In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import plotly.express as px
import seaborn as sns
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import MinMaxScaler
from sklearn.preprocessing import LabelEncoder
```

DATA IMPORT

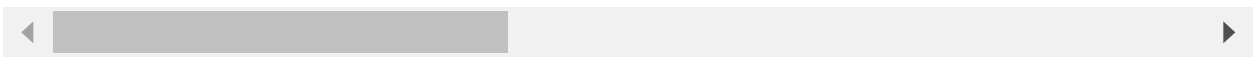
In [2]:
```
data=pd.read_csv("D:/Python Datasets/New York City Airbnb Open Data/AB_NYC_2019.c
```

In [3]:
```
data
```

Out[3]:

	id	name	host_id	host_name	neighbourhood_group	neighbourhood	
0	2539	Clean & quiet apt home by the park	2787	John	Brooklyn	Kensington	4
1	2595	Skylit Midtown Castle	2845	Jennifer	Manhattan	Midtown	4
2	3647	THE VILLAGE OF HARLEM....NEW YORK !	4632	Elisabeth	Manhattan	Harlem	4
3	3831	Cozy Entire Floor of Brownstone	4869	LisaRoxanne	Brooklyn	Clinton Hill	4
4	5022	Entire Apt: Spacious Studio/Loft by central park	7192	Laura	Manhattan	East Harlem	4
...	...	...	...	...	...	...	
48890	36484665	Charming one bedroom - newly renovated rowhouse	8232441	Sabrina	Brooklyn	Bedford-Stuyvesant	4
48891	36485057	Affordable room in Bushwick/East Williamsburg	6570630	Marisol	Brooklyn	Bushwick	4
48892	36485431	Sunny Studio at Historical Neighborhood	23492952	Ilgar & Aysel	Manhattan	Harlem	4
48893	36485609	43rd St. Time Square-cozy single bed	30985759	Taz	Manhattan	Hell's Kitchen	4
48894	36487245	Trendy duplex in the very heart of Hell's Kitchen	68119814	Christophe	Manhattan	Hell's Kitchen	4

48895 rows × 16 columns



In [4]:
```
data.describe
```

Out[4]:
```
<bound method NDFrame.describe of             id                                              name   host_id  \
0         2539                Clean & quiet apt home by the park      2787
1         2595                             Skylit Midtown Castle      2845
2         3647               THE VILLAGE OF HARLEM....NEW YORK !      4632
3         3831                   Cozy Entire Floor of Brownstone      4869
4         5022  Entire Apt: Spacious Studio/Loft by central park      7192
...        ...                                               ...       ...
48890  36484665    Charming one bedroom - newly renovated rowhouse   8232441
48891  36485057      Affordable room in Bushwick/East Williamsburg   6570630
48892  36485431            Sunny Studio at Historical Neighborhood  23492952
48893  36485609               43rd St. Time Square-cozy single bed  30985759
48894  36487245  Trendy duplex in the very heart of Hell's Kitchen  68119814

           host_name neighbourhood_group       neighbourhood  latitude  \
0               John            Brooklyn          Kensington  40.64749
1           Jennifer           Manhattan             Midtown  40.75362
2          Elisabeth           Manhattan              Harlem  40.80902
3        LisaRoxanne            Brooklyn        Clinton Hill  40.68514
4              Laura           Manhattan         East Harlem  40.79851
...              ...                 ...                 ...       ...
48890        Sabrina            Brooklyn  Bedford-Stuyvesant  40.67853
48891        Marisol            Brooklyn            Bushwick  40.70184
48892  Ilgar & Aysel           Manhattan              Harlem  40.81475
48893            Taz           Manhattan      Hell's Kitchen  40.75751
48894     Christophe           Manhattan      Hell's Kitchen  40.76404

       longitude        room_type  price  minimum_nights  number_of_reviews  \
0      -73.97237     Private room    149               1                  9
1      -73.98377  Entire home/apt    225               1                 45
2      -73.94190     Private room    150               3                  0
3      -73.95976  Entire home/apt     89               1                270
4      -73.94399  Entire home/apt     80              10                  9
...          ...              ...    ...             ...                ...
48890  -73.94995     Private room     70               2                  0
48891  -73.93317     Private room     40               4                  0
48892  -73.94867  Entire home/apt    115              10                  0
48893  -73.99112      Shared room     55               1                  0
48894  -73.98933     Private room     90               7                  0

      last_review  reviews_per_month  calculated_host_listings_count  \
0      2018-10-19               0.21                               6
1      2019-05-21               0.38                               2
2             NaN                NaN                               1
3      2019-07-05               4.64                               1
4      2018-11-19               0.10                               1
...           ...                ...                             ...
48890         NaN                NaN                               2
48891         NaN                NaN                               2
48892         NaN                NaN                               1
48893         NaN                NaN                               6
48894         NaN                NaN                               1

       availability_365
```

```
0                   365
1                   355
2                   365
3                   194
4                     0
...                 ...
48890                 9
48891                36
48892                27
48893                 2
48894                23

[48895 rows x 16 columns]>
```

In [5]:
```
data.dtypes
```

Out[5]:
```
id                                int64
name                             object
host_id                           int64
host_name                        object
neighbourhood_group              object
neighbourhood                    object
latitude                        float64
longitude                       float64
room_type                        object
price                             int64
minimum_nights                    int64
number_of_reviews                 int64
last_review                      object
reviews_per_month               float64
calculated_host_listings_count    int64
availability_365                  int64
dtype: object
```

In [6]:
```
data.head(5)
```

Out[6]:

	id	name	host_id	host_name	neighbourhood_group	neighbourhood	latitude	lo
0	2539	Clean & quiet apt home by the park	2787	John	Brooklyn	Kensington	40.64749	-7
1	2595	Skylit Midtown Castle	2845	Jennifer	Manhattan	Midtown	40.75362	-7
2	3647	THE VILLAGE OF HARLEM....NEW YORK !	4632	Elisabeth	Manhattan	Harlem	40.80902	-7
3	3831	Cozy Entire Floor of Brownstone	4869	LisaRoxanne	Brooklyn	Clinton Hill	40.68514	-7
4	5022	Entire Apt: Spacious Studio/Loft by central park	7192	Laura	Manhattan	East Harlem	40.79851	-7

In [7]:
```
data.shape
```

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

Data Cleaning(missing values & 0's)

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

Out[8]:
```
id                                    0
name                                 16
host_id                               0
host_name                            21
neighbourhood_group                   0
neighbourhood                         0
latitude                              0
longitude                             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
```

In [9]:
```
data2=data.dropna(subset=['name','host_name'])
```

In [10]:
```
data2.isnull().sum()
```

Out[10]:
```
id                                    0
name                                  0
host_id                               0
host_name                             0
neighbourhood_group                   0
neighbourhood                         0
latitude                              0
longitude                             0
room_type                             0
price                                 0
minimum_nights                        0
number_of_reviews                     0
last_review                       10037
reviews_per_month                 10037
calculated_host_listings_count        0
availability_365                      0
dtype: int64
```

In [11]:
```
data2.shape
```

Out[11]:
```
(48858, 16)
```

In [12]:
```
data2=data2[(data2.price!= 0) & (data2.minimum_nights!= 0) & (data2.number_of_rev
data2.reset_index(drop=True, inplace=True)
```

In [13]:
```
mean_availability_365 = data2['availability_365'].mean(skipna=True)
data2=data2.replace(0,mean_availability_365)
```

In [14]:
```
data2
```

Out[14]:

	id	name	host_id	host_name	neighbourhood_group	neighbourhood	latit
0	2539	Clean & quiet apt home by the park	2787	John	Brooklyn	Kensington	40.64
1	2595	Skylit Midtown Castle	2845	Jennifer	Manhattan	Midtown	40.75
2	3831	Cozy Entire Floor of Brownstone	4869	LisaRoxanne	Brooklyn	Clinton Hill	40.68
3	5022	Entire Apt: Spacious Studio/Loft by central park	7192	Laura	Manhattan	East Harlem	40.79
4	5099	Large Cozy 1 BR Apartment In Midtown East	7322	Chris	Manhattan	Murray Hill	40.74
...	...	...	...	...	...	...	
38806	36425863	Lovely Privet Bedroom with Privet Restroom	83554966	Rusaa	Manhattan	Upper East Side	40.78
38807	36427429	No.2 with queen size bed	257683179	H Ai	Queens	Flushing	40.75
38808	36438336	Seas The Moment	211644523	Ben	Staten Island	Great Kills	40.54
38809	36442252	1B-1B apartment near by Metro	273841667	Blaine	Bronx	Mott Haven	40.80
38810	36455809	Cozy Private Room in Bushwick, Brooklyn	74162901	Christine	Brooklyn	Bushwick	40.69

38811 rows × 16 columns

Changing Data Type

In [15]:
```
data2['availability_365']=data2['availability_365'].astype('int')
```

In [16]:
```
data2
```

Out[16]:

	id	name	host_id	host_name	neighbourhood_group	neighbourhood	latit
0	2539	Clean & quiet apt home by the park	2787	John	Brooklyn	Kensington	40.64
1	2595	Skylit Midtown Castle	2845	Jennifer	Manhattan	Midtown	40.75
2	3831	Cozy Entire Floor of Brownstone	4869	LisaRoxanne	Brooklyn	Clinton Hill	40.68
3	5022	Entire Apt: Spacious Studio/Loft by central park	7192	Laura	Manhattan	East Harlem	40.79
4	5099	Large Cozy 1 BR Apartment In Midtown East	7322	Chris	Manhattan	Murray Hill	40.74
...	...	...	...	...	...	...	
38806	36425863	Lovely Privet Bedroom with Privet Restroom	83554966	Rusaa	Manhattan	Upper East Side	40.78
38807	36427429	No.2 with queen size bed	257683179	H Ai	Queens	Flushing	40.75
38808	36438336	Seas The Moment	211644523	Ben	Staten Island	Great Kills	40.54
38809	36442252	1B-1B apartment near by Metro	273841667	Blaine	Bronx	Mott Haven	40.80
38810	36455809	Cozy Private Room in Bushwick, Brooklyn	74162901	Christine	Brooklyn	Bushwick	40.69

38811 rows × 16 columns

In [17]:
```
data2
```

Out[17]:

	id	name	host_id	host_name	neighbourhood_group	neighbourhood	latit
0	2539	Clean & quiet apt home by the park	2787	John	Brooklyn	Kensington	40.64
1	2595	Skylit Midtown Castle	2845	Jennifer	Manhattan	Midtown	40.75
2	3831	Cozy Entire Floor of Brownstone	4869	LisaRoxanne	Brooklyn	Clinton Hill	40.68
3	5022	Entire Apt: Spacious Studio/Loft by central park	7192	Laura	Manhattan	East Harlem	40.79
4	5099	Large Cozy 1 BR Apartment In Midtown East	7322	Chris	Manhattan	Murray Hill	40.74
...	...	...	...	...	...	...	
38806	36425863	Lovely Privet Bedroom with Privet Restroom	83554966	Rusaa	Manhattan	Upper East Side	40.78
38807	36427429	No.2 with queen size bed	257683179	H Ai	Queens	Flushing	40.75
38808	36438336	Seas The Moment	211644523	Ben	Staten Island	Great Kills	40.54
38809	36442252	1B-1B apartment near by Metro	273841667	Blaine	Bronx	Mott Haven	40.80
38810	36455809	Cozy Private Room in Bushwick, Brooklyn	74162901	Christine	Brooklyn	Bushwick	40.69

38811 rows × 16 columns

Deleting unneccesary columns

In [18]:
```
data3=data2
del data3['name']
del data3['host_name']
```

In [19]:
```
data3
```

Out[19]:

	id	host_id	neighbourhood_group	neighbourhood	latitude	longitude	room_type
0	2539	2787	Brooklyn	Kensington	40.64749	-73.97237	Private room
1	2595	2845	Manhattan	Midtown	40.75362	-73.98377	Entire home/ap
2	3831	4869	Brooklyn	Clinton Hill	40.68514	-73.95976	Entire home/ap
3	5022	7192	Manhattan	East Harlem	40.79851	-73.94399	Entire home/ap
4	5099	7322	Manhattan	Murray Hill	40.74767	-73.97500	Entire home/ap
...	...	...	...	...	...	...	..
38806	36425863	83554966	Manhattan	Upper East Side	40.78099	-73.95366	Private room
38807	36427429	257683179	Queens	Flushing	40.75104	-73.81459	Private room
38808	36438336	211644523	Staten Island	Great Kills	40.54179	-74.14275	Private room
38809	36442252	273841667	Bronx	Mott Haven	40.80787	-73.92400	Entire home/ap
38810	36455809	74162901	Brooklyn	Bushwick	40.69805	-73.92801	Private room

38811 rows × 14 columns

Exploratory Data Analysis

Class distribution check

In [20]:
```
data3['neighbourhood_group'].value_counts(normalize=True)
```

Out[20]:
```
Manhattan        0.428255
Brooklyn         0.423334
Queens           0.117802
Bronx            0.022519
Staten Island    0.008090
Name: neighbourhood_group, dtype: float64
```

In [21]:
```
data3['room_type'].value_counts(normalize=True)
```

Out[21]:
```
Entire home/apt    0.523563
Private room       0.454691
Shared room        0.021746
Name: room_type, dtype: float64
```

In [22]:
```
data3['price'].describe()
```

Out[22]:
```
count    38811.000000
mean       142.369199
std        197.006883
min         10.000000
25%         69.000000
50%        101.000000
75%        170.000000
max      10000.000000
Name: price, dtype: float64
```

Univariant analysis

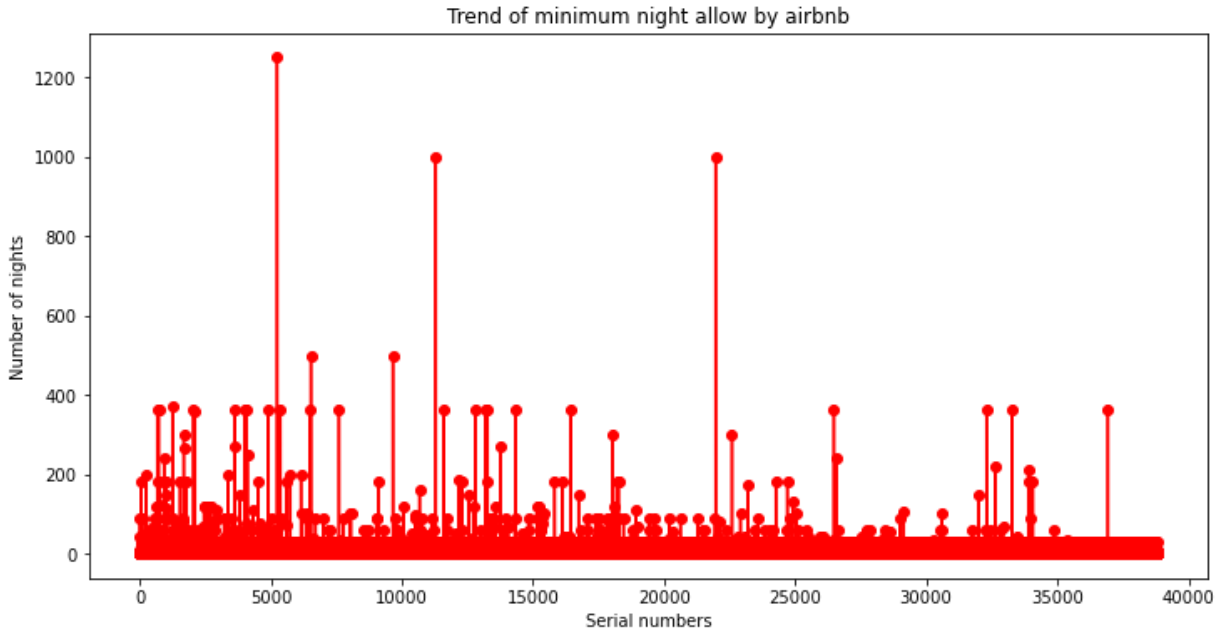
In [23]:
```
data3.shape
```

Out[23]:
```
(38811, 14)
```

In [24]:
```
data3['minimum_nights'].describe()
```

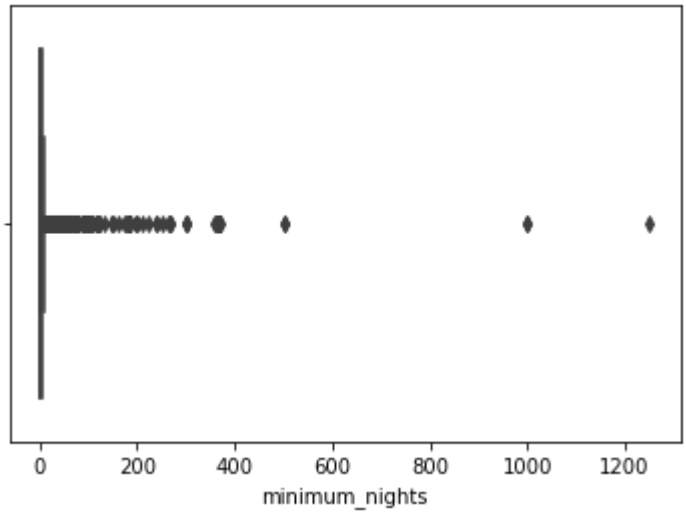
Out[24]:
```
count    38811.000000
mean         5.868723
std         17.390315
min          1.000000
25%          1.000000
50%          2.000000
75%          4.000000
max       1250.000000
Name: minimum_nights, dtype: float64
```

In [25]:
```
plt.figure(figsize=(12,6))
plt.plot(data3.index,data3['minimum_nights'],'ro-')
plt.title("Trend of minimum night allow by airbnb")
plt.xlabel("Serial numbers")
plt.ylabel("Number of nights")
plt.show()
```

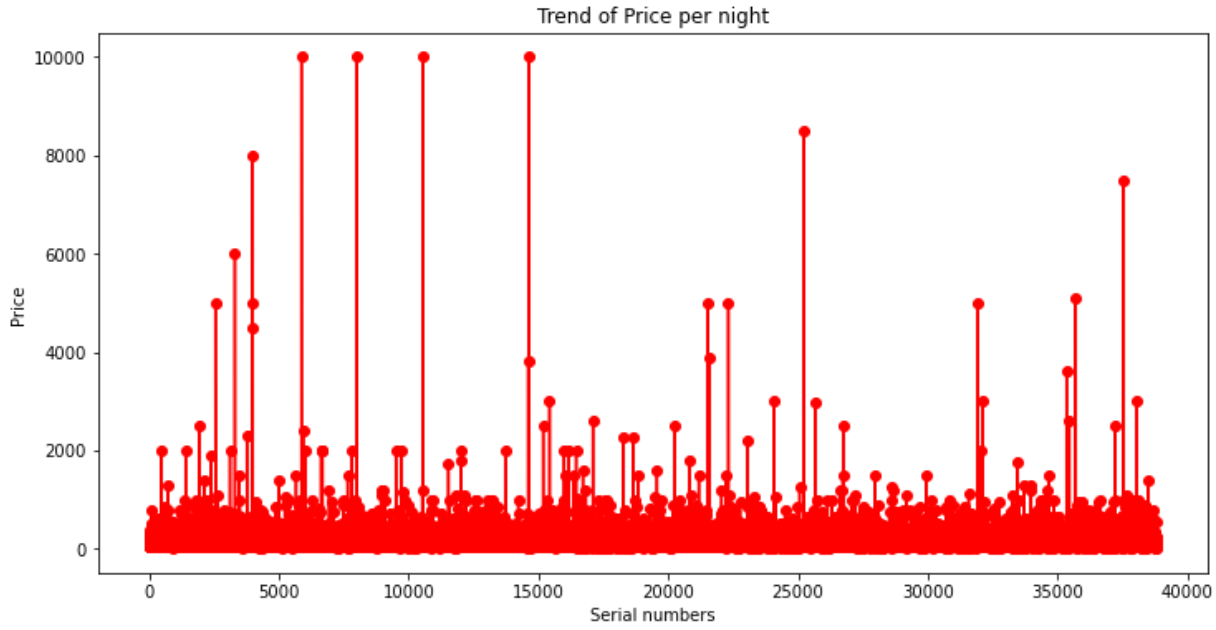


In [26]:
```
sns.boxplot(x='minimum_nights',data=data3)
```

Out[26]: <AxesSubplot:xlabel='minimum_nights'>

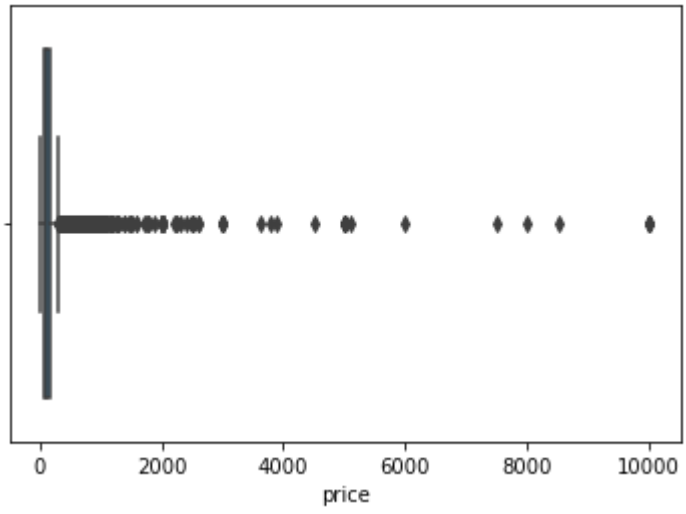


In [27]:
```
plt.figure(figsize=(12,6))
plt.plot(data3.index,data3['price'],'ro-')
plt.title("Trend of Price per night")
plt.xlabel("Serial numbers")
plt.ylabel("Price")
plt.show()
```

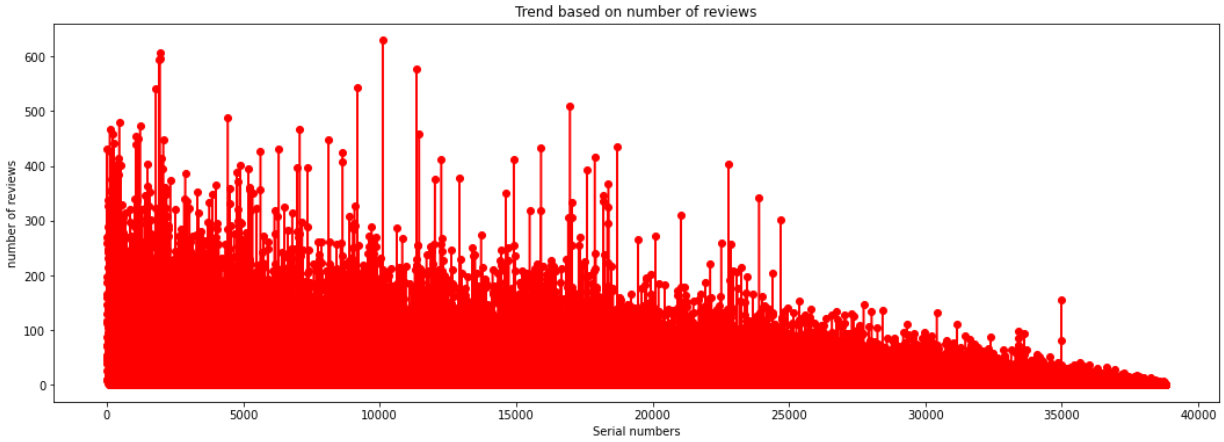


In [28]:
```
sns.boxplot(x='price',data=data3)
```

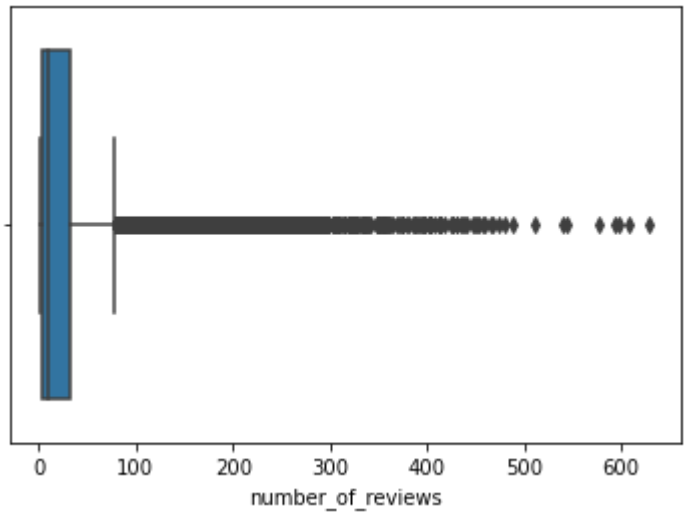
Out[28]: <AxesSubplot:xlabel='price'>



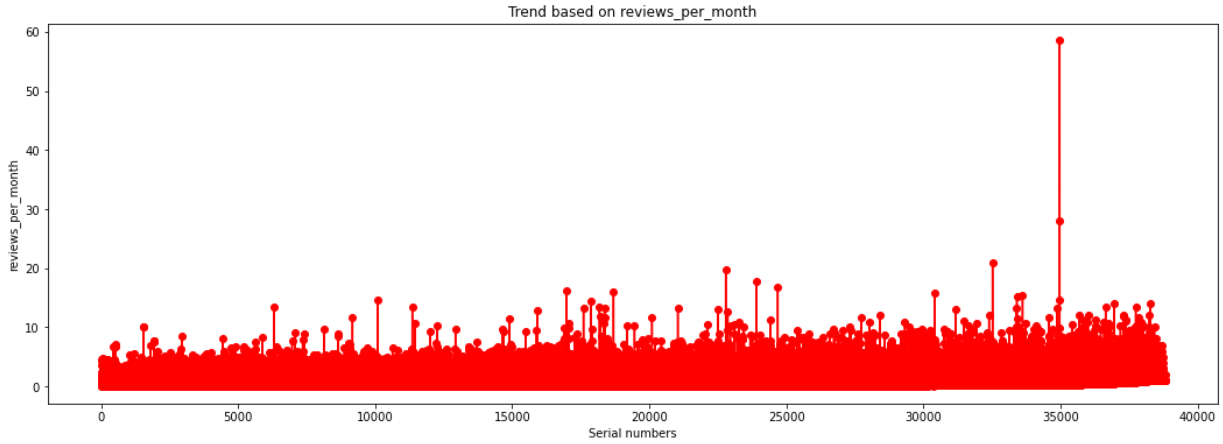
In [29]:
```
plt.figure(figsize=(18,6))
plt.plot(data3.index,data3['number_of_reviews'],'ro-')
plt.title("Trend based on number of reviews")
plt.xlabel("Serial numbers")
plt.ylabel("number of reviews")
plt.show()
sns.boxplot(x='number_of_reviews',data=data3)
```



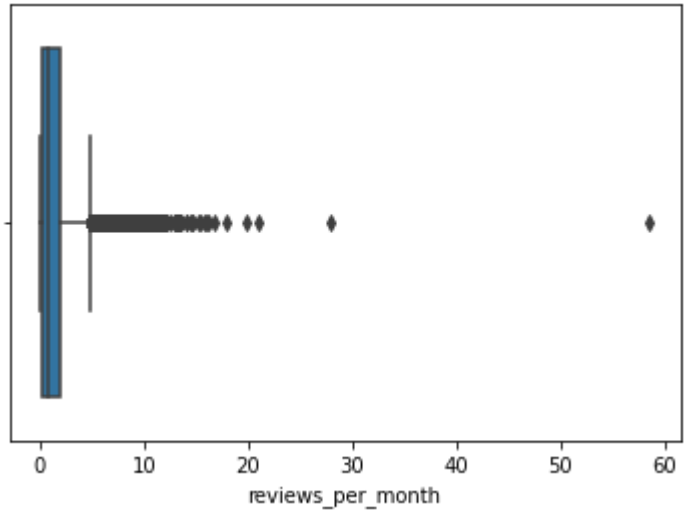
Out[29]: <AxesSubplot:xlabel='number_of_reviews'>



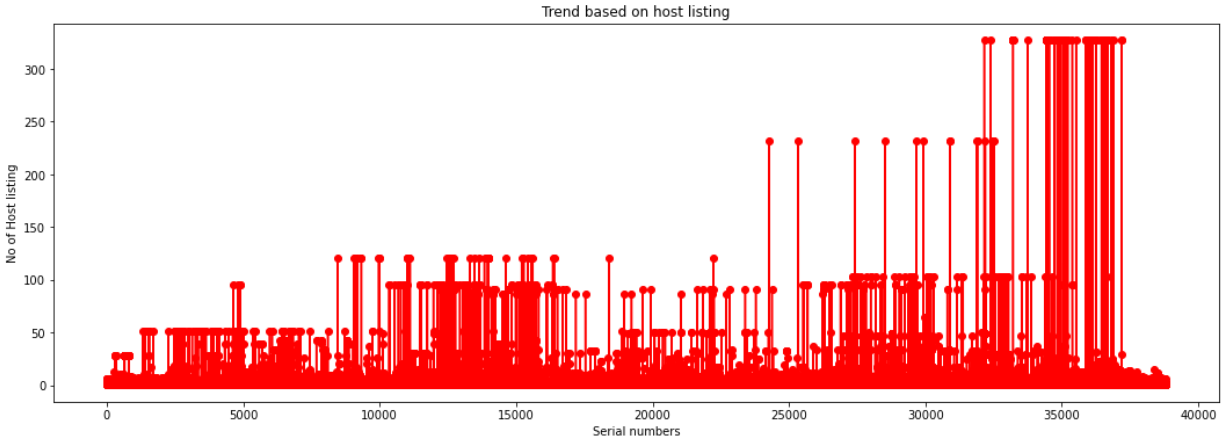
In [30]:
```
plt.figure(figsize=(18,6))
plt.plot(data3.index,data3['reviews_per_month'],'ro-')
plt.title("Trend based on reviews_per_month")
plt.xlabel("Serial numbers")
plt.ylabel("reviews_per_month")
plt.show()
sns.boxplot(x='reviews_per_month',data=data3)
```



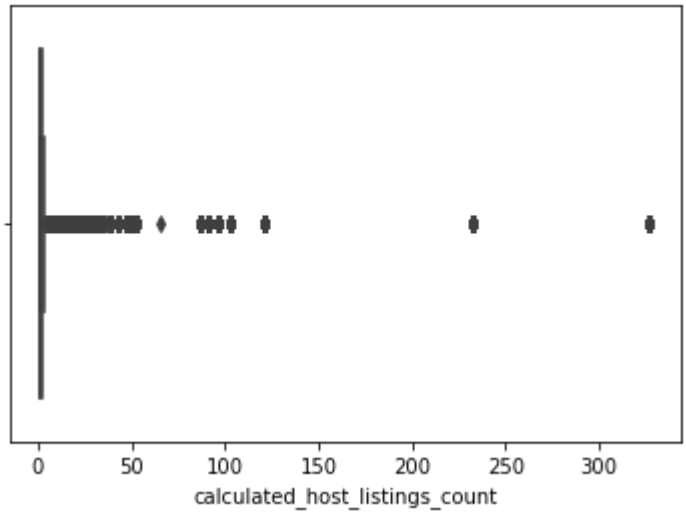
Out[30]: <AxesSubplot:xlabel='reviews_per_month'>



In [31]:
```
plt.figure(figsize=(18,6))
plt.plot(data3.index,data3['calculated_host_listings_count'],'ro-')
plt.title("Trend based on host listing")
plt.xlabel("Serial numbers")
plt.ylabel("No of Host listing")
plt.show()
sns.boxplot(x='calculated_host_listings_count',data=data3)
```



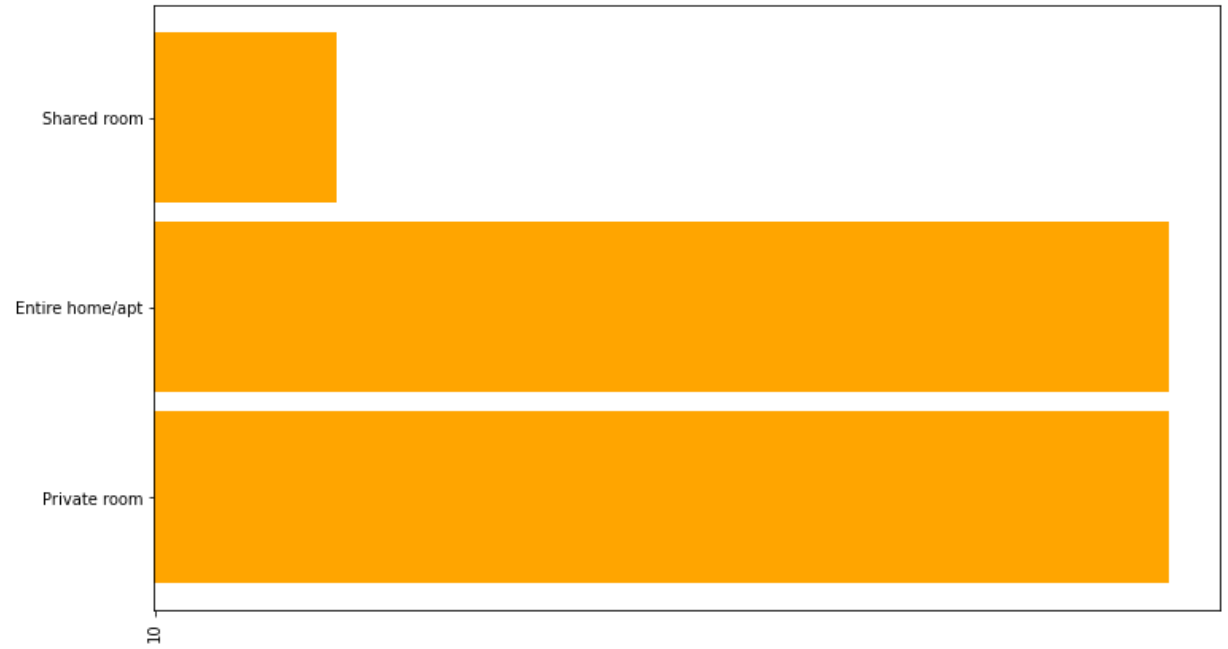
Out[31]: <AxesSubplot:xlabel='calculated_host_listings_count'>



All graphs are right skewed

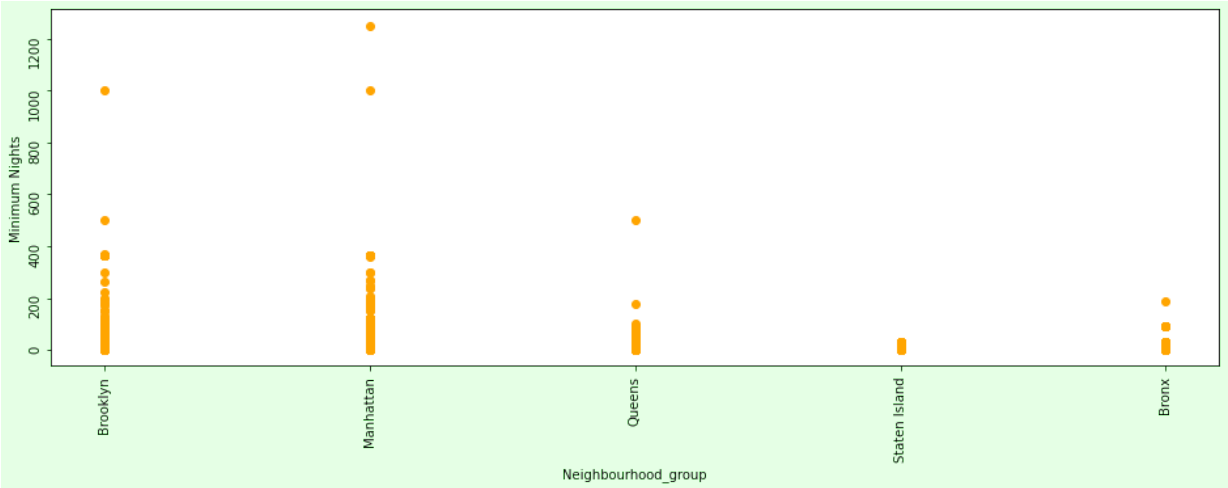
Bi-variant analysis

In [40]:
```
plt.figure(figsize=(12,7))
plt.barh(data3.room_type,data3.price,height=0.9,color="orange") #height arguement
plt.xticks(np.arange(data3.price.min(),data3.price.max(),10000),rotation="90")
plt.show()
```

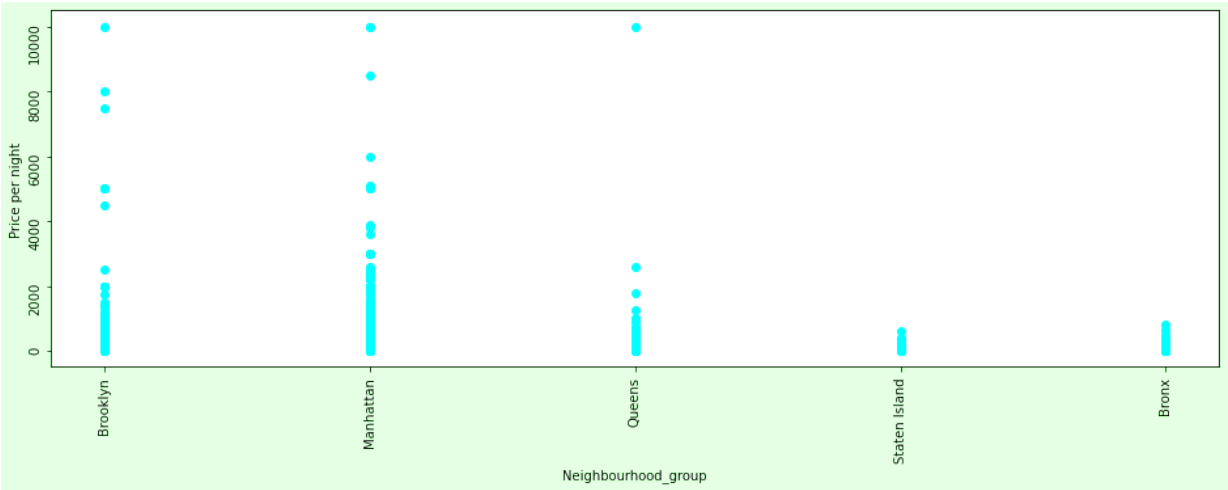


In [45]:
```
plt.figure(figsize=(12,7))
plt.barh(data3.room_type,data3.minimum_nights,height=0.9,color="blue") #height ar
plt.xticks(np.arange(data3.minimum_nights.min(),data3.price.max(),10000),rotatior
plt.show()
```

In [47]:
```
plt.figure(figsize=(16,5), facecolor=(0, 1, 0, .1))
plt.scatter(data3.neighbourhood_group,data3['minimum_nights'],color="orange",mark
plt.xlabel("Neighbourhood_group")
plt.ylabel("Minimum Nights")
plt.xticks(rotation ="90")
plt.yticks(rotation="90")#for rotating vertically
plt.show()
```



In [48]:
```
plt.figure(figsize=(16,5), facecolor=(0, 1, 0, .1))
plt.scatter(data3.neighbourhood_group,data3['price'],color="cyan",marker = "o")
plt.xlabel("Neighbourhood_group")
plt.ylabel("Price per night")
plt.xticks(rotation ="90")
plt.yticks(rotation="90")#for rotating vertically
plt.show()
```



In [ ]:
```
#Draw 2 plots on top of each other in the same figure
plt.figure(figsize=(16,5), facecolor=(0, 1, 0, .1))

plt.plot(data3.neighbourhood_group,data3['price'],label="Death Counts",color="blu
plt.plot(data3.neighbourhood_group,data3['number_of_reviews'],label="Recovered Co
plt.legend()
plt.xlabel("Date")
plt.ylabel("Count")
plt.show()
```