In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

import warnings
warnings.filterwarnings("ignore")
```

In [2]:

```
df = pd.read_csv("USA_Housing.csv")
df.head()
```

Out[2]:

	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price	Addr
0	79545.458574	5.682861	7.009188	4.09	23086.800503	1.059034e+06	208 Michael Ferry 674\nLaurabury, 37(
1	79248.642455	6.002900	6.730821	3.09	40173.072174	1.505891e+06	188 Johnson Vi Suite 079\nL Kathleen, C
2	61287.067179	5.865890	8.512727	5.13	36882.159400	1.058988e+06	9127 Elizal Stravenue\nDanieltc WI 064
3	63345.240046	7.188236	5.586729	3.26	34310.242831	1.260617e+06	USS Barnett\nFPC 44
4	59982.197226	5.040555	7.839388	4.23	26354.109472	6.309435e+05	USNS Raymond\nF AE 09

In [3]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5000 entries, 0 to 4999
Data columns (total 7 columns):
 #   Column                        Non-Null Count  Dtype  
---  ------                        --------------  -----  
 0   Avg. Area Income              5000 non-null   float64
 1   Avg. Area House Age           5000 non-null   float64
 2   Avg. Area Number of Rooms     5000 non-null   float64
 3   Avg. Area Number of Bedrooms  5000 non-null   float64
 4   Area Population               5000 non-null   float64
 5   Price                         5000 non-null   float64
 6   Address                       5000 non-null   object 
dtypes: float64(6), object(1)
memory usage: 273.6+ KB
```

In [4]:

```
df.describe()
```

Out[4]:

	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price
count	5000.000000	5000.000000	5000.000000	5000.000000	5000.000000	5.000000e+03
mean	68583.108984	5.977222	6.987792	3.981330	36163.516039	1.232073e+06
std	10657.991214	0.991456	1.005833	1.234137	9925.650114	3.531176e+05
min	17796.631190	2.644304	3.236194	2.000000	172.610686	1.593866e+04
25%	61480.562388	5.322283	6.299250	3.140000	29403.928702	9.975771e+05
50%	68804.286404	5.970429	7.002902	4.050000	36199.406689	1.232669e+06
75%	75783.338666	6.650808	7.665871	4.490000	42861.290769	1.471210e+06
max	107701.748378	9.519088	10.759588	6.500000	69621.713378	2.469066e+06

In [5]:

```
df.corr().style.background_gradient() # to check the correlation without using a heatmap
```

Out[5]:

	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price
Avg. Area Income	1.000000	-0.002007	-0.011032	0.019788	-0.016234	0.639734
Avg. Area House Age	-0.002007	1.000000	-0.009428	0.006149	-0.018743	0.452543
Avg. Area Number of Rooms	-0.011032	-0.009428	1.000000	0.462695	0.002040	0.335664
Avg. Area Number of Bedrooms	0.019788	0.006149	0.462695	1.000000	-0.022168	0.171071
Area Population	-0.016234	-0.018743	0.002040	-0.022168	1.000000	0.408556
Price	0.639734	0.452543	0.335664	0.171071	0.408556	1.000000

In [7]:

```
df.corr()["Price"].sort_values()
```

Out[7]:

```
Avg. Area Number of Bedrooms    0.171071
Avg. Area Number of Rooms       0.335664
Area Population                 0.408556
Avg. Area House Age             0.452543
Avg. Area Income                0.639734
Price                           1.000000
Name: Price, dtype: float64
```

- By using this method we can find the correlation of prices as compared to the Average no. of bedrooms, Area population etc.

-Now by using iloc method we will divide the dataset into X(independent values) and Y(Dependent Values)

Dividing Dataset into x and y

In [9]:

```
x = df.iloc[:,:-2].values
y = df.iloc[:,-2].values
# using the values method we can convert the data into numpy array
```

In [10]:

```
x
```

Out[10]:

```
array([[7.95454586e+04, 5.68286132e+00, 7.00918814e+00, 4.09000000e+00,
        2.30868005e+04],
       [7.92486425e+04, 6.00289981e+00, 6.73082102e+00, 3.09000000e+00,
        4.01730722e+04],
       [6.12870672e+04, 5.86588984e+00, 8.51272743e+00, 5.13000000e+00,
        3.68821594e+04],
       ...,
       [6.33906869e+04, 7.25059061e+00, 4.80508098e+00, 2.13000000e+00,
        3.32661455e+04],
       [6.80013312e+04, 5.53438842e+00, 7.13014386e+00, 5.44000000e+00,
        4.26256202e+04],
       [6.55105818e+04, 5.99230531e+00, 6.79233610e+00, 4.07000000e+00,
        4.65012838e+04]])
```

In [11]:

```
y
```

Out[11]:

```
array([1059033.55787012, 1505890.91484695, 1058987.98787608, ...,
       1030729.58315229, 1198656.87240769, 1298950.48026696])
```

Creating the model (dividing training and testing set)

In [12]:

```
from sklearn.model_selection import train_test_split
xtrain,xtest,ytrain,ytest=train_test_split(x,y, test_size= 0.2, random_state=1)
```

Performing Linear Regression by importing necessary Module

In [14]:

```
from sklearn.linear_model import LinearRegression
linreg = LinearRegression()
linreg.fit(xtrain,ytrain)
ypred = linreg.predict(xtest)
```

Displaying Intercept

In [17]:

```
linreg.intercept_
```

Out[17]:

```
-2637185.6400765334
```

Displaying Coefficient

In [18]:

```
linreg.coef_
```

Out[18]:

```
array([2.16667346e+01, 1.64990052e+05, 1.20784238e+05, 1.54252468e+03,
       1.51503697e+01])
```

To interpret the Coefficient more easily we need to convert this data into a Dataframe

In [20]:

```
x = df.iloc[:,:-2]
y = df.iloc[:,-2]
```

In [21]:

```
coef_df = pd.DataFrame(linreg.coef_,x.columns, columns = ["Coefficient"])
coef_df
```

Out[21]:

	Coefficient
Avg. Area Income	21.666735
Avg. Area House Age	164990.051829
Avg. Area Number of Rooms	120784.238317
Avg. Area Number of Bedrooms	1542.524676
Area Population	15.150370

Now, interpreting the coefficient has become much more easier!!

- for every unit growth in Average Area income, we estimate that the price will increase upto $21.66
- for every unit growth in Average area House age, we estimate that the price will increase upto $164990.05
- for every unit growth in Average area no. of rooms, we estimate that the price will increase upto $120784.23
- for every unit growth in Average area no. of bedrooms, we estimate that the price will increase upto $1542.52
- for every unit growth in Area population, we estimate that the price will increase upto $15.150

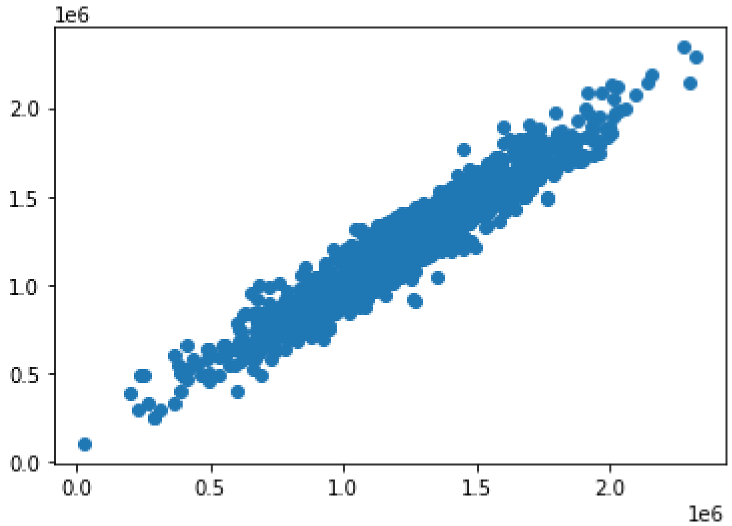
Visualising the Data after training and testing

In [23]:

```
plt.scatter(ytest,ypred)
```

Out[23]:

```
<matplotlib.collections.PathCollection at 0x971b927190>
```

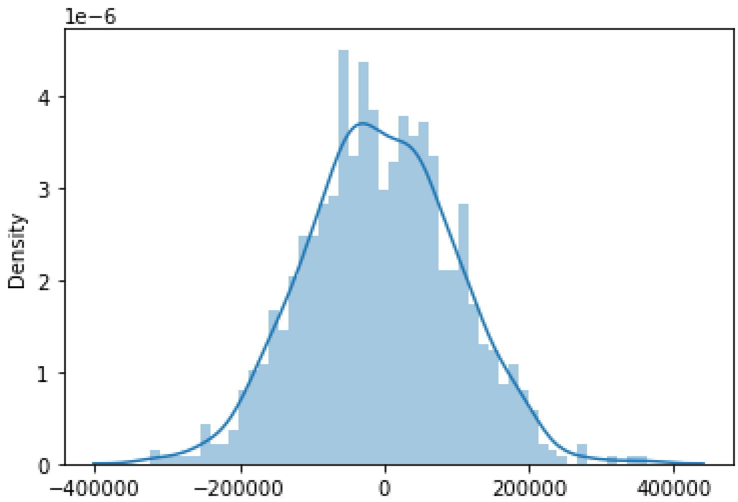


In [26]:

```
sns.distplot((ytest-ypred), bins = 50)
```

Out[26]:

```
<AxesSubplot:ylabel='Density'>
```



Displaying evaluation Metrics

- It is used to evaluate the the performance and the accuracy of the model
- we need to import some modules for evaluation

In [28]:

```
from sklearn.metrics import mean_absolute_error, mean_squared_error,r2_score
```

- MAE or Mean Absolute error represents the average of the absolute difference between the actual values and the predicted values in the given Dataset

In [34]:

```
print(f"MeanAbsoluteError :-  {mean_absolute_error(ytest,ypred)}")
```

```
MeanAbsoluteError :-  82494.73770124864
```

- Mean Squared Error or MSE represents the average of the squared difeerence between the actual and the predicted values in the given Dataset

In [35]:

```
print(f"MeanSquaredError :-  {mean_squared_error(ytest,ypred)}")
```

```
MeanSquaredError :-  10543597313.62453
```

- Root Mean Squared Error or RMSE represents the squareroot Mean Squared Error. It measures the Standard Deviation of the residuals

In [36]:

```
print(f"RootMeanSquaredError :-  {np.sqrt(mean_squared_error(ytest,ypred))}")
```

```
RootMeanSquaredError :-  102682.02040096665
```

- r2_score helps to determine the accuracy of the model

In [37]:

```
print(f"rSquared :-  {(r2_score(ytest,ypred))}")
```

```
rSquared :-  0.9215935236936377
```

CONCLUSION

- After evaluating this Dataset we can say that this model is 92% accurate and can be used for future predictions
- All the evaluation metrics has been displayed in the above Dataset

In [ ]: