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)
```

Read the file

In [2]:
```
hp= pd.read_csv("Bengaluru_House_Data.csv")
```

In [3]:
```
hp.head()
```

Out[3]:

	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 [4]:
```
hp.shape
```

Out[4]:
```
(13320, 9)
```

In [5]:
```
#Examine the Area type feature

hp.groupby('area_type')['area_type'].agg('count')
```

Out[5]:
```
area_type
Built-up  Area          2418
Carpet  Area              87
Plot  Area              2025
Super built-up  Area    8790
Name: area_type, dtype: int64
```

In [6]:
```
#lets drop certain colums which are not required for predicting the prices

hp1= hp.drop(['area_type','availability','society','balcony'], axis='columns')
hp1.head()
```

Out[6]:

	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

	location	size	total_sqft	bath	price
3	Lingadheeranahalli	3 BHK	1521	3.0	95.00
4	Kothanur	2 BHK	1200	2.0	51.00

Data Cleaning process

handling the NA values

In [7]:
```
hp1.isnull().sum()
```

Out[7]:
```
location       1
size          16
total_sqft     0
bath          73
price          0
dtype: int64
```

In [8]:
```
#Dropping the NA vlaues frpm hp2

hp2=hp1.dropna()
hp2.isnull().sum()

#hp2 will not have any na values as they are all dropped
```

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

In [9]:
```
hp2.shape
```

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

In [10]:
```
# Changing the Bedroom words into BHK by creating new column
#and in the new colums apply some function by taking string and tokenize it using th
#lambda x ( x conatins the colums values of each of the rows one by one) and on thos


hp2['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 [62]:
```
hp2['bhk']=hp2['size'].apply(lambda x:  int(x.split(' ')[0]))
```

```
<ipython-input-62-f00ffaf809d8>: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/u
ser_guide/indexing.html#returning-a-view-versus-a-copy
  hp2['bhk']=hp2['size'].apply(lambda x:  int(x.split(' ')[0]))
```

In [63]:
```
hp2.head()
```

Out[63]:

	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]:

```
hp2['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]:

```
hp2[hp2.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

here if u see there is an error bcoz none has 43 bedrooms in 2400 sqft so lets clean later

In [15]:

```
hp2['total_sqft'].unique()
```

Out[15]:

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

In [16]:

```
#'1133 - 1384' checking out the average of such numbers present

#by firstly defining the value is float or not by creating a funtion
#how this function works:  If i try to covert a value in total sqft into float and i
#and it will throw the exception

def is_float(x):
    try:
        float(x)
    except:
       return False
    return True
```

In [17]:

```
hp2[~hp2['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

	location	size	total_sqft	bath	price	bhk
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

'~' it is called negate operation it returns the data frame back to me

In [18]:
```
#when you find 34.46Sq. Meter, 4125Perch such kind of data just ignore them.
# 1042 - 1105 just take average of the numbers
```

In [19]:
```
#below code/function will return the average value of the total sqft

def convert_sqft_to_num(x):
    tokens= x.split('-')
    if len (tokens)== 2:   #if the tokens are 2
        return (float(tokens[0])+float(tokens[1]))/2  #then we convert the inuser to
    try:
        return float(x)
    except:
        return None
```

In [20]:
```
# Lets check

convert_sqft_to_num('2100 - 2850')
```

Out[20]: 2475.0

In [21]:
```
#now lets create a new dataframe which will include the convert funtion
hp3=hp2.copy()
hp3['total_sqft']=hp2['total_sqft'].apply(convert_sqft_to_num)
hp3.head(10)
```

Out[21]:

	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
5	Whitefield	2 BHK	1170.0	2.0	38.00	2
6	Old Airport Road	4 BHK	2732.0	4.0	204.00	4
7	Rajaji Nagar	4 BHK	3300.0	4.0	600.00	4
8	Marathahalli	3 BHK	1310.0	3.0	63.25	3
9	Gandhi Bazar	6 Bedroom	1020.0	6.0	370.00	6

In [22]:
```
#checking the particular index
#30      Yelahanka        4 BHK    2100 - 2850      4.0      186.000 4

