```python
In [37]: import pandas as pd
```

```python
In [38]: data=pd.read_csv("/home/placement/Downloads/fiat500.csv")
```

```python
In [39]: data.describe()
```

Out[39]:

|  | ID | engine_power | age_in_days | km | previous_owners | lat | lon | price |
|---|---|---|---|---|---|---|---|---|
| count | 1538.000000 | 1538.000000 | 1538.000000 | 1538.000000 | 1538.000000 | 1538.000000 | 1538.000000 | 1538.000000 |
| mean | 769.500000 | 51.904421 | 1650.980494 | 53396.011704 | 1.123537 | 43.541361 | 11.563428 | 8576.003901 |
| std | 444.126671 | 3.988023 | 1289.522278 | 40046.830723 | 0.416423 | 2.133518 | 2.328190 | 1939.958641 |
| min | 1.000000 | 51.000000 | 366.000000 | 1232.000000 | 1.000000 | 36.855839 | 7.245400 | 2500.000000 |
| 25% | 385.250000 | 51.000000 | 670.000000 | 20006.250000 | 1.000000 | 41.802990 | 9.505090 | 7122.500000 |
| 50% | 769.500000 | 51.000000 | 1035.000000 | 39031.000000 | 1.000000 | 44.394096 | 11.869260 | 9000.000000 |
| 75% | 1153.750000 | 51.000000 | 2616.000000 | 79667.750000 | 1.000000 | 45.467960 | 12.769040 | 10000.000000 |
| max | 1538.000000 | 77.000000 | 4658.000000 | 235000.000000 | 4.000000 | 46.795612 | 18.365520 | 11100.000000 |

In [40]: 
```
data.head(50)
```

Out[40]:

| | ID | model | engine_power | age_in_days | km | previous_owners | lat | lon | price |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | lounge | 51 | 882 | 25000 | 1 | 44.907242 | 8.611560 | 8900 |
| 1 | 2 | pop | 51 | 1186 | 32500 | 1 | 45.666359 | 12.241890 | 8800 |
| 2 | 3 | sport | 74 | 4658 | 142228 | 1 | 45.503300 | 11.417840 | 4200 |
| 3 | 4 | lounge | 51 | 2739 | 160000 | 1 | 40.633171 | 17.634609 | 6000 |
| 4 | 5 | pop | 73 | 3074 | 106880 | 1 | 41.903221 | 12.495650 | 5700 |
| 5 | 6 | pop | 74 | 3623 | 70225 | 1 | 45.000702 | 7.682270 | 7900 |
| 6 | 7 | lounge | 51 | 731 | 11600 | 1 | 44.907242 | 8.611560 | 10750 |
| 7 | 8 | lounge | 51 | 1521 | 49076 | 1 | 41.903221 | 12.495650 | 9190 |
| 8 | 9 | sport | 73 | 4049 | 76000 | 1 | 45.548000 | 11.549470 | 5600 |
| 9 | 10 | sport | 51 | 3653 | 89000 | 1 | 45.438301 | 10.991700 | 6000 |
| 10 | 11 | pop | 51 | 790 | 43286 | 1 | 40.871429 | 14.438960 | 8950 |
| 11 | 12 | lounge | 51 | 366 | 17500 | 1 | 45.069679 | 7.704920 | 10990 |
| 12 | 13 | lounge | 51 | 456 | 18450 | 1 | 45.426571 | 11.788130 | 9700 |
| 13 | 14 | pop | 51 | 3835 | 120000 | 1 | 40.531590 | 17.436159 | 4800 |
| 14 | 15 | lounge | 51 | 1035 | 40500 | 1 | 40.911362 | 14.211200 | 9300 |
| 15 | 16 | lounge | 51 | 1096 | 28200 | 1 | 45.697208 | 9.845970 | 9500 |
| 16 | 17 | lounge | 73 | 4200 | 110000 | 1 | 41.082352 | 14.254250 | 5250 |
| 17 | 18 | pop | 51 | 2223 | 96848 | 1 | 43.782372 | 11.254990 | 7990 |
| 18 | 19 | lounge | 51 | 2861 | 31000 | 1 | 45.069679 | 7.704920 | 7300 |
| 19 | 20 | lounge | 51 | 425 | 20030 | 1 | 45.354389 | 11.869260 | 10500 |
| 20 | 21 | lounge | 51 | 397 | 19037 | 1 | 45.707249 | 11.477600 | 10500 |
| 21 | 22 | lounge | 51 | 1886 | 110000 | 1 | 40.835812 | 14.504410 | 6990 |
| 22 | 23 | lounge | 51 | 1035 | 8000 | 1 | 44.506088 | 12.044170 | 10600 |
| 23 | 24 | lounge | 51 | 790 | 27595 | 1 | 45.688259 | 8.731450 | 10200 |

| | ID | model | engine_power | age_in_days | km | previous_owners | lat | lon | price |
|---|---|---|---|---|---|---|---|---|---|
| 24 | 25 | lounge | 51 | 1583 | 14900 | 1 | 45.069679 | 7.704920 | 9990 |
| 25 | 26 | lounge | 51 | 366 | 9218 | 1 | 45.438110 | 12.318150 | 10800 |
| 26 | 27 | pop | 51 | 3592 | 124000 | 1 | 40.966179 | 17.116480 | 6800 |
| 27 | 28 | sport | 51 | 3531 | 100000 | 1 | 40.976452 | 14.172280 | 4950 |
| 28 | 29 | lounge | 51 | 762 | 28900 | 1 | 45.131672 | 8.449170 | 10640 |
| 29 | 30 | lounge | 51 | 670 | 4000 | 1 | 41.349751 | 13.353320 | 9500 |
| 30 | 31 | lounge | 62 | 2769 | 59216 | 1 | 43.782372 | 11.254990 | 6990 |
| 31 | 32 | lounge | 51 | 4169 | 99477 | 2 | 40.550564 | 14.225625 | 5900 |
| 32 | 33 | lounge | 51 | 821 | 21730 | 2 | 41.903221 | 12.495650 | 10500 |
| 33 | 34 | sport | 51 | 3927 | 140000 | 2 | 40.755932 | 14.690190 | 5200 |
| 34 | 35 | lounge | 51 | 640 | 32033 | 2 | 44.283878 | 11.888140 | 9790 |
| 35 | 36 | pop | 51 | 3653 | 138116 | 2 | 40.633171 | 17.634609 | 5000 |
| 36 | 37 | pop | 51 | 852 | 17000 | 1 | 45.505161 | 8.939100 | 8990 |
| 37 | 38 | pop | 51 | 3013 | 58527 | 1 | 45.688259 | 8.731450 | 7200 |
| 38 | 39 | sport | 51 | 790 | 43100 | 1 | 45.334080 | 11.376870 | 9950 |
| 39 | 40 | pop | 51 | 1858 | 13373 | 1 | 41.903221 | 12.495650 | 9000 |
| 40 | 41 | sport | 51 | 4139 | 119000 | 1 | 45.349319 | 7.742600 | 4890 |
| 41 | 42 | pop | 51 | 609 | 28500 | 1 | 45.746021 | 9.049970 | 10900 |
| 42 | 43 | pop | 51 | 1096 | 83000 | 1 | 41.959721 | 12.798056 | 7900 |
| 43 | 44 | lounge | 73 | 4049 | 98000 | 1 | 38.218128 | 15.240240 | 5999 |
| 44 | 45 | lounge | 51 | 456 | 12693 | 1 | 45.393600 | 10.482240 | 10900 |
| 45 | 46 | lounge | 51 | 762 | 14586 | 1 | 42.341969 | 12.358490 | 10500 |
| 46 | 47 | lounge | 51 | 821 | 27640 | 1 | 41.903221 | 12.495650 | 10400 |
| 47 | 48 | lounge | 51 | 2039 | 49000 | 1 | 41.903221 | 12.495650 | 7500 |
| 48 | 49 | sport | 51 | 3684 | 160000 | 1 | 45.405472 | 10.278290 | 4900 |
| 49 | 50 | sport | 51 | 4596 | 107000 | 1 | 40.845901 | 14.369270 | 4300 |

In [41]: `data=data.loc[(data.previous_owners==1)]`

In [42]: `data`

Out[42]:

|  | ID | model | engine_power | age_in_days | km | previous_owners | lat | lon | price |
|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | lounge | 51 | 882 | 25000 | 1 | 44.907242 | 8.611560 | 8900 |
| **1** | 2 | pop | 51 | 1186 | 32500 | 1 | 45.666359 | 12.241890 | 8800 |
| **2** | 3 | sport | 74 | 4658 | 142228 | 1 | 45.503300 | 11.417840 | 4200 |
| **3** | 4 | lounge | 51 | 2739 | 160000 | 1 | 40.633171 | 17.634609 | 6000 |
| **4** | 5 | pop | 73 | 3074 | 106880 | 1 | 41.903221 | 12.495650 | 5700 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **1533** | 1534 | sport | 51 | 3712 | 115280 | 1 | 45.069679 | 7.704920 | 5200 |
| **1534** | 1535 | lounge | 74 | 3835 | 112000 | 1 | 45.845692 | 8.666870 | 4600 |
| **1535** | 1536 | pop | 51 | 2223 | 60457 | 1 | 45.481541 | 9.413480 | 7500 |
| **1536** | 1537 | lounge | 51 | 2557 | 80750 | 1 | 45.000702 | 7.682270 | 5990 |
| **1537** | 1538 | pop | 51 | 1766 | 54276 | 1 | 40.323410 | 17.568270 | 7900 |

1389 rows × 9 columns

In [43]: `data1=data.drop(['lat','lon','ID'],axis=1)`

In [44]: `data1`

Out[44]:

| | model | engine_power | age_in_days | km | previous_owners | price |
|---|---|---|---|---|---|---|
| 0 | lounge | 51 | 882 | 25000 | 1 | 8900 |
| 1 | pop | 51 | 1186 | 32500 | 1 | 8800 |
| 2 | sport | 74 | 4658 | 142228 | 1 | 4200 |
| 3 | lounge | 51 | 2739 | 160000 | 1 | 6000 |
| 4 | pop | 73 | 3074 | 106880 | 1 | 5700 |
| ... | ... | ... | ... | ... | ... | ... |
| 1533 | sport | 51 | 3712 | 115280 | 1 | 5200 |
| 1534 | lounge | 74 | 3835 | 112000 | 1 | 4600 |
| 1535 | pop | 51 | 2223 | 60457 | 1 | 7500 |
| 1536 | lounge | 51 | 2557 | 80750 | 1 | 5990 |
| 1537 | pop | 51 | 1766 | 54276 | 1 | 7900 |

1389 rows × 6 columns

In [45]:
```python
data2=pd.get_dummies(data1)
data2
```

Out[45]:

| | engine_power | age_in_days | km | previous_owners | price | model_lounge | model_pop | model_sport |
|---|---|---|---|---|---|---|---|---|
| 0 | 51 | 882 | 25000 | 1 | 8900 | 1 | 0 | 0 |
| 1 | 51 | 1186 | 32500 | 1 | 8800 | 0 | 1 | 0 |
| 2 | 74 | 4658 | 142228 | 1 | 4200 | 0 | 0 | 1 |
| 3 | 51 | 2739 | 160000 | 1 | 6000 | 1 | 0 | 0 |
| 4 | 73 | 3074 | 106880 | 1 | 5700 | 0 | 1 | 0 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 1533 | 51 | 3712 | 115280 | 1 | 5200 | 0 | 0 | 1 |
| 1534 | 74 | 3835 | 112000 | 1 | 4600 | 1 | 0 | 0 |
| 1535 | 51 | 2223 | 60457 | 1 | 7500 | 0 | 1 | 0 |
| 1536 | 51 | 2557 | 80750 | 1 | 5990 | 1 | 0 | 0 |
| 1537 | 51 | 1766 | 54276 | 1 | 7900 | 0 | 1 | 0 |

1389 rows × 8 columns

In [46]:
```python
y=data2['price']
x=data2.drop('price',axis=1)
```

In [47]: `y`

Out[47]: 
```
0        8900
1        8800
2        4200
3        6000
4        5700
         ...
1533     5200
1534     4600
1535     7500
1536     5990
1537     7900
Name: price, Length: 1389, dtype: int64
```

In [48]: 
```python
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.1,random_state=42)
```

In [49]: `x_test.head(5)`

Out[49]:

| | engine_power | age_in_days | km | previous_owners | model_lounge | model_pop | model_sport |
|---|---|---|---|---|---|---|---|
| **625** | 51 | 3347 | 148000 | 1 | 1 | 0 | 0 |
| **187** | 51 | 4322 | 117000 | 1 | 1 | 0 | 0 |
| **279** | 51 | 4322 | 120000 | 1 | 0 | 1 | 0 |
| **734** | 51 | 974 | 12500 | 1 | 0 | 1 | 0 |
| **315** | 51 | 1096 | 37000 | 1 | 1 | 0 | 0 |

In [50]: `y_test.head(5)`

Out[50]:
```
625      5400
187      5399
279      4900
734     10500
315      9300
Name: price, dtype: int64
```

In [51]:
```python
from sklearn.linear_model import ElasticNet
from sklearn.model_selection import GridSearchCV
elastic=ElasticNet()
parameters={'alpha':[1e-15,1e-10,1e-8,1e-4,1e-3,1e-2,1,5,10,20]}
elastic_regressor=GridSearchCV(elastic,parameters)
elastic_regressor.fit(x_train,y_train)
```

```
/home/placement/anaconda3/lib/python3.10/site-packages/sklearn/linear_model/_coordinate_descent.py:631: C
onvergenceWarning: Objective did not converge. You might want to increase the number of iterations, check
the scale of the features or consider increasing regularisation. Duality gap: 2.750e+08, tolerance: 3.611
e+05
  model = cd_fast.enet_coordinate_descent(
/home/placement/anaconda3/lib/python3.10/site-packages/sklearn/linear_model/_coordinate_descent.py:631: C
onvergenceWarning: Objective did not converge. You might want to increase the number of iterations, check
the scale of the features or consider increasing regularisation. Duality gap: 2.703e+08, tolerance: 3.517
e+05
  model = cd_fast.enet_coordinate_descent(
/home/placement/anaconda3/lib/python3.10/site-packages/sklearn/linear_model/_coordinate_descent.py:631: C
onvergenceWarning: Objective did not converge. You might want to increase the number of iterations, check
the scale of the features or consider increasing regularisation. Duality gap: 2.854e+08, tolerance: 3.711
e+05
  model = cd_fast.enet_coordinate_descent(
/home/placement/anaconda3/lib/python3.10/site-packages/sklearn/linear_model/_coordinate_descent.py:631: C
onvergenceWarning: Objective did not converge. You might want to increase the number of iterations, check
the scale of the features or consider increasing regularisation. Duality gap: 2.909e+08, tolerance: 3.576
e+05
  model = cd_fast.enet_coordinate_descent(
```

In [52]: `elastic_regressor.best_params_`

Out[52]: `{'alpha': 0.01}`

In [53]:
```python
elastic=ElasticNet(alpha=0.1)
elastic.fit(x_train,y_train)
y_pred_elastic=elastic.predict(x_test)
```

In [54]:
```python
from sklearn.metrics import r2_score
r2_score(y_test,y_pred_elastic)
```

Out[54]: 0.8488205369102257

In [56]:
```python
from sklearn.metrics import mean_squared_error
elastic_Error=mean_squared_error(y_pred_elastic,y_test)
elastic_Error
```

Out[56]: 604156.8414511626

In [57]:
```python
Results=pd.DataFrame(columns=['price','predicted'])
Results['price']=y_test
Results['predicted']=y_pred_elastic
Results=Results.reset_index()
Results['ID']=Results.index
Results.head(15)
```

Out[57]:

|    | index | price | predicted    | ID |
|----|-------|-------|--------------|----|
| 0  | 625   | 5400  | 5467.419026  | 0  |
| 1  | 187   | 5399  | 5128.262319  | 1  |
| 2  | 279   | 4900  | 4805.437183  | 2  |
| 3  | 734   | 10500 | 9669.896114  | 3  |
| 4  | 315   | 9300  | 9407.643214  | 4  |
| 5  | 652   | 10850 | 10349.137010 | 5  |
| 6  | 1472  | 9500  | 9810.214625  | 6  |
| 7  | 619   | 7999  | 8312.374646  | 7  |
| 8  | 992   | 6300  | 5916.485067  | 8  |
| 9  | 1154  | 10000 | 10151.323763 | 9  |
| 10 | 757   | 6000  | 5646.011712  | 10 |
| 11 | 1299  | 8500  | 7771.402126  | 11 |
| 12 | 400   | 8580  | 9717.015852  | 12 |
| 13 | 314   | 4600  | 4408.147383  | 13 |
| 14 | 72    | 7400  | 6560.282727  | 14 |

In [58]:
```python
data2=x.loc[:,"model_lounge"]
```

In [59]: `data2`

Out[59]:
```
0       1
1       0
2       0
3       1
4       0
       ..
1533    0
1534    1
1535    0
1536    1
1537    0
Name: model_lounge, Length: 1389, dtype: uint8
```

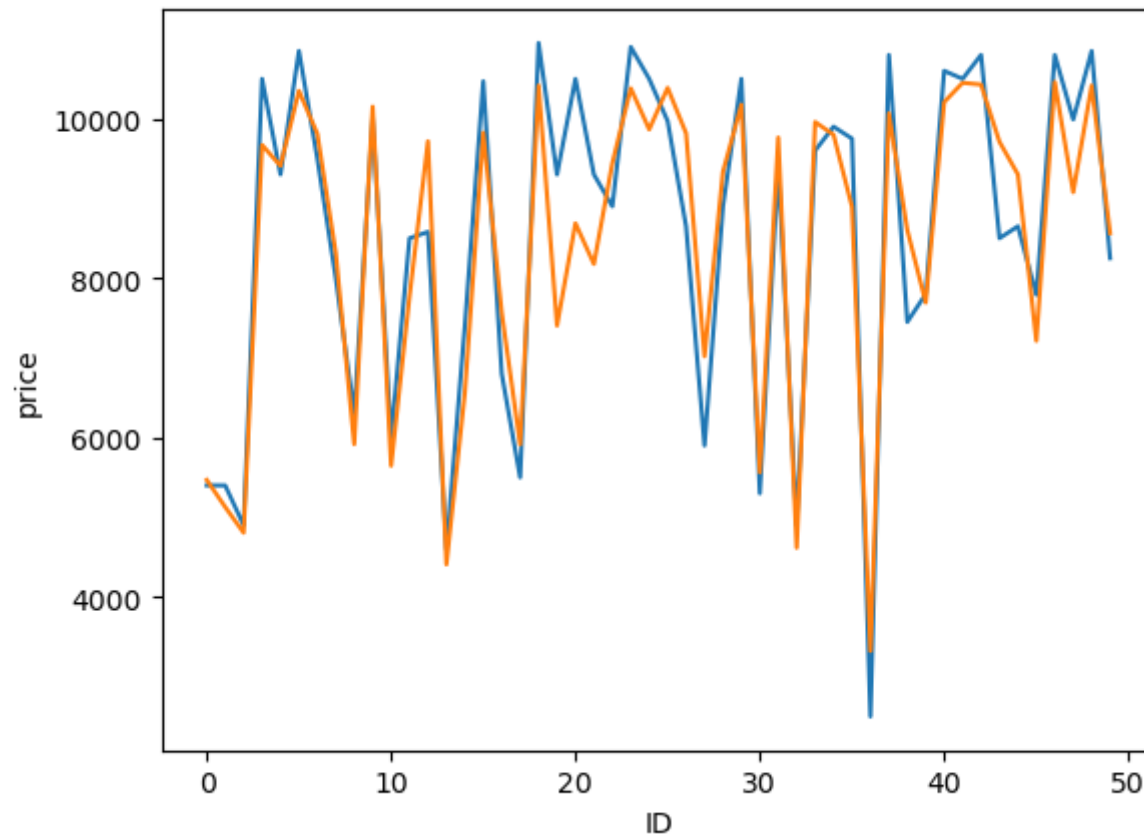In [60]: `data2=pd.get_dummies(data2)`

In [61]: `data2`

Out[61]:

|      | 0   | 1   |
| ---- | --- | --- |
| 0    | 0   | 1   |
| 1    | 1   | 0   |
| 2    | 1   | 0   |
| 3    | 0   | 1   |
| 4    | 1   | 0   |
| ...  | ... | ... |
| 1533 | 1   | 0   |
| 1534 | 0   | 1   |
| 1535 | 1   | 0   |
| 1536 | 0   | 1   |
| 1537 | 1   | 0   |

1389 rows × 2 columns

In [62]:
```python
import seaborn as sns
import matplotlib.pyplot as plt
sns.lineplot(x='ID',y='price',data=Results.head(50))
sns.lineplot(x='ID',y='predicted',data=Results.head(50))
plt.plot()
```

Out[62]: []

In [ ]: