PHASE 4

PROJECT: Predicting House Prices Using Machine Learning

Importing dependencies:

In [8]:
```
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.preprocessing import StandardScaler
from sklearn.metrics import r2_score, mean_absolute_error,mean_squared_error
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import Lasso
from sklearn.ensemble import RandomForestRegressor
from sklearn.svm import SVR

%matplotlib inline
import warnings
warnings.filterwarnings("ignore")
```

In [84]:
```
dataset = pd.read_csv('C:/Users/sakthivel/Desktop/Sakthivel/USA_Housing.csv')
```

In [91]:
```
dataset
```

Out [91]:

	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price	Address
0	79545.458574	5.682861	7.009188	4.09	23086.800503	1.059034e+06	208 Michael Ferry Apt. 674\nLaurabury, NE 3701...
1	79248.642455	6.002900	6.730821	3.09	40173.072174	1.505891e+06	188 Johnson Views Suite 079\nLake Kathleen, CA...
2	61287.067179	5.865890	8.512727	5.13	36882.159400	1.058988e+06	9127 Elizabeth Stravenue\nDanieltown, WI 06482...
3	63345.240046	7.188236	5.586729	3.26	34310.242831	1.260617e+06	USS Barnett\nFPO AP 44820
4	59982.197226	5.040555	7.839388	4.23	26354.109472	6.309435e+05	USNS Raymond\nFPO AE 09386
...	...	...	...	...	...	...	...
4995	60567.944140	7.830362	6.137356	3.46	22837.361035	1.060194e+06	USNS Williams\nFPO AP 30153-7653
4996	78491.275435	6.999135	6.576763	4.02	25616.115489	1.482618e+06	PSC 9258, Box 8489\nAPO AA 42991-

	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price	Address
							3352
4997	63390.686886	7.250591	4.805081	2.13	33266.145490	1.030730e+06	4215 Tracy Garden Suite 076\nJoshualand, VA 01...
4998	68001.331235	5.534388	7.130144	5.44	42625.620156	1.198657e+06	USS Wallace\nFPO AE 73316
4999	65510.581804	5.992305	6.792336	4.07	46501.283803	1.298950e+06	37778 George Ridges Apt. 509\nEast Holly, NV 2...

5000 rows × 7 columns

In [13]:
```
dataset.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 [14]:
```
dataset.describe()
```

Out [14]:

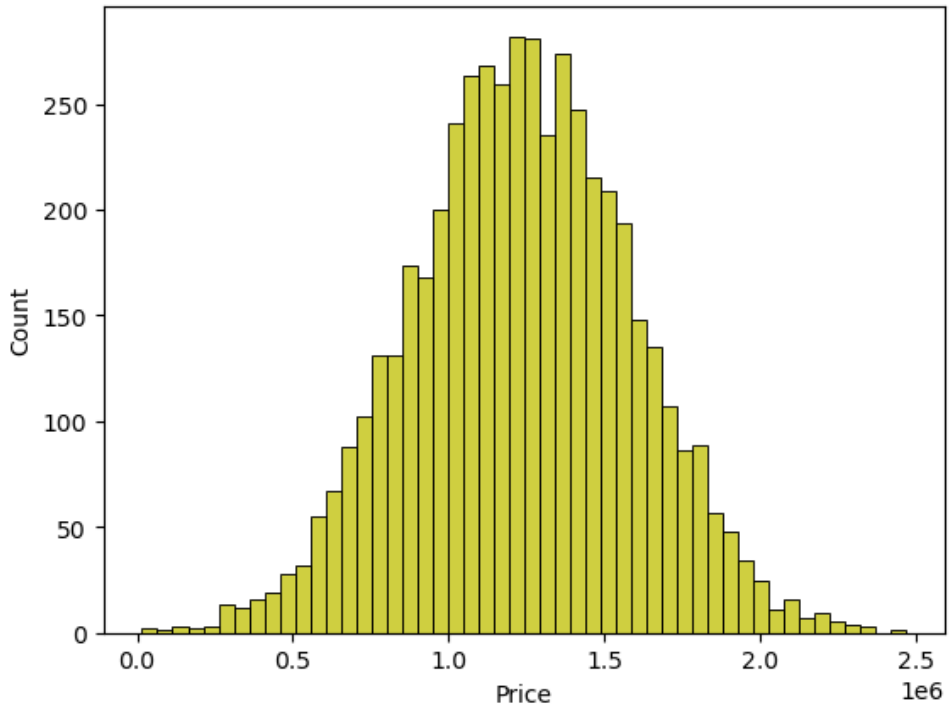
	Avg. Area Income	Avg. Area House Age	Avg. Area Number of Rooms	Avg. Area Number of Bedrooms	Area Population	Price
count	5000.000000	5000.000000	5000.000000	5000.000000	5000.000000	5.000000e+03
mean	68583.108984	5.977222	6.987792	3.981330	36163.516039	1.232073e+06
std	10657.991214	0.991456	1.005833	1.234137	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 [17]:
```
dataset.columns
```

Out [17]:
```
Index(['Avg. Area Income', 'Avg. Area House Age', 'Avg. Area Number of Rooms',
       'Avg. Area Number of Bedrooms', 'Area Population', 'Price', 'Address'],
      dtype='object')
```

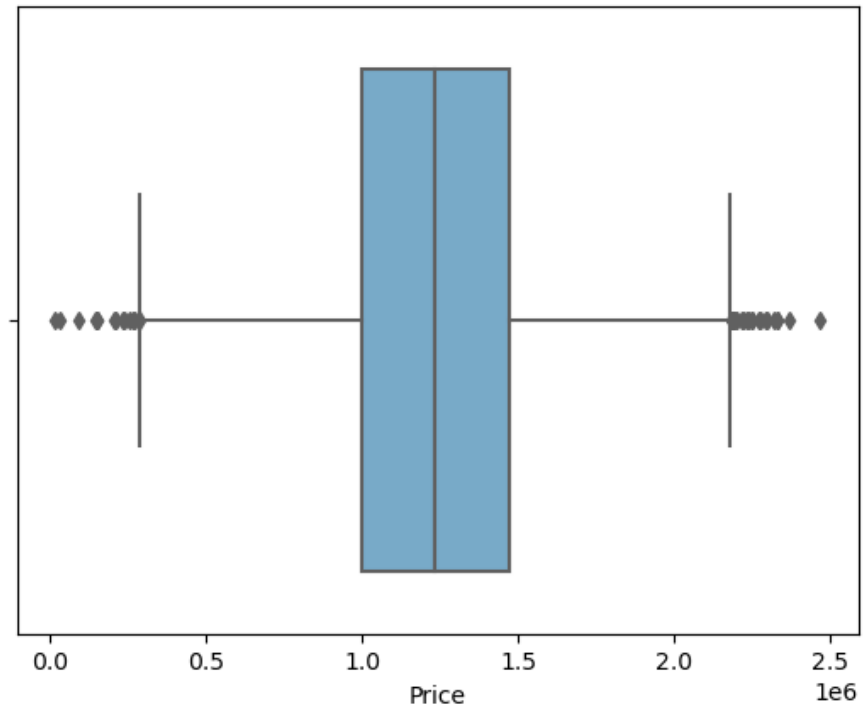
In [18]:
```
sns.histplot(dataset, x='Price', bins=50, color='y')
```

Out [18]:
```
<Axes: xlabel='Price', ylabel='Count'>
```



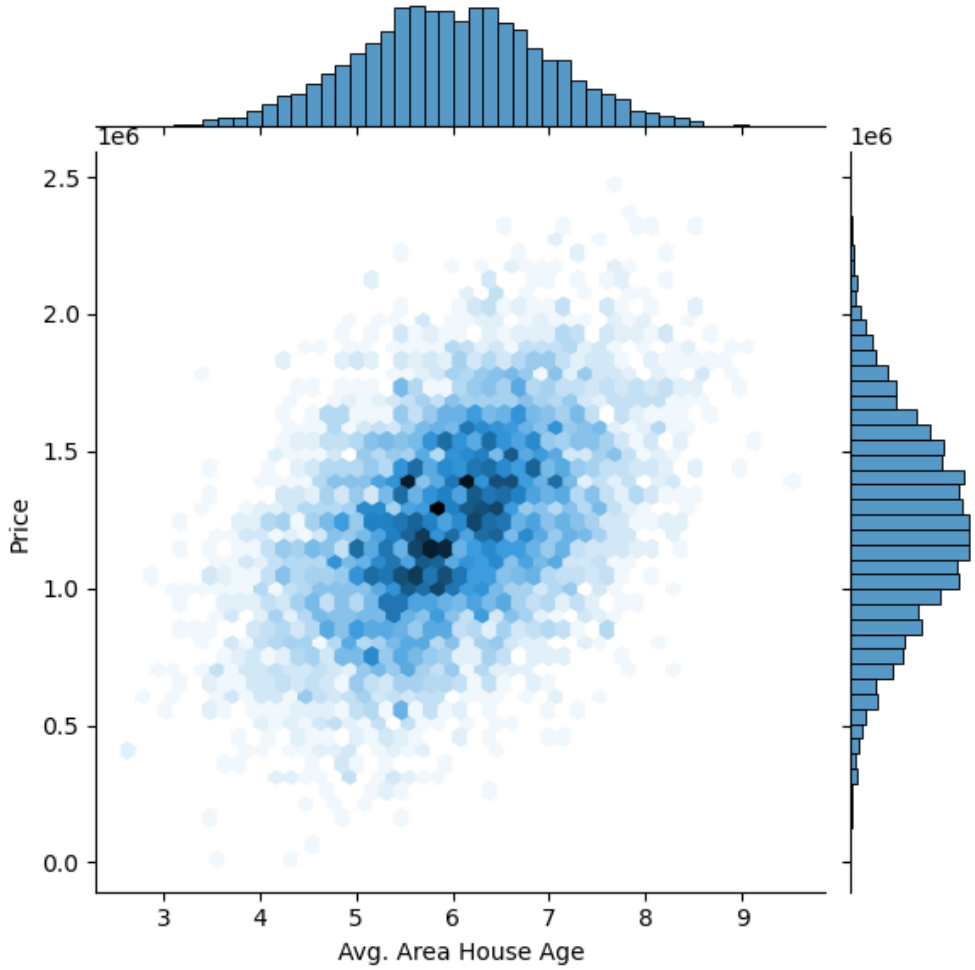
In [20]:
```
sns.boxplot(dataset, x='Price',  palette='Blues')
```

Out [20]: <Axes: xlabel='Price'>



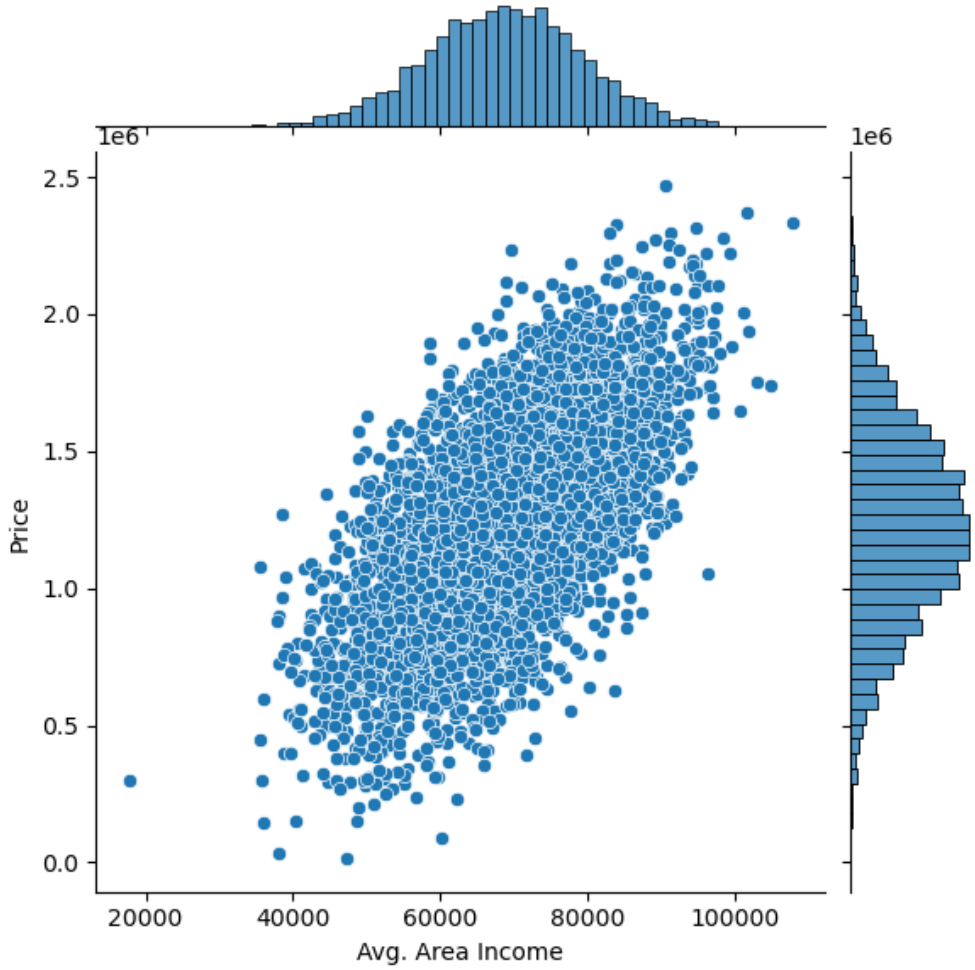
In [21]:
```
sns.jointplot(dataset, x='Avg. Area House Age', y='Price', kind='hex')
```

Out [21]: <seaborn.axisgrid.JointGrid at 0x1570cc77690>



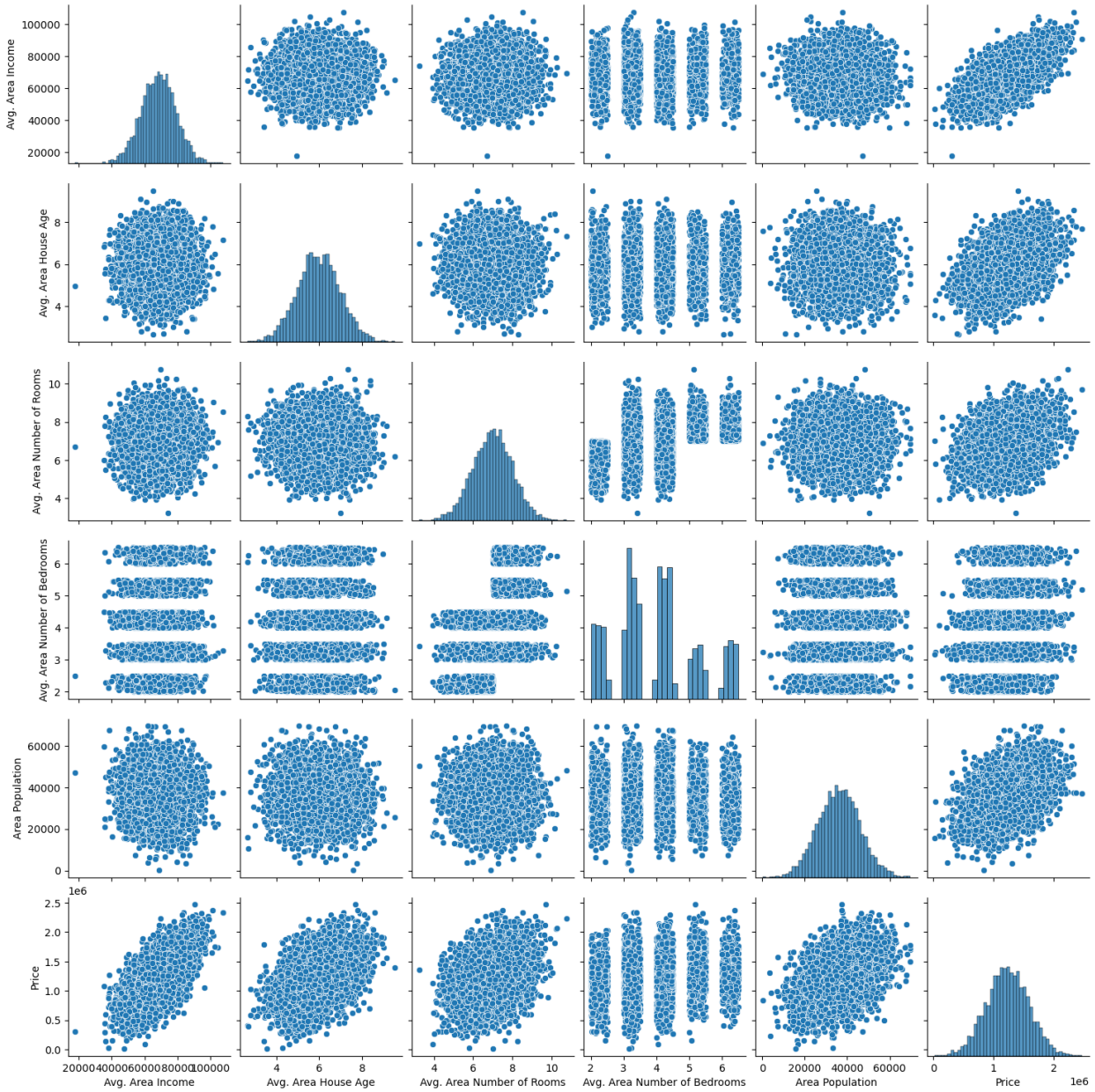
In [22]:
```
sns.jointplot(dataset, x='Avg. Area Income', y='Price')
```

Out [22]: <seaborn.axisgrid.JointGrid at 0x1570dfa73d0>



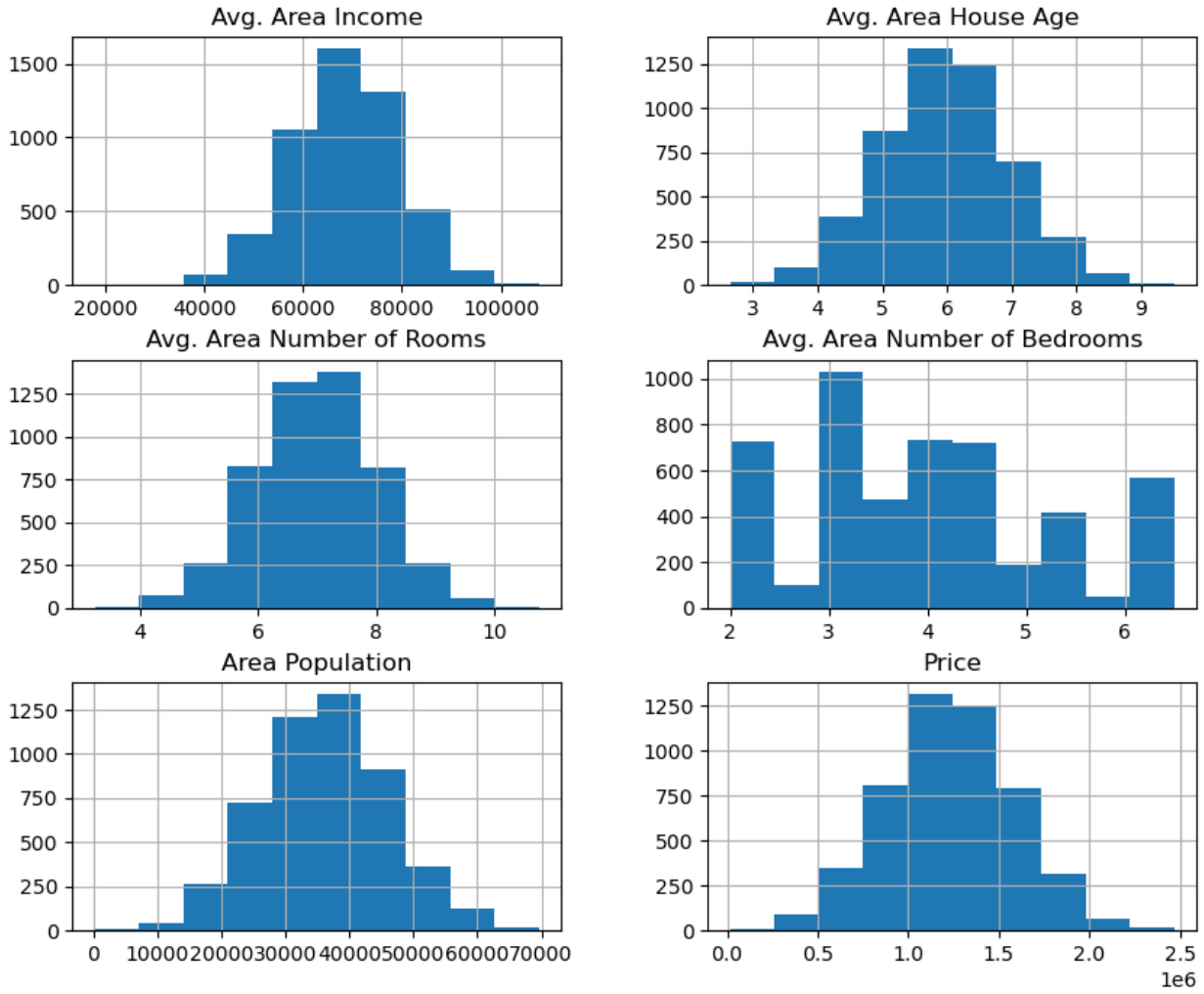
In [32]:
```
plt.figure(figsize=(12,8))
sns.pairplot(dataset)
```

Out [32]:
```
<seaborn.axisgrid.PairGrid at 0x15723570250>
<Figure size 1200x800 with 0 Axes>
```



In [33]:
```
dataset.hist(figsize=(10,8))
```

Out [33]:
```
array([[<Axes: title={'center': 'Avg. Area Income'}>,
        <Axes: title={'center': 'Avg. Area House Age'}>],
       [<Axes: title={'center': 'Avg. Area Number of Rooms'}>,
        <Axes: title={'center': 'Avg. Area Number of Bedrooms'}>],
       [<Axes: title={'center': 'Area Population'}>,
        <Axes: title={'center': 'Price'}>]], dtype=object)
```



In [34]:
```
dataset.corr(numeric_only=True)
```

Out [34]:

	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 [35]:
```
plt.figure(figsize=(10,5))
sns.heatmap(dataset.corr(numeric_only = True), annot=True)
```

Out [35]: <Axes: >

In [41]:
```
X = dataset[['Avg. Area Income', 'Avg. Area House Age', 'Avg. Area Number of Rooms',
       'Avg. Area Number of Bedrooms', 'Area Population']]
Y = dataset['Price']
```

In [40]:
```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.2, random_stat
```

In [38]:
```
Y_train.head()
```

Out [38]:
```
3413    1.305210e+06
1610    1.400961e+06
3459    1.048640e+06
4293    1.231157e+06
1039    1.391233e+06
Name: Price, dtype: float64
```

In [39]:
```
Y_train.shape
```

Out [39]:
```
(4000,)
```

In [42]:
```
Y_test.head()
```

Out [42]:
```
1718    1.251689e+06
2511    8.730483e+05
345     1.696978e+06
2521    1.063964e+06
54      9.487883e+05
Name: Price, dtype: float64
```

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

Out [43]:
```
(1000,)
```

In [55]:
```
sc = StandardScaler()
X_train_scal = sc.fit_transform(X_train)
X_test_scal = sc.fit_transform(X_test)
```

In [49]:
```
model_lr=LinearRegression()
```

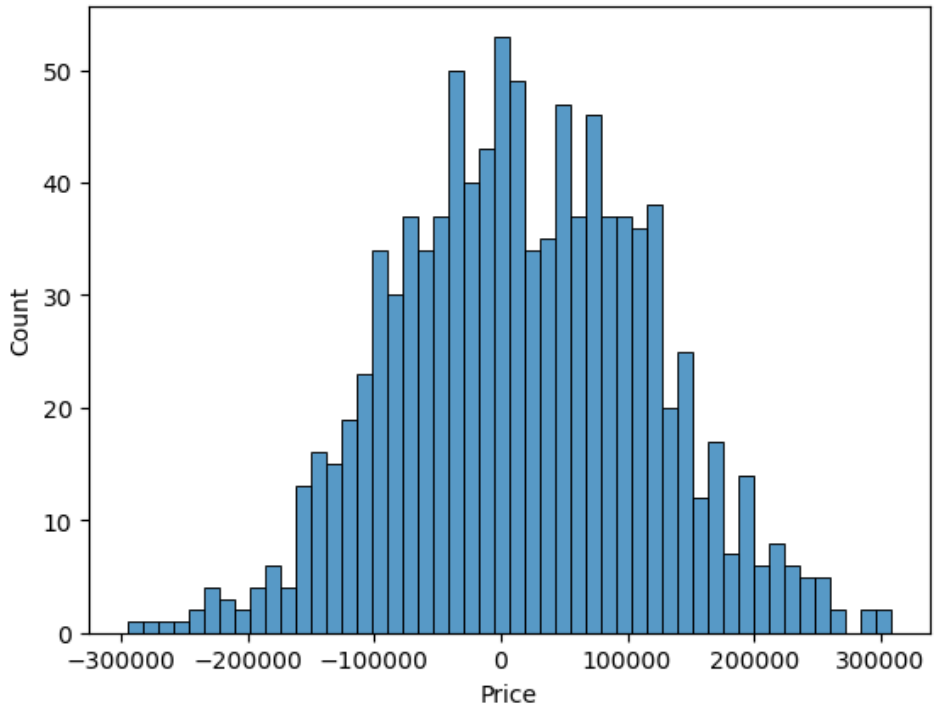
In [57]:
```
model_lr.fit(X_train_scal, Y_train)
```

Out [57]:
```
▾ LinearRegression
LinearRegression()
```

In [92]:
```
Prediction1 = model_lr.predict(X_test_scal)
```

In [63]:
```
sns.histplot((Y_test-Prediction1), bins=50)
```

Out [63]:
```
<Axes: xlabel='Price', ylabel='Count'>
```



In [64]:
```
print(r2_score(Y_test, Prediction1))
print(mean_absolute_error(Y_test, Prediction1))
print(mean_squared_error(Y_test, Prediction1))
```

```
0.918292817939292
82295.49779231752
10469084772.97595
```

In [65]:
```
model_svr = SVR()
```

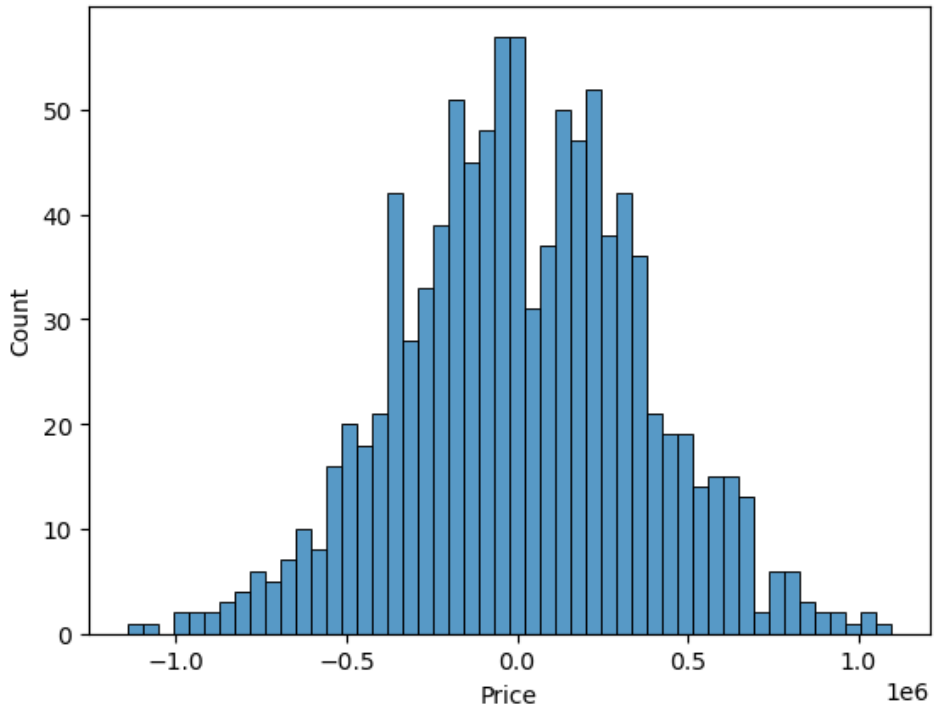
In [66]:
```
model_svr.fit(X_train_scal, Y_train)
```

Out [66]:
```
SVR
SVR()
```

In [67]:
```
Prediction2 = model_svr.predict(X_test_scal)
```

In [69]:
```
sns.histplot((Y_test-Prediction2), bins=50)
```

Out [69]: <Axes: xlabel='Price', ylabel='Count'>



In [70]:
```
print(r2_score(Y_test, Prediction2))
print(mean_absolute_error(Y_test, Prediction2))
print(mean_squared_error(Y_test, Prediction2))
```

```
-0.0006222175925689744
286137.81086908665
128209033251.4034
```

In [71]:
```
model_lar = Lasso(alpha=1)
```

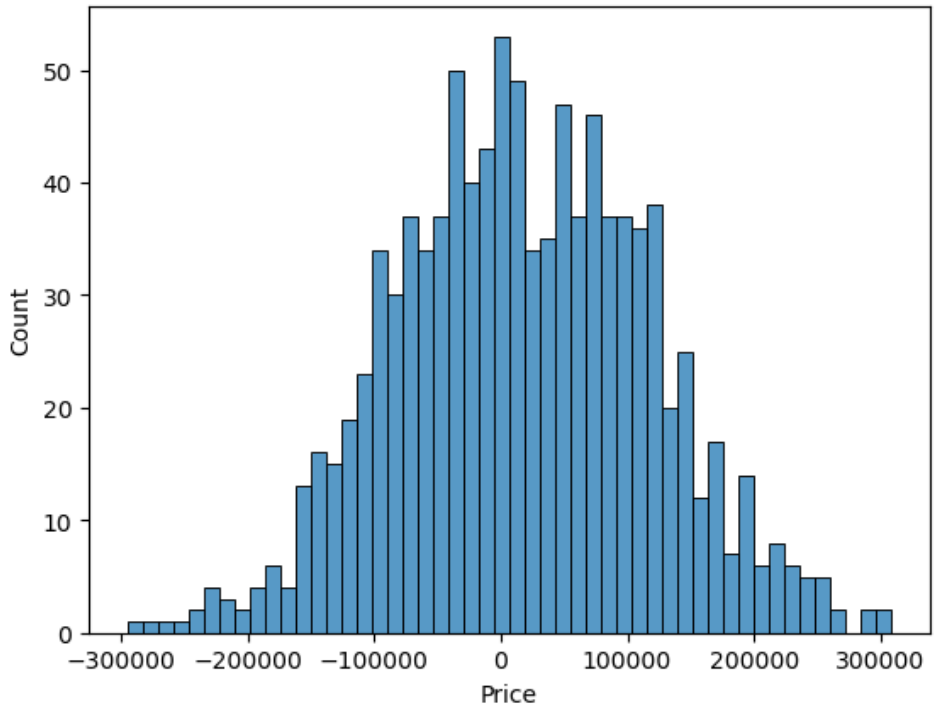
In [72]:
```
model_lar.fit(X_train_scal,Y_train)
```

Out [72]:
```
Lasso
Lasso(alpha=1)
```

In [73]:
```
Prediction3 = model_lar.predict(X_test_scal)
```

In [75]:
```
sns.histplot((Y_test-Prediction3), bins=50)
```

Out [75]: <Axes: xlabel='Price', ylabel='Count'>



In [76]:
```
print(r2_score(Y_test, Prediction2))
print(mean_absolute_error(Y_test, Prediction2))
print(mean_squared_error(Y_test, Prediction2))
```

```
-0.0006222175925689744
286137.81086908665
128209033251.4034
```

In [77]:
```
model_rf = RandomForestRegressor(n_estimators=50)
```

In [78]:
```
model_rf.fit(X_train_scal, Y_train)
```

Out [78]:
```
RandomForestRegressor
RandomForestRegressor(n_estimators=50)
```

In [81]:
```
print(r2_score(Y_test, Prediction2))
print(mean_absolute_error(Y_test, Prediction2))
print(mean_squared_error(Y_test, Prediction2))
```

```
-0.0006222175925689744
286137.81086908665
128209033251.4034
```