Importing the Required Libraries

In [1]:
```
import numpy as np
import pandas as pd
import requests
from bs4 import BeautifulSoup as bs
import csv
```

Data Preprocessing Pipeline

In [2]:
```
# importing weekday excel file
df = pd.read_csv("C:/Users/Vasu/Documents/web scraping/new/final/combined_weekday_f
```

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

Out[3]:

	Hotel Name	Area	Location	Original Price	Discounted Price	Discount	User Rating	Rating Summary
0	Flagship Padam Residency Near Laxmi Nagar metro	shankarpur	Shakarpur Khas Near Inferno Gym Block U, Delhi	2794	662	72%	3.4	3.4 (411 Ratings)·Fair
1	Flagship Padam Residency Near Laxmi Nagar metro	shankarpur	Shakarpur Khas Near Inferno Gym Block U, Delhi	2794	662	72%	3.4	3.4 (411 Ratings)·Fair
2	Townhouse 1190 The Grand Plaza	nampally	Nampally, Hyderabad	4125	889	74%	3.5	3.5 (63 Ratings)·Good
3	28119 Omkar Global Inn	bgs hospital	Near BGS hospital, Bangalore	2638	490	77%	3.4	3.4 (90 Ratings)·Fair
4	3 BY OYO Nami Residency Ahmedabad	paldi	Near Vs Hospital, V S Hospital, Ahmedabad	6000	2857	45%	4.6	4.6 (517 Ratings)·Excellent

In [4]:
```
# Extract numerical part from 'Total Ratings' and handle 'Not Available'
df['Total Ratings'] = df['Total Ratings'].apply(lambda x: int(x.split()[0]) if (isi
```

In [5]:
```
# Extracting the rating summary from the string using delemiter split
df[["tobedeleted", "Rating_Summary"]] = df["Rating Summary"].str.split(")", n=1, ex
```

In [6]:
```
# Dropping the unwanted columns
df.drop(columns=['tobedeleted', 'Rating Summary'], inplace=True)
```

In [7]:
```
df.columns = df.columns.str.strip()
```

In [8]:
```
# Extracting the numerical value from 'Tax'
df['Tax_Additional'] = df['Tax'].str.extract(r'(\d+\.?\d*)').astype(float)
```

In [9]:
```
df[['Tax', 'Tax_Additional']]
```

Out[9]:

	Tax	Tax_Additional
0	+ ₹120 taxes & fees · per room per night	120.0
1	+ ₹120 taxes & fees · per room per night	120.0
2	+ ₹147 taxes & fees · per room per night	147.0
3	+ ₹109 taxes & fees · per room per night	109.0
4	+ ₹443 taxes & fees · per room per night	443.0
...	...	...
1955	+ ₹136 taxes & fees · per room per night	136.0
1956	+ ₹155 taxes & fees · per room per night	155.0
1957	+ ₹129 taxes & fees · per room per night	129.0
1958	+ ₹212 taxes & fees · per room per night	212.0
1959	+ ₹159 taxes & fees · per room per night	159.0

1960 rows × 2 columns

In [10]:
```
# dropping unwanted columns
df.drop(columns=['Tax',], inplace=True)
```

In [11]:
```
# removing % from discount
df['Discount'] = df['Discount'].replace("%","", regex=True)
```

In [12]:
```
# extracting 12 characters from hotel name to derive hotel catrgory
df['Hotel Category'] = df['Hotel Name'].str[:12]
```

In [13]:
```
max_categories = 2
```

In [14]:
```
# Splitting the Hotel Category into two columns
df[['Category1', 'Category2']] = df['Hotel Category'].str.split(n=max_categories -
```

In [15]:
```
#concatanating both the category into Hotel_category
df['Hotel_Category'] = df['Category1'] + ' ' + df['Category2']
```

In [16]:
```
# dropping the unwanted columns
df.drop(['Category1', 'Category2', 'Hotel Category'], axis=1, inplace=True)
```

In [17]:
```
# Grouping the Hotel_Category
conditions = [
    df['Hotel_Category'].str.contains('Super OYO', case=False, na=False),
    df['Hotel_Category'].str.contains('Collection O', case=False, na=False),
    df['Hotel_Category'].str.contains('Capital O', case=False, na=False),
    df['Hotel_Category'].str.contains('Flagship', case=False, na=False),
    df['Hotel_Category'].str.contains('Townhouse', case=False, na=False),
    df['Hotel_Category'].str.contains('OYO Homes', case=False, na=False),
```

```
    df['Hotel_Category'].str.contains('Spot ON', case=False, na=False),
    df['Hotel_Category'].str.contains('SilverKe', case=False, na=False),
    df['Hotel_Category'].str.contains('OYO Hotel', case=False, na=False),
    df['Hotel_Category'].str.contains('OYO Palatte', case=False, na=False)
]
```

In [18]:
```
categories = ['Super OYO', 'Collection O', 'Capital O', 'Flagship', 'Townhouse', 'O
```

In [19]:
```
df['Hotel Category'] = np.select(conditions, categories, default='Others')
```

In [20]:
```
df['Hotel Category'].value_counts()
```

Out[20]:
```
Hotel Category
Flagship        501
Others          455
Super OYO       352
Collection O    287
OYO Hotels      159
Townhouse        82
Spot ON          56
Capital O        52
Silver Key       16
Name: count, dtype: int64
```

In [21]:
```
df
```

Out[21]:

	Hotel Name	Area	Location	Original Price	Discounted Price	Discount	User Rating	Total Ratings
0	Flagship Padam Residency Near Laxmi Nagar metro	shankarpur	Shakarpur Khas Near Inferno Gym Block U, Delhi	2794	662	72	3.4	411.0
1	Flagship Padam Residency Near Laxmi Nagar metro	shankarpur	Shakarpur Khas Near Inferno Gym Block U, Delhi	2794	662	72	3.4	411.0
2	Townhouse 1190 The Grand Plaza	nampally	Nampally, Hyderabad	4125	889	74	3.5	63.0
3	28119 Omkar Global Inn	bgs hospital	Near BGS hospital, Bangalore	2638	490	77	3.4	90.0
4	3 BY OYO Nami Residency Ahmedabad	paldi	Near Vs Hospital, V S Hospital, Ahmedabad	6000	2857	45	4.6	517.0
...	...	...	...	...	...	...	...	...
1955	Townhouse Singasandra Hosa Road	singasandra	Singasandra, Bangalore	3749	798	75	4.5	141.0
1956	Townhouse THE PRIME HOTELS HBR	hbr layout	Telecom Layout HBR Layout, Bangalore	3882	954	71	4.1	261.0
1957	Townhouse Vero Near World Mark Mall	sector 64	Dharam Tower, Near World Mark, Main Road Medaw...	3397	739	74	4.2	994.0
1958	Townhouse White Ridge 112 Shivam Road	nallakunta	New Nallakunta, Hyderabad	5557	1519	68	4.2	629.0
1959	Townhouse1298 The Bell House	sector 47	plot 812 sector 47near medanta, Gurgaon	6718	992	82	4.7	5.0

1960 rows × 14 columns

In [22]:
```
df2 = df.groupby('Region')['Hotel Category'].value_counts()
df2 = pd.DataFrame(df2)
df2
```

Out[22]:

		count
Region	**Hotel Category**	
Ahmedabad	**Collection O**	20
	Flagship	13
	OYO Hotels	12
	Others	5
	Super OYO	4
...	**...**	...
Pune	**OYO Hotels**	10
	Spot ON	7
	Capital O	3
	Townhouse	2
	Silver Key	1

87 rows × 1 columns

In [23]:
```
# Pivot the DataFrame
pivot_df = df2.pivot_table(index='Region', columns='Hotel Category', values='count'
pivot_df
```

Out[23]:

Hotel Category	Capital O	Collection O	Flagship	OYO Hotels	Others	Silver Key	Spot ON	Super OYO	Townhouse
Region									
Ahmedabad	2	20	13	12	5	1	1	4	2
Bangalore	11	43	46	14	70	0	23	63	10
Chennai	1	16	48	1	26	2	6	12	8
Delhi	2	23	117	40	72	2	2	37	5
Gurgaon	3	21	13	7	34	0	1	31	10
Hyderabad	10	47	76	10	60	6	3	108	20
Jaipur	4	40	47	40	48	0	7	24	10
Mumbai	4	9	46	10	25	2	3	16	5
Noida	12	27	60	15	75	2	3	16	10
Pune	3	41	35	10	40	1	7	41	2

In [24]:
```
# dropping the unwanted column
df.drop(['Hotel_Category', 'Location', 'Amenities'], axis=1, inplace=True)
```

In [25]:
```
df
```

Out[25]:

	Hotel Name	Area	Original Price	Discounted Price	Discount	User Rating	Total Ratings	Region	F
0	Flagship Padam Residency Near Laxmi Nagar metro	shankarpur	2794	662	72	3.4	411.0	Delhi	
1	Flagship Padam Residency Near Laxmi Nagar metro	shankarpur	2794	662	72	3.4	411.0	Delhi	
2	Townhouse 1190 The Grand Plaza	nampally	4125	889	74	3.5	63.0	Hyderabad	
3	28119 Omkar Global Inn	bgs hospital	2638	490	77	3.4	90.0	Bangalore	
4	3 BY OYO Nami Residency Ahmedabad	paldi	6000	2857	45	4.6	517.0	Ahmedabad	
...	...	...	...	...	...	...	...	...	
1955	Townhouse Singasandra Hosa Road	singasandra	3749	798	75	4.5	141.0	Bangalore	
1956	Townhouse THE PRIME HOTELS HBR	hbr layout	3882	954	71	4.1	261.0	Bangalore	
1957	Townhouse Vero Near World Mark Mall	sector 64	3397	739	74	4.2	994.0	Gurgaon	
1958	Townhouse White Ridge 112 Shivam Road	nallakunta	5557	1519	68	4.2	629.0	Hyderabad	
1959	Townhouse1298 The Bell House	sector 47	6718	992	82	4.7	5.0	Gurgaon	

1960 rows × 11 columns

Basic Operations

In [26]:
```
# First 10 rows
df.head(10)
```

Out[26]:

	Hotel Name	Area	Original Price	Discounted Price	Discount	User Rating	Total Ratings	Region	Rating
0	Flagship Padam Residency Near Laxmi Nagar metro	shankarpur	2794	662	72	3.4	411.0	Delhi	
1	Flagship Padam Residency Near Laxmi Nagar metro	shankarpur	2794	662	72	3.4	411.0	Delhi	
2	Townhouse 1190 The Grand Plaza	nampally	4125	889	74	3.5	63.0	Hyderabad	
3	28119 Omkar Global Inn	bgs hospital	2638	490	77	3.4	90.0	Bangalore	
4	3 BY OYO Nami Residency Ahmedabad	paldi	6000	2857	45	4.6	517.0	Ahmedabad	
5	49996 JJ Comforts	rr nagar	3061	734	71	4	499.0	Bangalore	
6	71863 THE RED VELVET OPPOSITE NOVEL OFFICE MAR...	varthur road	4771	1157	72	4.8	1785.0	Bangalore	
7	820312 Hotel Royal Inn	pimpri	2268	544	71	4.2	45.0	Pune	
8	821424 Sai Inn Lodging	pimple gurav	3288	787	71	4.1	156.0	Pune	
9	Astra Hotels & Suites - Koramangala	koramangala	7108	1950	68	4.5	44.0	Bangalore	

In [27]:
```
# Last 10 rows
df.tail(10)
```

Out[27]:

	Hotel Name	Area	Original Price	Discounted Price	Discount	User Rating	Total Ratings	Region	Ra
1950	Townhouse OAK The Tulip Regency	nirman nagar	3397	773	73	3.9	179.0	Jaipur	
1951	Townhouse OMR	omr	5739	1399	72	4.2	1287.0	Chennai	
1952	Townhouse Ramoji Filmcity - Formerly N7 Elite	champapet	4644	1291	68	4.3	2179.0	Hyderabad	
1953	Townhouse Ramoji Filmcity - Formerly N7 Elite	champapet	4644	1291	68	4.3	2179.0	Hyderabad	
1954	Townhouse Shubham Residency	s r s h hospital	3154	865	68	4.5	875.0	Noida	
1955	Townhouse Singasandra Hosa Road	singasandra	3749	798	75	4.5	141.0	Bangalore	
1956	Townhouse THE PRIME HOTELS HBR	hbr layout	3882	954	71	4.1	261.0	Bangalore	
1957	Townhouse Vero Near World Mark Mall	sector 64	3397	739	74	4.2	994.0	Gurgaon	
1958	Townhouse White Ridge 112 Shivam Road	nallakunta	5557	1519	68	4.2	629.0	Hyderabad	
1959	Townhouse1298 The Bell House	sector 47	6718	992	82	4.7	5.0	Gurgaon	

In [28]:
```
# Shape of DataFrame
df.shape
```

Out[28]:
```
(1960, 11)
```

In [29]:
```
# Information about DataFrame
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1960 entries, 0 to 1959
Data columns (total 11 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   Hotel Name        1960 non-null   object 
 1   Area              1960 non-null   object 
 2   Original Price    1960 non-null   int64  
 3   Discounted Price  1960 non-null   int64  
 4   Discount          1960 non-null   object 
 5   User Rating       1960 non-null   object 
 6   Total Ratings     1920 non-null   float64
 7   Region            1960 non-null   object 
 8   Rating_Summary    1920 non-null   object 
 9   Tax_Additional    1960 non-null   float64
 10  Hotel Category    1960 non-null   object 
dtypes: float64(2), int64(2), object(7)
memory usage: 168.6+ KB
```

In [30]:
```
# Summary statistics
df.describe()
```

Out[30]:

	Original Price	Discounted Price	Total Ratings	Tax_Additional
count	1960.000000	1960.000000	1920.000000	1960.000000
mean	3888.763776	917.271429	302.683854	150.153571
std	1691.747617	451.320803	458.121106	54.575146
min	1434.000000	399.000000	1.000000	78.000000
25%	2822.000000	626.000000	27.000000	114.000000
50%	3456.000000	797.500000	119.500000	136.000000
75%	4461.000000	1073.000000	366.000000	169.000000
max	16345.000000	4567.000000	4131.000000	588.000000

In [31]:
```
# Find the median for 'Total Ratings' and 'Discounted Price'
median_total_ratings = df['Total Ratings'].median()
median_discounted_price = df['Discounted Price'].median()

# Print the median values
print("Median Total Ratings:", median_total_ratings)
print("Median Discounted Price:", median_discounted_price)
```

```
Median Total Ratings: 119.5
Median Discounted Price: 797.5
```

In [32]:
```
# Transpose of summary statistics
df.describe().T
```

Out[32]:

	count	mean	std	min	25%	50%	75%	max
Original Price	1960.0	3888.763776	1691.747617	1434.0	2822.0	3456.0	4461.0	16345.0
Discounted Price	1960.0	917.271429	451.320803	399.0	626.0	797.5	1073.0	4567.0
Total Ratings	1920.0	302.683854	458.121106	1.0	27.0	119.5	366.0	4131.0
Tax_Additional	1960.0	150.153571	54.575146	78.0	114.0	136.0	169.0	588.0

In [33]:
```
# column names of the dataframe
df.columns
```

Out[33]:
```
Index(['Hotel Name', 'Area', 'Original Price', 'Discounted Price', 'Discount',
       'User Rating', 'Total Ratings', 'Region', 'Rating_Summary',
       'Tax_Additional', 'Hotel Category'],
      dtype='object')
```

In [34]:
```
#number of unique values in 'Region'
df['Region'].nunique()
```

Out[34]:
```
10
```

In [35]:
```
# count of unique values in 'Region'
df['Region'].value_counts()
```

Out[35]:
```
Region
Hyderabad    340
Delhi        300
Bangalore    280
Jaipur       220
Noida        220
Pune         180
Mumbai       120
Gurgaon      120
Chennai      120
Ahmedabad     60
Name: count, dtype: int64
```

In [36]:
```
#number of unique values in 'Rating_Summary'
df['Rating_Summary'].nunique()
```

Out[36]:
```
5
```

In [37]:
```
# count of unique values in 'Rating_Summary'
df['Rating_Summary'].value_counts()
```

Out[37]:
```
Rating_Summary
·Very Good    665
·Good         580
·Excellent    305
·Fair         254
·Fabulous     116
Name: count, dtype: int64
```

In [38]:
```
#number of unique values in 'Hotel Category'
df['Hotel Category'].nunique()
```

Out[38]:
```
9
```

In [39]:
```
# count of unique values in 'Hotel Category'
df['Hotel Category'].value_counts()
```

Out[39]:
```
Hotel Category
Flagship        501
Others          455
Super OYO       352
Collection O    287
OYO Hotels      159
Townhouse        82
Spot ON          56
Capital O        52
Silver Key       16
Name: count, dtype: int64
```

In [44]:
```
avg__prices = df.groupby(['Hotel Category'])['Discounted Price'].mean()
grouped_prices
```

Out[44]:
```
Hotel Category
Capital O        988.115385
Collection O     964.132404
Flagship         807.305389
OYO Hotels       731.339623
Others           865.360440
Silver Key      1041.250000
Spot ON          616.964286
Super OYO       1151.917614
Townhouse       1202.402439
Name: Discounted Price, dtype: float64
```

In [ ]:

In [ ]:

Missing Values Treatment

identifying missing values

In [45]:
```
#'Total Ratings' and 'Rating_Summary'has 40 missing values each and 'Amenities' has
# identifying missing values across dataframe
df.isna()
df.isnull()
```

Out[45]:

	Hotel Name	Area	Original Price	Discounted Price	Discount	User Rating	Total Ratings	Region	Rating_Summary	Ta
0	False	False	False	False	False	False	False	False	False	
1	False	False	False	False	False	False	False	False	False	
2	False	False	False	False	False	False	False	False	False	
3	False	False	False	False	False	False	False	False	False	
4	False	False	False	False	False	False	False	False	False	
...	...	...	...	...	...	...	...	...	...	
1955	False	False	False	False	False	False	False	False	False	
1956	False	False	False	False	False	False	False	False	False	
1957	False	False	False	False	False	False	False	False	False	
1958	False	False	False	False	False	False	False	False	False	
1959	False	False	False	False	False	False	False	False	False	

1960 rows × 11 columns

In [46]:
```
# identifying missing values across dataframe
df.isna().sum()
df.isnull().sum()
```

Out[46]:
```
Hotel Name           0
Area                 0
Original Price       0
Discounted Price     0
Discount             0
User Rating          0
Total Ratings       40
Region               0
Rating_Summary      40
Tax_Additional       0
Hotel Category       0
dtype: int64
```

In [47]:
```
# Impute missing values in 'Total Ratings' with mean
df['Total Ratings'].fillna(df['Total Ratings'].mean(), inplace=True)
```

In [48]:
```
# identifying missing values across dataframe
df.isna().sum()
df.isnull().sum()
```

Out[48]:
```
Hotel Name           0
Area                 0
Original Price       0
Discounted Price     0
Discount             0
User Rating          0
Total Ratings        0
Region               0
Rating_Summary      40
Tax_Additional       0
Hotel Category       0
dtype: int64
```

In [49]:
```
# Since all the 40 null values in the'Rating_Summary' are for New hotels,Replacing
df['Rating_Summary'].fillna('NEW', inplace=True)
```

In [50]:
```
# identifying missing values across dataframe
df.isna().sum()
df.isnull().sum()
```

Out[50]:
```
Hotel Name          0
Area                0
Original Price      0
Discounted Price    0
Discount            0
User Rating         0
Total Ratings       0
Region              0
Rating_Summary      0
Tax_Additional      0
Hotel Category      0
dtype: int64
```

Exploratory Data Analysis

In [51]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import math
```

In [53]:
```
# Distribution of Original Price
plt.figure(figsize=(10, 6))
plt.hist(df['Discounted Price'], bins=10, color='skyblue', edgecolor='black')
plt.title('Distribution of Discounted Price')
plt.xlabel('Discounted Price')
plt.ylabel('Frequency')
plt.grid(True)
plt.show()
```

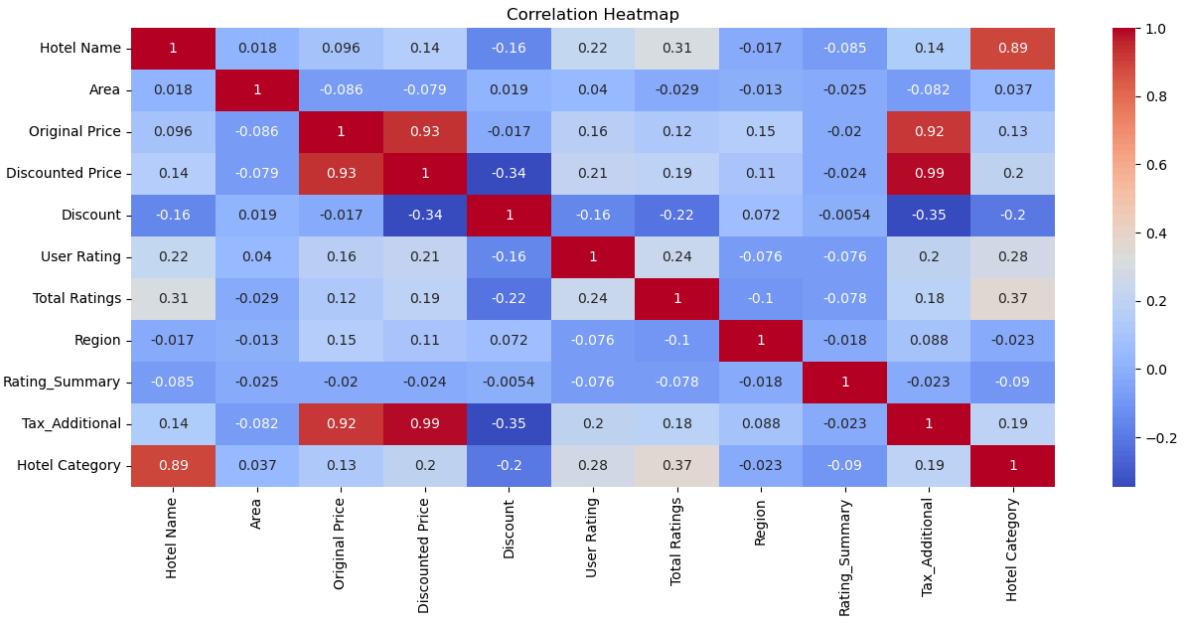
In [54]:
```
# Replace "NEW" with 0 in "User Rating" column
df["User Rating"] = df["User Rating"].replace("NEW", 0)
```

In [55]:
```
# Drop non-numeric columns
numeric_df = df.drop(columns=["Hotel Name", "Area", "Region", "Rating_Summary", "Ho
```

Correlation Matrix

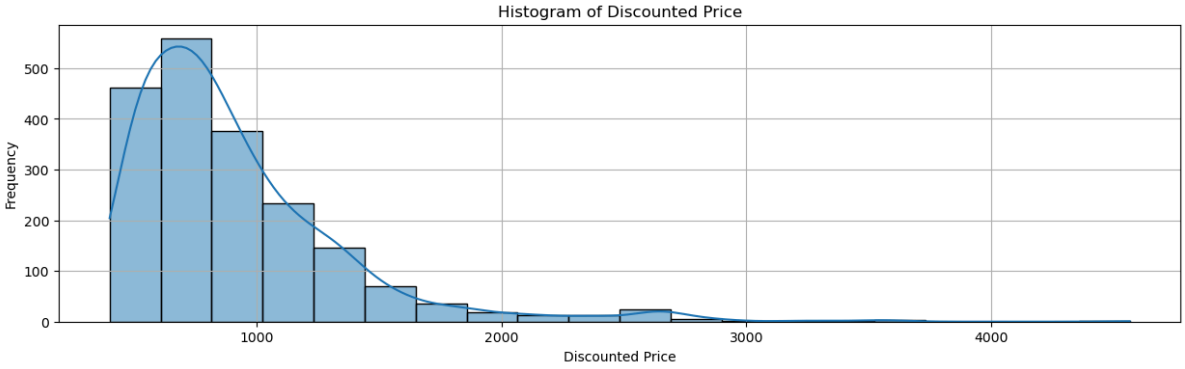
In [56]:
```
from sklearn.preprocessing import LabelEncoder

# Create a copy of the original DataFrame
encoded_df = df.copy()

# Initialize LabelEncoder
label_encoder = LabelEncoder()

# Iterate over non-numerical columns and encode them
for col in encoded_df.columns:
    if encoded_df[col].dtype == 'object':
        encoded_df[col] = label_encoder.fit_transform(encoded_df[col].astype(str))

# Calculate correlation matrix
corr = encoded_df.corr()
```

In [95]:
```
# Plot heatmap
plt.figure(figsize=(15, 6))
sns.heatmap(corr, annot=True, cmap='coolwarm')

# Add title
plt.title('Correlation Heatmap')

# Display the plot
plt.show()
```

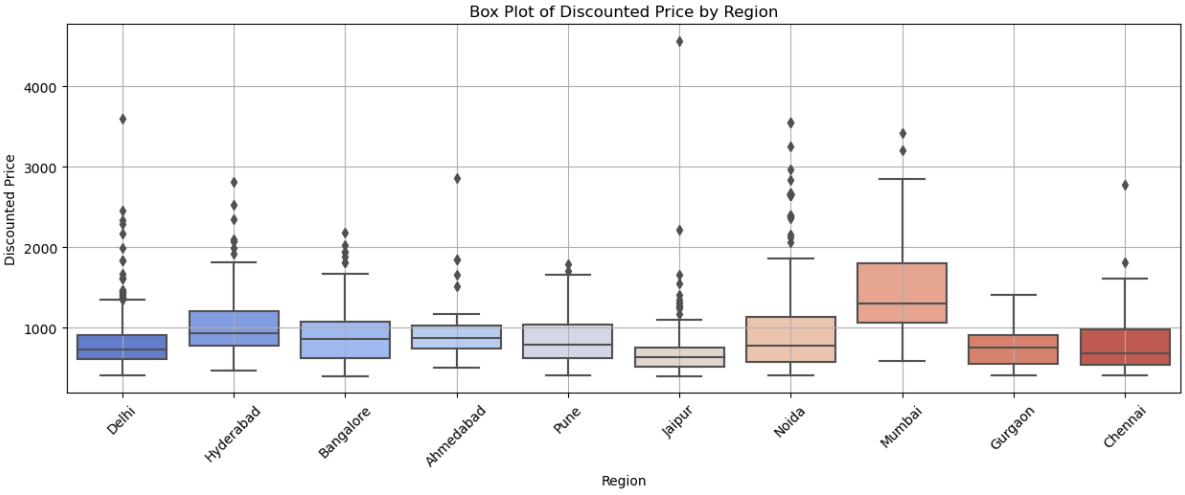


In [97]:
```
# Univariate Analysis
# Plotting the histogram
plt.figure(figsize=(15, 4))
sns.histplot(df['Discounted Price'], bins=20, kde=True)
plt.title('Histogram of Discounted Price')
plt.xlabel('Discounted Price')
plt.ylabel('Frequency')
```

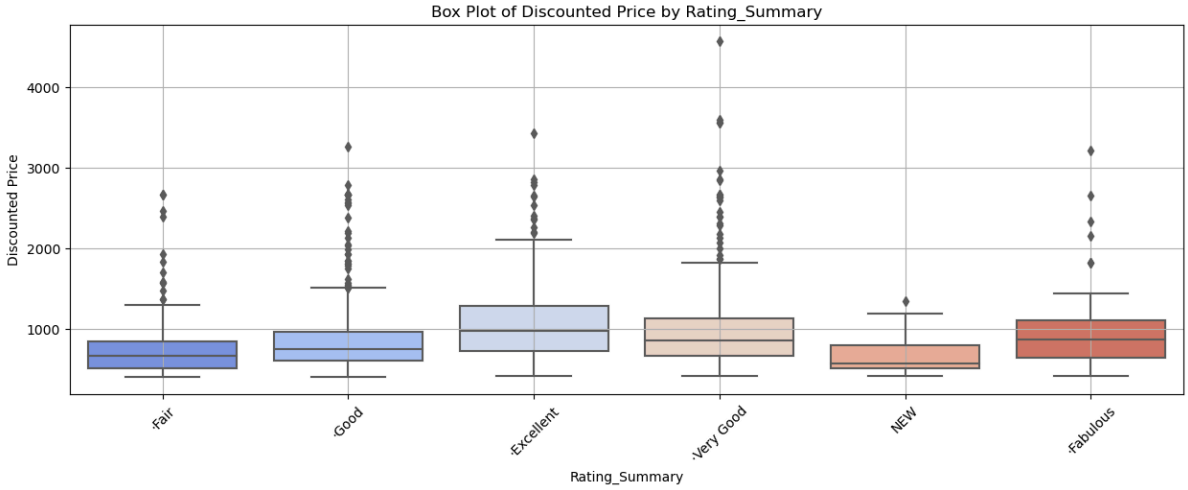
```
plt.grid(True)
plt.show()
```



In [98]:
```
# Plotting the box plot
plt.figure(figsize=(15, 5))
sns.boxplot(x='Region', y='Discounted Price', data=df, palette='coolwarm')
plt.title('Box Plot of Discounted Price by Region')
plt.xlabel('Region')
plt.ylabel('Discounted Price')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```

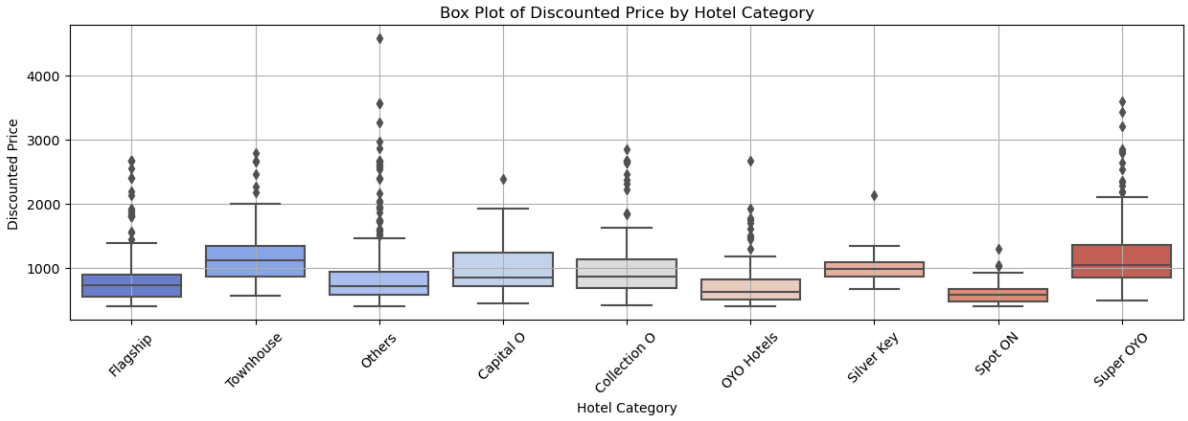


In [99]:
```
# Plotting the box plot
plt.figure(figsize=(15, 5))
sns.boxplot(x='Rating_Summary', y='Discounted Price', data=df, palette='coolwarm')
plt.title('Box Plot of Discounted Price by Rating_Summary')
plt.xlabel('Rating_Summary')
plt.ylabel('Discounted Price')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```



In [101…

```
# Plotting the box plot
plt.figure(figsize=(15, 4))
sns.boxplot(x='Hotel Category', y='Discounted Price', data=df, palette='coolwarm')
plt.title('Box Plot of Discounted Price by Hotel Category')
plt.xlabel('Hotel Category')
plt.ylabel('Discounted Price')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```

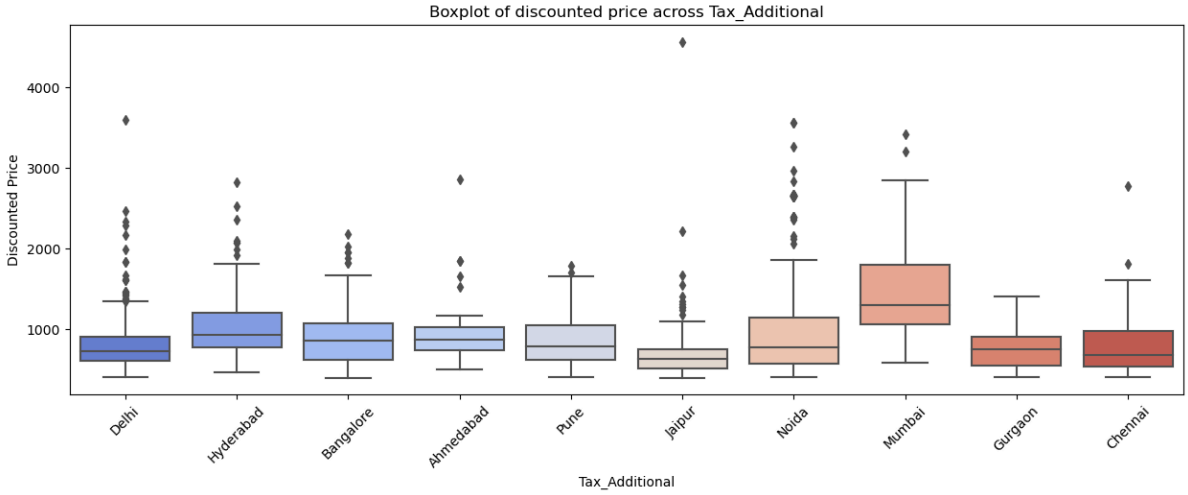


OUTLIERS

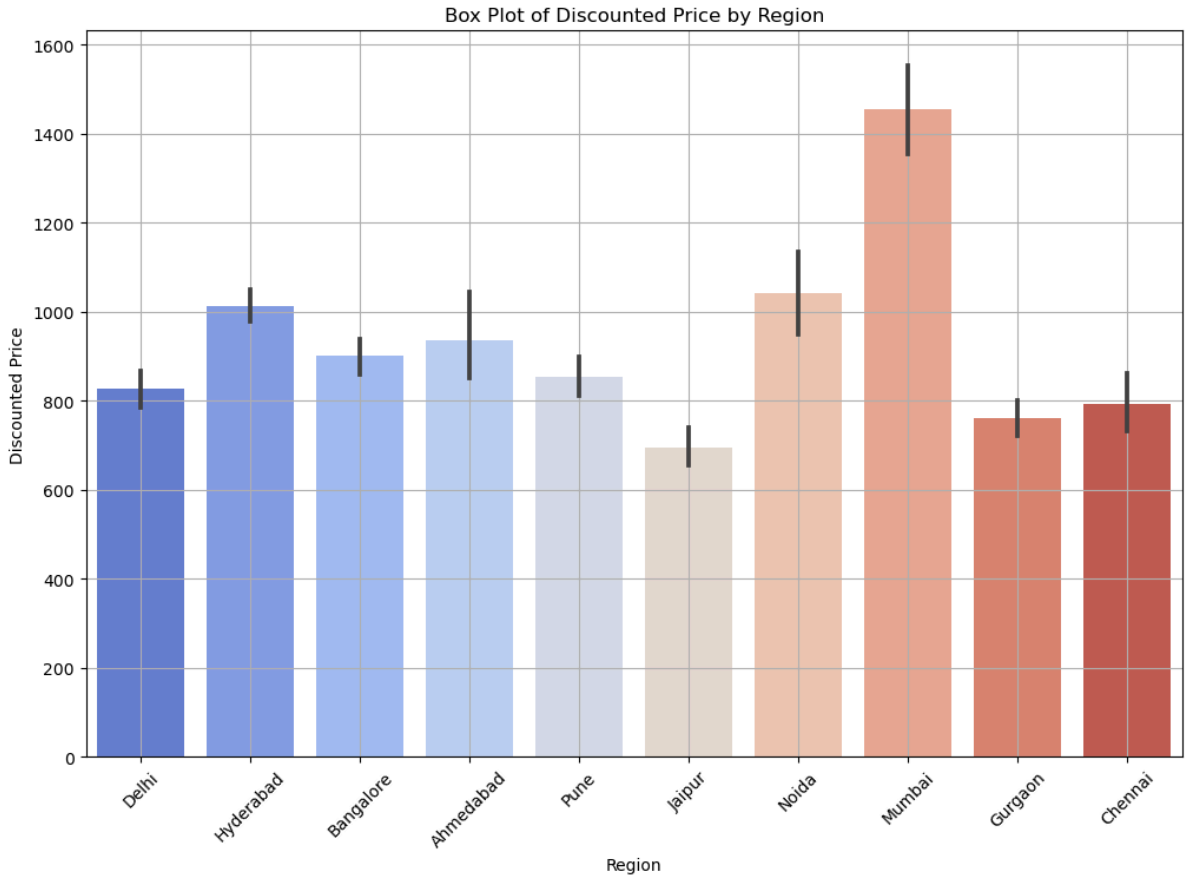
Identifying Outliers

In [102…

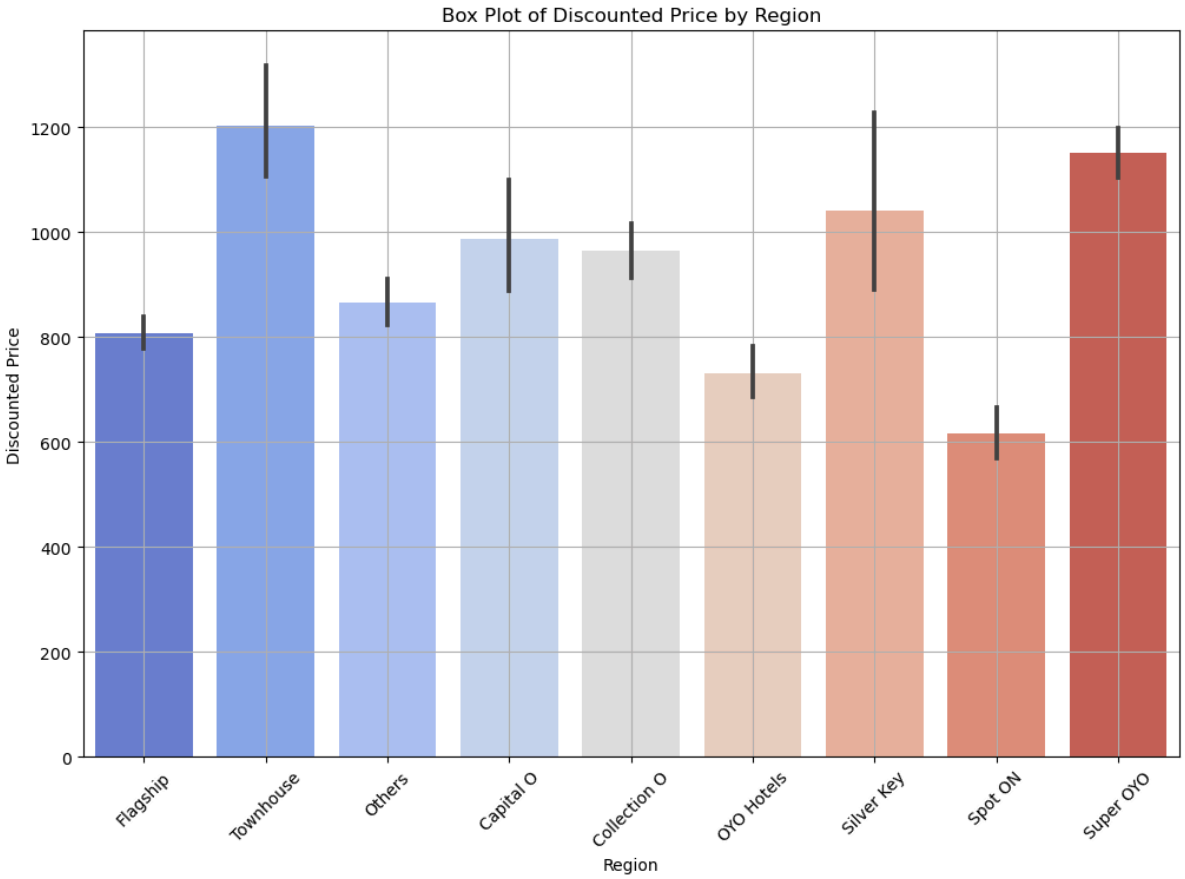
```
plt.figure(figsize=(15, 5))
sns.boxplot(data=df, x= 'Region', y='Discounted Price', palette='coolwarm')
plt.title(f'Boxplot of discounted price across {col}')
plt.xlabel(col)
plt.ylabel('Discounted Price')
plt.xticks(rotation=45)
plt.show()
```



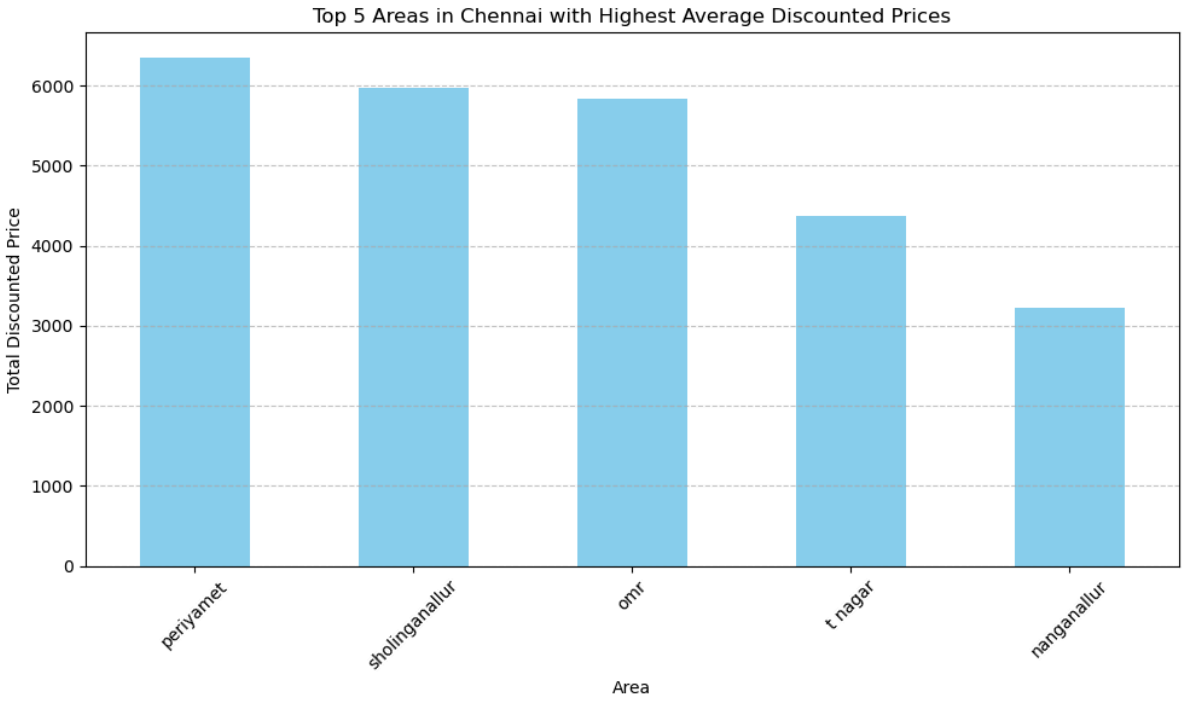
In [77]:
```
# Plotting the box plot
plt.figure(figsize=(12, 8))
sns.barplot(x='Region', y='Discounted Price', data=df, palette='coolwarm')
plt.title('Box Plot of Discounted Price by Region')
plt.xlabel('Region')
plt.ylabel('Discounted Price')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```



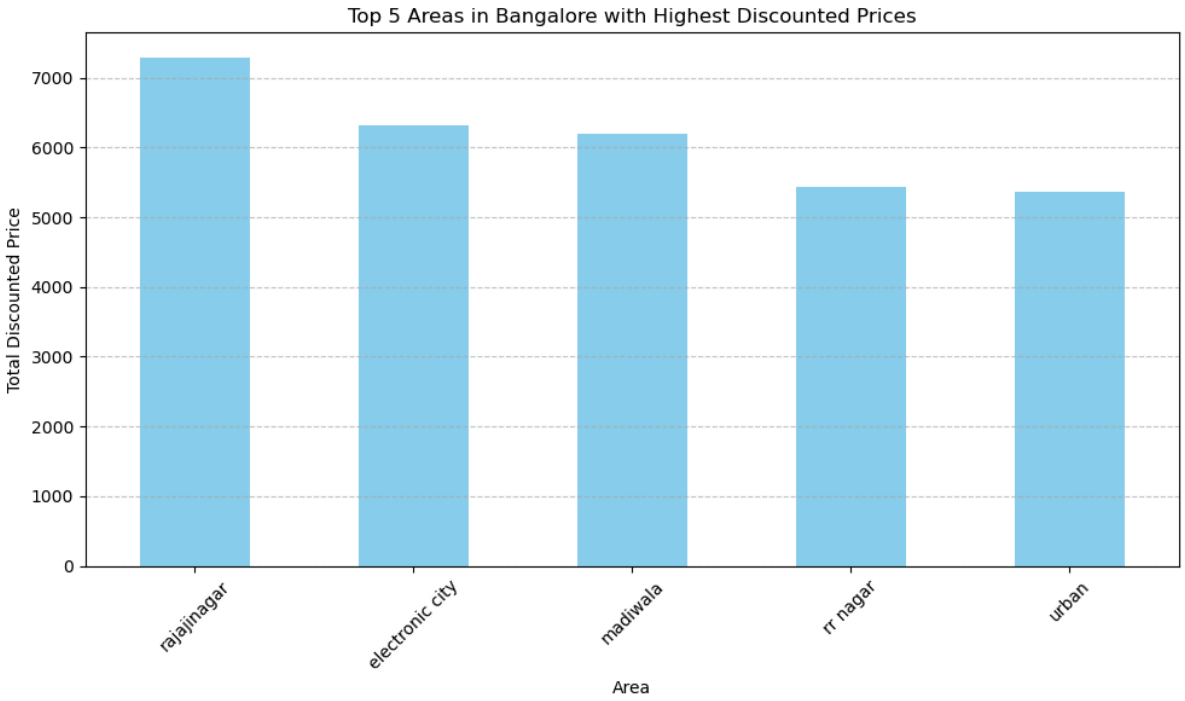
In [78]:
```
# Plotting the box plot
plt.figure(figsize=(12, 8))
sns.barplot(x='Hotel Category', y='Discounted Price', data=df, palette='coolwarm')
plt.title('Box Plot of Discounted Price by Region')
plt.xlabel('Region')
plt.ylabel('Discounted Price')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```



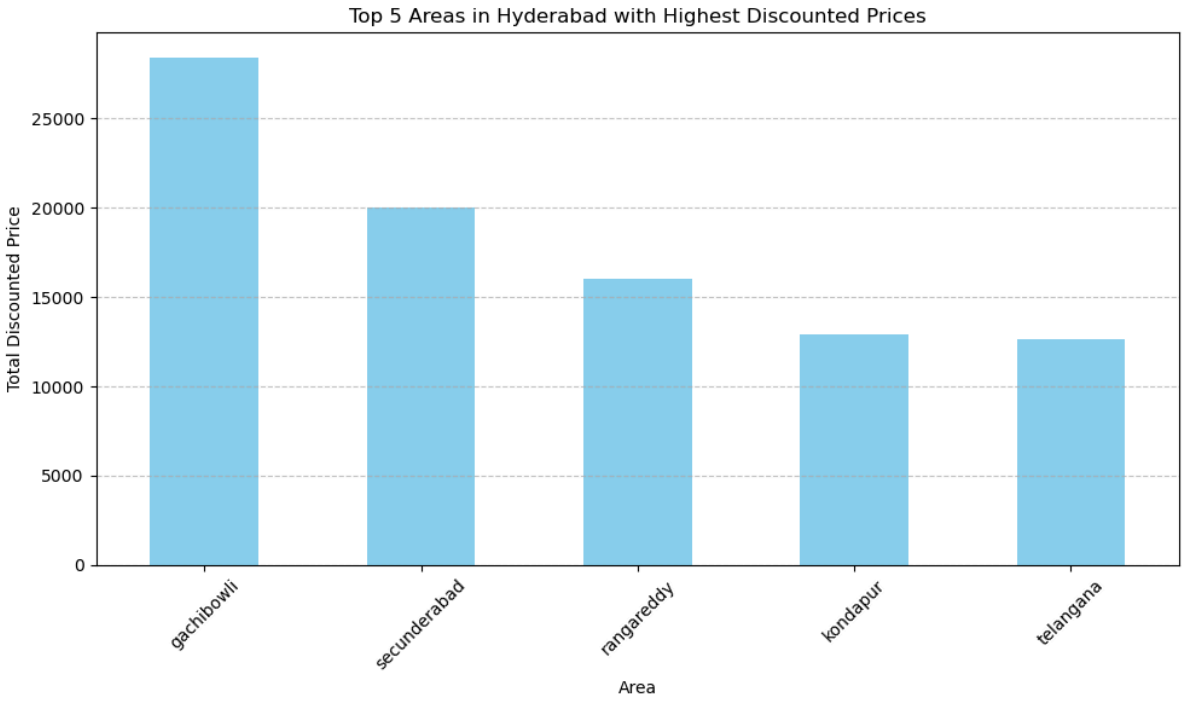
In [85]:
```
# Filter data for bookings in Chennai
chennai_bookings = df[df['Region'] == 'Chennai']

# Group by area and calculate the average discounted price
area_discounts = chennai_bookings.groupby('Area')['Discounted Price'].sum()

# Sort the areas based on the average discounted price and get the top 5
top_areas = area_discounts.sort_values(ascending=False).head(5)

# Plotting
plt.figure(figsize=(10, 6))
top_areas.plot(kind='bar', color='skyblue')
plt.title('Top 5 Areas in Chennai with Highest Average Discounted Prices')
plt.xlabel('Area')
plt.ylabel('Total Discounted Price')
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```



In [87]:
```
# Filter data for bookings in Chennai
Bangalore_bookings = df[df['Region'] == 'Bangalore']

# Group by area and calculate the average discounted price
area_discounts = Bangalore_bookings.groupby('Area')['Discounted Price'].sum()

# Sort the areas based on the average discounted price and get the top 5
top_areas = area_discounts.sort_values(ascending=False).head(5)

# Plotting
plt.figure(figsize=(10, 6))
top_areas.plot(kind='bar', color='skyblue')
plt.title('Top 5 Areas in Bangalore with Highest Discounted Prices')
plt.xlabel('Area')
plt.ylabel('Total Discounted Price')
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```

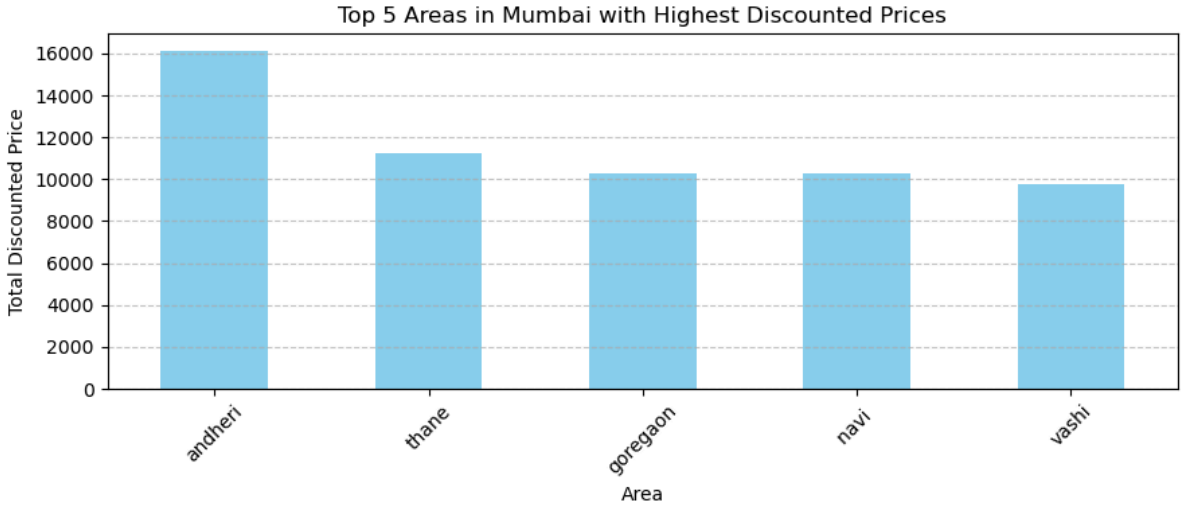


In [88]:
```
# Filter data for bookings in Hyderabad
Hyderabad_bookings = df[df['Region'] == 'Hyderabad']

# Group by area and calculate the average discounted price
area_discounts = Hyderabad_bookings.groupby('Area')['Discounted Price'].sum()

# Sort the areas based on the average discounted price and get the top 5
top_areas = area_discounts.sort_values(ascending=False).head(5)

# Plotting
plt.figure(figsize=(10, 6))
top_areas.plot(kind='bar', color='skyblue')
plt.title('Top 5 Areas in Hyderabad with Highest Discounted Prices')
plt.xlabel('Area')
plt.ylabel('Total Discounted Price')
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```



In [104…

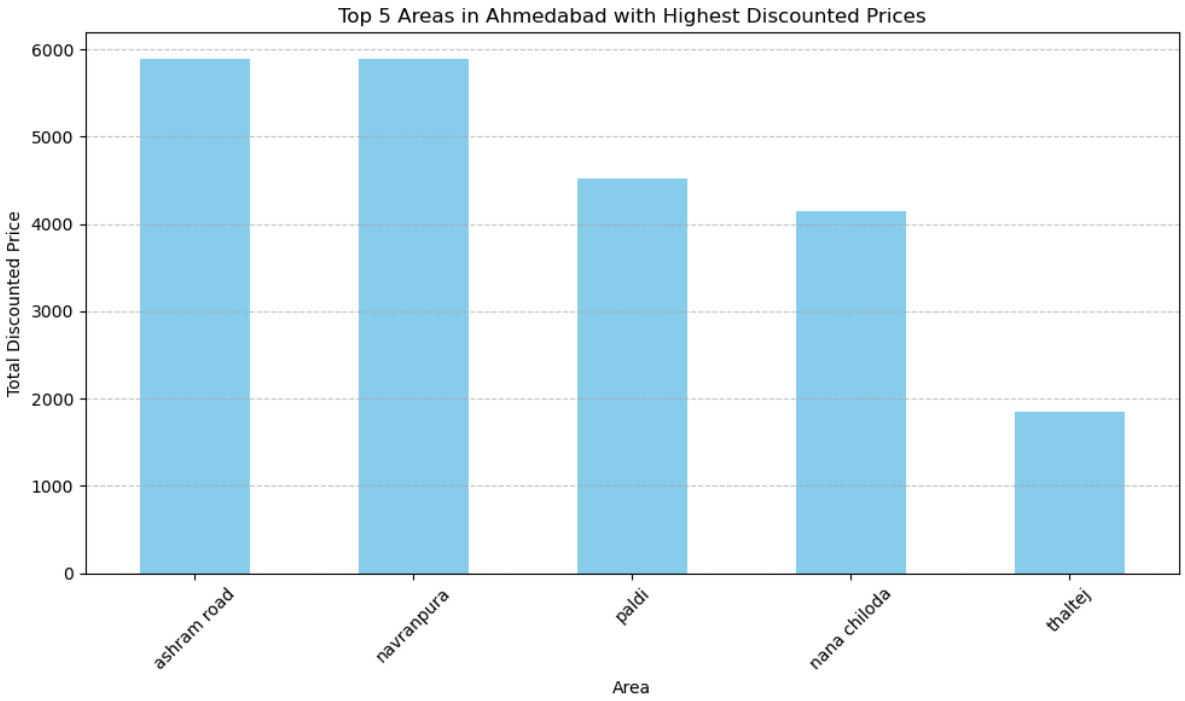
```
# Filter data for bookings in Mumbai
Mumbai_bookings = df[df['Region'] == 'Mumbai']

# Group by area and calculate the average discounted price
area_discounts = Mumbai_bookings.groupby('Area')['Discounted Price'].sum()

# Sort the areas based on the average discounted price and get the top 5
top_areas = area_discounts.sort_values(ascending=False).head(5)

# Plotting
plt.figure(figsize=(9, 4))
top_areas.plot(kind='bar', color='skyblue')
plt.title('Top 5 Areas in Mumbai with Highest Discounted Prices')
plt.xlabel('Area')
plt.ylabel('Total Discounted Price')
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```



In [90]:

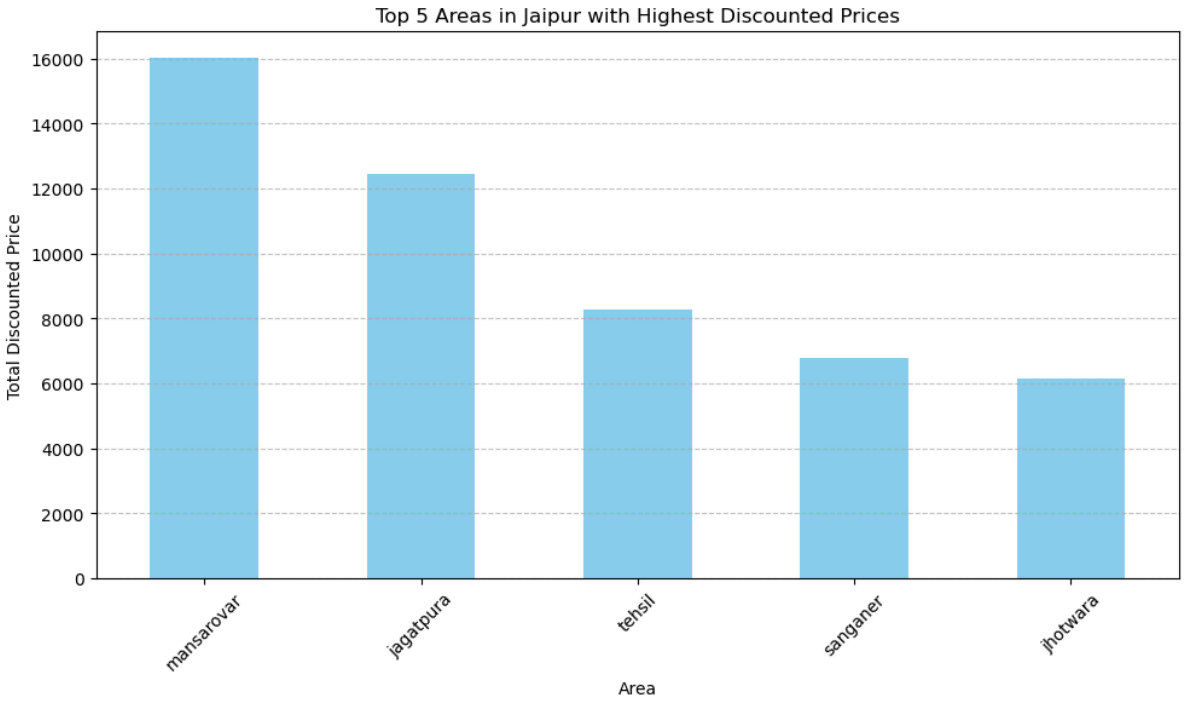
```
# Filter data for bookings in Ahmedabad
Ahmedabad_bookings = df[df['Region'] == 'Ahmedabad']

# Group by area and calculate the average discounted price
```

```
area_discounts = Ahmedabad_bookings.groupby('Area')['Discounted Price'].sum()

# Sort the areas based on the average discounted price and get the top 5
top_areas = area_discounts.sort_values(ascending=False).head(5)

# Plotting
plt.figure(figsize=(10, 6))
top_areas.plot(kind='bar', color='skyblue')
plt.title('Top 5 Areas in Ahmedabad with Highest Discounted Prices')
plt.xlabel('Area')
plt.ylabel('Total Discounted Price')
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```

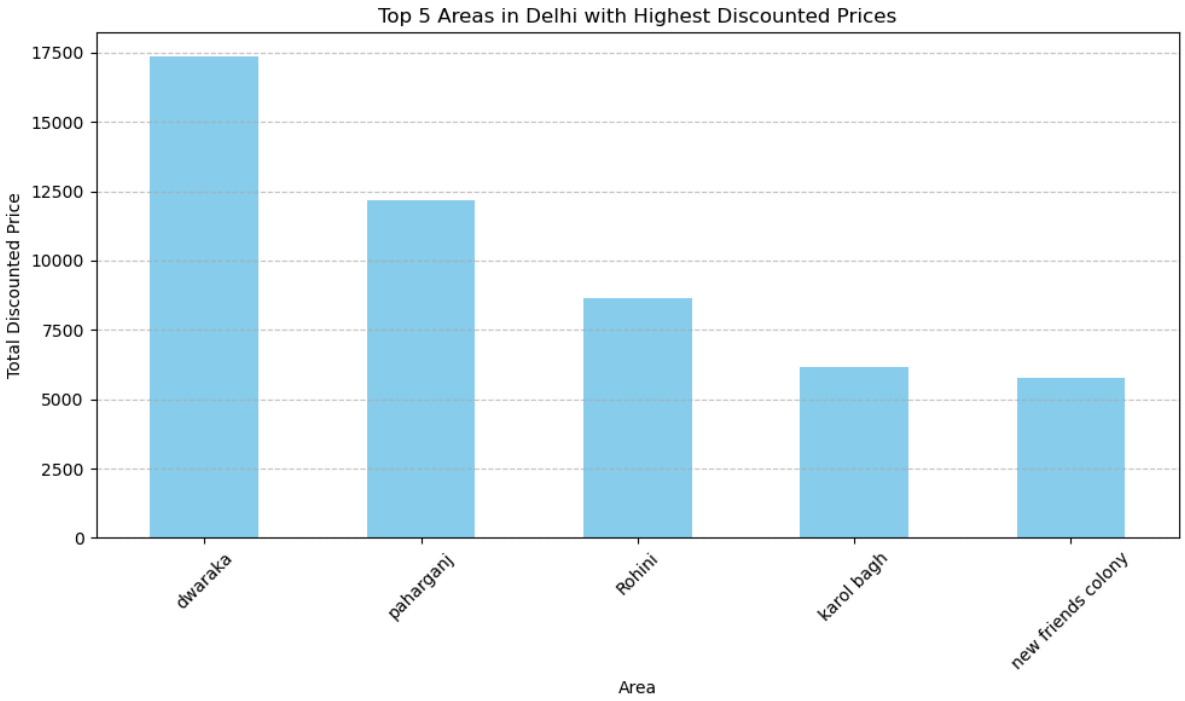


In [92]:

```
# Filter data for bookings in Jaipur
Jaipur_bookings = df[df['Region'] == 'Jaipur']

# Group by area and calculate the average discounted price
area_discounts = Jaipur_bookings.groupby('Area')['Discounted Price'].sum()

# Sort the areas based on the average discounted price and get the top 5
top_areas = area_discounts.sort_values(ascending=False).head(5)

# Plotting
plt.figure(figsize=(10, 6))
top_areas.plot(kind='bar', color='skyblue')
plt.title('Top 5 Areas in Jaipur with Highest Discounted Prices')
plt.xlabel('Area')
plt.ylabel('Total Discounted Price')
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```



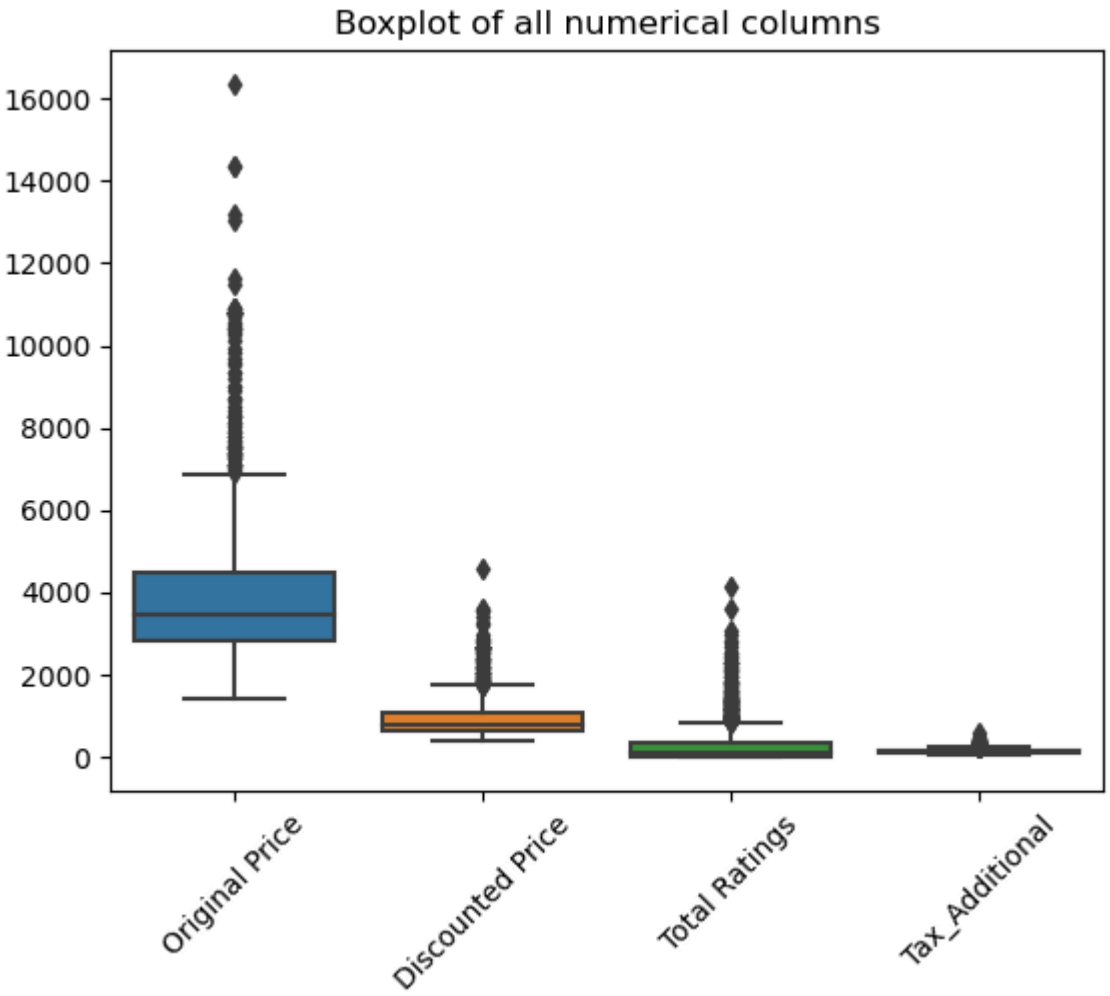
In [93]:
```
# Filter data for bookings in delhi
Delhi_bookings = df[df['Region'] == 'Delhi']

# Group by area and calculate the average discounted price
area_discounts = Delhi_bookings.groupby('Area')['Discounted Price'].sum()

# Sort the areas based on the average discounted price and get the top 5
top_areas = area_discounts.sort_values(ascending=False).head(5)

# Plotting
plt.figure(figsize=(10, 6))
top_areas.plot(kind='bar', color='skyblue')
plt.title('Top 5 Areas in Delhi with Highest Discounted Prices')
plt.xlabel('Area')
plt.ylabel('Total Discounted Price')
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```



In [94]:
```
# Filter data for bookings in noida
Noida_bookings = df[df['Region'] == 'Noida']

# Group by area and calculate the average discounted price
area_discounts = Noida_bookings.groupby('Area')['Discounted Price'].sum()

# Sort the areas based on the average discounted price and get the top 5
top_areas = area_discounts.sort_values(ascending=False).head(5)

# Plotting
plt.figure(figsize=(10, 6))
top_areas.plot(kind='bar', color='skyblue')
plt.title('Top 5 Areas in Noida with Highest Discounted Prices')
plt.xlabel('Area')
plt.ylabel('Total Discounted Price')
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.tight_layout()
plt.show()
```

In [ ]:

In [65]:
```
# Create a boxplot of the data with outliers shown
sns.boxplot(data=df)
plt.title('Boxplot of all numerical columns')
plt.xticks(rotation=45)
plt.show()
```



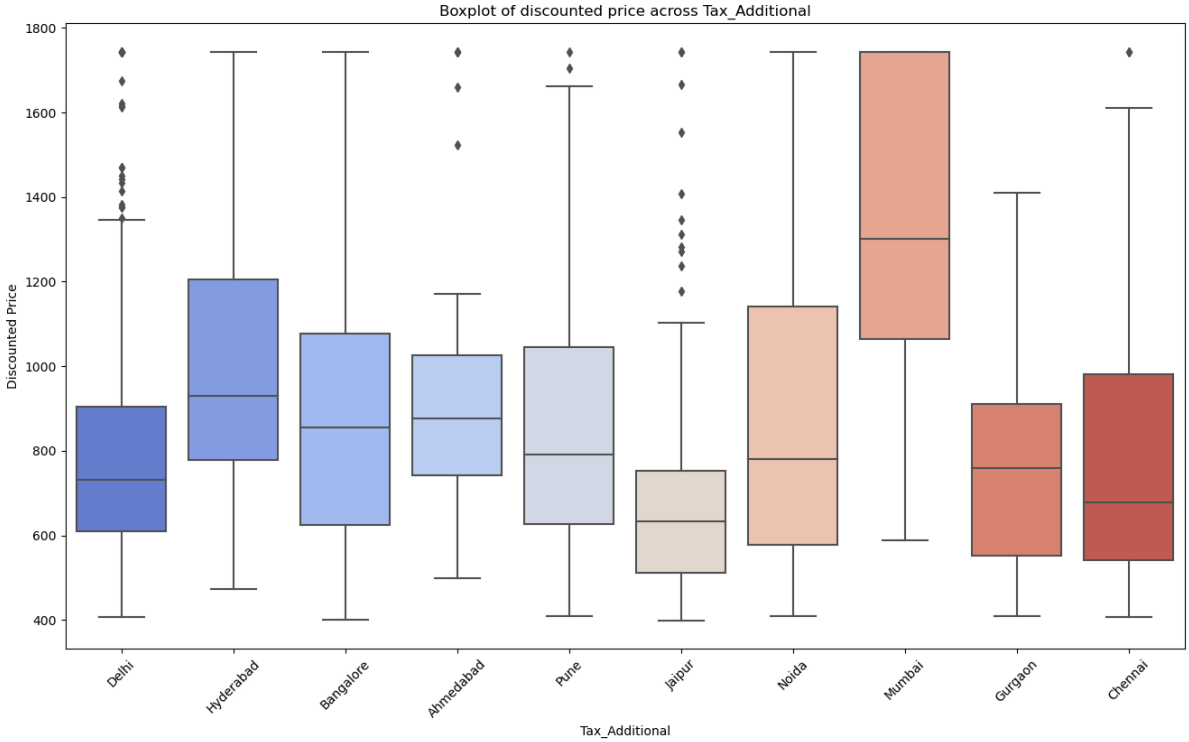
Treating Outliers

IQR Method and Z-Score Method

In [66]:
```
import numpy as np
import pandas as pd

# Select only numerical columns
numerical_cols = df.select_dtypes(include=['int', 'float']).columns

# Calculate z-scores for numerical columns
z_scores = (df[numerical_cols] - df[numerical_cols].mean()) / df[numerical_cols].st

# Define threshold for outliers (e.g., z-score > 3 or z-score < -3)
z_score_threshold = 3

# Identify outliers based on z-scores
outliers_z_score = (z_scores > z_score_threshold) | (z_scores < -z_score_threshold)

# Calculate quartiles for numerical columns
Q1 = df[numerical_cols].quantile(0.25)
Q3 = df[numerical_cols].quantile(0.75)
IQR = Q3 - Q1

# Define upper and lower limits for outliers detection using IQR method
upper_limit_iqr = Q3 + 1.5 * IQR
lower_limit_iqr = Q1 - 1.5 * IQR

# Identify outliers based on IQR method
outliers_iqr = (df[numerical_cols] < lower_limit_iqr) | (df[numerical_cols] > upper

# Cap outliers using both methods
capped_df_z_score = df.copy()  # Create copies to preserve the original DataFrame
capped_df_iqr = df.copy()

for col in numerical_cols:
    capped_df_z_score[col] = np.where(outliers_z_score[col], np.clip(df[col], df[co
    capped_df_iqr[col] = np.where(outliers_iqr[col], np.clip(df[col], lower_limit_i

# Calculate percentage of outliers detected by z-score method after capping
outlier_percentage_z_score_capped = ((capped_df_z_score != df).sum().sum() / (len(c

# Calculate percentage of outliers detected by IQR method after capping
outlier_percentage_iqr_capped = ((capped_df_iqr != df).sum().sum() / (len(df) * ler

# Print the results
print(f"Percentage of outliers detected by z-score method after capping: {outlier_p
print(f"Percentage of outliers detected by IQR method after capping: {outlier_perce
```

```
Percentage of outliers detected by z-score method after capping: 2.51275510204081
6%
Percentage of outliers detected by IQR method after capping: 6.275510204081633%
```

In [67]:
```
plt.figure(figsize=(16, 9))
sns.boxplot(data=capped_df_iqr, x= 'Region', y='Discounted Price', palette='coolwar
plt.title(f'Boxplot of discounted price across {col}')
plt.xlabel(col)
plt.ylabel('Discounted Price')
plt.xticks(rotation=45)
plt.show()
```

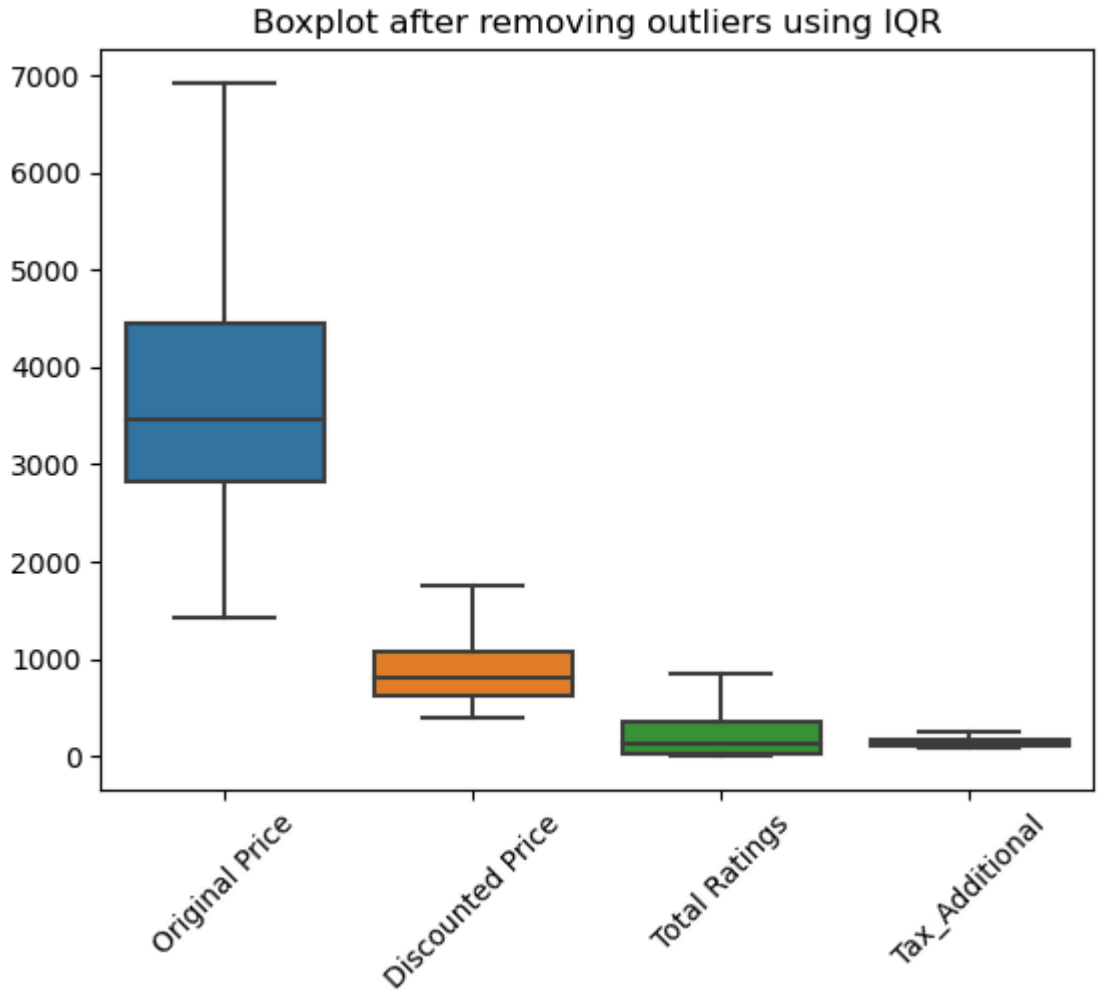


In [68]:
```
capped_df_iqr.describe().T
```

Out[68]:

	count	mean	std	min	25%	50%	75%	max
Original Price	1960.0	3767.498724	1283.304943	1434.0	2822.0	3456.0	4461.0	6919.5
Discounted Price	1960.0	886.804337	348.371238	399.0	626.0	797.5	1073.0	1743.5
Total Ratings	1960.0	246.763191	280.862375	1.0	27.0	124.0	358.0	854.5
Tax_Additional	1960.0	146.585459	42.428205	78.0	114.0	136.0	169.0	251.5

In [69]:
```
# Create boxplot after removing outliers using IQR method for numerical columns
sns.boxplot(data=capped_df_iqr)
plt.title('Boxplot after removing outliers using IQR')
plt.xticks(rotation=45)
plt.show()
```



Feature Engineering

Removing Highly Correlated variables

In [70]:
```
# Drop the specified columns ('Original Price', 'Tax_Additional' & 'Discount') whic
capped_df_iqr.drop(['Original Price', 'Tax_Additional', 'Discount'], axis=1, inplac

# Check the updated DataFrame
capped_df_iqr.head()
```

Out[70]:

	Hotel Name	Area	Discounted Price	User Rating	Total Ratings	Region	Rating_Summary	Hotel Category
0	Flagship Padam Residency Near Laxmi Nagar metro	shankarpur	662.0	3.4	411.0	Delhi	·Fair	Flagship
1	Flagship Padam Residency Near Laxmi Nagar metro	shankarpur	662.0	3.4	411.0	Delhi	·Fair	Flagship
2	Townhouse 1190 The Grand Plaza	nampally	889.0	3.5	63.0	Hyderabad	·Good	Townhouse
3	28119 Omkar Global Inn	bgs hospital	490.0	3.4	90.0	Bangalore	·Fair	Others
4	3 BY OYO Nami Residency Ahmedabad	paldi	1743.5	4.6	517.0	Ahmedabad	·Excellent	Others

In [71]:
```
# Perform one-hot encoding for categorical variables
df_encoded = pd.get_dummies(df, columns=['Hotel Name', 'Area', 'Region', 'Rating_Su

# Display the encoded DataFrame
df_encoded.head()
```

Out[71]:

	Original Price	Discounted Price	Discount	User Rating	Total Ratings	Tax_Additional	Hotel Name_ Flagship Padam Residency Near Laxmi Nagar metro	Hotel Name_ Townhouse 1190 The Grand Plaza	Name_ Glo
0	2794	662	72	3.4	411.0	120.0	True	False	
1	2794	662	72	3.4	411.0	120.0	True	False	
2	4125	889	74	3.5	63.0	147.0	False	True	
3	2638	490	77	3.4	90.0	109.0	False	False	
4	6000	2857	45	4.6	517.0	443.0	False	False	

5 rows × 2799 columns

In [ ]:

Data Spliting

In [72]:
```
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.preprocessing import StandardScaler
# Separate the predictor and target Variable
X = df_encoded.drop('Discounted Price', axis=1)
y = df_encoded['Discounted Price']
# Splitting the dataframe
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)
# Scaling
scaler = StandardScaler()
X_train_std = scaler.fit_transform(X_train)
X_test_std = scaler.transform(X_test)
X_std = scaler.transform(X)
```

Model Building

Linear Regression

In [73]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
import numpy as np

# Initialize the model
model = LinearRegression()

# Train the model on the training data
model.fit(X_train_std, y_train)

# Predict on the test set
y_pred = model.predict(X_test_std)

# Calculate RMSE
rmse = np.sqrt(mean_squared_error(y_test, y_pred))

# Calculate R-squared
r_squared = r2_score(y_test, y_pred)

print("RMSE:", rmse)
print("R-squared:", r_squared)
```

```
RMSE: 157.64172038946384
R-squared: 0.8614735814073674
```

Decision Tree Regression

In [74]:
```
from sklearn.tree import DecisionTreeRegressor
from sklearn.metrics import mean_squared_error, r2_score

# Initialize the Decision Tree Regressor model
model_desc = DecisionTreeRegressor(random_state=0)

# Train the model on the training data
model_desc.fit(X_train_std, y_train)
```

```
# Predict on the test set
y_pred = model_desc.predict(X_test_std)

# Calculate RMSE
rmse = mean_squared_error(y_test, y_pred, squared=False)

# Calculate R-squared
r_squared = r2_score(y_test, y_pred)

# Print the evaluation metrics
print("RMSE:", rmse)
print("R-squared:", r_squared)
```

```
RMSE: 84.28432202239934
R-squared: 0.9604010317863683
```

Random Forest Regression

In [75]:

```
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_squared_error, r2_score

# Initialize the model
model = RandomForestRegressor(random_state=0)

# Train the model on the training data
model.fit(X_train_std, y_train)

# Predict on the test set
y_pred = model.predict(X_test_std)

# Calculate RMSE
rmse = np.sqrt(mean_squared_error(y_test, y_pred))

# Calculate R-squared
r_squared = r2_score(y_test, y_pred)

print("RMSE:", rmse)
print("R-squared:", r_squared)
```

```
RMSE: 42.47032409007878
R-squared: 0.9899454780889136
```

XGBoost Regression

In [80]:

```
from xgboost import XGBRegressor
from sklearn.metrics import mean_squared_error, r2_score

# Initialize the model
model = XGBRegressor(random_state=0)

# Train the model on the training data
model.fit(X_train_std, y_train)

# Predict on the test set
y_pred = model.predict(X_test_std)

# Calculate RMSE
rmse = np.sqrt(mean_squared_error(y_test, y_pred))
```

```
# Calculate R-squared
r_squared = r2_score(y_test, y_pred)

print("RMSE:", rmse)
print("R-squared:", r_squared)
```

```
RMSE: 36.09271263592218
R-squared: 0.9927384501654256
```

In [ ]:
```
df.info
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]: