New_York_TLC_1_EDA

April 1, 2025

1 New York TLC project

Part 1 - Explanatory Data Analysis

In this activity, you will examine data provided and prepare it for analysis. You will also design a professional data visualization that tells a story, and will help data-driven decisions for business needs.

The purpose of this project is to conduct exploratory data analysis on a provided data set. Your mission is to perform further EDA on this data with the aim of learning more about the variables.

The goal is to clean data set and create a visualization.
This activity has 4 parts:

Part 1: Imports, links, and loading

Part 2: Data Exploration (Data cleaning)

Part 3: Building visualizations

Part 4: Evaluate and share results

1. Identify any outliers:

- Use a boxplot to visualize the distribution of the data
- Use histograms to visualize the distribution of the data

2. How do you make the decision to keep or exclude outliers from any future models?

- There are three main options for dealing with outliers: keeping them as they are, deleting them, or reassigning them. Whether you keep outliers as they are, delete them, or reassign values is a decision that you make taking into account the nature of the outlying data and the assumptions of the model you are building. To help you make the decision, you can start with these general guidelines:
  - Delete them: If you are sure the outliers are mistakes, typos, or errors and the dataset will be used for modeling or machine learning, then you are more likely to decide to delete outliers. Of the three choices, you'll use this one the least.
  - Reassign them: If the dataset is small and/or the data will be used for modeling or machine learning, you are more likely to choose a path of deriving new values to replace the outlier values.
  - Leave them: For a dataset that you plan to do EDA/analysis on and nothing else, or for a dataset you are preparing for a model that is resistant to outliers, it is most likely that you are going to leave them in.

1.0.1 Task 1. Imports, links, and loading

For EDA of the data, import the data and packages that would be most helpful, such as pandas, numpy and matplotlib.

[11]:

```
# Import packages and libraries
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

Note: As shown in this cell, the dataset has been automatically loaded in for you. You do not need to download the .csv file, or provide more code, in order to access the dataset and proceed with this lab. Please continue with this activity by completing the following instructions.

[12]:

```
# Load dataset into dataframe
df = pd.read_csv('2017_Yellow_Taxi_Trip_Data.csv')
```

1.0.2 Task 2a. Data exploration and cleaning

Decide which columns are applicable

The first step is to assess your data.

Given our scenario, which data columns are most applicable? Which data columns can I eliminate, knowing they won't solve our problem scenario?

Consider functions that help you understand and structure the data.

- head()
- describe()
- info()
- groupby()
- sortby()

What do the distributions of your variables tell you about the question you're asking or the problem you're trying to solve?

[13]:

```
df.head()
```

[13]:

```
   Unnamed: 0  VendorID    tpep_pickup_datetime   tpep_dropoff_datetime  \
0    24870114         2   03/25/2017 8:55:43 AM   03/25/2017 9:09:47 AM
1    35634249         1   04/11/2017 2:53:28 PM   04/11/2017 3:19:58 PM
2   106203690         1   12/15/2017 7:26:56 AM   12/15/2017 7:34:08 AM
3    38942136         2   05/07/2017 1:17:59 PM   05/07/2017 1:48:14 PM
4    30841670         2  04/15/2017 11:32:20 PM  04/15/2017 11:49:03 PM

   passenger_count  trip_distance  RatecodeID store_and_fwd_flag  \
0                6           3.34           1                  N
1                1           1.80           1                  N
2                1           1.00           1                  N
```

```
3                1          3.70           1                  N
4                1          4.37           1                  N

   PULocationID  DOLocationID  payment_type  fare_amount  extra  mta_tax  \
0           100           231             1         13.0    0.0      0.5
1           186            43             1         16.0    0.0      0.5
2           262           236             1          6.5    0.0      0.5
3           188            97             1         20.5    0.0      0.5
4             4           112             2         16.5    0.5      0.5

   tip_amount  tolls_amount  improvement_surcharge  total_amount
0        2.76           0.0                    0.3         16.56
1        4.00           0.0                    0.3         20.80
2        1.45           0.0                    0.3          8.75
3        6.39           0.0                    0.3         27.69
4        0.00           0.0                    0.3         17.80
```

[14]:
```
df.shape
```

[14]:
```
(22699, 18)
```

Use describe…

[15]:
```
df.describe()
```

[15]:
```
         Unnamed: 0      VendorID  passenger_count  trip_distance  \
count  2.269900e+04  22699.000000     22699.000000   22699.000000
mean   5.675849e+07      1.556236         1.642319       2.913313
std    3.274493e+07      0.496838         1.285231       3.653171
min    1.212700e+04      1.000000         0.000000       0.000000
25%    2.852056e+07      1.000000         1.000000       0.990000
50%    5.673150e+07      2.000000         1.000000       1.610000
75%    8.537452e+07      2.000000         2.000000       3.060000
max    1.134863e+08      2.000000         6.000000      33.960000

         RatecodeID  PULocationID  DOLocationID  payment_type   fare_amount  \
count  22699.000000  22699.000000  22699.000000  22699.000000  22699.000000
mean       1.043394    162.412353    161.527997      1.336887     13.026629
std        0.708391     66.633373     70.139691      0.496211     13.243791
min        1.000000      1.000000      1.000000      1.000000   -120.000000
25%        1.000000    114.000000    112.000000      1.000000      6.500000
50%        1.000000    162.000000    162.000000      1.000000      9.500000
75%        1.000000    233.000000    233.000000      2.000000     14.500000
max       99.000000    265.000000    265.000000      4.000000    999.990000

              extra       mta_tax    tip_amount  tolls_amount  \
count  22699.000000  22699.000000  22699.000000  22699.000000
mean       0.333275      0.497445      1.835781      0.312542
```

```
std        0.463097      0.039465      2.800626      1.399212
min       -1.000000     -0.500000      0.000000      0.000000
25%        0.000000      0.500000      0.000000      0.000000
50%        0.000000      0.500000      1.350000      0.000000
75%        0.500000      0.500000      2.450000      0.000000
max        4.500000      0.500000    200.000000     19.100000

       improvement_surcharge  total_amount
count           22699.000000  22699.000000
mean                0.299551     16.310502
std                 0.015673     16.097295
min                -0.300000   -120.300000
25%                 0.300000      8.750000
50%                 0.300000     11.800000
75%                 0.300000     17.800000
max                 0.300000   1200.290000
```

And info.

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 22699 entries, 0 to 22698
Data columns (total 18 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Unnamed: 0             22699 non-null  int64
 1   VendorID               22699 non-null  int64
 2   tpep_pickup_datetime   22699 non-null  object
 3   tpep_dropoff_datetime  22699 non-null  object
 4   passenger_count        22699 non-null  int64
 5   trip_distance          22699 non-null  float64
 6   RatecodeID             22699 non-null  int64
 7   store_and_fwd_flag     22699 non-null  object
 8   PULocationID           22699 non-null  int64
 9   DOLocationID           22699 non-null  int64
 10  payment_type           22699 non-null  int64
 11  fare_amount            22699 non-null  float64
 12  extra                  22699 non-null  float64
 13  mta_tax                22699 non-null  float64
 14  tip_amount             22699 non-null  float64
 15  tolls_amount           22699 non-null  float64
 16  improvement_surcharge  22699 non-null  float64
 17  total_amount           22699 non-null  float64
dtypes: float64(8), int64(7), object(3)
memory usage: 3.1+ MB
```

1.0.3 Task 2b. Select visualization type(s)

Now that you know which data columns you'll use, it is time to decide which data visualization makes the most sense for EDA of the TLC dataset. What type of data visualization(s) would be most helpful?

- Line graph
- Bar chart
- Box plot
- Histogram
- Heat map
- Scatter plot
- A geographic map

As you'll see below, a bar chart, box plot and scatter plot will be most helpful in your understanding of this data.

A box plot will be helpful to determine outliers and where the bulk of the data points reside in terms of `trip_distance`, `duration`, and `total_amount`

A scatter plot will be helpful to visualize the trends and patters and outliers of critical variables, such as `trip_distance` and `total_amount`

A bar chart will help determine average number of trips per month, weekday, weekend, etc.

1.0.4 Task 3. Data visualization

You've assessed your data, and decided on which data variables are most applicable. It's time to plot your visualization(s)!

1.0.5 Boxplots

Perform a check for outliers on relevant columns such as trip distance and trip duration. Remember, some of the best ways to identify the presence of outliers in data are box plots and histograms.

Note: Remember to convert your date columns to datetime in order to derive total trip duration.

[19]:

```
# Convert data columns to datetime
df["tpep_pickup_datetime"] = pd.to_datetime(df["tpep_pickup_datetime"])
df["tpep_dropoff_datetime"] = pd.to_datetime(df["tpep_dropoff_datetime"])
df.dtypes
```

[19]:

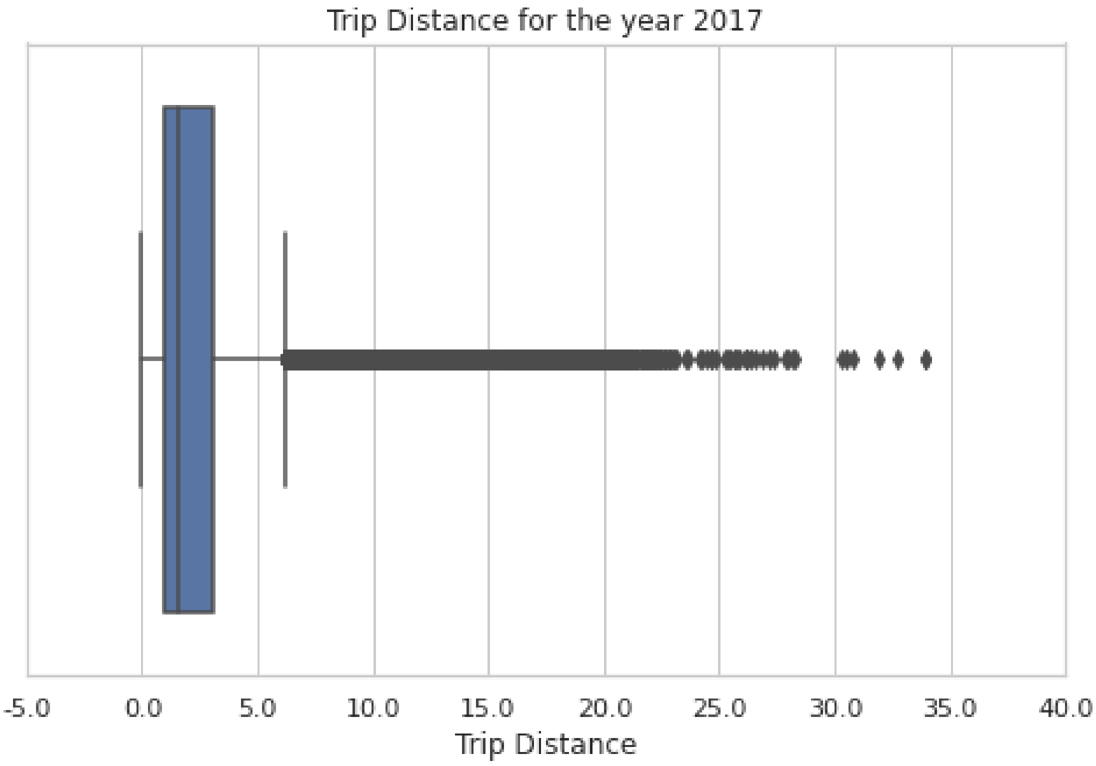
```
Unnamed: 0                        int64
VendorID                          int64
tpep_pickup_datetime     datetime64[ns]
tpep_dropoff_datetime    datetime64[ns]
passenger_count                   int64
trip_distance                   float64
RatecodeID                        int64
store_and_fwd_flag               object
PULocationID                      int64
DOLocationID                      int64
```

```
payment_type                       int64
fare_amount                      float64
extra                            float64
mta_tax                          float64
tip_amount                       float64
tolls_amount                     float64
improvement_surcharge            float64
total_amount                     float64
dtype: object
```

trip distance

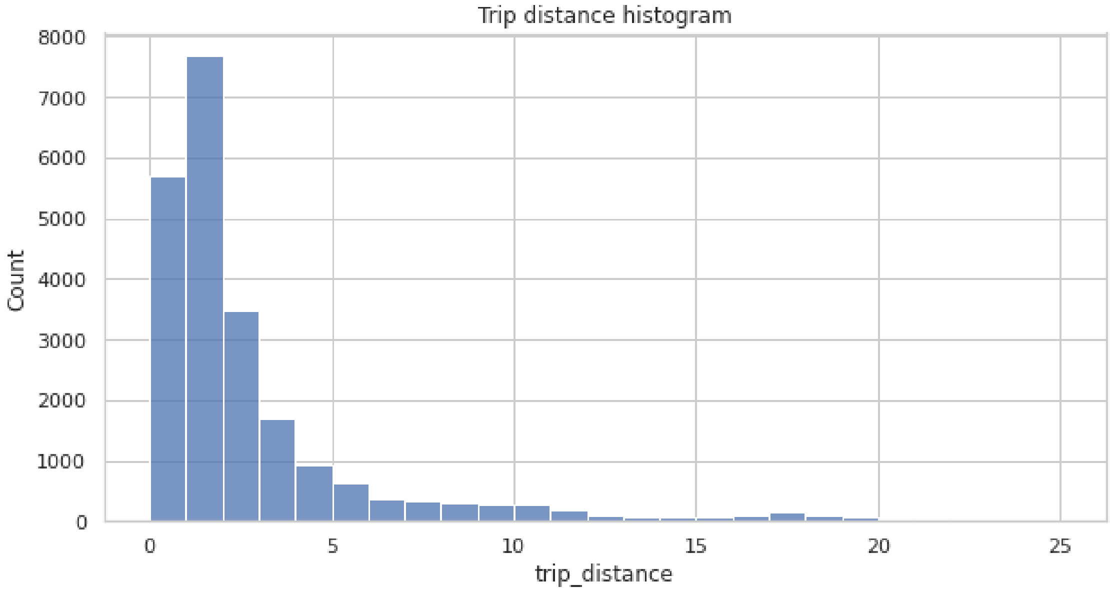
[21]:

```
# Create box plot of trip_distance

# Define readable_numbers function
def readable_numbers(x):
    return f"{x:,.1f}"  # Format with commas and 1 decimal

sns.set(style="whitegrid")  # Set seaborn style

plt.figure(figsize=(8, 5))  # Set figure size
box = sns.boxplot(x=df['trip_distance'])  # Create boxplot

g = plt.gca()  # Get current axes
plt.xticks(g.get_xticks(), [readable_numbers(x) for x in g.get_xticks()])  #␣
 ↪Format x-ticks
plt.xlabel('Trip Distance')
plt.title('Trip Distance for the year 2017')

plt.show()  # Display plot
```



[31]:

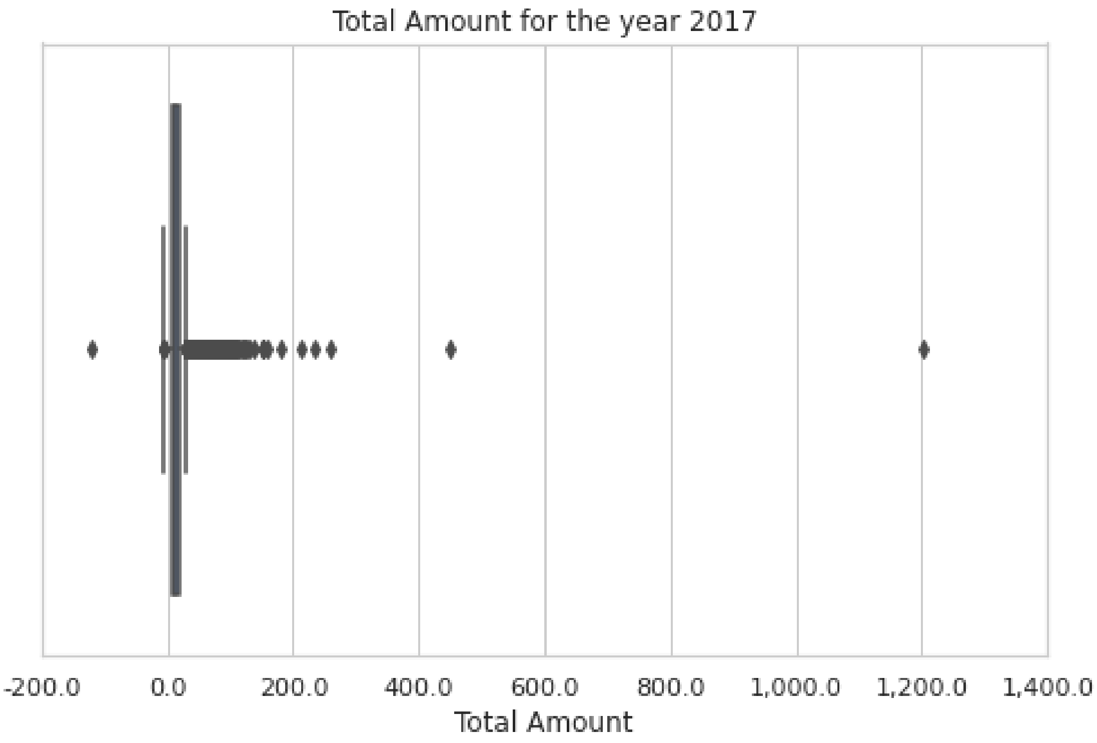
```
# Create histogram of trip_distance
plt.figure(figsize=(10,5))
sns.histplot(df['trip_distance'], bins=range(0,26,1))
plt.title('Trip distance histogram');
```



total amount

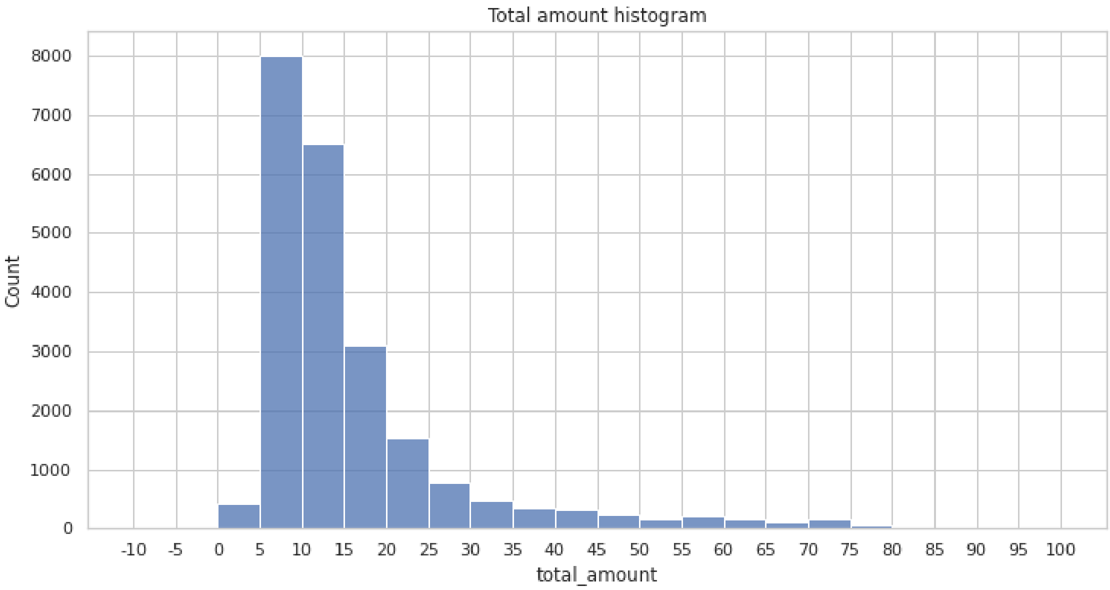
[25]:

```
# Create box plot of total_amount

# Define readable_numbers function
def readable_numbers(x):
    return f"{x:,.1f}"  # Format with commas and 1 decimal

sns.set(style="whitegrid")  # Set seaborn style

plt.figure(figsize=(8, 5))  # Set figure size
box = sns.boxplot(x=df['total_amount'])  # Create boxplot

g = plt.gca()  # Get current axes
plt.xticks(g.get_xticks(), [readable_numbers(x) for x in g.get_xticks()])  #␣
 ↪Format x-ticks

plt.xlabel('Total Amount')
plt.title('Total Amount for the year 2017')

plt.show()  # Display plot
```



[32]:

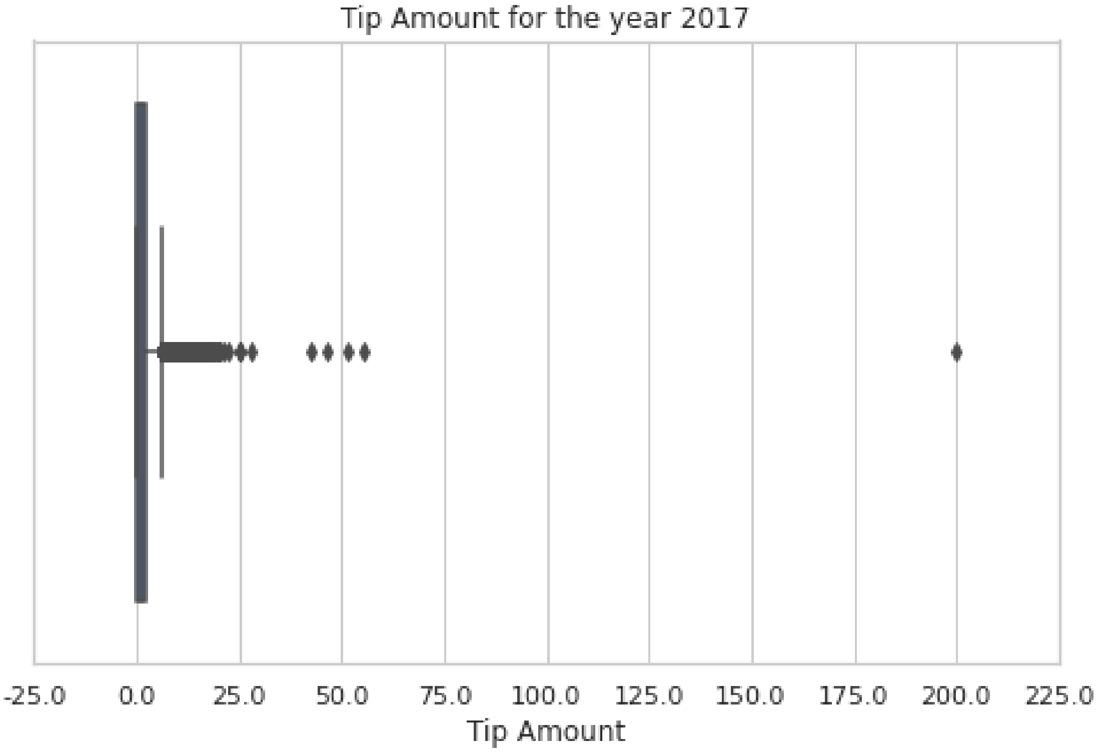
```
# Create histogram of total_amount
plt.figure(figsize=(12,6))
ax = sns.histplot(df['total_amount'], bins=range(-10,101,5))
ax.set_xticks(range(-10,101,5))
ax.set_xticklabels(range(-10,101,5))
plt.title('Total amount histogram');
```



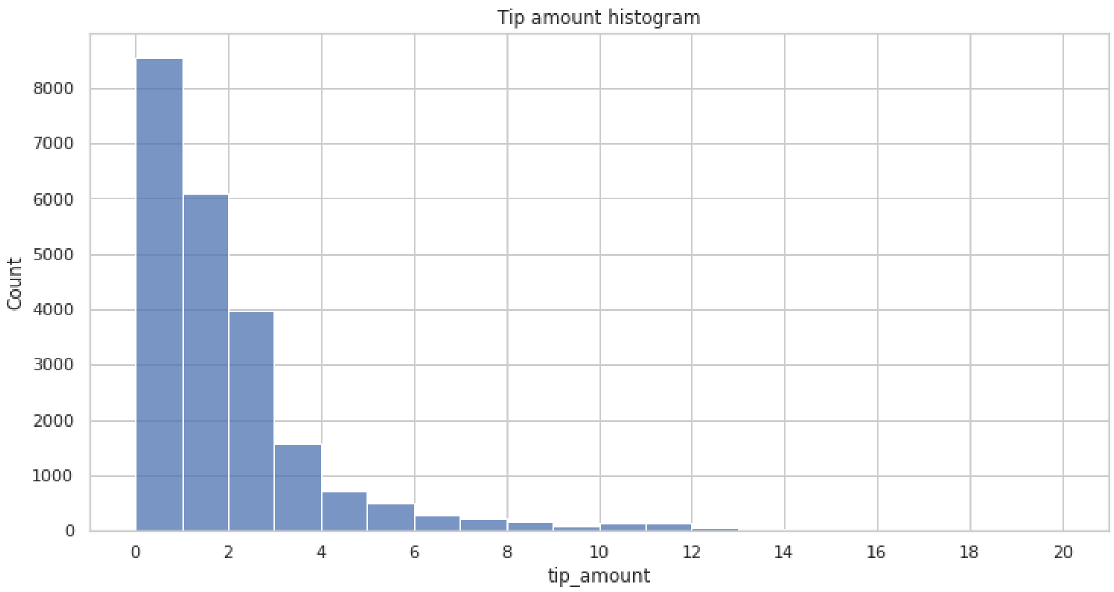
tip amount

[27]:

```
# Create box plot of tip_amount

# Define readable_numbers function
def readable_numbers(x):
    return f"{x:,.1f}"  # Format with commas and 1 decimal

sns.set(style="whitegrid")  # Set seaborn style

plt.figure(figsize=(8, 5))  # Set figure size
box = sns.boxplot(x=df['tip_amount'])  # Create boxplot

g = plt.gca()  # Get current axes
plt.xticks(g.get_xticks(), [readable_numbers(x) for x in g.get_xticks()])  #␣
  ↪Format x-ticks

plt.xlabel('Tip Amount')
plt.title('Tip Amount for the year 2017')

plt.show()  # Display plot
```

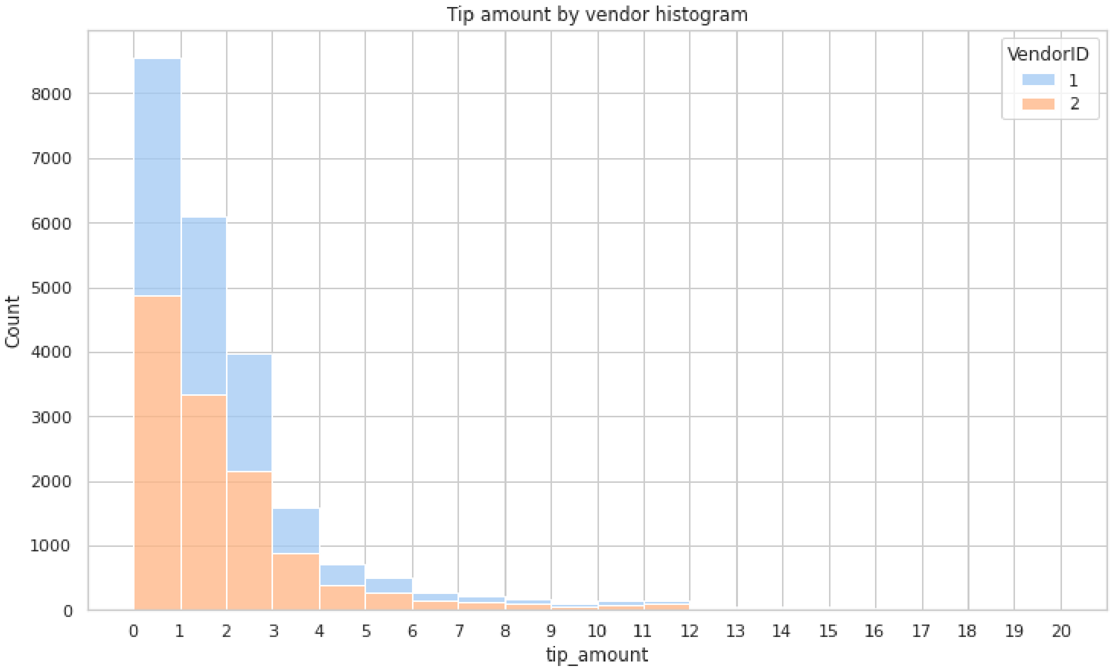


```
[33]: # Create histogram of tip_amount
      plt.figure(figsize=(12,6))
      ax = sns.histplot(df['tip_amount'], bins=range(0,21,1))
      ax.set_xticks(range(0,21,2))
      ax.set_xticklabels(range(0,21,2))
      plt.title('Tip amount histogram');
```



tip_amount by vendor

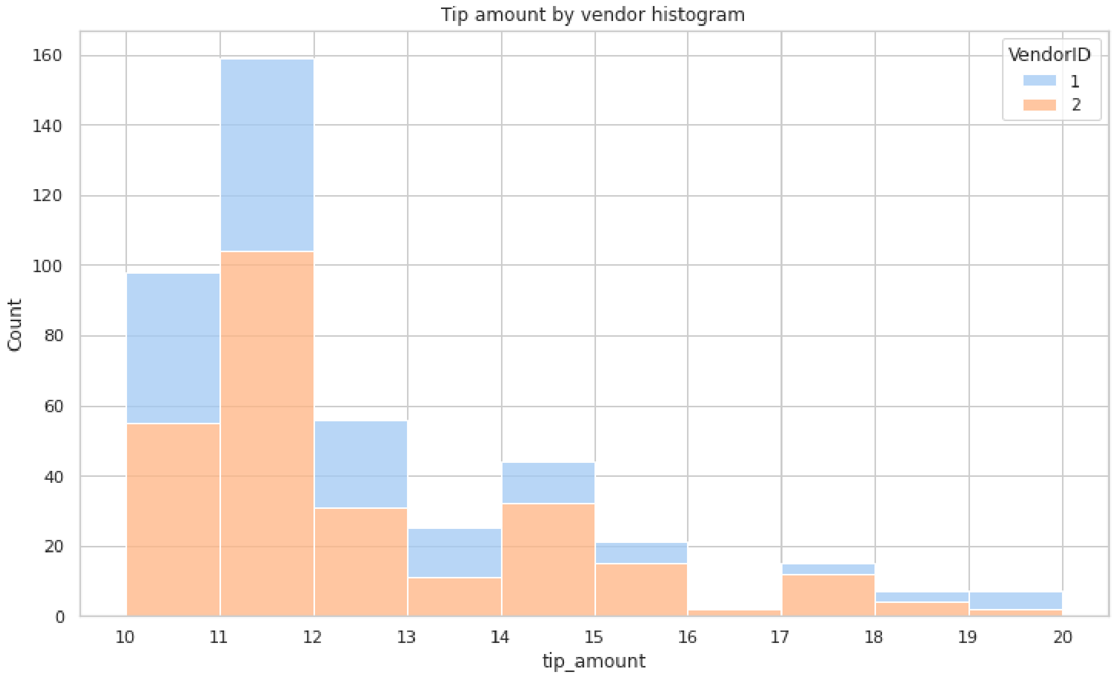
[34]:
```
# Create histogram of tip_amount by vendor
plt.figure(figsize=(12,7))
ax = sns.histplot(data=df, x='tip_amount', bins=range(0,21,1),
                  hue='VendorID',
                  multiple='stack',
                  palette='pastel')
ax.set_xticks(range(0,21,1))
ax.set_xticklabels(range(0,21,1))
plt.title('Tip amount by vendor histogram');
```



Next, zoom in on the upper end of the range of tips to check whether vendor one gets noticeably more of the most generous tips.

[35]:

```
# Create histogram of tip_amount by vendor for tips > $10
tips_over_ten = df[df['tip_amount'] > 10]
plt.figure(figsize=(12,7))
ax = sns.histplot(data=tips_over_ten, x='tip_amount', bins=range(10,21,1),
                  hue='VendorID',
                  multiple='stack',
                  palette='pastel')
ax.set_xticks(range(10,21,1))
ax.set_xticklabels(range(10,21,1))
plt.title('Tip amount by vendor histogram');
```



Mean tips by passenger count

Examine the unique values in the passenger_count column.

```
[36]: df['passenger_count'].value_counts()
```

```
[36]: 1    16117
      2     3305
      5     1143
      3      953
      6      693
      4      455
      0       33
      Name: passenger_count, dtype: int64
```

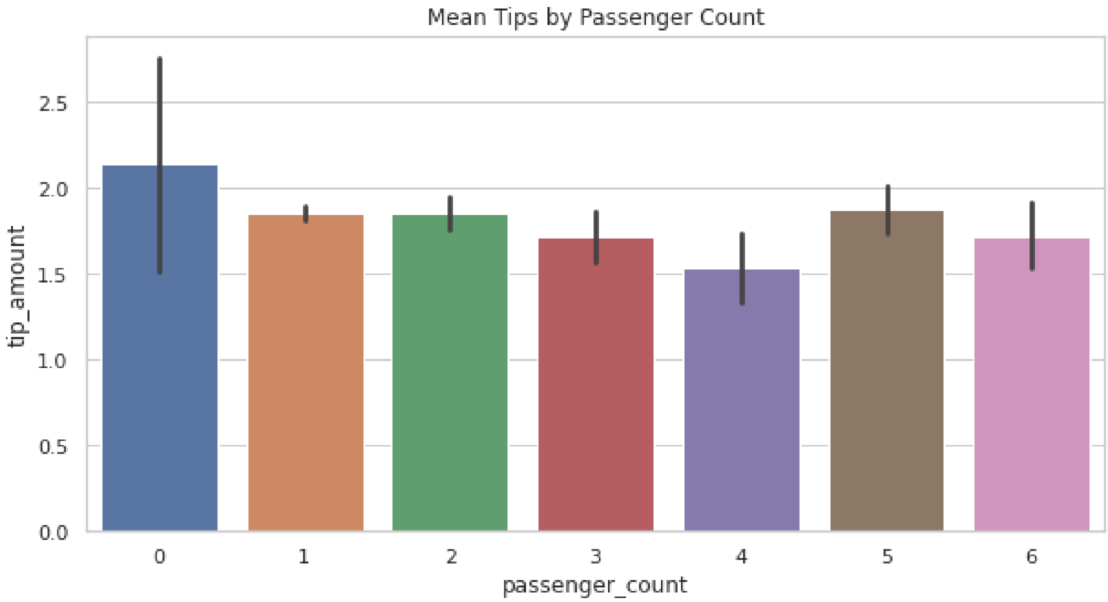
```
[37]: # Calculate mean tips by passenger_count
      mean_tips_by_passenger_count = df.groupby(['passenger_count']).
       ↪mean()[['tip_amount']]
      mean_tips_by_passenger_count
```

```
[37]:                  tip_amount
      passenger_count
      0                  2.135758
      1                  1.848920
      2                  1.856378
      3                  1.716768
```

```
4                   1.530264
5                   1.873185
6                   1.720260
```

[39]:

```
# Create bar plot for mean tips by passenger count
plt.figure(figsize=(10, 5))
sns.barplot(x='passenger_count', y='tip_amount', data=df)
plt.title("Mean Tips by Passenger Count")
# Show the plot.
plt.show()
```



Create month and day columns

[41]:

```
# Create a month column
df['month'] = df['tpep_pickup_datetime'].dt.month_name()
# Create a day column
df['day'] = df['tpep_pickup_datetime'].dt.day_name()
df.head()
```

[41]:

```
   Unnamed: 0  VendorID tpep_pickup_datetime tpep_dropoff_datetime  \
0    24870114         2  2017-03-25 08:55:43   2017-03-25 09:09:47
1    35634249         1  2017-04-11 14:53:28   2017-04-11 15:19:58
2   106203690         1  2017-12-15 07:26:56   2017-12-15 07:34:08
3    38942136         2  2017-05-07 13:17:59   2017-05-07 13:48:14
4    30841670         2  2017-04-15 23:32:20   2017-04-15 23:49:03

   passenger_count  trip_distance  RatecodeID store_and_fwd_flag  \
0                6           3.34          1                  N
1                1           1.80          1                  N
2                1           1.00          1                  N
3                1           3.70          1                  N
4                1           4.37          1                  N

   PULocationID  DOLocationID  payment_type  fare_amount  extra  mta_tax  \
0           100           231             1         13.0    0.0      0.5
1           186            43             1         16.0    0.0      0.5
2           262           236             1          6.5    0.0      0.5
3           188            97             1         20.5    0.0      0.5
4             4           112             2         16.5    0.5      0.5

   tip_amount  tolls_amount  improvement_surcharge  total_amount     month  \
0        2.76           0.0                    0.3         16.56     March
1        4.00           0.0                    0.3         20.80     April
2        1.45           0.0                    0.3          8.75  December
3        6.39           0.0                    0.3         27.69       May
4        0.00           0.0                    0.3         17.80     April

        day
0  Saturday
1   Tuesday
2    Friday
3    Sunday
4  Saturday
```

Plot total ride count by month

Begin by calculating total ride count by month.

[42]:

```
# Get total number of rides for each month
monthly_rides = df['month'].value_counts()
monthly_rides
```

[42]:

```
March        2049
October      2027
April        2019
May          2013
January      1997
June         1964
December     1863
November     1843
February     1769
September    1734
August       1724
July         1697
Name: month, dtype: int64
```

Reorder the results to put the months in calendar order.

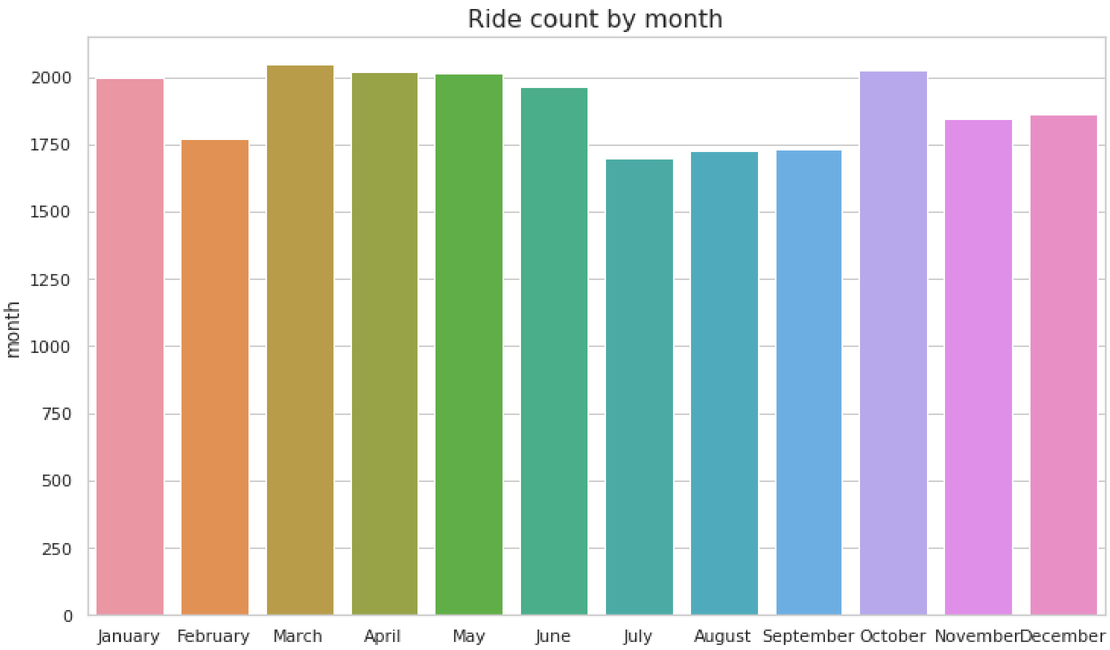
[43]:
```
# Reorder the monthly ride list so months go in order
month_order = ['January', 'February', 'March', 'April', 'May', 'June', 'July',
         'August', 'September', 'October', 'November', 'December']

monthly_rides = monthly_rides.reindex(index=month_order)
monthly_rides
```

[43]:
```
January      1997
February     1769
March        2049
April        2019
May          2013
June         1964
July         1697
August       1724
September    1734
October      2027
November     1843
December     1863
Name: month, dtype: int64
```

[44]:
```
# Show the index
monthly_rides.index
```

[44]:
```
Index(['January', 'February', 'March', 'April', 'May', 'June', 'July',
       'August', 'September', 'October', 'November', 'December'],
      dtype='object')
```

[45]:
```
# Create a bar plot of total rides per month
plt.figure(figsize=(12,7))
ax = sns.barplot(x=monthly_rides.index, y=monthly_rides)
ax.set_xticklabels(month_order)
plt.title('Ride count by month', fontsize=16);
```



Plot total ride count by day

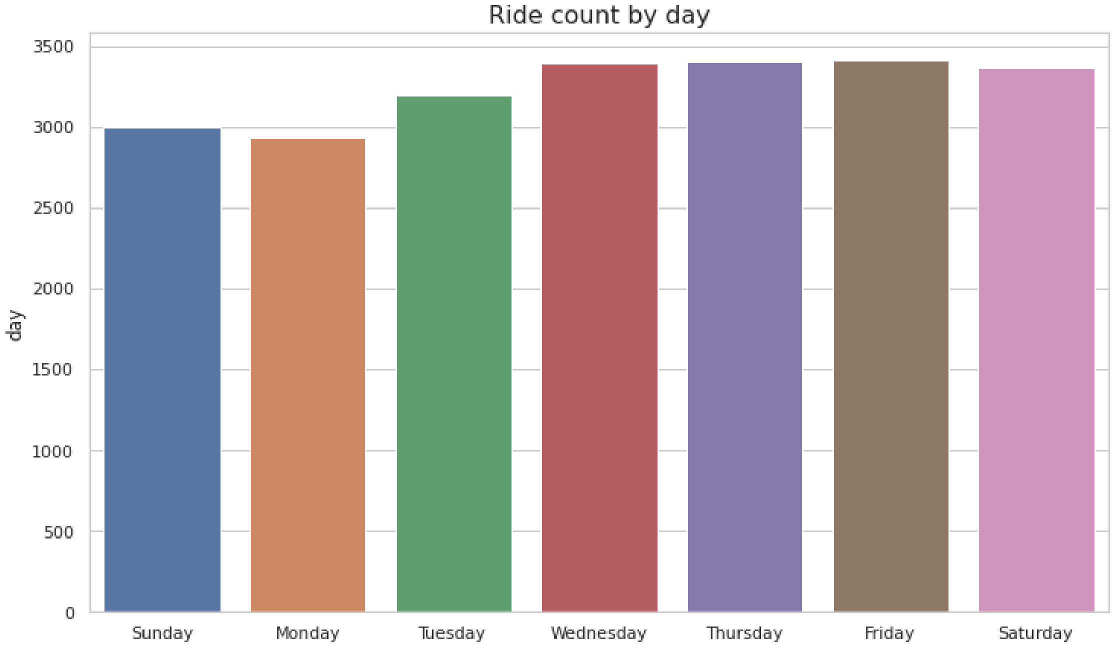
Repeat the above process, but now calculate the total rides by day of the week.

[46]:
```
# Repeat the above process, this time for rides by day
daily_rides = df['day'].value_counts()

day_order = ['Sunday', 'Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday',␣
 ↪'Saturday']

daily_rides = daily_rides.reindex(index=day_order)

daily_rides
```

[46]:
```
Sunday       2998
Monday       2931
Tuesday      3198
Wednesday    3390
Thursday     3402
Friday       3413
Saturday     3367
Name: day, dtype: int64
```

[47]:
```
# Create bar plot for ride count by day
plt.figure(figsize=(12,7))
ax = sns.barplot(x=daily_rides.index, y=daily_rides)
ax.set_xticklabels(day_order)
```

```
plt.title('Ride count by day', fontsize=16);
```



Plot total revenue by day of the week

Repeat the above process, but now calculate the total revenue by day of the week.

[52]:

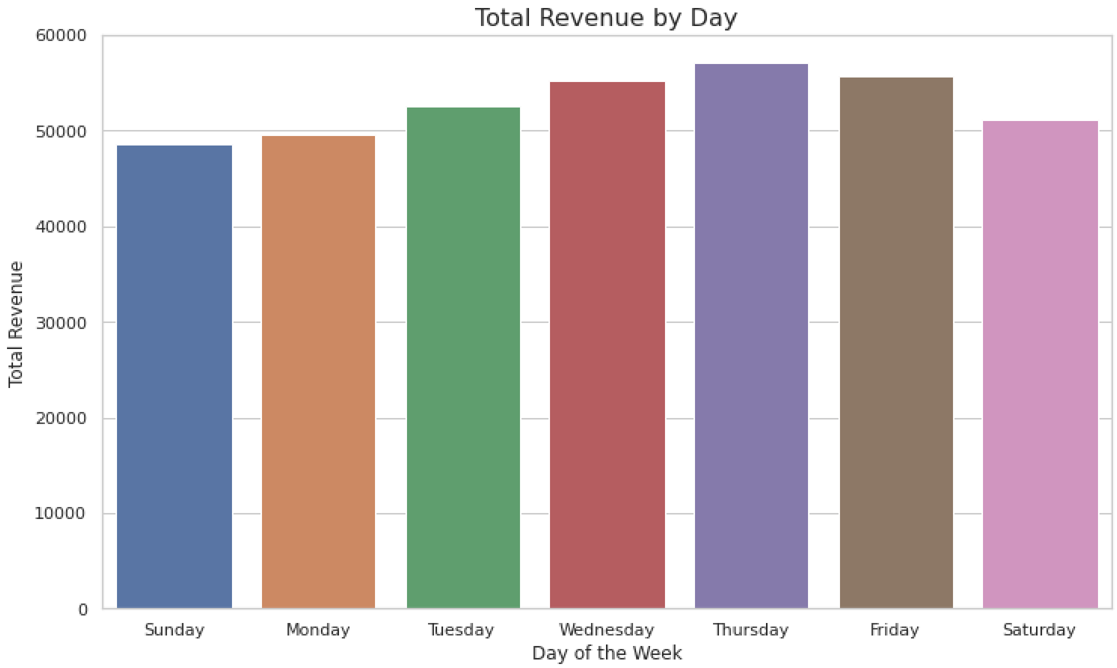
```
# Repeat the process, this time for total revenue by day
daily_revenue = df.groupby("day")[["total_amount"]].sum()
print(daily_revenue)
```

```
           total_amount
day
Friday         55818.74
Monday         49574.37
Saturday       51195.40
Sunday         48624.06
Thursday       57181.91
Tuesday        52527.14
Wednesday      55310.47
```

[56]:

```
# Create bar plot of total revenue by day

# Reindex to match day order
daily_revenue = daily_revenue.reindex(index=day_order)

# Convert daily_revenue to 1D Series
daily_revenue_series = daily_revenue["total_amount"]  # OR use .squeeze()
```

```python
# Plot
plt.figure(figsize=(12, 7))
ax = sns.barplot(x=daily_revenue_series.index, y=daily_revenue_series.values) #  FIX APPLIED
ax.set_xticklabels(day_order)
plt.title("Total Revenue by Day", fontsize=16)
plt.xlabel("Day of the Week")
plt.ylabel("Total Revenue")

plt.show()
```



Plot total revenue by month

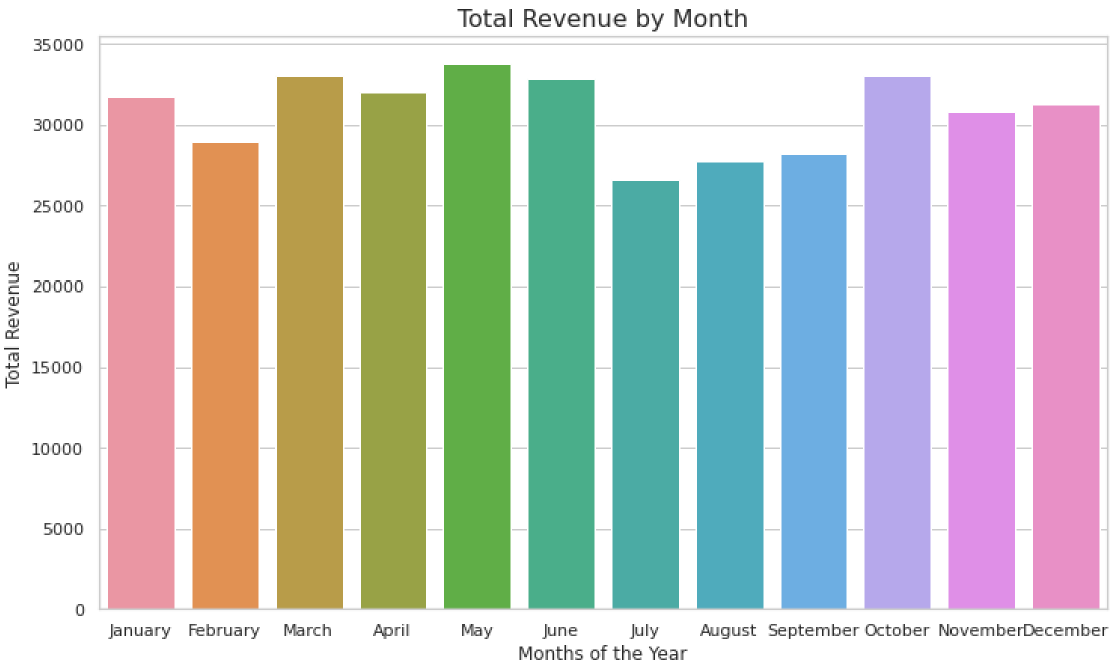
[57]:
```python
# Repeat the process, this time for total revenue by month
monthly_revenue = df.groupby("month")[["total_amount"]].sum()
print(monthly_revenue)
```

```
           total_amount
month
April          32012.54
August         27759.56
December       31261.57
February       28937.89
January        31735.25
July           26617.64
```

```
June         32920.52
March        33085.89
May          33828.58
November     30800.44
October      33065.83
September    28206.38
```

[59]:

```
# Create a bar plot of total revenue by month

# Reindex to match day order
monthly_revenue = monthly_revenue.reindex(index=month_order)

# Convert daily_revenue to 1D Series
monthly_revenue_series = monthly_revenue["total_amount"]  # OR use .squeeze()

# Plot
plt.figure(figsize=(12, 7))
ax = sns.barplot(x=monthly_revenue_series.index, y=monthly_revenue_series.
 ↪values)  #  FIX APPLIED
ax.set_xticklabels(month_order)
plt.title("Total Revenue by Month", fontsize=16)
plt.xlabel("Months of the Year")
plt.ylabel("Total Revenue")

plt.show()
```



Plot mean trip distance by drop-off location

[60]:

```
# Get number of unique drop-off location IDs
df['DOLocationID'].nunique()
```

[60]:

```
216
```

[61]:

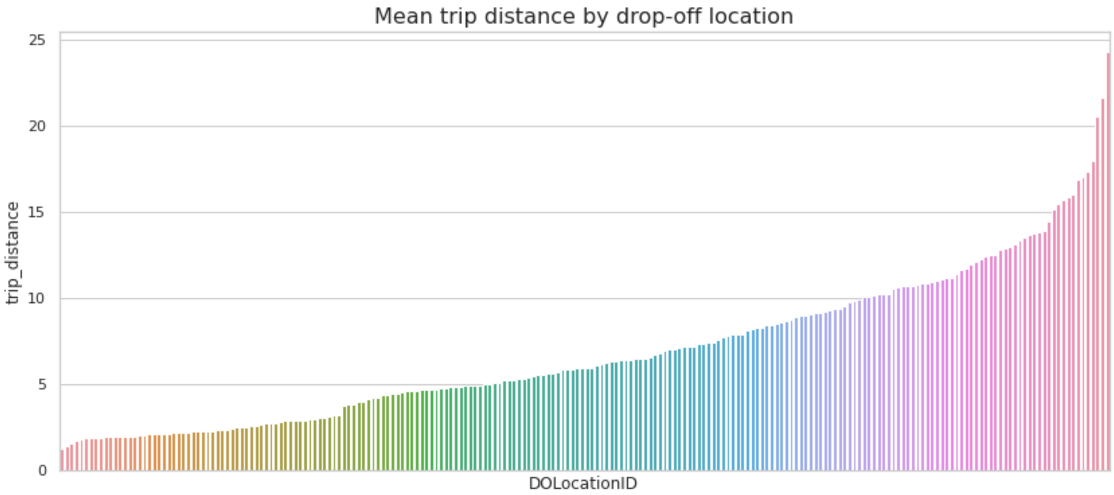
```
# Calculate the mean trip distance for each drop-off location
distance_by_dropoff = df.groupby('DOLocationID').mean()[['trip_distance']]

# Sort the results in descending order by mean trip distance
distance_by_dropoff = distance_by_dropoff.sort_values(by='trip_distance')
distance_by_dropoff
```

[61]:

```
              trip_distance
DOLocationID
207                1.200000
193                1.390556
237                1.555494
234                1.727806
137                1.818852
…                       …
51                17.310000
11                17.945000
210               20.500000
29                21.650000
23                24.275000

[216 rows x 1 columns]
```

[62]:

```
# Create a bar plot of mean trip distances by drop-off location in ascending␣
 ↪order by distance
plt.figure(figsize=(14,6))
ax = sns.barplot(x=distance_by_dropoff.index,
                 y=distance_by_dropoff['trip_distance'],
                 order=distance_by_dropoff.index)
ax.set_xticklabels([])
ax.set_xticks([])
plt.title('Mean trip distance by drop-off location', fontsize=16);
```



You’ve now completed professional data visualizations according to a business need. Well done!