```
import numpy as np
import pandas as pd
```

```
data=pd.read_csv("Bengaluru_House_Data.csv")
```

```
data.head()
```

	area_type	availability	location	size	society	total_sqft	bath	balcor
0	Super built-up Area	19-Dec	Electronic City Phase II	2 BHK	Coomee	1056	2.0	1
1	Plot Area	Ready To Move	Chikka Tirupathi	4 Bedroom	Theanmp	2600	5.0	3
2	Built-up	Ready To	Uttarahalli	3 BHK	NaN	1440	2.0	3

```
data.shape
```

```
(13320, 9)
```

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 13320 entries, 0 to 13319
Data columns (total 9 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   area_type     13320 non-null  object
 1   availability  13320 non-null  object
 2   location      13319 non-null  object
 3   size          13304 non-null  object
 4   society       7818 non-null   object
 5   total_sqft    13320 non-null  object
 6   bath          13247 non-null  float64
 7   balcony       12711 non-null  float64
 8   price         13320 non-null  float64
dtypes: float64(3), object(6)
memory usage: 936.7+ KB
```

```
for column in data.columns:
  print(data[column].value_counts())
  print()
```

```
Super built-up  Area    8790
Built-up  Area          2418
Plot  Area              2025
Carpet  Area              87
Name: area_type, dtype: int64

Ready To Move    10581
18-Dec             307
18-May             295
18-Apr             271
18-Aug             200
                 ...
15-Aug               1
17-Jan               1
16-Nov               1
16-Jan               1
14-Jul               1
Name: availability, Length: 81, dtype: int64

Whitefield                        540
Sarjapur  Road                    399
Electronic City                   302
Kanakpura Road                    273
Thanisandra                       234
                                 ...
Bapuji Layout                       1
1st Stage Radha Krishna Layout      1
BEML Layout 5th stage               1
singapura paradise                  1
```

```
Abshot Layout                      1
Name: location, Length: 1305, dtype: int64

2 BHK         5199
3 BHK         4310
4 Bedroom      826
4 BHK          591
3 Bedroom      547
1 BHK          538
2 Bedroom      329
5 Bedroom      297
6 Bedroom      191
1 Bedroom      105
8 Bedroom       84
7 Bedroom       83
5 BHK           59
9 Bedroom       46
6 BHK           30
7 BHK           17
1 RK            13
10 Bedroom      12
9 BHK            8
8 BHK            5
11 BHK           2
11 Bedroom       2
10 BHK           2
14 BHK           1
13 BHK           1
```

```
data.isna().sum()
```

```
area_type          0
availability       0
location           1
size              16
society         5502
total_sqft         0
bath              73
balcony          609
price              0
dtype: int64
```

```
data.drop(columns=['area_type','availability','society','balcony'],inplace=True)
```

```
data.describe()
```

	bath	price
count	13247.000000	13320.000000
mean	2.692610	112.565627
std	1.341458	148.971674
min	1.000000	8.000000
25%	2.000000	50.000000
50%	2.000000	72.000000
75%	3.000000	120.000000
max	40.000000	3600.000000

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 13320 entries, 0 to 13319
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   location    13319 non-null  object
 1   size        13304 non-null  object
 2   total_sqft  13320 non-null  object
 3   bath        13247 non-null  float64
 4   price       13320 non-null  float64
dtypes: float64(2), object(3)
memory usage: 520.4+ KB
```

```
data['location'].value_counts()
```

```
Whitefield                        540
Sarjapur  Road                    399
Electronic City                   302
Kanakpura Road                    273
Thanisandra                       234
                                 ...
Bapuji Layout                       1
1st Stage Radha Krishna Layout      1
BEML Layout 5th stage               1
singapura paradise                  1
Abshot Layout                       1
Name: location, Length: 1305, dtype: int64
```

```
data['location']=data['location'].fillna('Sarjapur road')
```

```
data['size'].value_counts()
```

```
2 BHK         5199
3 BHK         4310
4 Bedroom      826
4 BHK          591
3 Bedroom      547
1 BHK          538
2 Bedroom      329
5 Bedroom      297
6 Bedroom      191
1 Bedroom      105
8 Bedroom       84
7 Bedroom       83
5 BHK           59
9 Bedroom       46
6 BHK           30
7 BHK           17
1 RK            13
10 Bedroom      12
9 BHK            8
8 BHK            5
11 BHK           2
11 Bedroom       2
10 BHK           2
14 BHK           1
13 BHK           1
12 Bedroom       1
27 BHK           1
43 Bedroom       1
16 BHK           1
19 BHK           1
18 Bedroom       1
Name: size, dtype: int64
```

```
data['size']=data['size'].fillna('2 BHK')
```

```
data['bath']=data['bath'].fillna(data['bath'].median())
```

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 13320 entries, 0 to 13319
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   location    13320 non-null  object 
 1   size        13320 non-null  object 
 2   total_sqft  13320 non-null  object 
 3   bath        13320 non-null  float64
 4   price       13320 non-null  float64
dtypes: float64(2), object(3)
memory usage: 520.4+ KB
```

```
data['bhk']=data['size'].str.split().str.get(0).astype(int)
```

```
data[data.bhk>20]
```

```
                        location        size  total_sqft  bath  price  bhk
```

```
data['total_sqft'].unique()
```

```
array(['1056', '2600', '1440', ..., '1133 - 1384', '774', '4689'],
      dtype=object)
```

```
def convertRange(x):
  temp=x.split('-')
  if len(temp)==2:
    return (float(temp[0])+float(temp[1]))/2;
  try:
    return float(x);
  except:
    return None
```

```
data['total_sqft']=data['total_sqft'].apply(convertRange)
```

```
data.head()
```

	location	size	total_sqft	bath	price	bhk
0	Electronic City Phase II	2 BHK	1056.0	2.0	39.07	2
1	Chikka Tirupathi	4 Bedroom	2600.0	5.0	120.00	4
2	Uttarahalli	3 BHK	1440.0	2.0	62.00	3
3	Lingadheeranahalli	3 BHK	1521.0	3.0	95.00	3
4	Kothanur	2 BHK	1200.0	2.0	51.00	2

```
#price per square feet
```

```
data['price_per_sqft']=data['price']*100000/data['total_sqft']
```

```
data['price_per_sqft']
```

```
0         3699.810606
1         4615.384615
2         4305.555556
3         6245.890861
4         4250.000000
             ...
13315     6689.834926
13316    11111.111111
13317     5258.545136
13318    10407.336319
13319     3090.909091
Name: price_per_sqft, Length: 13320, dtype: float64
```

```
data.describe()
```

	total_sqft	bath	price	bhk	price_per_sqft
count	13274.000000	13320.000000	13320.000000	13320.000000	1.327400e+04
mean	1559.626694	2.688814	112.565627	2.802778	7.907501e+03
std	1238.405258	1.338754	148.971674	1.294496	1.064296e+05
min	1.000000	1.000000	8.000000	1.000000	2.678298e+02
25%	1100.000000	2.000000	50.000000	2.000000	4.266865e+03
50%	1276.000000	2.000000	72.000000	3.000000	5.434306e+03
75%	1680.000000	3.000000	120.000000	3.000000	7.311746e+03
max	52272.000000	40.000000	3600.000000	43.000000	1.200000e+07

```
data['location'].value_counts()
```

```
Whitefield                        540
Sarjapur  Road                    399
Electronic City                   302
```

```
Kanakpura Road                    273
Thanisandra                       234
                                 ...
1st Stage Radha Krishna Layout      1
BEML Layout 5th stage               1
singapura paradise                  1
Uvce Layout                         1
Abshot Layout                       1
Name: location, Length: 1306, dtype: int64
```

```
data['location']=data['location'].apply(lambda x:x.strip())
location_count=data['location'].value_counts()
```

```
location_count_less_10=location_count[location_count<=10]
location_count_less_10
```

```
BTM 1st Stage                         10
Nagadevanahalli                       10
Basapura                              10
Sector 1 HSR Layout                   10
Dairy Circle                          10
                                      ..
1Channasandra                          1
Hosahalli                              1
Vijayabank bank layout                 1
near Ramanashree California resort     1
Abshot Layout                          1
Name: location, Length: 1054, dtype: int64
```

```
data['location']=data['location'].apply(lambda x: 'other' if x in location_count_less_10 else x)
```

```
data['location'].value_counts()
```

```
other                 2886
Whitefield             541
Sarjapur  Road         399
Electronic City        304
Kanakpura Road         273
                      ...
Nehru Nagar             11
Banjara Layout          11
LB Shastri Nagar        11
Pattandur Agrahara      11
Narayanapura            11
Name: location, Length: 242, dtype: int64
```

```
(data['total_sqft']/data['bhk']).describe()
```

```
count    13274.000000
mean       575.074878
std        388.205175
min          0.250000
25%        473.333333
50%        552.500000
75%        625.000000
max      26136.000000
dtype: float64
```

```
data=data[((data['total_sqft']/data['bhk'])>=300)]
data.describe()
```

	total_sqft	bath	price	bhk	price_per_sqft
count	12530.000000	12530.000000	12530.000000	12530.000000	12530.000000
mean	1594.564544	2.559537	111.382401	2.650838	6303.979357
std	1261.271296	1.077938	152.077329	0.976678	4162.237981
min	300.000000	1.000000	8.440000	1.000000	267.829813
25%	1116.000000	2.000000	49.000000	2.000000	4210.526316
50%	1300.000000	2.000000	70.000000	3.000000	5294.117647
75%	1700.000000	3.000000	115.000000	3.000000	6916.666667
max	52272.000000	16.000000	3600.000000	16.000000	176470.588235

```
data.shape
```

```
(12530, 7)
```

```
data.price_per_sqft.describe()
```

```
count     12530.000000
mean       6303.979357
std        4162.237981
min         267.829813
25%        4210.526316
50%        5294.117647
75%        6916.666667
max      176470.588235
Name: price_per_sqft, dtype: float64
```

```
def remove_outliers_sqft(df):
  df_output=pd.DataFrame()
  for key,subdf in df.groupby('location'):
    m=np.mean(subdf.price_per_sqft)
    st=np.std(subdf.price_per_sqft)
    gen_df=subdf[(subdf.price_per_sqft>(m-st)) & (subdf.price_per_sqft<=(m+st))]
    df_output=pd.concat([df_output,gen_df],ignore_index=True)
  return df_output
data=remove_outliers_sqft(data)
data.describe()
```

	total_sqft	bath	price	bhk	price_per_sqft
count	10301.000000	10301.000000	10301.000000	10301.000000	10301.000000
mean	1508.440608	2.471702	91.286372	2.574896	5659.062876
std	880.694214	0.979449	86.342786	0.897649	2265.774749
min	300.000000	1.000000	10.000000	1.000000	1250.000000
25%	1110.000000	2.000000	49.000000	2.000000	4244.897959
50%	1286.000000	2.000000	67.000000	2.000000	5175.600739
75%	1650.000000	3.000000	100.000000	3.000000	6428.571429
max	30400.000000	16.000000	2200.000000	16.000000	24509.803922

```
def bhk_outlier_remover(df):
  exclude_indices=np.array([])
  for location,location_df in df.groupby('location'):
    bhk_stats={}
    for bhk,bhk_df in location_df.groupby('bhk'):
      bhk_stats[bhk]={
          'mean':np.mean(bhk_df.price_per_sqft),
          'std':np.std(bhk_df.price_per_sqft),
          'count':bhk_df.shape[0]
      }
    for bhk,bhk_df in location_df.groupby('bhk'):
      stats=bhk_stats.get(bhk-1)
      if stats and stats['count']>5:
        exclude_indices=np.append(exclude_indices,bhk_df[bhk_df.price_per_sqft<(stats['mean'])].index.values)
  return df.drop(exclude_indices,axis='index')
```

```
data=bhk_outlier_remover(data)
```

```
data.shape
```

```
(7361, 7)
```

```
data
```

	location	size	total_sqft	bath	price	bhk	price_per_sqft
0	1st Block Jayanagar	4 BHK	2850.0	4.0	428.0	4	15017.543860
1	1st Block Jayanagar	3 BHK	1630.0	3.0	194.0	3	11901.840491
2	1st Block Jayanagar	3 BHK	1875.0	2.0	235.0	3	12533.333333
3	1st Block Jayanagar	3 BHK	1200.0	2.0	130.0	3	10833.333333
4	1st Block Jayanagar	2 BHK	1235.0	2.0	148.0	2	11983.805668
...	...	...	...	...	...	...	...
10292	other	2 BHK	1200.0	2.0	70.0	2	5833.333333
10293	other	1 BHK	1800.0	1.0	200.0	1	11111.111111
10296	other	2 BHK	1353.0	2.0	110.0	2	8130.081301

```
data.drop(columns=['size','price_per_sqft'],inplace=True)
```

```
#Cleaned Data
```

```
     [illegible]
```

```
data.to_csv("Cleaned_data.csv")
```

```
X=data.drop(columns=['price'])
y=data['price']
```

```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression,Lasso,Ridge
from sklearn.preprocessing import OneHotEncoder,StandardScaler
from sklearn.compose import make_column_transformer
from sklearn.pipeline import make_pipeline
from sklearn.metrics import r2_score
```

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

```
print(X_train.shape)
print(X_test.shape)
```

```
     (5888, 4)
     (1473, 4)
```

```
column_trans=make_column_transformer((OneHotEncoder(sparse=False),['location']),remainder='passthrough')
```

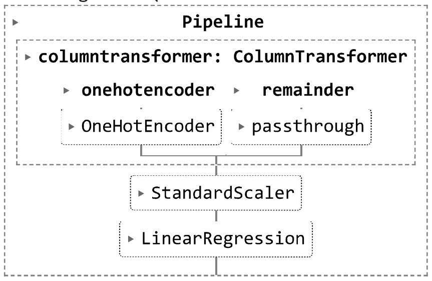
```
scaler=StandardScaler()
```

```
lr=LinearRegression()
```

```
pipe=make_pipeline(column_trans,scaler,lr)
```

```
pipe.fit(X_train,y_train)
```

```
     /usr/local/lib/python3.10/dist-packages/sklearn/preprocessing/_encoders.py:868: FutureWarning: `sparse`
       warnings.warn(
```



Double-click (or enter) to edit

```
y_pred_lr=pipe.predict(X_test)
```

```
r2_score(y_test,y_pred_lr)
```

```
    0.8233571524944501
```

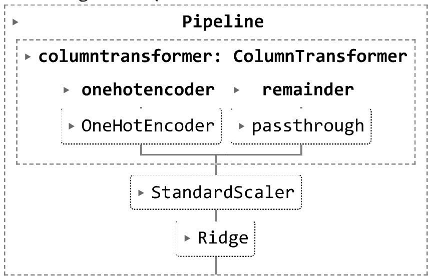
```
#Applying Lasso
```

```
ridge=Ridge()
```

```
pipe=make_pipeline(column_trans,scaler,ridge)
```

```
pipe.fit(X_train,y_train)
```

```
    /usr/local/lib/python3.10/dist-packages/sklearn/preprocessing/_encoders.py:868: FutureWarning: `sparse`
      warnings.warn(
```



```
Pipeline
columntransformer: ColumnTransformer
onehotencoder    remainder
OneHotEncoder    passthrough
StandardScaler
Ridge
```

```
y_pred_ridge=pipe.predict(X_test)
r2_score(y_test,y_pred_ridge)
```

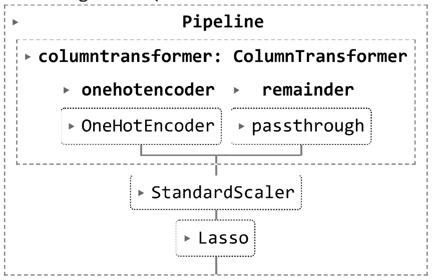
```
    0.8234146633312639
```

```
#lasso
```

```
lasso=Lasso()
pipe=make_pipeline(column_trans,scaler,lasso)
```

```
pipe.fit(X_train,y_train)
```

```
    /usr/local/lib/python3.10/dist-packages/sklearn/preprocessing/_encoders.py:868: FutureWarning: `sparse`
      warnings.warn(
```



```
Pipeline
columntransformer: ColumnTransformer
onehotencoder    remainder
OneHotEncoder    passthrough
StandardScaler
Lasso
```

```
y_pred_lasso=pipe.predict(X_test)
r2_score(y_test,y_pred_lasso)
```

```
    0.8128285650772719
```

```
print("No regularizattion: ",r2_score(y_test,y_pred_lr))
print('Lasso: ',r2_score(y_test,y_pred_lasso))
print('Ridege: ',r2_score(y_test,y_pred_ridge))
```

```
    No regularizattion:  0.8233571524944501
    Lasso:  0.8128285650772719
    Ridege:  0.8234146633312639
```

```
pickle.dump(pipe,open('RidgeModel.pkl','wb'))
```

```
a=pickle.load(open('/content/RidgeModel.pkl','rb'))
```

```
input=pd.DataFrame([['1st Block Jayanagar',2850.0,4.0,4]],columns=['location','total_sqft','bath','bhk'])
```

```
a.predict(input)
```

```
    array([304.19626765])
```