Data Science Regression Project: Predicting Home Prices in Banglore

In [1]:
```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
%matplotlib inline
import matplotlib
matplotlib.rcParams["figure.figsize"] = (20,10)
```

In [2]:
```
df = pd.read_csv(r"C:\Users\NITISH SINGH\Downloads\archive (33)\Bengaluru_House_Data.csv")
df.head()
```

Out[2]:

	area_type	availability	location	size	society	total_sqft	bath	balcony	price
0	Super built-up Area	19-Dec	Electronic City Phase II	2 BHK	Coomee	1056	2.0	1.0	39.07
1	Plot Area	Ready To Move	Chikka Tirupathi	4 Bedroom	Theanmp	2600	5.0	3.0	120.00
2	Built-up Area	Ready To Move	Uttarahalli	3 BHK	NaN	1440	2.0	3.0	62.00
3	Super built-up Area	Ready To Move	Lingadheeranahalli	3 BHK	Soiewre	1521	3.0	1.0	95.00
4	Super built-up Area	Ready To Move	Kothanur	2 BHK	NaN	1200	2.0	1.0	51.00

In [3]:
```
df.shape
```

Out[3]:
```
(13320, 9)
```

In [4]:
```
df.groupby('area_type')['area_type'].agg('count')
```

Out[4]:
```
area_type
Built-up  Area          2418
Carpet  Area              87
Plot  Area              2025
Super built-up  Area    8790
Name: area_type, dtype: int64
```

In [5]:
```
df1 = df.drop(['area_type','society','balcony','availability'],axis='columns')
df1.head()
```

Out[5]:

	location	size	total_sqft	bath	price
0	Electronic City Phase II	2 BHK	1056	2.0	39.07
1	Chikka Tirupathi	4 Bedroom	2600	5.0	120.00
2	Uttarahalli	3 BHK	1440	2.0	62.00
3	Lingadheeranahalli	3 BHK	1521	3.0	95.00
4	Kothanur	2 BHK	1200	2.0	51.00

In [6]:
```
df1.isnull().sum()
```

Out[6]:
```
location       1
size          16
total_sqft     0
bath          73
price          0
dtype: int64
```

In [7]:
```
df2 = df1.dropna()
```

In [8]:
```
df2.isnull().sum()
```

Out[8]:
```
location      0
size          0
total_sqft    0
bath          0
price         0
dtype: int64
```

In [9]:
```
df2.shape
```

Out[9]:
```
(13246, 5)
```

In [10]:
```
df2['size'].unique()
```

Out[10]:
```
array(['2 BHK', '4 Bedroom', '3 BHK', '4 BHK', '6 Bedroom', '3 Bedroom',
       '1 BHK', '1 RK', '1 Bedroom', '8 Bedroom', '2 Bedroom',
       '7 Bedroom', '5 BHK', '7 BHK', '6 BHK', '5 Bedroom', '11 BHK',
       '9 BHK', '9 Bedroom', '27 BHK', '10 Bedroom', '11 Bedroom',
       '10 BHK', '19 BHK', '16 BHK', '43 Bedroom', '14 BHK', '8 BHK',
       '12 Bedroom', '13 BHK', '18 Bedroom'], dtype=object)
```

In [11]:
```
df2['bhk'] = df2['size'].apply(lambda x: int(x.split(' ')[0]))
```

```
C:\Users\NITISH SINGH\AppData\Local\Temp\ipykernel_26336\1142257054.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df2['bhk'] = df2['size'].apply(lambda x: int(x.split(' ')[0]))
```

In [12]:
```
df2.head()
```

Out[12]:

	location	size	total_sqft	bath	price	bhk
0	Electronic City Phase II	2 BHK	1056	2.0	39.07	2
1	Chikka Tirupathi	4 Bedroom	2600	5.0	120.00	4
2	Uttarahalli	3 BHK	1440	2.0	62.00	3
3	Lingadheeranahalli	3 BHK	1521	3.0	95.00	3
4	Kothanur	2 BHK	1200	2.0	51.00	2

In [13]:
```
df2['bhk'].unique()
```

Out[13]:
```
array([ 2,  4,  3,  6,  1,  8,  7,  5, 11,  9, 27, 10, 19, 16, 43, 14, 12,
       13, 18], dtype=int64)
```

In [14]:
```
df2[df2.bhk>20]
```

Out[14]:

	location	size	total_sqft	bath	price	bhk
1718	2Electronic City Phase II	27 BHK	8000	27.0	230.0	27
4684	Munnekollal	43 Bedroom	2400	40.0	660.0	43

In [15]:
```
df2.total_sqft.unique()
```

Out[15]:
```
array(['1056', '2600', '1440', ..., '1133 - 1384', '774', '4689'],
      dtype=object)
```

In [16]:
```
def is_float(x):
    try:
        float(x)
    except:
      return False
    return True
```

In [17]:
```
df2[~df2['total_sqft'].apply(is_float)].head(10)
```

Out[17]:

	location	size	total_sqft	bath	price	bhk
30	Yelahanka	4 BHK	2100 - 2850	4.0	186.000	4
122	Hebbal	4 BHK	3067 - 8156	4.0	477.000	4
137	8th Phase JP Nagar	2 BHK	1042 - 1105	2.0	54.005	2
165	Sarjapur	2 BHK	1145 - 1340	2.0	43.490	2
188	KR Puram	2 BHK	1015 - 1540	2.0	56.800	2
410	Kengeri	1 BHK	34.46Sq. Meter	1.0	18.500	1
549	Hennur Road	2 BHK	1195 - 1440	2.0	63.770	2
648	Arekere	9 Bedroom	4125Perch	9.0	265.000	9
661	Yelahanka	2 BHK	1120 - 1145	2.0	48.130	2
672	Bettahalsoor	4 Bedroom	3090 - 5002	4.0	445.000	4

