au611220104040-assignment-3

October 20, 2023

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

```
<IPython.core.display.HTML object>
```

```
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	\
0	6762810145	42491	5	2.50	3650	
1	6762810635	42491	4	2.50	2920	
2	6762810998	42491	5	2.75	2910	
3	6762812605	42491	4	2.50	3310	
4	6762812919	42491	3	2.00	2710	

	lot area	number of floors	waterfront present	number of views	\
0	9050	2.0	0	4	
1	4000	1.5	0	0	
2	9480	1.5	0	0	
3	42998	2.0	0	0	
4	4500	1.5	0	0	

	condition of the house	…	Built Year	Renovation Year	Postal Code	\
0	5	…	1921	0	122003	
1	5	…	1909	0	122004	
2	3	…	1939	0	122004	

```
3                     3  …        2001                0       122005
4                     4  …        1929                0       122006

   Lattitude  Longitude  living_area_renov  lot_area_renov  \
0    52.8645   -114.557               2880            5400
1    52.8878   -114.470               2470            4000
2    52.8852   -114.468               2940            6600
3    52.9532   -114.321               3350           42847
4    52.9047   -114.485               2060            4500

   Number of schools nearby  Distance from the airport    Price
0                         2                         58  2380000
1                         2                         51  1400000
2                         1                         53  1200000
3                         3                         76   838000
4                         1                         51   805000

[5 rows x 23 columns]
```

[ ]:
```
df.tail()
```

[ ]:
```
               id   Date  number of bedrooms  number of bathrooms  \
14615  6762830250  42734                   2                  1.5
14616  6762830339  42734                   3                  2.0
14617  6762830618  42734                   2                  1.0
14618  6762830709  42734                   4                  1.0
14619  6762831463  42734                   3                  1.0

       living area  lot area  number of floors  waterfront present  \
14615         1556     20000               1.0                   0
14616         1680      7000               1.5                   0
14617         1070      6120               1.0                   0
14618         1030      6621               1.0                   0
14619          900      4770               1.0                   0

       number of views  condition of the house  …  Built Year  \
14615                0                       4  …        1957
14616                0                       4  …        1968
14617                0                       3  …        1962
14618                0                       4  …        1955
14619                0                       3  …        1969

       Renovation Year  Postal Code  Lattitude  Longitude  living_area_renov  \
14615                0       122066    52.6191   -114.472               2250
14616                0       122072    52.5075   -114.393               1540
14617                0       122056    52.7289   -114.507               1130
14618                0       122042    52.7157   -114.411               1420
```

```
14619             2009       122018    52.5338   -114.552                 900

       lot_area_renov  Number of schools nearby  Distance from the airport  \
14615           17286                         3                         76
14616            7480                         3                         59
14617            6120                         2                         64
14618            6631                         3                         54
14619            3480                         2                         55

        Price
14615  221700
14616  219200
14617  209000
14618  205000
14619  146000

[5 rows x 23 columns]
```

[ ]:
```
df
```

[ ]:
```
                id   Date  number of bedrooms  number of bathrooms  \
0       6762810145  42491                   5                 2.50
1       6762810635  42491                   4                 2.50
2       6762810998  42491                   5                 2.75
3       6762812605  42491                   4                 2.50
4       6762812919  42491                   3                 2.00
…              …    …                     …                    …
14615   6762830250  42734                   2                 1.50
14616   6762830339  42734                   3                 2.00
14617   6762830618  42734                   2                 1.00
14618   6762830709  42734                   4                 1.00
14619   6762831463  42734                   3                 1.00

       living area  lot area  number of floors  waterfront present  \
0             3650      9050               2.0                   0
1             2920      4000               1.5                   0
2             2910      9480               1.5                   0
3             3310     42998               2.0                   0
4             2710      4500               1.5                   0
…             …        …                  …                     …
14615         1556     20000               1.0                   0
14616         1680      7000               1.5                   0
14617         1070      6120               1.0                   0
14618         1030      6621               1.0                   0
14619          900      4770               1.0                   0

       number of views  condition of the house  …  Built Year  \
```

```
0                    4                     5  …        1921
1                    0                     5  …        1909
2                    0                     3  …        1939
3                    0                     3  …        2001
4                    0                     4  …        1929
…                  …                     …  …         …
14615                0                     4  …        1957
14616                0                     4  …        1968
14617                0                     3  …        1962
14618                0                     4  …        1955
14619                0                     3  …        1969

       Renovation Year  Postal Code  Lattitude  Longitude  living_area_renov  \
0                    0       122003    52.8645   -114.557               2880
1                    0       122004    52.8878   -114.470               2470
2                    0       122004    52.8852   -114.468               2940
3                    0       122005    52.9532   -114.321               3350
4                    0       122006    52.9047   -114.485               2060
…                  …          …         …         …                  …
14615                0       122066    52.6191   -114.472               2250
14616                0       122072    52.5075   -114.393               1540
14617                0       122056    52.7289   -114.507               1130
14618                0       122042    52.7157   -114.411               1420
14619             2009       122018    52.5338   -114.552                900

       lot_area_renov  Number of schools nearby  Distance from the airport  \
0                5400                         2                         58
1                4000                         2                         51
2                6600                         1                         53
3               42847                         3                         76
4                4500                         1                         51
…                …                           …                          …
14615           17286                         3                         76
14616            7480                         3                         59
14617            6120                         2                         64
14618            6631                         3                         54
14619            3480                         2                         55

         Price
0      2380000
1      1400000
2      1200000
3       838000
4       805000
…         …
14615   221700
14616   219200
```

```
14617   209000
14618   205000
14619   146000

[14620 rows x 23 columns]
```

[ ]:
```
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.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 bedrooms                      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())
```

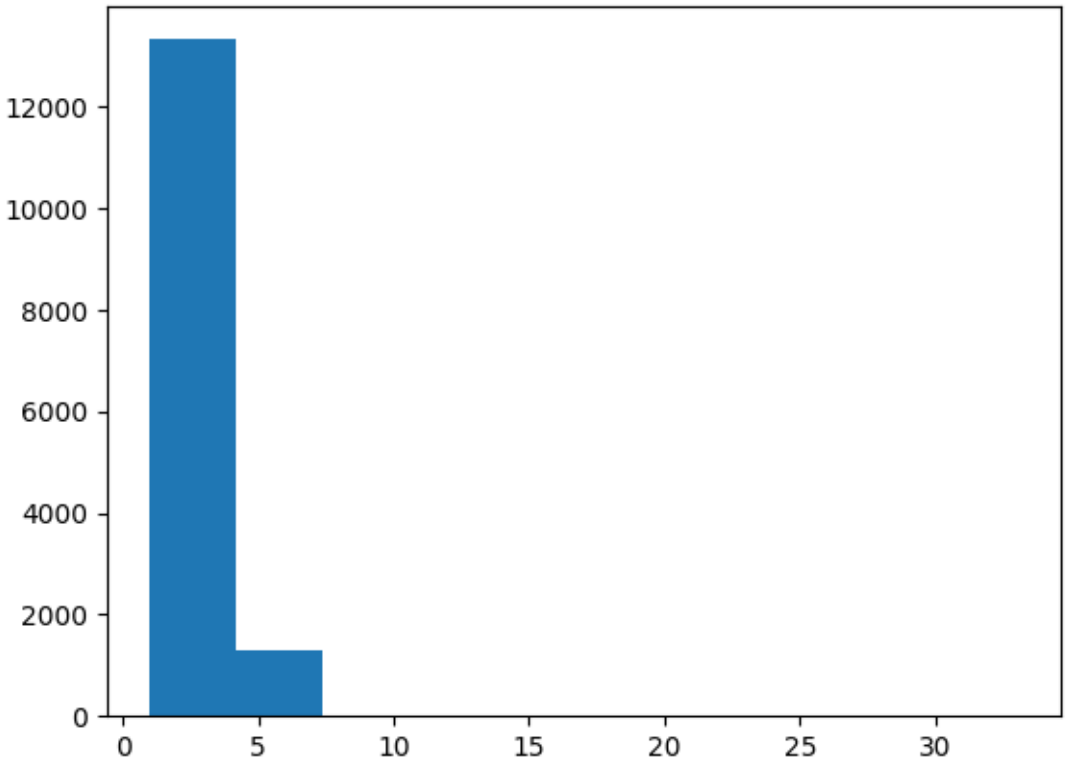
```
                 id          Date  number of bedrooms  number of bathrooms  \
count  1.462000e+04  14620.000000        14620.000000         14620.000000
mean   6.762821e+09  42604.538646            3.379343             2.129583
std    6.237575e+03     67.347991            0.938719             0.769934
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
```

```
max                    80.000000  7.700000e+06

[8 rows x 23 columns]
```

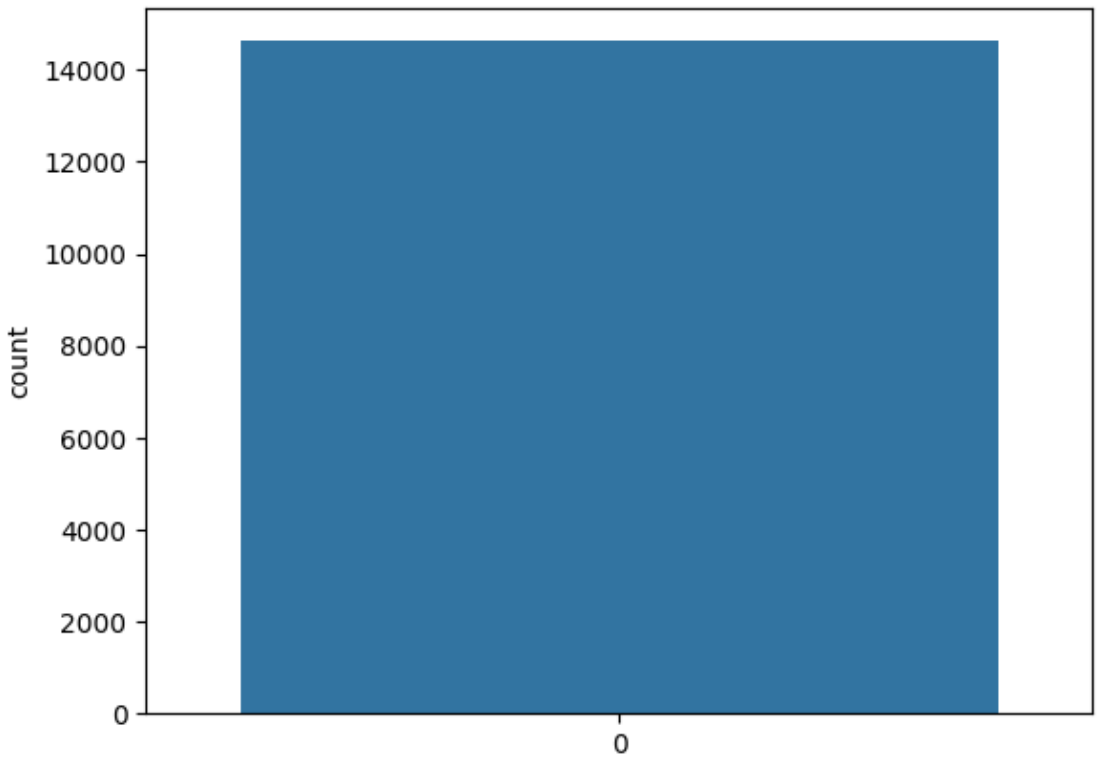
[ ]:
```
plt.hist(df['number of bedrooms'])
```

[ ]:
```
(array([1.3316e+04, 1.2850e+03, 1.7000e+01, 1.0000e+00, 0.0000e+00,
        0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 1.0000e+00]),
 array([ 1. ,  4.2,  7.4, 10.6, 13.8, 17. , 20.2, 23.4, 26.6, 29.8, 33. ]),
 <BarContainer object of 10 artists>)
```



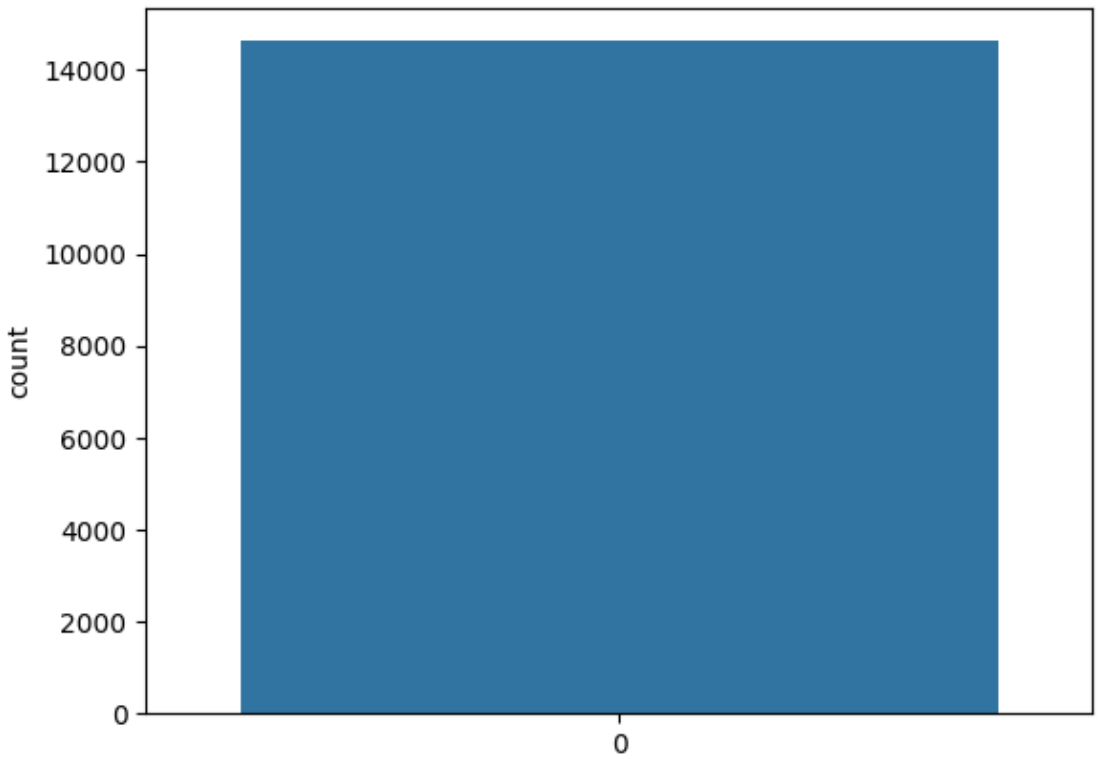
[ ]:
```
sns.countplot(df['living area'])
```

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



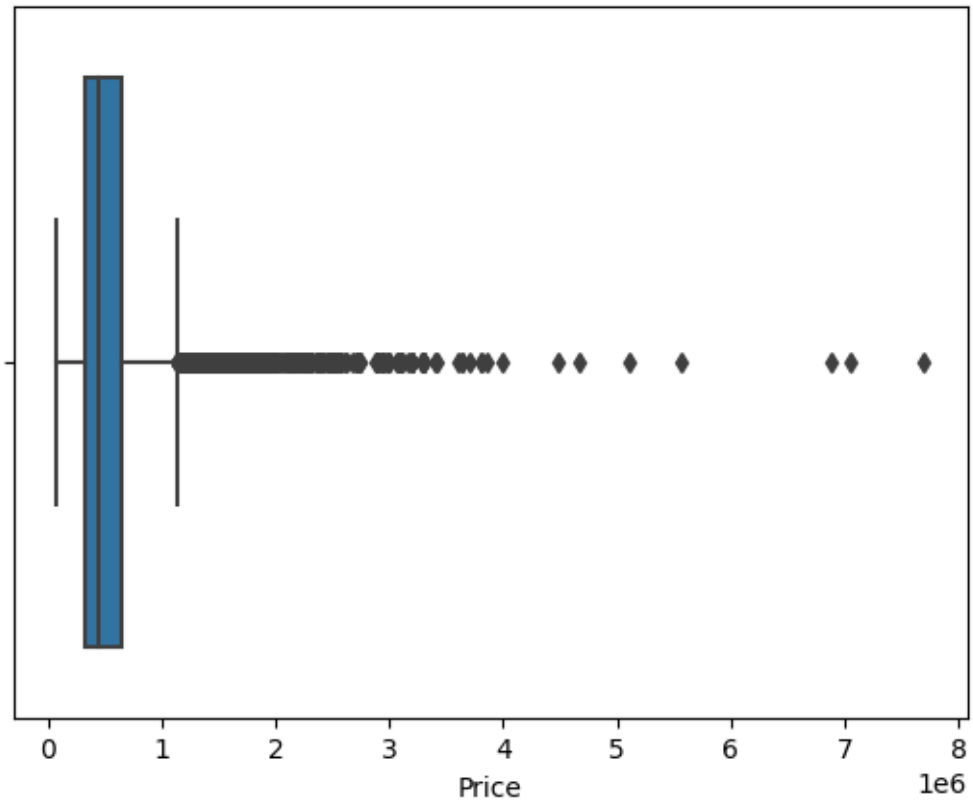
[ ]:
```
sns.countplot(df['number of floors'])
```

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



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

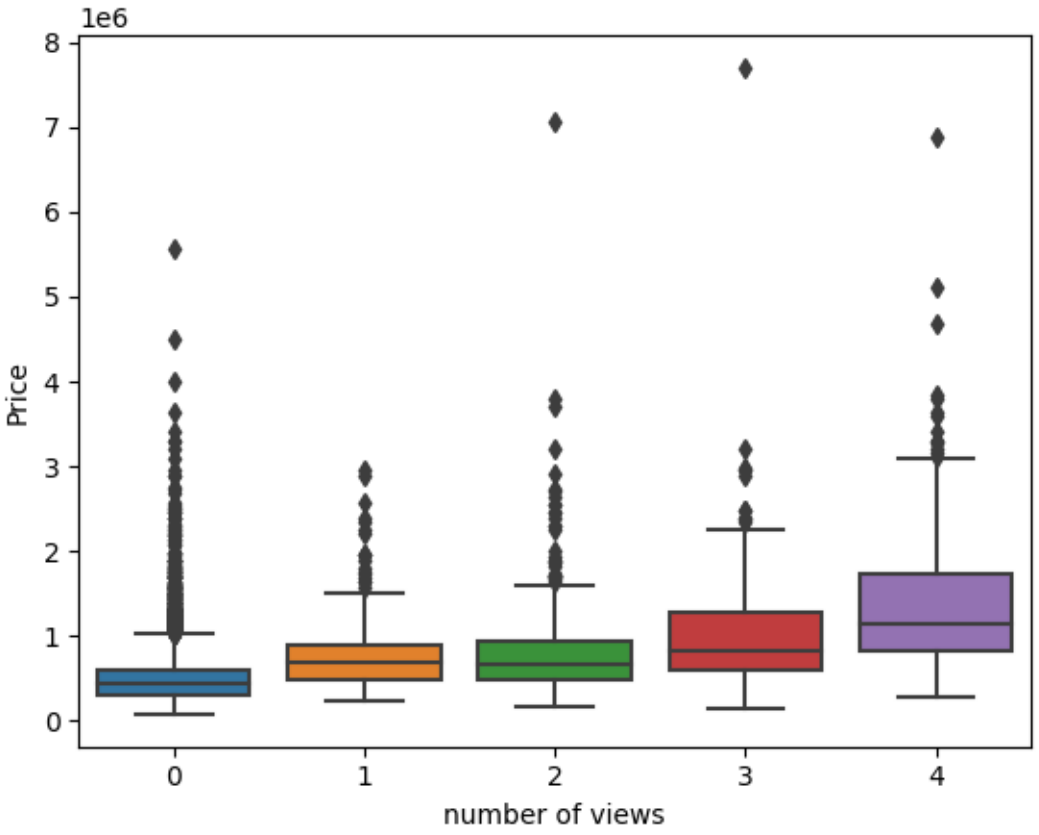
[ ]:
```
<Axes: xlabel='Price'>
```



Bivariate Analysis

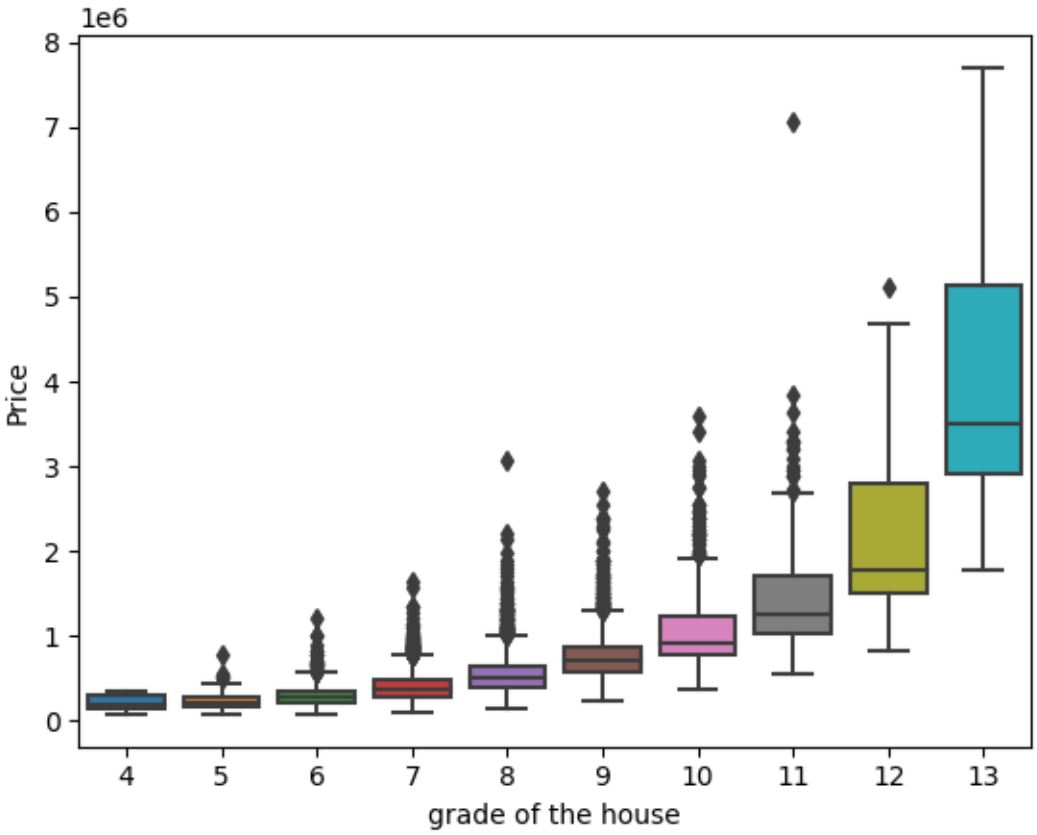
[ ]:
```
sns.boxplot(x=df['number of views'],y=df['Price'])
```

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



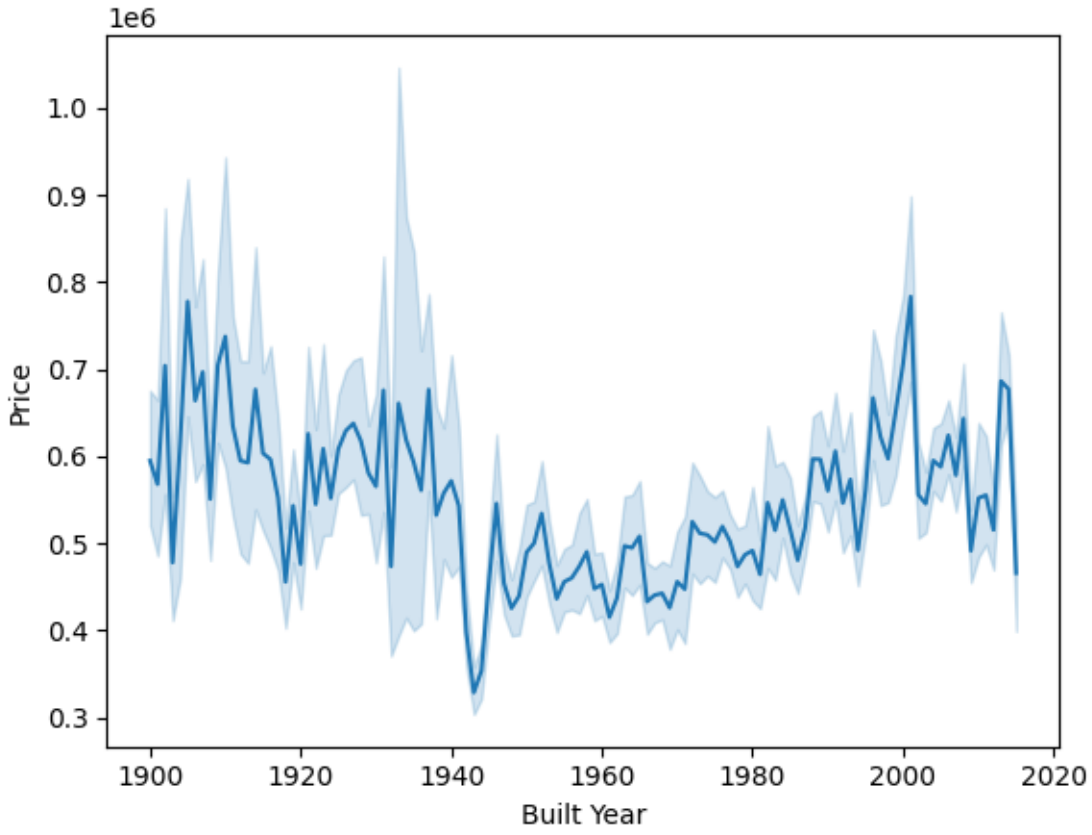
[ ]:
```
sns.boxplot(x=df['grade of the house'],y=df['Price'])
```

[ ]: <Axes: xlabel='grade of the house', ylabel='Price'>



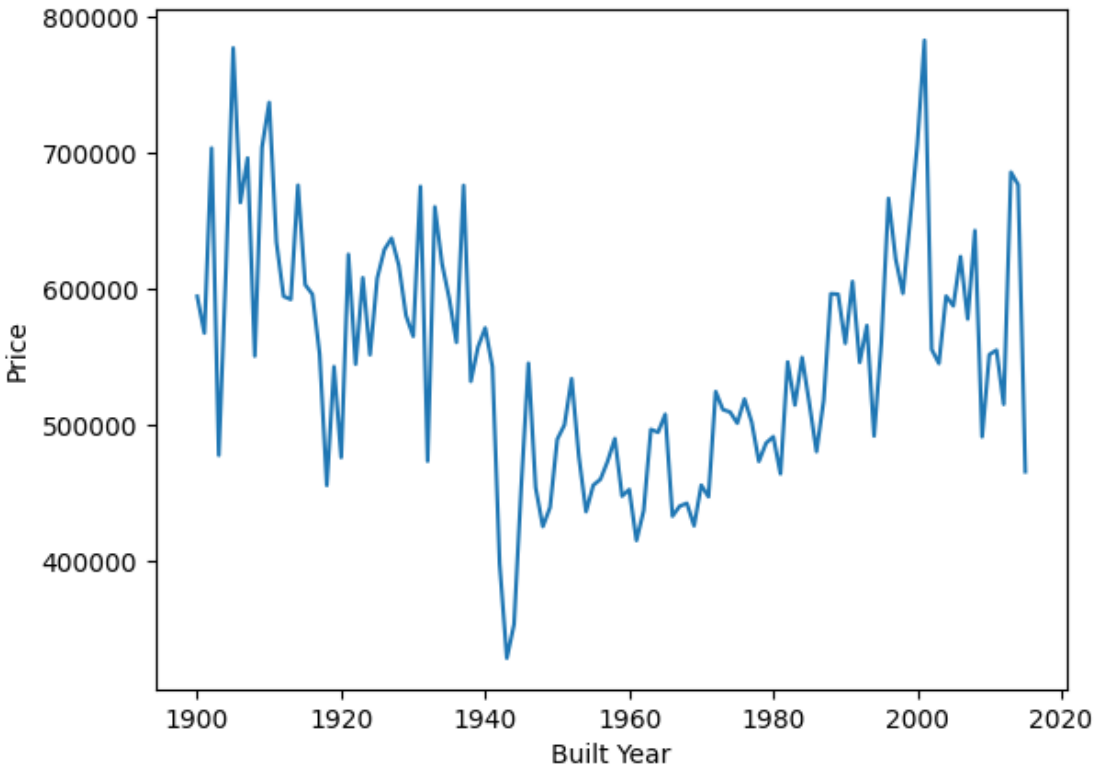
[ ]:
```
sns.lineplot(x=df['Built Year'],y=df['Price'])
```

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



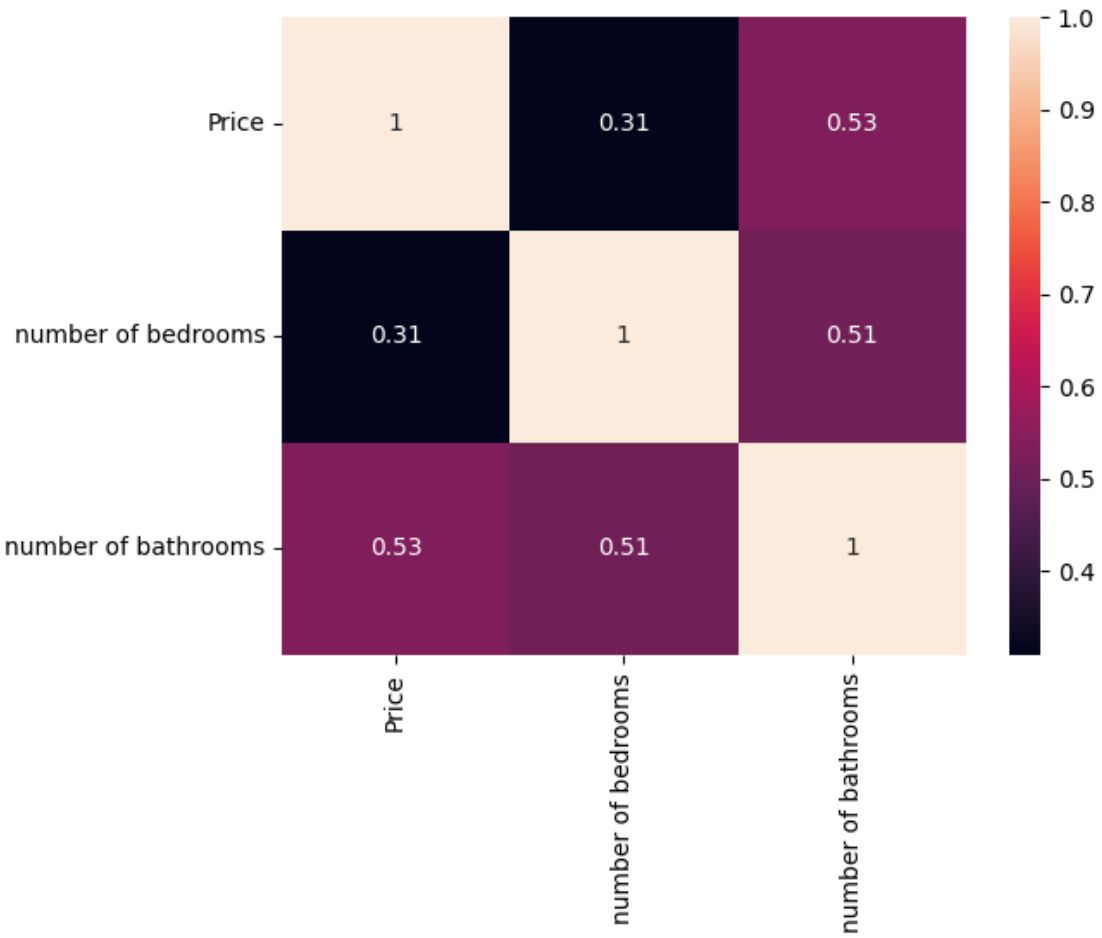
[ ]:
```
sns.lineplot(x=df.groupby('Built Year').mean().index,y=df.groupby('Built Year').
  ↪mean()['Price'])
plt.show
```

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



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

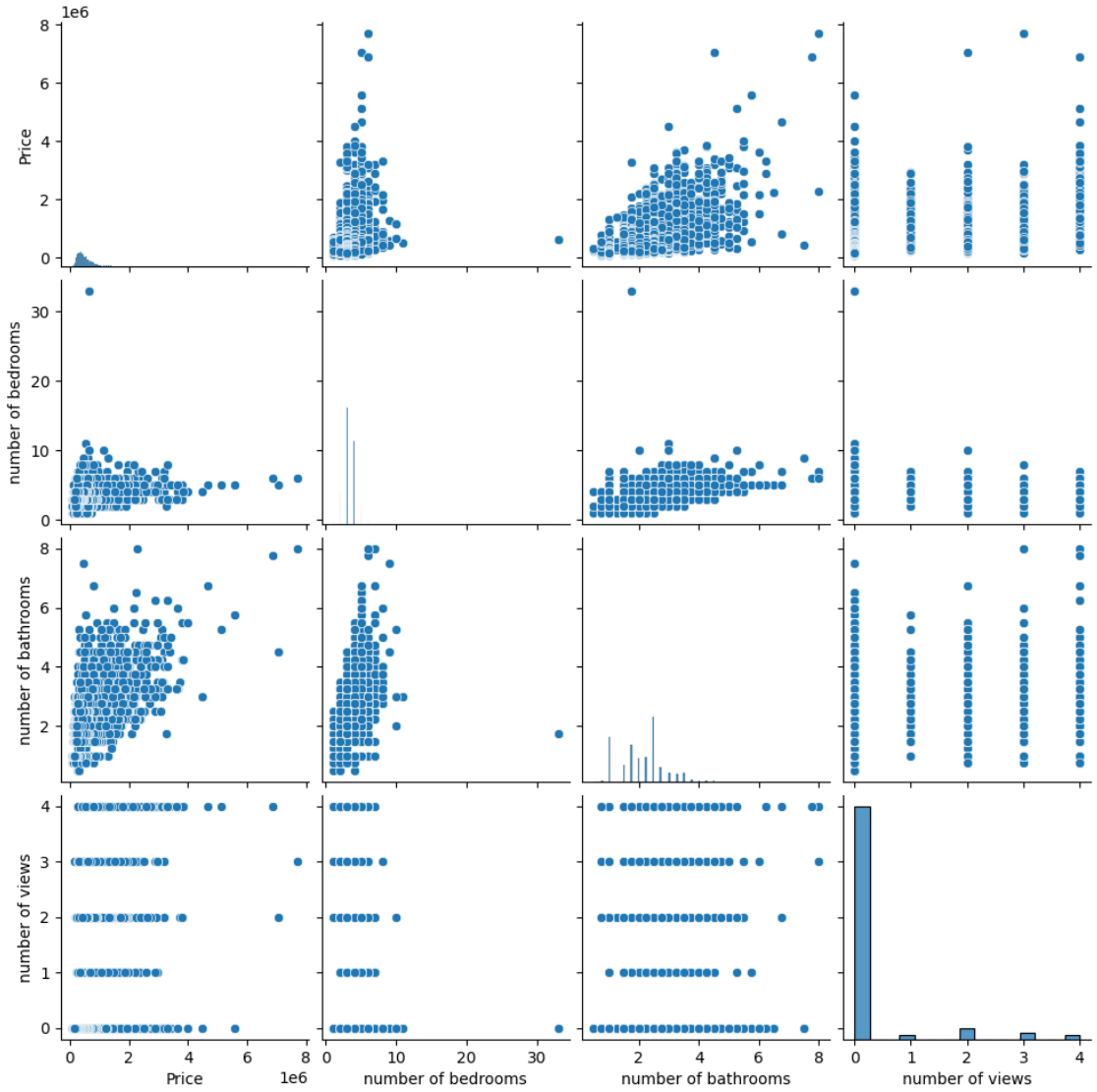
[ ]: <Axes: >



Multivariate Analysis

[ ]:
```
sns.pairplot(df[['Price','number of bedrooms','number of bathrooms','number of␣
↪views']])
```

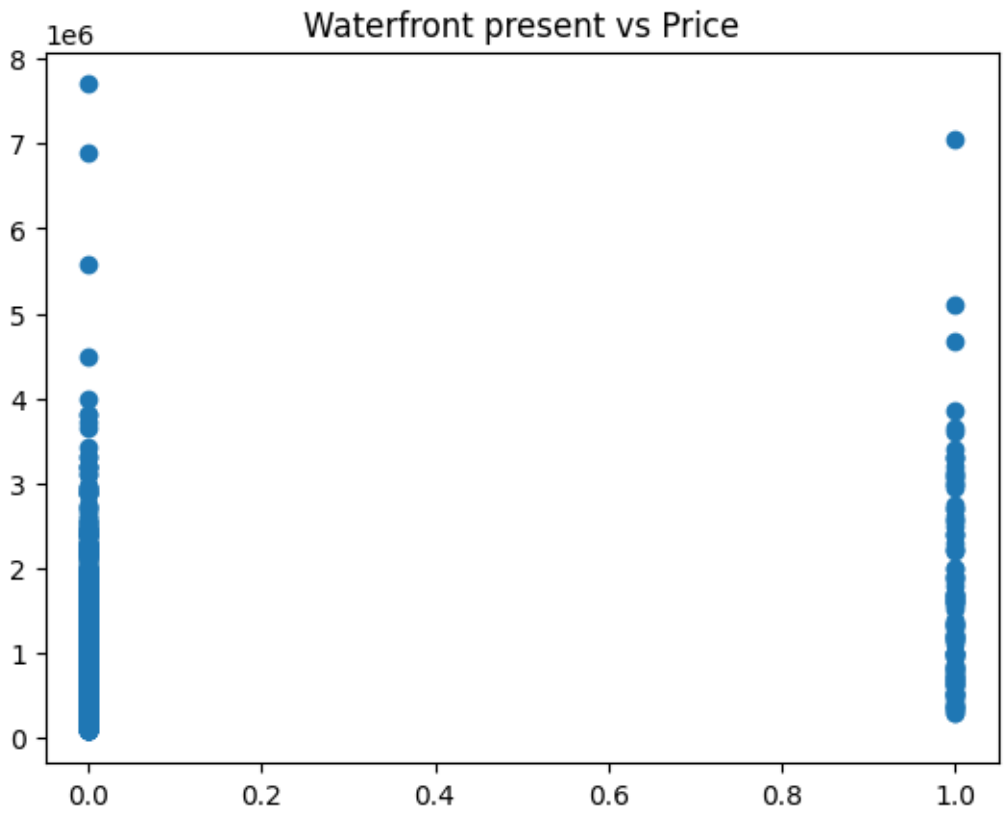
[ ]:
```
<seaborn.axisgrid.PairGrid at 0x7dad794a97e0>
```



[ ]:
```
df.duplicated().sum()
```

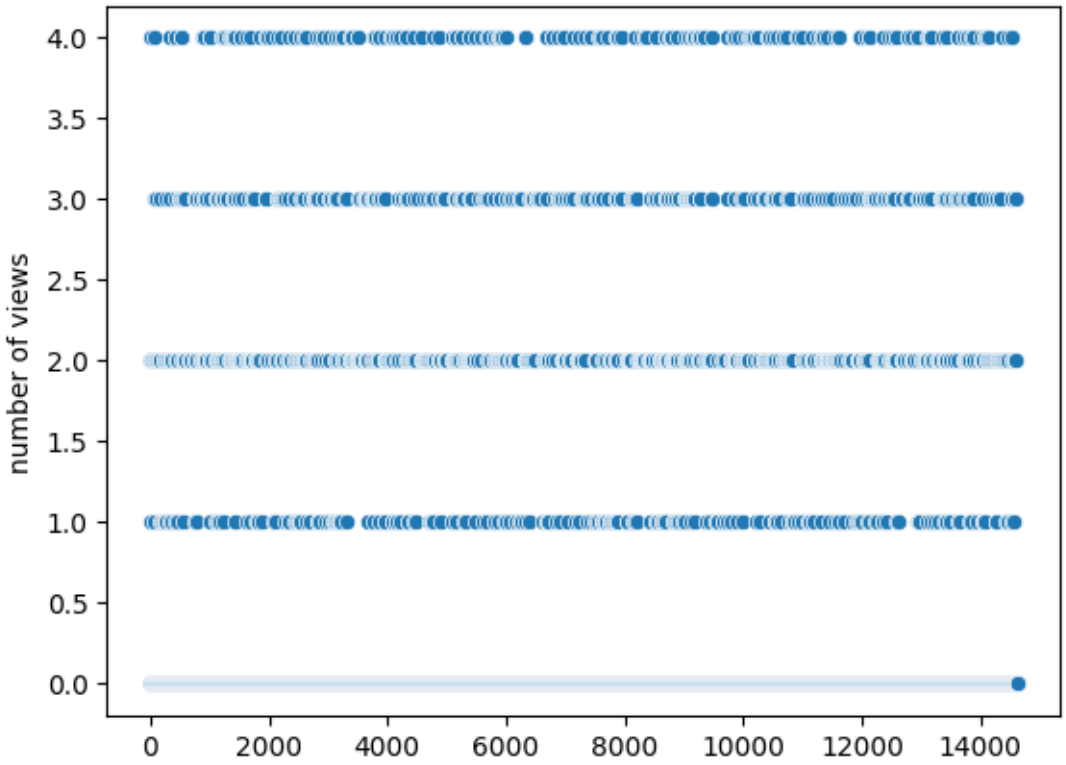
[ ]: 0

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

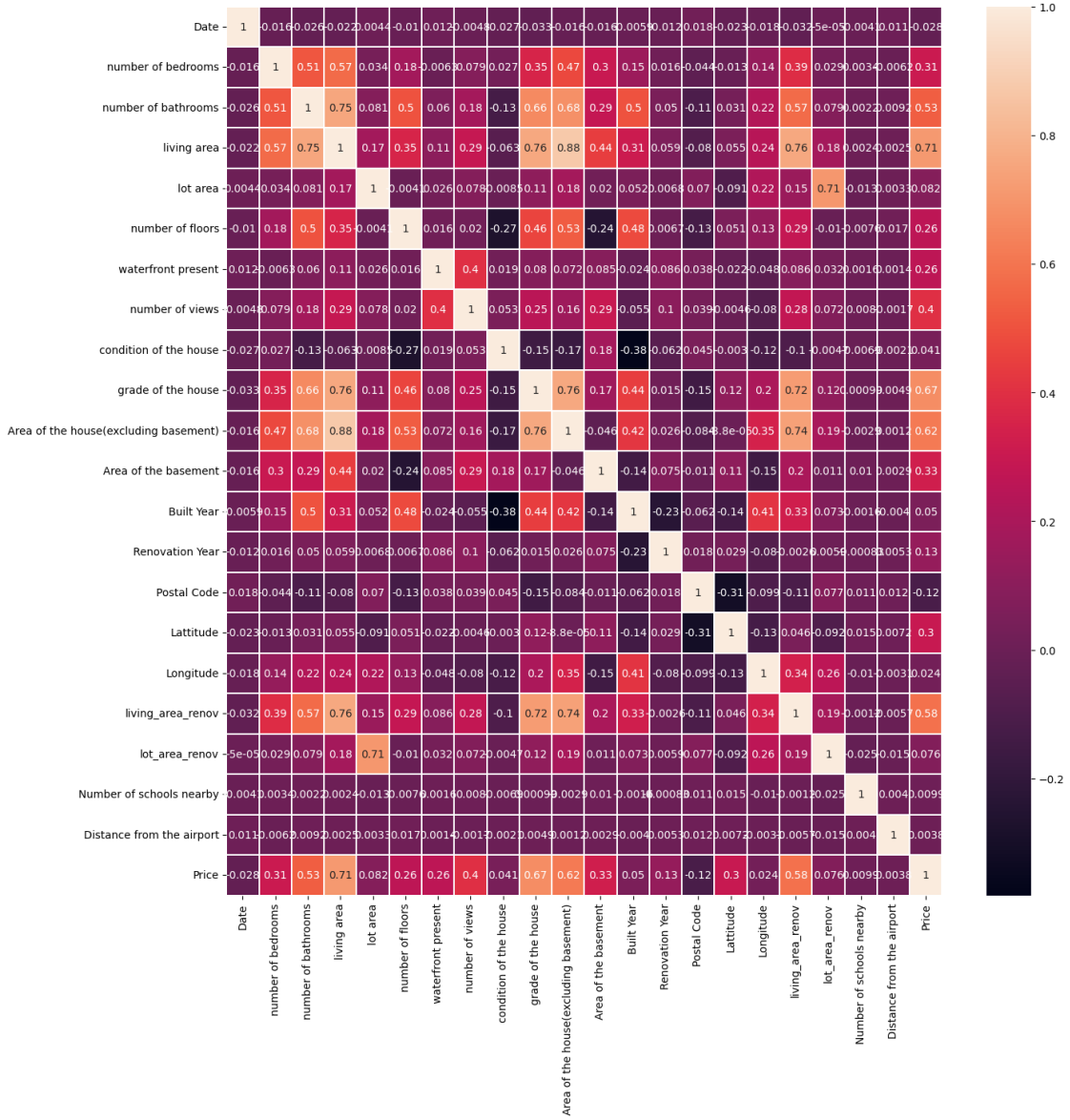


[ ]:
```
sns.scatterplot(df['number of views'])
```

[ ]:
```
<Axes: ylabel='number of views'>
```



[ ]:
```
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 bedrooms  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
```

```
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())
```

```
                                            id      Date  number of bedrooms  \
id                                    1.000000  0.045966           -0.329034
Date                                  0.045966  1.000000           -0.015663
number of bedrooms                   -0.329034 -0.015663            1.000000
number of bathrooms                  -0.516909 -0.026485            0.509784
living area                          -0.648127 -0.021958            0.570526
lot area                             -0.100269  0.004392            0.034416
number of floors                     -0.312305 -0.010335            0.177294
waterfront present                   -0.112937  0.012006           -0.006257
number of views                      -0.293004 -0.004782            0.078665
condition of the house               -0.045061 -0.027402            0.026597
grade of the house                   -0.673448 -0.033097            0.352945
Area of the house(excluding basement) -0.565116 -0.015994           0.473599
Area of the basement                 -0.290806 -0.015711            0.300332
Built Year                           -0.068645 -0.005869            0.152954
```

Renovation Year	-0.109155	-0.011636	0.016132
Postal Code	0.294709	0.018243	-0.044156
Lattitude	-0.479334	-0.023327	-0.013163
Longitude	-0.070841	-0.018231	0.135712
living_area_renov	-0.599900	-0.032495	0.389855
lot_area_renov	-0.089604	-0.000050	0.029400
Number of schools nearby	-0.004821	-0.004071	0.003397
Distance from the airport	-0.004542	0.011457	-0.006157
Price	-0.773114	-0.027919	0.308460

	number of bathrooms	living area	\
id	-0.516909	-0.648127	
Date	-0.026485	-0.021958	
number of bedrooms	0.509784	0.570526	
number of bathrooms	1.000000	0.753517	
living area	0.753517	1.000000	
lot area	0.080806	0.174420	
number of floors	0.502924	0.354743	
waterfront present	0.060104	0.105837	
number of views	0.183789	0.287728	
condition of the house	-0.128232	-0.063358	
grade of the house	0.663054	0.761835	
Area of the house(excluding basement)	0.684391	0.875793	
Area of the basement	0.287190	0.441491	
Built Year	0.498127	0.309602	
Renovation Year	0.049669	0.059400	
Postal Code	-0.105546	-0.080303	
Lattitude	0.031156	0.054518	
Longitude	0.223904	0.240208	
living_area_renov	0.570530	0.757571	
lot_area_renov	0.078627	0.180312	
Number of schools nearby	0.002180	0.002370	
Distance from the airport	0.009206	0.002511	
Price	0.531735	0.712169	

	lot area	number of floors	\
id	-0.100269	-0.312305	
Date	0.004392	-0.010335	
number of bedrooms	0.034416	0.177294	
number of bathrooms	0.080806	0.502924	
living area	0.174420	0.354743	
lot area	1.000000	-0.004138	
number of floors	-0.004138	1.000000	
waterfront present	0.026282	0.016316	
number of views	0.078308	0.020153	
condition of the house	-0.008548	-0.269928	
grade of the house	0.110546	0.463082	
Area of the house(excluding basement)	0.183553	0.525643	

Area of the basement	0.019755	-0.242976
Built Year	0.051615	0.481565
Renovation Year	0.006848	0.006705
Postal Code	0.070131	-0.129788
Lattitude	-0.090983	0.050731
Longitude	0.221432	0.127550
living_area_renov	0.149744	0.285093
lot_area_renov	0.706812	-0.010120
Number of schools nearby	-0.012671	-0.007579
Distance from the airport	0.003291	0.016567
Price	0.081992	0.262732

	waterfront present	number of views	\
id	-0.112937	-0.293004	
Date	0.012006	-0.004782	
number of bedrooms	-0.006257	0.078665	
number of bathrooms	0.060104	0.183789	
living area	0.105837	0.287728	
lot area	0.026282	0.078308	
number of floors	0.016316	0.020153	
waterfront present	1.000000	0.400206	
number of views	0.400206	1.000000	
condition of the house	0.018644	0.052533	
grade of the house	0.079831	0.254532	
Area of the house(excluding basement)	0.071865	0.162672	
Area of the basement	0.085441	0.293062	
Built Year	-0.024226	-0.055357	
Renovation Year	0.085865	0.102944	
Postal Code	0.038318	0.039268	
Lattitude	-0.021795	-0.004555	
Longitude	-0.047791	-0.079706	
living_area_renov	0.085743	0.281452	
lot_area_renov	0.032055	0.072300	
Number of schools nearby	0.001563	0.008004	
Distance from the airport	0.001448	-0.001657	
Price	0.263687	0.395973	

	condition of the house	…	\
id	-0.045061	…	
Date	-0.027402	…	
number of bedrooms	0.026597	…	
number of bathrooms	-0.128232	…	
living area	-0.063358	…	
lot area	-0.008548	…	
number of floors	-0.269928	…	
waterfront present	0.018644	…	
number of views	0.052533	…	
condition of the house	1.000000	…	

grade of the house	-0.152530	…
Area of the house(excluding basement)	-0.167695	…
Area of the basement	0.180609	…
Built Year	-0.381718	…
Renovation Year	-0.062126	…
Postal Code	0.045334	…
Lattitude	-0.002998	…
Longitude	-0.121189	…
living_area_renov	-0.099743	…
lot_area_renov	-0.004748	…
Number of schools nearby	-0.006939	…
Distance from the airport	-0.002136	…
Price	0.041376	…

	Built Year	Renovation Year	\
id	-0.068645	-0.109155	
Date	-0.005869	-0.011636	
number of bedrooms	0.152954	0.016132	
number of bathrooms	0.498127	0.049669	
living area	0.309602	0.059400	
lot area	0.051615	0.006848	
number of floors	0.481565	0.006705	
waterfront present	-0.024226	0.085865	
number of views	-0.055357	0.102944	
condition of the house	-0.381718	-0.062126	
grade of the house	0.440358	0.014501	
Area of the house(excluding basement)	0.419369	0.025727	
Area of the basement	-0.138843	0.075104	
Built Year	1.000000	-0.233683	
Renovation Year	-0.233683	1.000000	
Postal Code	-0.062349	0.018006	
Lattitude	-0.143153	0.028908	
Longitude	0.414591	-0.080050	
living_area_renov	0.328625	-0.002601	
lot_area_renov	0.072874	0.005869	
Number of schools nearby	-0.001631	-0.000826	
Distance from the airport	-0.003968	0.005342	
Price	0.050307	0.133173	

	Postal Code	Lattitude	Longitude	\
id	0.294709	-0.479334	-0.070841	
Date	0.018243	-0.023327	-0.018231	
number of bedrooms	-0.044156	-0.013163	0.135712	
number of bathrooms	-0.105546	0.031156	0.223904	
living area	-0.080303	0.054518	0.240208	
lot area	0.070131	-0.090983	0.221432	
number of floors	-0.129788	0.050731	0.127550	
waterfront present	0.038318	-0.021795	-0.047791	

number of views	0.039268	-0.004555	-0.079706
condition of the house	0.045334	-0.002998	-0.121189
grade of the house	-0.146342	0.115256	0.203754
Area of the house(excluding basement)	-0.083730	-0.000088	0.345899
Area of the basement	-0.010542	0.112989	-0.145879
Built Year	-0.062349	-0.143153	0.414591
Renovation Year	0.018006	0.028908	-0.080050
Postal Code	1.000000	-0.310172	-0.099003
Lattitude	-0.310172	1.000000	-0.131472
Longitude	-0.099003	-0.131472	1.000000
living_area_renov	-0.108454	0.046148	0.341221
lot_area_renov	0.077483	-0.091622	0.258066
Number of schools nearby	0.010605	0.014949	-0.010163
Distance from the airport	0.011528	0.007193	-0.003100
Price	-0.115908	0.297490	0.024414

	living_area_renov	lot_area_renov	\
id	-0.599900	-0.089604	
Date	-0.032495	-0.000050	
number of bedrooms	0.389855	0.029400	
number of bathrooms	0.570530	0.078627	
living area	0.757571	0.180312	
lot area	0.149744	0.706812	
number of floors	0.285093	-0.010120	
waterfront present	0.085743	0.032055	
number of views	0.281452	0.072300	
condition of the house	-0.099743	-0.004748	
grade of the house	0.720019	0.116725	
Area of the house(excluding basement)	0.737744	0.194670	
Area of the basement	0.196403	0.011283	
Built Year	0.328625	0.072874	
Renovation Year	-0.002601	0.005869	
Postal Code	-0.108454	0.077483	
Lattitude	0.046148	-0.091622	
Longitude	0.341221	0.258066	
living_area_renov	1.000000	0.189225	
lot_area_renov	0.189225	1.000000	
Number of schools nearby	-0.001203	-0.025014	
Distance from the airport	-0.005673	-0.014587	
Price	0.584924	0.075535	

	Number of schools nearby	\
id	-0.004821	
Date	-0.004071	
number of bedrooms	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 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()
```

[ ]:

id	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
6762810145	5	2.50	3650	9050	2.0	0	4	5	10	3370	280	1921	0	122003	52.8645	-114.557
6762810635	4	2.50	2920	4000	1.5	0	0	5	8	1910	1010	1909	0	122004	52.8878	-114.470
6762810998	5	2.75	2910	9480	1.5	0	0	3	8	2910	0	1939	0	122004	52.8852	-114.468
6762812605	4	2.50	3310	42998	2.0	0	0	3	9	3310	0	2001	0	122005	52.9532	-114.321
6762812919	3	2.00	2710	4500	1.5	0	0	4	8	1880	830					

```
6762812919        1929               0       122006    52.9047   -114.485

            living_area_renov  lot_area_renov  Number of schools nearby  \
id
6762810145               2880            5400                         2
6762810635               2470            4000                         2
6762810998               2940            6600                         1
6762812605               3350           42847                         3
6762812919               2060            4500                         1

            Distance from the airport
id
6762810145                         58
6762810635                         51
6762810998                         53
6762812605                         76
6762812919                         51
```

[ ]:
```
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(max_depth=5, n_estimators=400)
```

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

[ ]:
```
0.9137947680536929
```

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

[ ]:
```
0.9037858066677583
```

[ ]:
```
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 x 2 columns]