In [3]:
```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import warnings
warnings.filterwarnings('ignore')
```

In [4]:
```
df = pd.read_csv("DMV Dataset/Bengaluru_House_Data.csv")
```

In [5]:
```
df.head()
```

Out[5]:

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

In [6]:
```
df.shape
```

Out[6]:
```
(13320, 9)
```

In [7]:
```
df.columns
```

Out[7]:
```
Index(['area_type', 'availability', 'location', 'size', 'society',
       'total_sqft', 'bath', 'balcony', 'price'],
      dtype='object')
```

In [8]:
```
df['area_type']
```

Out[8]:
```
0        Super built-up  Area
1                  Plot  Area
2              Built-up  Area
3        Super built-up  Area
4        Super built-up  Area
                 ...
13315          Built-up  Area
13316    Super built-up  Area
13317          Built-up  Area
13318    Super built-up  Area
13319    Super built-up  Area
Name: area_type, Length: 13320, dtype: object
```

In [9]:
```
df['area_type'].unique()
```

Out[9]:
```
array(['Super built-up  Area', 'Plot  Area', 'Built-up  Area',
       'Carpet  Area'], dtype=object)
```

In [11]:
```
df['area_type'].value_counts()
```

Out[11]:
```
area_type
Super built-up  Area    8790
Built-up  Area          2418
Plot  Area              2025
Carpet  Area              87
Name: count, dtype: int64
```

In [12]:
```
df2 = df.drop(['area_type','society','balcony','availability'],axis='columns')
```

In [15]:
```
df2.shape
```

Out[15]:
```
(13320, 5)
```

In [16]:
```
df2.isnull().sum()
```

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

In [18]:
```
df3 = df2.dropna()
df3.isnull().sum()
```

Out[18]:
```
location      0
size          0
total_sqft    0
bath          0
price         0
dtype: int64
```

In [19]:
```
df3.shape
```

Out[19]:
```
(13246, 5)
```

In [20]:
```
df3['size'].unique()
```

Out[20]:
```
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 [21]:
```
df3['bhk'] = df3['size'].apply(lambda x: int(x.split(' ')[0]))
```

In [22]:
```
df3.head()
```

Out[22]:

	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 [23]:
```
df3.bhk.unique()
```

Out[23]:
```
array([ 2,  4,  3,  6,  1,  8,  7,  5, 11,  9, 27, 10, 19, 16, 43, 14, 12,
       13, 18], dtype=int64)
```

In [24]:
```
df3[df3.bhk>20]
```

Out[24]:

	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 [25]:
```
df3.total_sqft.unique()
```

Out[25]:
```
array(['1056', '2600', '1440', ..., '1133 - 1384', '774', '4689'],
      dtype=object)
```

In [26]:
```
def is_float(x):
    try:
        float(x)
        return True
    except(ValueError, TypeError):
        return False
```

In [27]:
```
df3[~df3['total_sqft'].apply(is_float)].head(10)
```

Out[27]:

	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 [28]:
```
def convert_sqft_to_num(x):
    tokens = x.split('-')
    if len(tokens) == 2:
        try:
            return (float(tokens[0])+float(tokens[1]))/2
        except ValueError:
            return None
    try:
        return float(x)
    except ValueError:
        return None

