In [1]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import Ridge, RidgeCV, Lasso
from sklearn.preprocessing import StandardScaler
```

In [2]:

```
data=pd.read_csv(r"C:\Users\Svijayalakshmi\Downloads\fiat500_VehicleSelection_Dataset.cs
data
```

Out[2]:

	ID	model	engine_power	age_in_days	km	previous_owners	lat	
0	1	lounge	51	882	25000	1	44.907242	8.611
1	2	pop	51	1186	32500	1	45.666359	12.241
2	3	sport	74	4658	142228	1	45.503300	11.417
3	4	lounge	51	2739	160000	1	40.633171	17.634
4	5	pop	73	3074	106880	1	41.903221	12.495
...	...	...	...	...	...	...	...	
1533	1534	sport	51	3712	115280	1	45.069679	7.704
1534	1535	lounge	74	3835	112000	1	45.845692	8.666
1535	1536	pop	51	2223	60457	1	45.481541	9.413
1536	1537	lounge	51	2557	80750	1	45.000702	7.682
1537	1538	pop	51	1766	54276	1	40.323410	17.568

1538 rows × 9 columns

In [3]:

```
data.head()
```

Out[3]:

	ID	model	engine_power	age_in_days	km	previous_owners	lat	lon	
0	1	lounge	51	882	25000	1	44.907242	8.611560	
1	2	pop	51	1186	32500	1	45.666359	12.241890	
2	3	sport	74	4658	142228	1	45.503300	11.417840	
3	4	lounge	51	2739	160000	1	40.633171	17.634609	
4	5	pop	73	3074	106880	1	41.903221	12.495650	

In [4]:

```
data.tail()
```

Out[4]:

	ID	model	engine_power	age_in_days	km	previous_owners	lat	lo
1533	1534	sport	51	3712	115280	1	45.069679	7.704
1534	1535	lounge	74	3835	112000	1	45.845692	8.666
1535	1536	pop	51	2223	60457	1	45.481541	9.413
1536	1537	lounge	51	2557	80750	1	45.000702	7.682
1537	1538	pop	51	1766	54276	1	40.323410	17.568

In [5]:

```
data.describe()
```

Out[5]:

	ID	engine_power	age_in_days	km	previous_owners	la
count	1538.000000	1538.000000	1538.000000	1538.000000	1538.000000	1538.00000
mean	769.500000	51.904421	1650.980494	53396.011704	1.123537	43.54136
std	444.126671	3.988023	1289.522278	40046.830723	0.416423	2.13351
min	1.000000	51.000000	366.000000	1232.000000	1.000000	36.85583
25%	385.250000	51.000000	670.000000	20006.250000	1.000000	41.80299
50%	769.500000	51.000000	1035.000000	39031.000000	1.000000	44.39409
75%	1153.750000	51.000000	2616.000000	79667.750000	1.000000	45.46796
max	1538.000000	77.000000	4658.000000	235000.000000	4.000000	46.79561

In [6]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1538 entries, 0 to 1537
Data columns (total 9 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   ID               1538 non-null   int64  
 1   model            1538 non-null   object 
 2   engine_power     1538 non-null   int64  
 3   age_in_days      1538 non-null   int64  
 4   km               1538 non-null   int64  
 5   previous_owners  1538 non-null   int64  
 6   lat              1538 non-null   float64
 7   lon              1538 non-null   float64
 8   price            1538 non-null   int64  
dtypes: float64(2), int64(6), object(1)
memory usage: 108.3+ KB
```

In [7]:

```
data.isna().sum()
```

Out[7]:

```
ID                0
model             0
engine_power      0
age_in_days       0
km                0
previous_owners   0
lat               0
lon               0
price             0
dtype: int64
```

In [8]:

```
data=data[['engine_power','km']]
```

In [9]:

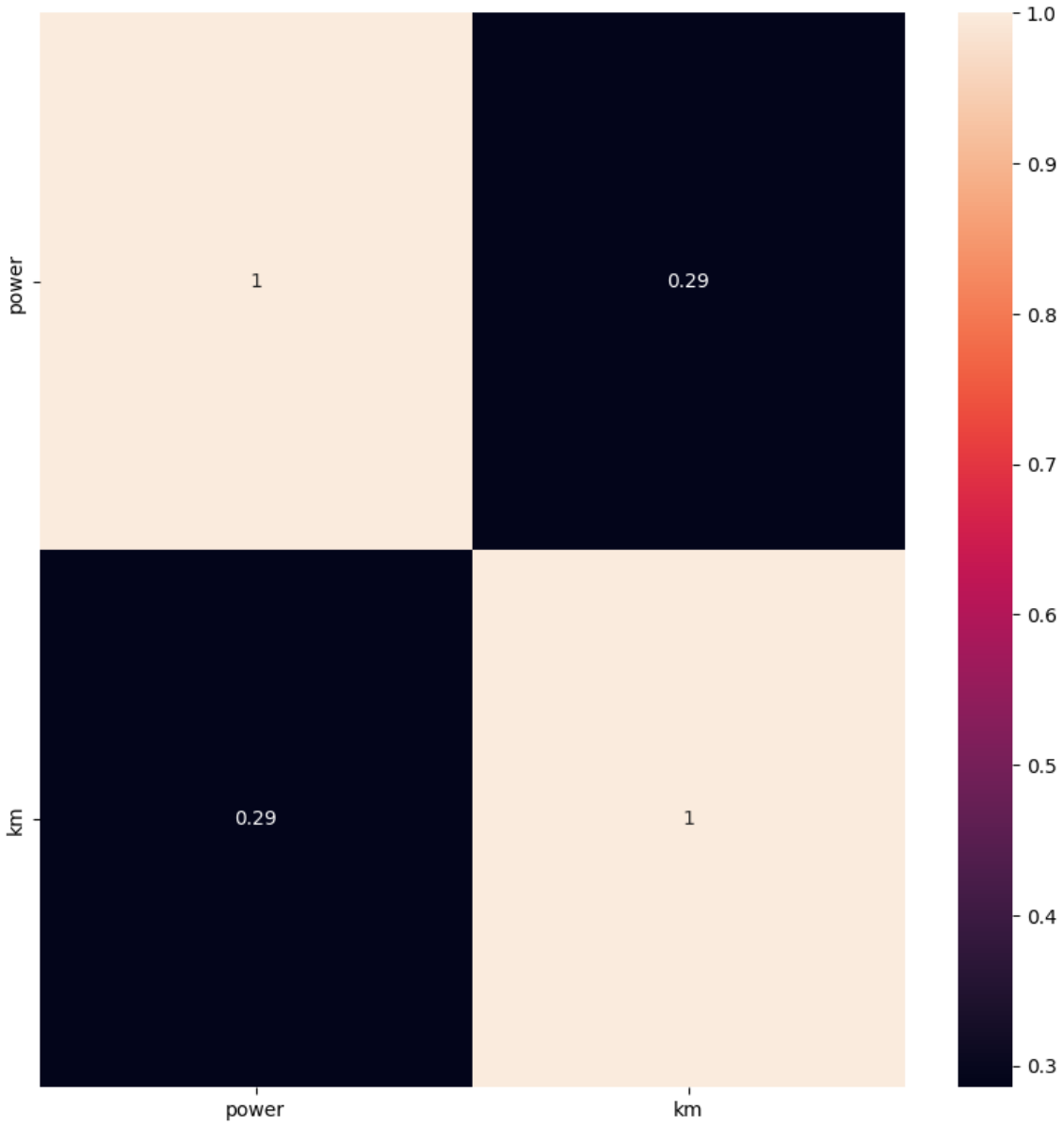
```
data.columns=['power','km']
```

In [10]:

```
plt.figure(figsize = (10, 10))
sns.heatmap(data.corr(), annot = True)
```

Out[10]:

<Axes: >



In [11]:

```
features = data.columns[0:2]
target = data.columns[-1]
#X and y values
X = data[features].values
y = data[target].values
#splot
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=17
print("The dimension of X_train is {}".format(X_train.shape))
print("The dimension of X_test is {}".format(X_test.shape))
#Scale features
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

```
The dimension of X_train is (1076, 2)
The dimension of X_test is (462, 2)
```

In [12]:

```
#Model
lr = LinearRegression()
#Fit model
lr.fit(X_train, y_train)
#predict
#prediction = lr.predict(X_test)
#actual
actual = y_test
train_score_lr = lr.score(X_train, y_train)
test_score_lr = lr.score(X_test, y_test)
print("\nLinear Regression Model:\n")
print("The train score for lr model is {}".format(train_score_lr))
print("The test score for lr model is {}".format(test_score_lr))
```

```
Linear Regression Model:

The train score for lr model is 1.0
The test score for lr model is 1.0
```

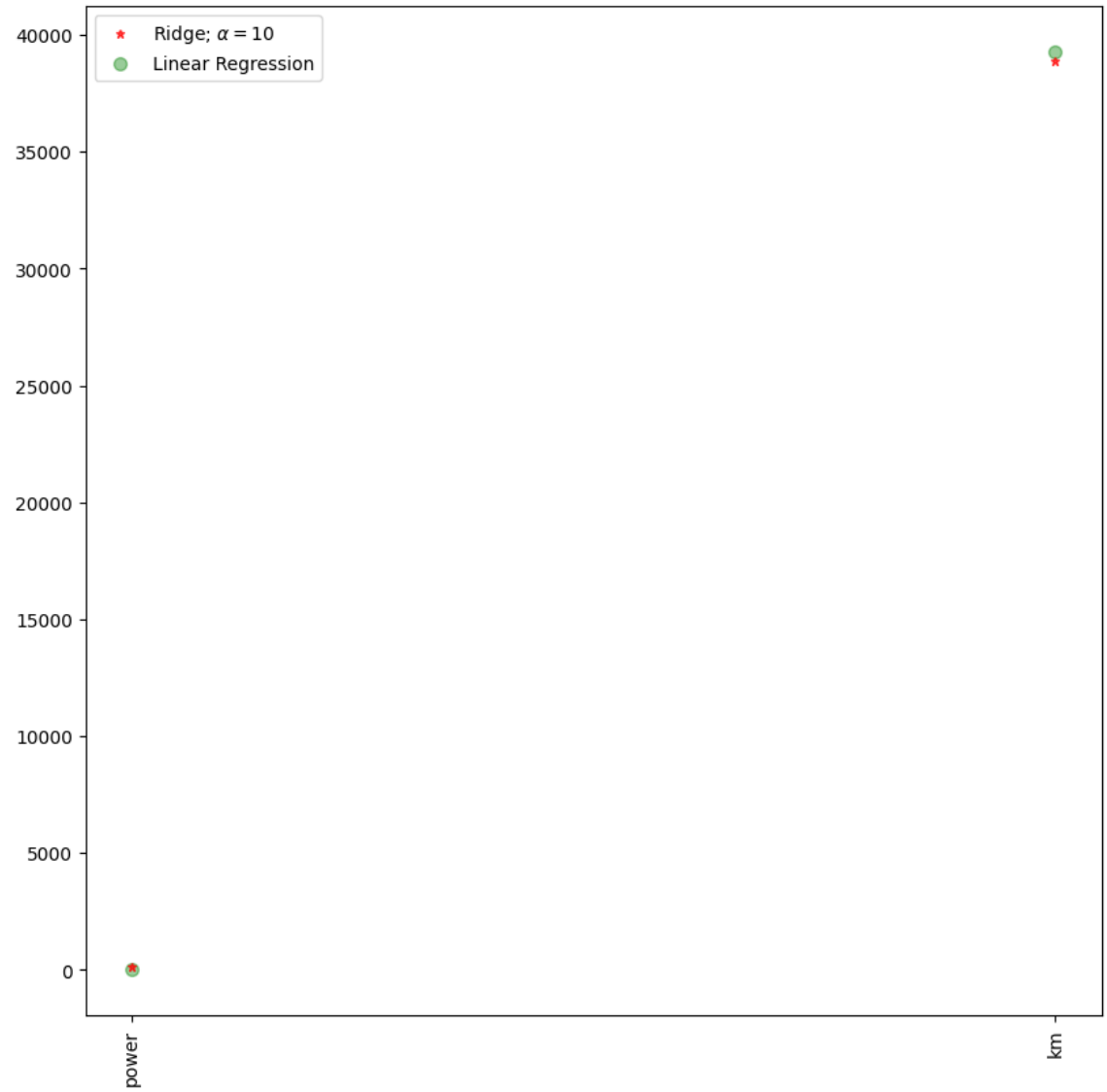
In [13]:

```
#Ridge Regression Model
ridgeReg = Ridge(alpha=10)
ridgeReg.fit(X_train,y_train)
#train and test scorefor ridge regression
train_score_ridge = ridgeReg.score(X_train, y_train)
test_score_ridge = ridgeReg.score(X_test, y_test)
print("\nRidge Model:\n")
print("The train score for ridge model is {}".format(train_score_ridge))
print("The test score for ridge model is {}".format(test_score_ridge))
```

```
Ridge Model:

The train score for ridge model is 0.999909078037421
The test score for ridge model is 0.999912009986221
```

In [14]:

```
plt.figure(figsize = (10, 10))
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',markersize=5,colo
#plt.plot(rr100.coef_,alpha=0.5,linestyle='none',marker='d',markersize=6,color='blue',la
plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersize=7,color='gre
plt.xticks(rotation = 90)
plt.legend()
plt.show()
```



In [24]:

```
from sklearn.linear_model import Lasso,Ridge
```

In [29]:

```
#Lasso regression model
print("\nLasso Model: \n")
lasso = Lasso(alpha = 10)
lasso.fit(X_train,y_train)
train_score_ls =lasso.score(X_train,y_train)
test_score_ls =lasso.score(X_test,y_test)
print("The train score for ls model is {}".format(train_score_ls))
print("The test score for ls model is {}".format(test_score_ls))
```

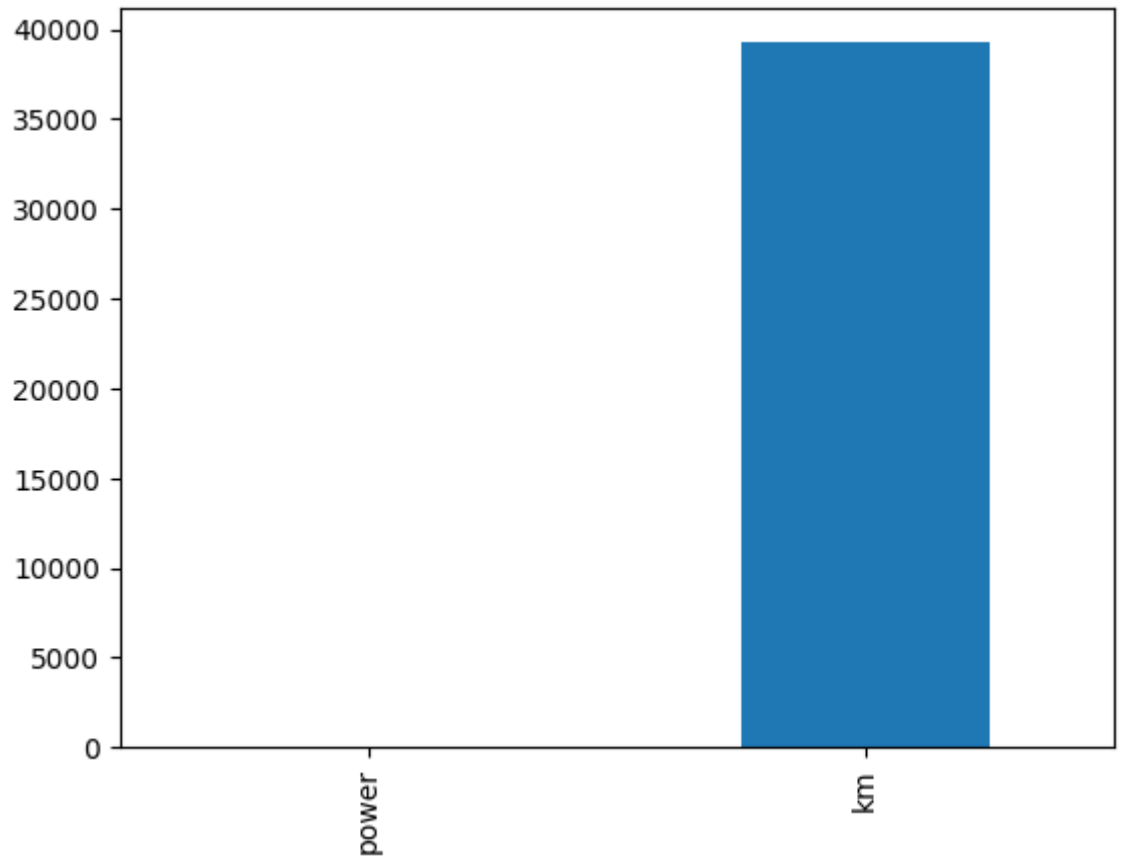
```
Lasso Model:

The train score for ls model is 0.9999999351296956
The test score for ls model is 0.9999999350726293
```

In [31]:

```
pd.Series(lasso.coef_, features).sort_values(ascending = True).plot(kind = "bar")
```

Out[31]:

```
<Axes: >
```



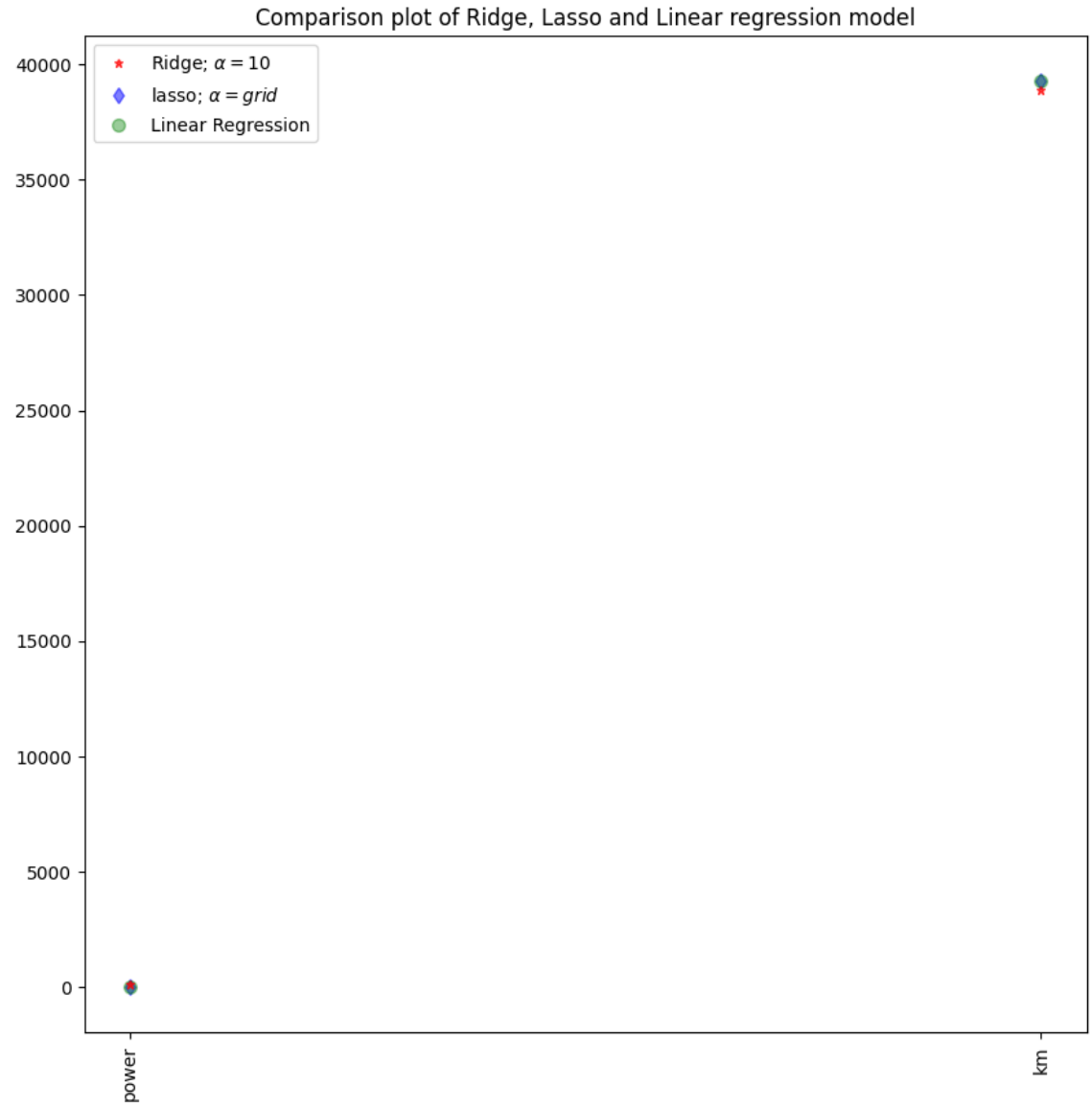
In [32]:

```
#Using the linear CV model
from sklearn.linear_model import LassoCV
#Lasso Cross validation
lasso_cv = LassoCV(alphas = [0.0001, 0.001,0.01, 0.1, 1, 10], random_state=0).fit(X_trai

#score
print(lasso_cv.score(X_train, y_train))
print(lasso_cv.score(X_test, y_test))
```

```
0.999999999962428
0.9999999999750315
```

In [33]:

```
#plot size
plt.figure(figsize = (10, 10))
#add plot for ridge regression
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',markersize=5,colo
#add plot for lasso regression
plt.plot(lasso_cv.coef_,alpha=0.5,linestyle='none',marker='d',markersize=6,color='blue',
#add plot for linear model
plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersize=7,color='gre
#rotate axis
plt.xticks(rotation = 90)
plt.legend()
plt.title("Comparison plot of Ridge, Lasso and Linear regression model")
plt.show()
```



In [34]:

```
#Using the linear CV model
from sklearn.linear_model import RidgeCV
#Ridge Cross validation
ridge_cv = RidgeCV(alphas = [0.0001, 0.001,0.01, 0.1, 1, 10]).fit(X_train, y_train)
#score
print("The train score for ridge model is {}".format(ridge_cv.score(X_train, y_train)))
print("The train score for ridge model is {}".format(ridge_cv.score(X_test, y_test)))
```

```
The train score for ridge model is 0.9999999999999912
The train score for ridge model is 0.9999999999999918
```

In [35]:

```
from sklearn.linear_model import ElasticNet
regr=ElasticNet()
regr.fit(X,y)
print(regr.coef_)
print(regr.intercept_)
```

```
[0. 1.]
3.331616608193144e-05
```

In [36]:

```
y_pred_elastic=regr.predict(X_train)
```

In [37]:

```
mean_squared_error=np.mean((y_pred_elastic-y_train)**2)
print("mean squared error on test set",mean_squared_error)
```

```
mean squared error on test set 4352996052.812122
```

In [ ]:

```

```