In [1]:

```
import numpy as np
import pandas as pd
```

In [2]:

```
df=pd.read_csv(r'https://github.com/philoma/Dataset/raw/main/Bike%20Prices.csv')
```

In [3]:

```
df.head
```

Out[3]:

```
<bound method NDFrame.head of       Brand                      Model  Selling_P
rice  Year Seller_Type  \
0       TVS                 TVS XL 100          30000  2017  Individual
1     Bajaj              Bajaj  ct 100          18000  2017  Individual
2        Yo                   Yo Style          20000  2011  Individual
3     Bajaj         Bajaj Discover 100          25000  2010  Individual
4     Bajaj         Bajaj Discover 100          24999  2012  Individual
...     ...                        ...            ...   ...          ...
1056  Royal  Royal Enfield Electra 5 S          90000  2012  Individual
1057   Hero            Hero Honda Hunk          20000  2010  Individual
1058  Bajaj     Bajaj Pulsar 220 DTS-i          60000  2014  Individual
1059   Hero     Hero Honda CBZ extreme          40000  2009  Individual
1060   Hero     Hero Honda CBZ extreme          35000  2012  Individual

          Owner  KM_Driven  Ex_Showroom_Price
0     1st owner       8000            30490.0
1     1st owner      35000            32000.0
2     1st owner      10000            37675.0
3     1st owner      43000            42859.0
4     2nd owner      35000            42859.0
...         ...        ...                ...
1056  1st owner      40000                NaN
1057  1st owner      17000                NaN
1058  1st owner      16000                NaN
1059  1st owner      50000                NaN
1060  1st owner      60000                NaN

[1061 rows x 8 columns]>
```

In [59]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1061 entries, 0 to 1060
Data columns (total 8 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Brand              1061 non-null   object 
 1   Model              1061 non-null   object 
 2   Selling_Price      1061 non-null   int64  
 3   Year               1061 non-null   int64  
 4   Seller_Type        1061 non-null   object 
 5   Owner              1061 non-null   object 
 6   KM_Driven          1061 non-null   int64  
 7   Ex_Showroom_Price  626 non-null    float64
dtypes: float64(1), int64(3), object(4)
memory usage: 66.4+ KB
```

In [60]:
```
df.shape
```

Out[60]:
```
(1061, 8)
```

In [61]:
```
#df['Ex_Showroom_Price'].fillna(df.groupby(['Brand'])['Selling_Price'].transform(
df=df.dropna()
```

In [62]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 626 entries, 0 to 625
Data columns (total 8 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Brand              626 non-null    object 
 1   Model              626 non-null    object 
 2   Selling_Price      626 non-null    int64  
 3   Year               626 non-null    int64  
 4   Seller_Type        626 non-null    object 
 5   Owner              626 non-null    object 
 6   KM_Driven          626 non-null    int64  
 7   Ex_Showroom_Price  626 non-null    float64
dtypes: float64(1), int64(3), object(4)
memory usage: 44.0+ KB
```

In [63]:
```
df.describe()
```

Out[63]:

	Selling_Price	Year	KM_Driven	Ex_Showroom_Price
count	626.000000	626.000000	626.000000	6.260000e+02
mean	59445.164537	2014.800319	32671.576677	8.795871e+04
std	59904.350888	3.018885	45479.661039	7.749659e+04
min	6000.000000	2001.000000	380.000000	3.049000e+04
25%	30000.000000	2013.000000	13031.250000	5.485200e+04
50%	45000.000000	2015.000000	25000.000000	7.275250e+04
75%	65000.000000	2017.000000	40000.000000	8.703150e+04
max	760000.000000	2020.000000	585659.000000	1.278000e+06

In [64]:
```
df.columns
```

Out[64]:
```
Index(['Brand', 'Model', 'Selling_Price', 'Year', 'Seller_Type', 'Owner',
       'KM_Driven', 'Ex_Showroom_Price'],
      dtype='object')
```

In [65]:
```
df[['Brand']].value_counts()
```

Out[65]:
```
Brand
Honda       170
Bajaj       143
Hero        108
Yamaha       94
Royal        40
TVS          23
Suzuki       18
KTM           6
Mahindra      6
Kawasaki      4
UM            3
Activa        3
Harley        2
Vespa         2
BMW           1
Hyosung       1
Benelli       1
Yo            1
dtype: int64
```

In [66]:
```
df.columns
```

Out[66]:
```
Index(['Brand', 'Model', 'Selling_Price', 'Year', 'Seller_Type', 'Owner',
       'KM_Driven', 'Ex_Showroom_Price'],
      dtype='object')
```

In [67]:
```
df[['Model']].value_counts()
```

Out[67]:
```
Model
Honda Activa [2000-2015]                     23
Honda CB Hornet 160R                         22
Bajaj Pulsar 180                             20
Yamaha FZ S V 2.0                            16
Bajaj Discover 125                           16
                                             ..
Royal Enfield Thunderbird 500                 1
Royal Enfield Continental GT [2013 - 2018]    1
Royal Enfield Classic Stealth Black           1
Royal Enfield Classic Squadron Blue           1
Yo Style                                      1
Length: 183, dtype: int64
```

In [68]:
```
df[['Seller_Type']].value_counts()
```

Out[68]:
```
Seller_Type
Individual     623
Dealer           3
dtype: int64
```

In [69]:
```
df.replace({'Seller_Type':{'Individual':0,'Dealer':1}},inplace=True)
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/indexing.py:1773: SettingWit
hCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/sta
ble/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pyd
ata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-c
opy)
  self._setitem_single_column(ilocs[0], value, pi)
```

In [70]:
```
df[['Owner']].value_counts()
```

Out[70]:
```
Owner
1st owner    556
2nd owner     66
3rd owner      3
4th owner      1
dtype: int64
```

In [71]:
```
df.replace({'Owner':{'1st owner'  : 0,
'2nd owner':1,
'3rd owner': 2,
'4th owner'   : 3  }},inplace=True)
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/indexing.py:1773: SettingWit
hCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/sta
ble/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pyd
ata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-c
opy)
  self._setitem_single_column(ilocs[0], value, pi)
```

In [72]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 626 entries, 0 to 625
Data columns (total 8 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Brand              626 non-null    object 
 1   Model              626 non-null    object 
 2   Selling_Price      626 non-null    int64  
 3   Year               626 non-null    int64  
 4   Seller_Type        626 non-null    int64  
 5   Owner              626 non-null    int64  
 6   KM_Driven          626 non-null    int64  
 7   Ex_Showroom_Price  626 non-null    float64
dtypes: float64(1), int64(5), object(2)
memory usage: 44.0+ KB
```

In [73]:
```
y=df['Selling_Price']
```

In [74]:
```
y.shape
```

Out[74]:
```
(626,)
```

In [75]:
```
df.columns
```

Out[75]:
```
Index(['Brand', 'Model', 'Selling_Price', 'Year', 'Seller_Type', 'Owner',
       'KM_Driven', 'Ex_Showroom_Price'],
      dtype='object')
```

In [76]:
```
X=df[['Year', 'Seller_Type', 'Owner',
       'KM_Driven', 'Ex_Showroom_Price']]
```

In [77]:
```
X.shape
```

Out[77]:
```
(626, 5)
```

In [78]:
```
X
```

Out[78]:

	Year	Seller_Type	Owner	KM_Driven	Ex_Showroom_Price
0	2017	0	0	8000	30490.0
1	2017	0	0	35000	32000.0
2	2011	0	0	10000	37675.0
3	2010	0	0	43000	42859.0
4	2012	0	1	35000	42859.0
...	...	...	...	...	...
621	2014	0	3	6500	534000.0
622	2011	0	0	12000	589000.0
623	2017	0	1	13600	599000.0
624	2019	0	0	2800	752020.0
625	2013	0	1	12000	1278000.0

626 rows × 5 columns

In [79]:
```
from sklearn.model_selection import train_test_split
```

In [80]:
```
X_train,X_test,y_train,y_test=train_test_split(X,y,train_size=0.7,random_state=25
```

In [81]:
```
from sklearn.linear_model import LinearRegression
```

In [82]:
```
lr=LinearRegression()
```

In [83]:
```
lr.fit(X_train,y_train)
```

Out[83]:
```
LinearRegression()
```

In [84]:
```
y_pred=lr.predict(X_test)
```

In [85]:
```
y_pred.shape
```

Out[85]:
```
(188,)
```

In [86]:
```
y_pred
```

Out[86]:
```
array([ 27210.52271465,  56340.08335163,  63471.94671996,  53627.63844785,
        55612.75744268,  53888.92259719,  33751.35275102,  60311.4950183 ,
       113713.05684467,  76639.49332954,  27826.7399381 ,  49919.83255841,
        65886.64311457,  26755.12664064,  48277.75426038, 127646.56079335,
        70047.10661635,  39350.67963653,  36081.03597878,  45360.79436339,
        48079.89470577,  44803.02464799,  55161.44026111,  71041.51821318,
        91689.22699159,  49301.53594645,  55988.19326252, 108171.54600296,
        32771.06897901,  25468.20072996,  17128.61806164, 179271.41130746,
        45698.99857622,  31371.09285079,  67886.52106737,  41492.49575815,
        56855.22238602,  47820.47003468,  74682.14053958,  24984.21822736,
        55374.00513699,  41412.36775222,  67991.60287764,  26553.59421844,
        89788.69870689,  45764.83633686, 133888.03770389, 106988.113825  ,
        71176.40667714,  25332.25485946,  79512.43778826,  63914.38088173,
        28632.12110986,  53656.13623937,  -5396.37132904,  70377.44571174,
        33313.03576476,  53994.92478411,  67509.85836352,  59735.05378847,
        22199.83644217,  15374.18984158,  44510.76819427,  30279.52476752,
       108243.77037514,  19291.8895874 ,  53614.312976  ,  59230.23269131,
        60174.2108109 ,  45924.63468736,  25770.81883496,  63471.36257814,
       242123.45729792,  61387.72544548,  56510.98127074,  48123.28087213,
        51668.27442011,  90279.76190495,  14827.76533556, 112437.70820504,
        35066.88027405,  30902.41069172,  31441.48921433, 125593.75847157,
        27705.38813164, -11590.29205553,  15582.17108685,  75113.64511232,
       504085.44522282, 123545.42050116,  74770.89327697,  50747.47663245,
        44174.3618212 ,  25426.7156106 ,  30298.3052462 ,  47625.67836414,
        27850.37544807,  28845.23330928,  31580.38624692,  32309.63375635,
        47979.16788554,  65955.46375944,  13432.28218017,  15368.80064986,
        31973.23052409, 110353.92870546,  68181.49509136,  23143.49139797,
        53194.65732076,  34603.36376989,  56002.50967868,  62432.66994305,
       391470.77533201,   3558.29480891,  36019.18494305,  70876.34866549,
        72890.00667025, 137596.01384364,  27620.36308877, 135789.30486854,
        39674.40366791,  58367.0924453 ,  42401.21202624,  61864.4379567 ,
        42688.89652842,  63710.34571021,  10604.39360071,  38458.82820943,
       112251.84744225, 115403.00577536,  13658.41734785,  36196.83359584,
        54146.22998932,  97297.85724851,  55029.68137265,  22923.26533437,
       104569.97029689,  41965.75852017,  38759.68546491,  28930.61369011,
        45231.66612551,  48475.43422775,  26739.7225731 ,  53598.65972203,
        32558.54954524,  32212.22834942,  68172.98738422,  71839.47716461,
        32003.46692215,  40652.69995971,  39935.92211843,  63444.41846202,
        44545.5818771 , 120873.38389616,  60926.58683174,  62641.82167496,
        60816.47379994,  27098.95433573,  26803.64749618,  48956.00468627,
        62032.88118713,  26471.97495723, 104937.23068766, 132903.3578847 ,
        37469.2040942 ,  57579.12080094,  40371.00915736,  -7039.40662503,
        26485.40030077,  90782.42554145,  52153.21149321,  56453.74542453,
        80440.59426003,  31890.46870273,  49505.97985573,  24288.36959514,
        25540.47481573, 117708.26333955,  23399.66596746,  63678.40865459,
        70144.29372668,  33434.89010059,  60885.29444481,  58389.55370878,
        35118.7040348 ,  58729.4540196 ,  34627.9532246 ,  38583.4623973 ])
```

In [89]:
```
from sklearn.metrics import mean_squared_error,mean_absolute_error,r2_score
```

```
In [90]: mean_absolute_error(y_test,y_pred)
```

```
Out[90]: 12225.7370104107
```

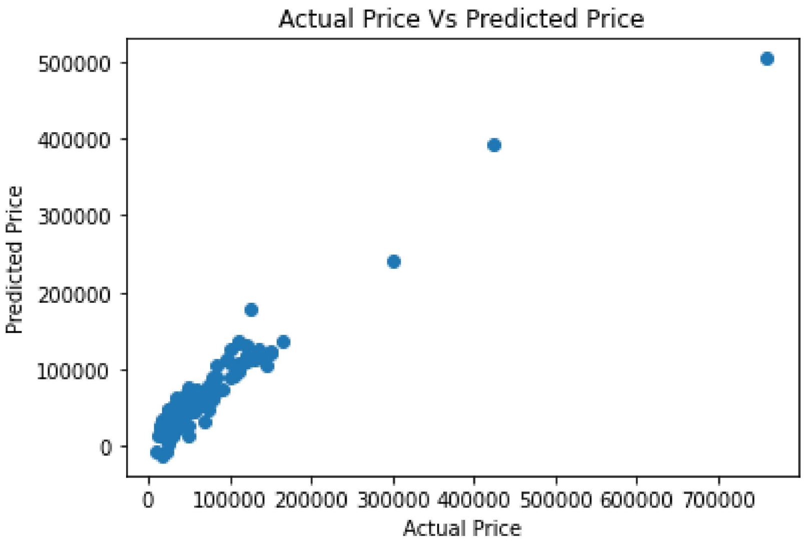
```
In [91]: mean_squared_error(y_test,y_pred)
```

```
Out[91]: 554715615.5043668
```

```
In [92]: r2_score(y_test,y_pred)
```

```
Out[92]: 0.8810414402984937
```

```
In [94]: import matplotlib.pyplot as plt
         plt.scatter(y_test,y_pred)
         plt.xlabel("Actual Price")
         plt.ylabel("Predicted Price")
         plt.title('Actual Price Vs Predicted Price')
         plt.show()
```



Get Future Predictions:

Steps: 1. extract a random row using sample function 2. separate X and y 3. predict

```
In [95]: df_new=df.sample(1)
```

In [96]:
```
df_new
```

Out[96]:

	Brand	Model	Selling_Price	Year	Seller_Type	Owner	KM_Driven	Ex_Showroom_Price
612	Royal	Royal Enfield Classic Stealth Black	160000	2018	0	0	7500	204977.0

In [97]:
```
df_new.shape
```

Out[97]:
```
(1, 8)
```

In [98]:
```
X_new=df_new.drop(['Brand','Model','Selling_Price'],axis=1)
```

In [99]:
```
y_pred_new=lr.predict(X_new)
```

In [101]:
```
print(y_pred_new)
```

```
[150105.70011051]
```

Thus 150105.70011051 is the predicted price of Royal Enfield Classic Stealth Black.