In [1]:

```
# Packages imports
import pandas as pd
import numpy as np
import datetime as dt
from functools import reduce
import matplotlib.pyplot as plt
import seaborn as sns
from matplotlib import image as mpimg
```

In [2]:

```
# Import the dataset named "airbnb_price.csv" as a DataFrame called prices

Airbnb_Analysis = pd.read_csv('Airbnb_Analysis.csv')

# Display top few rows, the dataframe names as "prices"

Airbnb_Analysis.head()
```

Out[2]:

	listing_id	price	borough	neighbourhood	price_per_month	latitude	longitude	room_type	description	h
0	2595	225.0	Manhattan	Midtown	6843.750000	40.75362	-73.98377	entire home/apt	Skylit Midtown Castle	
1	3831	89.0	Brooklyn	Clinton Hill	2707.083333	40.68514	-73.95976	entire home/apt	Cozy Entire Floor of Brownstone	Lis
2	5099	200.0	Manhattan	Murray Hill	6083.333333	40.74767	-73.97500	entire home/apt	Large Cozy 1 BR Apartment In Midtown East	
3	5178	79.0	Manhattan	Hell's Kitchen	2402.916667	40.76489	-73.98493	private room	Large Furnished Room Near B'way	
4	5238	150.0	Manhattan	Chinatown	4562.500000	40.71344	-73.99037	entire home/apt	Cute & Cozy Lower East Side 1 bdrm	

In [3]:

```
Airbnb_Analysis.shape
```

Out[3]:

```
(25209, 17)
```

In [4]:

```
Airbnb_Analysis.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 25209 entries, 0 to 25208
Data columns (total 17 columns):
 #   Column                          Non-Null Count  Dtype
---  ------                          --------------  -----
 0   listing_id                      25209 non-null  int64
 1   price                           25202 non-null  float64
 2   borough                         25202 non-null  object
 3   neighbourhood                   25202 non-null  object
 4   price_per_month                 25202 non-null  float64
 5   latitude                        25202 non-null  float64
 6   longitude                       25202 non-null  float64
 7   room_type                       25209 non-null  object
 8   description                     25199 non-null  object
 9   host_name                       25201 non-null  object 
 10  review_date                     25209 non-null  object 
 11  minimum_nights                  25209 non-null  int64  
 12  number_of_reviews               25209 non-null  int64  
 13  reviews_per_month               25209 non-null  float64
 14  calculated_host_listings_count  25209 non-null  int64  
 15  availability                    25209 non-null  int64  
 16  booked_days                     25209 non-null  int64  
dtypes: float64(5), int64(6), object(6)
memory usage: 3.3+ MB
```

```
In [5]: Airbnb_Analysis.isna().sum()
```

```
Out[5]: listing_id                         0
        price                              7
        borough                            7
        neighbourhood                      7
        price_per_month                    7
        latitude                           7
        longitude                          7
        room_type                          0
        description                       10
        host_name                          8
        review_date                        0
        minimum_nights                     0
        number_of_reviews                  0
        reviews_per_month                  0
        calculated_host_listings_count     0
        availability                       0
        booked_days                        0
        dtype: int64
```

```
In [6]: ## Number of unique listings:
        print(f'There are {Airbnb_Analysis.listing_id.nunique()} unique listings in the neighbou
```

```
There are 25209 unique listings in the neighbourhood
```

1.What is the most common room type in NYC Airbnb listings?

```
In [7]: Airbnb_Analysis["room_type"].value_counts()
```

```
Out[7]: entire home/apt    13266
        private room       11356
        shared room          587
        Name: room_type, dtype: int64
```

2.What is the average price of a listing by room type?

```
In [8]: Airbnb_Analysis.groupby("room_type")["price"].mean().round(2)
```

```
Out[8]: room_type
        entire home/apt    197.17
        private room        81.67
        shared room         53.65
        Name: price, dtype: float64
```

3.Which borough has the highest average price per month?

```
In [9]: Airbnb_Analysis.groupby("borough")["price_per_month"].mean().sort_values(ascending=False
```

```
Out[9]: borough
        Manhattan        5596.69
        Brooklyn         3710.06
        Queens           2823.09
        Staten Island    2617.20
```

```
Bronx            2410.25
Name: price_per_month, dtype: float64
```

4.How many listings of each room type are in each borough?

In [10]:
```
Airbnb_Analysis.groupby("borough")["room_type"].value_counts()
```

Out[10]:
```
borough        room_type
Bronx          private room        403
               entire home/apt     261
               shared room          33
Brooklyn       entire home/apt    5367
               private room       4906
               shared room         187
Manhattan      entire home/apt    6170
               private room       3901
               shared room         251
Queens         private room       2009
               entire home/apt    1335
               shared room         112
Staten Island  entire home/apt     133
               private room        132
               shared room           2
Name: room_type, dtype: int64
```

5.How many listings in each room type category have a price greater than $500 per night?

In [11]:
```
listings_above_500 = Airbnb_Analysis[Airbnb_Analysis["price"] > 500].groupby("room_type"
listings_above_500
```

Out[11]:
```
room_type
entire home/apt    395
private room        19
shared room          1
dtype: int64
```

6.What is the distribution of listing prices by borough?

In [12]:
```
distribution_of_listing_prices = Airbnb_Analysis.groupby('borough')['price'].agg(['min',
distribution_of_listing_prices.reset_index()
```

Out[12]:

	borough	min	max	mean
0	Bronx	20.0	670.0	79.241033
1	Brooklyn	10.0	7500.0	121.974665
2	Manhattan	10.0	5100.0	184.000678
3	Queens	10.0	2600.0	92.813947
4	Staten Island	13.0	300.0	86.044944

1. What is the estimated amount of revenue generated by hosts in each borough?

In [13]:
```
revenue_generated = Airbnb_Analysis.groupby('borough').apply(lambda x: (x['price'] * x['
revenue_generated
```

Out[13]:

	borough	estimated_total_amount
0	Bronx	9324180.0
1	Brooklyn	279130240.0

2	Manhattan	393420567.0
3	Queens	58404083.0
4	Staten Island	3443919.0

8.What is the average price per month for listings in each neighborhood?

In [14]:
```
average_price_per_month = Airbnb_Analysis.groupby(['neighbourhood', 'room_type'])['price
average_price_per_month_sorted = average_price_per_month.sort_values(by='price_per_month
average_price_per_month_sorted.round(2)
```

Out[14]:

	neighbourhood	room_type	price_per_month
387	Sea Gate	entire home/apt	24485.42
438	Tribeca	entire home/apt	13707.58
24	Bayside	entire home/apt	12133.48
172	Flatiron District	entire home/apt	11766.18
394	SoHo	entire home/apt	11674.97
...	...	...	...
176	Flatlands	shared room	669.17
454	Van Nest	shared room	608.33
386	Schuylerville	shared room	608.33
203	Graniteville	private room	608.33
360	Randall Manor	shared room	395.42

489 rows × 3 columns

9.How many listings have no reviews?

In [15]:
```
listings_with_no_reviews = Airbnb_Analysis[Airbnb_Analysis["number_of_reviews"] == 0]
num_listings_with_no_reviews = listings_with_no_reviews.shape[0]
num_listings_with_no_reviews
```

Out[15]:
```
0
```

1. How do the estimated book days correlate with the price of an Airbnb listing in New York City?

In [16]:
```
correlation = Airbnb_Analysis[["booked_days","price"]].corr()
correlation
```

Out[16]:

	booked_days	price
booked_days	1.000000	-0.079639
price	-0.079639	1.000000

1. What is the average price per room type for listings that have at least 100 reviews and are available more than 200 days a year?

In [17]:
```
available_room_types=Airbnb_Analysis[(Airbnb_Analysis["number_of_reviews"] >= 100) & (Ai
```

In [18]:
```
available_room_types.round(2)
```

Out[18]:
```
room_type
entire home/apt    179.54
private room        85.41
shared room         59.19
Name: price, dtype: float64
```

1. How many hosts have more than one listing, and what's the maximum number of listings by a single host name?

In [19]:
```
hosts_multiple_listings = Airbnb_Analysis.groupby('host_name').size().reset_index(name='
num_hosts_multiple_listings = len(hosts_multiple_listings[hosts_multiple_listings['listi

num_hosts_multiple_listings
```

Out[19]:
```
2929
```

In [20]:
```
max_listings_by_single_host = hosts_multiple_listings['listing_id'].max()
max_listings_by_single_host
```

Out[20]:
```
215
```

1. Determine the top 5 hosts who have the highest price_per_month for their listings, considering only hosts who have at least 10 listings.

In [21]:
```
host_of_more_than_10_listings = Airbnb_Analysis[Airbnb_Analysis["calculated_host_listing
top_five_hosts = host_of_more_than_10_listings.sort_values(ascending=False).head(5).roun

top_five_hosts
```

Out[21]:
```
host_name
Sally         109895.42
Red Awning     21452.58
Park Lane      12318.75
Janet          11334.01
Yotel           8749.86
Name: price_per_month, dtype: float64
```

1. Find the neighborhood(s) that have the highest variance in listing prices

In [22]:
```
neighborhood_variances = Airbnb_Analysis.groupby('neighbourhood')['price'].var().reset_i
neighborhood_variances = neighborhood_variances.sort_values(by='price', ascending=False)
neighborhood_variances = neighborhood_variances.dropna().round(2)
neighborhood_variances
```

Out[22]:

	neighbourhood	price
171	Sea Gate	924800.00
10	Bayside	230283.44
59	East Flatbush	173518.92
175	SoHo	122866.07
194	Tribeca	98547.14
...	...	...
196	Unionport	150.00

68	Eltingville	98.00
100	Hunts Point	94.02
153	Port Richmond	32.70
139	New Dorp Beach	8.00

206 rows × 2 columns

1. Calculate the average price_per_month for each neighborhood, taking into account only listings where the host has a minimum_nights value that is higher than the average minimum_nights value across all listings.

In [23]:

```
average_min_nights = Airbnb_Analysis['minimum_nights'].mean()

filtered_listings = Airbnb_Analysis[Airbnb_Analysis['minimum_nights'] > average_min_nigh

neighborhood_avg_price = filtered_listings.groupby('neighbourhood')['price_per_month'].m
neighborhood_avg_price.sort_values('price_per_month', ascending=False).round(2)
```

Out[23]:

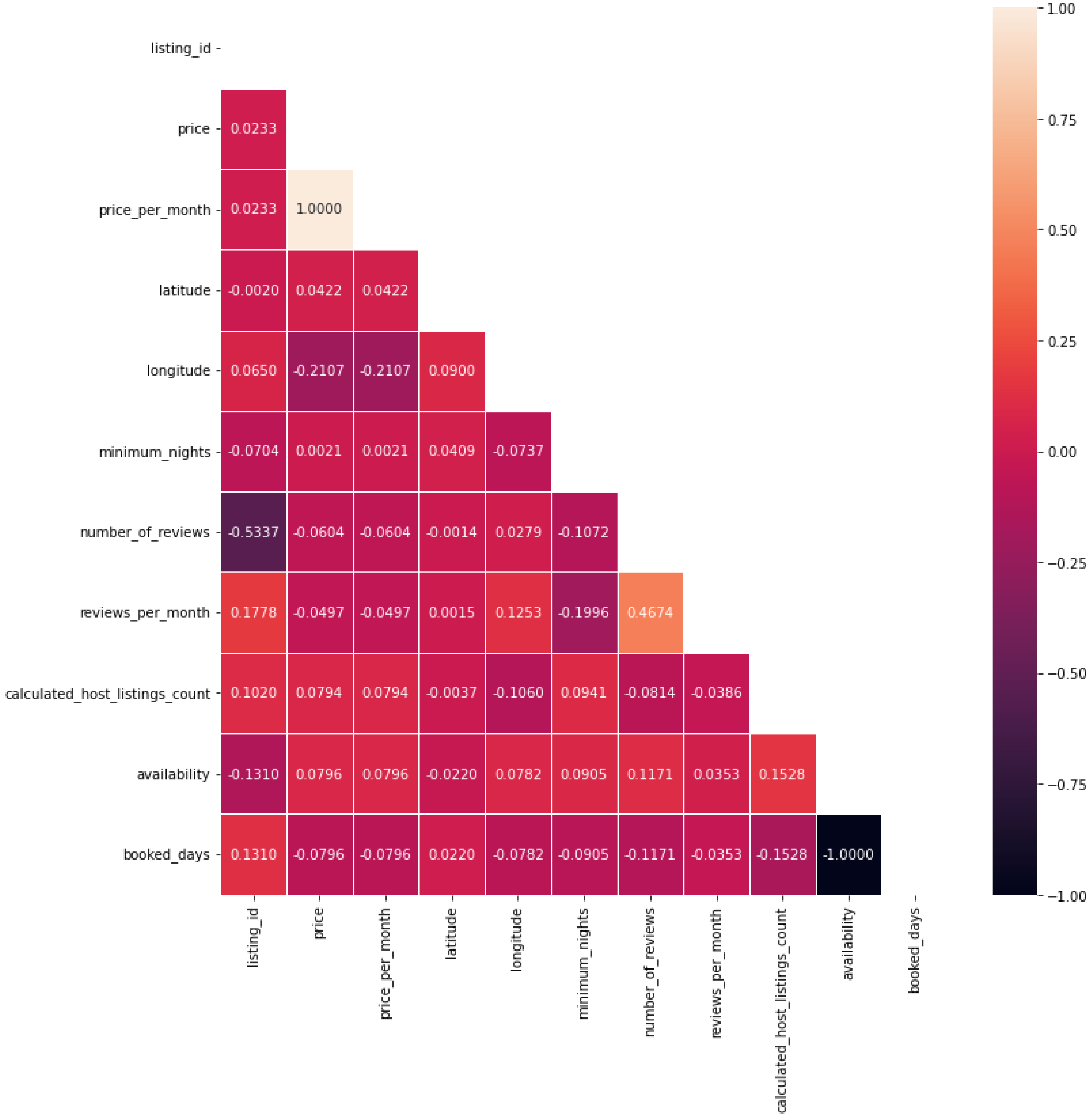
	neighbourhood	price_per_month
7	Bayside	11949.95
140	Tribeca	11791.53
56	Flatiron District	10172.69
127	SoHo	9549.23
104	NoHo	9374.04
...	...	...
148	West Brighton	1216.67
26	Clason Point	1216.67
3	Bath Beach	1003.75
66	Grant City	912.50
144	Van Nest	646.35

155 rows × 2 columns

Exploratory Data Analysis Correlation

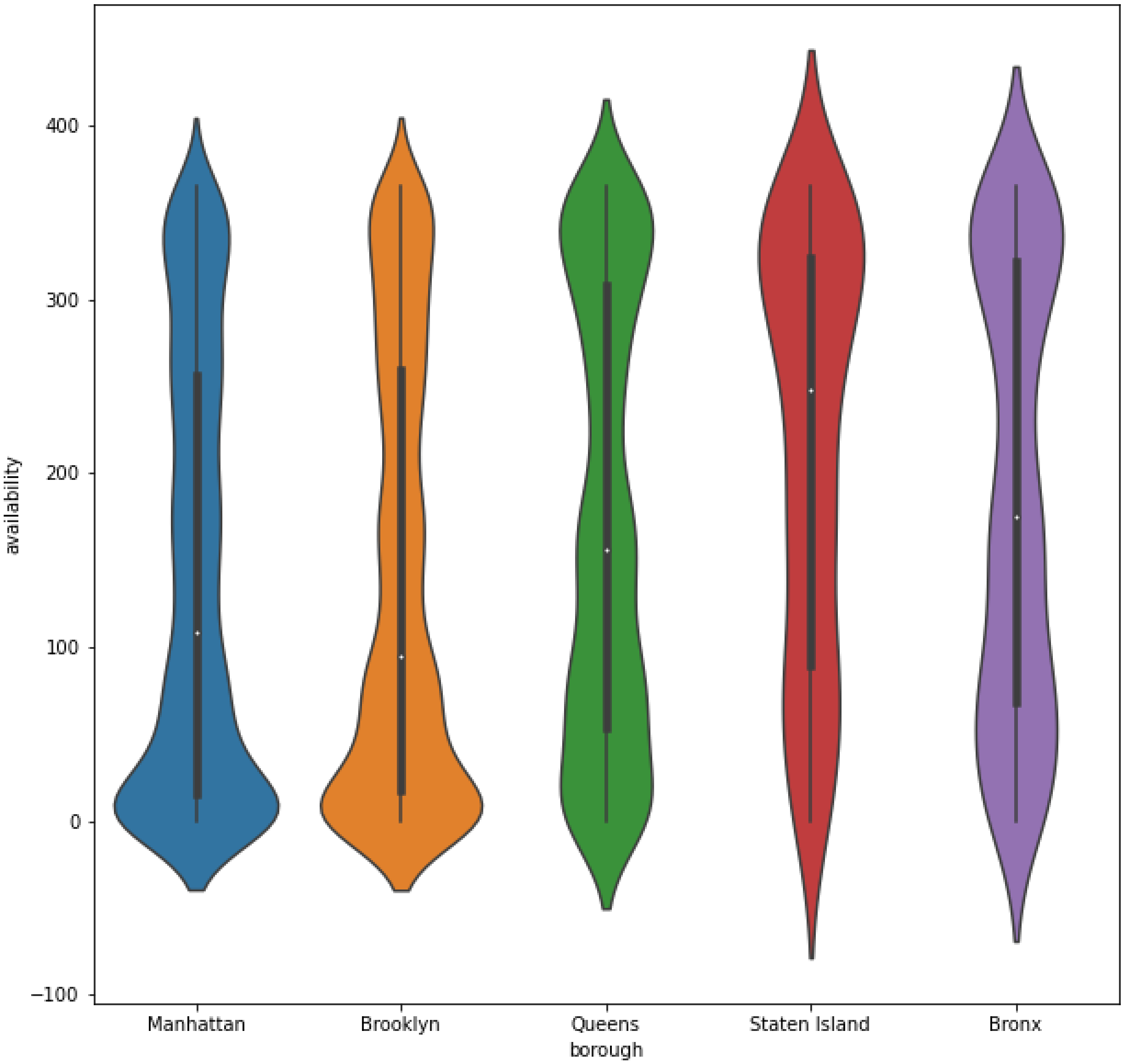
In [24]:

```
correlation_airbnb = Airbnb_Analysis.corr()
fig, ax = plt.subplots(figsize=(12, 12))
dropSelf = np.zeros_like(correlation_airbnb)
dropSelf[np.triu_indices_from(dropSelf)] = True
sns.heatmap(correlation_airbnb, linewidths=.5, annot=True, fmt=".4f", mask=dropSelf)
plt.savefig("correlation_airbnb.png")
plt.show()
```



Relation between neighbourhood group and availability

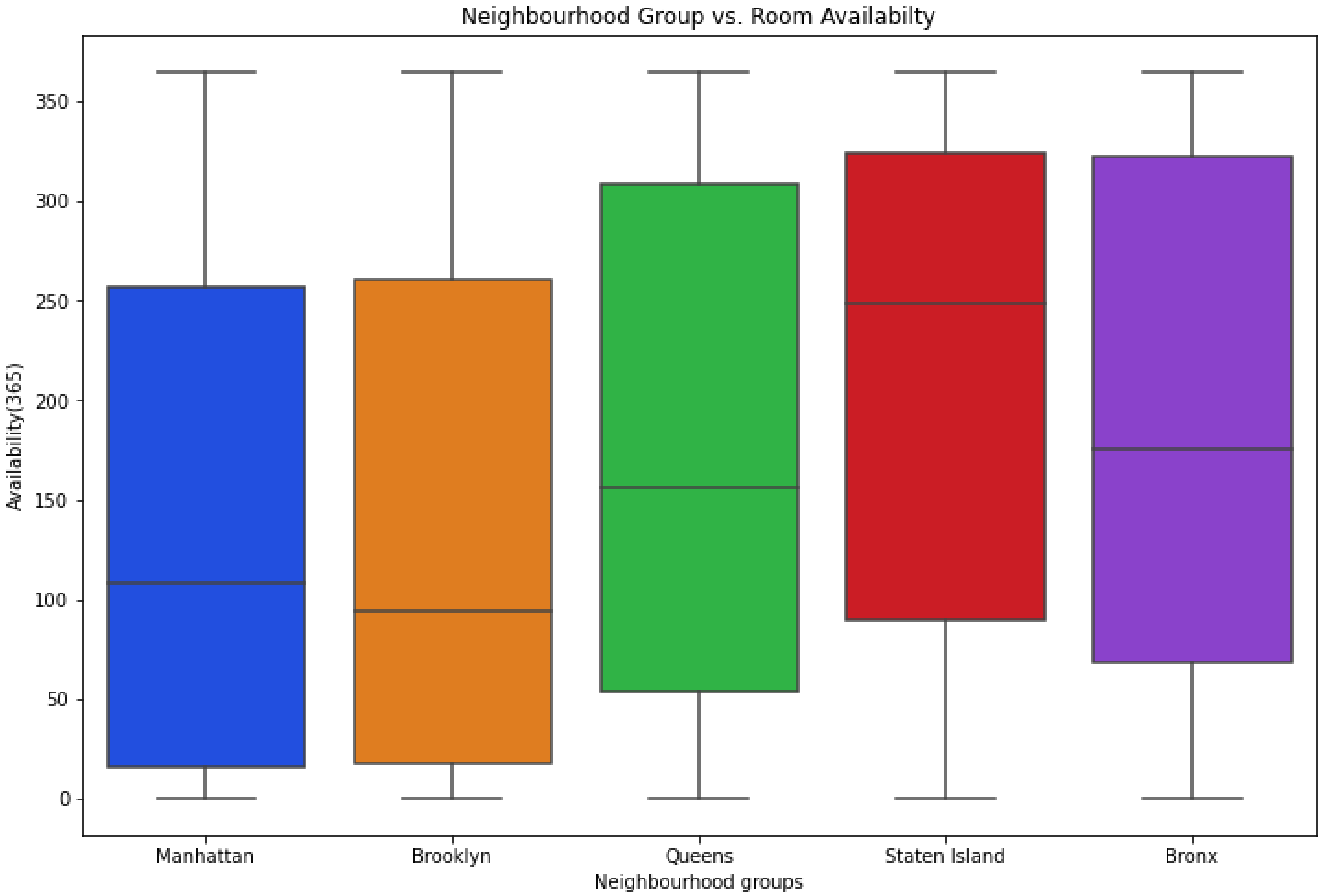
```
In [26]: plt.figure(figsize=(10,10))
         ax = sns.violinplot(data= Airbnb_Analysis, x="borough", y="availability")
```



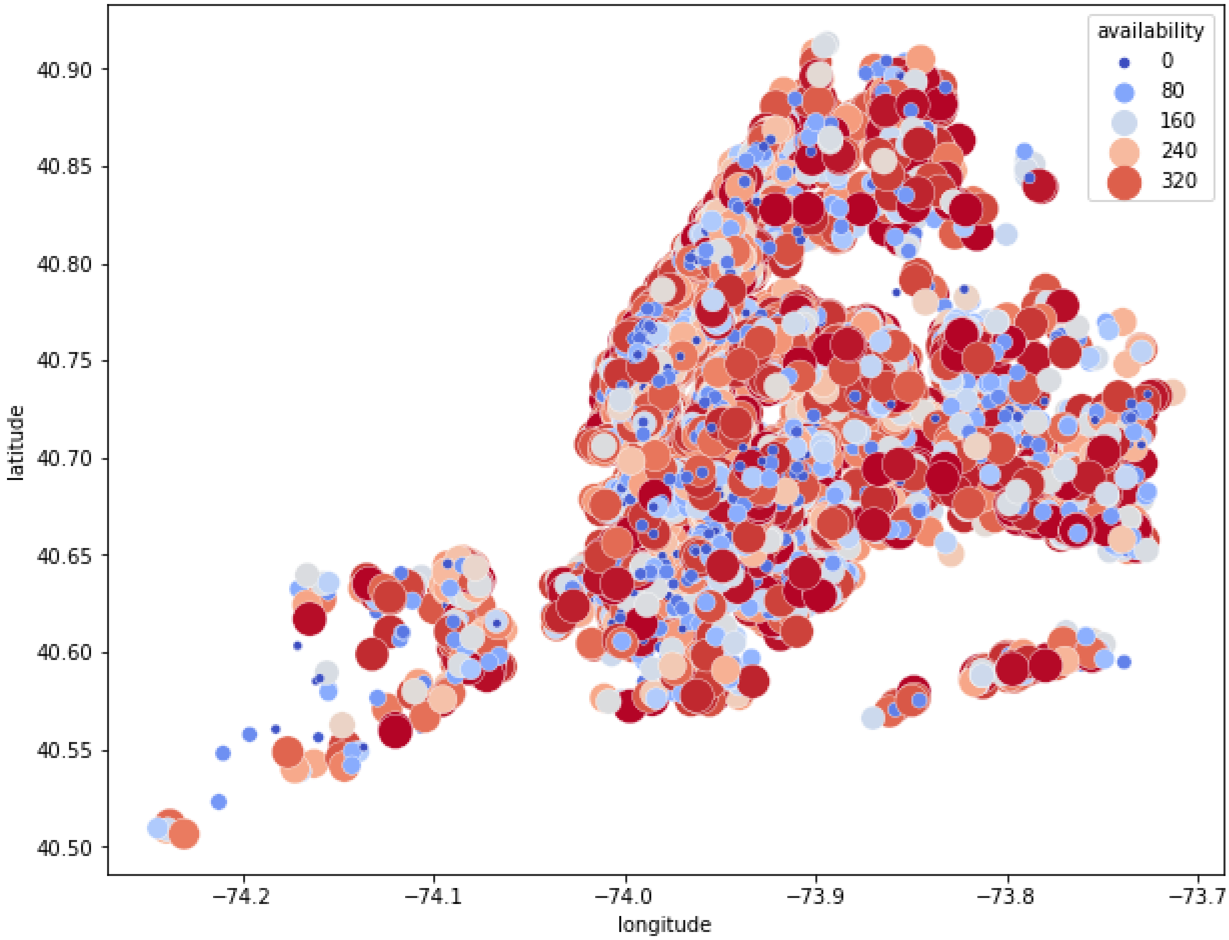
Room_types and their relation with availability in different neighbourhood groups!

In [27]:

```
f,ax = plt.subplots(figsize=(12,8))
ax=sns.boxplot(x='borough',y='availability',data=Airbnb_Analysis,palette="bright")
plt.title("Neighbourhood Group vs. Room Availabilty")
plt.xlabel('Neighbourhood groups')
plt.ylabel('Availability(365)')
plt.show()
```



```
In [28]: f, ax = plt.subplots(figsize=(10, 8))
         ax=sns.scatterplot(data=Airbnb_Analysis,x='longitude', y='latitude', hue="availability",
             sizes=(20,300))
```



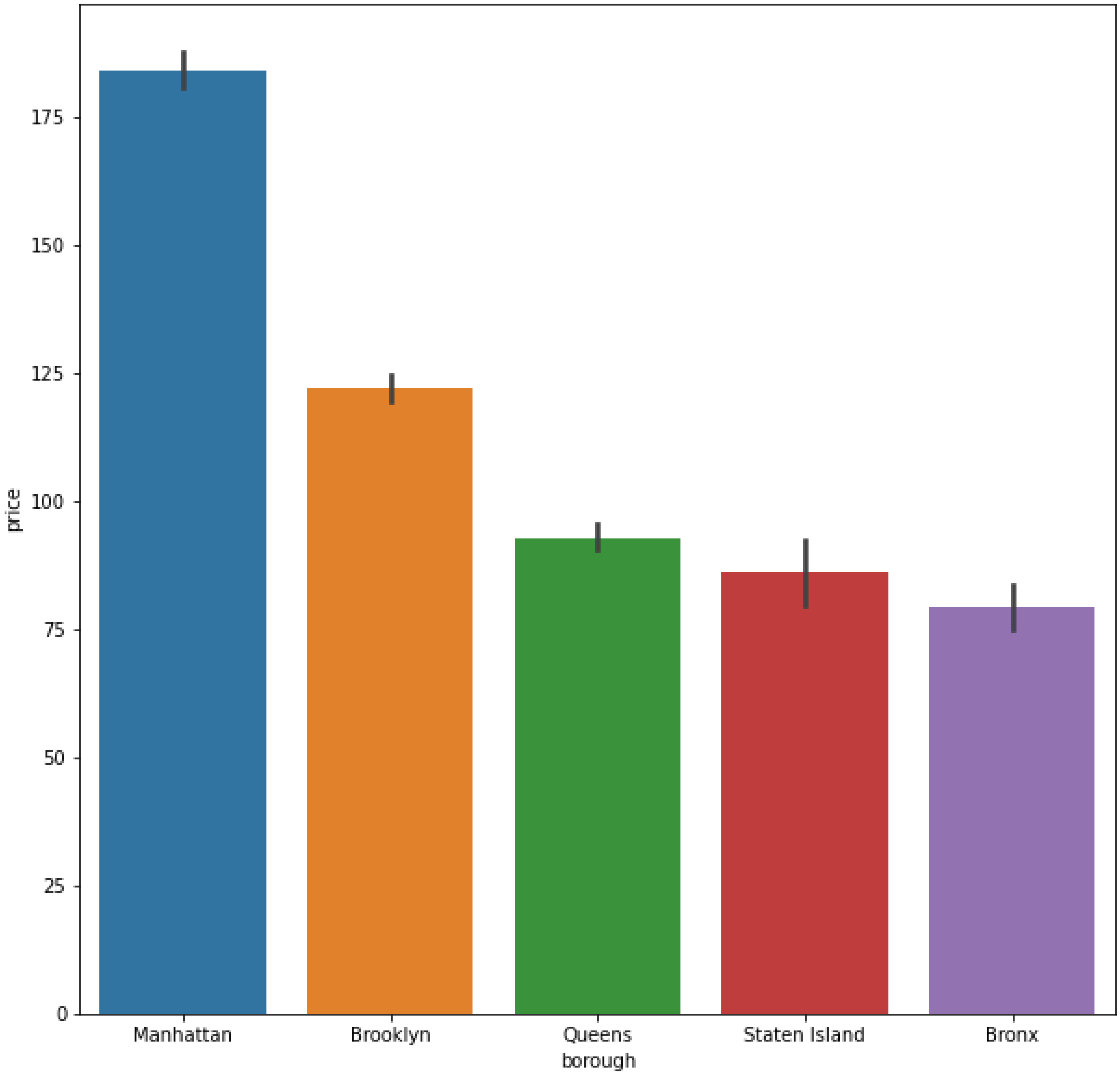
Relation between neighbourhood group and price

In [29]:

```
plt.figure(figsize=(10,10))
sns.barplot(data=Airbnb_Analysis, x='borough', y='price')
```

Out[29]:

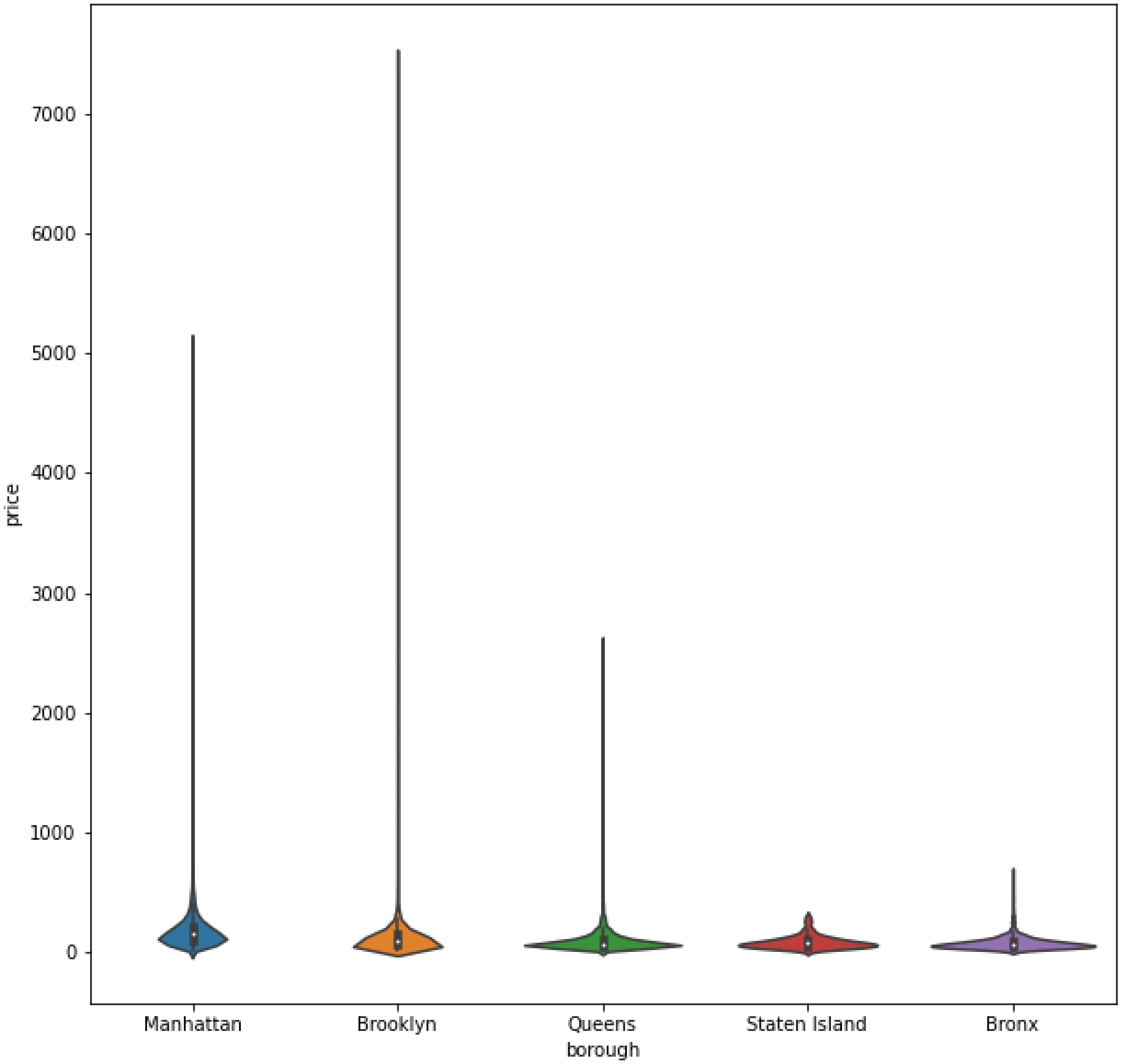
```
<AxesSubplot:xlabel='borough', ylabel='price'>
```



Relation between Borough and prices

In [30]:

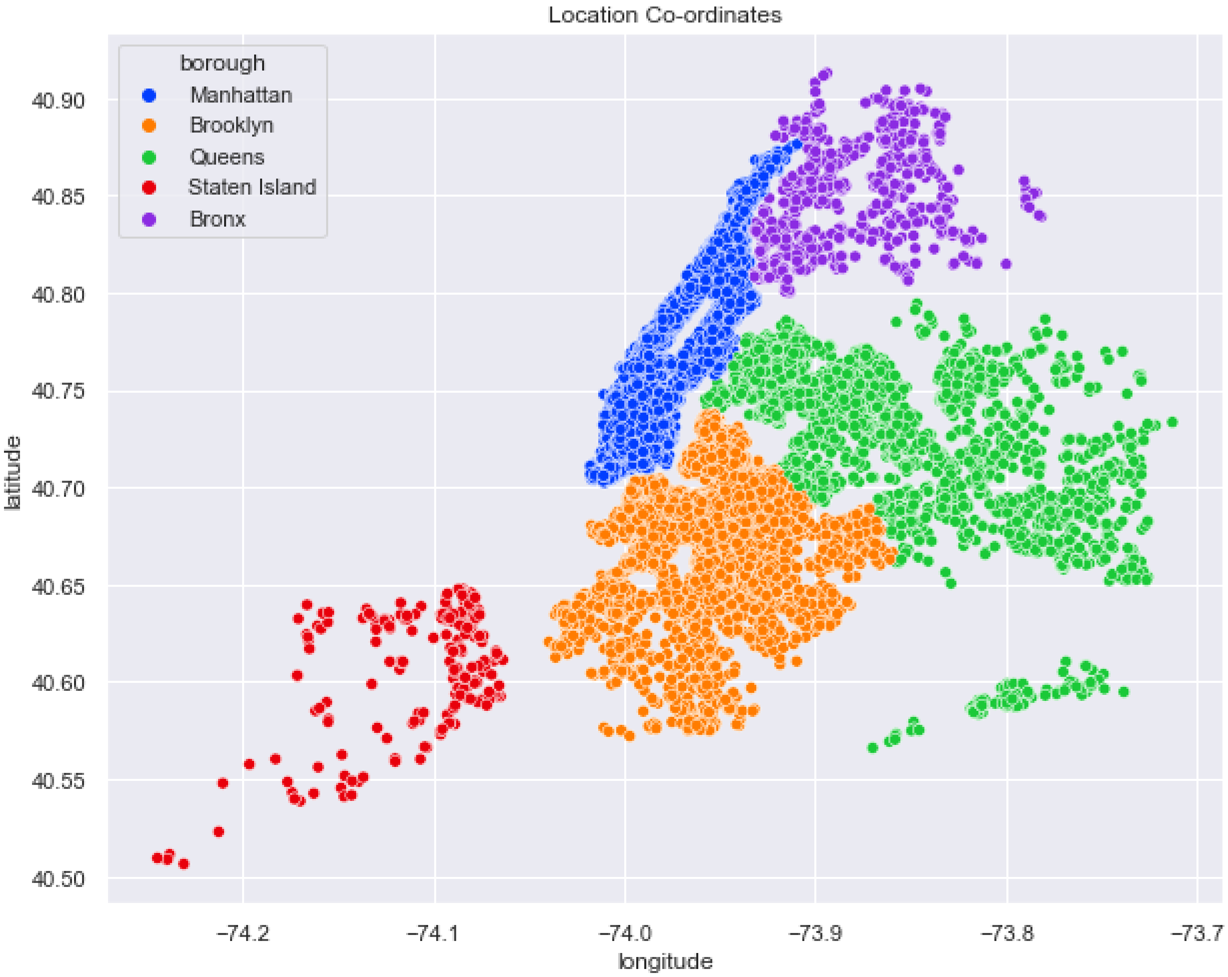
```
plt.figure(figsize=(10,10))
ax = sns.violinplot(data= Airbnb_Analysis, x="borough", y="price")
```



Since we have latitude and longitude of each listing, let's plot it using a scatterplot

```
In [31]: #trying to find where the coordinates belong from the latitude and longitude
         sns.set(rc={"figure.figsize": (10, 8)})
         ax= sns.scatterplot(data=Airbnb_Analysis, x="longitude", y="latitude",hue='borough',pale
         ax.set_title('Location Co-ordinates')
```

```
Out[31]: Text(0.5, 1.0, 'Location Co-ordinates')
```

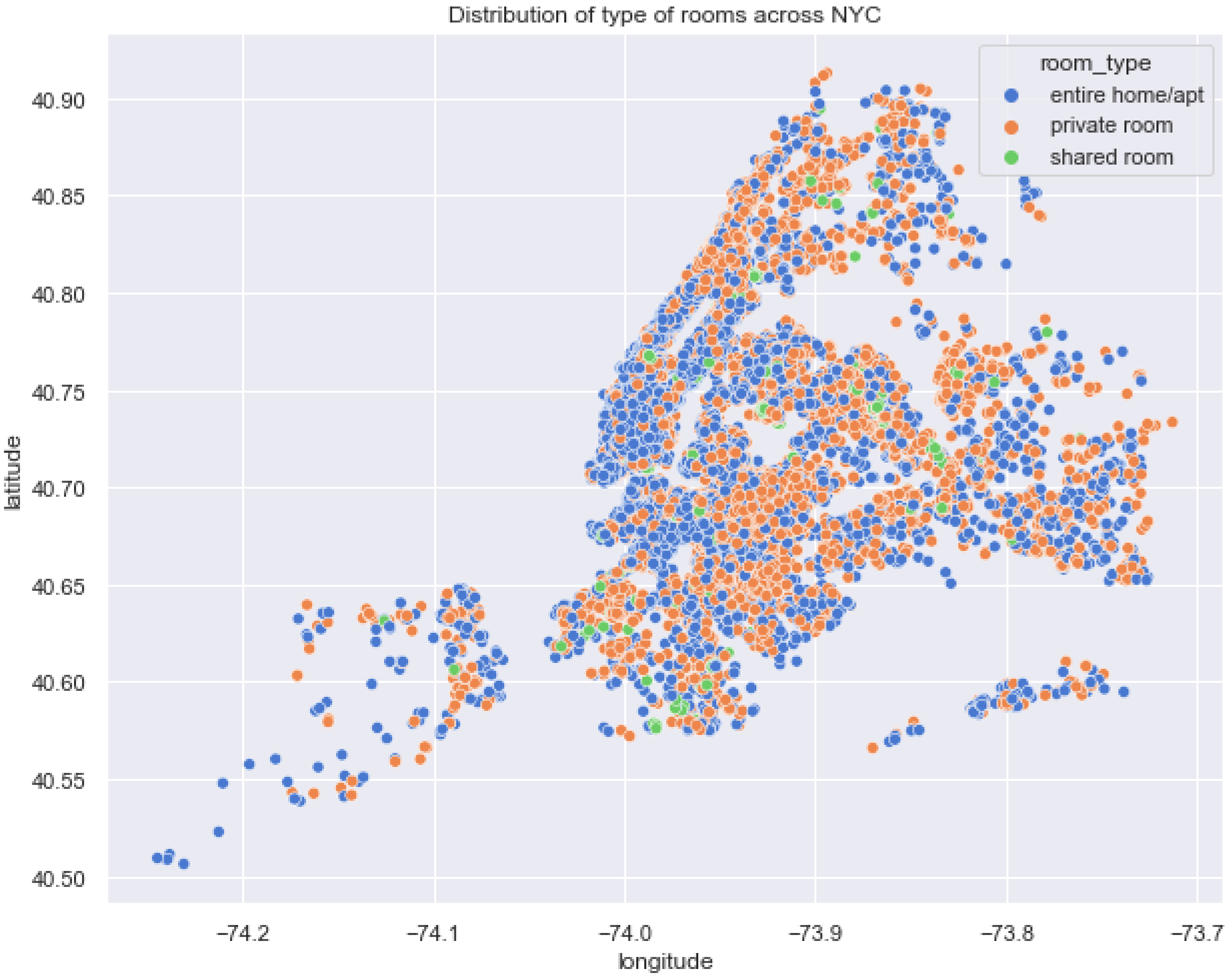


In [32]:

```
sns.set(rc={"figure.figsize": (10, 8)})
ax= sns.scatterplot(x=Airbnb_Analysis.longitude, y=Airbnb_Analysis.latitude,hue=Airbnb_A
ax.set_title('Distribution of type of rooms across NYC')
```

Out[32]:

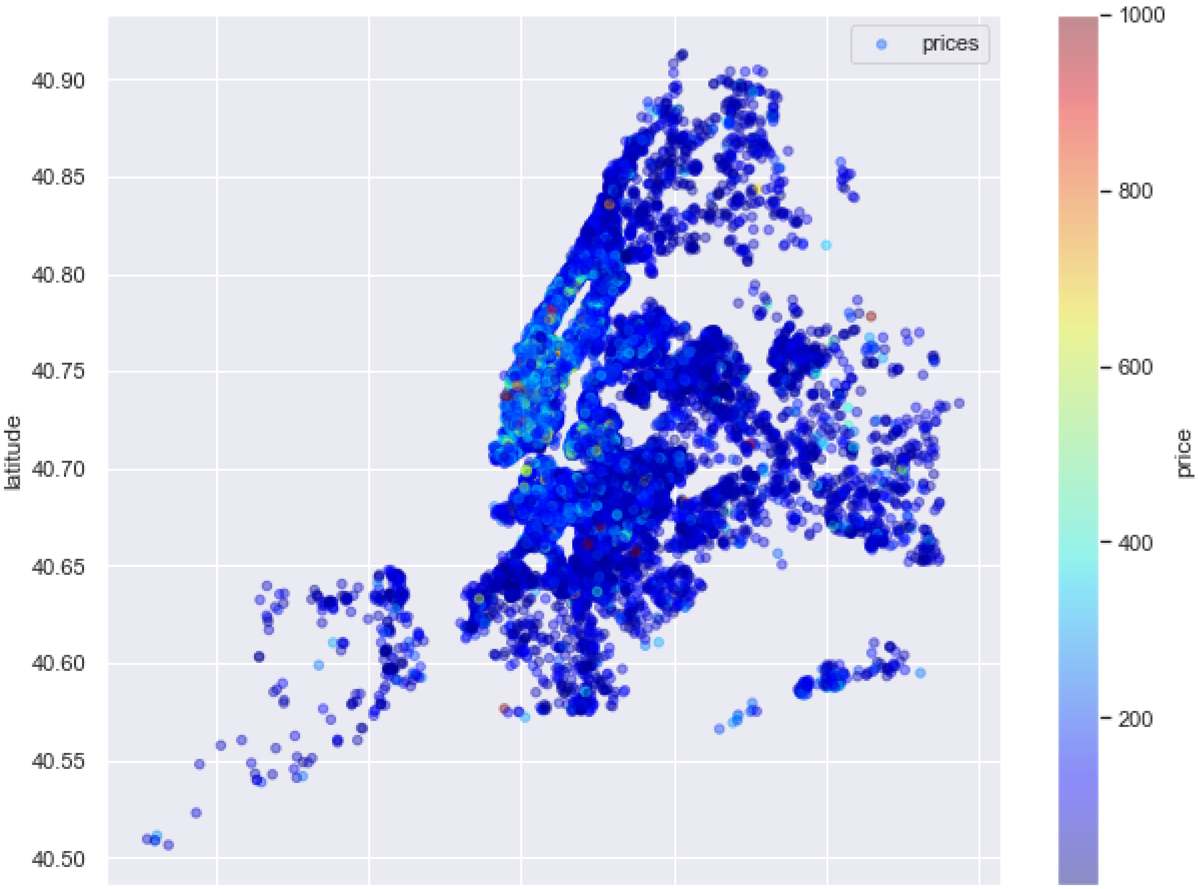
```
Text(0.5, 1.0, 'Distribution of type of rooms across NYC')
```



```
In [33]: lat_long = Airbnb_Analysis.plot(kind='scatter', x='longitude', y='latitude', label='pric
                                         cmap=plt.get_cmap('jet'), colorbar=True, alpha=0.4, figsi
                                         vmin=10,vmax=1000)

         lat_long.legend()
```

```
Out[33]: <matplotlib.legend.Legend at 0x1d7124affa0>
```



In [34]:

```
Airbnb_Analysis['price'].describe()
```

Out[34]:

```
count    25202.000000
mean       141.817316
std        147.350650
min         10.000000
25%         69.000000
50%        105.000000
75%        175.000000
max       7500.000000
Name: price, dtype: float64
```

Now let's categorise rooms based on price Let price less than 75 dollars be low, between 75 and 500 dollars be medium and above 500 dollars be high

In [35]:

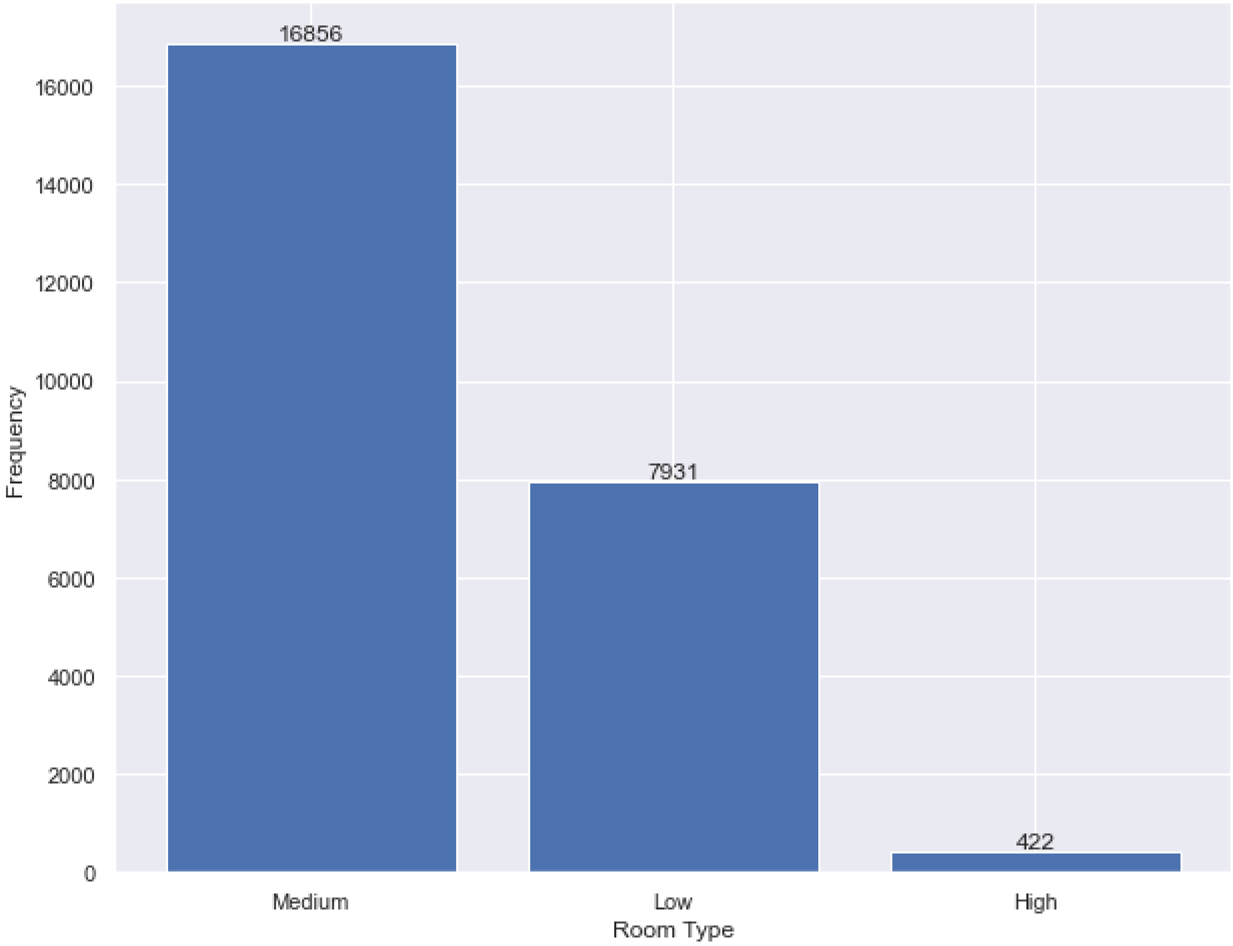
```
import matplotlib.pyplot as plt

def room_type(price):
    if price <= 75 :
        return 'Low'
    elif price > 75 and price <= 500:
        return 'Medium'
    else:
        return 'High'

room_type_counts = Airbnb_Analysis['price'].apply(room_type).value_counts()

plt.bar(room_type_counts.index, room_type_counts.values)
plt.xlabel('Room Type')
plt.ylabel('Frequency')

# Add frequency values on top of the bars
for i, value in enumerate(room_type_counts.values):
    plt.text(i, value, str(value), ha='center', va='bottom')
plt.show()
```



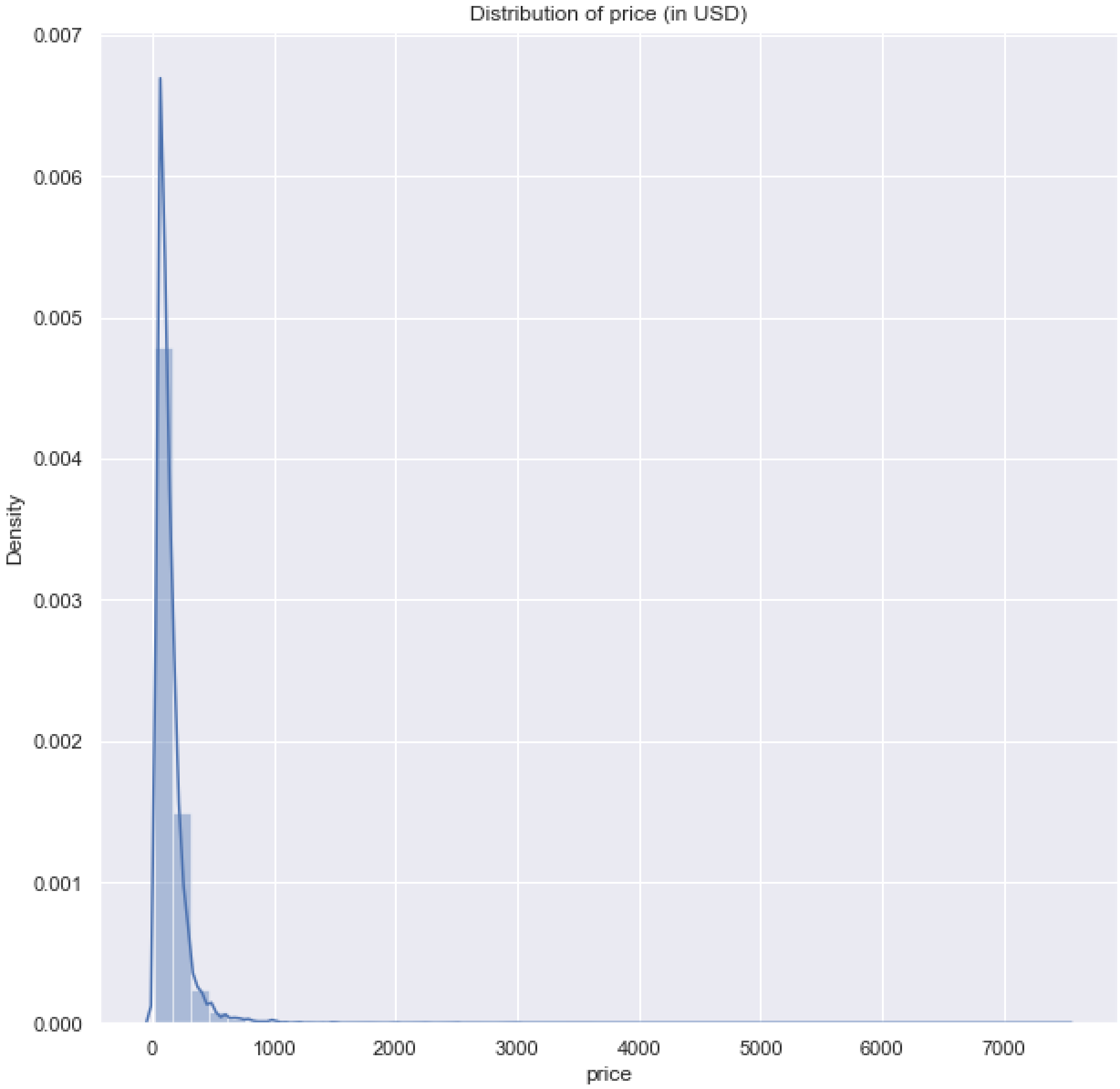
Price Analysis Distribution of price:

In [36]:

```
import matplotlib.pyplot as plt
import seaborn as sns

plt.figure(figsize=(10, 10))
sns.distplot(Airbnb_Analysis['price'], bins=50, kde=True)
plt.title("Distribution of price (in USD)")
plt.show()
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning:
`distplot` is a deprecated function and will be removed in a future version. Please adap
t your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

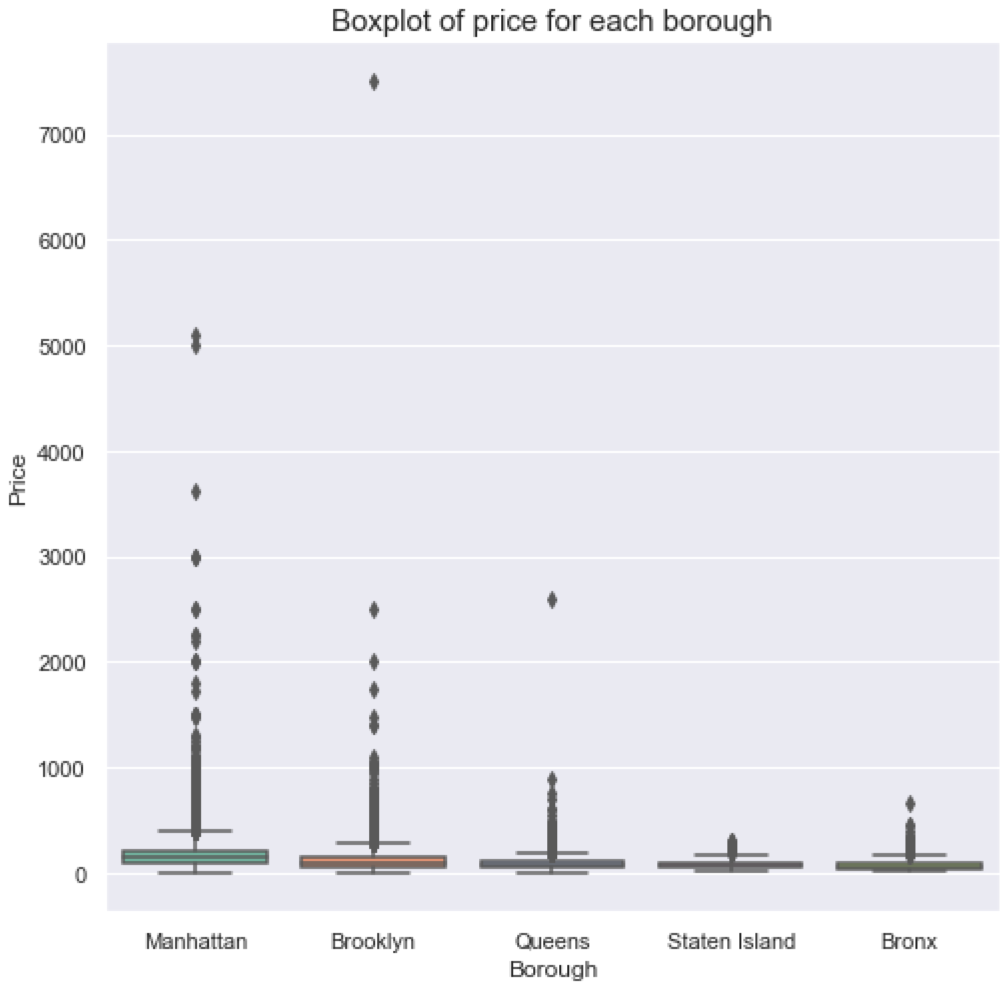


```
In [37]: Airbnb_Analysis['price'].describe()
```

```
Out[37]: count    25202.000000
         mean       141.817316
         std        147.350650
         min         10.000000
         25%         69.000000
         50%        105.000000
         75%        175.000000
         max       7500.000000
         Name: price, dtype: float64
```

Average property value for each neighbourhood group

```
In [38]: ## Check the average property value for each neighbourhood group:
         plt.figure(figsize=(8,8))
         sns.boxplot(x=Airbnb_Analysis['borough'],y=Airbnb_Analysis['price'],palette=sns.color_pa
         plt.title("Boxplot of price for each borough",fontsize=15)
         plt.xlabel("Borough",fontsize=12)
         plt.ylabel("Price",fontsize=12)
         plt.show()
```



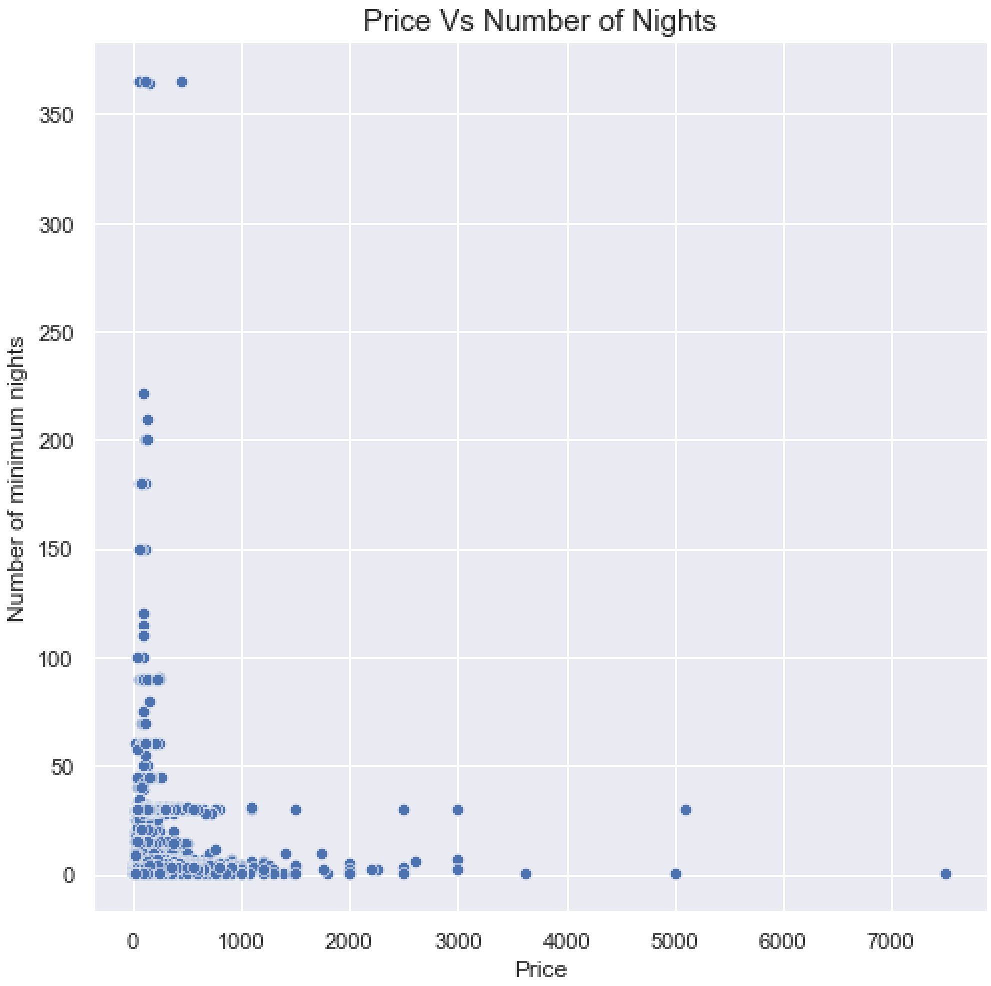
In [39]:
```
Airbnb_Analysis.groupby('borough')['price'].agg(['median','mean']).sort_values('median',
```

Out[39]:

	borough	median	mean
0	Manhattan	149.0	184.00
1	Brooklyn	95.0	121.97
2	Staten Island	71.0	86.04
3	Queens	70.0	92.81
4	Bronx	65.0	79.24

Minimum nights and price:

In [40]:
```
## Minimum nights and price:
plt.figure(figsize=(8,8))
sns.scatterplot(x='price',y='minimum_nights',data=Airbnb_Analysis[(Airbnb_Analysis.price
plt.title("Price Vs Number of Nights",fontsize=15)
plt.xlabel("Price",fontsize=12)
plt.ylabel("Number of minimum nights",fontsize=12)
plt.show()
```



In [41]:
```
Airbnb_Analysis.groupby('borough').agg({'price':'median','minimum_nights':'median'}).sor
```

Out[41]:

borough	price	minimum_nights
Manhattan	149.0	2.0
Brooklyn	95.0	2.0
Staten Island	71.0	2.0
Queens	70.0	2.0
Bronx	65.0	2.0

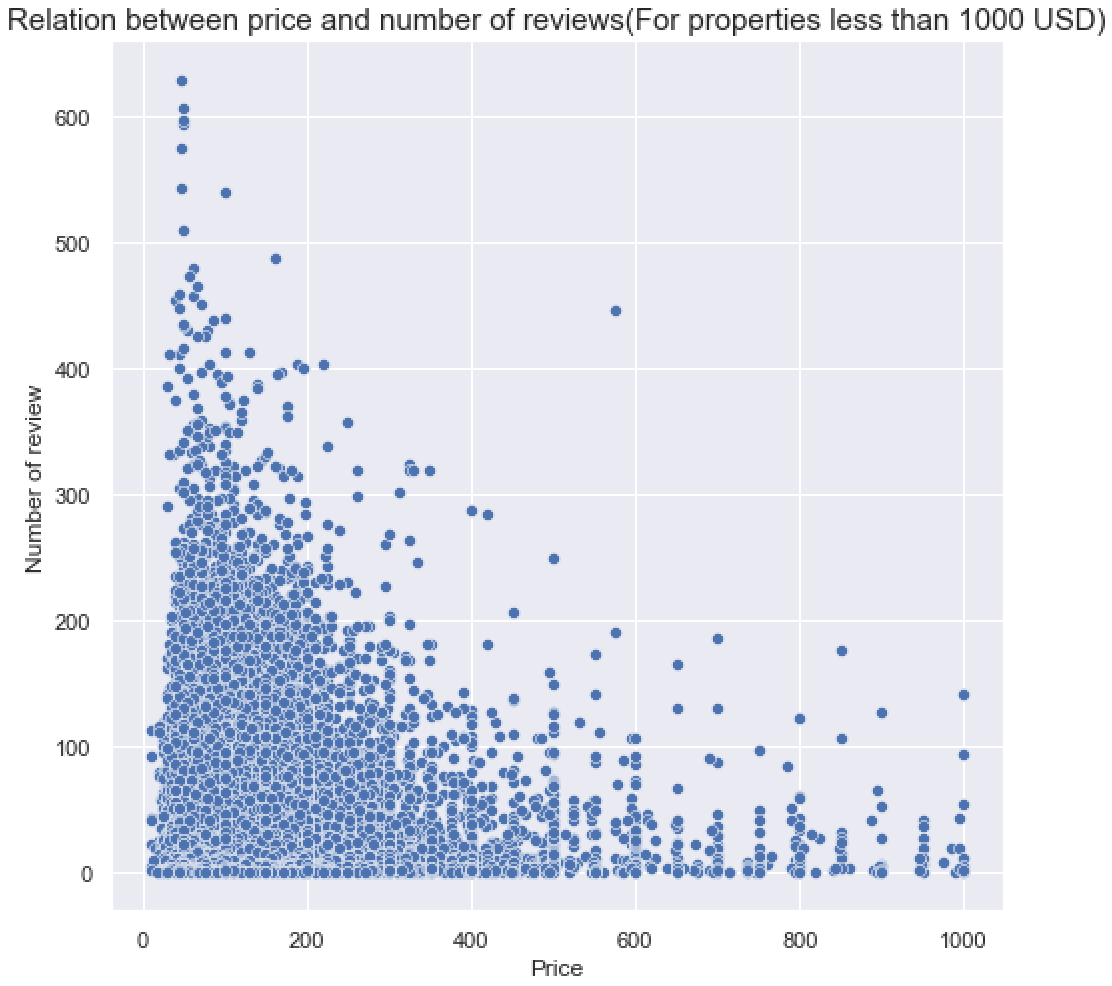
Room Type and Price

In [42]:
```
## Room Type and Price:
Airbnb_Analysis.groupby('room_type')['price'].median()
```

Out[42]:
```
room_type
entire home/apt    159.0
private room        70.0
shared room         41.0
Name: price, dtype: float64
```

Price and reviews

In [43]:
```
### Price and reviews:
plt.figure(figsize=(8,8))
sns.scatterplot(x='price',y='number_of_reviews',data=Airbnb_Analysis[Airbnb_Analysis.pri
plt.title("Relation between price and number of reviews(For properties less than 1000 US
plt.xlabel("Price",fontsize=12)
plt.ylabel("Number of review",fontsize=12)
plt.show()
```



Relation between price and number of reviews(For properties less than 1000 USD)

Host Analysis

In [44]:

```
print(f'There are {Airbnb_Analysis.host_name.nunique()} unique hosts in the dataset')
```

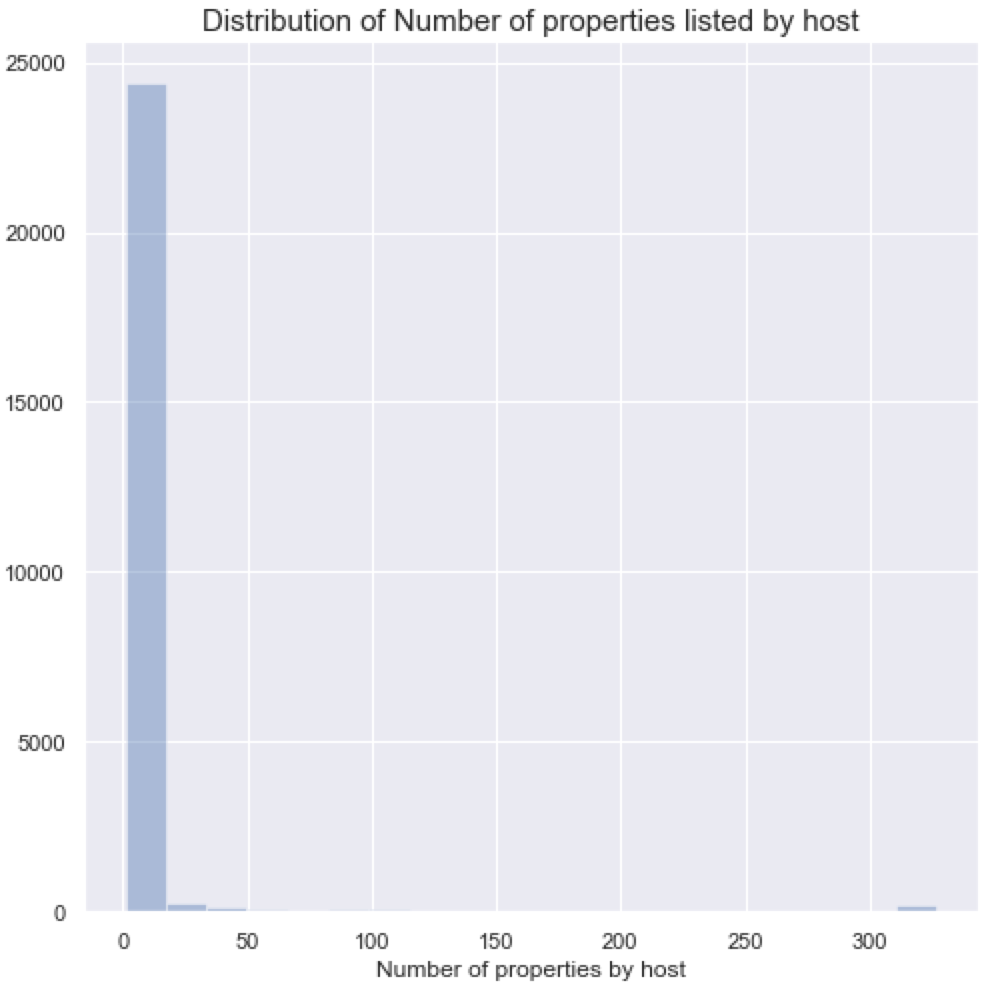
```
There are 7363 unique hosts in the dataset
```

Host listing count

In [45]:

```
## Host listing count:
plt.figure(figsize=(8,8))
sns.distplot(Airbnb_Analysis.calculated_host_listings_count,bins=20,kde=False)
plt.title("Distribution of Number of properties listed by host",fontsize=15)
plt.xlabel("Number of properties by host",fontsize=12)
plt.show()
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning:
`distplot` is a deprecated function and will be removed in a future version. Please adap
t your code to use either `displot` (a figure-level function with similar flexibility) o
r `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```



In [46]:

```
Airbnb_Analysis.calculated_host_listings_count.describe()
```

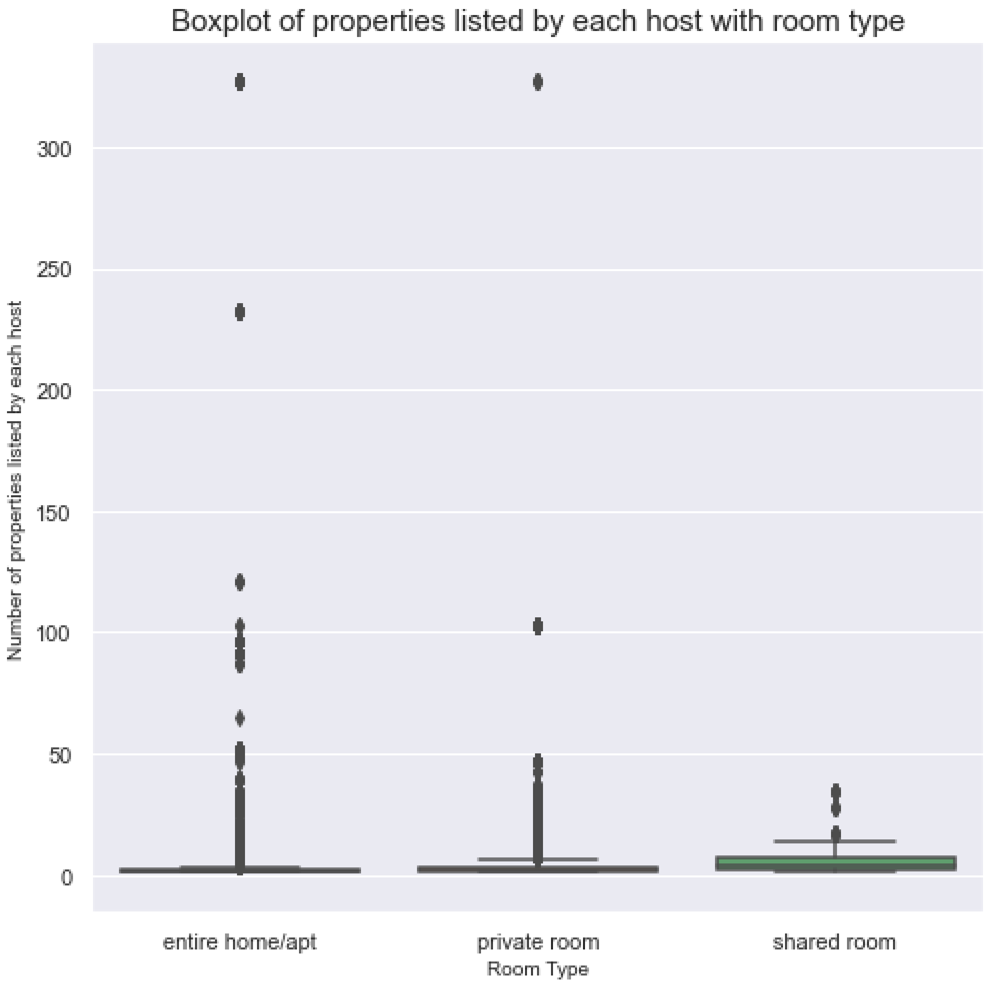
Out[46]:

```
count    25209.000000
mean         6.147606
std         31.354740
min          1.000000
25%          1.000000
50%          1.000000
75%          2.000000
max        327.000000
Name: calculated_host_listings_count, dtype: float64
```

Host and Room Type

In [47]:

```
plt.figure(figsize=(8,8))
sns.boxplot(x='room_type',y='calculated_host_listings_count',data=Airbnb_Analysis)
plt.title("Boxplot of properties listed by each host with room type",fontsize=15)
plt.xlabel("Room Type",fontsize=10)
plt.ylabel("Number of properties listed by each host",fontsize=10)
plt.show()
```



Host with all three room type

```
In [48]: variety=Airbnb_Analysis[Airbnb_Analysis.calculated_host_listings_count>1].groupby('host_
         print(f'Number of hosts with all three room types listed in Airbnb {len(variety[variety.
```

```
Number of hosts with all three room types listed in Airbnb 76
```

```
In [49]: variety_data=Airbnb_Analysis[Airbnb_Analysis.host_name.isin(variety[variety.room_type==3

         variety_data.groupby('host_name')['borough'].nunique().sort_values(ascending=False)
```

```
Out[49]: host_name
         Alex              5
         Michael           5
         Maria             5
         David             5
         Jessica           4
                          ..
         Jammie            1
         Cebile            1
         Lucca & Paula     1
         Joica             1
         Vie               1
         Name: borough, Length: 76, dtype: int64
```

```
In [50]: borough_counts = variety_data.groupby('host_name')['borough'].nunique()
         filtered_host_names = borough_counts[borough_counts >= 4].sort_values(ascending=False)
         filtered_host_names
```

```
Out[50]: host_name
         Alex        5
         David       5
         Maria       5
```

```
Michael        5
Sarah          4
Raquel         4
Nick           4
Tanya          4
Monica         4
Jorge          4
Melissa        4
Taylor         4
Luis           4
Lisa           4
Karen          4
Julie          4
Joseph         4
Jose           4
Jessica        4
Angela         4
Jean           4
Jay            4
James          4
George         4
Fernando       4
Eric           4
Elizabeth      4
Diana          4
Deborah        4
Chris          4
Charles        4
Carol          4
Brian          4
Ben            4
Victor         4
Name: borough, dtype: int64
```

Maximum Listing by host From our earlier analysis , we understood that the maximum number of listing by a single host is 327.Lets check the details for this host.

In [51]:

```
max_host=Airbnb_Analysis[Airbnb_Analysis.calculated_host_listings_count==327]
```

In [52]:

```
print(f'Name of host:{list(max_host.host_name.unique())}')
print(f'boroughs listed:{list(max_host.borough.unique())}')
print(f'Neighbourhoods listed:{list(max_host.neighbourhood.unique())}')
print(f'Room type listed:{list(max_host.room_type.unique())}')
print(f'Maximum price listed:{max(max_host.price)} USD Located in neighbourhood {max_hos
print(f'Minimum price listed:{min(max_host.price)} USD Located in neighbourhood {max_hos
```

```
Name of host:['Sonder (NYC)']
boroughs listed:['Manhattan']
Neighbourhoods listed:['Financial District', 'Murray Hill', "Hell's Kitchen", 'Theater D
istrict', 'Upper East Side']
Room type listed:['entire home/apt', 'private room']
Maximum price listed:616.0 USD Located in neighbourhood ['Financial District']
Minimum price listed:100.0 USD Located in neighbourhood ['Financial District']
```

In [53]:

```
## Top 5 Host with maximum median price and median nights for those holding more than 1
Airbnb_Analysis[Airbnb_Analysis.calculated_host_listings_count>10].groupby('host_name').
```

Out[53]:

	price	minimum_nights
host_name		
Sally	3613.0	1.0
Red Awning	699.0	3.0

Park Lane	425.0	1.0
Janet	387.0	1.0
Blueground	282.0	30.0

In [55]:

```
Airbnb_Analysis.groupby(['borough', 'room_type'])['price'].agg(['min', 'max', 'mean','me
```

Out[55]:

	borough	room_type	min	max	mean	median
0	Bronx	entire home/apt	35.0	670.0	120.517241	100.0
1	Bronx	private room	23.0	187.0	56.292804	50.0
2	Bronx	shared room	20.0	60.0	33.030303	28.0
3	Brooklyn	entire home/apt	10.0	2500.0	169.903671	145.0
4	Brooklyn	private room	10.0	7500.0	72.688545	65.0
5	Brooklyn	shared room	18.0	250.0	39.422460	35.0
6	Manhattan	entire home/apt	16.0	5100.0	238.024473	195.0
7	Manhattan	private room	10.0	1500.0	105.698795	90.0
8	Manhattan	shared room	25.0	800.0	72.960159	65.0
9	Queens	entire home/apt	10.0	2600.0	140.931086	120.0
10	Queens	private room	22.0	900.0	63.741165	58.0
11	Queens	shared room	15.0	120.0	40.767857	35.0
12	Staten Island	entire home/apt	49.0	300.0	116.774436	100.0
13	Staten Island	private room	20.0	235.0	56.060606	50.0
14	Staten Island	shared room	13.0	30.0	21.500000	21.5

In [ ]: