IBM SkillsBuild Capstone Project - Data Analytics

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- Project Name: IBM SkillsBuild - AirBnB Data Exploration and Visualisation
- Data: /kaggle/input/airbnbopendata/Airbnb_Open_Data.csv
- GitHub Link: https://github.com/GinnyBrown/IBM-SkillsBuild-Capstone-Project-AirBnB

Task 1: Data Loading

1. Read the csv file and load it into a pandas dataframe.
2. Display the first five rows of your dataframe.
3. Display the data types of the columns.

[85]:
```
# Importing the libraries
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import seaborn as sns
```

[86]:
```
# Import the data
import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join('Airbnb_Open_Data.csv'))
```

```
Airbnb_Open_Data.csv
```

[87]:
```
# 1. Read the csv file and load it into a pandas dataframe.
airbnb = pd.read_csv('/kaggle/input/airbnbopendata/Airbnb_Open_Data.csv', low_memory=False)
```

[88]:
```
# 2. Display the first five rows of your dataframe.
pd.set_option('display.max_columns', None)
airbnb.head()
```

[88…]

	id	NAME	host id	host_identity_verified	host name	neighbourhood group	neighbourhood	lat	long	country	country code	instant_bookable	cancellation_policy	room type	Cons
0	1001254	Clean & quiet apt home by the park	80014485718	unconfirmed	Madaline	Brooklyn	Kensington	40.64749	-73.97237	United States	US	False	strict	Private room	
1	1002102	Skylit Midtown Castle	52335172823	verified	Jenna	Manhattan	Midtown	40.75362	-73.98377	United States	US	False	moderate	Entire home/apt	
2	1002403	THE VILLAGE OF HARLEM....NEW YORK !	78829239556	NaN	Elise	Manhattan	Harlem	40.80902	-73.94190	United States	US	True	flexible	Private room	
3	1002755	NaN	85098326012	unconfirmed	Garry	Brooklyn	Clinton Hill	40.68514	-73.95976	United States	US	True	moderate	Entire home/apt	
4	1003689	Entire Apt: Spacious Studio/Loft by central park	92037596077	verified	Lyndon	Manhattan	East Harlem	40.79851	-73.94399	United States	US	False	moderate	Entire home/apt	

[89]:
```
# Looking at the columns
airbnb.columns
```

```
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')
```

[90]:
```
# Summary of the data
airbnb.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
```

[91]:
```
# 3. Display the data types of the columns.
airbnb.dtypes
```

```
id                                int64
NAME                             object
host id                           int64
host_identity_verified           object
host name                        object
neighbourhood group              object
neighbourhood                    object
lat                             float64
long                            float64
country                          object
country code                     object
instant_bookable                 object
cancellation_policy              object
room type                        object
Construction year               float64
price                            object
service fee                      object
minimum nights                  float64
number of reviews               float64
last review                      object
reviews per month               float64
review rate number              float64
calculated host listings count  float64
availability 365                float64
house_rules                      object
license                          object
dtype: object
```

Task 2a: Data Cleaning (Any Tool)

1. Drop some of the unwanted columns. These include host id, id, country and country code from the dataset.
2. State the reason for not including these columns for your Data Analytics.

If using Python for this exercise, please include the code in the cells below. If using any other tool, please include screenshots before and after the elimination of the columns.

```
[92]: airbnb.head()
```

[92…

	id	NAME	host id	host_identity_verified	host name	neighbourhood group	neighbourhood	lat	long	country	country code	instant_bookable	cancellation_policy	room type	Cons
0	1001254	Clean & quiet apt home by the park	80014485718	unconfirmed	Madaline	Brooklyn	Kensington	40.64749	-73.97237	United States	US	False	strict	Private room	
1	1002102	Skylit Midtown Castle	52335172823	verified	Jenna	Manhattan	Midtown	40.75362	-73.98377	United States	US	False	moderate	Entire home/apt	
2	1002403	THE VILLAGE OF HARLEM....NEW YORK !	78829239556	NaN	Elise	Manhattan	Harlem	40.80902	-73.94190	United States	US	True	flexible	Private room	
3	1002755	NaN	85098326012	unconfirmed	Garry	Brooklyn	Clinton Hill	40.68514	-73.95976	United States	US	True	moderate	Entire home/apt	
4	1003689	Entire Apt: Spacious Studio/Loft by central park	92037596077	verified	Lyndon	Manhattan	East Harlem	40.79851	-73.94399	United States	US	False	moderate	Entire home/apt	

```
[93]: # 1. Drop some of the unwanted columns. These include host id, id, country and country code from the dataset.
airbnb.drop(columns=['host id','id', 'country', 'country code'], axis=1, inplace=True)
```

```
[94]: airbnb.head()
```

[94…

	NAME	host_identity_verified	host name	neighbourhood group	neighbourhood	lat	long	instant_bookable	cancellation_policy	room type	Construction year	price	service fee	minimum nights	number of reviews
0	Clean & quiet apt home by the park	unconfirmed	Madaline	Brooklyn	Kensington	40.64749	-73.97237	False	strict	Private room	2020.0	$966	$193	10.0	9.0
1	Skylit Midtown Castle	verified	Jenna	Manhattan	Midtown	40.75362	-73.98377	False	moderate	Entire home/apt	2007.0	$142	$28	30.0	45.0
2	THE VILLAGE OF HARLEM....NEW YORK !	NaN	Elise	Manhattan	Harlem	40.80902	-73.94190	True	flexible	Private room	2005.0	$620	$124	3.0	0.0
3	NaN	unconfirmed	Garry	Brooklyn	Clinton Hill	40.68514	-73.95976	True	moderate	Entire home/apt	2005.0	$368	$74	30.0	270.0
4	Entire Apt: Spacious Studio/Loft by central park	verified	Lyndon	Manhattan	East Harlem	40.79851	-73.94399	False	moderate	Entire home/apt	2009.0	$204	$41	10.0	9.0

```
[95]: # 2. State the reason for not including these columns for your Data Analytics.
'''I am not including host id, or id because they are unique ids and I am going to be looking at the overall data rather than identifying individual prop
```

[95…

```
'I am not including host id, or id because they are unique ids and I am going to be looking at the overall data rather than identifying individual properties. I am n
ot including country or country code because the data is a sample rather than the population of Air BnB data because of this the country and country code are the sam
e, United States and US. '
```

Task 2b: Data Cleaning (Python)

1. Check for missing values in the dataframe and display the count in ascending order. If the values are missing, impute the values as per the datatype of the columns.
2. Check whether there are any duplicate values in the dataframe and, if present, remove them.
3. Display the total number of records in the dataframe before and after removing the duplicates.

[96]:
```
# Display the data types of the columns.
airbnb.dtypes
```

[96…
```
NAME                              object
host_identity_verified            object
host name                         object
neighbourhood group               object
neighbourhood                     object
lat                              float64
long                             float64
instant_bookable                  object
cancellation_policy               object
room type                         object
Construction year                float64
price                             object
service fee                       object
minimum nights                   float64
number of reviews                float64
last review                       object
reviews per month                float64
review rate number               float64
calculated host listings count   float64
availability 365                 float64
house_rules                       object
license                           object
dtype: object
```

[97]:
```
# 1. Check for missing values in the dataframe and display the count in ascending order.
airbnb.isnull().sum().sort_values
```

[97…
```
<bound method Series.sort_values of NAME                              250
host_identity_verified             289
host name                          406
neighbourhood group                 29
neighbourhood                       16
lat                                  8
long                                 8
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>
```

[98]:
```
# If the values are missing, impute the values as per the datatype of the columns.
for col in airbnb.columns:
    if airbnb[str(col)].dtype == 'object':
        print(col)
        airbnb[str(col)].fillna(value=airbnb[str(col)].mode()[0],inplace=True)
    elif airbnb[str(col)].dtype == 'int':
        print(col)
        airbnb[str(col)].fillna(value=airbnb[str(col)].median(),inplace=True)
    else :
        print(col)
        airbnb[str(col)].fillna(value=airbnb[str(col)].median(),inplace=True)
```

```
NAME
host_identity_verified
host name
neighbourhood group
neighbourhood
lat
long
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
```

[99]:
```
airbnb.isnull().sum().sort_values(ascending=0)
```

[99…
```
NAME                              0
host_identity_verified            0
house_rules                       0
availability 365                  0
calculated host listings count    0
review rate number                0
reviews per month                 0
last review                       0
number of reviews                 0
minimum nights                    0
service fee                       0
price                             0
Construction year                 0
room type                         0
cancellation_policy               0
instant_bookable                  0
long                              0
lat                               0
neighbourhood                     0
neighbourhood group               0
host name                         0
license                           0
dtype: int64
```

[100]:
```
# 2. Check whether there are any duplicate values in the dataframe and, if present, remove them.
airbnb.duplicated().sum()
```

[10…] 3461

[101]:
```
# 3. Display the total number of records in the dataframe before
airbnb.shape
```

[10…] (102599, 22)

[102]:
```
# 2. Remove dupliucate values/
airbnb.drop_duplicates(inplace=True)
```

[103]:
```
# 3. Display the total number of records in the dataframe after removing the duplicates.
airbnb.shape
```

[10…] (99138, 22)

Task 3: Data Transformation (Any Tool)

1. Rename the column availability 365 to days_booked
2. Convert all column names to lowercase and replace the spaces in the column names with an underscore "_".
3. Remove the dollar sign and comma from the columns price and service_fee. If necessary, convert these two columns to the appropriate data type.

[104]:
```
# Looking at the columns
airbnb.columns
```

[10…]
```
Index(['NAME', 'host_identity_verified', 'host name', 'neighbourhood group',
       'neighbourhood', 'lat', 'long', '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')
```

[105]:
```
# 1. Rename the column availability 365 to days_booked
airbnb.rename(columns={'availability 365':'days_booked'}, inplace=True)
```

[106]:
```
airbnb.columns
```

[10…]
```
Index(['NAME', 'host_identity_verified', 'host name', 'neighbourhood group',
       'neighbourhood', 'lat', 'long', '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', 'days_booked', 'house_rules',
       'license'],
      dtype='object')
```

[107]:
```
# 2.Convert all column names to lowercase and replace the spaces in the column names with an underscore "_".
airbnb.columns = [col.lower(). replace(" ", "_") for col in airbnb.columns]
```

[108]:
```
airbnb.columns
```

[10…
```
Index(['name', 'host_identity_verified', 'host_name', 'neighbourhood_group',
       'neighbourhood', 'lat', 'long', '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', 'days_booked', 'house_rules',
       'license'],
      dtype='object')
```

[109]:
```
# Display the data types of the columns.
airbnb.dtypes
```

[10…
```
name                              object
host_identity_verified            object
host_name                         object
neighbourhood_group               object
neighbourhood                     object
lat                              float64
long                             float64
instant_bookable                    bool
cancellation_policy               object
room_type                         object
construction_year                float64
price                             object
service_fee                       object
minimum_nights                   float64
number_of_reviews                float64
last_review                       object
reviews_per_month                float64
review_rate_number               float64
calculated_host_listings_count   float64
days_booked                      float64
house_rules                       object
license                           object
dtype: object
```

[110]:
```
airbnb[['price', 'service_fee']].head()
```

[11…

	price	service_fee
0	$966	$193
1	$142	$28
2	$620	$124
3	$368	$74
4	$204	$41

[111]:
```
# 3. Remove the dollar sign and comma from the columns price and service_fee.
# If necessary, convert these two columns to the appropriate data type.

airbnb["price"] = airbnb["price"].astype(str)
airbnb["price"] = airbnb["price"].str.strip("$").str.replace(",", "")
airbnb["price"] = airbnb["price"].astype(float)
airbnb["service_fee"] = airbnb["service_fee"].astype(str)
airbnb["service_fee"] = airbnb["service_fee"].str.strip("$")
airbnb["service_fee"] = airbnb["service_fee"].astype(float)
airbnb["construction_year"] = airbnb["construction_year"].astype(int)
airbnb["days_booked"] = airbnb["days_booked"].astype(int)
airbnb["minimum_nights"] = airbnb["minimum_nights"].astype(int)
```

[112]:
```
airbnb.dtypes
```

[11…
```
name                              object
host_identity_verified            object
host_name                         object
neighbourhood_group               object
neighbourhood                     object
lat                              float64
long                             float64
instant_bookable                    bool
cancellation_policy               object
room_type                         object
construction_year                  int64
price                            float64
service_fee                      float64
minimum_nights                     int64
number_of_reviews                float64
last_review                       object
reviews_per_month                float64
review_rate_number               float64
calculated_host_listings_count   float64
days_booked                        int64
house_rules                       object
license                           object
dtype: object
```

[113]:
```
airbnb[['price', 'service_fee']].head()
```

[11…

	price	service_fee
0	966.0	193.0
1	142.0	28.0
2	620.0	124.0
3	368.0	74.0
4	204.0	41.0

[120]:
```
# Correcting spelling errors in the Neighbourhood Group

airbnb["neighbourhood_group"] = airbnb["neighbourhood_group"].astype(str)
airbnb["neighbourhood_group"] = airbnb["neighbourhood_group"].str.replace("brookln", "Brooklyn")
airbnb["neighbourhood_group"] = airbnb["neighbourhood_group"].str.replace("manhatan", "Manhattan")
```

Task 4: Exploratory Data Analysis

1. List the count of various room types available in the dataset.
2. Which room type has the most strict cancellation policy?
3. List the average price per neighbourhood group, and highlight the most expensive neighbourhood to rent from.

[114]:
```
# 1. List the count of various room types avaliable in the dataset.

airbnb['room_type'].value_counts()
```

[11…
```
room_type
Entire home/apt    51987
Private room       44887
Shared room         2149
Hotel room           115
Name: count, dtype: int64
```

[115]:
```
# 2. Which room type has the most strict cancellation policy?

airbnb['cancellation_policy'].unique()
```

[11…
```
array(['strict', 'moderate', 'flexible'], dtype=object)
```

+ Code + Markdown

[116]:
```
airbnb_cancellation_policy_strict = airbnb[airbnb['cancellation_policy']=='strict']
```

[117]:
```
airbnb_cancellation_policy_strict.head()
```

[11…

	name	host_identity_verified	host_name	neighbourhood_group	neighbourhood	lat	long	instant_bookable	cancellation_policy	room_type	construction_year	price	service_f
0	Clean & quiet apt home by the park	unconfirmed	Madaline	Brooklyn	Kensington	40.64749	-73.97237	False	strict	Private room	2020	966.0	193
8	Large Furnished Room Near B'way	verified	Evelyn	Manhattan	Hell's Kitchen	40.76489	-73.98493	True	strict	Private room	2005	1018.0	204
9	Cozy Clean Guest Room - Family Apt	unconfirmed	Carl	Manhattan	Upper West Side	40.80178	-73.96723	False	strict	Private room	2015	291.0	58
12	Central Manhattan/near Broadway	verified	Michael	Manhattan	Hell's Kitchen	40.76076	-73.98867	False	strict	Private room	2008	714.0	143
24	CBG Helps Haiti Rm #2	unconfirmed	Charlotte	Brooklyn	Park Slope	40.68001	-73.97865	False	strict	Private room	2005	816.0	163

[118]:
```
airbnb_cancellation_policy_strict['room_type'].value_counts()
```

```
room_type
Entire home/apt    17238
Private room       14936
Shared room          718
Hotel room            34
Name: count, dtype: int64
```

[119]:
```
# 2. Which room type has the most strict cancellation policy?
'''The Entire home/apt room type has the most strict cancellation policy.'''
```

```
'The Entire home/apt room type has the most strict cancellation policy.'
```

[121]:
```
airbnb_cancellation_policy_strict['neighbourhood_group'].value_counts()
```

```
neighbourhood_group
Manhattan        13981
Brooklyn         13472
Queens            4319
Bronx              857
Staten Island      297
Name: count, dtype: int64
```

[122]:
```
# 3. List the average price per neighborhood group, and highlight the most expensive neighborhood to rent from.

airbnb_average_price_per_neighborhood = airbnb['price'].groupby(airbnb['neighbourhood_group']).mean().sort_values(ascending=False)
print(airbnb_average_price_per_neighborhood)
```

```
neighbourhood_group
Queens           628.668822
Brooklyn         625.470501
Bronx            625.271511
Staten Island    625.060870
Manhattan        621.662326
Name: price, dtype: float64
```

[123]:
```
# 3. List the average price per neighborhood group, and highlight the most expensive neighborhood to rent from.
'''Queens is the most expensive neighbourhood_group with a average price of £628.69.'''
```

```
'Queens is the most expensive neighbourhood_group with a average price of £628.69.'
```

[201]:
```
n and brookln) and two Manhattan (Manhattan and manhatan). I have gonne back and added code into Task 3 to replace brookln with Brooklyn and manhatan wit
```

```
'This has highlighted an error in the data as there are two Brooklyn (Brooklyn and brookln) and two Manhattan (Manhattan and manhatan). I have gonne back and added c
ode into Task 3 to replace brookln with Brooklyn and manhatan with Manhattan'
```

+ Code + Markdown

[125]:
```
airbnb_max_price_per_neighborhood = airbnb['price'].groupby(airbnb['neighbourhood_group']).max().sort_values(ascending=False)
print(airbnb_max_price_per_neighborhood)
```

```
neighbourhood_group
Bronx            1200.0
Brooklyn         1200.0
Manhattan        1200.0
Queens           1200.0
Staten Island    1200.0
Name: price, dtype: float64
```

[126]:
```
'''Bronx, Brooklyn, Manhattan, Queens and Staten Island all have an equal most expensive price at £1200.'''
```

```
'Bronx, Brooklyn, Manhattan, Queens and Staten Island all have an equal most expensive price at £1200.'
```

Task 5a: Data Visualization

1. List the top 10 neighbourhoods in the increasing order of their price with the help of a horizontal bar graph. Which is the cheapest neighbourhood.
2. List the neighbourhoods which offer short term rentals within 10 days. Illustrate with a bar graph
3. List the prices with respect to room type using a bar graph and also state your inferences.
4. Create a pie chart that shows distribution of booked days for each neighbourhood group .Which neighbourhood has the highest booking percentage.

[127]:
```
# 1. List the top 10 neighbourhoods in the increasing order of their price with the help of a horizontal bar graph.
# Which is the cheapest neighbourhood?

airbnb_top_10_neighbourhoods_sum = airbnb['price'].groupby(airbnb['neighbourhood']).sum().sort_values(ascending=False)
print(airbnb_top_10_neighbourhoods_sum)
```

```
neighbourhood
Bedford-Stuyvesant            4793673.0
Williamsburg                  4663153.0
Harlem                        3317743.0
Bushwick                      3038762.0
Hell's Kitchen                2394881.0
                                ...
Glen Oaks                      1101.0
Chelsea, Staten Island         1042.0
Bay Terrace, Staten Island      918.0
Rossville                       655.0
Lighthouse Hill                 323.0
Name: price, Length: 224, dtype: float64
```

[128]:
```
airbnb_top_10_neighbourhoods_sum.head(10)
```

[12…
```
neighbourhood
Bedford-Stuyvesant    4793673.0
Williamsburg          4663153.0
Harlem                3317743.0
Bushwick              3038762.0
Hell's Kitchen        2394881.0
Upper West Side       2306230.0
Upper East Side       2177795.0
East Village          2081467.0
Midtown               1985830.0
Crown Heights         1943244.0
Name: price, dtype: float64
```

[129]:
```
# 1. List the top 10 neighbourhoods in the increasing order of their price with the help of a horizontal bar graph.

airbnb_top_10_neighbourhoods_sum.head(10).plot(kind='barh', color={'green'})
plt.xlabel('Price $')
plt.ylabel('Neighbourhood')
plt.title('Top 10 Price sum vs Neighbourhoods')
plt.show()
```

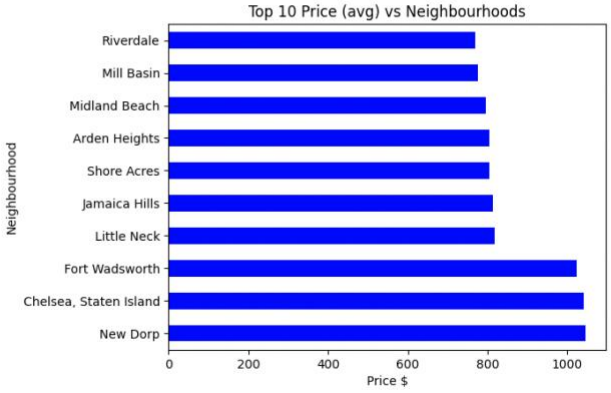
[130]:
```
airbnb_top_10_neighbourhoods_mean = airbnb['price'].groupby(airbnb['neighbourhood']).mean().sort_values(ascending=False)
print(airbnb_top_10_neighbourhoods_mean)
```

```
neighbourhood
New Dorp                      1045.333333
Chelsea, Staten Island        1042.000000
Fort Wadsworth                1024.000000
Little Neck                    817.750000
Jamaica Hills                  812.904762
                                  ...
Rossville                      327.500000
Breezy Point                   309.888889
Spuyten Duyvil                 307.000000
Bay Terrace, Staten Island     306.000000
Lighthouse Hill                107.666667
Name: price, Length: 224, dtype: float64
```

[131]:
```
airbnb_top_10_neighbourhoods_mean.head(10)
```

[13…
```
neighbourhood
New Dorp                1045.333333
Chelsea, Staten Island  1042.000000
Fort Wadsworth          1024.000000
Little Neck              817.750000
Jamaica Hills            812.904762
Shore Acres              805.142857
Arden Heights            804.888889
Midland Beach            796.176471
Mill Basin               775.142857
Riverdale                768.736842
Name: price, dtype: float64
```

[132]:
```
airbnb_top_10_neighbourhoods_mean.head(10).plot(kind='barh', color={'blue'})
plt.xlabel('Price $')
plt.ylabel('Neighbourhood')
plt.title('Top 10 Price (avg) vs Neighbourhoods')
plt.show()
```



[133]:
```
# Which is the cheapest neighbourhood?
'''The cheapest neighbourhood out of the Top 10 by Sum is Crown Heights if you go by average price the cheapest neigbourhood out of the Top 10 is Riverda
```

[13…
```
'The cheapest neighbourhood out of the Top 10 by Sum is Crown Heights if you go by average price the cheapest neigbourhood out of the Top 10 is Riverdale. The cheape
st out of all the nieghbourhoods for both the sum and the average is Lighthouse Hill.'
```

[134]:
```
#  2. List the neighbourhoods which offer short term rentals within 10 days. Illustrate with a bar graph

airbnb['minimum_nights'].unique()
```

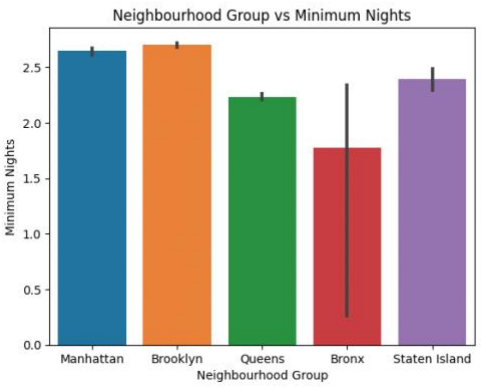
[13…
```
array([   10,    30,     3,    45,     2,     1,     5,     4,    90,
           7,    14,    60,   180,     9,    31,     6,    15,    29,
           8,    47,    81,   144,   371,   149,   273,   131,   275,
         323,    59,    99,   268,   -10,   189,   340,   128,   350,
         166,   110,    57,   142,   366,    28,   200,    50,   399,
          17,    11,   452,    25,    13,  3455,    -5,    21,    27,
          18,   365,    -1,    20,   -12,    40,    44,   398,    -2,
          65,    -3,    55,   120,   122,    19,   240,    88,   115,
         150,   370,    16,    80,   181,    26,   265,   300,   185,
         360,    56,    12,    70,    39,    24,    32,  1000,   270,
          22,    75,   250,    62,    23,  1250,   364,    74,   198,
         100,   500,    43,    35,    91,   480,    53,   160,   999,
         186,    68,    93,    87,   183,   299,   175,    98,   133,
         354,    42,    33,    37,   225,   400,   105,   184,   153,
         134,   222,    58,   210,   182,   954,  5645,  2645, -1223,
        -365,  -200,   114,    85,    36,    48,   155,   307,   129,
         145,    64,   333,   119,  -125,   125,    34,   458,   825])
```

[135]:
```
airbnb_short_term_rentals = airbnb[airbnb['minimum_nights']<10]
airbnb_short_term_rentals['neighbourhood_group'].value_counts()
```

[13…
```
neighbourhood_group
Brooklyn         34343
Manhattan        32788
Queens           10970
Bronx             2367
Staten Island      829
Name: count, dtype: int64
```

[198]:
```
sns.barplot(x='neighbourhood_group',
            y='minimum_nights',
            data=airbnb_short_term_rentals).set(title='Neighbourhood Group vs Minimum Nights')
plt.xlabel("Neighbourhood Group")
plt.ylabel("Minimum Nights")
```

[19…
```
Text(0, 0.5, 'Minimum Nights')
```



[137]:
```
# 3. List the prices with respect to room type using a bar graph and also state your inferences.

airbnb_prices_by_room_type = airbnb.groupby(['room_type']).agg(mean_price=('price', 'mean'))
```

[138]:
```
airbnb.reset_index()
```

[13…

	index	name	host_identity_verified	host_name	neighbourhood_group	neighbourhood	lat	long	instant_bookable	cancellation_policy	room_type	construction_year	pri
0	0	Clean & quiet apt home by the park	unconfirmed	Madaline	Brooklyn	Kensington	40.64749	-73.97237	False	strict	Private room	2020	966
1	1	Skylit Midtown Castle	verified	Jenna	Manhattan	Midtown	40.75362	-73.98377	False	moderate	Entire home/apt	2007	142
2	2	THE VILLAGE OF HARLEM....NEW YORK !	unconfirmed	Elise	Manhattan	Harlem	40.80902	-73.94190	True	flexible	Private room	2005	620
3	3	Home away from home	unconfirmed	Garry	Brooklyn	Clinton Hill	40.68514	-73.95976	True	moderate	Entire home/apt	2005	368
4	4	Entire Apt: Spacious Studio/Loft by central park	verified	Lyndon	Manhattan	East Harlem	40.79851	-73.94399	False	moderate	Entire home/apt	2009	204
...	...	...	...	...	...	...	...	...	...	...	...	...	...
99133	102053	Cozy bright room near Prospect Park	unconfirmed	Mariam	Brooklyn	Flatbush	40.64945	-73.96108	True	moderate	Private room	2012	696
99134	102054	Private Bedroom with Amazing Rooftop View	verified	Trey	Brooklyn	Bushwick	40.69872	-73.92718	False	flexible	Private room	2012	909
99135	102055	Pretty Brooklyn One-Bedroom for 2 to 4 people	verified	Michael	Brooklyn	Bedford-Stuyvesant	40.67810	-73.90822	True	moderate	Entire home/apt	2012	387
99136	102056	Room & private bathroom in historic Harlem	unconfirmed	Shireen	Manhattan	Harlem	40.81248	-73.94317	True	strict	Private room	2012	848
99137	102057	Rosalee Stewart	verified	Stanley	Manhattan	Harlem	40.81315	-73.94747	False	flexible	Entire home/apt	2011	1128

99138 rows × 23 columns

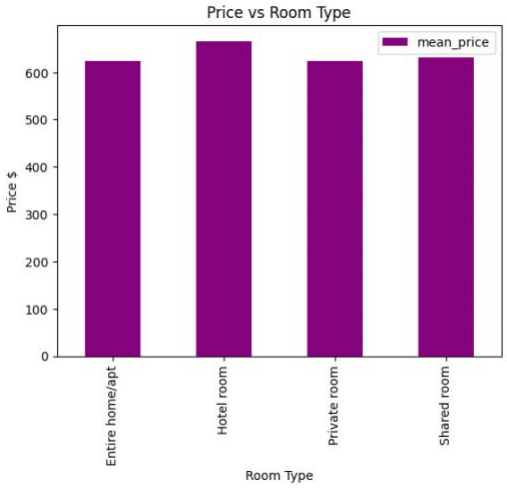
[139]:
```
airbnb_prices_by_room_type.head()
```

[13…

room_type	mean_price
Entire home/apt	624.227711
Hotel room	666.391304
Private room	623.842516
Shared room	630.912517

[140]:
```
#  3. List the prices with respect to room type using a bar graph and also state your inferences.

airbnb_prices_by_room_type.head().plot(kind='bar', color={'purple'})
plt.xlabel('Room Type')
plt.ylabel('Price $')
plt.title('Price vs Room Type')
plt.show()
```



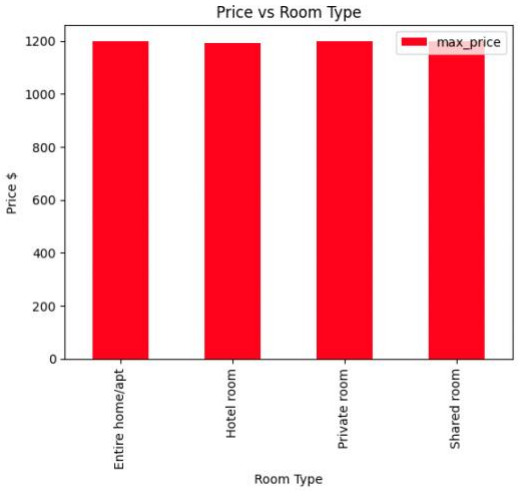
[183]:
```
airbnb_prices_by_room_type = airbnb.groupby(['room_type']).agg(max_price=('price', 'max')).reset_index()
```

[184]:
```
airbnb_prices_by_room_type.head()
```

[18…

	room_type	max_price
0	Entire home/apt	1200.0
1	Hotel room	1193.0
2	Private room	1200.0
3	Shared room	1199.0

[144]:
```
airbnb_prices_by_room_type.head().plot(kind='bar', color={'red'})
plt.xlabel('Room Type')
plt.ylabel('Price $')
plt.title('Price vs Room Type')
plt.show()
```



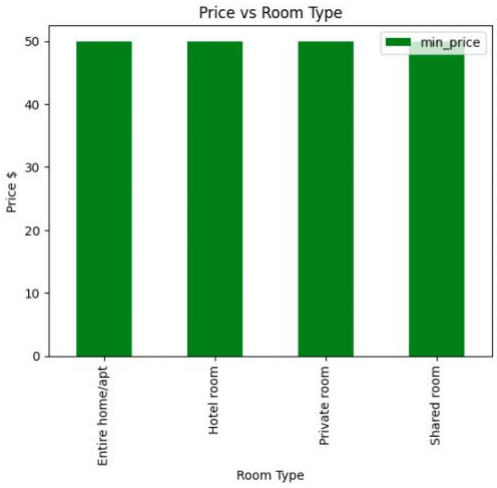
[186]:
```
airbnb_prices_by_room_type = airbnb.groupby(['room_type']).agg(min_price=('price', 'min')).reset_index()
```

[147]:
```
airbnb_prices_by_room_type.head()
```

[14…

room_type	min_price
Entire home/apt	50.0
Hotel room	50.0
Private room	50.0
Shared room	50.0

[148]:
```
airbnb_prices_by_room_type.head().plot(kind='bar', color={'green'})
plt.xlabel('Room Type')
plt.ylabel('Price $')
plt.title('Price vs Room Type')
plt.show()
```



[149]:
```
#  3. List the prices with respect to room type using a bar graph and also state your inferences.

'''Hotel rooms are more expensive on average than the other room types, the average price is $666 compared to the cheapest room type on average to rent t
```

[14…
```
'Hotel rooms are more expensive on average than the other room types, the average price is $666 compared to the cheapest room type on average to rent the Private roo
m which is $623 on average to rent. However the Entire home/appartment and Private Room have the most expensive price that could be paid at $1200. The cheapest price
that could be paid is $50 and you can get any room type for this price. '
```

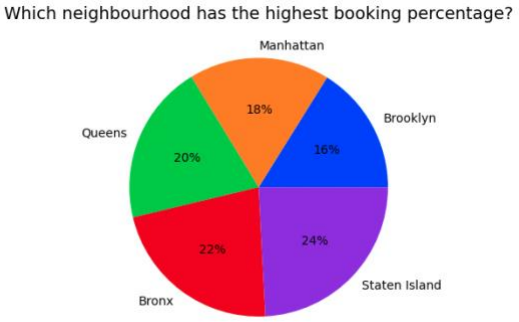
```
#  4. Create a pie chart that shows distribution of booked days for each neighbourhood group. Which neighbourhood has the highest booking percentage?

airbnb_days_booked_neighbourhood_group = airbnb['days_booked'].groupby(airbnb['neighbourhood_group']).mean().sort_values().reset_index()
print(airbnb_days_booked_neighbourhood_group)
```

```
  neighbourhood_group  days_booked
0            Brooklyn   130.763363
1           Manhattan   142.702121
2              Queens   162.424977
3               Bronx   178.993117
4       Staten Island   195.989130
```

[180]:
```
palette_color = sns.color_palette('bright')
plt.title('Which neighbourhood has the highest booking percentage?', size=14, color='black')
plt.pie(airbnb_days_booked_neighbourhood_group['days_booked'],
        labels=airbnb_days_booked_neighbourhood_group['neighbourhood_group'],
        colors=palette_color,
        autopct='%1.0f%%')
```

[18…
```
([<matplotlib.patches.Wedge at 0x7d1e099bf1f0>,
  <matplotlib.patches.Wedge at 0x7d1e099bf100>,
  <matplotlib.patches.Wedge at 0x7d1e099bfa90>,
  <matplotlib.patches.Wedge at 0x7d1e099f4160>,
  <matplotlib.patches.Wedge at 0x7d1e099f47f0>],
 [Text(0.9618279143982374, 0.5337481270078022, 'Brooklyn'),
  Text(0.005146054216595288, 1.0999879627186837, 'Manhattan'),
  Text(-1.0160101502883256, 0.4215725020813078, 'Queens'),
  Text(-0.6580950419600305, -0.8814255020973842, 'Bronx'),
  Text(0.7978290520241899, -0.7572772304421826, 'Staten Island')],
 [Text(0.5246334078535584, 0.2911353420042557, '16%'),
  Text(0.0028069386635974298, 0.5999934342101911, '18%'),
  Text(-0.554187354702723, 0.22994863749889513, '20%'),
  Text(-0.3589609319781845, -0.4807775465985732, '22%'),
  Text(0.4351794829222853, -0.4130603075139178, '24%')])
```



[152]:
```
# Which neighbourhood has the highest booking percentage?
''' Staten Island has the highest number of days booked with 24%. Brooklyn has the least with only 16%.'''
```

[15…
```
' Staten Island has the highest number of days booked with 24%. Brooklyn has the least with only 16%.'
```

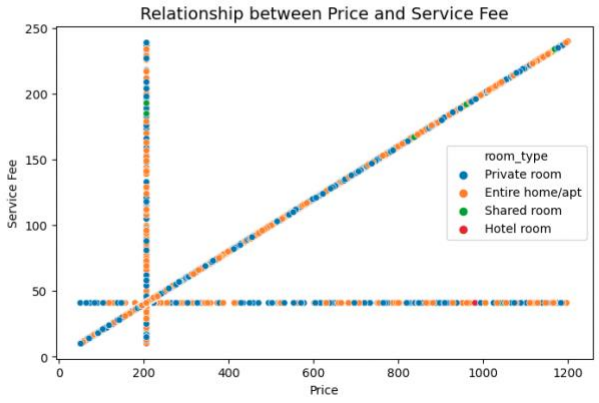
Task 5b: Data Visualization

1. Does service price and room price have an impact on each other. Illustrate this relationship with a scatter plot and state your inferences
2. Using a line graph show in which year the maximum construction of rooms took place.

[197]:
```
# 1. Does service price and room price have an impact on each other? Illustrate this relationship with a scatter plot and state your inferences

plt.figure(figsize=(8,5))
plt.title('Relationship between Price and Service Fee', size=14, color='black')
plt.xlabel("Price")
plt.ylabel("Service Fee")
sns.scatterplot(x=airbnb['price'], y=airbnb['service_fee'], hue=airbnb['room_type'], s=30)
```

[19…
```
<Axes: title={'center': 'Relationship between Price and Service Fee'}, xlabel='Price', ylabel='Service Fee'>
```



```
[154]: ''' The scatterplot shows a correlation between Price and Service Fee as the price increases so does the service fee. Although there are outliers where t
```

```
[15… ' The scatterplot shows a correlation between Price and Service Fee as the price increases so does the service fee. Although there are outliers where the service fee
is fixed/stays the same at approx $45 when the price rises and also ouliers where the price is staying the same at $200 but the service fee varies up to almost $25
0.'
```

```
[155]: airbnb.columns
```

```
[15… Index(['name', 'host_identity_verified', 'host_name', 'neighbourhood_group',
       'neighbourhood', 'lat', 'long', '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', 'days_booked', 'house_rules',
       'license'],
      dtype='object')
```

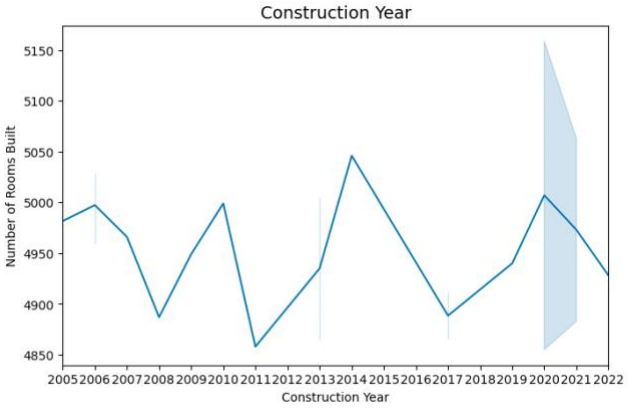
```
[156]: # 2. Using a line graph show in which year the maximum construction of rooms took place.

airbnb['construction_year_counts'] = airbnb['construction_year'].value_counts()
```

```
[157]: airbnb['construction_year'].unique()
```

```
[15… array([2020, 2007, 2005, 2009, 2013, 2015, 2004, 2008, 2010, 2019, 2018,
       2006, 2016, 2017, 2021, 2003, 2011, 2012, 2022, 2014])
```

```
[196]: fig, ax = plt.subplots()
fig.set_size_inches(8,5)
plt.title('Construction Year', size=14, color='black')
sns.lineplot(x='construction_year', y='construction_year_counts', data=airbnb, ax=ax)
ax.set_xlim(2005,2022)
ax.set_xticks(range(2005,2023))
plt.xlabel("Construction Year")
plt.ylabel("Number of Rooms Built")
plt.show()
```



Task 5c: Data Visualization

With the help of box plots illustrate the following:

1. Effect of Review Rate number on price
2. Effect of host identity verified on price

```
[159]: airbnb.columns
```

```
[15… Index(['name', 'host_identity_verified', 'host_name', 'neighbourhood_group',
       'neighbourhood', 'lat', 'long', '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', 'days_booked', 'house_rules',
       'license', 'construction_year_counts'],
      dtype='object')
```

[195]:
```
# 1. Use a box plot to illustrate the effect of Review Rate number on Price

sns.boxplot(x='review_rate_number', y='price', data=airbnb)
plt.title('Review Rate vs Price', size=14, color='black')
plt.xlabel("Review Rate Number")
plt.ylabel("Price")
```

[19… `Text(0, 0.5, 'Price')`

[161]:
```
airbnb[['review_rate_number', 'price']].head(25)
```

[16…

	review_rate_number	price
0	4.0	966.0
1	4.0	142.0
2	5.0	620.0
3	4.0	368.0
4	3.0	204.0
5	3.0	577.0
6	5.0	71.0
7	5.0	1060.0
8	3.0	1018.0
9	5.0	291.0
10	3.0	319.0
11	4.0	606.0
12	4.0	714.0
13	4.0	580.0
14	3.0	149.0
15	3.0	578.0
16	3.0	778.0
17	5.0	656.0
18	3.0	460.0
19	5.0	1095.0
20	3.0	281.0
21	3.0	477.0
22	4.0	133.0
23	3.0	1050.0
24	4.0	816.0

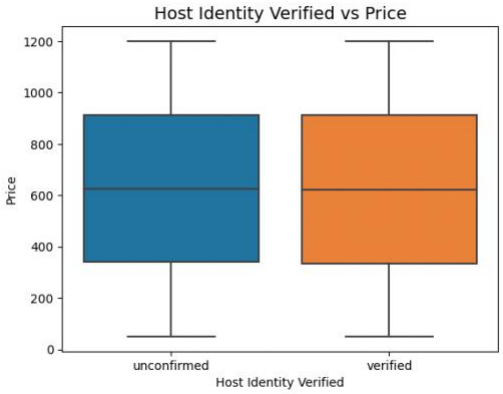
[162]:
```
''' There is no impact on price from the Review Rate. Whether a room has 1 star or 5 stars has no impact on the price. There are also no outliers.'''
```

[16… `' There is no impact on price from the Review Rate. Whether a room has 1 star or 5 stars has no impact on the price. There are also no outliers.'`

[194]:
```
# 2. Use a box plot to illustrate the effect of host identity verified on price

sns.boxplot(x='host_identity_verified', y='price', data=airbnb)
plt.xlabel("Host Identity Verified")
plt.ylabel("Price")
plt.title('Host Identity Verified vs Price', size=14, color='black')
```

[19…] Text(0.5, 1.0, 'Host Identity Verified vs Price')



[200]:
```
airbnb[['host_identity_verified', 'price']].head(10)
```

[20…]

	host_identity_verified	price
0	unconfirmed	966.0
1	verified	142.0
2	unconfirmed	620.0
3	unconfirmed	368.0
4	verified	204.0
5	verified	577.0
6	unconfirmed	71.0
7	unconfirmed	1060.0
8	verified	1018.0
9	unconfirmed	291.0

[165]:
```
''' There is no impact on price from whether the host is unconfirmed or verified. There are also no outliers.'''
```

[16…] ' There is no impact on price from whether the host is unconfirmed or verified. There are also no outliers.'

Extra Visualisation

[169]:
```
def filtered_table(dataFrame, column, value):
    filteredTable  = dataFrame[dataFrame[column] == value]
    return filteredTable
def selectneighbourhood(dataFrame, group, value, by):
    selectedTable = dataFrame.groupby(group)[value].mean()
    selectedTable = pd.DataFrame(selectedTable)
    selectedTable.sort_values(by = by, ascending= False )
    return selectedTable
```

[171]:
```
airbnb_brooklyn = filtered_table(airbnb, "neighbourhood_group", "Brooklyn")
airbnb_booklyn_price = selectneighbourhood(airbnb_brooklyn,"neighbourhood", "price", "price")
airbnb_manhattan = filtered_table(airbnb, "neighbourhood_group", "Manhattan")
airbnb_manhattan_price = selectneighbourhood(airbnb_manhattan,"neighbourhood", "price", "price")
airbnb_bronx = filtered_table(airbnb, "neighbourhood_group", "Bronx")
airbnb_bronx_price = selectneighbourhood(airbnb_bronx,"neighbourhood", "price", "price")
airbnb_queens = filtered_table(airbnb, "neighbourhood_group", "Queens")
airbnb_queens_price = selectneighbourhood(airbnb_queens,"neighbourhood", "price", "price")
airbnb_staten_island = filtered_table(airbnb, "neighbourhood_group", "Staten Island")
airbnb_staten_island_price = selectneighbourhood(airbnb_staten_island,"neighbourhood", "price", "price")
```

[84]:
```
plt.figure(figsize= (15,7))
sns.scatterplot(x = "neighbourhood",
                y = "price",
                label = "Brooklyn",
                data = airbnb_booklyn_price);
sns.scatterplot(x = "neighbourhood",
                y = "price",
                label = "Manhattan",
                data = airbnb_manhattan_price);
sns.scatterplot(x = "neighbourhood",
                y = "price",
                label = "Bronx",
                data = airbnb_bronx_price);
sns.scatterplot(x = "neighbourhood",
                y = "price",
                label = "Queens",
                data = airbnb_queens_price);
sns.scatterplot(x = "neighbourhood",
                y = "price",
                label = "Staten Island",
                data = airbnb_staten_island_price);
plt.xticks([])
plt.xlabel("")
plt.ylabel("Price")
plt.title('Neighbourhood Group by Price', size=14, color='black')
plt.grid(True)
plt.show()
```