Food Delivery Analysis

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1 How many times drivers take more than 30 mins to arrive at the restaurant?

2 Collaborators

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3 Introduction

In today's fast-paced world, the demand for convenience and efficiency in food delivery services has grown exponentially. One of the critical factors that determine the success of any food delivery platform is the time taken by delivery partners to pick up prepared meals from restaurants. This project report aims to delve into this pivotal aspect of the food delivery ecosystem, shedding light on the various factors that influence pickup times, their impact on customer satisfaction, and potential strategies for optimization.

The timely pickup of meals from restaurants is the first link in the chain of events that ultimately determines the overall delivery experience. It directly affects customer expectations and plays a significant role in shaping perceptions of the food delivery service. Whether it's a quick weekday lunch, a special dinner order, or a craving for a midnight snack, customers place a premium on the promptness of meal delivery. Hence, understanding and enhancing the efficiency of the pickup process holds paramount importance for food delivery platforms.

In this project report, we will explore the multifaceted nature of the pickup process. We will investigate the factors that can influence pickup times, including restaurant location, kitchen preparation times, traffic conditions, and the availability and performance of delivery partners. Through data analysis and case studies, we will highlight the real-world challenges faced by delivery platforms and restaurants in ensuring swift pickups.Furthermore, we will examine the implications of delayed pickups on customer satisfaction and retention rates. Understanding how delivery times impact the customer experience is crucial for food delivery businesses looking to establish a competitive edge in the market. High customer satisfaction not only fosters loyalty but also drives positive reviews and word-of-mouth referrals, which can significantly boost business growth.

4 Statement of Question

How many times drivers take more than 30 mins to arrive at the restaurant?

5 Possible Sources of Bias

1. Location Bias: Drivers may have biases towards or against certain delivery locations based on factors such as safety concerns, familiarity, or perceived tipping habits. This bias can lead to delays or selective acceptance of orders.
2. Customer Bias: Drivers may have biases toward specific customers. They may prioritize deliveries to customers they know or perceive as more generous with tips, potentially leaving other customers waiting longer.
3. Time-of-Day Bias: Drivers may have preferences for working during specific times of the day or week. This can lead to bias in terms of order acceptance and delivery times, as drivers may prioritize certain shifts.
4. Weather Bias: Weather conditions can impact driver behavior. They may be more likely to decline orders during adverse weather, leading to longer wait times for customers.
5. Operational Bias: Bias can occur in the allocation of resources and operational decisions. For example, if a food delivery platform prioritizes profitability over service quality, it can lead to biased decisions that favor cost-cutting at the expense of timely deliveries.

6 About the Dataset

Call Center Restaurant Orders Dataset

6.0.1 Source link:

Dataset source link

This dataset contains details of the order placed by the customers. In the below cell we can find the sample of the dataset with all the columns(details of the order).

6.0.2 Link to dataset on github

Dataset

[1]:
```
import pandas as pd
df = pd.read_excel('call-center_restaurant-orders-mv0x6oRrEEfBDJzn.xlsx')
df.head()
```

[1]:
```
        Date Time customer placed order Time order placed at restaurant  \
0 2020-01-01                   02:52:12                        03:00:25
1 2020-01-01                   15:58:57                        17:56:45
2 2020-01-01                   19:02:37                        19:12:51
3 2020-01-01                   04:01:57                        04:08:18
4 2020-01-01                   23:46:38                        23:49:32

  Time driver arrived at restaurant Delivery time  Driver ID Driver Name  \
0                         03:08:09      03:35:20       9329     Christy
1                         18:24:39      18:57:01       9175   Elizabeth
2                         19:19:59      19:31:09       9051       Janet
3                         04:13:02      04:37:57       9389   Jacquelyn
4                         23:54:29      00:37:15       9187      Lauren

   Restaurant ID  Customer ID Delivery Area ASAP Sub Total Delivery fee  \
0           7263      1143515       Fremont  Yes    $21.39        $0.43
1           7247      1136820       Hayward  Yes    $99.74        $6.05
2           7293      1081871       Hayward  Yes    $21.97        $2.74
3           7046      1128255    Union City  Yes    $32.79        $0.12
4           7385      1051183       Hayward  Yes    $67.56        $3.77

  Service fee Discount     Tip Refunded amount
0       $3.83    $2.00   $1.40           $0.00
1       $2.30    $2.00  $11.03           $0.00
2       $2.39    $8.00   $4.31           $0.00
3       $2.55    $2.00   $8.55           $0.00
4       $3.35    $2.00   $8.82           $0.00
```

7 Renaming the columns for consistency

[2]:
```
df.columns = ['DATE', 'TIME_CUSTOMER_PLACED_ORDER',␣
 ↪'TIME_ORDER_PLACED_AT_RESTAURANT',
              'TIME_DRIVER_ARRIVED_AT_RESTAURANT', 'DELIVERY_TIME', 'DRIVER_ID',
              'DRIVER_NAME', 'RESTAURANT_ID', 'CUSTOMER_ID', 'DELIVERY_AREA',␣
 ↪'ASAP',
              'SUB_TOTAL', 'DELIVERY_FEE', 'SERVICE_FEE', 'DISCOUNT', 'TIP',
              'REFUNDED_AMOUNT']
df.head()
```

[2]:
```
         DATE TIME_CUSTOMER_PLACED_ORDER TIME_ORDER_PLACED_AT_RESTAURANT  \
0 2020-01-01                   02:52:12                        03:00:25
1 2020-01-01                   15:58:57                        17:56:45
2 2020-01-01                   19:02:37                        19:12:51
3 2020-01-01                   04:01:57                        04:08:18
4 2020-01-01                   23:46:38                        23:49:32

  TIME_DRIVER_ARRIVED_AT_RESTAURANT DELIVERY_TIME  DRIVER_ID DRIVER_NAME  \
0                         03:08:09      03:35:20       9329     Christy
1                         18:24:39      18:57:01       9175   Elizabeth
2                         19:19:59      19:31:09       9051       Janet
3                         04:13:02      04:37:57       9389   Jacquelyn
4                         23:54:29      00:37:15       9187      Lauren

   RESTAURANT_ID  CUSTOMER_ID DELIVERY_AREA ASAP SUB_TOTAL DELIVERY_FEE  \
0           7263      1143515        Fremont  Yes    $21.39         $0.43
1           7247      1136820        Hayward  Yes    $99.74         $6.05
2           7293      1081871        Hayward  Yes    $21.97         $2.74
3           7046      1128255     Union City  Yes    $32.79         $0.12
4           7385      1051183        Hayward  Yes    $67.56         $3.77

  SERVICE_FEE DISCOUNT     TIP REFUNDED_AMOUNT
0       $3.83    $2.00   $1.40           $0.00
1       $2.30    $2.00  $11.03           $0.00
2       $2.39    $8.00   $4.31           $0.00
3       $2.55    $2.00   $8.55           $0.00
4       $3.35    $2.00   $8.82           $0.00
```

8 Data Cleaning - removing the Dollar sign

[3]:
```python
df['SUB_TOTAL'] = df['SUB_TOTAL'].str.replace('$', '')
df['DELIVERY_FEE'] = df['DELIVERY_FEE'].str.replace('$', '')
df['SERVICE_FEE'] = df['SERVICE_FEE'].str.replace('$', '')
df['DISCOUNT'] = df['DISCOUNT'].str.replace('$', '')
df['TIP'] = df['TIP'].str.replace('$', '')
df['REFUNDED_AMOUNT'] = df['REFUNDED_AMOUNT'].str.replace('$', '')
```

[4]:
```python
df.head()
```

[4]:
```
        DATE TIME_CUSTOMER_PLACED_ORDER TIME_ORDER_PLACED_AT_RESTAURANT  \
0 2020-01-01                   02:52:12                        03:00:25
1 2020-01-01                   15:58:57                        17:56:45
2 2020-01-01                   19:02:37                        19:12:51
3 2020-01-01                   04:01:57                        04:08:18
4 2020-01-01                   23:46:38                        23:49:32

  TIME_DRIVER_ARRIVED_AT_RESTAURANT DELIVERY_TIME  DRIVER_ID DRIVER_NAME  \
0                          03:08:09      03:35:20       9329     Christy
1                          18:24:39      18:57:01       9175   Elizabeth
2                          19:19:59      19:31:09       9051       Janet
3                          04:13:02      04:37:57       9389   Jacquelyn
4                          23:54:29      00:37:15       9187      Lauren

   RESTAURANT_ID  CUSTOMER_ID DELIVERY_AREA ASAP SUB_TOTAL DELIVERY_FEE  \
0           7263      1143515        Fremont  Yes     21.39         0.43
1           7247      1136820        Hayward  Yes     99.74         6.05
2           7293      1081871        Hayward  Yes     21.97         2.74
3           7046      1128255     Union City  Yes     32.79         0.12
4           7385      1051183        Hayward  Yes     67.56         3.77

  SERVICE_FEE DISCOUNT    TIP REFUNDED_AMOUNT
```

```
0         3.83      2.00    1.40              0.00
1         2.30      2.00   11.03              0.00
2         2.39      8.00    4.31              0.00
3         2.55      2.00    8.55              0.00
4         3.35      2.00    8.82              0.00
```

[5]:
```
df.shape
```

[5]:
```
(72314, 17)
```

9 Dealing missing values

[6]:
```
df.isna().sum()
```

[6]:
```
DATE                                    0
TIME_CUSTOMER_PLACED_ORDER              0
TIME_ORDER_PLACED_AT_RESTAURANT       160
TIME_DRIVER_ARRIVED_AT_RESTAURANT   18124
DELIVERY_TIME                           0
DRIVER_ID                               0
DRIVER_NAME                             0
RESTAURANT_ID                           0
CUSTOMER_ID                             0
DELIVERY_AREA                           0
ASAP                                    0
SUB_TOTAL                               0
DELIVERY_FEE                            0
SERVICE_FEE                             0
DISCOUNT                                0
TIP                                     0
REFUNDED_AMOUNT                         0
dtype: int64
```

[7]:
```
df=df.dropna()
```

[8]:
```
df.shape
```

[8]:
```
(54098, 17)
```

[9]:
```
df.isna().sum()
```

[9]:
```
DATE                                0
TIME_CUSTOMER_PLACED_ORDER          0
TIME_ORDER_PLACED_AT_RESTAURANT     0
TIME_DRIVER_ARRIVED_AT_RESTAURANT   0
DELIVERY_TIME                       0
DRIVER_ID                           0
```

```
DRIVER_NAME                     0
RESTAURANT_ID                   0
CUSTOMER_ID                     0
DELIVERY_AREA                   0
ASAP                            0
SUB_TOTAL                       0
DELIVERY_FEE                    0
SERVICE_FEE                     0
DISCOUNT                        0
TIP                             0
REFUNDED_AMOUNT                 0
dtype: int64
```

10 Defining Function to calculate time difference in seconds

[10]:
```
def calculate_time_difference(row):
    order_time = row['TIME_ORDER_PLACED_AT_RESTAURANT']
    driver_time = row['TIME_DRIVER_ARRIVED_AT_RESTAURANT']

    time_diff_seconds = (driver_time.hour * 3600 + driver_time.minute * 60 +␣
  ↪driver_time.second) - \
                        (order_time.hour * 3600 + order_time.minute * 60 +␣
  ↪order_time.second)

    return time_diff_seconds
```

11 Calculating time taken by the drive to arrive at the restaurant in Seconds and Minutes and creating new columns

[11]:
```
df['TIME_ORDER_PLACED_AT_RESTAURANT'] = pd.
  ↪to_datetime(df['TIME_ORDER_PLACED_AT_RESTAURANT'], format='%H:%M:%S').dt.time
df['TIME_DRIVER_ARRIVED_AT_RESTAURANT'] = pd.
  ↪to_datetime(df['TIME_DRIVER_ARRIVED_AT_RESTAURANT'], format='%H:%M:%S').dt.
  ↪time

df['TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_SECONDS'] = df.
  ↪apply(calculate_time_difference, axis=1)

df['TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES'] =␣
  ↪df['TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_SECONDS'] / 60

df[['TIME_ORDER_PLACED_AT_RESTAURANT', 'TIME_DRIVER_ARRIVED_AT_RESTAURANT',␣
  ↪'TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_SECONDS',␣
  ↪'TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES']].head()
```

```
[11]:   TIME_ORDER_PLACED_AT_RESTAURANT TIME_DRIVER_ARRIVED_AT_RESTAURANT  \
0                            03:00:25                          03:08:09
1                            17:56:45                          18:24:39
2                            19:12:51                          19:19:59
3                            04:08:18                          04:13:02
4                            23:49:32                          23:54:29

   TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_SECONDS  \
0                                                464
1                                               1674
2                                                428
3                                                284
4                                                297

   TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES
0                                           7.733333
1                                          27.900000
2                                           7.133333
3                                           4.733333
4                                           4.950000
```

12 Removing negative values

```
[12]: df = df[df['TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES'] >= 0]
```

```
[13]: df["TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES"].describe()
```

```
[13]: count    51452.000000
mean        23.199534
std         28.935337
min          0.016667
25%         11.000000
50%         17.475000
75%         28.750000
max       1430.566667
Name: TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES, dtype: float64
```

13 Resetting the Index

```
[14]: df.reset_index(drop=True, inplace=True)
```

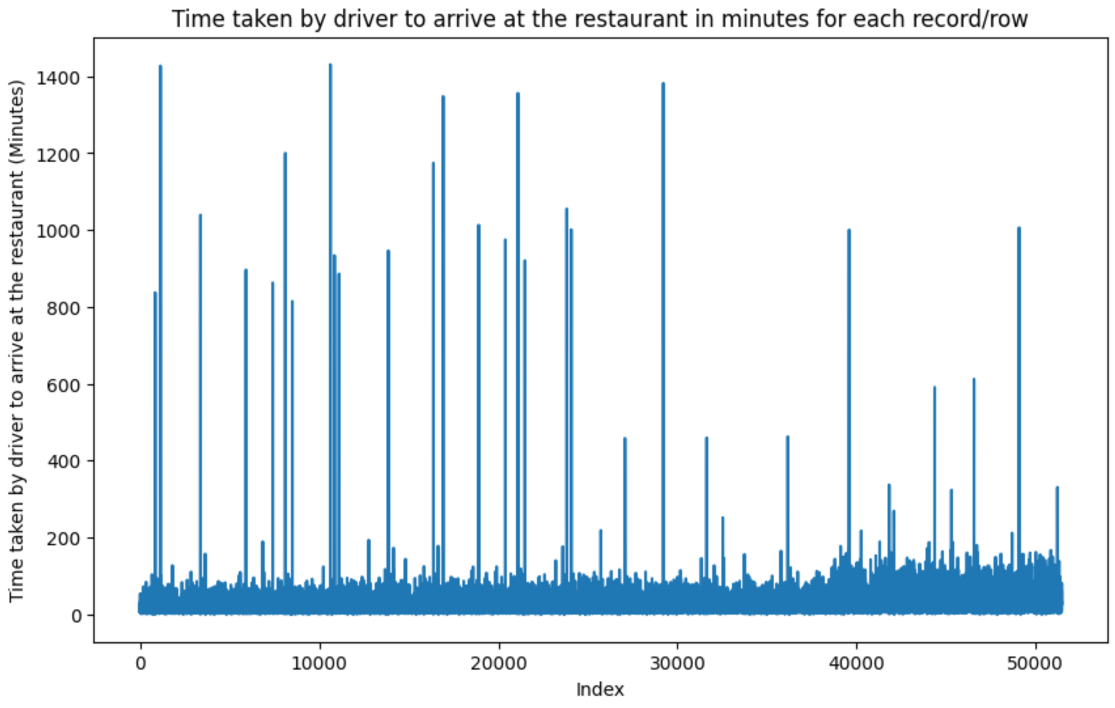
14 Visualization and Analysis

14.1 1. Line Plot - Time taken by driver to arrive at the restaurant in minutes for each record/row

[15]:
```
import matplotlib.pyplot as plt
!pip3 install seaborn
import seaborn as sns
plt.figure(figsize=(10, 6))
plt.plot(df["TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES"])
plt.xlabel('Index')
plt.ylabel('Time taken by driver to arrive at the restaurant (Minutes)')
plt.title('Time taken by driver to arrive at the restaurant in minutes for each␣
  ↪record/row')
plt.show()
```

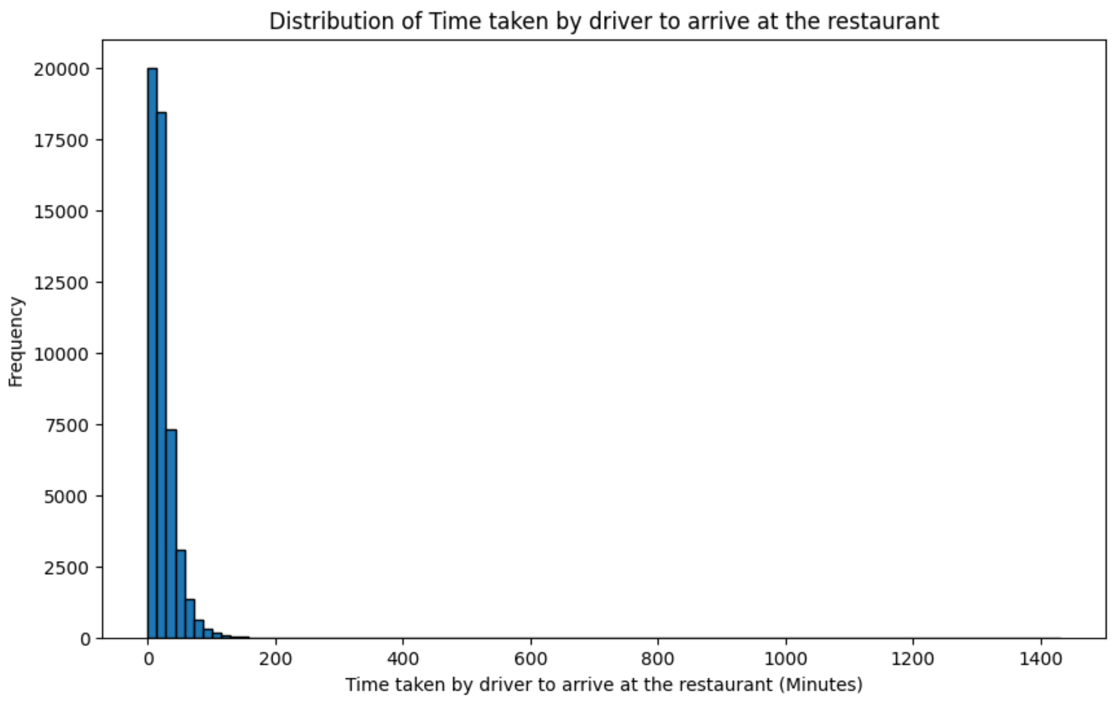
```
Requirement already satisfied: seaborn in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(0.12.2)
Requirement already satisfied: numpy!=1.24.0,>=1.17 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from seaborn) (1.25.2)
Requirement already satisfied: pandas>=0.25 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from seaborn) (2.0.3)
Requirement already satisfied: matplotlib!=3.6.1,>=3.1 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from seaborn) (3.7.2)
Requirement already satisfied: contourpy>=1.0.1 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from matplotlib!=3.6.1,>=3.1->seaborn) (1.1.0)
Requirement already satisfied: cycler>=0.10 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from matplotlib!=3.6.1,>=3.1->seaborn) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from matplotlib!=3.6.1,>=3.1->seaborn) (4.42.1)
Requirement already satisfied: kiwisolver>=1.0.1 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from matplotlib!=3.6.1,>=3.1->seaborn) (1.4.5)
Requirement already satisfied: packaging>=20.0 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from matplotlib!=3.6.1,>=3.1->seaborn) (23.1)
Requirement already satisfied: pillow>=6.2.0 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from matplotlib!=3.6.1,>=3.1->seaborn) (10.0.0)
Requirement already satisfied: pyparsing<3.1,>=2.3.1 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
```

```
(from matplotlib!=3.6.1,>=3.1->seaborn) (3.0.9)
Requirement already satisfied: python-dateutil>=2.7 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from matplotlib!=3.6.1,>=3.1->seaborn) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from pandas>=0.25->seaborn) (2023.3)
Requirement already satisfied: tzdata>=2022.1 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from pandas>=0.25->seaborn) (2023.3)
Requirement already satisfied: six>=1.5 in
/Library/Frameworks/Python.framework/Versions/3.11/lib/python3.11/site-packages
(from python-dateutil>=2.7->matplotlib!=3.6.1,>=3.1->seaborn) (1.16.0)
```



14.2 2. Histogram - Distribution of Time taken by driver to arrive at the restaurant

[16]:
```
plt.figure(figsize=(10, 6))
plt.hist(df['TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES'],␣
  ↪bins=100, edgecolor='k')
plt.xlabel('Time taken by driver to arrive at the restaurant (Minutes)')
plt.ylabel('Frequency')
plt.title('Distribution of Time taken by driver to arrive at the restaurant')
plt.show()
```



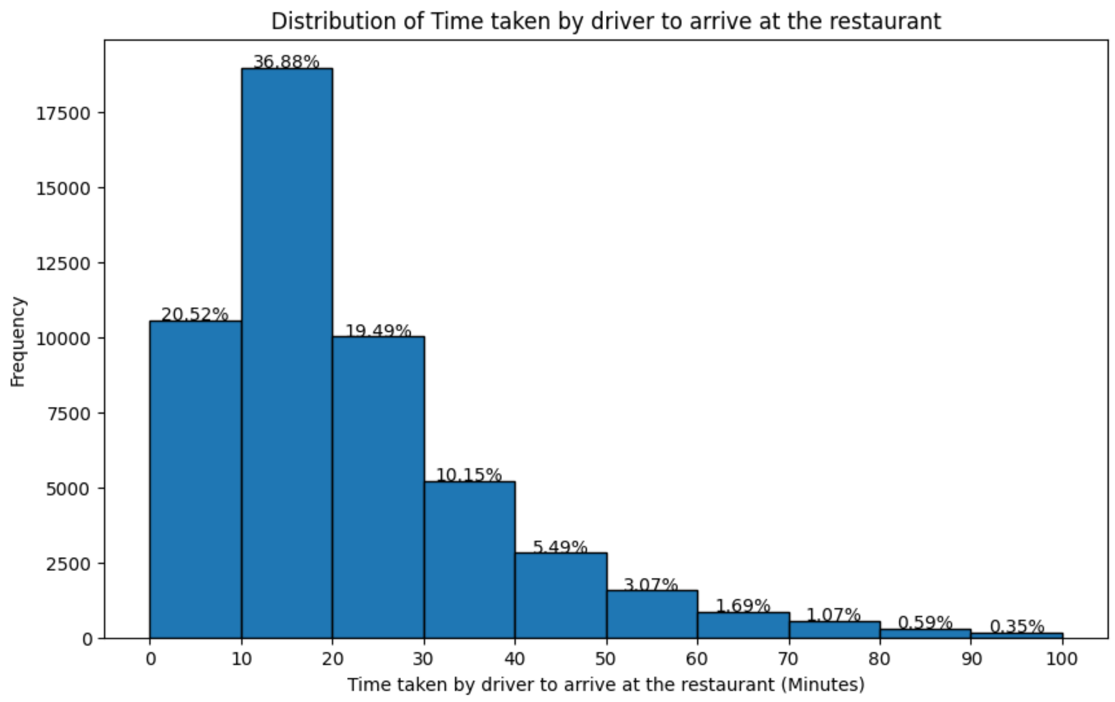
14.2.1 Histogram with time in range of 0-100. We did not consider values after that range as there are very few values.

[17]:
```
bins = range(0, 110, 10)
plt.figure(figsize=(10, 6))
n, bins, patches = plt.
 ↪hist(df['TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES'],␣
 ↪bins=bins, edgecolor='k')

total_count = len(df)
for i, patch in enumerate(patches):
    percentage = (n[i] / total_count) * 100
    plt.text(patch.get_x() + patch.get_width() / 2, patch.get_height() + 5,␣
 ↪f'{percentage:.2f}%', ha='center')

plt.xlabel('Time taken by driver to arrive at the restaurant (Minutes)')
plt.ylabel('Frequency')
plt.title('Distribution of Time taken by driver to arrive at the restaurant')
plt.xticks(bins)

plt.show()
```



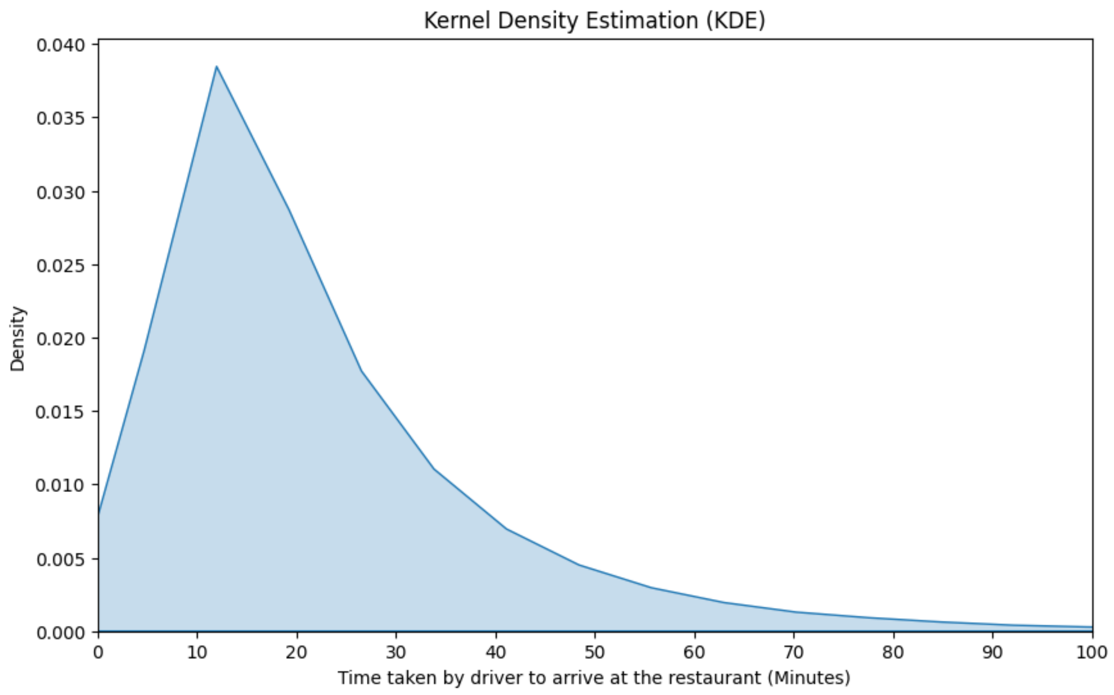
15 3. Kernel Density Estimation

The resulting KDE graph displays a smooth estimate of the probability density function (PDF) for the dataset. Here are some key points for interpretation:

15.0.1 Density:

The y-axis represents the estimated density of the data at various points along the x-axis. ### Peaks: Peaks in the KDE plot correspond to modes or clusters in the data. ### Spread: The width of the KDE curve at any point indicates the level of spread or uncertainty in the data.

```
[18]: plt.figure(figsize=(10, 6))
sns.kdeplot(df['TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES'],
  ↪fill=True)
plt.xlabel('Time taken by driver to arrive at the restaurant (Minutes)')
plt.ylabel('Density')
plt.title('Kernel Density Estimation (KDE)')
plt.xticks(range(0, 101, 10))
plt.xlim(0, 100)
plt.show()
```



[19]:
```
percentage_arriving_after_30_minutes =␣
  ↪(len(df[df['TIME_TAKEN_BY_DRIVER_TO_ARRIVE_AT_THE_RESTAURANT_MINUTES'] >␣
  ↪30]) / len(df)) * 100
percentage_arriving_after_30_minutes =␣
  ↪round(percentage_arriving_after_30_minutes, 2)
percentage_arriving_after_30_minutes
```

[19]:
```
23.09
```

16 Conclusion

To conclude, this project report aims to provide valuable insights into the intricate dynamics of meal pickups in the food delivery industry. By gaining a comprehensive understanding of the challenges and opportunities in this critical phase of the delivery process, food delivery platforms and restaurants can make informed decisions, implement effective strategies, and ultimately offer a more efficient and satisfying experience to their customers.

After performing insighful ananlysis on the data we also conclude that 23.09% of the time drivers arrive 30 minutes late for food or order pick up from a restaurant after food is being prepared and ready for pick up.