hp3.loc[30]
```

Out[22]:
```
location       Yelahanka
size               4 BHK
total_sqft          2475
bath                   4
price                186
bhk                    4
Name: 30, dtype: object
```

In [23]:
```
#checking the average
(2100+2850)/2
```

Out[23]:
```
2475.0
```

So this far I have removed NAs , dealt with unnecesarry features and cleaned the total sft column

FEATURE ENGINEERING AND DIMENSIONALITY REDUCTION TECHNIQUES

In [24]:
```
# COPY THE DATAFRAME INTO NEW ONE
# CREATING A NEW FAETURE WHICH WILL CALCULATE PRICE PER SQFT COLUMN. IT WILL ALSO HE
cleaned_hp= hp3.copy()
cleaned_hp['price_per_sqft'] = cleaned_hp['price']*100000 / cleaned_hp['total_sqft']
cleaned_hp.head()
```

Out[24]:

	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 [25]:
```
#EXPLORING LOCATION COLUMN : HOW MANY LOCATIONS ARE THERE AND HOW MANY ROWS ARE AVAI
#LOCATION IS A CATEGORICAL FEATURE as it is tax data. IF THERE ARE TOO MANT LOCATION
```

In [26]:
```
#NUMBER OF LOCATIONS

cleaned_hp.location.unique()
```

Out[26]:
```
array(['Electronic City Phase II', 'Chikka Tirupathi', 'Uttarahalli', ...,
       '12th cross srinivas nagar banshankari 3rd stage',
       'Havanur extension', 'Abshot Layout'], dtype=object)
```

In [27]:
```
#count
len(cleaned_hp.location.unique())
```

Out[27]:
```
1304
```

As you can see there are huge number of locations. So we'll apply a technique which will reduced the dimention.

In [28]:
```
# Below technique will show the particular location consisting number of rows
```

```
#this funtion will remove the leading space


cleaned_hp.location= cleaned_hp.location.apply(lambda x: x.strip())
location_stats= cleaned_hp.groupby('location')['location'].agg('count').sort_values(
location_stats
```

Out[28]:
```
location
Whitefield           535
Sarjapur  Road       392
Electronic City      304
Kanakpura Road       266
Thanisandra          236
                    ...
LIC Colony             1
Kuvempu Layout         1
Kumbhena Agrahara      1
Kudlu Village,         1
1 Annasandrapalya      1
Name: location, Length: 1293, dtype: int64
```

In [29]:
```
#I want to know how many locations has less then 10 numbers of datapoints

len(location_stats[location_stats<=10])
```

Out[29]: 1052

In [30]:
```
location_stats_less_than_10= location_stats[location_stats<=10]
location_stats_less_than_10
```

Out[30]:
```
location
BTM 1st Stage          10
Basapura               10
Sector 1 HSR Layout    10
Naganathapura          10
Kalkere                10
                       ..
LIC Colony              1
Kuvempu Layout          1
Kumbhena Agrahara       1
Kudlu Village,          1
1 Annasandrapalya       1
Name: location, Length: 1052, dtype: int64
```

In [31]:
```
# lets put these locations into other category

len(cleaned_hp.location.unique())
```

Out[31]: 1293

In [32]:
```
cleaned_hp.location= cleaned_hp.location.apply(lambda x: 'others' if x in location_s
len(cleaned_hp.location.unique())
```

Out[32]: 242

In [33]:
```
cleaned_hp.head(30)
```

Out[33]:

	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

	location	size	total_sqft	bath	price	bhk	price_per_sqft
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	others	6 Bedroom	1020.0	6.0	370.00	6	36274.509804
10	Whitefield	3 BHK	1800.0	2.0	70.00	3	3888.888889
11	Whitefield	4 Bedroom	2785.0	5.0	295.00	4	10592.459605
12	7th Phase JP Nagar	2 BHK	1000.0	2.0	38.00	2	3800.000000
13	Gottigere	2 BHK	1100.0	2.0	40.00	2	3636.363636
14	Sarjapur	3 Bedroom	2250.0	3.0	148.00	3	6577.777778
15	Mysore Road	2 BHK	1175.0	2.0	73.50	2	6255.319149
16	Bisuvanahalli	3 BHK	1180.0	3.0	48.00	3	4067.796610
17	Raja Rajeshwari Nagar	3 BHK	1540.0	3.0	60.00	3	3896.103896
18	others	3 BHK	2770.0	4.0	290.00	3	10469.314079
19	others	2 BHK	1100.0	2.0	48.00	2	4363.636364
20	Kengeri	1 BHK	600.0	1.0	15.00	1	2500.000000
21	Binny Pete	3 BHK	1755.0	3.0	122.00	3	6951.566952
22	Thanisandra	4 Bedroom	2800.0	5.0	380.00	4	13571.428571
23	Bellandur	3 BHK	1767.0	3.0	103.00	3	5829.088851
24	Thanisandra	1 RK	510.0	1.0	25.25	1	4950.980392
25	others	3 BHK	1250.0	3.0	56.00	3	4480.000000
26	Electronic City	2 BHK	660.0	1.0	23.10	2	3500.000000
27	Whitefield	3 BHK	1610.0	3.0	81.00	3	5031.055901
28	Ramagondanahalli	2 BHK	1151.0	2.0	48.77	2	4237.185056
29	Electronic City	3 BHK	1025.0	2.0	47.00	3	4585.365854

OUTLIER DETECTION AND REMOVAL

OUTLIERS ARE DATA POINTS WHICH ARE DATA ERRORS OR SOMEIMES THEY REPRESENT EXTREME VARIATIONS IN DATA WHICH MAY CREATE PROBLEMS

In [34]:

```
#SUPPOSE WE HAVE TO CHECK THE TOTAL SQFT PER BHK(P.S.THE COMMON THRESHHOLD PERBHK IS
#which are lesser THAN THAT IS UNCOMMON.)

cleaned_hp[cleaned_hp.total_sqft/ cleaned_hp.bhk<300].head(10)
```

Out[34]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft

	location	size	total_sqft	bath	price	bhk	price_per_sqft
9	others	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	others	3 Bedroom	500.0	3.0	100.0	3	20000.000000
78	Kaval Byrasandra	2 BHK	460.0	1.0	22.0	2	4782.608696
89	Rajaji Nagar	6 Bedroom	710.0	6.0	160.0	6	22535.211268
119	Hennur Road	2 Bedroom	276.0	3.0	23.0	2	8333.333333
129	Vishwapriya Layout	7 Bedroom	950.0	7.0	115.0	7	12105.263158
149	others	6 Bedroom	1034.0	5.0	185.0	6	17891.682785

remove all these datapoints

In [35]:
```
cleaned_hp.shape
```

Out[35]:
```
(13246, 7)
```

In [36]:
```
# THIS IS ONE OF THE WAY OF REMOVING OUTLIERS
cl_hp1= cleaned_hp[~(cleaned_hp.total_sqft/ cleaned_hp.bhk<300)]
cl_hp1.shape
```

Out[36]:
```
(12502, 7)
```

In [37]:
```
cl_hp1
```

Out[37]:

	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
...	...	...	...	...	...	...	...
13315	Whitefield	5 Bedroom	3453.0	4.0	231.00	5	6689.834926
13316	others	4 BHK	3600.0	5.0	400.00	4	11111.111111
13317	Raja Rajeshwari Nagar	2 BHK	1141.0	2.0	60.00	2	5258.545136
13318	Padmanabhanagar	4 BHK	4689.0	4.0	488.00	4	10407.336319
13319	Doddathoguru	1 BHK	550.0	1.0	17.00	1	3090.909091

12502 rows × 7 columns

In [38]:
```
cl_hp1.price_per_sqft.describe()
```

Out[38]:
```
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
```

In this we can see that the min price_per_sqft is 267.829813 and max is 176470.588235. So these are the extreme cases.

In [39]:
```
# We are going to build a funtion that can remove the extreme cases based on std .
#If data set has normal dist then most(68%) of the datapoint lie btwn mean and 1 std
#we are going to remove those who are beyong 1 std.
```

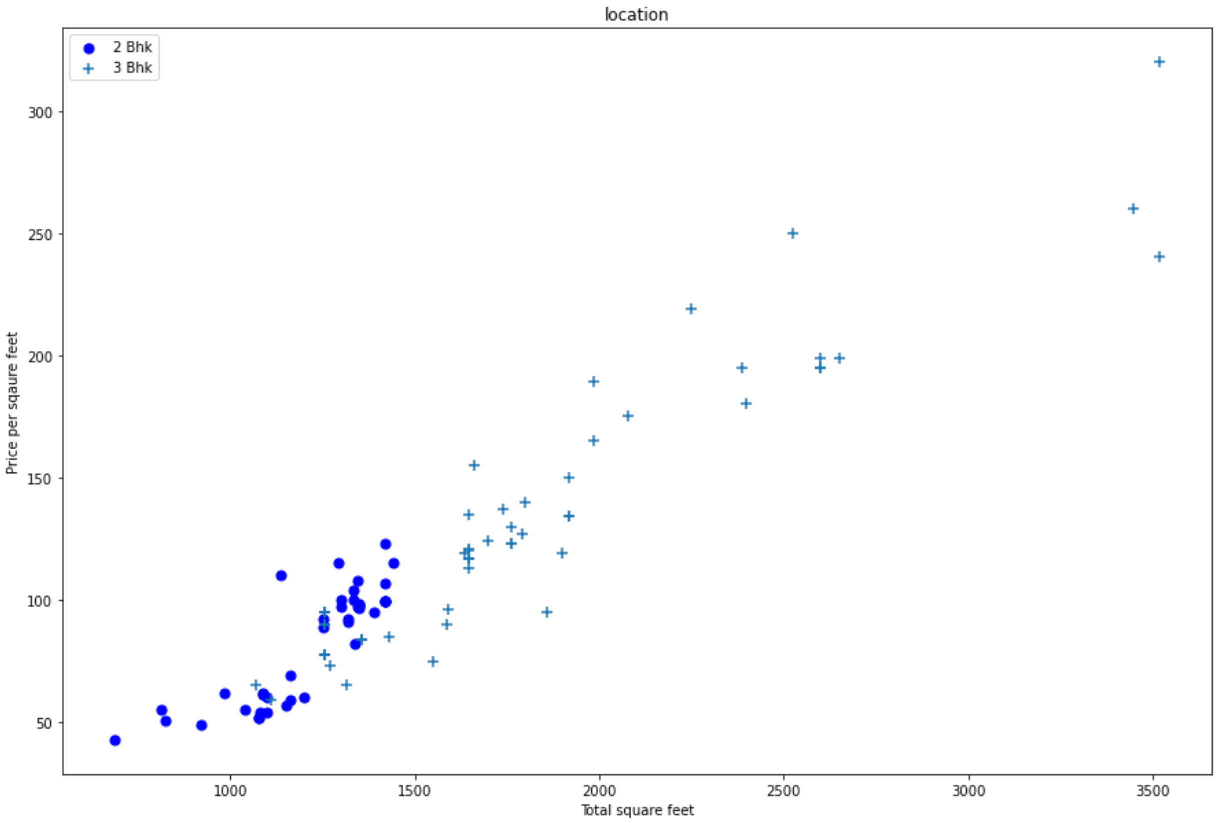
In [40]:
```
#function which will remove price per sqft outlier per location.
#bcoz some locations will have high price some will hve less price.
#per location find Mean and std and filter out data points which have beyond std poi

def remove_pps_outlier(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+
        df_out = pd.concat([df_out,reduced_df], ignore_index=True)
    return df_out
```

In [41]:
```
clhp2 = remove_pps_outlier(cl_hp1)
clhp2.shape
```

Out[41]: (10241, 7)

In [ ]:

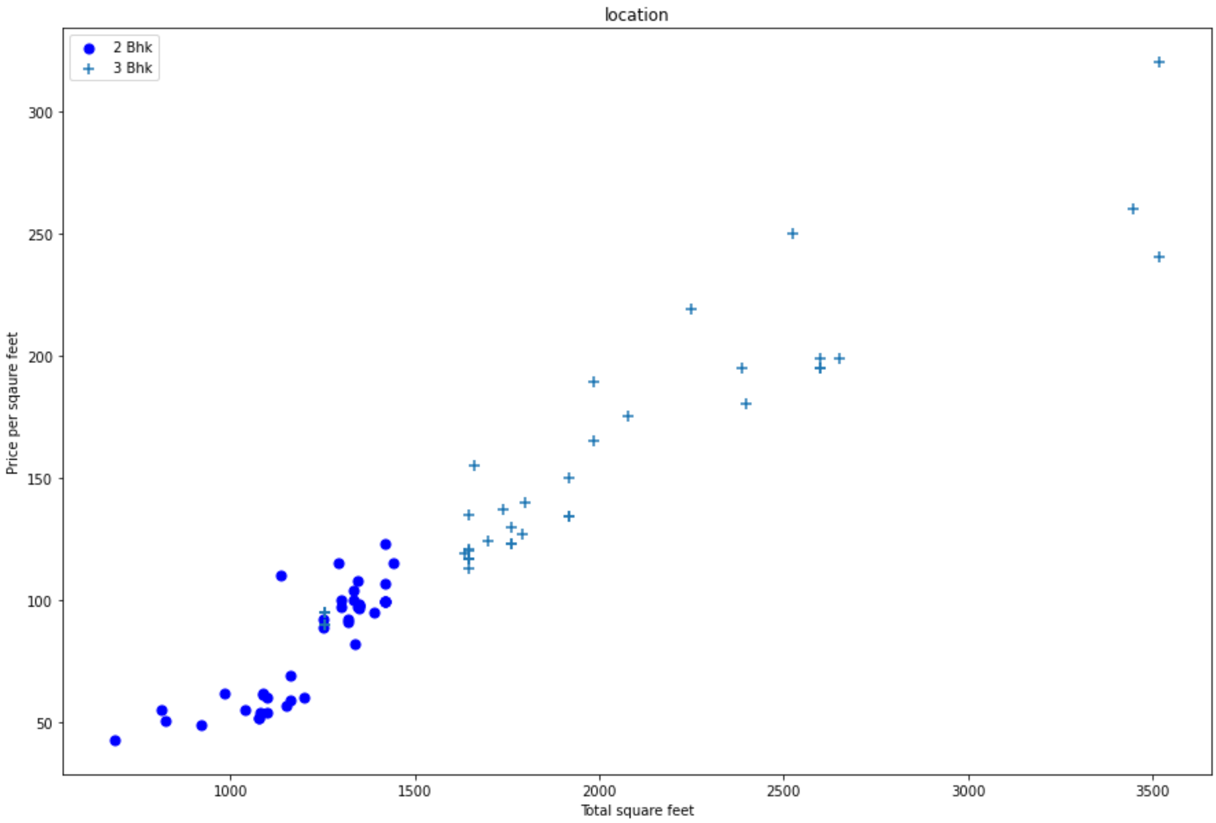
In [42]:
```
# So we should also not forget to check in the dataset that the property prices of s
#and we need to do the visualization of how many such cases we have

#lets try scatterplot function

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='+',label='3 Bhk', s=50)
    plt.xlabel("Total square feet")
    plt.ylabel("Price per sqaure feet")
    plt.title("location")
    plt.legend()



plot_scatter_chart(clhp2,"Hebbal")
```



In [43]:
```
# NOW WE'LL CREATE A FUNCTON, WHAT IT WILL DO IS, IT WILL CALCULATE MEAN, STD, AND C
#WHERE 2BHK PRICE WILL BE MORE THAN THAT OF 1BHK HOUSE.

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_
    return df.drop(exclude_indices,axis='index')



clhp3= remove_bhk_outliers(clhp2)
clhp3.shape
```

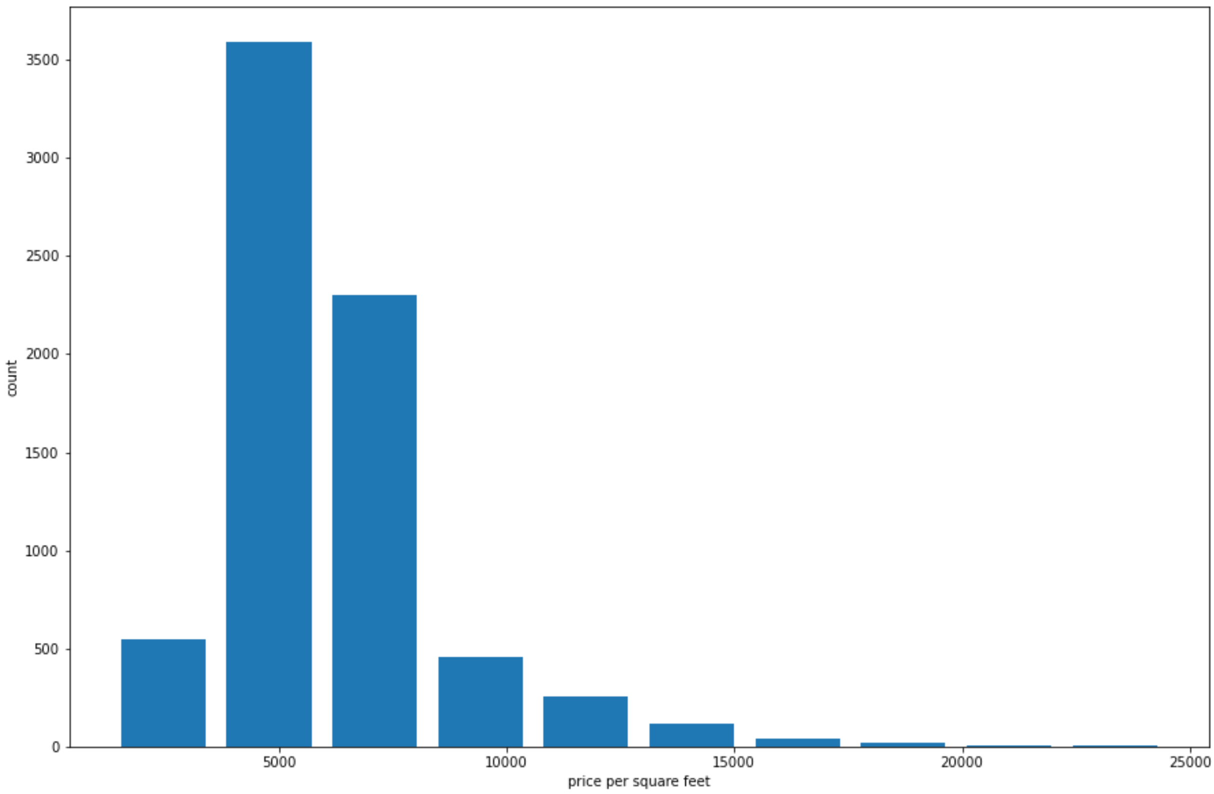
Out[43]: (7329, 7)

In [44]:
```
plot_scatter_chart(clhp3,"Hebbal")
```



In [45]:
```
import matplotlib

plt.hist(clhp3.price_per_sqft,rwidth=0.8)
plt.xlabel("price per square feet")
plt.ylabel("count")
```

Out[45]: Text(0, 0.5, 'count')



As we can see we have a majority of property on price per sqft from 0 to 1000 per sqft rupees range, We have majority of datapoints. And we can see that the dataset have bell curved shape. By that we can say our dataset has normal distribution.

In [46]:
```
#Lets explore bathrooms

clhp3.bath.unique()
```

Out[46]:
```
array([ 4.,  3.,  2.,  5.,  8.,  1.,  6.,  7.,  9., 12., 16., 13.])
```

In [47]:
```
#houses which have more than 9 bathrooms

clhp3[clhp3.bath>10]
```

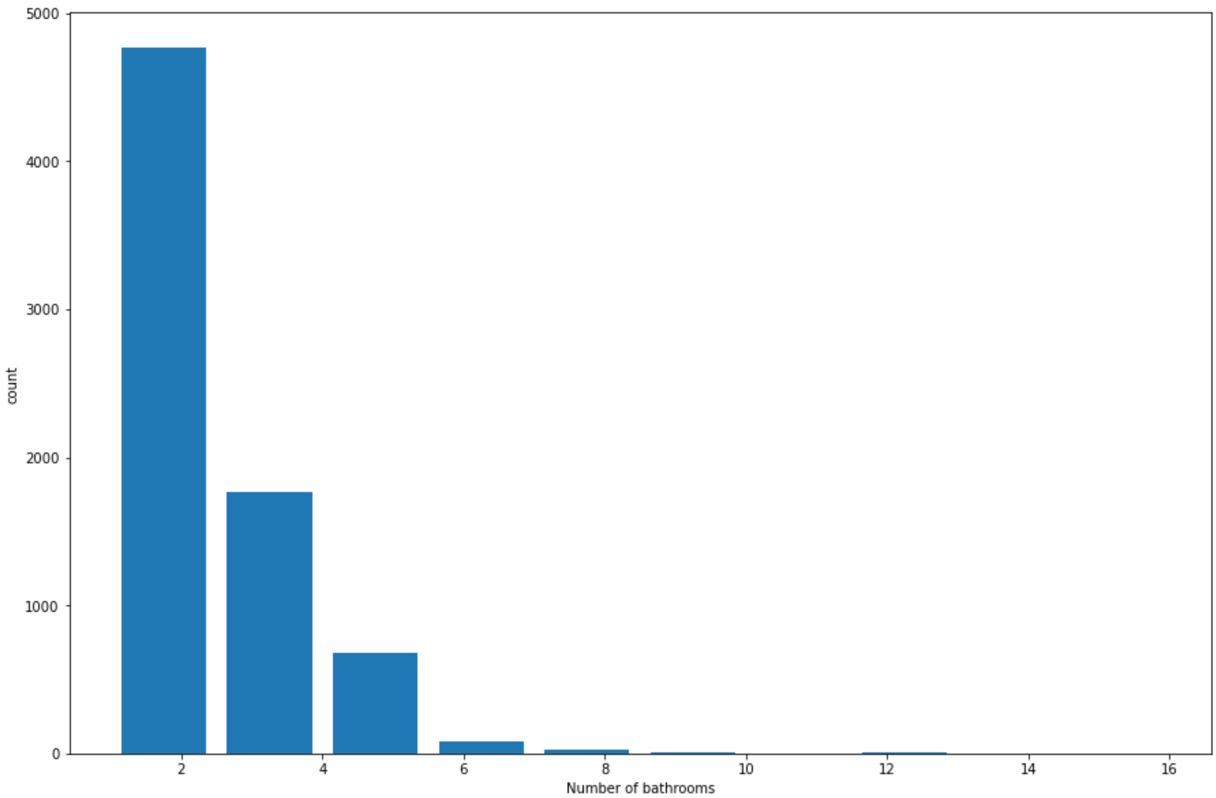
Out[47]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
5277	Neeladri Nagar	10 BHK	4000.0	12.0	160.0	10	4000.000000
8486	others	10 BHK	12000.0	12.0	525.0	10	4375.000000
8575	others	16 BHK	10000.0	16.0	550.0	16	5500.000000
9308	others	11 BHK	6000.0	12.0	150.0	11	2500.000000
9639	others	13 BHK	5425.0	13.0	275.0	13	5069.124424

Sometimes we might get a thought of houses having bathrooms which are greater than bedrooms. Normally in 2 bhk we can have 2 or 3 bathrooms. If you have 2bhk and 4 bathrooms that is unusual. So we'll also remove those outliers in further process.

In [48]:
```
#plotting the histogram

plt.hist(clhp3.bath,rwidth=0.8)
plt.xlabel("Number of bathrooms")
plt.ylabel("count")
```

Out[48]:
```
Text(0, 0.5, 'count')
```



In [49]:
```
#Lets mark the outliers which are +2 bathrooms more than bedrooms

clhp3[clhp3.bath>clhp3.bhk+2]
```

Out[49]:

	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
8411	others	6 BHK	11338.0	9.0	1000.0	6	8819.897689

All of these are outliers whihc needs to be removed

In [50]:

```
clhp4= clhp3[clhp3.bath<clhp3.bhk+2]
clhp4.shape
```

Out[50]: (7251, 7)

NOW MY DATASET LOOKS PRETTY MUCH CLEAN. SO LETS STARTS PREPARING FOR MACHINE LEARNING TRAINING

In [51]:

```
# BEFORE MOVING AHEAD LETS DROP MORE UNNECESSARY FEATURES BY CREATING NEW DATA FRAME

clhp5 = clhp4.drop(['size','price_per_sqft'],axis='columns')
clhp5.head(100)
```

Out[51]:

	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
3	1st Block Jayanagar	1200.0	2.0	130.0	3
4	1st Block Jayanagar	1235.0	2.0	148.0	2
...	...	...	...	...	...
106	7th Phase JP Nagar	1180.0	2.0	72.0	2
110	7th Phase JP Nagar	1400.0	3.0	115.0	3
111	7th Phase JP Nagar	1270.0	2.0	83.0	2
113	7th Phase JP Nagar	2503.0	4.0	188.0	4
114	7th Phase JP Nagar	2200.0	3.0	190.0	3

100 rows × 5 columns

MODEL BUILDING

We'll need to convert the clhp5 data into numeric , because machine learning cant predict the Text data. With the help of pandas dummy method

In [52]:

```
dummies= pd.get_dummies(clhp5.location)
dummies.head(3)
```

Out[52]:

	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	...	Vishv
0	1	0	0	0	0	0	0	0	0	0	...	
1	1	0	0	0	0	0	0	0	0	0	...	
2	1	0	0	0	0	0	0	0	0	0	...	

3 rows × 242 columns

In [53]:
```
clhp6= pd.concat([clhp5, dummies.drop('others', axis='columns')],axis='columns')
clhp6.head(10)
```

Out[53]:

	location	total_sqft	bath	price	bhk	1st Block Jayanagar	1st Phase JP Nagar	2nd Phase Judicial Layout	2nd Stage Nagarbhavi	5th Block Hbr Layout	...	Vij
0	1st Block Jayanagar	2850.0	4.0	428.0	4	1	0	0	0	0	...	
1	1st Block Jayanagar	1630.0	3.0	194.0	3	1	0	0	0	0	...	
2	1st Block Jayanagar	1875.0	2.0	235.0	3	1	0	0	0	0	...	
3	1st Block Jayanagar	1200.0	2.0	130.0	3	1	0	0	0	0	...	
4	1st Block Jayanagar	1235.0	2.0	148.0	2	1	0	0	0	0	...	
5	1st Block Jayanagar	2750.0	4.0	413.0	4	1	0	0	0	0	...	
6	1st Block Jayanagar	2450.0	4.0	368.0	4	1	0	0	0	0	...	
8	1st Phase JP Nagar	1875.0	3.0	167.0	3	0	1	0	0	0	...	
9	1st Phase JP Nagar	1500.0	5.0	85.0	5	0	1	0	0	0	...	
10	1st Phase JP Nagar	2065.0	4.0	210.0	3	0	1	0	0	0	...	

10 rows × 246 columns

In [54]:
```
clhp7= clhp6.drop('location', axis='columns')
clhp7.head(3)
```

Out[54]:

	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	...	Vijayar

	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	...	Vijayar
0	2850.0	4.0	428.0	4	1	0	0	0	0	0	...	
1	1630.0	3.0	194.0	3	1	0	0	0	0	0	...	
2	1875.0	2.0	235.0	3	1	0	0	0	0	0	...	

3 rows × 245 columns

In [55]:
```
clhp7.shape
```

Out[55]:
```
(7251, 245)
```

In [78]:
```
#here I will creat X variable which will have only independent variables

X=  clhp7.drop('price',axis='columns')
X.head()
```

Out[78]:

	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	...	Vijaya
0	2850.0	4.0	4	1	0	0	0	0	0	0	...	
1	1630.0	3.0	3	1	0	0	0	0	0	0	...	
2	1875.0	2.0	3	1	0	0	0	0	0	0	...	
3	1200.0	2.0	3	1	0	0	0	0	0	0	...	
4	1235.0	2.0	2	1	0	0	0	0	0	0	...	

5 rows × 244 columns

In [57]:
```
y= clhp7.price
y.head()
```

Out[57]:
```
0    428.0
1    194.0
2    235.0
3    130.0
4    148.0
Name: price, dtype: float64
```

In [58]:
```
#lets divide our data set and use  training dataset for model training,
#and test dataset is to eveluate model perfomance

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 [59]:
```
from sklearn.linear_model import LinearRegression
lr_clf= LinearRegression()
lr_clf.fit(X_train,y_train)
lr_clf.score(X_test,y_test)
```

Out[59]: 0.8452277697874301

pretty decent score it is 84%

k-fold cross validation method

In [71]:
```
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[71]: array([0.82430186, 0.77166234, 0.85089567, 0.80837764, 0.83653286])

Other techniques

GRIDSEARCHCV

In [72]:
```
from sklearn.model_selection import GridSearchCV

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


def find_best_model_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_scor
        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_gridsearchcv(X,y)
```

Out[72]:

	model	best_score	best_params
0	linear_regression	0.818354	{'normalize': True}
1	lasso	0.687478	{'alpha': 2, 'selection': 'random'}
2	decision_tree	0.743538	{'criterion': 'mse', 'splitter': 'random'}

The above function will tell me which algorithm is good. It is a time saver

In [79]:
```
X.columns
```

Out[79]:
```
Index(['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',
       'Vittasandra', 'Whitefield', 'Yelachenahalli', 'Yelahanka',
       'Yelahanka New Town', 'Yelenahalli', 'Yeshwanthpur'],
      dtype='object', length=244)
```

PROPERTY PRICE PREDICTION

In [65]:
```
#predict price function


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 [66]:
```
predict_price('1st Phase JP Nagar',1000,2, 2)
```

Out[66]: 83.4990467717485

In [67]:
```
predict_price('1st Phase JP Nagar',1000,2, 3)
```

Out[67]: 81.72616900750309

In [68]:
```
predict_price('Indira Nagar',1000,3, 3)
```

Out[68]: 184.58430202033497

In [ ]:

In [ ]:

Time to export our model to pickel file

In [76]:
```
import pickle
with open('Bengaluru_House_prices_model.pickle', 'wb') as f:
    pickle.dump(lr_clf,f)
```

In [77]:
```
import json
columns = {
    'data_columns': [col.lower() for col in X.columns]
}
with open("columns.json", "w") as f:
    f.write(json.dumps(columns))
```

In [ ]:

In [ ]:

In [ ]: