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

Choose Files House Price India.csv

- **House Price India.csv**(text/csv) - 1524561 bytes, last modified: 10/2/2023 - 100% done

```
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 bedrooms	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

5 rows × 23 columns

```
df.tail()
```

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

5 rows × 23 columns

```
df
```

	id	Date	number of bedrooms	number of bathrooms	living area	lot area	number of floors	waterfront present	num vi
0	6762810145	42491	5	2.50	3650	9050	2.0	0	
1	6762810635	42491	4	2.50	2920	4000	1.5	0	
2	6762810998	42491	5	2.75	2910	9480	1.5	0	
3	6762812605	42491	4	2.50	3310	42998	2.0	0	

```
df.columns
```

```
Index(['id', 'Date', 'number of bedrooms', '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 bedrooms                        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.shape
```

```
(14620, 23)
```

Univariate Analysis

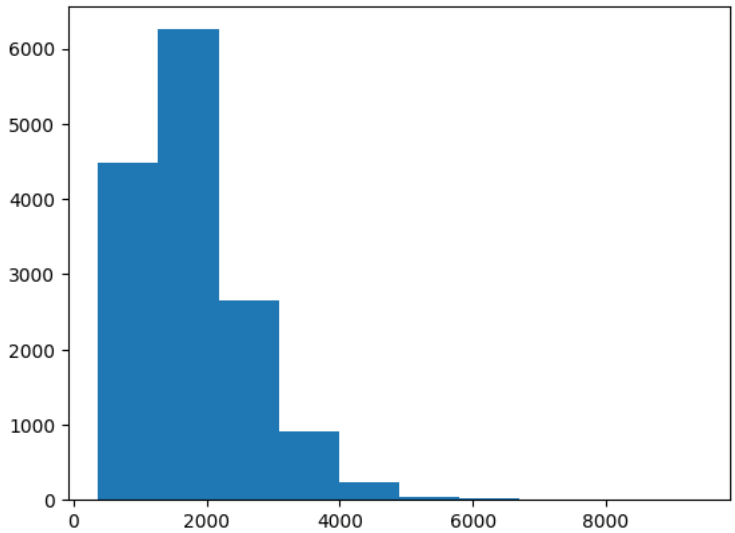
```
print(df.describe())
```

```
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
```

```
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
max                    80.000000  7.700000e+06

[8 rows x 23 columns]
```

```
plt.hist(df['Area of the house(excluding basement)'])
```

```
(array([4.479e+03, 6.255e+03, 2.653e+03, 9.190e+02, 2.440e+02, 4.600e+01,
        1.800e+01, 1.000e+00, 2.000e+00, 3.000e+00]),
 array([ 370., 1274., 2178., 3082., 3986., 4890., 5794., 6698., 7602.,
        8506., 9410.]),
 <BarContainer object of 10 artists>)
```

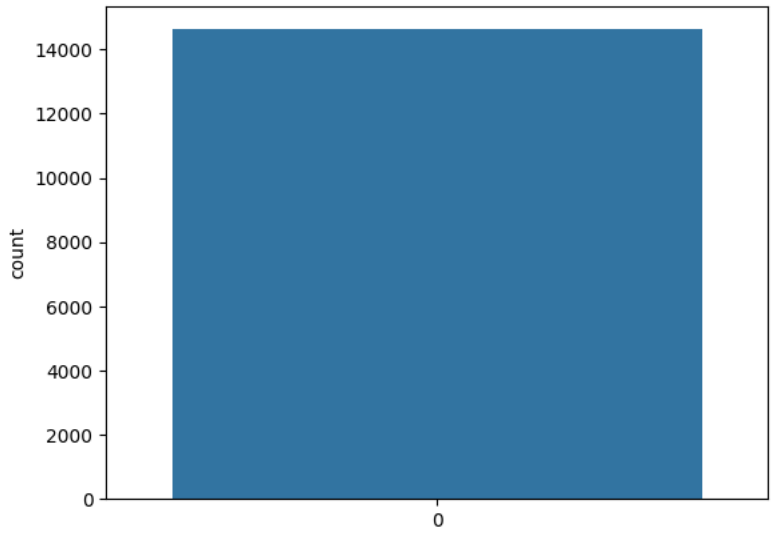



```
sns.countplot(df['number of floors'])
```

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

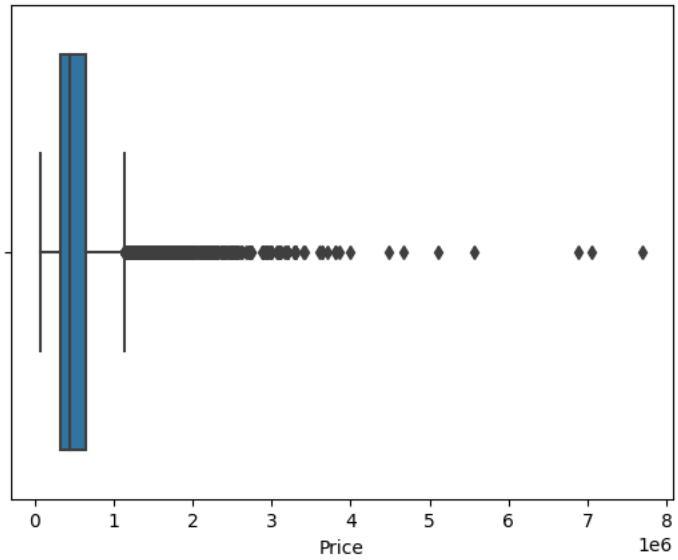

```
sns.countplot(df['number of bathrooms'])
```

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




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

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

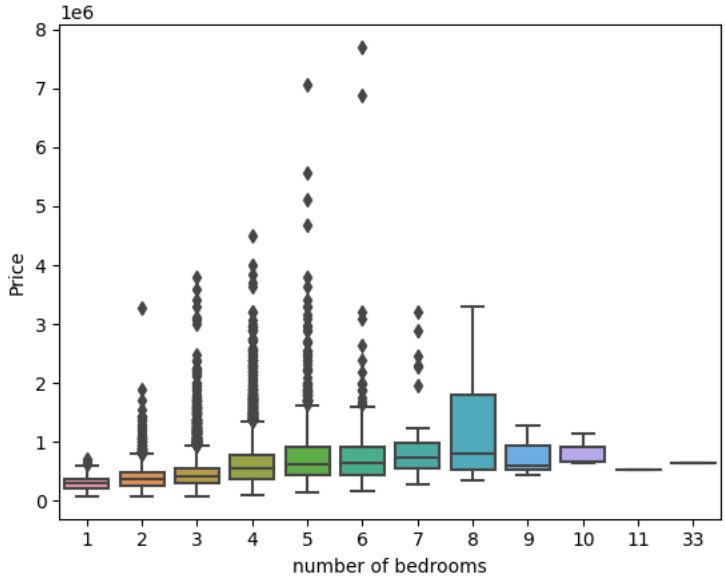



```
sns.boxplot(x=df['number of views'],y=df['Price'])
```

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

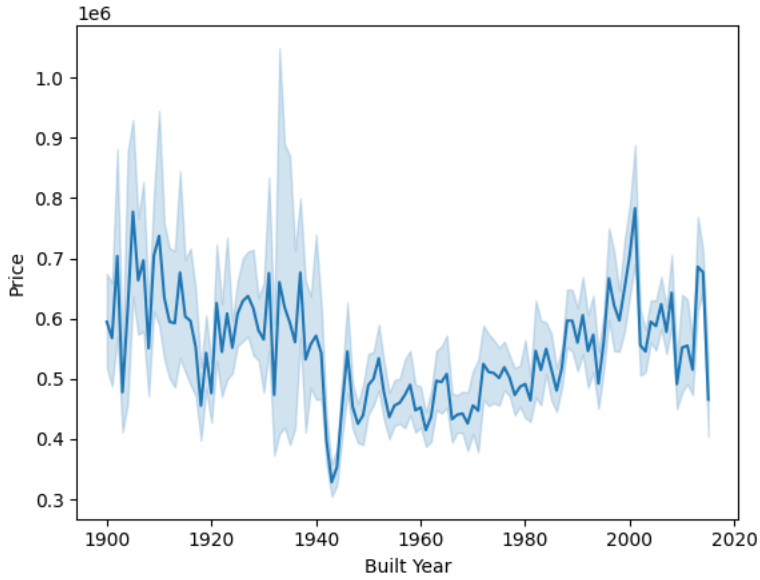

```
sns.boxplot(x=df['number of bedrooms'],y=df['Price'])
```

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




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

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

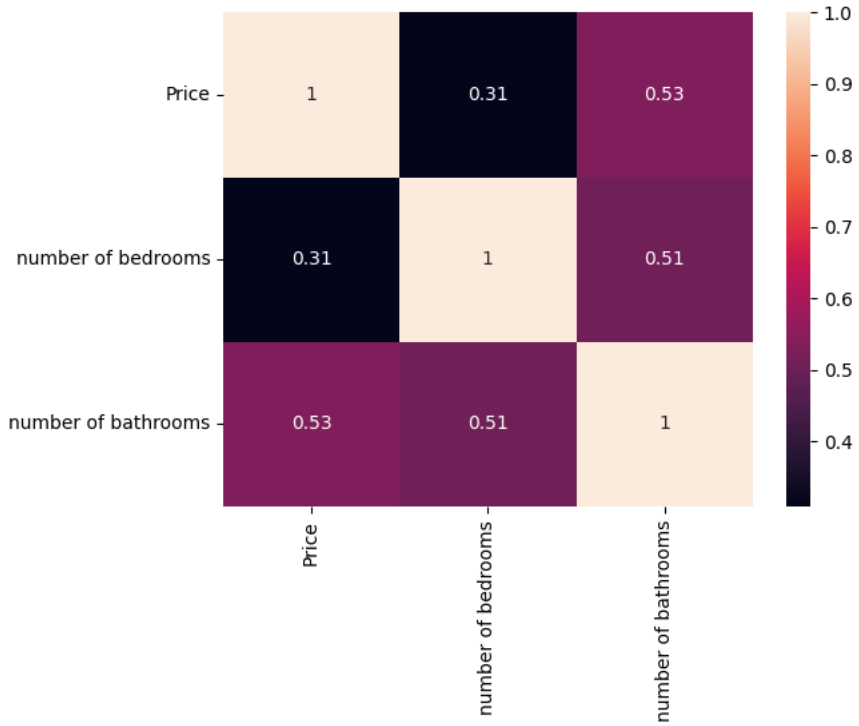



```
sns.lineplot(x=df.groupby('Built Year').mean().index,y=df.groupby('Built Year').mean()['Price'])
plt.show
()
```

```
()
```


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

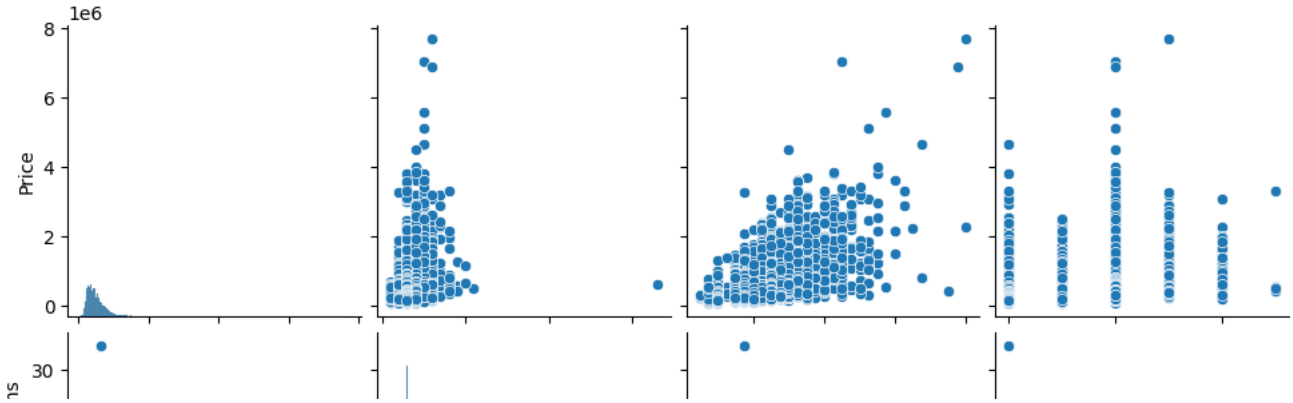
```
<Axes: >
```



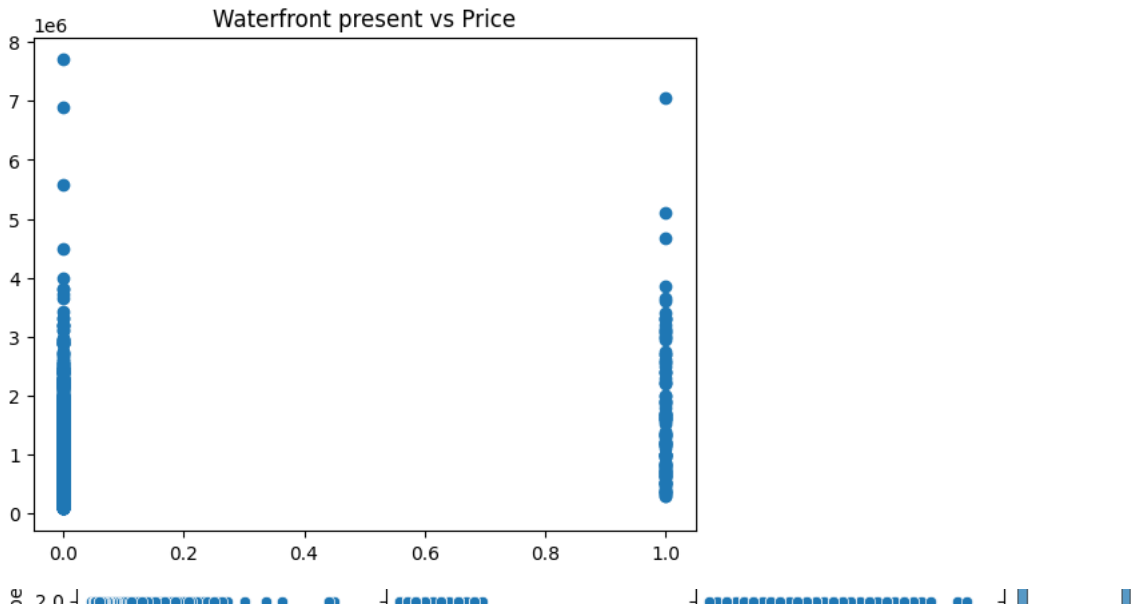
Multivariate Analysis

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

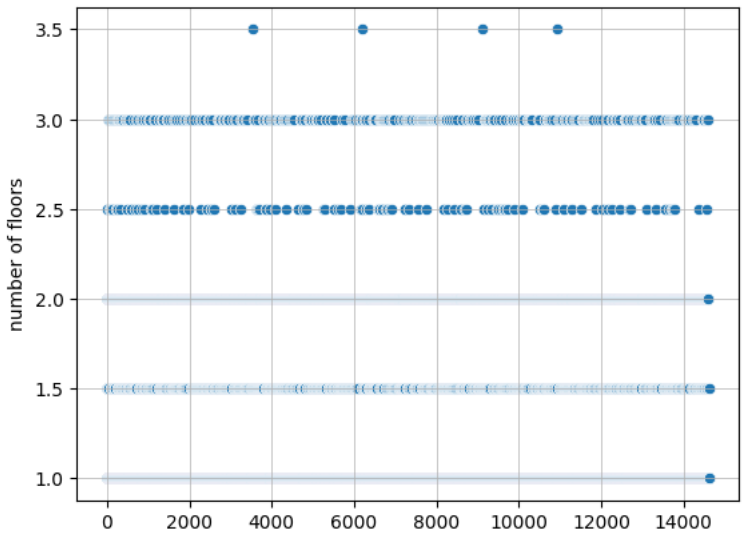
```
<seaborn.axisgrid.PairGrid at 0x7eb67ed5e560>
```



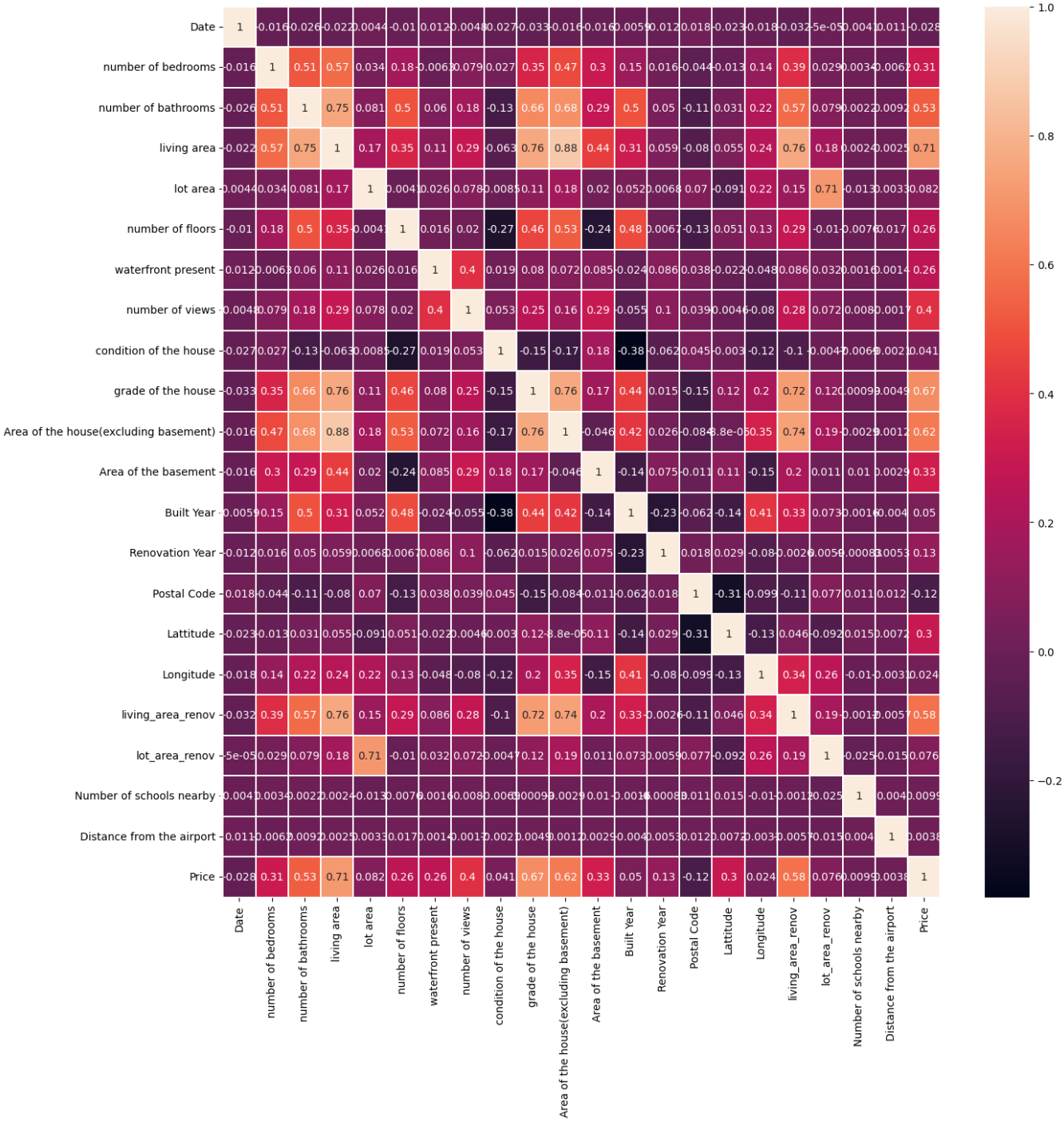

```
plt.scatter(df['waterfront present'],df['Price'])
plt.title("Waterfront present vs Price")
plt.grid(linestyle='-', linewidth=0.)
```




```
sns.scatterplot(df['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())
```

```
       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
```

```
       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
       max                    80.000000  7.700000e+06

       [8 rows x 23 columns]
```

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

```
       id                                      14620
       Date                                    14620
       number of bedrooms                      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())
```

```
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 bedrooms                                       -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 bedrooms                       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 bedrooms	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	Renov
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
GradientBoostingRegressor(max_depth=5, n_estimators=400)
```

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

```
0.9120405728552035
```

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

```
0.9013368036549116
```

```
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