1.0
##   0.01  4          0.1    0.5              5                1.0
##   0.01  4          0.1    0.8              1                0.5
##   0.01  4          0.1    0.8              1                0.5
##   0.01  4          0.1    0.8              1                0.6
##   0.01  4          0.1    0.8              1                0.6
##   0.01  4          0.1    0.8              1                0.7
##   0.01  4          0.1    0.8              1                0.7
##   0.01  4          0.1    0.8              1                0.8
##   0.01  4          0.1    0.8              1                0.8
##   0.01  4          0.1    0.8              1                0.9
##   0.01  4          0.1    0.8              1                0.9
##   0.01  4          0.1    0.8              1                1.0
##   0.01  4          0.1    0.8              1                1.0
##   0.01  4          0.1    0.8              5                0.5
##   0.01  4          0.1    0.8              5                0.5
##   0.01  4          0.1    0.8              5                0.6
##   0.01  4          0.1    0.8              5                0.6
##   0.01  4          0.1    0.8              5                0.7
##   0.01  4          0.1    0.8              5                0.7
##   0.01  4          0.1    0.8              5                0.8
##   0.01  4          0.1    0.8              5                0.8
##   0.01  4          0.1    0.8              5                0.9
##   0.01  4          0.1    0.8              5                0.9
##   0.01  4          0.1    0.8              5                1.0
##   0.01  4          0.1    0.8              5                1.0
##   0.05  3          0.0    0.5              1                0.5
##   0.05  3          0.0    0.5              1                0.5
##   0.05  3          0.0    0.5              1                0.6
##   0.05  3          0.0    0.5              1                0.6
##   0.05  3          0.0    0.5              1                0.7
##   0.05  3          0.0    0.5              1                0.7
##   0.05  3          0.0    0.5              1                0.8
##   0.05  3          0.0    0.5              1                0.8
##   0.05  3          0.0    0.5              1                0.9
##   0.05  3          0.0    0.5              1                0.9
```

```
##   0.05  3          0.0    0.5              1                1.0
##   0.05  3          0.0    0.5              1                1.0
##   0.05  3          0.0    0.5              5                0.5
##   0.05  3          0.0    0.5              5                0.5
##   0.05  3          0.0    0.5              5                0.6
##   0.05  3          0.0    0.5              5                0.6
##   0.05  3          0.0    0.5              5                0.7
##   0.05  3          0.0    0.5              5                0.7
##   0.05  3          0.0    0.5              5                0.8
##   0.05  3          0.0    0.5              5                0.8
##   0.05  3          0.0    0.5              5                0.9
##   0.05  3          0.0    0.5              5                0.9
##   0.05  3          0.0    0.5              5                1.0
##   0.05  3          0.0    0.5              5                1.0
##   0.05  3          0.0    0.8              1                0.5
##   0.05  3          0.0    0.8              1                0.5
##   0.05  3          0.0    0.8              1                0.6
##   0.05  3          0.0    0.8              1                0.6
##   0.05  3          0.0    0.8              1                0.7
##   0.05  3          0.0    0.8              1                0.7
##   0.05  3          0.0    0.8              1                0.8
##   0.05  3          0.0    0.8              1                0.8
##   0.05  3          0.0    0.8              1                0.9
##   0.05  3          0.0    0.8              1                0.9
##   0.05  3          0.0    0.8              1                1.0
##   0.05  3          0.0    0.8              1                1.0
##   0.05  3          0.0    0.8              5                0.5
##   0.05  3          0.0    0.8              5                0.5
##   0.05  3          0.0    0.8              5                0.6
##   0.05  3          0.0    0.8              5                0.6
##   0.05  3          0.0    0.8              5                0.7
##   0.05  3          0.0    0.8              5                0.7
##   0.05  3          0.0    0.8              5                0.8
##   0.05  3          0.0    0.8              5                0.8
##   0.05  3          0.0    0.8              5                0.9
##   0.05  3          0.0    0.8              5                0.9
##   0.05  3          0.0    0.8              5                1.0
##   0.05  3          0.0    0.8              5                1.0
##   0.05  3          0.1    0.5              1                0.5
##   0.05  3          0.1    0.5              1                0.5
##   0.05  3          0.1    0.5              1                0.6
##   0.05  3          0.1    0.5              1                0.6
##   0.05  3          0.1    0.5              1                0.7
##   0.05  3          0.1    0.5              1                0.7
##   0.05  3          0.1    0.5              1                0.8
##   0.05  3          0.1    0.5              1                0.8
##   0.05  3          0.1    0.5              1                0.9
##   0.05  3          0.1    0.5              1                0.9
##   0.05  3          0.1    0.5              1                1.0
##   0.05  3          0.1    0.5              1                1.0
##   0.05  3          0.1    0.5              5                0.5
##   0.05  3          0.1    0.5              5                0.5
##   0.05  3          0.1    0.5              5                0.6
##   0.05  3          0.1    0.5              5                0.6
```

```
##   0.05  3          0.1    0.5              5                0.7
##   0.05  3          0.1    0.5              5                0.7
##   0.05  3          0.1    0.5              5                0.8
##   0.05  3          0.1    0.5              5                0.8
##   0.05  3          0.1    0.5              5                0.9
##   0.05  3          0.1    0.5              5                0.9
##   0.05  3          0.1    0.5              5                1.0
##   0.05  3          0.1    0.5              5                1.0
##   0.05  3          0.1    0.8              1                0.5
##   0.05  3          0.1    0.8              1                0.5
##   0.05  3          0.1    0.8              1                0.6
##   0.05  3          0.1    0.8              1                0.6
##   0.05  3          0.1    0.8              1                0.7
##   0.05  3          0.1    0.8              1                0.7
##   0.05  3          0.1    0.8              1                0.8
##   0.05  3          0.1    0.8              1                0.8
##   0.05  3          0.1    0.8              1                0.9
##   0.05  3          0.1    0.8              1                0.9
##   0.05  3          0.1    0.8              1                1.0
##   0.05  3          0.1    0.8              1                1.0
##   0.05  3          0.1    0.8              5                0.5
##   0.05  3          0.1    0.8              5                0.5
##   0.05  3          0.1    0.8              5                0.6
##   0.05  3          0.1    0.8              5                0.6
##   0.05  3          0.1    0.8              5                0.7
##   0.05  3          0.1    0.8              5                0.7
##   0.05  3          0.1    0.8              5                0.8
##   0.05  3          0.1    0.8              5                0.8
##   0.05  3          0.1    0.8              5                0.9
##   0.05  3          0.1    0.8              5                0.9
##   0.05  3          0.1    0.8              5                1.0
##   0.05  3          0.1    0.8              5                1.0
##   0.05  4          0.0    0.5              1                0.5
##   0.05  4          0.0    0.5              1                0.5
##   0.05  4          0.0    0.5              1                0.6
##   0.05  4          0.0    0.5              1                0.6
##   0.05  4          0.0    0.5              1                0.7
##   0.05  4          0.0    0.5              1                0.7
##   0.05  4          0.0    0.5              1                0.8
##   0.05  4          0.0    0.5              1                0.8
##   0.05  4          0.0    0.5              1                0.9
##   0.05  4          0.0    0.5              1                0.9
##   0.05  4          0.0    0.5              1                1.0
##   0.05  4          0.0    0.5              1                1.0
##   0.05  4          0.0    0.5              5                0.5
##   0.05  4          0.0    0.5              5                0.5
##   0.05  4          0.0    0.5              5                0.6
##   0.05  4          0.0    0.5              5                0.6
##   0.05  4          0.0    0.5              5                0.7
##   0.05  4          0.0    0.5              5                0.7
##   0.05  4          0.0    0.5              5                0.8
##   0.05  4          0.0    0.5              5                0.8
##   0.05  4          0.0    0.5              5                0.9
##   0.05  4          0.0    0.5              5                0.9
```

```
##   0.05  4          0.0    0.5              5                1.0
##   0.05  4          0.0    0.5              5                1.0
##   0.05  4          0.0    0.8              1                0.5
##   0.05  4          0.0    0.8              1                0.5
##   0.05  4          0.0    0.8              1                0.6
##   0.05  4          0.0    0.8              1                0.6
##   0.05  4          0.0    0.8              1                0.7
##   0.05  4          0.0    0.8              1                0.7
##   0.05  4          0.0    0.8              1                0.8
##   0.05  4          0.0    0.8              1                0.8
##   0.05  4          0.0    0.8              1                0.9
##   0.05  4          0.0    0.8              1                0.9
##   0.05  4          0.0    0.8              1                1.0
##   0.05  4          0.0    0.8              1                1.0
##   0.05  4          0.0    0.8              5                0.5
##   0.05  4          0.0    0.8              5                0.5
##   0.05  4          0.0    0.8              5                0.6
##   0.05  4          0.0    0.8              5                0.6
##   0.05  4          0.0    0.8              5                0.7
##   0.05  4          0.0    0.8              5                0.7
##   0.05  4          0.0    0.8              5                0.8
##   0.05  4          0.0    0.8              5                0.8
##   0.05  4          0.0    0.8              5                0.9
##   0.05  4          0.0    0.8              5                0.9
##   0.05  4          0.0    0.8              5                1.0
##   0.05  4          0.0    0.8              5                1.0
##   0.05  4          0.1    0.5              1                0.5
##   0.05  4          0.1    0.5              1                0.5
##   0.05  4          0.1    0.5              1                0.6
##   0.05  4          0.1    0.5              1                0.6
##   0.05  4          0.1    0.5              1                0.7
##   0.05  4          0.1    0.5              1                0.7
##   0.05  4          0.1    0.5              1                0.8
##   0.05  4          0.1    0.5              1                0.8
##   0.05  4          0.1    0.5              1                0.9
##   0.05  4          0.1    0.5              1                0.9
##   0.05  4          0.1    0.5              1                1.0
##   0.05  4          0.1    0.5              1                1.0
##   0.05  4          0.1    0.5              5                0.5
##   0.05  4          0.1    0.5              5                0.5
##   0.05  4          0.1    0.5              5                0.6
##   0.05  4          0.1    0.5              5                0.6
##   0.05  4          0.1    0.5              5                0.7
##   0.05  4          0.1    0.5              5                0.7
##   0.05  4          0.1    0.5              5                0.8
##   0.05  4          0.1    0.5              5                0.8
##   0.05  4          0.1    0.5              5                0.9
##   0.05  4          0.1    0.5              5                0.9
##   0.05  4          0.1    0.5              5                1.0
##   0.05  4          0.1    0.5              5                1.0
##   0.05  4          0.1    0.8              1                0.5
##   0.05  4          0.1    0.8              1                0.5
##   0.05  4          0.1    0.8              1                0.6
##   0.05  4          0.1    0.8              1                0.6
```

```
##   0.05  4          0.1    0.8              1                0.7
##   0.05  4          0.1    0.8              1                0.7
##   0.05  4          0.1    0.8              1                0.8
##   0.05  4          0.1    0.8              1                0.8
##   0.05  4          0.1    0.8              1                0.9
##   0.05  4          0.1    0.8              1                0.9
##   0.05  4          0.1    0.8              1                1.0
##   0.05  4          0.1    0.8              1                1.0
##   0.05  4          0.1    0.8              5                0.5
##   0.05  4          0.1    0.8              5                0.5
##   0.05  4          0.1    0.8              5                0.6
##   0.05  4          0.1    0.8              5                0.6
##   0.05  4          0.1    0.8              5                0.7
##   0.05  4          0.1    0.8              5                0.7
##   0.05  4          0.1    0.8              5                0.8
##   0.05  4          0.1    0.8              5                0.8
##   0.05  4          0.1    0.8              5                0.9
##   0.05  4          0.1    0.8              5                0.9
##   0.05  4          0.1    0.8              5                1.0
##   0.05  4          0.1    0.8              5                1.0
##   nrounds  RMSE      Rsquared   MAE
##    50      4.230168  0.6848939  3.4118894
##   100      2.994271  0.7219663  2.2356476
##    50      4.218785  0.6804541  3.4006694
##   100      2.995950  0.7092988  2.2312023
##    50      4.213722  0.6954968  3.4032545
##   100      2.982597  0.7145489  2.2256691
##    50      4.206276  0.6851890  3.3935905
##   100      2.985411  0.7136118  2.2266582
##    50      4.206654  0.6800888  3.3922490
##   100      2.983304  0.7070905  2.2297259
##    50      4.211412  0.6783551  3.3988004
##   100      2.979328  0.7058305  2.2306709
##    50      4.238659  0.6742737  3.4243318
##   100      3.011942  0.7072342  2.2581433
##    50      4.223479  0.6798788  3.4110280
##   100      2.992214  0.7110644  2.2196925
##    50      4.213411  0.6803534  3.4049124
##   100      2.987544  0.7113540  2.2283785
##    50      4.214567  0.6789103  3.4053072
##   100      2.987262  0.7101921  2.2281585
##    50      4.204557  0.6771387  3.3993160
##   100      2.980187  0.7060114  2.2304200
##    50      4.211861  0.6663279  3.3945011
##   100      2.984161  0.6973895  2.2282309
##    50      4.171627  0.6759688  3.3984219
##   100      2.915898  0.7069511  2.1963204
##    50      4.161504  0.6834706  3.3940583
##   100      2.918855  0.7090957  2.2008929
##    50      4.162277  0.6717863  3.3914517
##   100      2.916666  0.6991895  2.1947718
##    50      4.165913  0.6692496  3.3950104
##   100      2.920186  0.6942003  2.2028017
##    50      4.161787  0.6609275  3.3911851
```

```
##   100      2.926650  0.6884372  2.2083629
##    50      4.165832  0.6491897  3.3936863
##   100      2.927084  0.6789214  2.2179575
##    50      4.162702  0.6784050  3.3930052
##   100      2.919078  0.7033606  2.1949965
##    50      4.165462  0.6732001  3.3939812
##   100      2.927385  0.7006653  2.2045373
##    50      4.166574  0.6729032  3.4001540
##   100      2.926412  0.6946288  2.2065214
##    50      4.163391  0.6648583  3.3952005
##   100      2.923019  0.6954998  2.1992965
##    50      4.163537  0.6564255  3.3971926
##   100      2.925226  0.6891258  2.2076087
##    50      4.162154  0.6526330  3.3899757
##   100      2.928983  0.6813056  2.2118875
##    50      4.213967  0.6903515  3.4058257
##   100      2.987391  0.7166987  2.2271767
##    50      4.222228  0.6886155  3.4040192
##   100      2.983519  0.7215418  2.2253863
##    50      4.210640  0.6826595  3.3962523
##   100      2.987923  0.7138809  2.2222191
##    50      4.208074  0.6839076  3.3932100
##   100      2.977837  0.7129315  2.2206220
##    50      4.222241  0.6759003  3.3975901
##   100      2.984901  0.7060939  2.2267923
##    50      4.213175  0.6709597  3.3903407
##   100      2.983991  0.7068781  2.2295988
##    50      4.232136  0.6793367  3.4240951
##   100      3.010061  0.7059835  2.2377335
##    50      4.215004  0.6786949  3.4032394
##   100      2.989139  0.7040381  2.2283630
##    50      4.213538  0.6808802  3.4031184
##   100      2.992775  0.7068949  2.2389525
##    50      4.207390  0.6843846  3.4037736
##   100      2.979265  0.7082437  2.2355192
##    50      4.216665  0.6758485  3.4015373
##   100      2.985558  0.7008850  2.2207381
##    50      4.219889  0.6609733  3.3968189
##   100      2.991419  0.6983624  2.2339734
##    50      4.168192  0.6811838  3.3978022
##   100      2.914216  0.7074248  2.1981846
##    50      4.172041  0.6757304  3.4012368
##   100      2.923095  0.7044625  2.2082142
##    50      4.164236  0.6712508  3.3925553
##   100      2.925743  0.6980774  2.2051643
##    50      4.157380  0.6656837  3.3904240
##   100      2.914751  0.6944669  2.2032192
##    50      4.165520  0.6526510  3.3956661
##   100      2.923086  0.6878665  2.2143936
##    50      4.167119  0.6432075  3.3947759
##   100      2.926621  0.6796619  2.2154275
##    50      4.169489  0.6738983  3.4003120
##   100      2.926362  0.6987018  2.2035215
##    50      4.162193  0.6813479  3.3986956
```

```
##   100      2.916625  0.7037277  2.1999244
##    50      4.164961  0.6736131  3.3928995
##   100      2.926272  0.6962008  2.2026126
##    50      4.167928  0.6602247  3.3945716
##   100      2.923325  0.6907674  2.2034018
##    50      4.159662  0.6593328  3.3936110
##   100      2.922199  0.6872559  2.2098655
##    50      4.166338  0.6476885  3.3935065
##   100      2.926974  0.6783958  2.2142736
##    50      4.197042  0.7310017  3.4104417
##   100      2.938591  0.7690258  2.2062837
##    50      4.195859  0.7305284  3.4080214
##   100      2.924195  0.7668619  2.1960682
##    50      4.181771  0.7395462  3.3945864
##   100      2.913857  0.7710311  2.1833639
##    50      4.178591  0.7345201  3.3940792
##   100      2.910084  0.7665801  2.1824855
##    50      4.176008  0.7446484  3.3952502
##   100      2.905601  0.7706530  2.1803316
##    50      4.178010  0.7266626  3.3871868
##   100      2.903422  0.7641282  2.1694254
##    50      4.208767  0.7232204  3.4203033
##   100      2.948055  0.7598234  2.2176590
##    50      4.187592  0.7287016  3.4126800
##   100      2.930710  0.7631779  2.2029748
##    50      4.180373  0.7297537  3.4036023
##   100      2.917619  0.7636330  2.1981282
##    50      4.185096  0.7239170  3.4051599
##   100      2.917101  0.7565617  2.1918349
##    50      4.182218  0.7278815  3.4011602
##   100      2.915628  0.7543561  2.1824782
##    50      4.184173  0.7193259  3.3951841
##   100      2.912251  0.7536682  2.1783468
##    50      4.138799  0.7296252  3.3937371
##   100      2.855605  0.7619587  2.1816821
##    50      4.142171  0.7314152  3.3934363
##   100      2.856581  0.7623451  2.1815960
##    50      4.134072  0.7209804  3.3928840
##   100      2.849313  0.7569374  2.1827064
##    50      4.131977  0.7240121  3.3932285
##   100      2.852016  0.7560391  2.1850398
##    50      4.131966  0.7203049  3.3901000
##   100      2.846586  0.7519534  2.1742267
##    50      4.127665  0.7131182  3.3825965
##   100      2.847614  0.7505317  2.1770883
##    50      4.154361  0.7213379  3.4103759
##   100      2.876636  0.7539927  2.2032652
##    50      4.143178  0.7142579  3.3994448
##   100      2.859102  0.7530042  2.1848772
##    50      4.137834  0.7140784  3.3980674
##   100      2.862293  0.7476182  2.1894201
##    50      4.128850  0.7276537  3.3910260
##   100      2.848627  0.7550661  2.1803996
##    50      4.133437  0.7120132  3.3947992
```

```
##   100      2.859708  0.7451821  2.1845242
##    50      4.128962  0.6975520  3.3921571
##   100      2.861369  0.7346911  2.1902934
##    50      4.198745  0.7278143  3.4125585
##   100      2.930666  0.7663958  2.2066667
##    50      4.190797  0.7379728  3.4019088
##   100      2.923998  0.7677951  2.1958206
##    50      4.190832  0.7371359  3.4026526
##   100      2.923128  0.7681343  2.1941830
##    50      4.183767  0.7428524  3.3909057
##   100      2.910488  0.7693940  2.1756563
##    50      4.172487  0.7404848  3.3858381
##   100      2.903181  0.7679894  2.1771031
##    50      4.174313  0.7256828  3.3873908
##   100      2.905862  0.7641899  2.1786705
##    50      4.202059  0.7335756  3.4180512
##   100      2.940597  0.7670048  2.2219499
##    50      4.193312  0.7404089  3.4110941
##   100      2.931551  0.7624563  2.2081538
##    50      4.183826  0.7406238  3.3963248
##   100      2.909833  0.7669969  2.1828052
##    50      4.186562  0.7232940  3.3927114
##   100      2.926089  0.7556866  2.1797686
##    50      4.186810  0.7246425  3.3994272
##   100      2.921998  0.7572328  2.1871161
##    50      4.182856  0.7250672  3.3935458
##   100      2.916480  0.7570088  2.1808028
##    50      4.143942  0.7343198  3.4001399
##   100      2.858629  0.7643189  2.1893792
##    50      4.137283  0.7308404  3.3943742
##   100      2.851922  0.7646297  2.1815627
##    50      4.130529  0.7345545  3.3849929
##   100      2.842297  0.7615856  2.1725777
##    50      4.127788  0.7240724  3.3867526
##   100      2.841806  0.7557106  2.1767711
##    50      4.131577  0.7245956  3.3856510
##   100      2.840843  0.7607887  2.1725961
##    50      4.123857  0.7169010  3.3798667
##   100      2.842791  0.7529996  2.1737751
##    50      4.148484  0.7196536  3.4038607
##   100      2.876101  0.7527071  2.1969781
##    50      4.137198  0.7236814  3.3962128
##   100      2.860384  0.7528885  2.1857954
##    50      4.136172  0.7169529  3.3945266
##   100      2.855182  0.7529633  2.1829518
##    50      4.133568  0.7192643  3.3922854
##   100      2.852217  0.7488439  2.1768740
##    50      4.133469  0.7106691  3.3951311
##   100      2.861619  0.7408270  2.1869547
##    50      4.134290  0.6946206  3.3972212
##   100      2.862114  0.7313565  2.1930358
##    50      1.708044  0.7737567  1.2381169
##   100      1.327314  0.8399047  0.9590977
##    50      1.697970  0.7795766  1.2307177
```

```
##   100      1.304506  0.8463447  0.9433549
##    50      1.683729  0.7843256  1.2261916
##   100      1.294444  0.8483620  0.9281433
##    50      1.688193  0.7797818  1.2224346
##   100      1.295991  0.8490609  0.9313413
##    50      1.681964  0.7823312  1.2310605
##   100      1.318178  0.8417392  0.9476350
##    50      1.688604  0.7779456  1.2246634
##   100      1.339180  0.8359388  0.9620885
##    50      1.709883  0.7702318  1.2247274
##   100      1.343114  0.8352975  0.9618663
##    50      1.714727  0.7689737  1.2313285
##   100      1.329153  0.8379841  0.9521204
##    50      1.709497  0.7707747  1.2373737
##   100      1.348806  0.8332397  0.9694269
##    50      1.726481  0.7664369  1.2559290
##   100      1.357861  0.8317981  0.9749494
##    50      1.706453  0.7696244  1.2256265
##   100      1.333621  0.8354151  0.9438318
##    50      1.709639  0.7703800  1.2465709
##   100      1.349701  0.8337790  0.9745862
##    50      1.638701  0.7797781  1.1383903
##   100      1.258496  0.8539969  0.8776633
##    50      1.626862  0.7858175  1.1451923
##   100      1.270459  0.8504857  0.8840130
##    50      1.619958  0.7835360  1.1364999
##   100      1.257161  0.8511720  0.8834262
##    50      1.635701  0.7825562  1.1498136
##   100      1.273186  0.8501168  0.8807254
##    50      1.626621  0.7844134  1.1603378
##   100      1.272106  0.8496945  0.8950891
##    50      1.654824  0.7726998  1.1660643
##   100      1.355525  0.8266428  0.9457587
##    50      1.665107  0.7702474  1.1606598
##   100      1.282335  0.8467124  0.8994322
##    50      1.650474  0.7790493  1.1575057
##   100      1.269685  0.8498580  0.8914286
##    50      1.640731  0.7797242  1.1439566
##   100      1.290960  0.8444591  0.8967963
##    50      1.645087  0.7811966  1.1561221
##   100      1.289684  0.8442761  0.8984172
##    50      1.641582  0.7779508  1.1539956
##   100      1.320652  0.8369596  0.9149156
##    50      1.670010  0.7691971  1.1770728
##   100      1.361549  0.8249159  0.9517865
##    50      1.703414  0.7692451  1.2269728
##   100      1.319613  0.8397348  0.9479082
##    50      1.667701  0.7865586  1.2075085
##   100      1.285595  0.8503951  0.9262070
##    50      1.672386  0.7848442  1.2135047
##   100      1.298055  0.8459108  0.9348106
##    50      1.697438  0.7751410  1.2241555
##   100      1.309365  0.8446088  0.9279780
##    50      1.684698  0.7800721  1.2132263
```

```
##   100      1.314906  0.8427613  0.9317019
##    50      1.690918  0.7755047  1.2233145
##   100      1.326482  0.8395611  0.9502275
##    50      1.705839  0.7714267  1.2285218
##   100      1.320387  0.8389382  0.9406791
##    50      1.722495  0.7671163  1.2465773
##   100      1.318685  0.8417181  0.9474819
##    50      1.711368  0.7757270  1.2536677
##   100      1.323010  0.8420668  0.9523687
##    50      1.718729  0.7643134  1.2336044
##   100      1.338110  0.8361288  0.9543977
##    50      1.701787  0.7720601  1.2340269
##   100      1.337272  0.8365859  0.9577358
##    50      1.708818  0.7723750  1.2394695
##   100      1.331696  0.8393410  0.9549221
##    50      1.643587  0.7803262  1.1541191
##   100      1.262916  0.8528276  0.8943932
##    50      1.626511  0.7847551  1.1287876
##   100      1.258022  0.8528950  0.8735468
##    50      1.620128  0.7874516  1.1464863
##   100      1.265990  0.8509992  0.8865238
##    50      1.615855  0.7864990  1.1401160
##   100      1.260752  0.8522045  0.8867685
##    50      1.638177  0.7795050  1.1472657
##   100      1.301545  0.8428090  0.8997794
##    50      1.637361  0.7792374  1.1538791
##   100      1.338019  0.8316978  0.9335479
##    50      1.652824  0.7753889  1.1420172
##   100      1.305830  0.8386588  0.9156071
##    50      1.652557  0.7756442  1.1550786
##   100      1.289934  0.8447755  0.8957030
##    50      1.658812  0.7745203  1.1490948
##   100      1.285349  0.8467780  0.9004094
##    50      1.666706  0.7691923  1.1665242
##   100      1.301107  0.8423479  0.9015639
##    50      1.638591  0.7789136  1.1531743
##   100      1.307264  0.8409899  0.9123399
##    50      1.633997  0.7804396  1.1657306
##   100      1.315155  0.8380444  0.9256590
##    50      1.543510  0.8288137  1.0972717
##   100      1.136893  0.8848532  0.8009675
##    50      1.509641  0.8393193  1.0715348
##   100      1.086384  0.8953666  0.7629663
##    50      1.509202  0.8353953  1.0597470
##   100      1.101864  0.8914634  0.7644286
##    50      1.506285  0.8407796  1.0790396
##   100      1.094426  0.8944071  0.7641807
##    50      1.515113  0.8322879  1.0684325
##   100      1.145670  0.8813447  0.7864017
##    50      1.517223  0.8302878  1.0724707
##   100      1.139052  0.8823880  0.7846840
##    50      1.608155  0.8072650  1.1451985
##   100      1.196550  0.8702156  0.8449680
##    50      1.571454  0.8170595  1.0987095
```

```
##   100      1.165770  0.8759649  0.8050151
##    50      1.544639  0.8294991  1.0997275
##   100      1.122789  0.8884143  0.7895822
##    50      1.552298  0.8254116  1.1081915
##   100      1.139093  0.8846399  0.7956011
##    50      1.535619  0.8315702  1.0889798
##   100      1.119200  0.8891823  0.7834124
##    50      1.510256  0.8324701  1.0668370
##   100      1.138072  0.8814529  0.7815408
##    50      1.459537  0.8408600  1.0030004
##   100      1.051666  0.8987139  0.7194156
##    50      1.455653  0.8351361  0.9995703
##   100      1.063004  0.8942397  0.7195142
##    50      1.437266  0.8423836  0.9855274
##   100      1.062980  0.8949379  0.7131608
##    50      1.417539  0.8469935  0.9849430
##   100      1.032491  0.9016513  0.6988866
##    50      1.434810  0.8401649  0.9902006
##   100      1.077837  0.8909822  0.7173101
##    50      1.470679  0.8307561  1.0169053
##   100      1.104941  0.8863077  0.7407431
##    50      1.481510  0.8312800  1.0132188
##   100      1.093175  0.8881637  0.7472468
##    50      1.498439  0.8236871  1.0311339
##   100      1.106941  0.8852043  0.7491096
##    50      1.486102  0.8242553  1.0122394
##   100      1.101522  0.8853771  0.7508847
##    50      1.480799  0.8270427  1.0164838
##   100      1.099259  0.8857767  0.7320718
##    50      1.462480  0.8290310  0.9931564
##   100      1.098447  0.8860466  0.7307629
##    50      1.495779  0.8223307  1.0345772
##   100      1.169898  0.8714268  0.7839130
##    50      1.549924  0.8269205  1.0957009
##   100      1.143847  0.8820424  0.7960348
##    50      1.525912  0.8321895  1.0765301
##   100      1.115470  0.8882885  0.7783385
##    50      1.547340  0.8272225  1.1014580
##   100      1.131595  0.8854679  0.8006006
##    50      1.519644  0.8325375  1.0703281
##   100      1.099865  0.8920768  0.7556768
##    50      1.525702  0.8375791  1.0924460
##   100      1.117661  0.8898958  0.7829567
##    50      1.538085  0.8262555  1.0842286
##   100      1.129630  0.8853767  0.7881391
##    50      1.583412  0.8178540  1.1387245
##   100      1.170078  0.8772518  0.8331029
##    50      1.551807  0.8254819  1.1084684
##   100      1.131626  0.8847086  0.7994977
##    50      1.561094  0.8181576  1.1042600
##   100      1.147657  0.8805267  0.7996441
##    50      1.515609  0.8349309  1.0878969
##   100      1.113907  0.8886379  0.7807948
##    50      1.543562  0.8295852  1.1062034
```

```
##   100      1.113100  0.8913744  0.7851458
##    50      1.518185  0.8335519  1.0679793
##   100      1.133548  0.8845986  0.7794735
##    50      1.452253  0.8412095  1.0008299
##   100      1.052184  0.8976088  0.7198278
##    50      1.451656  0.8392301  0.9961201
##   100      1.063751  0.8954188  0.7110697
##    50      1.425023  0.8433330  0.9965505
##   100      1.052904  0.8964220  0.7213235
##    50      1.450812  0.8361764  0.9888059
##   100      1.095147  0.8870125  0.7247276
##    50      1.482752  0.8269184  1.0120052
##   100      1.124946  0.8808954  0.7445072
##    50      1.479339  0.8277194  1.0117027
##   100      1.131863  0.8803563  0.7548511
##    50      1.503967  0.8241913  1.0281735
##   100      1.116579  0.8839958  0.7689952
##    50      1.483573  0.8256061  1.0026653
##   100      1.096368  0.8869156  0.7377888
##    50      1.475439  0.8298026  1.0070058
##   100      1.085476  0.8899612  0.7321835
##    50      1.456784  0.8368308  0.9991593
##   100      1.089107  0.8893652  0.7270109
##    50      1.472252  0.8269537  1.0115488
##   100      1.109634  0.8838453  0.7411898
##    50      1.477305  0.8273249  1.0101062
##   100      1.138739  0.8779855  0.7555636
##
## RMSE was used to select the optimal model using the smallest value.
## The final values used for the model were nrounds = 100, max_depth = 4, eta
##  = 0.05, gamma = 0, colsample_bytree = 0.8, min_child_weight = 1 and
##  subsample = 0.8.
```

```
# Make predictions on test data using the tuned model
test_X <- test_data[, 3:12]
test_y_pred <- predict(model_tune, newdata = as.matrix(test_X))

# Convert test_y_pred to a numeric matrix
test_y_pred_num <- as.matrix(test_y_pred)

# Use majority vote to combine the predictions
test_y_pred_majority <- ifelse(rowSums(test_y_pred_num == "0") >= 3, "0", "1")


# Compute misclassification rate
test_y <- test_data$y
misclassification_rate <- sum(test_y != test_y_pred_majority) / length(test_y)
print(paste0("Misclassification rate: ", misclassification_rate))
```

```
## [1] "Misclassification rate: 0.909090909090909"
```