

Lab3.R

2020-02-13

```
library(tidyverse)

library(ggplot2)

## Exercise 1 ##

#Importing dataset
ameslist <- read.table("https://msudataanalytics.github.io/SSC442/Labs/data/ames.csv",
                      header = TRUE,
                      sep = ",")

#Drops variables OverallCond and OverallQual
ameslist$OverallCond <- ameslist$OverallQual <- NULL

#Forward Selection
forward <- step(lm(SalePrice~ MSSubClass+LotArea+YearBuilt+YearRemodAdd+GarageArea+GrLivArea
                  +TotalBsmtSF+MasVnrArea+LotFrontage+BsmtFinSF1+BsmtFinSF2
                  +BsmtUnfSF+X1stFlrSF+X2ndFlrSF,ameslist),direction = "forward")

## Start: AIC=25447.51
## SalePrice ~ MSSubClass + LotArea + YearBuilt + YearRemodAdd +
## GarageArea + GrLivArea + TotalBsmtSF + MasVnrArea + LotFrontage +
## BsmtFinSF1 + BsmtFinSF2 + BsmtUnfSF + X1stFlrSF + X2ndFlrSF

#Residual
summary(forward)

##
## Call:
## lm(formula = SalePrice ~ MSSubClass + LotArea + YearBuilt + YearRemodAdd +
## GarageArea + GrLivArea + TotalBsmtSF + MasVnrArea + LotFrontage +
## BsmtFinSF1 + BsmtFinSF2 + BsmtUnfSF + X1stFlrSF + X2ndFlrSF,
## data = ameslist)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -594304  -18961   -2695   14856  283855
##
## Coefficients: (1 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -2.159e+06  1.297e+05 -16.649  < 2e-16 ***
```

```

## MSSubClass    -1.961e+02  3.353e+01  -5.850 6.35e-09 ***
## LotArea       6.821e-01  1.760e-01   3.876 0.000112 ***
## YearBuilt     4.651e+02  5.477e+01   8.492 < 2e-16 ***
## YearRemodAdd  6.446e+02  7.381e+01   8.733 < 2e-16 ***
## GarageArea    5.185e+01  7.396e+00   7.011 3.97e-12 ***
## GrLivArea     4.647e+01  2.428e+01   1.914 0.055831 .
## TotalBsmtSF   1.989e+01  5.366e+00   3.707 0.000219 ***
## MasVnrArea    4.684e+01  7.743e+00   6.049 1.95e-09 ***
## LotFrontage  -2.193e+02  6.469e+01  -3.390 0.000723 ***
## BsmtFinSF1    1.661e+01  3.168e+00   5.244 1.86e-07 ***
## BsmtFinSF2    1.318e+00  8.061e+00   0.163 0.870189
## BsmtUnfSF      NA         NA         NA      NA
## X1stFlrSF     2.336e+01  2.522e+01   0.926 0.354410
## X2ndFlrSF     2.554e+01  2.471e+01   1.034 0.301508
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 41840 on 1181 degrees of freedom
## (265 observations deleted due to missingness)
## Multiple R-squared:  0.7497, Adjusted R-squared:  0.7469
## F-statistic: 272 on 13 and 1181 DF, p-value: < 2.2e-16

#Complexity function
get_complexity = function(model) {
  +   length(coef(model)) - 1
}

#RMSE function
rmse = function(actual, predicted) {
  sqrt(mean((actual - predicted) ^ 2))
}

fit_1 = lm(SalePrice ~ LotArea, ameslist)

fit_2 = lm(SalePrice ~ LotArea+GarageArea, ameslist)

fit_3 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea, ameslist)

fit_4 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF, ameslist)

fit_5 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle, ameslist)

fit_6 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
+MSSubClass, ameslist)

fit_7 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
+MSSubClass+YearBuilt, ameslist)

```

```

fit_8 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
           +MSSubClass+YearBuilt+YearRemodAdd,ameslist)

fit_9 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
           +MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1,ameslist)

fit_10 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
            +MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2,ameslist
            )

fit_11 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
            +MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2
            +BsmUnfSF,ameslist)

fit_12 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
            +MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2
            +BsmUnfSF+X1stFlrSF,ameslist)

fit_13 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
            +MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2
            +BsmUnfSF+X1stFlrSF+X2ndFlrSF,ameslist)

fit_14 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
            +MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2
            +BsmUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle,ameslist)

fit_15 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
            +MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2
            +BsmUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition,ameslist)

```

#Help predict

?predict

```

predict_lm1 <- predict(fit_1)
predict_lm2 <- predict(fit_2)
predict_lm3 <- predict(fit_3)
predict_lm4 <- predict(fit_4)
predict_lm5 <- predict(fit_5)
predict_lm6 <- predict(fit_6)
predict_lm7 <- predict(fit_7)
predict_lm8 <- predict(fit_8)
predict_lm9 <- predict(fit_9)
predict_lm10 <- predict(fit_10)
predict_lm11 <- predict(fit_11)
predict_lm12 <- predict(fit_12)
predict_lm13 <- predict(fit_13)
predict_lm14 <- predict(fit_14)
predict_lm15 <- predict(fit_15)

```

#Get RMSE

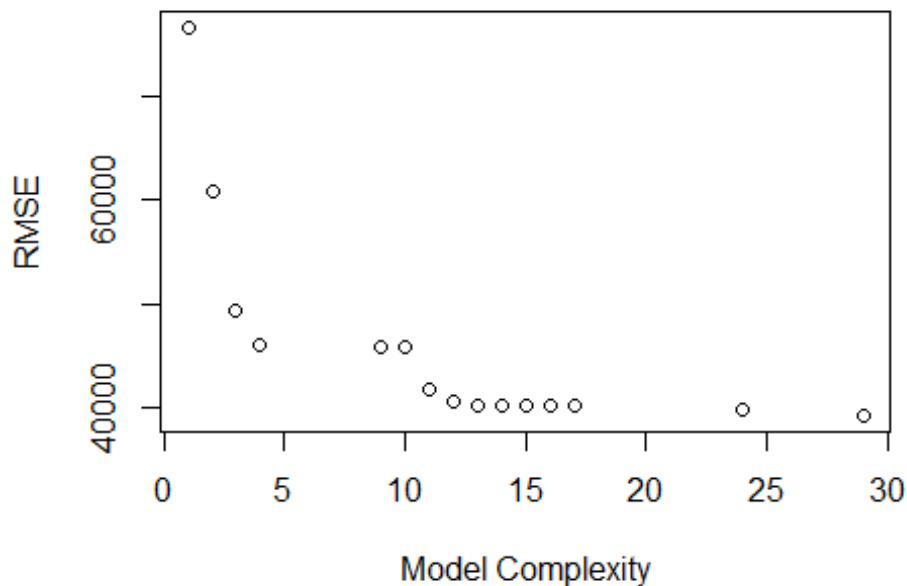
```
rmse_lm1 <- rmse(ameslist$SalePrice, predict_lm1)
rmse_lm2 <- rmse(ameslist$SalePrice, predict_lm2)
rmse_lm3 <- rmse(ameslist$SalePrice, predict_lm3)
rmse_lm4 <- rmse(ameslist$SalePrice, predict_lm4)
rmse_lm5 <- rmse(ameslist$SalePrice, predict_lm5)
rmse_lm6 <- rmse(ameslist$SalePrice, predict_lm6)
rmse_lm7 <- rmse(ameslist$SalePrice, predict_lm7)
rmse_lm8 <- rmse(ameslist$SalePrice, predict_lm8)
rmse_lm9 <- rmse(ameslist$SalePrice, predict_lm9)
rmse_lm10 <- rmse(ameslist$SalePrice, predict_lm10)
rmse_lm11 <- rmse(ameslist$SalePrice, predict_lm11)
rmse_lm12 <- rmse(ameslist$SalePrice, predict_lm12)
rmse_lm13 <- rmse(ameslist$SalePrice, predict_lm13)
rmse_lm14 <- rmse(ameslist$SalePrice, predict_lm14)
rmse_lm15 <- rmse(ameslist$SalePrice, predict_lm15)
```

#Get Complexity

```
complex_lm1 <- get_complexity(fit_1)
complex_lm2 <- get_complexity(fit_2)
complex_lm3 <- get_complexity(fit_3)
complex_lm4 <- get_complexity(fit_4)
complex_lm5 <- get_complexity(fit_5)
complex_lm6 <- get_complexity(fit_6)
complex_lm7 <- get_complexity(fit_7)
complex_lm8 <- get_complexity(fit_8)
complex_lm9 <- get_complexity(fit_9)
complex_lm10 <- get_complexity(fit_10)
complex_lm11 <- get_complexity(fit_11)
complex_lm12 <- get_complexity(fit_12)
complex_lm13 <- get_complexity(fit_13)
complex_lm14 <- get_complexity(fit_14)
complex_lm15 <- get_complexity(fit_15)
```

```
rmse_complexity_plot <- plot(c(complex_lm1,complex_lm2,complex_lm3,
                              complex_lm4,complex_lm5,complex_lm6,
                              complex_lm7,complex_lm8,complex_lm9,
                              complex_lm10,complex_lm11,complex_lm12,
                              complex_lm13,complex_lm14,complex_lm15),
                             c(rmse_lm1,rmse_lm2,rmse_lm3,rmse_lm4,
                              rmse_lm5,rmse_lm6,rmse_lm7,rmse_lm8,
                              rmse_lm9,rmse_lm10,rmse_lm11,rmse_lm12,
                              rmse_lm13,rmse_lm14,rmse_lm15),
                             main = "RMSE vs Complexity", xlab = "Model Complexity", ylab = "RMSE")
```

RMSE vs Complexity



#For this plot, we can see that RMSE drops as model complexity increases which is to be expected.

#It continues this way with small "peaks" which could be a sign of possible uncorrelated values.

#Despite this, we should not use the full-size model as having too large of a model, could cause

#it to predict poorly.

Exercise 2

Question 1

Test Train Split

set.seed(9)

num_obs = nrow(ameslist)

train_index = sample(num_obs, size = trunc(0.50 * num_obs))

train_data = ameslist[train_index,]

test_data = ameslist[-train_index,]

```
get_rmse = function(model, data, response) {  
  rmse(actual = subset(data, select = response, drop = TRUE),  
        predicted = predict(model, data))  
}
```

```

model_list = list(fit_1, fit_2, fit_3, fit_4, fit_5, fit_6, fit_7, fit_8,
                  fit_9, fit_10, fit_11, fit_12, fit_13, fit_14, fit_15)

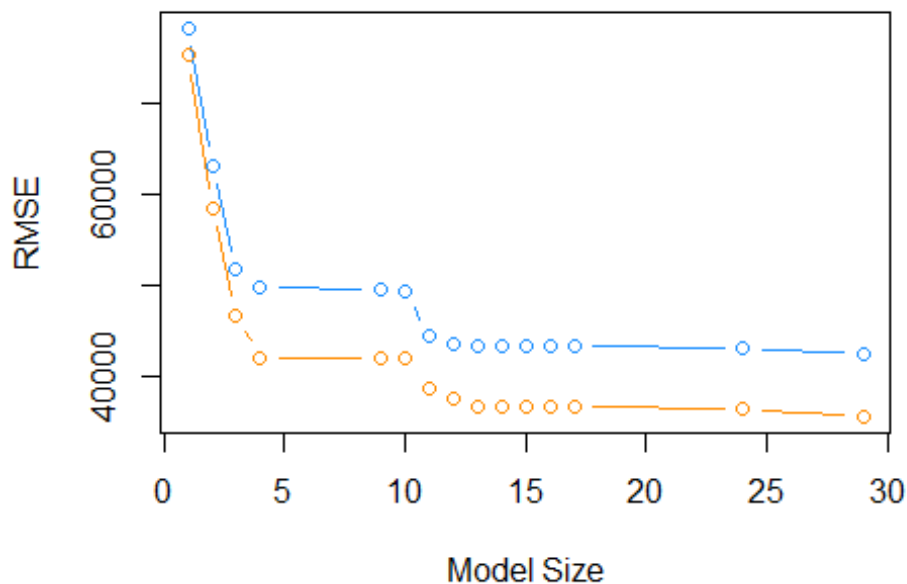
train_rmse = sapply(model_list, get_rmse, data = train_data, response = "Sale
Price")

test_rmse = sapply(model_list, get_rmse, data = test_data, response = "SalePr
ice")

model_complexity = sapply(model_list, get_complexity)

plot(model_complexity, train_rmse, type = "b",
      ylim = c(min(c(train_rmse, test_rmse)) - 0.02,
                max(c(train_rmse, test_rmse)) + 0.02),
      col = "dodgerblue",
      xlab = "Model Size",
      ylab = "RMSE")
lines(model_complexity, test_rmse, type = "b", col = "darkorange")
# Plot of the Train and Test RMSE for the first 15 models

```



```

RMSE_table = data.frame(
  Model = c('fit_1', 'fit_2', 'fit_3', 'fit_4', 'fit_5', 'fit_6', 'fit_7',
            'fit_8', 'fit_9', 'fit_10', 'fit_11', 'fit_12', 'fit_13', 'fit_14',
            'fit_15'),
  TestRMSE = test_rmse,
  TrainRMSE = train_rmse
)

# 2. Minimize RMSE

```

Additional models added for increased flexibility

```
fit_16 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle  
+MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2  
+BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+  
FullBath, ameslist)
```

```
fit_17 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle  
+MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2  
+BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+  
FullBath+BedroomAbvGr, ameslist)
```

```
fit_18 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle  
+MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2  
+BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+  
FullBath+BedroomAbvGr+BsmFullBath, ameslist)
```

```
fit_19 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle  
+MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2  
+BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+  
FullBath+BedroomAbvGr+BsmFullBath+BsmHalfBath, ameslist)
```

```
fit_20 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle  
+MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2  
+BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+  
FullBath+BedroomAbvGr+BsmFullBath+BsmHalfBath+  
KitchenAbvGr, ameslist)
```

```
fit_21 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle  
+MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2  
+BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+  
FullBath+BedroomAbvGr+BsmFullBath+HalfBath+  
KitchenAbvGr+Fireplaces, ameslist)
```

```
fit_22 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle  
+MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2  
+BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+  
FullBath+BedroomAbvGr+BsmFullBath+HalfBath+  
KitchenAbvGr+Fireplaces+HalfBath, ameslist)
```

```
fit_23 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle  
+MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2  
+BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+  
FullBath+BedroomAbvGr+BsmFullBath+HalfBath+  
KitchenAbvGr+Fireplaces+HalfBath+GarageCars, ameslist)
```

```
fit_24 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle  
+MSSubClass+YearBuilt+YearRemodAdd+BsmFinSF1+BsmFinSF2  
+BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+
```

```

        FullBath+BedroomAbvGr+BsmtFullBath+HalfBath+
        KitchenAbvGr+Fireplaces+HalfBath+GarageCars+GarageArea,ameslist
    )

fit_25 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
            +MSSubClass+YearBuilt+YearRemodAdd+BsmtFinSF1+BsmtFinSF2
            +BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+
            FullBath+BedroomAbvGr+BsmtFullBath+HalfBath+
            KitchenAbvGr+Fireplaces+HalfBath+GarageCars+GarageArea+
            WoodDeckSF,ameslist)

fit_26 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
            +MSSubClass+YearBuilt+YearRemodAdd+BsmtFinSF1+BsmtFinSF2
            +BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+
            FullBath+BedroomAbvGr+BsmtFullBath+HalfBath+
            KitchenAbvGr+Fireplaces+HalfBath+GarageCars+GarageArea+
            WoodDeckSF+OpenPorchSF,ameslist)

fit_27 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
            +MSSubClass+YearBuilt+YearRemodAdd+BsmtFinSF1+BsmtFinSF2
            +BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+
            FullBath+BedroomAbvGr+BsmtFullBath+HalfBath+
            KitchenAbvGr+Fireplaces+HalfBath+GarageCars+GarageArea+
            WoodDeckSF+OpenPorchSF+EnclosedPorch,ameslist)

fit_28 = lm(SalePrice ~ LotArea+GarageArea+GrLivArea+TotalBsmtSF+RoofStyle
            +MSSubClass+YearBuilt+YearRemodAdd+BsmtFinSF1+BsmtFinSF2
            +BsmtUnfSF+X1stFlrSF+X2ndFlrSF+HouseStyle+SaleCondition+
            FullBath+BedroomAbvGr+BsmtFullBath+HalfBath+
            KitchenAbvGr+Fireplaces+HalfBath+GarageCars+GarageArea+
            WoodDeckSF+OpenPorchSF+EnclosedPorch+YrSold,ameslist)

model_list = list(fit_1, fit_2, fit_3, fit_4, fit_5,fit_6, fit_7, fit_8,
                  fit_9, fit_10,fit_11, fit_12, fit_13, fit_14, fit_15,
                  fit_16,fit_17,fit_18,fit_19,fit_20,fit_21,fit_22,fit_23,
                  fit_24,fit_25,fit_26,fit_27,fit_28)

train_rmse = sapply(model_list, get_rmse, data = train_data, response = "Sale
Price")

test_rmse = sapply(model_list, get_rmse, data = test_data, response = "SalePr
ice")

model_complexity = sapply(model_list, get_complexity)

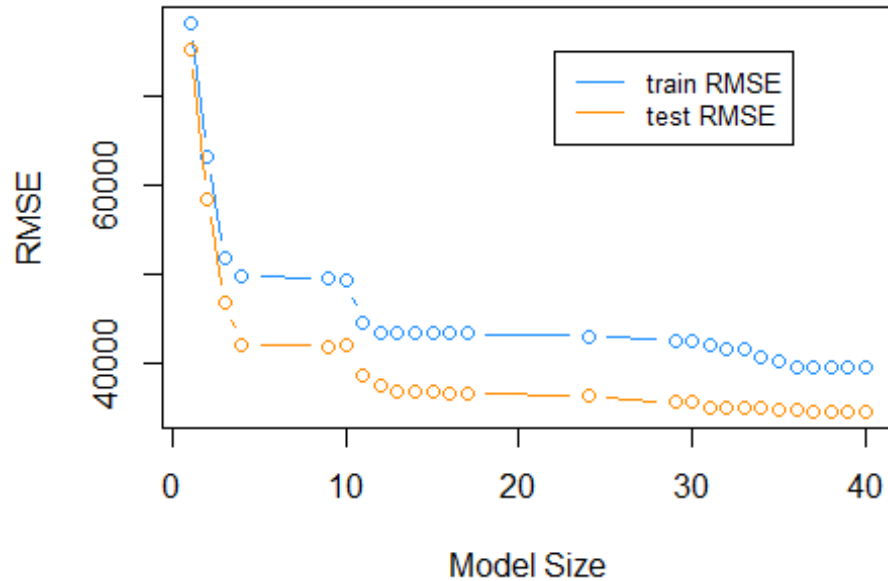
plot(model_complexity, train_rmse, type = "b",
     ylim = c(min(c(train_rmse, test_rmse)) - 0.02,
               max(c(train_rmse, test_rmse)) + 0.02),
     col = "dodgerblue",
     xlab = "Model Size",
     ylab = "RMSE")

```



```
lines(model_complexity, test_rmse, type = "b", col = "darkorange")
legend(22, 75000, legend=c("train RMSE", "test RMSE"),
      col=c("dodgerblue", "darkorange"),lty=1, cex=0.8)
```

Plot of the Train and Test RMSE to find Lowest RMSE



```
RMSE_table_FINAL = data.frame(
  Model = c('fit_1','fit_2','fit_3','fit_4','fit_5','fit_6','fit_7',
            'fit_8','fit_9','fit_10','fit_11','fit_12','fit_13','fit_14',
            'fit_15','fit_16','fit_17','fit_18','fit_19','fit_20','fit_21',
            'fit_22','fit_23','fit_24','fit_25','fit_26','fit_27','fit_28'),
  TestRMSE = test_rmse,
  TrainRMSE = train_rmse
)
View(RMSE_table_FINAL)
```

	Model	TestRMSE	TrainRMSE
1	fit_1	75089.04	78084.19
2	fit_2	58500.96	63166.31
3	fit_3	46776.91	51754.96
4	fit_4	42135.11	49787.40
5	fit_5	41984.74	49494.34
6	fit_6	42012.19	49415.60
7	fit_7	38767.64	44531.41
8	fit_8	37584.44	43562.59
9	fit_9	36836.38	43404.11
10	fit_10	36835.38	43402.19
11	fit_11	36835.38	43402.19
12	fit_12	36763.42	43416.78
13	fit_13	36741.61	43372.09
14	fit_14	36525.00	43102.76
15	fit_15	35716.88	42603.80
16	fit_16	35728.92	42591.59
17	fit_17	35067.42	42069.50
18	fit_18	35176.95	41764.57
19	fit_19	35219.57	41691.50
20	fit_20	35206.35	40859.97
21	fit_21	34897.51	40388.64
22	fit_22	34897.51	40388.64
23	fit_23	34908.91	39616.78
24	fit_24	34908.91	39616.78
25	fit_25	34680.65	39580.80
26	fit_26	34680.68	39580.77
27	fit_27	34696.14	39558.03
28	fit_28	34696.83	39556.95

```
# Lowest RMSE - 34680.65
```

```
#Check R^2 to see how we vary
```

```
r2_view <- step(fit_25,direction = "forward")
```

```
## Start: AIC=30805.17
```

```
## SalePrice ~ LotArea + GarageArea + GrLivArea + TotalBsmtSF +  
##   RoofStyle + MSSubClass + YearBuilt + YearRemodAdd + BsmtFinSF1 +  
##   BsmtFinSF2 + BsmtUnfSF + X1stFlrSF + X2ndFlrSF + HouseStyle +  
##   SaleCondition + FullBath + BedroomAbvGr + BsmtFullBath +  
##   HalfBath + KitchenAbvGr + Fireplaces + HalfBath + GarageCars +  
##   GarageArea + WoodDeckSF
```

```
summary(r2_view)
```

```
##
```

```
## Call:
```

```
## lm(formula = SalePrice ~ LotArea + GarageArea + GrLivArea + TotalBsmtSF +  
##   RoofStyle + MSSubClass + YearBuilt + YearRemodAdd + BsmtFinSF1 +  
##   BsmtFinSF2 + BsmtUnfSF + X1stFlrSF + X2ndFlrSF + HouseStyle +  
##   SaleCondition + FullBath + BedroomAbvGr + BsmtFullBath +  
##   HalfBath + KitchenAbvGr + Fireplaces + HalfBath + GarageCars +  
##   GarageArea + WoodDeckSF, data = ameslist)
```

```
##
```

```
## Residuals:
```

```
##      Min       1Q   Median       3Q      Max  
## -555319 -17254  -1196   14602  275328
```

```
##
```

```
## Coefficients: (1 not defined because of singularities)
```

```
##              Estimate Std. Error t value Pr(>|t|)  
## (Intercept)   -1.406e+06  1.425e+05  -9.866  < 2e-16 ***  
## LotArea        2.434e-01  1.089e-01   2.235  0.02560 *  
## GarageArea    -2.330e+00  1.058e+01  -0.220  0.82565  
## GrLivArea      5.806e+01  2.623e+01   2.213  0.02703 *  
## TotalBsmtSF    2.229e+01  4.564e+00   4.885  1.15e-06 ***  
## RoofStyleGable  3.502e+03  1.102e+04   0.318  0.75069  
## RoofStyleGambrel 1.132e+04  1.589e+04   0.713  0.47620  
## RoofStyleHip    1.507e+04  1.113e+04   1.354  0.17592  
## RoofStyleMansard -2.880e+03  1.818e+04  -0.158  0.87412  
## RoofStyleShed   -1.620e+04  2.944e+04  -0.550  0.58238  
## MSSubClass     -1.016e+02  3.112e+01  -3.264  0.00113 **  
## YearBuilt       3.121e+02  5.795e+01   5.385  8.45e-08 ***  
## YearRemodAdd    4.141e+02  6.486e+01   6.384  2.32e-10 ***  
## BsmtFinSF1      9.052e+00  3.431e+00   2.638  0.00842 **  
## BsmtFinSF2     -4.468e+00  6.713e+00  -0.666  0.50580  
## BsmtUnfSF       NA         NA         NA         NA  
## X1stFlrSF       4.695e+00  2.683e+01   0.175  0.86114  
## X2ndFlrSF       3.635e+01  2.601e+01   1.398  0.16243  
## HouseStyle1.5Unf 3.228e+04  1.114e+04   2.898  0.00381 **  
## HouseStyle1Story 1.389e+04  5.397e+03   2.573  0.01018 *  
## HouseStyle2.5Fin -1.354e+04  1.756e+04  -0.771  0.44080
```

```

## HouseStyle2.5Unf      -7.358e+03  1.224e+04  -0.601  0.54772
## HouseStyle2Story      -9.328e+03  4.625e+03  -2.017  0.04388 *
## HouseStyleSFoyer       1.230e+04  8.055e+03   1.528  0.12681
## HouseStyleSLvl        1.166e+04  6.496e+03   1.795  0.07287 .
## SaleConditionAdjLand   2.776e+04  1.997e+04   1.390  0.16463
## SaleConditionAlloca  -1.763e+03  1.218e+04  -0.145  0.88490
## SaleConditionFamily   -4.180e+03  9.320e+03  -0.448  0.65387
## SaleConditionNormal    7.172e+03  3.995e+03   1.795  0.07280 .
## SaleConditionPartial   3.353e+04  5.526e+03   6.068  1.66e-09 ***
## FullBath               6.707e+03  3.061e+03   2.191  0.02860 *
## BedroomAbvGr          -8.233e+03  1.656e+03  -4.971  7.47e-07 ***
## BsmtFullBath           8.238e+03  2.704e+03   3.047  0.00235 **
## HalfBath               1.275e+03  2.980e+03   0.428  0.66884
## KitchenAbvGr          -2.670e+04  5.501e+03  -4.854  1.34e-06 ***
## Fireplaces             8.880e+03  1.893e+03   4.692  2.97e-06 ***
## GarageCars             1.709e+04  3.070e+03   5.565  3.12e-08 ***
## WoodDeckSF            2.646e+01  8.530e+00   3.103  0.00196 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 37690 on 1423 degrees of freedom
## Multiple R-squared:  0.7804, Adjusted R-squared:  0.7749
## F-statistic: 140.5 on 36 and 1423 DF,  p-value: < 2.2e-16

```