LinzyLDD8521-7

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getwd()

## [1] "D:/SCHOOL\_WORK/Graduate\_School/PHD - NorthCentral University/DDS8521/Week7"

##Dataset

Read in the training and test dataset

train<-read.csv("house prices advanced regression - train.csv")  
test<-read.csv("house prices advanced regression - test.csv")

#Data Exploration

View the struction of the train dataset to identify the number of rows, number of columns, the column names, data types for each column, and a sample of data for each column.

str(train)

## 'data.frame': 1460 obs. of 81 variables:  
## $ Id : int 1 2 3 4 5 6 7 8 9 10 ...  
## $ MSSubClass : int 60 20 60 70 60 50 20 60 50 190 ...  
## $ MSZoning : chr "RL" "RL" "RL" "RL" ...  
## $ LotFrontage : int 65 80 68 60 84 85 75 NA 51 50 ...  
## $ LotArea : int 8450 9600 11250 9550 14260 14115 10084 10382 6120 7420 ...  
## $ Street : chr "Pave" "Pave" "Pave" "Pave" ...  
## $ Alley : chr NA NA NA NA ...  
## $ LotShape : chr "Reg" "Reg" "IR1" "IR1" ...  
## $ LandContour : chr "Lvl" "Lvl" "Lvl" "Lvl" ...  
## $ Utilities : chr "AllPub" "AllPub" "AllPub" "AllPub" ...  
## $ LotConfig : chr "Inside" "FR2" "Inside" "Corner" ...  
## $ LandSlope : chr "Gtl" "Gtl" "Gtl" "Gtl" ...  
## $ Neighborhood : chr "CollgCr" "Veenker" "CollgCr" "Crawfor" ...  
## $ Condition1 : chr "Norm" "Feedr" "Norm" "Norm" ...  
## $ Condition2 : chr "Norm" "Norm" "Norm" "Norm" ...  
## $ BldgType : chr "1Fam" "1Fam" "1Fam" "1Fam" ...  
## $ HouseStyle : chr "2Story" "1Story" "2Story" "2Story" ...  
## $ OverallQual : int 7 6 7 7 8 5 8 7 7 5 ...  
## $ OverallCond : int 5 8 5 5 5 5 5 6 5 6 ...  
## $ YearBuilt : int 2003 1976 2001 1915 2000 1993 2004 1973 1931 1939 ...  
## $ YearRemodAdd : int 2003 1976 2002 1970 2000 1995 2005 1973 1950 1950 ...  
## $ RoofStyle : chr "Gable" "Gable" "Gable" "Gable" ...  
## $ RoofMatl : chr "CompShg" "CompShg" "CompShg" "CompShg" ...  
## $ Exterior1st : chr "VinylSd" "MetalSd" "VinylSd" "Wd Sdng" ...  
## $ Exterior2nd : chr "VinylSd" "MetalSd" "VinylSd" "Wd Shng" ...  
## $ MasVnrType : chr "BrkFace" "None" "BrkFace" "None" ...  
## $ MasVnrArea : int 196 0 162 0 350 0 186 240 0 0 ...  
## $ ExterQual : chr "Gd" "TA" "Gd" "TA" ...  
## $ ExterCond : chr "TA" "TA" "TA" "TA" ...  
## $ Foundation : chr "PConc" "CBlock" "PConc" "BrkTil" ...  
## $ BsmtQual : chr "Gd" "Gd" "Gd" "TA" ...  
## $ BsmtCond : chr "TA" "TA" "TA" "Gd" ...  
## $ BsmtExposure : chr "No" "Gd" "Mn" "No" ...  
## $ BsmtFinType1 : chr "GLQ" "ALQ" "GLQ" "ALQ" ...  
## $ BsmtFinSF1 : int 706 978 486 216 655 732 1369 859 0 851 ...  
## $ BsmtFinType2 : chr "Unf" "Unf" "Unf" "Unf" ...  
## $ BsmtFinSF2 : int 0 0 0 0 0 0 0 32 0 0 ...  
## $ BsmtUnfSF : int 150 284 434 540 490 64 317 216 952 140 ...  
## $ TotalBsmtSF : int 856 1262 920 756 1145 796 1686 1107 952 991 ...  
## $ Heating : chr "GasA" "GasA" "GasA" "GasA" ...  
## $ HeatingQC : chr "Ex" "Ex" "Ex" "Gd" ...  
## $ CentralAir : chr "Y" "Y" "Y" "Y" ...  
## $ Electrical : chr "SBrkr" "SBrkr" "SBrkr" "SBrkr" ...  
## $ X1stFlrSF : int 856 1262 920 961 1145 796 1694 1107 1022 1077 ...  
## $ X2ndFlrSF : int 854 0 866 756 1053 566 0 983 752 0 ...  
## $ LowQualFinSF : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ GrLivArea : int 1710 1262 1786 1717 2198 1362 1694 2090 1774 1077 ...  
## $ BsmtFullBath : int 1 0 1 1 1 1 1 1 0 1 ...  
## $ BsmtHalfBath : int 0 1 0 0 0 0 0 0 0 0 ...  
## $ FullBath : int 2 2 2 1 2 1 2 2 2 1 ...  
## $ HalfBath : int 1 0 1 0 1 1 0 1 0 0 ...  
## $ BedroomAbvGr : int 3 3 3 3 4 1 3 3 2 2 ...  
## $ KitchenAbvGr : int 1 1 1 1 1 1 1 1 2 2 ...  
## $ KitchenQual : chr "Gd" "TA" "Gd" "Gd" ...  
## $ TotRmsAbvGrd : int 8 6 6 7 9 5 7 7 8 5 ...  
## $ Functional : chr "Typ" "Typ" "Typ" "Typ" ...  
## $ Fireplaces : int 0 1 1 1 1 0 1 2 2 2 ...  
## $ FireplaceQu : chr NA "TA" "TA" "Gd" ...  
## $ GarageType : chr "Attchd" "Attchd" "Attchd" "Detchd" ...  
## $ GarageYrBlt : int 2003 1976 2001 1998 2000 1993 2004 1973 1931 1939 ...  
## $ GarageFinish : chr "RFn" "RFn" "RFn" "Unf" ...  
## $ GarageCars : int 2 2 2 3 3 2 2 2 2 1 ...  
## $ GarageArea : int 548 460 608 642 836 480 636 484 468 205 ...  
## $ GarageQual : chr "TA" "TA" "TA" "TA" ...  
## $ GarageCond : chr "TA" "TA" "TA" "TA" ...  
## $ PavedDrive : chr "Y" "Y" "Y" "Y" ...  
## $ WoodDeckSF : int 0 298 0 0 192 40 255 235 90 0 ...  
## $ OpenPorchSF : int 61 0 42 35 84 30 57 204 0 4 ...  
## $ EnclosedPorch: int 0 0 0 272 0 0 0 228 205 0 ...  
## $ X3SsnPorch : int 0 0 0 0 0 320 0 0 0 0 ...  
## $ ScreenPorch : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ PoolArea : int 0 0 0 0 0 0 0 0 0 0 ...  
## $ PoolQC : chr NA NA NA NA ...  
## $ Fence : chr NA NA NA NA ...  
## $ MiscFeature : chr NA NA NA NA ...  
## $ MiscVal : int 0 0 0 0 0 700 0 350 0 0 ...  
## $ MoSold : int 2 5 9 2 12 10 8 11 4 1 ...  
## $ YrSold : int 2008 2007 2008 2006 2008 2009 2007 2009 2008 2008 ...  
## $ SaleType : chr "WD" "WD" "WD" "WD" ...  
## $ SaleCondition: chr "Normal" "Normal" "Normal" "Abnorml" ...  
## $ SalePrice : int 208500 181500 223500 140000 250000 143000 307000 200000 129900 118000 ...

Update datatypes for Id (from int to chr), MSSubClass (from int to factor), OverallQual (from int to factor), OverallCond (from int to factor), YearBuilt (from int to factor), YearRemodAdd (from int to factor), GarageYrBlt (from int to factor), YrSold (from int to factor), MoSold (from int to factor)

train$Id<-as.character(train$Id)  
train$MSSubClass<-as.factor(train$MSSubClass)  
train$OverallQual<-as.factor(train$OverallQual)  
train$OverallCond<-as.factor(train$OverallCond)  
train$YearBuilt<-as.factor(train$YearBuilt)  
train$YearRemodAdd<-as.factor(train$YearRemodAdd)  
train$GarageYrBlt<-as.factor(train$GarageYrBlt)  
train$YrSold<-as.factor(train$YrSold)  
train$MoSold<-as.factor(train$MoSold)

View summary statistics of dataset

summary(train)

## Id MSSubClass MSZoning LotFrontage   
## Length:1460 20 :536 Length:1460 Min. : 21.00   
## Class :character 60 :299 Class :character 1st Qu.: 59.00   
## Mode :character 50 :144 Mode :character Median : 69.00   
## 120 : 87 Mean : 70.05   
## 30 : 69 3rd Qu.: 80.00   
## 160 : 63 Max. :313.00   
## (Other):262 NA's :259   
## LotArea Street Alley LotShape   
## Min. : 1300 Length:1460 Length:1460 Length:1460   
## 1st Qu.: 7554 Class :character Class :character Class :character   
## Median : 9478 Mode :character Mode :character Mode :character   
## Mean : 10517   
## 3rd Qu.: 11602   
## Max. :215245   
##   
## LandContour Utilities LotConfig LandSlope   
## Length:1460 Length:1460 Length:1460 Length:1460   
## Class :character Class :character Class :character Class :character   
## Mode :character Mode :character Mode :character Mode :character   
##   
##   
##   
##   
## Neighborhood Condition1 Condition2 BldgType   
## Length:1460 Length:1460 Length:1460 Length:1460   
## Class :character Class :character Class :character Class :character   
## Mode :character Mode :character Mode :character Mode :character   
##   
##   
##   
##   
## HouseStyle OverallQual OverallCond YearBuilt YearRemodAdd  
## Length:1460 5 :397 5 :821 2006 : 67 1950 :178   
## Class :character 6 :374 6 :252 2005 : 64 2006 : 97   
## Mode :character 7 :319 7 :205 2004 : 54 2007 : 76   
## 8 :168 8 : 72 2007 : 49 2005 : 73   
## 4 :116 4 : 57 2003 : 45 2004 : 62   
## 9 : 43 3 : 25 1976 : 33 2000 : 55   
## (Other): 43 (Other): 28 (Other):1148 (Other):919   
## RoofStyle RoofMatl Exterior1st Exterior2nd   
## Length:1460 Length:1460 Length:1460 Length:1460   
## Class :character Class :character Class :character Class :character   
## Mode :character Mode :character Mode :character Mode :character   
##   
##   
##   
##   
## MasVnrType MasVnrArea ExterQual ExterCond   
## Length:1460 Min. : 0.0 Length:1460 Length:1460   
## Class :character 1st Qu.: 0.0 Class :character Class :character   
## Mode :character Median : 0.0 Mode :character Mode :character   
## Mean : 103.7   
## 3rd Qu.: 166.0   
## Max. :1600.0   
## NA's :8   
## Foundation BsmtQual BsmtCond BsmtExposure   
## Length:1460 Length:1460 Length:1460 Length:1460   
## Class :character Class :character Class :character Class :character   
## Mode :character Mode :character Mode :character Mode :character   
##   
##   
##   
##   
## BsmtFinType1 BsmtFinSF1 BsmtFinType2 BsmtFinSF2   
## Length:1460 Min. : 0.0 Length:1460 Min. : 0.00   
## Class :character 1st Qu.: 0.0 Class :character 1st Qu.: 0.00   
## Mode :character Median : 383.5 Mode :character Median : 0.00   
## Mean : 443.6 Mean : 46.55   
## 3rd Qu.: 712.2 3rd Qu.: 0.00   
## Max. :5644.0 Max. :1474.00   
##   
## BsmtUnfSF TotalBsmtSF Heating HeatingQC   
## Min. : 0.0 Min. : 0.0 Length:1460 Length:1460   
## 1st Qu.: 223.0 1st Qu.: 795.8 Class :character Class :character   
## Median : 477.5 Median : 991.5 Mode :character Mode :character   
## Mean : 567.2 Mean :1057.4   
## 3rd Qu.: 808.0 3rd Qu.:1298.2   
## Max. :2336.0 Max. :6110.0   
##   
## CentralAir Electrical X1stFlrSF X2ndFlrSF   
## Length:1460 Length:1460 Min. : 334 Min. : 0   
## Class :character Class :character 1st Qu.: 882 1st Qu.: 0   
## Mode :character Mode :character Median :1087 Median : 0   
## Mean :1163 Mean : 347   
## 3rd Qu.:1391 3rd Qu.: 728   
## Max. :4692 Max. :2065   
##   
## LowQualFinSF GrLivArea BsmtFullBath BsmtHalfBath   
## Min. : 0.000 Min. : 334 Min. :0.0000 Min. :0.00000   
## 1st Qu.: 0.000 1st Qu.:1130 1st Qu.:0.0000 1st Qu.:0.00000   
## Median : 0.000 Median :1464 Median :0.0000 Median :0.00000   
## Mean : 5.845 Mean :1515 Mean :0.4253 Mean :0.05753   
## 3rd Qu.: 0.000 3rd Qu.:1777 3rd Qu.:1.0000 3rd Qu.:0.00000   
## Max. :572.000 Max. :5642 Max. :3.0000 Max. :2.00000   
##   
## FullBath HalfBath BedroomAbvGr KitchenAbvGr   
## Min. :0.000 Min. :0.0000 Min. :0.000 Min. :0.000   
## 1st Qu.:1.000 1st Qu.:0.0000 1st Qu.:2.000 1st Qu.:1.000   
## Median :2.000 Median :0.0000 Median :3.000 Median :1.000   
## Mean :1.565 Mean :0.3829 Mean :2.866 Mean :1.047   
## 3rd Qu.:2.000 3rd Qu.:1.0000 3rd Qu.:3.000 3rd Qu.:1.000   
## Max. :3.000 Max. :2.0000 Max. :8.000 Max. :3.000   
##   
## KitchenQual TotRmsAbvGrd Functional Fireplaces   
## Length:1460 Min. : 2.000 Length:1460 Min. :0.000   
## Class :character 1st Qu.: 5.000 Class :character 1st Qu.:0.000   
## Mode :character Median : 6.000 Mode :character Median :1.000   
## Mean : 6.518 Mean :0.613   
## 3rd Qu.: 7.000 3rd Qu.:1.000   
## Max. :14.000 Max. :3.000   
##   
## FireplaceQu GarageType GarageYrBlt GarageFinish   
## Length:1460 Length:1460 2005 : 65 Length:1460   
## Class :character Class :character 2006 : 59 Class :character   
## Mode :character Mode :character 2004 : 53 Mode :character   
## 2003 : 50   
## 2007 : 49   
## (Other):1103   
## NA's : 81   
## GarageCars GarageArea GarageQual GarageCond   
## Min. :0.000 Min. : 0.0 Length:1460 Length:1460   
## 1st Qu.:1.000 1st Qu.: 334.5 Class :character Class :character   
## Median :2.000 Median : 480.0 Mode :character Mode :character   
## Mean :1.767 Mean : 473.0   
## 3rd Qu.:2.000 3rd Qu.: 576.0   
## Max. :4.000 Max. :1418.0   
##   
## PavedDrive WoodDeckSF OpenPorchSF EnclosedPorch   
## Length:1460 Min. : 0.00 Min. : 0.00 Min. : 0.00   
## Class :character 1st Qu.: 0.00 1st Qu.: 0.00 1st Qu.: 0.00   
## Mode :character Median : 0.00 Median : 25.00 Median : 0.00   
## Mean : 94.24 Mean : 46.66 Mean : 21.95   
## 3rd Qu.:168.00 3rd Qu.: 68.00 3rd Qu.: 0.00   
## Max. :857.00 Max. :547.00 Max. :552.00   
##   
## X3SsnPorch ScreenPorch PoolArea PoolQC   
## Min. : 0.00 Min. : 0.00 Min. : 0.000 Length:1460   
## 1st Qu.: 0.00 1st Qu.: 0.00 1st Qu.: 0.000 Class :character   
## Median : 0.00 Median : 0.00 Median : 0.000 Mode :character   
## Mean : 3.41 Mean : 15.06 Mean : 2.759   
## 3rd Qu.: 0.00 3rd Qu.: 0.00 3rd Qu.: 0.000   
## Max. :508.00 Max. :480.00 Max. :738.000   
##   
## Fence MiscFeature MiscVal MoSold   
## Length:1460 Length:1460 Min. : 0.00 6 :253   
## Class :character Class :character 1st Qu.: 0.00 7 :234   
## Mode :character Mode :character Median : 0.00 5 :204   
## Mean : 43.49 4 :141   
## 3rd Qu.: 0.00 8 :122   
## Max. :15500.00 3 :106   
## (Other):400   
## YrSold SaleType SaleCondition SalePrice   
## 2006:314 Length:1460 Length:1460 Min. : 34900   
## 2007:329 Class :character Class :character 1st Qu.:129975   
## 2008:304 Mode :character Mode :character Median :163000   
## 2009:338 Mean :180921   
## 2010:175 3rd Qu.:214000   
## Max. :755000   
##

Check for missingness

library(VIM)

## Loading required package: colorspace

## Loading required package: grid

## VIM is ready to use.

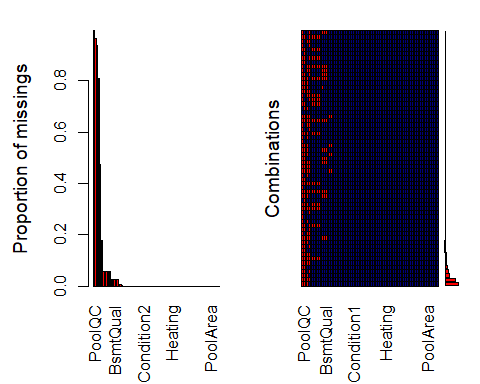
## Suggestions and bug-reports can be submitted at: https://github.com/statistikat/VIM/issues

##   
## Attaching package: 'VIM'

## The following object is masked from 'package:datasets':  
##   
## sleep

aggr(train, col=c("navyblue", "red"), numbers=TRUE, sortVars=TRUE, labels=names(train))

## Warning in plot.aggr(res, ...): not enough vertical space to display  
## frequencies (too many combinations)



##   
## Variables sorted by number of missings:   
## Variable Count  
## PoolQC 0.9952054795  
## MiscFeature 0.9630136986  
## Alley 0.9376712329  
## Fence 0.8075342466  
## FireplaceQu 0.4726027397  
## LotFrontage 0.1773972603  
## GarageType 0.0554794521  
## GarageYrBlt 0.0554794521  
## GarageFinish 0.0554794521  
## GarageQual 0.0554794521  
## GarageCond 0.0554794521  
## BsmtExposure 0.0260273973  
## BsmtFinType2 0.0260273973  
## BsmtQual 0.0253424658  
## BsmtCond 0.0253424658  
## BsmtFinType1 0.0253424658  
## MasVnrType 0.0054794521  
## MasVnrArea 0.0054794521  
## Electrical 0.0006849315  
## Id 0.0000000000  
## MSSubClass 0.0000000000  
## MSZoning 0.0000000000  
## LotArea 0.0000000000  
## Street 0.0000000000  
## LotShape 0.0000000000  
## LandContour 0.0000000000  
## Utilities 0.0000000000  
## LotConfig 0.0000000000  
## LandSlope 0.0000000000  
## Neighborhood 0.0000000000  
## Condition1 0.0000000000  
## Condition2 0.0000000000  
## BldgType 0.0000000000  
## HouseStyle 0.0000000000  
## OverallQual 0.0000000000  
## OverallCond 0.0000000000  
## YearBuilt 0.0000000000  
## YearRemodAdd 0.0000000000  
## RoofStyle 0.0000000000  
## RoofMatl 0.0000000000  
## Exterior1st 0.0000000000  
## Exterior2nd 0.0000000000  
## ExterQual 0.0000000000  
## ExterCond 0.0000000000  
## Foundation 0.0000000000  
## BsmtFinSF1 0.0000000000  
## BsmtFinSF2 0.0000000000  
## BsmtUnfSF 0.0000000000  
## TotalBsmtSF 0.0000000000  
## Heating 0.0000000000  
## HeatingQC 0.0000000000  
## CentralAir 0.0000000000  
## X1stFlrSF 0.0000000000  
## X2ndFlrSF 0.0000000000  
## LowQualFinSF 0.0000000000  
## GrLivArea 0.0000000000  
## BsmtFullBath 0.0000000000  
## BsmtHalfBath 0.0000000000  
## FullBath 0.0000000000  
## HalfBath 0.0000000000  
## BedroomAbvGr 0.0000000000  
## KitchenAbvGr 0.0000000000  
## KitchenQual 0.0000000000  
## TotRmsAbvGrd 0.0000000000  
## Functional 0.0000000000  
## Fireplaces 0.0000000000  
## GarageCars 0.0000000000  
## GarageArea 0.0000000000  
## PavedDrive 0.0000000000  
## WoodDeckSF 0.0000000000  
## OpenPorchSF 0.0000000000  
## EnclosedPorch 0.0000000000  
## X3SsnPorch 0.0000000000  
## ScreenPorch 0.0000000000  
## PoolArea 0.0000000000  
## MiscVal 0.0000000000  
## MoSold 0.0000000000  
## YrSold 0.0000000000  
## SaleType 0.0000000000  
## SaleCondition 0.0000000000  
## SalePrice 0.0000000000

Drop columns with missingness greater than 25% and Id

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

train<-train %>% select(-PoolQC, -MiscFeature, -Alley, -Fence, -FireplaceQu, -Id)

Build numeric dataset for historgram and correlation matrix. This data will also be used to view skewness and kurtosis

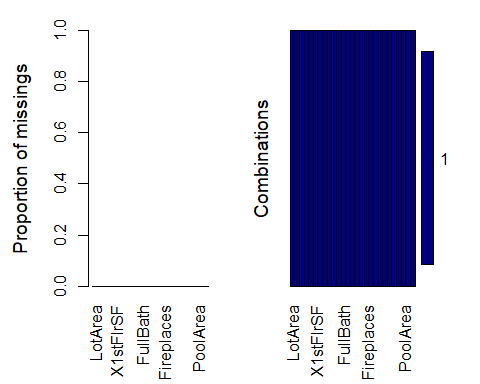
num\_cols<-sapply(train, is.numeric)  
numeric\_data<-train[,num\_cols]

Remove columns with any missing values

numeric\_data <- numeric\_data[ , colSums(is.na(numeric\_data)) == 0]

Validate missinging for numeric data

aggr(numeric\_data, col=c("navyblue", "red"), numbers=TRUE, sortVars=TRUE, labels=names(numeric\_data))



##   
## Variables sorted by number of missings:   
## Variable Count  
## LotArea 0  
## BsmtFinSF1 0  
## BsmtFinSF2 0  
## BsmtUnfSF 0  
## TotalBsmtSF 0  
## X1stFlrSF 0  
## X2ndFlrSF 0  
## LowQualFinSF 0  
## GrLivArea 0  
## BsmtFullBath 0  
## BsmtHalfBath 0  
## FullBath 0  
## HalfBath 0  
## BedroomAbvGr 0  
## KitchenAbvGr 0  
## TotRmsAbvGrd 0  
## Fireplaces 0  
## GarageCars 0  
## GarageArea 0  
## WoodDeckSF 0  
## OpenPorchSF 0  
## EnclosedPorch 0  
## X3SsnPorch 0  
## ScreenPorch 0  
## PoolArea 0  
## MiscVal 0  
## SalePrice 0

View skewness

library(moments)  
skewness(numeric\_data)

## LotArea BsmtFinSF1 BsmtFinSF2 BsmtUnfSF TotalBsmtSF   
## 12.19514213 1.68377090 4.25088802 0.91932270 1.52268809   
## X1stFlrSF X2ndFlrSF LowQualFinSF GrLivArea BsmtFullBath   
## 1.37534174 0.81219427 9.00208042 1.36515595 0.59545404   
## BsmtHalfBath FullBath HalfBath BedroomAbvGr KitchenAbvGr   
## 4.09918567 0.03652398 0.67520283 0.21157244 4.48378409   
## TotRmsAbvGrd Fireplaces GarageCars GarageArea WoodDeckSF   
## 0.67564577 0.64889763 -0.34219690 0.17979594 1.53979170   
## OpenPorchSF EnclosedPorch X3SsnPorch ScreenPorch PoolArea   
## 2.36191193 3.08669647 10.29375236 4.11797738 14.81313466   
## MiscVal SalePrice   
## 24.45163962 1.88094075

view kurtosis

kurtosis(numeric\_data)

## LotArea BsmtFinSF1 BsmtFinSF2 BsmtUnfSF TotalBsmtSF   
## 205.543793 14.076090 23.040415 3.469262 16.201042   
## X1stFlrSF X2ndFlrSF LowQualFinSF GrLivArea BsmtFullBath   
## 8.722076 2.444323 85.945932 7.874266 2.159666   
## BsmtHalfBath FullBath HalfBath BedroomAbvGr KitchenAbvGr   
## 19.336436 2.141783 1.922651 5.219135 24.454627   
## TotRmsAbvGrd Fireplaces GarageCars GarageArea WoodDeckSF   
## 3.873641 2.779399 3.216135 3.909823 5.978604   
## OpenPorchSF EnclosedPorch X3SsnPorch ScreenPorch PoolArea   
## 11.457180 13.390972 126.235177 21.371874 225.500507   
## MiscVal SalePrice   
## 701.600840 9.509812

Apply tranformations to numeric variable to coerce a normal distribution

library(car)

## Loading required package: carData

##   
## Attaching package: 'car'

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

require(car)  
PoolAreatrans<-powerTransform(numeric\_data$PoolArea, family = "yjPower")$lambda  
numeric\_data$PoolArea<-numeric\_data$PoolArea^PoolAreatrans  
  
totRmsAbvGrdtrans<-powerTransform(numeric\_data$TotRmsAbvGrd, family = "yjPower")$lambda  
numeric\_data$TotRmsAbvGrd<-numeric\_data$TotRmsAbvGrd^totRmsAbvGrdtrans  
  
X2ndFlrSFtrans<-powerTransform(numeric\_data$X2ndFlrSF, family = "yjPower")$lambda  
numeric\_data$X2ndFlrSF<-numeric\_data$X2ndFlrSF^X2ndFlrSFtrans  
  
ScreenPorchtrans<-powerTransform(numeric\_data$ScreenPorch, family = "yjPower")$lambda  
numeric\_data$ScreenPorch<-numeric\_data$ScreenPorch^ScreenPorchtrans  
  
KitchenAbvGrtrans<-powerTransform(numeric\_data$KitchenAbvGr, family = "yjPower")$lambda  
numeric\_data$KitchenAbvGr<-numeric\_data$KitchenAbvGr^KitchenAbvGrtrans  
  
X1stFlrSFtrans<-powerTransform(numeric\_data$X1stFlrSF, family = "yjPower")$lambda  
numeric\_data$X1stFlrSF<-numeric\_data$X1stFlrSF^X1stFlrSFtrans  
  
X3SsnPorchtrans<-powerTransform(numeric\_data$X3SsnPorch, family = "yjPower")$lambda  
numeric\_data$X3SsnPorch<-numeric\_data$X3SsnPorch^X3SsnPorchtrans  
  
BedroomAbvGRtrans<-powerTransform(numeric\_data$BedroomAbvGr, family = "yjPower")$lambda  
numeric\_data$BedroomAbvGr<-numeric\_data$BedroomAbvGr^BedroomAbvGRtrans  
  
TotalBsmtSFtrans<-powerTransform(numeric\_data$TotalBsmtSF, family = "yjPower")$lambda  
numeric\_data$TotalBsmtSF<-numeric\_data$TotalBsmtSF^TotalBsmtSFtrans  
  
EnclosedPorchtrans<-powerTransform(numeric\_data$EnclosedPorch, family = "yjPower")$lambda  
numeric\_data$EnclosedPorch<-numeric\_data$EnclosedPorch^EnclosedPorchtrans  
  
HalfBathtrans<-powerTransform(numeric\_data$HalfBath, family = "yjPower")$lambda  
numeric\_data$HalfBath<-numeric\_data$HalfBath^HalfBathtrans  
  
BsmtUnfSFtrans<-powerTransform(numeric\_data$BsmtUnfSF, family = "yjPower")$lambda  
numeric\_data$BsmtUnfSF<-numeric\_data$BsmtUnfSF^BsmtUnfSFtrans  
  
OpenPorchSFtrans<-powerTransform(numeric\_data$OpenPorchSF, family = "yjPower")$lambda  
numeric\_data$OpenPorchSF<-numeric\_data$OpenPorchSF^OpenPorchSFtrans  
  
FullBathtrans<-powerTransform(numeric\_data$FullBath, family = "yjPower")$lambda  
numeric\_data$FullBath<-numeric\_data$FullBath^FullBathtrans  
  
LowQualFinSFtrans<-powerTransform(numeric\_data$LowQualFinSF, family = "yjPower")$lambda  
numeric\_data$LowQualFinSF<-numeric\_data$LowQualFinSF^LowQualFinSFtrans  
  
Fireplacestrans<-powerTransform(numeric\_data$Fireplaces, family = "yjPower")$lambda  
numeric\_data$Fireplaces<-numeric\_data$Fireplaces^Fireplacestrans  
  
MiscValtrans<-powerTransform(numeric\_data$MiscVal, family = "yjPower")$lambda  
numeric\_data$MiscVal<-numeric\_data$MiscVal^MiscValtrans  
  
LotAreatrans<-powerTransform(numeric\_data$LotArea, family = "yjPower")$lambda  
numeric\_data$LotArea<-numeric\_data$LotArea^LotAreatrans  
  
GrLivAreatrans<-powerTransform(numeric\_data$GrLivArea, family = "yjPower")$lambda  
numeric\_data$GrLivArea<-numeric\_data$GrLivArea^GrLivAreatrans  
  
GarageCarstrans<-powerTransform(numeric\_data$GarageCars, family = "yjPower")$lambda  
numeric\_data$GarageCars<-numeric\_data$GarageCars^GarageCarstrans  
  
BsmtFullBathtrans<-powerTransform(numeric\_data$BsmtFullBath, family = "yjPower")$lambda  
numeric\_data$BsmtFullBath<-numeric\_data$BsmtFullBath^BsmtFullBathtrans  
  
GarageAreatrans<-powerTransform(numeric\_data$GarageArea, family = "yjPower")$lambda  
numeric\_data$GarageArea<-numeric\_data$GarageArea^GarageAreatrans  
  
BsmtFinSF1trans<-powerTransform(numeric\_data$BsmtFinSF1, family = "yjPower")$lambda  
numeric\_data$BsmtFinSF1<-numeric\_data$BsmtFinSF1^BsmtFinSF1trans  
  
BsmtHalfBathtrans<-powerTransform(numeric\_data$BsmtHalfBath, family = "yjPower")$lambda  
numeric\_data$BsmtHalfBath<-numeric\_data$BsmtHalfBath^BsmtHalfBathtrans  
  
WoodDeckSFtrans<-powerTransform(numeric\_data$WoodDeckSF, family = "yjPower")$lambda  
numeric\_data$WoodDeckSF<-numeric\_data$WoodDeckSF^WoodDeckSFtrans  
  
BsmtFinSF2trans<-powerTransform(numeric\_data$BsmtFinSF2, family = "yjPower")$lambda  
numeric\_data$BsmtFinSF2<-numeric\_data$BsmtFinSF2^BsmtFinSF2trans

Check skewness again to valid transformation

skewness(numeric\_data)

## LotArea BsmtFinSF1 BsmtFinSF2 BsmtUnfSF TotalBsmtSF   
## 0.0259603411 -0.5332838084 NaN -0.3524992073 0.2206554515   
## X1stFlrSF X2ndFlrSF LowQualFinSF GrLivArea BsmtFullBath   
## 0.0021584168 NaN NaN -0.0006770585 NaN   
## BsmtHalfBath FullBath HalfBath BedroomAbvGr KitchenAbvGr   
## NaN -0.1719807087 NaN 0.0799983748 NaN   
## TotRmsAbvGrd Fireplaces GarageCars GarageArea WoodDeckSF   
## -0.1171201034 NaN 0.2165008063 -0.3373809126 NaN   
## OpenPorchSF EnclosedPorch X3SsnPorch ScreenPorch PoolArea   
## -0.2033064899 NaN NaN NaN NaN   
## MiscVal SalePrice   
## NaN 1.8809407460

Correlation matrix

cor\_matrix<-cor(numeric\_data, use="complete.obs")  
cor\_matrix["SalePrice",]

## LotArea BsmtFinSF1 BsmtFinSF2 BsmtUnfSF TotalBsmtSF   
## 0.3895108 0.2130900 NaN 0.2010100 0.6010817   
## X1stFlrSF X2ndFlrSF LowQualFinSF GrLivArea BsmtFullBath   
## -0.5882493 NaN NaN 0.6953344 NaN   
## BsmtHalfBath FullBath HalfBath BedroomAbvGr KitchenAbvGr   
## NaN 0.5497149 NaN 0.1670659 NaN   
## TotRmsAbvGrd Fireplaces GarageCars GarageArea WoodDeckSF   
## 0.5207884 NaN 0.6622126 0.6084348 NaN   
## OpenPorchSF EnclosedPorch X3SsnPorch ScreenPorch PoolArea   
## 0.4144560 NaN NaN NaN NaN   
## MiscVal SalePrice   
## NaN 1.0000000

Updated numeric dataset to include only numeric variable with correlations .4 and greater

updated\_numeric\_data<-numeric\_data[, c("TotalBsmtSF", "X1stFlrSF", "GrLivArea", "FullBath", "TotRmsAbvGrd", "GarageCars", "GarageArea", "OpenPorchSF", "SalePrice")]

Identify character data

chr\_cols<-sapply(train, is.character)  
chr\_data<-train[,chr\_cols]

Convert character data to factor

chr\_data[]<-lapply(chr\_data, as.factor)

Identify factor data

fct\_cols<-sapply(train, is.factor)  
fct\_data<-train[,fct\_cols]

Combine dataset for statistical tests Non-numeric dataset

non\_numeric\_dataset<-cbind(chr\_data, fct\_data)  
non\_numeric\_dataset$SalePrice<-train$SalePrice

Use Kruskal-Wallis to test to determine the non-categorical variables significant to sale price

kruskal\_pvals <- sapply(names(non\_numeric\_dataset), function(col) {  
 f <- as.formula(paste("SalePrice ~", col))  
 result <- tryCatch(kruskal.test(f, data = non\_numeric\_dataset)$p.value, error = function(e) NA)  
 return(result)  
})  
  
significant <- names(kruskal\_pvals[kruskal\_pvals < 0.05])  
print(significant)

## [1] "MSZoning" "LotShape" "LandContour" "LotConfig"   
## [5] "Neighborhood" "Condition1" "Condition2" "BldgType"   
## [9] "HouseStyle" "RoofStyle" "RoofMatl" "Exterior1st"   
## [13] "Exterior2nd" "MasVnrType" "ExterQual" "ExterCond"   
## [17] "Foundation" "BsmtQual" "BsmtCond" "BsmtExposure"   
## [21] "BsmtFinType1" "Heating" "HeatingQC" "CentralAir"   
## [25] "Electrical" "KitchenQual" "Functional" "GarageType"   
## [29] "GarageFinish" "GarageQual" "GarageCond" "PavedDrive"   
## [33] "SaleType" "SaleCondition" "MSSubClass" "OverallQual"   
## [37] "OverallCond" "YearBuilt" "YearRemodAdd" "GarageYrBlt"   
## [41] NA

Updated training datasest with selected predictors

updated\_nonnumeric\_data<-non\_numeric\_dataset[, c("MSZoning", "LotShape","LandContour","LotConfig", "Neighborhood","Condition1", "Condition2", "BldgType", "HouseStyle","RoofStyle" ,"RoofMatl","Exterior1st", "Exterior2nd","MasVnrType","ExterQual","ExterCond","Foundation","BsmtQual","BsmtCond","BsmtExposure","BsmtFinType1","Heating","HeatingQC","CentralAir","Electrical", "KitchenQual", "Functional","GarageType","GarageFinish", "GarageQual", "GarageCond","PavedDrive","SaleType","SaleCondition", "MSSubClass","OverallQual","OverallCond","YearBuilt","YearRemodAdd","GarageYrBlt")]

updated\_training\_dataset<-cbind(updated\_numeric\_data, updated\_nonnumeric\_data)  
clean\_data <- na.omit(updated\_training\_dataset)

model<-lm(SalePrice~., data=clean\_data)  
summary(model)

##   
## Call:  
## lm(formula = SalePrice ~ ., data = clean\_data)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -145678 -9213 0 9254 150551   
##   
## Coefficients: (9 not defined because of singularities)  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -1.723e+07 2.551e+06 -6.754 2.65e-11 \*\*\*  
## TotalBsmtSF 2.779e+02 5.192e+01 5.352 1.11e-07 \*\*\*  
## X1stFlrSF 3.057e+05 2.792e+05 1.095 0.273914   
## GrLivArea 1.576e+07 2.367e+06 6.660 4.88e-11 \*\*\*  
## FullBath 6.787e+03 4.124e+03 1.646 0.100220   
## TotRmsAbvGrd 4.719e+04 8.465e+04 0.557 0.577352   
## GarageCars 4.547e+03 1.890e+03 2.406 0.016319 \*   
## GarageArea 5.398e+01 4.532e+01 1.191 0.233958   
## OpenPorchSF -6.140e+02 2.182e+03 -0.281 0.778429   
## MSZoningFV 5.508e+04 2.030e+04 2.714 0.006786 \*\*   
## MSZoningRH 4.478e+04 2.222e+04 2.015 0.044238 \*   
## MSZoningRL 4.678e+04 1.872e+04 2.498 0.012666 \*   
## MSZoningRM 4.599e+04 1.816e+04 2.533 0.011494 \*   
## LotShapeIR2 7.014e+03 5.307e+03 1.322 0.186635   
## LotShapeIR3 2.181e+04 1.045e+04 2.086 0.037253 \*   
## LotShapeReg 8.542e+02 2.171e+03 0.393 0.694128   
## LandContourHLS 8.020e+03 7.906e+03 1.014 0.310639   
## LandContourLow 7.052e+03 9.312e+03 0.757 0.449097   
## LandContourLvl 6.715e+03 6.205e+03 1.082 0.279507   
## LotConfigCulDSac 5.383e+03 4.229e+03 1.273 0.203385   
## LotConfigFR2 -1.515e+04 5.208e+03 -2.909 0.003724 \*\*   
## LotConfigFR3 -2.645e+04 1.519e+04 -1.742 0.081943 .   
## LotConfigInside -4.683e+03 2.427e+03 -1.929 0.054050 .   
## NeighborhoodBlueste -1.559e+04 2.583e+04 -0.604 0.546130   
## NeighborhoodBrDale 9.378e+03 1.599e+04 0.587 0.557616   
## NeighborhoodBrkSide 4.326e+02 1.319e+04 0.033 0.973843   
## NeighborhoodClearCr 2.703e+03 1.186e+04 0.228 0.819825   
## NeighborhoodCollgCr 1.061e+03 8.947e+03 0.119 0.905664   
## NeighborhoodCrawfor 1.967e+04 1.133e+04 1.736 0.082968 .   
## NeighborhoodEdwards -9.442e+03 1.018e+04 -0.928 0.353728   
## NeighborhoodGilbert 1.554e+03 9.671e+03 0.161 0.872373   
## NeighborhoodIDOTRR -1.213e+04 1.614e+04 -0.751 0.452635   
## NeighborhoodMeadowV -1.309e+04 1.723e+04 -0.760 0.447706   
## NeighborhoodMitchel -3.246e+03 1.056e+04 -0.307 0.758592   
## NeighborhoodNAmes -1.021e+04 9.845e+03 -1.037 0.299944   
## NeighborhoodNoRidge 4.229e+04 1.051e+04 4.023 6.25e-05 \*\*\*  
## NeighborhoodNPkVill 1.880e+04 1.749e+04 1.075 0.282593   
## NeighborhoodNridgHt 2.160e+04 9.036e+03 2.390 0.017068 \*   
## NeighborhoodNWAmes -4.915e+03 1.030e+04 -0.477 0.633226   
## NeighborhoodOldTown -1.033e+04 1.340e+04 -0.771 0.441072   
## NeighborhoodSawyer -5.096e+03 1.055e+04 -0.483 0.629149   
## NeighborhoodSawyerW 7.526e+03 1.014e+04 0.742 0.458252   
## NeighborhoodSomerst 7.608e+03 1.100e+04 0.692 0.489192   
## NeighborhoodStoneBr 3.699e+04 1.045e+04 3.538 0.000424 \*\*\*  
## NeighborhoodSWISU -1.133e+04 1.434e+04 -0.790 0.429596   
## NeighborhoodTimber -4.028e+02 1.000e+04 -0.040 0.967896   
## NeighborhoodVeenker 1.522e+04 1.352e+04 1.125 0.260797   
## Condition1Feedr 4.418e+03 8.669e+03 0.510 0.610467   
## Condition1Norm 1.001e+04 7.340e+03 1.364 0.173062   
## Condition1PosA 1.270e+04 1.424e+04 0.892 0.372761   
## Condition1PosN -5.752e+02 1.054e+04 -0.055 0.956475   
## Condition1RRAe -8.646e+03 1.371e+04 -0.631 0.528298   
## Condition1RRAn 8.186e+03 9.919e+03 0.825 0.409445   
## Condition1RRNe -2.723e+03 2.227e+04 -0.122 0.902732   
## Condition1RRNn 6.825e+03 1.683e+04 0.406 0.685110   
## Condition2Feedr 5.166e+04 4.440e+04 1.164 0.244900   
## Condition2Norm 5.632e+04 4.119e+04 1.368 0.171807   
## Condition2PosA 5.973e+04 7.118e+04 0.839 0.401635   
## Condition2PosN -1.674e+05 4.805e+04 -3.483 0.000520 \*\*\*  
## Condition2RRAe 4.298e+04 7.143e+04 0.602 0.547561   
## Condition2RRAn 3.948e+04 5.135e+04 0.769 0.442231   
## Condition2RRNn 9.243e+04 5.305e+04 1.742 0.081801 .   
## BldgType2fmCon -1.926e+04 6.662e+04 -0.289 0.772575   
## BldgTypeDuplex -3.663e+04 9.342e+03 -3.920 9.54e-05 \*\*\*  
## BldgTypeTwnhs 1.665e+03 2.041e+04 0.082 0.935018   
## BldgTypeTwnhsE 6.653e+03 1.938e+04 0.343 0.731443   
## HouseStyle1.5Unf 5.090e+04 4.104e+04 1.240 0.215191   
## HouseStyle1Story 1.395e+04 1.633e+04 0.854 0.393429   
## HouseStyle2.5Fin -1.378e+04 3.708e+04 -0.372 0.710170   
## HouseStyle2.5Unf 1.731e+04 3.509e+04 0.493 0.621918   
## HouseStyle2Story 3.655e+03 1.623e+04 0.225 0.821839   
## HouseStyleSFoyer 2.889e+04 2.099e+04 1.376 0.169043   
## HouseStyleSLvl 1.625e+04 2.013e+04 0.807 0.419821   
## RoofStyleGable -9.419e+03 2.521e+04 -0.374 0.708804   
## RoofStyleGambrel -5.669e+03 2.927e+04 -0.194 0.846491   
## RoofStyleHip -6.998e+03 2.526e+04 -0.277 0.781826   
## RoofStyleMansard -3.205e+04 3.169e+04 -1.011 0.312119   
## RoofStyleShed 1.219e+04 5.051e+04 0.241 0.809398   
## RoofMatlCompShg 5.048e+05 3.794e+04 13.303 < 2e-16 \*\*\*  
## RoofMatlMembran 5.321e+05 5.641e+04 9.432 < 2e-16 \*\*\*  
## RoofMatlMetal 5.157e+05 5.461e+04 9.444 < 2e-16 \*\*\*  
## RoofMatlRoll 4.819e+05 5.010e+04 9.619 < 2e-16 \*\*\*  
## RoofMatlTar&Grv 4.910e+05 4.570e+04 10.745 < 2e-16 \*\*\*  
## RoofMatlWdShake 5.247e+05 4.413e+04 11.890 < 2e-16 \*\*\*  
## RoofMatlWdShngl 5.831e+05 3.986e+04 14.627 < 2e-16 \*\*\*  
## Exterior1stBrkComm -5.204e+04 5.055e+04 -1.029 0.303535   
## Exterior1stBrkFace -2.719e+04 2.907e+04 -0.935 0.349821   
## Exterior1stCBlock -2.996e+04 4.620e+04 -0.648 0.516879   
## Exterior1stCemntBd 4.862e+04 3.669e+04 1.325 0.185466   
## Exterior1stHdBoard -4.758e+04 2.993e+04 -1.590 0.112285   
## Exterior1stImStucc -1.039e+05 4.146e+04 -2.505 0.012416 \*   
## Exterior1stMetalSd -3.875e+04 3.268e+04 -1.186 0.236099   
## Exterior1stPlywood -4.976e+04 2.990e+04 -1.664 0.096398 .   
## Exterior1stStone -5.259e+04 4.429e+04 -1.187 0.235371   
## Exterior1stStucco -2.897e+04 3.307e+04 -0.876 0.381183   
## Exterior1stVinylSd -5.733e+04 3.012e+04 -1.903 0.057309 .   
## Exterior1stWd Sdng -3.477e+04 2.888e+04 -1.204 0.228813   
## Exterior1stWdShing -3.522e+04 3.029e+04 -1.163 0.245173   
## Exterior2ndAsphShn 5.380e+04 3.828e+04 1.405 0.160263   
## Exterior2ndBrk Cmn 2.017e+04 3.286e+04 0.614 0.539429   
## Exterior2ndBrkFace 2.846e+04 2.580e+04 1.103 0.270333   
## Exterior2ndCBlock NA NA NA NA   
## Exterior2ndCmentBd -5.116e+04 3.305e+04 -1.548 0.122008   
## Exterior2ndHdBoard 3.375e+04 2.575e+04 1.311 0.190289   
## Exterior2ndImStucc 6.096e+04 2.705e+04 2.253 0.024487 \*   
## Exterior2ndMetalSd 2.781e+04 2.876e+04 0.967 0.333846   
## Exterior2ndOther 2.757e+04 3.823e+04 0.721 0.471027   
## Exterior2ndPlywood 3.670e+04 2.553e+04 1.438 0.150879   
## Exterior2ndStone 3.694e+04 4.429e+04 0.834 0.404493   
## Exterior2ndStucco 3.633e+04 2.985e+04 1.217 0.223875   
## Exterior2ndVinylSd 4.345e+04 2.625e+04 1.655 0.098189 .   
## Exterior2ndWd Sdng 2.445e+04 2.470e+04 0.990 0.322529   
## Exterior2ndWd Shng 2.325e+04 2.625e+04 0.886 0.375926   
## MasVnrTypeBrkFace 5.522e+03 9.512e+03 0.581 0.561681   
## MasVnrTypeNone 3.767e+03 9.410e+03 0.400 0.689006   
## MasVnrTypeStone 9.130e+03 9.990e+03 0.914 0.361030   
## ExterQualFa 1.855e+04 2.371e+04 0.782 0.434202   
## ExterQualGd 6.432e+03 6.709e+03 0.959 0.338002   
## ExterQualTA 6.161e+03 7.491e+03 0.822 0.411039   
## ExterCondFa 1.842e+04 3.921e+04 0.470 0.638691   
## ExterCondGd 1.970e+04 3.770e+04 0.523 0.601309   
## ExterCondTA 1.922e+04 3.770e+04 0.510 0.610405   
## FoundationCBlock 1.469e+04 6.683e+03 2.198 0.028213 \*   
## FoundationPConc 1.286e+04 6.742e+03 1.907 0.056810 .   
## FoundationStone 3.459e+04 1.832e+04 1.888 0.059303 .   
## FoundationWood 3.258e+03 1.943e+04 0.168 0.866858   
## BsmtQualFa -1.837e+04 1.033e+04 -1.777 0.075898 .   
## BsmtQualGd -1.651e+04 4.173e+03 -3.956 8.26e-05 \*\*\*  
## BsmtQualTA -1.837e+04 5.536e+03 -3.319 0.000942 \*\*\*  
## BsmtCondGd -1.196e+03 8.814e+03 -0.136 0.892071   
## BsmtCondPo 1.412e+05 7.745e+04 1.823 0.068704 .   
## BsmtCondTA 5.057e+03 7.711e+03 0.656 0.512087   
## BsmtExposureGd 1.616e+04 3.786e+03 4.267 2.20e-05 \*\*\*  
## BsmtExposureMn -2.737e+03 3.876e+03 -0.706 0.480244   
## BsmtExposureNo -7.124e+03 2.775e+03 -2.567 0.010425 \*   
## BsmtFinType1BLQ 1.226e+03 3.713e+03 0.330 0.741284   
## BsmtFinType1GLQ 5.614e+03 3.419e+03 1.642 0.100910   
## BsmtFinType1LwQ -7.815e+03 5.040e+03 -1.550 0.121421   
## BsmtFinType1Rec -3.963e+03 4.175e+03 -0.949 0.342830   
## BsmtFinType1Unf -9.943e+03 3.414e+03 -2.913 0.003675 \*\*   
## HeatingGasW 1.756e+04 1.129e+04 1.555 0.120238   
## HeatingGrav 5.098e+04 3.072e+04 1.660 0.097329 .   
## HeatingOthW -3.060e+04 4.400e+04 -0.695 0.487019   
## HeatingQCFa -1.955e+03 7.241e+03 -0.270 0.787216   
## HeatingQCGd -4.221e+03 2.928e+03 -1.442 0.149770   
## HeatingQCPo 9.390e+03 3.634e+04 0.258 0.796199   
## HeatingQCTA -3.747e+03 3.084e+03 -1.215 0.224719   
## CentralAirY 4.703e+03 7.353e+03 0.640 0.522606   
## ElectricalFuseF -9.699e+03 1.089e+04 -0.891 0.373276   
## ElectricalFuseP 3.237e+02 3.541e+04 0.009 0.992709   
## ElectricalMix NA NA NA NA   
## ElectricalSBrkr -1.368e+03 4.990e+03 -0.274 0.783975   
## KitchenQualFa -2.209e+04 9.893e+03 -2.233 0.025804 \*   
## KitchenQualGd -1.610e+04 4.581e+03 -3.514 0.000464 \*\*\*  
## KitchenQualTA -1.514e+04 5.352e+03 -2.828 0.004792 \*\*   
## FunctionalMaj2 -1.245e+04 2.325e+04 -0.535 0.592575   
## FunctionalMin1 9.614e+03 1.249e+04 0.769 0.441862   
## FunctionalMin2 2.438e+03 1.274e+04 0.191 0.848339   
## FunctionalMod 5.705e+02 1.560e+04 0.037 0.970838   
## FunctionalSev -5.147e+04 4.703e+04 -1.094 0.274054   
## FunctionalTyp 1.667e+04 1.081e+04 1.542 0.123352   
## GarageTypeAttchd 1.482e+04 1.683e+04 0.880 0.378871   
## GarageTypeBasment 7.269e+03 1.950e+04 0.373 0.709455   
## GarageTypeBuiltIn 1.805e+04 1.719e+04 1.050 0.294128   
## GarageTypeCarPort 3.037e+04 2.458e+04 1.236 0.216910   
## GarageTypeDetchd 1.312e+04 1.691e+04 0.776 0.438080   
## GarageFinishRFn -2.245e+03 2.509e+03 -0.895 0.371091   
## GarageFinishUnf -1.932e+03 3.289e+03 -0.587 0.557044   
## GarageQualFa -7.168e+04 5.994e+04 -1.196 0.232114   
## GarageQualGd -6.415e+04 6.093e+04 -1.053 0.292683   
## GarageQualPo -1.115e+05 7.819e+04 -1.427 0.154048   
## GarageQualTA -6.791e+04 5.963e+04 -1.139 0.255091   
## GarageCondFa 2.930e+04 6.713e+04 0.436 0.662586   
## GarageCondGd 2.732e+04 6.812e+04 0.401 0.688443   
## GarageCondPo 1.968e+04 7.174e+04 0.274 0.783949   
## GarageCondTA 2.936e+04 6.681e+04 0.439 0.660447   
## PavedDriveP -1.513e+04 1.022e+04 -1.481 0.138934   
## PavedDriveY -8.051e+03 6.862e+03 -1.173 0.241024   
## SaleTypeCon 3.471e+04 2.155e+04 1.611 0.107552   
## SaleTypeConLD 1.265e+04 1.602e+04 0.790 0.429884   
## SaleTypeConLI -1.443e+04 1.643e+04 -0.878 0.380136   
## SaleTypeConLw 4.751e+03 1.651e+04 0.288 0.773606   
## SaleTypeCWD 6.273e+03 1.767e+04 0.355 0.722645   
## SaleTypeNew 3.891e+04 1.979e+04 1.967 0.049538 \*   
## SaleTypeOth 3.268e+04 3.214e+04 1.017 0.309545   
## SaleTypeWD 1.434e+03 5.756e+03 0.249 0.803394   
## SaleConditionAdjLand 3.110e+04 3.312e+04 0.939 0.347957   
## SaleConditionAlloca 1.279e+04 1.608e+04 0.795 0.426605   
## SaleConditionFamily -1.034e+04 7.985e+03 -1.295 0.195797   
## SaleConditionNormal 1.901e+03 4.002e+03 0.475 0.635006   
## SaleConditionPartial -1.514e+04 1.878e+04 -0.806 0.420292   
## MSSubClass30 4.089e+03 9.039e+03 0.452 0.651097   
## MSSubClass40 9.203e+02 2.112e+04 0.044 0.965261   
## MSSubClass45 -2.671e+04 4.136e+04 -0.646 0.518659   
## MSSubClass50 8.344e+03 1.650e+04 0.506 0.613223   
## MSSubClass60 8.791e+03 1.275e+04 0.690 0.490514   
## MSSubClass70 1.590e+03 1.479e+04 0.108 0.914396   
## MSSubClass75 1.339e+04 3.211e+04 0.417 0.676924   
## MSSubClass80 -4.472e+03 1.565e+04 -0.286 0.775153   
## MSSubClass85 -1.805e+04 1.649e+04 -1.095 0.273861   
## MSSubClass90 NA NA NA NA   
## MSSubClass120 -1.830e+04 1.918e+04 -0.954 0.340457   
## MSSubClass160 -1.705e+04 2.367e+04 -0.721 0.471409   
## MSSubClass180 -1.771e+04 2.613e+04 -0.678 0.498145   
## MSSubClass190 9.195e+03 6.627e+04 0.139 0.889674   
## OverallQual3 -7.629e+04 3.236e+04 -2.358 0.018597 \*   
## OverallQual4 -7.408e+04 2.876e+04 -2.576 0.010156 \*   
## OverallQual5 -7.525e+04 2.889e+04 -2.604 0.009362 \*\*   
## OverallQual6 -7.503e+04 2.898e+04 -2.589 0.009794 \*\*   
## OverallQual7 -6.955e+04 2.930e+04 -2.373 0.017840 \*   
## OverallQual8 -5.443e+04 2.954e+04 -1.843 0.065744 .   
## OverallQual9 -1.750e+04 3.024e+04 -0.579 0.562933   
## OverallQual10 4.296e+04 3.137e+04 1.369 0.171247   
## OverallCond3 8.125e+04 5.723e+04 1.420 0.156075   
## OverallCond4 8.947e+04 5.641e+04 1.586 0.113104   
## OverallCond5 1.018e+05 5.619e+04 1.811 0.070491 .   
## OverallCond6 1.097e+05 5.644e+04 1.944 0.052255 .   
## OverallCond7 1.162e+05 5.626e+04 2.066 0.039148 \*   
## OverallCond8 1.166e+05 5.639e+04 2.068 0.038930 \*   
## OverallCond9 1.367e+05 5.703e+04 2.397 0.016742 \*   
## YearBuilt1882 -1.545e+04 4.646e+04 -0.333 0.739544   
## YearBuilt1885 3.327e+04 3.638e+04 0.914 0.360764   
## YearBuilt1890 -2.652e+04 3.330e+04 -0.796 0.426113   
## YearBuilt1892 -4.640e+04 4.421e+04 -1.050 0.294186   
## YearBuilt1893 NA NA NA NA   
## YearBuilt1898 -1.077e+05 6.094e+04 -1.767 0.077615 .   
## YearBuilt1900 2.382e+03 2.689e+04 0.089 0.929450   
## YearBuilt1904 2.352e+04 4.556e+04 0.516 0.605850   
## YearBuilt1905 2.886e+04 4.316e+04 0.669 0.503987   
## YearBuilt1906 3.113e+04 6.251e+04 0.498 0.618606   
## YearBuilt1908 -3.495e+04 5.509e+04 -0.634 0.526003   
## YearBuilt1910 4.765e+03 2.550e+04 0.187 0.851814   
## YearBuilt1912 -1.300e+03 4.301e+04 -0.030 0.975896   
## YearBuilt1913 1.226e+04 4.879e+04 0.251 0.801586   
## YearBuilt1914 1.094e+04 5.780e+04 0.189 0.849938   
## YearBuilt1915 2.171e+04 2.683e+04 0.809 0.418697   
## YearBuilt1916 2.830e+04 3.478e+04 0.814 0.416115   
## YearBuilt1917 NA NA NA NA   
## YearBuilt1918 1.725e+04 2.803e+04 0.616 0.538380   
## YearBuilt1919 -1.825e+04 4.375e+04 -0.417 0.676602   
## YearBuilt1920 1.866e+04 2.355e+04 0.793 0.428281   
## YearBuilt1921 2.671e+04 3.100e+04 0.862 0.389008   
## YearBuilt1922 1.183e+04 3.979e+04 0.297 0.766217   
## YearBuilt1923 3.611e+04 3.272e+04 1.104 0.270065   
## YearBuilt1924 -1.410e+04 3.630e+04 -0.388 0.697755   
## YearBuilt1925 2.597e+03 2.527e+04 0.103 0.918161   
## YearBuilt1926 4.354e+04 4.333e+04 1.005 0.315203   
## YearBuilt1927 9.134e+03 3.954e+04 0.231 0.817369   
## YearBuilt1928 2.483e+04 2.939e+04 0.845 0.398436   
## YearBuilt1929 2.256e+04 3.066e+04 0.736 0.461985   
## YearBuilt1930 3.452e+04 2.731e+04 1.264 0.206687   
## YearBuilt1931 2.406e+04 3.162e+04 0.761 0.446927   
## YearBuilt1932 5.787e+04 3.222e+04 1.796 0.072827 .   
## YearBuilt1934 -7.687e+01 3.236e+04 -0.002 0.998105   
## YearBuilt1935 4.170e+04 3.494e+04 1.193 0.233054   
## YearBuilt1936 4.183e+04 2.979e+04 1.404 0.160634   
## YearBuilt1937 1.140e+04 2.782e+04 0.410 0.682104   
## YearBuilt1938 2.230e+04 3.563e+04 0.626 0.531504   
## YearBuilt1939 2.000e+04 3.199e+04 0.625 0.532045   
## YearBuilt1940 -5.865e+03 3.011e+04 -0.195 0.845624   
## YearBuilt1941 1.246e+04 2.935e+04 0.425 0.671126   
## YearBuilt1942 4.601e+04 5.961e+04 0.772 0.440466   
## YearBuilt1945 3.136e+04 3.094e+04 1.013 0.311141   
## YearBuilt1946 -2.980e+04 5.361e+04 -0.556 0.578480   
## YearBuilt1947 -2.753e+04 3.327e+04 -0.827 0.408195   
## YearBuilt1948 1.336e+04 3.033e+04 0.441 0.659657   
## YearBuilt1949 1.328e+04 2.995e+04 0.443 0.657607   
## YearBuilt1950 1.406e+04 2.620e+04 0.537 0.591574   
## YearBuilt1951 1.650e+04 3.541e+04 0.466 0.641420   
## YearBuilt1952 5.753e+04 4.548e+04 1.265 0.206173   
## YearBuilt1953 5.447e+04 5.344e+04 1.019 0.308348   
## YearBuilt1954 2.301e+04 2.845e+04 0.809 0.418810   
## YearBuilt1955 1.011e+04 3.025e+04 0.334 0.738335   
## YearBuilt1956 -1.249e+04 3.603e+04 -0.347 0.728943   
## YearBuilt1957 3.443e+04 3.069e+04 1.122 0.262303   
## YearBuilt1958 2.873e+04 2.850e+04 1.008 0.313693   
## YearBuilt1959 2.164e+04 2.888e+04 0.749 0.453832   
## YearBuilt1960 3.623e+04 3.015e+04 1.202 0.229785   
## YearBuilt1961 1.139e+04 2.979e+04 0.382 0.702397   
## YearBuilt1962 -1.012e+04 2.977e+04 -0.340 0.733977   
## YearBuilt1963 2.920e+04 3.161e+04 0.924 0.355828   
## YearBuilt1964 -3.624e+03 3.147e+04 -0.115 0.908365   
## YearBuilt1965 1.087e+04 3.016e+04 0.360 0.718755   
## YearBuilt1966 3.829e+03 3.477e+04 0.110 0.912338   
## YearBuilt1967 4.369e+04 3.452e+04 1.266 0.205952   
## YearBuilt1968 2.845e+04 3.161e+04 0.900 0.368391   
## YearBuilt1969 3.885e+03 6.202e+04 0.063 0.950067   
## YearBuilt1970 1.330e+04 3.176e+04 0.419 0.675408   
## YearBuilt1971 2.980e+04 3.199e+04 0.932 0.351789   
## YearBuilt1972 3.020e+04 2.940e+04 1.027 0.304614   
## YearBuilt1973 -4.652e+03 3.858e+04 -0.121 0.904055   
## YearBuilt1974 3.464e+04 3.048e+04 1.137 0.256000   
## YearBuilt1975 2.119e+04 3.153e+04 0.672 0.501621   
## YearBuilt1976 7.325e+03 3.014e+04 0.243 0.808036   
## YearBuilt1977 2.540e+04 2.927e+04 0.868 0.385664   
## YearBuilt1978 1.012e+04 3.238e+04 0.312 0.754749   
## YearBuilt1979 1.353e+04 3.655e+04 0.370 0.711249   
## YearBuilt1980 9.224e+03 3.268e+04 0.282 0.777797   
## YearBuilt1981 -1.306e+04 3.694e+04 -0.354 0.723766   
## YearBuilt1982 2.529e+04 3.025e+04 0.836 0.403214   
## YearBuilt1983 3.198e+04 4.062e+04 0.787 0.431327   
## YearBuilt1984 -7.967e+03 4.752e+04 -0.168 0.866904   
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## YearBuilt1986 1.853e+04 3.474e+04 0.534 0.593794   
## YearBuilt1987 2.234e+04 3.776e+04 0.592 0.554279   
## YearBuilt1988 2.840e+04 3.448e+04 0.824 0.410372   
## YearBuilt1989 6.562e+04 3.454e+04 1.900 0.057826 .   
## YearBuilt1990 1.959e+04 3.445e+04 0.568 0.569851   
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## YearBuilt1997 1.740e+04 3.075e+04 0.566 0.571650   
## YearBuilt1998 2.376e+04 3.084e+04 0.770 0.441252   
## YearBuilt1999 2.392e+04 3.303e+04 0.724 0.469129   
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## YearBuilt2001 4.383e+04 5.554e+04 0.789 0.430269   
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## YearBuilt2003 1.138e+04 2.835e+04 0.401 0.688200   
## YearBuilt2004 -3.210e+02 3.342e+04 -0.010 0.992337   
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## YearBuilt2006 3.693e+03 3.129e+04 0.118 0.906087   
## YearBuilt2007 2.911e+04 3.215e+04 0.905 0.365480   
## YearBuilt2008 3.963e+04 3.354e+04 1.182 0.237593   
## YearBuilt2009 -3.240e+04 3.653e+04 -0.887 0.375313   
## YearBuilt2010 5.698e+04 7.866e+04 0.724 0.469030   
## YearRemodAdd1951 7.616e+03 3.027e+04 0.252 0.801398   
## YearRemodAdd1952 NA NA NA NA   
## YearRemodAdd1953 4.714e+03 2.065e+04 0.228 0.819430   
## YearRemodAdd1954 -2.826e+03 1.470e+04 -0.192 0.847596   
## YearRemodAdd1955 2.334e+04 1.858e+04 1.256 0.209370   
## YearRemodAdd1956 6.163e+03 2.073e+04 0.297 0.766310   
## YearRemodAdd1957 1.387e+04 1.513e+04 0.917 0.359340   
## YearRemodAdd1958 -6.752e+03 1.476e+04 -0.457 0.647436   
## YearRemodAdd1959 -9.156e+03 1.438e+04 -0.637 0.524386   
## YearRemodAdd1960 -5.290e+03 1.511e+04 -0.350 0.726424   
## YearRemodAdd1961 1.108e+04 1.888e+04 0.587 0.557402   
## YearRemodAdd1962 4.279e+04 1.858e+04 2.303 0.021520 \*   
## YearRemodAdd1963 -1.526e+04 2.202e+04 -0.693 0.488468   
## YearRemodAdd1964 9.602e+03 1.920e+04 0.500 0.617110   
## YearRemodAdd1965 5.391e+03 1.440e+04 0.374 0.708194   
## YearRemodAdd1966 3.424e+04 1.771e+04 1.934 0.053440 .   
## YearRemodAdd1967 6.697e+03 1.873e+04 0.358 0.720718   
## YearRemodAdd1968 1.888e+04 1.533e+04 1.231 0.218532   
## YearRemodAdd1969 -2.324e+04 2.948e+04 -0.788 0.430703   
## YearRemodAdd1970 6.690e+03 1.572e+04 0.425 0.670597   
## YearRemodAdd1971 2.131e+03 1.970e+04 0.108 0.913872   
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## YearRemodAdd1978 6.153e+03 1.657e+04 0.371 0.710523   
## YearRemodAdd1979 -6.563e+02 2.550e+04 -0.026 0.979476   
## YearRemodAdd1980 1.138e+04 1.963e+04 0.580 0.562217   
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## YearRemodAdd1982 -4.318e+03 1.725e+04 -0.250 0.802396   
## YearRemodAdd1983 -1.927e+03 2.074e+04 -0.093 0.926009   
## YearRemodAdd1984 7.795e+03 1.711e+04 0.456 0.648727   
## YearRemodAdd1985 1.033e+04 1.978e+04 0.523 0.601437   
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## YearRemodAdd1988 -4.716e+03 1.396e+04 -0.338 0.735610   
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## YearRemodAdd1992 -4.980e+00 1.199e+04 0.000 0.999669   
## YearRemodAdd1993 7.374e+03 1.110e+04 0.664 0.506842   
## YearRemodAdd1994 7.316e+03 9.592e+03 0.763 0.445836   
## YearRemodAdd1995 9.223e+03 8.990e+03 1.026 0.305231   
## YearRemodAdd1996 1.691e+04 8.771e+03 1.928 0.054168 .   
## YearRemodAdd1997 6.842e+03 1.011e+04 0.677 0.498563   
## YearRemodAdd1998 9.690e+03 9.889e+03 0.980 0.327383   
## YearRemodAdd1999 1.230e+04 1.021e+04 1.205 0.228579   
## YearRemodAdd2000 5.557e+03 8.480e+03 0.655 0.512439   
## YearRemodAdd2001 1.085e+04 9.697e+03 1.119 0.263382   
## YearRemodAdd2002 9.190e+03 8.664e+03 1.061 0.289103   
## YearRemodAdd2003 3.347e+03 8.756e+03 0.382 0.702346   
## YearRemodAdd2004 2.124e+03 8.432e+03 0.252 0.801165   
## YearRemodAdd2005 -2.073e+03 8.164e+03 -0.254 0.799670   
## YearRemodAdd2006 -2.729e+03 7.999e+03 -0.341 0.733074   
## YearRemodAdd2007 -3.631e+02 8.299e+03 -0.044 0.965117   
## YearRemodAdd2008 2.139e+04 1.189e+04 1.799 0.072404 .   
## YearRemodAdd2009 3.205e+03 1.779e+04 0.180 0.857091   
## YearRemodAdd2010 6.748e+04 2.191e+04 3.080 0.002135 \*\*   
## GarageYrBlt1906 NA NA NA NA   
## GarageYrBlt1908 1.197e+05 7.650e+04 1.565 0.117899   
## GarageYrBlt1910 5.259e+04 5.688e+04 0.925 0.355394   
## GarageYrBlt1914 -1.320e+03 7.512e+04 -0.018 0.985983   
## GarageYrBlt1915 -1.851e+04 5.559e+04 -0.333 0.739284   
## GarageYrBlt1916 -8.487e+03 5.903e+04 -0.144 0.885717   
## GarageYrBlt1918 -1.324e+04 6.642e+04 -0.199 0.841988   
## GarageYrBlt1920 3.906e+04 5.114e+04 0.764 0.445268   
## GarageYrBlt1921 3.746e+04 5.800e+04 0.646 0.518523   
## GarageYrBlt1922 4.639e+04 6.339e+04 0.732 0.464488   
## GarageYrBlt1923 1.747e+04 5.650e+04 0.309 0.757200   
## GarageYrBlt1924 6.752e+04 5.801e+04 1.164 0.244750   
## GarageYrBlt1925 3.521e+04 4.988e+04 0.706 0.480480   
## GarageYrBlt1926 1.027e+03 6.089e+04 0.017 0.986547   
## GarageYrBlt1927 4.057e+04 6.708e+04 0.605 0.545525   
## GarageYrBlt1928 2.903e+04 5.524e+04 0.526 0.599366   
## GarageYrBlt1929 1.520e+04 5.740e+04 0.265 0.791240   
## GarageYrBlt1930 2.183e+04 5.198e+04 0.420 0.674658   
## GarageYrBlt1931 1.952e+04 5.557e+04 0.351 0.725469   
## GarageYrBlt1932 3.050e+04 5.351e+04 0.570 0.568832   
## GarageYrBlt1933 1.241e+04 5.968e+04 0.208 0.835294   
## GarageYrBlt1934 8.595e+04 5.485e+04 1.567 0.117456   
## GarageYrBlt1935 -4.274e+03 5.353e+04 -0.080 0.936384   
## GarageYrBlt1936 1.460e+04 5.460e+04 0.267 0.789195   
## GarageYrBlt1937 4.302e+04 5.579e+04 0.771 0.440793   
## GarageYrBlt1938 3.704e+04 5.888e+04 0.629 0.529448   
## GarageYrBlt1939 4.491e+04 5.309e+04 0.846 0.397774   
## GarageYrBlt1940 6.125e+04 5.320e+04 1.151 0.249889   
## GarageYrBlt1941 2.409e+04 5.320e+04 0.453 0.650804   
## GarageYrBlt1942 NA NA NA NA   
## GarageYrBlt1945 2.104e+04 5.419e+04 0.388 0.697851   
## GarageYrBlt1946 6.163e+04 7.056e+04 0.873 0.382689   
## GarageYrBlt1947 7.911e+04 6.019e+04 1.314 0.189093   
## GarageYrBlt1948 4.299e+04 5.175e+04 0.831 0.406264   
## GarageYrBlt1949 2.026e+04 5.163e+04 0.392 0.694805   
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## GarageYrBlt1951 2.026e+04 5.342e+04 0.379 0.704656   
## GarageYrBlt1952 -2.388e+04 6.541e+04 -0.365 0.715164   
## GarageYrBlt1953 -1.523e+04 6.928e+04 -0.220 0.826003   
## GarageYrBlt1954 2.729e+04 4.974e+04 0.549 0.583407   
## GarageYrBlt1955 2.009e+04 5.101e+04 0.394 0.693803   
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## GarageYrBlt1957 -1.851e+03 5.143e+04 -0.036 0.971293   
## GarageYrBlt1958 1.833e+04 4.978e+04 0.368 0.712896   
## GarageYrBlt1959 3.335e+04 5.080e+04 0.656 0.511713   
## GarageYrBlt1960 1.427e+04 4.777e+04 0.299 0.765237   
## GarageYrBlt1961 2.764e+04 5.036e+04 0.549 0.583261   
## GarageYrBlt1962 2.807e+04 4.978e+04 0.564 0.573015   
## GarageYrBlt1963 2.565e+04 5.074e+04 0.506 0.613330   
## GarageYrBlt1964 2.705e+04 4.925e+04 0.549 0.582978   
## GarageYrBlt1965 3.445e+04 5.174e+04 0.666 0.505716   
## GarageYrBlt1966 2.257e+04 5.172e+04 0.437 0.662581   
## GarageYrBlt1967 -3.158e+01 5.210e+04 -0.001 0.999517   
## GarageYrBlt1968 3.942e+03 5.124e+04 0.077 0.938698   
## GarageYrBlt1969 6.217e+04 6.822e+04 0.911 0.362353   
## GarageYrBlt1970 1.784e+04 4.978e+04 0.358 0.720062   
## GarageYrBlt1971 7.490e+03 5.053e+04 0.148 0.882192   
## GarageYrBlt1972 2.648e+04 4.981e+04 0.532 0.595177   
## GarageYrBlt1973 4.834e+04 5.197e+04 0.930 0.352541   
## GarageYrBlt1974 2.231e+04 4.908e+04 0.455 0.649493   
## GarageYrBlt1975 2.672e+04 5.171e+04 0.517 0.605503   
## GarageYrBlt1976 2.768e+04 4.988e+04 0.555 0.579022   
## GarageYrBlt1977 1.441e+04 4.917e+04 0.293 0.769553   
## GarageYrBlt1978 2.870e+04 5.054e+04 0.568 0.570340   
## GarageYrBlt1979 3.569e+04 5.098e+04 0.700 0.484048   
## GarageYrBlt1980 3.802e+04 4.920e+04 0.773 0.439844   
## GarageYrBlt1981 2.266e+04 5.113e+04 0.443 0.657709   
## GarageYrBlt1982 5.031e+03 5.275e+04 0.095 0.924038   
## GarageYrBlt1983 2.642e+04 5.303e+04 0.498 0.618473   
## GarageYrBlt1984 3.467e+04 6.350e+04 0.546 0.585230   
## GarageYrBlt1985 2.532e+04 5.081e+04 0.498 0.618312   
## GarageYrBlt1986 2.960e+04 5.311e+04 0.557 0.577441   
## GarageYrBlt1987 3.255e+04 5.016e+04 0.649 0.516536   
## GarageYrBlt1988 1.963e+04 5.315e+04 0.369 0.711980   
## GarageYrBlt1989 2.586e+04 5.049e+04 0.512 0.608620   
## GarageYrBlt1990 1.861e+04 5.272e+04 0.353 0.724124   
## GarageYrBlt1991 1.691e+04 5.115e+04 0.331 0.740961   
## GarageYrBlt1992 2.212e+04 5.422e+04 0.408 0.683441   
## GarageYrBlt1993 2.452e+04 5.189e+04 0.472 0.636742   
## GarageYrBlt1994 2.517e+04 4.858e+04 0.518 0.604523   
## GarageYrBlt1995 1.944e+03 4.953e+04 0.039 0.968707   
## GarageYrBlt1996 2.670e+04 4.888e+04 0.546 0.585085   
## GarageYrBlt1997 2.868e+04 5.066e+04 0.566 0.571491   
## GarageYrBlt1998 1.552e+04 4.997e+04 0.311 0.756151   
## GarageYrBlt1999 1.384e+04 5.056e+04 0.274 0.784432   
## GarageYrBlt2000 1.641e+04 5.327e+04 0.308 0.758128   
## GarageYrBlt2001 NA NA NA NA   
## GarageYrBlt2002 2.220e+04 5.323e+04 0.417 0.676803   
## GarageYrBlt2003 4.140e+04 5.104e+04 0.811 0.417463   
## GarageYrBlt2004 5.441e+04 5.365e+04 1.014 0.310798   
## GarageYrBlt2005 3.103e+04 5.079e+04 0.611 0.541347   
## GarageYrBlt2006 5.065e+04 5.180e+04 0.978 0.328442   
## GarageYrBlt2007 1.271e+04 5.238e+04 0.243 0.808343   
## GarageYrBlt2008 5.012e+03 5.303e+04 0.095 0.924728   
## GarageYrBlt2009 7.482e+04 5.645e+04 1.325 0.185401   
## GarageYrBlt2010 2.180e+04 6.108e+04 0.357 0.721259   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 25900 on 864 degrees of freedom  
## Multiple R-squared: 0.9305, Adjusted R-squared: 0.8924   
## F-statistic: 24.4 on 474 and 864 DF, p-value: < 2.2e-16

length(coef(model))

## [1] 484

Stepwise regression to automatically add or drop predictors to minimize AIC

n <- nrow(clean\_data)  
bic\_model <- step(model, direction = "both", k = log(n))

## Start: AIC=30046.69  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition1 +   
## Condition2 + BldgType + HouseStyle + RoofStyle + RoofMatl +   
## Exterior1st + Exterior2nd + MasVnrType + ExterQual + ExterCond +   
## Foundation + BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 +   
## Heating + HeatingQC + CentralAir + Electrical + KitchenQual +   
## Functional + GarageType + GarageFinish + GarageQual + GarageCond +   
## PavedDrive + SaleType + SaleCondition + MSSubClass + OverallQual +   
## OverallCond + YearBuilt + YearRemodAdd + GarageYrBlt  
##   
## Df Sum of Sq RSS AIC  
## - YearBuilt 102 5.6559e+10 6.3598e+11 29437  
## - GarageYrBlt 93 5.0022e+10 6.2944e+11 29488  
## - YearRemodAdd 59 3.2552e+10 6.1197e+11 29695  
## - MSSubClass 13 4.6615e+09 5.8408e+11 29964  
## - Exterior2nd 14 2.0412e+10 5.9983e+11 29992  
## - Condition1 8 5.0525e+09 5.8447e+11 30001  
## - SaleType 8 5.9029e+09 5.8532e+11 30003  
## - HouseStyle 7 2.8260e+09 5.8225e+11 30003  
## - Exterior1st 12 2.0994e+10 6.0042e+11 30008  
## - RoofStyle 5 2.1921e+09 5.8161e+11 30016  
## - GarageType 5 2.2206e+09 5.8164e+11 30016  
## - GarageCond 4 2.2388e+08 5.7965e+11 30018  
## - SaleCondition 5 3.4884e+09 5.8291e+11 30019  
## - Neighborhood 24 6.7134e+10 6.4656e+11 30021  
## - Functional 6 7.6782e+09 5.8710e+11 30021  
## - GarageQual 4 1.5122e+09 5.8093e+11 30021  
## - HeatingQC 4 1.7929e+09 5.8121e+11 30022  
## - ExterCond 3 1.9461e+08 5.7962e+11 30026  
## - BldgType 3 5.0580e+08 5.7993e+11 30026  
## - Electrical 3 5.3709e+08 5.7996e+11 30026  
## - ExterQual 3 8.2751e+08 5.8025e+11 30027  
## - LandContour 3 8.6351e+08 5.8029e+11 30027  
## - MasVnrType 3 1.4814e+09 5.8090e+11 30029  
## - Foundation 4 4.7980e+09 5.8422e+11 30029  
## - MSZoning 4 5.1098e+09 5.8453e+11 30030  
## - GarageFinish 2 5.5167e+08 5.7997e+11 30034  
## - LotShape 3 3.8425e+09 5.8326e+11 30034  
## - PavedDrive 2 1.5769e+09 5.8100e+11 30036  
## - BsmtCond 2 1.6506e+09 5.8107e+11 30036  
## - OpenPorchSF 1 5.3125e+07 5.7948e+11 30040  
## - TotRmsAbvGrd 1 2.0841e+08 5.7963e+11 30040  
## - Heating 2 3.3574e+09 5.8278e+11 30040  
## - CentralAir 1 2.7434e+08 5.7970e+11 30040  
## - X1stFlrSF 1 8.0379e+08 5.8023e+11 30041  
## - GarageArea 1 9.5137e+08 5.8037e+11 30042  
## - FullBath 1 1.8160e+09 5.8124e+11 30044  
## - LotConfig 4 1.1602e+10 5.9102e+11 30044  
## - KitchenQual 3 8.8239e+09 5.8825e+11 30045  
## <none> 5.7942e+11 30047  
## - GarageCars 1 3.8835e+09 5.8331e+11 30048  
## - BsmtQual 3 1.0739e+10 5.9016e+11 30050  
## - OverallCond 7 2.5062e+10 6.0448e+11 30053  
## - BsmtFinType1 5 2.6584e+10 6.0601e+11 30071  
## - BsmtExposure 3 2.5353e+10 6.0478e+11 30082  
## - TotalBsmtSF 1 1.9212e+10 5.9863e+11 30083  
## - GrLivArea 1 2.9742e+10 6.0916e+11 30107  
## - Condition2 6 5.3421e+10 6.3284e+11 30122  
## - OverallQual 8 7.9249e+10 6.5867e+11 30161  
## - RoofMatl 7 1.4556e+11 7.2499e+11 30296  
##   
## Step: AIC=29437.04  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition1 +   
## Condition2 + BldgType + HouseStyle + RoofStyle + RoofMatl +   
## Exterior1st + Exterior2nd + MasVnrType + ExterQual + ExterCond +   
## Foundation + BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 +   
## Heating + HeatingQC + CentralAir + Electrical + KitchenQual +   
## Functional + GarageType + GarageFinish + GarageQual + GarageCond +   
## PavedDrive + SaleType + SaleCondition + MSSubClass + OverallQual +   
## OverallCond + YearRemodAdd + GarageYrBlt  
##   
## Df Sum of Sq RSS AIC  
## - GarageYrBlt 96 4.7733e+10 6.8371e+11 28843  
## - YearRemodAdd 60 3.2250e+10 6.6823e+11 29071  
## - MSSubClass 13 8.5663e+09 6.4455e+11 29361  
## - Exterior2nd 14 1.2304e+10 6.4829e+11 29362  
## - Exterior1st 12 1.2792e+10 6.4877e+11 29377  
## - SaleType 8 5.5480e+09 6.4153e+11 29391  
## - Condition1 8 6.2170e+09 6.4220e+11 29393  
## - HouseStyle 7 4.5885e+09 6.4057e+11 29396  
## - RoofStyle 5 2.1057e+09 6.3809e+11 29406  
## - SaleCondition 5 2.8555e+09 6.3884e+11 29407  
## - GarageType 5 4.1423e+09 6.4012e+11 29410  
## - GarageCond 4 1.1388e+09 6.3712e+11 29411  
## - GarageQual 4 1.5539e+09 6.3754e+11 29412  
## - HeatingQC 4 1.9693e+09 6.3795e+11 29412  
## - ExterCond 3 1.1098e+08 6.3609e+11 29416  
## - BldgType 3 4.1377e+08 6.3640e+11 29416  
## - LandContour 3 4.1759e+08 6.3640e+11 29416  
## - ExterQual 3 6.5869e+08 6.3664e+11 29417  
## - Electrical 3 9.2786e+08 6.3691e+11 29417  
## - Foundation 4 4.4298e+09 6.4041e+11 29418  
## - Functional 6 1.1460e+10 6.4744e+11 29418  
## - MSZoning 4 5.7239e+09 6.4171e+11 29420  
## - MasVnrType 3 2.3219e+09 6.3830e+11 29420  
## - Heating 3 2.6710e+09 6.3865e+11 29421  
## - LotShape 3 3.3377e+09 6.3932e+11 29422  
## - GarageFinish 2 6.2601e+08 6.3661e+11 29424  
## - PavedDrive 2 8.7407e+08 6.3686e+11 29425  
## - BsmtCond 2 1.8300e+09 6.3781e+11 29427  
## - OpenPorchSF 1 1.2974e+08 6.3611e+11 29430  
## - TotRmsAbvGrd 1 2.5863e+08 6.3624e+11 29430  
## - X1stFlrSF 1 7.4462e+08 6.3673e+11 29431  
## - CentralAir 1 1.3632e+09 6.3734e+11 29433  
## - FullBath 1 2.2687e+09 6.3825e+11 29435  
## - GarageCars 1 2.7835e+09 6.3876e+11 29436  
## - GarageArea 1 3.0141e+09 6.3900e+11 29436  
## <none> 6.3598e+11 29437  
## - LotConfig 4 1.4900e+10 6.5088e+11 29439  
## - Neighborhood 24 8.8849e+10 7.2483e+11 29439  
## - BsmtQual 3 1.1459e+10 6.4744e+11 29439  
## - OverallCond 7 2.5967e+10 6.6195e+11 29440  
## - KitchenQual 3 1.4740e+10 6.5072e+11 29446  
## - BsmtFinType1 5 3.0094e+10 6.6607e+11 29463  
## - TotalBsmtSF 1 2.1351e+10 6.5733e+11 29474  
## - BsmtExposure 3 2.9949e+10 6.6593e+11 29477  
## - GrLivArea 1 3.2849e+10 6.6883e+11 29497  
## - Condition2 7 5.8225e+10 6.9421e+11 29504  
## - OverallQual 8 7.6954e+10 7.1294e+11 29532  
## - RoofMatl 7 1.4945e+11 7.8543e+11 29669  
## + YearBuilt 102 5.6559e+10 5.7942e+11 30047  
##   
## Step: AIC=28842.77  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition1 +   
## Condition2 + BldgType + HouseStyle + RoofStyle + RoofMatl +   
## Exterior1st + Exterior2nd + MasVnrType + ExterQual + ExterCond +   
## Foundation + BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 +   
## Heating + HeatingQC + CentralAir + Electrical + KitchenQual +   
## Functional + GarageType + GarageFinish + GarageQual + GarageCond +   
## PavedDrive + SaleType + SaleCondition + MSSubClass + OverallQual +   
## OverallCond + YearRemodAdd  
##   
## Df Sum of Sq RSS AIC  
## - YearRemodAdd 60 3.9148e+10 7.2286e+11 28485  
## - Exterior2nd 14 1.1269e+10 6.9498e+11 28764  
## - MSSubClass 13 8.8573e+09 6.9257e+11 28766  
## - Exterior1st 12 1.4348e+10 6.9806e+11 28784  
## - SaleType 8 6.0010e+09 6.8972e+11 28797  
## - HouseStyle 7 4.0237e+09 6.8774e+11 28800  
## - Condition1 8 9.1216e+09 6.9284e+11 28803  
## - RoofStyle 5 1.8716e+09 6.8559e+11 28810  
## - GarageType 5 3.0225e+09 6.8674e+11 28813  
## - SaleCondition 5 4.1236e+09 6.8784e+11 28815  
## - GarageCond 4 1.0592e+09 6.8477e+11 28816  
## - GarageQual 4 1.2966e+09 6.8501e+11 28817  
## - HeatingQC 4 2.1038e+09 6.8582e+11 28818  
## - ExterQual 3 5.2257e+08 6.8424e+11 28822  
## - ExterCond 3 5.2898e+08 6.8424e+11 28822  
## - Electrical 3 8.4029e+08 6.8455e+11 28823  
## - LandContour 3 9.0259e+08 6.8462e+11 28823  
## - BldgType 3 9.4666e+08 6.8466e+11 28823  
## - Foundation 4 5.5363e+09 6.8925e+11 28825  
## - MasVnrType 3 1.9608e+09 6.8568e+11 28825  
## - Heating 3 2.0315e+09 6.8575e+11 28825  
## - Functional 6 1.4411e+10 6.9813e+11 28828  
## - PavedDrive 2 2.9974e+08 6.8401e+11 28829  
## - LotShape 3 4.3382e+09 6.8805e+11 28830  
## - GarageFinish 2 6.8444e+08 6.8440e+11 28830  
## - MSZoning 4 8.4056e+09 6.9212e+11 28830  
## - BsmtCond 2 1.1946e+09 6.8491e+11 28831  
## - TotRmsAbvGrd 1 1.1077e+08 6.8383e+11 28836  
## - X1stFlrSF 1 1.8267e+08 6.8390e+11 28836  
## - OpenPorchSF 1 3.0246e+08 6.8402e+11 28836  
## - LotConfig 4 1.1722e+10 6.9544e+11 28837  
## - CentralAir 1 1.4655e+09 6.8518e+11 28838  
## - GarageArea 1 2.2502e+09 6.8596e+11 28840  
## - GarageCars 1 3.6258e+09 6.8734e+11 28843  
## <none> 6.8371e+11 28843  
## - FullBath 1 3.7168e+09 6.8743e+11 28843  
## - BsmtQual 3 1.4501e+10 6.9822e+11 28849  
## - Neighborhood 24 9.9623e+10 7.8334e+11 28852  
## - KitchenQual 3 1.6333e+10 7.0005e+11 28853  
## - OverallCond 7 3.2307e+10 7.1602e+11 28854  
## - BsmtFinType1 5 3.1651e+10 7.1537e+11 28867  
## - TotalBsmtSF 1 1.9104e+10 7.0282e+11 28873  
## - BsmtExposure 3 3.4562e+10 7.1828e+11 28887  
## - GrLivArea 1 3.3709e+10 7.1742e+11 28900  
## - Condition2 7 6.3264e+10 7.4698e+11 28911  
## - OverallQual 8 8.6395e+10 7.7011e+11 28945  
## - RoofMatl 7 1.4720e+11 8.3092e+11 29054  
## + GarageYrBlt 96 4.7733e+10 6.3598e+11 29437  
## + YearBuilt 105 5.4270e+10 6.2944e+11 29488  
##   
## Step: AIC=28485.34  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition1 +   
## Condition2 + BldgType + HouseStyle + RoofStyle + RoofMatl +   
## Exterior1st + Exterior2nd + MasVnrType + ExterQual + ExterCond +   
## Foundation + BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 +   
## Heating + HeatingQC + CentralAir + Electrical + KitchenQual +   
## Functional + GarageType + GarageFinish + GarageQual + GarageCond +   
## PavedDrive + SaleType + SaleCondition + MSSubClass + OverallQual +   
## OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - Exterior2nd 14 1.0843e+10 7.3370e+11 28405  
## - MSSubClass 13 9.4173e+09 7.3228e+11 28409  
## - Exterior1st 12 1.5626e+10 7.3849e+11 28428  
## - SaleType 8 6.3558e+09 7.2922e+11 28440  
## - HouseStyle 7 4.2045e+09 7.2707e+11 28443  
## - Condition1 8 8.9849e+09 7.3185e+11 28444  
## - RoofStyle 5 2.4790e+09 7.2534e+11 28454  
## - GarageType 5 4.3901e+09 7.2725e+11 28458  
## - GarageCond 4 1.1594e+09 7.2402e+11 28459  
## - GarageQual 4 1.1963e+09 7.2406e+11 28459  
## - SaleCondition 5 5.3205e+09 7.2818e+11 28459  
## - HeatingQC 4 2.2705e+09 7.2513e+11 28461  
## - ExterQual 3 4.0064e+08 7.2326e+11 28465  
## - ExterCond 3 4.0430e+08 7.2327e+11 28465  
## - LandContour 3 8.6784e+08 7.2373e+11 28465  
## - Electrical 3 8.8521e+08 7.2375e+11 28465  
## - BldgType 3 9.1269e+08 7.2377e+11 28465  
## - Heating 3 1.8541e+09 7.2472e+11 28467  
## - Foundation 4 5.9669e+09 7.2883e+11 28468  
## - Functional 6 1.4605e+10 7.3747e+11 28469  
## - MasVnrType 3 3.2431e+09 7.2611e+11 28470  
## - PavedDrive 2 5.9037e+08 7.2345e+11 28472  
## - GarageFinish 2 8.1099e+08 7.2367e+11 28472  
## - MSZoning 4 9.5287e+09 7.3239e+11 28474  
## - LotShape 3 5.6413e+09 7.2850e+11 28474  
## - BsmtCond 2 1.8164e+09 7.2468e+11 28474  
## - OpenPorchSF 1 2.2167e+06 7.2286e+11 28478  
## - TotRmsAbvGrd 1 3.3400e+07 7.2290e+11 28478  
## - X1stFlrSF 1 3.7057e+08 7.2323e+11 28479  
## - LotConfig 4 1.2239e+10 7.3510e+11 28479  
## - CentralAir 1 1.6139e+09 7.2448e+11 28481  
## - GarageCars 1 2.5739e+09 7.2544e+11 28483  
## - FullBath 1 2.8381e+09 7.2570e+11 28483  
## - GarageArea 1 3.2063e+09 7.2607e+11 28484  
## <none> 7.2286e+11 28485  
## - BsmtQual 3 1.4635e+10 7.3750e+11 28491  
## - KitchenQual 3 1.9732e+10 7.4259e+11 28500  
## - OverallCond 7 3.8891e+10 7.6175e+11 28505  
## - BsmtFinType1 5 3.0862e+10 7.5372e+11 28505  
## - Neighborhood 24 1.1274e+11 8.3561e+11 28507  
## - TotalBsmtSF 1 1.9270e+10 7.4213e+11 28513  
## - BsmtExposure 3 3.4846e+10 7.5771e+11 28527  
## - GrLivArea 1 4.0287e+10 7.6315e+11 28551  
## - Condition2 7 6.7248e+10 7.9011e+11 28554  
## - OverallQual 8 9.9336e+10 8.2220e+11 28600  
## - RoofMatl 7 1.4840e+11 8.7126e+11 28685  
## + YearRemodAdd 60 3.9148e+10 6.8371e+11 28843  
## + GarageYrBlt 96 5.4631e+10 6.6823e+11 29071  
## + YearBuilt 106 6.2199e+10 6.6066e+11 29128  
##   
## Step: AIC=28404.48  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition1 +   
## Condition2 + BldgType + HouseStyle + RoofStyle + RoofMatl +   
## Exterior1st + MasVnrType + ExterQual + ExterCond + Foundation +   
## BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 + Heating +   
## HeatingQC + CentralAir + Electrical + KitchenQual + Functional +   
## GarageType + GarageFinish + GarageQual + GarageCond + PavedDrive +   
## SaleType + SaleCondition + MSSubClass + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - MSSubClass 13 1.0997e+10 7.4470e+11 28331  
## - Exterior1st 13 1.4790e+10 7.4849e+11 28338  
## - SaleType 8 6.4744e+09 7.4018e+11 28359  
## - HouseStyle 7 4.5541e+09 7.3826e+11 28362  
## - Condition1 8 9.1045e+09 7.4281e+11 28363  
## - RoofStyle 5 3.1552e+09 7.3686e+11 28374  
## - GarageType 5 4.5144e+09 7.3822e+11 28377  
## - SaleCondition 5 4.5821e+09 7.3829e+11 28377  
## - GarageQual 4 1.0615e+09 7.3477e+11 28378  
## - GarageCond 4 1.3506e+09 7.3506e+11 28378  
## - HeatingQC 4 1.9450e+09 7.3565e+11 28379  
## - ExterQual 3 2.5151e+08 7.3396e+11 28383  
## - ExterCond 3 3.9628e+08 7.3410e+11 28384  
## - Electrical 3 4.4831e+08 7.3415e+11 28384  
## - Functional 6 1.2398e+10 7.4610e+11 28384  
## - LandContour 3 8.6210e+08 7.3457e+11 28385  
## - BldgType 3 1.1161e+09 7.3482e+11 28385  
## - Foundation 4 5.6974e+09 7.3940e+11 28386  
## - Heating 3 1.7701e+09 7.3547e+11 28386  
## - MasVnrType 3 3.0992e+09 7.3680e+11 28389  
## - PavedDrive 2 5.2016e+08 7.3422e+11 28391  
## - GarageFinish 2 7.2566e+08 7.3443e+11 28391  
## - MSZoning 4 8.7996e+09 7.4250e+11 28392  
## - BsmtCond 2 1.8605e+09 7.3557e+11 28394  
## - LotShape 3 6.0045e+09 7.3971e+11 28394  
## - TotRmsAbvGrd 1 2.1802e+06 7.3371e+11 28397  
## - OpenPorchSF 1 2.8207e+06 7.3371e+11 28397  
## - X1stFlrSF 1 3.5027e+08 7.3405e+11 28398  
## - LotConfig 4 1.3309e+10 7.4701e+11 28400  
## - CentralAir 1 1.7309e+09 7.3544e+11 28400  
## - GarageCars 1 2.2308e+09 7.3594e+11 28401  
## - FullBath 1 3.0742e+09 7.3678e+11 28403  
## - GarageArea 1 3.8590e+09 7.3756e+11 28404  
## <none> 7.3370e+11 28405  
## - BsmtQual 3 1.4355e+10 7.4806e+11 28409  
## - KitchenQual 3 2.0452e+10 7.5416e+11 28420  
## - BsmtFinType1 5 3.1768e+10 7.6547e+11 28425  
## - OverallCond 7 4.0068e+10 7.7377e+11 28425  
## - TotalBsmtSF 1 1.9598e+10 7.5330e+11 28433  
## - Neighborhood 24 1.2113e+11 8.5484e+11 28436  
## - BsmtExposure 3 3.8405e+10 7.7211e+11 28451  
## - GrLivArea 1 4.0740e+10 7.7445e+11 28470  
## - Condition2 7 6.9915e+10 8.0362e+11 28476  
## + Exterior2nd 14 1.0843e+10 7.2286e+11 28485  
## - OverallQual 8 9.8847e+10 8.3255e+11 28516  
## - RoofMatl 7 1.4967e+11 8.8337e+11 28603  
## + YearRemodAdd 60 3.8721e+10 6.9498e+11 28764  
## + GarageYrBlt 96 5.2965e+10 6.8074e+11 28995  
## + YearBuilt 106 5.7943e+10 6.7576e+11 29058  
##   
## Step: AIC=28330.81  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition1 +   
## Condition2 + BldgType + HouseStyle + RoofStyle + RoofMatl +   
## Exterior1st + MasVnrType + ExterQual + ExterCond + Foundation +   
## BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 + Heating +   
## HeatingQC + CentralAir + Electrical + KitchenQual + Functional +   
## GarageType + GarageFinish + GarageQual + GarageCond + PavedDrive +   
## SaleType + SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - Exterior1st 13 1.5315e+10 7.6002e+11 28265  
## - HouseStyle 7 2.8046e+09 7.4751e+11 28285  
## - SaleType 8 6.8871e+09 7.5159e+11 28286  
## - Condition1 8 9.9142e+09 7.5462e+11 28291  
## - RoofStyle 5 3.2752e+09 7.4798e+11 28301  
## - GarageCond 4 1.2745e+09 7.4598e+11 28304  
## - GarageType 5 5.6138e+09 7.5032e+11 28305  
## - GarageQual 4 1.5919e+09 7.4629e+11 28305  
## - SaleCondition 5 6.2452e+09 7.5095e+11 28306  
## - HeatingQC 4 2.3021e+09 7.4700e+11 28306  
## - Functional 6 1.2244e+10 7.5695e+11 28309  
## - ExterCond 3 3.8963e+08 7.4509e+11 28310  
## - Electrical 3 6.3927e+08 7.4534e+11 28310  
## - ExterQual 3 7.1052e+08 7.4541e+11 28311  
## - LandContour 3 9.8768e+08 7.4569e+11 28311  
## - Foundation 4 5.2193e+09 7.4992e+11 28311  
## - Heating 3 2.8770e+09 7.4758e+11 28314  
## - MasVnrType 3 3.0469e+09 7.4775e+11 28315  
## - PavedDrive 2 6.9588e+08 7.4540e+11 28318  
## - GarageFinish 2 1.0146e+09 7.4572e+11 28318  
## - BsmtCond 2 1.7787e+09 7.4648e+11 28320  
## - LotShape 3 6.4931e+09 7.5120e+11 28321  
## - MSZoning 4 1.0801e+10 7.5550e+11 28321  
## - TotRmsAbvGrd 1 1.6827e+07 7.4472e+11 28324  
## - OpenPorchSF 1 2.5901e+08 7.4496e+11 28324  
## - X1stFlrSF 1 3.1238e+08 7.4501e+11 28324  
## - LotConfig 4 1.3086e+10 7.5779e+11 28325  
## - GarageCars 1 1.8859e+09 7.4659e+11 28327  
## - CentralAir 1 2.4083e+09 7.4711e+11 28328  
## - FullBath 1 2.6883e+09 7.4739e+11 28328  
## <none> 7.4470e+11 28331  
## - GarageArea 1 4.7549e+09 7.4946e+11 28332  
## - BsmtQual 3 1.5318e+10 7.6002e+11 28337  
## - KitchenQual 3 1.9797e+10 7.6450e+11 28344  
## - OverallCond 7 3.7425e+10 7.8213e+11 28346  
## - BsmtFinType1 5 3.3841e+10 7.7854e+11 28354  
## - TotalBsmtSF 1 1.8509e+10 7.6321e+11 28357  
## - BldgType 4 3.3285e+10 7.7799e+11 28361  
## - Neighborhood 24 1.2476e+11 8.6947e+11 28365  
## - BsmtExposure 3 3.8315e+10 7.8302e+11 28376  
## - GrLivArea 1 4.0614e+10 7.8532e+11 28395  
## - Condition2 7 7.2001e+10 8.1670e+11 28404  
## + MSSubClass 13 1.0997e+10 7.3370e+11 28405  
## + Exterior2nd 14 1.2423e+10 7.3228e+11 28409  
## - OverallQual 8 1.0392e+11 8.4862e+11 28448  
## - RoofMatl 7 1.4767e+11 8.9237e+11 28523  
## + YearRemodAdd 60 3.9216e+10 7.0549e+11 28690  
## + GarageYrBlt 96 5.3203e+10 6.9150e+11 28923  
## + YearBuilt 106 6.0972e+10 6.8373e+11 28980  
##   
## Step: AIC=28264.47  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition1 +   
## Condition2 + BldgType + HouseStyle + RoofStyle + RoofMatl +   
## MasVnrType + ExterQual + ExterCond + Foundation + BsmtQual +   
## BsmtCond + BsmtExposure + BsmtFinType1 + Heating + HeatingQC +   
## CentralAir + Electrical + KitchenQual + Functional + GarageType +   
## GarageFinish + GarageQual + GarageCond + PavedDrive + SaleType +   
## SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - HouseStyle 7 3.0781e+09 7.6310e+11 28220  
## - SaleType 8 7.7561e+09 7.6777e+11 28221  
## - Condition1 8 9.5246e+09 7.6954e+11 28224  
## - RoofStyle 5 4.5259e+09 7.6454e+11 28236  
## - GarageCond 4 1.5140e+09 7.6153e+11 28238  
## - GarageQual 4 1.6937e+09 7.6171e+11 28239  
## - GarageType 5 5.9429e+09 7.6596e+11 28239  
## - HeatingQC 4 3.0962e+09 7.6311e+11 28241  
## - SaleCondition 5 7.4566e+09 7.6747e+11 28242  
## - ExterQual 3 1.5519e+08 7.6017e+11 28243  
## - Electrical 3 3.2924e+08 7.6035e+11 28244  
## - ExterCond 3 3.8453e+08 7.6040e+11 28244  
## - Functional 6 1.2864e+10 7.7288e+11 28244  
## - Foundation 4 4.5995e+09 7.6462e+11 28244  
## - LandContour 3 5.4853e+08 7.6057e+11 28244  
## - MasVnrType 3 2.5878e+09 7.6261e+11 28247  
## - Heating 3 3.7588e+09 7.6378e+11 28250  
## - PavedDrive 2 6.8757e+08 7.6070e+11 28251  
## - GarageFinish 2 1.2801e+09 7.6130e+11 28252  
## - MSZoning 4 9.5349e+09 7.6955e+11 28252  
## - BsmtCond 2 2.2429e+09 7.6226e+11 28254  
## - LotShape 3 6.9697e+09 7.6699e+11 28255  
## - TotRmsAbvGrd 1 4.6087e+07 7.6006e+11 28257  
## - OpenPorchSF 1 1.5852e+08 7.6018e+11 28258  
## - X1stFlrSF 1 4.1715e+08 7.6043e+11 28258  
## - LotConfig 4 1.3153e+10 7.7317e+11 28259  
## - GarageCars 1 2.3311e+09 7.6235e+11 28261  
## - CentralAir 1 2.7569e+09 7.6277e+11 28262  
## - FullBath 1 3.5740e+09 7.6359e+11 28264  
## <none> 7.6002e+11 28265  
## - GarageArea 1 4.2440e+09 7.6426e+11 28265  
## - BsmtQual 3 1.4448e+10 7.7447e+11 28268  
## - OverallCond 7 3.7845e+10 7.9786e+11 28279  
## - KitchenQual 3 2.2820e+10 7.8284e+11 28283  
## - BsmtFinType1 5 3.3900e+10 7.9392e+11 28287  
## - TotalBsmtSF 1 2.0566e+10 7.8058e+11 28293  
## - Neighborhood 24 1.2422e+11 8.8424e+11 28294  
## - BldgType 4 3.4487e+10 7.9450e+11 28295  
## - BsmtExposure 3 3.7316e+10 7.9733e+11 28307  
## + Exterior1st 13 1.5315e+10 7.4470e+11 28331  
## - GrLivArea 1 4.3092e+10 8.0311e+11 28331  
## + MSSubClass 13 1.1523e+10 7.4849e+11 28338  
## - Condition2 7 7.4926e+10 8.3494e+11 28340  
## + Exterior2nd 15 1.1673e+10 7.4834e+11 28352  
## - OverallQual 8 1.0464e+11 8.6466e+11 28380  
## - RoofMatl 7 1.5668e+11 9.1669e+11 28465  
## + YearRemodAdd 60 3.9898e+10 7.2012e+11 28624  
## + GarageYrBlt 96 5.5648e+10 7.0437e+11 28854  
## + YearBuilt 106 6.4830e+10 6.9519e+11 28908  
##   
## Step: AIC=28219.48  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition1 +   
## Condition2 + BldgType + RoofStyle + RoofMatl + MasVnrType +   
## ExterQual + ExterCond + Foundation + BsmtQual + BsmtCond +   
## BsmtExposure + BsmtFinType1 + Heating + HeatingQC + CentralAir +   
## Electrical + KitchenQual + Functional + GarageType + GarageFinish +   
## GarageQual + GarageCond + PavedDrive + SaleType + SaleCondition +   
## OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - SaleType 8 7.8243e+09 7.7092e+11 28176  
## - Condition1 8 9.5358e+09 7.7263e+11 28179  
## - RoofStyle 5 5.1780e+09 7.6827e+11 28193  
## - GarageCond 4 1.3066e+09 7.6440e+11 28193  
## - GarageQual 4 1.3321e+09 7.6443e+11 28193  
## - GarageType 5 6.5844e+09 7.6968e+11 28195  
## - HeatingQC 4 3.0137e+09 7.6611e+11 28196  
## - SaleCondition 5 7.8669e+09 7.7096e+11 28197  
## - Functional 6 1.2596e+10 7.7569e+11 28198  
## - ExterQual 3 1.9486e+08 7.6329e+11 28198  
## - Electrical 3 2.4101e+08 7.6334e+11 28198  
## - ExterCond 3 2.8718e+08 7.6338e+11 28198  
## - LandContour 3 6.8633e+08 7.6378e+11 28199  
## - Foundation 4 4.9712e+09 7.6807e+11 28199  
## - MasVnrType 3 2.5452e+09 7.6564e+11 28202  
## - Heating 3 4.2456e+09 7.6734e+11 28205  
## - PavedDrive 2 5.2823e+08 7.6362e+11 28206  
## - GarageFinish 2 1.2431e+09 7.6434e+11 28207  
## - MSZoning 4 1.0087e+10 7.7318e+11 28208  
## - BsmtCond 2 2.1072e+09 7.6520e+11 28209  
## - LotShape 3 7.1229e+09 7.7022e+11 28210  
## - TotRmsAbvGrd 1 8.7370e+07 7.6318e+11 28212  
## - OpenPorchSF 1 2.9110e+08 7.6339e+11 28213  
## - X1stFlrSF 1 3.4082e+08 7.6344e+11 28213  
## - LotConfig 4 1.3896e+10 7.7699e+11 28215  
## - GarageCars 1 2.6460e+09 7.6574e+11 28217  
## - CentralAir 1 2.6608e+09 7.6576e+11 28217  
## - FullBath 1 3.7484e+09 7.6684e+11 28219  
## <none> 7.6310e+11 28220  
## - GarageArea 1 4.3659e+09 7.6746e+11 28220  
## - BsmtQual 3 1.4447e+10 7.7754e+11 28223  
## - OverallCond 7 3.7551e+10 8.0065e+11 28233  
## - KitchenQual 3 2.3432e+10 7.8653e+11 28238  
## - BsmtFinType1 5 3.4279e+10 7.9737e+11 28242  
## - BldgType 4 3.4272e+10 7.9737e+11 28250  
## - TotalBsmtSF 1 2.2757e+10 7.8585e+11 28252  
## - Neighborhood 24 1.2955e+11 8.9265e+11 28257  
## + HouseStyle 7 3.0781e+09 7.6002e+11 28265  
## - BsmtExposure 3 4.0463e+10 8.0356e+11 28267  
## + Exterior1st 13 1.5589e+10 7.4751e+11 28285  
## - Condition2 7 7.4510e+10 8.3761e+11 28294  
## + MSSubClass 13 9.6671e+09 7.5343e+11 28296  
## + Exterior2nd 15 1.1795e+10 7.5130e+11 28307  
## - OverallQual 8 1.0598e+11 8.6908e+11 28336  
## - GrLivArea 1 1.2044e+11 8.8354e+11 28409  
## - RoofMatl 7 1.5857e+11 9.2167e+11 28422  
## + YearRemodAdd 60 3.9959e+10 7.2314e+11 28579  
## + GarageYrBlt 96 5.4875e+10 7.0822e+11 28811  
## + YearBuilt 106 6.5050e+10 6.9805e+11 28863  
##   
## Step: AIC=28175.55  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition1 +   
## Condition2 + BldgType + RoofStyle + RoofMatl + MasVnrType +   
## ExterQual + ExterCond + Foundation + BsmtQual + BsmtCond +   
## BsmtExposure + BsmtFinType1 + Heating + HeatingQC + CentralAir +   
## Electrical + KitchenQual + Functional + GarageType + GarageFinish +   
## GarageQual + GarageCond + PavedDrive + SaleCondition + OverallQual +   
## OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - Condition1 8 1.0157e+10 7.8108e+11 28136  
## - RoofStyle 5 5.1218e+09 7.7604e+11 28148  
## - GarageCond 4 1.1841e+09 7.7210e+11 28149  
## - GarageQual 4 1.4540e+09 7.7237e+11 28149  
## - GarageType 5 6.4895e+09 7.7741e+11 28151  
## - HeatingQC 4 2.7209e+09 7.7364e+11 28152  
## - Functional 6 1.1629e+10 7.8255e+11 28152  
## - Electrical 3 3.1837e+08 7.7124e+11 28155  
## - ExterCond 3 3.1895e+08 7.7124e+11 28155  
## - ExterQual 3 3.4712e+08 7.7127e+11 28155  
## - Foundation 4 4.8921e+09 7.7581e+11 28155  
## - LandContour 3 7.7470e+08 7.7169e+11 28155  
## - MasVnrType 3 2.4666e+09 7.7339e+11 28158  
## - Heating 3 4.5733e+09 7.7549e+11 28162  
## - PavedDrive 2 4.5968e+08 7.7138e+11 28162  
## - GarageFinish 2 1.6483e+09 7.7257e+11 28164  
## - MSZoning 4 1.0279e+10 7.8120e+11 28165  
## - BsmtCond 2 1.9915e+09 7.7291e+11 28165  
## - LotShape 3 7.4706e+09 7.7839e+11 28167  
## - TotRmsAbvGrd 1 5.1692e+07 7.7097e+11 28168  
## - OpenPorchSF 1 2.5012e+08 7.7117e+11 28169  
## - X1stFlrSF 1 3.1087e+08 7.7123e+11 28169  
## - CentralAir 1 2.6735e+09 7.7359e+11 28173  
## - GarageCars 1 2.7851e+09 7.7370e+11 28173  
## - LotConfig 4 1.5627e+10 7.8655e+11 28174  
## - FullBath 1 3.6576e+09 7.7458e+11 28175  
## <none> 7.7092e+11 28176  
## - GarageArea 1 4.2864e+09 7.7521e+11 28176  
## - BsmtQual 3 1.4895e+10 7.8581e+11 28180  
## - OverallCond 7 3.7413e+10 8.0833e+11 28189  
## - KitchenQual 3 2.2393e+10 7.9331e+11 28192  
## - SaleCondition 5 3.1195e+10 8.0212e+11 28193  
## - BsmtFinType1 5 3.4662e+10 8.0558e+11 28198  
## - BldgType 4 3.3820e+10 8.0474e+11 28204  
## - TotalBsmtSF 1 2.2122e+10 7.9304e+11 28206  
## - Neighborhood 24 1.3155e+11 9.0247e+11 28214  
## + SaleType 8 7.8243e+09 7.6310e+11 28220  
## + HouseStyle 7 3.1463e+09 7.6777e+11 28221  
## - BsmtExposure 3 4.3314e+10 8.1423e+11 28227  
## + Exterior1st 13 1.6391e+10 7.5453e+11 28240  
## - Condition2 7 7.3991e+10 8.4491e+11 28248  
## + MSSubClass 13 9.7885e+09 7.6113e+11 28252  
## + Exterior2nd 15 1.2877e+10 7.5804e+11 28261  
## - OverallQual 8 1.0571e+11 8.7663e+11 28290  
## - GrLivArea 1 1.1984e+11 8.9076e+11 28362  
## - RoofMatl 7 1.5698e+11 9.2790e+11 28373  
## + YearRemodAdd 60 3.9561e+10 7.3136e+11 28537  
## + GarageYrBlt 96 5.5196e+10 7.1572e+11 28767  
## + YearBuilt 106 6.4737e+10 7.0618e+11 28821  
##   
## Step: AIC=28135.48  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofStyle + RoofMatl + MasVnrType + ExterQual +   
## ExterCond + Foundation + BsmtQual + BsmtCond + BsmtExposure +   
## BsmtFinType1 + Heating + HeatingQC + CentralAir + Electrical +   
## KitchenQual + Functional + GarageType + GarageFinish + GarageQual +   
## GarageCond + PavedDrive + SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - GarageQual 4 1.2384e+09 7.8232e+11 28109  
## - GarageCond 4 1.3481e+09 7.8242e+11 28109  
## - RoofStyle 5 5.6283e+09 7.8671e+11 28109  
## - HeatingQC 4 2.3988e+09 7.8348e+11 28111  
## - GarageType 5 6.7428e+09 7.8782e+11 28111  
## - Functional 6 1.1471e+10 7.9255e+11 28112  
## - Electrical 3 1.3258e+08 7.8121e+11 28114  
## - ExterQual 3 2.2346e+08 7.8130e+11 28114  
## - ExterCond 3 3.6642e+08 7.8144e+11 28115  
## - LandContour 3 5.4358e+08 7.8162e+11 28115  
## - Foundation 4 4.9186e+09 7.8600e+11 28115  
## - MasVnrType 3 2.3395e+09 7.8342e+11 28118  
## - Heating 3 4.1504e+09 7.8523e+11 28121  
## - PavedDrive 2 4.5332e+08 7.8153e+11 28122  
## - GarageFinish 2 1.9150e+09 7.8299e+11 28124  
## - BsmtCond 2 2.1589e+09 7.8324e+11 28125  
## - MSZoning 4 1.1063e+10 7.9214e+11 28126  
## - LotShape 3 7.5422e+09 7.8862e+11 28127  
## - TotRmsAbvGrd 1 4.2833e+07 7.8112e+11 28128  
## - X1stFlrSF 1 2.5816e+08 7.8133e+11 28129  
## - OpenPorchSF 1 3.6784e+08 7.8144e+11 28129  
## - CentralAir 1 2.5535e+09 7.8363e+11 28133  
## - GarageCars 1 2.8577e+09 7.8393e+11 28133  
## - LotConfig 4 1.5833e+10 7.9691e+11 28134  
## - GarageArea 1 4.0341e+09 7.8511e+11 28135  
## - FullBath 1 4.0954e+09 7.8517e+11 28135  
## <none> 7.8108e+11 28136  
## - BsmtQual 3 1.5880e+10 7.9696e+11 28141  
## - OverallCond 7 3.7971e+10 8.1905e+11 28149  
## - SaleCondition 5 3.0549e+10 8.1163e+11 28151  
## - KitchenQual 3 2.2733e+10 8.0381e+11 28152  
## - BsmtFinType1 5 3.3689e+10 8.1477e+11 28156  
## - BldgType 4 3.4591e+10 8.1567e+11 28165  
## - TotalBsmtSF 1 2.2868e+10 8.0394e+11 28167  
## + Condition1 8 1.0157e+10 7.7092e+11 28176  
## + SaleType 8 8.4455e+09 7.7263e+11 28179  
## + HouseStyle 7 3.1858e+09 7.7789e+11 28180  
## - Neighborhood 24 1.3932e+11 9.2040e+11 28183  
## - BsmtExposure 3 4.3266e+10 8.2434e+11 28186  
## + Exterior1st 13 1.5864e+10 7.6521e+11 28202  
## + MSSubClass 13 1.0564e+10 7.7051e+11 28211  
## + Exterior2nd 15 1.2548e+10 7.6853e+11 28222  
## - Condition2 7 8.4080e+10 8.6516e+11 28222  
## - OverallQual 8 1.0795e+11 8.8903e+11 28251  
## - GrLivArea 1 1.1670e+11 8.9778e+11 28315  
## - RoofMatl 7 1.6368e+11 9.4476e+11 28340  
## + YearRemodAdd 60 4.0406e+10 7.4067e+11 28496  
## + GarageYrBlt 96 5.8153e+10 7.2292e+11 28723  
## + YearBuilt 106 6.7099e+10 7.1398e+11 28778  
##   
## Step: AIC=28108.8  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofStyle + RoofMatl + MasVnrType + ExterQual +   
## ExterCond + Foundation + BsmtQual + BsmtCond + BsmtExposure +   
## BsmtFinType1 + Heating + HeatingQC + CentralAir + Electrical +   
## KitchenQual + Functional + GarageType + GarageFinish + GarageCond +   
## PavedDrive + SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - RoofStyle 5 5.6307e+09 7.8795e+11 28082  
## - GarageCond 4 1.9956e+09 7.8431e+11 28083  
## - HeatingQC 4 2.3583e+09 7.8467e+11 28084  
## - GarageType 5 6.7031e+09 7.8902e+11 28084  
## - Functional 6 1.1394e+10 7.9371e+11 28085  
## - Electrical 3 9.9961e+07 7.8242e+11 28087  
## - ExterQual 3 1.5353e+08 7.8247e+11 28088  
## - ExterCond 3 3.9399e+08 7.8271e+11 28088  
## - Foundation 4 4.7968e+09 7.8711e+11 28088  
## - LandContour 3 5.8259e+08 7.8290e+11 28088  
## - MasVnrType 3 2.2454e+09 7.8456e+11 28091  
## - Heating 3 3.8754e+09 7.8619e+11 28094  
## - PavedDrive 2 3.0567e+08 7.8262e+11 28095  
## - GarageFinish 2 1.8074e+09 7.8412e+11 28098  
## - BsmtCond 2 2.3539e+09 7.8467e+11 28098  
## - MSZoning 4 1.0903e+10 7.9322e+11 28099  
## - LotShape 3 8.4458e+09 7.9076e+11 28102  
## - TotRmsAbvGrd 1 5.6591e+07 7.8237e+11 28102  
## - X1stFlrSF 1 2.0735e+08 7.8252e+11 28102  
## - OpenPorchSF 1 4.3474e+08 7.8275e+11 28102  
## - CentralAir 1 2.2879e+09 7.8460e+11 28106  
## - GarageCars 1 2.8129e+09 7.8513e+11 28106  
## - LotConfig 4 1.5754e+10 7.9807e+11 28107  
## - GarageArea 1 4.1634e+09 7.8648e+11 28109  
## - FullBath 1 4.1679e+09 7.8648e+11 28109  
## <none> 7.8232e+11 28109  
## - BsmtQual 3 1.5744e+10 7.9806e+11 28114  
## - OverallCond 7 3.9075e+10 8.2139e+11 28124  
## - SaleCondition 5 3.1428e+10 8.1374e+11 28126  
## - KitchenQual 3 2.3053e+10 8.0537e+11 28126  
## - BsmtFinType1 5 3.3587e+10 8.1590e+11 28129  
## + GarageQual 4 1.2384e+09 7.8108e+11 28136  
## - BldgType 4 3.4387e+10 8.1670e+11 28138  
## - TotalBsmtSF 1 2.2379e+10 8.0469e+11 28139  
## + Condition1 8 9.9414e+09 7.7237e+11 28149  
## + SaleType 8 8.5761e+09 7.7374e+11 28152  
## + HouseStyle 7 2.8970e+09 7.7942e+11 28154  
## - Neighborhood 24 1.3988e+11 9.2220e+11 28156  
## - BsmtExposure 3 4.3199e+10 8.2551e+11 28159  
## + Exterior1st 13 1.5971e+10 7.6634e+11 28175  
## + MSSubClass 13 1.0363e+10 7.7195e+11 28185  
## + Exterior2nd 15 1.2456e+10 7.6986e+11 28195  
## - Condition2 7 8.4564e+10 8.6688e+11 28196  
## - OverallQual 8 1.1520e+11 8.9752e+11 28235  
## - GrLivArea 1 1.1733e+11 8.9964e+11 28289  
## - RoofMatl 7 1.7014e+11 9.5246e+11 28322  
## + YearRemodAdd 60 4.0777e+10 7.4154e+11 28469  
## + GarageYrBlt 96 5.7546e+10 7.2477e+11 28698  
## + YearBuilt 106 6.6065e+10 7.1625e+11 28754  
##   
## Step: AIC=28082.4  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofMatl + MasVnrType + ExterQual + ExterCond +   
## Foundation + BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 +   
## Heating + HeatingQC + CentralAir + Electrical + KitchenQual +   
## Functional + GarageType + GarageFinish + GarageCond + PavedDrive +   
## SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - GarageCond 4 2.0204e+09 7.8997e+11 28057  
## - HeatingQC 4 2.4208e+09 7.9037e+11 28058  
## - Functional 6 1.1345e+10 7.9929e+11 28058  
## - GarageType 5 7.0672e+09 7.9501e+11 28058  
## - Electrical 3 1.1224e+08 7.8806e+11 28061  
## - ExterQual 3 2.4723e+08 7.8819e+11 28061  
## - ExterCond 3 4.4039e+08 7.8839e+11 28062  
## - LandContour 3 5.7019e+08 7.8852e+11 28062  
## - Foundation 4 5.1572e+09 7.9310e+11 28062  
## - MasVnrType 3 2.1951e+09 7.9014e+11 28065  
## - Heating 3 3.8322e+09 7.9178e+11 28067  
## - PavedDrive 2 2.3473e+08 7.8818e+11 28068  
## - MSZoning 4 1.0568e+10 7.9851e+11 28071  
## - GarageFinish 2 2.1743e+09 7.9012e+11 28072  
## - BsmtCond 2 2.2809e+09 7.9023e+11 28072  
## - TotRmsAbvGrd 1 1.1603e+08 7.8806e+11 28075  
## - LotShape 3 8.6562e+09 7.9660e+11 28075  
## - X1stFlrSF 1 1.4279e+08 7.8809e+11 28075  
## - OpenPorchSF 1 1.8937e+08 7.8814e+11 28076  
## - CentralAir 1 1.7761e+09 7.8972e+11 28078  
## - LotConfig 4 1.4977e+10 8.0292e+11 28079  
## - GarageCars 1 3.0317e+09 7.9098e+11 28080  
## - FullBath 1 3.2914e+09 7.9124e+11 28081  
## - GarageArea 1 4.0929e+09 7.9204e+11 28082  
## <none> 7.8795e+11 28082  
## - BsmtQual 3 1.6495e+10 8.0444e+11 28089  
## - OverallCond 7 3.9880e+10 8.2783e+11 28098  
## - KitchenQual 3 2.2989e+10 8.1093e+11 28099  
## - SaleCondition 5 3.2277e+10 8.2022e+11 28100  
## - BsmtFinType1 5 3.3594e+10 8.2154e+11 28102  
## + RoofStyle 5 5.6307e+09 7.8232e+11 28109  
## + GarageQual 4 1.2408e+09 7.8671e+11 28109  
## - BldgType 4 3.5945e+10 8.2389e+11 28113  
## - TotalBsmtSF 1 2.3923e+10 8.1187e+11 28115  
## + Condition1 8 1.0407e+10 7.7754e+11 28122  
## + SaleType 8 8.5719e+09 7.7937e+11 28125  
## + HouseStyle 7 3.5557e+09 7.8439e+11 28127  
## - Neighborhood 24 1.3962e+11 9.2756e+11 28128  
## - BsmtExposure 3 4.3894e+10 8.3184e+11 28133  
## + Exterior1st 13 1.7324e+10 7.7062e+11 28146  
## + MSSubClass 13 1.0732e+10 7.7721e+11 28158  
## + Exterior2nd 15 1.4173e+10 7.7377e+11 28166  
## - Condition2 7 8.3039e+10 8.7098e+11 28166  
## - OverallQual 8 1.1681e+11 9.0476e+11 28210  
## - GrLivArea 1 1.2104e+11 9.0899e+11 28267  
## - RoofMatl 7 1.7049e+11 9.5843e+11 28294  
## + YearRemodAdd 60 4.1928e+10 7.4602e+11 28441  
## + GarageYrBlt 96 5.8102e+10 7.2984e+11 28671  
## + YearBuilt 106 6.6881e+10 7.2106e+11 28727  
##   
## Step: AIC=28057.03  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofMatl + MasVnrType + ExterQual + ExterCond +   
## Foundation + BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 +   
## Heating + HeatingQC + CentralAir + Electrical + KitchenQual +   
## Functional + GarageType + GarageFinish + PavedDrive + SaleCondition +   
## OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - Functional 6 1.1167e+10 8.0113e+11 28033  
## - HeatingQC 4 2.6128e+09 7.9258e+11 28033  
## - GarageType 5 7.3142e+09 7.9728e+11 28033  
## - ExterQual 3 2.6081e+08 7.9023e+11 28036  
## - Electrical 3 3.2482e+08 7.9029e+11 28036  
## - ExterCond 3 3.9773e+08 7.9036e+11 28036  
## - LandContour 3 5.0171e+08 7.9047e+11 28036  
## - Foundation 4 4.9277e+09 7.9489e+11 28037  
## - MasVnrType 3 2.2075e+09 7.9217e+11 28039  
## - Heating 3 3.0485e+09 7.9301e+11 28041  
## - PavedDrive 2 4.9058e+08 7.9046e+11 28044  
## - MSZoning 4 1.0725e+10 8.0069e+11 28046  
## - GarageFinish 2 2.2607e+09 7.9223e+11 28047  
## - BsmtCond 2 2.5580e+09 7.9252e+11 28047  
## - X1stFlrSF 1 1.6189e+08 7.9013e+11 28050  
## - TotRmsAbvGrd 1 1.7444e+08 7.9014e+11 28050  
## - OpenPorchSF 1 1.8854e+08 7.9015e+11 28050  
## - LotShape 3 8.9981e+09 7.9896e+11 28051  
## - LotConfig 4 1.4905e+10 8.0487e+11 28053  
## - CentralAir 1 2.1254e+09 7.9209e+11 28053  
## - GarageCars 1 2.8911e+09 7.9286e+11 28055  
## - FullBath 1 3.4571e+09 7.9342e+11 28056  
## <none> 7.8997e+11 28057  
## - GarageArea 1 4.7843e+09 7.9475e+11 28058  
## - BsmtQual 3 1.6549e+10 8.0651e+11 28063  
## - KitchenQual 3 2.2311e+10 8.1228e+11 28073  
## - OverallCond 7 3.9995e+10 8.2996e+11 28073  
## - SaleCondition 5 3.2583e+10 8.2255e+11 28075  
## - BsmtFinType1 5 3.3964e+10 8.2393e+11 28077  
## + GarageQual 4 2.0816e+09 7.8788e+11 28082  
## + GarageCond 4 2.0204e+09 7.8795e+11 28082  
## + RoofStyle 5 5.6555e+09 7.8431e+11 28083  
## - BldgType 4 3.5397e+10 8.2536e+11 28087  
## - TotalBsmtSF 1 2.3857e+10 8.1382e+11 28090  
## + Condition1 8 1.0574e+10 7.7939e+11 28097  
## + SaleType 8 8.3921e+09 7.8157e+11 28100  
## + HouseStyle 7 3.0043e+09 7.8696e+11 28102  
## - Neighborhood 24 1.4054e+11 9.3051e+11 28104  
## - BsmtExposure 3 4.3262e+10 8.3323e+11 28107  
## + Exterior1st 13 1.7544e+10 7.7242e+11 28121  
## + MSSubClass 13 1.0850e+10 7.7912e+11 28132  
## + Exterior2nd 15 1.4639e+10 7.7533e+11 28140  
## - Condition2 7 8.3505e+10 8.7347e+11 28141  
## - OverallQual 8 1.1922e+11 9.0919e+11 28188  
## - GrLivArea 1 1.2014e+11 9.1011e+11 28239  
## - RoofMatl 7 1.7189e+11 9.6186e+11 28270  
## + YearRemodAdd 60 4.2554e+10 7.4741e+11 28415  
## + GarageYrBlt 96 5.7715e+10 7.3225e+11 28647  
## + YearBuilt 106 6.7507e+10 7.2246e+11 28701  
##   
## Step: AIC=28032.63  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofMatl + MasVnrType + ExterQual + ExterCond +   
## Foundation + BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 +   
## Heating + HeatingQC + CentralAir + Electrical + KitchenQual +   
## GarageType + GarageFinish + PavedDrive + SaleCondition +   
## OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - HeatingQC 4 2.3964e+09 8.0353e+11 28008  
## - GarageType 5 7.5738e+09 8.0871e+11 28009  
## - ExterQual 3 1.8223e+08 8.0132e+11 28011  
## - Foundation 4 4.5618e+09 8.0570e+11 28011  
## - Electrical 3 3.4601e+08 8.0148e+11 28012  
## - ExterCond 3 3.6180e+08 8.0150e+11 28012  
## - LandContour 3 4.6192e+08 8.0160e+11 28012  
## - MasVnrType 3 2.4033e+09 8.0354e+11 28015  
## - Heating 3 3.1553e+09 8.0429e+11 28016  
## - PavedDrive 2 2.8202e+08 8.0142e+11 28019  
## - MSZoning 4 1.0599e+10 8.1173e+11 28021  
## - GarageFinish 2 2.2104e+09 8.0334e+11 28022  
## - BsmtCond 2 2.3570e+09 8.0349e+11 28022  
## - TotRmsAbvGrd 1 1.7119e+07 8.0115e+11 28026  
## - OpenPorchSF 1 2.4484e+08 8.0138e+11 28026  
## - X1stFlrSF 1 1.0374e+09 8.0217e+11 28027  
## - LotShape 3 1.0122e+10 8.1126e+11 28028  
## - LotConfig 4 1.5312e+10 8.1645e+11 28029  
## - CentralAir 1 2.8713e+09 8.0400e+11 28030  
## - GarageCars 1 3.2101e+09 8.0434e+11 28031  
## - FullBath 1 3.5347e+09 8.0467e+11 28031  
## <none> 8.0113e+11 28033  
## - GarageArea 1 4.5111e+09 8.0564e+11 28033  
## - BsmtQual 3 1.6343e+10 8.1748e+11 28038  
## - KitchenQual 3 2.3433e+10 8.2457e+11 28050  
## - SaleCondition 5 3.5008e+10 8.3614e+11 28054  
## - BsmtFinType1 5 3.5700e+10 8.3683e+11 28055  
## - OverallCond 7 4.5781e+10 8.4692e+11 28057  
## + Functional 6 1.1167e+10 7.8997e+11 28057  
## + GarageQual 4 2.0245e+09 7.9911e+11 28058  
## + GarageCond 4 1.8424e+09 7.9929e+11 28058  
## + RoofStyle 5 5.6487e+09 7.9548e+11 28059  
## - BldgType 4 3.3938e+10 8.3507e+11 28059  
## + Condition1 8 1.0462e+10 7.9067e+11 28073  
## - TotalBsmtSF 1 3.0006e+10 8.3114e+11 28075  
## + SaleType 8 7.6001e+09 7.9353e+11 28078  
## + HouseStyle 7 2.9351e+09 7.9820e+11 28078  
## - BsmtExposure 3 4.4347e+10 8.4548e+11 28083  
## - Neighborhood 24 1.4603e+11 9.4717e+11 28084  
## + Exterior1st 13 1.7949e+10 7.8318e+11 28096  
## + MSSubClass 13 1.0545e+10 7.9059e+11 28109  
## - Condition2 7 8.2323e+10 8.8346e+11 28113  
## + Exterior2nd 15 1.4524e+10 7.8661e+11 28116  
## - OverallQual 8 1.2275e+11 9.2388e+11 28166  
## - GrLivArea 1 1.1235e+11 9.1349e+11 28201  
## - RoofMatl 7 1.7625e+11 9.7738e+11 28249  
## + YearRemodAdd 60 4.3682e+10 7.5745e+11 28390  
## + GarageYrBlt 96 5.9474e+10 7.4166e+11 28621  
## + YearBuilt 106 6.9029e+10 7.3210e+11 28675  
##   
## Step: AIC=28007.83  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofMatl + MasVnrType + ExterQual + ExterCond +   
## Foundation + BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 +   
## Heating + CentralAir + Electrical + KitchenQual + GarageType +   
## GarageFinish + PavedDrive + SaleCondition + OverallQual +   
## OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - GarageType 5 7.9273e+09 8.1146e+11 27985  
## - Foundation 4 4.1966e+09 8.0773e+11 27986  
## - ExterQual 3 1.2603e+08 8.0366e+11 27986  
## - ExterCond 3 3.0198e+08 8.0383e+11 27987  
## - Electrical 3 4.4685e+08 8.0398e+11 27987  
## - LandContour 3 5.2167e+08 8.0405e+11 27987  
## - MasVnrType 3 2.6039e+09 8.0613e+11 27991  
## - Heating 3 3.2902e+09 8.0682e+11 27992  
## - PavedDrive 2 3.3784e+08 8.0387e+11 27994  
## - MSZoning 4 1.0659e+10 8.1419e+11 27997  
## - GarageFinish 2 2.4525e+09 8.0598e+11 27998  
## - BsmtCond 2 2.5444e+09 8.0607e+11 27998  
## - TotRmsAbvGrd 1 1.4780e+07 8.0354e+11 28001  
## - OpenPorchSF 1 2.6931e+08 8.0380e+11 28001  
## - X1stFlrSF 1 1.0141e+09 8.0454e+11 28002  
## - LotShape 3 1.0208e+10 8.1374e+11 28003  
## - LotConfig 4 1.5056e+10 8.1859e+11 28004  
## - GarageCars 1 3.2637e+09 8.0679e+11 28006  
## - CentralAir 1 3.2798e+09 8.0681e+11 28006  
## - FullBath 1 3.4677e+09 8.0700e+11 28006  
## <none> 8.0353e+11 28008  
## - GarageArea 1 4.4100e+09 8.0794e+11 28008  
## - BsmtQual 3 1.6913e+10 8.2044e+11 28014  
## - KitchenQual 3 2.3367e+10 8.2690e+11 28025  
## - SaleCondition 5 3.5308e+10 8.3884e+11 28029  
## - BsmtFinType1 5 3.5792e+10 8.3932e+11 28030  
## + HeatingQC 4 2.3964e+09 8.0113e+11 28033  
## + Functional 6 1.0951e+10 7.9258e+11 28033  
## + GarageQual 4 2.0642e+09 8.0147e+11 28033  
## + GarageCond 4 2.0178e+09 8.0151e+11 28033  
## - OverallCond 7 4.7127e+10 8.5066e+11 28034  
## + RoofStyle 5 5.6689e+09 7.9786e+11 28034  
## - BldgType 4 3.3946e+10 8.3748e+11 28034  
## + Condition1 8 1.0085e+10 7.9345e+11 28049  
## - TotalBsmtSF 1 3.0297e+10 8.3383e+11 28050  
## + SaleType 8 7.3191e+09 7.9621e+11 28053  
## + HouseStyle 7 2.8184e+09 8.0071e+11 28054  
## - BsmtExposure 3 4.3362e+10 8.4689e+11 28057  
## - Neighborhood 24 1.4588e+11 9.4941e+11 28058  
## + Exterior1st 13 1.8543e+10 7.8499e+11 28070  
## + MSSubClass 13 1.0525e+10 7.9300e+11 28084  
## - Condition2 7 8.2741e+10 8.8627e+11 28089  
## + Exterior2nd 15 1.4915e+10 7.8862e+11 28091  
## - OverallQual 8 1.2430e+11 9.2783e+11 28143  
## - GrLivArea 1 1.1301e+11 9.1654e+11 28177  
## - RoofMatl 7 1.7659e+11 9.8012e+11 28223  
## + YearRemodAdd 60 4.4175e+10 7.5936e+11 28364  
## + GarageYrBlt 96 6.0169e+10 7.4336e+11 28595  
## + YearBuilt 106 7.0268e+10 7.3326e+11 28649  
##   
## Step: AIC=27984.98  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofMatl + MasVnrType + ExterQual + ExterCond +   
## Foundation + BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 +   
## Heating + CentralAir + Electrical + KitchenQual + GarageFinish +   
## PavedDrive + SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - ExterQual 3 1.3495e+08 8.1159e+11 27964  
## - Electrical 3 3.2551e+08 8.1178e+11 27964  
## - ExterCond 3 3.8737e+08 8.1184e+11 27964  
## - Foundation 4 4.7691e+09 8.1623e+11 27964  
## - LandContour 3 8.3771e+08 8.1229e+11 27965  
## - MasVnrType 3 2.9176e+09 8.1437e+11 27968  
## - Heating 3 3.1863e+09 8.1464e+11 27969  
## - PavedDrive 2 3.6072e+08 8.1182e+11 27971  
## - MSZoning 4 9.9825e+09 8.2144e+11 27973  
## - BsmtCond 2 2.4346e+09 8.1389e+11 27975  
## - GarageFinish 2 3.6059e+09 8.1506e+11 27977  
## - TotRmsAbvGrd 1 2.5930e+07 8.1148e+11 27978  
## - OpenPorchSF 1 2.0053e+08 8.1166e+11 27978  
## - X1stFlrSF 1 1.2893e+09 8.1275e+11 27980  
## - LotConfig 4 1.5073e+10 8.2653e+11 27981  
## - GarageCars 1 2.9293e+09 8.1439e+11 27983  
## - LotShape 3 1.1942e+10 8.2340e+11 27983  
## - GarageArea 1 3.3626e+09 8.1482e+11 27983  
## - FullBath 1 3.5381e+09 8.1500e+11 27984  
## - CentralAir 1 3.8503e+09 8.1531e+11 27984  
## <none> 8.1146e+11 27985  
## - BsmtQual 3 1.7376e+10 8.2883e+11 27992  
## - KitchenQual 3 2.3624e+10 8.3508e+11 28002  
## - BsmtFinType1 5 3.5039e+10 8.4650e+11 28006  
## + GarageType 5 7.9273e+09 8.0353e+11 28008  
## - SaleCondition 5 3.7310e+10 8.4877e+11 28009  
## + HeatingQC 4 2.7499e+09 8.0871e+11 28009  
## + Functional 6 1.1184e+10 8.0027e+11 28010  
## + GarageCond 4 2.2805e+09 8.0918e+11 28010  
## + GarageQual 4 2.2362e+09 8.0922e+11 28010  
## + RoofStyle 5 5.9355e+09 8.0552e+11 28011  
## - OverallCond 7 4.7921e+10 8.5938e+11 28011  
## - BldgType 4 4.0563e+10 8.5202e+11 28022  
## + Condition1 8 1.0403e+10 8.0105e+11 28025  
## - TotalBsmtSF 1 2.9682e+10 8.4114e+11 28026  
## + HouseStyle 7 3.5742e+09 8.0788e+11 28030  
## + SaleType 8 7.1983e+09 8.0426e+11 28031  
## - Neighborhood 24 1.4513e+11 9.5658e+11 28033  
## - BsmtExposure 3 4.5175e+10 8.5663e+11 28036  
## + Exterior1st 13 1.8816e+10 7.9264e+11 28047  
## + MSSubClass 13 1.1932e+10 7.9952e+11 28059  
## - Condition2 7 8.1357e+10 8.9281e+11 28063  
## + Exterior2nd 15 1.6128e+10 7.9533e+11 28066  
## - OverallQual 8 1.2663e+11 9.3809e+11 28122  
## - GrLivArea 1 1.2456e+11 9.3602e+11 28169  
## - RoofMatl 7 1.7789e+11 9.8935e+11 28200  
## + YearRemodAdd 60 4.7217e+10 7.6424e+11 28337  
## + GarageYrBlt 96 6.1126e+10 7.5033e+11 28571  
## + YearBuilt 106 7.3632e+10 7.3783e+11 28621  
##   
## Step: AIC=27963.6  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofMatl + MasVnrType + ExterCond + Foundation +   
## BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 + Heating +   
## CentralAir + Electrical + KitchenQual + GarageFinish + PavedDrive +   
## SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - Electrical 3 3.3147e+08 8.1192e+11 27943  
## - ExterCond 3 3.9982e+08 8.1199e+11 27943  
## - Foundation 4 4.9101e+09 8.1650e+11 27943  
## - LandContour 3 8.2444e+08 8.1242e+11 27943  
## - MasVnrType 3 2.9313e+09 8.1452e+11 27947  
## - Heating 3 3.1723e+09 8.1476e+11 27947  
## - PavedDrive 2 3.5370e+08 8.1195e+11 27950  
## - MSZoning 4 1.0124e+10 8.2172e+11 27951  
## - BsmtCond 2 2.3973e+09 8.1399e+11 27953  
## - GarageFinish 2 3.6155e+09 8.1521e+11 27955  
## - TotRmsAbvGrd 1 1.9275e+07 8.1161e+11 27956  
## - OpenPorchSF 1 2.1336e+08 8.1181e+11 27957  
## - X1stFlrSF 1 1.3103e+09 8.1290e+11 27959  
## - LotConfig 4 1.5163e+10 8.2675e+11 27960  
## - GarageCars 1 2.8925e+09 8.1448e+11 27961  
## - LotShape 3 1.2228e+10 8.2382e+11 27962  
## - GarageArea 1 3.4306e+09 8.1502e+11 27962  
## - FullBath 1 3.5607e+09 8.1515e+11 27962  
## - CentralAir 1 3.8481e+09 8.1544e+11 27963  
## <none> 8.1159e+11 27964  
## - BsmtQual 3 1.8019e+10 8.2961e+11 27971  
## - KitchenQual 3 2.5292e+10 8.3688e+11 27983  
## - BsmtFinType1 5 3.5194e+10 8.4679e+11 27984  
## + ExterQual 3 1.3495e+08 8.1146e+11 27985  
## + GarageType 5 7.9362e+09 8.0366e+11 27986  
## + HeatingQC 4 2.7143e+09 8.0888e+11 27988  
## + Functional 6 1.1005e+10 8.0059e+11 27989  
## + GarageCond 4 2.2941e+09 8.0930e+11 27989  
## + GarageQual 4 2.1822e+09 8.0941e+11 27989  
## - SaleCondition 5 3.8432e+10 8.5002e+11 27990  
## + RoofStyle 5 6.0119e+09 8.0558e+11 27990  
## - OverallCond 7 4.8500e+10 8.6009e+11 27991  
## - BldgType 4 4.0632e+10 8.5222e+11 28000  
## + Condition1 8 1.0370e+10 8.0122e+11 28004  
## - TotalBsmtSF 1 3.0228e+10 8.4182e+11 28005  
## + HouseStyle 7 3.6045e+09 8.0799e+11 28008  
## + SaleType 8 7.2557e+09 8.0434e+11 28009  
## - Neighborhood 24 1.4696e+11 9.5855e+11 28014  
## - BsmtExposure 3 4.5682e+10 8.5727e+11 28015  
## + Exterior1st 13 1.8327e+10 7.9327e+11 28027  
## + MSSubClass 13 1.1772e+10 7.9982e+11 28038  
## - Condition2 7 8.1326e+10 8.9292e+11 28041  
## + Exterior2nd 15 1.5259e+10 7.9633e+11 28046  
## - OverallQual 8 1.4029e+11 9.5188e+11 28120  
## - GrLivArea 1 1.2491e+11 9.3650e+11 28148  
## - RoofMatl 7 1.7808e+11 9.8967e+11 28179  
## + YearRemodAdd 60 4.7132e+10 7.6446e+11 28316  
## + GarageYrBlt 96 6.1060e+10 7.5053e+11 28550  
## + YearBuilt 106 7.3730e+10 7.3786e+11 28599  
##   
## Step: AIC=27942.55  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofMatl + MasVnrType + ExterCond + Foundation +   
## BsmtQual + BsmtCond + BsmtExposure + BsmtFinType1 + Heating +   
## CentralAir + KitchenQual + GarageFinish + PavedDrive + SaleCondition +   
## OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - Foundation 4 4.7326e+09 8.1666e+11 27922  
## - ExterCond 3 3.7366e+08 8.1230e+11 27922  
## - LandContour 3 8.6626e+08 8.1279e+11 27922  
## - BsmtCond 3 2.3241e+09 8.1425e+11 27925  
## - MasVnrType 3 2.8890e+09 8.1481e+11 27926  
## - Heating 3 3.4179e+09 8.1534e+11 27927  
## - PavedDrive 2 3.8020e+08 8.1230e+11 27929  
## - MSZoning 4 9.9673e+09 8.2189e+11 27930  
## - GarageFinish 2 3.5848e+09 8.1551e+11 27934  
## - TotRmsAbvGrd 1 1.9965e+07 8.1194e+11 27935  
## - OpenPorchSF 1 2.1390e+08 8.1214e+11 27936  
## - X1stFlrSF 1 1.2652e+09 8.1319e+11 27937  
## - LotConfig 4 1.5274e+10 8.2720e+11 27939  
## - GarageCars 1 2.9409e+09 8.1486e+11 27940  
## - LotShape 3 1.2038e+10 8.2396e+11 27941  
## - GarageArea 1 3.3849e+09 8.1531e+11 27941  
## - FullBath 1 3.5450e+09 8.1547e+11 27941  
## <none> 8.1192e+11 27943  
## - CentralAir 1 4.4370e+09 8.1636e+11 27943  
## - BsmtQual 3 1.8010e+10 8.2993e+11 27950  
## - KitchenQual 3 2.5574e+10 8.3750e+11 27963  
## - BsmtFinType1 5 3.5278e+10 8.4720e+11 27964  
## + Electrical 3 3.3147e+08 8.1159e+11 27964  
## + ExterQual 3 1.4091e+08 8.1178e+11 27964  
## + GarageType 5 7.8274e+09 8.0410e+11 27966  
## + HeatingQC 4 2.7983e+09 8.0913e+11 27967  
## + GarageCond 4 2.4757e+09 8.0945e+11 27967  
## + GarageQual 4 2.3675e+09 8.0956e+11 27967  
## + Functional 6 1.0950e+10 8.0097e+11 27968  
## - SaleCondition 5 3.8410e+10 8.5033e+11 27968  
## + RoofStyle 5 6.0951e+09 8.0583e+11 27969  
## - OverallCond 7 4.9020e+10 8.6094e+11 27971  
## - BldgType 4 4.0748e+10 8.5267e+11 27979  
## + Condition1 8 1.0501e+10 8.0142e+11 27983  
## - TotalBsmtSF 1 3.0164e+10 8.4209e+11 27984  
## + HouseStyle 7 3.4805e+09 8.0844e+11 27987  
## + SaleType 8 7.3085e+09 8.0462e+11 27988  
## - Neighborhood 24 1.4717e+11 9.5910e+11 27993  
## - BsmtExposure 3 4.6096e+10 8.5802e+11 27995  
## + Exterior1st 13 1.8262e+10 7.9366e+11 28006  
## + MSSubClass 13 1.1818e+10 8.0011e+11 28017  
## - Condition2 7 8.1189e+10 8.9311e+11 28020  
## + Exterior2nd 15 1.5243e+10 7.9668e+11 28025  
## - OverallQual 8 1.4021e+11 9.5213e+11 28098  
## - GrLivArea 1 1.2540e+11 9.3732e+11 28128  
## - RoofMatl 7 1.7877e+11 9.9069e+11 28159  
## + YearRemodAdd 60 4.7191e+10 7.6473e+11 28294  
## + GarageYrBlt 96 6.1231e+10 7.5069e+11 28529  
## + YearBuilt 106 7.3340e+10 7.3858e+11 28579  
##   
## Step: AIC=27921.53  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofMatl + MasVnrType + ExterCond + BsmtQual +   
## BsmtCond + BsmtExposure + BsmtFinType1 + Heating + CentralAir +   
## KitchenQual + GarageFinish + PavedDrive + SaleCondition +   
## OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - ExterCond 3 3.5738e+08 8.1701e+11 27901  
## - LandContour 3 8.5204e+08 8.1751e+11 27901  
## - BsmtCond 3 2.4447e+09 8.1910e+11 27904  
## - Heating 3 2.5575e+09 8.1921e+11 27904  
## - MasVnrType 3 3.0480e+09 8.1970e+11 27905  
## - PavedDrive 2 4.7855e+08 8.1713e+11 27908  
## - MSZoning 4 9.8431e+09 8.2650e+11 27909  
## - GarageFinish 2 3.9189e+09 8.2058e+11 27914  
## - TotRmsAbvGrd 1 5.0918e+07 8.1671e+11 27914  
## - OpenPorchSF 1 2.1908e+08 8.1688e+11 27915  
## - X1stFlrSF 1 1.5231e+09 8.1818e+11 27917  
## - LotConfig 4 1.5797e+10 8.3245e+11 27918  
## - LotShape 3 1.1409e+10 8.2807e+11 27919  
## - GarageCars 1 3.0448e+09 8.1970e+11 27919  
## - GarageArea 1 3.2466e+09 8.1990e+11 27920  
## - FullBath 1 3.5921e+09 8.2025e+11 27920  
## <none> 8.1666e+11 27922  
## - CentralAir 1 4.9867e+09 8.2164e+11 27923  
## - BsmtQual 3 1.8329e+10 8.3498e+11 27930  
## - KitchenQual 3 2.5815e+10 8.4247e+11 27942  
## + Foundation 4 4.7326e+09 8.1192e+11 27943  
## + ExterQual 3 2.7856e+08 8.1638e+11 27943  
## + Electrical 3 1.5398e+08 8.1650e+11 27943  
## - BsmtFinType1 5 3.6117e+10 8.5277e+11 27944  
## + GarageType 5 8.4350e+09 8.0822e+11 27944  
## + HeatingQC 4 2.4681e+09 8.1419e+11 27946  
## + GarageQual 4 2.4344e+09 8.1422e+11 27946  
## + GarageCond 4 2.2008e+09 8.1446e+11 27947  
## + RoofStyle 5 6.4937e+09 8.1016e+11 27947  
## + Functional 6 1.0576e+10 8.0608e+11 27947  
## - SaleCondition 5 3.8745e+10 8.5540e+11 27948  
## - OverallCond 7 4.9218e+10 8.6587e+11 27950  
## - BldgType 4 3.9330e+10 8.5599e+11 27956  
## + Condition1 8 1.0261e+10 8.0639e+11 27962  
## + HouseStyle 7 4.1648e+09 8.1249e+11 27965  
## - TotalBsmtSF 1 3.1882e+10 8.4854e+11 27966  
## + SaleType 8 7.3616e+09 8.0929e+11 27967  
## - Neighborhood 24 1.4829e+11 9.6495e+11 27972  
## - BsmtExposure 3 4.6764e+10 8.6342e+11 27975  
## + Exterior1st 13 1.6841e+10 7.9981e+11 27987  
## + MSSubClass 13 1.2456e+10 8.0420e+11 27995  
## - Condition2 7 8.1368e+10 8.9802e+11 27998  
## + Exterior2nd 15 1.4333e+10 8.0232e+11 28006  
## - OverallQual 8 1.4037e+11 9.5703e+11 28076  
## - GrLivArea 1 1.2756e+11 9.4421e+11 28109  
## - RoofMatl 7 1.7876e+11 9.9541e+11 28136  
## + YearRemodAdd 60 4.8060e+10 7.6860e+11 28272  
## + GarageYrBlt 96 6.0422e+10 7.5623e+11 28510  
## + YearBuilt 106 7.6035e+10 7.4062e+11 28554  
##   
## Step: AIC=27900.52  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LandContour + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofMatl + MasVnrType + BsmtQual + BsmtCond +   
## BsmtExposure + BsmtFinType1 + Heating + CentralAir + KitchenQual +   
## GarageFinish + PavedDrive + SaleCondition + OverallQual +   
## OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - LandContour 3 8.5535e+08 8.1787e+11 27880  
## - Heating 3 2.4936e+09 8.1951e+11 27883  
## - BsmtCond 3 2.8003e+09 8.1981e+11 27884  
## - MasVnrType 3 3.0773e+09 8.2009e+11 27884  
## - PavedDrive 2 4.7271e+08 8.1749e+11 27887  
## - MSZoning 4 9.8298e+09 8.2684e+11 27888  
## - GarageFinish 2 3.8807e+09 8.2089e+11 27893  
## - TotRmsAbvGrd 1 5.7792e+07 8.1707e+11 27893  
## - OpenPorchSF 1 2.1813e+08 8.1723e+11 27894  
## - X1stFlrSF 1 1.5442e+09 8.1856e+11 27896  
## - LotConfig 4 1.5688e+10 8.3270e+11 27897  
## - LotShape 3 1.1470e+10 8.2848e+11 27898  
## - GarageCars 1 3.1496e+09 8.2016e+11 27899  
## - GarageArea 1 3.1902e+09 8.2020e+11 27899  
## - FullBath 1 3.4173e+09 8.2043e+11 27899  
## <none> 8.1701e+11 27901  
## - CentralAir 1 4.8760e+09 8.2189e+11 27901  
## - BsmtQual 3 1.8411e+10 8.3542e+11 27909  
## - KitchenQual 3 2.5856e+10 8.4287e+11 27921  
## + ExterCond 3 3.5738e+08 8.1666e+11 27922  
## + Foundation 4 4.7163e+09 8.1230e+11 27922  
## + ExterQual 3 2.9665e+08 8.1672e+11 27922  
## + Electrical 3 1.4447e+08 8.1687e+11 27922  
## - BsmtFinType1 5 3.5887e+10 8.5290e+11 27922  
## + GarageType 5 8.5162e+09 8.0850e+11 27923  
## + HeatingQC 4 2.3988e+09 8.1461e+11 27925  
## + GarageQual 4 2.3714e+09 8.1464e+11 27925  
## + RoofStyle 5 6.4864e+09 8.1053e+11 27926  
## + GarageCond 4 2.0809e+09 8.1493e+11 27926  
## + Functional 6 1.0522e+10 8.0649e+11 27926  
## - SaleCondition 5 3.8820e+10 8.5583e+11 27927  
## - OverallCond 7 5.0385e+10 8.6740e+11 27930  
## - BldgType 4 3.9136e+10 8.5615e+11 27934  
## + Condition1 8 1.0358e+10 8.0666e+11 27941  
## + HouseStyle 7 4.1221e+09 8.1289e+11 27944  
## - TotalBsmtSF 1 3.1945e+10 8.4896e+11 27945  
## + SaleType 8 7.3182e+09 8.0970e+11 27946  
## - Neighborhood 24 1.4837e+11 9.6539e+11 27951  
## - BsmtExposure 3 4.6718e+10 8.6373e+11 27953  
## + Exterior1st 13 1.6827e+10 8.0019e+11 27966  
## + MSSubClass 13 1.2596e+10 8.0442e+11 27973  
## - Condition2 7 8.1170e+10 8.9818e+11 27977  
## + Exterior2nd 15 1.4305e+10 8.0271e+11 27985  
## - OverallQual 8 1.4025e+11 9.5726e+11 28055  
## - GrLivArea 1 1.2857e+11 9.4559e+11 28089  
## - RoofMatl 7 1.7895e+11 9.9596e+11 28115  
## + YearRemodAdd 60 4.7913e+10 7.6910e+11 28252  
## + GarageYrBlt 96 6.0525e+10 7.5649e+11 28489  
## + YearBuilt 106 7.5752e+10 7.4126e+11 28533  
##   
## Step: AIC=27880.32  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LotConfig + Neighborhood + Condition2 + BldgType +   
## RoofMatl + MasVnrType + BsmtQual + BsmtCond + BsmtExposure +   
## BsmtFinType1 + Heating + CentralAir + KitchenQual + GarageFinish +   
## PavedDrive + SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - Heating 3 2.6709e+09 8.2054e+11 27863  
## - BsmtCond 3 2.7612e+09 8.2063e+11 27863  
## - MasVnrType 3 3.2023e+09 8.2107e+11 27864  
## - PavedDrive 2 6.0829e+08 8.1848e+11 27867  
## - MSZoning 4 1.0281e+10 8.2815e+11 27868  
## - GarageFinish 2 3.8750e+09 8.2174e+11 27872  
## - TotRmsAbvGrd 1 4.0693e+07 8.1791e+11 27873  
## - OpenPorchSF 1 2.2839e+08 8.1810e+11 27874  
## - X1stFlrSF 1 1.7016e+09 8.1957e+11 27876  
## - LotShape 3 1.0817e+10 8.2869e+11 27876  
## - LotConfig 4 1.5823e+10 8.3369e+11 27877  
## - GarageCars 1 3.0974e+09 8.2097e+11 27878  
## - GarageArea 1 3.1031e+09 8.2097e+11 27878  
## - FullBath 1 3.7595e+09 8.2163e+11 27879  
## <none> 8.1787e+11 27880  
## - CentralAir 1 4.9960e+09 8.2286e+11 27881  
## - BsmtQual 3 1.8558e+10 8.3643e+11 27889  
## + LandContour 3 8.5535e+08 8.1701e+11 27901  
## - KitchenQual 3 2.6052e+10 8.4392e+11 27901  
## + ExterCond 3 3.6069e+08 8.1751e+11 27901  
## + Foundation 4 4.6964e+09 8.1317e+11 27901  
## + ExterQual 3 2.4025e+08 8.1763e+11 27902  
## + Electrical 3 1.6181e+08 8.1771e+11 27902  
## + GarageType 5 8.8196e+09 8.0905e+11 27902  
## - BsmtFinType1 5 3.5923e+10 8.5379e+11 27902  
## + HeatingQC 4 2.4864e+09 8.1538e+11 27905  
## + GarageQual 4 2.4255e+09 8.1544e+11 27905  
## + RoofStyle 5 6.5113e+09 8.1136e+11 27906  
## + GarageCond 4 2.0152e+09 8.1585e+11 27906  
## + Functional 6 1.0531e+10 8.0734e+11 27906  
## - SaleCondition 5 3.9227e+10 8.5710e+11 27907  
## - OverallCond 7 5.0519e+10 8.6839e+11 27910  
## - BldgType 4 3.9110e+10 8.5698e+11 27914  
## + Condition1 8 1.0059e+10 8.0781e+11 27921  
## + HouseStyle 7 4.2700e+09 8.1360e+11 27924  
## - TotalBsmtSF 1 3.2710e+10 8.5058e+11 27926  
## + SaleType 8 7.4477e+09 8.1042e+11 27926  
## - Neighborhood 24 1.4814e+11 9.6601e+11 27930  
## - BsmtExposure 3 4.7269e+10 8.6514e+11 27934  
## + Exterior1st 13 1.6511e+10 8.0136e+11 27947  
## + MSSubClass 13 1.2756e+10 8.0511e+11 27953  
## - Condition2 7 8.3741e+10 9.0161e+11 27961  
## + Exterior2nd 15 1.4103e+10 8.0377e+11 27965  
## - OverallQual 8 1.4344e+11 9.6130e+11 28039  
## - GrLivArea 1 1.2811e+11 9.4598e+11 28068  
## - RoofMatl 7 1.8337e+11 1.0012e+12 28101  
## + YearRemodAdd 60 4.8115e+10 7.6975e+11 28231  
## + GarageYrBlt 96 6.1078e+10 7.5679e+11 28468  
## + YearBuilt 106 7.5822e+10 7.4205e+11 28513  
##   
## Step: AIC=27863.09  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LotConfig + Neighborhood + Condition2 + BldgType +   
## RoofMatl + MasVnrType + BsmtQual + BsmtCond + BsmtExposure +   
## BsmtFinType1 + CentralAir + KitchenQual + GarageFinish +   
## PavedDrive + SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - BsmtCond 3 2.7163e+09 8.2326e+11 27846  
## - MasVnrType 3 3.1116e+09 8.2365e+11 27847  
## - PavedDrive 2 5.0130e+08 8.2104e+11 27850  
## - MSZoning 4 9.7143e+09 8.3025e+11 27850  
## - GarageFinish 2 3.7704e+09 8.2431e+11 27855  
## - TotRmsAbvGrd 1 7.6214e+07 8.2062e+11 27856  
## - OpenPorchSF 1 2.6999e+08 8.2081e+11 27856  
## - X1stFlrSF 1 1.9333e+09 8.2247e+11 27859  
## - LotShape 3 1.1221e+10 8.3176e+11 27860  
## - LotConfig 4 1.5766e+10 8.3631e+11 27860  
## - GarageArea 1 3.0130e+09 8.2355e+11 27861  
## - GarageCars 1 3.2809e+09 8.2382e+11 27861  
## - CentralAir 1 3.4989e+09 8.2404e+11 27862  
## - FullBath 1 3.9463e+09 8.2449e+11 27862  
## <none> 8.2054e+11 27863  
## - BsmtQual 3 1.8387e+10 8.3893e+11 27871  
## + Heating 3 2.6709e+09 8.1787e+11 27880  
## - KitchenQual 3 2.5738e+10 8.4628e+11 27883  
## + LandContour 3 1.0327e+09 8.1951e+11 27883  
## + Electrical 3 3.1156e+08 8.2023e+11 27884  
## + ExterCond 3 2.9316e+08 8.2025e+11 27884  
## + ExterQual 3 2.1701e+08 8.2032e+11 27884  
## + GarageType 5 8.6853e+09 8.1185e+11 27885  
## - BsmtFinType1 5 3.6441e+10 8.5698e+11 27885  
## + Foundation 4 3.8444e+09 8.1670e+11 27886  
## + HeatingQC 4 2.6088e+09 8.1793e+11 27888  
## + RoofStyle 5 6.5506e+09 8.1399e+11 27888  
## + GarageQual 4 1.9842e+09 8.1856e+11 27889  
## + Functional 6 1.0570e+10 8.0997e+11 27889  
## - SaleCondition 5 3.8850e+10 8.5939e+11 27889  
## + GarageCond 4 1.4826e+09 8.1906e+11 27890  
## - OverallCond 7 5.0425e+10 8.7096e+11 27893  
## - BldgType 4 3.9142e+10 8.5968e+11 27897  
## + Condition1 8 9.9529e+09 8.1059e+11 27904  
## + HouseStyle 7 4.1073e+09 8.1643e+11 27907  
## + SaleType 8 7.5543e+09 8.1299e+11 27908  
## - TotalBsmtSF 1 3.4231e+10 8.5477e+11 27911  
## - Neighborhood 24 1.4821e+11 9.6875e+11 27913  
## - BsmtExposure 3 4.7086e+10 8.6763e+11 27916  
## + Exterior1st 13 1.7530e+10 8.0301e+11 27928  
## + MSSubClass 13 1.2067e+10 8.0847e+11 27937  
## - Condition2 7 8.3972e+10 9.0451e+11 27943  
## + Exterior2nd 15 1.4601e+10 8.0594e+11 27947  
## - OverallQual 8 1.4266e+11 9.6320e+11 28020  
## - GrLivArea 1 1.3084e+11 9.5138e+11 28054  
## - RoofMatl 7 1.8534e+11 1.0059e+12 28085  
## + YearRemodAdd 60 4.7530e+10 7.7301e+11 28215  
## + GarageYrBlt 96 5.9092e+10 7.6145e+11 28454  
## + YearBuilt 107 7.5711e+10 7.4483e+11 28504  
##   
## Step: AIC=27845.92  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LotConfig + Neighborhood + Condition2 + BldgType +   
## RoofMatl + MasVnrType + BsmtQual + BsmtExposure + BsmtFinType1 +   
## CentralAir + KitchenQual + GarageFinish + PavedDrive + SaleCondition +   
## OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - MasVnrType 3 3.0192e+09 8.2628e+11 27829  
## - PavedDrive 2 5.4258e+08 8.2380e+11 27832  
## - MSZoning 4 9.6611e+09 8.3292e+11 27833  
## - GarageFinish 2 3.8242e+09 8.2708e+11 27838  
## - TotRmsAbvGrd 1 5.8422e+07 8.2331e+11 27839  
## - OpenPorchSF 1 2.9871e+08 8.2355e+11 27839  
## - X1stFlrSF 1 1.9723e+09 8.2523e+11 27842  
## - LotShape 3 1.1180e+10 8.3444e+11 27842  
## - LotConfig 4 1.5793e+10 8.3905e+11 27843  
## - GarageCars 1 3.1303e+09 8.2639e+11 27844  
## - GarageArea 1 3.1545e+09 8.2641e+11 27844  
## - FullBath 1 3.9312e+09 8.2719e+11 27845  
## - CentralAir 1 4.0871e+09 8.2734e+11 27845  
## <none> 8.2326e+11 27846  
## - BsmtQual 3 1.8264e+10 8.4152e+11 27854  
## + BsmtCond 3 2.7163e+09 8.2054e+11 27863  
## + Heating 3 2.6260e+09 8.2063e+11 27863  
## - KitchenQual 3 2.5790e+10 8.4905e+11 27866  
## + LandContour 3 9.6833e+08 8.2229e+11 27866  
## + ExterCond 3 6.0670e+08 8.2265e+11 27867  
## + ExterQual 3 1.6505e+08 8.2309e+11 27867  
## + GarageType 5 8.5198e+09 8.1474e+11 27868  
## + Foundation 4 3.8787e+09 8.1938e+11 27868  
## - BsmtFinType1 5 3.7489e+10 8.6075e+11 27870  
## + HeatingQC 4 2.6800e+09 8.2058e+11 27870  
## - SaleCondition 5 3.8294e+10 8.6155e+11 27871  
## + RoofStyle 5 6.4064e+09 8.1685e+11 27872  
## + GarageQual 4 1.9973e+09 8.2126e+11 27872  
## + GarageCond 4 1.6314e+09 8.2162e+11 27872  
## + Functional 6 1.0183e+10 8.1307e+11 27872  
## + Electrical 4 2.0548e+08 8.2305e+11 27874  
## - BldgType 4 3.8950e+10 8.6221e+11 27879  
## - OverallCond 7 5.3427e+10 8.7668e+11 27880  
## + Condition1 8 1.0039e+10 8.1322e+11 27887  
## + HouseStyle 7 4.0352e+09 8.1922e+11 27890  
## + SaleType 8 7.4502e+09 8.1581e+11 27891  
## - TotalBsmtSF 1 3.4560e+10 8.5782e+11 27894  
## - Neighborhood 24 1.4825e+11 9.7151e+11 27895  
## - BsmtExposure 3 4.7208e+10 8.7046e+11 27899  
## + Exterior1st 13 1.7989e+10 8.0527e+11 27910  
## + MSSubClass 13 1.2091e+10 8.1117e+11 27920  
## - Condition2 7 8.3844e+10 9.0710e+11 27925  
## + Exterior2nd 15 1.4605e+10 8.0865e+11 27930  
## - OverallQual 8 1.4300e+11 9.6626e+11 28003  
## - GrLivArea 1 1.2986e+11 9.5311e+11 28035  
## - RoofMatl 7 1.8568e+11 1.0089e+12 28068  
## + YearRemodAdd 60 4.8045e+10 7.7521e+11 28197  
## + GarageYrBlt 96 5.8739e+10 7.6452e+11 28438  
## + YearBuilt 107 7.6354e+10 7.4690e+11 28486  
##   
## Step: AIC=27829.22  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + MSZoning +   
## LotShape + LotConfig + Neighborhood + Condition2 + BldgType +   
## RoofMatl + BsmtQual + BsmtExposure + BsmtFinType1 + CentralAir +   
## KitchenQual + GarageFinish + PavedDrive + SaleCondition +   
## OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - MSZoning 4 8.6874e+09 8.3496e+11 27814  
## - PavedDrive 2 5.5954e+08 8.2683e+11 27816  
## - GarageFinish 2 4.1850e+09 8.3046e+11 27822  
## - TotRmsAbvGrd 1 3.4214e+07 8.2631e+11 27822  
## - OpenPorchSF 1 3.0249e+08 8.2658e+11 27823  
## - LotShape 3 1.0469e+10 8.3674e+11 27825  
## - X1stFlrSF 1 1.8327e+09 8.2811e+11 27825  
## - LotConfig 4 1.5561e+10 8.4184e+11 27825  
## - GarageArea 1 2.9890e+09 8.2926e+11 27827  
## - GarageCars 1 3.5456e+09 8.2982e+11 27828  
## - FullBath 1 3.9117e+09 8.3019e+11 27828  
## - CentralAir 1 4.1179e+09 8.3039e+11 27829  
## <none> 8.2628e+11 27829  
## - BsmtQual 3 1.8804e+10 8.4508e+11 27838  
## + MasVnrType 3 3.0192e+09 8.2326e+11 27846  
## + BsmtCond 3 2.6239e+09 8.2365e+11 27847  
## + Heating 3 2.5418e+09 8.2373e+11 27847  
## - KitchenQual 3 2.5624e+10 8.5190e+11 27849  
## + LandContour 3 1.0868e+09 8.2519e+11 27849  
## + ExterCond 3 6.4527e+08 8.2563e+11 27850  
## + ExterQual 3 1.9710e+08 8.2608e+11 27851  
## + GarageType 5 8.8634e+09 8.1741e+11 27851  
## + Foundation 4 4.0490e+09 8.2223e+11 27851  
## + HeatingQC 4 2.8931e+09 8.2338e+11 27853  
## + RoofStyle 5 6.5308e+09 8.1974e+11 27855  
## + GarageQual 4 1.9226e+09 8.2435e+11 27855  
## + Functional 6 1.0604e+10 8.1567e+11 27855  
## - BsmtFinType1 5 3.9213e+10 8.6549e+11 27855  
## + GarageCond 4 1.6139e+09 8.2466e+11 27855  
## - SaleCondition 5 4.0348e+10 8.6662e+11 27857  
## + Electrical 4 1.8149e+08 8.2609e+11 27858  
## - BldgType 4 3.7537e+10 8.6381e+11 27860  
## - OverallCond 7 5.3722e+10 8.8000e+11 27863  
## + Condition1 8 1.0109e+10 8.1617e+11 27870  
## + HouseStyle 7 4.1559e+09 8.2212e+11 27873  
## + SaleType 8 7.2121e+09 8.1906e+11 27875  
## - Neighborhood 24 1.4746e+11 9.7374e+11 27876  
## - TotalBsmtSF 1 3.4712e+10 8.6099e+11 27877  
## - BsmtExposure 3 4.8774e+10 8.7505e+11 27884  
## + Exterior1st 13 1.6592e+10 8.0968e+11 27896  
## + MSSubClass 13 1.1982e+10 8.1429e+11 27903  
## - Condition2 7 8.4213e+10 9.1049e+11 27909  
## + Exterior2nd 15 1.3659e+10 8.1262e+11 27915  
## - OverallQual 8 1.4529e+11 9.7157e+11 27989  
## - GrLivArea 1 1.2911e+11 9.5539e+11 28016  
## - RoofMatl 7 1.8463e+11 1.0109e+12 28049  
## + YearRemodAdd 60 4.8851e+10 7.7742e+11 28180  
## + GarageYrBlt 96 5.9469e+10 7.6681e+11 28420  
## + YearBuilt 107 7.8286e+10 7.4799e+11 28466  
##   
## Step: AIC=27814.42  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + LotShape +   
## LotConfig + Neighborhood + Condition2 + BldgType + RoofMatl +   
## BsmtQual + BsmtExposure + BsmtFinType1 + CentralAir + KitchenQual +   
## GarageFinish + PavedDrive + SaleCondition + OverallQual +   
## OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - PavedDrive 2 4.2963e+08 8.3539e+11 27801  
## - GarageFinish 2 4.1383e+09 8.3910e+11 27807  
## - TotRmsAbvGrd 1 1.3785e+08 8.3510e+11 27807  
## - OpenPorchSF 1 3.4786e+08 8.3531e+11 27808  
## - LotShape 3 1.0639e+10 8.4560e+11 27810  
## - X1stFlrSF 1 2.1682e+09 8.3713e+11 27811  
## - LotConfig 4 1.6034e+10 8.5100e+11 27811  
## - GarageArea 1 2.7029e+09 8.3767e+11 27812  
## - GarageCars 1 3.2756e+09 8.3824e+11 27813  
## - FullBath 1 4.2268e+09 8.3919e+11 27814  
## <none> 8.3496e+11 27814  
## - CentralAir 1 4.6675e+09 8.3963e+11 27815  
## - BsmtQual 3 1.8738e+10 8.5370e+11 27823  
## + MSZoning 4 8.6874e+09 8.2628e+11 27829  
## + BsmtCond 3 2.5606e+09 8.3240e+11 27832  
## - KitchenQual 3 2.5146e+10 8.6011e+11 27833  
## + MasVnrType 3 2.0455e+09 8.3292e+11 27833  
## + Heating 3 2.0381e+09 8.3292e+11 27833  
## + LandContour 3 1.4830e+09 8.3348e+11 27834  
## + ExterCond 3 6.1659e+08 8.3435e+11 27835  
## + ExterQual 3 3.3326e+08 8.3463e+11 27836  
## + GarageType 5 8.6015e+09 8.2636e+11 27837  
## + Foundation 4 3.9082e+09 8.3105e+11 27837  
## + HeatingQC 4 2.9620e+09 8.3200e+11 27839  
## + GarageQual 4 2.0785e+09 8.3288e+11 27840  
## + GarageCond 4 1.6942e+09 8.3327e+11 27841  
## + Functional 6 1.0605e+10 8.2436e+11 27841  
## - SaleCondition 5 3.9629e+10 8.7459e+11 27841  
## + RoofStyle 5 6.0223e+09 8.2894e+11 27841  
## + Electrical 4 2.1595e+08 8.3475e+11 27843  
## - BsmtFinType1 5 4.1366e+10 8.7633e+11 27843  
## - BldgType 4 3.8975e+10 8.7394e+11 27847  
## - OverallCond 7 5.4320e+10 8.8928e+11 27848  
## + Condition1 8 1.0480e+10 8.2448e+11 27855  
## + HouseStyle 7 4.9052e+09 8.3006e+11 27857  
## + SaleType 8 7.4050e+09 8.2756e+11 27860  
## - TotalBsmtSF 1 3.4257e+10 8.6922e+11 27861  
## - BsmtExposure 3 4.8349e+10 8.8331e+11 27868  
## - Neighborhood 24 1.5972e+11 9.9468e+11 27876  
## + Exterior1st 13 1.6336e+10 8.1863e+11 27882  
## + MSSubClass 13 1.2352e+10 8.2261e+11 27888  
## - Condition2 7 8.4076e+10 9.1904e+11 27893  
## + Exterior2nd 15 1.2597e+10 8.2237e+11 27902  
## - OverallQual 8 1.4494e+11 9.7990e+11 27971  
## - GrLivArea 1 1.3453e+11 9.6949e+11 28007  
## - RoofMatl 7 1.8364e+11 1.0186e+12 28030  
## + YearRemodAdd 60 4.9709e+10 7.8525e+11 28164  
## + GarageYrBlt 96 6.3314e+10 7.7165e+11 28400  
## + YearBuilt 107 7.7914e+10 7.5705e+11 28454  
##   
## Step: AIC=27800.71  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + LotShape +   
## LotConfig + Neighborhood + Condition2 + BldgType + RoofMatl +   
## BsmtQual + BsmtExposure + BsmtFinType1 + CentralAir + KitchenQual +   
## GarageFinish + SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - GarageFinish 2 4.1339e+09 8.3953e+11 27793  
## - TotRmsAbvGrd 1 1.5540e+08 8.3555e+11 27794  
## - OpenPorchSF 1 3.7628e+08 8.3577e+11 27794  
## - LotShape 3 1.0597e+10 8.4599e+11 27796  
## - X1stFlrSF 1 2.2025e+09 8.3759e+11 27797  
## - LotConfig 4 1.6096e+10 8.5149e+11 27798  
## - GarageArea 1 2.8920e+09 8.3828e+11 27798  
## - GarageCars 1 3.2432e+09 8.3864e+11 27799  
## - FullBath 1 4.2815e+09 8.3967e+11 27800  
## <none> 8.3539e+11 27801  
## - CentralAir 1 4.9982e+09 8.4039e+11 27802  
## - BsmtQual 3 1.8857e+10 8.5425e+11 27809  
## + PavedDrive 2 4.2963e+08 8.3496e+11 27814  
## + MSZoning 4 8.5575e+09 8.2683e+11 27816  
## + BsmtCond 3 2.6098e+09 8.3278e+11 27818  
## - KitchenQual 3 2.5208e+10 8.6060e+11 27819  
## + MasVnrType 3 2.0741e+09 8.3332e+11 27819  
## + Heating 3 1.9796e+09 8.3341e+11 27819  
## + LandContour 3 1.6127e+09 8.3378e+11 27820  
## + ExterCond 3 6.1307e+08 8.3478e+11 27821  
## + ExterQual 3 3.5529e+08 8.3504e+11 27822  
## + GarageType 5 8.7598e+09 8.2663e+11 27823  
## + Foundation 4 4.0536e+09 8.3134e+11 27823  
## + HeatingQC 4 2.9699e+09 8.3242e+11 27825  
## + GarageQual 4 2.1215e+09 8.3327e+11 27826  
## + GarageCond 4 1.9282e+09 8.3346e+11 27826  
## - SaleCondition 5 3.9576e+10 8.7497e+11 27827  
## + Functional 6 1.0314e+10 8.2508e+11 27827  
## + RoofStyle 5 5.8168e+09 8.2958e+11 27827  
## + Electrical 4 1.9705e+08 8.3520e+11 27829  
## - BsmtFinType1 5 4.2733e+10 8.7813e+11 27832  
## - BldgType 4 3.8926e+10 8.7432e+11 27833  
## - OverallCond 7 5.4258e+10 8.8965e+11 27835  
## + Condition1 8 1.0469e+10 8.2492e+11 27841  
## + HouseStyle 7 4.8003e+09 8.3059e+11 27843  
## + SaleType 8 7.2858e+09 8.2811e+11 27847  
## - TotalBsmtSF 1 3.4380e+10 8.6977e+11 27848  
## - BsmtExposure 3 4.8140e+10 8.8353e+11 27854  
## - Neighborhood 24 1.6168e+11 9.9708e+11 27865  
## + Exterior1st 13 1.6270e+10 8.1912e+11 27868  
## + MSSubClass 13 1.2510e+10 8.2288e+11 27874  
## - Condition2 7 8.4261e+10 9.1965e+11 27879  
## + Exterior2nd 15 1.2598e+10 8.2279e+11 27888  
## - OverallQual 8 1.4526e+11 9.8066e+11 27958  
## - GrLivArea 1 1.3471e+11 9.7010e+11 27994  
## - RoofMatl 7 1.8400e+11 1.0194e+12 28017  
## + YearRemodAdd 60 4.9881e+10 7.8551e+11 28150  
## + GarageYrBlt 96 6.2965e+10 7.7243e+11 28387  
## + YearBuilt 107 7.8216e+10 7.5718e+11 28439  
##   
## Step: AIC=27792.92  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## TotRmsAbvGrd + GarageCars + GarageArea + OpenPorchSF + LotShape +   
## LotConfig + Neighborhood + Condition2 + BldgType + RoofMatl +   
## BsmtQual + BsmtExposure + BsmtFinType1 + CentralAir + KitchenQual +   
## SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - TotRmsAbvGrd 1 1.2736e+08 8.3965e+11 27786  
## - OpenPorchSF 1 4.1893e+08 8.3995e+11 27786  
## - LotShape 3 1.0954e+10 8.5048e+11 27789  
## - LotConfig 4 1.5872e+10 8.5540e+11 27789  
## - X1stFlrSF 1 2.3358e+09 8.4186e+11 27789  
## - GarageArea 1 2.6584e+09 8.4218e+11 27790  
## - GarageCars 1 3.6320e+09 8.4316e+11 27792  
## - FullBath 1 4.3842e+09 8.4391e+11 27793  
## <none> 8.3953e+11 27793  
## - CentralAir 1 5.4223e+09 8.4495e+11 27794  
## + GarageFinish 2 4.1339e+09 8.3539e+11 27801  
## - BsmtQual 3 2.0668e+10 8.6019e+11 27804  
## + PavedDrive 2 4.2525e+08 8.3910e+11 27807  
## + MSZoning 4 8.5114e+09 8.3101e+11 27808  
## + BsmtCond 3 2.6594e+09 8.3687e+11 27810  
## + MasVnrType 3 2.3167e+09 8.3721e+11 27811  
## + Heating 3 1.8765e+09 8.3765e+11 27812  
## + LandContour 3 1.5542e+09 8.3797e+11 27812  
## + GarageType 5 1.0175e+10 8.2935e+11 27813  
## + ExterCond 3 5.8190e+08 8.3894e+11 27814  
## + ExterQual 3 3.4576e+08 8.3918e+11 27814  
## - KitchenQual 3 2.7224e+10 8.6675e+11 27814  
## + Foundation 4 4.3739e+09 8.3515e+11 27815  
## + HeatingQC 4 3.4386e+09 8.3609e+11 27816  
## + GarageQual 4 2.2010e+09 8.3733e+11 27818  
## + GarageCond 4 2.1652e+09 8.3736e+11 27818  
## + RoofStyle 5 6.4543e+09 8.3307e+11 27819  
## - SaleCondition 5 3.9954e+10 8.7948e+11 27819  
## + Functional 6 1.0367e+10 8.2916e+11 27820  
## + Electrical 4 1.7748e+08 8.3935e+11 27821  
## - OverallCond 7 5.3872e+10 8.9340e+11 27826  
## - BldgType 4 4.0139e+10 8.7967e+11 27827  
## - BsmtFinType1 5 4.5300e+10 8.8483e+11 27827  
## + Condition1 8 1.0957e+10 8.2857e+11 27833  
## + HouseStyle 7 5.2453e+09 8.3428e+11 27835  
## + SaleType 8 7.8408e+09 8.3169e+11 27838  
## - TotalBsmtSF 1 3.4539e+10 8.7407e+11 27840  
## - BsmtExposure 3 4.8633e+10 8.8816e+11 27847  
## - Neighborhood 24 1.6094e+11 1.0005e+12 27855  
## + Exterior1st 13 1.7015e+10 8.2251e+11 27859  
## + MSSubClass 13 1.4053e+10 8.2547e+11 27864  
## - Condition2 7 8.3804e+10 9.2333e+11 27870  
## + Exterior2nd 15 1.2244e+10 8.2728e+11 27881  
## - OverallQual 8 1.5054e+11 9.9006e+11 27956  
## - GrLivArea 1 1.3627e+11 9.7580e+11 27987  
## - RoofMatl 7 1.8382e+11 1.0233e+12 28008  
## + YearRemodAdd 60 5.0581e+10 7.8895e+11 28142  
## + GarageYrBlt 96 6.2825e+10 7.7670e+11 28380  
## + YearBuilt 107 7.9796e+10 7.5973e+11 28430  
##   
## Step: AIC=27785.93  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## GarageCars + GarageArea + OpenPorchSF + LotShape + LotConfig +   
## Neighborhood + Condition2 + BldgType + RoofMatl + BsmtQual +   
## BsmtExposure + BsmtFinType1 + CentralAir + KitchenQual +   
## SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - OpenPorchSF 1 4.1973e+08 8.4007e+11 27779  
## - LotShape 3 1.1011e+10 8.5066e+11 27782  
## - LotConfig 4 1.5955e+10 8.5561e+11 27782  
## - X1stFlrSF 1 2.3244e+09 8.4198e+11 27782  
## - GarageArea 1 2.7832e+09 8.4244e+11 27783  
## - GarageCars 1 3.5436e+09 8.4320e+11 27784  
## - FullBath 1 4.2669e+09 8.4392e+11 27786  
## <none> 8.3965e+11 27786  
## - CentralAir 1 5.4582e+09 8.4511e+11 27787  
## + TotRmsAbvGrd 1 1.2736e+08 8.3953e+11 27793  
## + GarageFinish 2 4.1059e+09 8.3555e+11 27794  
## - BsmtQual 3 2.0700e+10 8.6035e+11 27797  
## + PavedDrive 2 4.4128e+08 8.3921e+11 27800  
## + MSZoning 4 8.6074e+09 8.3105e+11 27801  
## + BsmtCond 3 2.6394e+09 8.3701e+11 27803  
## + MasVnrType 3 2.2768e+09 8.3738e+11 27804  
## + Heating 3 1.9099e+09 8.3774e+11 27805  
## + LandContour 3 1.5246e+09 8.3813e+11 27805  
## + GarageType 5 1.0205e+10 8.2945e+11 27806  
## + ExterCond 3 5.8872e+08 8.3906e+11 27807  
## + ExterQual 3 3.2304e+08 8.3933e+11 27807  
## - KitchenQual 3 2.7213e+10 8.6687e+11 27807  
## + Foundation 4 4.4238e+09 8.3523e+11 27808  
## + HeatingQC 4 3.4176e+09 8.3624e+11 27809  
## + GarageQual 4 2.2259e+09 8.3743e+11 27811  
## + GarageCond 4 2.1990e+09 8.3745e+11 27811  
## + RoofStyle 5 6.4883e+09 8.3317e+11 27812  
## - SaleCondition 5 3.9845e+10 8.7950e+11 27812  
## + Functional 6 1.0174e+10 8.2948e+11 27813  
## + Electrical 4 1.7814e+08 8.3948e+11 27814  
## - OverallCond 7 5.3753e+10 8.9341e+11 27819  
## - BldgType 4 4.0117e+10 8.7977e+11 27820  
## - BsmtFinType1 5 4.5583e+10 8.8524e+11 27821  
## + Condition1 8 1.0952e+10 8.2870e+11 27826  
## + HouseStyle 7 5.2748e+09 8.3438e+11 27828  
## + SaleType 8 7.8141e+09 8.3184e+11 27831  
## - TotalBsmtSF 1 3.4901e+10 8.7456e+11 27833  
## - BsmtExposure 3 4.9336e+10 8.8899e+11 27841  
## - Neighborhood 24 1.6169e+11 1.0013e+12 27849  
## + Exterior1st 13 1.7025e+10 8.2263e+11 27852  
## + MSSubClass 13 1.4047e+10 8.2561e+11 27857  
## - Condition2 7 8.3736e+10 9.2339e+11 27863  
## + Exterior2nd 15 1.2349e+10 8.2730e+11 27874  
## - OverallQual 8 1.5053e+11 9.9018e+11 27949  
## - RoofMatl 7 1.8410e+11 1.0238e+12 28001  
## - GrLivArea 1 2.4027e+11 1.0799e+12 28116  
## + YearRemodAdd 60 5.0648e+10 7.8901e+11 28135  
## + GarageYrBlt 96 6.2952e+10 7.7670e+11 28373  
## + YearBuilt 107 7.9828e+10 7.5983e+11 28423  
##   
## Step: AIC=27779.4  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## GarageCars + GarageArea + LotShape + LotConfig + Neighborhood +   
## Condition2 + BldgType + RoofMatl + BsmtQual + BsmtExposure +   
## BsmtFinType1 + CentralAir + KitchenQual + SaleCondition +   
## OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - LotShape 3 1.0942e+10 8.5102e+11 27775  
## - X1stFlrSF 1 2.2856e+09 8.4236e+11 27776  
## - LotConfig 4 1.6021e+10 8.5609e+11 27776  
## - GarageArea 1 2.8607e+09 8.4293e+11 27777  
## - GarageCars 1 3.4848e+09 8.4356e+11 27778  
## - FullBath 1 4.3875e+09 8.4446e+11 27779  
## <none> 8.4007e+11 27779  
## - CentralAir 1 5.2766e+09 8.4535e+11 27781  
## + OpenPorchSF 1 4.1973e+08 8.3965e+11 27786  
## + TotRmsAbvGrd 1 1.2817e+08 8.3995e+11 27786  
## + GarageFinish 2 4.1502e+09 8.3592e+11 27787  
## - BsmtQual 3 2.1055e+10 8.6113e+11 27791  
## + PavedDrive 2 4.7345e+08 8.3960e+11 27793  
## + MSZoning 4 8.6134e+09 8.3146e+11 27794  
## + BsmtCond 3 2.6836e+09 8.3739e+11 27797  
## + MasVnrType 3 2.2940e+09 8.3778e+11 27797  
## + Heating 3 1.9616e+09 8.3811e+11 27798  
## + LandContour 3 1.5600e+09 8.3851e+11 27799  
## + GarageType 5 1.0187e+10 8.2989e+11 27799  
## + ExterCond 3 6.0271e+08 8.3947e+11 27800  
## + ExterQual 3 3.5452e+08 8.3972e+11 27800  
## - KitchenQual 3 2.7325e+10 8.6740e+11 27801  
## + Foundation 4 4.4719e+09 8.3560e+11 27801  
## + HeatingQC 4 3.4749e+09 8.3660e+11 27803  
## + GarageQual 4 2.3394e+09 8.3773e+11 27805  
## + GarageCond 4 2.2640e+09 8.3781e+11 27805  
## + RoofStyle 5 6.2023e+09 8.3387e+11 27806  
## - SaleCondition 5 3.9961e+10 8.8003e+11 27806  
## + Functional 6 1.0217e+10 8.2986e+11 27806  
## + Electrical 4 1.6688e+08 8.3991e+11 27808  
## - OverallCond 7 5.3961e+10 8.9403e+11 27812  
## - BldgType 4 4.0607e+10 8.8068e+11 27814  
## - BsmtFinType1 5 4.5886e+10 8.8596e+11 27815  
## + Condition1 8 1.1094e+10 8.2898e+11 27819  
## + HouseStyle 7 5.5066e+09 8.3457e+11 27821  
## + SaleType 8 7.7594e+09 8.3231e+11 27825  
## - TotalBsmtSF 1 3.4957e+10 8.7503e+11 27827  
## - BsmtExposure 3 4.9182e+10 8.8926e+11 27834  
## - Neighborhood 24 1.6128e+11 1.0014e+12 27842  
## + Exterior1st 13 1.6795e+10 8.2328e+11 27846  
## + MSSubClass 13 1.4466e+10 8.2561e+11 27850  
## - Condition2 7 8.3830e+10 9.2390e+11 27856  
## + Exterior2nd 15 1.2316e+10 8.2776e+11 27868  
## - OverallQual 8 1.5039e+11 9.9046e+11 27942  
## - RoofMatl 7 1.8442e+11 1.0245e+12 27995  
## - GrLivArea 1 2.4719e+11 1.0873e+12 28118  
## + YearRemodAdd 60 5.1068e+10 7.8901e+11 28127  
## + GarageYrBlt 96 6.3253e+10 7.7682e+11 28366  
## + YearBuilt 107 8.0248e+10 7.5983e+11 28415  
##   
## Step: AIC=27775.12  
## SalePrice ~ TotalBsmtSF + X1stFlrSF + GrLivArea + FullBath +   
## GarageCars + GarageArea + LotConfig + Neighborhood + Condition2 +   
## BldgType + RoofMatl + BsmtQual + BsmtExposure + BsmtFinType1 +   
## CentralAir + KitchenQual + SaleCondition + OverallQual +   
## OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - X1stFlrSF 1 2.3834e+09 8.5340e+11 27772  
## - GarageArea 1 2.7164e+09 8.5373e+11 27772  
## - GarageCars 1 3.8251e+09 8.5484e+11 27774  
## <none> 8.5102e+11 27775  
## - FullBath 1 4.8368e+09 8.5585e+11 27776  
## - LotConfig 4 1.8760e+10 8.6978e+11 27776  
## - CentralAir 1 4.8707e+09 8.5589e+11 27776  
## + LotShape 3 1.0942e+10 8.4007e+11 27779  
## + OpenPorchSF 1 3.5068e+08 8.5066e+11 27782  
## + TotRmsAbvGrd 1 1.8470e+08 8.5083e+11 27782  
## + GarageFinish 2 4.4830e+09 8.4653e+11 27783  
## - BsmtQual 3 2.1291e+10 8.7231e+11 27787  
## + PavedDrive 2 4.2956e+08 8.5059e+11 27789  
## + MSZoning 4 8.8640e+09 8.4215e+11 27790  
## + GarageType 5 1.1695e+10 8.3932e+11 27793  
## + BsmtCond 3 2.5263e+09 8.4849e+11 27793  
## + Heating 3 2.2531e+09 8.4876e+11 27793  
## + MasVnrType 3 1.6122e+09 8.4940e+11 27794  
## + ExterCond 3 6.3501e+08 8.5038e+11 27796  
## + ExterQual 3 5.1439e+08 8.5050e+11 27796  
## + LandContour 3 4.5741e+08 8.5056e+11 27796  
## - KitchenQual 3 2.7739e+10 8.7875e+11 27797  
## + Foundation 4 3.7756e+09 8.4724e+11 27798  
## + HeatingQC 4 3.6564e+09 8.4736e+11 27798  
## + GarageQual 4 2.8730e+09 8.4814e+11 27799  
## - SaleCondition 5 3.9339e+10 8.9035e+11 27800  
## + GarageCond 4 2.4034e+09 8.4861e+11 27800  
## + Functional 6 1.1185e+10 8.3983e+11 27801  
## + RoofStyle 5 6.4465e+09 8.4457e+11 27801  
## + Electrical 4 7.6932e+07 8.5094e+11 27804  
## - OverallCond 7 5.3794e+10 9.0481e+11 27807  
## - BldgType 4 4.0747e+10 8.9176e+11 27809  
## - BsmtFinType1 5 4.6114e+10 8.9713e+11 27810  
## + Condition1 8 1.1122e+10 8.3989e+11 27815  
## + HouseStyle 7 5.6957e+09 8.4532e+11 27817  
## + SaleType 8 8.1397e+09 8.4288e+11 27820  
## - TotalBsmtSF 1 3.5636e+10 8.8665e+11 27823  
## - BsmtExposure 3 5.0689e+10 9.0170e+11 27831  
## - Neighborhood 24 1.6421e+11 1.0152e+12 27839  
## + Exterior1st 13 1.8393e+10 8.3262e+11 27840  
## + MSSubClass 13 1.5429e+10 8.3559e+11 27844  
## - Condition2 7 8.4878e+10 9.3589e+11 27852  
## + Exterior2nd 15 1.3442e+10 8.3757e+11 27862  
## - OverallQual 8 1.5000e+11 1.0010e+12 27935  
## - RoofMatl 7 1.8144e+11 1.0325e+12 27984  
## - GrLivArea 1 2.4854e+11 1.0996e+12 28111  
## + YearRemodAdd 60 5.3901e+10 7.9711e+11 28120  
## + GarageYrBlt 96 6.5674e+10 7.8534e+11 28359  
## + YearBuilt 107 8.3199e+10 7.6782e+11 28408  
##   
## Step: AIC=27771.67  
## SalePrice ~ TotalBsmtSF + GrLivArea + FullBath + GarageCars +   
## GarageArea + LotConfig + Neighborhood + Condition2 + BldgType +   
## RoofMatl + BsmtQual + BsmtExposure + BsmtFinType1 + CentralAir +   
## KitchenQual + SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - GarageArea 1 2.2413e+09 8.5564e+11 27768  
## - GarageCars 1 4.1314e+09 8.5753e+11 27771  
## - LotConfig 4 1.8498e+10 8.7190e+11 27772  
## <none> 8.5340e+11 27772  
## - FullBath 1 4.6019e+09 8.5800e+11 27772  
## - CentralAir 1 4.7173e+09 8.5812e+11 27772  
## + X1stFlrSF 1 2.3834e+09 8.5102e+11 27775  
## + LotShape 3 1.1040e+10 8.4236e+11 27776  
## + OpenPorchSF 1 3.1413e+08 8.5308e+11 27778  
## + TotRmsAbvGrd 1 1.7121e+08 8.5323e+11 27779  
## + GarageFinish 2 4.6208e+09 8.4878e+11 27779  
## - BsmtQual 3 2.1603e+10 8.7500e+11 27784  
## + PavedDrive 2 4.6117e+08 8.5294e+11 27785  
## + MSZoning 4 9.2600e+09 8.4414e+11 27786  
## + GarageType 5 1.2318e+10 8.4108e+11 27788  
## + BsmtCond 3 2.5627e+09 8.5084e+11 27789  
## + Heating 3 2.5014e+09 8.5090e+11 27789  
## + MasVnrType 3 1.4962e+09 8.5190e+11 27791  
## + ExterCond 3 6.5088e+08 8.5275e+11 27792  
## + ExterQual 3 6.3164e+08 8.5277e+11 27792  
## + LandContour 3 5.7455e+08 8.5282e+11 27792  
## - KitchenQual 3 2.7868e+10 8.8127e+11 27793  
## + Foundation 4 4.0972e+09 8.4930e+11 27794  
## + Functional 6 1.2784e+10 8.4061e+11 27795  
## + HeatingQC 4 3.6919e+09 8.4971e+11 27795  
## - SaleCondition 5 3.8874e+10 8.9227e+11 27795  
## + GarageQual 4 2.7616e+09 8.5064e+11 27796  
## + GarageCond 4 2.3873e+09 8.5101e+11 27797  
## + RoofStyle 5 6.1668e+09 8.4723e+11 27798  
## + Electrical 4 1.0778e+08 8.5329e+11 27800  
## - OverallCond 7 5.3255e+10 9.0665e+11 27802  
## - BldgType 4 3.9668e+10 8.9307e+11 27804  
## - BsmtFinType1 5 4.5452e+10 8.9885e+11 27805  
## + Condition1 8 1.0913e+10 8.4249e+11 27812  
## + HouseStyle 7 4.6220e+09 8.4878e+11 27815  
## + SaleType 8 8.2107e+09 8.4519e+11 27816  
## - BsmtExposure 3 4.9924e+10 9.0332e+11 27826  
## + Exterior1st 13 1.8204e+10 8.3519e+11 27836  
## + MSSubClass 13 1.6889e+10 8.3651e+11 27839  
## - Neighborhood 24 1.6806e+11 1.0215e+12 27840  
## - Condition2 7 8.3813e+10 9.3721e+11 27847  
## - TotalBsmtSF 1 6.0022e+10 9.1342e+11 27856  
## + Exterior2nd 15 1.3562e+10 8.3984e+11 27858  
## - OverallQual 8 1.5267e+11 1.0061e+12 27934  
## - RoofMatl 7 1.8200e+11 1.0354e+12 27980  
## + YearRemodAdd 60 5.3704e+10 7.9969e+11 28117  
## - GrLivArea 1 2.5755e+11 1.1110e+12 28118  
## + GarageYrBlt 96 6.4696e+10 7.8870e+11 28357  
## + YearBuilt 107 8.3270e+10 7.7013e+11 28405  
##   
## Step: AIC=27767.98  
## SalePrice ~ TotalBsmtSF + GrLivArea + FullBath + GarageCars +   
## LotConfig + Neighborhood + Condition2 + BldgType + RoofMatl +   
## BsmtQual + BsmtExposure + BsmtFinType1 + CentralAir + KitchenQual +   
## SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - FullBath 1 4.5758e+09 8.6022e+11 27768  
## <none> 8.5564e+11 27768  
## - LotConfig 4 1.9060e+10 8.7470e+11 27769  
## - CentralAir 1 5.0683e+09 8.6071e+11 27769  
## + GarageArea 1 2.2413e+09 8.5340e+11 27772  
## + X1stFlrSF 1 1.9084e+09 8.5373e+11 27772  
## + LotShape 3 1.0897e+10 8.4474e+11 27772  
## + OpenPorchSF 1 3.7898e+08 8.5526e+11 27775  
## + TotRmsAbvGrd 1 2.9732e+08 8.5534e+11 27775  
## + GarageFinish 2 4.3597e+09 8.5128e+11 27776  
## - BsmtQual 3 2.1802e+10 8.7744e+11 27780  
## + PavedDrive 2 6.4464e+08 8.5500e+11 27781  
## + MSZoning 4 8.9724e+09 8.4667e+11 27783  
## + BsmtCond 3 2.7128e+09 8.5293e+11 27785  
## + Heating 3 2.4349e+09 8.5320e+11 27786  
## + GarageType 5 1.1156e+10 8.4448e+11 27786  
## + MasVnrType 3 1.4273e+09 8.5421e+11 27787  
## + ExterCond 3 6.1325e+08 8.5503e+11 27789  
## + ExterQual 3 5.8668e+08 8.5505e+11 27789  
## + LandContour 3 5.0406e+08 8.5514e+11 27789  
## - KitchenQual 3 2.8000e+10 8.8364e+11 27790  
## + Foundation 4 4.1119e+09 8.5153e+11 27790  
## + GarageQual 4 3.6173e+09 8.5202e+11 27791  
## + HeatingQC 4 3.5257e+09 8.5211e+11 27791  
## - SaleCondition 5 3.8902e+10 8.9454e+11 27792  
## + GarageCond 4 3.1561e+09 8.5248e+11 27792  
## + Functional 6 1.2270e+10 8.4337e+11 27792  
## - GarageCars 1 2.1179e+10 8.7682e+11 27794  
## + RoofStyle 5 6.1256e+09 8.4951e+11 27794  
## + Electrical 4 1.4150e+08 8.5550e+11 27797  
## - OverallCond 7 5.3697e+10 9.0934e+11 27799  
## - BldgType 4 4.0758e+10 8.9640e+11 27802  
## - BsmtFinType1 5 4.7484e+10 9.0312e+11 27804  
## + Condition1 8 1.0829e+10 8.4481e+11 27809  
## + HouseStyle 7 4.6694e+09 8.5097e+11 27811  
## + SaleType 8 8.0904e+09 8.4755e+11 27813  
## - BsmtExposure 3 5.0183e+10 9.0582e+11 27823  
## + Exterior1st 13 1.7643e+10 8.3800e+11 27834  
## + MSSubClass 13 1.7309e+10 8.3833e+11 27834  
## - Neighborhood 24 1.6803e+11 1.0237e+12 27835  
## - Condition2 7 8.2455e+10 9.3809e+11 27841  
## - TotalBsmtSF 1 6.2227e+10 9.1787e+11 27855  
## + Exterior2nd 15 1.3071e+10 8.4257e+11 27855  
## - OverallQual 8 1.5137e+11 1.0070e+12 27929  
## - RoofMatl 7 1.8049e+11 1.0361e+12 27974  
## + YearRemodAdd 60 5.4677e+10 8.0096e+11 28112  
## - GrLivArea 1 2.6202e+11 1.1177e+12 28119  
## + GarageYrBlt 96 6.4813e+10 7.9083e+11 28354  
## + YearBuilt 107 8.4270e+10 7.7137e+11 28400  
##   
## Step: AIC=27767.92  
## SalePrice ~ TotalBsmtSF + GrLivArea + GarageCars + LotConfig +   
## Neighborhood + Condition2 + BldgType + RoofMatl + BsmtQual +   
## BsmtExposure + BsmtFinType1 + CentralAir + KitchenQual +   
## SaleCondition + OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - LotConfig 4 1.7355e+10 8.7757e+11 27766  
## <none> 8.6022e+11 27768  
## + FullBath 1 4.5758e+09 8.5564e+11 27768  
## - CentralAir 1 4.7505e+09 8.6497e+11 27768  
## + GarageArea 1 2.2152e+09 8.5800e+11 27772  
## + LotShape 3 1.1330e+10 8.4889e+11 27772  
## + X1stFlrSF 1 1.7031e+09 8.5851e+11 27773  
## + OpenPorchSF 1 4.9813e+08 8.5972e+11 27774  
## + TotRmsAbvGrd 1 7.7849e+07 8.6014e+11 27775  
## + GarageFinish 2 4.5289e+09 8.5569e+11 27775  
## - BsmtQual 3 2.1660e+10 8.8188e+11 27780  
## + PavedDrive 2 6.7748e+08 8.5954e+11 27781  
## + MSZoning 4 9.1514e+09 8.5106e+11 27782  
## + BsmtCond 3 2.7309e+09 8.5748e+11 27785  
## + Heating 3 2.6194e+09 8.5760e+11 27785  
## + GarageType 5 1.1395e+10 8.4882e+11 27786  
## + MasVnrType 3 1.3327e+09 8.5888e+11 27787  
## - KitchenQual 3 2.6937e+10 8.8715e+11 27788  
## + LandContour 3 7.9055e+08 8.5943e+11 27788  
## + ExterQual 3 6.6596e+08 8.5955e+11 27789  
## + ExterCond 3 3.4400e+08 8.5987e+11 27789  
## + Foundation 4 4.2172e+09 8.5600e+11 27790  
## + GarageQual 4 4.0308e+09 8.5618e+11 27790  
## + HeatingQC 4 3.7373e+09 8.5648e+11 27791  
## - SaleCondition 5 3.8775e+10 8.9899e+11 27791  
## + GarageCond 4 3.5198e+09 8.5670e+11 27791  
## + Functional 6 1.2383e+10 8.4783e+11 27792  
## - GarageCars 1 2.1809e+10 8.8202e+11 27794  
## + RoofStyle 5 5.2071e+09 8.5501e+11 27796  
## + Electrical 4 1.8832e+08 8.6003e+11 27796  
## - BldgType 4 3.9091e+10 8.9931e+11 27799  
## - OverallCond 7 5.4622e+10 9.1484e+11 27800  
## - BsmtFinType1 5 4.5682e+10 9.0590e+11 27801  
## + Condition1 8 1.1286e+10 8.4893e+11 27808  
## + HouseStyle 7 4.9383e+09 8.5528e+11 27811  
## + SaleType 8 8.1918e+09 8.5202e+11 27813  
## - BsmtExposure 3 4.9281e+10 9.0950e+11 27821  
## - Neighborhood 24 1.6637e+11 1.0266e+12 27832  
## + Exterior1st 13 1.8575e+10 8.4164e+11 27832  
## + MSSubClass 13 1.8437e+10 8.4178e+11 27833  
## - Condition2 7 8.2962e+10 9.4318e+11 27841  
## + Exterior2nd 15 1.3362e+10 8.4685e+11 27855  
## - TotalBsmtSF 1 6.4878e+10 9.2509e+11 27858  
## - OverallQual 8 1.5394e+11 1.0142e+12 27931  
## - RoofMatl 7 1.8313e+11 1.0433e+12 27976  
## + YearRemodAdd 60 5.4099e+10 8.0612e+11 28113  
## - GrLivArea 1 3.7689e+11 1.2371e+12 28247  
## + GarageYrBlt 96 6.3918e+10 7.9630e+11 28356  
## + YearBuilt 107 8.4807e+10 7.7541e+11 28399  
##   
## Step: AIC=27765.87  
## SalePrice ~ TotalBsmtSF + GrLivArea + GarageCars + Neighborhood +   
## Condition2 + BldgType + RoofMatl + BsmtQual + BsmtExposure +   
## BsmtFinType1 + CentralAir + KitchenQual + SaleCondition +   
## OverallQual + OverallCond  
##   
## Df Sum of Sq RSS AIC  
## - CentralAir 1 4.3657e+09 8.8194e+11 27765  
## <none> 8.7757e+11 27766  
## + LotShape 3 1.3927e+10 8.6364e+11 27766  
## + LotConfig 4 1.7355e+10 8.6022e+11 27768  
## + FullBath 1 2.8707e+09 8.7470e+11 27769  
## + GarageArea 1 2.7542e+09 8.7482e+11 27769  
## + X1stFlrSF 1 1.4808e+09 8.7609e+11 27771  
## + OpenPorchSF 1 5.8626e+08 8.7698e+11 27772  
## + TotRmsAbvGrd 1 1.9173e+08 8.7738e+11 27773  
## + GarageFinish 2 4.4307e+09 8.7314e+11 27774  
## - BsmtQual 3 2.1551e+10 8.9912e+11 27777  
## + PavedDrive 2 8.4366e+08 8.7673e+11 27779  
## + MSZoning 4 9.3436e+09 8.6823e+11 27780  
## + BsmtCond 3 2.7743e+09 8.7480e+11 27783  
## - KitchenQual 3 2.6145e+10 9.0372e+11 27784  
## + Heating 3 2.5367e+09 8.7503e+11 27784  
## + GarageType 5 1.1314e+10 8.6626e+11 27785  
## + MasVnrType 3 1.1543e+09 8.7642e+11 27786  
## + ExterQual 3 7.9196e+08 8.7678e+11 27786  
## + LandContour 3 6.9740e+08 8.7687e+11 27786  
## - SaleCondition 5 3.8018e+10 9.1559e+11 27787  
## + ExterCond 3 2.4332e+08 8.7733e+11 27787  
## + Foundation 4 4.5188e+09 8.7305e+11 27788  
## + GarageQual 4 4.0864e+09 8.7348e+11 27788  
## + GarageCond 4 3.6842e+09 8.7389e+11 27789  
## + Functional 6 1.2831e+10 8.6474e+11 27789  
## + HeatingQC 4 3.2714e+09 8.7430e+11 27790  
## - GarageCars 1 2.2003e+10 8.9957e+11 27792  
## - BsmtFinType1 5 4.2904e+10 9.2048e+11 27794  
## + Electrical 4 2.0001e+08 8.7737e+11 27794  
## + RoofStyle 5 4.4788e+09 8.7309e+11 27795  
## - BldgType 4 4.1724e+10 9.1929e+11 27799  
## - OverallCond 7 5.8276e+10 9.3585e+11 27802  
## + Condition1 8 1.1827e+10 8.6574e+11 27805  
## + HouseStyle 7 5.4816e+09 8.7209e+11 27808  
## + SaleType 8 1.0009e+10 8.6756e+11 27808  
## - BsmtExposure 3 4.9555e+10 9.2713e+11 27818  
## + MSSubClass 13 1.9433e+10 8.5814e+11 27830  
## - Neighborhood 24 1.7048e+11 1.0480e+12 27831  
## + Exterior1st 13 1.8233e+10 8.5934e+11 27831  
## - Condition2 7 8.3977e+10 9.6155e+11 27838  
## + Exterior2nd 15 1.3096e+10 8.6447e+11 27854  
## - TotalBsmtSF 1 6.7572e+10 9.4514e+11 27858  
## - OverallQual 8 1.5635e+11 1.0339e+12 27928  
## - RoofMatl 7 1.8277e+11 1.0603e+12 27969  
## + YearRemodAdd 60 5.4322e+10 8.2325e+11 28112  
## - GrLivArea 1 3.8346e+11 1.2610e+12 28244  
## + GarageYrBlt 96 6.1129e+10 8.1644e+11 28360  
## + YearBuilt 107 8.3890e+10 7.9368e+11 28402  
##   
## Step: AIC=27765.32  
## SalePrice ~ TotalBsmtSF + GrLivArea + GarageCars + Neighborhood +   
## Condition2 + BldgType + RoofMatl + BsmtQual + BsmtExposure +   
## BsmtFinType1 + KitchenQual + SaleCondition + OverallQual +   
## OverallCond  
##   
## Df Sum of Sq RSS AIC  
## <none> 8.8194e+11 27765  
## + CentralAir 1 4.3657e+09 8.7757e+11 27766  
## + LotShape 3 1.3365e+10 8.6857e+11 27767  
## + GarageArea 1 3.1043e+09 8.7883e+11 27768  
## + LotConfig 4 1.6971e+10 8.6497e+11 27768  
## + FullBath 1 2.6485e+09 8.7929e+11 27769  
## + X1stFlrSF 1 1.3498e+09 8.8059e+11 27771  
## + OpenPorchSF 1 3.8567e+08 8.8155e+11 27772  
## + TotRmsAbvGrd 1 2.4498e+08 8.8169e+11 27772  
## + GarageFinish 2 4.8489e+09 8.7709e+11 27772  
## - BsmtQual 3 2.1435e+10 9.0337e+11 27776  
## + PavedDrive 2 1.2650e+09 8.8067e+11 27778  
## + MSZoning 4 9.5426e+09 8.7239e+11 27780  
## + BsmtCond 3 3.6000e+09 8.7834e+11 27781  
## + GarageType 5 1.2386e+10 8.6955e+11 27782  
## - KitchenQual 3 2.6593e+10 9.0853e+11 27784  
## + Heating 3 1.4674e+09 8.8047e+11 27785  
## + Foundation 4 5.9148e+09 8.7602e+11 27785  
## + MasVnrType 3 1.1618e+09 8.8077e+11 27785  
## + LandContour 3 7.7581e+08 8.8116e+11 27786  
## + ExterQual 3 7.1886e+08 8.8122e+11 27786  
## - SaleCondition 5 3.8089e+10 9.2003e+11 27786  
## + GarageCond 4 5.0405e+09 8.7690e+11 27786  
## + ExterCond 3 1.9838e+08 8.8174e+11 27787  
## + GarageQual 4 4.5366e+09 8.7740e+11 27787  
## + HeatingQC 4 3.9022e+09 8.7803e+11 27788  
## + Functional 6 1.3233e+10 8.6870e+11 27788  
## - GarageCars 1 2.1768e+10 9.0370e+11 27791  
## + Electrical 4 3.9157e+08 8.8155e+11 27794  
## - BsmtFinType1 5 4.3529e+10 9.2547e+11 27794  
## + RoofStyle 5 4.2236e+09 8.7771e+11 27795  
## - BldgType 4 4.3340e+10 9.2528e+11 27801  
## + Condition1 8 1.1676e+10 8.7026e+11 27805  
## + HouseStyle 7 5.3093e+09 8.7663e+11 27808  
## + SaleType 8 9.8744e+09 8.7206e+11 27808  
## - OverallCond 7 6.4588e+10 9.4653e+11 27810  
## - BsmtExposure 3 4.9652e+10 9.3159e+11 27817  
## + MSSubClass 13 1.9896e+10 8.6204e+11 27828  
## + Exterior1st 13 1.8738e+10 8.6320e+11 27830  
## - Condition2 7 8.3207e+10 9.6514e+11 27836  
## - Neighborhood 24 1.7608e+11 1.0580e+12 27836  
## + Exterior2nd 15 1.3138e+10 8.6880e+11 27853  
## - TotalBsmtSF 1 6.9335e+10 9.5127e+11 27860  
## - OverallQual 8 1.5551e+11 1.0374e+12 27925  
## - RoofMatl 7 1.8321e+11 1.0651e+12 27968  
## + YearRemodAdd 60 5.5172e+10 8.2677e+11 28111  
## - GrLivArea 1 3.8456e+11 1.2665e+12 28243  
## + GarageYrBlt 96 6.3505e+10 8.1843e+11 28356  
## + YearBuilt 107 8.8250e+10 7.9369e+11 28395

summary(bic\_model)

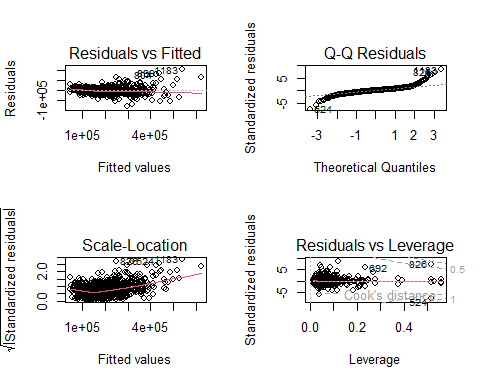
##   
## Call:  
## lm(formula = SalePrice ~ TotalBsmtSF + GrLivArea + GarageCars +   
## Neighborhood + Condition2 + BldgType + RoofMatl + BsmtQual +   
## BsmtExposure + BsmtFinType1 + KitchenQual + SaleCondition +   
## OverallQual + OverallCond, data = clean\_data)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -151033 -11755 0 11559 207431   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -1.506e+07 6.299e+05 -23.909 < 2e-16 \*\*\*  
## TotalBsmtSF 2.324e+02 2.336e+01 9.949 < 2e-16 \*\*\*  
## GrLivArea 1.418e+07 6.053e+05 23.430 < 2e-16 \*\*\*  
## GarageCars 5.705e+03 1.023e+03 5.574 3.03e-08 \*\*\*  
## NeighborhoodBlueste 4.279e+02 2.047e+04 0.021 0.983331   
## NeighborhoodBrDale 6.854e+03 1.089e+04 0.629 0.529303   
## NeighborhoodBrkSide -5.832e+03 8.908e+03 -0.655 0.512811   
## NeighborhoodClearCr 7.037e+03 9.489e+03 0.742 0.458468   
## NeighborhoodCollgCr 7.445e+03 7.590e+03 0.981 0.326835   
## NeighborhoodCrawfor 1.971e+04 8.524e+03 2.312 0.020924 \*   
## NeighborhoodEdwards -1.314e+04 8.318e+03 -1.580 0.114355   
## NeighborhoodGilbert 9.762e+03 8.115e+03 1.203 0.229195   
## NeighborhoodIDOTRR -1.690e+04 9.432e+03 -1.791 0.073482 .   
## NeighborhoodMeadowV -3.979e+03 1.073e+04 -0.371 0.710788   
## NeighborhoodMitchel -5.383e+02 8.614e+03 -0.062 0.950182   
## NeighborhoodNAmes -6.238e+03 8.027e+03 -0.777 0.437200   
## NeighborhoodNoRidge 5.313e+04 8.611e+03 6.170 9.17e-10 \*\*\*  
## NeighborhoodNPkVill 6.138e+03 1.163e+04 0.528 0.597692   
## NeighborhoodNridgHt 2.527e+04 7.800e+03 3.239 0.001230 \*\*   
## NeighborhoodNWAmes -4.161e+03 8.246e+03 -0.505 0.613917   
## NeighborhoodOldTown -2.415e+04 8.372e+03 -2.885 0.003986 \*\*   
## NeighborhoodSawyer -2.482e+03 8.477e+03 -0.293 0.769706   
## NeighborhoodSawyerW 8.937e+03 8.193e+03 1.091 0.275617   
## NeighborhoodSomerst 1.681e+04 7.599e+03 2.212 0.027137 \*   
## NeighborhoodStoneBr 4.356e+04 8.738e+03 4.985 7.07e-07 \*\*\*  
## NeighborhoodSWISU -1.888e+04 9.988e+03 -1.890 0.059024 .   
## NeighborhoodTimber 3.533e+03 8.592e+03 0.411 0.680969   
## NeighborhoodVeenker 1.495e+04 1.087e+04 1.376 0.169147   
## Condition2Feedr 4.773e+03 2.392e+04 0.200 0.841878   
## Condition2Norm 2.165e+04 2.072e+04 1.045 0.296434   
## Condition2PosA -7.763e+03 3.553e+04 -0.218 0.827106   
## Condition2PosN -1.970e+05 2.913e+04 -6.761 2.09e-11 \*\*\*  
## Condition2RRAe 2.145e+04 3.429e+04 0.625 0.531786   
## Condition2RRAn 1.056e+04 3.433e+04 0.308 0.758491   
## Condition2RRNn 5.520e+04 2.835e+04 1.947 0.051747 .   
## BldgType2fmCon -1.025e+04 6.417e+03 -1.597 0.110440   
## BldgTypeDuplex -3.488e+04 5.986e+03 -5.827 7.14e-09 \*\*\*  
## BldgTypeTwnhs -2.266e+04 5.726e+03 -3.958 7.98e-05 \*\*\*  
## BldgTypeTwnhsE -1.528e+04 3.602e+03 -4.242 2.38e-05 \*\*\*  
## RoofMatlCompShg 4.416e+05 2.950e+04 14.969 < 2e-16 \*\*\*  
## RoofMatlMembran 4.607e+05 4.033e+04 11.421 < 2e-16 \*\*\*  
## RoofMatlMetal 4.583e+05 4.052e+04 11.311 < 2e-16 \*\*\*  
## RoofMatlRoll 4.419e+05 4.032e+04 10.959 < 2e-16 \*\*\*  
## RoofMatlTar&Grv 4.228e+05 3.077e+04 13.742 < 2e-16 \*\*\*  
## RoofMatlWdShake 4.499e+05 3.189e+04 14.106 < 2e-16 \*\*\*  
## RoofMatlWdShngl 4.924e+05 3.072e+04 16.031 < 2e-16 \*\*\*  
## BsmtQualFa -2.070e+04 6.792e+03 -3.048 0.002355 \*\*   
## BsmtQualGd -1.934e+04 3.698e+03 -5.230 1.98e-07 \*\*\*  
## BsmtQualTA -2.297e+04 4.373e+03 -5.252 1.76e-07 \*\*\*  
## BsmtExposureGd 2.057e+04 3.259e+03 6.313 3.80e-10 \*\*\*  
## BsmtExposureMn -2.193e+03 3.248e+03 -0.675 0.499649   
## BsmtExposureNo -4.826e+03 2.275e+03 -2.121 0.034092 \*   
## BsmtFinType1BLQ -5.278e+02 3.028e+03 -0.174 0.861661   
## BsmtFinType1GLQ 4.005e+03 2.733e+03 1.466 0.142973   
## BsmtFinType1LwQ -8.890e+03 3.902e+03 -2.278 0.022877 \*   
## BsmtFinType1Rec -4.748e+03 3.185e+03 -1.491 0.136234   
## BsmtFinType1Unf -1.231e+04 2.652e+03 -4.641 3.83e-06 \*\*\*  
## KitchenQualFa -3.392e+04 7.294e+03 -4.651 3.65e-06 \*\*\*  
## KitchenQualGd -2.204e+04 3.906e+03 -5.642 2.08e-08 \*\*\*  
## KitchenQualTA -2.531e+04 4.324e+03 -5.854 6.12e-09 \*\*\*  
## SaleConditionAdjLand 1.367e+04 2.698e+04 0.507 0.612350   
## SaleConditionAlloca 2.526e+04 1.104e+04 2.289 0.022224 \*   
## SaleConditionFamily 4.767e+02 6.774e+03 0.070 0.943907   
## SaleConditionNormal 7.766e+03 3.080e+03 2.522 0.011794 \*   
## SaleConditionPartial 2.786e+04 4.263e+03 6.536 9.15e-11 \*\*\*  
## OverallQual3 -5.220e+04 2.222e+04 -2.350 0.018946 \*   
## OverallQual4 -4.951e+04 2.019e+04 -2.452 0.014322 \*   
## OverallQual5 -4.846e+04 2.013e+04 -2.407 0.016221 \*   
## OverallQual6 -4.613e+04 2.024e+04 -2.279 0.022844 \*   
## OverallQual7 -3.492e+04 2.044e+04 -1.709 0.087789 .   
## OverallQual8 -1.652e+04 2.069e+04 -0.798 0.424782   
## OverallQual9 2.329e+04 2.143e+04 1.087 0.277268   
## OverallQual10 8.708e+04 2.267e+04 3.841 0.000129 \*\*\*  
## OverallCond3 7.347e+03 1.721e+04 0.427 0.669481   
## OverallCond4 2.116e+04 1.624e+04 1.302 0.193006   
## OverallCond5 3.508e+04 1.576e+04 2.225 0.026228 \*   
## OverallCond6 4.277e+04 1.584e+04 2.700 0.007017 \*\*   
## OverallCond7 4.972e+04 1.587e+04 3.133 0.001770 \*\*   
## OverallCond8 5.014e+04 1.611e+04 3.112 0.001902 \*\*   
## OverallCond9 6.578e+04 1.706e+04 3.856 0.000121 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 26470 on 1259 degrees of freedom  
## Multiple R-squared: 0.8942, Adjusted R-squared: 0.8876   
## F-statistic: 134.7 on 79 and 1259 DF, p-value: < 2.2e-16

##Residual Analysis

Diagnostic Plots.  
Residuals vs Fitted to check for non-linearity or heteroscedasticity. Normal Q-Q to check if residuals are normally distributed Scale-Location to view variance of residuals (should be flat) Residuals vs Leverage to detect influence points

par(mfrow = c(2, 2))   
plot(bic\_model)

## Warning: not plotting observations with leverage one:  
## 111, 247, 384, 535, 920, 1128, 1169, 1190



##Model Validation Validate model with k-fold cross-validation for regression

library(caret)

## Loading required package: ggplot2

## Loading required package: lattice

set.seed(123)  
cv\_control <- trainControl(method = "cv", number = 10)  
  
model\_cv <- train(  
 SalePrice ~ .,  
 data = clean\_data,  
 method = "lm",  
 trControl = cv\_control,  
 metric = "RMSE"  
)

## Warning in predict.lm(modelFit, newdata): prediction from rank-deficient fit;  
## attr(\*, "non-estim") has doubtful cases  
## Warning in predict.lm(modelFit, newdata): prediction from rank-deficient fit;  
## attr(\*, "non-estim") has doubtful cases  
## Warning in predict.lm(modelFit, newdata): prediction from rank-deficient fit;  
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## Warning in predict.lm(modelFit, newdata): prediction from rank-deficient fit;  
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## Warning in predict.lm(modelFit, newdata): prediction from rank-deficient fit;  
## attr(\*, "non-estim") has doubtful cases  
## Warning in predict.lm(modelFit, newdata): prediction from rank-deficient fit;  
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## attr(\*, "non-estim") has doubtful cases  
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## attr(\*, "non-estim") has doubtful cases  
## Warning in predict.lm(modelFit, newdata): prediction from rank-deficient fit;  
## attr(\*, "non-estim") has doubtful cases

print(model\_cv$results)

## intercept RMSE Rsquared MAE RMSESD RsquaredSD MAESD  
## 1 TRUE 47276.01 0.6912945 26649.54 12143.6 0.1337933 2930.894