# Assignment Subjective Questions:

## 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 for lasso and ridge are 0.0001 and 0.6 respectively. If we increase the alpha (hyper parameter value) the accuracy of the model starts dropping gradually. It might increase a bit till the optimal hyper parameter value but the accuracy will decrease with the increase in alpha and model will become more parse.

The most important predictor variables before and after the change is implemented is as follows:

| Features that lasso provides at optimal alpha (0.0001): | Features that lasso provides at double optimal alpha (0.0002): |
|---|---|

| | Featuere | Coef |
|---|---|---|
| 20 | Exterior1st | 0.147596 |
| 40 | 2ndFlrSF | 0.145204 |
| 2 | LotArea | 0.102753 |
| 13 | HouseStyle | 0.088614 |
| 9 | Neighborhood | 0.056936 |
| 29 | BsmtFinType1 | 0.039178 |
| 25 | Foundation | 0.035226 |
| 18 | RoofStyle | 0.034562 |
| 28 | BsmtExposure | 0.018644 |
| 27 | BsmtCond | 0.018632 |

| | Featuere | Coef |
|---|---|---|
| 2 | LotArea | 0.153609 |
| 20 | Exterior1st | 0.153348 |
| 40 | 2ndFlrSF | 0.133359 |
| 13 | HouseStyle | 0.087848 |
| 9 | Neighborhood | 0.062660 |
| 25 | Foundation | 0.049455 |
| 18 | RoofStyle | 0.041088 |
| 3 | Street | 0.038178 |
| 29 | BsmtFinType1 | 0.038008 |
| 28 | BsmtExposure | 0.021185 |

**R2 Score at optimal alpha (0.0001):**

```
R2 Score of Lasso Model on train data set: 0.8992813976336642
R2 Score of Lasso Model on test data set: 0.8610799341034835
```

**R2 Score at double optimal alpha (0.0002):**

```
R2 Score of Lasso Model on train data set: 0.8964094765274814
R2 Score of Lasso Model on test data set: 0.8606118898787734
```

| Features that Ridge model provides at optimal alpha (0.06): | Features that Ridge model provides at double optimal alpha (1.2): |
|---|---|

| | Feaure | Coef |
|---|---|---|
| 2 | LotArea | 0.157491 |
| 20 | Exterior1st | 0.108171 |
| 18 | RoofStyle | 0.097227 |
| 40 | 2ndFlrSF | 0.089103 |
| 13 | HouseStyle | 0.068700 |
| 9 | Neighborhood | 0.067417 |
| 25 | Foundation | 0.062591 |
| 3 | Street | 0.055238 |
| 16 | YearBuilt | 0.043504 |
| 19 | RoofMatl | 0.038970 |

| | Feaure | Coef |
|---|---|---|
| 2 | LotArea | 0.128277 |
| 20 | Exterior1st | 0.104037 |
| 18 | RoofStyle | 0.093200 |
| 40 | 2ndFlrSF | 0.088085 |
| 13 | HouseStyle | 0.069445 |
| 9 | Neighborhood | 0.065312 |
| 25 | Foundation | 0.059800 |
| 3 | Street | 0.045776 |
| 16 | YearBuilt | 0.045753 |
| 19 | RoofMatl | 0.038601 |

**R2 Score at optimal alpha (0.6):**

```
R2 Score of Ridge Model on train data set: 0.9001702140862855
R2 Score of Ridge Model on test data set: 0.8595824483759553
```

**R2 Score at optimal alpha (1.2):**

```
R2 Score of Ridge Model on train data set: 0.8995027973969958
R2 Score of Ridge Model on test data set: 0.8594995056658381
```

## 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:**

After creating model in both Ridge and Lasso we can see that the r2_scores are almost same for both of them but as lasso will penalise more on the dataset and can also help in feature elimination. Therefore, we are going to consider that as our final model.

## Question 3

After building the model, you realised 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:**

The five values that best describe the final model are as follows:

| Featuere | Coef |
|---|---|
| Exterior1st | 0.147596 |
| 2ndFlrSF | 0.145204 |
| LotArea | 0.102753 |
| HouseStyle | 0.088614 |
| Neighborhood | 0.056936 |

## Question 4

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

**Answer:**

We should ensure that the model is robust and generalisable by regularizing the model and using a regularisation term with the RSS because the hyper parameter will ensure to strike the right balance between the model being too simple or too complex. Making the model more generalisable may take a toll on accuracy up to some extent but we can also have a look at the precision and recall of the model because sensitivity and specificity also play an important role in the model evaluation criteria. Together if all three are above average we may accept the model. A very accurate model may have a chance of getting overfitted.