ClaimsPrediction

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### In this data science project, we will develop automated methods for predicting the cost, and severity of insurance claims.

#### Data Input step

train <- read.csv("D:/ML-in-R/ML-in-R/All State Insurance Claims Severity Prediction/Datasets/train.csv")  
train<-train[1:2000,]  
  
test <- read.csv("D:/ML-in-R/ML-in-R/All State Insurance Claims Severity Prediction/Datasets/test.csv")  
test<-test[1:2000,]

head(train)

## id cat1 cat2 cat3 cat4 cat5 cat6 cat7 cat8 cat9 cat10 cat11 cat12 cat13 cat14  
## 1 1 A B A B A A A A B A B A A A  
## 2 2 A B A A A A A A B B A A A A  
## 3 5 A B A A B A A A B B B B B A  
## 4 10 B B A B A A A A B A A A A A  
## 5 11 A B A B A A A A B B A B A A  
## 6 13 A B A A A A A A B A A A A A  
## cat15 cat16 cat17 cat18 cat19 cat20 cat21 cat22 cat23 cat24 cat25 cat26 cat27  
## 1 A A A A A A A A B A A A A  
## 2 A A A A A A A A A A A A A  
## 3 A A A A A A A A A A A A A  
## 4 A A A A A A A A B A A A A  
## 5 A A A A A A A A B A A A A  
## 6 A A A A A A A A A A A A A  
## cat28 cat29 cat30 cat31 cat32 cat33 cat34 cat35 cat36 cat37 cat38 cat39 cat40  
## 1 A A A A A A A A A A A A A  
## 2 A A A A A A A A A A A A A  
## 3 A A A A A A A A B A A A A  
## 4 A A A A A A A A A A A A A  
## 5 A A A A A A A A A A A A A  
## 6 A A A A A A A A A A A A A  
## cat41 cat42 cat43 cat44 cat45 cat46 cat47 cat48 cat49 cat50 cat51 cat52 cat53  
## 1 A A A A A A A A A A A A A  
## 2 A A A A A A A A A A A A A  
## 3 A A A A A A A A A A A A A  
## 4 A A A A A A A A A A A A A  
## 5 A A A A A A A A A A A A A  
## 6 A A A A A A A A A A A A A  
## cat54 cat55 cat56 cat57 cat58 cat59 cat60 cat61 cat62 cat63 cat64 cat65 cat66  
## 1 A A A A A A A A A A A A A  
## 2 A A A A A A A A A A A A A  
## 3 A A A A A A A A A A A A A  
## 4 A A A A A A A A A A A A A  
## 5 A A A A A A A A A A A A A  
## 6 A A A A A A A A A A A A A  
## cat67 cat68 cat69 cat70 cat71 cat72 cat73 cat74 cat75 cat76 cat77 cat78 cat79  
## 1 A A A A A A A A B A D B B  
## 2 A A A A A A A A A A D B B  
## 3 A A A A A A A A A A D B B  
## 4 A A A A A A B A A A D B B  
## 5 A A A A A B A A A A D B D  
## 6 A A A A A B A A A A D B D  
## cat80 cat81 cat82 cat83 cat84 cat85 cat86 cat87 cat88 cat89 cat90 cat91 cat92  
## 1 D D B D C B D B A A A A A  
## 2 D D A B C B D B A A A A A  
## 3 B D B D C B B B A A A A A  
## 4 D D D B C B D B A A A A A  
## 5 B D B B C B B C A A A B H  
## 6 B D B B C B B B A A A A A  
## cat93 cat94 cat95 cat96 cat97 cat98 cat99 cat100 cat101 cat102 cat103 cat104  
## 1 D B C E A C T B G A A I  
## 2 D D C E E D T L F A A E  
## 3 D D C E E A D L O A B E  
## 4 D D C E E D T I D A A E  
## 5 D B D E E A P F J A A D  
## 6 D D D E C A P J D A A E  
## cat105 cat106 cat107 cat108 cat109 cat110 cat111 cat112 cat113 cat114 cat115  
## 1 E G J G BU BC C AS S A O  
## 2 E I K K BI CQ A AV BM A O  
## 3 F H F A AB DK A C AF A I  
## 4 E I K K BI CS C N AE A O  
## 5 E K G B H C C Y BM A K  
## 6 E H F B BI CS A AS AE A K  
## cat116 cont1 cont2 cont3 cont4 cont5 cont6 cont7 cont8  
## 1 LB 0.726300 0.245921 0.187583 0.789639 0.310061 0.718367 0.335060 0.30260  
## 2 DP 0.330514 0.737068 0.592681 0.614134 0.885834 0.438917 0.436585 0.60087  
## 3 GK 0.261841 0.358319 0.484196 0.236924 0.397069 0.289648 0.315545 0.27320  
## 4 DJ 0.321594 0.555782 0.527991 0.373816 0.422268 0.440945 0.391128 0.31796  
## 5 CK 0.273204 0.159990 0.527991 0.473202 0.704268 0.178193 0.247408 0.24564  
## 6 DJ 0.546670 0.681761 0.634224 0.373816 0.302678 0.364464 0.401162 0.26847  
## cont9 cont10 cont11 cont12 cont13 cont14 loss  
## 1 0.67135 0.83510 0.569745 0.594646 0.822493 0.714843 2213.18  
## 2 0.35127 0.43919 0.338312 0.366307 0.611431 0.304496 1283.60  
## 3 0.26076 0.32446 0.381398 0.373424 0.195709 0.774425 3005.09  
## 4 0.32128 0.44467 0.327915 0.321570 0.605077 0.602642 939.85  
## 5 0.22089 0.21230 0.204687 0.202213 0.246011 0.432606 2763.85  
## 6 0.46226 0.50556 0.366788 0.359249 0.345247 0.726792 5142.87

dim(train)

## [1] 2000 132

str(train)

## 'data.frame': 2000 obs. of 132 variables:  
## $ id : int 1 2 5 10 11 13 14 20 23 24 ...  
## $ cat1 : chr "A" "A" "A" "B" ...  
## $ cat2 : chr "B" "B" "B" "B" ...  
## $ cat3 : chr "A" "A" "A" "A" ...  
## $ cat4 : chr "B" "A" "A" "B" ...  
## $ cat5 : chr "A" "A" "B" "A" ...  
## $ cat6 : chr "A" "A" "A" "A" ...  
## $ cat7 : chr "A" "A" "A" "A" ...  
## $ cat8 : chr "A" "A" "A" "A" ...  
## $ cat9 : chr "B" "B" "B" "B" ...  
## $ cat10 : chr "A" "B" "B" "A" ...  
## $ cat11 : chr "B" "A" "B" "A" ...  
## $ cat12 : chr "A" "A" "B" "A" ...  
## $ cat13 : chr "A" "A" "B" "A" ...  
## $ cat14 : chr "A" "A" "A" "A" ...  
## $ cat15 : chr "A" "A" "A" "A" ...  
## $ cat16 : chr "A" "A" "A" "A" ...  
## $ cat17 : chr "A" "A" "A" "A" ...  
## $ cat18 : chr "A" "A" "A" "A" ...  
## $ cat19 : chr "A" "A" "A" "A" ...  
## $ cat20 : chr "A" "A" "A" "A" ...  
## $ cat21 : chr "A" "A" "A" "A" ...  
## $ cat22 : chr "A" "A" "A" "A" ...  
## $ cat23 : chr "B" "A" "A" "B" ...  
## $ cat24 : chr "A" "A" "A" "A" ...  
## $ cat25 : chr "A" "A" "A" "A" ...  
## $ cat26 : chr "A" "A" "A" "A" ...  
## $ cat27 : chr "A" "A" "A" "A" ...  
## $ cat28 : chr "A" "A" "A" "A" ...  
## $ cat29 : chr "A" "A" "A" "A" ...  
## $ cat30 : chr "A" "A" "A" "A" ...  
## $ cat31 : chr "A" "A" "A" "A" ...  
## $ cat32 : chr "A" "A" "A" "A" ...  
## $ cat33 : chr "A" "A" "A" "A" ...  
## $ cat34 : chr "A" "A" "A" "A" ...  
## $ cat35 : chr "A" "A" "A" "A" ...  
## $ cat36 : chr "A" "A" "B" "A" ...  
## $ cat37 : chr "A" "A" "A" "A" ...  
## $ cat38 : chr "A" "A" "A" "A" ...  
## $ cat39 : chr "A" "A" "A" "A" ...  
## $ cat40 : chr "A" "A" "A" "A" ...  
## $ cat41 : chr "A" "A" "A" "A" ...  
## $ cat42 : chr "A" "A" "A" "A" ...  
## $ cat43 : chr "A" "A" "A" "A" ...  
## $ cat44 : chr "A" "A" "A" "A" ...  
## $ cat45 : chr "A" "A" "A" "A" ...  
## $ cat46 : chr "A" "A" "A" "A" ...  
## $ cat47 : chr "A" "A" "A" "A" ...  
## $ cat48 : chr "A" "A" "A" "A" ...  
## $ cat49 : chr "A" "A" "A" "A" ...  
## $ cat50 : chr "A" "A" "A" "A" ...  
## $ cat51 : chr "A" "A" "A" "A" ...  
## $ cat52 : chr "A" "A" "A" "A" ...  
## $ cat53 : chr "A" "A" "A" "A" ...  
## $ cat54 : chr "A" "A" "A" "A" ...  
## $ cat55 : chr "A" "A" "A" "A" ...  
## $ cat56 : chr "A" "A" "A" "A" ...  
## $ cat57 : chr "A" "A" "A" "A" ...  
## $ cat58 : chr "A" "A" "A" "A" ...  
## $ cat59 : chr "A" "A" "A" "A" ...  
## $ cat60 : chr "A" "A" "A" "A" ...  
## $ cat61 : chr "A" "A" "A" "A" ...  
## $ cat62 : chr "A" "A" "A" "A" ...  
## $ cat63 : chr "A" "A" "A" "A" ...  
## $ cat64 : chr "A" "A" "A" "A" ...  
## $ cat65 : chr "A" "A" "A" "A" ...  
## $ cat66 : chr "A" "A" "A" "A" ...  
## $ cat67 : chr "A" "A" "A" "A" ...  
## $ cat68 : chr "A" "A" "A" "A" ...  
## $ cat69 : chr "A" "A" "A" "A" ...  
## $ cat70 : chr "A" "A" "A" "A" ...  
## $ cat71 : chr "A" "A" "A" "A" ...  
## $ cat72 : chr "A" "A" "A" "A" ...  
## $ cat73 : chr "A" "A" "A" "B" ...  
## $ cat74 : chr "A" "A" "A" "A" ...  
## $ cat75 : chr "B" "A" "A" "A" ...  
## $ cat76 : chr "A" "A" "A" "A" ...  
## $ cat77 : chr "D" "D" "D" "D" ...  
## $ cat78 : chr "B" "B" "B" "B" ...  
## $ cat79 : chr "B" "B" "B" "B" ...  
## $ cat80 : chr "D" "D" "B" "D" ...  
## $ cat81 : chr "D" "D" "D" "D" ...  
## $ cat82 : chr "B" "A" "B" "D" ...  
## $ cat83 : chr "D" "B" "D" "B" ...  
## $ cat84 : chr "C" "C" "C" "C" ...  
## $ cat85 : chr "B" "B" "B" "B" ...  
## $ cat86 : chr "D" "D" "B" "D" ...  
## $ cat87 : chr "B" "B" "B" "B" ...  
## $ cat88 : chr "A" "A" "A" "A" ...  
## $ cat89 : chr "A" "A" "A" "A" ...  
## $ cat90 : chr "A" "A" "A" "A" ...  
## $ cat91 : chr "A" "A" "A" "A" ...  
## $ cat92 : chr "A" "A" "A" "A" ...  
## $ cat93 : chr "D" "D" "D" "D" ...  
## $ cat94 : chr "B" "D" "D" "D" ...  
## $ cat95 : chr "C" "C" "C" "C" ...  
## $ cat96 : chr "E" "E" "E" "E" ...  
## $ cat97 : chr "A" "E" "E" "E" ...  
## $ cat98 : chr "C" "D" "A" "D" ...  
## [list output truncated]

#### Target variable is a continuous variable -it is a prediction problem

# exploratory data analysis  
table(train$cat1);table(train$cat2);table(train$cat3);table(train$cat4);table(train$cat5)

##   
## A B   
## 1516 484

##   
## A B   
## 1124 876

##   
## A B   
## 1881 119

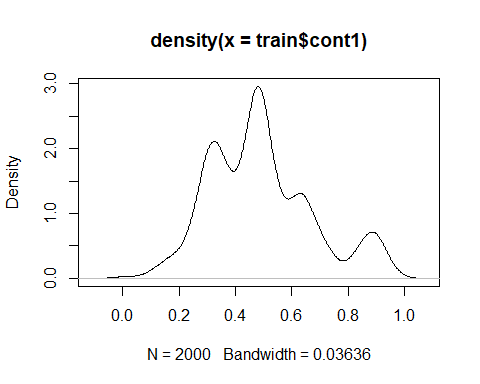
##   
## A B   
## 1354 646

##   
## A B   
## 1309 691

df <-train[,c(2:117)]  
apply(df,2,table)

## $cat1  
##   
## A B   
## 1516 484   
##   
## $cat2  
##   
## A B   
## 1124 876   
##   
## $cat3  
##   
## A B   
## 1881 119   
##   
## $cat4  
##   
## A B   
## 1354 646   
##   
## $cat5  
##   
## A B   
## 1309 691   
##   
## $cat6  
##   
## A B   
## 1387 613   
##   
## $cat7  
##   
## A B   
## 1941 59   
##   
## $cat8  
##   
## A B   
## 1865 135   
##   
## $cat9  
##   
## A B   
## 1188 812   
##   
## $cat10  
##   
## A B   
## 1692 308   
##   
## $cat11  
##   
## A B   
## 1763 237   
##   
## $cat12  
##   
## A B   
## 1697 303   
##   
## $cat13  
##   
## A B   
## 1796 204   
##   
## $cat14  
##   
## A B   
## 1974 26   
##   
## $cat15  
##   
## A   
## 2000   
##   
## $cat16  
##   
## A B   
## 1926 74   
##   
## $cat17  
##   
## A B   
## 1986 14   
##   
## $cat18  
##   
## A B   
## 1991 9   
##   
## $cat19  
##   
## A B   
## 1979 21   
##   
## $cat20  
##   
## A B   
## 1998 2   
##   
## $cat21  
##   
## A B   
## 1992 8   
##   
## $cat22  
##   
## A   
## 2000   
##   
## $cat23  
##   
## A B   
## 1659 341   
##   
## $cat24  
##   
## A B   
## 1937 63   
##   
## $cat25  
##   
## A B   
## 1815 185   
##   
## $cat26  
##   
## A B   
## 1891 109   
##   
## $cat27  
##   
## A B   
## 1780 220   
##   
## $cat28  
##   
## A B   
## 1927 73   
##   
## $cat29  
##   
## A B   
## 1956 44   
##   
## $cat30  
##   
## A B   
## 1968 32   
##   
## $cat31  
##   
## A B   
## 1951 49   
##   
## $cat32  
##   
## A B   
## 1985 15   
##   
## $cat33  
##   
## A B   
## 1990 10   
##   
## $cat34  
##   
## A B   
## 1994 6   
##   
## $cat35  
##   
## A B   
## 1998 2   
##   
## $cat36  
##   
## A B   
## 1670 330   
##   
## $cat37  
##   
## A B   
## 1732 268   
##   
## $cat38  
##   
## A B   
## 1832 168   
##   
## $cat39  
##   
## A B   
## 1963 37   
##   
## $cat40  
##   
## A B   
## 1919 81   
##   
## $cat41  
##   
## A B   
## 1929 71   
##   
## $cat42  
##   
## A B   
## 1983 17   
##   
## $cat43  
##   
## A B   
## 1956 44   
##   
## $cat44  
##   
## A B   
## 1822 178   
##   
## $cat45  
##   
## A B   
## 1948 52   
##   
## $cat46  
##   
## A B   
## 1993 7   
##   
## $cat47  
##   
## A B   
## 1988 12   
##   
## $cat48  
##   
## A B   
## 1999 1   
##   
## $cat49  
##   
## A B   
## 1904 96   
##   
## $cat50  
##   
## A B   
## 1461 539   
##   
## $cat51  
##   
## A B   
## 1982 18   
##   
## $cat52  
##   
## A B   
## 1916 84   
##   
## $cat53  
##   
## A B   
## 1822 178   
##   
## $cat54  
##   
## A B   
## 1949 51   
##   
## $cat55  
##   
## A B   
## 1999 1   
##   
## $cat56  
##   
## A B   
## 1999 1   
##   
## $cat57  
##   
## A B   
## 1958 42   
##   
## $cat58  
##   
## A B   
## 1999 1   
##   
## $cat59  
##   
## A B   
## 1999 1   
##   
## $cat60  
##   
## A B   
## 1997 3   
##   
## $cat61  
##   
## A B   
## 1989 11   
##   
## $cat62  
##   
## A   
## 2000   
##   
## $cat63  
##   
## A B   
## 1999 1   
##   
## $cat64  
##   
## A B   
## 1998 2   
##   
## $cat65  
##   
## A B   
## 1971 29   
##   
## $cat66  
##   
## A B   
## 1897 103   
##   
## $cat67  
##   
## A B   
## 1993 7   
##   
## $cat68  
##   
## A B   
## 1999 1   
##   
## $cat69  
##   
## A B   
## 1994 6   
##   
## $cat70  
##   
## A   
## 2000   
##   
## $cat71  
##   
## A B   
## 1879 121   
##   
## $cat72  
##   
## A B   
## 1239 761   
##   
## $cat73  
##   
## A B   
## 1653 347   
##   
## $cat74  
##   
## A B   
## 1964 36   
##   
## $cat75  
##   
## A B   
## 1669 331   
##   
## $cat76  
##   
## A B C   
## 1917 74 9   
##   
## $cat77  
##   
## B C D   
## 4 5 1991   
##   
## $cat78  
##   
## A B C D   
## 9 1977 11 3   
##   
## $cat79  
##   
## A B C D   
## 64 1634 17 285   
##   
## $cat80  
##   
## A B C D   
## 9 497 34 1460   
##   
## $cat81  
##   
## A B C D   
## 9 254 74 1663   
##   
## $cat82  
##   
## A B C D   
## 217 1538 28 217   
##   
## $cat83  
##   
## A B C D   
## 302 1490 52 156   
##   
## $cat84  
##   
## A B C D   
## 298 3 1668 31   
##   
## $cat85  
##   
## A B C D   
## 9 1979 11 1   
##   
## $cat86  
##   
## A B C D   
## 24 1109 94 773   
##   
## $cat87  
##   
## A B C D   
## 9 1781 83 127   
##   
## $cat88  
##   
## A D E   
## 1799 200 1   
##   
## $cat89  
##   
## A B C   
## 1941 57 2   
##   
## $cat90  
##   
## A B C   
## 1881 110 9   
##   
## $cat91  
##   
## A B C D E G   
## 1189 460 73 8 4 266   
##   
## $cat92  
##   
## A B C D H   
## 1322 10 2 1 665   
##   
## $cat93  
##   
## A B C D E   
## 9 10 378 1591 12   
##   
## $cat94  
##   
## A B C D E F   
## 11 538 160 1285 1 5   
##   
## $cat95  
##   
## A C D E   
## 54 913 865 168   
##   
## $cat96  
##   
## B D E F G   
## 30 78 1853 8 31   
##   
## $cat97  
##   
## A C D E F G   
## 461 857 33 495 4 150   
##   
## $cat98  
##   
## A B C D E   
## 1133 6 232 535 94   
##   
## $cat99  
##   
## C D E F J K N P R S T   
## 1 92 20 34 3 18 26 865 94 73 774   
##   
## $cat100  
##   
## A B C D F G H I J K L M N O   
## 86 72 6 11 472 116 123 397 138 171 214 45 90 59   
##   
## $cat101  
##   
## A C D F G I J L M O Q R S   
## 1124 189 174 115 108 78 69 38 39 31 33 1 1   
##   
## $cat102  
##   
## A B C D E G   
## 1865 60 63 7 4 1   
##   
## $cat103  
##   
## A B C D E F G H   
## 1309 367 180 70 52 13 7 2   
##   
## $cat104  
##   
## C D E F G H I J K L M N O P   
## 64 303 449 203 428 191 124 41 143 33 13 2 4 2   
##   
## $cat105  
##   
## A C D E F G H I J K M   
## 1 1 121 787 677 204 135 48 14 9 3   
##   
## $cat106  
##   
## A C D E F G H I J K L M   
## 1 1 17 144 384 502 405 238 184 90 28 6   
##   
## $cat107  
##   
## A C D E F G H I J K L M N O Q   
## 1 3 34 120 527 325 246 182 226 226 72 30 6 1 1   
##   
## $cat108  
##   
## A B C D E F G H I J K   
## 90 685 6 230 74 94 231 55 73 4 458   
##   
## $cat109  
##   
## AB AL AM AR AS AT BE BH BI BJ BL BM BO BQ BR BU   
## 218 2 1 1 3 1 1 3 1634 1 2 1 3 9 1 32   
## C CD CF CI CL D F G H I K L M N R S   
## 1 2 1 2 3 1 3 21 3 1 31 3 6 5 1 1   
## U X   
## 1 1   
##   
## $cat110  
##   
## A AC AD AI AK AM AP AR AW AX AY BA BC BG BP BS BT BX C CF   
## 10 39 7 27 5 6 5 1 1 1 4 1 52 2 30 18 163 2 40 1   
## CG CH CI CJ CL CM CO CQ CR CS DA DC DF DH DK DL DM DT DU DW   
## 2 5 7 2 277 14 198 34 8 238 1 2 1 2 20 6 7 1 1 34   
## DX EA EB EE EF EG EL EM G I L N O R T U V W X   
## 39 3 215 16 17 270 87 3 1 1 1 3 1 1 5 2 21 36 3   
##   
## $cat111  
##   
## A C E G I K M O S W   
## 1354 382 145 59 30 17 6 3 3 1   
##   
## $cat112  
##   
## A AA AB AC AD AE AF AG AH AI AJ AK AL AM AN AO AP AQ AR AS   
## 27 11 1 11 18 3 105 10 215 43 1 62 13 12 87 4 32 1 32 201   
## AT AU AV AW AX AY B BA C D E F G H I J K L M N   
## 10 4 77 40 10 15 5 2 29 10 266 37 37 7 6 186 60 5 6 92   
## O P Q R S T U V W X Y   
## 22 7 4 8 35 7 83 8 5 13 15   
##   
## $cat113  
##   
## A AD AE AF AG AH AI AJ AK AM AN AO AQ AS AT AU AV AW AX AY   
## 32 51 221 58 25 1 7 54 41 8 56 12 1 42 61 15 4 16 155 7   
## BC BD BF BG BH BJ BK BM BN BO C F G H I J K L M N   
## 24 3 6 22 5 21 13 284 40 13 2 18 1 62 34 38 75 123 29 33   
## Q S X Y   
## 29 68 81 109   
##   
## $cat114  
##   
## A B C E F I J L N O R U   
## 1387 1 175 190 72 25 99 9 27 5 7 3   
##   
## $cat115  
##   
## A F G H I J K L M N O P Q R S   
## 1 5 3 31 78 258 485 155 128 223 291 224 89 28 1   
##   
## $cat116  
##   
## AC B BA BD BO BP BX BY CB CD CF CG CI CK CN CO CP CR CS CT   
## 1 1 1 3 2 3 6 14 16 4 1 1 13 102 2 3 3 74 10 1   
## CU CW CY DA DC DD DF DH DI DJ DK DM DN DP DS DX E EA EB EC   
## 8 8 1 1 53 3 25 6 3 192 9 1 6 99 9 1 3 2 1 15   
## ED EE EF EI EK EL EN EO EP ES EY FA FB FC FD FE FG FH FR FT   
## 2 3 1 4 8 4 1 8 2 2 2 1 9 3 3 2 2 4 9 3   
## FW FX GA GB GC GE GI GJ GK GL GM GN GO GS GT GU GW GX H HA   
## 1 2 4 3 33 13 21 2 28 2 2 9 1 93 5 4 1 10 1 16   
## HB HC HG HH HI HJ HK HL HM HN HP HQ HR HV HW HX IC ID IE IF   
## 16 11 47 2 2 26 204 6 7 20 2 42 1 54 2 67 7 1 48 5   
## IG IH II IL IQ IT IU IY JG JL JR JU JW JX K KA KB KC KD KE   
## 21 13 1 1 2 4 4 2 1 1 12 2 2 3 2 5 3 16 2 1   
## KI KJ KL KN KP KQ KR KT KW LA LB LC LE LF LH LI LJ LL LM LN   
## 4 2 2 3 2 3 6 1 42 1 35 3 1 20 2 3 9 2 21 32   
## LO LQ LV LW LX LY MC MD ME MG MI MJ MO MP U   
## 15 8 3 4 7 19 8 25 3 7 1 3 1 2 1

plot(density(train$cont1))

 ##### shapiro test ##### Null : the distribution is normal ##### Alt : the distribution is not normal

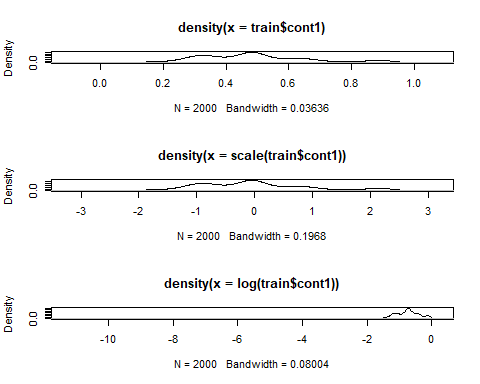
# shapiro test on cont1  
shapiro.test(train[1:1000,"cont1"])

##   
## Shapiro-Wilk normality test  
##   
## data: train[1:1000, "cont1"]  
## W = 0.96971, p-value = 1.385e-13

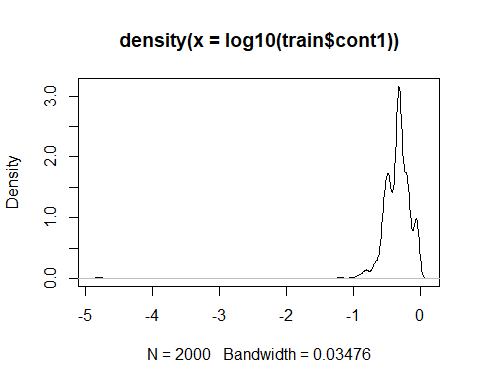
# we should not check the normality assumption for samples > 5000

##### since the p-value is less than 0.05 we can reject the null hypothesis

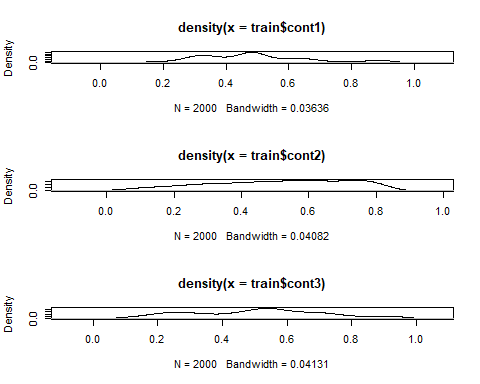
par(mfrow=c(3,1))  
plot(density(train$cont1));plot(density(scale(train$cont1)));plot(density(log(train$cont1)))



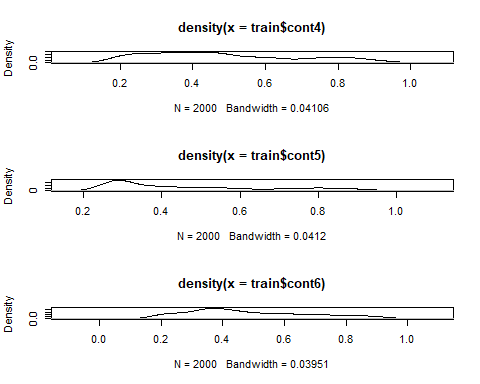
plot(density(log10(train$cont1)))



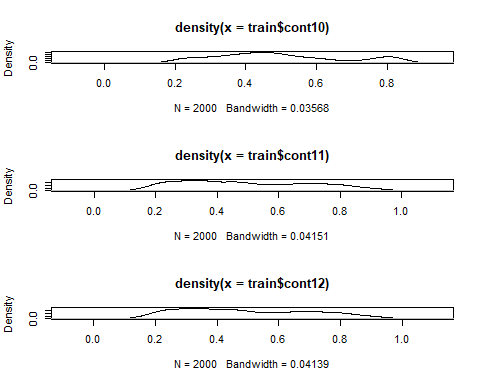
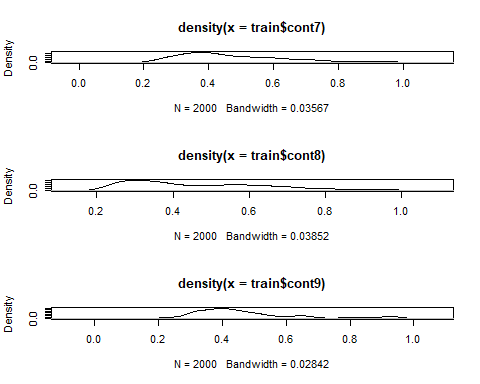
par(mfrow=c(3,1))  
plot(density(train$cont1));plot(density(train$cont2));plot(density(train$cont3));plot(density(train$cont4))



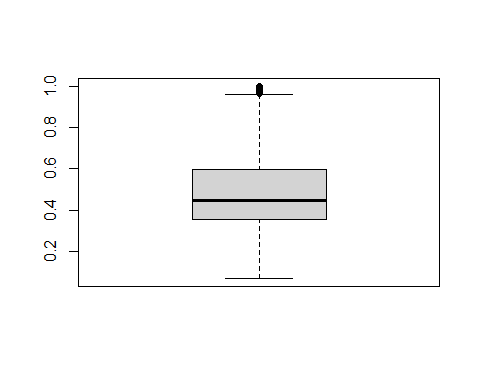
plot(density(train$cont5));plot(density(train$cont6));plot(density(train$cont7));plot(density(train$cont8))



plot(density(train$cont9));plot(density(train$cont10));plot(density(train$cont11));plot(density(train$cont12))



x7 <- boxplot(train$cont7)



length(x7$out)

## [1] 31

(140/188318)\*100 # cont7

## [1] 0.07434234

(13194/188318)\*100 #cont 9

## [1] 7.006234

(2659/188318)\*100 #cont 10

## [1] 1.411973

###### outlier definition

###### XL < 1.5\*IQR # outlier on the lower side

###### XU > 1.5 \* IQR # outlier on the higher side

###### IQR = Q3-Q1

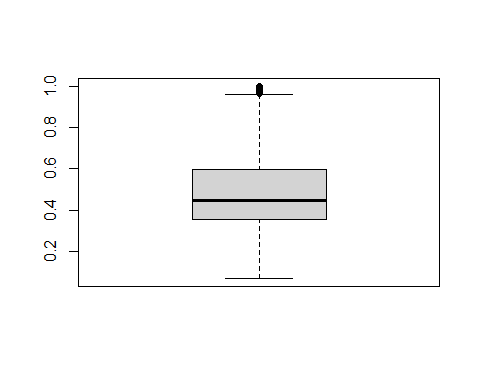
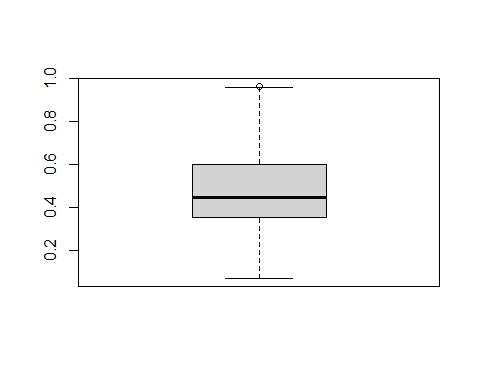
t<-quantile(train$cont7,prob=c(0.01,0.05,0.95,0.985));min(x7$out);max(x7$out);length(x7$out)

## [1] 0.964994

## [1] 1

## [1] 31

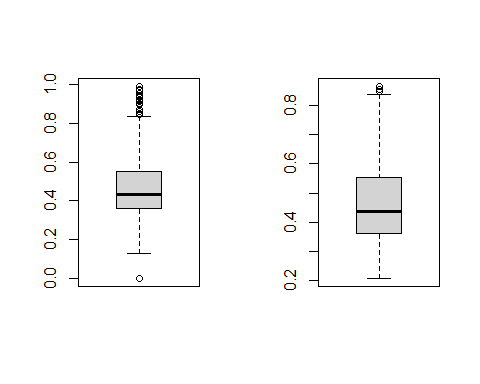
train$cont7\_new<-ifelse(train$cont7>t[4],t[4],train$cont7)  
  
boxplot(train$cont7\_new);boxplot(train$cont7)



t<-quantile(train$cont9,prob=c(0.01,0.05,0.93,0.95))  
t

## 1% 5% 93% 95%   
## 0.2081500 0.2892200 0.8646506 0.9164400

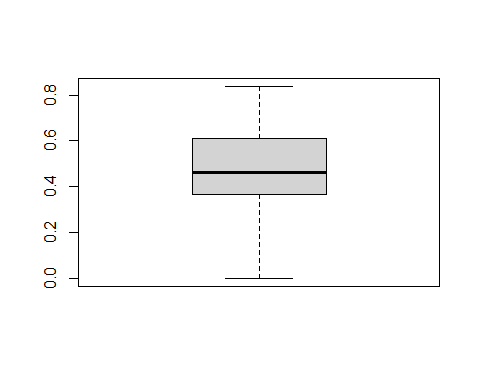
train$cont9\_new<-ifelse(train$cont9<t[1],t[1],ifelse(train$cont9>t[3],t[3],train$cont9))  
par(mfrow=c(1,2))  
boxplot(train$cont9);boxplot(train$cont9\_new)



t<-quantile(train$cont10,prob=c(0.01,0.05,0.95,0.99))  
t

## 1% 5% 95% 99%   
## 0.20496 0.21983 0.81923 0.83510

#train$cont9\_new<-ifelse(train$cont9<t[1],t[1],ifelse(train$cont9>t[3],t[3],train$cont9))#  
#par(mfrow=c(1,2))  
boxplot(train$cont10);#boxplot(train$cont9\_new)



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

idVar = "id"  
catVars = paste0("cat",seq(1,116))  
contVars = paste0("cont",seq(1,14))  
targetVar = "loss"

contVars

## [1] "cont1" "cont2" "cont3" "cont4" "cont5" "cont6" "cont7" "cont8"   
## [9] "cont9" "cont10" "cont11" "cont12" "cont13" "cont14"

summary(train[,contVars])

## cont1 cont2 cont3 cont4   
## Min. :0.000016 Min. :0.003362 Min. :0.04183 Min. :0.1769   
## 1st Qu.:0.347403 1st Qu.:0.358319 1st Qu.:0.33696 1st Qu.:0.3184   
## Median :0.475784 Median :0.555782 Median :0.52799 Median :0.4529   
## Mean :0.490707 Mean :0.506186 Mean :0.50573 Mean :0.4870   
## 3rd Qu.:0.599120 3rd Qu.:0.681761 3rd Qu.:0.65431 3rd Qu.:0.6238   
## Max. :0.968775 Max. :0.862654 Max. :0.94425 Max. :0.9525   
## cont5 cont6 cont7 cont8   
## Min. :0.2811 Min. :0.01268 Min. :0.0695 Min. :0.2369   
## 1st Qu.:0.2811 1st Qu.:0.34164 1st Qu.:0.3555 1st Qu.:0.3180   
## Median :0.4223 Median :0.44153 Median :0.4467 Median :0.4470   
## Mean :0.4839 Mean :0.49002 Mean :0.4922 Mean :0.4877   
## 3rd Qu.:0.6433 3rd Qu.:0.63619 3rd Qu.:0.5984 3rd Qu.:0.6179   
## Max. :0.9825 Max. :0.98039 Max. :1.0000 Max. :0.9802   
## cont9 cont10 cont11 cont12   
## Min. :0.00008 Min. :0.0000 Min. :0.03532 Min. :0.03623   
## 1st Qu.:0.36091 1st Qu.:0.3646 1st Qu.:0.32792 1st Qu.:0.32743   
## Median :0.43524 Median :0.4612 Median :0.46884 Median :0.47750   
## Mean :0.48318 Mean :0.4941 Mean :0.50161 Mean :0.50070   
## 3rd Qu.:0.55441 3rd Qu.:0.6093 3rd Qu.:0.69320 3rd Qu.:0.68324   
## Max. :0.99140 Max. :0.8381 Max. :0.99505 Max. :0.99421   
## cont13 cont14   
## Min. :0.000228 Min. :0.1854   
## 1st Qu.:0.312885 1st Qu.:0.2946   
## Median :0.360468 Median :0.4144   
## Mean :0.489410 Mean :0.4980   
## 3rd Qu.:0.689974 3rd Qu.:0.7251   
## Max. :0.925532 Max. :0.8439

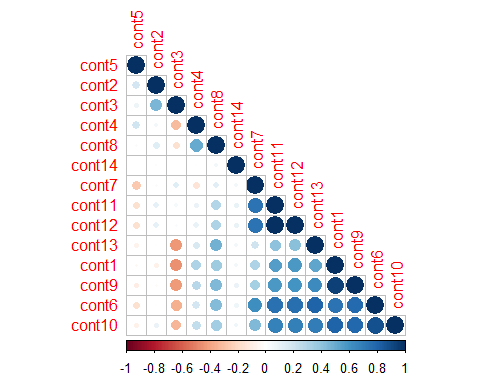
corContPred = cor(train[,contVars])  
corContPred

## cont1 cont2 cont3 cont4 cont5  
## cont1 1.00000000 -0.071339941 -0.452171452 0.307909306 -0.033760042  
## cont2 -0.07133994 1.000000000 0.455439449 0.054752056 0.187380004  
## cont3 -0.45217145 0.455439449 1.000000000 -0.313165688 0.077701686  
## cont4 0.30790931 0.054752056 -0.313165688 1.000000000 0.196795192  
## cont5 -0.03376004 0.187380004 0.077701686 0.196795192 1.000000000  
## cont6 0.73863483 0.009345397 -0.351243845 0.186147206 -0.166225845  
## cont7 0.30705218 0.024717994 0.130618524 -0.149728007 -0.264732726  
## cont8 0.35582434 0.135556758 -0.166403404 0.505660467 0.028838431  
## cont9 0.93298870 -0.022783362 -0.422432047 0.274499363 -0.093124554  
## cont10 0.80063735 0.080776548 -0.335977320 0.249567536 -0.073251511  
## cont11 0.55441220 0.109338215 0.041252612 0.086482231 -0.167249533  
## cont12 0.57274314 0.102265244 0.025767456 0.096347892 -0.163291206  
## cont13 0.52711982 0.007950392 -0.439497952 0.167697525 -0.063065983  
## cont14 0.05146730 -0.014025657 0.008749616 0.009658125 -0.008736543  
## cont6 cont7 cont8 cont9 cont10 cont11  
## cont1 0.738634832 0.30705218 0.35582434 0.93298870 0.80063735 0.55441220  
## cont2 0.009345397 0.02471799 0.13555676 -0.02278336 0.08077655 0.10933822  
## cont3 -0.351243845 0.13061852 -0.16640340 -0.42243205 -0.33597732 0.04125261  
## cont4 0.186147206 -0.14972801 0.50566047 0.27449936 0.24956754 0.08648223  
## cont5 -0.166225845 -0.26473273 0.02883843 -0.09312455 -0.07325151 -0.16724953  
## cont6 1.000000000 0.61571428 0.43530991 0.77970871 0.87889052 0.74629891  
## cont7 0.615714283 1.00000000 0.12332213 0.33240307 0.44584306 0.73574426  
## cont8 0.435309907 0.12332213 1.00000000 0.44730804 0.34908069 0.29346065  
## cont9 0.779708711 0.33240307 0.44730804 1.00000000 0.78059862 0.57281096  
## cont10 0.878890520 0.44584306 0.34908069 0.78059862 1.00000000 0.67172230  
## cont11 0.746298910 0.73574426 0.29346065 0.57281096 0.67172230 1.00000000  
## cont12 0.757690258 0.73213761 0.30703973 0.59131798 0.68258275 0.99471810  
## cont13 0.802915204 0.20489907 0.47265078 0.63242853 0.69954364 0.40509479  
## cont14 0.067794583 0.05582226 0.05201701 0.08301008 0.06132640 0.09269691  
## cont12 cont13 cont14  
## cont1 0.57274314 0.527119818 0.051467298  
## cont2 0.10226524 0.007950392 -0.014025657  
## cont3 0.02576746 -0.439497952 0.008749616  
## cont4 0.09634789 0.167697525 0.009658125  
## cont5 -0.16329121 -0.063065983 -0.008736543  
## cont6 0.75769026 0.802915204 0.067794583  
## cont7 0.73213761 0.204899069 0.055822255  
## cont8 0.30703973 0.472650780 0.052017013  
## cont9 0.59131798 0.632428530 0.083010082  
## cont10 0.68258275 0.699543639 0.061326400  
## cont11 0.99471810 0.405094792 0.092696912  
## cont12 1.00000000 0.418100903 0.091927781  
## cont13 0.41810090 1.000000000 0.057133251  
## cont14 0.09192778 0.057133251 1.000000000

library(corrplot)

## corrplot 0.92 loaded

corrplot(corContPred,type="lower",order="hclust")



library(caret)

## Loading required package: ggplot2

## Loading required package: lattice

#check variance  
zero.var = nearZeroVar(train, saveMetrics = T)  
zero.var

## freqRatio percentUnique zeroVar nzv  
## id 1.000000 100.00 FALSE FALSE  
## cat1 3.132231 0.10 FALSE FALSE  
## cat2 1.283105 0.10 FALSE FALSE  
## cat3 15.806723 0.10 FALSE FALSE  
## cat4 2.095975 0.10 FALSE FALSE  
## cat5 1.894356 0.10 FALSE FALSE  
## cat6 2.262643 0.10 FALSE FALSE  
## cat7 32.898305 0.10 FALSE TRUE  
## cat8 13.814815 0.10 FALSE FALSE  
## cat9 1.463054 0.10 FALSE FALSE  
## cat10 5.493506 0.10 FALSE FALSE  
## cat11 7.438819 0.10 FALSE FALSE  
## cat12 5.600660 0.10 FALSE FALSE  
## cat13 8.803922 0.10 FALSE FALSE  
## cat14 75.923077 0.10 FALSE TRUE  
## cat15 0.000000 0.05 TRUE TRUE  
## cat16 26.027027 0.10 FALSE TRUE  
## cat17 141.857143 0.10 FALSE TRUE  
## cat18 221.222222 0.10 FALSE TRUE  
## cat19 94.238095 0.10 FALSE TRUE  
## cat20 999.000000 0.10 FALSE TRUE  
## cat21 249.000000 0.10 FALSE TRUE  
## cat22 0.000000 0.05 TRUE TRUE  
## cat23 4.865103 0.10 FALSE FALSE  
## cat24 30.746032 0.10 FALSE TRUE  
## cat25 9.810811 0.10 FALSE FALSE  
## cat26 17.348624 0.10 FALSE FALSE  
## cat27 8.090909 0.10 FALSE FALSE  
## cat28 26.397260 0.10 FALSE TRUE  
## cat29 44.454545 0.10 FALSE TRUE  
## cat30 61.500000 0.10 FALSE TRUE  
## cat31 39.816327 0.10 FALSE TRUE  
## cat32 132.333333 0.10 FALSE TRUE  
## cat33 199.000000 0.10 FALSE TRUE  
## cat34 332.333333 0.10 FALSE TRUE  
## cat35 999.000000 0.10 FALSE TRUE  
## cat36 5.060606 0.10 FALSE FALSE  
## cat37 6.462687 0.10 FALSE FALSE  
## cat38 10.904762 0.10 FALSE FALSE  
## cat39 53.054054 0.10 FALSE TRUE  
## cat40 23.691358 0.10 FALSE TRUE  
## cat41 27.169014 0.10 FALSE TRUE  
## cat42 116.647059 0.10 FALSE TRUE  
## cat43 44.454545 0.10 FALSE TRUE  
## cat44 10.235955 0.10 FALSE FALSE  
## cat45 37.461538 0.10 FALSE TRUE  
## cat46 284.714286 0.10 FALSE TRUE  
## cat47 165.666667 0.10 FALSE TRUE  
## cat48 1999.000000 0.10 FALSE TRUE  
## cat49 19.833333 0.10 FALSE TRUE  
## cat50 2.710575 0.10 FALSE FALSE  
## cat51 110.111111 0.10 FALSE TRUE  
## cat52 22.809524 0.10 FALSE TRUE  
## cat53 10.235955 0.10 FALSE FALSE  
## cat54 38.215686 0.10 FALSE TRUE  
## cat55 1999.000000 0.10 FALSE TRUE  
## cat56 1999.000000 0.10 FALSE TRUE  
## cat57 46.619048 0.10 FALSE TRUE  
## cat58 1999.000000 0.10 FALSE TRUE  
## cat59 1999.000000 0.10 FALSE TRUE  
## cat60 665.666667 0.10 FALSE TRUE  
## cat61 180.818182 0.10 FALSE TRUE  
## cat62 0.000000 0.05 TRUE TRUE  
## cat63 1999.000000 0.10 FALSE TRUE  
## cat64 999.000000 0.10 FALSE TRUE  
## cat65 67.965517 0.10 FALSE TRUE  
## cat66 18.417476 0.10 FALSE FALSE  
## cat67 284.714286 0.10 FALSE TRUE  
## cat68 1999.000000 0.10 FALSE TRUE  
## cat69 332.333333 0.10 FALSE TRUE  
## cat70 0.000000 0.05 TRUE TRUE  
## cat71 15.528926 0.10 FALSE FALSE  
## cat72 1.628121 0.10 FALSE FALSE  
## cat73 4.763689 0.10 FALSE FALSE  
## cat74 54.555556 0.10 FALSE TRUE  
## cat75 5.042296 0.10 FALSE FALSE  
## cat76 25.905405 0.15 FALSE TRUE  
## cat77 398.200000 0.15 FALSE TRUE  
## cat78 179.727273 0.20 FALSE TRUE  
## cat79 5.733333 0.20 FALSE FALSE  
## cat80 2.937626 0.20 FALSE FALSE  
## cat81 6.547244 0.20 FALSE FALSE  
## cat82 7.087558 0.20 FALSE FALSE  
## cat83 4.933775 0.20 FALSE FALSE  
## cat84 5.597315 0.20 FALSE FALSE  
## cat85 179.909091 0.20 FALSE TRUE  
## cat86 1.434670 0.20 FALSE FALSE  
## cat87 14.023622 0.20 FALSE FALSE  
## cat88 8.995000 0.15 FALSE FALSE  
## cat89 34.052632 0.15 FALSE TRUE  
## cat90 17.100000 0.15 FALSE FALSE  
## cat91 2.584783 0.30 FALSE FALSE  
## cat92 1.987970 0.25 FALSE FALSE  
## cat93 4.208995 0.25 FALSE FALSE  
## cat94 2.388476 0.30 FALSE FALSE  
## cat95 1.055491 0.20 FALSE FALSE  
## cat96 23.756410 0.25 FALSE TRUE  
## cat97 1.731313 0.30 FALSE FALSE  
## cat98 2.117757 0.25 FALSE FALSE  
## cat99 1.117571 0.55 FALSE FALSE  
## cat100 1.188917 0.70 FALSE FALSE  
## cat101 5.947090 0.65 FALSE FALSE  
## cat102 29.603175 0.30 FALSE TRUE  
## cat103 3.566757 0.40 FALSE FALSE  
## cat104 1.049065 0.70 FALSE FALSE  
## cat105 1.162482 0.55 FALSE FALSE  
## cat106 1.239506 0.60 FALSE FALSE  
## cat107 1.621538 0.75 FALSE FALSE  
## cat108 1.495633 0.55 FALSE FALSE  
## cat109 7.495413 1.70 FALSE FALSE  
## cat110 1.025926 2.95 FALSE FALSE  
## cat111 3.544503 0.50 FALSE FALSE  
## cat112 1.237209 2.55 FALSE FALSE  
## cat113 1.285068 2.20 FALSE FALSE  
## cat114 7.300000 0.60 FALSE FALSE  
## cat115 1.666667 0.75 FALSE FALSE  
## cat116 1.062500 7.75 FALSE FALSE  
## cont1 1.621622 18.95 FALSE FALSE  
## cont2 1.018957 1.35 FALSE FALSE  
## cont3 1.966292 3.15 FALSE FALSE  
## cont4 1.065934 5.00 FALSE FALSE  
## cont5 6.188889 5.45 FALSE FALSE  
## cont6 1.291667 43.05 FALSE FALSE  
## cont7 1.230769 60.05 FALSE FALSE  
## cont8 1.277778 7.55 FALSE FALSE  
## cont9 1.323944 9.90 FALSE FALSE  
## cont10 1.061538 6.75 FALSE FALSE  
## cont11 1.037037 9.90 FALSE FALSE  
## cont12 1.075000 9.80 FALSE FALSE  
## cont13 1.781818 12.05 FALSE FALSE  
## cont14 1.250000 87.25 FALSE FALSE  
## loss 1.000000 99.80 FALSE FALSE  
## cont7\_new 1.875000 58.80 FALSE FALSE  
## cont9\_new 1.489362 8.55 FALSE FALSE

dim(zero.var[zero.var$nzv == TRUE,])

## [1] 55 4

head(zero.var[zero.var$nzv == TRUE,])

## freqRatio percentUnique zeroVar nzv  
## cat7 32.89831 0.10 FALSE TRUE  
## cat14 75.92308 0.10 FALSE TRUE  
## cat15 0.00000 0.05 TRUE TRUE  
## cat16 26.02703 0.10 FALSE TRUE  
## cat17 141.85714 0.10 FALSE TRUE  
## cat18 221.22222 0.10 FALSE TRUE

# regression experiment  
fit<-lm(loss~ cont1+cont2+cont3+cont4+cont5+cont6+cont7+cont8+cont9+cont10+cont11+cont12+cont13+cont14+  
 cat1+cat2+cat3+cat114+cat5+cat6+cat7+cat8+cat18,data=train)  
summary(fit)

##   
## Call:  
## lm(formula = loss ~ cont1 + cont2 + cont3 + cont4 + cont5 + cont6 +   
## cont7 + cont8 + cont9 + cont10 + cont11 + cont12 + cont13 +   
## cont14 + cat1 + cat2 + cat3 + cat114 + cat5 + cat6 + cat7 +   
## cat8 + cat18, data = train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -10486.1 -1490.7 -431.3 891.9 24706.9   
##   
## Coefficients: (1 not defined because of singularities)  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 156.658 437.147 0.358 0.72011   
## cont1 -2543.815 1099.825 -2.313 0.02083 \*   
## cont2 1595.852 337.917 4.723 2.49e-06 \*\*\*  
## cont3 486.803 429.936 1.132 0.25766   
## cont4 -353.240 368.009 -0.960 0.33724   
## cont5 -2.356 294.958 -0.008 0.99363   
## cont6 -987.053 1252.160 -0.788 0.43063   
## cont7 2094.634 653.901 3.203 0.00138 \*\*   
## cont8 214.100 406.400 0.527 0.59838   
## cont9 2094.085 1047.652 1.999 0.04576 \*   
## cont10 1084.451 805.015 1.347 0.17810   
## cont11 -5746.168 2661.276 -2.159 0.03096 \*   
## cont12 6467.807 2714.496 2.383 0.01728 \*   
## cont13 -580.582 707.181 -0.821 0.41176   
## cont14 598.391 253.135 2.364 0.01818 \*   
## cat1B -998.682 134.323 -7.435 1.55e-13 \*\*\*  
## cat2B 1112.379 132.333 8.406 < 2e-16 \*\*\*  
## cat3B 1569.189 252.231 6.221 6.01e-10 \*\*\*  
## cat114B 320.215 2501.724 0.128 0.89816   
## cat114C -100.244 213.586 -0.469 0.63888   
## cat114E -341.418 206.068 -1.657 0.09772 .   
## cat114F 99.898 311.719 0.320 0.74864   
## cat114I 1325.159 509.867 2.599 0.00942 \*\*   
## cat114J 492.502 271.416 1.815 0.06974 .   
## cat114L 2596.885 840.747 3.089 0.00204 \*\*   
## cat114N 688.616 492.426 1.398 0.16215   
## cat114O 6053.147 1126.068 5.375 8.55e-08 \*\*\*  
## cat114R 1696.641 950.941 1.784 0.07455 .   
## cat114U 10327.922 1449.773 7.124 1.47e-12 \*\*\*  
## cat5B 610.363 121.446 5.026 5.47e-07 \*\*\*  
## cat6B NA NA NA NA   
## cat7B 4715.586 335.615 14.051 < 2e-16 \*\*\*  
## cat8B 281.733 229.398 1.228 0.21954   
## cat18B -11.818 870.070 -0.014 0.98916   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2492 on 1967 degrees of freedom  
## Multiple R-squared: 0.2877, Adjusted R-squared: 0.2761   
## F-statistic: 24.82 on 32 and 1967 DF, p-value: < 2.2e-16

fit1<-lm(loss~ cont1+cont2+cont3+cont4+cont5+cont6+cont7+cont8+cont9+cont10+cont11+cont12+cont13+cont14+  
 cat1+cat2+cat3+cat4+cat5+cat6+cat7+cat8+cat9+cat10+cat11+cat12+cat13+cat14+  
 #cat15+cat22+cat70+cat62+  
 cat16+cat17+cat18  
 +cat19+cat20+cat21+cat23+cat24+cat25+cat26+cat27+cat28+cat29+cat30+cat31+cat32+cat33+cat34+cat35  
 +cat36+cat37+cat38+cat39+cat40+cat41+cat42+cat43+cat44+cat45+cat46+cat47+cat48+cat49+cat50+cat51+cat52  
 #cat53+cat54+cat55+cat56+cat57+cat58+cat59+cat60+cat61+cat63+cat64+cat65+cat66+cat67+cat68+cat69+  
 #cat71+cat72+cat73+cat74+cat75+cat76+cat77+cat78+cat79+cat80+cat81+cat82+cat83+cat84+cat85+cat86+  
 #cat87+cat88+cat89+cat90+cat91+cat92+cat93+cat94+cat95+cat96+cat97+cat98+cat99+cat100+cat101+cat102+cat103+  
 #cat104+cat105+cat106+cat107+cat108+cat109+cat110+cat111+cat112+cat113+cat114+cat115+cat116  
 ,data=train)  
summary(fit1)

##   
## Call:  
## lm(formula = loss ~ cont1 + cont2 + cont3 + cont4 + cont5 + cont6 +   
## cont7 + cont8 + cont9 + cont10 + cont11 + cont12 + cont13 +   
## cont14 + cat1 + cat2 + cat3 + cat4 + cat5 + cat6 + cat7 +   
## cat8 + cat9 + cat10 + cat11 + cat12 + cat13 + cat14 + cat16 +   
## cat17 + cat18 + cat19 + cat20 + cat21 + cat23 + cat24 + cat25 +   
## cat26 + cat27 + cat28 + cat29 + cat30 + cat31 + cat32 + cat33 +   
## cat34 + cat35 + cat36 + cat37 + cat38 + cat39 + cat40 + cat41 +   
## cat42 + cat43 + cat44 + cat45 + cat46 + cat47 + cat48 + cat49 +   
## cat50 + cat51 + cat52, data = train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -7497.0 -1269.0 -420.2 741.8 23388.4   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -471.870 419.659 -1.124 0.260978   
## cont1 -2880.168 1036.106 -2.780 0.005492 \*\*   
## cont2 1715.866 318.095 5.394 7.73e-08 \*\*\*  
## cont3 367.197 404.385 0.908 0.363971   
## cont4 -491.876 346.811 -1.418 0.156270   
## cont5 50.852 278.161 0.183 0.854962   
## cont6 -1251.333 1175.224 -1.065 0.287117   
## cont7 2199.142 615.134 3.575 0.000359 \*\*\*  
## cont8 19.424 382.233 0.051 0.959476   
## cont9 2241.158 991.915 2.259 0.023968 \*   
## cont10 1379.834 761.274 1.813 0.070059 .   
## cont11 -3238.006 2525.261 -1.282 0.199910   
## cont12 4028.049 2575.575 1.564 0.117995   
## cont13 -512.838 664.520 -0.772 0.440361   
## cont14 596.494 238.700 2.499 0.012539 \*   
## cat1B -807.264 128.463 -6.284 4.07e-10 \*\*\*  
## cat2B -174.024 334.343 -0.520 0.602778   
## cat3B -77.259 1109.203 -0.070 0.944477   
## cat4B -74.797 231.195 -0.324 0.746334   
## cat5B 75.200 227.518 0.331 0.741041   
## cat6B 178.144 316.011 0.564 0.573005   
## cat7B 4090.082 319.053 12.819 < 2e-16 \*\*\*  
## cat8B 319.213 225.736 1.414 0.157494   
## cat9B 641.885 318.804 2.013 0.044209 \*   
## cat10B 769.917 193.399 3.981 7.12e-05 \*\*\*  
## cat11B 311.135 207.196 1.502 0.133351   
## cat12B 1493.316 198.309 7.530 7.72e-14 \*\*\*  
## cat13B 815.779 214.032 3.811 0.000142 \*\*\*  
## cat14B 1383.670 493.350 2.805 0.005088 \*\*   
## cat16B 981.624 1075.594 0.913 0.361549   
## cat17B 6.764 874.727 0.008 0.993831   
## cat18B 691.968 1264.213 0.547 0.584201   
## cat19B 1478.801 1201.509 1.231 0.218552   
## cat20B 2597.844 1764.172 1.473 0.141033   
## cat21B 1772.742 1395.257 1.271 0.204042   
## cat23B 571.746 236.797 2.415 0.015849 \*   
## cat24B 700.306 367.298 1.907 0.056715 .   
## cat25B 842.795 234.908 3.588 0.000342 \*\*\*  
## cat26B 629.613 281.261 2.239 0.025300 \*   
## cat27B 495.943 251.592 1.971 0.048841 \*   
## cat28B 508.480 340.002 1.496 0.134942   
## cat29B 513.114 429.509 1.195 0.232369   
## cat30B -347.478 491.251 -0.707 0.479445   
## cat31B -117.599 374.521 -0.314 0.753556   
## cat32B -262.635 692.090 -0.379 0.704372   
## cat33B -129.926 910.528 -0.143 0.886548   
## cat34B 3838.251 1204.945 3.185 0.001468 \*\*   
## cat35B -127.581 1881.468 -0.068 0.945944   
## cat36B 349.812 230.965 1.515 0.130046   
## cat37B 191.649 229.612 0.835 0.404009   
## cat38B 586.110 234.031 2.504 0.012347 \*   
## cat39B -448.458 421.451 -1.064 0.287425   
## cat40B 591.928 333.256 1.776 0.075857 .   
## cat41B -64.424 350.240 -0.184 0.854077   
## cat42B 1547.689 610.205 2.536 0.011280 \*   
## cat43B 1233.368 418.635 2.946 0.003256 \*\*   
## cat44B 1052.499 243.339 4.325 1.60e-05 \*\*\*  
## cat45B -43.743 392.524 -0.111 0.911278   
## cat46B 1765.335 908.322 1.944 0.052099 .   
## cat47B 224.590 690.268 0.325 0.744938   
## cat48B 574.864 2349.492 0.245 0.806733   
## cat49B 1387.612 272.664 5.089 3.95e-07 \*\*\*  
## cat50B 113.529 300.647 0.378 0.705759   
## cat51B 1462.193 573.263 2.551 0.010829 \*   
## cat52B 1120.543 291.174 3.848 0.000123 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2327 on 1935 degrees of freedom  
## Multiple R-squared: 0.3888, Adjusted R-squared: 0.3686   
## F-statistic: 19.24 on 64 and 1935 DF, p-value: < 2.2e-16

library(car)

## Loading required package: carData

##   
## Attaching package: 'car'

## The following object is masked from 'package:dplyr':  
##   
## recode

library(MASS)

##   
## Attaching package: 'MASS'

## The following object is masked from 'package:dplyr':  
##   
## select

step\_fit <- stepAIC(fit1,direction = "backward")

## Start: AIC=31073.54  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont5 + cont6 + cont7 +   
## cont8 + cont9 + cont10 + cont11 + cont12 + cont13 + cont14 +   
## cat1 + cat2 + cat3 + cat4 + cat5 + cat6 + cat7 + cat8 + cat9 +   
## cat10 + cat11 + cat12 + cat13 + cat14 + cat16 + cat17 + cat18 +   
## cat19 + cat20 + cat21 + cat23 + cat24 + cat25 + cat26 + cat27 +   
## cat28 + cat29 + cat30 + cat31 + cat32 + cat33 + cat34 + cat35 +   
## cat36 + cat37 + cat38 + cat39 + cat40 + cat41 + cat42 + cat43 +   
## cat44 + cat45 + cat46 + cat47 + cat48 + cat49 + cat50 + cat51 +   
## cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat17 1 324 1.0479e+10 31072  
## - cont8 1 13985 1.0479e+10 31072  
## - cat35 1 24902 1.0479e+10 31072  
## - cat3 1 26274 1.0479e+10 31072  
## - cat45 1 67258 1.0479e+10 31072  
## - cat33 1 110270 1.0479e+10 31072  
## - cont5 1 181001 1.0480e+10 31072  
## - cat41 1 183240 1.0480e+10 31072  
## - cat48 1 324217 1.0480e+10 31072  
## - cat31 1 533960 1.0480e+10 31072  
## - cat4 1 566847 1.0480e+10 31072  
## - cat47 1 573325 1.0480e+10 31072  
## - cat5 1 591638 1.0480e+10 31072  
## - cat50 1 772237 1.0480e+10 31072  
## - cat32 1 779891 1.0480e+10 31072  
## - cat2 1 1467191 1.0481e+10 31072  
## - cat18 1 1622501 1.0481e+10 31072  
## - cat6 1 1721041 1.0481e+10 31072  
## - cat30 1 2709579 1.0482e+10 31072  
## - cont13 1 3225512 1.0483e+10 31072  
## - cat37 1 3772928 1.0483e+10 31072  
## - cont3 1 4465419 1.0484e+10 31072  
## - cat16 1 4510737 1.0484e+10 31072  
## - cat39 1 6132010 1.0485e+10 31073  
## - cont6 1 6139863 1.0486e+10 31073  
## - cat29 1 7729266 1.0487e+10 31073  
## - cat19 1 8203881 1.0488e+10 31073  
## - cat21 1 8742515 1.0488e+10 31073  
## - cont11 1 8904233 1.0488e+10 31073  
## <none> 1.0479e+10 31074  
## - cat8 1 10829636 1.0490e+10 31074  
## - cont4 1 10893774 1.0490e+10 31074  
## - cat20 1 11743517 1.0491e+10 31074  
## - cat28 1 12112633 1.0491e+10 31074  
## - cat11 1 12212077 1.0492e+10 31074  
## - cat36 1 12423069 1.0492e+10 31074  
## - cont12 1 13246308 1.0493e+10 31074  
## - cat40 1 17085841 1.0496e+10 31075  
## - cont10 1 17792055 1.0497e+10 31075  
## - cat24 1 19687581 1.0499e+10 31075  
## - cat46 1 20456385 1.0500e+10 31075  
## - cat27 1 21043866 1.0500e+10 31076  
## - cat9 1 21954380 1.0501e+10 31076  
## - cat26 1 27138186 1.0506e+10 31077  
## - cont9 1 27647138 1.0507e+10 31077  
## - cat23 1 31572462 1.0511e+10 31078  
## - cont14 1 33818981 1.0513e+10 31078  
## - cat38 1 33967635 1.0513e+10 31078  
## - cat42 1 34839258 1.0514e+10 31078  
## - cat51 1 35233507 1.0515e+10 31078  
## - cont1 1 41848657 1.0521e+10 31080  
## - cat14 1 42599966 1.0522e+10 31080  
## - cat43 1 47007526 1.0526e+10 31081  
## - cat34 1 54952321 1.0534e+10 31082  
## - cont7 1 69218225 1.0549e+10 31085  
## - cat25 1 69710816 1.0549e+10 31085  
## - cat13 1 78675572 1.0558e+10 31087  
## - cat52 1 80205597 1.0560e+10 31087  
## - cat10 1 85828387 1.0565e+10 31088  
## - cat44 1 101314818 1.0581e+10 31091  
## - cat49 1 140260694 1.0620e+10 31098  
## - cont2 1 157582386 1.0637e+10 31101  
## - cat1 1 213858322 1.0693e+10 31112  
## - cat12 1 307094340 1.0786e+10 31129  
## - cat7 1 890002015 1.1369e+10 31235  
##   
## Step: AIC=31071.54  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont5 + cont6 + cont7 +   
## cont8 + cont9 + cont10 + cont11 + cont12 + cont13 + cont14 +   
## cat1 + cat2 + cat3 + cat4 + cat5 + cat6 + cat7 + cat8 + cat9 +   
## cat10 + cat11 + cat12 + cat13 + cat14 + cat16 + cat18 + cat19 +   
## cat20 + cat21 + cat23 + cat24 + cat25 + cat26 + cat27 + cat28 +   
## cat29 + cat30 + cat31 + cat32 + cat33 + cat34 + cat35 + cat36 +   
## cat37 + cat38 + cat39 + cat40 + cat41 + cat42 + cat43 + cat44 +   
## cat45 + cat46 + cat47 + cat48 + cat49 + cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cont8 1 13940 1.0479e+10 31070  
## - cat35 1 24969 1.0479e+10 31070  
## - cat3 1 40381 1.0479e+10 31070  
## - cat45 1 67273 1.0479e+10 31070  
## - cat33 1 110461 1.0479e+10 31070  
## - cont5 1 180897 1.0480e+10 31070  
## - cat41 1 183024 1.0480e+10 31070  
## - cat48 1 324225 1.0480e+10 31070  
## - cat31 1 533640 1.0480e+10 31070  
## - cat4 1 566952 1.0480e+10 31070  
## - cat47 1 573382 1.0480e+10 31070  
## - cat5 1 591347 1.0480e+10 31070  
## - cat50 1 773434 1.0480e+10 31070  
## - cat32 1 780202 1.0480e+10 31070  
## - cat2 1 1466876 1.0481e+10 31070  
## - cat6 1 1722476 1.0481e+10 31070  
## - cat18 1 2217631 1.0482e+10 31070  
## - cat30 1 2709683 1.0482e+10 31070  
## - cont13 1 3225365 1.0483e+10 31070  
## - cat37 1 3773078 1.0483e+10 31070  
## - cont3 1 4465164 1.0484e+10 31070  
## - cat39 1 6132611 1.0485e+10 31071  
## - cont6 1 6140466 1.0486e+10 31071  
## - cat16 1 7007993 1.0486e+10 31071  
## - cat29 1 7730113 1.0487e+10 31071  
## - cont11 1 8905028 1.0488e+10 31071  
## <none> 1.0479e+10 31072  
## - cat8 1 10850595 1.0490e+10 31072  
## - cont4 1 10898569 1.0490e+10 31072  
## - cat28 1 12120311 1.0491e+10 31072  
## - cat21 1 12143972 1.0492e+10 31072  
## - cat11 1 12222538 1.0492e+10 31072  
## - cat19 1 12260834 1.0492e+10 31072  
## - cat20 1 12376756 1.0492e+10 31072  
## - cat36 1 12426189 1.0492e+10 31072  
## - cont12 1 13248933 1.0493e+10 31072  
## - cat40 1 17120471 1.0496e+10 31073  
## - cont10 1 17791756 1.0497e+10 31073  
## - cat24 1 19688470 1.0499e+10 31073  
## - cat46 1 20456672 1.0500e+10 31073  
## - cat27 1 21044262 1.0500e+10 31074  
## - cat9 1 21969617 1.0501e+10 31074  
## - cat26 1 27145252 1.0507e+10 31075  
## - cont9 1 27664149 1.0507e+10 31075  
## - cat23 1 31573804 1.0511e+10 31076  
## - cont14 1 33821930 1.0513e+10 31076  
## - cat38 1 33968265 1.0513e+10 31076  
## - cat42 1 34839062 1.0514e+10 31076  
## - cat51 1 35233186 1.0515e+10 31076  
## - cont1 1 41852870 1.0521e+10 31078  
## - cat14 1 42766016 1.0522e+10 31078  
## - cat43 1 47007816 1.0526e+10 31079  
## - cat34 1 55033918 1.0534e+10 31080  
## - cont7 1 69218172 1.0549e+10 31083  
## - cat25 1 69784851 1.0549e+10 31083  
## - cat13 1 78702733 1.0558e+10 31085  
## - cat52 1 80227718 1.0560e+10 31085  
## - cat10 1 85841881 1.0565e+10 31086  
## - cat44 1 101315952 1.0581e+10 31089  
## - cat49 1 140264240 1.0620e+10 31096  
## - cont2 1 157616240 1.0637e+10 31099  
## - cat1 1 213883938 1.0693e+10 31110  
## - cat12 1 307535792 1.0787e+10 31127  
## - cat7 1 890758451 1.1370e+10 31233  
##   
## Step: AIC=31069.54  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont5 + cont6 + cont7 +   
## cont9 + cont10 + cont11 + cont12 + cont13 + cont14 + cat1 +   
## cat2 + cat3 + cat4 + cat5 + cat6 + cat7 + cat8 + cat9 + cat10 +   
## cat11 + cat12 + cat13 + cat14 + cat16 + cat18 + cat19 + cat20 +   
## cat21 + cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat29 +   
## cat30 + cat31 + cat32 + cat33 + cat34 + cat35 + cat36 + cat37 +   
## cat38 + cat39 + cat40 + cat41 + cat42 + cat43 + cat44 + cat45 +   
## cat46 + cat47 + cat48 + cat49 + cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat35 1 25746 1.0479e+10 31068  
## - cat3 1 41109 1.0479e+10 31068  
## - cat45 1 66580 1.0479e+10 31068  
## - cat33 1 111066 1.0479e+10 31068  
## - cont5 1 178345 1.0480e+10 31068  
## - cat41 1 183425 1.0480e+10 31068  
## - cat48 1 321754 1.0480e+10 31068  
## - cat31 1 529620 1.0480e+10 31068  
## - cat4 1 564103 1.0480e+10 31068  
## - cat47 1 571021 1.0480e+10 31068  
## - cat5 1 593023 1.0480e+10 31068  
## - cat32 1 775658 1.0480e+10 31068  
## - cat50 1 784062 1.0480e+10 31068  
## - cat2 1 1469874 1.0481e+10 31068  
## - cat6 1 1711531 1.0481e+10 31068  
## - cat18 1 2217029 1.0482e+10 31068  
## - cat30 1 2701070 1.0482e+10 31068  
## - cont13 1 3307340 1.0483e+10 31068  
## - cat37 1 3770447 1.0483e+10 31068  
## - cont3 1 4611951 1.0484e+10 31068  
## - cat39 1 6122580 1.0485e+10 31069  
## - cont6 1 6131963 1.0486e+10 31069  
## - cat16 1 7037671 1.0486e+10 31069  
## - cat29 1 7736854 1.0487e+10 31069  
## - cont11 1 8960431 1.0488e+10 31069  
## <none> 1.0479e+10 31070  
## - cat8 1 10857559 1.0490e+10 31070  
## - cat21 1 12157123 1.0492e+10 31070  
## - cat28 1 12168931 1.0492e+10 31070  
## - cat11 1 12214981 1.0492e+10 31070  
## - cat19 1 12292160 1.0492e+10 31070  
## - cat20 1 12364328 1.0492e+10 31070  
## - cat36 1 12416632 1.0492e+10 31070  
## - cont12 1 13333762 1.0493e+10 31070  
## - cont4 1 14257603 1.0494e+10 31070  
## - cat40 1 17130716 1.0497e+10 31071  
## - cont10 1 18295351 1.0498e+10 31071  
## - cat24 1 19674707 1.0499e+10 31071  
## - cat46 1 20453081 1.0500e+10 31071  
## - cat27 1 21054914 1.0500e+10 31072  
## - cat9 1 21959446 1.0501e+10 31072  
## - cat26 1 27151099 1.0507e+10 31073  
## - cont9 1 28818078 1.0508e+10 31073  
## - cat23 1 31584693 1.0511e+10 31074  
## - cont14 1 33829283 1.0513e+10 31074  
## - cat38 1 33997492 1.0513e+10 31074  
## - cat42 1 34825878 1.0514e+10 31074  
## - cat51 1 35239967 1.0515e+10 31074  
## - cont1 1 42134402 1.0522e+10 31076  
## - cat14 1 42758662 1.0522e+10 31076  
## - cat43 1 46996674 1.0526e+10 31077  
## - cat34 1 55021010 1.0534e+10 31078  
## - cont7 1 69540355 1.0549e+10 31081  
## - cat25 1 69846723 1.0549e+10 31081  
## - cat13 1 78736348 1.0558e+10 31083  
## - cat52 1 80213787 1.0560e+10 31083  
## - cat10 1 85838699 1.0565e+10 31084  
## - cat44 1 101539935 1.0581e+10 31087  
## - cat49 1 140275881 1.0620e+10 31094  
## - cont2 1 158478708 1.0638e+10 31098  
## - cat1 1 213882978 1.0693e+10 31108  
## - cat12 1 308559308 1.0788e+10 31126  
## - cat7 1 890747121 1.1370e+10 31231  
##   
## Step: AIC=31067.55  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont5 + cont6 + cont7 +   
## cont9 + cont10 + cont11 + cont12 + cont13 + cont14 + cat1 +   
## cat2 + cat3 + cat4 + cat5 + cat6 + cat7 + cat8 + cat9 + cat10 +   
## cat11 + cat12 + cat13 + cat14 + cat16 + cat18 + cat19 + cat20 +   
## cat21 + cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat29 +   
## cat30 + cat31 + cat32 + cat33 + cat34 + cat36 + cat37 + cat38 +   
## cat39 + cat40 + cat41 + cat42 + cat43 + cat44 + cat45 + cat46 +   
## cat47 + cat48 + cat49 + cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat3 1 38553 1.0479e+10 31066  
## - cat45 1 66517 1.0479e+10 31066  
## - cat33 1 121644 1.0480e+10 31066  
## - cont5 1 174503 1.0480e+10 31066  
## - cat41 1 184085 1.0480e+10 31066  
## - cat48 1 320695 1.0480e+10 31066  
## - cat31 1 538895 1.0480e+10 31066  
## - cat4 1 559049 1.0480e+10 31066  
## - cat47 1 570528 1.0480e+10 31066  
## - cat5 1 599392 1.0480e+10 31066  
## - cat50 1 800674 1.0480e+10 31066  
## - cat32 1 1013631 1.0480e+10 31066  
## - cat2 1 1466880 1.0481e+10 31066  
## - cat6 1 1696392 1.0481e+10 31066  
## - cat18 1 2205031 1.0482e+10 31066  
## - cat30 1 2684206 1.0482e+10 31066  
## - cont13 1 3305013 1.0483e+10 31066  
## - cat37 1 3760250 1.0483e+10 31066  
## - cont3 1 4619067 1.0484e+10 31066  
## - cat39 1 6135077 1.0486e+10 31067  
## - cont6 1 6137834 1.0486e+10 31067  
## - cat16 1 7016206 1.0486e+10 31067  
## - cat29 1 7761344 1.0487e+10 31067  
## - cont11 1 9007208 1.0488e+10 31067  
## <none> 1.0479e+10 31068  
## - cat8 1 10860961 1.0490e+10 31068  
## - cat21 1 12133728 1.0492e+10 31068  
## - cat11 1 12198460 1.0492e+10 31068  
## - cat28 1 12218525 1.0492e+10 31068  
## - cat19 1 12270388 1.0492e+10 31068  
## - cat20 1 12357663 1.0492e+10 31068  
## - cat36 1 12407401 1.0492e+10 31068  
## - cont12 1 13397894 1.0493e+10 31068  
## - cont4 1 14254270 1.0494e+10 31068  
## - cat40 1 17116377 1.0497e+10 31069  
## - cont10 1 18324979 1.0498e+10 31069  
## - cat24 1 19802210 1.0499e+10 31069  
## - cat46 1 20446261 1.0500e+10 31069  
## - cat27 1 21035221 1.0500e+10 31070  
## - cat9 1 21956001 1.0501e+10 31070  
## - cat26 1 27249407 1.0507e+10 31071  
## - cont9 1 28794913 1.0508e+10 31071  
## - cat23 1 31576055 1.0511e+10 31072  
## - cont14 1 33806260 1.0513e+10 31072  
## - cat38 1 33989038 1.0513e+10 31072  
## - cat42 1 35174302 1.0515e+10 31072  
## - cat51 1 35312677 1.0515e+10 31072  
## - cont1 1 42111859 1.0522e+10 31074  
## - cat14 1 42775968 1.0522e+10 31074  
## - cat43 1 46985771 1.0526e+10 31075  
## - cat34 1 56907347 1.0536e+10 31076  
## - cont7 1 69518124 1.0549e+10 31079  
## - cat25 1 69950451 1.0549e+10 31079  
## - cat13 1 78745587 1.0558e+10 31081  
## - cat52 1 80203539 1.0560e+10 31081  
## - cat10 1 86013453 1.0565e+10 31082  
## - cat44 1 101529258 1.0581e+10 31085  
## - cat49 1 140554477 1.0620e+10 31092  
## - cont2 1 158671554 1.0638e+10 31096  
## - cat1 1 213875437 1.0693e+10 31106  
## - cat12 1 308724638 1.0788e+10 31124  
## - cat7 1 891379011 1.1371e+10 31229  
##   
## Step: AIC=31065.56  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont5 + cont6 + cont7 +   
## cont9 + cont10 + cont11 + cont12 + cont13 + cont14 + cat1 +   
## cat2 + cat4 + cat5 + cat6 + cat7 + cat8 + cat9 + cat10 +   
## cat11 + cat12 + cat13 + cat14 + cat16 + cat18 + cat19 + cat20 +   
## cat21 + cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat29 +   
## cat30 + cat31 + cat32 + cat33 + cat34 + cat36 + cat37 + cat38 +   
## cat39 + cat40 + cat41 + cat42 + cat43 + cat44 + cat45 + cat46 +   
## cat47 + cat48 + cat49 + cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat45 1 62397 1.0480e+10 31064  
## - cat33 1 126463 1.0480e+10 31064  
## - cont5 1 174254 1.0480e+10 31064  
## - cat41 1 183404 1.0480e+10 31064  
## - cat48 1 321020 1.0480e+10 31064  
## - cat31 1 542342 1.0480e+10 31064  
## - cat4 1 544159 1.0480e+10 31064  
## - cat47 1 569357 1.0480e+10 31064  
## - cat5 1 595185 1.0480e+10 31064  
## - cat50 1 802566 1.0480e+10 31064  
## - cat32 1 1007179 1.0480e+10 31064  
## - cat2 1 1464142 1.0481e+10 31064  
## - cat6 1 1691134 1.0481e+10 31064  
## - cat30 1 2664811 1.0482e+10 31064  
## - cont13 1 3287442 1.0483e+10 31064  
## - cat18 1 3371100 1.0483e+10 31064  
## - cat37 1 3778448 1.0483e+10 31064  
## - cont3 1 4614448 1.0484e+10 31064  
## - cat39 1 6133744 1.0486e+10 31065  
## - cont6 1 6155600 1.0486e+10 31065  
## - cat29 1 7765745 1.0487e+10 31065  
## - cont11 1 9009877 1.0488e+10 31065  
## <none> 1.0479e+10 31066  
## - cat8 1 10823555 1.0490e+10 31066  
## - cat11 1 12168468 1.0492e+10 31066  
## - cat28 1 12200934 1.0492e+10 31066  
## - cat36 1 12405284 1.0492e+10 31066  
## - cat20 1 12779267 1.0492e+10 31066  
## - cont12 1 13402822 1.0493e+10 31066  
## - cont4 1 14216331 1.0494e+10 31066  
## - cat40 1 17091709 1.0497e+10 31067  
## - cont10 1 18307794 1.0498e+10 31067  
## - cat24 1 19800229 1.0499e+10 31067  
## - cat46 1 20438211 1.0500e+10 31068  
## - cat27 1 20998955 1.0500e+10 31068  
## - cat21 1 21731468 1.0501e+10 31068  
## - cat9 1 21941399 1.0501e+10 31068  
## - cat26 1 27214526 1.0507e+10 31069  
## - cont9 1 28832892 1.0508e+10 31069  
## - cat23 1 31539865 1.0511e+10 31070  
## - cont14 1 33953760 1.0513e+10 31070  
## - cat38 1 34033491 1.0513e+10 31070  
## - cat42 1 35151348 1.0515e+10 31070  
## - cat51 1 35321551 1.0515e+10 31070  
## - cat19 1 38709010 1.0518e+10 31071  
## - cont1 1 42136013 1.0522e+10 31072  
## - cat14 1 42796363 1.0522e+10 31072  
## - cat43 1 46991774 1.0526e+10 31073  
## - cat16 1 51329399 1.0531e+10 31073  
## - cat34 1 57032150 1.0536e+10 31074  
## - cont7 1 69660535 1.0549e+10 31077  
## - cat25 1 69914324 1.0549e+10 31077  
## - cat13 1 78832442 1.0558e+10 31079  
## - cat52 1 80279879 1.0560e+10 31079  
## - cat10 1 86165737 1.0566e+10 31080  
## - cat44 1 101617746 1.0581e+10 31083  
## - cat49 1 140649792 1.0620e+10 31090  
## - cont2 1 158633482 1.0638e+10 31094  
## - cat1 1 213841422 1.0693e+10 31104  
## - cat12 1 308689926 1.0788e+10 31122  
## - cat7 1 895710989 1.1375e+10 31228  
##   
## Step: AIC=31063.57  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont5 + cont6 + cont7 +   
## cont9 + cont10 + cont11 + cont12 + cont13 + cont14 + cat1 +   
## cat2 + cat4 + cat5 + cat6 + cat7 + cat8 + cat9 + cat10 +   
## cat11 + cat12 + cat13 + cat14 + cat16 + cat18 + cat19 + cat20 +   
## cat21 + cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat29 +   
## cat30 + cat31 + cat32 + cat33 + cat34 + cat36 + cat37 + cat38 +   
## cat39 + cat40 + cat41 + cat42 + cat43 + cat44 + cat46 + cat47 +   
## cat48 + cat49 + cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat33 1 125261 1.0480e+10 31062  
## - cont5 1 164020 1.0480e+10 31062  
## - cat41 1 171845 1.0480e+10 31062  
## - cat48 1 324390 1.0480e+10 31062  
## - cat4 1 540234 1.0480e+10 31062  
## - cat31 1 543026 1.0480e+10 31062  
## - cat47 1 556282 1.0480e+10 31062  
## - cat5 1 559130 1.0480e+10 31062  
## - cat50 1 803504 1.0480e+10 31062  
## - cat32 1 1007665 1.0481e+10 31062  
## - cat2 1 1461248 1.0481e+10 31062  
## - cat6 1 1688627 1.0481e+10 31062  
## - cat30 1 2622027 1.0482e+10 31062  
## - cont13 1 3284494 1.0483e+10 31062  
## - cat18 1 3383104 1.0483e+10 31062  
## - cat37 1 3787288 1.0483e+10 31062  
## - cont3 1 4632542 1.0484e+10 31063  
## - cat39 1 6109282 1.0486e+10 31063  
## - cont6 1 6148989 1.0486e+10 31063  
## - cat29 1 7714240 1.0487e+10 31063  
## - cont11 1 9051873 1.0489e+10 31063  
## <none> 1.0480e+10 31064  
## - cat8 1 10766488 1.0490e+10 31064  
## - cat11 1 12185299 1.0492e+10 31064  
## - cat28 1 12261121 1.0492e+10 31064  
## - cat36 1 12642471 1.0492e+10 31064  
## - cat20 1 12771776 1.0492e+10 31064  
## - cont12 1 13438856 1.0493e+10 31064  
## - cont4 1 14276490 1.0494e+10 31064  
## - cat40 1 17177353 1.0497e+10 31065  
## - cont10 1 18367807 1.0498e+10 31065  
## - cat24 1 19818414 1.0499e+10 31065  
## - cat46 1 20375888 1.0500e+10 31066  
## - cat27 1 20964782 1.0500e+10 31066  
## - cat21 1 21676799 1.0501e+10 31066  
## - cat9 1 21897705 1.0501e+10 31066  
## - cat26 1 27261883 1.0507e+10 31067  
## - cont9 1 28809806 1.0508e+10 31067  
## - cat23 1 31501942 1.0511e+10 31068  
## - cont14 1 33936518 1.0513e+10 31068  
## - cat38 1 34258126 1.0514e+10 31068  
## - cat42 1 35262985 1.0515e+10 31068  
## - cat51 1 35332309 1.0515e+10 31068  
## - cat19 1 38668973 1.0518e+10 31069  
## - cont1 1 42103891 1.0522e+10 31070  
## - cat14 1 42737085 1.0522e+10 31070  
## - cat16 1 51452991 1.0531e+10 31071  
## - cat43 1 55525982 1.0535e+10 31072  
## - cat34 1 57052613 1.0537e+10 31072  
## - cont7 1 69613630 1.0549e+10 31075  
## - cat25 1 69892569 1.0549e+10 31075  
## - cat13 1 78864249 1.0558e+10 31077  
## - cat52 1 80362325 1.0560e+10 31077  
## - cat10 1 86302453 1.0566e+10 31078  
## - cat44 1 101559377 1.0581e+10 31081  
## - cat49 1 140695368 1.0620e+10 31088  
## - cont2 1 158755806 1.0638e+10 31092  
## - cat1 1 213868557 1.0693e+10 31102  
## - cat12 1 308821055 1.0788e+10 31120  
## - cat7 1 897131430 1.1377e+10 31226  
##   
## Step: AIC=31061.59  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont5 + cont6 + cont7 +   
## cont9 + cont10 + cont11 + cont12 + cont13 + cont14 + cat1 +   
## cat2 + cat4 + cat5 + cat6 + cat7 + cat8 + cat9 + cat10 +   
## cat11 + cat12 + cat13 + cat14 + cat16 + cat18 + cat19 + cat20 +   
## cat21 + cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat29 +   
## cat30 + cat31 + cat32 + cat34 + cat36 + cat37 + cat38 + cat39 +   
## cat40 + cat41 + cat42 + cat43 + cat44 + cat46 + cat47 + cat48 +   
## cat49 + cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat41 1 163996 1.0480e+10 31060  
## - cont5 1 173621 1.0480e+10 31060  
## - cat48 1 324957 1.0480e+10 31060  
## - cat5 1 548165 1.0480e+10 31060  
## - cat47 1 559037 1.0480e+10 31060  
## - cat4 1 571306 1.0480e+10 31060  
## - cat31 1 656837 1.0480e+10 31060  
## - cat50 1 838886 1.0480e+10 31060  
## - cat32 1 1008193 1.0481e+10 31060  
## - cat2 1 1476861 1.0481e+10 31060  
## - cat6 1 1637048 1.0481e+10 31060  
## - cat30 1 2584456 1.0482e+10 31060  
## - cont13 1 3300190 1.0483e+10 31060  
## - cat18 1 3396359 1.0483e+10 31060  
## - cat37 1 3795824 1.0483e+10 31060  
## - cont3 1 4641152 1.0484e+10 31061  
## - cat39 1 6109986 1.0486e+10 31061  
## - cont6 1 6137175 1.0486e+10 31061  
## - cat29 1 7779670 1.0487e+10 31061  
## - cont11 1 9068327 1.0489e+10 31061  
## <none> 1.0480e+10 31062  
## - cat8 1 10824444 1.0490e+10 31062  
## - cat11 1 12177919 1.0492e+10 31062  
## - cat28 1 12253787 1.0492e+10 31062  
## - cat36 1 12669371 1.0492e+10 31062  
## - cat20 1 12785489 1.0492e+10 31062  
## - cont12 1 13459162 1.0493e+10 31062  
## - cont4 1 14268115 1.0494e+10 31062  
## - cat40 1 17082724 1.0497e+10 31063  
## - cont10 1 18374604 1.0498e+10 31063  
## - cat24 1 19722221 1.0499e+10 31063  
## - cat46 1 20370893 1.0500e+10 31064  
## - cat27 1 21296340 1.0501e+10 31064  
## - cat21 1 21658228 1.0501e+10 31064  
## - cat9 1 21952245 1.0502e+10 31064  
## - cat26 1 27148222 1.0507e+10 31065  
## - cont9 1 28742328 1.0508e+10 31065  
## - cat23 1 31977232 1.0512e+10 31066  
## - cont14 1 33985651 1.0514e+10 31066  
## - cat38 1 34278145 1.0514e+10 31066  
## - cat42 1 35330902 1.0515e+10 31066  
## - cat51 1 35369992 1.0515e+10 31066  
## - cat19 1 38660703 1.0518e+10 31067  
## - cont1 1 42037436 1.0522e+10 31068  
## - cat14 1 42613243 1.0522e+10 31068  
## - cat16 1 51329189 1.0531e+10 31069  
## - cat43 1 55539972 1.0535e+10 31070  
## - cont7 1 69580555 1.0549e+10 31073  
## - cat25 1 69767919 1.0549e+10 31073  
## - cat34 1 70382120 1.0550e+10 31073  
## - cat13 1 78972831 1.0559e+10 31075  
## - cat52 1 80501010 1.0560e+10 31075  
## - cat10 1 86275220 1.0566e+10 31076  
## - cat44 1 101593726 1.0581e+10 31079  
## - cat49 1 140789168 1.0620e+10 31086  
## - cont2 1 158882123 1.0639e+10 31090  
## - cat1 1 213992965 1.0694e+10 31100  
## - cat12 1 308871680 1.0788e+10 31118  
## - cat7 1 898731840 1.1378e+10 31224  
##   
## Step: AIC=31059.62  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont5 + cont6 + cont7 +   
## cont9 + cont10 + cont11 + cont12 + cont13 + cont14 + cat1 +   
## cat2 + cat4 + cat5 + cat6 + cat7 + cat8 + cat9 + cat10 +   
## cat11 + cat12 + cat13 + cat14 + cat16 + cat18 + cat19 + cat20 +   
## cat21 + cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat29 +   
## cat30 + cat31 + cat32 + cat34 + cat36 + cat37 + cat38 + cat39 +   
## cat40 + cat42 + cat43 + cat44 + cat46 + cat47 + cat48 + cat49 +   
## cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cont5 1 167129 1.0480e+10 31058  
## - cat48 1 329618 1.0480e+10 31058  
## - cat5 1 493074 1.0480e+10 31058  
## - cat4 1 551719 1.0480e+10 31058  
## - cat47 1 564827 1.0480e+10 31058  
## - cat31 1 660272 1.0480e+10 31058  
## - cat50 1 830541 1.0481e+10 31058  
## - cat32 1 1008903 1.0481e+10 31058  
## - cat2 1 1454185 1.0481e+10 31058  
## - cat6 1 1669475 1.0481e+10 31058  
## - cat30 1 2577215 1.0482e+10 31058  
## - cont13 1 3245410 1.0483e+10 31058  
## - cat18 1 3442857 1.0483e+10 31058  
## - cat37 1 3970736 1.0484e+10 31058  
## - cont3 1 4727177 1.0485e+10 31059  
## - cat39 1 6026739 1.0486e+10 31059  
## - cont6 1 6128779 1.0486e+10 31059  
## - cat29 1 7813426 1.0488e+10 31059  
## - cont11 1 9124226 1.0489e+10 31059  
## <none> 1.0480e+10 31060  
## - cat8 1 10738834 1.0491e+10 31060  
## - cat11 1 12094995 1.0492e+10 31060  
## - cat28 1 12501196 1.0492e+10 31060  
## - cat36 1 12586367 1.0492e+10 31060  
## - cat20 1 12775860 1.0493e+10 31060  
## - cont12 1 13506481 1.0493e+10 31060  
## - cont4 1 14220671 1.0494e+10 31060  
## - cont10 1 18351871 1.0498e+10 31061  
## - cat24 1 19596057 1.0499e+10 31061  
## - cat40 1 19660054 1.0499e+10 31061  
## - cat46 1 20383070 1.0500e+10 31062  
## - cat27 1 21238708 1.0501e+10 31062  
## - cat21 1 21771247 1.0502e+10 31062  
## - cat9 1 21895149 1.0502e+10 31062  
## - cat26 1 27085700 1.0507e+10 31063  
## - cont9 1 28705744 1.0508e+10 31063  
## - cat23 1 31992594 1.0512e+10 31064  
## - cont14 1 34028242 1.0514e+10 31064  
## - cat38 1 34207533 1.0514e+10 31064  
## - cat51 1 35336041 1.0515e+10 31064  
## - cat42 1 35382672 1.0515e+10 31064  
## - cat19 1 38689734 1.0518e+10 31065  
## - cont1 1 42016338 1.0522e+10 31066  
## - cat14 1 42518192 1.0522e+10 31066  
## - cat16 1 51604957 1.0531e+10 31067  
## - cat43 1 55847131 1.0536e+10 31068  
## - cont7 1 69734772 1.0550e+10 31071  
## - cat25 1 69752736 1.0550e+10 31071  
## - cat34 1 70415211 1.0550e+10 31071  
## - cat13 1 79643799 1.0559e+10 31073  
## - cat52 1 80687177 1.0560e+10 31073  
## - cat10 1 86347312 1.0566e+10 31074  
## - cat44 1 102636229 1.0582e+10 31077  
## - cat49 1 140725794 1.0621e+10 31084  
## - cont2 1 158718950 1.0639e+10 31088  
## - cat1 1 213832931 1.0694e+10 31098  
## - cat12 1 309002942 1.0789e+10 31116  
## - cat7 1 898639145 1.1378e+10 31222  
##   
## Step: AIC=31057.66  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont13 + cont14 + cat1 + cat2 +   
## cat4 + cat5 + cat6 + cat7 + cat8 + cat9 + cat10 + cat11 +   
## cat12 + cat13 + cat14 + cat16 + cat18 + cat19 + cat20 + cat21 +   
## cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat29 + cat30 +   
## cat31 + cat32 + cat34 + cat36 + cat37 + cat38 + cat39 + cat40 +   
## cat42 + cat43 + cat44 + cat46 + cat47 + cat48 + cat49 + cat50 +   
## cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat48 1 316557 1.0480e+10 31056  
## - cat5 1 496009 1.0480e+10 31056  
## - cat4 1 559825 1.0481e+10 31056  
## - cat47 1 576171 1.0481e+10 31056  
## - cat31 1 675643 1.0481e+10 31056  
## - cat50 1 820284 1.0481e+10 31056  
## - cat32 1 1008854 1.0481e+10 31056  
## - cat2 1 1461020 1.0481e+10 31056  
## - cat6 1 1693131 1.0482e+10 31056  
## - cat30 1 2615817 1.0483e+10 31056  
## - cont13 1 3113418 1.0483e+10 31056  
## - cat18 1 3457446 1.0483e+10 31056  
## - cat37 1 3940594 1.0484e+10 31056  
## - cont3 1 4973773 1.0485e+10 31057  
## - cat39 1 6123108 1.0486e+10 31057  
## - cont6 1 6355501 1.0486e+10 31057  
## - cat29 1 7884195 1.0488e+10 31057  
## - cont11 1 9242075 1.0489e+10 31057  
## <none> 1.0480e+10 31058  
## - cat8 1 10690154 1.0491e+10 31058  
## - cat11 1 12025997 1.0492e+10 31058  
## - cat36 1 12539057 1.0492e+10 31058  
## - cat28 1 12565798 1.0493e+10 31058  
## - cat20 1 12751048 1.0493e+10 31058  
## - cont12 1 13630839 1.0494e+10 31058  
## - cont4 1 14141700 1.0494e+10 31058  
## - cont10 1 18323303 1.0498e+10 31059  
## - cat24 1 19555125 1.0500e+10 31059  
## - cat40 1 19729891 1.0500e+10 31059  
## - cat46 1 20322695 1.0500e+10 31060  
## - cat27 1 21332405 1.0501e+10 31060  
## - cat21 1 21802397 1.0502e+10 31060  
## - cat9 1 21921179 1.0502e+10 31060  
## - cat26 1 26992436 1.0507e+10 31061  
## - cont9 1 28811098 1.0509e+10 31061  
## - cat23 1 32018097 1.0512e+10 31062  
## - cat38 1 34136806 1.0514e+10 31062  
## - cont14 1 34141145 1.0514e+10 31062  
## - cat42 1 35242042 1.0515e+10 31062  
## - cat51 1 35331095 1.0515e+10 31062  
## - cat19 1 38737927 1.0519e+10 31063  
## - cat14 1 42368328 1.0522e+10 31064  
## - cont1 1 42661011 1.0523e+10 31064  
## - cat16 1 51624822 1.0532e+10 31066  
## - cat43 1 55685981 1.0536e+10 31066  
## - cont7 1 69569353 1.0550e+10 31069  
## - cat25 1 69995825 1.0550e+10 31069  
## - cat34 1 70324634 1.0550e+10 31069  
## - cat13 1 79784639 1.0560e+10 31071  
## - cat52 1 80590918 1.0561e+10 31071  
## - cat10 1 86746665 1.0567e+10 31072  
## - cat44 1 102739246 1.0583e+10 31075  
## - cat49 1 140842640 1.0621e+10 31082  
## - cont2 1 162857327 1.0643e+10 31087  
## - cat1 1 213879227 1.0694e+10 31096  
## - cat12 1 308860782 1.0789e+10 31114  
## - cat7 1 898667695 1.1379e+10 31220  
##   
## Step: AIC=31055.72  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont13 + cont14 + cat1 + cat2 +   
## cat4 + cat5 + cat6 + cat7 + cat8 + cat9 + cat10 + cat11 +   
## cat12 + cat13 + cat14 + cat16 + cat18 + cat19 + cat20 + cat21 +   
## cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat29 + cat30 +   
## cat31 + cat32 + cat34 + cat36 + cat37 + cat38 + cat39 + cat40 +   
## cat42 + cat43 + cat44 + cat46 + cat47 + cat49 + cat50 + cat51 +   
## cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat4 1 564655 1.0481e+10 31054  
## - cat47 1 568976 1.0481e+10 31054  
## - cat5 1 571334 1.0481e+10 31054  
## - cat31 1 675357 1.0481e+10 31054  
## - cat50 1 818813 1.0481e+10 31054  
## - cat32 1 1017561 1.0481e+10 31054  
## - cat2 1 1442062 1.0482e+10 31054  
## - cat6 1 1693571 1.0482e+10 31054  
## - cat30 1 2612842 1.0483e+10 31054  
## - cont13 1 3068425 1.0483e+10 31054  
## - cat18 1 3459668 1.0484e+10 31054  
## - cat37 1 3835219 1.0484e+10 31054  
## - cont3 1 4983964 1.0485e+10 31055  
## - cat39 1 6144315 1.0486e+10 31055  
## - cont6 1 6404821 1.0487e+10 31055  
## - cat29 1 7903746 1.0488e+10 31055  
## - cont11 1 9272025 1.0490e+10 31056  
## <none> 1.0480e+10 31056  
## - cat8 1 10658247 1.0491e+10 31056  
## - cat11 1 12001739 1.0492e+10 31056  
## - cat36 1 12324316 1.0493e+10 31056  
## - cat28 1 12567233 1.0493e+10 31056  
## - cat20 1 12759066 1.0493e+10 31056  
## - cont12 1 13703844 1.0494e+10 31056  
## - cont4 1 14048045 1.0494e+10 31056  
## - cont10 1 18410159 1.0499e+10 31057  
## - cat24 1 19557700 1.0500e+10 31057  
## - cat40 1 19598807 1.0500e+10 31058  
## - cat46 1 20311800 1.0501e+10 31058  
## - cat27 1 21365298 1.0502e+10 31058  
## - cat21 1 21823258 1.0502e+10 31058  
## - cat9 1 21966278 1.0502e+10 31058  
## - cat26 1 27001470 1.0507e+10 31059  
## - cont9 1 28723946 1.0509e+10 31059  
## - cat23 1 31961532 1.0512e+10 31060  
## - cont14 1 33979143 1.0514e+10 31060  
## - cat38 1 34085720 1.0514e+10 31060  
## - cat42 1 35193804 1.0515e+10 31060  
## - cat51 1 35319103 1.0516e+10 31060  
## - cat19 1 38729211 1.0519e+10 31061  
## - cat14 1 42338197 1.0523e+10 31062  
## - cont1 1 42622762 1.0523e+10 31062  
## - cat16 1 51598674 1.0532e+10 31064  
## - cat43 1 55590132 1.0536e+10 31064  
## - cont7 1 69475444 1.0550e+10 31067  
## - cat25 1 70062061 1.0550e+10 31067  
## - cat34 1 70316852 1.0551e+10 31067  
## - cat13 1 79669352 1.0560e+10 31069  
## - cat52 1 80536229 1.0561e+10 31069  
## - cat10 1 86600861 1.0567e+10 31070  
## - cat44 1 102568505 1.0583e+10 31073  
## - cat49 1 140902059 1.0621e+10 31080  
## - cont2 1 162628522 1.0643e+10 31085  
## - cat1 1 214282581 1.0695e+10 31094  
## - cat12 1 308704275 1.0789e+10 31112  
## - cat7 1 898615690 1.1379e+10 31218  
##   
## Step: AIC=31053.82  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont13 + cont14 + cat1 + cat2 +   
## cat5 + cat6 + cat7 + cat8 + cat9 + cat10 + cat11 + cat12 +   
## cat13 + cat14 + cat16 + cat18 + cat19 + cat20 + cat21 + cat23 +   
## cat24 + cat25 + cat26 + cat27 + cat28 + cat29 + cat30 + cat31 +   
## cat32 + cat34 + cat36 + cat37 + cat38 + cat39 + cat40 + cat42 +   
## cat43 + cat44 + cat46 + cat47 + cat49 + cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat47 1 526444 1.0481e+10 31052  
## - cat5 1 640356 1.0481e+10 31052  
## - cat31 1 659509 1.0481e+10 31052  
## - cat50 1 862328 1.0482e+10 31052  
## - cat32 1 1115722 1.0482e+10 31052  
## - cat2 1 1371491 1.0482e+10 31052  
## - cat6 1 1819906 1.0483e+10 31052  
## - cat30 1 2439509 1.0483e+10 31052  
## - cont13 1 3075006 1.0484e+10 31052  
## - cat18 1 3551174 1.0484e+10 31053  
## - cat37 1 3879763 1.0485e+10 31053  
## - cont3 1 4959408 1.0486e+10 31053  
## - cat39 1 6029870 1.0487e+10 31053  
## - cont6 1 6423783 1.0487e+10 31053  
## - cat29 1 7372616 1.0488e+10 31053  
## - cont11 1 9251015 1.0490e+10 31054  
## <none> 1.0481e+10 31054  
## - cat8 1 10486740 1.0491e+10 31054  
## - cat11 1 11665897 1.0493e+10 31054  
## - cat28 1 12052658 1.0493e+10 31054  
## - cat36 1 12236838 1.0493e+10 31054  
## - cat20 1 12696222 1.0494e+10 31054  
## - cont12 1 13686560 1.0495e+10 31054  
## - cont4 1 14057080 1.0495e+10 31055  
## - cont10 1 18509202 1.0499e+10 31055  
## - cat24 1 19588970 1.0500e+10 31056  
## - cat40 1 19765401 1.0501e+10 31056  
## - cat46 1 20445498 1.0501e+10 31056  
## - cat9 1 22130615 1.0503e+10 31056  
## - cat21 1 22303480 1.0503e+10 31056  
## - cat26 1 26883258 1.0508e+10 31057  
## - cat27 1 27068150 1.0508e+10 31057  
## - cont9 1 28456309 1.0509e+10 31057  
## - cat38 1 34388369 1.0515e+10 31058  
## - cont14 1 34434856 1.0515e+10 31058  
## - cat42 1 34872393 1.0516e+10 31059  
## - cat51 1 35351547 1.0516e+10 31059  
## - cat19 1 38689604 1.0520e+10 31059  
## - cont1 1 42403376 1.0523e+10 31060  
## - cat14 1 42439923 1.0523e+10 31060  
## - cat23 1 47884188 1.0529e+10 31061  
## - cat16 1 51643209 1.0532e+10 31062  
## - cat43 1 55775184 1.0537e+10 31062  
## - cont7 1 69447757 1.0550e+10 31065  
## - cat25 1 72055603 1.0553e+10 31066  
## - cat34 1 74934359 1.0556e+10 31066  
## - cat13 1 80668059 1.0562e+10 31067  
## - cat52 1 81081068 1.0562e+10 31067  
## - cat10 1 87554462 1.0568e+10 31069  
## - cat44 1 104070579 1.0585e+10 31072  
## - cat49 1 140505446 1.0621e+10 31079  
## - cont2 1 163293009 1.0644e+10 31083  
## - cat1 1 214222979 1.0695e+10 31092  
## - cat12 1 308238087 1.0789e+10 31110  
## - cat7 1 898821466 1.1380e+10 31216  
##   
## Step: AIC=31051.92  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont13 + cont14 + cat1 + cat2 +   
## cat5 + cat6 + cat7 + cat8 + cat9 + cat10 + cat11 + cat12 +   
## cat13 + cat14 + cat16 + cat18 + cat19 + cat20 + cat21 + cat23 +   
## cat24 + cat25 + cat26 + cat27 + cat28 + cat29 + cat30 + cat31 +   
## cat32 + cat34 + cat36 + cat37 + cat38 + cat39 + cat40 + cat42 +   
## cat43 + cat44 + cat46 + cat49 + cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat31 1 660194 1.0482e+10 31050  
## - cat5 1 736176 1.0482e+10 31050  
## - cat50 1 831934 1.0482e+10 31050  
## - cat32 1 1127825 1.0482e+10 31050  
## - cat2 1 1360998 1.0483e+10 31050  
## - cat6 1 1863741 1.0483e+10 31050  
## - cat30 1 2480742 1.0484e+10 31050  
## - cont13 1 3088287 1.0484e+10 31051  
## - cat18 1 3546525 1.0485e+10 31051  
## - cat37 1 4001202 1.0485e+10 31051  
## - cont3 1 4875799 1.0486e+10 31051  
## - cat39 1 5973469 1.0487e+10 31051  
## - cont6 1 6428511 1.0488e+10 31051  
## - cat29 1 7550622 1.0489e+10 31051  
## - cont11 1 9323635 1.0491e+10 31052  
## <none> 1.0481e+10 31052  
## - cat8 1 10519772 1.0492e+10 31052  
## - cat11 1 11679478 1.0493e+10 31052  
## - cat36 1 11962603 1.0493e+10 31052  
## - cat28 1 11992563 1.0493e+10 31052  
## - cat20 1 12693869 1.0494e+10 31052  
## - cont12 1 13801421 1.0495e+10 31053  
## - cont4 1 14225697 1.0496e+10 31053  
## - cont10 1 18702347 1.0500e+10 31054  
## - cat40 1 19579233 1.0501e+10 31054  
## - cat24 1 19606891 1.0501e+10 31054  
## - cat46 1 20301905 1.0502e+10 31054  
## - cat9 1 22196664 1.0504e+10 31054  
## - cat21 1 22317148 1.0504e+10 31054  
## - cat27 1 26988216 1.0508e+10 31055  
## - cat26 1 27106947 1.0508e+10 31055  
## - cont9 1 28730143 1.0510e+10 31055  
## - cat38 1 34353440 1.0516e+10 31057  
## - cont14 1 34597709 1.0516e+10 31057  
## - cat42 1 34712332 1.0516e+10 31057  
## - cat51 1 35284258 1.0517e+10 31057  
## - cat19 1 38575965 1.0520e+10 31057  
## - cat14 1 42364221 1.0524e+10 31058  
## - cont1 1 43070635 1.0524e+10 31058  
## - cat23 1 47823483 1.0529e+10 31059  
## - cat16 1 51619933 1.0533e+10 31060  
## - cat43 1 55658740 1.0537e+10 31061  
## - cont7 1 69197585 1.0551e+10 31063  
## - cat25 1 72083258 1.0553e+10 31064  
## - cat34 1 74902153 1.0556e+10 31064  
## - cat13 1 80579642 1.0562e+10 31065  
## - cat52 1 80778654 1.0562e+10 31065  
## - cat10 1 87470302 1.0569e+10 31067  
## - cat44 1 104810606 1.0586e+10 31070  
## - cat49 1 141838101 1.0623e+10 31077  
## - cont2 1 163259294 1.0645e+10 31081  
## - cat1 1 215017183 1.0696e+10 31091  
## - cat12 1 308046648 1.0789e+10 31108  
## - cat7 1 898470506 1.1380e+10 31214  
##   
## Step: AIC=31050.05  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont13 + cont14 + cat1 + cat2 +   
## cat5 + cat6 + cat7 + cat8 + cat9 + cat10 + cat11 + cat12 +   
## cat13 + cat14 + cat16 + cat18 + cat19 + cat20 + cat21 + cat23 +   
## cat24 + cat25 + cat26 + cat27 + cat28 + cat29 + cat30 + cat32 +   
## cat34 + cat36 + cat37 + cat38 + cat39 + cat40 + cat42 + cat43 +   
## cat44 + cat46 + cat49 + cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat5 1 744425 1.0483e+10 31048  
## - cat50 1 856283 1.0483e+10 31048  
## - cat32 1 1149956 1.0483e+10 31048  
## - cat2 1 1331248 1.0483e+10 31048  
## - cat6 1 1872617 1.0484e+10 31048  
## - cat30 1 2463628 1.0484e+10 31049  
## - cont13 1 3054807 1.0485e+10 31049  
## - cat18 1 3434178 1.0485e+10 31049  
## - cat37 1 4012982 1.0486e+10 31049  
## - cont3 1 4841356 1.0487e+10 31049  
## - cat39 1 5959944 1.0488e+10 31049  
## - cont6 1 6382723 1.0488e+10 31049  
## - cat29 1 7518840 1.0490e+10 31050  
## - cont11 1 9150673 1.0491e+10 31050  
## <none> 1.0482e+10 31050  
## - cat8 1 10752252 1.0493e+10 31050  
## - cat11 1 11481117 1.0494e+10 31050  
## - cat36 1 11983309 1.0494e+10 31050  
## - cat28 1 12135653 1.0494e+10 31050  
## - cat20 1 12724706 1.0495e+10 31051  
## - cont12 1 13609202 1.0496e+10 31051  
## - cont4 1 14142147 1.0496e+10 31051  
## - cont10 1 18617304 1.0501e+10 31052  
## - cat24 1 19223115 1.0501e+10 31052  
## - cat40 1 19490246 1.0502e+10 31052  
## - cat46 1 20302338 1.0502e+10 31052  
## - cat9 1 22156039 1.0504e+10 31052  
## - cat21 1 22363554 1.0504e+10 31052  
## - cat27 1 26494223 1.0509e+10 31053  
## - cat26 1 27036399 1.0509e+10 31053  
## - cont9 1 28587333 1.0511e+10 31054  
## - cont14 1 34492921 1.0517e+10 31055  
## - cat38 1 34596065 1.0517e+10 31055  
## - cat42 1 34776471 1.0517e+10 31055  
## - cat51 1 35255648 1.0517e+10 31055  
## - cat19 1 38564058 1.0521e+10 31055  
## - cat14 1 42108496 1.0524e+10 31056  
## - cont1 1 43147589 1.0525e+10 31056  
## - cat23 1 47647241 1.0530e+10 31057  
## - cat16 1 51626341 1.0534e+10 31058  
## - cat43 1 55788809 1.0538e+10 31059  
## - cont7 1 69002518 1.0551e+10 31061  
## - cat25 1 73283413 1.0555e+10 31062  
## - cat34 1 74249423 1.0556e+10 31062  
## - cat13 1 80611948 1.0563e+10 31063  
## - cat52 1 80781560 1.0563e+10 31063  
## - cat10 1 87566389 1.0570e+10 31065  
## - cat44 1 104604633 1.0587e+10 31068  
## - cat49 1 142165792 1.0624e+10 31075  
## - cont2 1 163473628 1.0646e+10 31079  
## - cat1 1 214461538 1.0696e+10 31089  
## - cat12 1 309187022 1.0791e+10 31106  
## - cat7 1 898895517 1.1381e+10 31213  
##   
## Step: AIC=31048.19  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont13 + cont14 + cat1 + cat2 +   
## cat6 + cat7 + cat8 + cat9 + cat10 + cat11 + cat12 + cat13 +   
## cat14 + cat16 + cat18 + cat19 + cat20 + cat21 + cat23 + cat24 +   
## cat25 + cat26 + cat27 + cat28 + cat29 + cat30 + cat32 + cat34 +   
## cat36 + cat37 + cat38 + cat39 + cat40 + cat42 + cat43 + cat44 +   
## cat46 + cat49 + cat50 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat50 1 895303 1.0484e+10 31046  
## - cat32 1 1061961 1.0484e+10 31046  
## - cat2 1 1542253 1.0484e+10 31047  
## - cat6 1 1673995 1.0484e+10 31047  
## - cat30 1 2562966 1.0485e+10 31047  
## - cont13 1 2989131 1.0486e+10 31047  
## - cat18 1 3406652 1.0486e+10 31047  
## - cont3 1 5074172 1.0488e+10 31047  
## - cat39 1 5746362 1.0489e+10 31047  
## - cont6 1 6337261 1.0489e+10 31047  
## - cat29 1 7433203 1.0490e+10 31048  
## - cont11 1 8879817 1.0492e+10 31048  
## - cat37 1 9441438 1.0492e+10 31048  
## <none> 1.0483e+10 31048  
## - cat8 1 10915469 1.0494e+10 31048  
## - cat11 1 11281197 1.0494e+10 31048  
## - cat28 1 12099055 1.0495e+10 31049  
## - cat20 1 12685176 1.0495e+10 31049  
## - cont12 1 13274712 1.0496e+10 31049  
## - cont4 1 13901737 1.0497e+10 31049  
## - cont10 1 18612222 1.0501e+10 31050  
## - cat24 1 19217185 1.0502e+10 31050  
## - cat46 1 20420010 1.0503e+10 31050  
## - cat21 1 21935584 1.0505e+10 31050  
## - cat9 1 22264023 1.0505e+10 31050  
## - cat40 1 23352429 1.0506e+10 31051  
## - cat27 1 26045838 1.0509e+10 31051  
## - cat26 1 26816627 1.0510e+10 31051  
## - cont9 1 28342962 1.0511e+10 31052  
## - cat36 1 30170482 1.0513e+10 31052  
## - cont14 1 34504850 1.0517e+10 31053  
## - cat51 1 35146733 1.0518e+10 31053  
## - cat38 1 35468364 1.0518e+10 31053  
## - cat42 1 35536850 1.0518e+10 31053  
## - cat19 1 38571183 1.0521e+10 31054  
## - cat14 1 42268324 1.0525e+10 31054  
## - cont1 1 42873243 1.0526e+10 31054  
## - cat23 1 47705520 1.0530e+10 31055  
## - cat16 1 51805456 1.0535e+10 31056  
## - cat43 1 58558544 1.0541e+10 31057  
## - cont7 1 68739563 1.0552e+10 31059  
## - cat25 1 72573596 1.0555e+10 31060  
## - cat34 1 74496534 1.0557e+10 31060  
## - cat13 1 82178800 1.0565e+10 31062  
## - cat52 1 82698394 1.0565e+10 31062  
## - cat10 1 87477281 1.0570e+10 31063  
## - cat44 1 110614669 1.0593e+10 31067  
## - cat49 1 141768511 1.0625e+10 31073  
## - cont2 1 163134007 1.0646e+10 31077  
## - cat1 1 213780211 1.0697e+10 31087  
## - cat12 1 309256780 1.0792e+10 31104  
## - cat7 1 898867507 1.1382e+10 31211  
##   
## Step: AIC=31046.36  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont13 + cont14 + cat1 + cat2 +   
## cat6 + cat7 + cat8 + cat9 + cat10 + cat11 + cat12 + cat13 +   
## cat14 + cat16 + cat18 + cat19 + cat20 + cat21 + cat23 + cat24 +   
## cat25 + cat26 + cat27 + cat28 + cat29 + cat30 + cat32 + cat34 +   
## cat36 + cat37 + cat38 + cat39 + cat40 + cat42 + cat43 + cat44 +   
## cat46 + cat49 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat32 1 1147447 1.0485e+10 31045  
## - cat2 1 1516137 1.0485e+10 31045  
## - cat30 1 2596363 1.0486e+10 31045  
## - cont13 1 3090305 1.0487e+10 31045  
## - cat18 1 3433613 1.0487e+10 31045  
## - cont3 1 5156669 1.0489e+10 31045  
## - cat39 1 5710719 1.0489e+10 31046  
## - cont6 1 6382389 1.0490e+10 31046  
## - cat29 1 7470041 1.0491e+10 31046  
## - cont11 1 9143473 1.0493e+10 31046  
## - cat37 1 9780691 1.0493e+10 31046  
## <none> 1.0484e+10 31046  
## - cat8 1 10936938 1.0495e+10 31046  
## - cat11 1 11206852 1.0495e+10 31047  
## - cat28 1 12040109 1.0496e+10 31047  
## - cat20 1 12224893 1.0496e+10 31047  
## - cont12 1 13603819 1.0497e+10 31047  
## - cont4 1 13795148 1.0497e+10 31047  
## - cont10 1 19053915 1.0503e+10 31048  
## - cat24 1 19280916 1.0503e+10 31048  
## - cat6 1 19368897 1.0503e+10 31048  
## - cat46 1 20427103 1.0504e+10 31048  
## - cat9 1 22274793 1.0506e+10 31049  
## - cat21 1 22436965 1.0506e+10 31049  
## - cat40 1 23324596 1.0507e+10 31049  
## - cat27 1 25936707 1.0510e+10 31049  
## - cat26 1 26956721 1.0511e+10 31050  
## - cont9 1 28464976 1.0512e+10 31050  
## - cat36 1 30033303 1.0514e+10 31050  
## - cat51 1 34266793 1.0518e+10 31051  
## - cont14 1 34774592 1.0518e+10 31051  
## - cat42 1 35472618 1.0519e+10 31051  
## - cat38 1 35773312 1.0519e+10 31051  
## - cat19 1 38972257 1.0523e+10 31052  
## - cat14 1 42299790 1.0526e+10 31052  
## - cont1 1 43443166 1.0527e+10 31053  
## - cat23 1 47837406 1.0532e+10 31054  
## - cat16 1 51908186 1.0536e+10 31054  
## - cat43 1 58126674 1.0542e+10 31055  
## - cont7 1 69042014 1.0553e+10 31058  
## - cat25 1 72515251 1.0556e+10 31058  
## - cat34 1 74026694 1.0558e+10 31058  
## - cat52 1 81894140 1.0566e+10 31060  
## - cat13 1 82200662 1.0566e+10 31060  
## - cat10 1 87484599 1.0571e+10 31061  
## - cat44 1 110031512 1.0594e+10 31065  
## - cat49 1 141166011 1.0625e+10 31071  
## - cont2 1 162775028 1.0646e+10 31075  
## - cat1 1 213519528 1.0697e+10 31085  
## - cat12 1 309023593 1.0793e+10 31103  
## - cat7 1 899368905 1.1383e+10 31209  
##   
## Step: AIC=31044.58  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont13 + cont14 + cat1 + cat2 +   
## cat6 + cat7 + cat8 + cat9 + cat10 + cat11 + cat12 + cat13 +   
## cat14 + cat16 + cat18 + cat19 + cat20 + cat21 + cat23 + cat24 +   
## cat25 + cat26 + cat27 + cat28 + cat29 + cat30 + cat34 + cat36 +   
## cat37 + cat38 + cat39 + cat40 + cat42 + cat43 + cat44 + cat46 +   
## cat49 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat2 1 1471764 1.0486e+10 31043  
## - cat30 1 2777868 1.0488e+10 31043  
## - cont13 1 3131002 1.0488e+10 31043  
## - cat18 1 3450584 1.0488e+10 31043  
## - cont3 1 5331893 1.0490e+10 31044  
## - cat39 1 5553185 1.0490e+10 31044  
## - cont6 1 6295497 1.0491e+10 31044  
## - cat29 1 7431673 1.0492e+10 31044  
## - cont11 1 8810764 1.0494e+10 31044  
## - cat37 1 10010786 1.0495e+10 31045  
## <none> 1.0485e+10 31045  
## - cat8 1 11037509 1.0496e+10 31045  
## - cat11 1 11226511 1.0496e+10 31045  
## - cat28 1 11771572 1.0497e+10 31045  
## - cat20 1 12208390 1.0497e+10 31045  
## - cont12 1 13178724 1.0498e+10 31045  
## - cont4 1 13577978 1.0498e+10 31045  
## - cat6 1 19267273 1.0504e+10 31046  
## - cont10 1 19368938 1.0504e+10 31046  
## - cat24 1 19693705 1.0505e+10 31046  
## - cat46 1 20598889 1.0505e+10 31047  
## - cat9 1 22206746 1.0507e+10 31047  
## - cat21 1 22565570 1.0507e+10 31047  
## - cat40 1 23449746 1.0508e+10 31047  
## - cat26 1 26054465 1.0511e+10 31048  
## - cat27 1 26174985 1.0511e+10 31048  
## - cont9 1 27704688 1.0513e+10 31048  
## - cat36 1 29991164 1.0515e+10 31048  
## - cat51 1 33761987 1.0519e+10 31049  
## - cat42 1 34336026 1.0519e+10 31049  
## - cont14 1 35662506 1.0520e+10 31049  
## - cat38 1 35862364 1.0521e+10 31049  
## - cat19 1 38531717 1.0523e+10 31050  
## - cat14 1 42328450 1.0527e+10 31051  
## - cont1 1 43181110 1.0528e+10 31051  
## - cat23 1 47299288 1.0532e+10 31052  
## - cat16 1 51909085 1.0537e+10 31053  
## - cat43 1 58369661 1.0543e+10 31054  
## - cont7 1 69168466 1.0554e+10 31056  
## - cat25 1 72571860 1.0557e+10 31056  
## - cat34 1 73096144 1.0558e+10 31057  
## - cat13 1 82262312 1.0567e+10 31058  
## - cat52 1 82567538 1.0567e+10 31058  
## - cat10 1 88019873 1.0573e+10 31059  
## - cat44 1 109810051 1.0595e+10 31063  
## - cat49 1 140168464 1.0625e+10 31069  
## - cont2 1 162372870 1.0647e+10 31073  
## - cat1 1 212609283 1.0697e+10 31083  
## - cat12 1 308625699 1.0793e+10 31101  
## - cat7 1 898498970 1.1383e+10 31207  
##   
## Step: AIC=31042.86  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont13 + cont14 + cat1 + cat6 +   
## cat7 + cat8 + cat9 + cat10 + cat11 + cat12 + cat13 + cat14 +   
## cat16 + cat18 + cat19 + cat20 + cat21 + cat23 + cat24 + cat25 +   
## cat26 + cat27 + cat28 + cat29 + cat30 + cat34 + cat36 + cat37 +   
## cat38 + cat39 + cat40 + cat42 + cat43 + cat44 + cat46 + cat49 +   
## cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat30 1 2755451 1.0489e+10 31041  
## - cont13 1 3066360 1.0489e+10 31041  
## - cat18 1 3542228 1.0490e+10 31042  
## - cont3 1 5464406 1.0492e+10 31042  
## - cat39 1 5901746 1.0492e+10 31042  
## - cont6 1 6343856 1.0493e+10 31042  
## - cat29 1 7627955 1.0494e+10 31042  
## - cont11 1 8857193 1.0495e+10 31043  
## <none> 1.0486e+10 31043  
## - cat37 1 10501314 1.0497e+10 31043  
## - cat11 1 10737053 1.0497e+10 31043  
## - cat8 1 11063309 1.0497e+10 31043  
## - cat28 1 12020779 1.0498e+10 31043  
## - cat20 1 12183223 1.0498e+10 31043  
## - cont12 1 13216797 1.0500e+10 31043  
## - cont4 1 13624704 1.0500e+10 31044  
## - cat24 1 19242336 1.0506e+10 31045  
## - cont10 1 19321080 1.0506e+10 31045  
## - cat46 1 20902409 1.0507e+10 31045  
## - cat6 1 21382058 1.0508e+10 31045  
## - cat21 1 22960264 1.0509e+10 31045  
## - cat40 1 23672919 1.0510e+10 31045  
## - cat26 1 26446896 1.0513e+10 31046  
## - cat27 1 26473015 1.0513e+10 31046  
## - cont9 1 27740957 1.0514e+10 31046  
## - cat36 1 29571786 1.0516e+10 31047  
## - cat51 1 33771419 1.0520e+10 31047  
## - cat42 1 34571258 1.0521e+10 31047  
## - cat38 1 35907869 1.0522e+10 31048  
## - cont14 1 35917677 1.0522e+10 31048  
## - cat19 1 38621415 1.0525e+10 31048  
## - cat14 1 41200158 1.0527e+10 31049  
## - cont1 1 43127847 1.0529e+10 31049  
## - cat23 1 46531975 1.0533e+10 31050  
## - cat16 1 52669910 1.0539e+10 31051  
## - cat43 1 58729568 1.0545e+10 31052  
## - cat9 1 60833025 1.0547e+10 31052  
## - cont7 1 69051654 1.0555e+10 31054  
## - cat25 1 72786387 1.0559e+10 31055  
## - cat34 1 73011532 1.0559e+10 31055  
## - cat13 1 80936352 1.0567e+10 31056  
## - cat52 1 82295759 1.0569e+10 31057  
## - cat10 1 87427178 1.0574e+10 31058  
## - cat44 1 111139657 1.0597e+10 31062  
## - cat49 1 140379423 1.0627e+10 31068  
## - cont2 1 163032634 1.0649e+10 31072  
## - cat1 1 211787705 1.0698e+10 31081  
## - cat12 1 307232104 1.0794e+10 31099  
## - cat7 1 898850021 1.1385e+10 31205  
##   
## Step: AIC=31041.39  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont13 + cont14 + cat1 + cat6 +   
## cat7 + cat8 + cat9 + cat10 + cat11 + cat12 + cat13 + cat14 +   
## cat16 + cat18 + cat19 + cat20 + cat21 + cat23 + cat24 + cat25 +   
## cat26 + cat27 + cat28 + cat29 + cat34 + cat36 + cat37 + cat38 +   
## cat39 + cat40 + cat42 + cat43 + cat44 + cat46 + cat49 + cat51 +   
## cat52  
##   
## Df Sum of Sq RSS AIC  
## - cont13 1 3031092 1.0492e+10 31040  
## - cat18 1 3646666 1.0493e+10 31040  
## - cat29 1 5204713 1.0494e+10 31040  
## - cont3 1 5310403 1.0494e+10 31040  
## - cat39 1 5918483 1.0495e+10 31041  
## - cont6 1 6540871 1.0496e+10 31041  
## - cont11 1 9022981 1.0498e+10 31041  
## <none> 1.0489e+10 31041  
## - cat11 1 10600988 1.0500e+10 31041  
## - cat37 1 10618662 1.0500e+10 31041  
## - cat8 1 11257630 1.0500e+10 31042  
## - cat20 1 12295563 1.0501e+10 31042  
## - cat28 1 12929497 1.0502e+10 31042  
## - cont12 1 13435165 1.0502e+10 31042  
## - cont4 1 13741185 1.0503e+10 31042  
## - cat24 1 17250995 1.0506e+10 31043  
## - cont10 1 19290919 1.0508e+10 31043  
## - cat46 1 20878763 1.0510e+10 31043  
## - cat6 1 21242151 1.0510e+10 31043  
## - cat21 1 23299566 1.0512e+10 31044  
## - cat40 1 24013001 1.0513e+10 31044  
## - cat27 1 24513935 1.0514e+10 31044  
## - cat26 1 26092508 1.0515e+10 31044  
## - cont9 1 28621978 1.0518e+10 31045  
## - cat36 1 29344766 1.0518e+10 31045  
## - cat51 1 33706693 1.0523e+10 31046  
## - cat42 1 34425247 1.0523e+10 31046  
## - cat38 1 35783328 1.0525e+10 31046  
## - cont14 1 36038227 1.0525e+10 31046  
## - cat19 1 39018456 1.0528e+10 31047  
## - cat14 1 42055489 1.0531e+10 31047  
## - cont1 1 43809705 1.0533e+10 31048  
## - cat23 1 46726240 1.0536e+10 31048  
## - cat16 1 52762778 1.0542e+10 31049  
## - cat43 1 58115195 1.0547e+10 31050  
## - cat9 1 61170320 1.0550e+10 31051  
## - cont7 1 69735660 1.0559e+10 31053  
## - cat25 1 71625890 1.0561e+10 31053  
## - cat34 1 72175212 1.0561e+10 31053  
## - cat13 1 80777538 1.0570e+10 31055  
## - cat52 1 82569359 1.0572e+10 31055  
## - cat10 1 86711048 1.0576e+10 31056  
## - cat44 1 111114104 1.0600e+10 31061  
## - cat49 1 143291440 1.0632e+10 31067  
## - cont2 1 163156437 1.0652e+10 31070  
## - cat1 1 210925363 1.0700e+10 31079  
## - cat12 1 308964095 1.0798e+10 31097  
## - cat7 1 898560310 1.1388e+10 31204  
##   
## Step: AIC=31039.97  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont14 + cat1 + cat6 + cat7 +   
## cat8 + cat9 + cat10 + cat11 + cat12 + cat13 + cat14 + cat16 +   
## cat18 + cat19 + cat20 + cat21 + cat23 + cat24 + cat25 + cat26 +   
## cat27 + cat28 + cat29 + cat34 + cat36 + cat37 + cat38 + cat39 +   
## cat40 + cat42 + cat43 + cat44 + cat46 + cat49 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat18 1 3909854 1.0496e+10 31039  
## - cat29 1 4978612 1.0497e+10 31039  
## - cat39 1 5844599 1.0498e+10 31039  
## - cont3 1 5975155 1.0498e+10 31039  
## - cont11 1 8759743 1.0501e+10 31040  
## - cat11 1 10347751 1.0502e+10 31040  
## <none> 1.0492e+10 31040  
## - cat37 1 10890038 1.0503e+10 31040  
## - cat8 1 11155131 1.0503e+10 31040  
## - cont4 1 11948200 1.0504e+10 31040  
## - cat20 1 12355504 1.0504e+10 31040  
## - cat28 1 13093728 1.0505e+10 31041  
## - cont12 1 13484993 1.0506e+10 31041  
## - cat24 1 17299496 1.0509e+10 31041  
## - cont10 1 18558308 1.0511e+10 31042  
## - cat6 1 20342266 1.0512e+10 31042  
## - cat46 1 20577651 1.0513e+10 31042  
## - cat21 1 22950160 1.0515e+10 31042  
## - cat40 1 24175933 1.0516e+10 31043  
## - cat27 1 24804919 1.0517e+10 31043  
## - cont9 1 25611339 1.0518e+10 31043  
## - cat26 1 26387263 1.0518e+10 31043  
## - cat36 1 29093161 1.0521e+10 31044  
## - cont6 1 32551353 1.0525e+10 31044  
## - cat42 1 33635014 1.0526e+10 31044  
## - cat51 1 34128802 1.0526e+10 31045  
## - cat38 1 35566533 1.0528e+10 31045  
## - cont14 1 35807357 1.0528e+10 31045  
## - cat19 1 39201433 1.0531e+10 31045  
## - cat14 1 41761900 1.0534e+10 31046  
## - cont1 1 42479549 1.0535e+10 31046  
## - cat23 1 46779614 1.0539e+10 31047  
## - cat16 1 52059163 1.0544e+10 31048  
## - cat43 1 58524224 1.0551e+10 31049  
## - cat9 1 60039190 1.0552e+10 31049  
## - cat34 1 71625272 1.0564e+10 31052  
## - cat25 1 71693508 1.0564e+10 31052  
## - cat52 1 82326498 1.0574e+10 31054  
## - cat13 1 82415874 1.0574e+10 31054  
## - cat10 1 87705449 1.0580e+10 31055  
## - cat44 1 109925659 1.0602e+10 31059  
## - cont7 1 128173278 1.0620e+10 31062  
## - cat49 1 143040584 1.0635e+10 31065  
## - cont2 1 162409798 1.0654e+10 31069  
## - cat1 1 210388573 1.0702e+10 31078  
## - cat12 1 309629303 1.0802e+10 31096  
## - cat7 1 899817399 1.1392e+10 31203  
##   
## Step: AIC=31038.71  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont14 + cat1 + cat6 + cat7 +   
## cat8 + cat9 + cat10 + cat11 + cat12 + cat13 + cat14 + cat16 +   
## cat19 + cat20 + cat21 + cat23 + cat24 + cat25 + cat26 + cat27 +   
## cat28 + cat29 + cat34 + cat36 + cat37 + cat38 + cat39 + cat40 +   
## cat42 + cat43 + cat44 + cat46 + cat49 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat29 1 4777021 1.0501e+10 31038  
## - cat39 1 5792713 1.0502e+10 31038  
## - cont3 1 5936277 1.0502e+10 31038  
## - cont11 1 8459114 1.0504e+10 31038  
## - cat11 1 10449857 1.0506e+10 31039  
## <none> 1.0496e+10 31039  
## - cat37 1 10768909 1.0507e+10 31039  
## - cont4 1 12095871 1.0508e+10 31039  
## - cat20 1 12305265 1.0508e+10 31039  
## - cat8 1 12546282 1.0509e+10 31039  
## - cont12 1 13157952 1.0509e+10 31039  
## - cat28 1 13401064 1.0509e+10 31039  
## - cat24 1 17705811 1.0514e+10 31040  
## - cont10 1 18305225 1.0514e+10 31040  
## - cat46 1 20553079 1.0517e+10 31041  
## - cat6 1 20555726 1.0517e+10 31041  
## - cat21 1 22810537 1.0519e+10 31041  
## - cat40 1 24563877 1.0521e+10 31041  
## - cat27 1 24811665 1.0521e+10 31041  
## - cont9 1 25300002 1.0521e+10 31042  
## - cat26 1 26825667 1.0523e+10 31042  
## - cat36 1 28536455 1.0525e+10 31042  
## - cont6 1 31913373 1.0528e+10 31043  
## - cat42 1 33741997 1.0530e+10 31043  
## - cat51 1 33937494 1.0530e+10 31043  
## - cat38 1 35524944 1.0532e+10 31044  
## - cont14 1 35683187 1.0532e+10 31044  
## - cat19 1 38810265 1.0535e+10 31044  
## - cat14 1 41611938 1.0538e+10 31045  
## - cont1 1 42414733 1.0538e+10 31045  
## - cat23 1 48118320 1.0544e+10 31046  
## - cat16 1 52190210 1.0548e+10 31047  
## - cat43 1 58303375 1.0554e+10 31048  
## - cat9 1 59747813 1.0556e+10 31048  
## - cat34 1 70821943 1.0567e+10 31050  
## - cat25 1 70972597 1.0567e+10 31050  
## - cat52 1 82240404 1.0578e+10 31052  
## - cat13 1 82436275 1.0578e+10 31052  
## - cat10 1 88245591 1.0584e+10 31054  
## - cat44 1 109871387 1.0606e+10 31058  
## - cont7 1 126688494 1.0623e+10 31061  
## - cat49 1 142497913 1.0638e+10 31064  
## - cont2 1 163446335 1.0659e+10 31068  
## - cat1 1 210418354 1.0706e+10 31076  
## - cat12 1 311176219 1.0807e+10 31095  
## - cat7 1 897073509 1.1393e+10 31201  
##   
## Step: AIC=31037.62  
## loss ~ cont1 + cont2 + cont3 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont11 + cont12 + cont14 + cat1 + cat6 + cat7 +   
## cat8 + cat9 + cat10 + cat11 + cat12 + cat13 + cat14 + cat16 +   
## cat19 + cat20 + cat21 + cat23 + cat24 + cat25 + cat26 + cat27 +   
## cat28 + cat34 + cat36 + cat37 + cat38 + cat39 + cat40 + cat42 +   
## cat43 + cat44 + cat46 + cat49 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cont3 1 5740431 1.0506e+10 31037  
## - cat39 1 6055091 1.0507e+10 31037  
## - cont11 1 8645791 1.0509e+10 31037  
## - cat11 1 10244903 1.0511e+10 31038  
## <none> 1.0501e+10 31038  
## - cat37 1 11073151 1.0512e+10 31038  
## - cont4 1 11723030 1.0512e+10 31038  
## - cat20 1 12169543 1.0513e+10 31038  
## - cont12 1 13349023 1.0514e+10 31038  
## - cat8 1 13446989 1.0514e+10 31038  
## - cat28 1 16764592 1.0518e+10 31039  
## - cat24 1 16881850 1.0518e+10 31039  
## - cont10 1 17576805 1.0518e+10 31039  
## - cat6 1 19642285 1.0520e+10 31039  
## - cat46 1 20437713 1.0521e+10 31040  
## - cat21 1 23306296 1.0524e+10 31040  
## - cat40 1 24018198 1.0525e+10 31040  
## - cont9 1 25807158 1.0527e+10 31041  
## - cat36 1 28519919 1.0529e+10 31041  
## - cat26 1 28556353 1.0529e+10 31041  
## - cat27 1 28973472 1.0530e+10 31041  
## - cont6 1 31917079 1.0533e+10 31042  
## - cat51 1 33663128 1.0534e+10 31042  
## - cat42 1 33804102 1.0535e+10 31042  
## - cat38 1 35663491 1.0536e+10 31042  
## - cont14 1 36136169 1.0537e+10 31043  
## - cat19 1 39152650 1.0540e+10 31043  
## - cat14 1 42817982 1.0544e+10 31044  
## - cont1 1 42854501 1.0544e+10 31044  
## - cat23 1 47835359 1.0549e+10 31045  
## - cat16 1 51754213 1.0553e+10 31046  
## - cat9 1 57408357 1.0558e+10 31047  
## - cat43 1 58207907 1.0559e+10 31047  
## - cat25 1 68472235 1.0569e+10 31049  
## - cat34 1 73684831 1.0574e+10 31050  
## - cat52 1 82271088 1.0583e+10 31051  
## - cat13 1 82812847 1.0584e+10 31051  
## - cat10 1 88505622 1.0589e+10 31052  
## - cat44 1 108333453 1.0609e+10 31056  
## - cont7 1 129564549 1.0630e+10 31060  
## - cat49 1 141667594 1.0642e+10 31062  
## - cont2 1 165374918 1.0666e+10 31067  
## - cat1 1 216508357 1.0717e+10 31076  
## - cat12 1 310283905 1.0811e+10 31094  
## - cat7 1 903791579 1.1405e+10 31201  
##   
## Step: AIC=31036.71  
## loss ~ cont1 + cont2 + cont4 + cont6 + cont7 + cont9 + cont10 +   
## cont11 + cont12 + cont14 + cat1 + cat6 + cat7 + cat8 + cat9 +   
## cat10 + cat11 + cat12 + cat13 + cat14 + cat16 + cat19 + cat20 +   
## cat21 + cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat34 +   
## cat36 + cat37 + cat38 + cat39 + cat40 + cat42 + cat43 + cat44 +   
## cat46 + cat49 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat39 1 6510726 1.0513e+10 31036  
## - cont11 1 8437067 1.0515e+10 31036  
## - cat11 1 9957719 1.0516e+10 31037  
## <none> 1.0506e+10 31037  
## - cat37 1 11118665 1.0518e+10 31037  
## - cat20 1 12383090 1.0519e+10 31037  
## - cat8 1 13552004 1.0520e+10 31037  
## - cont12 1 14313422 1.0521e+10 31037  
## - cont4 1 16106781 1.0523e+10 31038  
## - cat24 1 16255551 1.0523e+10 31038  
## - cat28 1 17094501 1.0524e+10 31038  
## - cont10 1 18136994 1.0525e+10 31038  
## - cat6 1 19283503 1.0526e+10 31038  
## - cat46 1 20189805 1.0527e+10 31039  
## - cat21 1 23988020 1.0530e+10 31039  
## - cat40 1 24234798 1.0531e+10 31039  
## - cont9 1 26141940 1.0533e+10 31040  
## - cat36 1 28225066 1.0535e+10 31040  
## - cat27 1 28527724 1.0535e+10 31040  
## - cat26 1 28871533 1.0535e+10 31040  
## - cat51 1 34026450 1.0541e+10 31041  
## - cat42 1 34227125 1.0541e+10 31041  
## - cat38 1 35936210 1.0542e+10 31042  
## - cont14 1 36872517 1.0543e+10 31042  
## - cat19 1 39181929 1.0546e+10 31042  
## - cat14 1 42940998 1.0549e+10 31043  
## - cont1 1 47969519 1.0554e+10 31044  
## - cont6 1 48031284 1.0555e+10 31044  
## - cat23 1 48337508 1.0555e+10 31044  
## - cat16 1 51822396 1.0558e+10 31045  
## - cat9 1 57147641 1.0564e+10 31046  
## - cat43 1 57514723 1.0564e+10 31046  
## - cat25 1 69035312 1.0576e+10 31048  
## - cat34 1 74176056 1.0581e+10 31049  
## - cat13 1 82216439 1.0589e+10 31050  
## - cat52 1 82279632 1.0589e+10 31050  
## - cat10 1 88003930 1.0595e+10 31051  
## - cat44 1 110287939 1.0617e+10 31056  
## - cat49 1 141933345 1.0648e+10 31062  
## - cont7 1 149295114 1.0656e+10 31063  
## - cat1 1 213816200 1.0720e+10 31075  
## - cont2 1 265830668 1.0772e+10 31085  
## - cat12 1 313545755 1.0820e+10 31094  
## - cat7 1 908513570 1.1415e+10 31201  
##   
## Step: AIC=31035.95  
## loss ~ cont1 + cont2 + cont4 + cont6 + cont7 + cont9 + cont10 +   
## cont11 + cont12 + cont14 + cat1 + cat6 + cat7 + cat8 + cat9 +   
## cat10 + cat11 + cat12 + cat13 + cat14 + cat16 + cat19 + cat20 +   
## cat21 + cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat34 +   
## cat36 + cat37 + cat38 + cat40 + cat42 + cat43 + cat44 + cat46 +   
## cat49 + cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cont11 1 8204745 1.0521e+10 31036  
## - cat11 1 9971291 1.0523e+10 31036  
## <none> 1.0513e+10 31036  
## - cat37 1 10617395 1.0524e+10 31036  
## - cat20 1 12351247 1.0525e+10 31036  
## - cat8 1 14051612 1.0527e+10 31037  
## - cont12 1 14108506 1.0527e+10 31037  
## - cat24 1 16287605 1.0529e+10 31037  
## - cont4 1 16664990 1.0530e+10 31037  
## - cat28 1 16712555 1.0530e+10 31037  
## - cat46 1 17401095 1.0530e+10 31037  
## - cont10 1 17809564 1.0531e+10 31037  
## - cat6 1 20917324 1.0534e+10 31038  
## - cat21 1 24210919 1.0537e+10 31039  
## - cat40 1 25595538 1.0539e+10 31039  
## - cont9 1 25843588 1.0539e+10 31039  
## - cat36 1 27612333 1.0541e+10 31039  
## - cat27 1 28822225 1.0542e+10 31039  
## - cat26 1 29168277 1.0542e+10 31040  
## - cat42 1 31150790 1.0544e+10 31040  
## - cat38 1 31664374 1.0545e+10 31040  
## - cat51 1 33964170 1.0547e+10 31040  
## - cont14 1 38572553 1.0552e+10 31041  
## - cat19 1 39601857 1.0553e+10 31042  
## - cat14 1 41108585 1.0554e+10 31042  
## - cont6 1 46481853 1.0559e+10 31043  
## - cont1 1 48527082 1.0562e+10 31043  
## - cat23 1 48669072 1.0562e+10 31043  
## - cat16 1 52238355 1.0565e+10 31044  
## - cat43 1 58880535 1.0572e+10 31045  
## - cat9 1 59000389 1.0572e+10 31045  
## - cat25 1 70604794 1.0584e+10 31047  
## - cat34 1 73691438 1.0587e+10 31048  
## - cat52 1 82272017 1.0595e+10 31050  
## - cat13 1 82373707 1.0595e+10 31050  
## - cat10 1 88785992 1.0602e+10 31051  
## - cat44 1 108329156 1.0621e+10 31055  
## - cat49 1 141764774 1.0655e+10 31061  
## - cont7 1 146245472 1.0659e+10 31062  
## - cat1 1 209284164 1.0722e+10 31073  
## - cont2 1 264829250 1.0778e+10 31084  
## - cat12 1 315703252 1.0829e+10 31093  
## - cat7 1 913294717 1.1426e+10 31201  
##   
## Step: AIC=31035.51  
## loss ~ cont1 + cont2 + cont4 + cont6 + cont7 + cont9 + cont10 +   
## cont12 + cont14 + cat1 + cat6 + cat7 + cat8 + cat9 + cat10 +   
## cat11 + cat12 + cat13 + cat14 + cat16 + cat19 + cat20 + cat21 +   
## cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat34 + cat36 +   
## cat37 + cat38 + cat40 + cat42 + cat43 + cat44 + cat46 + cat49 +   
## cat51 + cat52  
##   
## Df Sum of Sq RSS AIC  
## - cat11 1 8979987 1.0530e+10 31035  
## <none> 1.0521e+10 31036  
## - cat37 1 10716580 1.0532e+10 31036  
## - cat20 1 12466318 1.0534e+10 31036  
## - cat8 1 15374998 1.0537e+10 31036  
## - cat24 1 15475962 1.0537e+10 31037  
## - cont4 1 16250104 1.0537e+10 31037  
## - cat28 1 16748459 1.0538e+10 31037  
## - cont10 1 16794651 1.0538e+10 31037  
## - cat46 1 19038452 1.0540e+10 31037  
## - cat6 1 20384158 1.0542e+10 31037  
## - cat21 1 24154271 1.0545e+10 31038  
## - cat40 1 25503703 1.0547e+10 31038  
## - cont12 1 25850531 1.0547e+10 31038  
## - cat36 1 26809441 1.0548e+10 31039  
## - cont9 1 26837880 1.0548e+10 31039  
## - cat26 1 29177875 1.0550e+10 31039  
## - cat27 1 30080111 1.0551e+10 31039  
## - cat42 1 30994145 1.0552e+10 31039  
## - cat38 1 31256520 1.0552e+10 31039  
## - cat51 1 33287159 1.0555e+10 31040  
## - cont14 1 37924174 1.0559e+10 31041  
## - cat14 1 41531722 1.0563e+10 31041  
## - cat19 1 41549060 1.0563e+10 31041  
## - cont6 1 44953245 1.0566e+10 31042  
## - cont1 1 47083788 1.0568e+10 31042  
## - cat23 1 50397922 1.0572e+10 31043  
## - cat16 1 50623183 1.0572e+10 31043  
## - cat9 1 59145848 1.0580e+10 31045  
## - cat43 1 59462775 1.0581e+10 31045  
## - cat25 1 70264894 1.0591e+10 31047  
## - cat34 1 73179509 1.0594e+10 31047  
## - cat13 1 82967888 1.0604e+10 31049  
## - cat52 1 84355785 1.0606e+10 31050  
## - cat10 1 91295418 1.0613e+10 31051  
## - cat44 1 107201409 1.0628e+10 31054  
## - cat49 1 141076748 1.0662e+10 31060  
## - cont7 1 141587850 1.0663e+10 31060  
## - cat1 1 209471527 1.0731e+10 31073  
## - cont2 1 260943600 1.0782e+10 31083  
## - cat12 1 323185823 1.0844e+10 31094  
## - cat7 1 910973541 1.1432e+10 31200  
##   
## Step: AIC=31035.22  
## loss ~ cont1 + cont2 + cont4 + cont6 + cont7 + cont9 + cont10 +   
## cont12 + cont14 + cat1 + cat6 + cat7 + cat8 + cat9 + cat10 +   
## cat12 + cat13 + cat14 + cat16 + cat19 + cat20 + cat21 + cat23 +   
## cat24 + cat25 + cat26 + cat27 + cat28 + cat34 + cat36 + cat37 +   
## cat38 + cat40 + cat42 + cat43 + cat44 + cat46 + cat49 + cat51 +   
## cat52  
##   
## Df Sum of Sq RSS AIC  
## <none> 1.0530e+10 31035  
## - cat37 1 10679047 1.0541e+10 31035  
## - cat20 1 12075455 1.0542e+10 31036  
## - cat24 1 15094071 1.0545e+10 31036  
## - cat8 1 15438059 1.0546e+10 31036  
## - cont4 1 15490602 1.0546e+10 31036  
## - cat28 1 17345045 1.0548e+10 31037  
## - cont10 1 17729132 1.0548e+10 31037  
## - cat46 1 19238071 1.0549e+10 31037  
## - cat6 1 19998134 1.0550e+10 31037  
## - cat36 1 21797452 1.0552e+10 31037  
## - cat21 1 23964927 1.0554e+10 31038  
## - cat40 1 24816650 1.0555e+10 31038  
## - cont12 1 26208050 1.0556e+10 31038  
## - cont9 1 26396862 1.0557e+10 31038  
## - cat26 1 27559829 1.0558e+10 31038  
## - cat27 1 30076578 1.0560e+10 31039  
## - cat42 1 30966041 1.0561e+10 31039  
## - cat38 1 32660609 1.0563e+10 31039  
## - cat51 1 33109399 1.0563e+10 31040  
## - cont14 1 38999278 1.0569e+10 31041  
## - cat14 1 40598155 1.0571e+10 31041  
## - cat19 1 41282167 1.0571e+10 31041  
## - cont6 1 46048565 1.0576e+10 31042  
## - cont1 1 47172784 1.0577e+10 31042  
## - cat16 1 50612922 1.0581e+10 31043  
## - cat43 1 58995402 1.0589e+10 31044  
## - cat9 1 64850406 1.0595e+10 31046  
## - cat25 1 69176240 1.0599e+10 31046  
## - cat23 1 72648026 1.0603e+10 31047  
## - cat34 1 73818044 1.0604e+10 31047  
## - cat52 1 84253772 1.0614e+10 31049  
## - cat10 1 97769132 1.0628e+10 31052  
## - cat13 1 105436565 1.0636e+10 31053  
## - cat44 1 106671755 1.0637e+10 31053  
## - cont7 1 141625890 1.0672e+10 31060  
## - cat49 1 141634911 1.0672e+10 31060  
## - cat1 1 207211218 1.0737e+10 31072  
## - cont2 1 256616835 1.0787e+10 31081  
## - cat12 1 349324927 1.0880e+10 31099  
## - cat7 1 917620937 1.1448e+10 31200

final\_model <- lm(loss ~ cont1 + cont2 + cont4 + cont6 + cont7 + cont9 + cont10 +   
 cont12 + cont14 + cat1 + cat6 + cat7 + cat8 + cat9 + cat10 +   
 cat12 + cat13 + cat14 + cat16 + cat19 + cat20 + cat21 + cat23 +   
 cat24 + cat25 + cat26 + cat27 + cat28 + cat34 + cat36 + cat37 +   
 cat38 + cat40 + cat42 + cat43 + cat44 + cat46 + cat49 + cat51 +   
 cat52,data=train)

summary(final\_model)

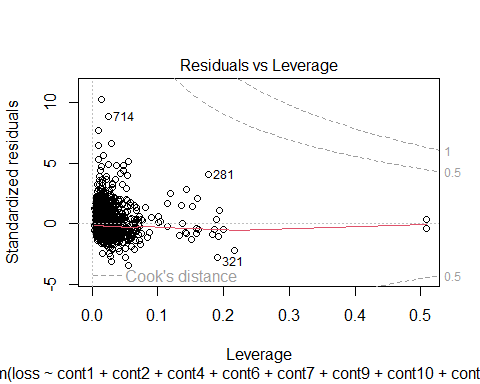
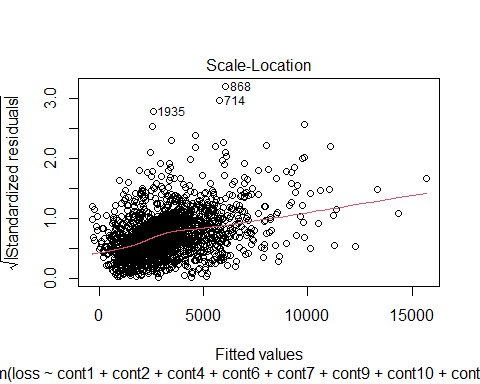
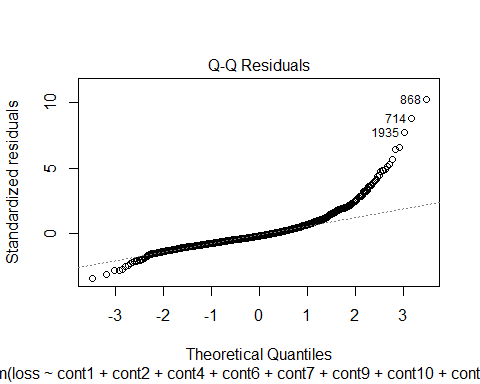
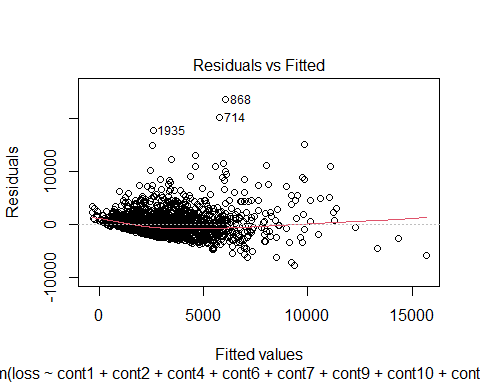
##   
## Call:  
## lm(formula = loss ~ cont1 + cont2 + cont4 + cont6 + cont7 + cont9 +   
## cont10 + cont12 + cont14 + cat1 + cat6 + cat7 + cat8 + cat9 +   
## cat10 + cat12 + cat13 + cat14 + cat16 + cat19 + cat20 + cat21 +   
## cat23 + cat24 + cat25 + cat26 + cat27 + cat28 + cat34 + cat36 +   
## cat37 + cat38 + cat40 + cat42 + cat43 + cat44 + cat46 + cat49 +   
## cat51 + cat52, data = train)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -7700.1 -1274.0 -407.1 760.4 23553.4   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -444.1 305.4 -1.454 0.146109   
## cont1 -2647.7 893.8 -2.962 0.003089 \*\*   
## cont2 1858.3 268.9 6.909 6.56e-12 \*\*\*  
## cont4 -473.7 279.0 -1.698 0.089744 .   
## cont6 -2145.5 733.0 -2.927 0.003463 \*\*   
## cont7 2500.7 487.2 5.133 3.13e-07 \*\*\*  
## cont9 2006.8 905.6 2.216 0.026804 \*   
## cont10 1340.9 738.4 1.816 0.069506 .   
## cont12 1037.6 469.9 2.208 0.027354 \*   
## cont14 635.4 235.9 2.694 0.007130 \*\*   
## cat1B -785.0 126.4 -6.209 6.50e-10 \*\*\*  
## cat6B 284.3 147.4 1.929 0.053896 .   
## cat7B 4112.8 314.8 13.066 < 2e-16 \*\*\*  
## cat8B 375.5 221.6 1.695 0.090289 .   
## cat9B 508.2 146.3 3.473 0.000525 \*\*\*  
## cat10B 812.8 190.6 4.265 2.10e-05 \*\*\*  
## cat12B 1555.4 192.9 8.061 1.30e-15 \*\*\*  
## cat13B 899.7 203.1 4.429 9.99e-06 \*\*\*  
## cat14B 1287.0 468.3 2.748 0.006047 \*\*   
## cat16B 897.8 292.6 3.069 0.002181 \*\*   
## cat19B 1444.4 521.2 2.771 0.005636 \*\*   
## cat20B 2475.8 1651.8 1.499 0.134080   
## cat21B 1767.2 836.9 2.111 0.034857 \*   
## cat23B 605.4 164.7 3.676 0.000243 \*\*\*  
## cat24B 596.5 356.0 1.676 0.093952 .   
## cat25B 772.2 215.2 3.587 0.000342 \*\*\*  
## cat26B 623.3 275.3 2.264 0.023663 \*   
## cat27B 459.3 194.2 2.365 0.018105 \*   
## cat28B 587.2 326.9 1.796 0.072596 .   
## cat34B 3710.8 1001.3 3.706 0.000217 \*\*\*  
## cat36B 330.5 164.1 2.014 0.044174 \*   
## cat37B 259.6 184.2 1.410 0.158846   
## cat38B 561.0 227.6 2.465 0.013788 \*   
## cat40B 600.2 279.4 2.149 0.031782 \*   
## cat42B 1416.2 590.1 2.400 0.016480 \*   
## cat43B 1220.6 368.4 3.313 0.000940 \*\*\*  
## cat44B 1052.5 236.3 4.455 8.87e-06 \*\*\*  
## cat46B 1685.5 891.0 1.892 0.058662 .   
## cat49B 1378.0 268.4 5.133 3.13e-07 \*\*\*  
## cat51B 1400.6 564.3 2.482 0.013154 \*   
## cat52B 1129.9 285.4 3.959 7.79e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2318 on 1959 degrees of freedom  
## Multiple R-squared: 0.3859, Adjusted R-squared: 0.3733   
## F-statistic: 30.77 on 40 and 1959 DF, p-value: < 2.2e-16

###### option of a linear regression model

# residuals from the model follow a normal distribution  
# no multicolinearity amongst the predictor variables  
# no heteroscedasticity in the model  
  
vif(final\_model)

## cont1 cont2 cont4 cont6 cont7 cont9 cont10 cont12   
## 10.140055 1.157325 1.260549 8.055664 2.957173 9.985447 6.663622 3.631457   
## cont14 cat1 cat6 cat7 cat8 cat9 cat10 cat12   
## 1.031184 1.091096 1.718115 1.055500 1.149684 1.921138 1.760729 1.780593   
## cat13 cat14 cat16 cat19 cat20 cat21 cat23 cat24   
## 1.406472 1.046981 1.134911 1.050097 1.014205 1.038302 1.426875 1.438270   
## cat25 cat26 cat27 cat28 cat34 cat36 cat37 cat38   
## 1.447091 1.452602 1.373273 1.398028 1.115858 1.380692 1.465074 1.482638   
## cat40 cat42 cat43 cat44 cat46 cat49 cat51 cat52   
## 1.128316 1.091761 1.086656 1.683966 1.030118 1.225201 1.056850 1.219336

plot(final\_model)



durbinWatsonTest(final\_model)

## lag Autocorrelation D-W Statistic p-value  
## 1 -0.0151057 2.029747 0.518  
## Alternative hypothesis: rho != 0

durbinWatsonTest(fit1)

## lag Autocorrelation D-W Statistic p-value  
## 1 -0.01356325 2.026719 0.592  
## Alternative hypothesis: rho != 0