```
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 bedrooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views	condition of the house	...	Built Year	Renovation Year	Postal Code
0	6762810145	42491	5	2.50	3650	9050	2.0	0	4	5	...	1921	0	122003
1	6762810635	42491	4	2.50	2920	4000	1.5	0	0	5	...	1909	0	122004
2	6762810998	42491	5	2.75	2910	9480	1.5	0	0	3	...	1939	0	122004
3	6762812605	42491	4	2.50	3310	42998	2.0	0	0	3	...	2001	0	122005
4	6762812919	42491	3	2.00	2710	4500	1.5	0	0	4	...	1929	0	122006

5 rows × 23 columns

```
df.tail()
```

	id	Date	number of bedrooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views	condition of the house	...	Built Year	Renovation Year	Posta Cod
14615	6762830250	42734	2	1.5	1556	20000	1.0	0	0	4	...	1957	0	12206
14616	6762830339	42734	3	2.0	1680	7000	1.5	0	0	4	...	1968	0	12207
14617	6762830618	42734	2	1.0	1070	6120	1.0	0	0	3	...	1962	0	12205
14618	6762830709	42734	4	1.0	1030	6621	1.0	0	0	4	...	1955	0	12204
14619	6762831463	42734	3	1.0	900	4770	1.0	0	0	3	...	1969	2009	12201

5 rows × 23 columns

```
df
```

	id	Date	number of bedrooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views	condition of the house	...	Built Year	Renovation Year	Postal Code
0	6762810145	42491	5	2.50	3650	9050	2.0	0	4	5	...	1921	0	122003
1	6762810635	42491	4	2.50	2920	4000	1.5	0	0	5	...	1909	0	122004
2	6762810998	42491	5	2.75	2910	9480	1.5	0	0	3	...	1939	0	122004
3	6762812605	42491	4	2.50	3310	42998	2.0	0	0	3	...	2001	0	122005
4	6762812919	42491	3	2.00	2710	4500	1.5	0	0	4	...	1929	0	122006

```
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')
```

14620 rows × 23 columns

```
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
```

```
<bound method DataFrame.info of                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
```

```
df.shape
```

```
(14620, 23)
```

Univariate Analysis

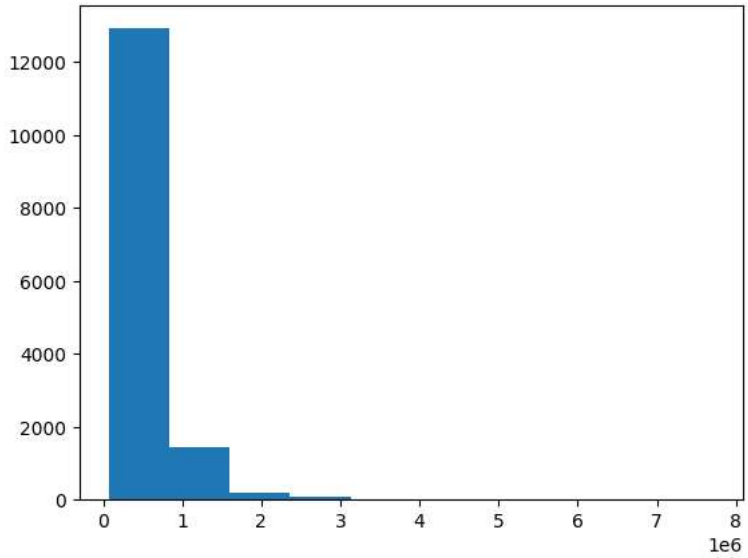
```
print(df.describe())
```

```
                  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
```

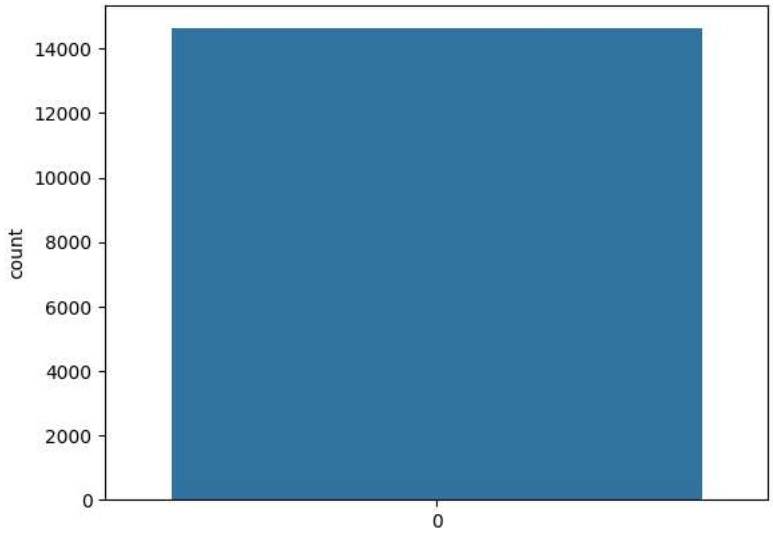
```
plt.hist(df['Price'])
```

```
(array([1.2916e+04, 1.4260e+03, 1.9100e+02, 6.0000e+01, 1.9000e+01,
        2.0000e+00, 2.0000e+00, 1.0000e+00, 1.0000e+00, 2.0000e+00]),
 array([  78000.,  840200., 1602400., 2364600., 3126800., 3889000.,
        4651200., 5413400., 6175600., 6937800., 7700000.]),
 <BarContainer object of 10 artists>)
```



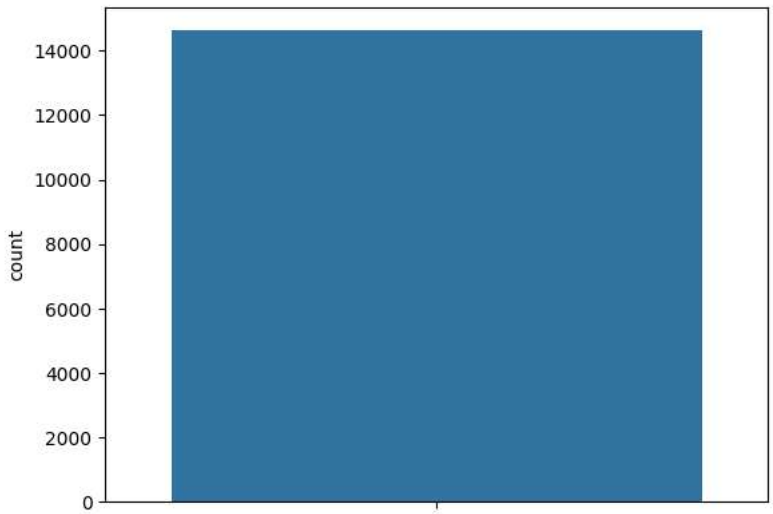

```
sns.countplot(df['number of views'])
```

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



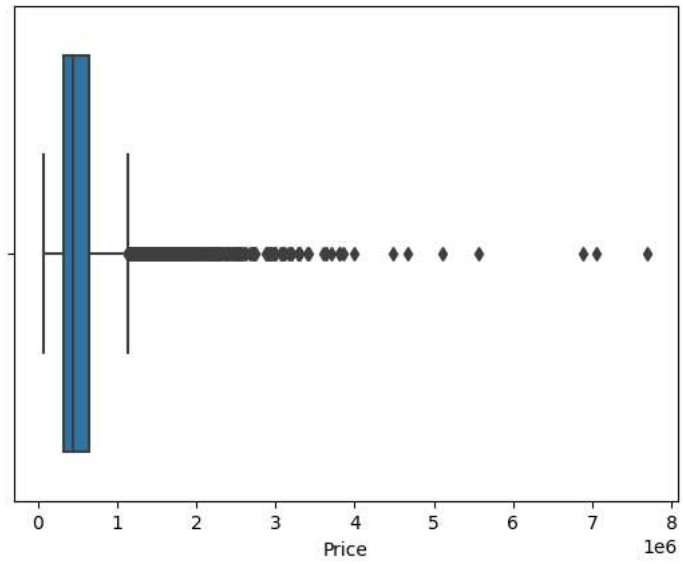

```
sns.countplot(df['number of floors'])
```

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



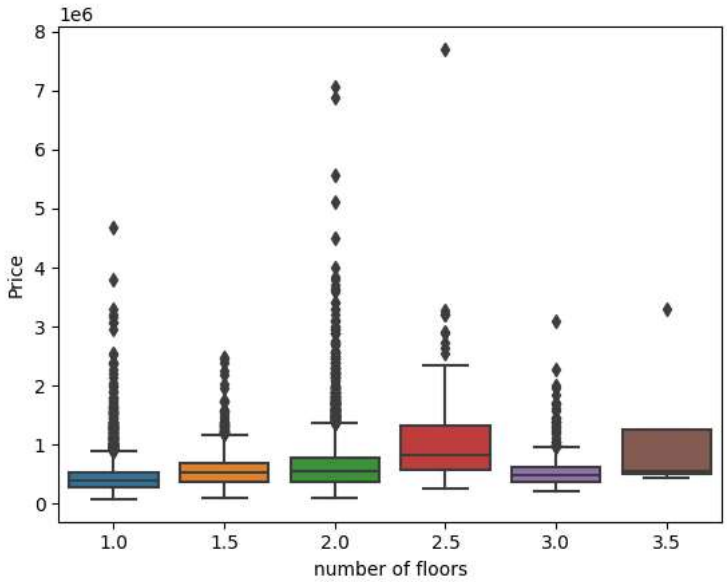

```
sns.boxplot(x=df['Price'])
```

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



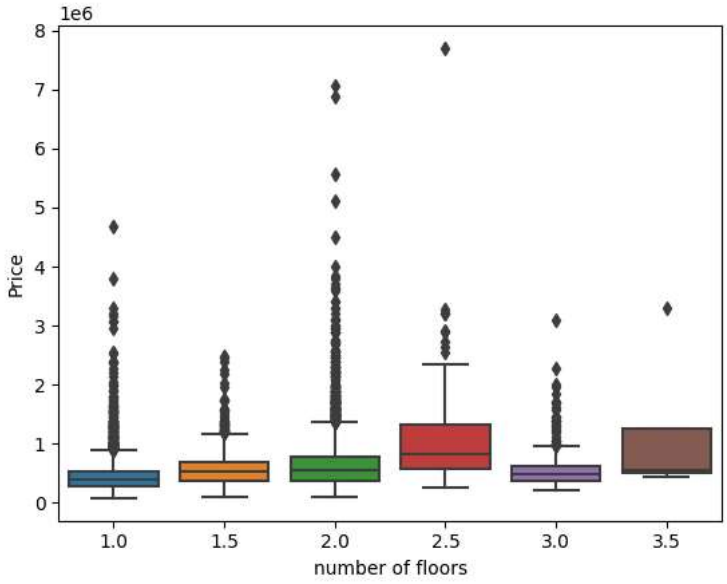

```
sns.boxplot(x=df['number of floors'],y=df['Price'])
```

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



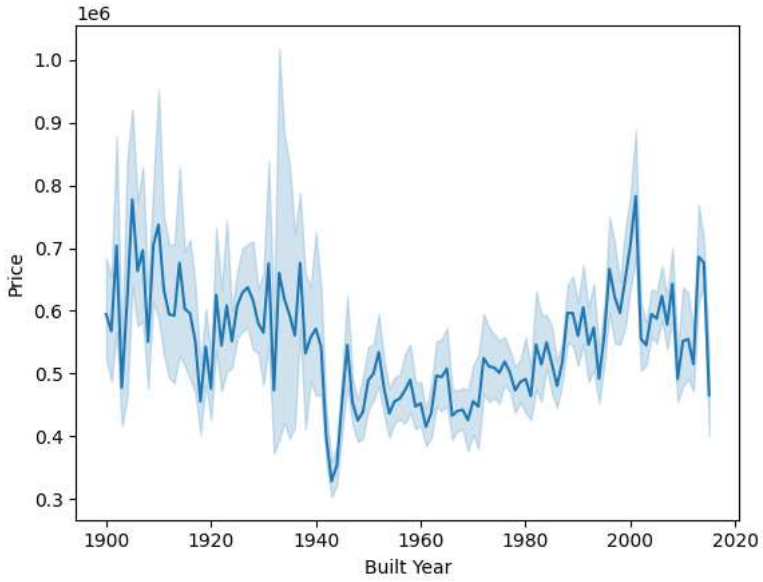
```
sns.boxplot(x=df['number of floors'],y=df['Price'])
```

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

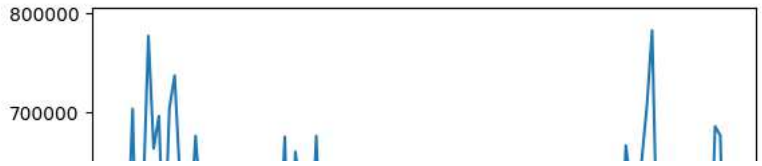



```
sns.lineplot(x=df['Built Year'],y=df['Price'])
```

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

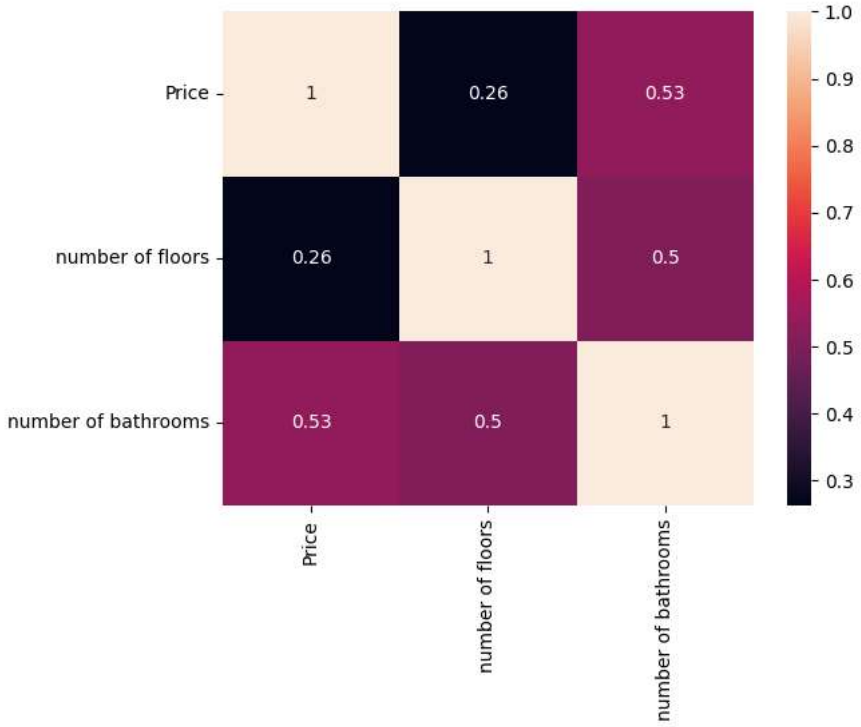



```
sns.lineplot(x=df.groupby('Built Year').mean().index, y=df.groupby('Built Year').mean()['Price'])
plt.show()
```




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

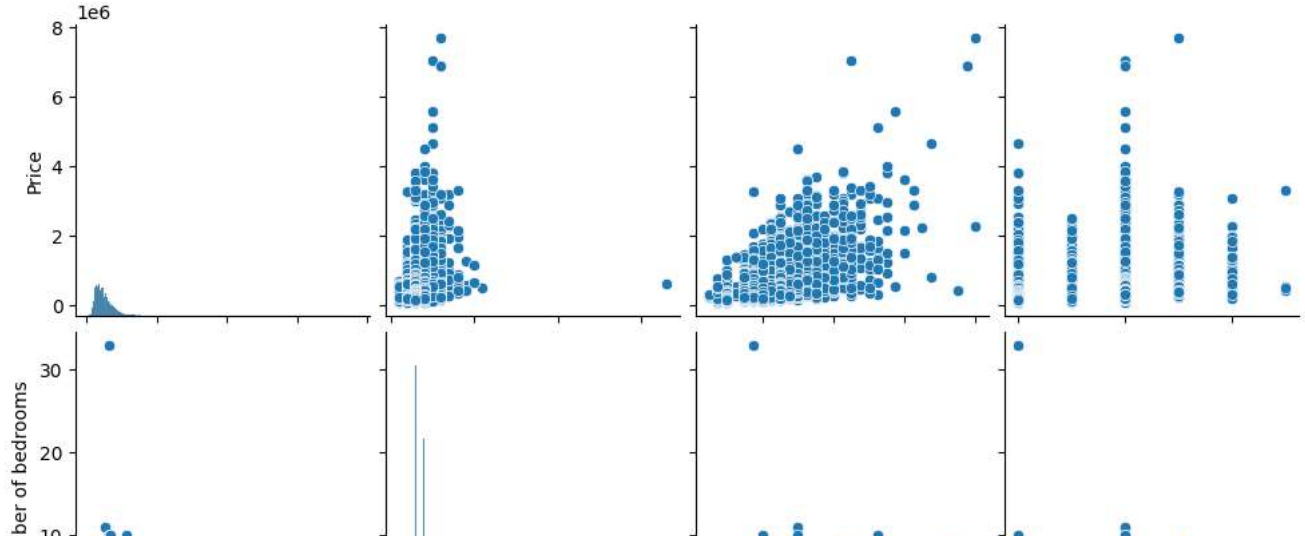
```
<Axes: >
```



Multivariate Analysis

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

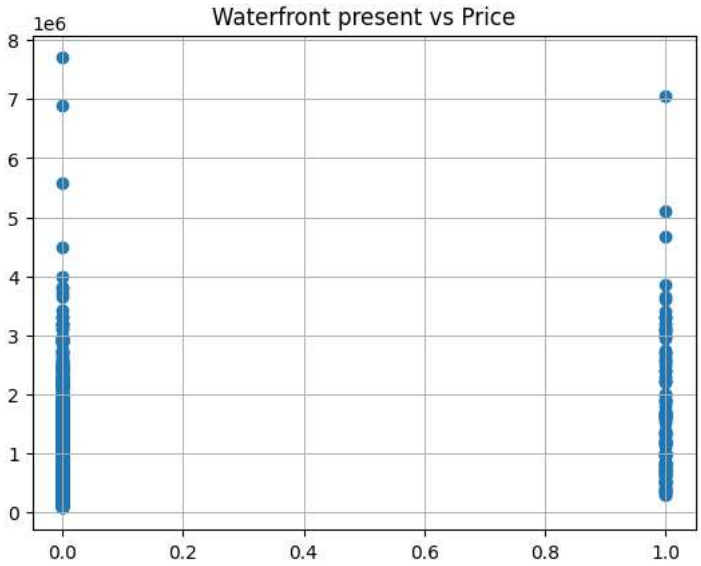
```
<seaborn.axisgrid.PairGrid at 0x7a6cd53b1990>
```



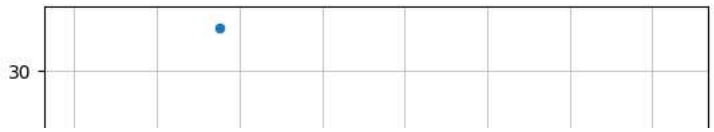

```
df.duplicated().sum()
```

```
0
```

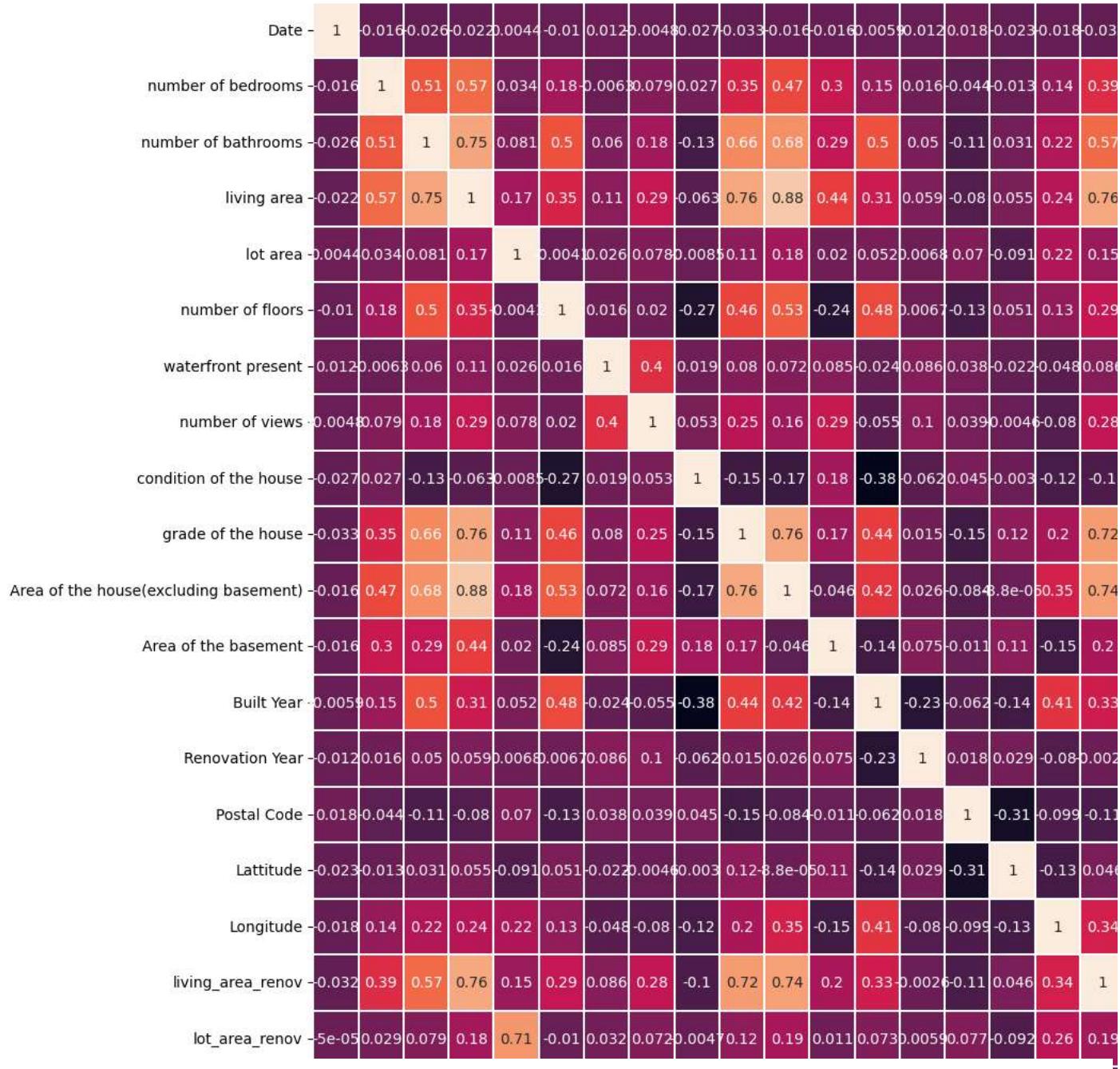
```
plt.scatter(df['waterfront present'], df['Price'])
plt.title("Waterfront present vs Price")
plt.grid(linestyle='-', linewidth=0.7)
```




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

```
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
```

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

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

```
sc=StandardScaler()
sc=MinMaxScaler()
x=pd.DataFrame(sc.fit_transform(x),columns=x.columns.values)
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	Renovati Ye
0	0.12500	0.266667	0.249051	0.007945	0.4	0.0	1.0	1.00	0.666667	0.331858	0.058091	0.182609	
1	0.09375	0.266667	0.193622	0.003241	0.2	0.0	0.0	1.00	0.444444	0.170354	0.209544	0.078261	
2	0.12500	0.300000	0.192863	0.008345	0.2	0.0	0.0	0.50	0.444444	0.280973	0.000000	0.339130	
3	0.09375	0.266667	0.223235	0.039562	0.4	0.0	0.0	0.50	0.555556	0.325221	0.000000	0.878261	
4	0.06250	0.200000	0.177677	0.003707	0.2	0.0	0.0	0.75	0.444444	0.167035	0.172199	0.252174	

```
y.head()
```

	id	Price
0	6762810145	2380000
1	6762810635	1400000

```
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)
```

```
0.9118862866954918
```

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

```
0.9012749137875955
```

```
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