ASSIGNMENT-3

NAME: GAYATHRI V

```
from google.colab import files
uploaded = files.upload()
```

Choose Files No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
Saving House Price India.csv to House Price India.csv
```

```
import pandas as pd
```

```
import numpy as np
```

```
import matplotlib.pyplot as plt
```

```
import seaborn as sns
```

```
import io
df = pd.read_csv(io.BytesIO(uploaded['House Price India.csv']))
```

```
df.head()
```

	id	Date	number of rooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views	co
0	6762810145	42491	5	2.50	3650	9050	2.0	0	4	
1	6762810635	42491	4	2.50	2920	4000	1.5	0	0	
2	6762810998	42491	5	2.75	2910	9480	1.5	0	0	
3	6762812605	42491	4	2.50	3310	42998	2.0	0	0	
4	6762812919	42491	3	2.00	2710	4500	1.5	0	0	

5 rows × 23 columns

```
df.tail()
```

	id	Date	number of rooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views
14615	6762830250	42734	2	1.5	1556	20000	1.0	0	0
14616	6762830339	42734	3	2.0	1680	7000	1.5	0	0
14617	6762830618	42734	2	1.0	1070	6120	1.0	0	0
14618	6762830709	42734	4	1.0	1030	6621	1.0	0	0
14619	6762831463	42734	3	1.0	900	4770	1.0	0	0

5 rows × 23 columns

```
df
```

	id	Date	number of rooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views
0	6762810145	42491	5	2.50	3650	9050	2.0	0	4
1	6762810635	42491	4	2.50	2920	4000	1.5	0	0
2	6762810998	42491	5	2.75	2910	9480	1.5	0	0
3	6762812605	42491	4	2.50	3310	42998	2.0	0	0
4	6762812919	42491	3	2.00	2710	4500	1.5	0	0
...	...	...	...	...	...	...	...	...	...

```
df.columns
```

```
Index(['id', 'Date', 'number of rooms', 'number of bathrooms',
       'living area', 'lot area', 'number of floors', 'waterfront present',
       'number of views', 'condition of the house', 'grade of the house',
       'Area of the house(excluding basement)', 'Area of the basement',
       'Built Year', 'Renovation Year', 'Postal Code', 'Lattitude',
       'Longitude', 'living_area_renov', 'lot_area_renov',
       'Number of schools nearby', 'Distance from the airport', 'Price'],
      dtype='object')
```

```
df.dtypes
```

```
id                                         int64
Date                                       int64
number of rooms                            int64
number of bathrooms                      float64
living area                                int64
lot area                                   int64
number of floors                         float64
waterfront present                         int64
number of views                            int64
condition of the house                     int64
grade of the house                         int64
Area of the house(excluding basement)      int64
Area of the basement                       int64
Built Year                                 int64
Renovation Year                            int64
Postal Code                                int64
Lattitude                                float64
Longitude                                float64
living_area_renov                          int64
lot_area_renov                             int64
Number of schools nearby                   int64
Distance from the airport                  int64
Price                                      int64
dtype: object
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 14620 entries, 0 to 14619
Data columns (total 23 columns):
 #   Column                                 Non-Null Count  Dtype  
---                                         --------------  -----  
 0   id                                     14620 non-null  int64  
 1   Date                                   14620 non-null  int64  
 2   number of rooms                        14620 non-null  int64  
 3   number of bathrooms                    14620 non-null  float64
 4   living area                            14620 non-null  int64  
 5   lot area                               14620 non-null  int64  
 6   number of floors                       14620 non-null  float64
 7   waterfront present                     14620 non-null  int64  
 8   number of views                        14620 non-null  int64  
 9   condition of the house                 14620 non-null  int64  
 10  grade of the house                     14620 non-null  int64  
 11  Area of the house(excluding basement)  14620 non-null  int64  
 12  Area of the basement                   14620 non-null  int64  
 13  Built Year                             14620 non-null  int64  
 14  Renovation Year                        14620 non-null  int64  
 15  Postal Code                            14620 non-null  int64  
 16  Lattitude                              14620 non-null  float64
 17  Longitude                              14620 non-null  float64
 18  living_area_renov                      14620 non-null  int64  
 19  lot_area_renov                         14620 non-null  int64  
 20  Number of schools nearby               14620 non-null  int64
 21  Distance from the airport              14620 non-null  int64
 22  Price                                  14620 non-null  int64
dtypes: float64(4), int64(19)
memory usage: 2.6 MB
```

```
df.shape
```

```
(14620, 23)
```

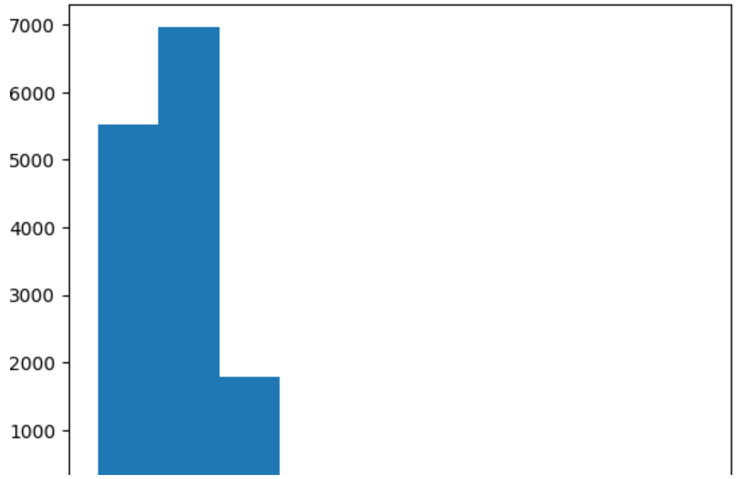
Univariate Analysis

```
print(df.describe())
```

```
                 id          Date     number of rooms  number of bathrooms  \
count  1.462000e+04  14620.000000        14620.000000         14620.000000   
mean   6.762821e+09  42604.538646            3.379343             2.129583   
std    6.237575e+03     67.347991            0.938719             0.769934   
min    6.762810e+09  42491.000000            1.000000             0.500000   
25%    6.762815e+09  42546.000000            3.000000             1.750000   
50%    6.762821e+09  42600.000000            3.000000             2.250000   
75%    6.762826e+09  42662.000000            4.000000             2.500000   
max    6.762832e+09  42734.000000           33.000000             8.000000   

        living area      lot area  number of floors  waterfront present  \
count  14620.000000  1.462000e+04      14620.000000        14620.000000   
mean    2098.262996  1.509328e+04          1.502360            0.007661   
std      928.275721  3.791962e+04          0.540239            0.087193   
min      370.000000  5.200000e+02          1.000000            0.000000   
25%     1440.000000  5.010750e+03          1.000000            0.000000   
50%     1930.000000  7.620000e+03          1.500000            0.000000   
75%     2570.000000  1.080000e+04          2.000000            0.000000   
max    13540.000000  1.074218e+06          3.500000            1.000000   

       number of views  condition of the house  ...    Built Year  \
count     14620.000000            14620.000000  ...  14620.000000   
mean          0.233105                3.430506  ...   1970.926402   
std           0.766259                0.664151  ...     29.493625   
min           0.000000                1.000000  ...   1900.000000   
25%           0.000000                3.000000  ...   1951.000000   
50%           0.000000                3.000000  ...   1975.000000   
75%           0.000000                4.000000  ...   1997.000000   
max           4.000000                5.000000  ...   2015.000000   

       Renovation Year    Postal Code     Lattitude     Longitude  \
count     14620.000000   14620.000000  14620.000000  14620.000000   
mean         90.924008  122033.062244     52.792848   -114.404007   
std         416.216661      19.082418      0.137522      0.141326   
min           0.000000  122003.000000     52.385900   -114.709000   
25%           0.000000  122017.000000     52.707600   -114.519000   
50%           0.000000  122032.000000     52.806400   -114.421000   
75%           0.000000  122048.000000     52.908900   -114.315000   
max        2015.000000  122072.000000     53.007600   -113.505000   

       living_area_renov  lot_area_renov  Number of schools nearby  \
count       14620.000000    14620.000000              14620.000000   
mean         1996.702257    12753.500068                  2.012244   
std           691.093366    26058.414467                  0.817284   
min           460.000000      651.000000                  1.000000   
25%          1490.000000     5097.750000                  1.000000   
50%          1850.000000     7620.000000                  2.000000   
75%          2380.000000    10125.000000                  3.000000   
max          6110.000000   560617.000000                  3.000000   

       Distance from the airport         Price  
count               14620.000000  1.462000e+04  
mean                   64.950958  5.389322e+05  
std                     8.936008  3.675324e+05  
min                    50.000000  7.800000e+04  
25%                    57.000000  3.200000e+05  
50%                    65.000000  4.500000e+05  
75%                    73.000000  6.450000e+05  
```

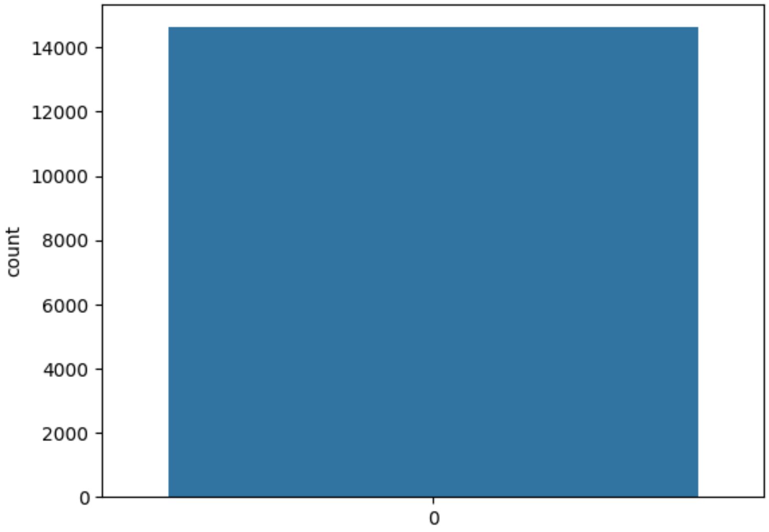
```
plt.hist(df['living area'])
```

```
(array([5.530e+03, 6.958e+03, 1.779e+03, 2.770e+02, 5.500e+01, 1.400e+01,
        2.000e+00, 3.000e+00, 1.000e+00, 1.000e+00]),
 array([  370.,  1687.,  3004.,  4321.,  5638.,  6955.,  8272.,  9589.,
        10906., 12223., 13540.]),
 <BarContainer object of 10 artists>)
```



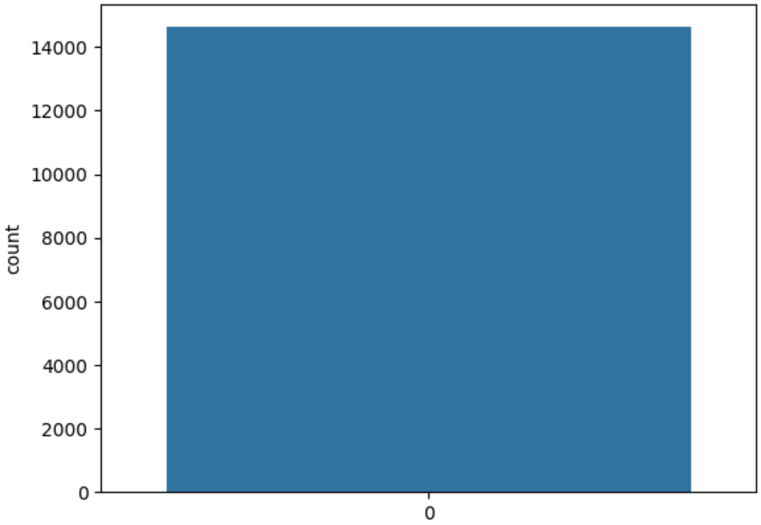
```
sns.countplot(df['number of floors'])
```

```
<Axes: ylabel='count'>
```



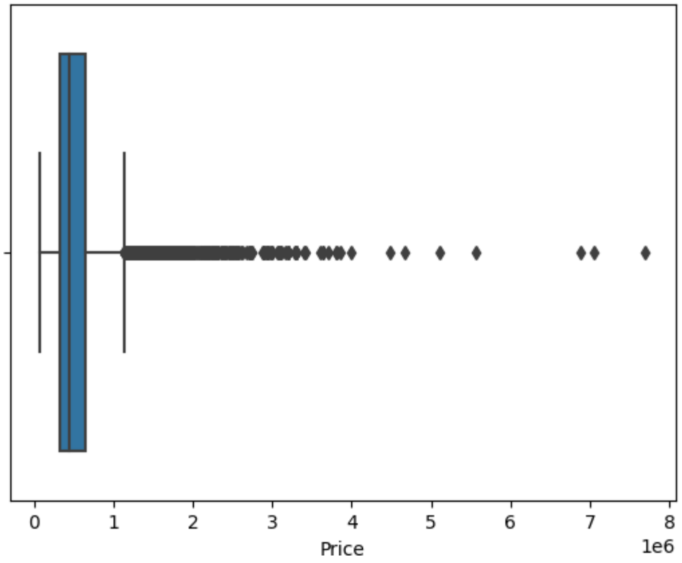
```
sns.countplot(df['number of bathrooms'])
```

```
<Axes: ylabel='count'>
```



```
sns.boxplot(x=df['Price'])
```

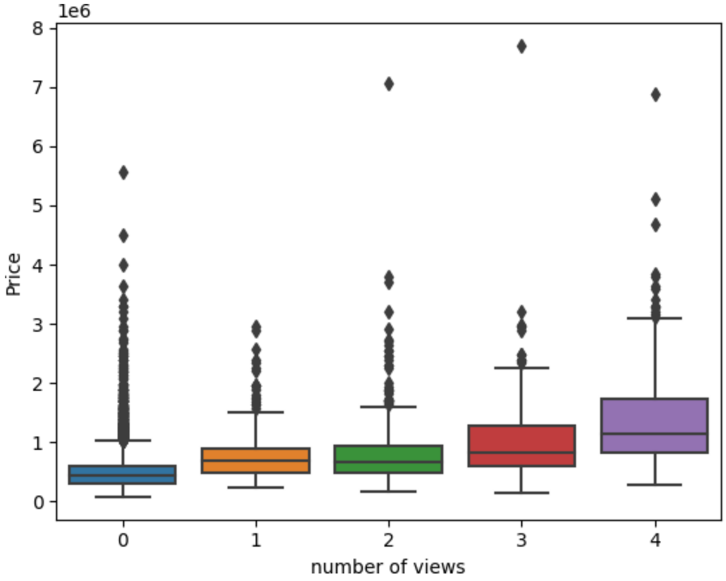
```
<Axes: xlabel='Price'>
```



Bivariate Analysis

```
sns.boxplot(x=df['number of views'],y=df['Price'])
```

```
<Axes: xlabel='number of views', ylabel='Price'>
```

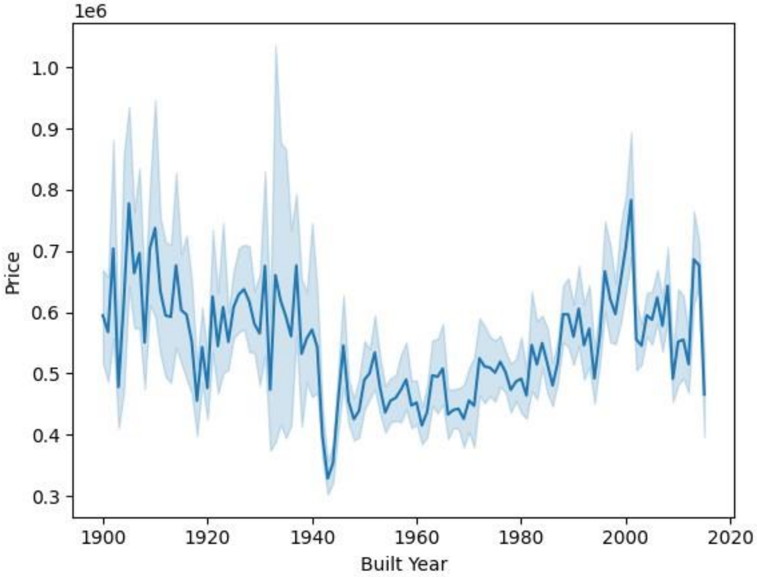


```
sns.boxplot(x=df['number of rooms'],y=df['Price'])
```

```
<Axes: xlabel='number of rooms', ylabel='Price'>
```

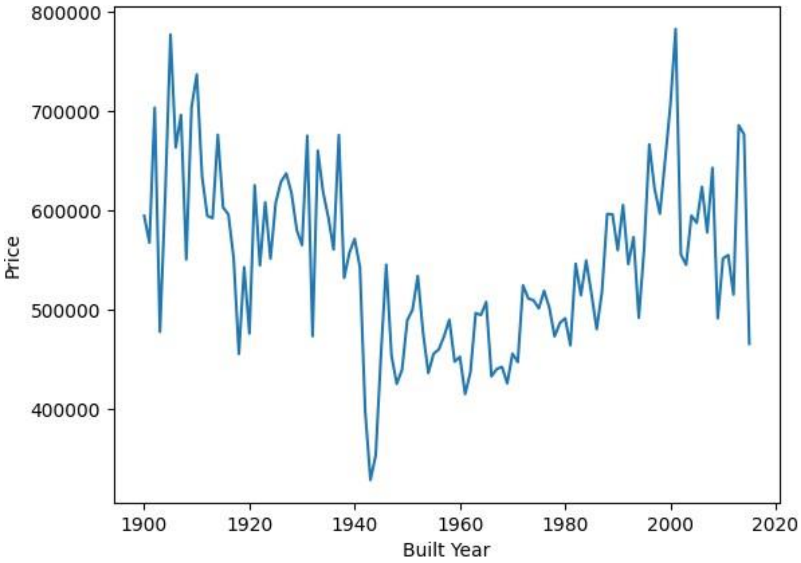
```
sns.lineplot(x=df['Built Year'],y=df['Price'])
```

```
<Axes: xlabel='Built Year', ylabel='Price'>
```



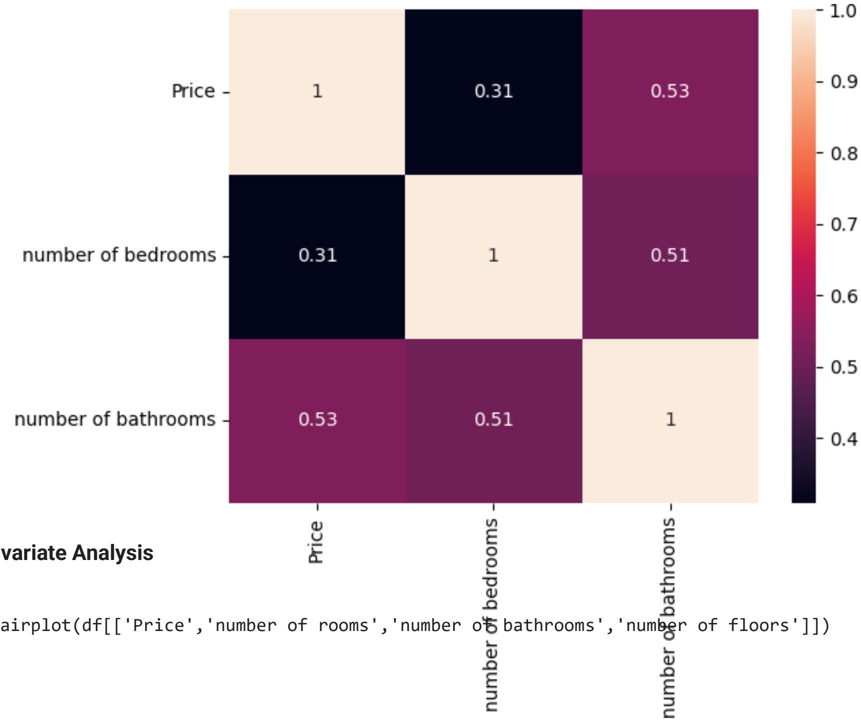
```
sns.lineplot(x=df.groupby('Built Year').mean().index,y=df.groupby('Built Year').mean()['Price'])
plt.show
```

```
<function matplotlib.pyplot.show(close=None, block=None)>
```



```
sns.heatmap(df[['Price','number of rooms','number of bathrooms']].corr(),annot=True)
```

```
<Axes: >
```



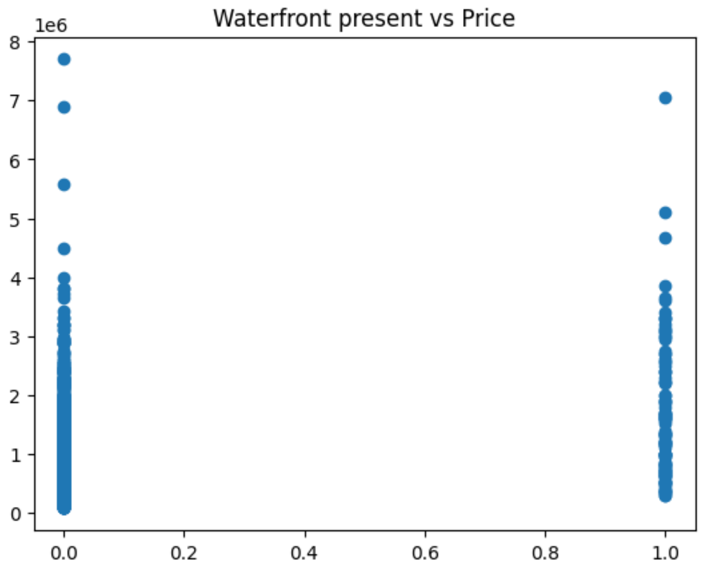
Multivariate Analysis

```
sns.pairplot(df[['Price','number of rooms','number of bathrooms','number of floors']])
```

```
df.duplicated().sum()
```

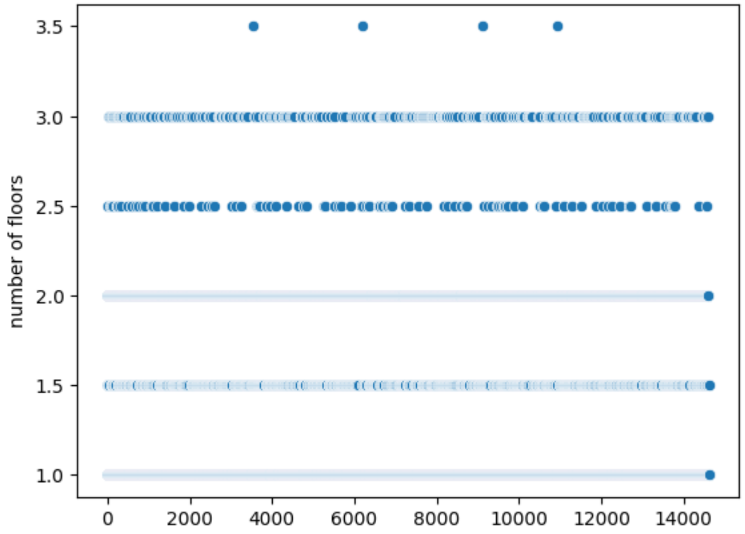
```
0
```

```
plt.scatter(df['waterfront present'],df['Price'])
plt.title("Waterfront present vs Price")
plt.grid(linestyle='-', linewidth=0.)
```

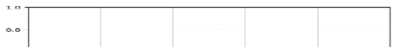


```
sns.scatterplot(df['number of floors'])
```

```
<Axes: ylabel='number of floors'>
```



```
plt.grid(linestyle='-',linewidth=0.5)
```



```
plt.subplots(figsize=(15,15))
sns.heatmap(df.drop(['id'],axis=1).corr(),linewidth=0.3,annot=True)
plt.show()
```

```
print(df.describe())
```

```
                 id          Date     number of rooms  number of bathrooms  \
count  1.462000e+04  14620.000000        14620.000000         14620.000000
mean   6.762821e+09  42604.538646            3.379343             2.129583
std    6.237575e+03     67.347991            0.938719             0.769934
min    6.762810e+09  42491.000000            1.000000             0.500000
25%    6.762815e+09  42546.000000            3.000000             1.750000
50%    6.762821e+09  42600.000000            3.000000             2.250000
75%    6.762826e+09  42662.000000            4.000000             2.500000
max    6.762832e+09  42734.000000           33.000000             8.000000

        living area      lot area  number of floors  waterfront present \
count  14620.000000  1.462000e+04      14620.000000        14620.000000
mean    2098.262996  1.509328e+04          1.502360            0.007661
```

```
std      928.275721  3.791962e+04          0.540239           0.087193
min      370.000000  5.200000e+02          1.000000           0.000000
25%     1440.000000  5.010750e+03          1.000000           0.000000
50%     1930.000000  7.620000e+03          1.500000           0.000000
75%     2570.000000  1.080000e+04          2.000000           0.000000
max    13540.000000  1.074218e+06          3.500000           1.000000

       number of views  condition of the house  ...    Built Year  \
count     14620.000000            14620.000000  ...  14620.000000
mean          0.233105                3.430506  ...   1970.926402
std           0.766259                0.664151  ...     29.493625
min           0.000000                1.000000  ...   1900.000000
25%           0.000000                3.000000  ...   1951.000000
50%           0.000000                3.000000  ...   1975.000000
75%           0.000000                4.000000  ...   1997.000000
max           4.000000                5.000000  ...   2015.000000

       Renovation Year    Postal Code     Lattitude     Longitude  \
count     14620.000000   14620.000000  14620.000000  14620.000000
mean         90.924008  122033.062244     52.792848   -114.404007
std         416.216661      19.082418      0.137522      0.141326
min           0.000000  122003.000000     52.385900   -114.709000
25%           0.000000  122017.000000     52.707600   -114.519000
50%           0.000000  122032.000000     52.806400   -114.421000
75%           0.000000  122048.000000     52.908900   -114.315000
max        2015.000000  122072.000000     53.007600   -113.505000

       living_area_renov  lot_area_renov  Number of schools nearby  \
count       14620.000000    14620.000000              14620.000000
mean         1996.702257    12753.500068                  2.012244
std           691.093366    26058.414467                  0.817284
min           460.000000      651.000000                  1.000000
25%          1490.000000     5097.750000                  1.000000
50%          1850.000000     7620.000000                  2.000000
75%          2380.000000    10125.000000                  3.000000
max          6110.000000   560617.000000                  3.000000

       Distance from the airport         Price
count               14620.000000  1.462000e+04
mean                   64.950958  5.389322e+05
std                     8.936008  3.675324e+05
min                    50.000000  7.800000e+04
25%                    57.000000  3.200000e+05
50%                    65.000000  4.500000e+05
```

```
print(df.count())
```

```
id                                       14620
Date                                     14620
number of rooms                          14620
number of bathrooms                      14620
living area                              14620
lot area                                 14620
number of floors                         14620
waterfront present                       14620
number of views                          14620
condition of the house                   14620
grade of the house                       14620
Area of the house(excluding basement)    14620
Area of the basement                     14620
Built Year                               14620
Renovation Year                          14620
Postal Code                              14620
Lattitude                                14620
Longitude                                14620
living_area_renov                        14620
lot_area_renov                           14620
Number of schools nearby                 14620
Distance from the airport                14620
Price                                    14620
dtype: int64
```

```
print(df.corr())
```

```
id                                                  -0.004821
Date                                                -0.004071
number of rooms                                      0.003397
number of bathrooms                                  0.002180
living area                                          0.002370
lot area                                            -0.012671
number of floors                                    -0.007579
waterfront present                                   0.001563
number of views                                      0.008004
condition of the house                              -0.006939
grade of the house                                   0.000986
Area of the house(excluding basement)               -0.002894
Area of the basement                                 0.010284
Built Year                                          -0.001631
Renovation Year                                     -0.000826
Postal Code                                          0.010605
Lattitude                                            0.014949
Longitude                                           -0.010163
living_area_renov                                   -0.001203
lot_area_renov                                      -0.025014
Number of schools nearby                             1.000000
Distance from the airport                            0.004035
Price                                                0.009890

                                       Distance from the airport     Price
id                                                     -0.004542 -0.773114
Date                                                    0.011457 -0.027919
number of rooms                                        -0.006157  0.308460
number of bathrooms                                     0.009206  0.531735
living area                                             0.002511  0.712169
lot area                                                0.003291  0.081992
number of floors                                        0.016567  0.262732
waterfront present                                      0.001448  0.263687
number of views                                        -0.001657  0.395973
condition of the house                                 -0.002136  0.041376
grade of the house                                      0.004940  0.671814
Area of the house(excluding basement)                   0.001222  0.615220
Area of the basement                                    0.002926  0.330202
Built Year                                             -0.003968  0.050307
Renovation Year                                         0.005342  0.133173
Postal Code                                             0.011528 -0.115908
Lattitude                                               0.007193  0.297490
Longitude                                              -0.003100  0.024414
living_area_renov                                      -0.005673  0.584924
lot_area_renov                                         -0.014587  0.075535
Number of schools nearby                                0.004035  0.009890
Distance from the airport                               1.000000  0.003804
Price                                                   0.003804  1.000000

[23 rows x 23 columns]
```

```
print(df['Number of schools nearby'].value_counts())
```

```
3    4973
2    4853
1    4794
Name: Number of schools nearby, dtype: int64
```

```
print('Mean:',df['Distance from the airport'].mean())
print('Median:',df['Area of the basement'].median())
print('Mode:',df['grade of the house'].mode())
```

```
Mean: 64.95095759233926
Median: 0.0
Mode: 0    7
Name: grade of the house, dtype: int64
```

Handle the Missing values

```
print(df.isnull().sum())
```

```
id                                     0
Date                                   0
number of rooms                        0
number of bathrooms                    0
living area                            0
lot area                               0
number of floors                       0
waterfront present                     0
number of views                        0
condition of the house                 0
```

```
grade of the house                       0
Area of the house(excluding basement)    0
Area of the basement                     0
Built Year                               0
Renovation Year                          0
Postal Code                              0
Lattitude                                0
Longitude                                0
living_area_renov                        0
lot_area_renov                           0
Number of schools nearby                 0
Distance from the airport                0
Price                                    0
dtype: int64
```

```
df.dropna(inplace=True)
```

```
df.fillna(0,inplace=True)
```

```
df.interpolate(inplace=True)
```

```
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import MinMaxScaler
```

```
x=df.drop(['Price','Date'],axis=1)
x.set_index(['id'],inplace=True)
y=df[['id','Price']]
```

```
x.head()
```

	number of rooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views	condition of the house	grade of the house	Area of the house(excluding basement)	Area of the basement	Built Year	Renovatio Yea
id													
6762810145	5	2.50	3650	9050	2.0	0	4	5	10	3370	280	1921	
6762810635	4	2.50	2920	4000	1.5	0	0	5	8	1910	1010	1909	
6762810998	5	2.75	2910	9480	1.5	0	0	3	8	2910	0	1939	
6762812605	4	2.50	3310	42998	2.0	0	0	3	9	3310	0	2001	
6762812919	3	2.00	2710	4500	1.5	0	0	4	8	1880	830	1929	

```
y.head()
```

	id	Price
0	6762810145	2380000
1	6762810635	1400000
2	6762810998	1200000
3	6762812605	838000
4	6762812919	805000

```
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor
from sklearn.ensemble import GradientBoostingRegressor
from sklearn.metrics import r2_score
```

```
x_train,x_test,y_train,y_test = train_test_split(x,y['Price'],test_size =0.1,random_state=2)
model = GradientBoostingRegressor(n_estimators=400,max_depth=5,min_samples_split=2,learning_rate=0.1)
model.fit(x_train,y_train)
```

```
▾         GradientBoostingRegressor
```

```
y_pred = model.predict(x_test)
model.score(x_test,y_test)
```

```
0.9130832899171425
```

```
r2_score(y_pred,y_test)
```

```
0.9024515293863141
```

```
y_pred
```

```
array([497766.12740438, 244495.3776842 , 293819.40063242, ...,
       698495.60350629, 297006.00386358, 245881.76921871])
```

```
y_pred_list = y['id'][-len(y_pred):].tolist()
```

```
y_pred_df=pd.DataFrame(y_pred_list,columns=['ID'])
y_pred_df['Predicted Price']= y_pred.round(2)
```

```
y_pred_df
```

	ID	Predicted Price
0	6762811233	497766.13
1	6762811403	244495.38
2	6762811775	293819.40
3	6762811861	397555.35
4	6762812009	474843.29
...	...	...
1457	6762830250	1041014.57
1458	6762830339	317512.59
1459	6762830618	698495.60
1460	6762830709	297006.00
1461	6762831463	245881.77

1462 rows × 2 columns