airbnb-data-analysis

August 28, 2025

1 Importing libraries

```
[1]: import numpy as np
     import pandas as pd
     import matplotlib.pyplot as plt
     import seaborn as sns
```

2 Load the dataset

```
[2]: df = pd.read_csv('compressed_data.csv')
```

```
/tmp/ipython-input-2682954081.py:1: DtypeWarning: Columns (25) have mixed types.
Specify dtype option on import or set low_memory=False.
  df = pd.read_csv('compressed_data.csv')
```

3 To check few values

```
[3]: df.head()
```

```
[3]:        id                                              NAME      host id  \
     0  1001254                Clean & quiet apt home by the park  80014485718
     1  1002102                             Skylit Midtown Castle  52335172823
     2  1002403               THE VILLAGE OF HARLEM…NEW YORK !  78829239556
     3  1002755                                               NaN  85098326012
     4  1003689  Entire Apt: Spacious Studio/Loft by central park  92037596077

       host_identity_verified host name neighbourhood group neighbourhood  \
     0            unconfirmed  Madaline            Brooklyn    Kensington
     1               verified     Jenna           Manhattan       Midtown
     2                    NaN     Elise           Manhattan        Harlem
     3            unconfirmed     Garry            Brooklyn  Clinton Hill
     4               verified    Lyndon           Manhattan   East Harlem

             lat      long        country  … service fee minimum nights  \
     0  40.64749 -73.97237  United States  …        $193           10.0
     1  40.75362 -73.98377  United States  …         $28           30.0
```

```
2  40.80902 -73.94190  United States  …       $124             3.0
3  40.68514 -73.95976  United States  …        $74            30.0
4  40.79851 -73.94399  United States  …        $41            10.0

  number of reviews last review  reviews per month review rate number  \
0               9.0  10/19/2021               0.21                4.0
1              45.0   5/21/2022               0.38                4.0
2               0.0         NaN                NaN                5.0
3             270.0    7/5/2019               4.64                4.0
4               9.0  11/19/2018               0.10                3.0

  calculated host listings count  availability 365  \
0                            6.0             286.0
1                            2.0             228.0
2                            1.0             352.0
3                            1.0             322.0
4                            1.0             289.0

                                         house_rules license
0  Clean up and treat the home the way you'd like…     NaN
1  Pet friendly but please confirm with me if the…     NaN
2  I encourage you to use my kitchen, cooking and…     NaN
3                                              NaN     NaN
4  Please no smoking in the house, porch or on th…     NaN

[5 rows x 26 columns]
```

[4]:
```
df.tail()
```

[4]:
```
             id                            NAME      host id  \
102594  6092437        Spare room in Williamsburg  12312296767
102595  6092990     Best Location near Columbia U  77864383453
102596  6093542    Comfy, bright room in Brooklyn  69050334417
102597  6094094  Big Studio-One Stop from Midtown  11160591270
102598  6094647              585 sf Luxury Studio  68170633372

       host_identity_verified    host name neighbourhood group  \
102594               verified         Krik            Brooklyn
102595            unconfirmed        Mifan           Manhattan
102596            unconfirmed        Megan            Brooklyn
102597            unconfirmed  Christopher              Queens
102598            unconfirmed      Rebecca           Manhattan

              neighbourhood       lat      long        country  …  \
102594         Williamsburg  40.70862 -73.94651  United States  …
102595  Morningside Heights  40.80460 -73.96545  United States  …
102596           Park Slope  40.67505 -73.98045  United States  …
```

```
102597     Long Island City  40.74989 -73.93777  United States  …
102598      Upper West Side  40.76807 -73.98342  United States  …

       service fee minimum nights number of reviews last review  \
102594       $169             1.0               0.0         NaN
102595       $167             1.0               1.0    7/6/2015
102596       $198             3.0               0.0         NaN
102597       $109             2.0               5.0  10/11/2015
102598       $206             1.0               0.0         NaN

        reviews per month review rate number calculated host listings count  \
102594                NaN                3.0                            1.0
102595               0.02                2.0                            2.0
102596                NaN                5.0                            1.0
102597               0.10                3.0                            1.0
102598                NaN                3.0                            1.0

        availability 365                                        house_rules  \
102594             227.0  No Smoking No Parties or Events of any kind Pl…
102595             395.0  House rules: Guests agree to the following ter…
102596             342.0                                                NaN
102597             386.0                                                NaN
102598              69.0                                                NaN

       license
102594     NaN
102595     NaN
102596     NaN
102597     NaN
102598     NaN

[5 rows x 26 columns]
```

4 Check the column names in the Dataset

```
[6]: df.columns
```

```
[6]: Index(['id', 'NAME', 'host id', 'host_identity_verified', 'host name',
       'neighbourhood group', 'neighbourhood', 'lat', 'long', 'country',
       'country code', 'instant_bookable', 'cancellation_policy', 'room type',
       'Construction year', 'price', 'service fee', 'minimum nights',
       'number of reviews', 'last review', 'reviews per month',
       'review rate number', 'calculated host listings count',
       'availability 365', 'house_rules', 'license'],
      dtype='object')
```

5 checking missing values

[7]:

```python
print(df.isnull().sum())
```

```
id                                     0
NAME                                 250
host id                                0
host_identity_verified               289
host name                            406
neighbourhood group                   29
neighbourhood                         16
lat                                    8
long                                   8
country                              532
country code                         131
instant_bookable                     105
cancellation_policy                   76
room type                              0
Construction year                    214
price                                247
service fee                          273
minimum nights                       409
number of reviews                    183
last review                        15893
reviews per month                  15879
review rate number                   326
calculated host listings count       319
availability 365                     448
house_rules                        52131
license                           102597
dtype: int64
```

[8]:

```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 102599 entries, 0 to 102598
Data columns (total 26 columns):
 #   Column                          Non-Null Count   Dtype
---  ------                          --------------   -----
 0   id                              102599 non-null  int64
 1   NAME                            102349 non-null  object
 2   host id                         102599 non-null  int64
 3   host_identity_verified          102310 non-null  object
 4   host name                       102193 non-null  object
 5   neighbourhood group             102570 non-null  object
 6   neighbourhood                   102583 non-null  object
 7   lat                             102591 non-null  float64
 8   long                            102591 non-null  float64
 9   country                         102067 non-null  object
 10  country code                    102468 non-null  object
 11  instant_bookable                102494 non-null  object
 12  cancellation_policy             102523 non-null  object
 13  room type                       102599 non-null  object
 14  Construction year               102385 non-null  float64
 15  price                           102352 non-null  object
 16  service fee                     102326 non-null  object
 17  minimum nights                  102190 non-null  float64
 18  number of reviews               102416 non-null  float64
 19  last review                     86706 non-null   object
 20  reviews per month               86720 non-null   float64
 21  review rate number              102273 non-null  float64
 22  calculated host listings count  102280 non-null  float64
 23  availability 365                102151 non-null  float64
 24  house_rules                     50468 non-null   object
 25  license                         2 non-null       object
dtypes: float64(9), int64(2), object(15)
memory usage: 20.4+ MB
```

6 Handle Missing Values

[55]:
```
df['last review']=pd.to_datetime(df['last review'],errors='coerce')
```

[10]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 102599 entries, 0 to 102598
Data columns (total 26 columns):
 #   Column                          Non-Null Count   Dtype
---  ------                          --------------   -----
 0   id                              102599 non-null  int64
 1   NAME                            102349 non-null  object
 2   host id                         102599 non-null  int64
 3   host_identity_verified          102310 non-null  object
 4   host name                       102193 non-null  object
 5   neighbourhood group             102570 non-null  object
 6   neighbourhood                   102583 non-null  object
 7   lat                             102591 non-null  float64
 8   long                            102591 non-null  float64
 9   country                         102067 non-null  object
 10  country code                    102468 non-null  object
 11  instant_bookable                102494 non-null  object
 12  cancellation_policy             102523 non-null  object
 13  room type                       102599 non-null  object
 14  Construction year               102385 non-null  float64
 15  price                           102352 non-null  object
 16  service fee                     102326 non-null  object
 17  minimum nights                  102190 non-null  float64
 18  number of reviews               102416 non-null  float64
 19  last review                     86706 non-null   datetime64[ns]
 20  reviews per month               86720 non-null   float64
 21  review rate number              102273 non-null  float64
 22  calculated host listings count  102280 non-null  float64
 23  availability 365                102151 non-null  float64
 24  house_rules                     50468 non-null   object
 25  license                         2 non-null       object
dtypes: datetime64[ns](1), float64(9), int64(2), object(14)
memory usage: 20.4+ MB
```

[11]:
```
df.fillna({'reviews per month':0,'last review':df['last review'].min()},inplace␣
 ↪= True)
```

[17]:
```
df.dropna(subset=['NAME','host name'],inplace=True)
```

[18]:
```
print(df.isnull().sum())
```

```
id                                     0
NAME                                   0
host id                                0
host_identity_verified               276
host name                              0
neighbourhood group                   26
neighbourhood                         16
lat                                    8
long                                   8
country                              526
country code                         122
instant_bookable                      96
cancellation_policy                   70
room type                              0
Construction year                    200
price                                239
service fee                          268
minimum nights                       403
number of reviews                    182
last review                            0
reviews per month                      0
review rate number                   314
calculated host listings count       318
availability 365                     420
house_rules                        51867
license                           101947
dtype: int64
```

[19]:

```python
df=df.drop(columns=["license","house_rules"],errors='ignore')
```

[20]:

```python
df.head()
```

[20]:

```
        id                                              NAME      host id  \
0  1001254                Clean & quiet apt home by the park  80014485718   
1  1002102                             Skylit Midtown Castle  52335172823   
2  1002403               THE VILLAGE OF HARLEM…NEW YORK !  78829239556   
4  1003689  Entire Apt: Spacious Studio/Loft by central park  92037596077   
5  1004098         Large Cozy 1 BR Apartment In Midtown East  45498551794   

  host_identity_verified host name neighbourhood group neighbourhood  \
0            unconfirmed  Madaline            Brooklyn    Kensington   
1               verified     Jenna           Manhattan       Midtown   
2                    NaN     Elise           Manhattan        Harlem   
4               verified    Lyndon           Manhattan   East Harlem   
5               verified  Michelle           Manhattan   Murray Hill   

        lat      long        country  … Construction year  price  \
0  40.64749 -73.97237  United States  …            2020.0  $966   
1  40.75362 -73.98377  United States  …            2007.0  $142   
2  40.80902 -73.94190  United States  …            2005.0  $620   
4  40.79851 -73.94399  United States  …            2009.0  $204   
5  40.74767 -73.97500  United States  …            2013.0  $577   

  service fee minimum nights  number of reviews last review reviews per month  \
0       $193            10.0                9.0  2021-10-19              0.21   
1        $28            30.0               45.0  2022-05-21              0.38   
2       $124             3.0                0.0  2012-07-11              0.00   
4        $41            10.0                9.0  2018-11-19              0.10   
5       $115             3.0               74.0  2019-06-22              0.59   

   review rate number  calculated host listings count availability 365
0                 4.0                             6.0            286.0
1                 4.0                             2.0            228.0
2                 5.0                             1.0            352.0
4                 3.0                             1.0            289.0
5                 3.0                             1.0            374.0

[5 rows x 24 columns]
```

7 remove dollar signs and convert to float

[56]:

```
df['price']=df['price'].replace('[\$,]','',regex=True).astype(float)
df['service fee']=df['service fee'].replace('[\$]','',regex=True).astype(float)
```

```
<>:1: SyntaxWarning: invalid escape sequence '\$'
<>:2: SyntaxWarning: invalid escape sequence '\$'
<>:1: SyntaxWarning: invalid escape sequence '\$'
<>:2: SyntaxWarning: invalid escape sequence '\$'
/tmp/ipython-input-583359669.py:1: SyntaxWarning: invalid escape sequence '\$'
  df['price']=df['price'].replace('[\$,]','',regex=True).astype(float)
/tmp/ipython-input-583359669.py:2: SyntaxWarning: invalid escape sequence '\$'
  df['service fee']=df['service
fee'].replace('[\$]','',regex=True).astype(float)
```

[22]:

```
df.head()
```

[22]:

```
        id                                              NAME      host id  \
0  1001254                Clean & quiet apt home by the park  80014485718
1  1002102                             Skylit Midtown Castle  52335172823
2  1002403               THE VILLAGE OF HARLEM…NEW YORK !  78829239556
4  1003689  Entire Apt: Spacious Studio/Loft by central park  92037596077
5  1004098          Large Cozy 1 BR Apartment In Midtown East  45498551794

  host_identity_verified host name neighbourhood group neighbourhood  \
0            unconfirmed  Madaline            Brooklyn   Kensington
1               verified     Jenna           Manhattan      Midtown
2                    NaN     Elise           Manhattan       Harlem
4               verified    Lyndon           Manhattan  East Harlem
5               verified  Michelle           Manhattan  Murray Hill

        lat      long        country  … Construction year  price  \
0  40.64749 -73.97237  United States  …            2020.0  966.0
1  40.75362 -73.98377  United States  …            2007.0  142.0
2  40.80902 -73.94190  United States  …            2005.0  620.0
4  40.79851 -73.94399  United States  …            2009.0  204.0
5  40.74767 -73.97500  United States  …            2013.0  577.0

  service fee minimum nights  number of reviews  last review  \
0       193.0           10.0                9.0   2021-10-19
1        28.0           30.0               45.0   2022-05-21
2       124.0            3.0                0.0   2012-07-11
4        41.0           10.0                9.0   2018-11-19
5       115.0            3.0               74.0   2019-06-22

   reviews per month  review rate number  calculated host listings count  \
0               0.21                 4.0                             6.0
```

```
1          0.38          4.0                    2.0
2          0.00          5.0                    1.0
4          0.10          3.0                    1.0
5          0.59          3.0                    1.0

  availability 365
0           286.0
1           228.0
2           352.0
4           289.0
5           374.0

[5 rows x 24 columns]
```

8 remove duplicates

[23]:
```
df.drop_duplicates(inplace=True)
```

[24]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 101410 entries, 0 to 102057
Data columns (total 24 columns):
 #   Column                         Non-Null Count   Dtype
---  ------                         --------------   -----
 0   id                             101410 non-null  int64
 1   NAME                           101410 non-null  object
 2   host id                        101410 non-null  int64
 3   host_identity_verified         101134 non-null  object
 4   host name                      101410 non-null  object
 5   neighbourhood group            101384 non-null  object
 6   neighbourhood                  101394 non-null  object
 7   lat                            101402 non-null  float64
 8   long                           101402 non-null  float64
 9   country                        100884 non-null  object
 10  country code                   101288 non-null  object
 11  instant_bookable               101314 non-null  object
 12  cancellation_policy            101340 non-null  object
 13  room type                      101410 non-null  object
 14  Construction year              101210 non-null  float64
 15  price                          101171 non-null  float64
 16  service fee                    101142 non-null  float64
 17  minimum nights                 101016 non-null  float64
 18  number of reviews              101228 non-null  float64
 19  last review                    101410 non-null  datetime64[ns]
 20  reviews per month              101410 non-null  float64
 21  review rate number              101103 non-null  float64
 22  calculated host listings count  101092 non-null  float64
 23  availability 365                100990 non-null  float64
dtypes: datetime64[ns](1), float64(11), int64(2), object(10)
memory usage: 19.3+ MB
```

9 Descriptive statistics

[25]:
```
df.describe()
```

[25]:
```
                 id       host id            lat           long  \
count  1.014100e+05  1.014100e+05  101402.000000  101402.000000
mean   2.920959e+07  4.926155e+10      40.728082     -73.949663
min    1.001254e+06  1.236005e+08      40.499790     -74.249840
25%    1.507574e+07  2.459183e+10      40.688730     -73.982570
50%    2.922911e+07  4.912069e+10      40.722300     -73.954440
75%    4.328308e+07  7.399747e+10      40.762750     -73.932340
max    5.736742e+07  9.876313e+10      40.916970     -73.705220
std    1.626820e+07  2.853703e+10       0.055850       0.049474

       Construction year          price    service fee  minimum nights  \
count      101210.000000  101171.000000  101142.000000   101016.000000
mean         2012.486908     625.381008     125.043998        8.113744
min          2003.000000      50.000000      10.000000    -1223.000000
25%          2007.000000     340.000000      68.000000        2.000000
50%          2012.000000     625.000000     125.000000        3.000000
75%          2017.000000     913.000000     183.000000        5.000000
max          2022.000000    1200.000000     240.000000     5645.000000
std             5.765130     331.609111      66.313374       30.378014

       number of reviews                    last review  reviews per month  \
count      101228.000000                         101410      101410.000000
mean           27.511854  2018-05-15 21:26:08.721033728           1.163207
min             0.000000            2012-07-11 00:00:00           0.000000
25%             1.000000            2017-07-30 00:00:00           0.090000
50%             7.000000            2019-05-23 00:00:00           0.480000
75%            31.000000            2019-07-01 00:00:00           1.710000
max          1024.000000            2058-06-16 00:00:00          90.000000
std            49.549258                            NaN           1.683708

       review rate number  calculated host listings count  availability 365
count       101103.000000                   101092.000000     100990.000000
mean             3.278558                        7.948463        141.164660
min              1.000000                        1.000000        -10.000000
25%              2.000000                        1.000000          3.000000
50%              3.000000                        1.000000         96.000000
75%              4.000000                        2.000000        269.000000
```

```
max                5.000000                            332.000000        3677.000000
std                1.285369                             32.328974         135.419199
```

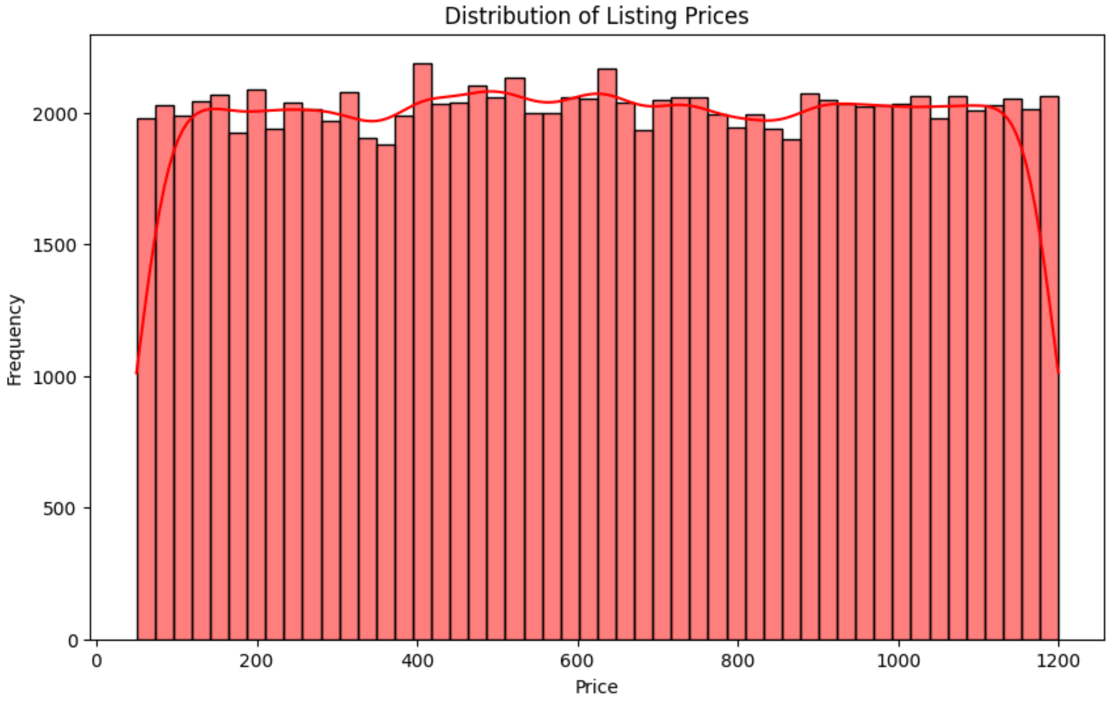
10 Visualization

11 what is the distribution of listing prices

[30]:

```python
#Visualization
#what is the distribution of listing prices

plt.figure(figsize=(10,6))
sns.histplot(df['price'],bins=50,kde=True,color='red')
plt.title('Distribution of Listing Prices')
plt.xlabel('Price')
plt.ylabel('Frequency')
plt.show()
```



The histogram shows a fairly even distribution of listing prices across different price ranges, indicating no particular concentration of listings in any specific price range. The KDE line helps visualize this even spread more clearly, confirming that the dataset contains listings with a wide variety of prices

12 Room Type Analysis

13 How are different room types didtributed

[32]:

```
df['room type']
```

[32]:

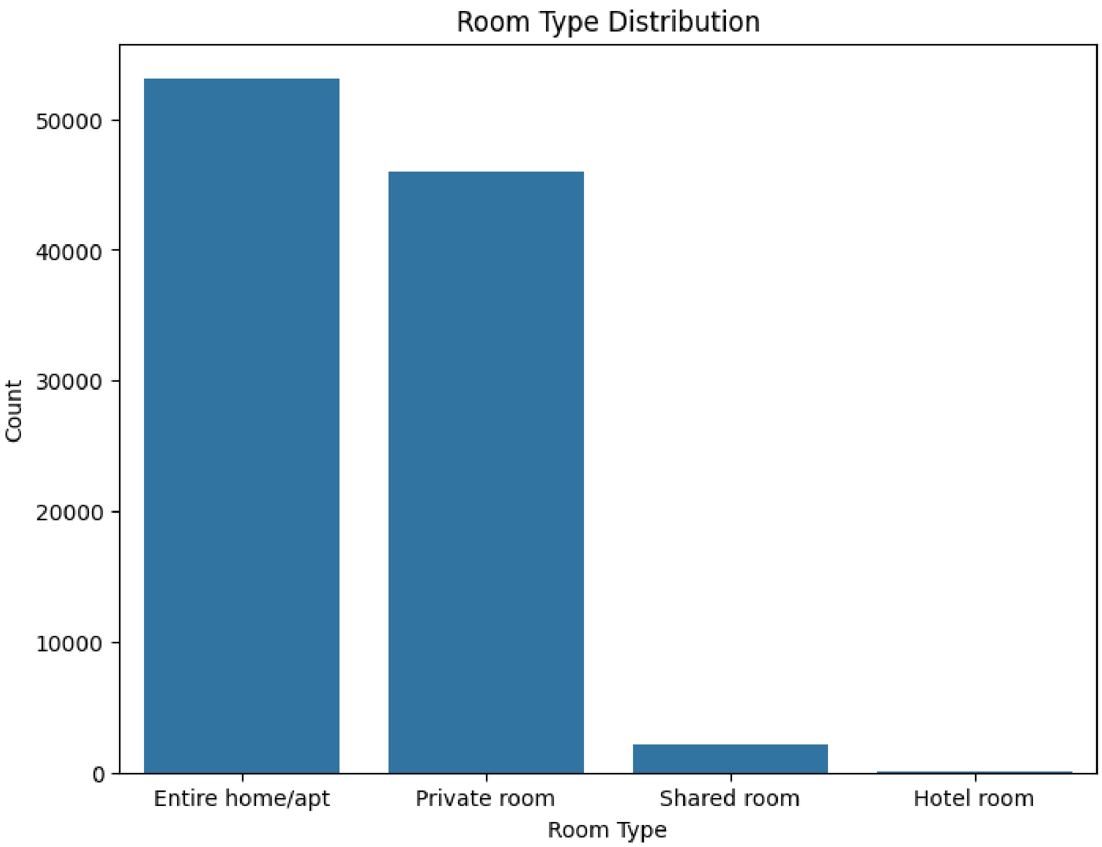
```
0             Private room
1          Entire home/apt
2             Private room
4          Entire home/apt
5          Entire home/apt
               …
102053        Private room
102054        Private room
102055     Entire home/apt
102056        Private room
102057     Entire home/apt
Name: room type, Length: 101410, dtype: object
```

[33]:

```
plt.figure(figsize=(8,6))
sns.countplot(data=df,x='room type',order=df['room type'].value_counts().index)
plt.title('Room Type Distribution')
plt.xlabel('Room Type')
plt.ylabel('Count')
```

[33]:

```
Text(0, 0.5, 'Count')
```

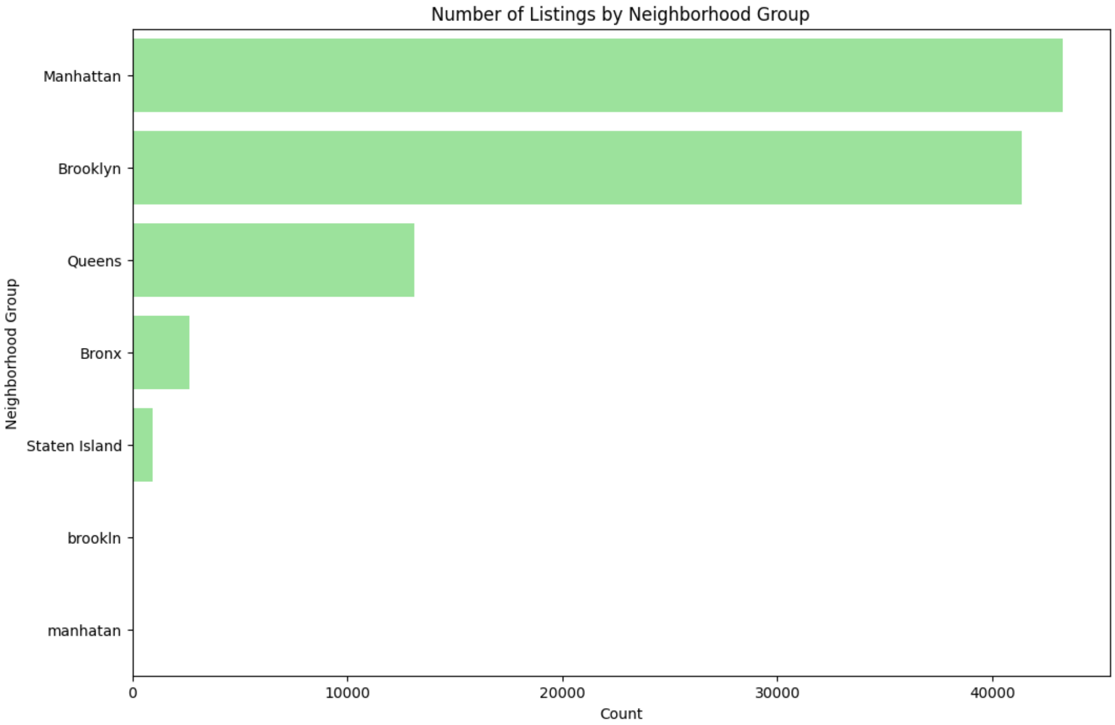


The count plot shows a clear distribution of the different room types available in the Airbnb dataset. The majority of listings are for 'Entire home/apt' and 'Private room', with 'Shared room' and 'Hotel room' being much less common. This insight can be useful for understanding the availability and popularity of different types of accommodations on Airbnb.

14 Neighborhood Analysis

15 Examine how listings are distributed across different neighborhoods.

[46]:
```
plt.figure(figsize=(12, 8))
sns.countplot(y='neighbourhood group', data=df,color="lightgreen" ,␣
 ↪order=df['neighbourhood group'].value_counts().index)
plt.title('Number of Listings by Neighborhood Group')
plt.xlabel('Count')
plt.ylabel('Neighborhood Group')
plt.show()
```

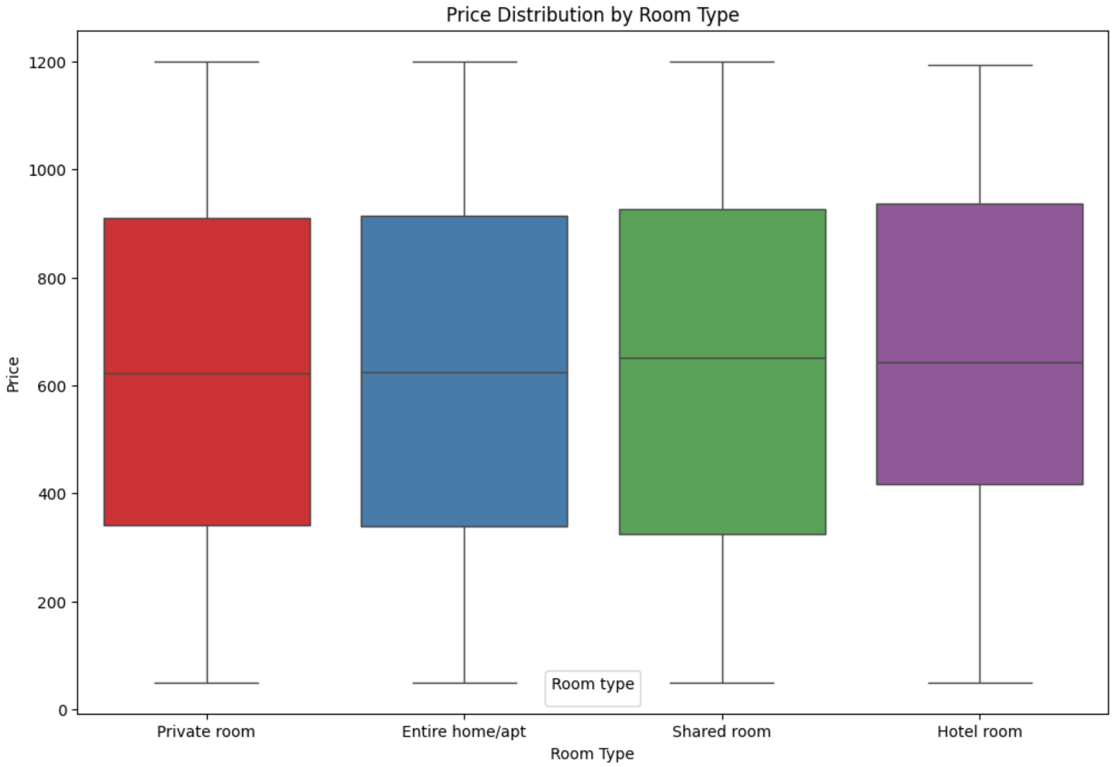


The count plot shows a clear distribution of the number of listings across different neighborhood groups. Manhattan and Brooklyn dominate the listings, suggesting they are prime locations for Airbnb. Queens, Bronx, and Staten Island have fewer listings, indicating less availability or popularity

16 what is the relationship between price and room type

[57]:
```
plt.figure(figsize=(12, 8))
sns.boxplot(x='room type', y='price', data=df,hue='room type', palette='Set1')
plt.title('Price Distribution by Room Type')
plt.xlabel('Room Type')
plt.ylabel('Price')
plt.legend(title='Room type')
plt.show()
```

```
/tmp/ipython-input-4062271688.py:6: UserWarning: No artists with labels found to
put in legend.  Note that artists whose label start with an underscore are
ignored when legend() is called with no argument.
  plt.legend(title='Room type')
```

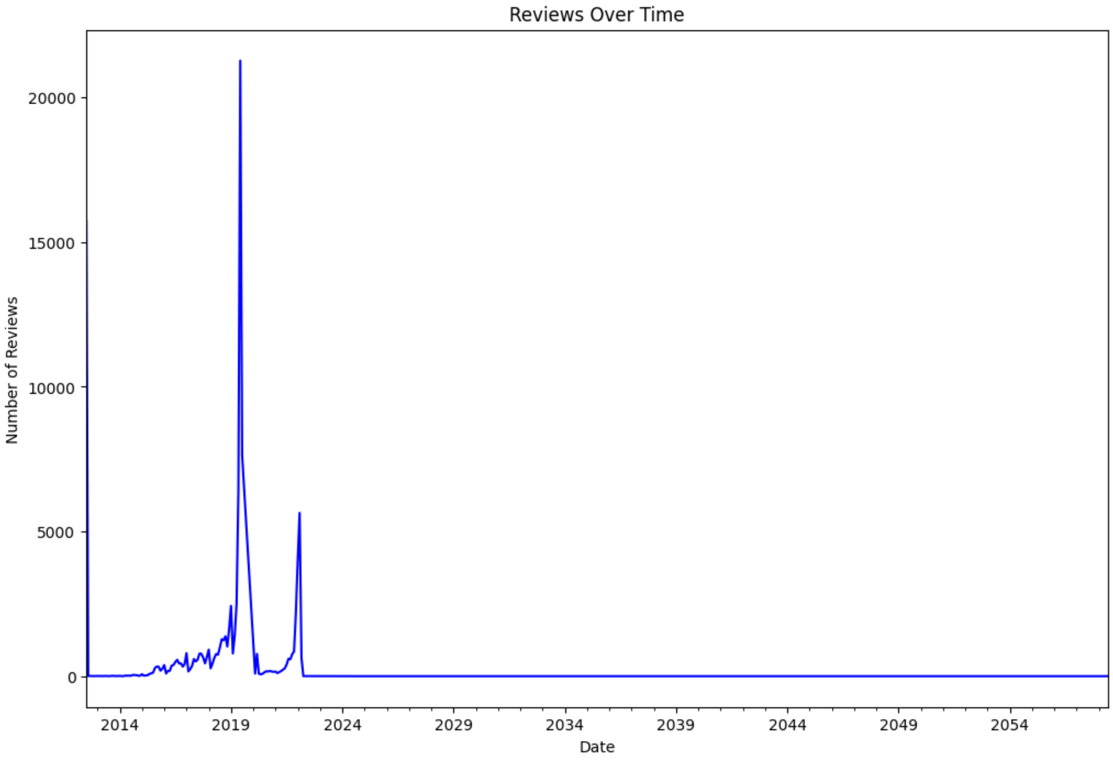


Price vs. Room Type The box plot provides a detailed view of how prices vary across different room types in the Airbnb dataset. It shows that while ‘Shared room’ tends to have lower prices, ‘Private room’, ‘Entire home/apt’, and ‘Hotel room’ have higher and more varied price ranges. This visualization helps in understanding the pricing dynamics for different types of accommodations on Airbnb

Reviews Over Time # the number of reviews changed over with time

[58]:
```
df['last review'] = pd.to_datetime(df['last review'])
reviews_over_time=df.groupby(df['last review'].dt.to_period('M')).size()

plt.figure(figsize=(12, 8))
reviews_over_time.plot(kind='line', color='blue')
plt.title('Reviews Over Time')
plt.xlabel('Date')
plt.ylabel('Number of Reviews')
plt.show()
```



The line plot provides a clear visualization of the number of reviews over time. It helps identify trends and patterns in review activity, such as periods of high or low activity. This information can be useful for understanding the dynamics of user engagement and the popularity of Airbnb listings over time. The significant spikes and drops in reviews might be worth further investigation to understand the underlying causes, such as changes in Airbnb policies, market conditions, or external events.