In [18]:
```
def convert_sqft_to_num(x):
    tokens = x.split('-')
    if len(tokens) == 2:
        return (float(tokens[0])+float(tokens[1]))/2
    try:
        return float(x)
    except:
        return None
```

In [19]:
```
df3 = df2.copy()
df3.total_sqft = df3.total_sqft.apply(convert_sqft_to_num)
```

```
df3 = df3[df3.total_sqft.notnull()]
df3.head(2)
```

Out[19]:

	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

In [20]:
```
df3.loc[30]
```

Out[20]:
```
location      Yelahanka
size              4 BHK
total_sqft       2475.0
bath                4.0
price             186.0
bhk                   4
Name: 30, dtype: object
```

Feature Engineering

In [21]:
```
df4 = df3.copy()
df4['price_per_sqft'] = df4['price']*100000/df4['total_sqft']
df4.head()
```

Out[21]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
0	Electronic City Phase II	2 BHK	1056.0	2.0	39.07	2	3699.810606
1	Chikka Tirupathi	4 Bedroom	2600.0	5.0	120.00	4	4615.384615
2	Uttarahalli	3 BHK	1440.0	2.0	62.00	3	4305.555556
3	Lingadheeranahalli	3 BHK	1521.0	3.0	95.00	3	6245.890861
4	Kothanur	2 BHK	1200.0	2.0	51.00	2	4250.000000

In [22]:
```
len(df4.location.unique())
```

Out[22]:
```
1298
```

In [23]:
```
df4.location = df4.location.apply(lambda x: x.strip())

location_stats = df4.groupby('location')['location'].agg('count').sort_values(ascending=False)
location_stats
```

Out[23]:
```
location
Whitefield               533
Sarjapur  Road           392
Electronic City          304
Kanakpura Road           264
Thanisandra              235
                        ...
1 Giri Nagar               1
Kanakapura Road,           1
Kanakapura main  Road      1
Kannur                     1
whitefiled                 1
Name: location, Length: 1287, dtype: int64
```

In [24]:
```
len(location_stats[location_stats<=10])
```

Out[24]:
```
1047
```

In [25]:
```
location_stats_less_than_10 = location_stats[location_stats<=10]
location_stats_less_than_10
```

Out[25]:
```
location
Sadashiva Nagar          10
Naganathapura            10
Basapura                 10
Nagadevanahalli          10
Kalkere                  10
                         ..
1 Giri Nagar              1
Kanakapura Road,          1
Kanakapura main  Road     1
Kannur                    1
whitefiled                1
Name: location, Length: 1047, dtype: int64
```

In [26]:
```
len(df4.location.unique())
```

Out[26]:
```
1287
```

In [27]:
```
df4.location = df4.location.apply(lambda x: 'other' if x in location_stats_less_than_10 else x)
```

```
In [27]: len(df4.location.unique())
Out[27]: 241
```

```
In [28]: df4.head(10)
```

Out[28]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
0	Electronic City Phase II	2 BHK	1056.0	2.0	39.07	2	3699.810606
1	Chikka Tirupathi	4 Bedroom	2600.0	5.0	120.00	4	4615.384615
2	Uttarahalli	3 BHK	1440.0	2.0	62.00	3	4305.555556
3	Lingadheeranahalli	3 BHK	1521.0	3.0	95.00	3	6245.890861
4	Kothanur	2 BHK	1200.0	2.0	51.00	2	4250.000000
5	Whitefield	2 BHK	1170.0	2.0	38.00	2	3247.863248
6	Old Airport Road	4 BHK	2732.0	4.0	204.00	4	7467.057101
7	Rajaji Nagar	4 BHK	3300.0	4.0	600.00	4	18181.818182
8	Marathahalli	3 BHK	1310.0	3.0	63.25	3	4828.244275
9	other	6 Bedroom	1020.0	6.0	370.00	6	36274.509804

```
In [ ]:
```

Outlier Removal Using Business Logic

```
In [29]: df4[df4.total_sqft/df4.bhk<300].head()
```

Out[29]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
9	other	6 Bedroom	1020.0	6.0	370.0	6	36274.509804
45	HSR Layout	8 Bedroom	600.0	9.0	200.0	8	33333.333333
58	Murugeshpalya	6 Bedroom	1407.0	4.0	150.0	6	10660.980810
68	Devarachikkanahalli	8 Bedroom	1350.0	7.0	85.0	8	6296.296296
70	other	3 Bedroom	500.0	3.0	100.0	3	20000.000000

```
In [30]: df5 = df4[~(df4.total_sqft/df4.bhk<300)]
         df5.shape
Out[30]: (12456, 7)
```

Outlier Removal Using Standard Deviation and Mean

```
In [36]: df5.price_per_sqft.describe()
Out[36]: count     12456.000000
         mean       6308.502826
         std        4168.127339
         min         267.829813
         25%        4210.526316
         50%        5294.117647
         75%        6916.666667
         max      176470.588235
         Name: price_per_sqft, dtype: float64
```

Here we find that min price per sqft is 267 rs/sqft whereas max is 12000000, this shows a wide variation in property prices. We should remove outliers per location using mean and one standard deviation

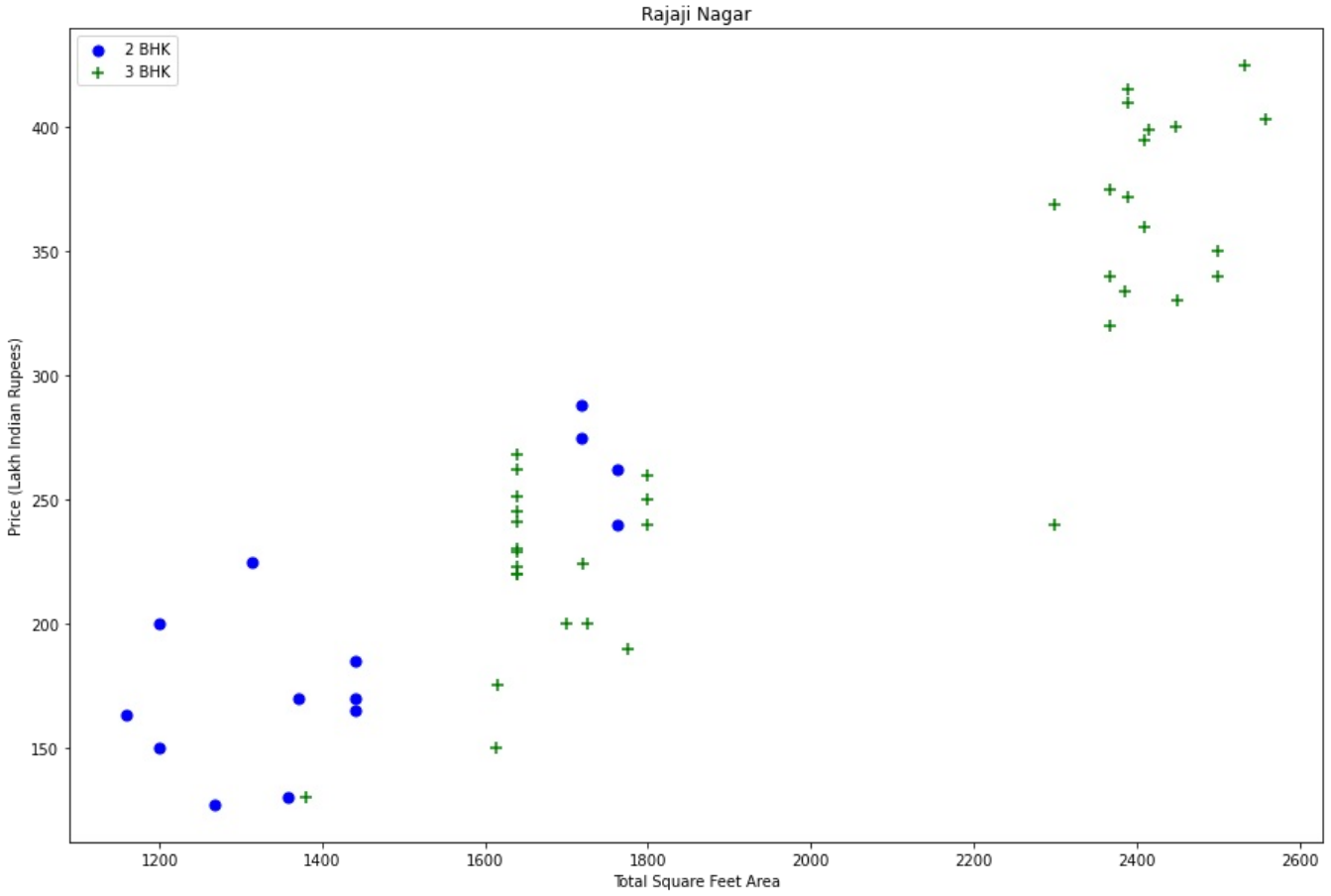
```
In [31]: def remove_pps_outliers(df):
             df_out = pd.DataFrame()
             for key, subdf in df.groupby('location'):
                 m = np.mean(subdf.price_per_sqft)
                 st = np.std(subdf.price_per_sqft)
                 reduced_df = subdf[(subdf.price_per_sqft>(m-st)) & (subdf.price_per_sqft<=(m+st))]
                 df_out = pd.concat([df_out,reduced_df],ignore_index=True)
             return df_out
         df6 = remove_pps_outliers(df5)
         df6.shape
Out[31]: (10242, 7)
```

