Question 1

What is the optimal value of alpha for ridge and lasso regression? What will be the changes in the model if you choose double the value of alpha for both ridge and lasso? What will be the most important predictor variables after the change is implemented?

Answer : The optimal value of alpha is as below:

- **Ridge – 2.0**
- **Lasso – 50**

After **Doubling The Value Of Alpha**, the model complexity reduced, there by reducing the overfitting issue by introducing more bias and reducing the variance.

After the changes are made the **important 5 predictor** according to **Ridge Regularization are:**

	Ridge	Lasso
OverallQual_10	71105.194733	105590.542270
OverallQual_9	57012.364732	85015.861432
Neighborhood_NoRidge	51796.264852	52946.507393
Neighborhood_StoneBr	42564.983817	44081.893592
FullBath_3	37584.384204	49700.633487

```
top_5_Ridge_variables = ['OverallQual_10', 'OverallQual_9', 'Neighborhood_NoRidge','Neighborhood_StoneBr', 'FullBath_3']
```

The top 5 predictors according to Lasso Regularization are:

	Ridge	Lasso
OverallQual_10	71105.194733	105590.542270
OverallQual_9	57012.364732	85015.861432
Neighborhood_NoRidge	51796.264852	52946.507393
FullBath_3	37584.384204	49700.633487
Neighborhood_StoneBr	42564.983817	44081.893592

```
top_5_Lasso_variables = ['OverallQual_10', 'OverallQual_9', 'Neighborhood_NoRidge', 'FullBath_3','Neighborhood_StoneBr']
```

Question 2

You have determined the optimal value of lambda for ridge and lasso regression during the assignment. Now, which one will you choose to apply and why?

Answer 2: After applying the Regularization techniques the optimal value of alpha is found to be 2.0 for Ridge and 50 for Lasso. There has been significant improvement in the r2 score of the test set compared to vanilla linear regression model. However, Lasso regularization did the feature elimination by driving their coefficients to zero thereby simplifying the model. In this dataset, Lasso eliminated 28 features from 120 (selected by RFE). Ridge regularization only pushed certain variables towards zero without actually making them zero. **So, its better to choose Lasso Model as it simplifies the model by doing feature elimination.**

OBSERVATION:

we can see that some of the betas have become zero.

```
#Number of variables in model after feature elimination
betas[betas!=0].count()
```

```
Linear    121
Ridge     120
Lasso      92
dtype: int64
```

Question 3

After building the model, you realized that the five most important predictor variables in the lasso model are not available in the incoming data. You will now have to create another model excluding the five most important predictor variables. Which are the five most important predictor variables now?

Answer : After dropping the 5 most important variables according to Lasso, the next 5 important variables are:

a. **According to Ridge Regularization:**

```
betas = betas.sort_values(by="Ridge",ascending=False)
```

```
betas.head()
```

	Ridge	Lasso
OverallQual_3	64754.824019	96515.620516
OverallQual_4	58920.088116	83981.508959
OverallQual_5	57465.510960	80372.369059
FullBath_1	55472.440526	56871.703041
OverallQual_6	53832.412051	75684.892712

b. **According to Lasso Regularization:**

```
betas = betas.sort_values(by="Lasso",ascending=False)
```

```
betas.head()
```

	Ridge	Lasso
OverallQual_3	64754.824019	96515.620516
OverallQual_4	58920.088116	83981.508959
OverallQual_5	57465.510960	80372.369059
OverallQual_6	53832.412051	75684.892712
BsmtCond_Po	36282.268630	63899.672653

Question 4

How can you make sure that a model is robust and generalizable? What are the implications of the same for the accuracy of the model and why?

Answer: we can apply **regularization techniques like Lasso and Ridge** to ensure model robustness and generalizability.

A robust model will make consistent prediction on training as well as testing data.

The **implications of these techniques** on model accuracy is that after employing these techniques the model accuracy will be almost same on training and testing set. The issue overfitting will be addressed and model will become simpler and more robust.