

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

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

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 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	co
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	number of views	co
14615	6762830250	42734	2	1.5	1556	20000	1.0	0	0	
14616	6762830339	42734	3	2.0	1680	7000	1.5	0	0	
14617	6762830618	42734	2	1.0	1070	6120	1.0	0	0	
14618	6762830709	42734	4	1.0	1030	6621	1.0	0	0	
14619	6762831463	42734	3	1.0	900	4770	1.0	0	0	

5 rows × 23 columns

```
df
```

# Assignment-3 - Colaboratory

	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

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', 'Latitude',
      '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
Latitude             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  Latitude                           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)

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  Latitude  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

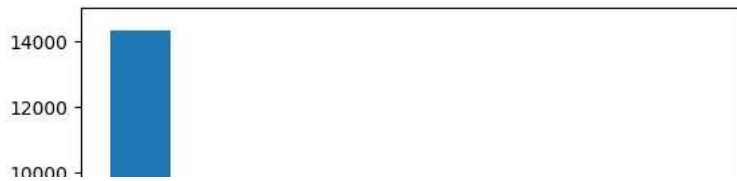
      living_area_renov  lot_area_renov  Number of schools nearby \
count  14620.000000  14620.000000      14620.000000
mean    1996.702257    12753.500068          2.012244
std     691.093366    26058.414467          0.817284
min     460.000000     651.000000          1.000000
25%    1490.000000    5097.750000          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

```

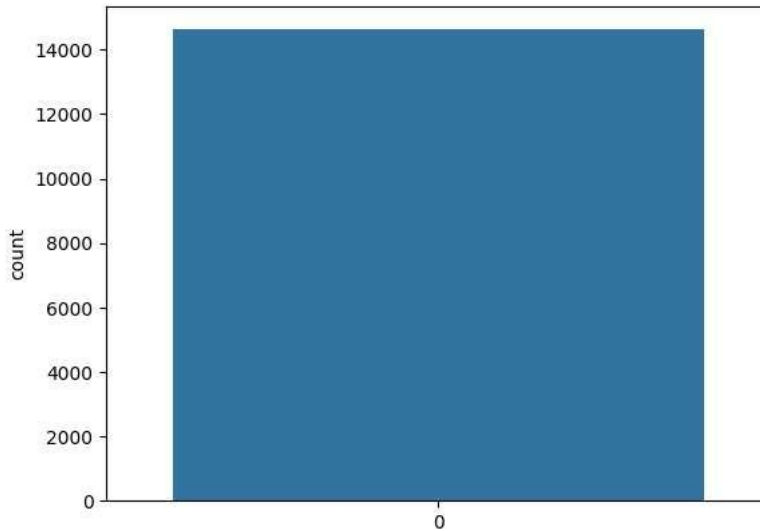
plt.hist(df['lot area'])

```
(array([1.4313e+04, 1.7600e+02, 9.2000e+01, 1.9000e+01, 1.4000e+01,
        2.0000e+00, 0.0000e+00, 1.0000e+00, 0.0000e+00, 3.0000e+00]),
 array([5.200000e+02, 1.078898e+05, 2.152596e+05, 3.226294e+05,
        4.299992e+05, 5.373690e+05, 6.447388e+05, 7.521086e+05,
        8.594784e+05, 9.668482e+05, 1.074218e+06]),
 <BarContainer object of 10 artists>)
```



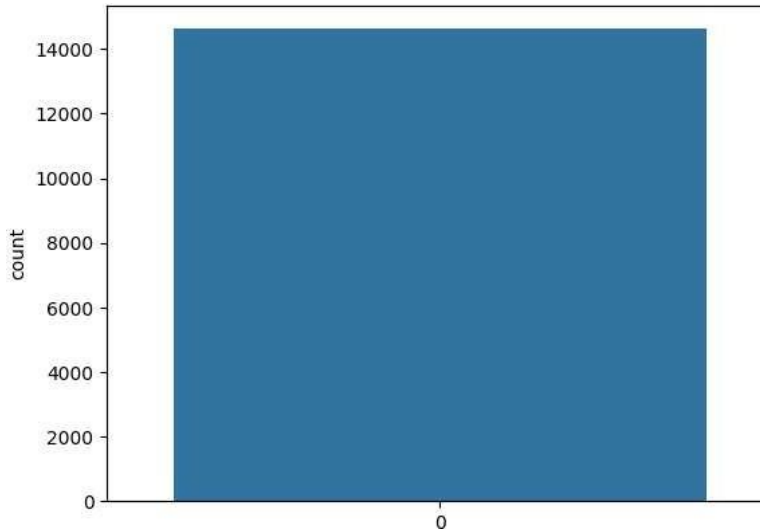
```
sns.countplot(df['number of bedrooms'])
```

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



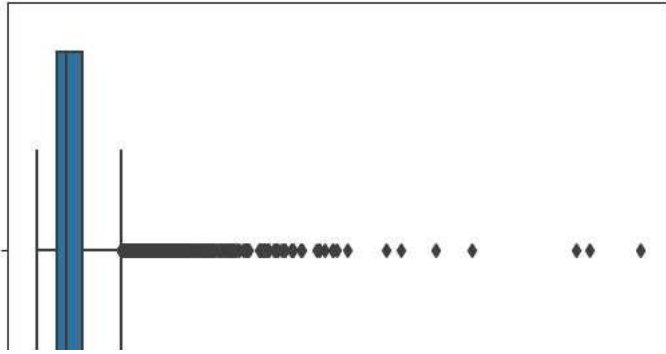
```
sns.countplot(df['number of floors'])
```

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



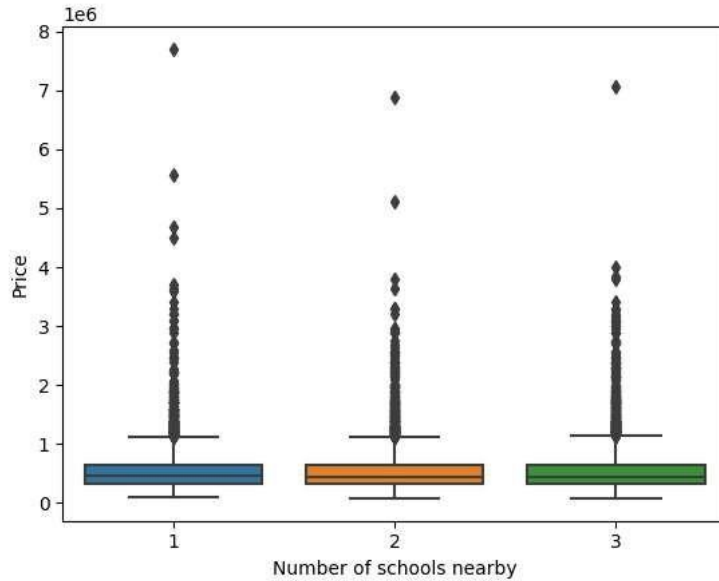
```
sns.boxplot(x=df['Price'])
```

<Axes: xlabel='Price'>



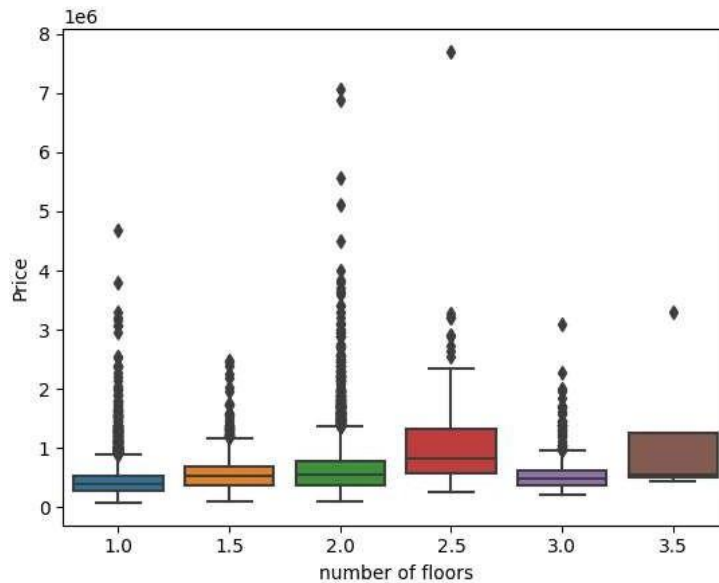
```
sns.boxplot(x=df['Number of schools nearby'],y=df['Price'])
```

<Axes: xlabel='Number of schools nearby', ylabel='Price'>



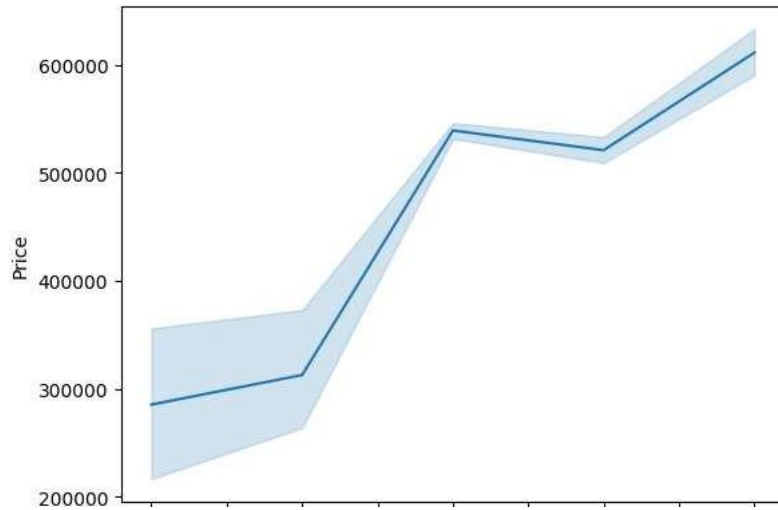
```
sns.boxplot(x=df['number of floors'],y=df['Price'])
```

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



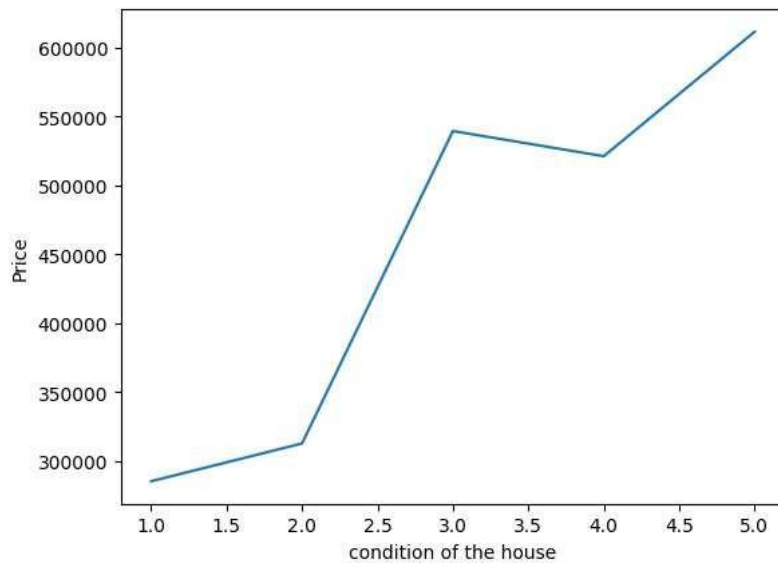
```
sns.lineplot(x=df['condition of the house'],y=df['Price'])
```

```
<Axes: xlabel='condition of the house', ylabel='Price'>
```



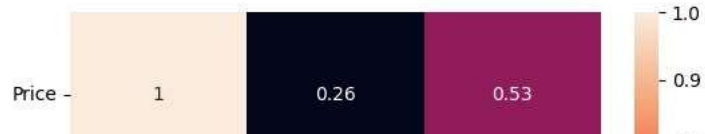
```
sns.lineplot(x=df.groupby('condition of the house').mean().index,y=df.groupby('condition of the house').mean()['Price'])
plt.show
```

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



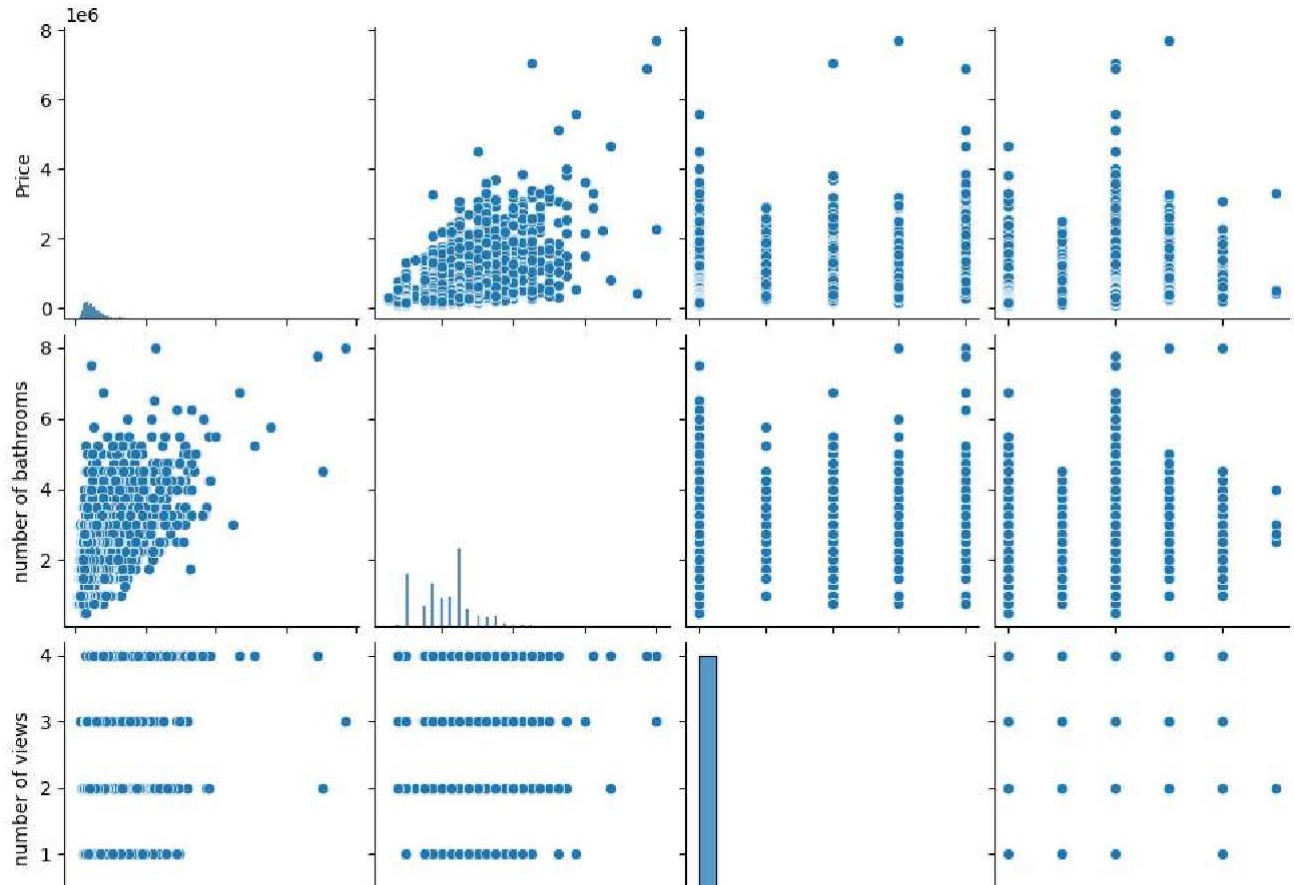
```
sns.heatmap(df[['Price','number of floors','number of bathrooms']].corr(),annot=True)
```

&lt;Axes: &gt;



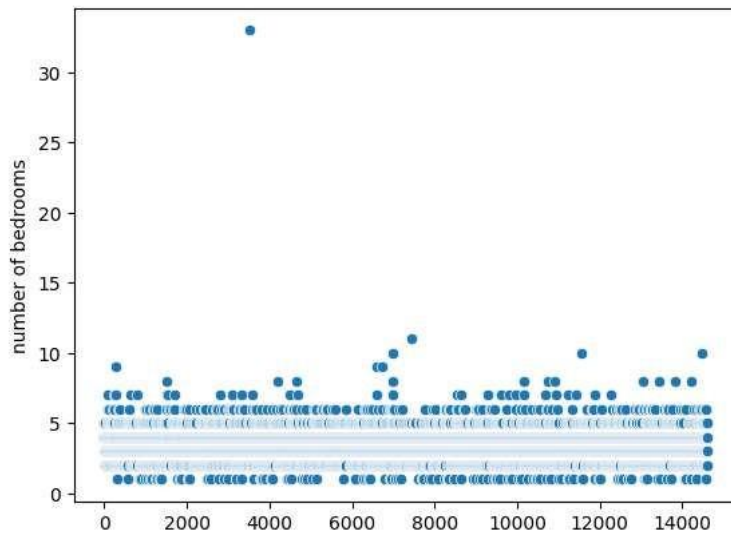
```
sns.pairplot(df[['Price','number of bathrooms','number of views','number of floors']])
```

&lt;seaborn.axisgrid.PairGrid at 0x7cfe168504f0&gt;

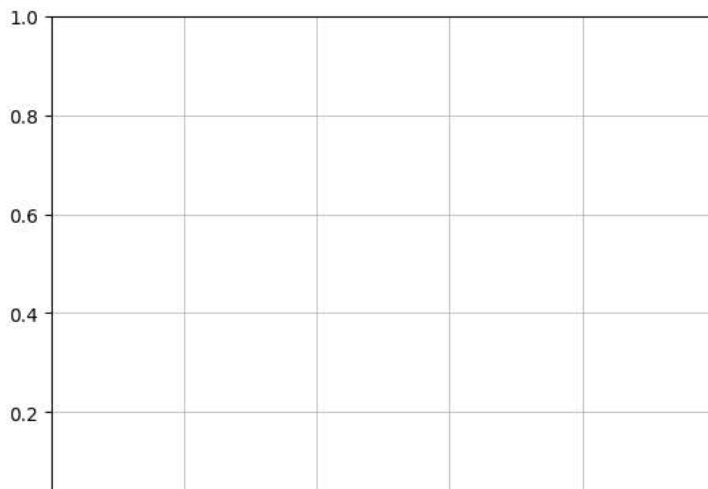


```
sns.scatterplot(df['number of bedrooms'])
```

&lt;Axes: ylabel='number of bedrooms'&gt;



```
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	



# Assignment-3 - Colaboratory

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	Latitude	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

```
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
Latitude	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
Latitude	-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
Latitude	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['Distance from the airport'].value_counts())
```

```

54    514
70    511
64    500
50    495
79    487
60    486
67    485
56    484
53    484
59    482
69    481
58    474
55    473
74    471
72    471
66    470
62    470
57    467
73    466
75    466
71    465
77    465
78    461
76    458
80    454
63    453
68    449
52    447
65    446

```

```
61 443
51 442
Name: Distance from the airport, dtype: int64
```

```
print('Mean:',df['Area of the basement'].mean())
print('Median:',df['Distance from the airport'].median())
print('Mode:',df['grade of the house'].mode())
```

```
Mean: 296.47906976744184
Median: 65.0
Mode: 0 7
Name: grade of the house, dtype: int64
```

```
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
Latitude 0
Longitude 0
living_area_renov 0
lot_area_renov 0
Number of schools nearby 0
Distance from the airport 0
Price 0
dtype: int64
```

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

```
x.head()
```

	number of bedrooms	number of bathrooms	living area	lot area	number of floors	waterfront present	number of views	condition of the house	g h
id									
6762810145	5	2.50	3650	9050	2.0	0	4	5	
6762810635	4	2.50	2920	4000	1.5	0	0	5	
6762810998	5	2.75	2910	9480	1.5	0	0	3	
6762812605	4	2.50	3310	42998	2.0	0	0	3	
6762812919	3	2.00	2710	4500	1.5	0	0	4	

```
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

GradientBoostingRegressor(max\_depth=5, n\_estimators=400)

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

```
0.9130901919275989
```

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

```
0.9026890923961436
```

```
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
```

