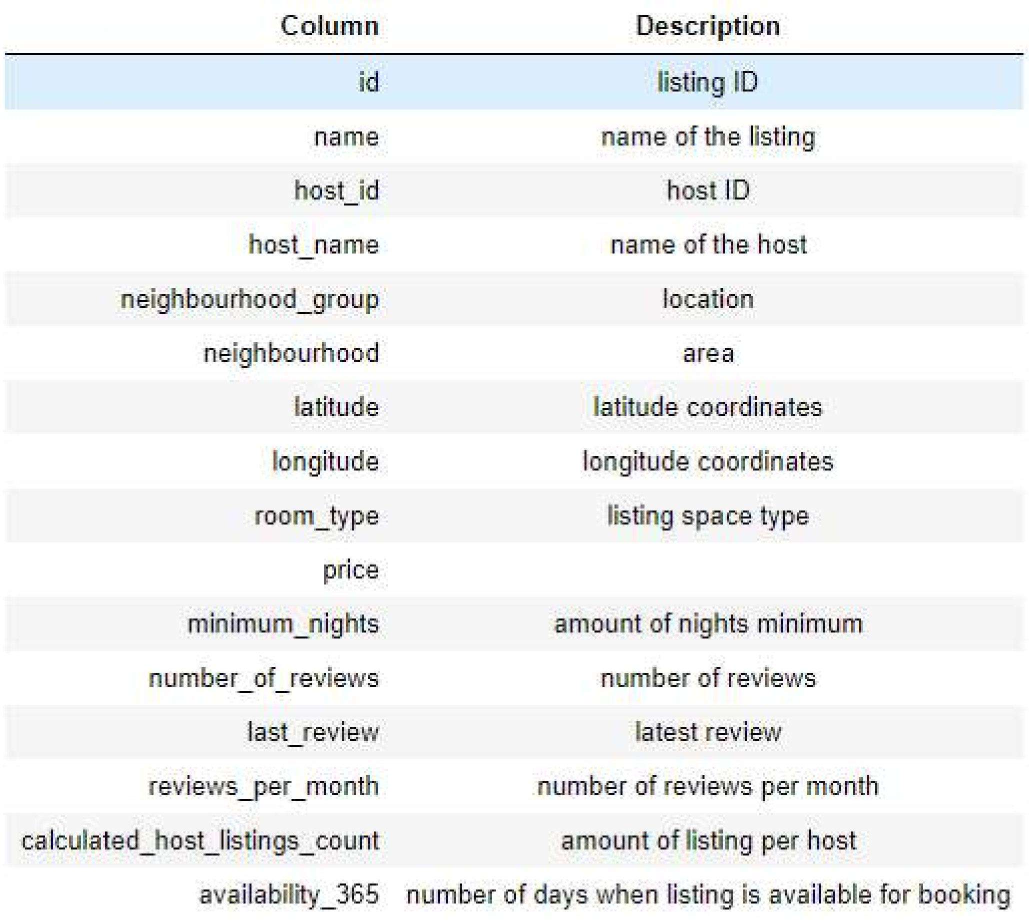
Problem Statement

Suppose that you are working as a data analyst at Airbnb. For the past few months, Airbnb has seen a major decline in revenue. Now that the restrictions have started lifting and people have started to travel more, Airbnb wants to make sure that it is fully prepared for this change.

The different leaders at Airbnb want to understand some important insights based on various attributes in the dataset so as to increase the revenue such as -

Which type of hosts to acquire more and where? The categorisation of customers based on their preferences. What are the neighbourhoods they need to target? What is the pricing ranges preferred by customers? The various kinds of properties that exist w.r.t. customer preferences. Adjustments in the existing properties to make it more customer-oriented

Columns Discription



Column	Description
id	listing ID
name	name of the listing
host_id	host ID
host_name	name of the host
neighbourhood_group	location
neighbourhood	area
latitude	latitude coordinates
longitude	longitude coordinates
room_type	listing space type
price	
minimum_nights	amount of nights minimum
number_of_reviews	number of reviews
last_review	latest review
reviews_per_month	number of reviews per month
calculated_host_listings_count	amount of listing per host
availability_365	number of days when listing is available for booking

In [2]:
```python
# Import the library to be used

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [3]:
```python
# Reading the Data
bnb = pd.read_csv(r"C:\Users\amann\Downloads\AB_NYC_2019.csv")
```

In [4]:
```python
bnb.head()
```

Out[4]:

	id	name	host_id	host_name	neighbourhood_group	neighbourhood	latitude
0	2539	Clean & quiet apt home by the park	2787	John	Brooklyn	Kensington	40.64749
1	2595	Skylit Midtown Castle	2845	Jennifer	Manhattan	Midtown	40.75362
2	3647	THE VILLAGE OF HARLEM....NEW YORK !	4632	Elisabeth	Manhattan	Harlem	40.80902
3	3831	Cozy Entire Floor of Brownstone	4869	LisaRoxanne	Brooklyn	Clinton Hill	40.68514
4	5022	Entire Apt: Spacious Studio/Loft by central park	7192	Laura	Manhattan	East Harlem	40.79851

In [5]:
```
bnb.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 48895 entries, 0 to 48894
Data columns (total 16 columns):
 #   Column                          Non-Null Count  Dtype  
---  ------                          --------------  -----  
 0   id                              48895 non-null  int64  
 1   name                            48879 non-null  object 
 2   host_id                         48895 non-null  int64  
 3   host_name                       48874 non-null  object 
 4   neighbourhood_group             48895 non-null  object 
 5   neighbourhood                   48895 non-null  object 
 6   latitude                        48895 non-null  float64
 7   longitude                       48895 non-null  float64
 8   room_type                       48895 non-null  object 
 9   price                           48895 non-null  int64  
 10  minimum_nights                  48895 non-null  int64  
 11  number_of_reviews               48895 non-null  int64  
 12  last_review                     38843 non-null  object 
 13  reviews_per_month               38843 non-null  float64
 14  calculated_host_listings_count  48895 non-null  int64  
 15  availability_365                48895 non-null  int64  
dtypes: float64(3), int64(7), object(6)
memory usage: 6.0+ MB
```

In [6]:
```
## Checking the column Name's.
bnb.columns
```

Out[6]:
```
Index(['id', 'name', 'host_id', 'host_name', 'neighbourhood_group',
       'neighbourhood', 'latitude', 'longitude', 'room_type', 'price',
       'minimum_nights', 'number_of_reviews', 'last_review',
       'reviews_per_month', 'calculated_host_listings_count',
       'availability_365'],
      dtype='object')
```

In [7]:
```
#Checking number of Rows and columns.
bnb.shape
```

Out[7]:
```
(48895, 16)
```

In [8]:
```
#Checking for duplicates in 'name' column.
boolean = bnb.duplicated(subset = ['name']).any()
boolean
```

Out[8]:
```
True
```

In [9]:
```
#Checking for duplicates in 'host_id' column.
boolean = bnb.duplicated(subset = ['host_id']).any()
boolean
```

Out[9]:
```
True
```

In [10]:
```
## Code for compairing the duplicate Values in 'name' , 'host_id' AND 'id
bnb2 = bnb.loc[bnb.duplicated(keep = 'first'), : ]
bnb2.head()

```

Out[10]:

id	name	host_id	host_name	neighbourhood_group	neighbourhood	latitude	longitude	roo

With the above information we understand that there are no duplicate entries in the data as 'id' column confirms that all enries are unique.

Latitude and Longitude column is not relevent to us, as all the data is from NY City only. When we have host ID we don't need host name. Thus we will be droping the 'latitude' , 'longitude', and 'host_name' columns.

In [11]:
```
bnb = bnb.drop(['latitude','longitude', 'host_name'], axis =1)
bnb.head()
```

Out[11]:

	id	name	host_id	neighbourhood_group	neighbourhood	room_type	price	mir
0	2539	Clean & quiet apt home by the park	2787	Brooklyn	Kensington	Private room	149	
1	2595	Skylit Midtown Castle	2845	Manhattan	Midtown	Entire home/apt	225	
2	3647	THE VILLAGE OF HARLEM....NEW YORK !	4632	Manhattan	Harlem	Private room	150	
3	3831	Cozy Entire Floor of Brownstone	4869	Brooklyn	Clinton Hill	Entire home/apt	89	
4	5022	Entire Apt: Spacious Studio/Loft by central park	7192	Manhattan	East Harlem	Entire home/apt	80	

In [12]:
```
#Checking if any extra rows at the end of data, it is allways a good prac
bnb.tail(10)
```

Out[12]:

	id	name	host_id	neighbourhood_group	neighbourhood	room_type
48885	36482809	Stunning Bedroom NYC! Walking to Central Park!!	131529729	Manhattan	East Harlem	Private room
48886	36483010	Comfy 1 Bedroom in Midtown East	274311461	Manhattan	Midtown	Entire home/apt
48887	36483152	Garden Jewel Apartment in Williamsburg New York	208514239	Brooklyn	Williamsburg	Entire home/apt
48888	36484087	Spacious Room w/ Private Rooftop, Central loca...	274321313	Manhattan	Hell's Kitchen	Private room
48889	36484363	QUIT PRIVATE HOUSE	107716952	Queens	Jamaica	Private room
48890	36484665	Charming one bedroom - newly renovated rowhouse	8232441	Brooklyn	Bedford-Stuyvesant	Private room
48891	36485057	Affordable room in Bushwick/East Williamsburg	6570630	Brooklyn	Bushwick	Private room
48892	36485431	Sunny Studio at Historical Neighborhood	23492952	Manhattan	Harlem	Entire home/apt
48893	36485609	43rd St. Time Square-cozy single bed	30985759	Manhattan	Hell's Kitchen	Shared room
48894	36487245	Trendy duplex in the very heart of Hell's Kitchen	68119814	Manhattan	Hell's Kitchen	Private room

In [13]:
```
# Checking new number of Rows and columns.
bnb.shape
```

Out[13]:
```
(48895, 13)
```

In [14]:
```
#checking How many colums have null value in them.
nulval = ((bnb.isnull().sum()>0).sum())
nulval
```

Out[14]:
```
3
```

Checking which columns have missing values

In [15]:
```
bnb.isnull().sum()
```

Out[15]:
```
id                                    0
name                                 16
host_id                               0
neighbourhood_group                   0
neighbourhood                         0
room_type                             0
price                                 0
minimum_nights                        0
number_of_reviews                     0
last_review                       10052
reviews_per_month                 10052
calculated_host_listings_count        0
availability_365                      0
dtype: int64
```

Handeling missing values

In [16]:
```
## what percentahe of value is missing
missing_name = float(100*16/48895)
missing_last_review = float(100*10052/48895)
print(missing_name)
print(missing_last_review)
```

```
0.03272318232948154
20.55833929849678
```

In [17]:
```
## Droping 'Name' null record as they comprise of only 0.03% of data.
bnb1 = bnb[~bnb.name.isnull()].copy()
bnb1.shape
```

Out[17]:
```
(48879, 13)
```

In [18]:
```
bnb1.isnull().sum()
```

Out[18]:
```
id                                    0
name                                  0
host_id                               0
neighbourhood_group                   0
neighbourhood                         0
room_type                             0
price                                 0
minimum_nights                        0
number_of_reviews                     0
last_review                       10042
reviews_per_month                 10042
calculated_host_listings_count        0
availability_365                      0
dtype: int64
```

Assuming that 'reviews_per_month' column is blank because no reviews have been posted. Thus we can fill it up with 0.

In [19]:
```
## Filling '0' in place of 'null' in 'newviews_per_month'
bnb1['reviews_per_month'] = bnb1['reviews_per_month'].replace(np.nan, 0)
bnb1['reviews_per_month'].isnull().sum()
```

Out[19]:
```
0
```

In [20]:
```
# Now only 'Last_review' column is left and it is about 20% of the data m
# We can drop the column to clean our data completly.

bnb1 = bnb1.drop(['last_review'], axis = 1)
bnb1.head()
```

Out[20]:

	id	name	host_id	neighbourhood_group	neighbourhood	room_type	price	mir
0	2539	Clean & quiet apt home by the park	2787	Brooklyn	Kensington	Private room	149	
1	2595	Skylit Midtown Castle	2845	Manhattan	Midtown	Entire home/apt	225	
2	3647	THE VILLAGE OF HARLEM....NEW YORK !	4632	Manhattan	Harlem	Private room	150	
3	3831	Cozy Entire Floor of Brownstone	4869	Brooklyn	Clinton Hill	Entire home/apt	89	
4	5022	Entire Apt: Spacious Studio/Loft by central park	7192	Manhattan	East Harlem	Entire home/apt	80	

In [21]:
```
bnb1.isnull().sum()
```

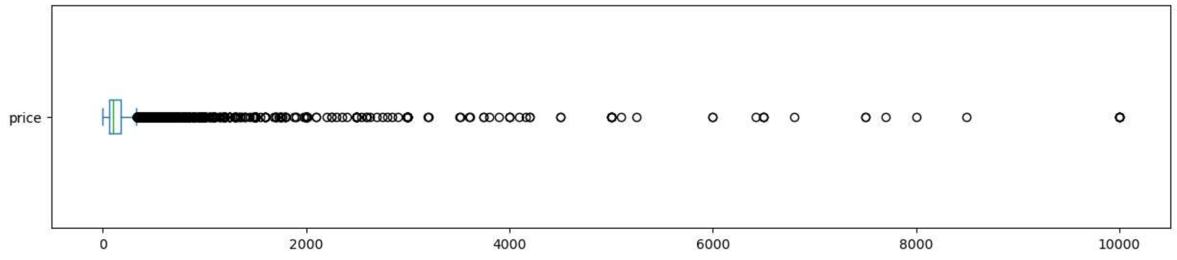
Out[21]:
```
id                                0
name                              0
host_id                           0
neighbourhood_group               0
neighbourhood                     0
room_type                         0
price                             0
minimum_nights                    0
number_of_reviews                 0
reviews_per_month                 0
calculated_host_listings_count    0
availability_365                  0
dtype: int64
```

Now data is cleaned we can start exploring it more:-

In [22]:
```
# Starting with 'price' Column.
bnb1.price.describe()
```

Out[22]:
```
count    48879.000000
mean       152.722355
std        240.186804
min          0.000000
25%         69.000000
50%        106.000000
75%        175.000000
max      10000.000000
Name: price, dtype: float64
```

In [23]:
```
#We find the that pice is even quoted as Zero so lets find out the number

# Displaying the box plot
bnb1['price'].plot(kind='box', vert=False, figsize=(15,3))
plt.show()

# Calculating the number and the percentage of prices that are equal to
500.00
print('Values over $500.00: ')
print(len(bnb1[bnb1['price'] > 500]))
print('{:.4f}%'.format((len(bnb1[bnb1['price'] > 500]) / bnb1.shape[0]) *
print('\n')
print('Values equal to $0: ')
print(len(bnb1[bnb1['price'] == 0]))
print('{:.4f}%'.format((len(bnb1[bnb1['price'] == 0]) / bnb1.shape[0]) *

```

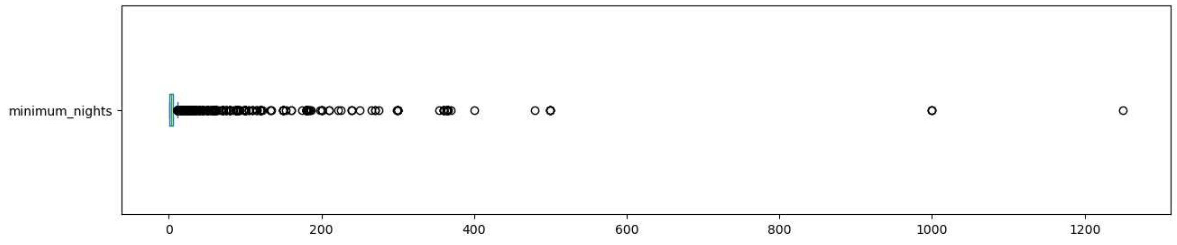


```
Values over $500.00:
1044
2.1359%


Values equal to $0:
11
0.0225%
```

In [24]:
```
#Similarly lets check for minimum_night
bnb1.minimum_nights.describe()
```

Out[24]:
```
count    48879.000000
mean         7.011027
std         20.016000
min          1.000000
25%          1.000000
50%          3.000000
75%          5.000000
max       1250.000000
Name: minimum_nights, dtype: float64
```

In [25]:
```
# We see that minimum nights to be booked is going as high as 1250 days.
# There are definitely outliers in this column as well so lets explore mo
# Displaying the box plot
bnb1['minimum_nights'].plot(kind='box', vert=False, figsize=(15,3))
plt.show()

# Calculating the number and the percentage of rooms with the minimum nig
print('Values over 30 nights: ')
print(len(bnb1[bnb1['minimum_nights'] > 30]))
print('{:.4f}%'.format((len(bnb1[bnb1['minimum_nights'] > 30]) / bnb1.sha
```



```
Values over 30 nights:
746
1.5262%
```

In [26]:
```
#since hardly 3.5% of data is in outliers lets drop these Rows.
bnb1 = bnb1[(bnb1['price'] <= 500) & (bnb1['price'] > 0) & (bnb1['minimum
```

In [27]:
```
##Let's find number of unique values in each Columns
bnb1.nunique(axis = 0)
```

Out[27]:
```
id                                47110
name                              46157
host_id                           36245
neighbourhood_group                   5
neighbourhood                       219
room_type                             3
price                               454
minimum_nights                       30
number_of_reviews                   393
reviews_per_month                   938
calculated_host_listings_count       47
availability_365                    366
dtype: int64
```

By this we understand that 'neighbourhood_group' & 'room_type' are the parameters on which we can compare diffrent aspects.

In [28]:
```
bnb1.room_type.unique()
```

Out[28]:
```
array(['Private room', 'Entire home/apt', 'Shared room'], dtype=object)
```

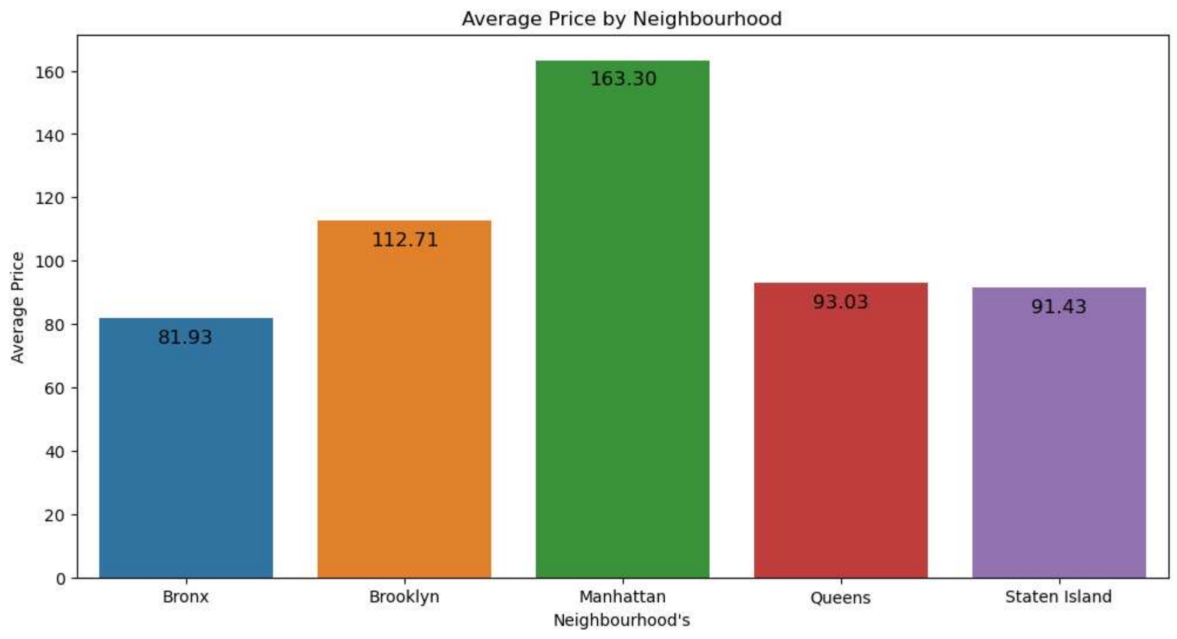
In [29]:
```python
bnb1.neighbourhood_group.unique()
```

Out[29]:
```
array(['Brooklyn', 'Manhattan', 'Queens', 'Staten Island', 'Bronx'],
      dtype=object)
```

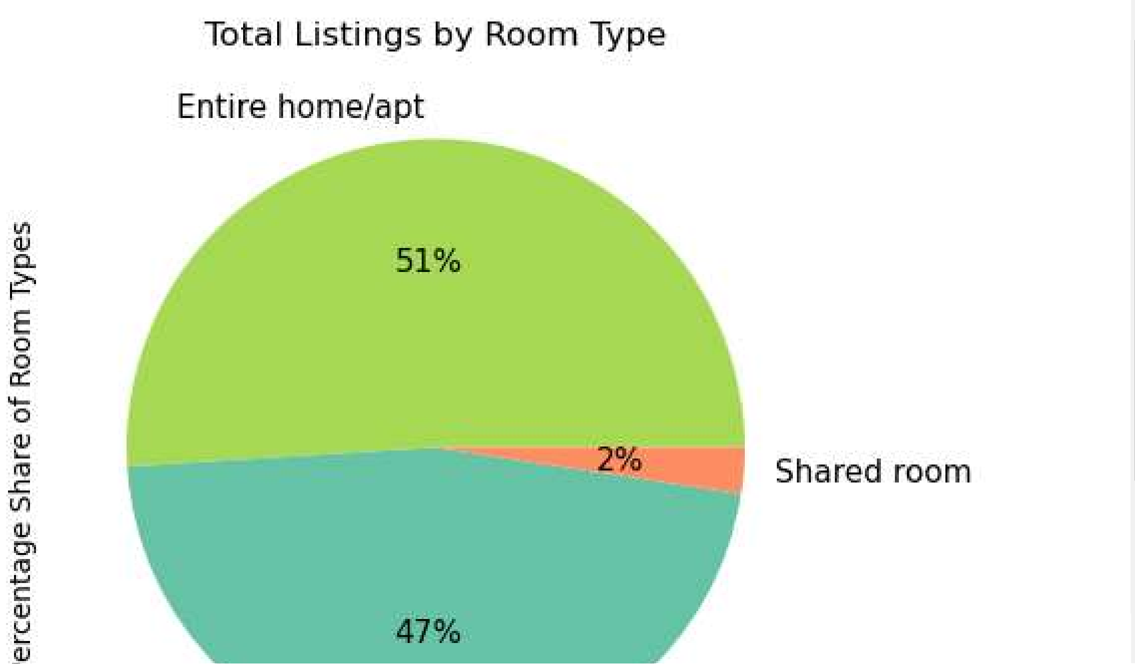
In [30]:
```python
# Lets check final form of Data
bnb1.shape
```

Out[30]:
```
(47110, 12)
```

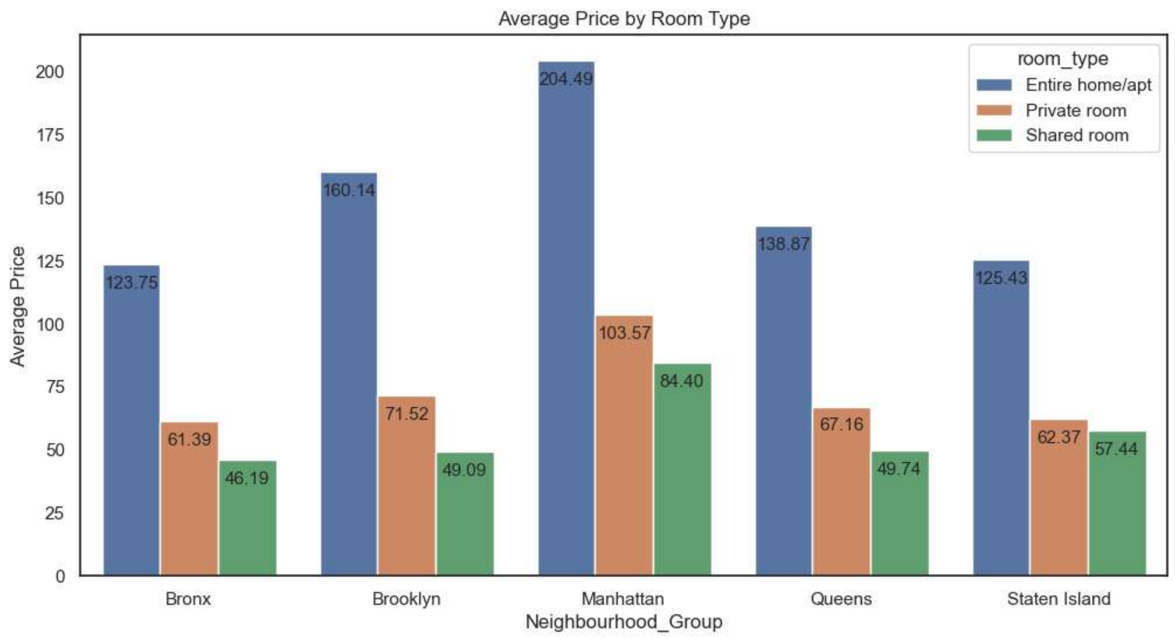
In [31]:
```python
# Lets now compare the price of diffrent neighborhood.
df = bnb1[['neighbourhood_group', 'price']]
df = bnb1.groupby(['neighbourhood_group'], as_index=False)[['price']].mea

plt.figure(figsize=(12, 6))
df = sns.barplot(x="neighbourhood_group", y="price", data=df)
for p in df.patches:
    df.annotate(format(p.get_height(), '.2f'),
                   (p.get_x() + p.get_width() / 2., p.get_height()),
                   ha = 'center', va = 'center', size = 12,
                   xytext = (0, -12), textcoords = 'offset points')

plt.xlabel('Neighbourhood\'s')
plt.ylabel('Average Price')
plt.title('Average Price by Neighbourhood')
plt.show()

```



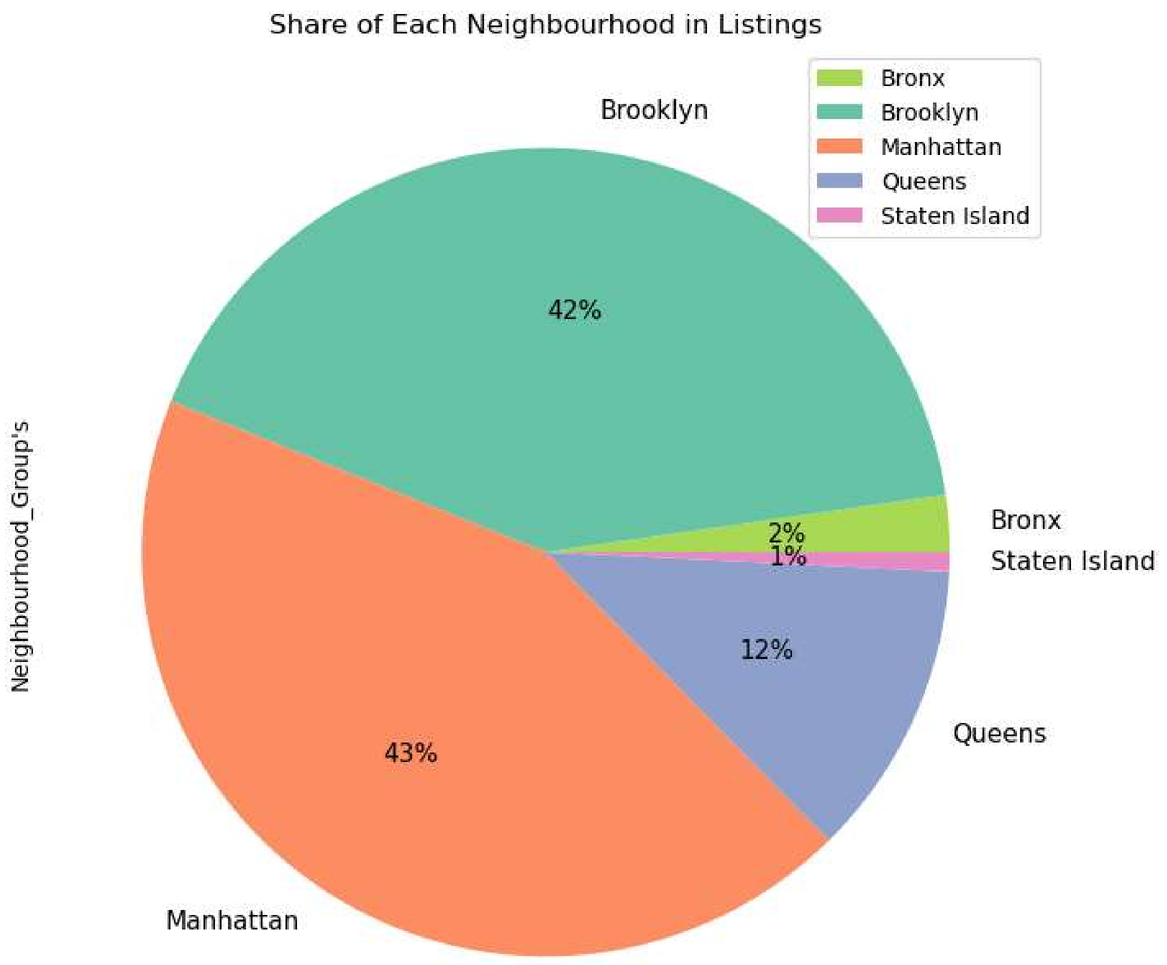
In [39]:
```
#Lets also figure out which type of room_type are booked the most

df2 = bnb1.groupby(['room_type'])['id'].count()
df2.plot.pie(ylabel='Percentage Share of Room Types', title='Total Listin
            autopct= "%1.0f%%", fontsize='11', colors=['#a6d854', '#66c2a
             startangle=0, figsize=(7,5))
plt.show()
```



In [32]:
```
# Checking price of diifrent room type at diffrent Neighboourhood_Groups

df3 = bnb1[['neighbourhood_group', 'room_type', 'price']]
df3 = df3.groupby(['neighbourhood_group', 'room_type'], as_index=False)[[

plt.figure(figsize=(12, 6))
sns.set_theme(style='white')
df = sns.barplot(x="neighbourhood_group", y="price", data=df3, hue='room_
for p in df.patches:
    df.annotate(format(p.get_height(), '.2f'),
                   (p.get_x() + p.get_width() / 2., p.get_height()),
                   ha = 'center', va = 'center', size = 11,
                   xytext = (0, -12), textcoords = 'offset points')

plt.xlabel('Neighbourhood_Group')
plt.ylabel('Average Price')
plt.title('Average Price by Room Type')
plt.show()
```



In [38]:
```
# Share of Each neighbourhood_group in Airbnb
# lets check percentage of Airbnb in different Neighborhoods_group

df4 = bnb1.groupby(['neighbourhood_group'])['id'].count()
df4.plot.pie(ylabel='Neighbourhood_Group\'s', title='Share of Each Neighb
              autopct='%1.0f%%', fontsize='11', colors=['#a6d854', '#66c2
                            startangle=0, figsize=(8,8))
plt.legend()
plt.show()

```



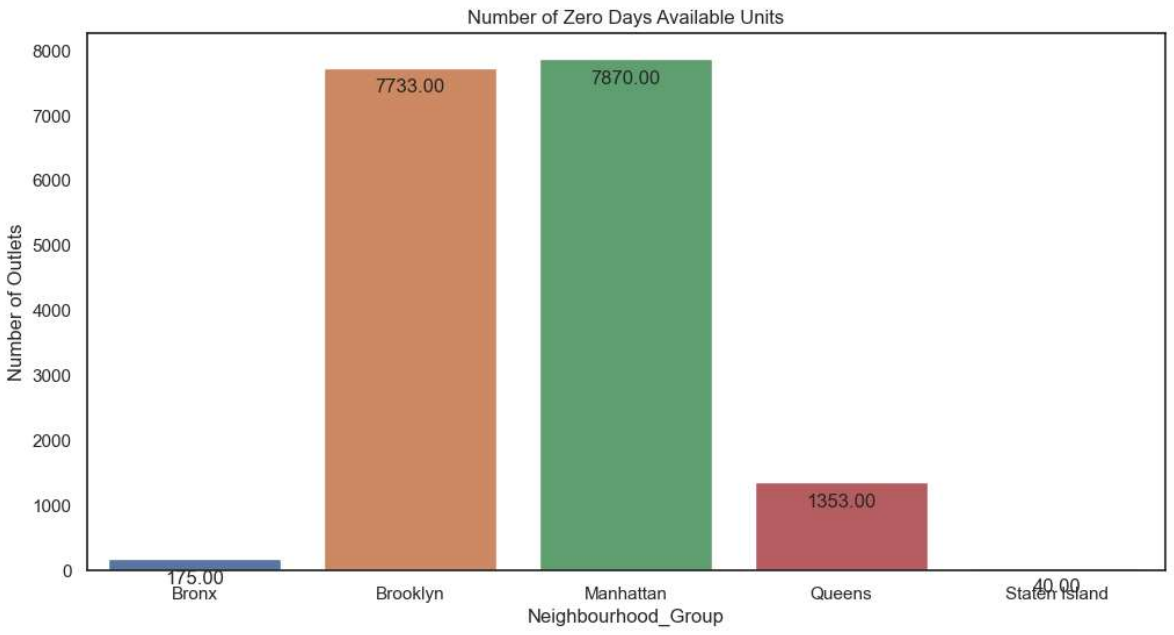
In [34]:
```
#Lets check number of Zero nights available venues at different Neighbour
```

In [35]:
```python
df5 = bnb1[(bnb1['availability_365'] == 0)]
df5.head(2)
```

Out[35]:

	id	name	host_id	neighbourhood_group	neighbourhood	room_type	price	minimum
4	5022	Entire Apt: Spacious Studio/Loft by central park	7192	Manhattan	East Harlem	Entire home/apt	80	
8	5203	Cozy Clean Guest Room - Family Apt	7490	Manhattan	Upper West Side	Private room	79	

In [36]:
```python
df6 = df5[['neighbourhood_group', 'availability_365']].copy()
df6 = df5.groupby(['neighbourhood_group'], as_index=False)[['availability

plt.figure(figsize=(12, 6))
df = sns.barplot(x="neighbourhood_group", y="availability_365", data=df6)
for p in df.patches:
    df.annotate(format(p.get_height(), '.2f'),
                       (p.get_x() + p.get_width() / 2., p.get_height()),
                       ha = 'center', va = 'center', size = 12,
                       xytext = (0, -12), textcoords = 'offset points')

plt.xlabel('Neighbourhood_Group')
plt.ylabel('Number of Outlets')
plt.title('Number of Zero Days Available Units')
plt.show()
```



In [37]:
```
# Share of Zero days available Airbnb in each Neighbourhood_Group
#assuming 46175(count of unique name) as total number od listings in Airb
#data for 0 night AirBnb
bronx = 177/(46175*.02)*100
brooklyn = 7733/(46175*.41)*100
manhattan = 7870/(46175*.44)*100
queens = 1353/(46175*.12)*100
staten = 40/(46175*.01)*100

print('Following is the Percentage of listings which are showing availabe
print('Bronx =' , bronx)
print('Brooklyn =' , brooklyn)
print('Manhattan =' , manhattan)
print('Queens =' , queens)
print('Statten Island =' , staten)
```

```
Following is the Percentage of listings which are showing availabe for 0 Nig
hts
Bronx = 19.16621548456957
Brooklyn = 40.84672573850806
Manhattan = 38.73603386326722
Queens = 24.41797509474824
Statten Island = 8.662696264212236
```

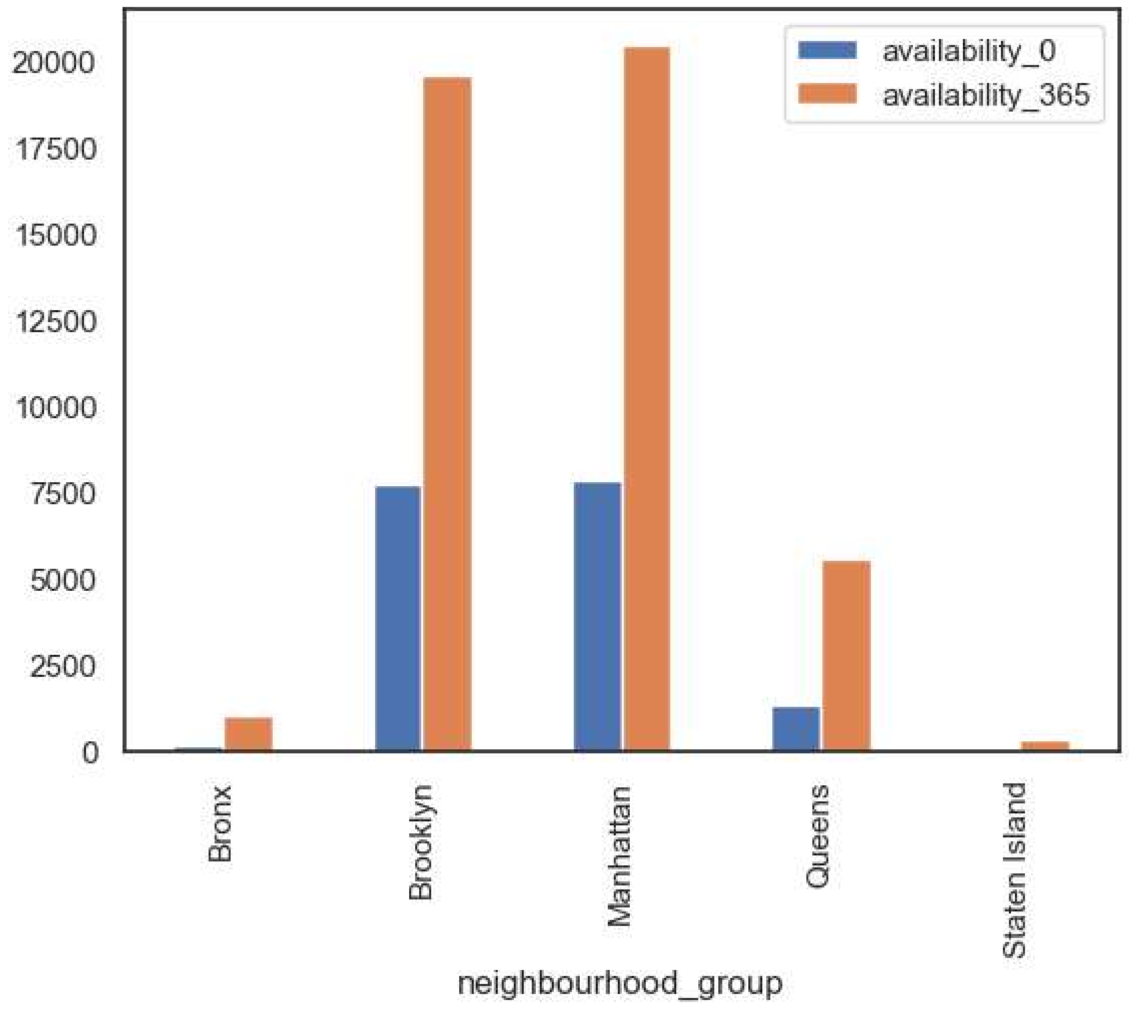
In [39]:
```
df6.rename(columns = {'availability_365':'availability_0'}, inplace = Tru
df6.head()
```

Out[39]:

	neighbourhood_group	availability_0
0	Bronx	175
1	Brooklyn	7733
2	Manhattan	7870
3	Queens	1353
4	Staten Island	40

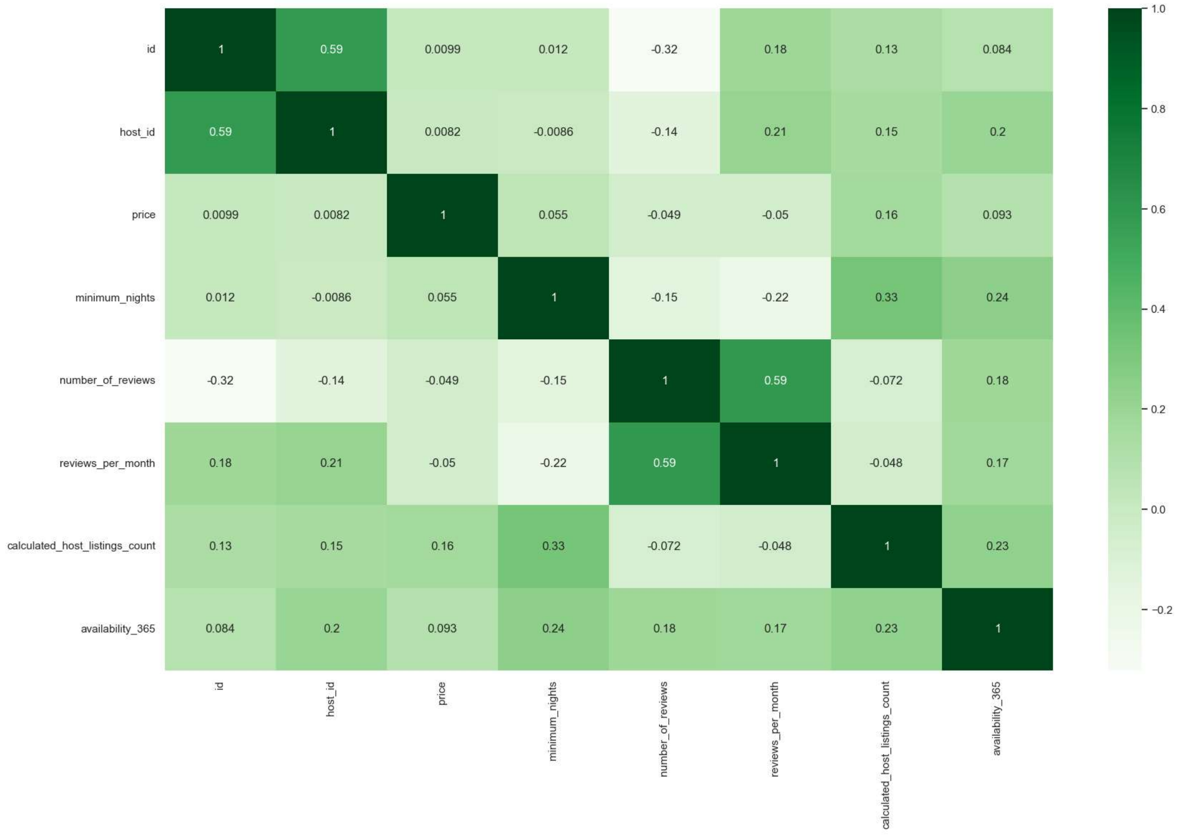
In [49]:
```
df7 = bnb1.groupby(['neighbourhood_group'], as_index=False)[['availabilit
df8 = pd.concat([df6.set_index('neighbourhood_group'), df7.set_index('nei

```

In [50]:
```
df8.head()
ax = df8.plot(kind='bar')
plt.show()
```



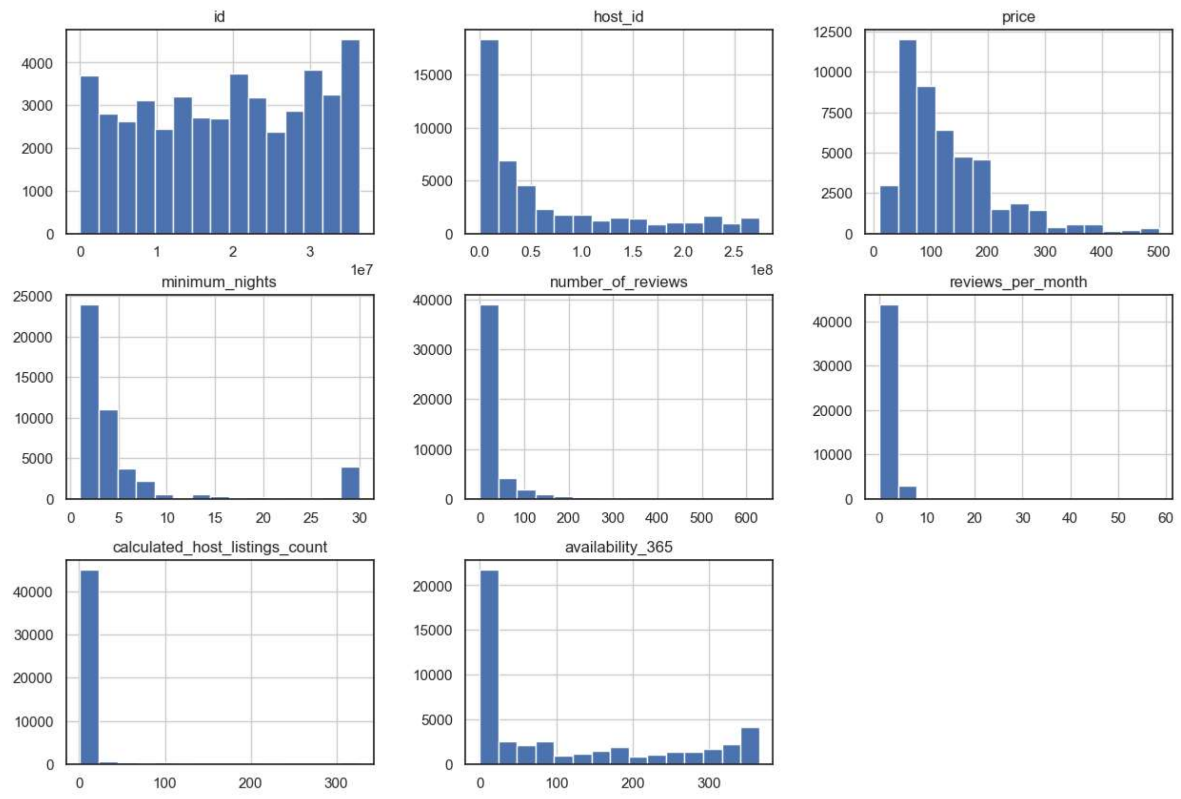
In [44]:
```
# Lets make a heatmap and find out if any other corelation we can determi

plt.figure(figsize=(20,12))


abnb_corr = bnb1.corr().copy()
_ = sns.heatmap(abnb_corr ,cbar=True,annot=True, cmap="Greens")
```

```
C:\Users\amann\AppData\Local\Temp\ipykernel_11072\2508971639.py:6: FutureWar
ning: 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 spe
cify the value of numeric_only to silence this warning.
  abnb_corr = bnb1.corr().copy()
```



In [45]:
```
### we see that only 'reviews_per_month' and 'Id' are showing some signs
### somce hosts are more efficient in getting reviews than others.
```

In [46]:
```
### Lets see if histogram can give any new insights
bnb1.hist(bins=15, figsize=(15,10));
```



In [47]:
```
#### Checking that lot of rooms are not available for rent !!!###
bnb1.availability_365.value_counts()
```

Out[47]:
```
0      17171
365     1109
364      450
1        401
89       344
       ...
195       25
183       24
196       23
181       23
202       20
Name: availability_365, Length: 366, dtype: int64
```

#Conclusion From our investigation of the Airbnb NYC dataset, we found that the neighborhood, room type, have a relationship with the price of a listing. We also saw that the demand in different neighborhood groups and room types, which may imply an indirect relationship with price. Moreover, listings that are the entire home are generally more expensive than the other room types (private room or shared room). Interestingly, we also found that a large percentage of listings are showing 0 days/Nights availabilty in 'available_365' column. This might indicate that a property was earlier listed on Airbnb and now it's avialabity has gone due to being listed on some other platform or owner not being happy with Airbnb services. This is worth exploring into.

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]: