KIRUTHIKAA N

Perform the Below Tasks to complete the assignment:- Tasks:-

1. Download the dataset
2. Load the dataset.
3. Perform the Below Visualizations. ● Univariate Analysis ● Bi - Variate Analysis ● Multi-Variate Analysis
4. Perform descriptive statistics on the dataset.
5. Handle the Missing values.

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

Choose Files House Price India.csv

- **House Price India.csv**(text/csv) - 1524561 bytes, last modified: 3/27/2023 - 100% done

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

```
import pandas as pd
import seaborn as sns
import numpy as np
import io
df = pd.read_csv('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	Latt
0	6762810145	42491	5	2.50	3650	9050	2.0	0	4	5	...	1921	0	122003	52
1	6762810635	42491	4	2.50	2920	4000	1.5	0	0	5	...	1909	0	122004	52
2	6762810998	42491	5	2.75	2910	9480	1.5	0	0	3	...	1939	0	122004	52
3	6762812605	42491	4	2.50	3310	42998	2.0	0	0	3	...	2001	0	122005	52
4	6762812919	42491	3	2.00	2710	4500	1.5	0	0	4	...	1929	0	122006	52

```
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	Postal Code
14615	6762830250	42734	2	1.5	1556	20000	1.0	0	0	4	...	1957	0	122066
14616	6762830339	42734	3	2.0	1680	7000	1.5	0	0	4	...	1968	0	122072
14617	6762830618	42734	2	1.0	1070	6120	1.0	0	0	3	...	1962	0	122056
14618	6762830709	42734	4	1.0	1030	6621	1.0	0	0	4	...	1955	0	122042
14619	6762831463	42734	3	1.0	900	4770	1.0	0	0	3	...	1969	2009	122018

```
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

```
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
```

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

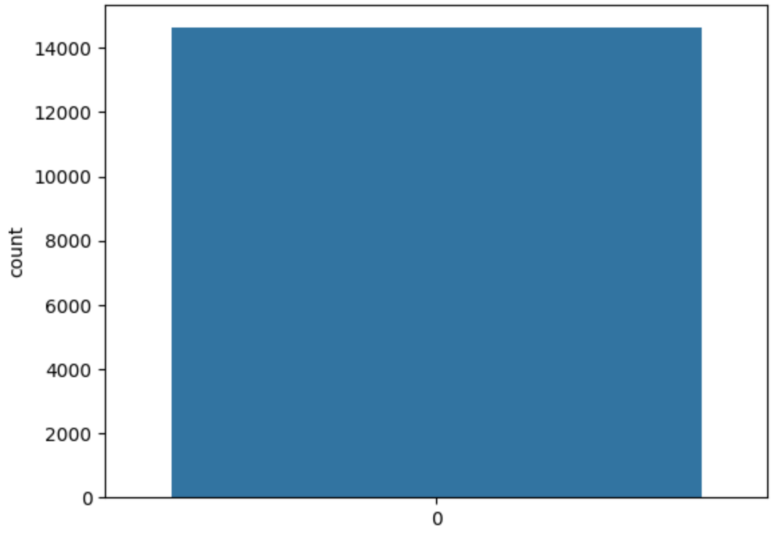
```
mean   6.762821e+09  42604.958040           3.379343             2.129583
std    6.237575e+03     67.347991           0.938719             0.769934
min    6.762810e+09  42491.000000           1.000000             0.500000
25%    6.762815e+09  42546.000000           3.000000             1.750000
50%    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]
```

```
import matplotlib.pyplot as plt
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 ])
```

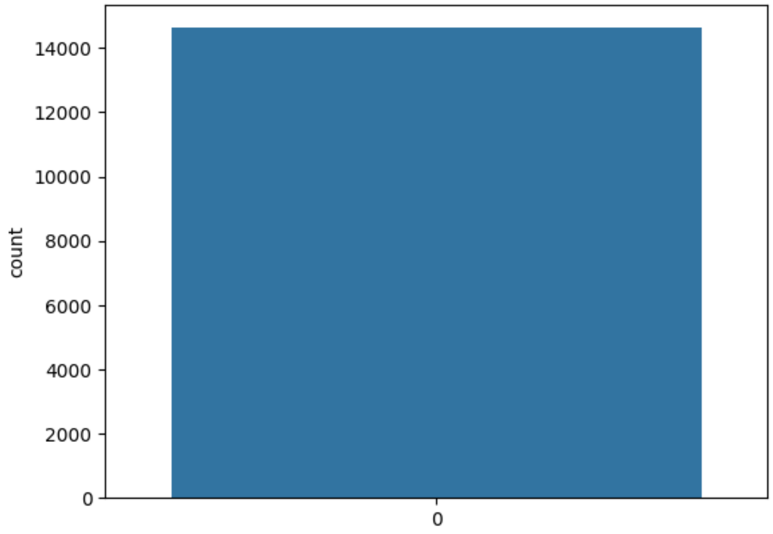
```
sns.countplot(df['number of floors'])
```

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



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

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

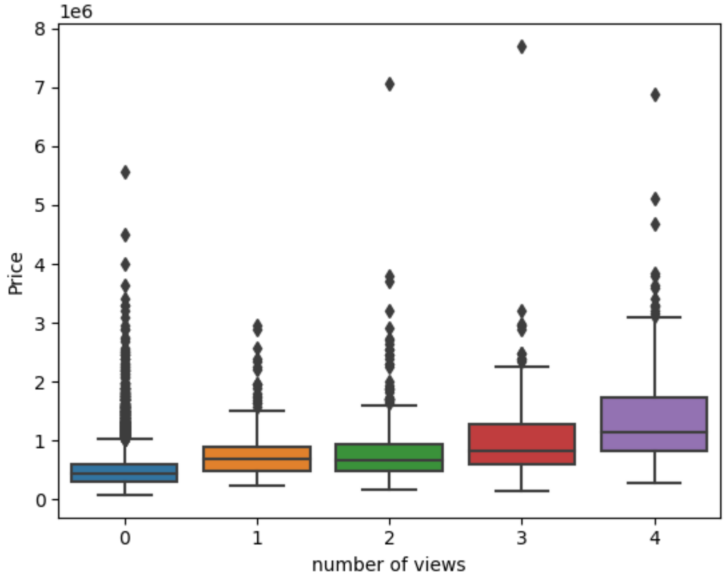


```
sns.boxplot(data=df,x="Price")
```

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

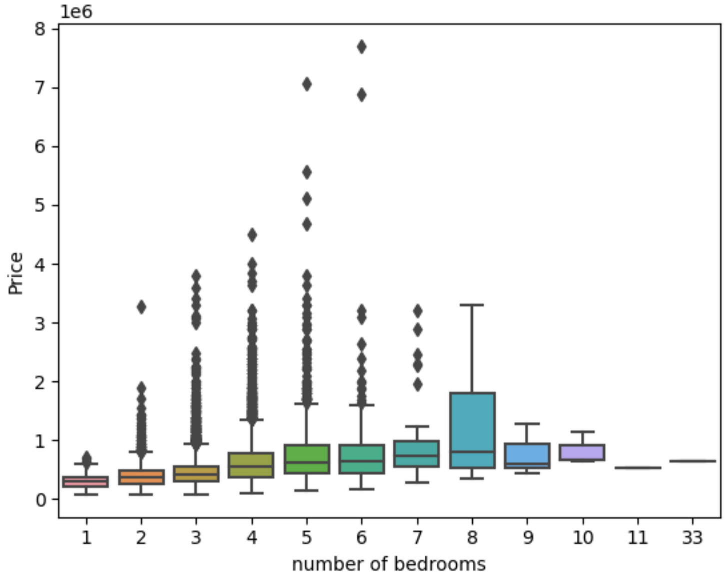
```
sns.boxplot(x=df['number of views'],y=df['Price'])
```

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



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

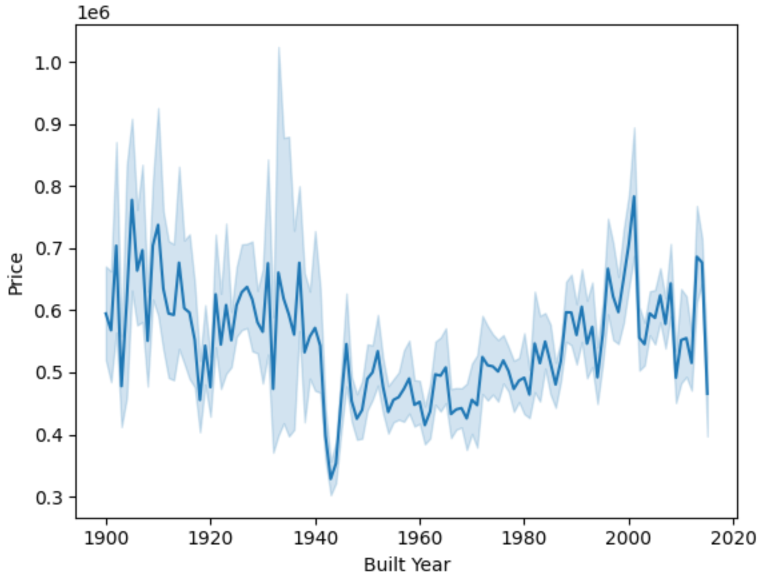
```
<Axes: xlabel='number of bedrooms', ylabel='Price'>
```



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

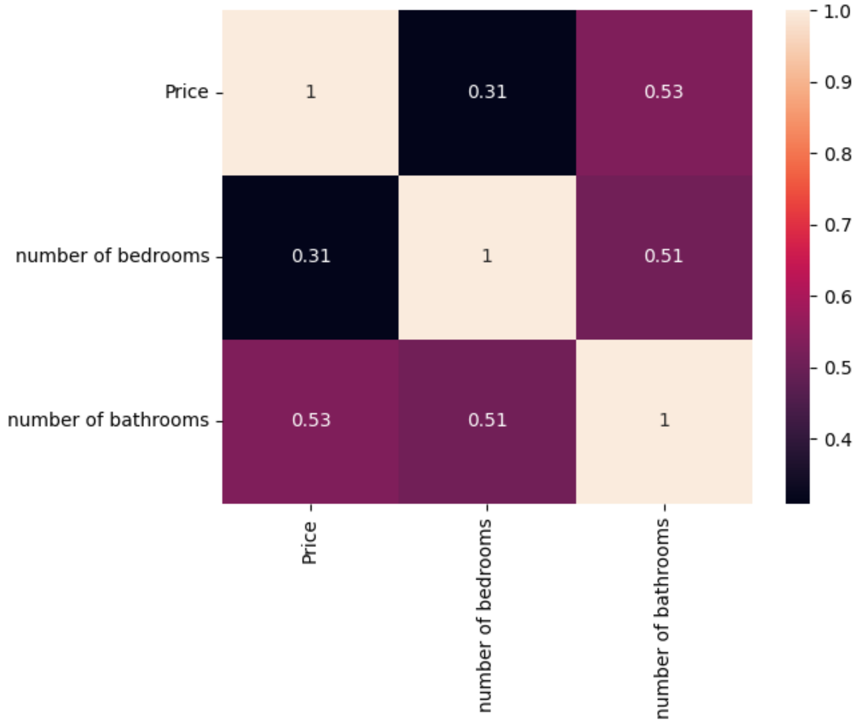
```
sns.lineplot(x=df['Built Year'],y=df['Price'])
```

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



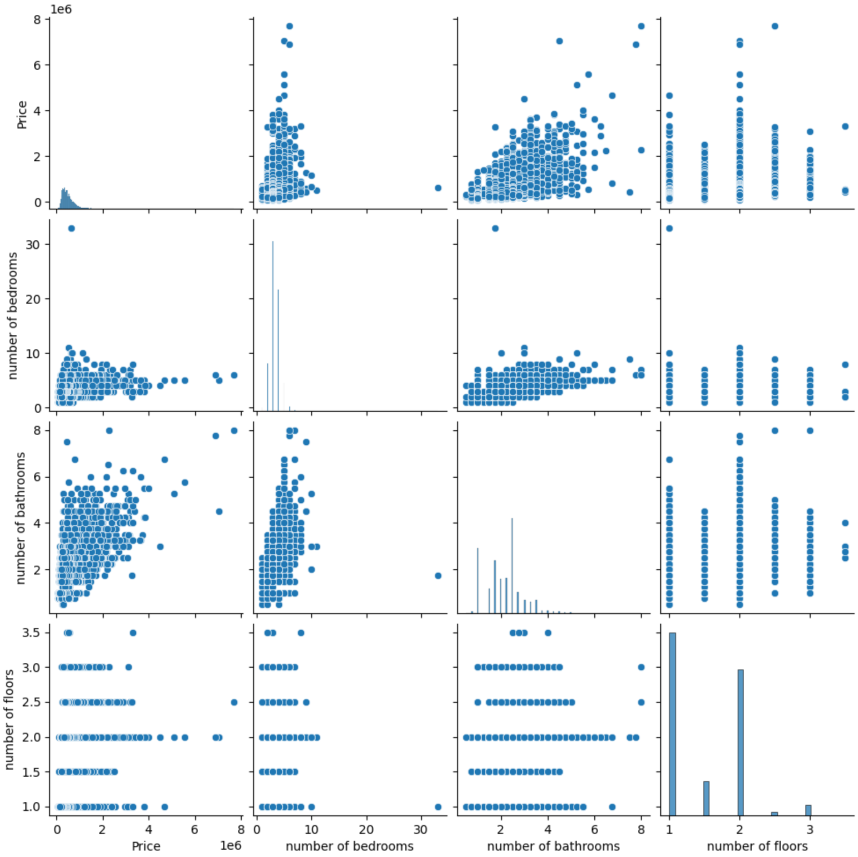
```
sns.heatmap(df[['Price', 'number of bedrooms', 'number of bathrooms']].corr(), annot=True)
```

```
<Axes: >
```



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

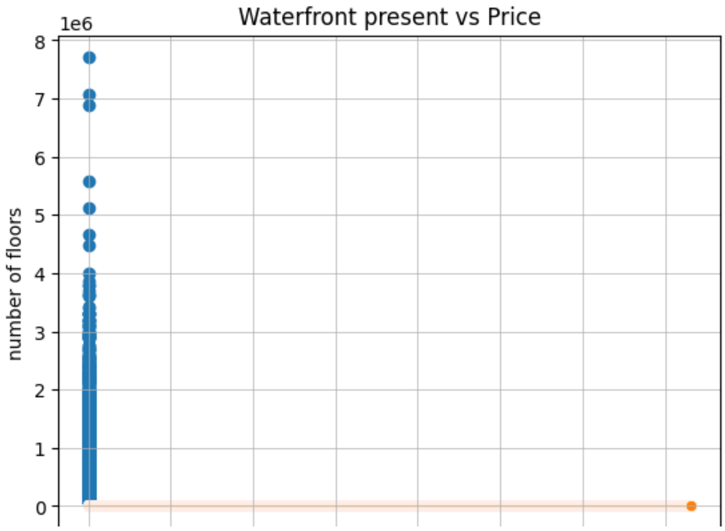
```
<seaborn.axisgrid.PairGrid at 0x7fcd63f242b0>
```



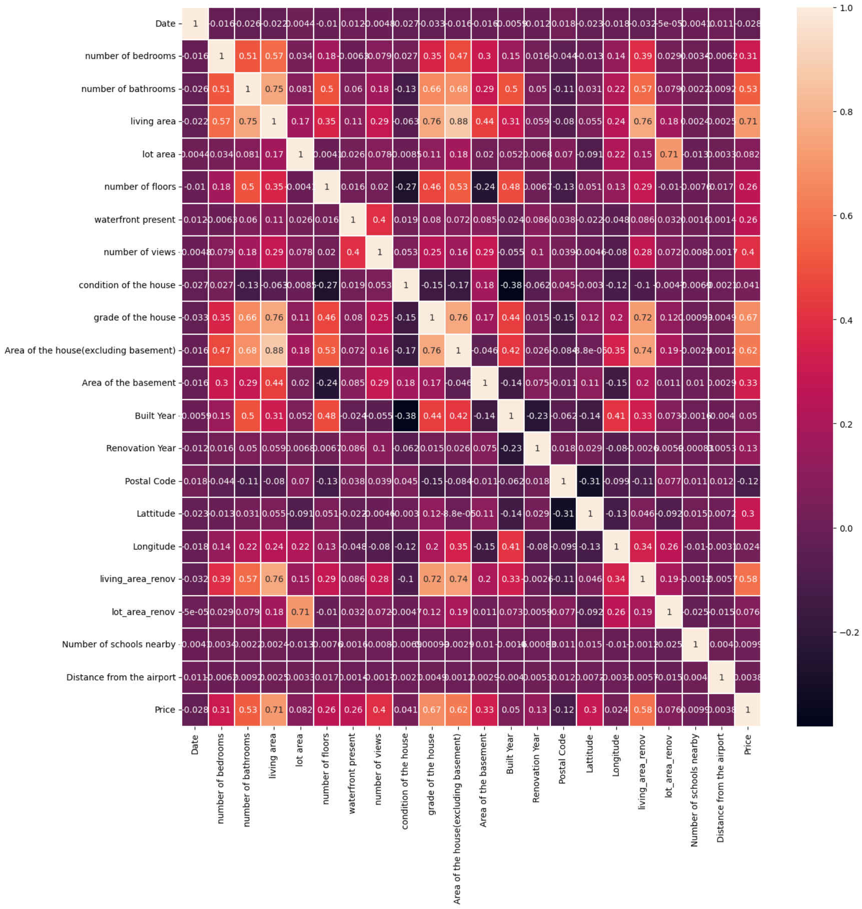
```
df.duplicated().sum()
```

```
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 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.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())
```

```
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
```

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

```
mean    6.762821e+09  42604.558646            3.379543             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
```

```
       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  
```

```
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
```

```
df.dropna(inplace=True)
df.fillna(0, inplace=True)
df.interpolate(inplace=True)
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import MinMaxScaler
x=df.drop(['Price','Date'],axis=1)
x.set_index(['id'],inplace=True)
y=df[['id','Price']]
x.head()
```

	number of bedrooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views	condition of the house
id								
6762810145	5	2.50	3650	9050	2.0	0	4	5

```
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
```

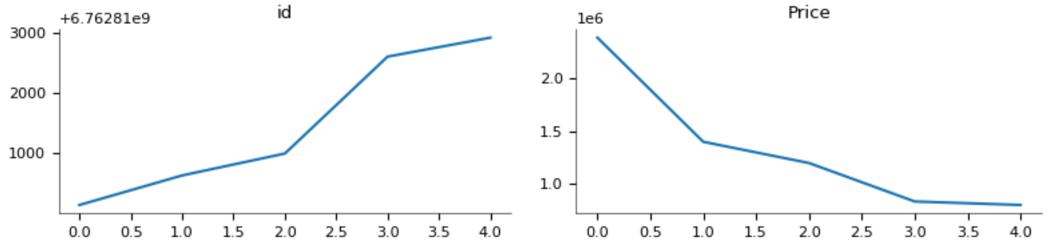
```
sc=StandardScaler()
sc=MinMaxScaler()
x=pd.DataFrame(sc.fit_transform(x),columns=x.columns.values)
x.head()
```

	number of bedrooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views	condition of the house	g o h
0	0.12500	0.266667	0.249051	0.007945	0.4	0.0	1.0	1.00	0.66
1	0.09375	0.266667	0.193622	0.003241	0.2	0.0	0.0	1.00	0.44
2	0.12500	0.300000	0.192863	0.008345	0.2	0.0	0.0	0.50	0.44
3	0.09375	0.266667	0.223235	0.039562	0.4	0.0	0.0	0.50	0.55
4	0.06250	0.200000	0.177677	0.003707	0.2	0.0	0.0	0.75	0.44

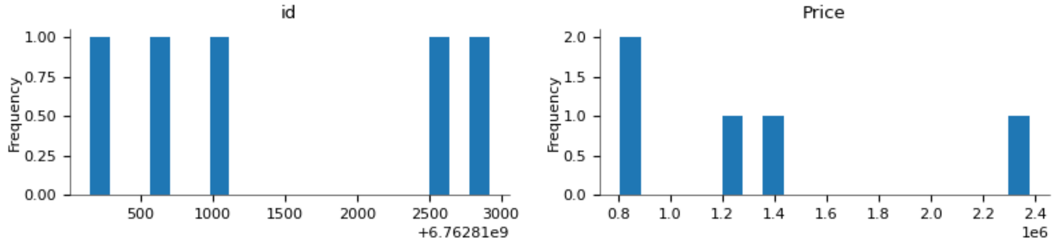
```
y.head()
```

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

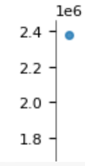
Values



Distributions



2-d distributions



```
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)

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

```
0.9111918507210961
```

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

```
0.900323276786278
```

```
y_pred
```

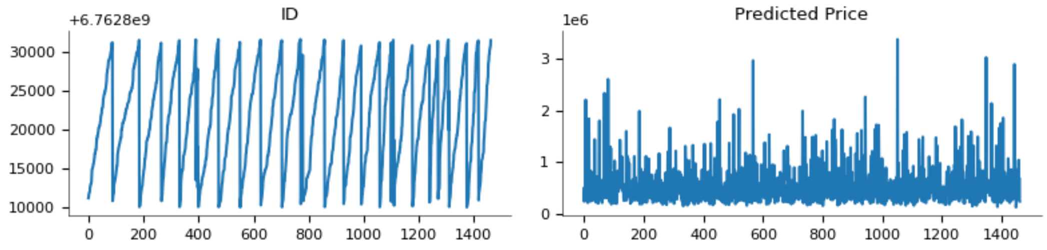
```
array([497766.12740438, 244495.3776842 , 293819.40063242, ...,
       698495.60350629, 297006.00386358, 245881.76921871])
```

```
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)
```

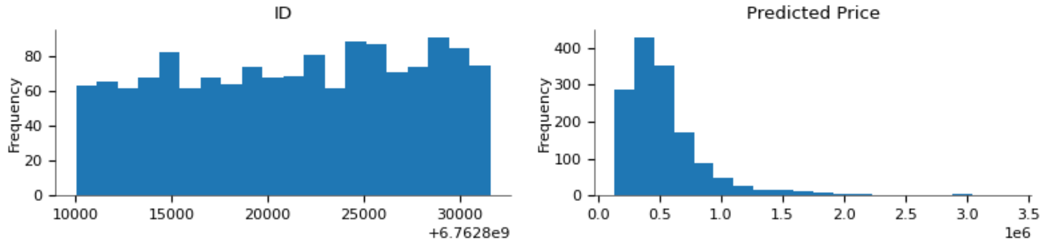
```
y_pred_df
```

```
              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
```

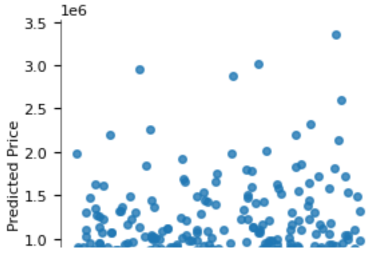
Values



Distributions



2-d distributions


1e6
Predicted Price