result = convert_sqft_to_num('2100 - 2850')
print(result)
```

```
2475.0
```

In [29]:
```
convert_sqft_to_num('34.46Sq. Meter')
df4 = df3.copy()
df4.total_sqft = df4.total_sqft.apply(convert_sqft_to_num)
df4
```

Out[29]:

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

13246 rows × 6 columns

In [30]:
```
df4 = df4[df4.total_sqft.notnull()]
df4
```

Out[30]:

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

13200 rows × 6 columns

In [31]:
```
df4.loc[30]
```

Out[31]:
```
location      Yelahanka
size              4 BHK
total_sqft       2475.0
bath                4.0
price             186.0
bhk                   4
Name: 30, dtype: object
```

In [32]:
```
df5 = df4.copy()
df5['price_per_sqft'] = df5['price']*100000/df5['total_sqft']
df5.head()
```

Out[32]:

	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 [33]:
```
df5_stats = df5['price_per_sqft'].describe()
df5_stats
```

Out[33]:
```
count    1.320000e+04
mean     7.920759e+03
std      1.067272e+05
min      2.678298e+02
25%      4.267701e+03
50%      5.438331e+03
75%      7.317073e+03
max      1.200000e+07
Name: price_per_sqft, dtype: float64
```

In [34]:
```
# df5.to_csv("DMV Dataset/bhp.csv",index=False)
```

In [35]:
```
df5.location = df5.location.apply(lambda x: x.strip())
location_stats = df5['location'].value_counts(ascending=False)
location_stats
```

Out[35]:
```
location
Whitefield                    533
Sarjapur  Road                392
Electronic City               304
Kanakpura Road                264
Thanisandra                   235
                             ...
Rajanna Layout                  1
Subramanyanagar                 1
Lakshmipura Vidyaanyapura       1
Malur Hosur Road                1
Abshot Layout                   1
Name: count, Length: 1287, dtype: int64
```

In [36]:
```
len(location_stats[location_stats>10])
```

Out[36]:
```
240
```

In [37]:
```
len(location_stats)
```

Out[37]:
```
1287
```

In [38]:
```
len(location_stats[location_stats<=10])
```

Out[38]:
```
1047
```

In [39]:
```
location_stats_less_than_10 = location_stats[location_stats<=10]
location_stats_less_than_10
```

Out[39]:
```
location
BTM 1st Stage                 10
Gunjur Palya                  10
Nagappa Reddy Layout          10
Sector 1 HSR Layout           10
Thyagaraja Nagar              10
                              ..
Rajanna Layout                 1
Subramanyanagar                1
Lakshmipura Vidyaanyapura      1
Malur Hosur Road               1
Abshot Layout                  1
Name: count, Length: 1047, dtype: int64
```

In [40]:
```
len(df5.location.unique())
```

Out[40]:
```
1287
```

In [41]:
```
df5.location = df5.location.apply(lambda x: 'other' if x in location_stats_less_
len(df5.location.unique())
```

Out[41]:
```
241
```

In [42]:
```
df5.head(10)
```

Out[42]:

	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 [43]:
```
df5[df5.total_sqft/df5.bhk<300].head()
```

Out[43]:

	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 [44]:
```
df5.shape
```

Out[44]:
```
(13200, 7)
```

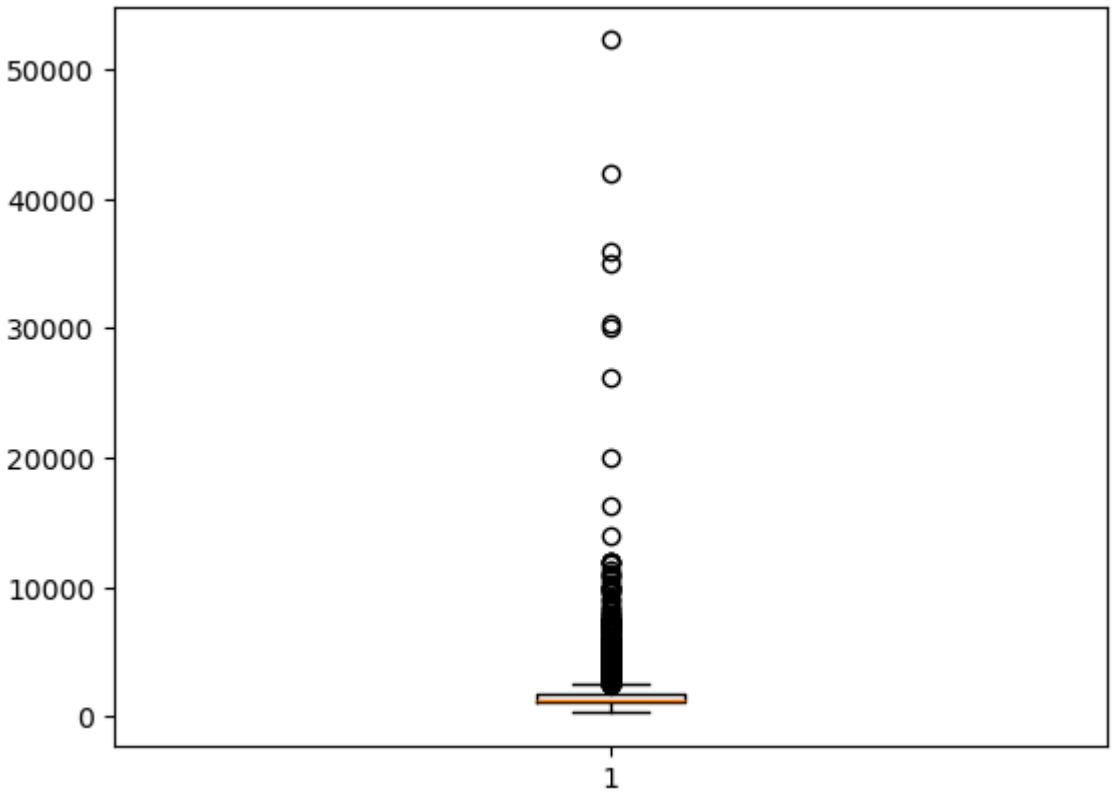
In [45]:
```
df6 = df5[~(df5.total_sqft/df5.bhk<300)]
df6.shape
```

Out[45]:
```
(12456, 7)
```

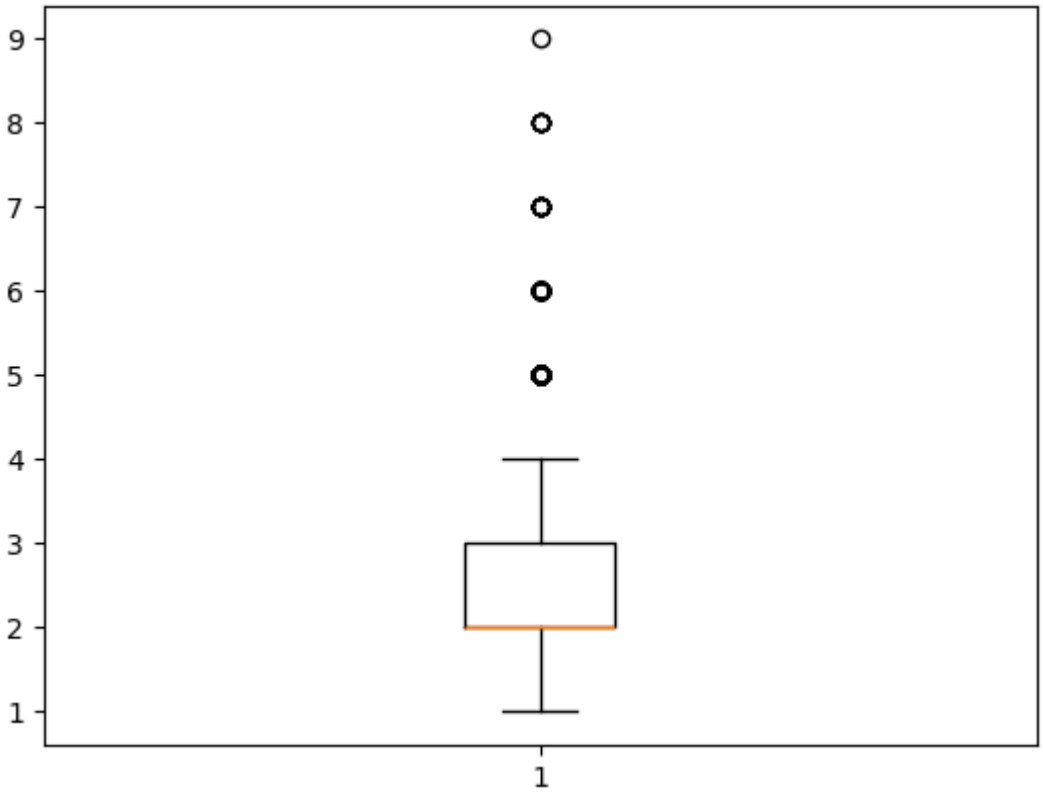
In [46]:
```
df6.columns
```

Out[46]:
```
Index(['location', 'size', 'total_sqft', 'bath', 'price', 'bhk',
       'price_per_sqft'],
      dtype='object')
```

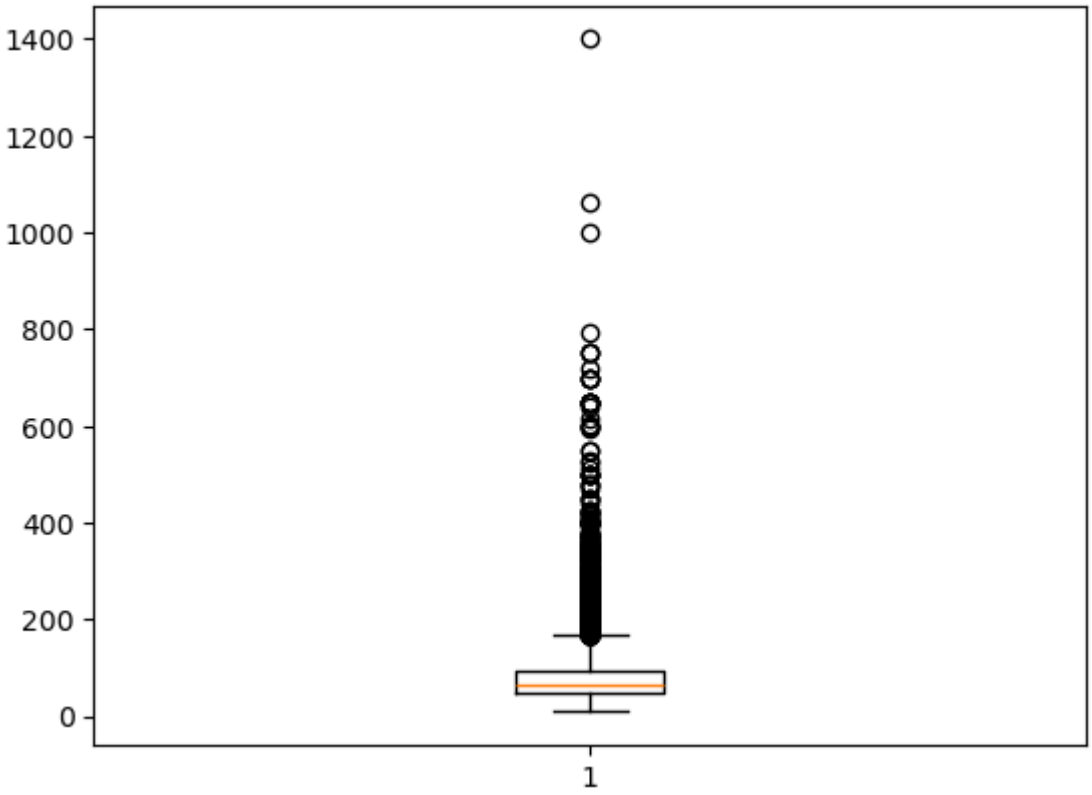
In [47]:
```
plt.boxplot(df6['total_sqft'])
plt.show()
```



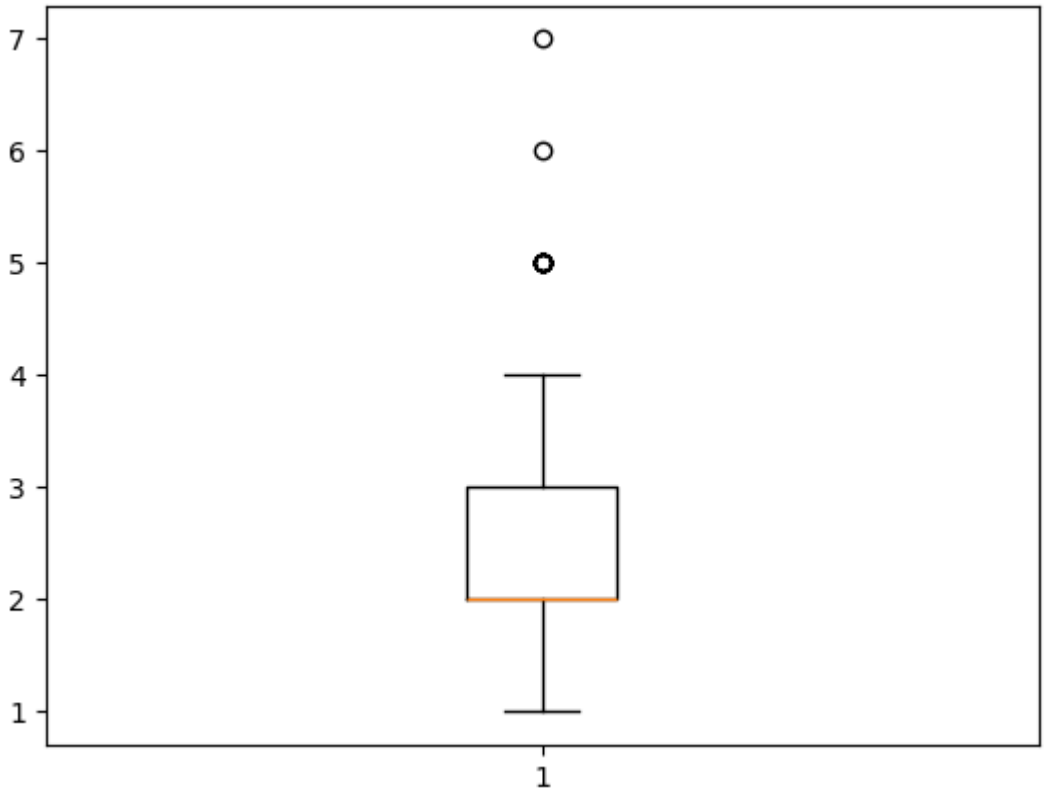
In [48]:
```
Q1 = np.percentile(df6['total_sqft'], 25.) # 25th percentile of the data of the
Q3 = np.percentile(df6['total_sqft'], 75.) # 75th percentile of the data of the
IQR = Q3-Q1 #Interquartile Range
ll = Q1 - (1.5*IQR)
ul = Q3 + (1.5*IQR)
upper_outliers = df6[df6['total_sqft'] > ul].index.tolist()
lower_outliers = df6[df6['total_sqft'] < ll].index.tolist()
bad_indices = list(set(upper_outliers + lower_outliers))
drop = True
if drop:
    df6.drop(bad_indices, inplace = True, errors = 'ignore')

plt.boxplot(df6['bath'])
plt.show()
```



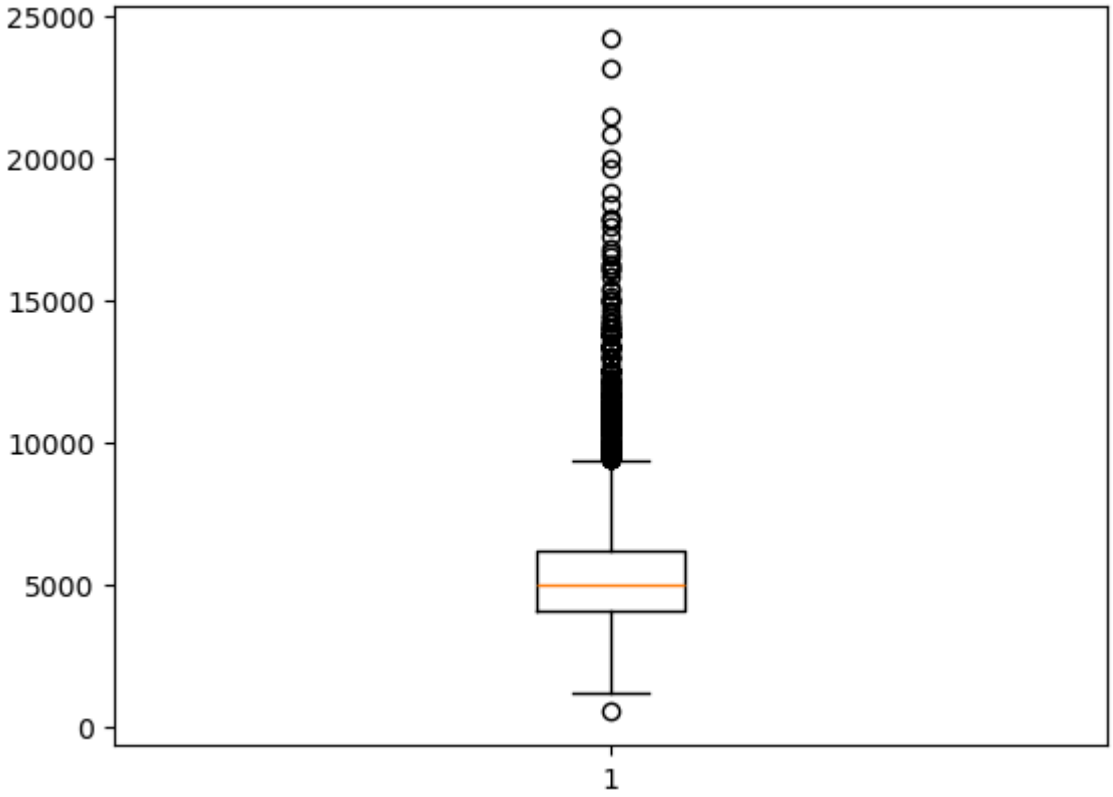
In [49]:
```
Q1 = np.percentile(df6['bath'], 25.) # 25th percentile of the data of the given
Q3 = np.percentile(df6['bath'], 75.) # 75th percentile of the data of the given
IQR = Q3-Q1 #Interquartile Range
ll = Q1 - (1.5*IQR)
ul = Q3 + (1.5*IQR)
upper_outliers = df6[df6['bath'] > ul].index.tolist()
lower_outliers = df6[df6['bath'] < ll].index.tolist()
bad_indices = list(set(upper_outliers + lower_outliers))
drop = True
if drop:
    df6.drop(bad_indices, inplace = True, errors = 'ignore')
plt.boxplot(df6['price'])
plt.show()
```



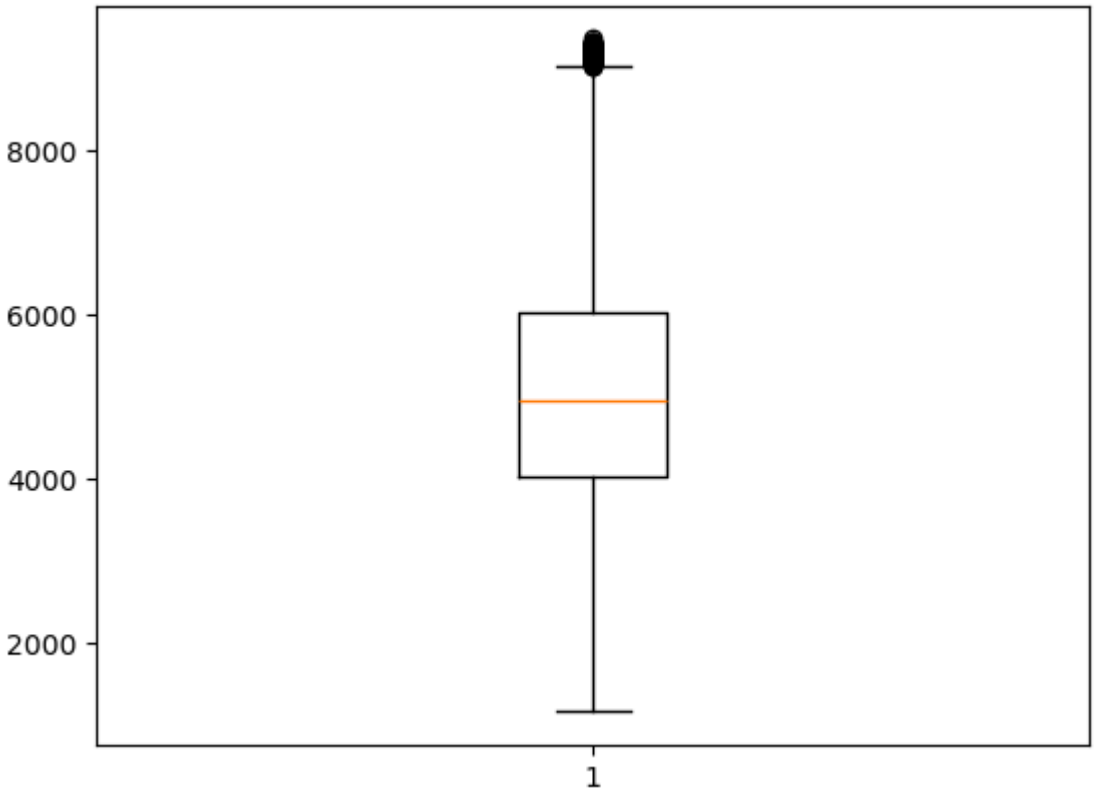
In [50]:
```
Q1 = np.percentile(df6['price'], 25.) # 25th percentile of the data of the given
Q3 = np.percentile(df6['price'], 75.) # 75th percentile of the data of the given
IQR = Q3-Q1 #Interquartile Range
ll = Q1 - (1.5*IQR)
ul = Q3 + (1.5*IQR)

upper_outliers = df6[df6['price'] > ul].index.tolist()
lower_outliers = df6[df6['price'] < ll].index.tolist()
bad_indices = list(set(upper_outliers + lower_outliers))
drop = True
if drop:
    df6.drop(bad_indices, inplace = True, errors = 'ignore')

plt.boxplot(df6['bhk'])
plt.show()
```



In [51]:
```
Q1 = np.percentile(df6['bhk'], 25.) # 25th percentile of the data of the given f
Q3 = np.percentile(df6['bhk'], 75.) # 75th percentile of the data of the given f
IQR = Q3-Q1 #Interquartile Range
ll = Q1 - (1.5*IQR)
ul = Q3 + (1.5*IQR)
upper_outliers = df6[df6['bhk'] > ul].index.tolist()
lower_outliers = df6[df6['bhk'] < ll].index.tolist()
bad_indices = list(set(upper_outliers + lower_outliers))
drop = True
if drop:
    df6.drop(bad_indices, inplace = True, errors = 'ignore')

plt.boxplot(df6['price_per_sqft'])
plt.show()
```



In [52]:
```
Q1 = np.percentile(df6['price_per_sqft'], 25.) # 25th percentile of the data of
Q3 = np.percentile(df6['price_per_sqft'], 75.) # 75th percentile of the data of
IQR = Q3-Q1 #Interquartile Range
ll = Q1 - (1.5*IQR)
ul = Q3 + (1.5*IQR)
upper_outliers = df6[df6['price_per_sqft'] > ul].index.tolist()
lower_outliers = df6[df6['price_per_sqft'] < ll].index.tolist()
bad_indices = list(set(upper_outliers + lower_outliers))
drop = True
if drop:
    df6.drop(bad_indices, inplace = True, errors = 'ignore')

plt.boxplot(df6['price_per_sqft'])
plt.show()
```



In [53]:
```
df6.shape
```

Out[53]:
```
(10090, 7)
```

In [54]:
```
X = df6.drop(['price'],axis='columns')
X.head(3)
```

Out[54]:

	location	size	total_sqft	bath	bhk	price_per_sqft
0	Electronic City Phase II	2 BHK	1056.0	2.0	2	3699.810606
2	Uttarahalli	3 BHK	1440.0	2.0	3	4305.555556
3	Lingadheeranahalli	3 BHK	1521.0	3.0	3	6245.890861

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

Out[55]:
```
(10090, 6)
```

In [56]:
```
y = df6.price
y.head(3)
```

Out[56]:
```
0    39.07
2    62.00
3    95.00
Name: price, dtype: float64
```

In [57]:
```
len(y)
```

Out[57]:
```
10090
```