Problem Statement

It is your job to predict the sales price for each house. For each Id in the test set, you must predict the value of the SalePrice variable. Metric Submissions are evaluated on Mean-Squared-Error (MSE). The file should contain a header and have the following format:

Id,SalePrice 1461,169000.1 1462,187724.1233 1463,175221

In [5]:
```
from warnings import filterwarnings
filterwarnings("ignore")
```

In [6]:
```
from os import chdir
chdir("D:/Etlhive/1st project/")
```

In [7]:
```
import pandas as pd
train = pd.read_csv("training_set.csv")
test = pd.read_csv("testing_set.csv")
```

In [8]:
```
train.head()
```

Out[8]:

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotShape	LandContour	Utilitie
0	1	60	RL	65.0	8450	Pave	NaN	Reg	Lvl	AllPu
1	2	20	RL	80.0	9600	Pave	NaN	Reg	Lvl	AllPu
2	3	60	RL	68.0	11250	Pave	NaN	IR1	Lvl	AllPu
3	4	70	RL	60.0	9550	Pave	NaN	IR1	Lvl	AllPu
4	5	60	RL	84.0	14260	Pave	NaN	IR1	Lvl	AllPu

5 rows × 81 columns

In [9]:
```
test.head()
```

Out[9]:

	Id	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotShape	LandContour	Util
0	1461	20	RH	80.0	11622	Pave	NaN	Reg	Lvl	Al
1	1462	20	RL	81.0	14267	Pave	NaN	IR1	Lvl	Al
2	1463	60	RL	74.0	13830	Pave	NaN	IR1	Lvl	Al
3	1464	60	RL	78.0	9978	Pave	NaN	IR1	Lvl	Al
4	1465	120	RL	43.0	5005	Pave	NaN	IR1	HLS	Al

5 rows × 80 columns

In [ ]:

```
#Missing Data treatment
```

In [10]:
```
train.isna().sum()
```

Out[10]:
```
Id                0
MSSubClass        0
MSZoning          0
LotFrontage     259
LotArea           0
                 ...
MoSold            0
YrSold            0
SaleType          0
SaleCondition     0
SalePrice         0
Length: 81, dtype: int64
```

In [11]:
```
train.Alley = train.Alley.fillna("No alley access")
train.BsmtQual = train.BsmtQual.fillna("No Basement")
train.BsmtCond = train.BsmtCond.fillna("No Basement")
train.BsmtExposure = train.BsmtExposure.fillna("No Basement")
train.BsmtFinType1 = train.BsmtFinType1.fillna("No Basement")
train.BsmtFinType2 = train.BsmtFinType2.fillna("No Basement")
train.FireplaceQu = train.FireplaceQu.fillna("No Fireplace")
train.GarageType = train.GarageType.fillna("No Garage")
train.GarageFinish = train.GarageFinish.fillna("No Garage")
train.GarageQual = train.GarageQual.fillna("No Garage")
train.GarageCond = train.GarageCond.fillna("No Garage")
train.PoolQC = train.PoolQC.fillna("No Pool")
train.Fence = train.Fence.fillna("No Fence")
train.MiscFeature = train.MiscFeature.fillna("None")
```

In [12]:
```
test.Alley = test.Alley.fillna("No alley access")
test.BsmtQual = test.BsmtQual.fillna("No Basement")
test.BsmtCond = test.BsmtCond.fillna("No Basement")
test.BsmtExposure = test.BsmtExposure.fillna("No Basement")
test.BsmtFinType1 = test.BsmtFinType1.fillna("No Basement")
test.BsmtFinType2 = test.BsmtFinType2.fillna("No Basement")
test.FireplaceQu = test.FireplaceQu.fillna("No Fireplace")
test.GarageType = test.GarageType.fillna("No Garage")
test.GarageFinish = test.GarageFinish.fillna("No Garage")
test.GarageQual = test.GarageQual.fillna("No Garage")
test.GarageCond = test.GarageCond.fillna("No Garage")
test.PoolQC = test.PoolQC.fillna("No Pool")
test.Fence = test.Fence.fillna("No Fence")
test.MiscFeature = test.MiscFeature.fillna("None")
```

In [13]:
```
train.isna().sum()
```

Out[13]:
```
Id                0
MSSubClass        0
MSZoning          0
LotFrontage     259
LotArea           0
                 ...
MoSold            0
YrSold            0
SaleType          0
SaleCondition     0
```

```
SalePrice          0
Length: 81, dtype: int64
```

In [14]:
```
test.isna().sum()
```

Out[14]:
```
Id                 0
MSSubClass         0
MSZoning           4
LotFrontage      227
LotArea            0
                ...
MiscVal            0
MoSold             0
YrSold             0
SaleType           1
SaleCondition      0
Length: 80, dtype: int64
```

In [15]:
```
cat = []
con = []
for i in train.columns:
    if(train[i].dtypes == "object"):
        cat.append(i)
        x = train[i].mode()[0]
        train[i] = train[i].fillna(x)
    else:
        con.append(i)
        x = round(train[i].mean(),2)
        train[i] = train[i].fillna(x)
```

In [16]:
```
for i in test.columns:
    if(test[i].dtypes == "object"):
        x = test[i].mode()[0]
        test[i] = test[i].fillna(x)
    else:
        x = round(test[i].mean(),2)
        test[i] = test[i].fillna(x)
```

In [17]:
```
train.isna().sum()
```

Out[17]:
```
Id               0
MSSubClass       0
MSZoning         0
LotFrontage      0
LotArea          0
                ..
MoSold           0
YrSold           0
SaleType         0
SaleCondition    0
SalePrice        0
Length: 81, dtype: int64
```

In [18]:
```
test.isna().sum()
```

Out[18]:
```
Id               0
MSSubClass       0
MSZoning         0
LotFrontage      0
```

```
LotArea          0
                ..
MiscVal          0
MoSold           0
YrSold           0
SaleType         0
SaleCondition    0
Length: 80, dtype: int64
```

In [14]:
```
#Intial X and Y
```

In [19]:
```
Y = train[['SalePrice']]
X = train.drop(labels=["Id","SalePrice"],axis=1)
```

In [ ]:
```
#Divide data into Categorical and Continuous
```

In [22]:
```
cat = []
con = []
for i in X.columns:
    if(X[i].dtypes == "object"):
        cat.append(i)
    else:
        con.append(i)
```

In [ ]:
```
#Standardize Data
```

In [23]:
```
from sklearn.preprocessing import StandardScaler
ss = StandardScaler()
X1 = pd.DataFrame(ss.fit_transform(X[con]),columns=con)
```

In [ ]:
```
#Remove Outliers
```

In [26]:
```
outliers = []
for i in X1.columns:
    outliers.extend(list(X1[(X1[i]>3) | (X1[i]<-3)].index))
```

In [27]:
```
import numpy as np
outliers = np.unique(outliers)
```

In [28]:
```
X = X.drop(index=outliers,axis=0)
Y = Y.drop(index=outliers,axis=0)
```

In [29]:
```
X
```

Out[29]:

	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotShape	LandContour	Utiliti
0	60	RL	65.0	8450	Pave	No alley access	Reg	Lvl	AllPu

	MSSubClass	MSZoning	LotFrontage	LotArea	Street	Alley	LotShape	LandContour	Utiliti
2	60	RL	68.0	11250	Pave	No alley access	IR1	Lvl	AllPu
4	60	RL	84.0	14260	Pave	No alley access	IR1	Lvl	AllPu
6	20	RL	75.0	10084	Pave	No alley access	Reg	Lvl	AllPu
10	20	RL	70.0	11200	Pave	No alley access	Reg	Lvl	AllPu
...	...	...	...	...	...	...	...	...	
1452	180	RM	35.0	3675	Pave	No alley access	Reg	Lvl	AllPu
1453	20	RL	90.0	17217	Pave	No alley access	Reg	Lvl	AllPu
1454	20	FV	62.0	7500	Pave	Pave	Reg	Lvl	AllPu
1455	60	RL	62.0	7917	Pave	No alley access	Reg	Lvl	AllPu
1456	20	RL	85.0	13175	Pave	No alley access	Reg	Lvl	AllPu

1021 rows × 79 columns

In [30]:
```
Y
```

Out[30]:

	SalePrice
0	208500
2	223500
4	250000
6	307000
10	129500
...	...
1452	145000
1453	84500
1454	185000
1455	175000
1456	210000

1021 rows × 1 columns

In [31]:
```
X.shape
```

Out[31]:
```
(1021, 79)
```

In [32]:
```
Y.shape
```

Out[32]:
```
(1021, 1)
```

In [33]:
```
X.index = range(0,1021,1)
Y.index = range(0,1021,1)
```

In [ ]:
```
#Remove Categorical data if pvalue is greater than 0.05
```

In [34]:
```
for i in cat:
    import pandas as pd
    from statsmodels.formula.api import ols
    rel = "SalePrice ~ " + str(i)
    model = ols(rel,train).fit()
    from statsmodels.stats.anova import anova_lm
    anova_results = anova_lm(model)
    print(rel,"--->  ",round(anova_results.iloc[0,4],4))
```

```
SalePrice ~ MSZoning --->   0.0
SalePrice ~ Street --->   0.117
SalePrice ~ Alley --->   0.0
SalePrice ~ LotShape --->   0.0
SalePrice ~ LandContour --->   0.0
SalePrice ~ Utilities --->   0.5847
SalePrice ~ LotConfig --->   0.0
SalePrice ~ LandSlope --->   0.1414
SalePrice ~ Neighborhood --->   0.0
SalePrice ~ Condition1 --->   0.0
SalePrice ~ Condition2 --->   0.0434
SalePrice ~ BldgType --->   0.0
SalePrice ~ HouseStyle --->   0.0
SalePrice ~ RoofStyle --->   0.0
SalePrice ~ RoofMatl --->   0.0
SalePrice ~ Exterior1st --->   0.0
SalePrice ~ Exterior2nd --->   0.0
SalePrice ~ MasVnrType --->   0.0
SalePrice ~ ExterQual --->   0.0
SalePrice ~ ExterCond --->   0.0
SalePrice ~ Foundation --->   0.0
SalePrice ~ BsmtQual --->   0.0
SalePrice ~ BsmtCond --->   0.0
SalePrice ~ BsmtExposure --->   0.0
SalePrice ~ BsmtFinType1 --->   0.0
SalePrice ~ BsmtFinType2 --->   0.0
SalePrice ~ Heating --->   0.0008
SalePrice ~ HeatingQC --->   0.0
SalePrice ~ CentralAir --->   0.0
SalePrice ~ Electrical --->   0.0
SalePrice ~ KitchenQual --->   0.0
SalePrice ~ Functional --->   0.0005
```

```
SalePrice ~ FireplaceQu --->   0.0
SalePrice ~ GarageType --->   0.0
SalePrice ~ GarageFinish --->   0.0
SalePrice ~ GarageQual --->   0.0
SalePrice ~ GarageCond --->   0.0
SalePrice ~ PavedDrive --->   0.0
SalePrice ~ PoolQC --->   0.0
SalePrice ~ Fence --->   0.0
SalePrice ~ MiscFeature --->   0.035
SalePrice ~ SaleType --->   0.0
SalePrice ~ SaleCondition --->   0.0
```

In [35]:
```
cat.remove("Street")
cat.remove("Utilities")
cat.remove("LandSlope")
```

In [36]:
```
train.corr()["SalePrice"].sort_values()
```

Out[36]:
```
KitchenAbvGr    -0.135907
EnclosedPorch   -0.128578
MSSubClass      -0.084284
OverallCond     -0.077856
YrSold          -0.028923
LowQualFinSF    -0.025606
Id              -0.021917
MiscVal         -0.021190
BsmtHalfBath    -0.016844
BsmtFinSF2      -0.011378
3SsnPorch        0.044584
MoSold           0.046432
PoolArea         0.092404
ScreenPorch      0.111447
BedroomAbvGr     0.168213
BsmtUnfSF        0.214479
BsmtFullBath     0.227122
LotArea          0.263843
HalfBath         0.284108
OpenPorchSF      0.315856
2ndFlrSF         0.319334
WoodDeckSF       0.324413
LotFrontage      0.334901
BsmtFinSF1       0.386420
Fireplaces       0.466929
GarageYrBlt      0.470169
MasVnrArea       0.475241
YearRemodAdd     0.507101
YearBuilt        0.522897
TotRmsAbvGrd     0.533723
FullBath         0.560664
1stFlrSF         0.605852
TotalBsmtSF      0.613581
GarageArea       0.623431
GarageCars       0.640409
GrLivArea        0.708624
OverallQual      0.790982
SalePrice        1.000000
Name: SalePrice, dtype: float64
```

In [ ]:
```
#Consider only highest Correlated features based on Correlation
```

In [37]:

```
train.corr()["SalePrice"].sort_values().index[0:13]
```

Out[37]:
```
Index(['KitchenAbvGr', 'EnclosedPorch', 'MSSubClass', 'OverallCond', 'YrSold',
       'LowQualFinSF', 'Id', 'MiscVal', 'BsmtHalfBath', 'BsmtFinSF2',
       '3SsnPorch', 'MoSold', 'PoolArea'],
      dtype='object')
```

In [38]:
```
u = ['KitchenAbvGr', 'EnclosedPorch', 'MSSubClass', 'OverallCond', 'YrSold',
       'LowQualFinSF', 'MiscVal', 'BsmtHalfBath', 'BsmtFinSF2',
       '3SsnPorch', 'MoSold', 'PoolArea']

for i in u:
    con.remove(i)
```

In [39]:
```
X1 = pd.DataFrame(ss.fit_transform(X[con]),columns=con)
X2 = pd.get_dummies(X[cat])
```

In [ ]:
```
#Join both Continuous and Categorical data
```

In [40]:
```
Xnew = X1.join(X2)
```

In [41]:
```
Xnew
```

Out[41]:

	LotFrontage	LotArea	OverallQual	YearBuilt	YearRemodAdd	MasVnrArea	BsmtFinSF1	Bs
0	-0.142725	-0.196750	0.683815	0.953684	0.812282	0.861524	0.708378	-
1	0.020778	0.572050	0.683815	0.884839	0.764039	0.600444	0.168088	-
2	0.892795	1.398510	1.435348	0.850416	0.667554	2.044059	0.583129	-
3	0.402285	0.251900	1.435348	0.988107	0.908768	0.784736	2.336615	-
4	0.129780	0.558321	-0.819253	-0.354374	-1.020940	-0.643521	1.199551	-
...	...	...	...	...	...	...	...	
1016	-1.777756	-1.507829	-0.819253	1.022529	0.908768	-0.029217	0.317896	-
1017	1.219801	2.210418	-0.819253	1.056952	0.957010	-0.643521	-1.025461	
1018	-0.306228	-0.457593	0.683815	0.988107	0.908768	-0.643521	-0.018557	
1019	-0.306228	-0.343097	-0.067719	0.815994	0.667554	-0.643521	-1.025461	
1020	0.947296	1.100600	-0.067719	0.093120	0.088642	0.270256	0.914670	

1021 rows × 255 columns

In [42]:
```
Xnew.shape
```

Out[42]:
```
(1021, 255)
```

In [43]:
```
Y.shape
```

```
(1021, 1)
```

Out[43]:

In [ ]:
```
#Split the Data into Training and Testing Set
```

In [44]:
```
from sklearn.model_selection import train_test_split
xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
```

In [ ]:
```
#Create Backward Elemination Model
```

In [45]:
```
from statsmodels.api import add_constant,OLS
xconst = add_constant(xtrain,has_constant="add")
```

In [46]:
```
ols = OLS(ytrain,xconst)
model = ols.fit()
model.summary()
```

Out[46]:

OLS Regression Results

Dep. Variable:	SalePrice	**R-squared:**	0.944
Model:	OLS	**Adj. R-squared:**	0.926
Method:	Least Squares	**F-statistic:**	52.02
Date:	Fri, 29 Jul 2022	**Prob (F-statistic):**	6.08e-292
Time:	12:32:08	**Log-Likelihood:**	-9054.5
No. Observations:	816	**AIC:**	1.851e+04
Df Residuals:	616	**BIC:**	1.945e+04
Df Model:	199		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	1.333e+04	2178.289	6.117	0.000	9047.773	1.76e+04
LotFrontage	-266.4252	1146.443	-0.232	0.816	-2517.836	1984.985
LotArea	5142.1532	1239.017	4.150	0.000	2708.943	7575.363
OverallQual	8225.7713	1600.579	5.139	0.000	5082.519	1.14e+04
YearBuilt	6684.8536	2824.732	2.367	0.018	1137.581	1.22e+04
YearRemodAdd	5781.0512	1373.400	4.209	0.000	3083.937	8478.166
MasVnrArea	-861.1007	1280.919	-0.672	0.502	-3376.599	1654.398
BsmtFinSF1	-464.0506	8501.900	-0.055	0.956	-1.72e+04	1.62e+04
BsmtUnfSF	-7112.4224	8957.034	-0.794	0.427	-2.47e+04	1.05e+04
TotalBsmtSF	1.422e+04	7908.072	1.799	0.073	-1306.003	2.98e+04
1stFlrSF	7202.6049	4.76e+04	0.151	0.880	-8.63e+04	1.01e+05
2ndFlrSF	1.771e+04	5.82e+04	0.304	0.761	-9.67e+04	1.32e+05
GrLivArea	9592.0505	6.22e+04	0.154	0.878	-1.13e+05	1.32e+05

BsmtFullBath	-278.2839	1143.314	-0.243	0.808	-2523.550	1966.982
FullBath	-583.2277	1492.683	-0.391	0.696	-3514.591	2348.136
HalfBath	251.2976	1257.040	0.200	0.842	-2217.306	2719.901
BedroomAbvGr	-1100.1187	1255.045	-0.877	0.381	-3564.805	1364.568
TotRmsAbvGrd	426.2803	1655.399	0.258	0.797	-2824.630	3677.191
Fireplaces	-418.4419	2049.280	-0.204	0.838	-4442.865	3605.981
GarageYrBlt	-2394.4310	1933.742	-1.238	0.216	-6191.958	1403.096
GarageCars	2667.5878	1911.611	1.395	0.163	-1086.476	6421.652
GarageArea	4431.6809	1858.717	2.384	0.017	781.490	8081.872
WoodDeckSF	3440.2774	813.520	4.229	0.000	1842.669	5037.886
OpenPorchSF	2182.2623	862.036	2.532	0.012	489.376	3875.149
ScreenPorch	1094.1589	723.836	1.512	0.131	-327.326	2515.644
MSZoning_C (all)	-2.305e+04	1.02e+04	-2.251	0.025	-4.32e+04	-2940.859
MSZoning_FV	2.347e+04	6684.528	3.511	0.000	1.03e+04	3.66e+04
MSZoning_RH	-1383.8473	8738.917	-0.158	0.874	-1.85e+04	1.58e+04
MSZoning_RL	6009.6151	4114.647	1.461	0.145	-2070.821	1.41e+04
MSZoning_RM	8278.5218	4796.827	1.726	0.085	-1141.596	1.77e+04
Alley_Grvl	6168.4607	4127.275	1.495	0.136	-1936.775	1.43e+04
Alley_No alley access	4676.3276	2603.904	1.796	0.073	-437.278	9789.933
Alley_Pave	2480.7580	3989.321	0.622	0.534	-5353.560	1.03e+04
LotShape_IR1	8072.9482	3431.747	2.352	0.019	1333.605	1.48e+04
LotShape_IR2	6544.2369	4875.612	1.342	0.180	-3030.600	1.61e+04
LotShape_IR3	-8377.3737	9047.254	-0.926	0.355	-2.61e+04	9389.827
LotShape_Reg	7085.7349	3569.262	1.985	0.048	76.339	1.41e+04
LandContour_Bnk	5819.6088	4444.299	1.309	0.191	-2908.206	1.45e+04
LandContour_HLS	8573.0029	3943.517	2.174	0.030	828.635	1.63e+04
LandContour_Low	-6148.3567	6215.337	-0.989	0.323	-1.84e+04	6057.463
LandContour_Lvl	5081.2913	2736.468	1.857	0.064	-292.646	1.05e+04
LotConfig_Corner	6895.2198	3074.720	2.243	0.025	857.016	1.29e+04
LotConfig_CulDSac	1.031e+04	3660.739	2.817	0.005	3123.874	1.75e+04
LotConfig_FR2	-657.1564	4183.800	-0.157	0.875	-8873.397	7559.084
LotConfig_FR3	-8557.7873	9112.539	-0.939	0.348	-2.65e+04	9337.621
LotConfig_Inside	5332.3539	2739.536	1.946	0.052	-47.609	1.07e+04
Neighborhood_Blmngtn	1.301e+04	7342.270	1.772	0.077	-1405.891	2.74e+04
Neighborhood_Blueste	-3987.1539	1.95e+04	-0.204	0.838	-4.23e+04	3.43e+04
Neighborhood_BrDale	1.291e+04	8643.301	1.494	0.136	-4062.833	2.99e+04
Neighborhood_BrkSide	-1630.8758	6475.764	-0.252	0.801	-1.43e+04	1.11e+04

Neighborhood_ClearCr	-1.133e+04	7861.716	-1.441	0.150	-2.68e+04	4113.714
Neighborhood_CollgCr	-5219.1262	3266.575	-1.598	0.111	-1.16e+04	1195.848
Neighborhood_Crawfor	2.627e+04	6609.171	3.975	0.000	1.33e+04	3.92e+04
Neighborhood_Edwards	-1.336e+04	3680.315	-3.631	0.000	-2.06e+04	-6135.110
Neighborhood_Gilbert	-5798.4543	4403.101	-1.317	0.188	-1.44e+04	2848.454
Neighborhood_IDOTRR	-5797.9849	7695.283	-0.753	0.451	-2.09e+04	9314.185
Neighborhood_MeadowV	-1.156e+04	9382.908	-1.232	0.218	-3e+04	6866.203
Neighborhood_Mitchel	-1.066e+04	4813.483	-2.214	0.027	-2.01e+04	-1204.720
Neighborhood_NAmes	-6699.8951	3355.145	-1.997	0.046	-1.33e+04	-110.986
Neighborhood_NPkVill	2.025e+04	1.44e+04	1.405	0.160	-8048.268	4.86e+04
Neighborhood_NWAmes	-9890.7946	4281.629	-2.310	0.021	-1.83e+04	-1482.436
Neighborhood_NoRidge	6732.0934	6162.427	1.092	0.275	-5369.819	1.88e+04
Neighborhood_NridgHt	1.365e+04	4874.324	2.801	0.005	4080.410	2.32e+04
Neighborhood_OldTown	-9852.7250	6341.064	-1.554	0.121	-2.23e+04	2599.999
Neighborhood_SWISU	-1.276e+04	8238.537	-1.549	0.122	-2.89e+04	3420.751
Neighborhood_Sawyer	-5095.8935	3959.619	-1.287	0.199	-1.29e+04	2680.096
Neighborhood_SawyerW	-8.8963	4511.766	-0.002	0.998	-8869.205	8851.412
Neighborhood_Somerst	-6422.9664	6530.078	-0.984	0.326	-1.92e+04	6400.948
Neighborhood_StoneBr	4.472e+04	6436.249	6.949	0.000	3.21e+04	5.74e+04
Neighborhood_Timber	-8672.2341	5346.982	-1.622	0.105	-1.92e+04	1828.289
Neighborhood_Veenker	4510.2577	9657.133	0.467	0.641	-1.45e+04	2.35e+04
Condition1_Artery	-3157.2641	6177.245	-0.511	0.609	-1.53e+04	8973.749
Condition1_Feedr	2747.3615	4800.957	0.572	0.567	-6680.866	1.22e+04
Condition1_Norm	9393.5077	3755.077	2.502	0.013	2019.204	1.68e+04
Condition1_PosA	-8188.6936	1.12e+04	-0.728	0.467	-3.03e+04	1.39e+04
Condition1_PosN	1.872e+04	9321.359	2.008	0.045	409.957	3.7e+04
Condition1_RRAe	-1.938e+04	7641.144	-2.536	0.011	-3.44e+04	-4374.980
Condition1_RRAn	3353.5147	6594.816	0.509	0.611	-9597.534	1.63e+04
Condition1_RRNe	5.296e-11	1.89e-10	0.281	0.779	-3.17e-10	4.23e-10
Condition1_RRNn	9842.4989	1.79e+04	0.549	0.583	-2.53e+04	4.5e+04
Condition2_Feedr	1.129e+04	1.72e+04	0.656	0.512	-2.25e+04	4.51e+04
Condition2_Norm	2034.2435	1.59e+04	0.128	0.898	-2.92e+04	3.33e+04
Condition2_RRNn	-1.875e-11	3.06e-10	-0.061	0.951	-6.19e-10	5.82e-10
BldgType_1Fam	2.318e+04	6474.453	3.580	0.000	1.05e+04	3.59e+04
BldgType_2fmCon	-1.82e+04	2.35e+04	-0.775	0.439	-6.43e+04	2.79e+04
BldgType_Duplex	5618.5176	1.05e+04	0.536	0.592	-1.5e+04	2.62e+04
BldgType_Twnhs	-407.0774	7620.940	-0.053	0.957	-1.54e+04	1.46e+04

BldgType_TwnhsE	3138.1690	6735.720	0.466	0.641	-1.01e+04	1.64e+04
HouseStyle_1.5Fin	533.9376	3926.815	0.136	0.892	-7177.630	8245.505
HouseStyle_1.5Unf	1.78e+04	9389.569	1.895	0.059	-643.557	3.62e+04
HouseStyle_1Story	1.032e+04	3730.655	2.767	0.006	2997.000	1.76e+04
HouseStyle_2.5Unf	-1.777e+04	1.3e+04	-1.364	0.173	-4.34e+04	7813.418
HouseStyle_2Story	-3270.9492	4419.260	-0.740	0.459	-1.19e+04	5407.692
HouseStyle_SFoyer	3999.6207	5572.050	0.718	0.473	-6942.896	1.49e+04
HouseStyle_SLvl	1717.1860	4605.704	0.373	0.709	-7327.599	1.08e+04
RoofStyle_Flat	-3109.8700	8543.276	-0.364	0.716	-1.99e+04	1.37e+04
RoofStyle_Gable	985.1964	6746.479	0.146	0.884	-1.23e+04	1.42e+04
RoofStyle_Gambrel	5733.9528	1.06e+04	0.542	0.588	-1.5e+04	2.65e+04
RoofStyle_Hip	3129.1665	7000.077	0.447	0.655	-1.06e+04	1.69e+04
RoofStyle_Mansard	6587.1005	1.67e+04	0.396	0.693	-2.61e+04	3.93e+04
RoofMatl_CompShg	1.705e+04	1.2e+04	1.420	0.156	-6536.289	4.06e+04
RoofMatl_Tar&Grv	-3109.8700	8543.276	-0.364	0.716	-1.99e+04	1.37e+04
RoofMatl_WdShake	-5347.4162	2.34e+04	-0.228	0.820	-5.14e+04	4.07e+04
RoofMatl_WdShngl	4730.3204	1.85e+04	0.255	0.799	-3.17e+04	4.11e+04
Exterior1st_AsbShng	2.743e+04	2.27e+04	1.207	0.228	-1.72e+04	7.21e+04
Exterior1st_BrkComm	2.184e+04	2.51e+04	0.870	0.385	-2.75e+04	7.11e+04
Exterior1st_BrkFace	1.608e+04	7468.630	2.153	0.032	1412.222	3.07e+04
Exterior1st_CBlock	-7014.5340	1.3e+04	-0.540	0.589	-3.25e+04	1.85e+04
Exterior1st_CemntBd	-1.934e+04	2.05e+04	-0.943	0.346	-5.96e+04	2.1e+04
Exterior1st_HdBoard	-8521.9747	6131.057	-1.390	0.165	-2.06e+04	3518.333
Exterior1st_ImStucc	1.832e+04	2.26e+04	0.811	0.418	-2.6e+04	6.27e+04
Exterior1st_MetalSd	-812.9788	1.02e+04	-0.080	0.937	-2.09e+04	1.93e+04
Exterior1st_Plywood	-7092.3513	6376.576	-1.112	0.266	-1.96e+04	5430.113
Exterior1st_Stucco	-7367.6951	1.19e+04	-0.619	0.536	-3.07e+04	1.6e+04
Exterior1st_VinylSd	-9051.2916	8370.531	-1.081	0.280	-2.55e+04	7386.946
Exterior1st_Wd Sdng	-1.135e+04	6025.353	-1.883	0.060	-2.32e+04	486.905
Exterior1st_WdShing	193.6045	8122.547	0.024	0.981	-1.58e+04	1.61e+04
Exterior2nd_AsbShng	-1.967e+04	2.06e+04	-0.953	0.341	-6.02e+04	2.09e+04
Exterior2nd_Brk Cmn	3057.2449	1.8e+04	0.170	0.865	-3.23e+04	3.84e+04
Exterior2nd_BrkFace	-6543.6580	9316.969	-0.702	0.483	-2.48e+04	1.18e+04
Exterior2nd_CBlock	-7014.5340	1.3e+04	-0.540	0.589	-3.25e+04	1.85e+04
Exterior2nd_CmentBd	2.561e+04	2.12e+04	1.208	0.228	-1.6e+04	6.72e+04
Exterior2nd_HdBoard	2540.0997	6234.430	0.407	0.684	-9703.215	1.48e+04
Exterior2nd_ImStucc	-4079.7709	1.21e+04	-0.338	0.736	-2.78e+04	1.96e+04

Exterior2nd_MetalSd	6399.5008	1.06e+04	0.606	0.545	-1.43e+04	2.71e+04
Exterior2nd_Other	-2.088e+04	2.07e+04	-1.010	0.313	-6.15e+04	1.97e+04
Exterior2nd_Plywood	-444.8060	5877.955	-0.076	0.940	-1.2e+04	1.11e+04
Exterior2nd_Stone	-1.587e+04	2.09e+04	-0.759	0.448	-5.69e+04	2.52e+04
Exterior2nd_Stucco	3.409e+04	1.17e+04	2.921	0.004	1.12e+04	5.7e+04
Exterior2nd_VinylSd	7634.1732	7945.595	0.961	0.337	-7969.566	2.32e+04
Exterior2nd_Wd Sdng	9585.4239	5881.970	1.630	0.104	-1965.720	2.11e+04
Exterior2nd_Wd Shng	-1078.4058	7163.692	-0.151	0.880	-1.51e+04	1.3e+04
MasVnrType_BrkCmn	-1599.9595	6873.784	-0.233	0.816	-1.51e+04	1.19e+04
MasVnrType_BrkFace	2896.4609	2638.929	1.098	0.273	-2285.927	8078.849
MasVnrType_None	977.4864	2939.769	0.333	0.740	-4795.699	6750.672
MasVnrType_Stone	1.105e+04	3139.499	3.520	0.000	4886.140	1.72e+04
ExterQual_Ex	6303.0897	6386.713	0.987	0.324	-6239.281	1.88e+04
ExterQual_Fa	1.588e+04	1.24e+04	1.284	0.200	-8416.497	4.02e+04
ExterQual_Gd	-3579.3241	4650.266	-0.770	0.442	-1.27e+04	5552.972
ExterQual_TA	-5281.8465	4765.960	-1.108	0.268	-1.46e+04	4077.654
ExterCond_Fa	-9783.8094	6120.102	-1.599	0.110	-2.18e+04	2234.985
ExterCond_Gd	9054.0113	3490.659	2.594	0.010	2198.976	1.59e+04
ExterCond_TA	1.406e+04	3101.689	4.532	0.000	7964.178	2.01e+04
Foundation_BrkTil	-4461.4196	4776.184	-0.934	0.351	-1.38e+04	4918.158
Foundation_CBlock	-696.8586	4026.804	-0.173	0.863	-8604.787	7211.069
Foundation_PConc	-59.4035	4408.590	-0.013	0.989	-8717.092	8598.285
Foundation_Slab	390.0644	9530.595	0.041	0.967	-1.83e+04	1.91e+04
Foundation_Stone	1.815e+04	1.29e+04	1.410	0.159	-7134.955	4.34e+04
Foundation_Wood	4.059e-11	2.51e-11	1.617	0.106	-8.69e-12	8.99e-11
BsmtQual_Ex	1.583e+04	3862.241	4.099	0.000	8247.459	2.34e+04
BsmtQual_Fa	4986.2576	5706.792	0.874	0.383	-6220.868	1.62e+04
BsmtQual_Gd	-5700.6219	2651.078	-2.150	0.032	-1.09e+04	-494.375
BsmtQual_No Basement	2353.5190	2044.784	1.151	0.250	-1662.075	6369.113
BsmtQual_TA	-4145.8232	2755.382	-1.505	0.133	-9556.904	1265.257
BsmtCond_Fa	-1547.2971	3466.331	-0.446	0.655	-8354.555	5259.961
BsmtCond_Gd	5527.5409	3066.606	1.802	0.072	-494.728	1.15e+04
BsmtCond_No Basement	2353.5190	2044.784	1.151	0.250	-1662.075	6369.113
BsmtCond_TA	6991.7834	2157.382	3.241	0.001	2755.068	1.12e+04
BsmtExposure_Av	854.9888	1916.049	0.446	0.656	-2907.791	4617.769
BsmtExposure_Gd	1.641e+04	2681.451	6.122	0.000	1.11e+04	2.17e+04
BsmtExposure_Mn	-3393.2818	2492.803	-1.361	0.174	-8288.704	1502.141

BsmtExposure_No	-2904.3260	1662.240	-1.747	0.081	-6168.671	360.019
BsmtExposure_No Basement	2353.5190	2044.784	1.151	0.250	-1662.075	6369.113
BsmtFinType1_ALQ	3046.6597	2168.611	1.405	0.161	-1212.108	7305.428
BsmtFinType1_BLQ	-65.2461	2421.781	-0.027	0.979	-4821.193	4690.701
BsmtFinType1_GLQ	9564.1352	2243.199	4.264	0.000	5158.890	1.4e+04
BsmtFinType1_LwQ	-2689.9869	3855.870	-0.698	0.486	-1.03e+04	4882.257
BsmtFinType1_No Basement	2353.5190	2044.784	1.151	0.250	-1662.075	6369.113
BsmtFinType1_Rec	-546.2887	2579.077	-0.212	0.832	-5611.139	4518.561
BsmtFinType1_Unf	1662.7540	2345.231	0.709	0.479	-2942.863	6268.371
BsmtFinType2_ALQ	6184.7252	1.18e+04	0.522	0.602	-1.71e+04	2.94e+04
BsmtFinType2_BLQ	-5844.7145	5791.580	-1.009	0.313	-1.72e+04	5528.921
BsmtFinType2_GLQ	1.797e+04	1.14e+04	1.570	0.117	-4504.038	4.05e+04
BsmtFinType2_LwQ	-3876.3285	5301.441	-0.731	0.465	-1.43e+04	6534.761
BsmtFinType2_No Basement	2353.5190	2044.784	1.151	0.250	-1662.075	6369.113
BsmtFinType2_Rec	-3321.1699	5309.788	-0.625	0.532	-1.37e+04	7106.312
BsmtFinType2_Unf	-144.3728	5653.815	-0.026	0.980	-1.12e+04	1.1e+04
Heating_Floor	-8.98e-12	7.67e-12	-1.171	0.242	-2.4e-11	6.08e-12
Heating_GasA	-4721.5271	8779.689	-0.538	0.591	-2.2e+04	1.25e+04
Heating_GasW	1373.6503	1.1e+04	0.125	0.901	-2.03e+04	2.3e+04
Heating_Grav	-3247.9569	1.42e+04	-0.229	0.819	-3.11e+04	2.46e+04
Heating_Wall	1.992e+04	1.86e+04	1.072	0.284	-1.66e+04	5.64e+04
HeatingQC_Ex	5822.4382	2185.979	2.664	0.008	1529.563	1.01e+04
HeatingQC_Fa	1033.9247	4540.369	0.228	0.820	-7882.554	9950.404
HeatingQC_Gd	2419.0460	2247.963	1.076	0.282	-1995.555	6833.647
HeatingQC_TA	4050.1373	2027.738	1.997	0.046	68.020	8032.254
CentralAir_N	7484.9158	2911.740	2.571	0.010	1766.775	1.32e+04
CentralAir_Y	5840.6304	3052.670	1.913	0.056	-154.272	1.18e+04
Electrical_FuseA	3809.9138	3272.165	1.164	0.245	-2616.037	1.02e+04
Electrical_FuseF	4694.3194	4897.293	0.959	0.338	-4923.096	1.43e+04
Electrical_FuseP	5.053e-13	9.1e-12	0.056	0.956	-1.74e-11	1.84e-11
Electrical_SBrkr	4821.3131	3036.003	1.588	0.113	-1140.858	1.08e+04
KitchenQual_Ex	1.556e+04	3658.840	4.251	0.000	8369.952	2.27e+04
KitchenQual_Fa	1411.9871	5024.981	0.281	0.779	-8456.184	1.13e+04
KitchenQual_Gd	-3233.2214	2376.988	-1.360	0.174	-7901.204	1434.761
KitchenQual_TA	-408.4833	2312.634	-0.177	0.860	-4950.085	4133.119
Functional_Maj1	8645.1658	9533.667	0.907	0.365	-1.01e+04	2.74e+04
Functional_Maj2	-2097.9744	1.78e+04	-0.118	0.906	-3.71e+04	3.29e+04

Functional_Min1	-1107.7488	6229.040	-0.178	0.859	-1.33e+04	1.11e+04
Functional_Min2	1.017e+04	6100.429	1.668	0.096	-1806.716	2.22e+04
Functional_Mod	-1.916e+04	9460.476	-2.025	0.043	-3.77e+04	-581.096
Functional_Typ	1.687e+04	4592.630	3.674	0.000	7853.342	2.59e+04
FireplaceQu_Ex	5940.2631	6045.509	0.983	0.326	-5932.044	1.78e+04
FireplaceQu_Fa	-8197.8320	4653.630	-1.762	0.079	-1.73e+04	941.072
FireplaceQu_Gd	2565.9780	2492.026	1.030	0.304	-2327.918	7459.874
FireplaceQu_No Fireplace	-1345.0988	3803.861	-0.354	0.724	-8815.206	6125.009
FireplaceQu_Po	1.206e+04	5979.304	2.018	0.044	322.171	2.38e+04
FireplaceQu_TA	2297.7719	2693.773	0.853	0.394	-2992.320	7587.864
GarageType_Attchd	-5968.5855	4384.026	-1.361	0.174	-1.46e+04	2640.864
GarageType_Basment	-4667.8253	6742.090	-0.692	0.489	-1.79e+04	8572.444
GarageType_BuiltIn	-2681.8884	5317.297	-0.504	0.614	-1.31e+04	7760.339
GarageType_CarPort	2.862e+04	1.67e+04	1.718	0.086	-4088.361	6.13e+04
GarageType_Detchd	-3586.7363	4487.262	-0.799	0.424	-1.24e+04	5225.450
GarageType_No Garage	1611.7606	1769.023	0.911	0.363	-1862.286	5085.807
GarageFinish_Fin	2566.2738	1718.576	1.493	0.136	-808.704	5941.252
GarageFinish_No Garage	1611.7606	1769.023	0.911	0.363	-1862.286	5085.807
GarageFinish_RFn	5360.0327	1560.776	3.434	0.001	2294.946	8425.119
GarageFinish_Unf	3787.4791	1800.048	2.104	0.036	252.504	7322.454
GarageQual_Ex	3857.7788	6395.270	0.603	0.547	-8701.396	1.64e+04
GarageQual_Fa	-5711.8138	5227.801	-1.093	0.275	-1.6e+04	4554.660
GarageQual_Gd	1.087e+04	7405.503	1.467	0.143	-3676.568	2.54e+04
GarageQual_No Garage	1611.7606	1769.023	0.911	0.363	-1862.286	5085.807
GarageQual_Po	0	0	nan	nan	0	0
GarageQual_TA	2701.2948	3870.065	0.698	0.485	-4898.827	1.03e+04
GarageCond_Ex	3857.7788	6395.270	0.603	0.547	-8701.396	1.64e+04
GarageCond_Fa	-5931.6472	6931.792	-0.856	0.392	-1.95e+04	7681.161
GarageCond_Gd	3917.5187	9387.021	0.417	0.677	-1.45e+04	2.24e+04
GarageCond_No Garage	1611.7606	1769.023	0.911	0.363	-1862.286	5085.807
GarageCond_Po	9405.2894	1.5e+04	0.627	0.531	-2.01e+04	3.89e+04
GarageCond_TA	464.8460	5380.312	0.086	0.931	-1.01e+04	1.1e+04
PavedDrive_N	7064.6020	3269.168	2.161	0.031	644.537	1.35e+04
PavedDrive_P	918.7346	4147.905	0.221	0.825	-7227.014	9064.483
PavedDrive_Y	5342.2096	2706.584	1.974	0.049	26.959	1.07e+04
PoolQC_No Pool	1.333e+04	2178.289	6.117	0.000	9047.773	1.76e+04
Fence_GdPrv	2420.8700	4093.444	0.591	0.554	-5617.928	1.05e+04

Fence_GdWo	3508.6488	3570.629	0.983	0.326	-3503.433	1.05e+04
Fence_MnPrv	5796.2033	2777.244	2.087	0.037	342.190	1.13e+04
Fence_MnWw	-3456.9503	6793.835	-0.509	0.611	-1.68e+04	9884.936
Fence_No Fence	5056.7744	2370.186	2.133	0.033	402.150	9711.399
MiscFeature_None	3322.3013	2487.796	1.335	0.182	-1563.288	8207.890
MiscFeature_Shed	1e+04	2682.370	3.729	0.000	4735.546	1.53e+04
SaleType_COD	-3434.2107	6584.954	-0.522	0.602	-1.64e+04	9497.470
SaleType_CWD	4.15e+04	1.35e+04	3.073	0.002	1.5e+04	6.8e+04
SaleType_Con	1.237e+04	1.79e+04	0.692	0.489	-2.27e+04	4.75e+04
SaleType_ConLD	-7131.8047	1.05e+04	-0.677	0.498	-2.78e+04	1.35e+04
SaleType_ConLI	-4125.3259	1.14e+04	-0.361	0.718	-2.66e+04	1.83e+04
SaleType_ConLw	-8076.5383	1.97e+04	-0.410	0.682	-4.67e+04	3.06e+04
SaleType_New	-1.892e+04	1.41e+04	-1.346	0.179	-4.65e+04	8692.728
SaleType_Oth	-383.6193	1.34e+04	-0.029	0.977	-2.66e+04	2.59e+04
SaleType_WD	1530.5175	4953.654	0.309	0.757	-8197.579	1.13e+04
SaleCondition_Abnorml	2100.9827	5571.741	0.377	0.706	-8840.927	1.3e+04
SaleCondition_AdjLand	2.63e+04	1.53e+04	1.717	0.087	-3787.507	5.64e+04
SaleCondition_Alloca	-5.745e+04	1.74e+04	-3.311	0.001	-9.15e+04	-2.34e+04
SaleCondition_Family	-1838.3893	7511.557	-0.245	0.807	-1.66e+04	1.29e+04
SaleCondition_Normal	6724.2173	5173.617	1.300	0.194	-3435.848	1.69e+04
SaleCondition_Partial	3.749e+04	1.37e+04	2.735	0.006	1.06e+04	6.44e+04

Omnibus:	158.266	**Durbin-Watson:**	2.124
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	3625.343
Skew:	0.090	**Prob(JB):**	0.00
Kurtosis:	13.325	**Cond. No.**	1.25e+16

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The smallest eigenvalue is 1.41e-28. This might indicate that there are
strong multicollinearity problems or that the design matrix is singular.

In [39]:
```
model.rsquared_adj
```

Out[39]:
```
0.925694687920248
```

In [48]:
```
col_drop = model.pvalues.sort_values().index[-1]
```

In [49]:
```
for i in range(0,8):
```

```
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9257
Neighborhood_SawyerW
0.9257
Foundation_PConc
0.9257
Exterior1st_WdShing
0.9257
Condition2_RRNn
0.9257
BsmtFinType2_Unf
0.9257
BsmtFinType1_BLQ
0.9257
SaleType_Oth
0.9257
Foundation_Slab
```

In [50]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9258
BsmtFinSF1
0.9259
BldgType_Twnhs
0.9259
Condition1_RRNe
0.9259
Exterior2nd_Plywood
0.9259
Foundation_Wood
0.9259
Exterior2nd_Wd Shng
0.9261
Exterior1st_MetalSd
0.9262
GarageCond_TA
```

In [51]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9262
Condition2_Norm
0.9262
Functional_Maj2
0.9262
Functional_Min1
0.9263
Heating_GasW
0.9263
Heating_Floor
0.9263
BsmtFinType1_Rec
0.9264
Electrical_FuseP
0.9264
SaleType_WD
```

In [52]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9265
LotConfig_FR2
0.9265
1stFlrSF
0.9266
HouseStyle_1.5Fin
0.9266
MSZoning_RH
0.9266
RoofStyle_Gable
0.9266
KitchenQual_TA
0.9266
Exterior2nd_Brk Cmn
0.9268
Neighborhood_BrkSide
```

In [53]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9269
Neighborhood_Blueste
0.927
BsmtFullBath
0.9271
PavedDrive_P
0.9271
HouseStyle_SLvl
0.9272
```

```
RoofMatl_WdShake
0.9272
RoofStyle_Flat
0.9272
RoofMatl_Tar&Grv
0.9273
HeatingQC_Fa
```

In [54]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9273
HeatingQC_Gd
0.9274
LotFrontage
0.9275
HalfBath
0.9276
Foundation_CBlock
0.9278
MasVnrType_BrkCmn
0.9278
Fireplaces
0.9279
MasVnrType_None
0.928
SaleCondition_Family
```

In [55]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.928
TotRmsAbvGrd
0.9281
KitchenQual_Fa
0.9282
Condition2_Feedr
0.9283
Heating_Grav
0.9284
Exterior2nd_ImStucc
0.9285
RoofStyle_Mansard
0.9286
GarageCond_Gd
0.9287
FireplaceQu_No Fireplace
```

In [56]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9287
RoofMatl_WdShngl
0.9288
BsmtCond_Fa
0.9288
RoofStyle_Gambrel
0.9289
BldgType_Duplex
0.929
GarageType_BuiltIn
0.929
GarageType_Detchd
0.9291
GarageType_Basment
0.9292
BsmtExposure_Av
```

In [57]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9292
Heating_GasA
0.9292
SaleType_ConLw
0.9293
BsmtFinType2_ALQ
0.9294
BsmtFinType1_LwQ
0.9295
BldgType_TwnhsE
0.9296
Exterior1st_CBlock
0.9296
Exterior2nd_CBlock
0.9297
HouseStyle_SFoyer
```

In [58]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9298
FullBath
0.9299
SaleType_ConLI
0.9299
Exterior2nd_BrkFace
0.93
Condition1_RRAn
0.93
Condition1_Feedr
0.9301
Fence_MnWw
0.9301
Alley_Pave
0.9301
Alley_No alley access
```

In [59]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9302
Alley_Grvl
0.9303
GarageCond_Ex
0.9303
GarageQual_TA
0.9303
GarageQual_Ex
0.9304
Neighborhood_Veenker
0.9305
Exterior2nd_AsbShng
0.9305
Exterior2nd_Stone
0.9306
ExterQual_Gd
```

In [60]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9306
ExterQual_TA
0.9307
SaleType_Con
0.9308
Condition1_RRNn
0.9308
```

```
LotConfig_FR3
0.9309
SaleCondition_Abnorml
0.931
BsmtFinType2_Rec
0.931
Exterior1st_Stucco
0.9311
MSZoning_RL
```

In [61]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9312
MSZoning_RM
0.9312
Neighborhood_IDOTRR
0.9313
SaleType_ConLD
0.9314
BldgType_2fmCon
0.9314
BsmtFinType2_LwQ
0.9315
BsmtFinType1_Unf
0.9315
GarageCond_Po
0.9316
PavedDrive_Y
```

In [62]:

```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9317
PavedDrive_N
0.9317
LandContour_Low
0.9317
Exterior1st_CemntBd
0.9318
Fence_GdPrv
0.9318
Fence_GdWo
0.9319
Fence_MnPrv
0.9319
Fence_No Fence
0.932
Exterior1st_ImStucc
```

In [63]:
```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9321
Condition1_PosA
0.9321
Exterior2nd_HdBoard
0.9322
LotShape_IR3
0.9322
BedroomAbvGr
0.9322
Condition1_Artery
0.9322
SaleType_COD
0.9322
Exterior2nd_Other
0.9323
HeatingQC_TA
```

In [64]:
```
for i in range(0,8):
    Xnew = Xnew.drop(labels=col_drop,axis=1)
    xtrain,xtest,ytrain,ytest=train_test_split(Xnew,Y,test_size=0.2,random_state=31)
    xconst = add_constant(xtrain,has_constant="add")
    ols = OLS(ytrain,xconst)
    model = ols.fit()
    print(round(model.rsquared_adj,4))
    col_drop = model.pvalues.sort_values().index[-1]
    print(col_drop)
```

```
0.9323
MasVnrArea
0.9323
MasVnrType_BrkFace
0.9323
BsmtFinType2_BLQ
0.9324
GarageCond_Fa
0.9324
Neighborhood_Somerst
0.9323
SaleType_New
0.9323
Exterior1st_AsbShng
0.9323
BsmtCond_Gd
```

In [65]:
```
from sklearn.linear_model import LinearRegression
lm = LinearRegression()
model = lm.fit(xtrain,ytrain)
tr_pred = model.predict(xtrain)
ts_pred = model.predict(xtest)

from sklearn.metrics import mean_squared_error
```

```
tr_err = round(mean_squared_error(ytrain,tr_pred),2)
ts_err = round(mean_squared_error(ytest,ts_pred),2)
print(tr_err)
print(ts_err)
```

```
264023137.26
7.109277238337266e+29
```

In [ ]:

```
Since training error is less than testing error. Model suffers from Overfitting.
#Regularization using Lasso and Ridge regression
```

In [66]:

```
tr = []
ts = []
```

In [67]:

```
w = []
y = 10.0
for i in range(0,1000):
    y = round(y + 0.01,2)
    w.append(y)
```

In [68]:

```
from sklearn.linear_model import Ridge
```

In [69]:

```
for i in w:
    rr = Ridge(alpha=i)
    model = rr.fit(xtrain,ytrain)
    tr_pred = model.predict(xtrain)
    ts_pred = model.predict(xtest)
    tr_err = round(mean_squared_error(ytrain,tr_pred),2)
    ts_err = round(mean_squared_error(ytest,ts_pred),2)
    tr.append(tr_err)
    ts.append(ts_err)
    print("==========",i,"===========")
    print(tr_err)
    print(ts_err)
    if(tr_err < ts_err):
        print("Overfitting")
    else:
        print("Best fit")
```

```
========== 10.01 ===========
305594503.81
310487228.59
Overfitting
========== 10.02 ===========
305624540.82
310504155.43
Overfitting
========== 10.03 ===========
305654562.8
310521092.75
Overfitting
========== 10.04 ===========
305684569.78
310538040.51
Overfitting
========== 10.05 ===========
305714561.78
310554998.66
```

```
Overfitting
========== 10.06 ===========
305744538.8
310571967.14
Overfitting
========== 10.07 ===========
305774500.86
310588945.92
Overfitting
========== 10.08 ===========
305804448.0
310605934.94
Overfitting
========== 10.09 ===========
305834380.21
310622934.15
Overfitting
========== 10.1 ===========
305864297.52
310639943.52
Overfitting
========== 10.11 ===========
305894199.95
310656962.98
Overfitting
========== 10.12 ===========
305924087.52
310673992.5
Overfitting
========== 10.13 ===========
305953960.23
310691032.03
Overfitting
========== 10.14 ===========
305983818.11
310708081.52
Overfitting
========== 10.15 ===========
306013661.18
310725140.92
Overfitting
========== 10.16 ===========
306043489.45
310742210.19
Overfitting
========== 10.17 ===========
306073302.94
310759289.29
Overfitting
========== 10.18 ===========
306103101.67
310776378.16
Overfitting
========== 10.19 ===========
306132885.65
310793476.76
Overfitting
========== 10.2 ===========
306162654.91
310810585.05
Overfitting
========== 10.21 ===========
306192409.45
310827702.97
```

```
Overfitting
========== 10.22 ==========
306222149.3
310844830.49
Overfitting
========== 10.23 ==========
306251874.46
310861967.56
Overfitting
========== 10.24 ==========
306281584.97
310879114.13
Overfitting
========== 10.25 ==========
306311280.84
310896270.17
Overfitting
========== 10.26 ==========
306340962.07
310913435.61
Overfitting
========== 10.27 ==========
306370628.7
310930610.43
Overfitting
========== 10.28 ==========
306400280.73
310947794.58
Overfitting
========== 10.29 ==========
306429918.19
310964988.0
Overfitting
========== 10.3 ==========
306459541.08
310982190.67
Overfitting
========== 10.31 ==========
306489149.44
310999402.52
Overfitting
========== 10.32 ==========
306518743.26
311016623.53
Overfitting
========== 10.33 ==========
306548322.58
311033853.64
Overfitting
========== 10.34 ==========
306577887.4
311051092.82
Overfitting
========== 10.35 ==========
306607437.75
311068341.02
Overfitting
========== 10.36 ==========
306636973.63
311085598.2
Overfitting
========== 10.37 ==========
306666495.07
311102864.31
```

```
Overfitting
========== 10.38 ==========
306696002.09
311120139.31
Overfitting
========== 10.39 ==========
306725494.69
311137423.16
Overfitting
========== 10.4 ==========
306754972.9
311154715.82
Overfitting
========== 10.41 ==========
306784436.73
311172017.24
Overfitting
========== 10.42 ==========
306813886.2
311189327.38
Overfitting
========== 10.43 ==========
306843321.33
311206646.2
Overfitting
========== 10.44 ==========
306872742.12
311223973.67
Overfitting
========== 10.45 ==========
306902148.61
311241309.73
Overfitting
========== 10.46 ==========
306931540.79
311258654.34
Overfitting
========== 10.47 ==========
306960918.7
311276007.47
Overfitting
========== 10.48 ==========
306990282.34
311293369.07
Overfitting
========== 10.49 ==========
307019631.73
311310739.1
Overfitting
========== 10.5 ==========
307048966.9
311328117.52
Overfitting
========== 10.51 ==========
307078287.84
311345504.29
Overfitting
========== 10.52 ==========
307107594.59
311362899.38
Overfitting
========== 10.53 ==========
307136887.15
311380302.73
```

```
Overfitting
========== 10.54 ===========
307166165.55
311397714.3
Overfitting
========== 10.55 ===========
307195429.79
311415134.07
Overfitting
========== 10.56 ===========
307224679.9
311432561.98
Overfitting
========== 10.57 ===========
307253915.89
311449998.01
Overfitting
========== 10.58 ===========
307283137.77
311467442.1
Overfitting
========== 10.59 ===========
307312345.57
311484894.22
Overfitting
========== 10.6 ===========
307341539.29
311502354.32
Overfitting
========== 10.61 ===========
307370718.96
311519822.38
Overfitting
========== 10.62 ===========
307399884.59
311537298.35
Overfitting
========== 10.63 ===========
307429036.19
311554782.19
Overfitting
========== 10.64 ===========
307458173.78
311572273.86
Overfitting
========== 10.65 ===========
307487297.38
311589773.33
Overfitting
========== 10.66 ===========
307516407.0
311607280.55
Overfitting
========== 10.67 ===========
307545502.66
311624795.49
Overfitting
========== 10.68 ===========
307574584.37
311642318.11
Overfitting
========== 10.69 ===========
307603652.15
311659848.36
```

```
Overfitting
========== 10.7 ==========
307632706.02
311677386.22
Overfitting
========== 10.71 ==========
307661745.98
311694931.64
Overfitting
========== 10.72 ==========
307690772.06
311712484.59
Overfitting
========== 10.73 ==========
307719784.28
311730045.03
Overfitting
========== 10.74 ==========
307748782.63
311747612.92
Overfitting
========== 10.75 ==========
307777767.15
311765188.22
Overfitting
========== 10.76 ==========
307806737.85
311782770.89
Overfitting
========== 10.77 ==========
307835694.74
311800360.91
Overfitting
========== 10.78 ==========
307864637.83
311817958.22
Overfitting
========== 10.79 ==========
307893567.15
311835562.8
Overfitting
========== 10.8 ==========
307922482.71
311853174.61
Overfitting
========== 10.81 ==========
307951384.52
311870793.61
Overfitting
========== 10.82 ==========
307980272.6
311888419.77
Overfitting
========== 10.83 ==========
308009146.96
311906053.04
Overfitting
========== 10.84 ==========
308038007.63
311923693.4
Overfitting
========== 10.85 ==========
308066854.6
311941340.8
```

```
Overfitting
========== 10.86 ===========
308095687.91
311958995.21
Overfitting
========== 10.87 ===========
308124507.56
311976656.6
Overfitting
========== 10.88 ===========
308153313.57
311994324.92
Overfitting
========== 10.89 ===========
308182105.95
312012000.15
Overfitting
========== 10.9 ===========
308210884.72
312029682.24
Overfitting
========== 10.91 ===========
308239649.9
312047371.17
Overfitting
========== 10.92 ===========
308268401.5
312065066.89
Overfitting
========== 10.93 ===========
308297139.52
312082769.37
Overfitting
========== 10.94 ===========
308325864.0
312100478.58
Overfitting
========== 10.95 ===========
308354574.95
312118194.49
Overfitting
========== 10.96 ===========
308383272.37
312135917.04
Overfitting
========== 10.97 ===========
308411956.28
312153646.22
Overfitting
========== 10.98 ===========
308440626.7
312171381.99
Overfitting
========== 10.99 ===========
308469283.65
312189124.31
Overfitting
========== 11.0 ===========
308497927.13
312206873.15
Overfitting
========== 11.01 ===========
308526557.17
312224628.47
```

```
Overfitting
========== 11.02 ==========
308555173.77
312242390.25
Overfitting
========== 11.03 ==========
308583776.95
312260158.44
Overfitting
========== 11.04 ==========
308612366.73
312277933.01
Overfitting
========== 11.05 ==========
308640943.12
312295713.94
Overfitting
========== 11.06 ==========
308669506.14
312313501.17
Overfitting
========== 11.07 ==========
308698055.79
312331294.69
Overfitting
========== 11.08 ==========
308726592.1
312349094.46
Overfitting
========== 11.09 ==========
308755115.08
312366900.45
Overfitting
========== 11.1 ==========
308783624.75
312384712.62
Overfitting
========== 11.11 ==========
308812121.11
312402530.93
Overfitting
========== 11.12 ==========
308840604.18
312420355.37
Overfitting
========== 11.13 ==========
308869073.98
312438185.88
Overfitting
========== 11.14 ==========
308897530.52
312456022.45
Overfitting
========== 11.15 ==========
308925973.81
312473865.04
Overfitting
========== 11.16 ==========
308954403.87
312491713.61
Overfitting
========== 11.17 ==========
308982820.72
312509568.14
```

```
Overfitting
========== 11.18 ==========
309011224.37
312527428.59
Overfitting
========== 11.19 ==========
309039614.83
312545294.93
Overfitting
========== 11.2 ==========
309067992.11
312563167.12
Overfitting
========== 11.21 ==========
309096356.24
312581045.14
Overfitting
========== 11.22 ==========
309124707.22
312598928.96
Overfitting
========== 11.23 ==========
309153045.07
312616818.54
Overfitting
========== 11.24 ==========
309181369.8
312634713.85
Overfitting
========== 11.25 ==========
309209681.43
312652614.86
Overfitting
========== 11.26 ==========
309237979.97
312670521.53
Overfitting
========== 11.27 ==========
309266265.43
312688433.85
Overfitting
========== 11.28 ==========
309294537.84
312706351.77
Overfitting
========== 11.29 ==========
309322797.19
312724275.26
Overfitting
========== 11.3 ==========
309351043.52
312742204.3
Overfitting
========== 11.31 ==========
309379276.82
312760138.85
Overfitting
========== 11.32 ==========
309407497.13
312778078.89
Overfitting
========== 11.33 ==========
309435704.43
312796024.37
```

```
Overfitting
========== 11.34 ===========
309463898.77
312813975.28
Overfitting
========== 11.35 ===========
309492080.14
312831931.58
Overfitting
========== 11.36 ===========
309520248.56
312849893.24
Overfitting
========== 11.37 ===========
309548404.04
312867860.23
Overfitting
========== 11.38 ===========
309576546.6
312885832.52
Overfitting
========== 11.39 ===========
309604676.25
312903810.09
Overfitting
========== 11.4 ===========
309632793.01
312921792.89
Overfitting
========== 11.41 ===========
309660896.89
312939780.9
Overfitting
========== 11.42 ===========
309688987.9
312957774.1
Overfitting
========== 11.43 ===========
309717066.05
312975772.45
Overfitting
========== 11.44 ===========
309745131.37
312993775.92
Overfitting
========== 11.45 ===========
309773183.86
313011784.49
Overfitting
========== 11.46 ===========
309801223.54
313029798.12
Overfitting
========== 11.47 ===========
309829250.41
313047816.78
Overfitting
========== 11.48 ===========
309857264.51
313065840.45
Overfitting
========== 11.49 ===========
309885265.83
313083869.1
```

```
Overfitting
========== 11.5 ==========
309913254.39
313101902.7
Overfitting
========== 11.51 ==========
309941230.2
313119941.21
Overfitting
========== 11.52 ==========
309969193.29
313137984.62
Overfitting
========== 11.53 ==========
309997143.65
313156032.89
Overfitting
========== 11.54 ==========
310025081.31
313174085.99
Overfitting
========== 11.55 ==========
310053006.28
313192143.9
Overfitting
========== 11.56 ==========
310080918.57
313210206.59
Overfitting
========== 11.57 ==========
310108818.19
313228274.02
Overfitting
========== 11.58 ==========
310136705.17
313246346.18
Overfitting
========== 11.59 ==========
310164579.5
313264423.03
Overfitting
========== 11.6 ==========
310192441.21
313282504.55
Overfitting
========== 11.61 ==========
310220290.31
313300590.71
Overfitting
========== 11.62 ==========
310248126.8
313318681.47
Overfitting
========== 11.63 ==========
310275950.72
313336776.82
Overfitting
========== 11.64 ==========
310303762.06
313354876.72
Overfitting
========== 11.65 ==========
310331560.84
313372981.16
```

```
Overfitting
========== 11.66 ===========
310359347.07
313391090.09
Overfitting
========== 11.67 ===========
310387120.77
313409203.49
Overfitting
========== 11.68 ===========
310414881.96
313427321.35
Overfitting
========== 11.69 ===========
310442630.63
313445443.62
Overfitting
========== 11.7 ===========
310470366.81
313463570.28
Overfitting
========== 11.71 ===========
310498090.51
313481701.31
Overfitting
========== 11.72 ===========
310525801.74
313499836.68
Overfitting
========== 11.73 ===========
310553500.52
313517976.36
Overfitting
========== 11.74 ===========
310581186.85
313536120.33
Overfitting
========== 11.75 ===========
310608860.76
313554268.55
Overfitting
========== 11.76 ===========
310636522.25
313572421.01
Overfitting
========== 11.77 ===========
310664171.33
313590577.68
Overfitting
========== 11.78 ===========
310691808.03
313608738.53
Overfitting
========== 11.79 ===========
310719432.35
313626903.53
Overfitting
========== 11.8 ===========
310747044.3
313645072.66
Overfitting
========== 11.81 ===========
310774643.9
313663245.89
```

```
Overfitting
========== 11.82 ===========
310802231.16
313681423.2
Overfitting
========== 11.83 ===========
310829806.1
313699604.56
Overfitting
========== 11.84 ===========
310857368.72
313717789.95
Overfitting
========== 11.85 ===========
310884919.04
313735979.33
Overfitting
========== 11.86 ===========
310912457.07
313754172.69
Overfitting
========== 11.87 ===========
310939982.82
313772370.0
Overfitting
========== 11.88 ===========
310967496.32
313790571.24
Overfitting
========== 11.89 ===========
310994997.56
313808776.37
Overfitting
========== 11.9 ===========
311022486.56
313826985.37
Overfitting
========== 11.91 ===========
311049963.34
313845198.23
Overfitting
========== 11.92 ===========
311077427.91
313863414.91
Overfitting
========== 11.93 ===========
311104880.27
313881635.38
Overfitting
========== 11.94 ===========
311132320.45
313899859.63
Overfitting
========== 11.95 ===========
311159748.45
313918087.63
Overfitting
========== 11.96 ===========
311187164.29
313936319.36
Overfitting
========== 11.97 ===========
311214567.98
313954554.78
```

```
Overfitting
========== 11.98 ==========
311241959.53
313972793.88
Overfitting
========== 11.99 ==========
311269338.96
313991036.63
Overfitting
========== 12.0 ==========
311296706.27
314009283.01
Overfitting
========== 12.01 ==========
311324061.48
314027532.99
Overfitting
========== 12.02 ==========
311351404.6
314045786.55
Overfitting
========== 12.03 ==========
311378735.65
314064043.66
Overfitting
========== 12.04 ==========
311406054.64
314082304.31
Overfitting
========== 12.05 ==========
311433361.57
314100568.46
Overfitting
========== 12.06 ==========
311460656.46
314118836.09
Overfitting
========== 12.07 ==========
311487939.33
314137107.19
Overfitting
========== 12.08 ==========
311515210.18
314155381.72
Overfitting
========== 12.09 ==========
311542469.03
314173659.66
Overfitting
========== 12.1 ==========
311569715.89
314191940.99
Overfitting
========== 12.11 ==========
311596950.77
314210225.68
Overfitting
========== 12.12 ==========
311624173.68
314228513.72
Overfitting
========== 12.13 ==========
311651384.64
314246805.08
```

```
Overfitting
========== 12.14 ==========
311678583.66
314265099.73
Overfitting
========== 12.15 ==========
311705770.75
314283397.66
Overfitting
========== 12.16 ==========
311732945.92
314301698.83
Overfitting
========== 12.17 ==========
311760109.19
314320003.23
Overfitting
========== 12.18 ==========
311787260.56
314338310.84
Overfitting
========== 12.19 ==========
311814400.05
314356621.62
Overfitting
========== 12.2 ==========
311841527.68
314374935.57
Overfitting
========== 12.21 ==========
311868643.44
314393252.65
Overfitting
========== 12.22 ==========
311895747.36
314411572.84
Overfitting
========== 12.23 ==========
311922839.44
314429896.13
Overfitting
========== 12.24 ==========
311949919.71
314448222.48
Overfitting
========== 12.25 ==========
311976988.16
314466551.88
Overfitting
========== 12.26 ==========
312004044.82
314484884.3
Overfitting
========== 12.27 ==========
312031089.68
314503219.73
Overfitting
========== 12.28 ==========
312058122.78
314521558.13
Overfitting
========== 12.29 ==========
312085144.11
314539899.49
```

```
Overfitting
========== 12.3 ==========
312112153.69
314558243.79
Overfitting
========== 12.31 ==========
312139151.54
314576591.0
Overfitting
========== 12.32 ==========
312166137.65
314594941.11
Overfitting
========== 12.33 ==========
312193112.05
314613294.08
Overfitting
========== 12.34 ==========
312220074.75
314631649.9
Overfitting
========== 12.35 ==========
312247025.75
314650008.55
Overfitting
========== 12.36 ==========
312273965.08
314668370.01
Overfitting
========== 12.37 ==========
312300892.73
314686734.25
Overfitting
========== 12.38 ==========
312327808.73
314705101.25
Overfitting
========== 12.39 ==========
312354713.09
314723471.0
Overfitting
========== 12.4 ==========
312381605.81
314741843.46
Overfitting
========== 12.41 ==========
312408486.9
314760218.63
Overfitting
========== 12.42 ==========
312435356.39
314778596.47
Overfitting
========== 12.43 ==========
312462214.28
314796976.97
Overfitting
========== 12.44 ==========
312489060.58
314815360.11
Overfitting
========== 12.45 ==========
312515895.3
314833745.86
```

```
Overfitting
========== 12.46 ==========
312542718.46
314852134.21
Overfitting
========== 12.47 ==========
312569530.07
314870525.13
Overfitting
========== 12.48 ==========
312596330.14
314888918.6
Overfitting
========== 12.49 ==========
312623118.67
314907314.61
Overfitting
========== 12.5 ==========
312649895.69
314925713.13
Overfitting
========== 12.51 ==========
312676661.2
314944114.14
Overfitting
========== 12.52 ==========
312703415.21
314962517.63
Overfitting
========== 12.53 ==========
312730157.74
314980923.56
Overfitting
========== 12.54 ==========
312756888.8
314999331.93
Overfitting
========== 12.55 ==========
312783608.39
315017742.7
Overfitting
========== 12.56 ==========
312810316.54
315036155.87
Overfitting
========== 12.57 ==========
312837013.24
315054571.41
Overfitting
========== 12.58 ==========
312863698.52
315072989.3
Overfitting
========== 12.59 ==========
312890372.38
315091409.52
Overfitting
========== 12.6 ==========
312917034.83
315109832.05
Overfitting
========== 12.61 ==========
312943685.89
315128256.88
```

```
Overfitting
========== 12.62 ==========
312970325.57
315146683.97
Overfitting
========== 12.63 ==========
312996953.87
315165113.32
Overfitting
========== 12.64 ==========
313023570.82
315183544.9
Overfitting
========== 12.65 ==========
313050176.41
315201978.69
Overfitting
========== 12.66 ==========
313076770.67
315220414.67
Overfitting
========== 12.67 ==========
313103353.6
315238852.84
Overfitting
========== 12.68 ==========
313129925.22
315257293.15
Overfitting
========== 12.69 ==========
313156485.52
315275735.6
Overfitting
========== 12.7 ==========
313183034.54
315294180.17
Overfitting
========== 12.71 ==========
313209572.27
315312626.83
Overfitting
========== 12.72 ==========
313236098.73
315331075.58
Overfitting
========== 12.73 ==========
313262613.93
315349526.38
Overfitting
========== 12.74 ==========
313289117.88
315367979.23
Overfitting
========== 12.75 ==========
313315610.59
315386434.09
Overfitting
========== 12.76 ==========
313342092.07
315404890.96
Overfitting
========== 12.77 ==========
313368562.34
315423349.81
```

```
Overfitting
========== 12.78 ==========
313395021.4
315441810.63
Overfitting
========== 12.79 ==========
313421469.26
315460273.4
Overfitting
========== 12.8 ==========
313447905.94
315478738.09
Overfitting
========== 12.81 ==========
313474331.45
315497204.69
Overfitting
========== 12.82 ==========
313500745.79
315515673.19
Overfitting
========== 12.83 ==========
313527148.99
315534143.56
Overfitting
========== 12.84 ==========
313553541.04
315552615.78
Overfitting
========== 12.85 ==========
313579921.96
315571089.84
Overfitting
========== 12.86 ==========
313606291.76
315589565.72
Overfitting
========== 12.87 ==========
313632650.46
315608043.4
Overfitting
========== 12.88 ==========
313658998.05
315626522.86
Overfitting
========== 12.89 ==========
313685334.56
315645004.08
Overfitting
========== 12.9 ==========
313711660.0
315663487.06
Overfitting
========== 12.91 ==========
313737974.37
315681971.76
Overfitting
========== 12.92 ==========
313764277.68
315700458.17
Overfitting
========== 12.93 ==========
313790569.95
315718946.27
```

```
Overfitting
========== 12.94 ==========
313816851.18
315737436.05
Overfitting
========== 12.95 ==========
313843121.4
315755927.49
Overfitting
========== 12.96 ==========
313869380.6
315774420.57
Overfitting
========== 12.97 ==========
313895628.8
315792915.27
Overfitting
========== 12.98 ==========
313921866.0
315811411.57
Overfitting
========== 12.99 ==========
313948092.23
315829909.47
Overfitting
========== 13.0 ==========
313974307.49
315848408.93
Overfitting
========== 13.01 ==========
314000511.79
315866909.95
Overfitting
========== 13.02 ==========
314026705.14
315885412.5
Overfitting
========== 13.03 ==========
314052887.55
315903916.57
Overfitting
========== 13.04 ==========
314079059.03
315922422.15
Overfitting
========== 13.05 ==========
314105219.6
315940929.21
Overfitting
========== 13.06 ==========
314131369.26
315959437.73
Overfitting
========== 13.07 ==========
314157508.02
315977947.71
Overfitting
========== 13.08 ==========
314183635.9
315996459.12
Overfitting
========== 13.09 ==========
314209752.9
316014971.95
```

```
Overfitting
========== 13.1 ==========
314235859.04
316033486.18
Overfitting
========== 13.11 ==========
314261954.32
316052001.79
Overfitting
========== 13.12 ==========
314288038.76
316070518.77
Overfitting
========== 13.13 ==========
314314112.37
316089037.1
Overfitting
========== 13.14 ==========
314340175.15
316107556.76
Overfitting
========== 13.15 ==========
314366227.11
316126077.74
Overfitting
========== 13.16 ==========
314392268.28
316144600.02
Overfitting
========== 13.17 ==========
314418298.65
316163123.58
Overfitting
========== 13.18 ==========
314444318.24
316181648.42
Overfitting
========== 13.19 ==========
314470327.05
316200174.5
Overfitting
========== 13.2 ==========
314496325.11
316218701.82
Overfitting
========== 13.21 ==========
314522312.41
316237230.37
Overfitting
========== 13.22 ==========
314548288.97
316255760.11
Overfitting
========== 13.23 ==========
314574254.8
316274291.04
Overfitting
========== 13.24 ==========
314600209.91
316292823.14
Overfitting
========== 13.25 ==========
314626154.31
316311356.4
```

```
Overfitting
========== 13.26 ==========
314652088.01
316329890.8
Overfitting
========== 13.27 ==========
314678011.01
316348426.32
Overfitting
========== 13.28 ==========
314703923.34
316366962.95
Overfitting
========== 13.29 ==========
314729825.0
316385500.67
Overfitting
========== 13.3 ==========
314755715.99
316404039.47
Overfitting
========== 13.31 ==========
314781596.34
316422579.33
Overfitting
========== 13.32 ==========
314807466.04
316441120.23
Overfitting
========== 13.33 ==========
314833325.12
316459662.17
Overfitting
========== 13.34 ==========
314859173.57
316478205.11
Overfitting
========== 13.35 ==========
314885011.42
316496749.06
Overfitting
========== 13.36 ==========
314910838.66
316515293.99
Overfitting
========== 13.37 ==========
314936655.31
316533839.89
Overfitting
========== 13.38 ==========
314962461.39
316552386.74
Overfitting
========== 13.39 ==========
314988256.89
316570934.53
Overfitting
========== 13.4 ==========
315014041.83
316589483.24
Overfitting
========== 13.41 ==========
315039816.23
316608032.86
```

```
Overfitting
========== 13.42 ==========
315065580.08
316626583.37
Overfitting
========== 13.43 ==========
315091333.4
316645134.75
Overfitting
========== 13.44 ==========
315117076.2
316663687.0
Overfitting
========== 13.45 ==========
315142808.49
316682240.1
Overfitting
========== 13.46 ==========
315168530.28
316700794.03
Overfitting
========== 13.47 ==========
315194241.58
316719348.78
Overfitting
========== 13.48 ==========
315219942.4
316737904.33
Overfitting
========== 13.49 ==========
315245632.75
316756460.67
Overfitting
========== 13.5 ==========
315271312.63
316775017.78
Overfitting
========== 13.51 ==========
315296982.06
316793575.65
Overfitting
========== 13.52 ==========
315322641.05
316812134.27
Overfitting
========== 13.53 ==========
315348289.61
316830693.61
Overfitting
========== 13.54 ==========
315373927.74
316849253.67
Overfitting
========== 13.55 ==========
315399555.47
316867814.43
Overfitting
========== 13.56 ==========
315425172.78
316886375.88
Overfitting
========== 13.57 ==========
315450779.71
316904938.0
```

```
Overfitting
========== 13.58 ==========
315476376.25
316923500.78
Overfitting
========== 13.59 ==========
315501962.42
316942064.2
Overfitting
========== 13.6 ==========
315527538.22
316960628.25
Overfitting
========== 13.61 ==========
315553103.67
316979192.91
Overfitting
========== 13.62 ==========
315578658.77
316997758.18
Overfitting
========== 13.63 ==========
315604203.54
317016324.03
Overfitting
========== 13.64 ==========
315629737.98
317034890.46
Overfitting
========== 13.65 ==========
315655262.1
317053457.44
Overfitting
========== 13.66 ==========
315680775.92
317072024.97
Overfitting
========== 13.67 ==========
315706279.43
317090593.04
Overfitting
========== 13.68 ==========
315731772.67
317109161.61
Overfitting
========== 13.69 ==========
315757255.62
317127730.7
Overfitting
========== 13.7 ==========
315782728.3
317146300.27
Overfitting
========== 13.71 ==========
315808190.73
317164870.32
Overfitting
========== 13.72 ==========
315833642.9
317183440.83
Overfitting
========== 13.73 ==========
315859084.84
317202011.79
```

```
Overfitting
========== 13.74 ==========
315884516.54
317220583.19
Overfitting
========== 13.75 ==========
315909938.02
317239155.01
Overfitting
========== 13.76 ==========
315935349.29
317257727.23
Overfitting
========== 13.77 ==========
315960750.36
317276299.86
Overfitting
========== 13.78 ==========
315986141.23
317294872.86
Overfitting
========== 13.79 ==========
316011521.92
317313446.23
Overfitting
========== 13.8 ==========
316036892.43
317332019.96
Overfitting
========== 13.81 ==========
316062252.78
317350594.03
Overfitting
========== 13.82 ==========
316087602.98
317369168.43
Overfitting
========== 13.83 ==========
316112943.02
317387743.14
Overfitting
========== 13.84 ==========
316138272.93
317406318.16
Overfitting
========== 13.85 ==========
316163592.71
317424893.46
Overfitting
========== 13.86 ==========
316188902.38
317443469.04
Overfitting
========== 13.87 ==========
316214201.93
317462044.89
Overfitting
========== 13.88 ==========
316239491.38
317480620.98
Overfitting
========== 13.89 ==========
316264770.75
317499197.32
```

```
Overfitting
========== 13.9 ==========
316290040.03
317517773.87
Overfitting
========== 13.91 ==========
316315299.24
317536350.64
Overfitting
========== 13.92 ==========
316340548.38
317554927.61
Overfitting
========== 13.93 ==========
316365787.47
317573504.76
Overfitting
========== 13.94 ==========
316391016.52
317592082.09
Overfitting
========== 13.95 ==========
316416235.53
317610659.58
Overfitting
========== 13.96 ==========
316441444.51
317629237.22
Overfitting
========== 13.97 ==========
316466643.48
317647814.99
Overfitting
========== 13.98 ==========
316491832.44
317666392.89
Overfitting
========== 13.99 ==========
316517011.4
317684970.9
Overfitting
========== 14.0 ==========
316542180.37
317703549.01
Overfitting
========== 14.01 ==========
316567339.35
317722127.2
Overfitting
========== 14.02 ==========
316592488.37
317740705.47
Overfitting
========== 14.03 ==========
316617627.42
317759283.79
Overfitting
========== 14.04 ==========
316642756.52
317777862.17
Overfitting
========== 14.05 ==========
316667875.68
317796440.58
```

```
Overfitting
========== 14.06 ===========
316692984.89
317815019.02
Overfitting
========== 14.07 ===========
316718084.19
317833597.47
Overfitting
========== 14.08 ===========
316743173.56
317852175.93
Overfitting
========== 14.09 ===========
316768253.03
317870754.37
Overfitting
========== 14.1 ===========
316793322.59
317889332.78
Overfitting
========== 14.11 ===========
316818382.27
317907911.16
Overfitting
========== 14.12 ===========
316843432.06
317926489.5
Overfitting
========== 14.13 ===========
316868471.98
317945067.77
Overfitting
========== 14.14 ===========
316893502.03
317963645.97
Overfitting
========== 14.15 ===========
316918522.23
317982224.09
Overfitting
========== 14.16 ===========
316943532.59
318000802.12
Overfitting
========== 14.17 ===========
316968533.11
318019380.04
Overfitting
========== 14.18 ===========
316993523.79
318037957.84
Overfitting
========== 14.19 ===========
317018504.66
318056535.5
Overfitting
========== 14.2 ===========
317043475.72
318075113.03
Overfitting
========== 14.21 ===========
317068436.98
318093690.41
```

```
Overfitting
========== 14.22 ==========
317093388.44
318112267.62
Overfitting
========== 14.23 ==========
317118330.12
318130844.65
Overfitting
========== 14.24 ==========
317143262.02
318149421.5
Overfitting
========== 14.25 ==========
317168184.15
318167998.14
Overfitting
========== 14.26 ==========
317193096.53
318186574.58
Overfitting
========== 14.27 ==========
317217999.16
318205150.79
Overfitting
========== 14.28 ==========
317242892.05
318223726.77
Overfitting
========== 14.29 ==========
317267775.2
318242302.51
Overfitting
========== 14.3 ==========
317292648.64
318260877.99
Overfitting
========== 14.31 ==========
317317512.36
318279453.2
Overfitting
========== 14.32 ==========
317342366.37
318298028.13
Overfitting
========== 14.33 ==========
317367210.68
318316602.78
Overfitting
========== 14.34 ==========
317392045.31
318335177.12
Overfitting
========== 14.35 ==========
317416870.26
318353751.16
Overfitting
========== 14.36 ==========
317441685.54
318372324.87
Overfitting
========== 14.37 ==========
317466491.15
318390898.24
```

```
Overfitting
========== 14.38 ==========
317491287.11
318409471.27
Overfitting
========== 14.39 ==========
317516073.42
318428043.95
Overfitting
========== 14.4 ==========
317540850.1
318446616.26
Overfitting
========== 14.41 ==========
317565617.15
318465188.19
Overfitting
========== 14.42 ==========
317590374.58
318483759.74
Overfitting
========== 14.43 ==========
317615122.4
318502330.88
Overfitting
========== 14.44 ==========
317639860.62
318520901.62
Overfitting
========== 14.45 ==========
317664589.25
318539471.94
Overfitting
========== 14.46 ==========
317689308.28
318558041.82
Overfitting
========== 14.47 ==========
317714017.75
318576611.26
Overfitting
========== 14.48 ==========
317738717.64
318595180.25
Overfitting
========== 14.49 ==========
317763407.97
318613748.78
Overfitting
========== 14.5 ==========
317788088.75
318632316.84
Overfitting
========== 14.51 ==========
317812759.99
318650884.41
Overfitting
========== 14.52 ==========
317837421.7
318669451.49
Overfitting
========== 14.53 ==========
317862073.88
318688018.06
```

```
Overfitting
========== 14.54 ===========
317886716.54
318706584.11
Overfitting
========== 14.55 ===========
317911349.69
318725149.65
Overfitting
========== 14.56 ===========
317935973.34
318743714.64
Overfitting
========== 14.57 ===========
317960587.5
318762279.09
Overfitting
========== 14.58 ===========
317985192.18
318780842.99
Overfitting
========== 14.59 ===========
318009787.38
318799406.31
Overfitting
========== 14.6 ===========
318034373.11
318817969.06
Overfitting
========== 14.61 ===========
318058949.38
318836531.23
Overfitting
========== 14.62 ===========
318083516.2
318855092.79
Overfitting
========== 14.63 ===========
318108073.58
318873653.75
Overfitting
========== 14.64 ===========
318132621.53
318892214.1
Overfitting
========== 14.65 ===========
318157160.05
318910773.81
Overfitting
========== 14.66 ===========
318181689.15
318929332.89
Overfitting
========== 14.67 ===========
318206208.85
318947891.32
Overfitting
========== 14.68 ===========
318230719.14
318966449.09
Overfitting
========== 14.69 ===========
318255220.04
318985006.2
```

```
Overfitting
========== 14.7 ==========
318279711.56
319003562.63
Overfitting
========== 14.71 ==========
318304193.7
319022118.38
Overfitting
========== 14.72 ==========
318328666.47
319040673.42
Overfitting
========== 14.73 ==========
318353129.89
319059227.77
Overfitting
========== 14.74 ==========
318377583.95
319077781.39
Overfitting
========== 14.75 ==========
318402028.67
319096334.29
Overfitting
========== 14.76 ==========
318426464.05
319114886.46
Overfitting
========== 14.77 ==========
318450890.1
319133437.88
Overfitting
========== 14.78 ==========
318475306.84
319151988.54
Overfitting
========== 14.79 ==========
318499714.27
319170538.45
Overfitting
========== 14.8 ==========
318524112.39
319189087.58
Overfitting
========== 14.81 ==========
318548501.22
319207635.92
Overfitting
========== 14.82 ==========
318572880.77
319226183.47
Overfitting
========== 14.83 ==========
318597251.03
319244730.23
Overfitting
========== 14.84 ==========
318621612.03
319263276.17
Overfitting
========== 14.85 ==========
318645963.76
319281821.29
```

```
Overfitting
========== 14.86 ===========
318670306.24
319300365.58
Overfitting
========== 14.87 ===========
318694639.47
319318909.03
Overfitting
========== 14.88 ===========
318718963.47
319337451.63
Overfitting
========== 14.89 ===========
318743278.23
319355993.37
Overfitting
========== 14.9 ===========
318767583.78
319374534.25
Overfitting
========== 14.91 ===========
318791880.1
319393074.25
Overfitting
========== 14.92 ===========
318816167.23
319411613.37
Overfitting
========== 14.93 ===========
318840445.15
319430151.59
Overfitting
========== 14.94 ===========
318864713.89
319448688.91
Overfitting
========== 14.95 ===========
318888973.44
319467225.31
Overfitting
========== 14.96 ===========
318913223.82
319485760.79
Overfitting
========== 14.97 ===========
318937465.04
319504295.35
Overfitting
========== 14.98 ===========
318961697.09
319522828.96
Overfitting
========== 14.99 ===========
318985920.0
319541361.63
Overfitting
========== 15.0 ===========
319010133.76
319559893.33
Overfitting
========== 15.01 ===========
319034338.39
319578424.07
```

```
Overfitting
========== 15.02 ==========
319058533.89
319596953.84
Overfitting
========== 15.03 ==========
319082720.28
319615482.62
Overfitting
========== 15.04 ==========
319106897.55
319634010.41
Overfitting
========== 15.05 ==========
319131065.72
319652537.19
Overfitting
========== 15.06 ==========
319155224.8
319671062.97
Overfitting
========== 15.07 ==========
319179374.78
319689587.73
Overfitting
========== 15.08 ==========
319203515.69
319708111.46
Overfitting
========== 15.09 ==========
319227647.53
319726634.15
Overfitting
========== 15.1 ==========
319251770.3
319745155.8
Overfitting
========== 15.11 ==========
319275884.02
319763676.39
Overfitting
========== 15.12 ==========
319299988.69
319782195.93
Overfitting
========== 15.13 ==========
319324084.32
319800714.39
Overfitting
========== 15.14 ==========
319348170.91
319819231.77
Overfitting
========== 15.15 ==========
319372248.48
319837748.07
Overfitting
========== 15.16 ==========
319396317.04
319856263.26
Overfitting
========== 15.17 ==========
319420376.58
319874777.36
```

```
Overfitting
========== 15.18 ==========
319444427.12
319893290.34
Overfitting
========== 15.19 ==========
319468468.67
319911802.2
Overfitting
========== 15.2 ==========
319492501.23
319930312.93
Overfitting
========== 15.21 ==========
319516524.82
319948822.52
Overfitting
========== 15.22 ==========
319540539.43
319967330.97
Overfitting
========== 15.23 ==========
319564545.08
319985838.26
Overfitting
========== 15.24 ==========
319588541.77
320004344.39
Overfitting
========== 15.25 ==========
319612529.52
320022849.35
Overfitting
========== 15.26 ==========
319636508.32
320041353.13
Overfitting
========== 15.27 ==========
319660478.2
320059855.72
Overfitting
========== 15.28 ==========
319684439.14
320078357.11
Overfitting
========== 15.29 ==========
319708391.17
320096857.31
Overfitting
========== 15.3 ==========
319732334.29
320115356.29
Overfitting
========== 15.31 ==========
319756268.51
320133854.05
Overfitting
========== 15.32 ==========
319780193.83
320152350.58
Overfitting
========== 15.33 ==========
319804110.27
320170845.88
```

```
Overfitting
========== 15.34 ===========
319828017.82
320189339.94
Overfitting
========== 15.35 ===========
319851916.51
320207832.74
Overfitting
========== 15.36 ===========
319875806.33
320226324.29
Overfitting
========== 15.37 ===========
319899687.29
320244814.57
Overfitting
========== 15.38 ===========
319923559.4
320263303.57
Overfitting
========== 15.39 ===========
319947422.67
320281791.29
Overfitting
========== 15.4 ===========
319971277.11
320300277.72
Overfitting
========== 15.41 ===========
319995122.72
320318762.85
Overfitting
========== 15.42 ===========
320018959.51
320337246.67
Overfitting
========== 15.43 ===========
320042787.48
320355729.18
Overfitting
========== 15.44 ===========
320066606.66
320374210.37
Overfitting
========== 15.45 ===========
320090417.03
320392690.23
Overfitting
========== 15.46 ===========
320114218.62
320411168.76
Overfitting
========== 15.47 ===========
320138011.42
320429645.93
Overfitting
========== 15.48 ===========
320161795.45
320448121.76
Overfitting
========== 15.49 ===========
320185570.71
320466596.23
```

```
Overfitting
========== 15.5 ==========
320209337.21
320485069.33
Overfitting
========== 15.51 ==========
320233094.96
320503541.05
Overfitting
========== 15.52 ==========
320256843.96
320522011.4
Overfitting
========== 15.53 ==========
320280584.23
320540480.35
Overfitting
========== 15.54 ==========
320304315.76
320558947.91
Overfitting
========== 15.55 ==========
320328038.57
320577414.06
Overfitting
========== 15.56 ==========
320351752.66
320595878.8
Overfitting
========== 15.57 ==========
320375458.05
320614342.12
Overfitting
========== 15.58 ==========
320399154.74
320632804.01
Overfitting
========== 15.59 ==========
320422842.73
320651264.47
Overfitting
========== 15.6 ==========
320446522.03
320669723.49
Overfitting
========== 15.61 ==========
320470192.66
320688181.07
Overfitting
========== 15.62 ==========
320493854.61
320706637.18
Overfitting
========== 15.63 ==========
320517507.9
320725091.83
Overfitting
========== 15.64 ==========
320541152.53
320743545.02
Overfitting
========== 15.65 ==========
320564788.5
320761996.72
```

```
Overfitting
========== 15.66 ===========
320588415.84
320780446.94
Overfitting
========== 15.67 ===========
320612034.54
320798895.67
Overfitting
========== 15.68 ===========
320635644.61
320817342.9
Overfitting
========== 15.69 ===========
320659246.06
320835788.63
Overfitting
========== 15.7 ===========
320682838.9
320854232.84
Overfitting
========== 15.71 ===========
320706423.13
320872675.54
Overfitting
========== 15.72 ===========
320729998.76
320891116.7
Overfitting
========== 15.73 ===========
320753565.8
320909556.34
Overfitting
========== 15.74 ===========
320777124.25
320927994.43
Overfitting
========== 15.75 ===========
320800674.12
320946430.98
Overfitting
========== 15.76 ===========
320824215.42
320964865.97
Overfitting
========== 15.77 ===========
320847748.16
320983299.4
Overfitting
========== 15.78 ===========
320871272.34
321001731.26
Overfitting
========== 15.79 ===========
320894787.97
321020161.54
Overfitting
========== 15.8 ===========
320918295.06
321038590.25
Overfitting
========== 15.81 ===========
320941793.61
321057017.37
```

```
Overfitting
========== 15.82 ==========
320965283.64
321075442.89
Overfitting
========== 15.83 ==========
320988765.14
321093866.81
Overfitting
========== 15.84 ==========
321012238.13
321112289.12
Overfitting
========== 15.85 ==========
321035702.61
321130709.81
Overfitting
========== 15.86 ==========
321059158.59
321149128.88
Overfitting
========== 15.87 ==========
321082606.07
321167546.33
Overfitting
========== 15.88 ==========
321106045.08
321185962.14
Overfitting
========== 15.89 ==========
321129475.6
321204376.3
Overfitting
========== 15.9 ==========
321152897.65
321222788.82
Overfitting
========== 15.91 ==========
321176311.23
321241199.68
Overfitting
========== 15.92 ==========
321199716.36
321259608.88
Overfitting
========== 15.93 ==========
321223113.04
321278016.42
Overfitting
========== 15.94 ==========
321246501.27
321296422.28
Overfitting
========== 15.95 ==========
321269881.06
321314826.45
Overfitting
========== 15.96 ==========
321293252.42
321333228.94
Overfitting
========== 15.97 ==========
321316615.37
321351629.74
```

```
Overfitting
========== 15.98 ==========
321339969.89
321370028.83
Overfitting
========== 15.99 ==========
321363316.01
321388426.22
Overfitting
========== 16.0 ==========
321386653.72
321406821.9
Overfitting
========== 16.01 ==========
321409983.04
321425215.85
Overfitting
========== 16.02 ==========
321433303.96
321443608.08
Overfitting
========== 16.03 ==========
321456616.51
321461998.58
Overfitting
========== 16.04 ==========
321479920.68
321480387.34
Overfitting
========== 16.05 ==========
321503216.49
321498774.36
Best fit
========== 16.06 ==========
321526503.93
321517159.62
Best fit
========== 16.07 ==========
321549783.02
321535543.13
Best fit
========== 16.08 ==========
321573053.76
321553924.87
Best fit
========== 16.09 ==========
321596316.16
321572304.85
Best fit
========== 16.1 ==========
321619570.23
321590683.05
Best fit
========== 16.11 ==========
321642815.97
321609059.46
Best fit
========== 16.12 ==========
321666053.39
321627434.09
Best fit
========== 16.13 ==========
321689282.5
321645806.93
```

```
Best fit
========== 16.14 ===========
321712503.3
321664177.96
Best fit
========== 16.15 ===========
321735715.8
321682547.19
Best fit
========== 16.16 ===========
321758920.01
321700914.61
Best fit
========== 16.17 ===========
321782115.94
321719280.21
Best fit
========== 16.18 ===========
321805303.58
321737643.99
Best fit
========== 16.19 ===========
321828482.95
321756005.94
Best fit
========== 16.2 ===========
321851654.06
321774366.05
Best fit
========== 16.21 ===========
321874816.9
321792724.32
Best fit
========== 16.22 ===========
321897971.5
321811080.74
Best fit
========== 16.23 ===========
321921117.85
321829435.3
Best fit
========== 16.24 ===========
321944255.96
321847788.01
Best fit
========== 16.25 ===========
321967385.83
321866138.86
Best fit
========== 16.26 ===========
321990507.49
321884487.83
Best fit
========== 16.27 ===========
322013620.92
321902834.92
Best fit
========== 16.28 ===========
322036726.14
321921180.14
Best fit
========== 16.29 ===========
322059823.16
321939523.46
```

```
Best fit
========== 16.3 ==========
322082911.98
321957864.89
Best fit
========== 16.31 ==========
322105992.6
321976204.42
Best fit
========== 16.32 ==========
322129065.05
321994542.05
Best fit
========== 16.33 ==========
322152129.31
322012877.76
Best fit
========== 16.34 ==========
322175185.4
322031211.56
Best fit
========== 16.35 ==========
322198233.32
322049543.43
Best fit
========== 16.36 ==========
322221273.09
322067873.38
Best fit
========== 16.37 ==========
322244304.7
322086201.39
Best fit
========== 16.38 ==========
322267328.17
322104527.47
Best fit
========== 16.39 ==========
322290343.5
322122851.6
Best fit
========== 16.4 ==========
322313350.7
322141173.78
Best fit
========== 16.41 ==========
322336349.77
322159494.0
Best fit
========== 16.42 ==========
322359340.72
322177812.26
Best fit
========== 16.43 ==========
322382323.56
322196128.56
Best fit
========== 16.44 ==========
322405298.29
322214442.88
Best fit
========== 16.45 ==========
322428264.92
322232755.22
```

```
Best fit
========== 16.46 ===========
322451223.46
322251065.59
Best fit
========== 16.47 ===========
322474173.92
322269373.96
Best fit
========== 16.48 ===========
322497116.29
322287680.34
Best fit
========== 16.49 ===========
322520050.59
322305984.72
Best fit
========== 16.5 ===========
322542976.82
322324287.09
Best fit
========== 16.51 ===========
322565895.0
322342587.46
Best fit
========== 16.52 ===========
322588805.12
322360885.81
Best fit
========== 16.53 ===========
322611707.19
322379182.14
Best fit
========== 16.54 ===========
322634601.22
322397476.44
Best fit
========== 16.55 ===========
322657487.21
322415768.71
Best fit
========== 16.56 ===========
322680365.18
322434058.95
Best fit
========== 16.57 ===========
322703235.12
322452347.15
Best fit
========== 16.58 ===========
322726097.05
322470633.29
Best fit
========== 16.59 ===========
322748950.97
322488917.39
Best fit
========== 16.6 ===========
322771796.89
322507199.43
Best fit
========== 16.61 ===========
322794634.81
322525479.4
```

```
Best fit
========== 16.62 ==========
322817464.75
322543757.31
Best fit
========== 16.63 ==========
322840286.7
322562033.15
Best fit
========== 16.64 ==========
322863100.67
322580306.91
Best fit
========== 16.65 ==========
322885906.67
322598578.59
Best fit
========== 16.66 ==========
322908704.71
322616848.17
Best fit
========== 16.67 ==========
322931494.79
322635115.67
Best fit
========== 16.68 ==========
322954276.92
322653381.07
Best fit
========== 16.69 ==========
322977051.11
322671644.36
Best fit
========== 16.7 ==========
322999817.35
322689905.55
Best fit
========== 16.71 ==========
323022575.66
322708164.63
Best fit
========== 16.72 ==========
323045326.05
322726421.58
Best fit
========== 16.73 ==========
323068068.52
322744676.42
Best fit
========== 16.74 ==========
323090803.07
322762929.12
Best fit
========== 16.75 ==========
323113529.72
322781179.7
Best fit
========== 16.76 ==========
323136248.47
322799428.14
Best fit
========== 16.77 ==========
323158959.32
322817674.43
```

```
Best fit
========== 16.78 ==========
323181662.28
322835918.58
Best fit
========== 16.79 ==========
323204357.36
322854160.57
Best fit
========== 16.8 ==========
323227044.57
322872400.41
Best fit
========== 16.81 ==========
323249723.91
322890638.09
Best fit
========== 16.82 ==========
323272395.38
322908873.6
Best fit
========== 16.83 ==========
323295059.0
322927106.94
Best fit
========== 16.84 ==========
323317714.76
322945338.11
Best fit
========== 16.85 ==========
323340362.68
322963567.09
Best fit
========== 16.86 ==========
323363002.77
322981793.89
Best fit
========== 16.87 ==========
323385635.02
323000018.5
Best fit
========== 16.88 ==========
323408259.44
323018240.92
Best fit
========== 16.89 ==========
323430876.05
323036461.13
Best fit
========== 16.9 ==========
323453484.84
323054679.14
Best fit
========== 16.91 ==========
323476085.83
323072894.95
Best fit
========== 16.92 ==========
323498679.01
323091108.54
Best fit
========== 16.93 ==========
323521264.4
323109319.91
```

```
Best fit
========== 16.94 ==========
323543842.0
323127529.06
Best fit
========== 16.95 ==========
323566411.82
323145735.98
Best fit
========== 16.96 ==========
323588973.86
323163940.67
Best fit
========== 16.97 ==========
323611528.13
323182143.13
Best fit
========== 16.98 ==========
323634074.63
323200343.34
Best fit
========== 16.99 ==========
323656613.38
323218541.31
Best fit
========== 17.0 ==========
323679144.38
323236737.03
Best fit
========== 17.01 ==========
323701667.63
323254930.5
Best fit
========== 17.02 ==========
323724183.14
323273121.71
Best fit
========== 17.03 ==========
323746690.92
323291310.65
Best fit
========== 17.04 ==========
323769190.97
323309497.33
Best fit
========== 17.05 ==========
323791683.29
323327681.74
Best fit
========== 17.06 ==========
323814167.91
323345863.87
Best fit
========== 17.07 ==========
323836644.81
323364043.72
Best fit
========== 17.08 ==========
323859114.01
323382221.29
Best fit
========== 17.09 ==========
323881575.51
323400396.56
```

```
Best fit
========== 17.1 ==========
323904029.32
323418569.55
Best fit
========== 17.11 ==========
323926475.45
323436740.23
Best fit
========== 17.12 ==========
323948913.89
323454908.62
Best fit
========== 17.13 ==========
323971344.67
323473074.69
Best fit
========== 17.14 ==========
323993767.77
323491238.46
Best fit
========== 17.15 ==========
324016183.22
323509399.91
Best fit
========== 17.16 ==========
324038591.01
323527559.05
Best fit
========== 17.17 ==========
324060991.15
323545715.86
Best fit
========== 17.18 ==========
324083383.64
323563870.34
Best fit
========== 17.19 ==========
324105768.5
323582022.49
Best fit
========== 17.2 ==========
324128145.73
323600172.31
Best fit
========== 17.21 ==========
324150515.33
323618319.78
Best fit
========== 17.22 ==========
324172877.32
323636464.91
Best fit
========== 17.23 ==========
324195231.69
323654607.69
Best fit
========== 17.24 ==========
324217578.45
323672748.13
Best fit
========== 17.25 ==========
324239917.61
323690886.2
```

```
Best fit
========== 17.26 ===========
324262249.18
323709021.91
Best fit
========== 17.27 ===========
324284573.15
323727155.26
Best fit
========== 17.28 ===========
324306889.55
323745286.24
Best fit
========== 17.29 ===========
324329198.36
323763414.85
Best fit
========== 17.3 ===========
324351499.6
323781541.08
Best fit
========== 17.31 ===========
324373793.28
323799664.93
Best fit
========== 17.32 ===========
324396079.39
323817786.4
Best fit
========== 17.33 ===========
324418357.95
323835905.48
Best fit
========== 17.34 ===========
324440628.97
323854022.16
Best fit
========== 17.35 ===========
324462892.44
323872136.45
Best fit
========== 17.36 ===========
324485148.37
323890248.34
Best fit
========== 17.37 ===========
324507396.77
323908357.82
Best fit
========== 17.38 ===========
324529637.65
323926464.9
Best fit
========== 17.39 ===========
324551871.01
323944569.56
Best fit
========== 17.4 ===========
324574096.85
323962671.81
Best fit
========== 17.41 ===========
324596315.19
323980771.63
```

```
Best fit
========== 17.42 ==========
324618526.02
323998869.04
Best fit
========== 17.43 ==========
324640729.36
324016964.01
Best fit
========== 17.44 ==========
324662925.21
324035056.56
Best fit
========== 17.45 ==========
324685113.57
324053146.66
Best fit
========== 17.46 ==========
324707294.46
324071234.33
Best fit
========== 17.47 ==========
324729467.87
324089319.56
Best fit
========== 17.48 ==========
324751633.81
324107402.34
Best fit
========== 17.49 ==========
324773792.3
324125482.67
Best fit
========== 17.5 ==========
324795943.33
324143560.55
Best fit
========== 17.51 ==========
324818086.9
324161635.97
Best fit
========== 17.52 ==========
324840223.04
324179708.92
Best fit
========== 17.53 ==========
324862351.73
324197779.42
Best fit
========== 17.54 ==========
324884473.0
324215847.44
Best fit
========== 17.55 ==========
324906586.83
324233912.99
Best fit
========== 17.56 ==========
324928693.25
324251976.06
Best fit
========== 17.57 ==========
324950792.25
324270036.66
```

```
Best fit
========== 17.58 ==========
324972883.83
324288094.77
Best fit
========== 17.59 ==========
324994968.02
324306150.39
Best fit
========== 17.6 ==========
325017044.81
324324203.53
Best fit
========== 17.61 ==========
325039114.2
324342254.16
Best fit
========== 17.62 ==========
325061176.21
324360302.31
Best fit
========== 17.63 ==========
325083230.83
324378347.94
Best fit
========== 17.64 ==========
325105278.08
324396391.08
Best fit
========== 17.65 ==========
325127317.96
324414431.71
Best fit
========== 17.66 ==========
325149350.47
324432469.82
Best fit
========== 17.67 ==========
325171375.63
324450505.42
Best fit
========== 17.68 ==========
325193393.43
324468538.5
Best fit
========== 17.69 ==========
325215403.89
324486569.06
Best fit
========== 17.7 ==========
325237407.0
324504597.09
Best fit
========== 17.71 ==========
325259402.78
324522622.59
Best fit
========== 17.72 ==========
325281391.22
324540645.56
Best fit
========== 17.73 ==========
325303372.34
324558665.99
```

```
Best fit
========== 17.74 ===========
325325346.14
324576683.88
Best fit
========== 17.75 ===========
325347312.63
324594699.23
Best fit
========== 17.76 ===========
325369271.81
324612712.04
Best fit
========== 17.77 ===========
325391223.69
324630722.29
Best fit
========== 17.78 ===========
325413168.26
324648729.99
Best fit
========== 17.79 ===========
325435105.55
324666735.14
Best fit
========== 17.8 ===========
325457035.55
324684737.72
Best fit
========== 17.81 ===========
325478958.27
324702737.74
Best fit
========== 17.82 ===========
325500873.72
324720735.2
Best fit
========== 17.83 ===========
325522781.89
324738730.08
Best fit
========== 17.84 ===========
325544682.8
324756722.39
Best fit
========== 17.85 ===========
325566576.46
324774712.13
Best fit
========== 17.86 ===========
325588462.86
324792699.28
Best fit
========== 17.87 ===========
325610342.01
324810683.86
Best fit
========== 17.88 ===========
325632213.92
324828665.84
Best fit
========== 17.89 ===========
325654078.59
324846645.24
```

```
Best fit
========== 17.9 ==========
325675936.04
324864622.04
Best fit
========== 17.91 ==========
325697786.25
324882596.25
Best fit
========== 17.92 ==========
325719629.25
324900567.86
Best fit
========== 17.93 ==========
325741465.03
324918536.87
Best fit
========== 17.94 ==========
325763293.61
324936503.27
Best fit
========== 17.95 ==========
325785114.98
324954467.06
Best fit
========== 17.96 ==========
325806929.15
324972428.25
Best fit
========== 17.97 ==========
325828736.13
324990386.81
Best fit
========== 17.98 ==========
325850535.92
325008342.76
Best fit
========== 17.99 ==========
325872328.53
325026296.09
Best fit
========== 18.0 ==========
325894113.97
325044246.79
Best fit
========== 18.01 ==========
325915892.23
325062194.87
Best fit
========== 18.02 ==========
325937663.32
325080140.32
Best fit
========== 18.03 ==========
325959427.26
325098083.13
Best fit
========== 18.04 ==========
325981184.04
325116023.31
Best fit
========== 18.05 ==========
326002933.68
325133960.85
```

```
Best fit
========== 18.06 ===========
326024676.16
325151895.74
Best fit
========== 18.07 ===========
326046411.51
325169827.99
Best fit
========== 18.08 ===========
326068139.73
325187757.59
Best fit
========== 18.09 ===========
326089860.82
325205684.54
Best fit
========== 18.1 ===========
326111574.79
325223608.84
Best fit
========== 18.11 ===========
326133281.63
325241530.48
Best fit
========== 18.12 ===========
326154981.37
325259449.45
Best fit
========== 18.13 ===========
326176674.0
325277365.77
Best fit
========== 18.14 ===========
326198359.53
325295279.42
Best fit
========== 18.15 ===========
326220037.97
325313190.4
Best fit
========== 18.16 ===========
326241709.31
325331098.7
Best fit
========== 18.17 ===========
326263373.57
325349004.34
Best fit
========== 18.18 ===========
326285030.74
325366907.29
Best fit
========== 18.19 ===========
326306680.85
325384807.57
Best fit
========== 18.2 ===========
326328323.88
325402705.16
Best fit
========== 18.21 ===========
326349959.85
325420600.06
```

```
Best fit
========== 18.22 ==========
326371588.76
325438492.28
Best fit
========== 18.23 ==========
326393210.62
325456381.8
Best fit
========== 18.24 ==========
326414825.43
325474268.63
Best fit
========== 18.25 ==========
326436433.2
325492152.76
Best fit
========== 18.26 ==========
326458033.93
325510034.19
Best fit
========== 18.27 ==========
326479627.63
325527912.92
Best fit
========== 18.28 ==========
326501214.3
325545788.94
Best fit
========== 18.29 ==========
326522793.94
325563662.25
Best fit
========== 18.3 ==========
326544366.58
325581532.85
Best fit
========== 18.31 ==========
326565932.2
325599400.74
Best fit
========== 18.32 ==========
326587490.81
325617265.91
Best fit
========== 18.33 ==========
326609042.42
325635128.36
Best fit
========== 18.34 ==========
326630587.04
325652988.08
Best fit
========== 18.35 ==========
326652124.67
325670845.09
Best fit
========== 18.36 ==========
326673655.31
325688699.36
Best fit
========== 18.37 ==========
326695178.97
325706550.91
```

```
Best fit
========== 18.38 ==========
326716695.66
325724399.72
Best fit
========== 18.39 ==========
326738205.38
325742245.79
Best fit
========== 18.4 ==========
326759708.13
325760089.13
Best fit
========== 18.41 ==========
326781203.92
325777929.72
Best fit
========== 18.42 ==========
326802692.76
325795767.58
Best fit
========== 18.43 ==========
326824174.65
325813602.68
Best fit
========== 18.44 ==========
326845649.6
325831435.04
Best fit
========== 18.45 ==========
326867117.61
325849264.65
Best fit
========== 18.46 ==========
326888578.68
325867091.5
Best fit
========== 18.47 ==========
326910032.82
325884915.59
Best fit
========== 18.48 ==========
326931480.05
325902736.93
Best fit
========== 18.49 ==========
326952920.35
325920555.5
Best fit
========== 18.5 ==========
326974353.74
325938371.31
Best fit
========== 18.51 ==========
326995780.22
325956184.35
Best fit
========== 18.52 ==========
327017199.8
325973994.63
Best fit
========== 18.53 ==========
327038612.49
325991802.13
```

```
Best fit
========== 18.54 ===========
327060018.28
326009606.85
Best fit
========== 18.55 ===========
327081417.18
326027408.8
Best fit
========== 18.56 ===========
327102809.2
326045207.98
Best fit
========== 18.57 ===========
327124194.34
326063004.37
Best fit
========== 18.58 ===========
327145572.61
326080797.97
Best fit
========== 18.59 ===========
327166944.02
326098588.79
Best fit
========== 18.6 ===========
327188308.56
326116376.82
Best fit
========== 18.61 ===========
327209666.24
326134162.06
Best fit
========== 18.62 ===========
327231017.07
326151944.5
Best fit
========== 18.63 ===========
327252361.06
326169724.15
Best fit
========== 18.64 ===========
327273698.2
326187501.0
Best fit
========== 18.65 ===========
327295028.5
326205275.04
Best fit
========== 18.66 ===========
327316351.98
326223046.29
Best fit
========== 18.67 ===========
327337668.63
326240814.73
Best fit
========== 18.68 ===========
327358978.45
326258580.35
Best fit
========== 18.69 ===========
327380281.46
326276343.17
```

```
Best fit
========== 18.7 ==========
327401577.66
326294103.18
Best fit
========== 18.71 ==========
327422867.05
326311860.37
Best fit
========== 18.72 ==========
327444149.63
326329614.74
Best fit
========== 18.73 ==========
327465425.42
326347366.3
Best fit
========== 18.74 ==========
327486694.42
326365115.03
Best fit
========== 18.75 ==========
327507956.64
326382860.94
Best fit
========== 18.76 ==========
327529212.07
326400604.02
Best fit
========== 18.77 ==========
327550460.72
326418344.27
Best fit
========== 18.78 ==========
327571702.6
326436081.69
Best fit
========== 18.79 ==========
327592937.71
326453816.27
Best fit
========== 18.8 ==========
327614166.07
326471548.02
Best fit
========== 18.81 ==========
327635387.66
326489276.94
Best fit
========== 18.82 ==========
327656602.51
326507003.01
Best fit
========== 18.83 ==========
327677810.6
326524726.24
Best fit
========== 18.84 ==========
327699011.95
326542446.62
Best fit
========== 18.85 ==========
327720206.57
326560164.16
```

```
Best fit
========== 18.86 ===========
327741394.45
326577878.85
Best fit
========== 18.87 ===========
327762575.61
326595590.69
Best fit
========== 18.88 ===========
327783750.04
326613299.67
Best fit
========== 18.89 ===========
327804917.76
326631005.8
Best fit
========== 18.9 ===========
327826078.76
326648709.07
Best fit
========== 18.91 ===========
327847233.06
326666409.48
Best fit
========== 18.92 ===========
327868380.65
326684107.03
Best fit
========== 18.93 ===========
327889521.54
326701801.72
Best fit
========== 18.94 ===========
327910655.74
326719493.54
Best fit
========== 18.95 ===========
327931783.25
326737182.49
Best fit
========== 18.96 ===========
327952904.08
326754868.57
Best fit
========== 18.97 ===========
327974018.23
326772551.77
Best fit
========== 18.98 ===========
327995125.7
326790232.11
Best fit
========== 18.99 ===========
328016226.51
326807909.56
Best fit
========== 19.0 ===========
328037320.65
326825584.14
Best fit
========== 19.01 ===========
328058408.13
326843255.84
```

```
Best fit
========== 19.02 ==========
328079488.96
326860924.65
Best fit
========== 19.03 ==========
328100563.14
326878590.58
Best fit
========== 19.04 ==========
328121630.67
326896253.62
Best fit
========== 19.05 ==========
328142691.57
326913913.78
Best fit
========== 19.06 ==========
328163745.82
326931571.04
Best fit
========== 19.07 ==========
328184793.45
326949225.41
Best fit
========== 19.08 ==========
328205834.45
326966876.88
Best fit
========== 19.09 ==========
328226868.83
326984525.46
Best fit
========== 19.1 ==========
328247896.6
327002171.14
Best fit
========== 19.11 ==========
328268917.75
327019813.92
Best fit
========== 19.12 ==========
328289932.3
327037453.79
Best fit
========== 19.13 ==========
328310940.24
327055090.76
Best fit
========== 19.14 ==========
328331941.59
327072724.83
Best fit
========== 19.15 ==========
328352936.35
327090355.98
Best fit
========== 19.16 ==========
328373924.52
327107984.23
Best fit
========== 19.17 ==========
328394906.1
327125609.56
```

```
Best fit
========== 19.18 ==========
328415881.11
327143231.98
Best fit
========== 19.19 ==========
328436849.54
327160851.48
Best fit
========== 19.2 ==========
328457811.41
327178468.07
Best fit
========== 19.21 ==========
328478766.71
327196081.73
Best fit
========== 19.22 ==========
328499715.45
327213692.47
Best fit
========== 19.23 ==========
328520657.64
327231300.29
Best fit
========== 19.24 ==========
328541593.28
327248905.18
Best fit
========== 19.25 ==========
328562522.38
327266507.15
Best fit
========== 19.26 ==========
328583444.93
327284106.19
Best fit
========== 19.27 ==========
328604360.95
327301702.29
Best fit
========== 19.28 ==========
328625270.43
327319295.46
Best fit
========== 19.29 ==========
328646173.4
327336885.7
Best fit
========== 19.3 ==========
328667069.84
327354473.0
Best fit
========== 19.31 ==========
328687959.76
327372057.37
Best fit
========== 19.32 ==========
328708843.17
327389638.79
Best fit
========== 19.33 ==========
328729720.07
327407217.27
```

```
Best fit
========== 19.34 ==========
328750590.47
327424792.81
Best fit
========== 19.35 ==========
328771454.38
327442365.4
Best fit
========== 19.36 ==========
328792311.79
327459935.05
Best fit
========== 19.37 ==========
328813162.71
327477501.74
Best fit
========== 19.38 ==========
328834007.14
327495065.49
Best fit
========== 19.39 ==========
328854845.1
327512626.28
Best fit
========== 19.4 ==========
328875676.58
327530184.12
Best fit
========== 19.41 ==========
328896501.59
327547739.0
Best fit
========== 19.42 ==========
328917320.14
327565290.93
Best fit
========== 19.43 ==========
328938132.22
327582839.89
Best fit
========== 19.44 ==========
328958937.85
327600385.9
Best fit
========== 19.45 ==========
328979737.03
327617928.94
Best fit
========== 19.46 ==========
329000529.76
327635469.02
Best fit
========== 19.47 ==========
329021316.04
327653006.14
Best fit
========== 19.48 ==========
329042095.89
327670540.28
Best fit
========== 19.49 ==========
329062869.31
327688071.46
```

```
Best fit
========== 19.5 ==========
329083636.29
327705599.66
Best fit
========== 19.51 ==========
329104396.86
327723124.89
Best fit
========== 19.52 ==========
329125151.0
327740647.15
Best fit
========== 19.53 ==========
329145898.72
327758166.44
Best fit
========== 19.54 ==========
329166640.04
327775682.74
Best fit
========== 19.55 ==========
329187374.95
327793196.07
Best fit
========== 19.56 ==========
329208103.46
327810706.41
Best fit
========== 19.57 ==========
329228825.57
327828213.78
Best fit
========== 19.58 ==========
329249541.29
327845718.16
Best fit
========== 19.59 ==========
329270250.62
327863219.55
Best fit
========== 19.6 ==========
329290953.57
327880717.96
Best fit
========== 19.61 ==========
329311650.14
327898213.38
Best fit
========== 19.62 ==========
329332340.34
327915705.81
Best fit
========== 19.63 ==========
329353024.16
327933195.24
Best fit
========== 19.64 ==========
329373701.62
327950681.69
Best fit
========== 19.65 ==========
329394372.72
327968165.14
```

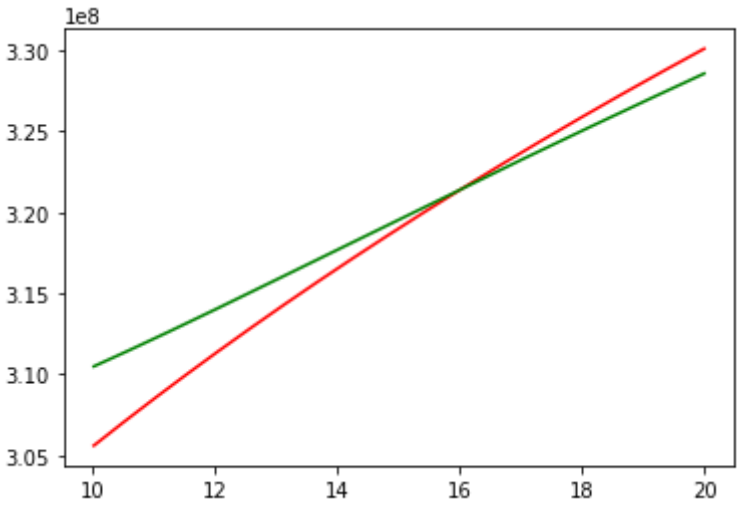
```
Best fit
========== 19.66 ==========
329415037.47
327985645.59
Best fit
========== 19.67 ==========
329435695.86
328003123.05
Best fit
========== 19.68 ==========
329456347.9
328020597.5
Best fit
========== 19.69 ==========
329476993.61
328038068.96
Best fit
========== 19.7 ==========
329497632.97
328055537.41
Best fit
========== 19.71 ==========
329518266.0
328073002.86
Best fit
========== 19.72 ==========
329538892.7
328090465.31
Best fit
========== 19.73 ==========
329559513.08
328107924.74
Best fit
========== 19.74 ==========
329580127.13
328125381.17
Best fit
========== 19.75 ==========
329600734.87
328142834.59
Best fit
========== 19.76 ==========
329621336.3
328160285.0
Best fit
========== 19.77 ==========
329641931.42
328177732.4
Best fit
========== 19.78 ==========
329662520.24
328195176.78
Best fit
========== 19.79 ==========
329683102.76
328212618.15
Best fit
========== 19.8 ==========
329703678.98
328230056.5
Best fit
========== 19.81 ==========
329724248.92
328247491.83
```

```
Best fit
========== 19.82 ==========
329744812.57
328264924.15
Best fit
========== 19.83 ==========
329765369.94
328282353.44
Best fit
========== 19.84 ==========
329785921.04
328299779.71
Best fit
========== 19.85 ==========
329806465.86
328317202.96
Best fit
========== 19.86 ==========
329827004.42
328334623.18
Best fit
========== 19.87 ==========
329847536.72
328352040.37
Best fit
========== 19.88 ==========
329868062.75
328369454.54
Best fit
========== 19.89 ==========
329888582.53
328386865.67
Best fit
========== 19.9 ==========
329909096.07
328404273.78
Best fit
========== 19.91 ==========
329929603.35
328421678.85
Best fit
========== 19.92 ==========
329950104.4
328439080.9
Best fit
========== 19.93 ==========
329970599.21
328456479.9
Best fit
========== 19.94 ==========
329991087.79
328473875.87
Best fit
========== 19.95 ==========
330011570.14
328491268.81
Best fit
========== 19.96 ==========
330032046.26
328508658.7
Best fit
========== 19.97 ==========
330052516.17
328526045.56
```

```
Best fit
========== 19.98 ==========
330072979.86
328543429.37
Best fit
========== 19.99 ==========
330093437.35
328560810.14
Best fit
========== 20.0 ==========
330113888.62
328578187.87
Best fit
```

In [70]:
```
import matplotlib.pyplot as plt
plt.plot(w,tr,c="red")
plt.plot(w,ts,c="green")
```

Out[70]:
```
[<matplotlib.lines.Line2D at 0x2cfa425cd30>]
```



In [71]:
```
rr = Ridge(alpha=16.39)
model = rr.fit(xtrain,ytrain)
tr_pred = model.predict(xtrain)
ts_pred = model.predict(xtest)
tr_err = round(mean_squared_error(ytrain,tr_pred),2)
ts_err = round(mean_squared_error(ytest,ts_pred),2)
print(tr_err,ts_err)
```

```
322290343.5 322122851.6
```

In [ ]:
```
#since Training Error is greater than testing Error. Model doesn't suffer from Overf
```

In [73]:
```
#Lasso Regression
```

In [84]:
```
w = []
y = 300
for i in range(0,1000):
    y = round(y + 0.05,2)
    w.append(y)
```

In [85]:
```
from sklearn.linear_model import Lasso
```

```
tr = []
ts = []
for i in w:
    rr = Lasso(alpha=i)
    model = rr.fit(xtrain,ytrain)
    tr_pred = model.predict(xtrain)
    ts_pred = model.predict(xtest)
    tr_err = round(mean_squared_error(ytrain,tr_pred),2)
    ts_err = round(mean_squared_error(ytest,ts_pred),2)
    tr.append(tr_err)
    ts.append(ts_err)
    print("==========",i,"===========")
    print(tr_err)
    print(ts_err)
    if(tr_err < ts_err):
        print("Overfitting")
    else:
        print("Best fit")
```

```
========== 300.05 ===========
375653428.06
375891536.37
Overfitting
========== 300.1 ===========
375666952.59
375902723.11
Overfitting
========== 300.15 ===========
375680479.36
375913912.24
Overfitting
========== 300.2 ===========
375694007.71
375925109.82
Overfitting
========== 300.25 ===========
375707537.3
375936311.44
Overfitting
========== 300.3 ===========
375721069.11
375947515.55
Overfitting
========== 300.35 ===========
375734603.17
375958722.05
Overfitting
========== 300.4 ===========
375748139.57
375969932.27
Overfitting
========== 300.45 ===========
375761678.38
375981147.39
Overfitting
========== 300.5 ===========
375775218.73
375992365.39
Overfitting
========== 300.55 ===========
375788760.92
376003586.07
Overfitting
========== 300.6 ===========
```

```
375802306.45
376014813.46
Overfitting
========== 300.65 ===========
375815854.24
376026043.24
Overfitting
========== 300.7 ===========
375829405.74
376037278.3
Overfitting
========== 300.75 ===========
375842960.24
376048517.22
Overfitting
========== 300.8 ===========
375856519.1
376059760.68
Overfitting
========== 300.85 ===========
375870081.66
376071007.86
Overfitting
========== 300.9 ===========
375883649.97
376082258.37
Overfitting
========== 300.95 ===========
375897222.49
376093511.06
Overfitting
========== 301.0 ===========
375909902.78
376104040.99
Overfitting
========== 301.05 ===========
375922044.82
376113848.36
Overfitting
========== 301.1 ===========
375934211.96
376123580.02
Overfitting
========== 301.15 ===========
375946385.1
376133309.32
Overfitting
========== 301.2 ===========
375958560.27
376143040.96
Overfitting
========== 301.25 ===========
375970737.45
376152774.95
Overfitting
========== 301.3 ===========
375982916.63
376162511.28
Overfitting
========== 301.35 ===========
375995097.83
376172249.94
Overfitting
========== 301.4 ===========
```

```
376007281.05
376181990.95
Overfitting
========== 301.45 ===========
376019466.29
376191734.29
Overfitting
========== 301.5 ===========
376031653.56
376201479.97
Overfitting
========== 301.55 ===========
376043844.65
376211229.38
Overfitting
========== 301.6 ===========
376056038.04
376220981.34
Overfitting
========== 301.65 ===========
376068233.52
376230735.82
Overfitting
========== 301.7 ===========
376080431.14
376240492.99
Overfitting
========== 301.75 ===========
376092630.79
376250252.49
Overfitting
========== 301.8 ===========
376104831.49
376260014.16
Overfitting
========== 301.85 ===========
376117034.46
376269778.83
Overfitting
========== 301.9 ===========
376129239.68
376279546.35
Overfitting
========== 301.95 ===========
376141447.56
376289317.49
Overfitting
========== 302.0 ===========
376153657.96
376299091.74
Overfitting
========== 302.05 ===========
376165871.06
376308869.3
Overfitting
========== 302.1 ===========
376178087.29
376318650.77
Overfitting
========== 302.15 ===========
376190306.72
376328435.96
Overfitting
========== 302.2 ===========
```

```
376202530.08
376338225.52
Overfitting
========== 302.25 ===========
376214758.83
376348020.62
Overfitting
========== 302.3 ===========
376226995.32
376357823.25
Overfitting
========== 302.35 ===========
376238528.15
376367180.42
Overfitting
========== 302.4 ===========
376249751.04
376376342.66
Overfitting
========== 302.45 ===========
376260975.77
376385507.31
Overfitting
========== 302.5 ===========
376272202.41
376394674.51
Overfitting
========== 302.55 ===========
376283430.92
376403844.16
Overfitting
========== 302.6 ===========
376294661.29
376413016.22
Overfitting
========== 302.65 ===========
376305893.51
376422190.69
Overfitting
========== 302.7 ===========
376317127.58
376431367.59
Overfitting
========== 302.75 ===========
376328363.51
376440546.9
Overfitting
========== 302.8 ===========
376339601.29
376449728.64
Overfitting
========== 302.85 ===========
376350840.65
376458912.57
Overfitting
========== 302.9 ===========
376362081.18
376468098.36
Overfitting
========== 302.95 ===========
376373323.56
376477286.57
Overfitting
========== 303.0 ===========
```

```
376384567.8
376486477.2
Overfitting
========== 303.05 ===========
376395813.9
376495670.25
Overfitting
========== 303.1 ===========
376407061.88
376504865.83
Overfitting
========== 303.15 ===========
376418311.75
376514063.82
Overfitting
========== 303.2 ===========
376429563.53
376523264.23
Overfitting
========== 303.25 ===========
376440817.15
376532467.05
Overfitting
========== 303.3 ===========
376452072.63
376541672.29
Overfitting
========== 303.35 ===========
376463329.96
376550879.95
Overfitting
========== 303.4 ===========
376474589.15
376560090.03
Overfitting
========== 303.45 ===========
376485850.2
376569302.52
Overfitting
========== 303.5 ===========
376497113.1
376578517.43
Overfitting
========== 303.55 ===========
376508377.9
376587734.75
Overfitting
========== 303.6 ===========
376519644.56
376596954.37
Overfitting
========== 303.65 ===========
376530913.08
376606176.41
Overfitting
========== 303.7 ===========
376542183.46
376615400.91
Overfitting
========== 303.75 ===========
376553455.71
376624627.84
Overfitting
========== 303.8 ===========
```

```
376564729.81
376633857.2
Overfitting
========== 303.85 ==========
376576005.77
376643088.98
Overfitting
========== 303.9 ==========
376587283.58
376652323.17
Overfitting
========== 303.95 ==========
376598563.24
376661559.79
Overfitting
========== 304.0 ==========
376609844.76
376670798.82
Overfitting
========== 304.05 ==========
376621128.13
376680040.27
Overfitting
========== 304.1 ==========
376632413.36
376689284.14
Overfitting
========== 304.15 ==========
376643700.45
376698530.43
Overfitting
========== 304.2 ==========
376654989.15
376707778.73
Overfitting
========== 304.25 ==========
376666279.36
376717029.04
Overfitting
========== 304.3 ==========
376677571.43
376726281.77
Overfitting
========== 304.35 ==========
376688865.37
376735536.93
Overfitting
========== 304.4 ==========
376700161.16
376744794.51
Overfitting
========== 304.45 ==========
376711458.81
376754054.51
Overfitting
========== 304.5 ==========
376722758.31
376763316.93
Overfitting
========== 304.55 ==========
376734059.66
376772581.76
Overfitting
========== 304.6 ==========
```

```
376745362.87
376781849.02
Overfitting
========== 304.65 ===========
376756667.93
376791118.69
Overfitting
========== 304.7 ===========
376769633.16
376799691.71
Overfitting
========== 304.75 ===========
376780940.89
376808968.62
Overfitting
========== 304.8 ===========
376792250.48
376818247.94
Overfitting
========== 304.85 ===========
376803561.95
376827529.66
Overfitting
========== 304.9 ===========
376814875.29
376836813.79
Overfitting
========== 304.95 ===========
376826190.56
376846100.29
Overfitting
========== 305.0 ===========
376837507.67
376855389.2
Overfitting
========== 305.05 ===========
376848826.65
376864680.53
Overfitting
========== 305.1 ===========
376860147.51
376873974.24
Overfitting
========== 305.15 ===========
376871470.22
376883270.37
Overfitting
========== 305.2 ===========
376882794.79
376892568.92
Overfitting
========== 305.25 ===========
376894121.22
376901869.89
Overfitting
========== 305.3 ===========
376905449.49
376911173.28
Overfitting
========== 305.35 ===========
376916779.64
376920479.07
Overfitting
========== 305.4 ===========
```

```
376928111.69
376929787.21
Overfitting
========== 305.45 ==========
376939445.6
376939097.77
Best fit
========== 305.5 ==========
376950781.32
376948410.67
Best fit
========== 305.55 ==========
376962118.89
376957725.87
Best fit
========== 305.6 ==========
376973458.34
376967043.46
Best fit
========== 305.65 ==========
376984799.65
376976363.46
Best fit
========== 305.7 ==========
376996142.2
376985685.15
Best fit
========== 305.75 ==========
377007486.53
376995009.17
Best fit
========== 305.8 ==========
377018832.71
377004335.61
Best fit
========== 305.85 ==========
377030180.75
377013664.29
Best fit
========== 305.9 ==========
377041530.65
377022995.13
Best fit
========== 305.95 ==========
377052882.4
377032328.39
Best fit
========== 306.0 ==========
377064236.0
377041664.07
Best fit
========== 306.05 ==========
377075591.46
377051002.16
Best fit
========== 306.1 ==========
377086948.77
377060342.67
Best fit
========== 306.15 ==========
377098307.93
377069685.6
Best fit
========== 306.2 ==========
```

```
377109668.94
377079030.95
Best fit
========== 306.25 ===========
377121032.04
377088377.36
Best fit
========== 306.3 ===========
377132397.15
377097725.79
Best fit
========== 306.35 ===========
377143764.11
377107076.63
Best fit
========== 306.4 ===========
377155132.92
377116429.89
Best fit
========== 306.45 ===========
377166503.57
377125785.55
Best fit
========== 306.5 ===========
377177875.81
377135143.42
Best fit
========== 306.55 ===========
377189249.9
377144503.71
Best fit
========== 306.6 ===========
377200625.84
377153866.41
Best fit
========== 306.65 ===========
377212003.63
377163231.53
Best fit
========== 306.7 ===========
377223383.28
377172599.07
Best fit
========== 306.75 ===========
377234764.78
377181969.03
Best fit
========== 306.8 ===========
377246148.34
377191341.55
Best fit
========== 306.85 ===========
377257535.93
377200718.22
Best fit
========== 306.9 ===========
377268925.34
377210097.31
Best fit
========== 306.95 ===========
377280316.64
377219478.82
Best fit
========== 307.0 ===========
```

```
377291709.81
377228862.74
Best fit
========== 307.05 ===========
377303104.83
377238249.08
Best fit
========== 307.1 ===========
377314501.7
377247637.84
Best fit
========== 307.15 ===========
377325900.14
377257028.51
Best fit
========== 307.2 ===========
377337300.32
377266421.39
Best fit
========== 307.25 ===========
377348702.36
377275816.69
Best fit
========== 307.3 ===========
377360106.25
377285214.41
Best fit
========== 307.35 ===========
377371511.99
377294614.55
Best fit
========== 307.4 ===========
377382919.59
377304017.11
Best fit
========== 307.45 ===========
377394329.04
377313422.08
Best fit
========== 307.5 ===========
377405740.34
377322829.48
Best fit
========== 307.55 ===========
377417153.5
377332239.3
Best fit
========== 307.6 ===========
377428568.51
377341651.53
Best fit
========== 307.65 ===========
377439985.38
377351066.18
Best fit
========== 307.7 ===========
377451404.1
377360483.26
Best fit
========== 307.75 ===========
377462824.67
377369902.75
Best fit
========== 307.8 ===========
```

```
377474247.1
377379324.66
Best fit
========== 307.85 ===========
377485671.38
377388748.99
Best fit
========== 307.9 ===========
377497097.52
377398175.74
Best fit
========== 307.95 ===========
377508525.51
377407604.91
Best fit
========== 308.0 ===========
377519955.35
377417036.49
Best fit
========== 308.05 ===========
377531387.05
377426470.5
Best fit
========== 308.1 ===========
377542820.46
377435906.48
Best fit
========== 308.15 ===========
377554255.69
377445344.79
Best fit
========== 308.2 ===========
377565692.78
377454785.53
Best fit
========== 308.25 ===========
377577131.72
377464228.67
Best fit
========== 308.3 ===========
377588572.51
377473674.24
Best fit
========== 308.35 ===========
377600015.16
377483122.23
Best fit
========== 308.4 ===========
377611459.66
377492572.64
Best fit
========== 308.45 ===========
377622906.02
377502025.46
Best fit
========== 308.5 ===========
377634354.23
377511480.71
Best fit
========== 308.55 ===========
377645804.3
377520938.37
Best fit
========== 308.6 ===========
```

```
377657256.34
377530398.39
Best fit
========== 308.65 ===========
377668710.25
377539860.83
Best fit
========== 308.7 ===========
377680166.01
377549325.67
Best fit
========== 308.75 ===========
377691623.71
377558792.76
Best fit
========== 308.8 ===========
377703083.27
377568262.26
Best fit
========== 308.85 ===========
377714544.65
377577733.83
Best fit
========== 308.9 ===========
377726007.88
377587207.75
Best fit
========== 308.95 ===========
377737472.97
377596684.1
Best fit
========== 309.0 ===========
377748939.91
377606162.86
Best fit
========== 309.05 ===========
377760408.7
377615644.04
Best fit
========== 309.1 ===========
377771879.39
377625127.48
Best fit
========== 309.15 ===========
377783351.95
377634613.3
Best fit
========== 309.2 ===========
377794826.37
377644101.54
Best fit
========== 309.25 ===========
377806302.66
377653592.26
Best fit
========== 309.3 ===========
377817780.8
377663085.39
Best fit
========== 309.35 ===========
377829260.79
377672580.93
Best fit
========== 309.4 ===========
```

```
377840742.64
377682078.9
Best fit
========== 309.45 ===========
377852226.39
377691579.17
Best fit
========== 309.5 ===========
377863712.04
377701081.71
Best fit
========== 309.55 ===========
377875199.55
377710586.67
Best fit
========== 309.6 ===========
377886688.91
377720094.05
Best fit
========== 309.65 ===========
377898180.12
377729603.84
Best fit
========== 309.7 ===========
377909673.19
377739116.06
Best fit
========== 309.75 ===========
377921168.12
377748630.69
Best fit
========== 309.8 ===========
377932665.0
377758147.68
Best fit
========== 309.85 ===========
377944163.76
377767667.08
Best fit
========== 309.9 ===========
377955664.39
377777188.87
Best fit
========== 309.95 ===========
377967166.96
377786712.98
Best fit
========== 310.0 ===========
377978671.39
377796239.5
Best fit
========== 310.05 ===========
377990177.66
377805768.44
Best fit
========== 310.1 ===========
378001685.81
377815299.79
Best fit
========== 310.15 ===========
378013195.87
377824833.51
Best fit
========== 310.2 ===========
```

```
378024707.78
377834369.65
Best fit
========== 310.25 ===========
378036221.55
377843908.22
Best fit
========== 310.3 ===========
378047737.18
377853449.2
Best fit
========== 310.35 ===========
378059254.66
377862992.6
Best fit
========== 310.4 ===========
378070773.99
377872538.42
Best fit
========== 310.45 ===========
378082295.18
377882086.66
Best fit
========== 310.5 ===========
378093818.22
377891637.32
Best fit
========== 310.55 ===========
378105343.11
377901190.4
Best fit
========== 310.6 ===========
378116869.88
377910745.88
Best fit
========== 310.65 ===========
378128398.53
377920303.77
Best fit
========== 310.7 ===========
378139929.03
377929864.07
Best fit
========== 310.75 ===========
378151461.39
377939426.8
Best fit
========== 310.8 ===========
378162995.6
377948991.94
Best fit
========== 310.85 ===========
378174531.6
377958559.44
Best fit
========== 310.9 ===========
378186069.36
377968129.24
Best fit
========== 310.95 ===========
378197608.96
377977701.45
Best fit
========== 311.0 ===========
```

```
378209150.42
377987276.09
Best fit
========== 311.05 ===========
378220693.72
377996853.15
Best fit
========== 311.1 ===========
378232238.88
378006432.63
Best fit
========== 311.15 ===========
378243785.89
378016014.53
Best fit
========== 311.2 ===========
378255334.75
378025598.85
Best fit
========== 311.25 ===========
378266885.47
378035185.59
Best fit
========== 311.3 ===========
378278438.05
378044774.74
Best fit
========== 311.35 ===========
378289992.47
378054366.32
Best fit
========== 311.4 ===========
378301548.75
378063960.32
Best fit
========== 311.45 ===========
378313106.88
378073556.73
Best fit
========== 311.5 ===========
378324666.86
378083155.56
Best fit
========== 311.55 ===========
378336228.7
378092756.82
Best fit
========== 311.6 ===========
378347792.37
378102360.47
Best fit
========== 311.65 ===========
378359357.88
378111966.53
Best fit
========== 311.7 ===========
378370925.25
378121575.0
Best fit
========== 311.75 ===========
378382494.47
378131185.9
Best fit
========== 311.8 ===========
```

```
378394065.54
378140799.22
Best fit
========== 311.85 ===========
378405638.47
378150414.96
Best fit
========== 311.9 ===========
378417213.26
378160033.11
Best fit
========== 311.95 ===========
378428789.9
378169653.69
Best fit
========== 312.0 ===========
378440368.39
378179276.68
Best fit
========== 312.05 ===========
378451948.73
378188902.1
Best fit
========== 312.1 ===========
378463530.93
378198529.93
Best fit
========== 312.15 ===========
378475114.99
378208160.18
Best fit
========== 312.2 ===========
378486700.9
378217792.86
Best fit
========== 312.25 ===========
378498288.66
378227427.9
Best fit
========== 312.3 ===========
378509878.29
378237065.36
Best fit
========== 312.35 ===========
378521469.77
378246705.24
Best fit
========== 312.4 ===========
378533063.1
378256347.53
Best fit
========== 312.45 ===========
378544659.92
378265994.03
Best fit
========== 312.5 ===========
378556259.29
378275643.7
Best fit
========== 312.55 ===========
378567860.52
378285295.79
Best fit
========== 312.6 ===========
```

```
378579463.6
378294950.3
Best fit
========== 312.65 ===========
378591068.53
378304607.23
Best fit
========== 312.7 ===========
378602675.32
378314266.58
Best fit
========== 312.75 ===========
378614283.96
378323928.36
Best fit
========== 312.8 ===========
378625894.46
378333592.55
Best fit
========== 312.85 ===========
378637506.82
378343259.16
Best fit
========== 312.9 ===========
378649121.03
378352928.2
Best fit
========== 312.95 ===========
378660737.09
378362599.65
Best fit
========== 313.0 ===========
378672355.01
378372273.53
Best fit
========== 313.05 ===========
378683974.78
378381949.82
Best fit
========== 313.1 ===========
378695596.41
378391628.54
Best fit
========== 313.15 ===========
378707219.89
378401309.67
Best fit
========== 313.2 ===========
378718845.19
378410993.26
Best fit
========== 313.25 ===========
378730472.34
378420679.26
Best fit
========== 313.3 ===========
378742101.35
378430367.69
Best fit
========== 313.35 ===========
378753732.21
378440058.52
Best fit
========== 313.4 ===========
```

```
378765364.92
378449751.72
Best fit
========== 313.45 ===========
378776999.48
378459447.33
Best fit
========== 313.5 ===========
378788635.9
378469145.36
Best fit
========== 313.55 ===========
378801683.25
378477926.34
Best fit
========== 313.6 ===========
378813322.69
378487631.26
Best fit
========== 313.65 ===========
378824963.98
378497338.59
Best fit
========== 313.7 ===========
378836607.12
378507048.35
Best fit
========== 313.75 ===========
378848252.12
378516760.52
Best fit
========== 313.8 ===========
378859898.98
378526475.12
Best fit
========== 313.85 ===========
378871547.69
378536192.14
Best fit
========== 313.9 ===========
378883198.25
378545911.57
Best fit
========== 313.95 ===========
378894850.67
378555633.43
Best fit
========== 314.0 ===========
378906504.94
378565357.7
Best fit
========== 314.05 ===========
378918161.07
378575084.4
Best fit
========== 314.1 ===========
378929819.05
378584813.51
Best fit
========== 314.15 ===========
378941478.06
378594542.85
Best fit
========== 314.2 ===========
```

```
378953138.65
378604273.53
Best fit
========== 314.25 ===========
378964801.09
378614006.64
Best fit
========== 314.3 ===========
378976465.39
378623742.17
Best fit
========== 314.35 ===========
378988131.54
378633480.11
Best fit
========== 314.4 ===========
378999799.56
378643220.46
Best fit
========== 314.45 ===========
379011469.46
378652963.21
Best fit
========== 314.5 ===========
379023141.22
378662708.35
Best fit
========== 314.55 ===========
379034814.84
378672455.91
Best fit
========== 314.6 ===========
379046490.31
378682205.89
Best fit
========== 314.65 ===========
379058167.63
378691958.29
Best fit
========== 314.7 ===========
379069846.82
378701713.1
Best fit
========== 314.75 ===========
379081527.85
378711470.32
Best fit
========== 314.8 ===========
379093210.75
378721229.96
Best fit
========== 314.85 ===========
379104895.5
378730992.02
Best fit
========== 314.9 ===========
379116582.1
378740756.5
Best fit
========== 314.95 ===========
379128270.55
378750523.4
Best fit
========== 315.0 ===========
```

```
379139960.86
378760292.72
Best fit
========== 315.05 ===========
379151653.03
378770064.46
Best fit
========== 315.1 ===========
379163346.99
378779838.35
Best fit
========== 315.15 ===========
379175042.81
378789614.66
Best fit
========== 315.2 ===========
379186740.5
378799393.38
Best fit
========== 315.25 ===========
379198440.07
378809174.53
Best fit
========== 315.3 ===========
379210141.49
378818958.09
Best fit
========== 315.35 ===========
379221844.77
378828744.07
Best fit
========== 315.4 ===========
379233549.9
378838532.47
Best fit
========== 315.45 ===========
379245256.93
378848323.25
Best fit
========== 315.5 ===========
379256965.82
378858116.46
Best fit
========== 315.55 ===========
379268676.56
378867912.08
Best fit
========== 315.6 ===========
379280389.15
378877710.13
Best fit
========== 315.65 ===========
379292103.6
378887510.59
Best fit
========== 315.7 ===========
379303819.9
378897313.46
Best fit
========== 315.75 ===========
379315538.06
378907118.75
Best fit
========== 315.8 ===========
```

```
379327258.07
378916926.46
Best fit
========== 315.85 ===========
379338979.93
378926736.59
Best fit
========== 315.9 ===========
379350703.64
378936549.14
Best fit
========== 315.95 ===========
379362429.22
378946364.11
Best fit
========== 316.0 ===========
379374156.64
378956181.5
Best fit
========== 316.05 ===========
379385885.92
378966001.31
Best fit
========== 316.1 ===========
379397617.05
378975823.53
Best fit
========== 316.15 ===========
379409350.04
378985648.18
Best fit
========== 316.2 ===========
379421084.88
378995475.25
Best fit
========== 316.25 ===========
379432821.58
379005304.73
Best fit
========== 316.3 ===========
379444560.08
379015136.58
Best fit
========== 316.35 ===========
379456300.33
379024970.69
Best fit
========== 316.4 ===========
379468042.45
379034807.2
Best fit
========== 316.45 ===========
379479786.42
379044646.13
Best fit
========== 316.5 ===========
379491532.24
379054487.47
Best fit
========== 316.55 ===========
379503279.92
379064331.24
Best fit
========== 316.6 ===========
```

```
379515029.45
379074177.43
Best fit
========== 316.65 ===========
379526780.84
379084026.03
Best fit
========== 316.7 ===========
379538534.08
379093877.06
Best fit
========== 316.75 ===========
379550289.17
379103730.5
Best fit
========== 316.8 ===========
379562046.12
379113586.36
Best fit
========== 316.85 ===========
379573804.92
379123444.64
Best fit
========== 316.9 ===========
379585565.58
379133305.35
Best fit
========== 316.95 ===========
379597328.09
379143168.47
Best fit
========== 317.0 ===========
379609092.46
379153034.01
Best fit
========== 317.05 ===========
379620858.68
379162901.97
Best fit
========== 317.1 ===========
379632626.75
379172772.35
Best fit
========== 317.15 ===========
379644396.68
379182645.15
Best fit
========== 317.2 ===========
379656168.46
379192520.36
Best fit
========== 317.25 ===========
379667942.1
379202398.0
Best fit
========== 317.3 ===========
379679717.59
379212278.06
Best fit
========== 317.35 ===========
379691494.93
379222160.53
Best fit
========== 317.4 ===========
```

```
379703274.13
379232045.43
Best fit
========== 317.45 ===========
379715055.19
379241932.75
Best fit
========== 317.5 ===========
379726838.09
379251822.48
Best fit
========== 317.55 ===========
379738622.85
379261714.63
Best fit
========== 317.6 ===========
379750409.47
379271609.21
Best fit
========== 317.65 ===========
379762197.94
379281506.2
Best fit
========== 317.7 ===========
379773988.26
379291405.61
Best fit
========== 317.75 ===========
379785780.44
379301307.44
Best fit
========== 317.8 ===========
379797574.47
379311211.69
Best fit
========== 317.85 ===========
379809370.36
379321118.36
Best fit
========== 317.9 ===========
379821168.09
379331027.45
Best fit
========== 317.95 ===========
379832967.73
379340938.92
Best fit
========== 318.0 ===========
379844769.22
379350852.82
Best fit
========== 318.05 ===========
379856572.57
379360769.13
Best fit
========== 318.1 ===========
379868377.77
379370687.86
Best fit
========== 318.15 ===========
379880184.83
379380609.01
Best fit
========== 318.2 ===========
```

```
379891993.74
379390532.59
Best fit
========== 318.25 ===========
379903804.5
379400458.58
Best fit
========== 318.3 ===========
379915617.12
379410386.99
Best fit
========== 318.35 ===========
379927431.59
379420317.82
Best fit
========== 318.4 ===========
379939247.91
379430251.07
Best fit
========== 318.45 ===========
379951066.09
379440186.74
Best fit
========== 318.5 ===========
379962886.13
379450124.82
Best fit
========== 318.55 ===========
379974708.06
379460065.32
Best fit
========== 318.6 ===========
379986531.9
379470008.21
Best fit
========== 318.65 ===========
379998357.57
379479953.54
Best fit
========== 318.7 ===========
380010185.1
379489901.2
Best fit
========== 318.75 ===========
380022014.48
379499851.29
Best fit
========== 318.8 ===========
380033845.71
379509803.79
Best fit
========== 318.85 ===========
380045680.95
379519761.07
Best fit
========== 318.9 ===========
380057518.25
379529721.0
Best fit
========== 318.95 ===========
380069357.4
379539683.35
Best fit
========== 319.0 ===========
```

```
380081198.41
379549648.13
Best fit
========== 319.05 ===========
380093041.27
379559615.32
Best fit
========== 319.1 ===========
380104885.99
379569584.93
Best fit
========== 319.15 ===========
380116732.57
379579556.97
Best fit
========== 319.2 ===========
380128581.0
379589531.43
Best fit
========== 319.25 ===========
380140431.28
379599508.3
Best fit
========== 319.3 ===========
380152283.42
379609487.6
Best fit
========== 319.35 ===========
380164137.41
379619469.32
Best fit
========== 319.4 ===========
380175993.26
379629453.46
Best fit
========== 319.45 ===========
380187850.96
379639440.01
Best fit
========== 319.5 ===========
380199710.51
379649428.97
Best fit
========== 319.55 ===========
380211571.91
379659420.35
Best fit
========== 319.6 ===========
380223435.17
379669414.15
Best fit
========== 319.65 ===========
380235300.29
379679410.37
Best fit
========== 319.7 ===========
380247167.26
379689409.02
Best fit
========== 319.75 ===========
380259036.08
379699410.08
Best fit
========== 319.8 ===========
```

```
380270906.79
379709413.59
Best fit
========== 319.85 ===========
380282779.36
379719419.51
Best fit
========== 319.9 ===========
380294653.78
379729427.86
Best fit
========== 319.95 ===========
380306530.06
379739438.63
Best fit
========== 320.0 ===========
380318408.19
379749451.82
Best fit
========== 320.05 ===========
380330288.18
379759467.43
Best fit
========== 320.1 ===========
380342170.02
379769485.46
Best fit
========== 320.15 ===========
380354053.72
379779505.91
Best fit
========== 320.2 ===========
380365939.27
379789528.79
Best fit
========== 320.25 ===========
380377826.67
379799554.08
Best fit
========== 320.3 ===========
380389715.94
379809581.79
Best fit
========== 320.35 ===========
380401607.05
379819611.93
Best fit
========== 320.4 ===========
380413500.02
379829644.48
Best fit
========== 320.45 ===========
380425394.85
379839679.46
Best fit
========== 320.5 ===========
380437291.53
379849716.85
Best fit
========== 320.55 ===========
380449190.07
379859756.67
Best fit
========== 320.6 ===========
```

```
380461090.46
379869798.91
Best fit
========== 320.65 ===========
380472992.71
379879843.57
Best fit
========== 320.7 ===========
380484896.81
379889890.65
Best fit
========== 320.75 ===========
380496802.76
379899940.15
Best fit
========== 320.8 ===========
380508710.58
379909992.07
Best fit
========== 320.85 ===========
380520620.24
379920046.41
Best fit
========== 320.9 ===========
380532531.76
379930103.17
Best fit
========== 320.95 ===========
380544445.14
379940162.35
Best fit
========== 321.0 ===========
380556360.37
379950223.95
Best fit
========== 321.05 ===========
380568277.46
379960287.98
Best fit
========== 321.1 ===========
380580196.4
379970354.42
Best fit
========== 321.15 ===========
380592117.19
379980423.29
Best fit
========== 321.2 ===========
380604039.84
379990494.57
Best fit
========== 321.25 ===========
380615964.37
380000568.26
Best fit
========== 321.3 ===========
380627890.78
380010644.35
Best fit
========== 321.35 ===========
380639819.06
380020722.85
Best fit
========== 321.4 ===========
```

```
380651749.19
380030803.78
Best fit
========== 321.45 ===========
380663681.17
380040887.13
Best fit
========== 321.5 ===========
380675615.01
380050972.9
Best fit
========== 321.55 ===========
380687550.7
380061061.1
Best fit
========== 321.6 ===========
380699488.25
380071151.71
Best fit
========== 321.65 ===========
380711427.65
380081244.74
Best fit
========== 321.7 ===========
380723368.91
380091340.19
Best fit
========== 321.75 ===========
380735312.03
380101438.07
Best fit
========== 321.8 ===========
380747256.99
380111538.36
Best fit
========== 321.85 ===========
380759203.82
380121641.08
Best fit
========== 321.9 ===========
380771152.5
380131746.21
Best fit
========== 321.95 ===========
380783103.03
380141853.77
Best fit
========== 322.0 ===========
380795055.43
380151963.75
Best fit
========== 322.05 ===========
380807009.69
380162076.14
Best fit
========== 322.1 ===========
380818965.8
380172190.96
Best fit
========== 322.15 ===========
380830923.77
380182308.2
Best fit
========== 322.2 ===========
```

```
380842883.59
380192427.86
Best fit
========== 322.25 ===========
380854845.27
380202549.94
Best fit
========== 322.3 ===========
380866808.8
380212674.44
Best fit
========== 322.35 ===========
380878774.19
380222801.36
Best fit
========== 322.4 ===========
380890741.36
380232930.59
Best fit
========== 322.45 ===========
380903742.18
380241804.76
Best fit
========== 322.5 ===========
380915712.51
380251939.58
Best fit
========== 322.55 ===========
380927684.8
380262076.22
Best fit
========== 322.6 ===========
380939658.94
380272215.27
Best fit
========== 322.65 ===========
380951634.94
380282356.75
Best fit
========== 322.7 ===========
380963612.79
380292500.64
Best fit
========== 322.75 ===========
380975592.5
380302646.96
Best fit
========== 322.8 ===========
380987574.06
380312795.7
Best fit
========== 322.85 ===========
380999557.47
380322946.86
Best fit
========== 322.9 ===========
381011542.74
380333100.43
Best fit
========== 322.95 ===========
381023529.87
380343256.43
Best fit
========== 323.0 ===========
```

```
381035518.85
380353414.85
Best fit
========== 323.05 ===========
381047509.69
380363575.69
Best fit
========== 323.1 ===========
381059502.33
380373739.01
Best fit
========== 323.15 ===========
381071496.81
380383904.78
Best fit
========== 323.2 ===========
381083493.14
380394072.96
Best fit
========== 323.25 ===========
381095491.34
380404243.56
Best fit
========== 323.3 ===========
381107491.38
380414416.59
Best fit
========== 323.35 ===========
381119493.28
380424592.03
Best fit
========== 323.4 ===========
381131497.04
380434769.9
Best fit
========== 323.45 ===========
381143502.65
380444950.18
Best fit
========== 323.5 ===========
381155510.11
380455132.89
Best fit
========== 323.55 ===========
381167519.43
380465318.01
Best fit
========== 323.6 ===========
381179530.61
380475505.56
Best fit
========== 323.65 ===========
381191543.64
380485695.53
Best fit
========== 323.7 ===========
381203558.52
380495887.91
Best fit
========== 323.75 ===========
381215575.26
380506082.72
Best fit
========== 323.8 ===========
```

```
381227593.85
380516279.95
Best fit
========== 323.85 ===========
381239614.3
380526479.59
Best fit
========== 323.9 ===========
381251636.6
380536681.66
Best fit
========== 323.95 ===========
381263660.76
380546886.15
Best fit
========== 324.0 ===========
381275686.77
380557093.06
Best fit
========== 324.05 ===========
381287714.64
380567302.39
Best fit
========== 324.1 ===========
381299744.36
380577514.14
Best fit
========== 324.15 ===========
381311775.93
380587728.31
Best fit
========== 324.2 ===========
381323809.37
380597944.9
Best fit
========== 324.25 ===========
381335844.65
380608163.91
Best fit
========== 324.3 ===========
381347881.79
380618385.34
Best fit
========== 324.35 ===========
381359920.79
380628609.19
Best fit
========== 324.4 ===========
381371961.64
380638835.46
Best fit
========== 324.45 ===========
381384004.34
380649064.15
Best fit
========== 324.5 ===========
381396048.69
380659295.01
Best fit
========== 324.55 ===========
381408093.68
380669526.8
Best fit
========== 324.6 ===========
```

```
381420140.53
380679761.01
Best fit
========== 324.65 ===========
381432189.22
380689997.64
Best fit
========== 324.7 ===========
381444239.78
380700236.68
Best fit
========== 324.75 ===========
381456292.18
380710478.15
Best fit
========== 324.8 ===========
381468346.44
380720722.04
Best fit
========== 324.85 ===========
381480402.64
380730968.24
Best fit
========== 324.9 ===========
381492460.87
380741216.57
Best fit
========== 324.95 ===========
381504520.98
380751467.31
Best fit
========== 325.0 ===========
381516582.95
380761720.48
Best fit
========== 325.05 ===========
381528646.78
380771976.06
Best fit
========== 325.1 ===========
381540712.46
380782234.06
Best fit
========== 325.15 ===========
381552779.99
380792494.47
Best fit
========== 325.2 ===========
381564849.38
380802757.31
Best fit
========== 325.25 ===========
381576920.63
380813022.57
Best fit
========== 325.3 ===========
381588993.73
380823290.25
Best fit
========== 325.35 ===========
381601068.68
380833560.35
Best fit
========== 325.4 ===========
```

```
381613145.49
380843832.87
Best fit
========== 325.45 ===========
381625224.15
380854107.81
Best fit
========== 325.5 ===========
381637306.67
380864387.4
Best fit
========== 325.55 ===========
381649391.44
380874669.84
Best fit
========== 325.6 ===========
381661478.07
380884954.71
Best fit
========== 325.65 ===========
381673566.55
380895241.99
Best fit
========== 325.7 ===========
381685656.88
380905531.7
Best fit
========== 325.75 ===========
381697749.07
380915823.82
Best fit
========== 325.8 ===========
381709843.11
380926118.37
Best fit
========== 325.85 ===========
381721939.01
380936415.34
Best fit
========== 325.9 ===========
381734036.76
380946714.73
Best fit
========== 325.95 ===========
381746136.37
380957016.54
Best fit
========== 326.0 ===========
381758237.84
380967320.77
Best fit
========== 326.05 ===========
381770341.16
380977627.43
Best fit
========== 326.1 ===========
381782446.34
380987936.5
Best fit
========== 326.15 ===========
381794553.38
380998248.0
Best fit
========== 326.2 ===========
```

```
381806662.27
381008561.92
Best fit
========== 326.25 ===========
381818773.01
381018878.26
Best fit
========== 326.3 ===========
381830885.61
381029197.02
Best fit
========== 326.35 ===========
381843000.07
381039518.2
Best fit
========== 326.4 ===========
381855116.38
381049841.8
Best fit
========== 326.45 ===========
381867234.55
381060167.83
Best fit
========== 326.5 ===========
381879354.57
381070496.27
Best fit
========== 326.55 ===========
381891476.45
381080827.14
Best fit
========== 326.6 ===========
381903600.18
381091160.42
Best fit
========== 326.65 ===========
381915725.76
381101496.13
Best fit
========== 326.7 ===========
381927853.21
381111834.26
Best fit
========== 326.75 ===========
381939982.5
381122174.81
Best fit
========== 326.8 ===========
381952113.66
381132517.78
Best fit
========== 326.85 ===========
381964246.66
381142863.17
Best fit
========== 326.9 ===========
381976381.53
381153210.98
Best fit
========== 326.95 ===========
381988518.24
381163561.22
Best fit
========== 327.0 ===========
```

```
382000656.82
381173913.87
Best fit
========== 327.05 ===========
382012797.24
381184268.98
Best fit
========== 327.1 ===========
382024939.49
381194626.6
Best fit
========== 327.15 ===========
382037083.59
381204986.64
Best fit
========== 327.2 ===========
382049229.55
381215349.1
Best fit
========== 327.25 ===========
382061377.37
381225713.99
Best fit
========== 327.3 ===========
382073527.04
381236081.29
Best fit
========== 327.35 ===========
382085678.56
381246451.01
Best fit
========== 327.4 ===========
382097831.94
381256823.16
Best fit
========== 327.45 ===========
382109987.18
381267197.73
Best fit
========== 327.5 ===========
382122144.27
381277574.71
Best fit
========== 327.55 ===========
382134303.22
381287954.12
Best fit
========== 327.6 ===========
382146464.02
381298335.95
Best fit
========== 327.65 ===========
382158626.67
381308720.2
Best fit
========== 327.7 ===========
382170791.18
381319106.88
Best fit
========== 327.75 ===========
382182957.55
381329495.97
Best fit
========== 327.8 ===========
```

```
382195125.77
381339887.48
Best fit
========== 327.85 ===========
382207295.85
381350281.42
Best fit
========== 327.9 ===========
382219467.78
381360677.77
Best fit
========== 327.95 ===========
382231641.57
381371076.55
Best fit
========== 328.0 ===========
382243817.21
381381477.75
Best fit
========== 328.05 ===========
382255994.71
381391881.36
Best fit
========== 328.1 ===========
382268174.06
381402287.4
Best fit
========== 328.15 ===========
382280355.27
381412695.86
Best fit
========== 328.2 ===========
382292538.33
381423106.74
Best fit
========== 328.25 ===========
382304723.25
381433520.05
Best fit
========== 328.3 ===========
382316910.02
381443935.77
Best fit
========== 328.35 ===========
382329098.65
381454353.91
Best fit
========== 328.4 ===========
382341289.13
381464774.48
Best fit
========== 328.45 ===========
382353481.47
381475197.47
Best fit
========== 328.5 ===========
382365675.67
381485622.88
Best fit
========== 328.55 ===========
382377871.72
381496050.71
Best fit
========== 328.6 ===========
```

```
382390069.63
381506480.97
Best fit
========== 328.65 ===========
382402269.4
381516913.64
Best fit
========== 328.7 ===========
382414471.02
381527348.74
Best fit
========== 328.75 ===========
382426674.49
381537786.26
Best fit
========== 328.8 ===========
382438879.82
381548226.2
Best fit
========== 328.85 ===========
382451087.01
381558668.56
Best fit
========== 328.9 ===========
382463296.05
381569113.34
Best fit
========== 328.95 ===========
382475506.94
381579560.54
Best fit
========== 329.0 ===========
382487719.7
381590010.16
Best fit
========== 329.05 ===========
382499934.3
381600462.2
Best fit
========== 329.1 ===========
382512150.75
381610916.65
Best fit
========== 329.15 ===========
382524368.98
381621373.37
Best fit
========== 329.2 ===========
382536589.06
381631832.52
Best fit
========== 329.25 ===========
382548811.0
381642294.09
Best fit
========== 329.3 ===========
382561034.79
381652758.08
Best fit
========== 329.35 ===========
382573260.44
381663224.49
Best fit
========== 329.4 ===========
```

```
382585487.94
381673693.32
Best fit
========== 329.45 ===========
382597717.3
381684164.57
Best fit
========== 329.5 ===========
382609948.51
381694638.25
Best fit
========== 329.55 ===========
382622181.58
381705114.34
Best fit
========== 329.6 ===========
382634416.5
381715592.86
Best fit
========== 329.65 ===========
382646653.28
381726073.79
Best fit
========== 329.7 ===========
382658891.92
381736557.02
Best fit
========== 329.75 ===========
382671132.41
381747042.58
Best fit
========== 329.8 ===========
382683374.75
381757530.58
Best fit
========== 329.85 ===========
382695618.95
381768020.99
Best fit
========== 329.9 ===========
382707865.04
381778513.81
Best fit
========== 329.95 ===========
382720113.02
381789009.05
Best fit
========== 330.0 ===========
382732362.85
381799506.72
Best fit
========== 330.05 ===========
382744614.53
381810006.8
Best fit
========== 330.1 ===========
382756868.08
381820509.3
Best fit
========== 330.15 ===========
382769123.48
381831014.23
Best fit
========== 330.2 ===========
```

```
382781380.72
381841521.71
Best fit
========== 330.25 ===========
382793639.81
381852031.68
Best fit
========== 330.3 ===========
382805900.76
381862544.06
Best fit
========== 330.35 ===========
382818163.57
381873058.87
Best fit
========== 330.4 ===========
382830428.23
381883576.1
Best fit
========== 330.45 ===========
382842694.74
381894095.75
Best fit
========== 330.5 ===========
382854963.11
381904617.83
Best fit
========== 330.55 ===========
382867780.26
381913472.17
Best fit
========== 330.6 ===========
382880051.55
381924000.58
Best fit
========== 330.65 ===========
382892324.69
381934531.41
Best fit
========== 330.7 ===========
382904599.69
381945064.65
Best fit
========== 330.75 ===========
382916876.56
381955600.29
Best fit
========== 330.8 ===========
382929155.29
381966138.34
Best fit
========== 330.85 ===========
382941435.87
381976678.81
Best fit
========== 330.9 ===========
382953718.31
381987221.69
Best fit
========== 330.95 ===========
382966002.6
381997767.0
Best fit
========== 331.0 ===========
```

```
382978288.75
382008314.73
Best fit
========== 331.05 ===========
382990576.75
382018864.88
Best fit
========== 331.1 ===========
383002866.61
382029417.45
Best fit
========== 331.15 ===========
383015158.39
382039972.02
Best fit
========== 331.2 ===========
383027452.22
382050527.89
Best fit
========== 331.25 ===========
383039747.9
382061086.18
Best fit
========== 331.3 ===========
383052045.44
382071646.89
Best fit
========== 331.35 ===========
383064344.83
382082210.03
Best fit
========== 331.4 ===========
383076646.08
382092775.58
Best fit
========== 331.45 ===========
383088949.18
382103343.55
Best fit
========== 331.5 ===========
383101254.14
382113913.95
Best fit
========== 331.55 ===========
383113560.95
382124486.77
Best fit
========== 331.6 ===========
383125869.64
382135061.9
Best fit
========== 331.65 ===========
383138180.2
382145639.42
Best fit
========== 331.7 ===========
383150492.61
382156219.36
Best fit
========== 331.75 ===========
383162806.88
382166801.72
Best fit
========== 331.8 ===========
```

```
383175123.01
382177386.5
Best fit
========== 331.85 ===========
383187440.98
382187973.7
Best fit
========== 331.9 ===========
383199760.82
382198563.32
Best fit
========== 331.95 ===========
383212082.51
382209155.36
Best fit
========== 332.0 ===========
383224406.05
382219749.83
Best fit
========== 332.05 ===========
383236731.45
382230346.71
Best fit
========== 332.1 ===========
383249058.7
382240946.01
Best fit
========== 332.15 ===========
383261387.81
382251547.74
Best fit
========== 332.2 ===========
383273718.77
382262151.88
Best fit
========== 332.25 ===========
383286051.61
382272758.51
Best fit
========== 332.3 ===========
383298386.37
382283367.82
Best fit
========== 332.35 ===========
383310721.48
382293977.86
Best fit
========== 332.4 ===========
383323054.77
382304587.59
Best fit
========== 332.45 ===========
383335385.36
382315199.05
Best fit
========== 332.5 ===========
383347712.51
382325814.56
Best fit
========== 332.55 ===========
383360035.27
382336438.02
Best fit
========== 332.6 ===========
```

```
383372352.93
382347076.95
Best fit
========== 332.65 ===========
383384677.16
382357736.52
Best fit
========== 332.7 ===========
383396881.96
382368250.65
Best fit
========== 332.75 ===========
383409023.6
382378710.64
Best fit
========== 332.8 ===========
383421167.07
382389173.02
Best fit
========== 332.85 ===========
383433312.36
382399637.79
Best fit
========== 332.9 ===========
383445459.48
382410104.94
Best fit
========== 332.95 ===========
383457608.87
382420574.18
Best fit
========== 333.0 ===========
383469760.32
382431045.94
Best fit
========== 333.05 ===========
383481913.65
382441520.21
Best fit
========== 333.1 ===========
383494068.8
382451996.86
Best fit
========== 333.15 ===========
383506225.78
382462475.89
Best fit
========== 333.2 ===========
383518384.58
382472957.31
Best fit
========== 333.25 ===========
383530545.21
382483441.11
Best fit
========== 333.3 ===========
383542707.66
382493927.3
Best fit
========== 333.35 ===========
383554872.32
382504415.86
Best fit
========== 333.4 ===========
```

```
383567039.05
382514906.8
Best fit
========== 333.45 ===========
383579207.61
382525400.1
Best fit
========== 333.5 ===========
383591378.01
382535895.79
Best fit
========== 333.55 ===========
383603550.35
382546394.04
Best fit
========== 333.6 ===========
383615724.63
382556894.85
Best fit
========== 333.65 ===========
383627900.42
382567398.51
Best fit
========== 333.7 ===========
383640077.95
382577904.68
Best fit
========== 333.75 ===========
383652257.31
382588413.23
Best fit
========== 333.8 ===========
383664438.49
382598924.16
Best fit
========== 333.85 ===========
383676621.49
382609437.48
Best fit
========== 333.9 ===========
383688806.32
382619953.18
Best fit
========== 333.95 ===========
383700992.97
382630471.26
Best fit
========== 334.0 ===========
383713181.9
382640991.89
Best fit
========== 334.05 ===========
383725372.82
382651514.96
Best fit
========== 334.1 ===========
383737565.83
382662040.72
Best fit
========== 334.15 ===========
383749760.72
382672568.92
Best fit
========== 334.2 ===========
```

```
383761957.42
382683099.5
Best fit
========== 334.25 ===========
383774155.94
382693632.47
Best fit
========== 334.3 ===========
383786356.29
382704167.81
Best fit
========== 334.35 ===========
383798558.47
382714705.55
Best fit
========== 334.4 ===========
383810762.46
382725245.67
Best fit
========== 334.45 ===========
383822968.28
382735788.17
Best fit
========== 334.5 ===========
383835175.93
382746333.06
Best fit
========== 334.55 ===========
383847385.42
382756880.33
Best fit
========== 334.6 ===========
383859597.14
382767430.19
Best fit
========== 334.65 ===========
383871811.17
382777982.82
Best fit
========== 334.7 ===========
383884027.07
382788537.73
Best fit
========== 334.75 ===========
383896244.82
382799095.0
Best fit
========== 334.8 ===========
383908464.4
382809654.65
Best fit
========== 334.85 ===========
383920685.8
382820216.7
Best fit
========== 334.9 ===========
383932908.94
382830780.96
Best fit
========== 334.95 ===========
383945133.89
382841347.6
Best fit
========== 335.0 ===========
```

```
383957360.67
382851916.62
Best fit
========== 335.05 ===========
383969589.28
382862488.03
Best fit
========== 335.1 ===========
383981819.7
382873061.83
Best fit
========== 335.15 ===========
383994051.96
382883638.01
Best fit
========== 335.2 ===========
384006286.03
382894216.58
Best fit
========== 335.25 ===========
384018521.93
382904797.53
Best fit
========== 335.3 ===========
384030759.66
382915380.87
Best fit
========== 335.35 ===========
384042999.24
382925966.53
Best fit
========== 335.4 ===========
384055240.64
382936554.57
Best fit
========== 335.45 ===========
384067483.87
382947144.99
Best fit
========== 335.5 ===========
384079728.92
382957737.81
Best fit
========== 335.55 ===========
384091975.79
382968333.01
Best fit
========== 335.6 ===========
384104224.49
382978930.59
Best fit
========== 335.65 ===========
384116475.01
382989530.56
Best fit
========== 335.7 ===========
384128727.36
383000132.92
Best fit
========== 335.75 ===========
384140981.53
383010737.67
Best fit
========== 335.8 ===========
```

```
384153237.53
383021344.8
Best fit
========== 335.85 ===========
384165495.34
383031954.31
Best fit
========== 335.9 ===========
384177754.98
383042566.21
Best fit
========== 335.95 ===========
384190016.44
383053180.5
Best fit
========== 336.0 ===========
384202279.72
383063797.17
Best fit
========== 336.05 ===========
384214544.83
383074416.23
Best fit
========== 336.1 ===========
384226811.77
383085037.67
Best fit
========== 336.15 ===========
384239080.52
383095661.5
Best fit
========== 336.2 ===========
384251351.11
383106287.72
Best fit
========== 336.25 ===========
384263623.41
383116916.16
Best fit
========== 336.3 ===========
384275897.53
383127546.98
Best fit
========== 336.35 ===========
384288173.45
383138180.17
Best fit
========== 336.4 ===========
384300451.19
383148815.74
Best fit
========== 336.45 ===========
384312730.75
383159453.69
Best fit
========== 336.5 ===========
384325012.14
383170094.03
Best fit
========== 336.55 ===========
384337295.35
383180736.76
Best fit
========== 336.6 ===========
```

```
384349580.39
383191381.87
Best fit
========== 336.65 ===========
384361867.25
383202029.37
Best fit
========== 336.7 ===========
384374155.93
383212679.25
Best fit
========== 336.75 ===========
384386446.44
383223331.53
Best fit
========== 336.8 ===========
384398738.77
383233986.18
Best fit
========== 336.85 ===========
384411032.93
383244643.22
Best fit
========== 336.9 ===========
384423328.91
383255302.65
Best fit
========== 336.95 ===========
384435626.71
383265964.47
Best fit
========== 337.0 ===========
384447926.34
383276628.67
Best fit
========== 337.05 ===========
384460227.79
383287295.25
Best fit
========== 337.1 ===========
384472531.07
383297964.23
Best fit
========== 337.15 ===========
384484836.17
383308635.59
Best fit
========== 337.2 ===========
384497143.13
383319309.33
Best fit
========== 337.25 ===========
384509451.93
383329985.47
Best fit
========== 337.3 ===========
384521762.55
383340663.99
Best fit
========== 337.35 ===========
384534075.01
383351344.9
Best fit
========== 337.4 ===========
```

```
384546389.29
383362028.19
Best fit
========== 337.45 ===========
384558705.39
383372713.87
Best fit
========== 337.5 ===========
384571023.34
383383401.93
Best fit
========== 337.55 ===========
384583343.15
383394092.37
Best fit
========== 337.6 ===========
384595664.77
383404785.21
Best fit
========== 337.65 ===========
384607988.22
383415480.42
Best fit
========== 337.7 ===========
384620313.5
383426178.03
Best fit
========== 337.75 ===========
384632640.6
383436878.02
Best fit
========== 337.8 ===========
384644969.52
383447580.39
Best fit
========== 337.85 ===========
384657300.27
383458285.15
Best fit
========== 337.9 ===========
384669632.85
383468992.31
Best fit
========== 337.95 ===========
384681967.25
383479701.85
Best fit
========== 338.0 ===========
384694303.47
383490413.78
Best fit
========== 338.05 ===========
384706641.52
383501128.1
Best fit
========== 338.1 ===========
384718981.4
383511844.8
Best fit
========== 338.15 ===========
384731323.1
383522563.89
Best fit
========== 338.2 ===========
```

```
384743666.62
383533285.37
Best fit
========== 338.25 ===========
384756011.97
383544009.23
Best fit
========== 338.3 ===========
384768359.14
383554735.48
Best fit
========== 338.35 ===========
384780708.13
383565464.11
Best fit
========== 338.4 ===========
384793058.95
383576195.13
Best fit
========== 338.45 ===========
384805411.59
383586928.54
Best fit
========== 338.5 ===========
384817766.06
383597664.33
Best fit
========== 338.55 ===========
384830122.35
383608402.51
Best fit
========== 338.6 ===========
384842480.46
383619143.07
Best fit
========== 338.65 ===========
384854840.4
383629886.02
Best fit
========== 338.7 ===========
384867202.17
383640631.36
Best fit
========== 338.75 ===========
384879565.77
383651379.09
Best fit
========== 338.8 ===========
384891931.19
383662129.21
Best fit
========== 338.85 ===========
384904298.45
383672881.71
Best fit
========== 338.9 ===========
384916667.52
383683636.6
Best fit
========== 338.95 ===========
384929038.42
383694393.88
Best fit
========== 339.0 ===========
```

```
384941411.15
383705153.54
Best fit
========== 339.05 ===========
384953785.7
383715915.59
Best fit
========== 339.1 ===========
384966162.07
383726680.03
Best fit
========== 339.15 ===========
384978540.26
383737446.85
Best fit
========== 339.2 ===========
384990920.29
383748216.06
Best fit
========== 339.25 ===========
385003302.13
383758987.65
Best fit
========== 339.3 ===========
385015685.8
383769761.63
Best fit
========== 339.35 ===========
385028071.29
383780537.99
Best fit
========== 339.4 ===========
385040458.61
383791316.75
Best fit
========== 339.45 ===========
385052847.75
383802097.88
Best fit
========== 339.5 ===========
385065238.71
383812881.41
Best fit
========== 339.55 ===========
385077631.5
383823667.32
Best fit
========== 339.6 ===========
385090026.83
383834456.53
Best fit
========== 339.65 ===========
385102424.05
383845248.22
Best fit
========== 339.7 ===========
385114822.79
383856041.22
Best fit
========== 339.75 ===========
385127223.33
383866835.9
Best fit
========== 339.8 ===========
```

```
385139625.7
383877632.88
Best fit
========== 339.85 ===========
385152029.47
383888431.41
Best fit
========== 339.9 ===========
385164434.86
383899231.93
Best fit
========== 339.95 ===========
385176842.07
383910034.83
Best fit
========== 340.0 ===========
385189251.42
383920839.63
Best fit
========== 340.05 ===========
385201663.09
383931646.1
Best fit
========== 340.1 ===========
385214076.58
383942454.96
Best fit
========== 340.15 ===========
385226491.16
383953265.29
Best fit
========== 340.2 ===========
385238907.18
383964077.52
Best fit
========== 340.25 ===========
385251325.02
383974892.14
Best fit
========== 340.3 ===========
385263744.69
383985709.14
Best fit
========== 340.35 ===========
385276166.18
383996528.53
Best fit
========== 340.4 ===========
385288589.51
384007350.29
Best fit
========== 340.45 ===========
385301014.67
384018174.43
Best fit
========== 340.5 ===========
385313440.08
384028999.76
Best fit
========== 340.55 ===========
385325867.09
384039827.26
Best fit
========== 340.6 ===========
```

```
385338295.92
384050657.15
Best fit
========== 340.65 ===========
385350726.74
384061489.31
Best fit
========== 340.7 ===========
385363159.46
384072323.81
Best fit
========== 340.75 ===========
385375594.01
384083160.68
Best fit
========== 340.8 ===========
385388029.16
384093999.37
Best fit
========== 340.85 ===========
385400464.69
384104839.87
Best fit
========== 340.9 ===========
385412902.03
384115682.75
Best fit
========== 340.95 ===========
385425341.2
384126528.02
Best fit
========== 341.0 ===========
385437782.2
384137375.67
Best fit
========== 341.05 ===========
385450225.01
384148225.71
Best fit
========== 341.1 ===========
385462666.08
384159077.84
Best fit
========== 341.15 ===========
385475108.84
384169932.35
Best fit
========== 341.2 ===========
385487553.43
384180789.25
Best fit
========== 341.25 ===========
385499999.83
384191648.52
Best fit
========== 341.3 ===========
385512445.73
384202510.62
Best fit
========== 341.35 ===========
385524891.18
384213375.52
Best fit
========== 341.4 ===========
```

```
385537338.45
384224242.81
Best fit
========== 341.45 ===========
385549787.34
384235112.55
Best fit
========== 341.5 ===========
385562233.23
384245986.64
Best fit
========== 341.55 ===========
385574356.77
384254798.4
Best fit
========== 341.6 ===========
385586800.51
384265680.6
Best fit
========== 341.65 ===========
385599245.31
384276565.55
Best fit
========== 341.7 ===========
385611694.69
384287450.34
Best fit
========== 341.75 ===========
385624152.41
384298331.83
Best fit
========== 341.8 ===========
385636638.29
384309195.22
Best fit
========== 341.85 ===========
385648936.5
384319290.71
Best fit
========== 341.9 ===========
385661199.42
384329276.54
Best fit
========== 341.95 ===========
385673464.14
384339264.7
Best fit
========== 342.0 ===========
385685730.86
384349255.11
Best fit
========== 342.05 ===========
385697999.39
384359247.83
Best fit
========== 342.1 ===========
385710269.72
384369242.87
Best fit
========== 342.15 ===========
385722541.84
384379240.24
Best fit
========== 342.2 ===========
```

```
385734815.75
384389239.94
Best fit
========== 342.25 ===========
385747091.45
384399241.97
Best fit
========== 342.3 ===========
385759368.94
384409246.32
Best fit
========== 342.35 ===========
385771648.23
384419253.01
Best fit
========== 342.4 ===========
385783929.31
384429262.02
Best fit
========== 342.45 ===========
385796212.18
384439273.37
Best fit
========== 342.5 ===========
385808496.85
384449287.02
Best fit
========== 342.55 ===========
385820783.32
384459303.0
Best fit
========== 342.6 ===========
385833071.57
384469321.3
Best fit
========== 342.65 ===========
385845361.63
384479341.94
Best fit
========== 342.7 ===========
385857653.48
384489364.9
Best fit
========== 342.75 ===========
385869947.05
384499390.11
Best fit
========== 342.8 ===========
385882242.35
384509417.53
Best fit
========== 342.85 ===========
385894539.43
384519447.28
Best fit
========== 342.9 ===========
385906838.31
384529479.35
Best fit
========== 342.95 ===========
385919138.98
384539513.76
Best fit
========== 343.0 ===========
```

```
385931441.44
384549550.5
Best fit
========== 343.05 ===========
385943745.7
384559589.56
Best fit
========== 343.1 ===========
385956051.74
384569630.96
Best fit
========== 343.15 ===========
385968359.6
384579674.68
Best fit
========== 343.2 ===========
385980669.27
384589720.73
Best fit
========== 343.25 ===========
385992980.72
384599769.12
Best fit
========== 343.3 ===========
386005293.97
384609819.83
Best fit
========== 343.35 ===========
386017609.02
384619872.87
Best fit
========== 343.4 ===========
386029925.85
384629928.24
Best fit
========== 343.45 ===========
386042244.48
384639985.94
Best fit
========== 343.5 ===========
386054564.9
384650045.97
Best fit
========== 343.55 ===========
386066887.16
384660108.34
Best fit
========== 343.6 ===========
386079211.44
384670173.07
Best fit
========== 343.65 ===========
386091537.5
384680240.13
Best fit
========== 343.7 ===========
386103865.36
384690309.52
Best fit
========== 343.75 ===========
386116194.97
384700381.1
Best fit
========== 343.8 ===========
```

```
386128526.37
384710454.94
Best fit
========== 343.85 ===========
386140859.56
384720531.12
Best fit
========== 343.9 ===========
386153194.54
384730609.62
Best fit
========== 343.95 ===========
386165531.31
384740690.46
Best fit
========== 344.0 ===========
386177869.88
384750773.62
Best fit
========== 344.05 ===========
386190210.23
384760859.11
Best fit
========== 344.1 ===========
386202552.38
384770946.93
Best fit
========== 344.15 ===========
386214896.33
384781037.08
Best fit
========== 344.2 ===========
386227242.06
384791129.56
Best fit
========== 344.25 ===========
386239589.59
384801224.37
Best fit
========== 344.3 ===========
386251938.91
384811321.5
Best fit
========== 344.35 ===========
386264290.02
384821420.97
Best fit
========== 344.4 ===========
386276642.94
384831522.77
Best fit
========== 344.45 ===========
386288997.65
384841626.9
Best fit
========== 344.5 ===========
386301354.16
384851733.36
Best fit
========== 344.55 ===========
386313712.45
384861842.15
Best fit
========== 344.6 ===========
```

```
386326072.54
384871953.27
Best fit
========== 344.65 ===========
386338434.42
384882066.71
Best fit
========== 344.7 ===========
386350798.1
384892182.49
Best fit
========== 344.75 ===========
386363163.56
384902300.59
Best fit
========== 344.8 ===========
386375530.82
384912421.03
Best fit
========== 344.85 ===========
386387899.88
384922543.76
Best fit
========== 344.9 ===========
386400270.72
384932668.81
Best fit
========== 344.95 ===========
386412643.36
384942796.19
Best fit
========== 345.0 ===========
386425017.8
384952925.9
Best fit
========== 345.05 ===========
386437394.02
384963057.94
Best fit
========== 345.1 ===========
386449772.04
384973192.31
Best fit
========== 345.15 ===========
386462151.85
384983329.0
Best fit
========== 345.2 ===========
386474533.45
384993468.03
Best fit
========== 345.25 ===========
386486916.85
385003609.38
Best fit
========== 345.3 ===========
386499302.12
385013753.1
Best fit
========== 345.35 ===========
386511689.37
385023899.24
Best fit
========== 345.4 ===========
```

```
386524078.41
385034047.7
Best fit
========== 345.45 ===========
386536469.24
385044198.49
Best fit
========== 345.5 ===========
386548861.86
385054351.62
Best fit
========== 345.55 ===========
386561256.27
385064507.07
Best fit
========== 345.6 ===========
386573652.48
385074664.85
Best fit
========== 345.65 ===========
386586050.48
385084824.96
Best fit
========== 345.7 ===========
386598450.28
385094987.4
Best fit
========== 345.75 ===========
386610851.86
385105152.17
Best fit
========== 345.8 ===========
386623255.24
385115319.26
Best fit
========== 345.85 ===========
386635660.41
385125488.69
Best fit
========== 345.9 ===========
386648067.38
385135660.45
Best fit
========== 345.95 ===========
386660476.13
385145834.53
Best fit
========== 346.0 ===========
386672886.68
385156010.95
Best fit
========== 346.05 ===========
386685299.02
385166189.69
Best fit
========== 346.1 ===========
386697713.16
385176370.76
Best fit
========== 346.15 ===========
386710129.09
385186554.16
Best fit
========== 346.2 ===========
```

```
386722546.81
385196739.89
Best fit
========== 346.25 ===========
386734966.32
385206927.95
Best fit
========== 346.3 ===========
386747387.62
385217118.34
Best fit
========== 346.35 ===========
386759810.72
385227311.06
Best fit
========== 346.4 ===========
386772235.58
385237506.08
Best fit
========== 346.45 ===========
386784662.23
385247703.42
Best fit
========== 346.5 ===========
386797090.67
385257903.09
Best fit
========== 346.55 ===========
386809520.9
385268105.08
Best fit
========== 346.6 ===========
386821952.93
385278309.41
Best fit
========== 346.65 ===========
386834386.75
385288516.07
Best fit
========== 346.7 ===========
386846822.36
385298725.06
Best fit
========== 346.75 ===========
386859259.76
385308936.37
Best fit
========== 346.8 ===========
386871698.96
385319150.01
Best fit
========== 346.85 ===========
386884139.94
385329365.99
Best fit
========== 346.9 ===========
386896582.73
385339584.29
Best fit
========== 346.95 ===========
386909027.3
385349804.92
Best fit
========== 347.0 ===========
```

```
386921473.67
385360027.88
Best fit
========== 347.05 ===========
386933921.97
385370253.27
Best fit
========== 347.1 ===========
386946372.16
385380481.06
Best fit
========== 347.15 ===========
386958824.15
385390711.18
Best fit
========== 347.2 ===========
386971277.93
385400943.63
Best fit
========== 347.25 ===========
386983733.51
385411178.4
Best fit
========== 347.3 ===========
386996190.91
385421415.55
Best fit
========== 347.35 ===========
387008650.98
385431656.17
Best fit
========== 347.4 ===========
387021112.88
385441899.12
Best fit
========== 347.45 ===========
387033576.57
385452144.4
Best fit
========== 347.5 ===========
387046042.05
385462392.01
Best fit
========== 347.55 ===========
387058509.32
385472641.94
Best fit
========== 347.6 ===========
387070978.39
385482894.21
Best fit
========== 347.65 ===========
387083449.25
385493148.81
Best fit
========== 347.7 ===========
387095921.9
385503405.74
Best fit
========== 347.75 ===========
387108396.35
385513665.0
Best fit
========== 347.8 ===========
```

```
387120872.59
385523926.58
Best fit
========== 347.85 ===========
387133350.62
385534190.5
Best fit
========== 347.9 ===========
387145830.45
385544456.75
Best fit
========== 347.95 ===========
387158312.07
385554725.32
Best fit
========== 348.0 ===========
387170795.48
385564996.23
Best fit
========== 348.05 ===========
387183280.68
385575269.46
Best fit
========== 348.1 ===========
387195767.68
385585545.03
Best fit
========== 348.15 ===========
387208256.47
385595822.92
Best fit
========== 348.2 ===========
387220747.05
385606103.14
Best fit
========== 348.25 ===========
387233239.34
385616385.54
Best fit
========== 348.3 ===========
387245733.43
385626670.28
Best fit
========== 348.35 ===========
387258229.32
385636957.34
Best fit
========== 348.4 ===========
387270726.99
385647246.73
Best fit
========== 348.45 ===========
387283226.46
385657538.45
Best fit
========== 348.5 ===========
387295727.87
385667832.64
Best fit
========== 348.55 ===========
387308231.13
385678129.2
Best fit
========== 348.6 ===========
```

```
387320736.2
385688428.11
Best fit
========== 348.65 ===========
387333243.06
385698729.36
Best fit
========== 348.7 ===========
387345751.67
385709032.81
Best fit
========== 348.75 ===========
387358261.99
385719338.43
Best fit
========== 348.8 ===========
387370774.09
385729646.37
Best fit
========== 348.85 ===========
387383287.99
385739956.64
Best fit
========== 348.9 ===========
387395803.68
385750269.24
Best fit
========== 348.95 ===========
387408321.16
385760584.17
Best fit
========== 349.0 ===========
387420840.43
385770901.43
Best fit
========== 349.05 ===========
387433361.5
385781221.01
Best fit
========== 349.1 ===========
387445884.36
385791542.93
Best fit
========== 349.15 ===========
387458409.01
385801867.18
Best fit
========== 349.2 ===========
387470935.45
385812193.75
Best fit
========== 349.25 ===========
387483463.69
385822522.66
Best fit
========== 349.3 ===========
387495993.72
385832853.9
Best fit
========== 349.35 ===========
387508525.55
385843187.46
Best fit
========== 349.4 ===========
```

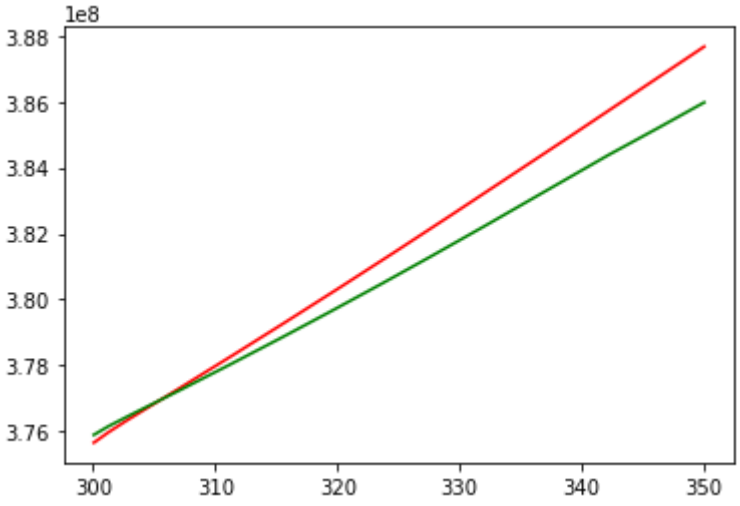
```
387521059.16
385853523.36
Best fit
========== 349.45 ===========
387533594.58
385863861.58
Best fit
========== 349.5 ===========
387546131.88
385874202.1
Best fit
========== 349.55 ===========
387558671.51
385884544.38
Best fit
========== 349.6 ===========
387571212.94
385894888.98
Best fit
========== 349.65 ===========
387583756.18
385905235.91
Best fit
========== 349.7 ===========
387596301.21
385915585.17
Best fit
========== 349.75 ===========
387608848.03
385925936.75
Best fit
========== 349.8 ===========
387621396.64
385936290.67
Best fit
========== 349.85 ===========
387633947.05
385946646.92
Best fit
========== 349.9 ===========
387646499.35
385957005.6
Best fit
========== 349.95 ===========
387659053.51
385967366.7
Best fit
========== 350.0 ===========
387671609.47
385977730.14
Best fit
```

In [86]:

```
import matplotlib.pyplot as plt
plt.plot(w,tr,c="red")
plt.plot(w,ts,c="green")
```

Out[86]:

```
[<matplotlib.lines.Line2D at 0x2cfaca5c1c0>]
```



In [87]:
```
rr = Lasso(alpha=307)
model = rr.fit(xtrain,ytrain)
tr_pred = model.predict(xtrain)
ts_pred = model.predict(xtest)
tr_err = round(mean_squared_error(ytrain,tr_pred),2)
ts_err = round(mean_squared_error(ytest,ts_pred),2)
print(tr_err,ts_err)
```

```
377291709.81 377228862.74
```

In [88]:
```
#since Training Error is greater than testing Error. Model doesn't suffer from Overf
```

In [ ]:
```
#Use Trained Data to get prediction on Testing Set
```

In [89]:
```
cat
```

Out[89]:
```
['MSZoning',
 'Alley',
 'LotShape',
 'LandContour',
 'LotConfig',
 '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']
```

In [90]:
```
con
```

Out[90]:
```
['LotFrontage',
 'LotArea',
 'OverallQual',
 'YearBuilt',
 'YearRemodAdd',
 'MasVnrArea',
 'BsmtFinSF1',
 'BsmtUnfSF',
 'TotalBsmtSF',
 '1stFlrSF',
 '2ndFlrSF',
 'GrLivArea',
 'BsmtFullBath',
 'FullBath',
 'HalfBath',
 'BedroomAbvGr',
 'TotRmsAbvGrd',
 'Fireplaces',
 'GarageYrBlt',
 'GarageCars',
 'GarageArea',
 'WoodDeckSF',
 'OpenPorchSF',
 'ScreenPorch']
```

In [91]:
```
Xtest1= pd.DataFrame(ss.fit_transform(test[con]),columns=con)
```

In [92]:
```
Xtest2 = pd.get_dummies(test[cat])
```

In [93]:
```
Xtest_new = Xtest1.join(Xtest2)
```

In [94]:
```
Xtest_new
```

Out[94]:

	LotFrontage	LotArea	OverallQual	YearBuilt	YearRemodAdd	MasVnrArea	BsmtFinSF1	Bs
0	0.555590	0.363929	-0.751101	-0.340945	-1.072885	-0.570108	0.063295	-
1	0.604242	0.897861	-0.054877	-0.439695	-1.214908	0.041273	1.063392	-
2	0.263679	0.809646	-0.751101	0.844059	0.678742	-0.570108	0.773254	-
3	0.458286	0.032064	-0.054877	0.876976	0.678742	-0.456889	0.357829	-

	LotFrontage	LotArea	OverallQual	YearBuilt	YearRemodAdd	MasVnrArea	BsmtFinSF1	Bs
4	-1.244530	-0.971808	1.337571	0.679475	0.394694	-0.570108	-0.387298	
...	...	...	...	...	...	...	...	
1454	-2.314872	-1.591330	-1.447325	-0.044694	-0.646813	-0.570108	-0.965376	-
1455	-2.314872	-1.599808	-1.447325	-0.044694	-0.646813	-0.570108	-0.411477	-
1456	4.447742	2.055150	-0.751101	-0.373861	0.584059	-0.570108	1.724994	-
1457	-0.320144	0.125527	-0.751101	0.679475	0.394694	-0.570108	-0.224645	
1458	0.263679	-0.038790	0.641347	0.712392	0.489377	-0.037980	0.700719	-

1459 rows × 266 columns

In [95]:
```
cols_to_keep = xtrain.columns
```

In [96]:
```
final_test= Xtest_new[cols_to_keep]
```

In [97]:
```
pred = model.predict(final_test)
```

In [98]:
```
T = test[["Id"]]
T['SalePrice']=pred
```

In [99]:
```
T.head(3)
```

Out[99]:

	Id	SalePrice
0	1461	121592.677190
1	1462	166011.643893
2	1463	187042.390680

In [ ]:
```
#Save the predicted Output in .CSV format
```

In [100…
```
T.to_csv("D:/Etlhive/1st project/sample_submission.csv")
```

In [ ]:
```

```