*Let's check if for a given location how does the 2 BHK and 3 BHK

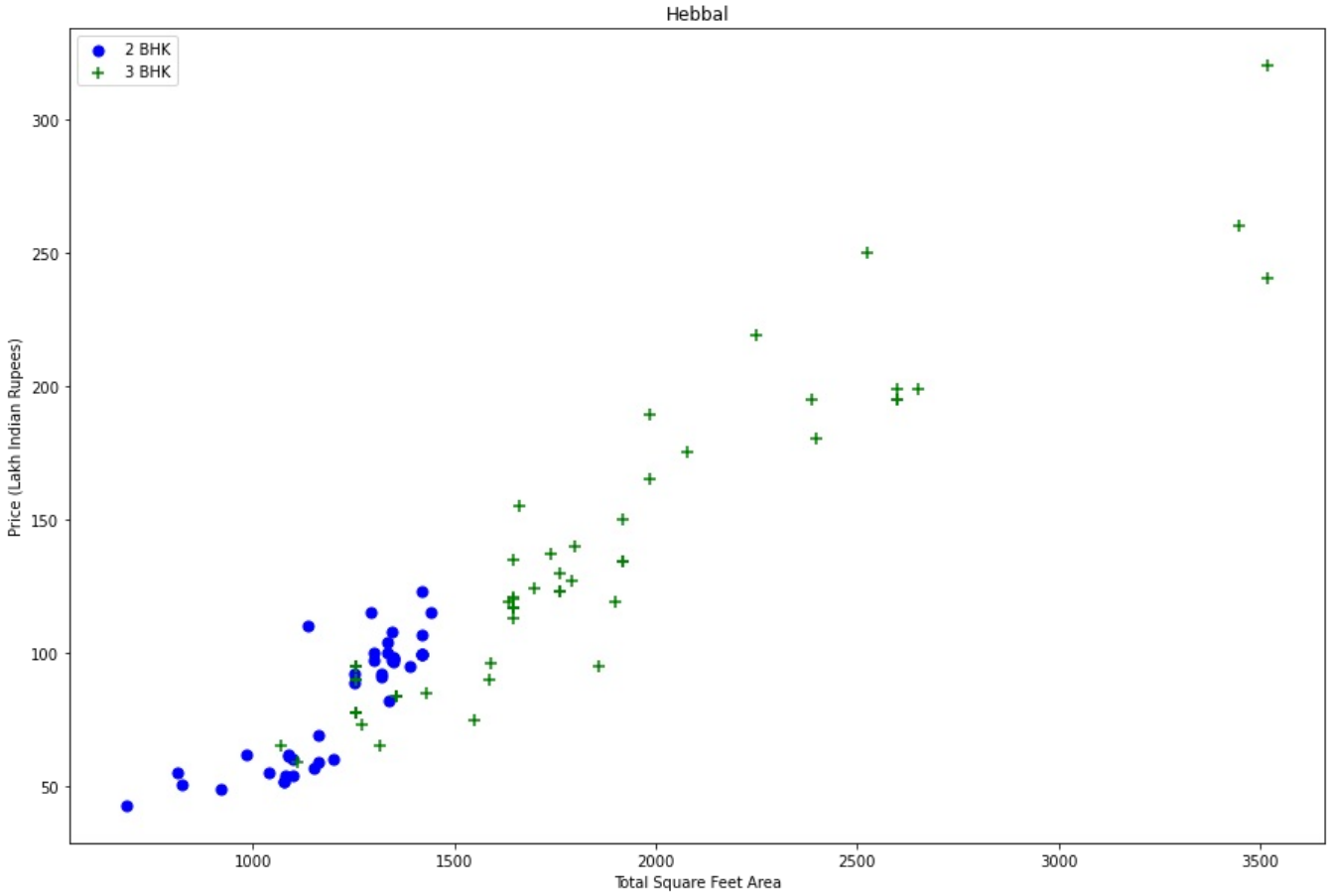
property prices look like

In [33]:
```
def plot_scatter_chart(df,location):
    bhk2 = df[(df.location==location) & (df.bhk==2)]
    bhk3 = df[(df.location==location) & (df.bhk==3)]
    matplotlib.rcParams['figure.figsize'] = (15,10)
    plt.scatter(bhk2.total_sqft,bhk2.price,color='blue',label='2 BHK', s=50)
    plt.scatter(bhk3.total_sqft,bhk3.price,marker='+', color='green',label='3 BHK', s=50)
    plt.xlabel("Total Square Feet Area")
    plt.ylabel("Price (Lakh Indian Rupees)")
    plt.title(location)
    plt.legend()

plot_scatter_chart(df6,"Rajaji Nagar")
```



In [34]:
```
plot_scatter_chart(df6,"Hebbal")
```



We should also remove properties where for same location, the price of (for example) 3 bedroom apartment is less than 2 bedroom apartment (with same square ft area). What we will do is for a given location, we will build a dictionary of stats per bhk, i.e.

```
{

    '1' : {
        'mean': 4000,
        'std: 2000,
        'count': 34
    },
    '2' : {
        'mean': 4300,
        'std: 2300,
        'count': 22
    },

}
```

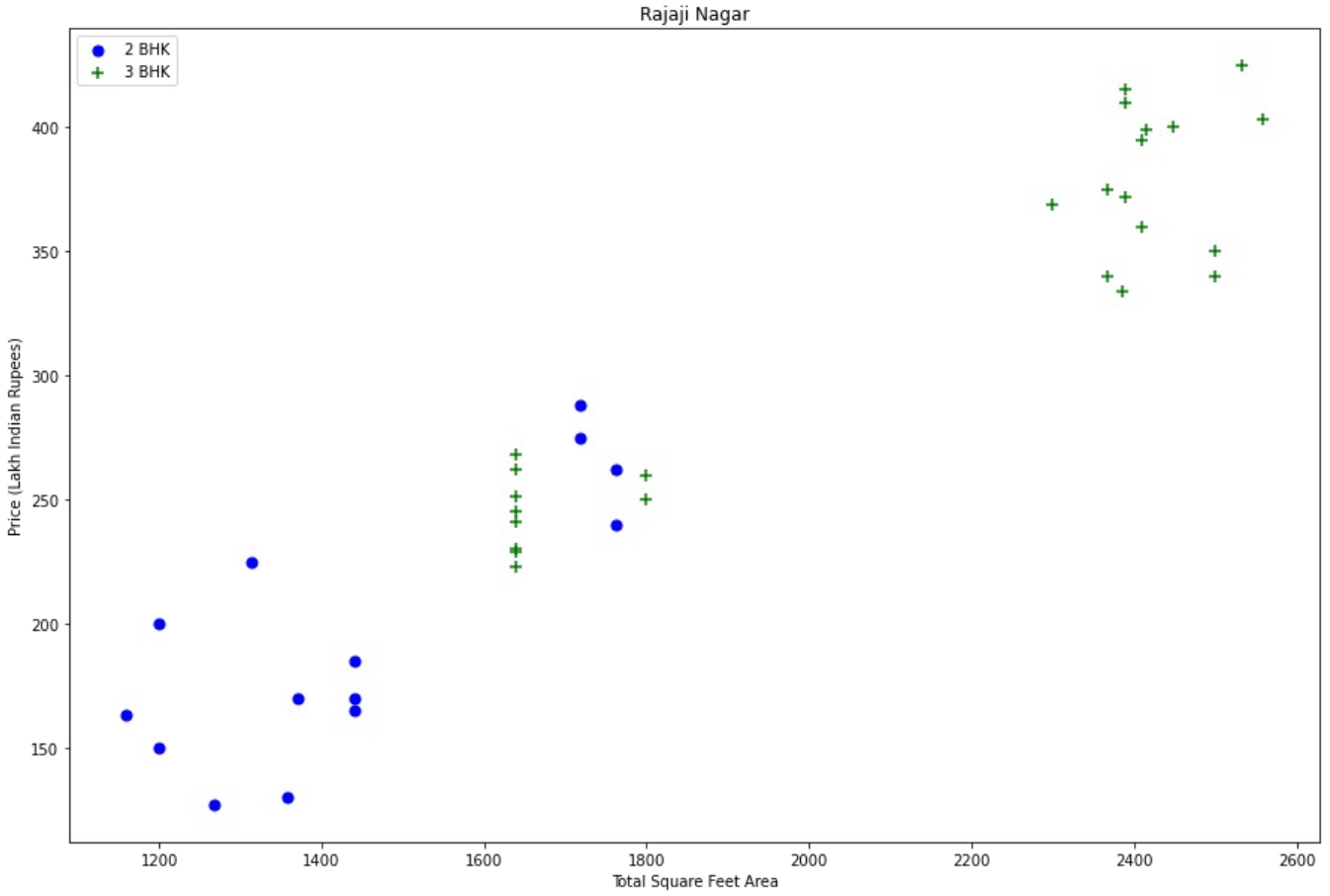
Now we can remove those 2 BHK apartments whose price_per_sqft is less than mean price_per_sqft of 1 BHK apartment

In [36]:
```
def remove_bhk_outliers(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'])].inde
    return df.drop(exclude_indices,axis='index')
df7 = remove_bhk_outliers(df6)
# df7 = df6.copy()
df7.shape
```

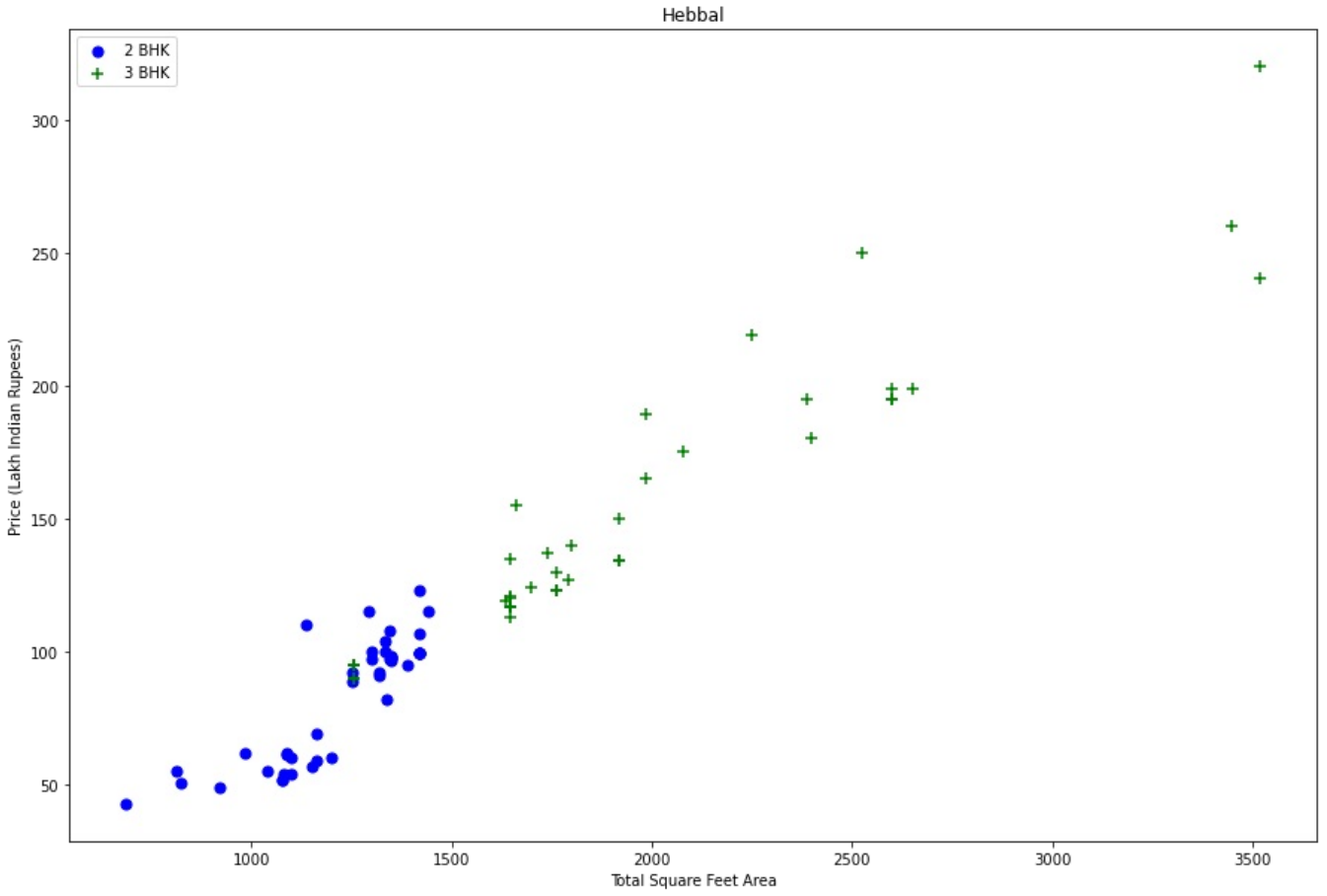
Out[36]:
```
(7317, 7)
```

Plot same scatter chart again to visualize price_per_sqft for 2 BHK and 3 BHK properties

In [37]:
```
plot_scatter_chart(df7,"Rajaji Nagar")
```

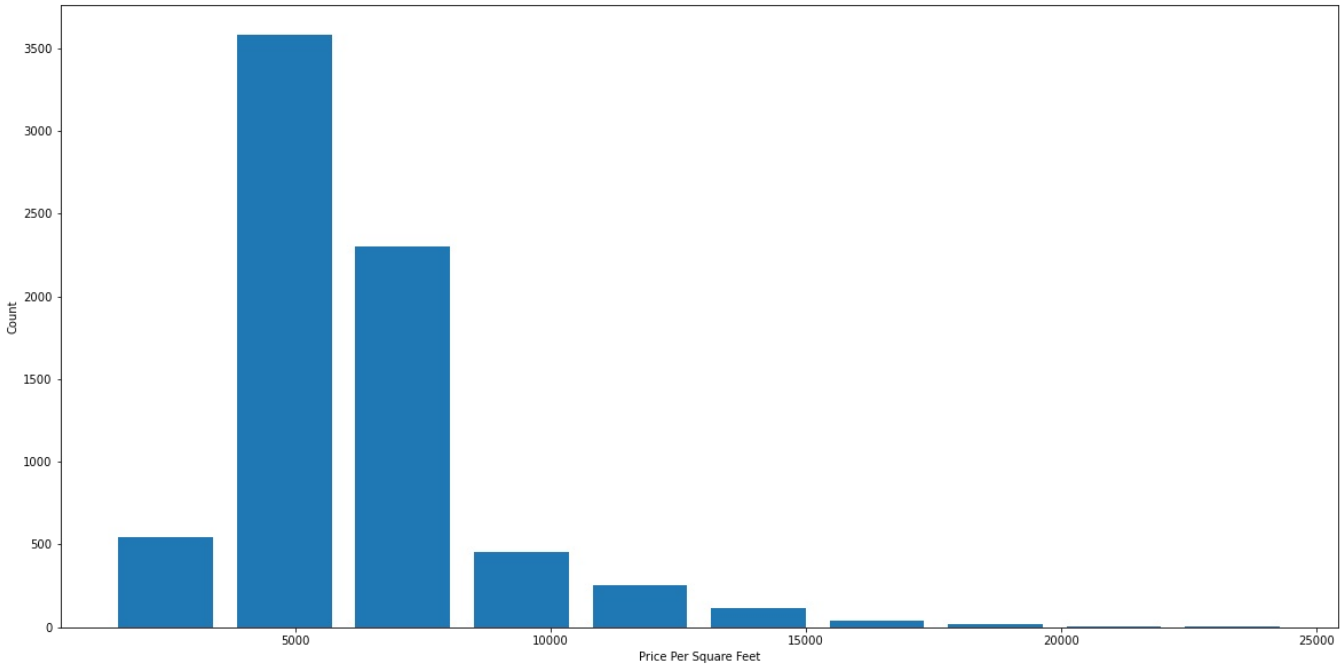


In [38]:
```
plot_scatter_chart(df7,"Hebbal")
```



In [39]:
```
import matplotlib
matplotlib.rcParams["figure.figsize"] = (20,10)
plt.hist(df7.price_per_sqft,rwidth=0.8)
plt.xlabel("Price Per Square Feet")
plt.ylabel("Count")
```

Out[39]:
```
Text(0, 0.5, 'Count')
```



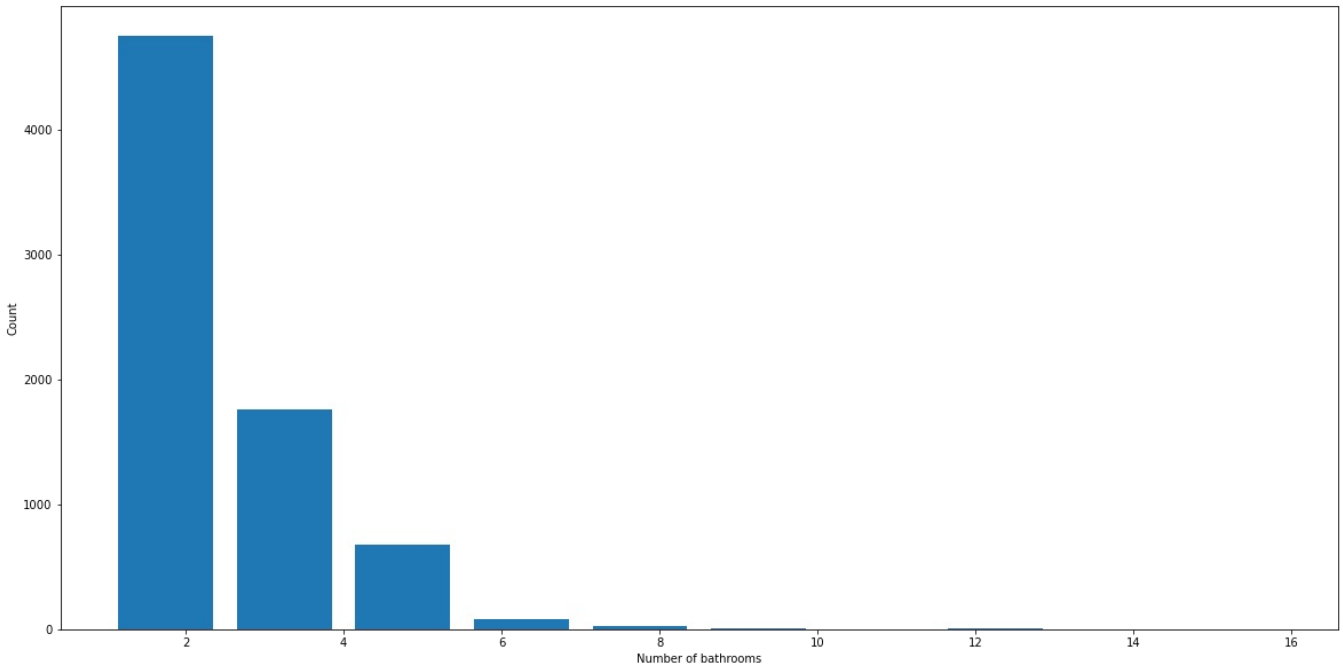
Outlier Removal Using Bathrooms Feature

In [40]:
```
df7.bath.unique()
```

Out[40]:
```
array([ 4.,  3.,  2.,  5.,  8.,  1.,  6.,  7.,  9., 12., 16., 13.])
```

In [41]:
```
plt.hist(df7.bath,rwidth=0.8)
plt.xlabel("Number of bathrooms")
plt.ylabel("Count")
```

Out[41]:
```
Text(0, 0.5, 'Count')
```



In [42]:
```
df7[df7.bath>10]
```

Out[42]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
5277	Neeladri Nagar	10 BHK	4000.0	12.0	160.0	10	4000.000000
8483	other	10 BHK	12000.0	12.0	525.0	10	4375.000000
8572	other	16 BHK	10000.0	16.0	550.0	16	5500.000000
9306	other	11 BHK	6000.0	12.0	150.0	11	2500.000000
9637	other	13 BHK	5425.0	13.0	275.0	13	5069.124424

It is unusual to have 2 more bathrooms than number of bedrooms in a home

In [43]:
```
df7[df7.bath>df7.bhk+2]
```

Out[43]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
1626	Chikkabanavar	4 Bedroom	2460.0	7.0	80.0	4	3252.032520
5238	Nagasandra	4 Bedroom	7000.0	8.0	450.0	4	6428.571429
6711	Thanisandra	3 BHK	1806.0	6.0	116.0	3	6423.034330
8408	other	6 BHK	11338.0	9.0	1000.0	6	8819.897689

Again the business manager has a conversation with you (i.e. a data scientist) that if you have 4 bedroom home and even if you have bathroom in all 4 rooms plus one guest bathroom, you will have total bath = total bed + 1 max. Anything above that is an outlier or a data error and can be removed

In [44]:
```
df8 = df7[df7.bath<df7.bhk+2]
df8.shape
```

Out[44]:
```
(7239, 7)
```

In [45]:
```
df8.head(2)
```

Out[45]:

	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

In [47]:
```
df9 = df8.drop(['size','price_per_sqft'],axis='columns')
df9.head(3)
```

Out[47]:

	location	total_sqft	bath	price	bhk
0	1st Block Jayanagar	2850.0	4.0	428.0	4
1	1st Block Jayanagar	1630.0	3.0	194.0	3
2	1st Block Jayanagar	1875.0	2.0	235.0	3

Use One Hot Encoding For Location

In [48]:
```
dummies = pd.get_dummies(df9.location)
dummies.head(3)
```

Out[48]:

	1st Block Jayanagar	1st Phase JP Nagar	2nd Phase Judicial Layout	2nd Stage Nagarbhavi	5th Block Hbr Layout	5th Phase JP Nagar	6th Phase JP Nagar	7th Phase JP Nagar	8th Phase JP Nagar	9th Phase JP Nagar	...	Vishveshwarya Layout	Vishwapriya Layout	Vittasandra	White
0	1	0	0	0	0	0	0	0	0	0	...	0	0	0	
1	1	0	0	0	0	0	0	0	0	0	...	0	0	0	
2	1	0	0	0	0	0	0	0	0	0	...	0	0	0	

3 rows × 241 columns

In [49]:
```
df10 = pd.concat([df9,dummies.drop('other',axis='columns')],axis='columns')
df10.head()
```

Out[49]:

	location	total_sqft	bath	price	bhk	1st Block Jayanagar	1st Phase JP Nagar	2nd Phase Judicial Layout	2nd Stage Nagarbhavi	5th Block Hbr Layout	...	Vijayanagar	Vishveshwarya Layout	Vishwapriya Layout	Vitt
0	1st Block Jayanagar	2850.0	4.0	428.0	4	1	0	0	0	0	...	0	0	0	
1	1st Block Jayanagar	1630.0	3.0	194.0	3	1	0	0	0	0	...	0	0	0	
2	1st Block Jayanagar	1875.0	2.0	235.0	3	1	0	0	0	0	...	0	0	0	
3	1st Block Jayanagar	1200.0	2.0	130.0	3	1	0	0	0	0	...	0	0	0	
4	1st Block Jayanagar	1235.0	2.0	148.0	2	1	0	0	0	0	...	0	0	0	

5 rows × 245 columns

In [50]:
```
df11 = df10.drop('location',axis='columns')
```

```
df11.head(2)
```

Out[50]:

	total_sqft	bath	price	bhk	1st Block Jayanagar	1st Phase JP Nagar	2nd Phase Judicial Layout	2nd Stage Nagarbhavi	5th Block Hbr Layout	5th Phase JP Nagar	...	Vijayanagar	Vishveshwarya Layout	Vishwapriya Layout	Vittasa
0	2850.0	4.0	428.0	4	1	0	0	0	0	0	...	0	0	0	
1	1630.0	3.0	194.0	3	1	0	0	0	0	0	...	0	0	0	

2 rows × 244 columns

Build a Model Now...

In [51]:
```
df11.shape
```

Out[51]:
```
(7239, 244)
```

In [52]:
```
X = df11.drop(['price'],axis='columns')
X.head(3)
```

Out[52]:

	total_sqft	bath	bhk	1st Block Jayanagar	1st Phase JP Nagar	2nd Phase Judicial Layout	2nd Stage Nagarbhavi	5th Block Hbr Layout	5th Phase JP Nagar	6th Phase JP Nagar	...	Vijayanagar	Vishveshwarya Layout	Vishwapriya Layout	Vittas
0	2850.0	4.0	4	1	0	0	0	0	0	0	...	0	0	0	
1	1630.0	3.0	3	1	0	0	0	0	0	0	...	0	0	0	
2	1875.0	2.0	3	1	0	0	0	0	0	0	...	0	0	0	

3 rows × 243 columns

In [53]:
```
X.shape
```

Out[53]:
```
(7239, 243)
```

In [55]:
```
y = df11.price
y.head(3)
```

Out[55]:
```
0    428.0
1    194.0
2    235.0
Name: price, dtype: float64
```

In [56]:
```
len(y)
```

Out[56]:
```
7239
```

In [57]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.2,random_state=10)
```

In [58]:
```
from sklearn.linear_model import LinearRegression
lr_clf = LinearRegression()
lr_clf.fit(X_train,y_train)
lr_clf.score(X_test,y_test)
```

Out[58]:
```
0.8629132245229444
```

Use K Fold cross validation to measure accuracy of our LinearRegression model

In [59]:
```
from sklearn.model_selection import ShuffleSplit
from sklearn.model_selection import cross_val_score

cv = ShuffleSplit(n_splits=5, test_size=0.2, random_state=0)

cross_val_score(LinearRegression(), X, y, cv=cv)
```

Out[59]:
```
array([0.82702546, 0.86027005, 0.85322178, 0.8436466 , 0.85481502])
```

We can see that in 5 iterations we get a score above 80% all the time. This is pretty good but we want to test few other algorithms for regression to see if we can get even better score. We will use GridSearchCV for this purpose

Find best model using GridSearchCV

In [60]:

```
from sklearn.model_selection import GridSearchCV

from sklearn.linear_model import Lasso
from sklearn.tree import DecisionTreeRegressor

def find_best_model_using_gridsearchcv(X,y):
    algos = {
        'linear_regression' : {
            'model': LinearRegression(),
            'params': {
                'normalize': [True, False]
            }
        },
        'lasso': {
            'model': Lasso(),
            'params': {
                'alpha': [1,2],
                'selection': ['random', 'cyclic']
            }
        },
        'decision_tree': {
            'model': DecisionTreeRegressor(),
            'params': {
                'criterion' : ['mse','friedman_mse'],
                'splitter': ['best','random']
            }
        }
    }
    scores = []
    cv = ShuffleSplit(n_splits=5, test_size=0.2, random_state=0)
    for algo_name, config in algos.items():
        gs =  GridSearchCV(config['model'], config['params'], cv=cv, return_train_score=False)
        gs.fit(X,y)
        scores.append({
            'model': algo_name,
            'best_score': gs.best_score_,
            'best_params': gs.best_params_
        })

    return pd.DataFrame(scores,columns=['model','best_score','best_params'])

find_best_model_using_gridsearchcv(X,y)
```

```
C:\Users\NITISH SINGH\anaconda3\lib\site-packages\sklearn\linear_model\_base.py:141: FutureWarning: 'normalize'
was deprecated in version 1.0 and will be removed in 1.2.
If you wish to scale the data, use Pipeline with a StandardScaler in a preprocessing stage. To reproduce the pr
evious behavior:

from sklearn.pipeline import make_pipeline

model = make_pipeline(StandardScaler(with_mean=False), LinearRegression())

If you wish to pass a sample_weight parameter, you need to pass it as a fit parameter to each step of the pipel
ine as follows:

kwargs = {s[0] + '__sample_weight': sample_weight for s in model.steps}
model.fit(X, y, **kwargs)


  warnings.warn(
C:\Users\NITISH SINGH\anaconda3\lib\site-packages\sklearn\linear_model\_base.py:141: FutureWarning: 'normalize'
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```
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  warnings.warn(
```

Out[60]:

	model	best_score	best_params
0	linear_regression	0.847796	{'normalize': False}
1	lasso	0.726805	{'alpha': 2, 'selection': 'random'}
2	decision_tree	0.743887	{'criterion': 'mse', 'splitter': 'random'}

Based on above results we can say that LinearRegression gives the best score. Hence we will use that.

Test the model for few properties

In [61]:

```
def predict_price(location,sqft,bath,bhk):
    loc_index = np.where(X.columns==location)[0][0]

    x = np.zeros(len(X.columns))
    x[0] = sqft
    x[1] = bath
    x[2] = bhk
    if loc_index >= 0:
        x[loc_index] = 1

    return lr_clf.predict([x])[0]
```

In [62]:

```
predict_price('1st Phase JP Nagar',1000, 2, 2)
```

```
C:\Users\NITISH SINGH\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature names, but LinearRegression was fitted with feature names
  warnings.warn(
```

Out[62]: 83.8657025831206

In [63]:

```
predict_price('1st Phase JP Nagar',1000, 3, 3)
```

```
C:\Users\NITISH SINGH\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature names, but LinearRegression was fitted with feature names
  warnings.warn(
```

Out[63]: 86.0806228498683

In [64]:

```
predict_price('Indira Nagar',1000, 2, 2)
```

```
C:\Users\NITISH SINGH\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature names, but LinearRegression was fitted with feature names
  warnings.warn(
```

Out[64]: 193.31197733179843

In [65]:

```
predict_price('Indira Nagar',1000, 3, 3)
```

```
C:\Users\NITISH SINGH\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature names, but LinearRegression was fitted with feature names
  warnings.warn(
```

Out[65]: 195.52689759854616

In [ ]: