```
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 | |
| **4** | 6762812919 | 42491 | 3 | 2.00 | 2710 | 4500 | 1.5 | 0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | |
| **14615** | 6762830250 | 42734 | 2 | 1.50 | 1556 | 20000 | 1.0 | 0 | |
| **14616** | 6762830339 | 42734 | 3 | 2.00 | 1680 | 7000 | 1.5 | 0 | |
| **14617** | 6762830618 | 42734 | 2 | 1.00 | 1070 | 6120 | 1.0 | 0 | |
| **14618** | 6762830709 | 42734 | 4 | 1.00 | 1030 | 6621 | 1.0 | 0 | |
| **14619** | 6762831463 | 42734 | 3 | 1.00 | 900 | 4770 | 1.0 | 0 | |

14620 rows × 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**

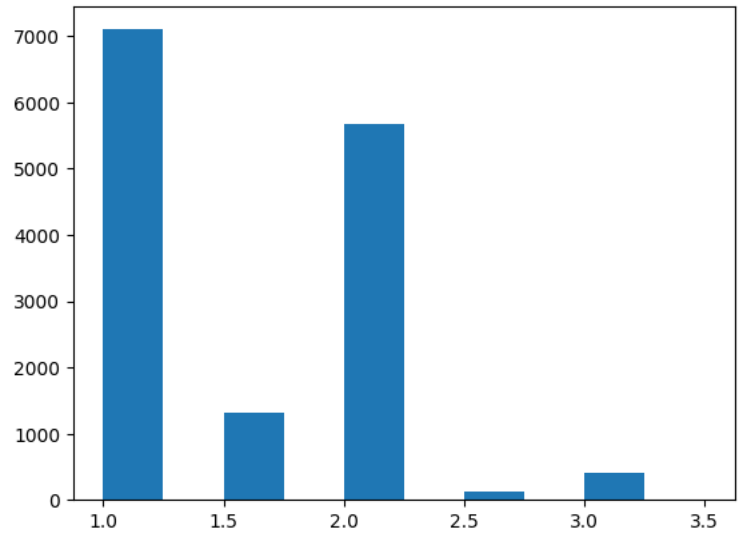
```
print(df.describe())
```

```
std    6.237575e+03     67.347991           0.938719            0.769934
min    6.762810e+09  42491.000000           1.000000            0.500000
```

```
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]
```

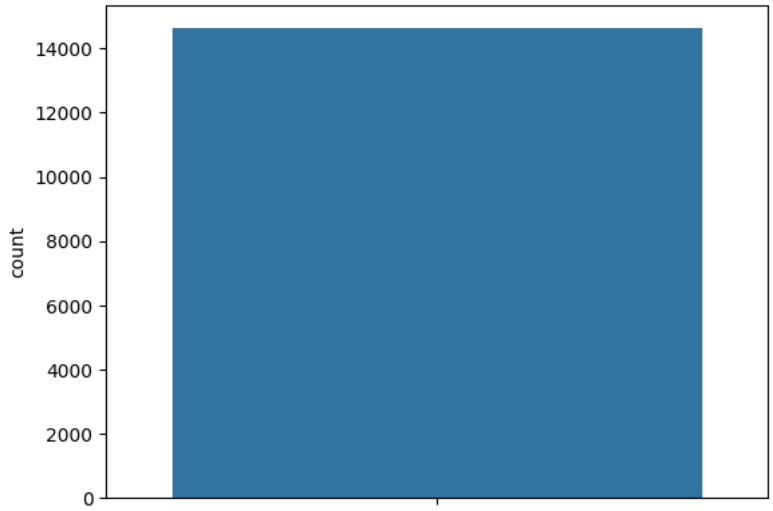
```
plt.hist(df['number of floors'])
```

```
(array([7.103e+03, 0.000e+00, 1.311e+03, 0.000e+00, 5.666e+03, 0.000e+00,
        1.180e+02, 0.000e+00, 4.180e+02, 4.000e+00]),
 array([1.  , 1.25, 1.5 , 1.75, 2.  , 2.25, 2.5 , 2.75, 3.  , 3.25, 3.5 ]),
 <BarContainer object of 10 artists>)
```



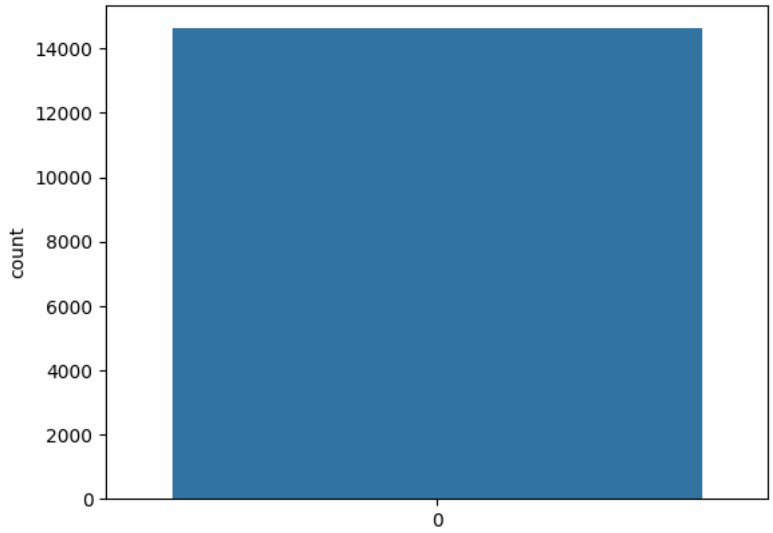

```
sns.countplot(df['number of bedrooms'])
```

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



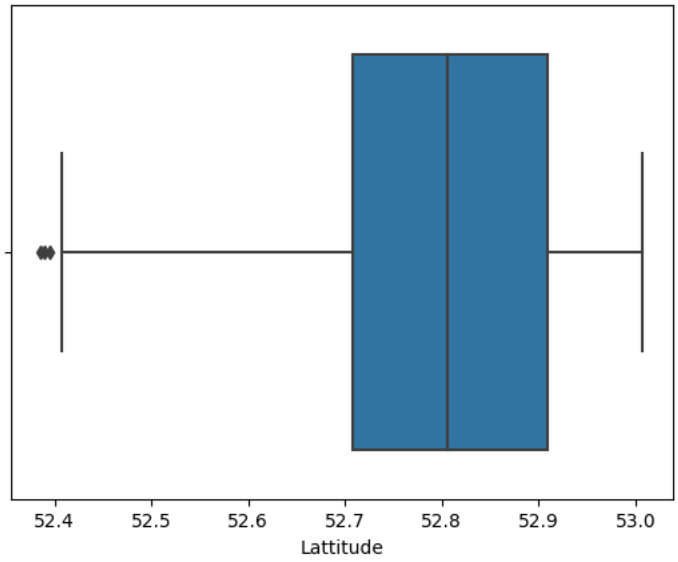

```
sns.countplot(df['Area of the basement'])
```

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




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

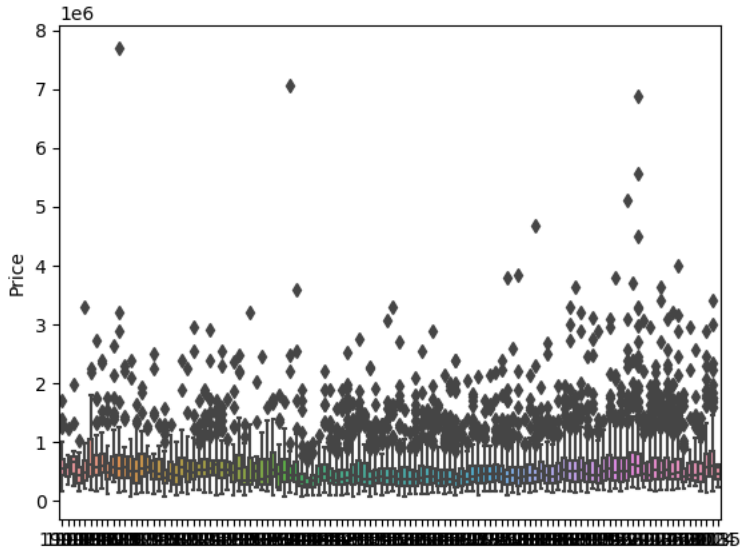
```
<Axes: xlabel='Lattitude'>
```




**Bivariate Analysis**

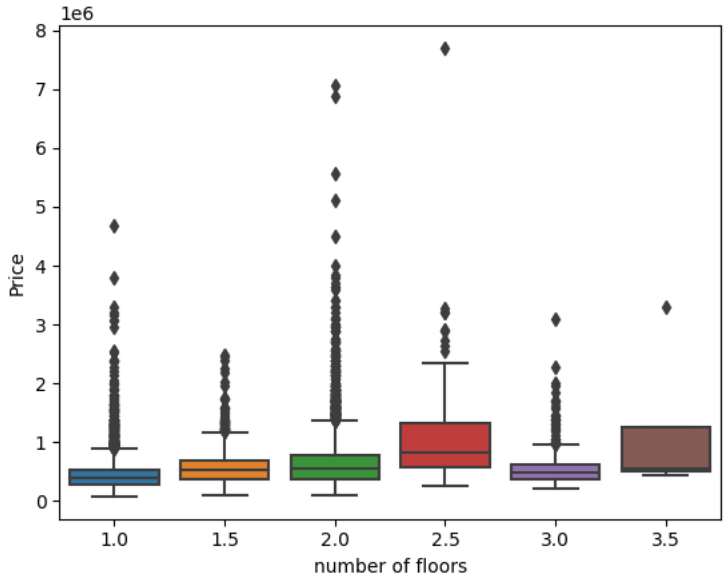
```
sns.boxplot(x=df['Built Year'],y=df['Price'])
```

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



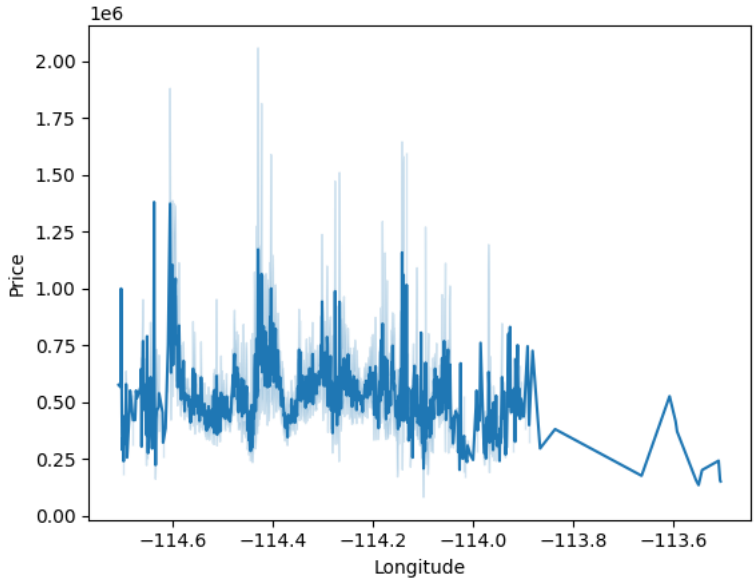

```
sns.boxplot(x=df['number of floors'],y=df['Price'])
```

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

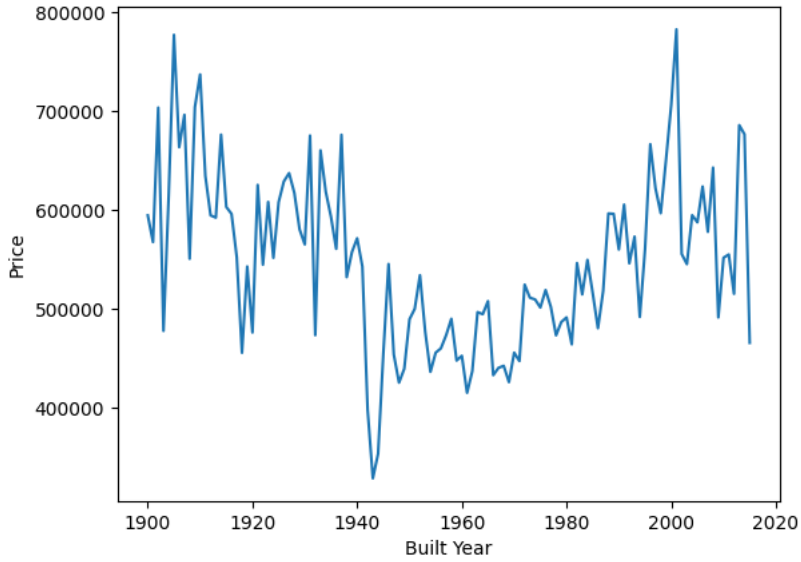



```
sns.lineplot(x=df['Longitude'],y=df['Price'])
```

```
<Axes: xlabel='Longitude', ylabel='Price'>
```




```
groupby('Built Year').mean().index,y=df.groupby('Built Year').mean()['Price'])
```



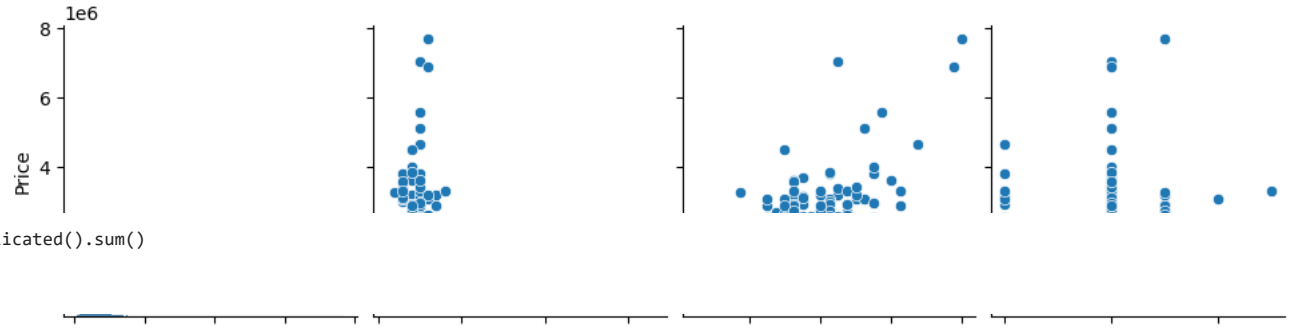

```
sns.heatmap(df[['Price','living area','lot area']].corr(),annot=True)
```

```
<Axes: >
```


**Multivariate Analysis**

```
ot(df[['Price','number of bedrooms','number of bathrooms','number of floors']])
```

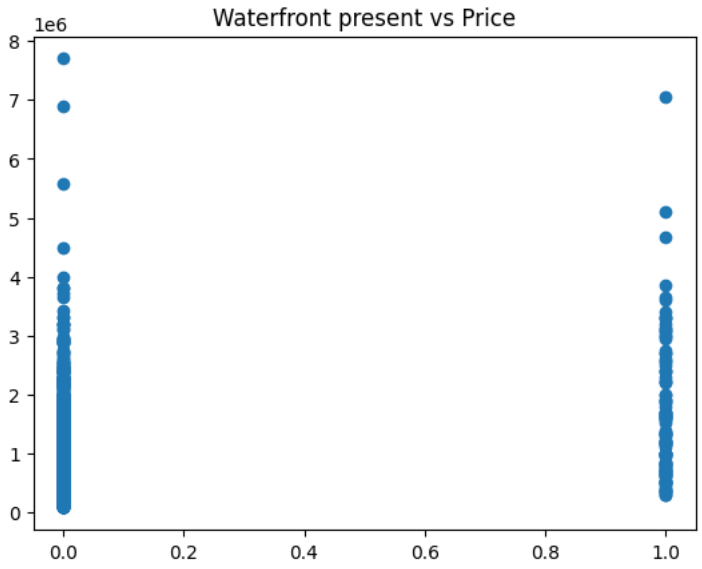
```
<seaborn.axisgrid.PairGrid at 0x79f1f4817e20>
```



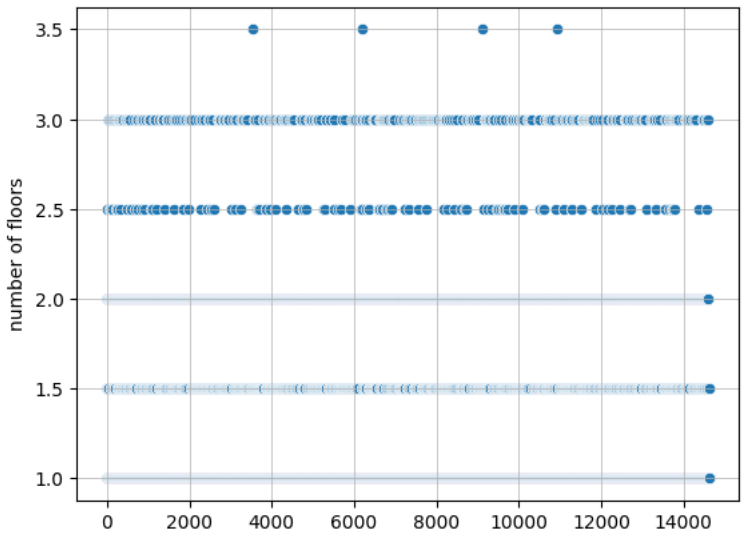

```
df.duplicated().sum()
```

```
0
```

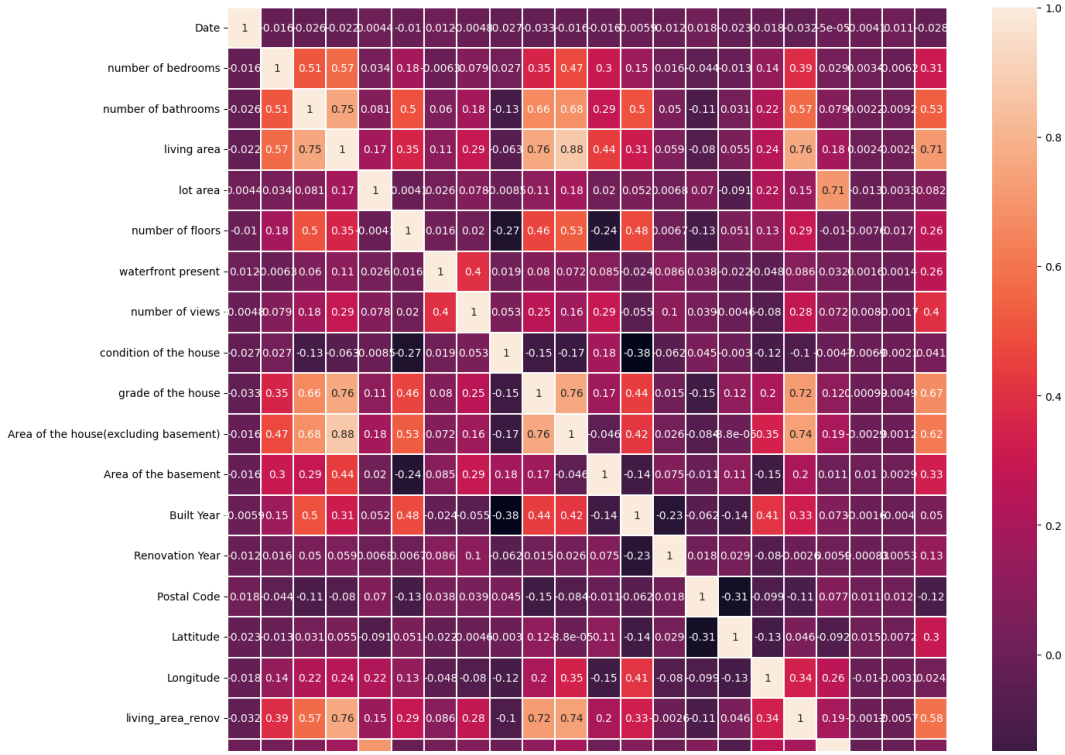
```
plt.scatter(df['waterfront present'],df['Price'])
plt.title("Waterfront present vs Price")
plt.grid(linestyle='-', linewidth=0.)
```




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

```
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
```

```
print(df['number of floors'].value_counts())
```

```
1.0    7103
2.0    5666
1.5    1311
3.0     418
2.5     118
3.5       4
Name: number of floors, 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 | Renov |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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)
```

```
0.9128838338164694
```

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

```
0.9025269198972291
```

```
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