Project Python Foundations: FoodHub Data Analysis

Context

The number of restaurants in New York is increasing day by day. Lots of students and busy professionals rely on those restaurants due to their hectic lifestyles. Online food delivery service is a great option for them. It provides them with good food from their favorite restaurants. A food aggregator company FoodHub offers access to multiple restaurants through a single smartphone app.

The app allows the restaurants to receive a direct online order from a customer. The app assigns a delivery person from the company to pick up the order after it is confirmed by the restaurant. The delivery person then uses the map to reach the restaurant and waits for the food package. Once the food package is handed over to the delivery person, he/she confirms the pick-up in the app and travels to the customer's location to deliver the food. The delivery person confirms the drop-off in the app after delivering the food package to the customer. The customer can rate the order in the app. The food aggregator earns money by collecting a fixed margin of the delivery order from the restaurants.

Objective

The food aggregator company has stored the data of the different orders made by the registered customers in their online portal. They want to analyze the data to get a fair idea about the demand of different restaurants which will help them in enhancing their customer experience. Suppose you are hired as a Data Scientist in this company and the Data Science team has shared some of the key questions that need to be answered. Perform the data analysis to find answers to these questions that will help the company to improve the business.

Data Description

The data contains the different data related to a food order. The detailed data dictionary is given below.

Data Dictionary

- order_id: Unique ID of the order
- customer_id: ID of the customer who ordered the food
- restaurant_name: Name of the restaurant
- cuisine_type: Cuisine ordered by the customer
- cost_of_the_order: Cost of the order
- day_of_the_week: Indicates whether the order is placed on a weekday or weekend (The weekday is from Monday to Friday and the weekend is Saturday and Sunday)
- rating: Rating given by the customer out of 5
- food_preparation_time: Time (in minutes) taken by the restaurant to prepare the food. This is calculated by taking the difference between the timestamps of the restaurant's order confirmation and the delivery person's pick-up confirmation.
- delivery_time: Time (in minutes) taken by the delivery person to deliver the food package. This is calculated by taking the difference between the timestamps of the delivery person's pick-up confirmation and drop-off information

Let us start by importing the required libraries

In [46]:

```
# Installing the libraries with the specified version.
!pip install numpy==1.25.2 pandas==1.5.3 matplotlib==3.7.1 seaborn==0.13.1 -q --user
```

Note: *After running the above cell, kindly restart the notebook kernel and run all cells sequentially from the start again.*

In [47]:

```
# import libraries for data manipulation
import numpy as np
import pandas as pd

# import libraries for data visualization
import matplotlib.pyplot as plt
import seaborn as sns
```

Understanding the structure of the data

In [48]:

```
# uncomment and run the following lines for Google Colab
# from google.colab import drive
# drive.mount('/content/drive')

from google.colab import drive
drive.mount("/content/drive")

path='/content/drive/My Drive/python/foodhub_order.csv'

df = pd.read_csv(path)
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/
drive", force_remount=True).
```

In [49]:

```
# Write your code here to read the data
df
```

Out[49]:

	order_id	customer_id	restaurant_name	cuisine_type	cost_of_the_order	day_of_the_week	rating	food_preparation_time	deliver
0	1477147	337525	Hangawi	Korean	30.75	Weekend	Not given	25	
1	1477685	358141	Blue Ribbon Sushi Izakaya	Japanese	12.08	Weekend	Not given	25	
2	1477070	66393	Cafe Habana	Mexican	12.23	Weekday	5	23	
3	1477334	106968	Blue Ribbon Fried Chicken	American	29.20	Weekend	3	25	
4	1478249	76942	Dirty Bird to Go	American	11.59	Weekday	4	25	
...	...	...	...	...	...	...	...	...	
1893	1476701	292602	Chipotle Mexican Grill $1.99 Delivery	Mexican	22.31	Weekend	5	31	
1894	1477421	397537	The Smile	American	12.18	Weekend	5	31	
1895	1477819	35309	Blue Ribbon Sushi	Japanese	25.22	Weekday	Not given	31	
1896	1477513	64151	Jack's Wife Freda	Mediterranean	12.18	Weekday	5	23	
1897	1478056	120353	Blue Ribbon Sushi	Japanese	19.45	Weekend	Not given	28	

1898 rows × 9 columns

In [50]:

```
# Write your code here to view the first 5 rows
df.head()
```

Out[50]:

	order_id	customer_id	restaurant_name	cuisine_type	cost_of_the_order	day_of_the_week	rating	food_preparation_time	delivery_ti
0	1477147	337525	Hangawi	Korean	30.75	Weekend	Not given	25	
1	1477685	358141	Blue Ribbon Sushi Izakaya	Japanese	12.08	Weekend	Not given	25	
2	1477070	66393	Cafe Habana	Mexican	12.23	Weekday	5	23	
3	1477334	106968	Blue Ribbon Fried Chicken	American	29.20	Weekend	3	25	
4	1478249	76942	Dirty Bird to Go	American	11.59	Weekday	4	25	

In [51]:

```
#Just looking into the data.... to understand
shakeshack_rows = df[df['restaurant_name'] == 'Shake Shack']
shakeshack_rows
```

Out[51]:

	order_id	customer_id	restaurant_name	cuisine_type	cost_of_the_order	day_of_the_week	rating	food_preparation_time	delivery_t
15	1477414	66222	Shake Shack	American	16.20	Weekend	5	33	
21	1478226	137565	Shake Shack	American	15.91	Weekend	Not given	25	
22	1478287	150599	Shake Shack	American	29.10	Weekday	5	21	
39	1476891	220693	Shake Shack	American	19.89	Weekend	Not given	27	
64	1478077	82041	Shake Shack	American	33.03	Weekday	Not given	22	
...	...	...	...	...	...	...	...	...	
1881	1476700	127036	Shake Shack	American	12.23	Weekend	Not given	27	
1884	1477437	304993	Shake Shack	American	31.43	Weekend	3	31	
1885	1477550	97324	Shake Shack	American	29.05	Weekday	4	27	
1887	1476873	237616	Shake Shack	American	5.82	Weekend	Not given	26	
1891	1476981	138586	Shake Shack	American	5.82	Weekend	Not given	22	

219 rows × 9 columns

Question 1: How many rows and columns are present in the data? [0.5 mark]

In [52]:

```
# Write your code here
print(df.shape)
```

```
(1898, 9)
```

Answer 1: There are 1898 rows and 9 columns

Observations:

There are 1898 rows and 9 columns

Question 2: What are the datatypes of the different columns in the dataset? (The info() function can be used) [0.5 mark]

In [53]:

```
# Write your code here
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1898 entries, 0 to 1897
Data columns (total 9 columns):
 #   Column                 Non-Null Count  Dtype  
---  ------                 --------------  -----  
 0   order_id               1898 non-null   int64  
 1   customer_id            1898 non-null   int64  
 2   restaurant_name        1898 non-null   object 
 3   cuisine_type           1898 non-null   object 
 4   cost_of_the_order      1898 non-null   float64
 5   day_of_the_week        1898 non-null   object 
 6   rating                 1898 non-null   object 
 7   food_preparation_time  1898 non-null   int64  
 8   delivery_time          1898 non-null   int64  
dtypes: float64(1), int64(4), object(4)
memory usage: 133.6+ KB
```

Observations:

Answer 2] Order cost is a float, the food preparation time and delivery time are integers. The order id and customer id are also integers and the rest are objects

Question 3: Are there any missing values in the data? If yes, treat them using an appropriate method. [1 mark]

In [54]:

```
# Write your code here
```

Observations:

Answer 3] There are no missing values in the data bold text

Question 4: Check the statistical summary of the data. What is the minimum, average, and maximum time it takes for food to be prepared once an order is placed? [2 marks]

In [55]:

```
# Write your code here
df.describe()
```

Out[55]:

	order_id	customer_id	cost_of_the_order	food_preparation_time	delivery_time
count	1.898000e+03	1898.000000	1898.000000	1898.000000	1898.000000
mean	1.477496e+06	171168.478398	16.498851	27.371970	24.161749
std	5.480497e+02	113698.139743	7.483812	4.632481	4.972637
min	1.476547e+06	1311.000000	4.470000	20.000000	15.000000
25%	1.477021e+06	77787.750000	12.080000	23.000000	20.000000
50%	1.477496e+06	128600.000000	14.140000	27.000000	25.000000
75%	1.477970e+06	270525.000000	22.297500	31.000000	28.000000
max	1.478444e+06	405334.000000	35.410000	35.000000	33.000000

Observations:

Answer 4] The mininum time it takes to prepare the food is 20 minutes, maximum is 35 minutes and the average time is 27.37 minutes

Question 5: How many orders are not rated? [1 mark]

In [56]:

```
# Write the code here
null_count = df[df['rating'] == 'Not given'].count()
print("Number of not rated values in the rating column" , null_count)
```

```
Number of not rated values in the rating column order_id                736
customer_id              736
restaurant_name          736
cuisine_type             736
cost_of_the_order        736
day_of_the_week          736
rating                   736
food_preparation_time    736
delivery_time            736
dtype: int64
```

Observations:

Answer 5] There are 736 orders that are not rated.

Exploratory Data Analysis (EDA)

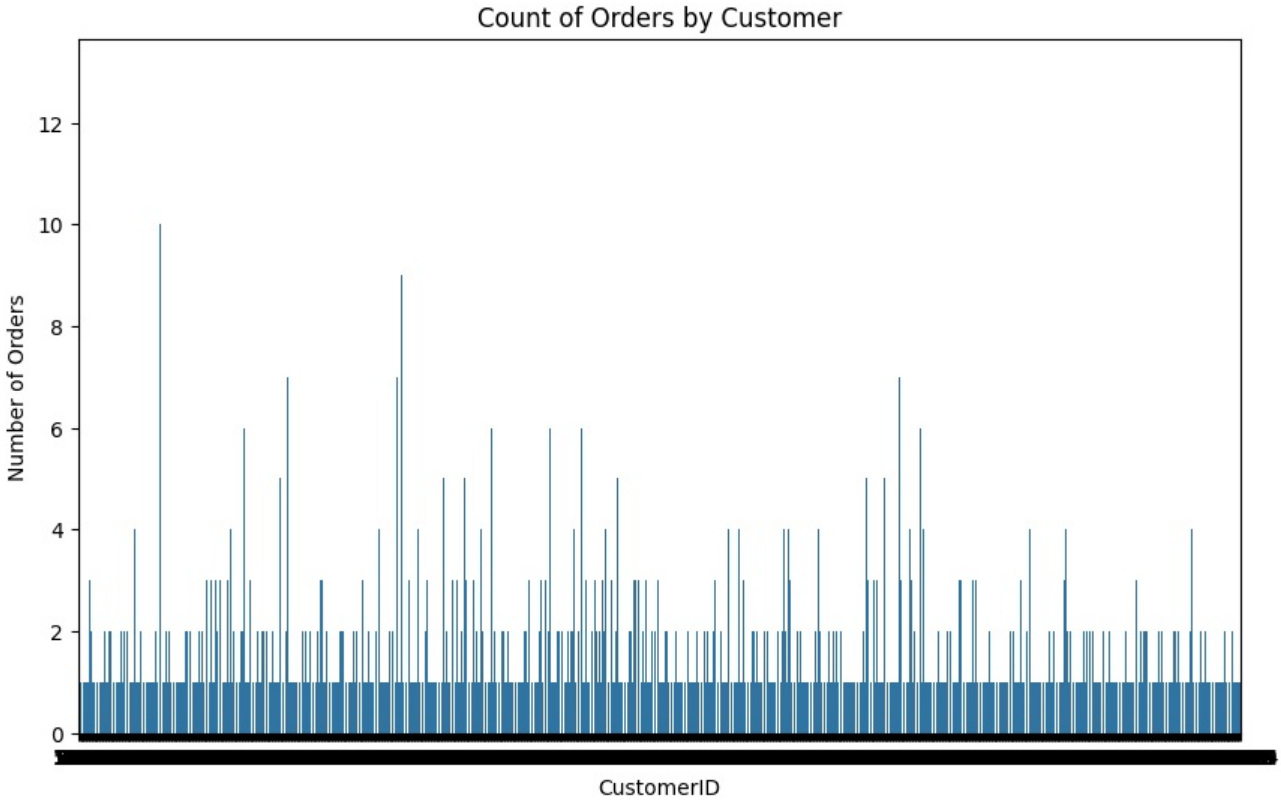
Univariate Analysis

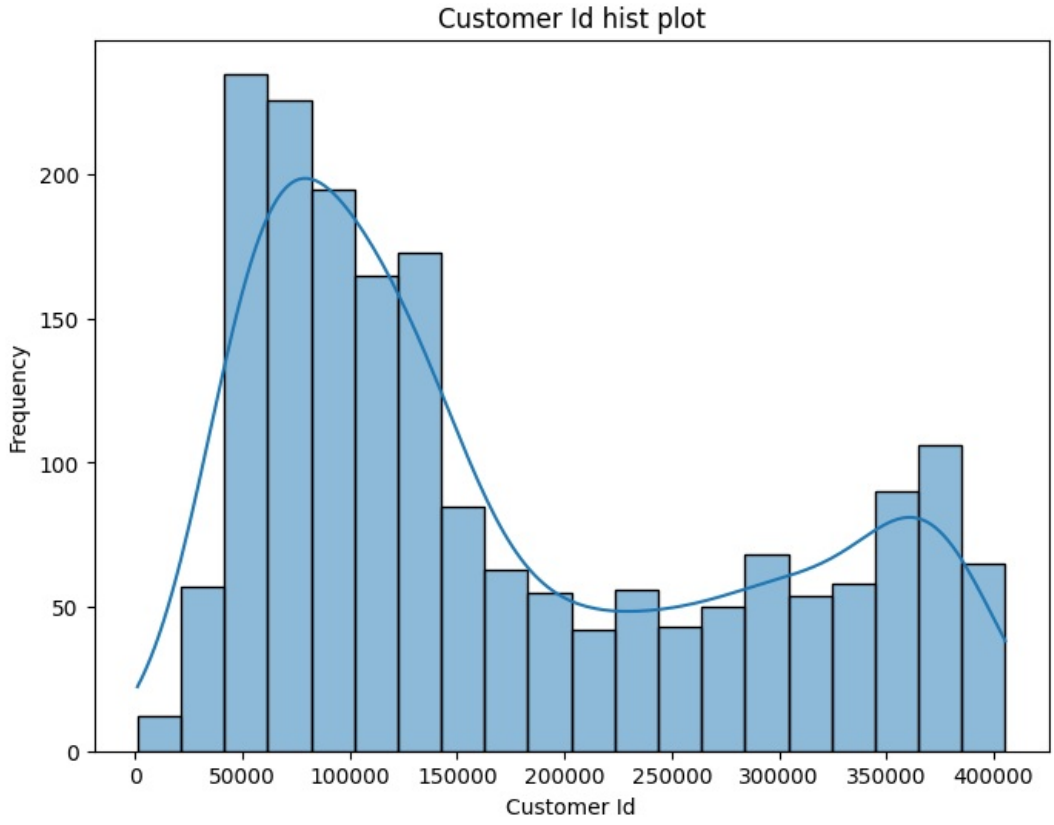
Question 6: Explore all the variables and provide observations on their distributions. (Generally, histograms, boxplots, countplots, etc. are used for univariate exploration.) [9 marks]

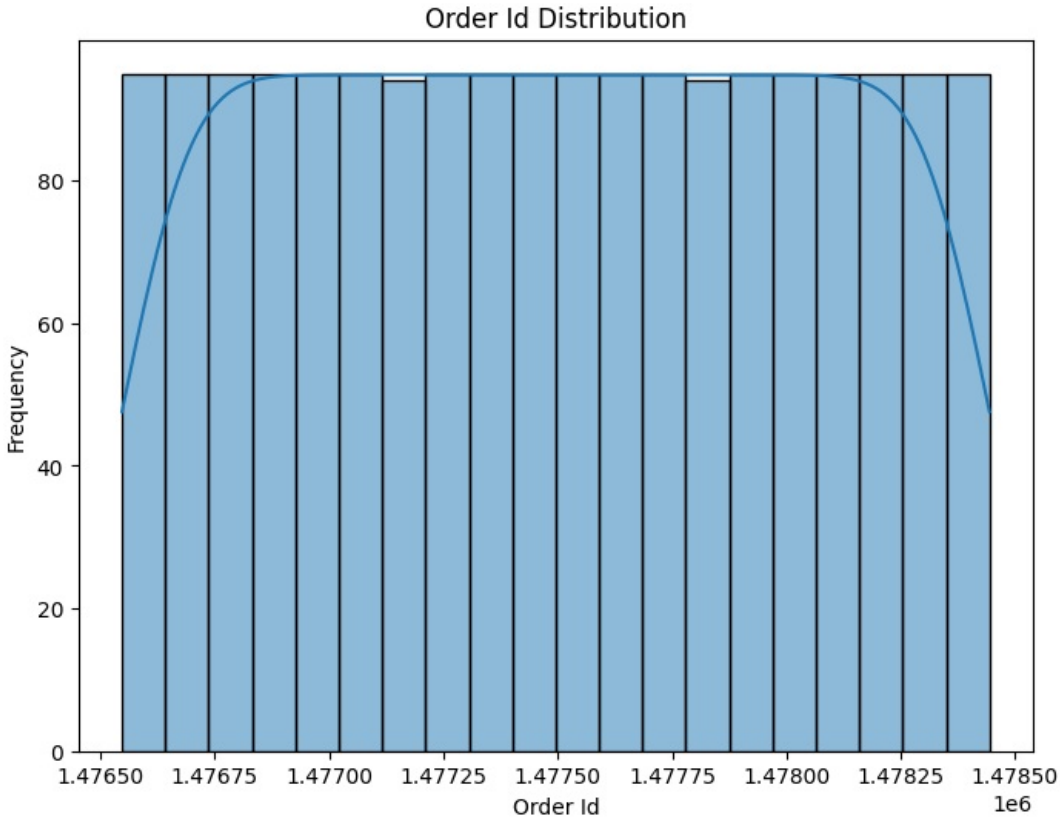
In [57]:

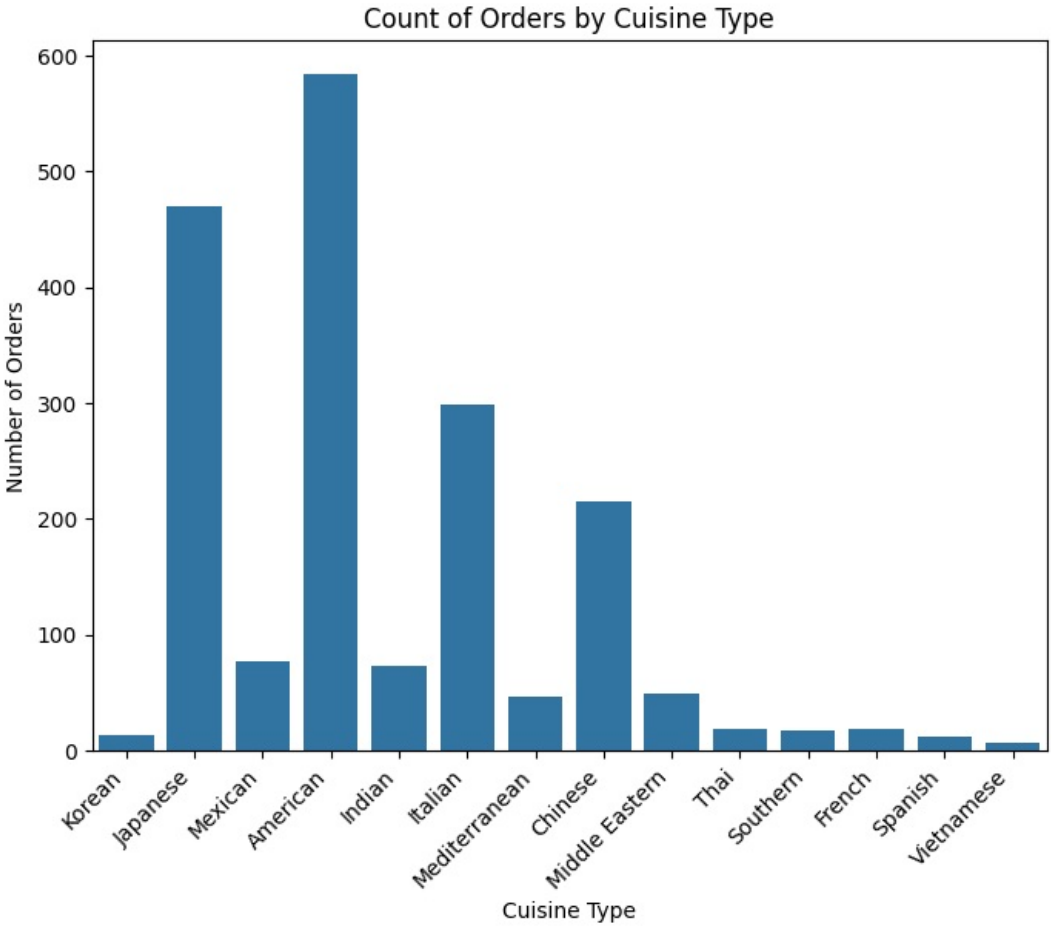
```
import matplotlib.pyplot as plt

# customer Id
plt.figure(figsize=(10, 6))
sns.countplot(x='customer_id', data=df)
plt.title('Count of Orders by Customer')
plt.xlabel('CustomerID')
plt.ylabel('Number of Orders')
plt.show()

plt.figure(figsize=(8, 6))
sns.histplot(df['customer_id'], bins=20, kde=True)
plt.title('Customer Id hist plot')
plt.xlabel('Customer Id')
plt.ylabel('Frequency')
plt.show()
#observation - There are multiple repeat customers.

#order id
plt.figure(figsize=(8, 6))
sns.histplot(df['order_id'], bins=20, kde=True)
plt.title('Order Id Distribution')
plt.xlabel('Order Id')
plt.ylabel('Frequency')
plt.show()

#Cuisine type
plt.figure(figsize=(8, 6))
sns.countplot(x='cuisine_type', data=df)
plt.title('Count of Orders by Cuisine Type')
plt.xlabel('Cuisine Type')
plt.ylabel('Number of Orders')
plt.xticks(rotation=45, ha='right')
plt.show()
#American, Japanese, Italian and Chinese

#cost of the order
plt.figure(figsize=(8, 6))
sns.histplot(df['cost_of_the_order'], bins=20, kde=True)
plt.title('Distribution of Cost of the Order')
plt.xlabel('Cost of the Order $')
plt.ylabel('Frequency')
plt.show()

#day of the week
plt.figure(figsize=(8, 6))
sns.countplot(x='day_of_the_week', data=df)
plt.title('Count of Orders by Day of the Week')
plt.xlabel('Day of the Week')
plt.ylabel('Number of Orders')
plt.show()

#Rating
plt.figure(figsize=(8, 6))
sns.countplot(x='rating', data=df)
plt.title('Count of Orders by Rating')
plt.xlabel('Rating')
plt.ylabel('Number of Orders')
plt.show()

#Food prep time
plt.figure(figsize=(8, 6))
sns.histplot(df['food_preparation_time'], bins=20, kde=True)
plt.title('Distribution of Food Preparation Time')
plt.xlabel('Food Preparation Time (minutes)')
plt.ylabel('Frequency')
plt.show()

#Food prep time
plt.figure(figsize=(8, 6))
sns.boxplot(x='food_preparation_time', data=df)
plt.title('Boxplot of Food Preparation Time')
plt.xlabel('Food Preparation Time (minutes)')
plt.show()
```

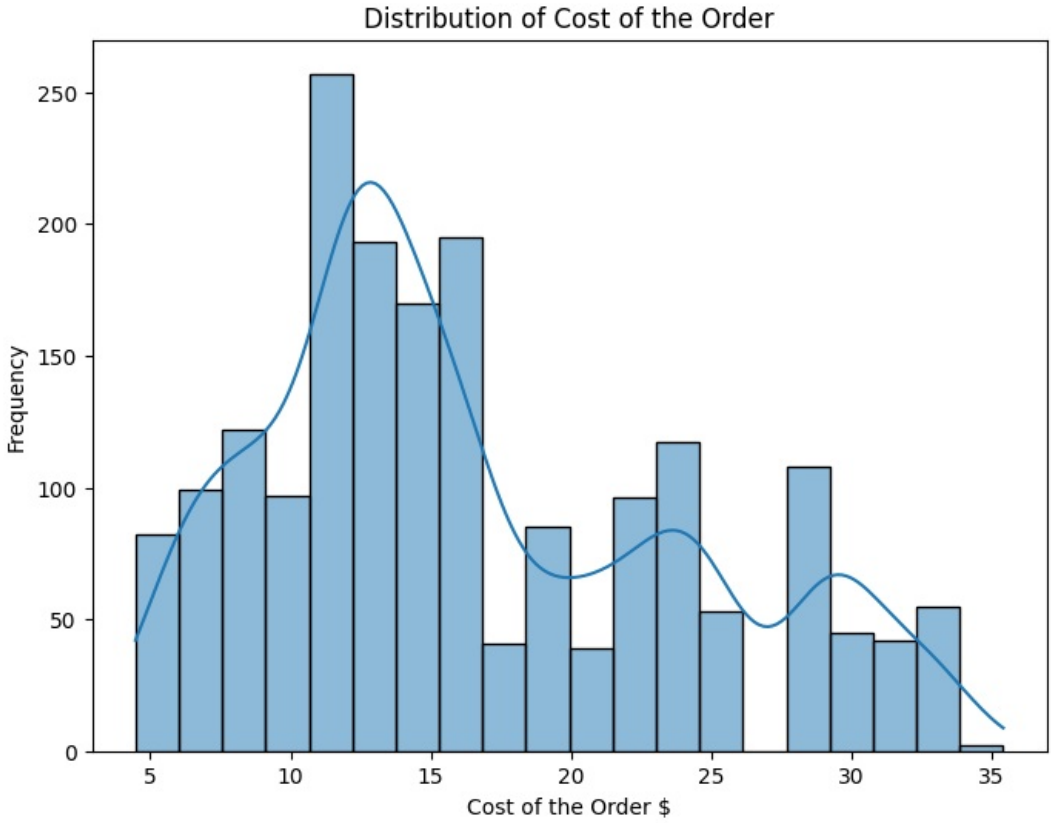
```
plt.show()

#delivery time
plt.figure(figsize=(8, 6))
sns.histplot(df['delivery_time'], bins=20, kde=True)
plt.title('Distribution of Delivery Time')
plt.xlabel('Delivery Time (minutes)')
plt.ylabel('Frequency')
plt.show()

plt.figure(figsize=(8, 6))
sns.boxplot(x='delivery_time', data=df)
plt.title('Boxplot of Delivery Time')
plt.xlabel('Delivery Time (minutes)')
plt.show()
```

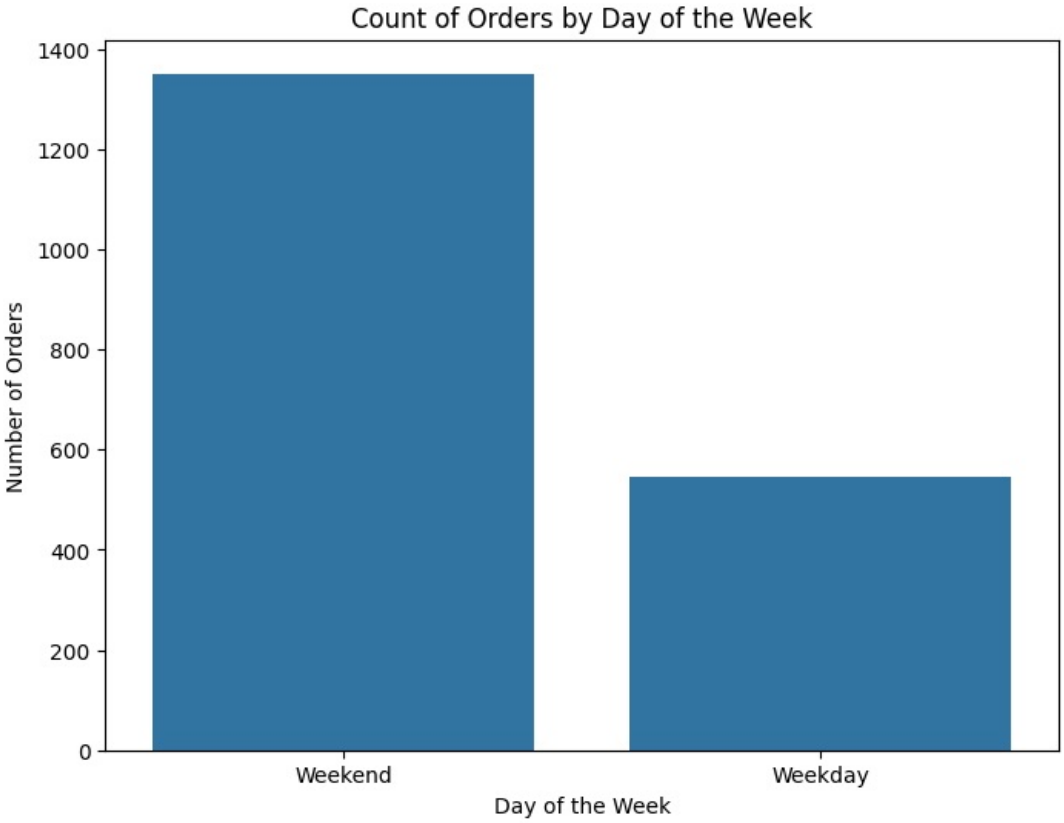


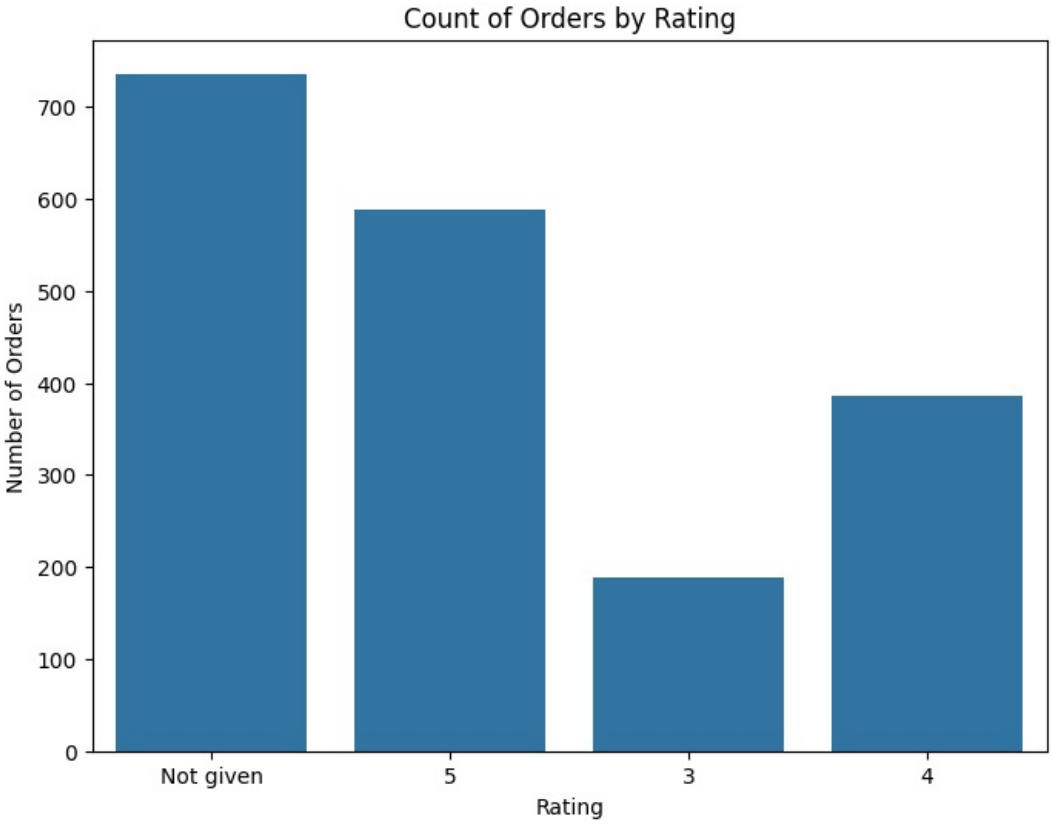


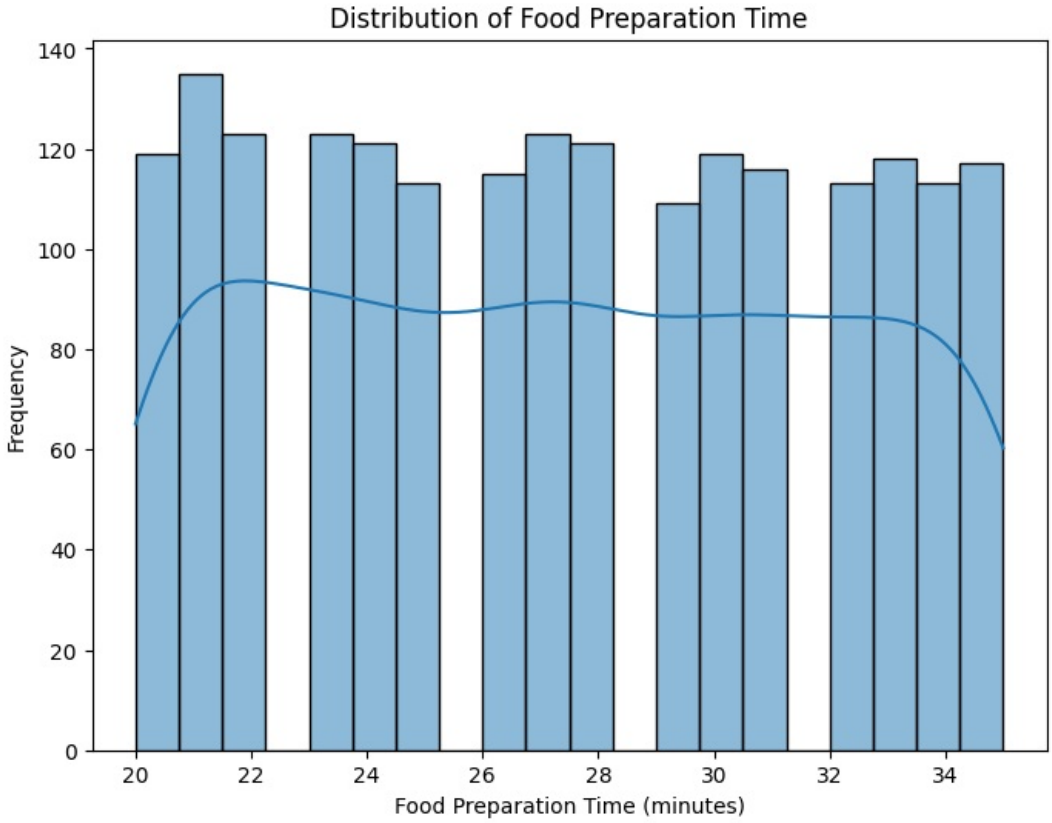

Order Id Distribution
Frequency
0
20
40
60
80
1.47650
1.47675
1.47700
1.47725
1.47750
1.47775
1.47800
1.47825
1.47850
1e6
Order Id

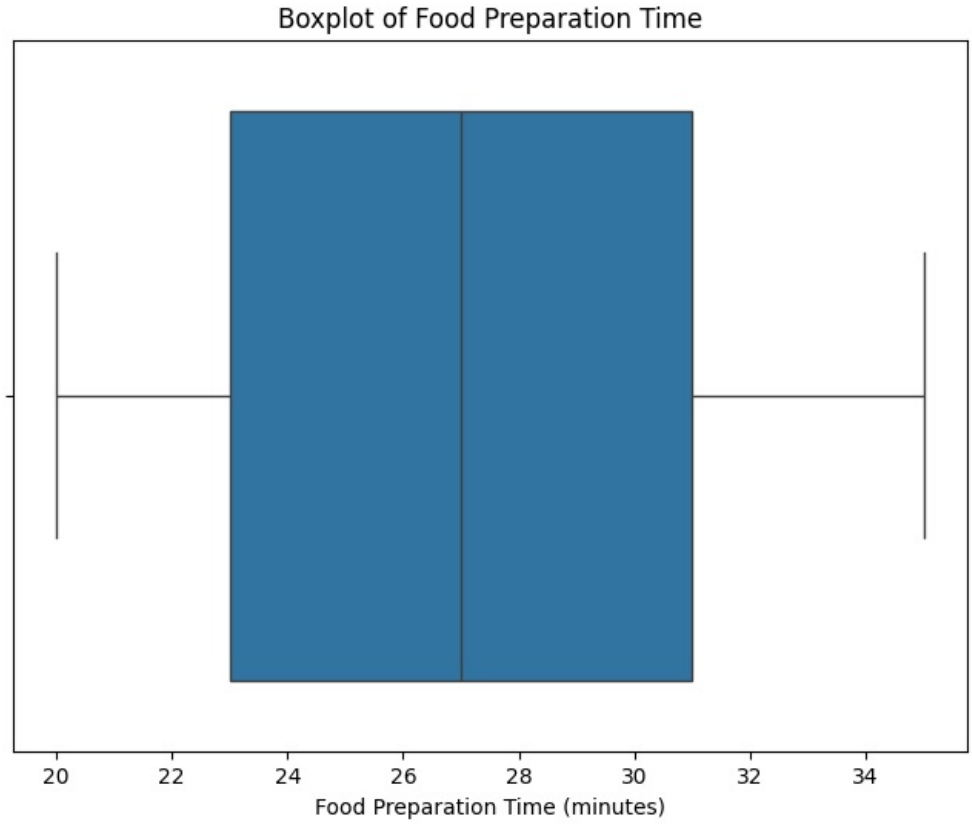

Count of Orders by Cuisine Type
Number of Orders
0
100
200
300
400
500
600
Korean
Japanese
Mexican
American
Indian
Italian
Mediterranean
Chinese
Middle Eastern
Thai
Southern
French
Spanish
Vietnamese
Cuisine Type

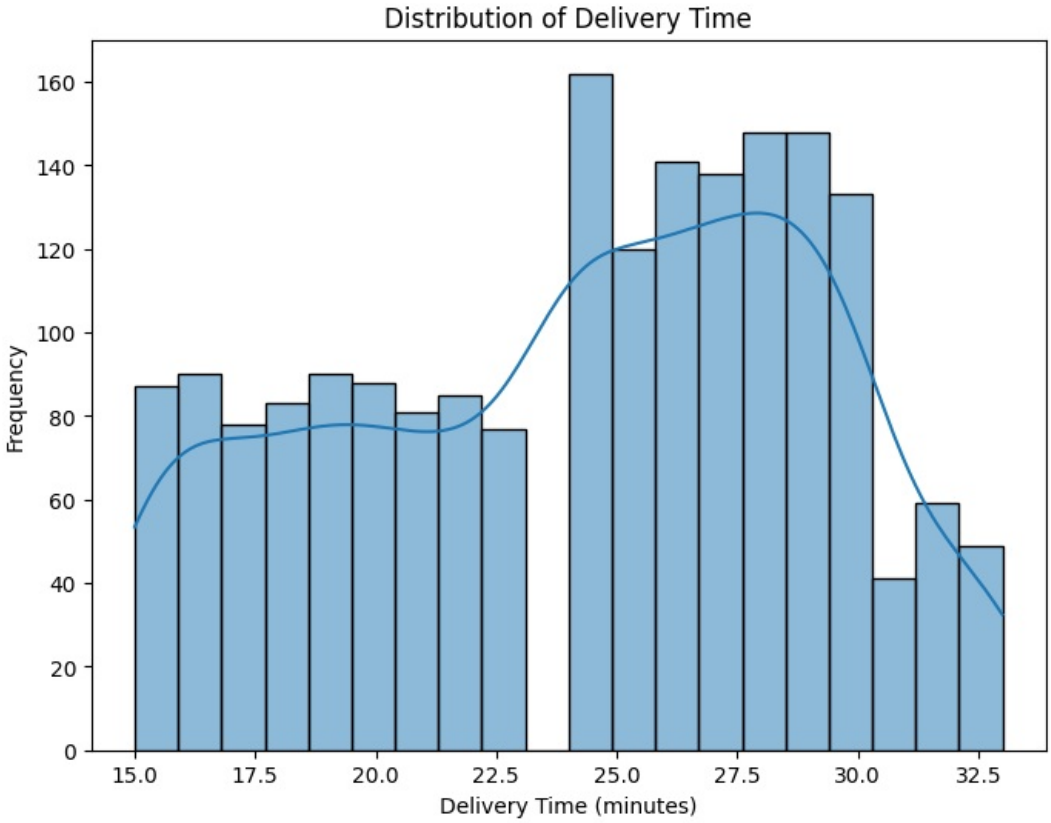

Distribution of Cost of the Order
Frequency
Cost of the Order $
0
50
100
150
200
250
5
10
15
20
25
30
35


Count of Orders by Day of the Week
Number of Orders
Day of the Week
0
200
400
600
800
1000
1200
1400
Weekend
Weekday


Count of Orders by Rating
Number of Orders
0
100
200
300
400
500
600
700
Not given
5
3
4
Rating


Distribution of Food Preparation Time
Frequency
0
20
40
60
80
100
120
140
20
22
24
26
28
30
32
34
Food Preparation Time (minutes)


Boxplot of Food Preparation Time
20
22
24
26
28
30
32
34
Food Preparation Time (minutes)


Distribution of Delivery Time
Frequency
0
20
40
60
80
100
120
140
160
15.0
17.5
20.0
22.5
25.0
27.5
30.0
32.5
Delivery Time (minutes)

1. Customer id - There are multiple repeat customers, which shows a good trend.
2. Cuisine type - The American cuisine orders were more, followed by Japanese. Closely was Italian and Thai Cusine
3. Cost of the order - For the lower cost and higher cost the demand is low. Most of the orders (100 and above) are between 7.5$and32.5$
4. Number of orders - The orders were more on the week end, about 1350 vs on the weekdays which was about 550.
5. Rating - About 710-720 order were not rated.
6. Food Prep time - The average food prep time is 27 minutes (see box plot).
7. Delivery time -The average delivery time is 25 minutes (see box plot).

Question 7: Which are the top 5 restaurants in terms of the number of orders received? [1 mark]

In [58]:

```
# Group by restaurant name and count the number of orders
top_restaurants = df.groupby('restaurant_name')['order_id'].count().nlargest(5)

print(top_restaurants)
```

```
restaurant_name
Shake Shack                  219
The Meatball Shop            132
Blue Ribbon Sushi            119
Blue Ribbon Fried Chicken     96
Parm                          68
Name: order_id, dtype: int64
```

Observations:

The Top restuarants are

1. Shake Shack
2. The meatball Shop
3. Blue Ribbon Sushi
4. Blue Ribbon Fried Chicken
5. Parm

Question 8: Which is the most popular cuisine on weekends? [1 mark]

In [59]:

```
weekend_orders = df[df['day_of_the_week'] == 'Weekend']
most_popular_cuisine_weekend = weekend_orders.groupby('cuisine_type')['order_id'].count().idxmax()

print(f"The most popular cuisine on weekends is: {most_popular_cuisine_weekend}")
```

```
The most popular cuisine on weekends is: American
```

Observations:

Answer 8] The most populr cuisine is **American**

Question 9: What percentage of the orders cost more than 20 dollars? [2 marks]

In [60]:

```
# Write the code here
df['cost_of_the_order'] = pd.to_numeric(df['cost_of_the_order'], errors='coerce')
high_cost_orders = df[df['cost_of_the_order'] > 20]
percentage_high_cost_orders = (len(high_cost_orders) / len(df)) * 100
print(f"Percentage of orders costing more than $20: {percentage_high_cost_orders:.2f}%")
```

```
Percentage of orders costing more than $20: 29.24%
```

Observations:

There are 29.24% of order more than 20 dollars

Question 10: What is the mean order delivery time? [1 mark]

In [61]:

```
# Write the code here
df['delivery_time'] = pd.to_numeric(df['delivery_time'], errors='coerce')
mean_delivery_time = df['delivery_time'].mean()
print(f"The mean order delivery time is: {mean_delivery_time:.2f} minutes")
```

```
The mean order delivery time is: 24.16 minutes
```

Observations:

The mean order deilivery ime is 24.16 minutes

Question 11: The company has decided to give 20% discount vouchers to the top 3 most frequent customers. Find the IDs of these customers and the number of orders they placed. [1 mark]

In [62]:

```
# Write the code here
top_customers = df['customer_id'].value_counts().head(3)
print("Top 3 most frequent customers:")
print(top_customers)
```

```
Top 3 most frequent customers:
customer_id
52832    13
47440    10
83287     9
Name: count, dtype: int64
```

Observations:

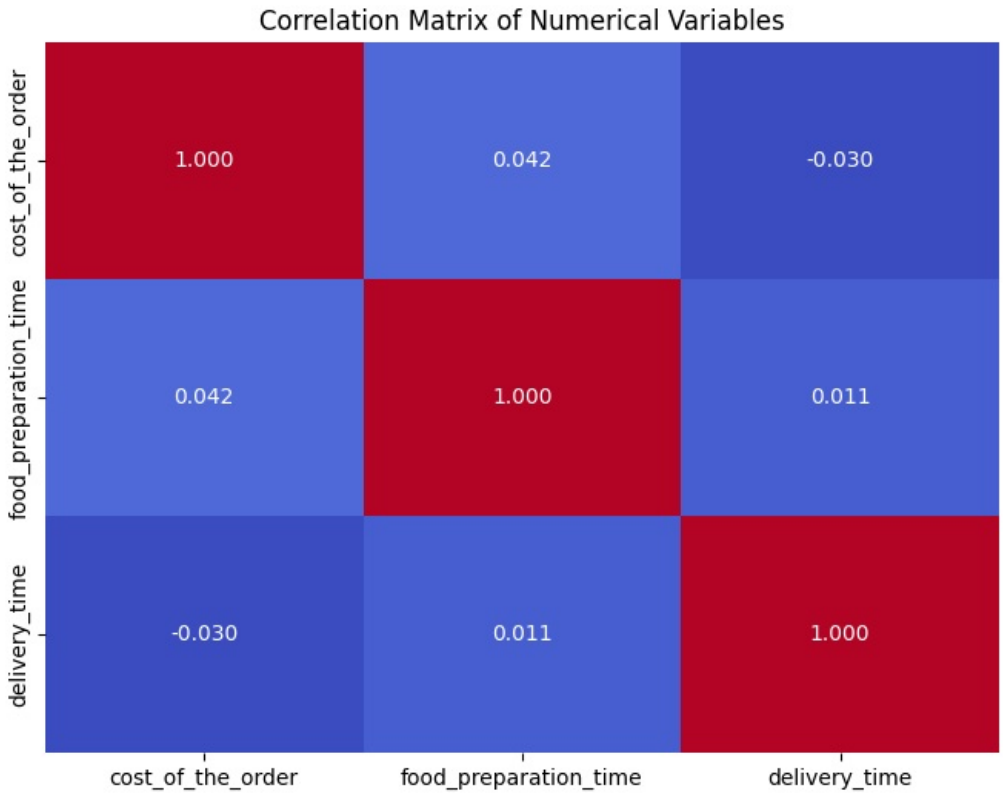
The customer id's are : 52832, 47440, 83287 and they have placed 13, 10 and 9 orders respectively.

Multivariate Analysis

Question 12: Perform a multivariate analysis to explore relationships between the important variables in the dataset. (It is a good idea to explore relations between numerical variables as well as relations between numerical and categorical variables) [10 marks]

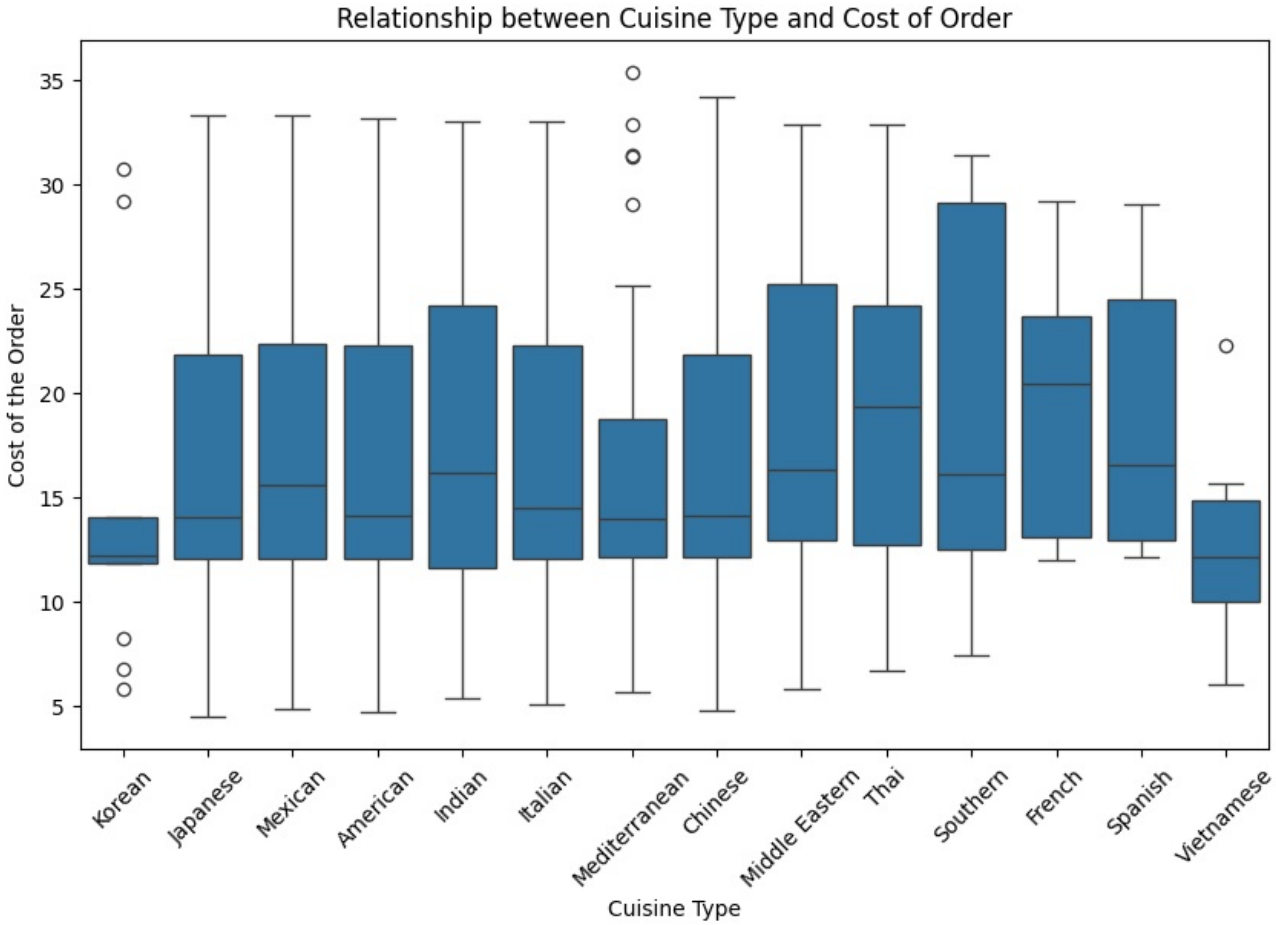
In [63]:

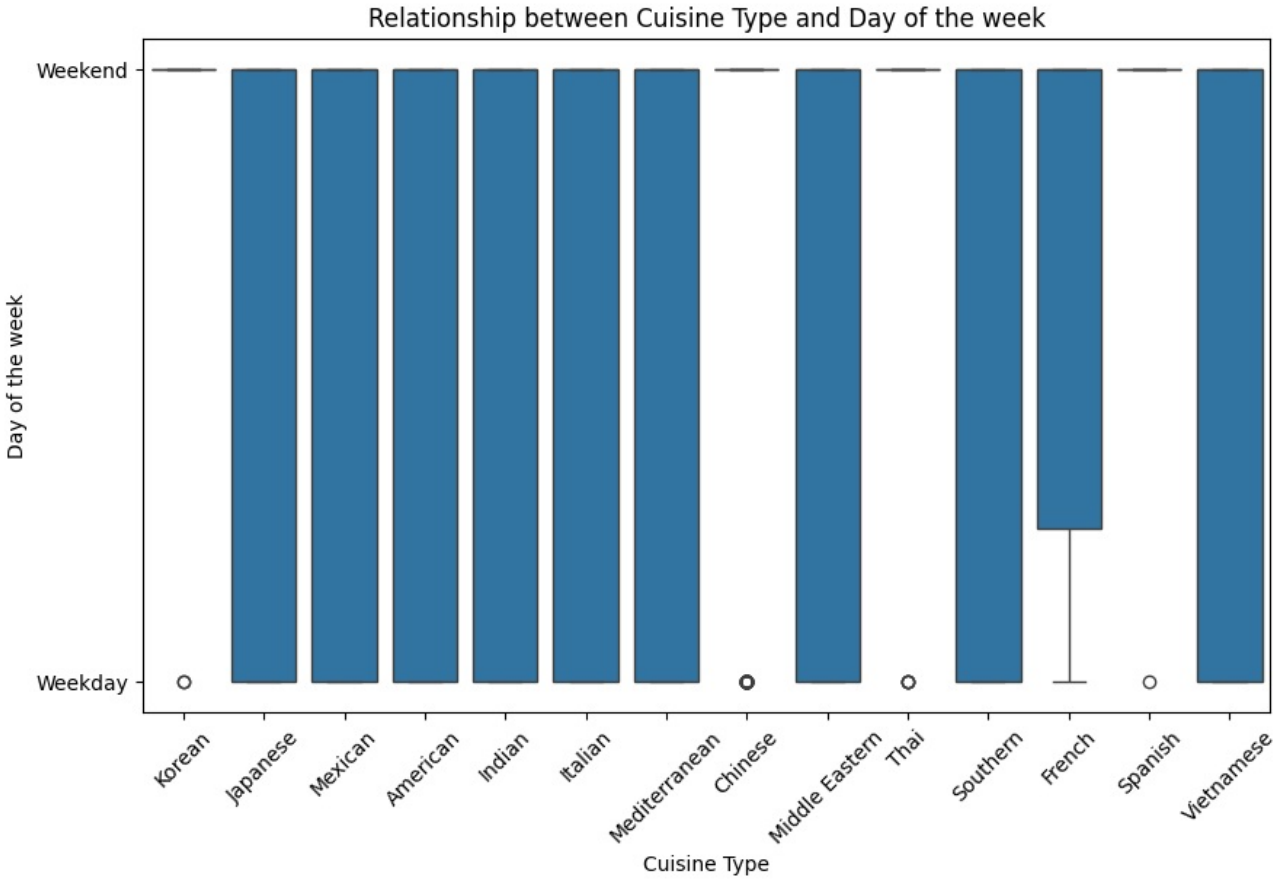
```
# Heatmaps between prep time, delivery and order cost.
import matplotlib.pyplot as plt
# Correlation Matrix
correlation_matrix = df[['cost_of_the_order', 'food_preparation_time', 'delivery_time']].corr()
plt.figure(figsize=(8, 6))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', cbar=False, fmt= '0.3f')
plt.title('Correlation Matrix of Numerical Variables')
plt.show()
```

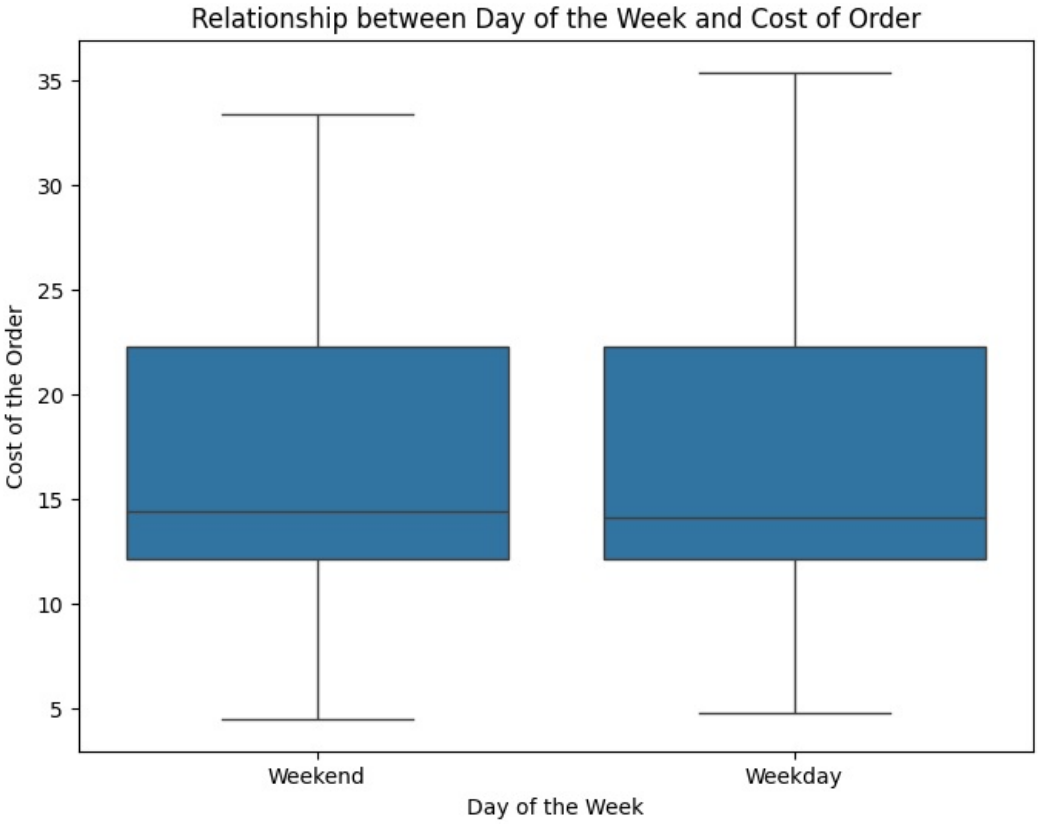


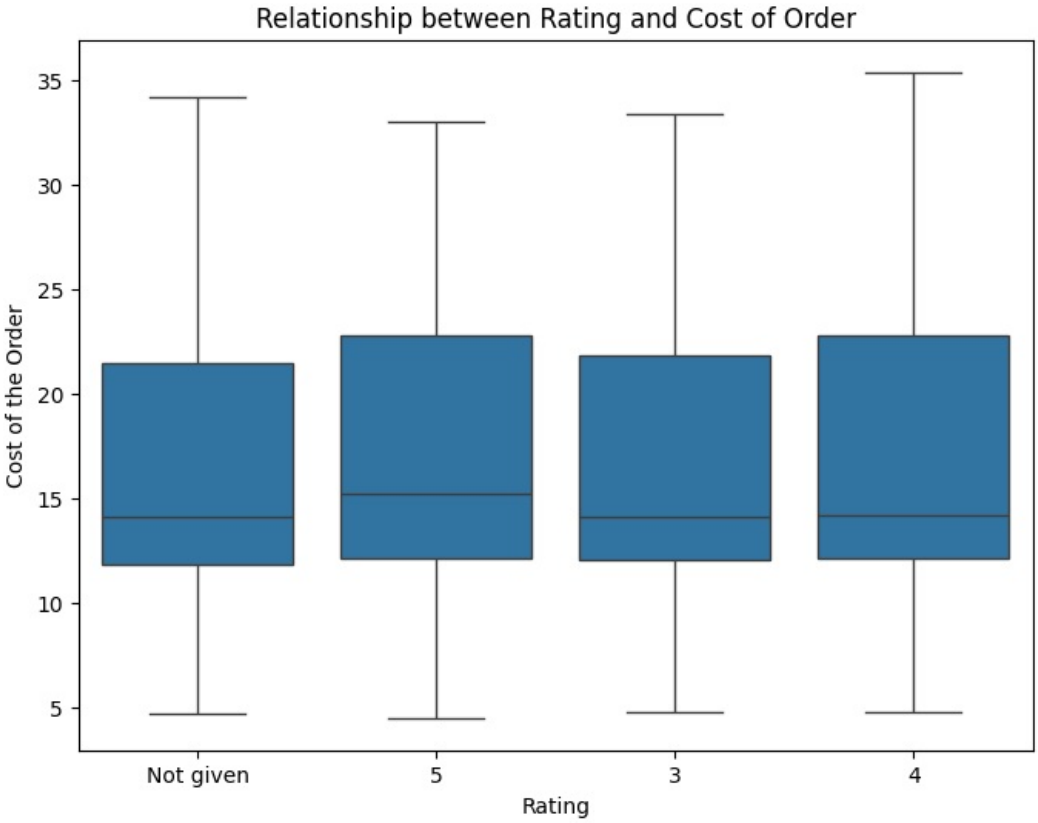
In [64]:

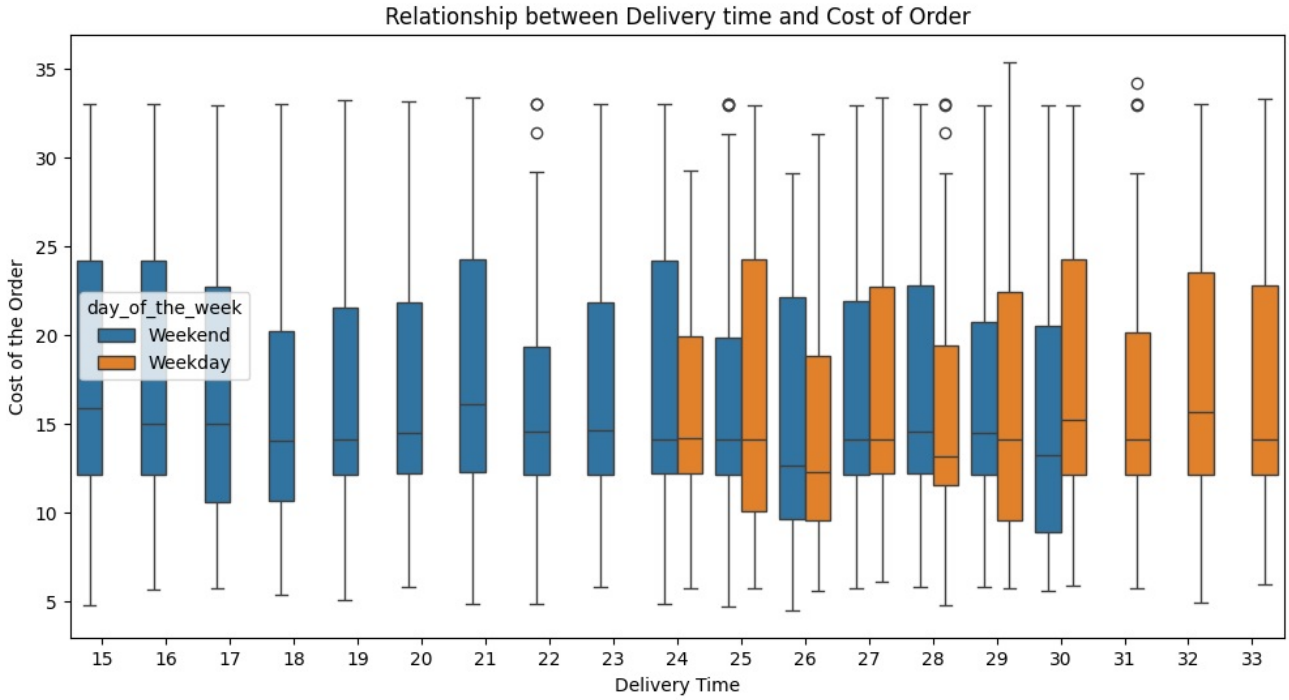
```
# Lets do the following boxplots to understand the cost of hte order vs the cusine, order time (week day/Week end
), and Rating
#Relationship between Cuisine Type and Cost of Order
plt.figure(figsize=(10, 6))
sns.boxplot(x='cuisine_type', y='cost_of_the_order', data=df)
plt.title('Relationship between Cuisine Type and Cost of Order')
plt.xlabel('Cuisine Type')
plt.ylabel('Cost of the Order')
plt.xticks(rotation=45, ha='center')
plt.show()


# relationship between cusine and day of the week
plt.figure(figsize=(10, 6))
sns.boxplot(x='cuisine_type', y='day_of_the_week', data=df)
plt.title('Relationship between Cuisine Type and Day of the week')
plt.xlabel('Cuisine Type')
plt.ylabel('Day of the week')
plt.xticks(rotation=45, ha='center')
plt.show()

# Relationship between Day of the Week and Cost of Order
plt.figure(figsize=(8, 6))
sns.boxplot(x='day_of_the_week', y='cost_of_the_order', data=df)
plt.title('Relationship between Day of the Week and Cost of Order')
plt.xlabel('Day of the Week')
plt.ylabel('Cost of the Order')
plt.show()

# Relationship between Rating and Cost of Order
plt.figure(figsize=(8, 6))
sns.boxplot(x='rating', y='cost_of_the_order', data=df)
plt.title('Relationship between Rating and Cost of Order')
plt.xlabel('Rating')
plt.ylabel('Cost of the Order')
plt.show()

# Relationship between Rating and Cost of Order
plt.figure(figsize=(12, 6))
sns.boxplot(x='delivery_time', y='cost_of_the_order', data=df, hue='day_of_the_week')
plt.title('Relationship between Delivery time and Cost of Order')
plt.xlabel('Delivery Time')
plt.ylabel('Cost of the Order')
plt.show()

# Relationship between Rating and delivery time
plt.figure(figsize=(12, 8))
sns.boxplot(x='delivery_time', y='rating', data=df, hue='day_of_the_week')
plt.title('Relationship between Delivery time and Rating')
plt.xlabel('Delivery Time')
plt.ylabel('rating')
plt.show()

# Relationship between Rating and Food preparation time
plt.figure(figsize=(12, 8))
sns.boxplot(x='food_preparation_time', y='rating', data=df, hue='day_of_the_week')
plt.title('Relationship between Food preparation Time and Rating')
plt.xlabel('Food Preparation Time')
plt.ylabel('rating')
plt.show()

#1 - The higher the order the more the food preparation time, per the heat map
#2 The cost doesnt change on a weekday vs a week end. Just an observation
#3 The cost for Southern and Indian cusine is High, but not much in demand.
#4 As far as rating and cost of the order goes, there is not a relation showing a relation that a higher cost cau
ses a lower rating. Which means, cosumers are not worried about the cost as much.
#5 The week end delivery times are much less. The company needs to invest more to find out why the delivery times
are more on the week days.
#6 Not only the delivery times less on the weekend, the rating are just as high.
```

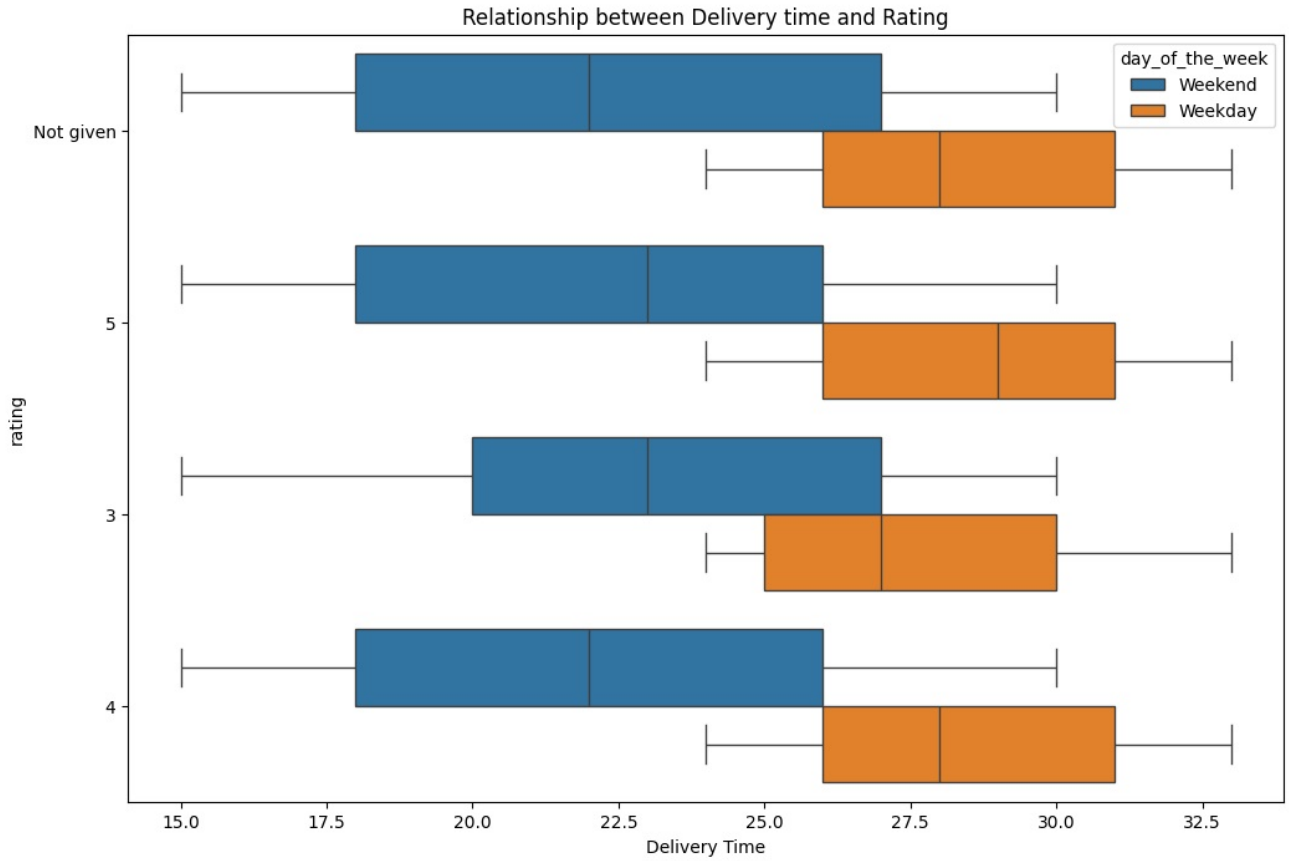

Relationship between Cuisine Type and Cost of Order
Cost of the Order
35
30
25
20
15
10
5
Korean
Japanese
Mexican
American
Indian
Italian
Mediterranean
Chinese
Middle Eastern
Thai
Southern
French
Spanish
Vietnamese
Cuisine Type

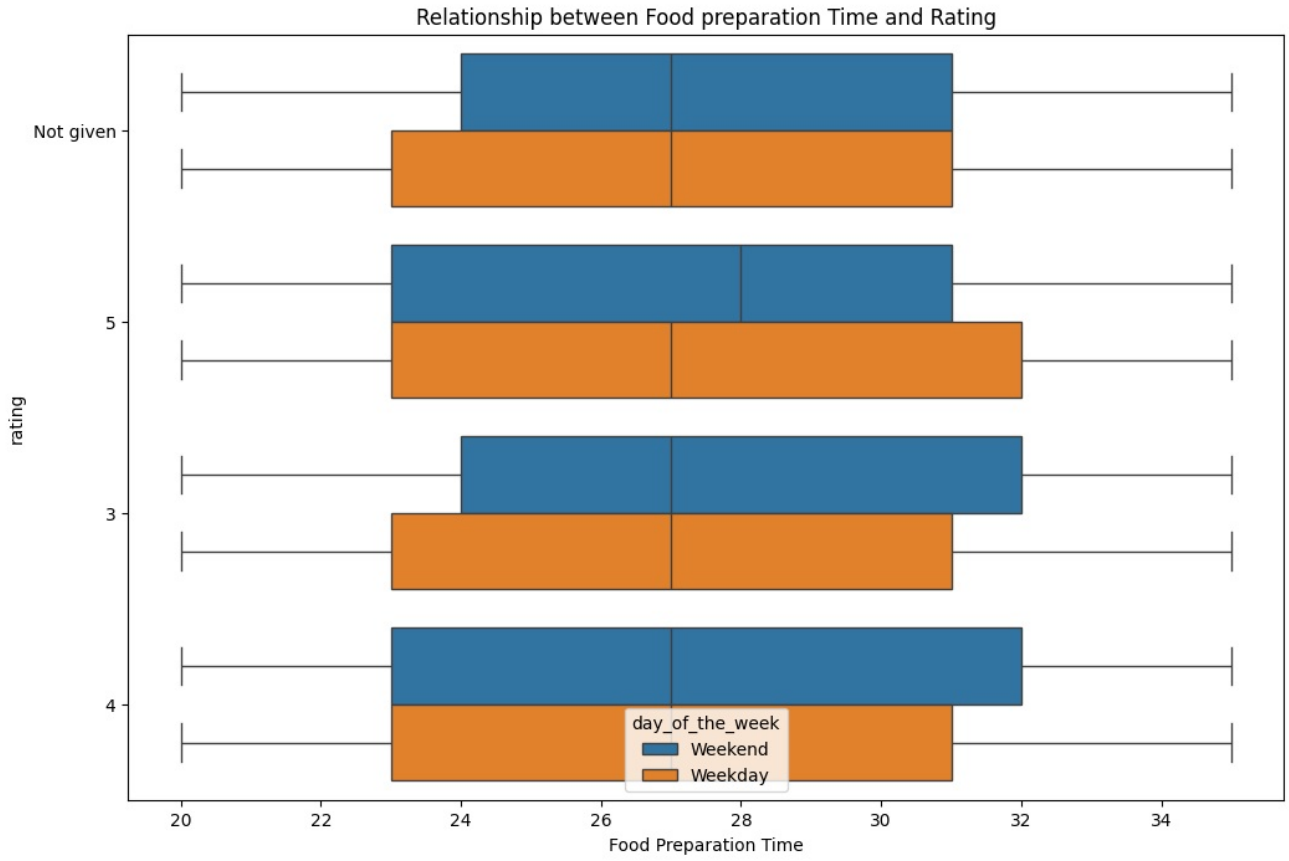

Relationship between Cuisine Type and Day of the week
Day of the week
Weekend
Weekday
Korean
Japanese
Mexican
American
Indian
Italian
Mediterranean
Chinese
Middle Eastern
Thai
Southern
French
Spanish
Vietnamese
Cuisine Type


Relationship between Day of the Week and Cost of Order
Cost of the Order
35
30
25
20
15
10
5
Weekend
Weekday
Day of the Week


Relationship between Rating and Cost of Order
Cost of the Order
35
30
25
20
15
10
5
Not given
5
3
4
Rating

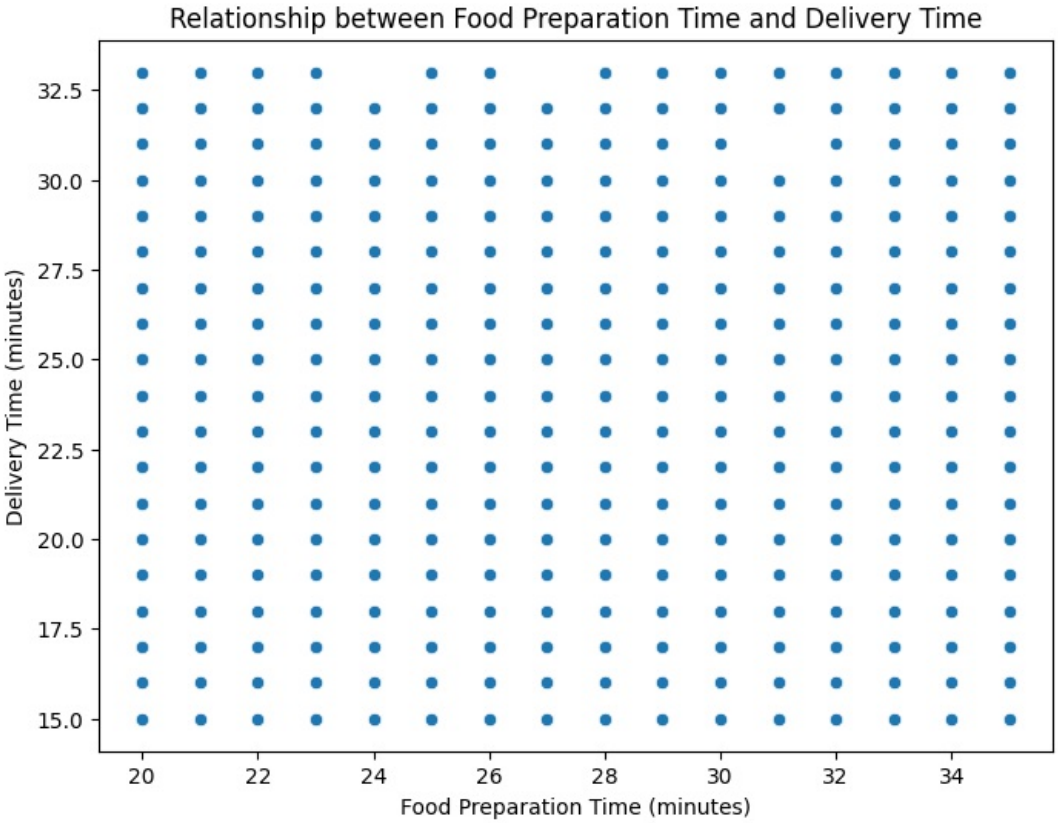

Relationship between Delivery time and Cost of Order
Cost of the Order
Delivery Time
day_of_the_week
Weekend
Weekday
35
30
25
20
15
10
5
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33

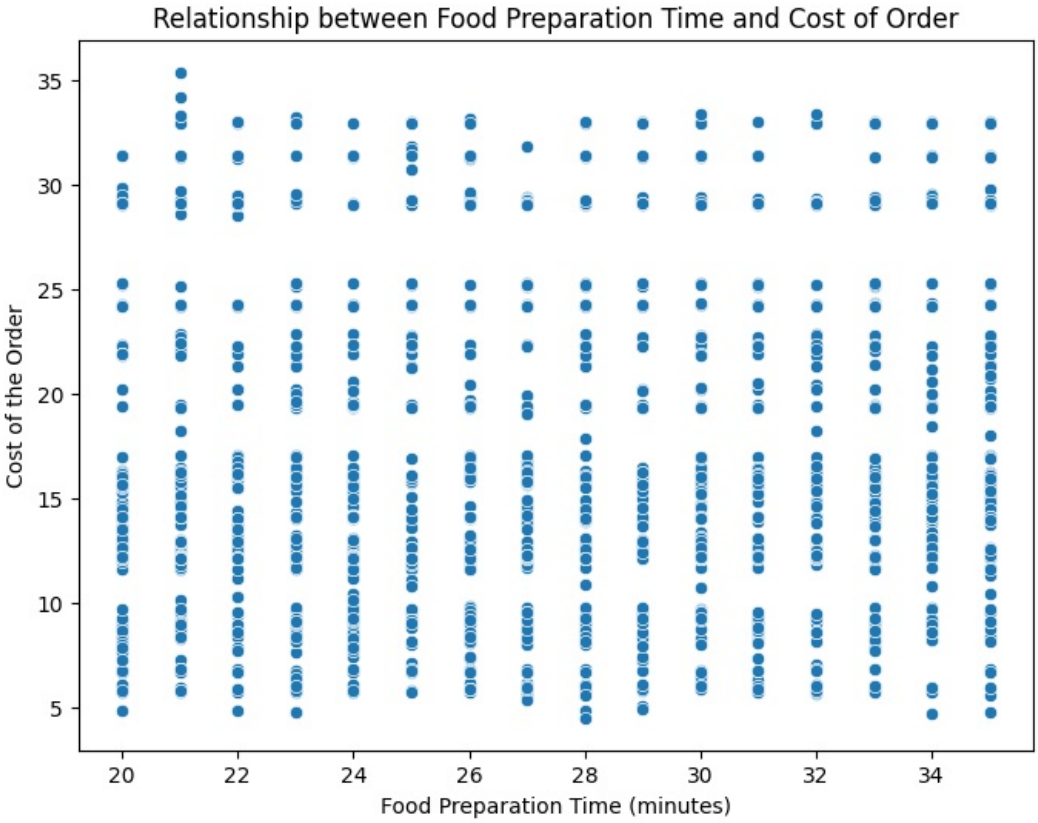

Relationship between Delivery time and Rating
rating
Delivery Time
day_of_the_week
Weekend
Weekday
Not given
5
3
4
15.0
17.5
20.0
22.5
25.0
27.5
30.0
32.5

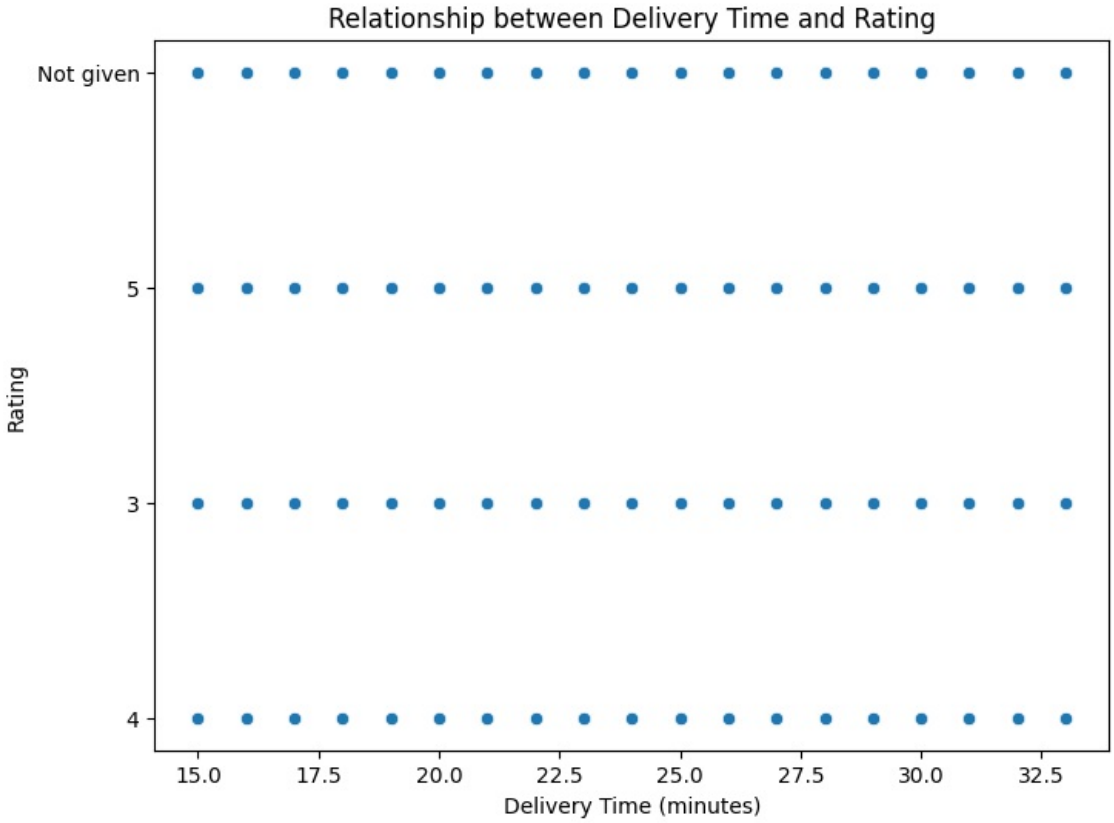


In [68]:

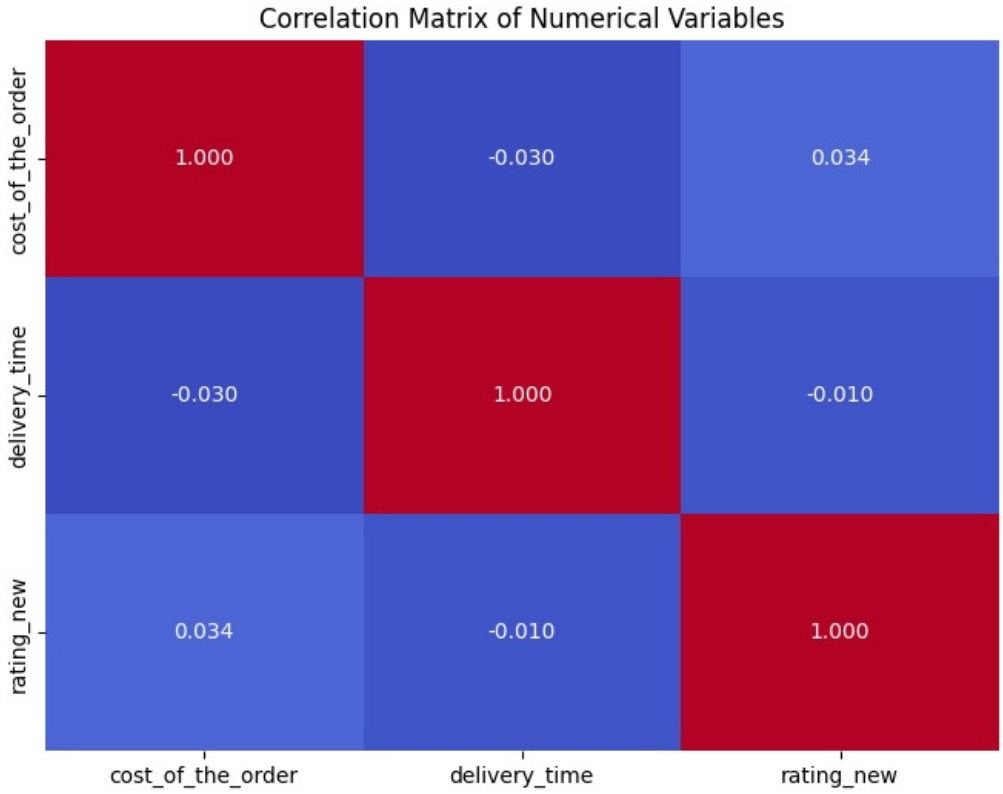
```
#time for scatter plots
# Relationship between Food Preparation Time and Delivery Time
plt.figure(figsize=(8, 6))
sns.scatterplot(x='food_preparation_time', y='delivery_time', data=df)
plt.title('Relationship between Food Preparation Time and Delivery Time')
plt.xlabel('Food Preparation Time (minutes)')
plt.ylabel('Delivery Time (minutes)')
plt.show()

# Relationship between Food Preparation Time and Cost of Order
plt.figure(figsize=(8, 6))
sns.scatterplot(x='food_preparation_time', y='cost_of_the_order', data=df)
plt.title('Relationship between Food Preparation Time and Cost of Order')
plt.xlabel('Food Preparation Time (minutes)')
plt.ylabel('Cost of the Order')
plt.show()

# Relationship between Delivery Time and Cost of Order
plt.figure(figsize=(8, 6))
sns.scatterplot(x='delivery_time', y='cost_of_the_order', data=df)
plt.title('Relationship between Delivery Time and Cost of Order')
plt.xlabel('Delivery Time (minutes)')
plt.ylabel('Cost of the Order')
plt.show()

# Relationship between Delivery Time and Cost of Order
plt.figure(figsize=(8, 6))
sns.scatterplot(x='delivery_time', y='rating', data=df)
plt.title('Relationship between Delivery Time and Rating')
plt.xlabel('Delivery Time (minutes)')
plt.ylabel('Rating')
plt.show()

# Correlation Matrix
df.info()
correlation_matrix = df[['cost_of_the_order','delivery_time', 'rating_new']].corr()
plt.figure(figsize=(8, 6))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', cbar=False, fmt= '0.3f')
plt.title('Correlation Matrix of Numerical Variables')
plt.show()
```


Relationship between Food Preparation Time and Delivery Time
Delivery Time (minutes)
Food Preparation Time (minutes)
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
20
22
24
26
28
30
32
34


Relationship between Food Preparation Time and Cost of Order
Cost of the Order
Food Preparation Time (minutes)
35
30
25
20
15
10
5
20
22
24
26
28
30
32
34




```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1898 entries, 0 to 1897
Data columns (total 10 columns):
 #   Column                 Non-Null Count  Dtype  
---  ------                 --------------  -----  
 0   order_id               1898 non-null   int64  
 1   customer_id            1898 non-null   int64  
 2   restaurant_name        1898 non-null   object 
 3   cuisine_type           1898 non-null   object 
 4   cost_of_the_order      1898 non-null   float64
 5   day_of_the_week        1898 non-null   object 
 6   rating                 1898 non-null   object 
 7   food_preparation_time  1898 non-null   int64  
 8   delivery_time          1898 non-null   int64  
 9   rating_new             1162 non-null   float64
dtypes: float64(2), int64(4), object(4)
memory usage: 148.4+ KB
```



Answer 12]

1 - The higher the order the more the food preparation time, per the heat map.

2 The cost doesnt change on a weekday vs a week end. Just an observation.

3 The cost for Southern and Indian cusine is High, but not much in demand.

4 As far as rating and cost of the order goes, there is not a relation showing a relation that a higher cost causes a lower rating. Which means, cosumers are not worried about the cost as much.

5 The week end delivery times are much less. The company needs to invest more to find out why the delivery times are more on the week days.

6 Not only the delivery times less on the weekend, the rating are just as high.

Question 13: The company wants to provide a promotional offer in the advertisement of the restaurants. The condition to get the offer is that the restaurants must have a rating count of more than 50 and the average rating should be greater than 4. Find the restaurants fulfilling the criteria to get the promotional offer. [3 marks]

In [67]:

```
# Convert to numeric, replacing 'Not Given' with NaN. Lets do that on a new column, that way we dont mess with th
e original data
df['rating_new'] = pd.to_numeric(df['rating'], errors='coerce')

# Filter restaurants with rating count > 50 and average rating > 4

# Step 1 - Lets start doing a group by first
restaurant_ratings = df.groupby('restaurant_name')['rating_new'].agg(['count', 'mean'])

# Step 2 - Filter restaurants with rating count > 50 and average rating > 4
promotional_restaurants = restaurant_ratings[(restaurant_ratings['count'] > 50) & (restaurant_ratings['mean'] > 4
)]
print("Promotional_restaurants \n", promotional_restaurants)
```

```
Promotional_restaurants
                          count      mean
restaurant_name
Blue Ribbon Fried Chicken     64  4.328125
Blue Ribbon Sushi             73  4.219178
Shake Shack                  133  4.278195
The Meatball Shop             84  4.511905
```

Observations:

The following restaurants fultill the promotional offer criteria

1. Blue Ribbon Fried Chicken
2. Blue Ribbon Sushi
3. Shake Shack
4. The Meatball Shop

Question 14: The company charges the restaurant 25% on the orders having cost greater than 20 dollars and 15% on the orders having cost greater than 5 dollars. Find the net revenue generated by the company across all orders. [3 marks]

In [69]:

```
# Calculate the revenue for orders greater than $20
revenue_greater_than_20 = df[df['cost_of_the_order'] > 20]['cost_of_the_order'].sum() * 0.25
print("Total orders with revenue greater than $20 = " , revenue_greater_than_20)


# Calculate the revenue for orders greater than $5 and less than or equal to $20
revenue_greater_than_5 = df[(df['cost_of_the_order'] > 5) & (df['cost_of_the_order'] <= 20)]['cost_of_the_order']
.sum() * 0.15
print("Total orders with revenue more than $5 (but less than $20)= " , revenue_greater_than_5)

# Calculate the total net revenue
total_revenue = revenue_greater_than_20 + revenue_greater_than_5

print(f"The net revenue generated by the company across all orders is: ${total_revenue:.2f}")
```

```
Total orders with revenue greater than $20 =  3688.7275
Total orders with revenue more than $5 (but less than $20)=  2477.5755000000004
The net revenue generated by the company across all orders is: $6166.30
```

Observations:

Total orders with revenue greater than $20 = **3688.72**

Total orders with revenue more than $5(butlessthan20)= **2477.57**

The net revenue generated by the company across all orders is: **$6166.30**

Question 15: The company wants to analyze the total time required to deliver the food. What percentage of orders take more than 60 minutes to get delivered from the time the order is placed? (The food has to be prepared and then delivered.) [2 marks]

In [70]:

```
# Calculate the total delivery time (food preparation + delivery time)
df['total_delivery_time'] = df['food_preparation_time'] + df['delivery_time']

# Calculate the percentage of orders that take more than 60 minutes
percentage_orders_over_60_minutes = (len(df[df['total_delivery_time'] > 60]) / len(df)) * 100

print(f"Percentage of orders taking more than 60 minutes to deliver: {percentage_orders_over_60_minutes:.2f}%")
```

```
Percentage of orders taking more than 60 minutes to deliver: 10.54%
```

Observations:

Percentage of orders taking more than 60 minutes to deliver: 10.54%

Question 16: The company wants to analyze the delivery time of the orders on weekdays and weekends. How does the mean delivery time vary during weekdays and weekends? [2 marks]

In [71]:

```
# Group by 'day_of_the_week' and calculate the mean delivery time
mean_delivery_time_by_day = df.groupby('day_of_the_week')['delivery_time'].mean()

mean_delivery_time_by_day
```

Out[71]:

day_of_the_week	delivery_time
Weekday	28.340037
Weekend	22.470022

dtype: float64

Observations:

The mean delivery time on week days is 28.34 minutes and week ends is 22.47 minutes.

Conclusion and Recommendations

Question 17: What are your conclusions from the analysis? What recommendations would you like to share to help improve the business? (You can use cuisine type and feedback ratings to drive your business recommendations.) [6 marks]

In [72]:

```
#how many ratings are 'Not Given' by day of the week?
not_given_ratings_by_day = df[df['rating'] == 'Not given'].groupby('day_of_the_week')['rating'].count()
print("The time of the week when ratings are not given is " , not_given_ratings_by_day)

df['day_of_the_week'] = pd.Categorical(df['day_of_the_week'], categories=['Weekday', 'Weekend'])

# Group by day of the week and calculate the average delivery time
average_delivery_time_by_day = df.groupby('day_of_the_week')['delivery_time'].mean()

print(average_delivery_time_by_day)
```

```
The time of the week when ratings are not given is  day_of_the_week
Weekday    207
Weekend    529
Name: rating, dtype: int64
day_of_the_week
Weekday    28.340037
Weekend    22.470022
Name: delivery_time, dtype: float64

<ipython-input-72-33edfa2a1c27>:8: FutureWarning: The default of observed=False is deprecated and wi
ll be changed to True in a future version of pandas. Pass observed=False to retain current behavior
or observed=True to adopt the future default and silence this warning.
  average_delivery_time_by_day = df.groupby('day_of_the_week')['delivery_time'].mean()
```

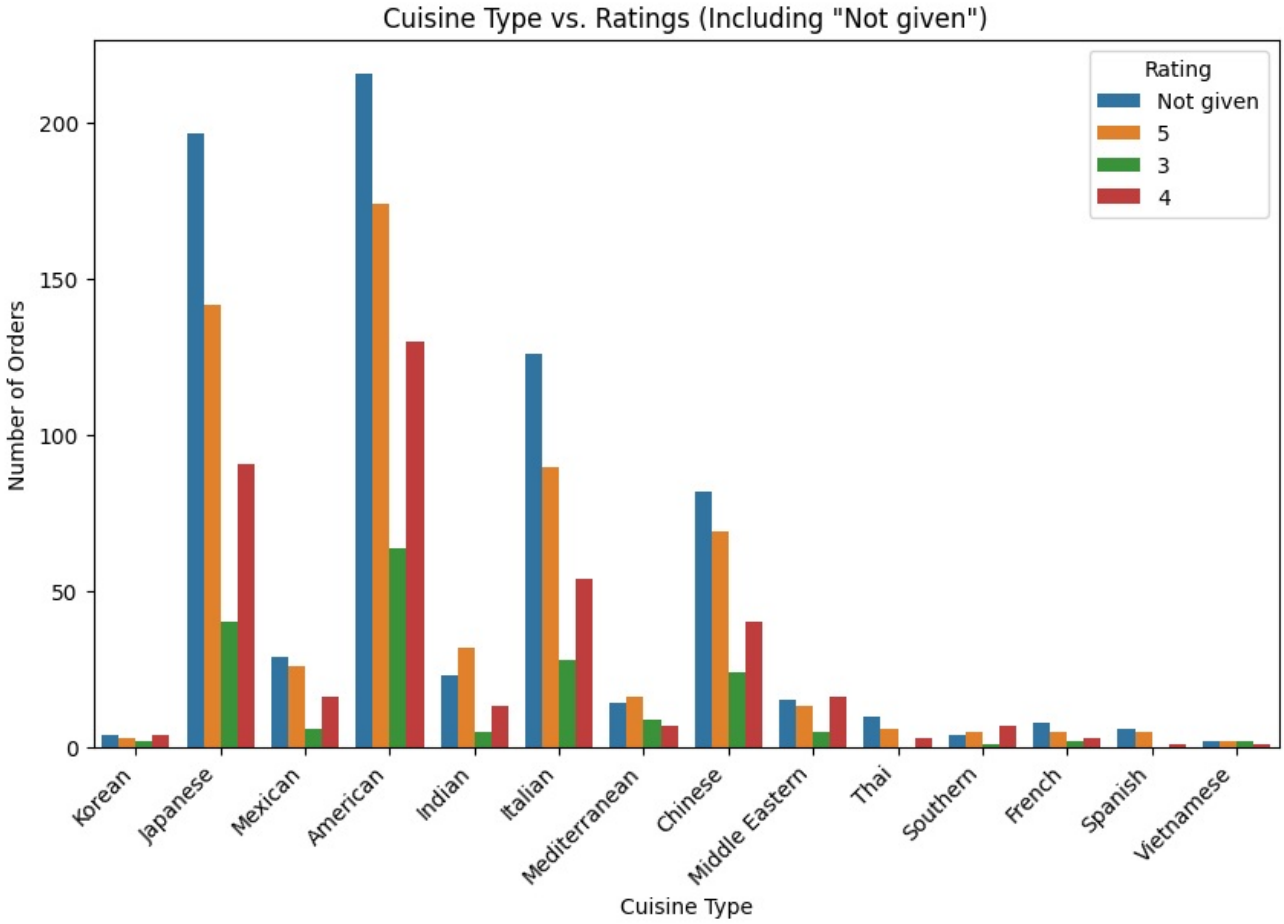
Conclusions:

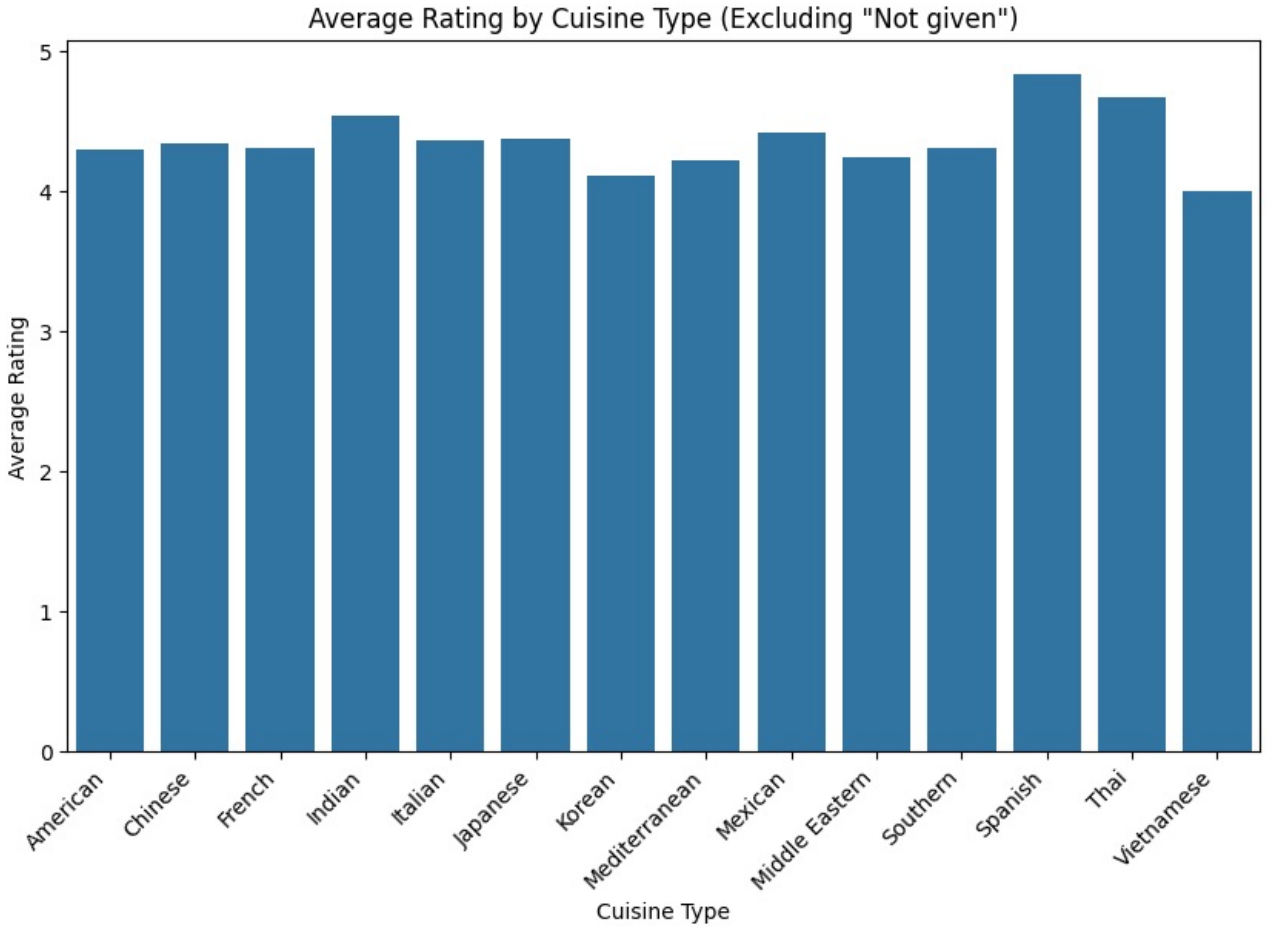
- The american cusine on the week ends is in much demand but the ratings on the week end needs to be worked on.

In [73]:

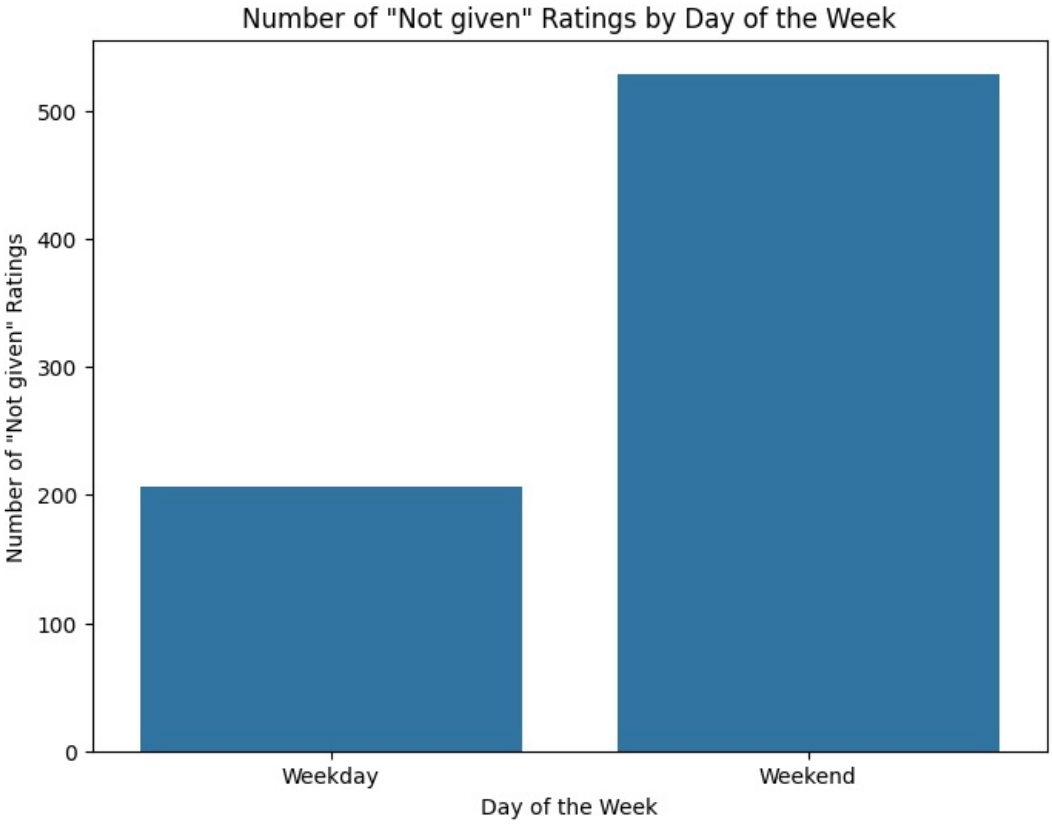
```
# Analyze cuisine type and 'Not given' ratings

# Group by cuisine type and calculate the number of 'Not given' ratings
not_given_by_cuisine = df[df['rating'] == 'Not given'].groupby('cuisine_type')['rating'].count()

# Print the results
print("Number of 'Not given' ratings by cuisine type:\n", not_given_by_cuisine)

# Analyze the relationship between cuisine type and 'Not given' ratings
plt.figure(figsize=(10, 6))
sns.countplot(x='cuisine_type', hue='rating', data=df)
plt.title('Cuisine Type vs. Ratings (Including "Not given")')
plt.xlabel('Cuisine Type')
plt.ylabel('Number of Orders')
plt.xticks(rotation=45, ha='right')
plt.legend(title='Rating')
plt.show()

# Analyze the relationship between cuisine type and average rating (excluding 'Not given')

average_rating_by_cuisine = df[df['rating'] != 'Not given'].groupby('cuisine_type')['rating_new'].mean()
plt.figure(figsize=(10, 6))
sns.barplot(x=average_rating_by_cuisine.index, y=average_rating_by_cuisine.values)
plt.title('Average Rating by Cuisine Type (Excluding "Not given")')
plt.xlabel('Cuisine Type')
plt.ylabel('Average Rating')
plt.xticks(rotation=45, ha='right')
plt.show()

# Analyze the relationship between 'Not given' ratings and day of the week
not_given_by_day = df[df['rating'] == 'Not given'].groupby('day_of_the_week')['rating'].count()
plt.figure(figsize=(8, 6))
sns.barplot(x=not_given_by_day.index, y=not_given_by_day.values)
plt.title('Number of "Not given" Ratings by Day of the Week')
plt.xlabel('Day of the Week')
plt.ylabel('Number of "Not given" Ratings')
plt.show()
```

```
Number of 'Not given' ratings by cuisine type:
 cuisine_type
American          216
Chinese            82
French              8
Indian             23
Italian           126
Japanese          197
Korean              4
Mediterranean      14
Mexican            29
Middle Eastern     15
Southern            4
Spanish             6
Thai               10
Vietnamese          2
Name: rating, dtype: int64
```






```
<ipython-input-73-7f925b4a1fe0>:31: FutureWarning: The default of observed=False is deprecated and w
ill be changed to True in a future version of pandas. Pass observed=False to retain current behavior
or observed=True to adopt the future default and silence this warning.
  not_given_by_day = df[df['rating'] == 'Not given'].groupby('day_of_the_week')['rating'].count()
```



Recommendations:

- Better the delivery time on the week days.
- On the week ends the American and Japanese cuisine needs more ratings to reduce the 'Not Given' ratings. Maybe come up with a better strategy to capture ratings for these cuisine types.
- Some of the cusinies like Southern, Indian have high cost, but they dont have much demand. So, they can be observed more to see if they should even be offered on week days.
- The delivery time on the week days is generally higher. The business needs to double click and find out why.
- Some cuisines like Vietnamese also are not much in demand and needs to be observed closely.
- The company would need to see what strategy can be done on the weekends to improve the ratings.