SMARTBRIDGE EXTERNSHIP - APPLIED DATA SCIENCE
ASSIGNMENT-3

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ADS Assignment 3

Problem Statement: House Price Prediction

Description:- House price prediction is a common problem in the real estate industry and involves predicting the selling price of a house based on various features and attributes. The problem is typically approached as a regression problem, where the target variable is the price of the house, and the features are various attributes of the house

The features used in house price prediction can include both quantitative and categorical variables, such as the number of bedrooms, house area, bedrooms, furnished, nearness to main road, and various amenities such as a garage and other factors that may influence the value of the property.

Accurate predictions can help agents and appraisers price homes correctly, while homeowners can use the predictions to set a reasonable asking price for their properties. Accurate house price prediction can also be useful for buyers who are looking to make informed decisions about purchasing a property and obtaining a fair price for their investment.

Attribute Information:

Name - Description

1- Price-Prices of the houses
2- Area- Area of the houses
3- Bedrooms- No of house bedrooms
4- Bathrooms- No of bathrooms
5- Stories- No of house stories
6- Main Road- Weather connected to Main road
7- Guestroom-Weather has a guest room
8- Basement-Weather has a basement
9- Hot water heating- Weather has a hot water heater
10-Airconditioning-Weather has a air conditioner
11-Parking- No of house parking
12-Furnishing Status-Furnishing status of house

Building a Regression Model

1. Download the dataset: Dataset
2. Load the dataset into the tool.

```
[1] import pandas as pd
    import numpy as np
```

```
[2] df=pd.read_csv('Housing.csv')
```

```
df
```

	price	area	bedrooms	bathrooms	stories	mainroad	guestroom	basement	hotwaterheating	airconditioning	parking	furnishingstatus
0	13300000	7420	4	2	3	yes	no	no	no	yes	2	furnished
1	12250000	8960	4	4	4	yes	no	no	no	yes	3	furnished
2	12250000	9960	3	2	2	yes	no	yes	no	no	2	semi-furnished
3	12215000	7500	4	2	2	yes	no	yes	no	yes	3	furnished
4	11410000	7420	4	1	2	yes	yes	yes	no	yes	2	furnished
...	...	...	...	...	...	...	...	...	...	...	...	...
540	1820000	3000	2	1	1	yes	no	yes	no	no	2	unfurnished
541	1767150	2400	3	1	1	no	no	no	no	no	0	semi-furnished
542	1750000	3620	2	1	1	yes	no	no	no	no	0	unfurnished
543	1750000	2910	3	1	1	no	no	no	no	no	0	furnished
544	1750000	3850	3	1	2	yes	no	no	no	no	0	unfurnished

545 rows × 12 columns

```
[4] df.dtypes
```

```
price                int64
area                 int64
bedrooms             int64
bathrooms            int64
stories              int64
mainroad            object
guestroom           object
basement            object
hotwaterheating     object
airconditioning     object
parking              int64
furnishingstatus    object
dtype: object
```

```
[7] df.head()
```

	price	area	bedrooms	bathrooms	stories	mainroad	guestroom	basement	hotwaterheating	airconditioning	parking	furnishingstatus
0	13300000	7420	4	2	3	yes	no	no	no	yes	2	furnished
1	12250000	8960	4	4	4	yes	no	no	no	yes	3	furnished
2	12250000	9960	3	2	2	yes	no	yes	no	no	2	semi-furnished
3	12215000	7500	4	2	2	yes	no	yes	no	yes	3	furnished
4	11410000	7420	4	1	2	yes	yes	yes	no	yes	2	furnished

```
df.replace('?',np.nan,inplace=True)
```

```
[9] df.replace('?',np.nan,inplace=True)
```

```
[10] df.shape
```

```
(545, 12)
```

```
[11] df.describe()
```

	price	area	bedrooms	bathrooms	stories	parking
count	5.450000e+02	545.000000	545.000000	545.000000	545.000000	545.000000
mean	4.766729e+06	5150.541284	2.965138	1.286239	1.805505	0.693578
std	1.870440e+06	2170.141023	0.738064	0.502470	0.867492	0.861586
min	1.750000e+06	1650.000000	1.000000	1.000000	1.000000	0.000000
25%	3.430000e+06	3600.000000	2.000000	1.000000	1.000000	0.000000
50%	4.340000e+06	4600.000000	3.000000	1.000000	2.000000	0.000000
75%	5.740000e+06	6360.000000	3.000000	2.000000	2.000000	1.000000
max	1.330000e+07	16200.000000	6.000000	4.000000	4.000000	3.000000

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 545 entries, 0 to 544
Data columns (total 12 columns):
```

```
df.info()
```

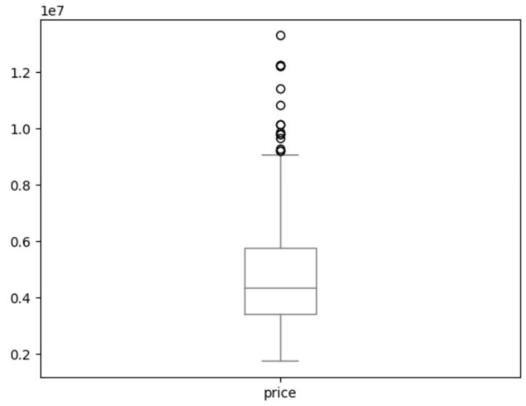
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 545 entries, 0 to 544
Data columns (total 12 columns):
 #   Column            Non-Null Count  Dtype 
---  ------            --------------  ----- 
 0   price             545 non-null    int64 
 1   area              545 non-null    int64 
 2   bedrooms          545 non-null    int64 
 3   bathrooms         545 non-null    int64 
 4   stories           545 non-null    int64 
 5   mainroad          545 non-null    object
 6   guestroom         545 non-null    object
 7   basement          545 non-null    object
 8   hotwaterheating   545 non-null    object
 9   airconditioning   545 non-null    object
 10  parking           545 non-null    int64 
 11  furnishingstatus  545 non-null    object
dtypes: int64(6), object(6)
memory usage: 51.2+ KB
```

3. Perform Below Visualizations.

- Univariate Analysis

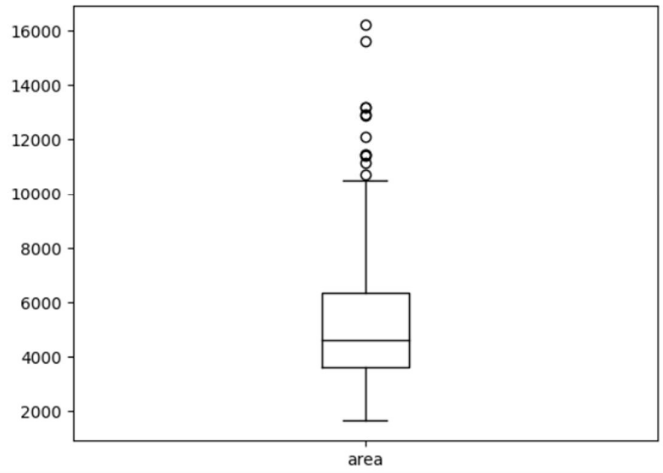
```
df.boxplot(column=['price'], grid=False, color='grey')
```

```
<Axes: >
```



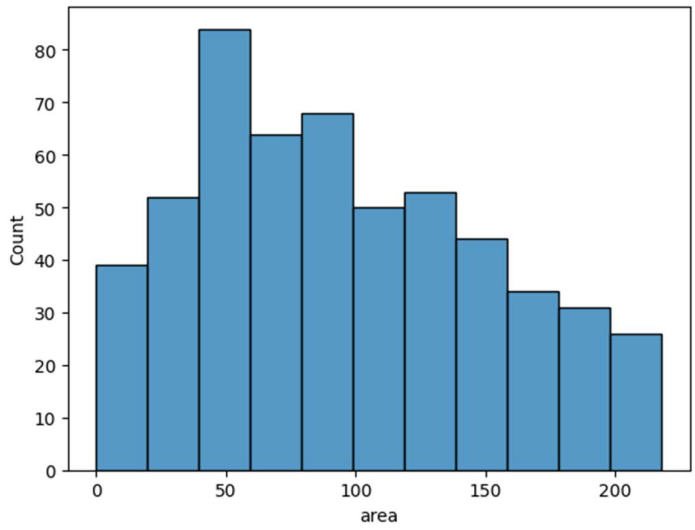

```
df.boxplot(column=['area'], grid=False, color='black')
```

```
<Axes: >
```



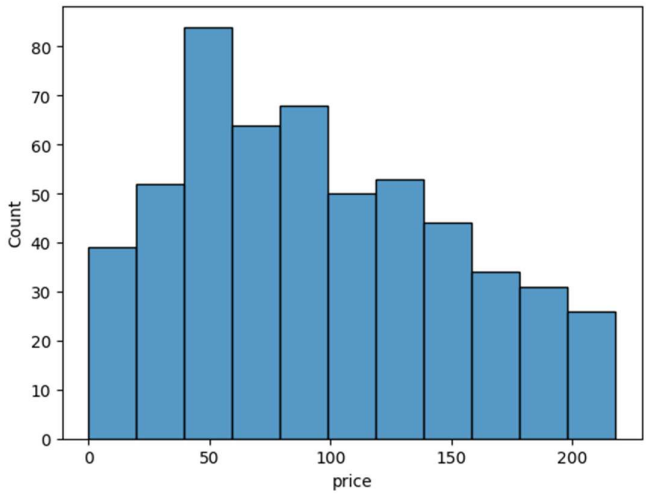
```
sns.histplot(df['area'])
```

```
<Axes: xlabel='area', ylabel='Count'>
```



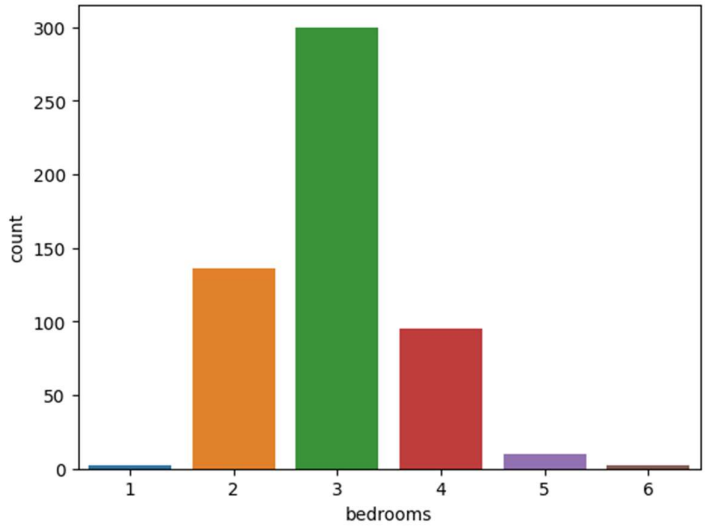

```
sns.histplot(df['price'])
```

```
<Axes: xlabel='price', ylabel='Count'>
```



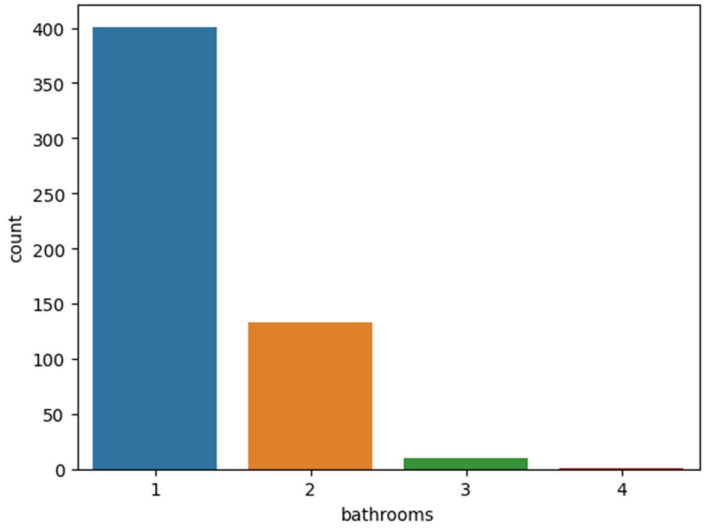
```
sns.countplot(x = df['bedrooms'])
```

```
<Axes: xlabel='bedrooms', ylabel='count'>
```



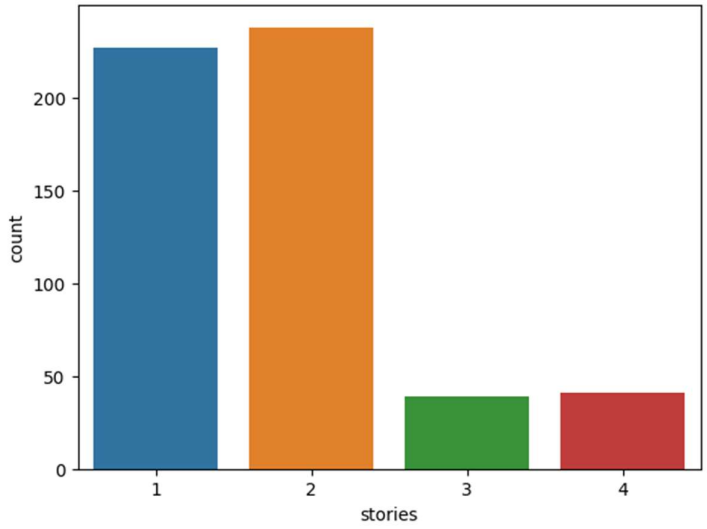

```
sns.countplot(x = df['bathrooms'])
```

```
<Axes: xlabel='bathrooms', ylabel='count'>
```



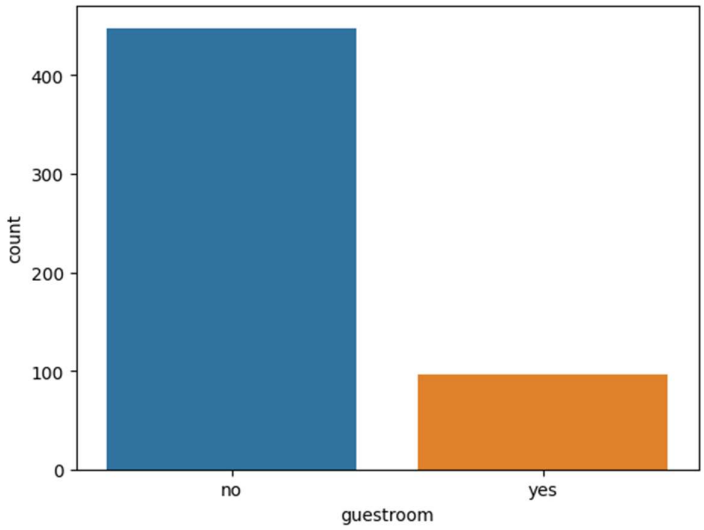
```
sns.countplot(x = df['stories'])
```

```
<Axes: xlabel='stories', ylabel='count'>
```



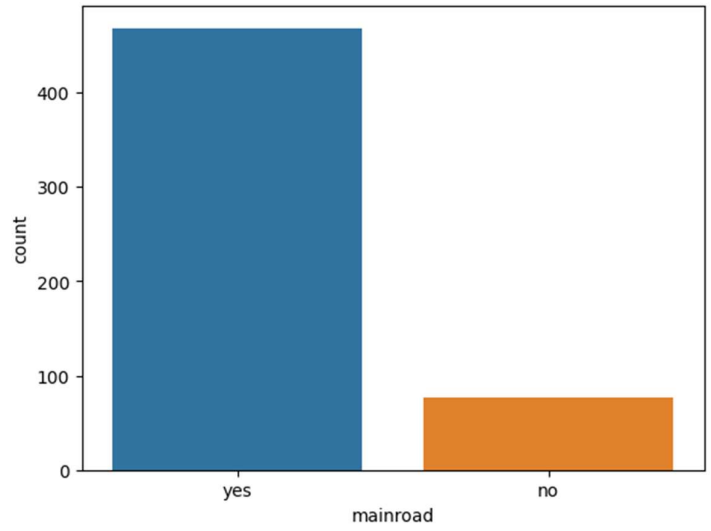

```
sns.countplot(x = df['guestroom'])
```

```
<Axes: xlabel='guestroom', ylabel='count'>
```



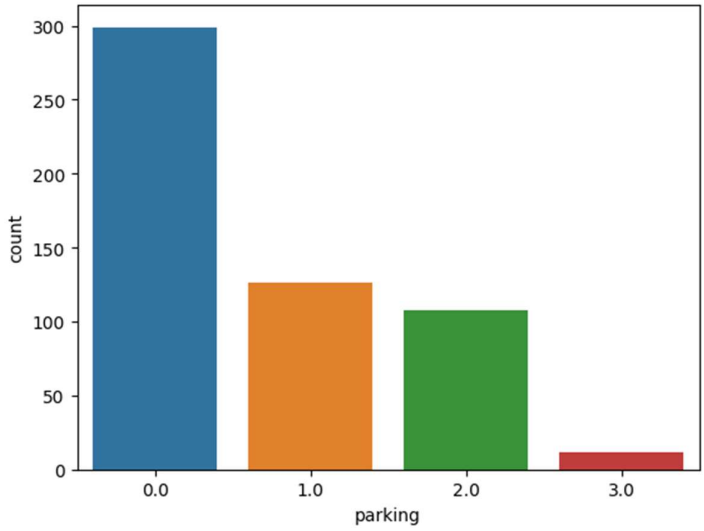
```
sns.countplot(x = df['mainroad'])
```

```
<Axes: xlabel='mainroad', ylabel='count'>
```



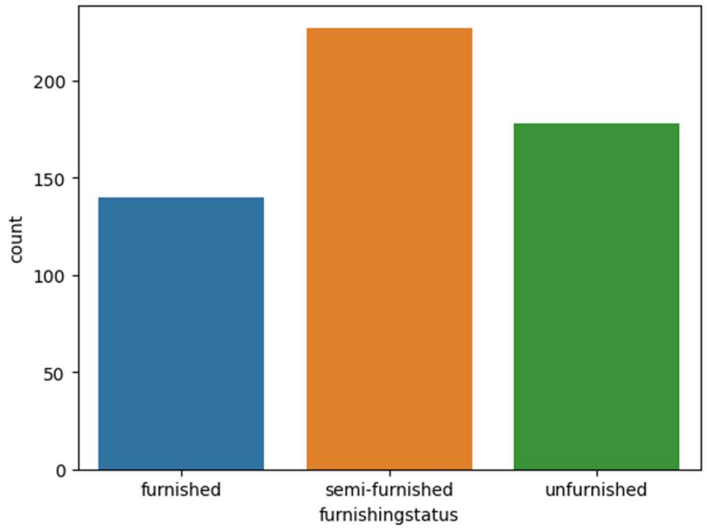

```
sns.countplot(x = df['parking'])
```

```
<Axes: xlabel='parking', ylabel='count'>
```



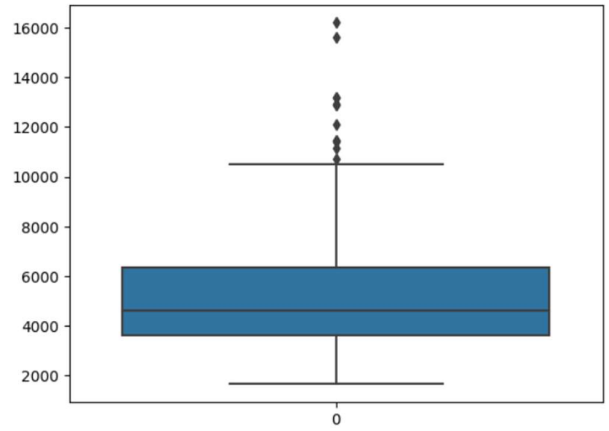
```
sns.countplot(x = df['furnishingstatus'])
```

```
<Axes: xlabel='furnishingstatus', ylabel='count'>
```



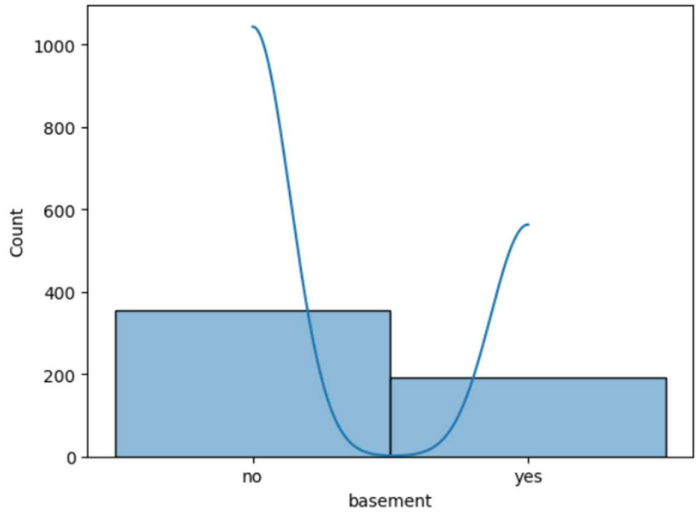

```
sns.boxplot(df.area)
```

```
<Axes: >
```



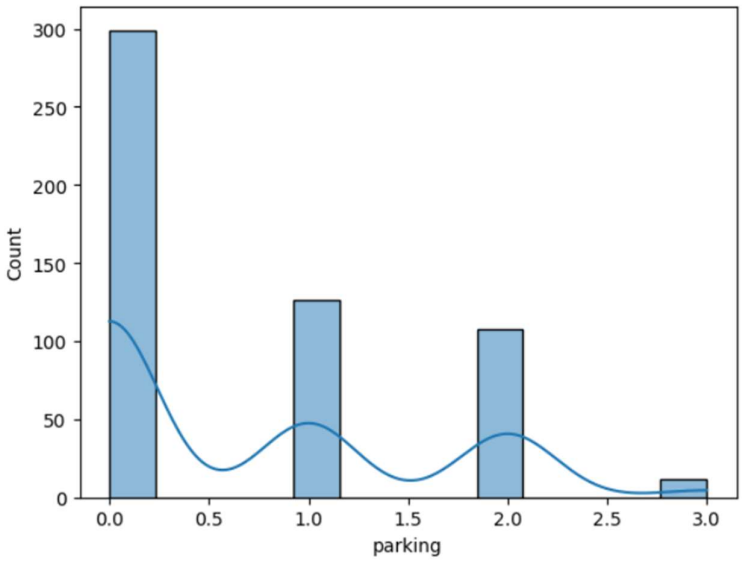
```
sns.histplot(df.basement,kde=True)
```

```
<Axes: xlabel='basement', ylabel='Count'>
```



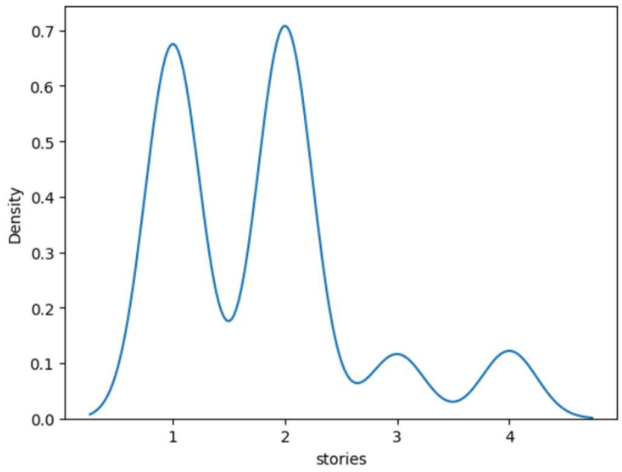

```
sns.histplot(df.parking,kde=True)
```

```
<Axes: xlabel='parking', ylabel='Count'>
```



```
sns.kdeplot(df['stories'])
```

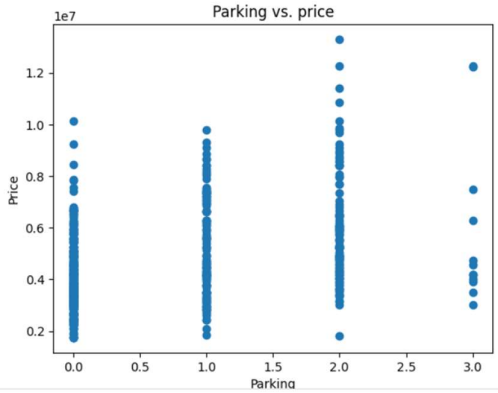
```
<Axes: xlabel='stories', ylabel='Density'>
```



- Bi-Variate Analysis

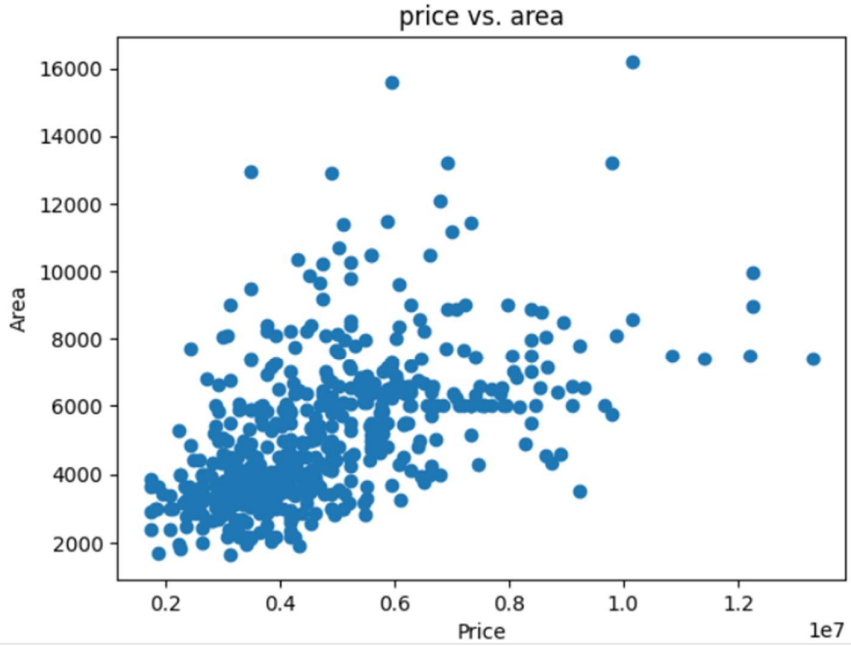
```
#Scatter Plot
plt.scatter(df.parking, df.price)
plt.title('Parking vs. price')
plt.xlabel('Parking')
plt.ylabel('Price')
```

```
Text(0, 0.5, 'Price')
```



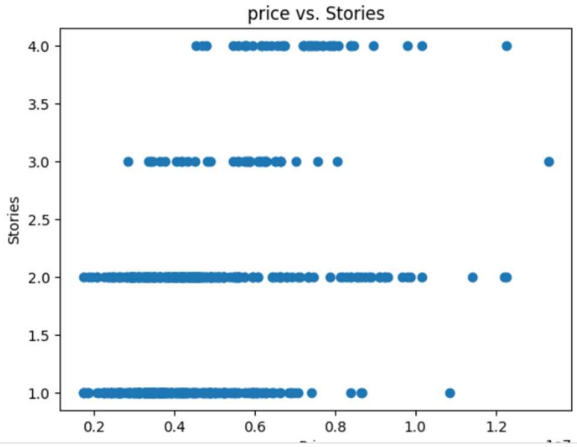
```
#Scatter Plot
plt.scatter(df.price, df.area)
plt.title('price vs. area')
plt.xlabel('Price')
plt.ylabel('Area')
```

```
Text(0, 0.5, 'Area')
```




```
#Scatter Plot
plt.scatter(df.price, df.stories)
plt.title('price vs. Stories')
plt.xlabel('Price')
plt.ylabel('Stories')
```

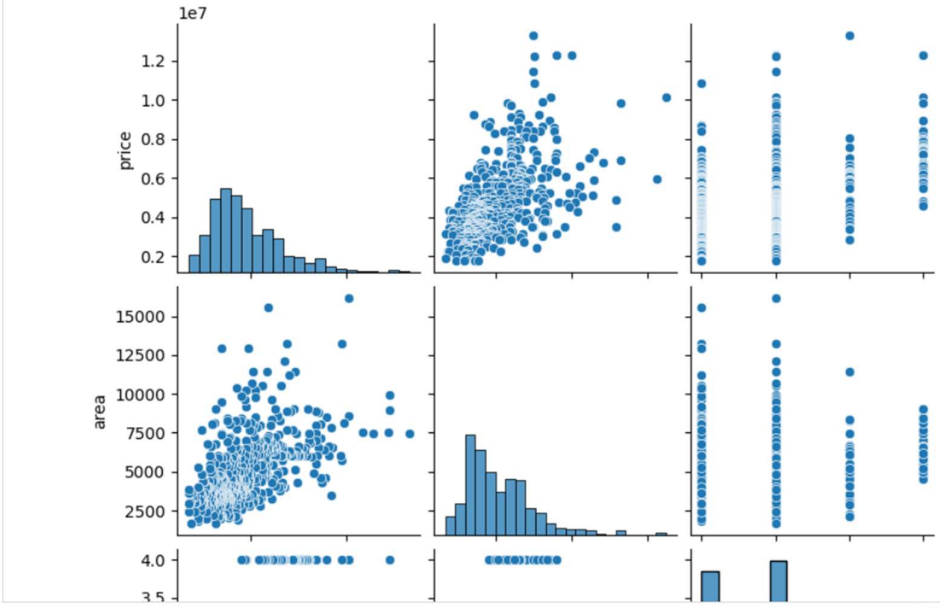
```
Text(0, 0.5, 'Stories')
```



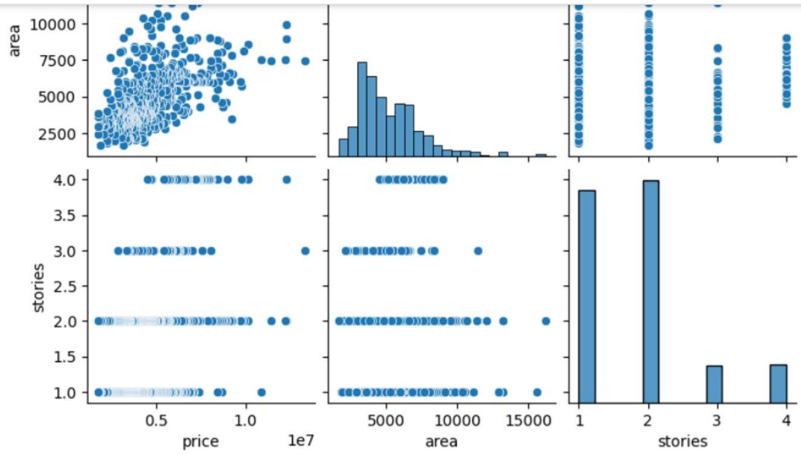
- Multi-Variate Analysis

```
sns.pairplot(data = df[['price', 'area', 'stories']])
```

```
<seaborn.axisgrid.PairGrid at 0x7f4cc4219990>
```

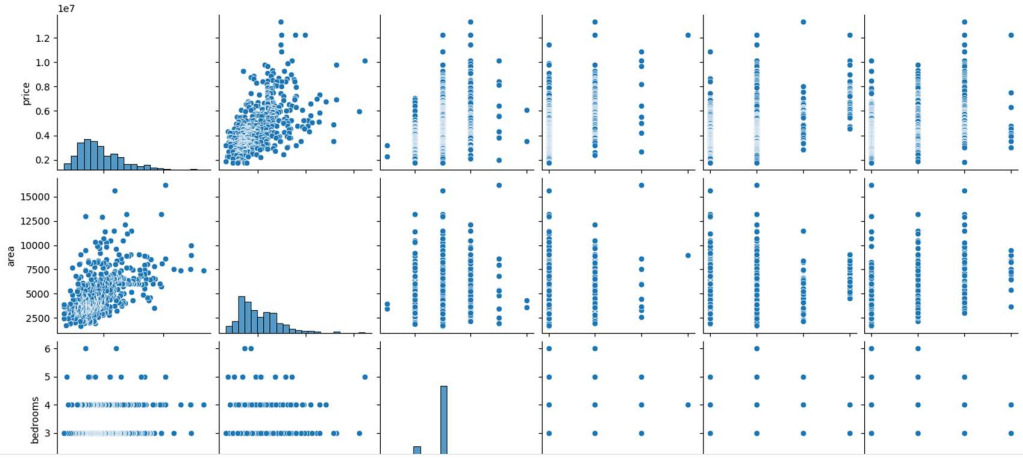


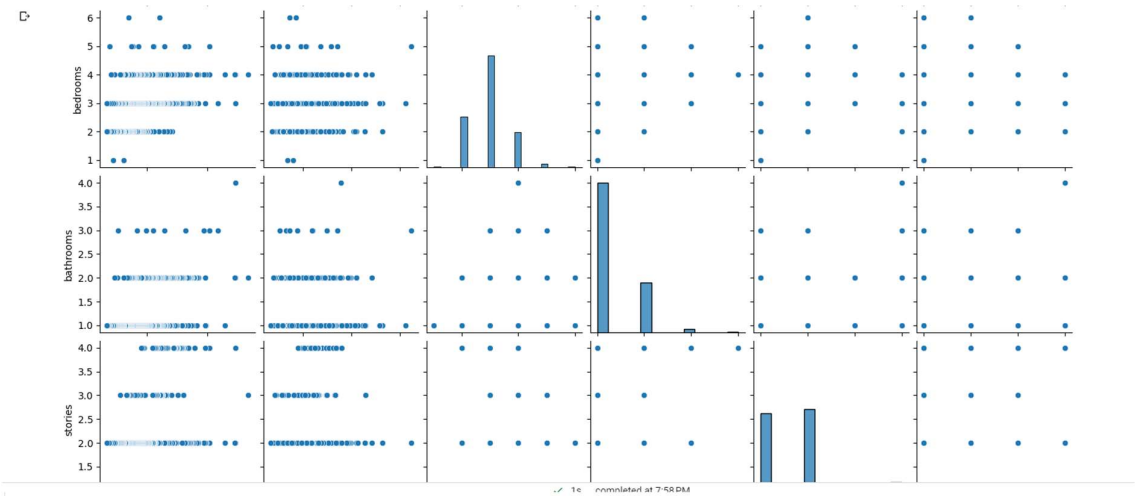
[36]




```
sns.pairplot(df)
```

```
<seaborn.axisgrid.PairGrid at 0x7f4cc3bd8910>
```






```
#Correlation

df.corr()
```


```
<ipython-input-31-4431e0efce13>:3: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version, it will default to False. Select only valid columns or specify the value of numeric_only to si
```

	price	area	bedrooms	bathrooms	stories	parking
price	1.000000	0.535997	0.366494	0.517545	0.420712	0.384394
area	0.535997	1.000000	0.151858	0.193820	0.083996	0.352980
bedrooms	0.366494	0.151858	1.000000	0.373930	0.408564	0.139270
bathrooms	0.517545	0.193820	0.373930	1.000000	0.326165	0.177496
stories	0.420712	0.083996	0.408564	0.326165	1.000000	0.045547
parking	0.384394	0.352980	0.139270	0.177496	0.045547	1.000000


```
#Simple Linear Regression
import statsmodels.api as sm

#define response variable
y = df['price']

#define explanatory variable
x = df[['area']]

#add constant to predictor variables
x = sm.add_constant(x)

#fit linear regression model
model = sm.OLS(y, x).fit()

#view model summary
print(model.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:                  price   R-squared:                       0.287
Model:                            OLS   Adj. R-squared:                  0.286
Method:                 Least Squares   F-statistic:                     218.9
Date:                Wed, 07 Jun 2023   Prob (F-statistic):           7.39e-42
Time:                        14:13:20   Log-Likelihood:                -8551.2
No. Observations:                 545   AIC:                         1.711e+04
Df Residuals:                     543   BIC:                         1.712e+04
```

4. Perform descriptive statistics on the dataset.

```
stats = df.describe(include = 'all')
print(stats)
```

```
                price          area    bedrooms   bathrooms     stories  \
count   5.450000e+02    545.000000  545.000000  545.000000  545.000000
unique           NaN           NaN         NaN         NaN         NaN
top              NaN           NaN         NaN         NaN         NaN
freq             NaN           NaN         NaN         NaN         NaN
mean    4.766729e+06   5150.541284    2.965138    1.286239    1.805505
std     1.870440e+06   2170.141023    0.738064    0.502470    0.867492
min     1.750000e+06   1650.000000    1.000000    1.000000    1.000000
25%     3.430000e+06   3600.000000    2.000000    1.000000    1.000000
50%     4.340000e+06   4600.000000    3.000000    1.000000    2.000000
75%     5.740000e+06   6360.000000    3.000000    2.000000    2.000000
max     1.330000e+07  16200.000000    6.000000    4.000000    4.000000

       mainroad guestroom basement hotwaterheating airconditioning  \
count       545       545      545             545             545
unique        2         2        2               2               2
top         yes        no       no              no              no
freq        468       448      354             520             373
mean        NaN       NaN      NaN             NaN             NaN
std         NaN       NaN      NaN             NaN             NaN
min         NaN       NaN      NaN             NaN             NaN
25%         NaN       NaN      NaN             NaN             NaN
50%         NaN       NaN      NaN             NaN             NaN
75%         NaN       NaN      NaN             NaN             NaN
max         NaN       NaN      NaN             NaN             NaN

            parking furnishingstatus
count   545.000000               545
unique         NaN                 3
top            NaN   semi-furnished
freq           NaN               227
mean      0.693578               NaN
std       0.861586               NaN
min       0.000000               NaN
25%       0.000000               NaN
50%       0.000000               NaN
75%       1.000000               NaN
```

```
[40] df.mean()
```

```
<ipython-input-40-c61f0c8f89b5>:1: FutureWarning: The default value of numeric_only in DataFrame.mean is deprecated. In a future version, it will default to False. I
price        4.766729e+06
area         5.150541e+03
bedrooms     2.965138e+00
bathrooms    1.286239e+00
stories      1.805505e+00
parking      6.935780e-01
dtype: float64
```

```
[41] df.median()
```

```
<ipython-input-41-6d467abf240d>:1: FutureWarning: The default value of numeric_only in DataFrame.median is deprecated. In
price        4340000.0
area            4600.0
bedrooms           3.0
bathrooms          1.0
stories            2.0
parking            0.0
dtype: float64
```

```
df.max()
```

```
price                 13300000
area                     16200
bedrooms                     6
bathrooms                    4
stories                      4
mainroad                   yes
guestroom                  yes
basement                   yes
hotwaterheating            yes
airconditioning            yes
parking                      3
furnishingstatus    unfurnished
dtype: object
```

```
[43] df.std()
```

```
<ipython-input-43-ce97bb7eaef8>:1: FutureWarning: The default value of numeric_only in DataFrame.std is deprecated. In a future version,
price        1.870440e+06
area         2.170141e+03
bedrooms     7.380639e-01
bathrooms    5.024696e-01
stories      8.674925e-01
parking      8.615858e-01
dtype: float64
```

```
df.isnull()
```

	price	area	bedrooms	bathrooms	stories	mainroad	guestroom	basement	hotwaterheating	airconditioning	parking	furnishingstatus
0	False	False	False	False	False	False	False	False	False	False	False	False
1	False	False	False	False	False	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False	False	False	False	False	False
3	False	False	False	False	False	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False	False	False	False	False	False
...	...	...	...	...	...	...	...	...	...	...	...	...
540	False	False	False	False	False	False	False	False	False	False	False	False
541	False	False	False	False	False	False	False	False	False	False	False	False
542	False	False	False	False	False	False	False	False	False	False	False	False
543	False	False	False	False	False	False	False	False	False	False	False	False
544	False	False	False	False	False	False	False	False	False	False	False	False

545 rows × 12 columns

+ Code + Text

5. Check for Missing values and deal with them.

```
[44] df.isnull()
```

	price	area	bedrooms	bathrooms	stories	mainroad	guestroom	basement	hotwaterheating	airconditioning	parking	furnishingstatus
0	False	False	False	False	False	False	False	False	False	False	False	False
1	False	False	False	False	False	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False	False	False	False	False	False
3	False	False	False	False	False	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False	False	False	False	False	False
...	...	...	...	...	...	...	...	...	...	...	...	...
540	False	False	False	False	False	False	False	False	False	False	False	False
541	False	False	False	False	False	False	False	False	False	False	False	False
542	False	False	False	False	False	False	False	False	False	False	False	False
543	False	False	False	False	False	False	False	False	False	False	False	False
544	False	False	False	False	False	False	False	False	False	False	False	False

545 rows × 12 columns

```
pd.isnull(df["parking"])
```

```
0      False
1      False
2      False
3      False
4      False
       ...
```

```
[46] df['area'].fillna(df['area'].mean(),inplace=True)
```

6. Find the outliers and replace them outliers

```
[47] from scipy import stats
     import numpy as np
     z = np.abs(stats.zscore(df['parking']))
     print(z)
```

```
0      1.517692
1      2.679409
2      1.517692
3      2.679409
4      1.517692
         ...
540    1.517692
541    0.805741
542    0.805741
543    0.805741
544    0.805741
Name: parking, Length: 545, dtype: float64
```

```
[48] threshold = 2

     # Position of the outlier
     print(np.where(z > 2))
```

```
(array([  1,   3,  47,  93, 225, 247, 299, 304, 323, 331, 401, 472]),)
```

```
[49] Q1 = np.percentile(df['parking'], 25, method='midpoint')
     Q3 = np.percentile(df['parking'], 75, method='midpoint')
     IQR = Q3 - Q1
     print(IQR)
```

```
1.0
```

```
[50] # Above Upper bound
     upper=Q3+1.5*IQR
     upper_array=np.array(df['parking']>=upper)
     print("Upper Bound:",upper)
     print(upper_array.sum())

     #Below Lower bound
     lower=Q1-1.5*IQR
     lower_array=np.array(df['parking']<=lower)
     print("Lower Bound:",lower)
     print(lower_array.sum())
```

```
Upper Bound: 2.5
12
Lower Bound: -1.5
0
```

```
print("Old Shape: ", df.shape)

''' Detection '''
# IQR
# Calculate the upper and lower limits
Q1 = df['parking'].quantile(0.25)
Q3 = df['parking'].quantile(0.75)
IQR = Q3 - Q1
lower = Q1 - 1.5*IQR
upper = Q3 + 1.5*IQR

# Create arrays of Boolean values indicating the outlier rows
upper_array = np.where(df['parking']>=upper)[0]
lower_array = np.where(df['parking']<=lower)[0]

# Removing the outliers
df['parking'].drop(index=upper_array, inplace=True)
df['parking'].drop(index=lower_array, inplace=True)
```

```
# Create arrays of Boolean values indicating the outlier rows
upper_array = np.where(df['parking']>=upper)[0]
lower_array = np.where(df['parking']<=lower)[0]

# Removing the outliers
df['parking'].drop(index=upper_array, inplace=True)
df['parking'].drop(index=lower_array, inplace=True)

# Print the new shape of the DataFrame
print("New Shape: ", df['parking'].shape)
```

```
Old Shape:  (545, 12)
New Shape:  (545,)
```

```
[53] median = df.loc[df['parking']<13, 'parking'].median()
     df.loc[df.parking > 13, 'parking'] = np.nan
     df.fillna(median,inplace=True)
```

7. Check for Categorical columns and perform encoding.

```
df_main.corr()
```

```
<ipython-input-61-b764c75a6398>:1: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version, it will default to False. Select only valid c
```

	price	area	bedrooms	bathrooms	parking	stories_1	stories_2	stories_3	stories_4
price	1.000000	1.000000	0.373302	0.493090	0.363694	-0.266898	-0.017796	0.158267	0.377645
area	1.000000	1.000000	0.373302	0.493090	0.363694	-0.266898	-0.017796	0.158267	0.377645
bedrooms	0.373302	0.373302	1.000000	0.373930	0.139270	-0.510235	0.377769	0.100010	0.145561
bathrooms	0.493090	0.493090	0.373930	1.000000	0.177496	-0.251905	0.080144	0.040225	0.280809
parking	0.363694	0.363694	0.139270	0.177496	1.000000	0.015383	-0.043285	-0.074838	0.125775
stories_1	-0.266898	-0.266898	-0.510235	-0.251905	0.015383	1.000000	-0.743907	-0.234561	-0.240977
stories_2	-0.017796	-0.017796	0.377769	0.080144	-0.043285	-0.743907	1.000000	-0.244442	-0.251128
stories_3	0.158267	0.158267	0.100010	0.040225	-0.074838	-0.234561	-0.244442	1.000000	-0.079183
stories_4	0.377645	0.377645	0.145561	0.280809	0.125775	-0.240977	-0.251128	-0.079183	1.000000

x

```
[55] #label encoding
     from sklearn.preprocessing import LabelEncoder
     le=LabelEncoder()
     df.price=le.fit_transform(df.price)
```

```
[57] df.area=le.fit_transform(df.price)
```

```
[58] df.head()
```

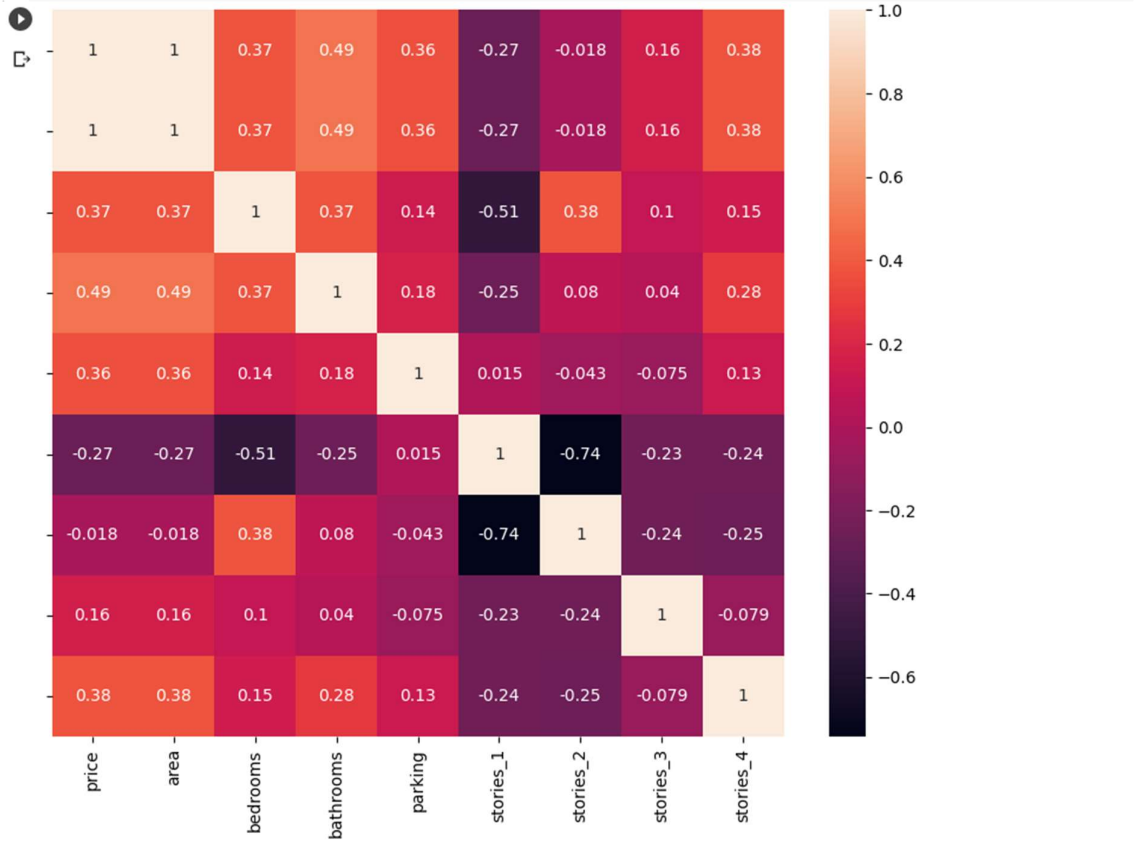
	price	area	bedrooms	bathrooms	stories	mainroad	guestroom	basement	hotwaterheating	airconditioning	parking	furnishingstatus
0	218	218	4	2	3	yes	no	no	no	yes	2.0	furnished
1	217	217	4	4	4	yes	no	no	no	yes	3.0	furnished
2	217	217	3	2	2	yes	no	yes	no	no	2.0	semi-furnished
3	216	216	4	2	2	yes	no	yes	no	yes	3.0	furnished
4	215	215	4	1	2	yes	yes	yes	no	yes	2.0	furnished

```
[59] df_main=pd.get_dummies(df,columns=['stories'])
```

```
df_main.head()
```

	price	area	bedrooms	bathrooms	mainroad	guestroom	basement	hotwaterheating	airconditioning	parking	furnishingstatus	stories_1	stories_2	stories_3	stories_4
0	218	218	4	2	yes	no	no	no	yes	2.0	furnished	0	0	1	0
1	217	217	4	4	yes	no	no	no	yes	3.0	furnished	0	0	0	1
2	217	217	3	2	yes	no	yes	no	no	2.0	semi-furnished	0	1	0	0
3	216	216	4	2	yes	no	yes	no	yes	3.0	furnished	0	1	0	0
4	215	215	4	1	yes	yes	yes	no	yes	2.0	furnished	0	1	0	0

```
#Heatmap
plt.figure(figsize=(10,8))
sns.heatmap(df_main.corr(),annot=True)
```



8. Split the data
into dependent and independent variables.

```
[63] # Y is dependent variable(target)
     y=df_main['price']
     y.head()
```

```
0    218
1    217
2    217
3    216
4    215
Name: price, dtype: int64
```

```
[65] # X is independent variable or predictors
     X=df_main.drop(columns=['price', 'hotwaterheating', 'basement', 'airconditioning', 'furnishingstatus', 'mainroad', 'guestroom'],axis=1)
     X.head()
```

	area	bedrooms	bathrooms	parking	stories_1	stories_2	stories_3	stories_4
0	218	4	2	2.0	0	0	1	0
1	217	4	4	3.0	0	0	0	1
2	217	3	2	2.0	0	1	0	0
3	216	4	2	3.0	0	1	0	0
4	215	4	1	2.0	0	1	0	0

9. Scale the independent variables

```
[66] name=X.columns
     name
```

```
Index(['area', 'bedrooms', 'bathrooms', 'parking', 'stories_1', 'stories_2',
       'stories_3', 'stories_4'],
      dtype='object')
```

```
[67] from sklearn.preprocessing import MinMaxScaler
     scale=MinMaxScaler()
```

```
[68] X_scaled=scale.fit_transform(X)
     X_scaled
```

```
array([[1.        , 0.6       , 0.33333333, ..., 0.        , 1.        ,
        0.        ],
       [0.99541284, 0.6       , 1.        , ..., 0.        , 0.        ,
        1.        ],
       [0.99541284, 0.4       , 0.33333333, ..., 1.        , 0.        ,
        0.        ],
       ...,
       [0.        , 0.2       , 0.        , ..., 0.        , 0.        ,
        0.        ],
       [0.        , 0.4       , 0.        , ..., 0.        , 0.        ,
        0.        ],
       [0.        , 0.4       , 0.        , ..., 1.        , 0.        ,
        0.        ]])
```

```
X=pd.DataFrame(X_scaled,columns=name)
X
```

	area	bedrooms	bathrooms	parking	stories_1	stories_2	stories_3	stories_4
0	1.000000	0.6	0.333333	0.666667	0.0	0.0	1.0	0.0
1	0.995413	0.6	1.000000	1.000000	0.0	0.0	0.0	1.0
2	0.995413	0.4	0.333333	0.666667	0.0	1.0	0.0	0.0

```
[69] X=pd.DataFrame(X_scaled,columns=name)
     X
```

	area	bedrooms	bathrooms	parking	stories_1	stories_2	stories_3	stories_4
0	1.000000	0.6	0.333333	0.666667	0.0	0.0	1.0	0.0
1	0.995413	0.6	1.000000	1.000000	0.0	0.0	0.0	1.0
2	0.995413	0.4	0.333333	0.666667	0.0	1.0	0.0	0.0
3	0.990826	0.6	0.333333	1.000000	0.0	1.0	0.0	0.0
4	0.986239	0.6	0.000000	0.666667	0.0	1.0	0.0	0.0
...	...	...	...	...	...	...	...	...
540	0.009174	0.2	0.000000	0.666667	1.0	0.0	0.0	0.0
541	0.004587	0.4	0.000000	0.000000	1.0	0.0	0.0	0.0
542	0.000000	0.2	0.000000	0.000000	1.0	0.0	0.0	0.0
543	0.000000	0.4	0.000000	0.000000	1.0	0.0	0.0	0.0
544	0.000000	0.4	0.000000	0.000000	0.0	1.0	0.0	0.0

545 rows × 8 columns

10. Split the data into training and testing

```
[70] from sklearn.model_selection import train_test_split
```

```
[71] X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2,random_state=0)
```

```
[72] X_train.head()
```

	area	bedrooms	bathrooms	parking	stories_1	stories_2	stories_3	stories_4
542	0.000000	0.2	0.0	0.0	1.0	0.0	0.0	0.0
496	0.100917	0.2	0.0	0.0	1.0	0.0	0.0	0.0
484	0.123853	0.2	0.0	0.0	1.0	0.0	0.0	0.0
507	0.082569	0.2	0.0	0.0	1.0	0.0	0.0	0.0
252	0.435780	0.4	0.0	0.0	1.0	0.0	0.0	0.0

```
[73] X_test.head()
```

	area	bedrooms	bathrooms	parking	stories_1	stories_2	stories_3	stories_4
239	0.449541	0.4	0.0	0.333333	0.0	1.0	0.0	0.0
113	0.674312	0.4	0.0	0.666667	1.0	0.0	0.0	0.0
325	0.330275	0.6	0.0	0.000000	0.0	1.0	0.0	0.0
66	0.788991	0.2	0.0	0.333333	1.0	0.0	0.0	0.0
479	0.128440	0.6	0.0	0.000000	0.0	1.0	0.0	0.0

```
y_train
```

```
542     0
496    22
484    27
```

```
[74] y_train
```

```
542     0
496    22
484    27
507    18
252    95
      ...
70    169
277    85
9     211
359    62
192   117
Name: price, Length: 436, dtype: int64
```

```
y_test
```

```
239     98
113    147
325     72
66     172
479     28
      ...
76     165
132    140
311     77
464     34
155    133
Name: price, Length: 109, dtype: int64
```

11. Build the Model
12. Train the Model
13. Test the Model
14. Measure the performance using Metrics.

```
[76] X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.33, random_state=101)
```

```
[77] from sklearn.model_selection import train_test_split
     from sklearn.linear_model import LinearRegression
     from sklearn import metrics
     %matplotlib inline
```

```
[78] lm = LinearRegression()
```

```
[79] lm.fit(X_train,y_train)
```

```
▾ LinearRegression
LinearRegression()
```

```
[80] print(lm.intercept_)
```

```
2.842170943040401e-14
```

```
[81] lm.coef_
```

```
array([ 2.18000000e+02,  5.09309693e-14,  6.56039411e-14, -9.06361449e-14,
       -3.53024649e-14, -8.03981922e-15, -1.75456812e-14, -4.83003205e-14])
```

```
cdf = pd.DataFrame(lm.coef_,X.columns,columns=['coeff'])
cdf
```

[82]

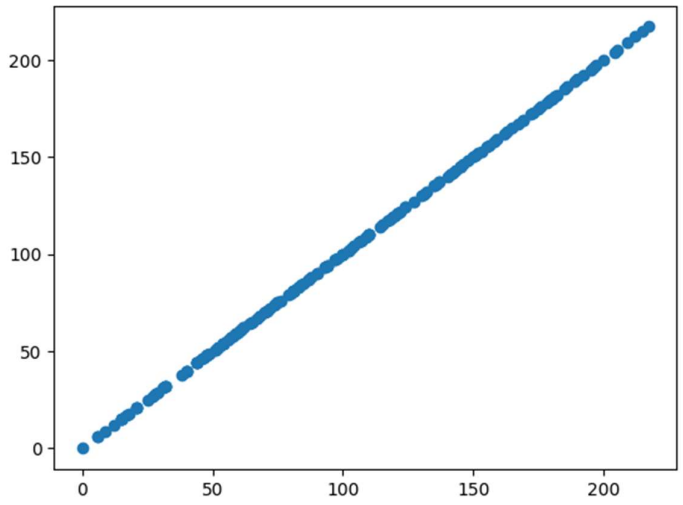
	coeff
area	2.180000e+02
bedrooms	5.093097e-14
bathrooms	6.560394e-14
parking	-9.063614e-14
stories_1	-3.530246e-14
stories_2	-8.039819e-15
stories_3	-1.754568e-14
stories_4	-4.830032e-14

```
predictions = lm.predict(X_test)
predictions
```

```
array([1.03000000e+02, 2.05000000e+02, 1.82000000e+02, 6.40000000e+01,
       6.50000000e+01, 6.10000000e+01, 1.89000000e+02, 5.40000000e+01,
       7.60000000e+01, 1.24000000e+02, 8.10000000e+01, 2.12000000e+02,
       4.40000000e+01, 7.50000000e+01, 1.53000000e+02, 1.22000000e+02,
       4.00000000e+01, 1.62000000e+02, 5.60000000e+01, 9.30000000e+01,
       1.46000000e+02, 1.45000000e+02, 1.63000000e+02, 1.45000000e+02,
       9.70000000e+01, 9.00000000e+01, 3.20000000e+01, 8.10000000e+01,
       5.90000000e+01, 1.80000000e+02, 1.45000000e+02, 6.00000000e+00,
       1.96000000e+02, 4.00000000e+01, 1.30000000e+02, 4.80000000e+01,
       1.07000000e+02, 1.06000000e+02, 5.40000000e+01, 1.80000000e+01,
       9.80000000e+01, 2.15000000e+02, 1.18000000e+02, 8.10000000e+01,
       2.10000000e+01, 5.10000000e+01, 4.90000000e+01, 1.02000000e+02,
       1.55000000e+02, 8.10000000e+01, 6.50000000e+01, 1.20000000e+02,
       2.17000000e+02, 4.40000000e+01, 1.21000000e+02, 7.40000000e+01,
       4.70000000e+01, 1.10000000e+02, 9.40000000e+01, 5.90000000e+01,
       3.80000000e+01, 2.00000000e+02, 1.97000000e+02, 8.70000000e+01,
       1.00000000e+02, 1.51000000e+02, 4.60000000e+01, 1.73000000e+02,
       5.70000000e+01, 9.40000000e+01, 1.75000000e+02, 2.09000000e+02,
       8.30000000e+01, 4.80000000e+01, 4.00000000e+01, 1.09000000e+02,
       1.50000000e+01, 9.00000000e+00, 9.30000000e+01, 1.42000000e+02,
```

```
plt.scatter(y_test,predictions)
```

```
<matplotlib.collections.PathCollection at 0x7f4cc01bfdf0>
```



```
sns.distplot(y_test-predictions,bins=30)
```

```
<ipython-input-85-5eafd2b47918>:1: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

<Axes: xlabel='price', ylabel='Density'>
```