**Insights in Ames, Iowa: Real Estate**

MSDS 6371

Samuel Arellano, Eric Balke, Spencer Fogelman, Karen Somes

***Made up a dumb title and needs more work but here’s something to start with!!***

1. **Overview**

The selling prices of homes drive the real estate business. However, many factors influence a client’s purchasing decision and additionally the selling price. Aligning the client’s preferences with home attributes that also maximize selling price leads to satisfied buyers and optimal profitability. We will investigate what home characteristics are associated with selling price, so that Century 21 Ames can best position themselves in the market.

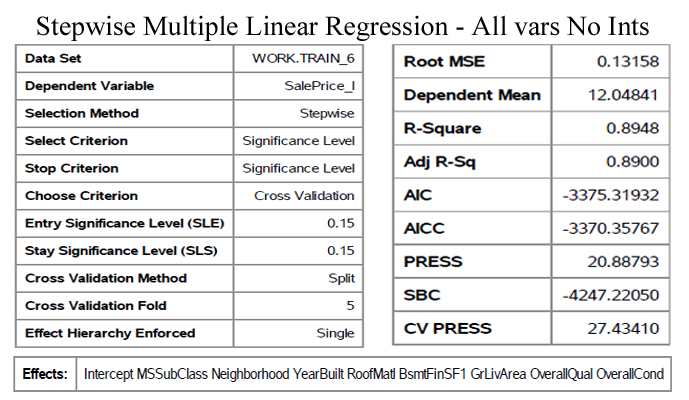
The Ames Housing Dataset compiled by Dean De Cock includes 79 explanatory variables to determine the corresponding selling price. There are 1,460 observations in the training data set and 1,459 in the testing data set. A full description of each variable can be found in the “data\_description” text file on Kaggle.com. *Insert all the important variables.*

1. **Century 21 Analysis**
2. **Predicting Selling Prices**

Determining the correlations between the predictive variables and the final selling price of a home allows us to go further and in the analysis process and begin modeling. By creating statistical models and using regression techniques we are able to create prediction models that allow us to estimate the predicted selling price of a home based on readily available listing information. Being able to accurately predict the sales price will allow Century 21 to better evaluate listing prices, estimate commissions, and allocate agent resources.

**Model Selection**

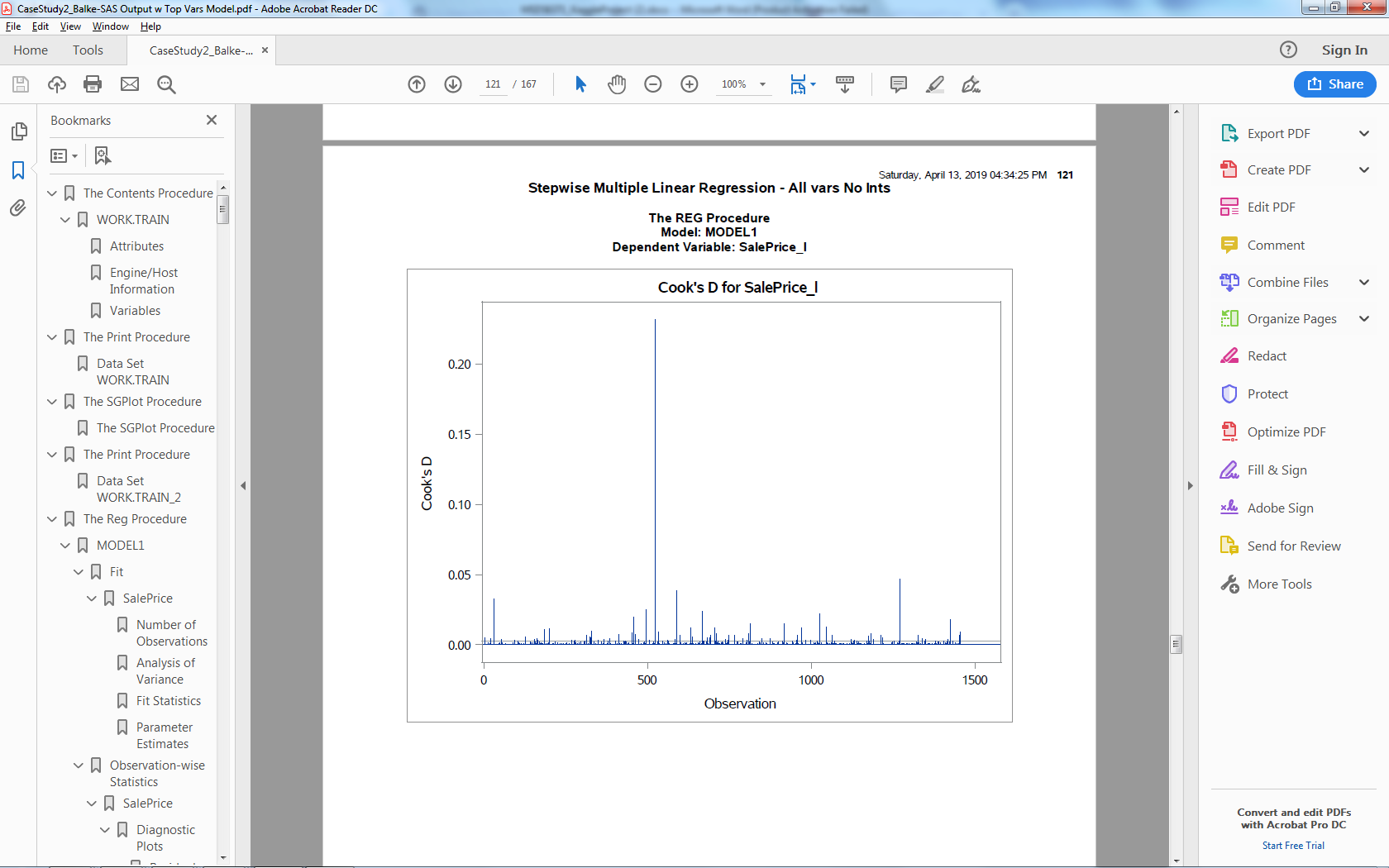
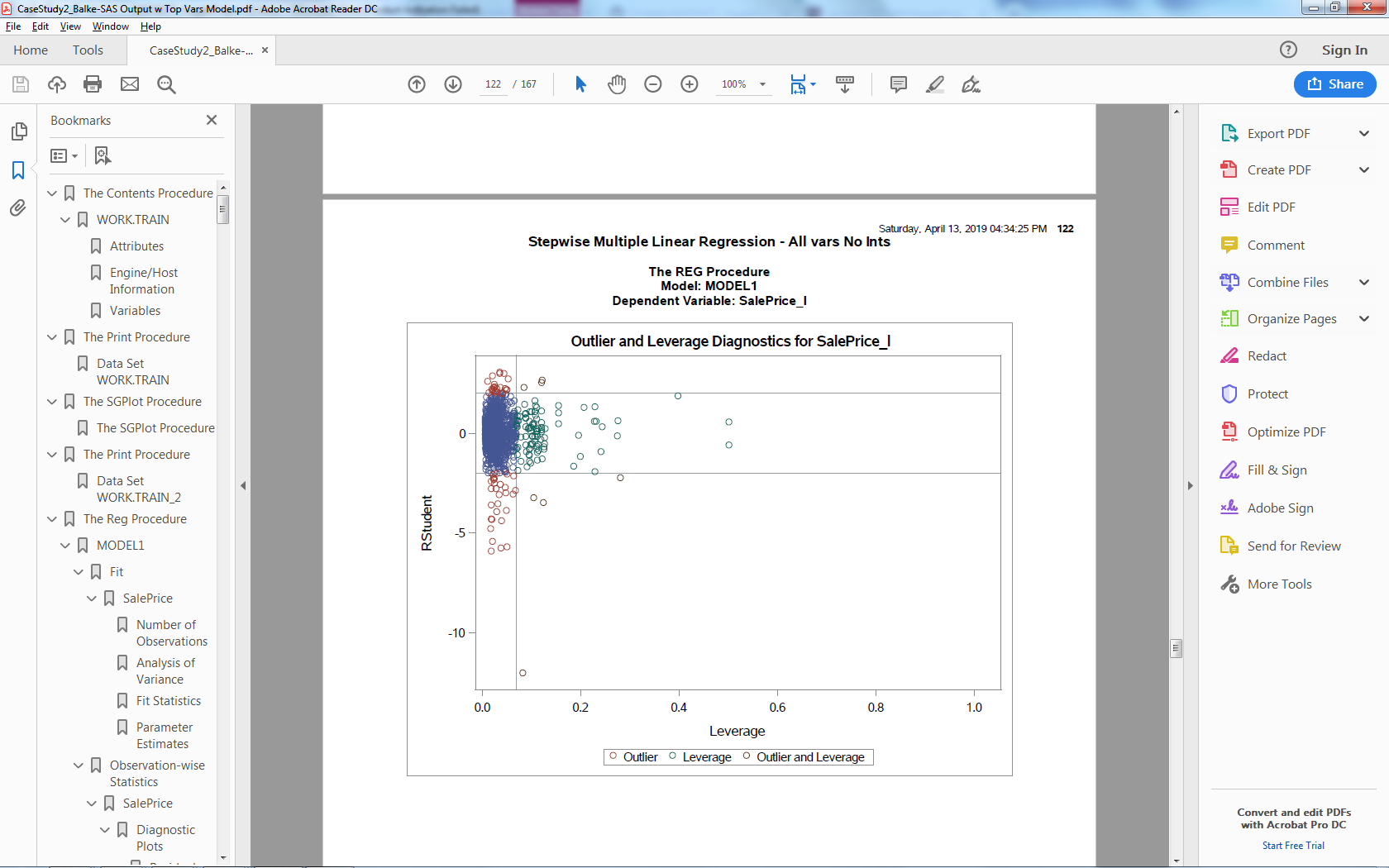
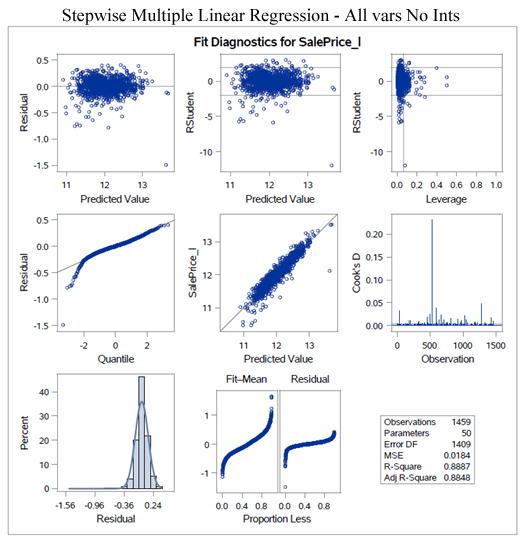
Based on the results of the exploratory data analysis, new variables were created for the log of the sales price and the log of the living area. For each model, the log of the sales price (SalePrice\_l) was used as the dependent variable. The first model selection process used was stepwise multiple linear regression using all explanatory variables and no interaction variables. Selection of criterion was based on a significance level of .15 for both entry and stay significance. The step selection process resulted in a reduced model with 8 effect variables and a RMSE of .1315.



The next model was built using a forward multiple regression process with all explanatory variables and no interaction variables. As with the stepwise regression, significance level was used as the selection criterion but the entry significance level was set to .5 and resulted in a model with

**Checking Assumptions**

Multilinear regression requires that certain assumptions be made about the data being used and that those assumptions be tested as part of the process. These assumptions are that there is a linear relationship (linearity) between the response variable and the explanatory variables, that there is a normal distribution of residuals (normality), and that independent variables are not highly correlated with each other (no multicollinearity). Linearity was checked by reviewing scatterplots of the residuals. Normality was verified by reviewing residual scatterplots and by analyzing the impact of outlier data points. Multicollinearity was checked by testing Variance Inflation Factor (VIF) values and using model selection processes that reduced the effects of collinearity.

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**Comparison of Models**

The model was the simplest model while the model had the lowest Kaggle score. The average Adjusted R2 score was with \_\_\_\_ at \_\_\_ being the lowest and

|  |  |  |  |
| --- | --- | --- | --- |
| **Predictive Models** | **Adjusted R2** | **CV PRESS** | **Kaggle Score** |
| Stepwise | .89 | 27.43 |  |
| Forward |  |  |  |
| Backward |  |  |  |
| CUSTOM |  |  |  |

**Conclusion**

Based on the \_\_\_\_ of the \_\_\_\_ the \_\_\_ model is the best at \_\_\_\_ and will be able to do lots of cool stuff for you so give us a good grade.

**Appendix**

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/  
/\* Century 21 Analysis \*/  
/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

options mlogic symbolgen;  
  
data train;  
 %let \_EFIERR\_ = 0;  
  
 /\* set the ERROR detection macro variable \*/  
 infile '/home/ spencer.fogelman/CaseStudy2/train.csv' delimiter=','

MISSOVER DSD   
 lrecl=32767 firstobs=2;   
 informat Id best32.;  
 informat MSSubClass $3.;  
 informat MSZoning $2.;  
 informat LotFrontage best32.;  
 informat LotArea best32.;  
 informat Street $4.;  
 informat Alley $2.;  
 informat LotShape $3.;  
 informat LandContour $3.;  
 informat Utilities $6.;  
 informat LotConfig $7.;  
 informat LandSlope $3.;  
 informat Neighborhood $7.;  
 informat Condition1 $6.;  
 informat Condition2 $6.;  
 informat BldgType $6.;  
 informat HouseStyle $6.;  
 informat OverallQual best32.;  
 informat OverallCond best32.;  
 informat YearBuilt best32.;  
 informat YearRemodAdd best32.;  
 informat RoofStyle $5.;  
 informat RoofMatl $7.;  
 informat Exterior1st $7.;  
 informat Exterior2nd $7.;  
 informat MasVnrType $7.;  
 informat MasVnrArea best32.;  
 informat ExterQual $2.;  
 informat ExterCond $2.;  
 informat Foundation $6.;  
 informat BsmtQual $2.;  
 informat BsmtCond $2.;  
 informat BsmtExposure $2.;  
 informat BsmtFinType1 $3.;  
 informat BsmtFinSF1 best32.;  
 informat BsmtFinType2 $3.;  
 informat BsmtFinSF2 best32.;  
 informat BsmtUnfSF best32.;  
 informat TotalBsmtSF best32.;  
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 informat HeatingQC $2.;  
 informat CentralAir $1.;  
 informat Electrical $5.;  
 informat "1stFlrSF"N best32.;  
 informat "2ndFlrSF"N best32.;  
 informat LowQualFinSF best32.;  
 informat GrLivArea best32.;  
 informat BsmtFullBath best32.;  
 informat BsmtHalfBath best32.;  
 informat FullBath best32.;  
 informat HalfBath best32.;  
 informat BedroomAbvGr best32.;  
 informat KitchenAbvGr best32.;  
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 informat TotRmsAbvGrd best32.;  
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 informat Fireplaces best32.;  
 informat FireplaceQu $2.;  
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 informat GarageFinish $3.;  
 informat GarageCars best32.;  
 informat GarageArea best32.;  
 informat GarageQual $2.;  
 informat GarageCond $2.;  
 informat PavedDrive $1.;  
 informat WoodDeckSF best32.;  
 informat OpenPorchSF best32.;  
 informat EnclosedPorch best32.;  
 informat "3SsnPorch"N best32.;  
 informat ScreenPorch best32.;  
 informat PoolArea best32.;  
 informat PoolQC $2.;  
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 informat MiscFeature $4.;  
 informat MiscVal best32.;  
 informat MoSold best32.;  
 informat YrSold best32.;  
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 informat SaleCondition $7.;  
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 format YearRemodAdd best12.;  
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 format HalfBath best12.;  
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 format SalePrice best12.;  
 input Id MSSubClass $  
 MSZoning $  
 LotFrontage LotArea Street $  
 Alley $  
 LotShape $  
 LandContour $  
 Utilities $  
 LotConfig $  
 LandSlope $  
 Neighborhood $  
 Condition1 $  
 Condition2 $  
 BldgType $  
 HouseStyle $  
 OverallQual OverallCond YearBuilt YearRemodAdd   
 RoofStyle $  
 RoofMatl $  
 Exterior1st $  
 Exterior2nd $  
 MasVnrType $  
 MasVnrArea ExterQual $  
 ExterCond $  
 Foundation $  
 BsmtQual $  
 BsmtCond $  
 BsmtExposure $  
 BsmtFinType1 $  
 BsmtFinSF1 BsmtFinType2 $  
 BsmtFinSF2 BsmtUnfSF TotalBsmtSF Heating $  
 HeatingQC $  
 CentralAir $  
 Electrical $  
 "1stFlrSF"N "2ndFlrSF"N LowQualFinSF GrLivArea   
 BsmtFullBath BsmtHalfBath FullBath HalfBath BedroomAbvGr

KitchenAbvGr   
 KitchenQual $  
 TotRmsAbvGrd Functional $  
 Fireplaces FireplaceQu $  
 GarageType $  
 GarageYrBlt GarageFinish $  
 GarageCars GarageArea GarageQual $  
 GarageCond $  
 PavedDrive $  
 WoodDeckSF OpenPorchSF EnclosedPorch "3SsnPorch"N   
 ScreenPorch PoolArea PoolQC $  
 Fence $  
 MiscFeature $  
 MiscVal MoSold YrSold SaleType $  
 SaleCondition $  
 SalePrice;  
  
 if \_ERROR\_ then  
 call symputx('\_EFIERR\_', 1);  
  
 /\* set ERROR detection macro variable \*/  
run;  
  
proc contents data=train;  
run;  
  
proc print data=train (obs=10);  
run;  
  
data train\_1;  
 set train;  
 where Neighborhood in ("NAmes", "Edwards", "BrkSide");  
run;  
  
data train\_2;  
 set train\_1;  
 N\_Dummy=0;  
 E\_Dummy=0;  
  
 if Neighborhood="NAmes" then  
 N\_Dummy=1;  
 else if Neighborhood="Edwards" then  
 E\_Dummy=1;  
 int\_e=E\_Dummy \* GrLIvArea;  
 int\_n=N\_Dummy \* GrLIvArea;  
run;  
  
title "Scatterplot of original data";  
  
proc sgplot data=train\_2;  
 scatter x=GrLIvArea y=SalePrice / datalabel=Id   
 markerattrs=(symbol=CircleFilled) group=Neighborhood;  
run;  
  
title;  
  
proc print data=train\_2 (obs=10);  
run;  
  
ods graphics on;  
title   
 "Linear-Linear MLR with Dummy and Interactions with Influential Point 1299";  
  
proc reg data=train\_2 plots=all;  
 model SalePrice=GrLIvArea E\_Dummy N\_Dummy int\_e int\_n;  
 ID id;  
 run;  
quit;  
  
title;  
ods graphics off;  
  
data train\_3;  
 set train\_2;  
 where Id ne 1299;  
run;  
  
ods graphics on;  
title   
 "Linear-Linear MLR with Dummy and Interactions w/o Influential Point 1299";  
  
proc reg data=train\_3 plots=all;  
 model SalePrice=GrLIvArea E\_Dummy N\_Dummy int\_e int\_n;  
 ID id;  
 run;  
quit;  
  
title;  
ods graphics off;  
  
data train\_4;  
 set train\_2;  
 SalePrice\_l=log(SalePrice);  
 GrLIvArea\_l=log(GrLIvArea);  
 int\_e\_l=E\_Dummy \* GrLIvArea\_l;  
 int\_n\_l=N\_Dummy \* GrLIvArea\_l;  
run;  
  
ods graphics on;  
title "Log-Linear MLR with Dummy and Interactions";  
  
proc reg data=train\_4 plots=all;  
 model SalePrice\_l=GrLIvArea E\_Dummy N\_Dummy int\_e int\_n;  
 ID id;  
 run;  
quit;  
  
title;  
ods graphics off;  
ods graphics on;  
title "Linear-Log MLR with Dummy and Interactions";  
  
proc reg data=train\_4 plots=all;  
 model SalePrice=GrLIvArea\_l E\_Dummy N\_Dummy int\_e\_l int\_n\_l;  
 ID id;  
 run;  
quit;  
  
title;  
ods graphics off;  
ods graphics on;  
title "Log-Log MLR with Dummy and Interactions";  
  
proc reg data=train\_4 plots=all;  
 model SalePrice\_l=GrLIvArea\_l E\_Dummy N\_Dummy int\_e\_l int\_n\_l;  
 ID id;  
 run;  
quit;  
  
title;  
ods graphics off;  
  
proc means data=train\_4;  
 var GrLIvArea\_l E\_Dummy N\_Dummy;  
run;  
  
data train\_5;  
 set train\_4;  
 centE=(GrLIvArea\_l - 7.1193132)\*(E\_Dummy - 0.2610966);  
 centN=(GrLIvArea\_l - 7.1193132)\*(N\_Dummy - 0.5874674);  
run;  
  
ods graphics on;  
title "Log-Log MLR with Dummy and Centered Interactions";  
  
proc reg data=train\_5 plots=all;  
 model SalePrice\_l=GrLIvArea\_l E\_Dummy N\_Dummy centE centN;  
 ID id;  
 run;  
quit;  
  
title;  
ods graphics off;  
  
/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/  
/\* Predicting Selling Prices \*/  
/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

/\* Import the test data \*/  
data test;  
 %let \_EFIERR\_ = 0;  
  
 /\* set the ERROR detection macro variable \*/  
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 informat Exterior2nd $7.;  
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 informat ExterCond $2.;  
 informat Foundation $6.;  
 informat BsmtQual $2.;  
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 informat BsmtUnfSF best32.;  
 informat TotalBsmtSF best32.;  
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 informat HeatingQC $2.;  
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 informat Electrical $5.;  
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 informat "2ndFlrSF"N best32.;  
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 informat GrLivArea best32.;  
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 informat BsmtHalfBath best32.;  
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 informat HalfBath best32.;  
 informat BedroomAbvGr best32.;  
 informat KitchenAbvGr best32.;  
 informat KitchenQual $2.;  
 informat TotRmsAbvGrd best32.;  
 informat Functional $4.;  
 informat Fireplaces best32.;  
 informat FireplaceQu $2.;  
 informat GarageType $7.;  
 informat GarageYrBlt best32.;  
 informat GarageFinish $3.;  
 informat GarageCars best32.;  
 informat GarageArea best32.;  
 informat GarageQual $2.;  
 informat GarageCond $2.;  
 informat PavedDrive $1.;  
 informat WoodDeckSF best32.;  
 informat OpenPorchSF best32.;  
 informat EnclosedPorch best32.;  
 informat "3SsnPorch"N best32.;  
 informat ScreenPorch best32.;  
 informat PoolArea best32.;  
 informat PoolQC $2.;  
 informat Fence $5.;  
 informat MiscFeature $4.;  
 informat MiscVal best32.;  
 informat MoSold best32.;  
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 informat SaleCondition $7.;  
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 format Alley $2.;  
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 format Utilities $6.;  
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 format LandSlope $3.;  
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 format HeatingQC $2.;  
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 format LowQualFinSF best12.;  
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 format FullBath best12.;  
 format HalfBath best12.;  
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 format KitchenAbvGr best12.;  
 format KitchenQual $2.;  
 format TotRmsAbvGrd best12.;  
 format Functional $4.;  
 format Fireplaces best12.;  
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 format EnclosedPorch best12.;  
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 format ScreenPorch best12.;  
 format PoolArea best12.;  
 format PoolQC $2.;  
 format Fence $5.;  
 format MiscFeature $4.;  
 format MiscVal best12.;  
 format MoSold best12.;  
 format YrSold best12.;  
 format SaleType $3.;  
 format SaleCondition $7.;  
 input Id MSSubClass $  
 MSZoning $  
 LotFrontage LotArea Street $  
 Alley $  
 LotShape $  
 LandContour $  
 Utilities $  
 LotConfig $  
 LandSlope $  
 Neighborhood $  
 Condition1 $  
 Condition2 $  
 BldgType $  
 HouseStyle $  
 OverallQual OverallCond YearBuilt YearRemodAdd   
 RoofStyle $  
 RoofMatl $  
 Exterior1st $  
 Exterior2nd $  
 MasVnrType $  
 MasVnrArea ExterQual $  
 ExterCond $  
 Foundation $  
 BsmtQual $  
 BsmtCond $  
 BsmtExposure $  
 BsmtFinType1 $  
 BsmtFinSF1 BsmtFinType2 $  
 BsmtFinSF2 BsmtUnfSF TotalBsmtSF Heating $  
 HeatingQC $  
 CentralAir $  
 Electrical $  
 "1stFlrSF"N "2ndFlrSF"N LowQualFinSF GrLivArea   
 BsmtFullBath BsmtHalfBath FullBath HalfBath BedroomAbvGr KitchenAbvGr   
 KitchenQual $  
 TotRmsAbvGrd Functional $  
 Fireplaces FireplaceQu $  
 GarageType $  
 GarageYrBlt GarageFinish $  
 GarageCars GarageArea GarageQual $  
 GarageCond $  
 PavedDrive $  
 WoodDeckSF OpenPorchSF EnclosedPorch "3SsnPorch"N   
 ScreenPorch PoolArea PoolQC $  
 Fence $  
 MiscFeature $  
 MiscVal MoSold YrSold SaleType $  
 SaleCondition $;  
  
 if \_ERROR\_ then  
 call symputx('\_EFIERR\_', 1);  
  
 /\* set ERROR detection macro variable \*/  
run;  
  
/\* Stack the test and train datasets so the GLMSELECTS can learn the coefficients \*/  
/\* with the train data and predict the value of the log of the sale price with the test data \*/  
proc append data=test base=train force;  
run;  
  
proc contents data=train;  
run;  
  
proc print data=train (obs=10);  
run;  
  
data train\_6;  
 set train;  
 SalePrice\_l=log(SalePrice);  
 GrLIvArea\_l=log(GrLIvArea);  
run;  
  
ods graphics on;  
title "Stepwise Multiple Linear Regression - All vars No Ints";  
  
proc glmselect data=train\_6 plots(stepAxis=number)=(criterionPanel ASEPlot)   
 outdesign (addinputvars)=step\_allvars\_sel;  
 class MSZoning MSSubClass Street Alley LotShape LandContour Utilities   
 LotConfig LandSlope Neighborhood Condition1 Condition2 BldgType HouseStyle   
 RoofStyle RoofMatl Exterior1st Exterior2nd MasVnrType ExterQual ExterCond   
 Foundation BsmtQual BsmtCond BsmtExposure BsmtFinType1 BsmtFinType2 Heating   
 HeatingQC CentralAir Electrical KitchenQual Functional FireplaceQu GarageType   
 GarageFinish GarageQual GarageCond PavedDrive PoolQC Fence MiscFeature   
 SaleType SaleCondition / param=ref;  
 model SalePrice\_l=MSZoning MSSubClass Street Alley LotShape LandContour   
 Utilities LotConfig LandSlope Neighborhood Condition1 Condition2 BldgType   
 HouseStyle YearBuilt YearRemodAdd RoofStyle RoofMatl Exterior1st Exterior2nd   
 MasVnrType ExterQual ExterCond Foundation BsmtQual BsmtCond BsmtExposure   
 BsmtFinType1 BsmtFinType2 Heating HeatingQC CentralAir Electrical KitchenQual   
 Functional FireplaceQu GarageType GarageYrBlt GarageFinish GarageQual   
 GarageCond PavedDrive PoolQC Fence MiscFeature YrSold SaleType SaleCondition   
 LotFrontage LotArea MasVnrArea BsmtFinSF1 BsmtFinSF2 BsmtUnfSF TotalBsmtSF   
 "1stFlrSF"n "2ndFlrSF"n LowQualFinSF GrLivArea BsmtFullBath BsmtHalfBath   
 FullBath HalfBath BedroomAbvGr KitchenAbvGr TotRmsAbvGrd Fireplaces   
 GarageCars GarageArea WoodDeckSF OpenPorchSF EnclosedPorch "3SsnPorch"n   
 ScreenPorch PoolArea MiscVal MoSold OverallQual OverallCond /   
 selection=stepwise(choose=cv select=sl) stats=press cvMethod=split(5)   
 cvDetails=all hierarchy=single;  
 output out=outData\_step\_allvars predicted=pred\_step\_allvars\_l;  
run;  
  
proc contents data=step\_allvars\_sel;  
run;  
  
proc reg data=step\_allvars\_sel plots=all;  
 model SalePrice\_l=&\_GLSMOD.;  
 ID id;  
 run;  
 title;  
 ods graphics off;  
 ods graphics on;  
 title "Forward Multiple Linear Regression - All Vars No Ints";  
  
proc glmselect data=train\_6 plots(stepAxis=number)=(criterionPanel ASEPlot)   
 outdesign (addinputvars)=forw\_allvars\_sel;  
 class MSZoning MSSubClass Street Alley LotShape LandContour Utilities   
 LotConfig LandSlope Neighborhood Condition1 Condition2 BldgType HouseStyle   
 RoofStyle RoofMatl Exterior1st Exterior2nd MasVnrType ExterQual ExterCond   
 Foundation BsmtQual BsmtCond BsmtExposure BsmtFinType1 BsmtFinType2 Heating   
 HeatingQC CentralAir Electrical KitchenQual Functional FireplaceQu GarageType   
 GarageFinish GarageQual GarageCond PavedDrive PoolQC Fence MiscFeature   
 SaleType SaleCondition / param=ref;  
 model SalePrice\_l=MSZoning MSSubClass Street Alley LotShape LandContour   
 Utilities LotConfig LandSlope Neighborhood Condition1 Condition2 BldgType   
 HouseStyle YearBuilt YearRemodAdd RoofStyle RoofMatl Exterior1st Exterior2nd   
 MasVnrType ExterQual ExterCond Foundation BsmtQual BsmtCond BsmtExposure   
 BsmtFinType1 BsmtFinType2 Heating HeatingQC CentralAir Electrical KitchenQual   
 Functional FireplaceQu GarageType GarageYrBlt GarageFinish GarageQual   
 GarageCond PavedDrive PoolQC Fence MiscFeature YrSold SaleType SaleCondition   
 LotFrontage LotArea MasVnrArea BsmtFinSF1 BsmtFinSF2 BsmtUnfSF TotalBsmtSF   
 "1stFlrSF"n "2ndFlrSF"n LowQualFinSF GrLivArea BsmtFullBath BsmtHalfBath   
 FullBath HalfBath BedroomAbvGr KitchenAbvGr TotRmsAbvGrd Fireplaces   
 GarageCars GarageArea WoodDeckSF OpenPorchSF EnclosedPorch "3SsnPorch"n   
 ScreenPorch PoolArea MiscVal MoSold OverallQual OverallCond /   
 selection=forward(choose=cv select=sl) stats=press cvMethod=split(5)   
 cvDetails=all hierarchy=single;  
 output out=outData\_forw\_allvars predicted=pred\_forw\_allvars\_l;  
run;  
  
proc reg data=forw\_allvars\_sel plots=all;  
 model SalePrice\_l=&\_GLSMOD.;  
 ID id;  
 run;  
 title;  
 ods graphics off;  
 ods graphics on;  
 title "Backward Selection Multiple Linear Regression - All Vars No Ints";  
  
proc glmselect data=train\_6 plots(stepAxis=number)=(criterionPanel ASEPlot)   
 outdesign (addinputvars)=back\_allvars\_sel;  
 class MSZoning MSSubClass Street Alley LotShape LandContour Utilities   
 LotConfig LandSlope Neighborhood Condition1 Condition2 BldgType HouseStyle   
 RoofStyle RoofMatl Exterior1st Exterior2nd MasVnrType ExterQual ExterCond   
 Foundation BsmtQual BsmtCond BsmtExposure BsmtFinType1 BsmtFinType2 Heating   
 HeatingQC CentralAir Electrical KitchenQual Functional FireplaceQu GarageType   
 GarageFinish GarageQual GarageCond PavedDrive PoolQC Fence MiscFeature   
 SaleType SaleCondition / param=ref;  
 model SalePrice\_l=MSZoning MSSubClass Street Alley LotShape LandContour   
 Utilities LotConfig LandSlope Neighborhood Condition1 Condition2 BldgType   
 HouseStyle YearBuilt YearRemodAdd RoofStyle RoofMatl Exterior1st Exterior2nd   
 MasVnrType ExterQual ExterCond Foundation BsmtQual BsmtCond BsmtExposure   
 BsmtFinType1 BsmtFinType2 Heating HeatingQC CentralAir Electrical KitchenQual   
 Functional FireplaceQu GarageType GarageYrBlt GarageFinish GarageQual   
 GarageCond PavedDrive PoolQC Fence MiscFeature YrSold SaleType SaleCondition   
 LotFrontage LotArea MasVnrArea BsmtFinSF1 BsmtFinSF2 BsmtUnfSF TotalBsmtSF   
 "1stFlrSF"n "2ndFlrSF"n LowQualFinSF GrLivArea BsmtFullBath BsmtHalfBath   
 FullBath HalfBath BedroomAbvGr KitchenAbvGr TotRmsAbvGrd Fireplaces   
 GarageCars GarageArea WoodDeckSF OpenPorchSF EnclosedPorch "3SsnPorch"n   
 ScreenPorch PoolArea MiscVal MoSold OverallQual OverallCond /   
 selection=backward (choose=cv select=sl) stats=press cvMethod=split(5)   
 cvDetails=all hierarchy=single;  
 output out=outData\_back\_allvars predicted=pred\_back\_allvars\_l;  
run;  
  
proc reg data=back\_allvars\_sel plots=all;  
 model SalePrice\_l=&\_GLSMOD.;  
 ID id;  
 run;  
 title;  
 ods graphics off;  
 ods graphics on;  
 title "Stepwise Selection Multiple Linear Regression - Most Promising Previously Selected Vars + Interactions";  
  
proc glmselect data=train\_6 plots(stepAxis=number)=(criterionPanel ASEPlot)   
 outdesign (addinputvars)=step\_topvarsints\_sel;  
 class MSSubClass Neighborhood RoofMatl Condition2 MSZoning SaleCondition   
 CentralAir KitchenQual/ param=ref;  
 model SalePrice\_l=MSSubClass|Neighborhood|YearBuilt|RoofMatl|BsmtFinSF1|GrLivArea|OverallQual|OverallCond|Condition2|MSZoning|GarageCars|TotalBsmtSF|SaleCondition|LotArea|CentralAir|KitchenQual|ScreenPorch  
 @2 / selection=stepwise (choose=cv select=sl) stats=press cvMethod=split(5)   
 cvDetails=all hierarchy=single;  
 output out=outData\_step\_topvarsints predicted=pred\_step\_topvarsints\_l;  
run;  
  
proc reg data=step\_topvarsints\_sel plots=all;  
 model SalePrice\_l=&\_GLSMOD.;  
 ID id;  
 run;  
 title;  
 ods graphics off;  
  
 /\* Macro to loop through creating each of the the three submission files \*/  
 %macro create\_submissions (method);  
 data &method.\_test\_stage1;  
 set outData\_&method.;  
  
 if Id ge 1461;  
 SalePrice=exp(pred\_&method.\_l);  
 run;  
  
 data &method.\_test\_stage2 (keep=Id SalePrice);  
 set &method.\_test\_stage1;  
 run;  
  
 /\* Routine to impute median value when predicted value is missing \*/  
 proc means data=&method.\_test\_stage2 median;  
 var SalePrice;  
 output out=tmp\_median\_SalePrice median=tmp\_median\_SalePrice;  
 run;  
  
 data \_null\_;  
 set tmp\_median\_SalePrice;  
 call symputx('tmp\_median\_SalePrice', tmp\_median\_SalePrice);  
 run;  
  
 %put &tmp\_median\_SalePrice.;  
  
 data &method.\_submission;  
 set &method.\_test\_stage2;  
  
 if SalePrice=. then  
 do;  
 SalePrice=input(&tmp\_median\_SalePrice., 11.2);  
 end;  
 run;  
  
 proc export data=&method.\_submission   
 outfile="/home/sarellano0/dataSets/&method.\_submission.csv"

dbms=csv replace;  
 run;  
  
%mend create\_submissions;  
  
%create\_submissions(method=step\_allvars);  
%create\_submissions(method=forw\_allvars);  
%create\_submissions(method=back\_allvars);  
%create\_submissions(method=step\_topvarsints);