In [1]:
```
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
```

In [2]:
```
uber = pd.read_csv('uber.csv')

uber.head()
```

Out[2]:

	Unnamed: 0	key	fare_amount	pickup_datetime	pickup_longitude	pickup_latitud
0	24238194	2015-05-07 19:52:06.0000003	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.73835
1	27835199	2009-07-17 20:04:56.0000002	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.72822
2	44984355	2009-08-24 21:45:00.00000061	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.74077
3	25894730	2009-06-26 08:22:21.0000001	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.79084
4	17610152	2014-08-28 17:47:00.000000188	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.74408

In [3]:
```
uber.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200000 entries, 0 to 199999
Data columns (total 9 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   Unnamed: 0         200000 non-null  int64  
 1   key                200000 non-null  object 
 2   fare_amount        200000 non-null  float64
 3   pickup_datetime    200000 non-null  object 
 4   pickup_longitude   200000 non-null  float64
 5   pickup_latitude    200000 non-null  float64
 6   dropoff_longitude  199999 non-null  float64
 7   dropoff_latitude   199999 non-null  float64
 8   passenger_count    200000 non-null  int64  
dtypes: float64(5), int64(2), object(2)
memory usage: 13.7+ MB
```

In [4]:
```
uber.isnull().sum()
```

Out[4]:
```
Unnamed: 0           0
key                  0
fare_amount          0
pickup_datetime      0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    1
dropoff_latitude     1
passenger_count      0
dtype: int64
```

In [5]:
```
uber_2 = uber.drop(['Unnamed: 0','key'],axis=1)
uber_2.dropna(axis=0,inplace=True)
```

In [6]:
```
uber_2.isnull().sum()
```

Out[6]:
```
fare_amount          0
pickup_datetime      0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    0
dropoff_latitude     0
passenger_count      0
dtype: int64
```

In [7]:
```
def haversine (lon_1, lon_2, lat_1, lat_2):

    lon_1, lon_2, lat_1, lat_2 = map(np.radians, [lon_1, lon_2, lat_1, lat_2])


    diff_lon = lon_2 - lon_1
    diff_lat = lat_2 - lat_1


    km = 2 * 6371 * np.arcsin(np.sqrt(np.sin(diff_lat/2.0)**2 +
                                      np.cos(lat_1) * np.cos(lat_2) * np.sin(d

    return km
```

In [8]:
```
uber_2['Distance']= haversine(uber_2['pickup_longitude'],uber_2['dropoff_longi
                              uber_2['pickup_latitude'],uber_2['dropoff_latitud

uber_2['Distance'] = uber_2['Distance'].astype(float).round(2)
```

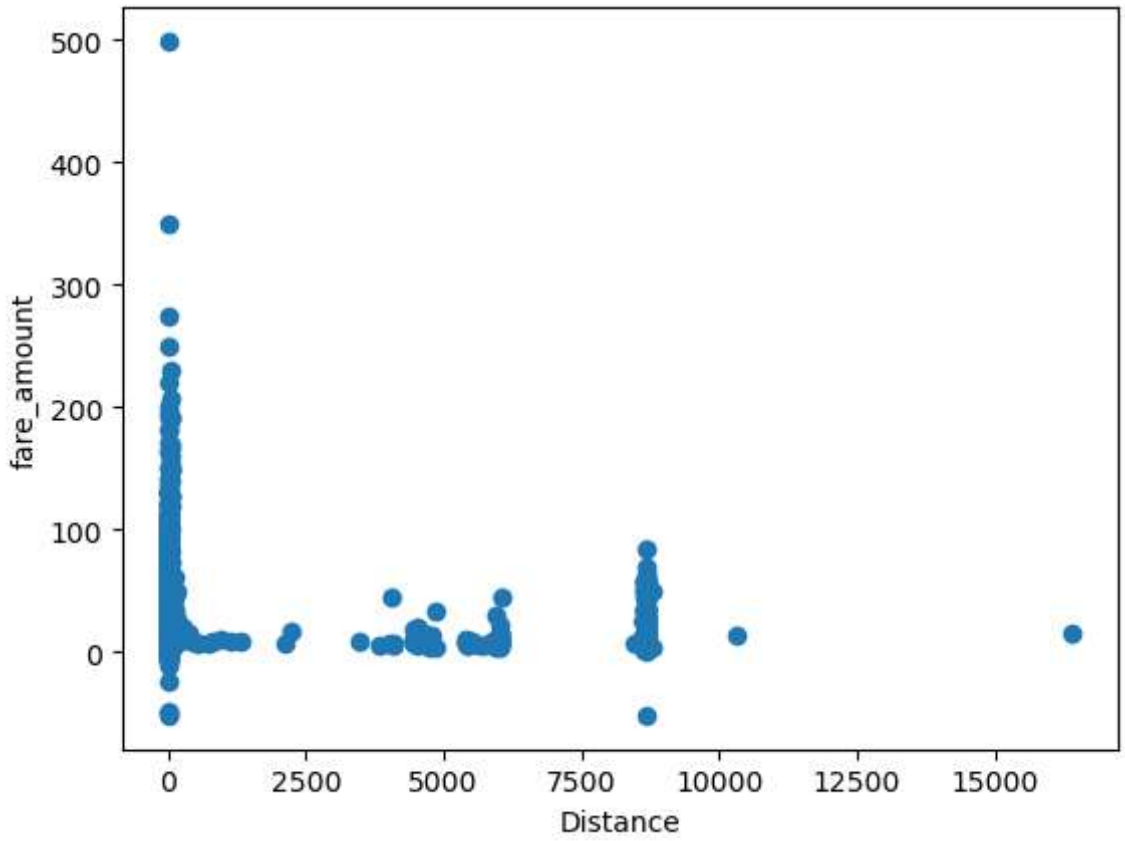
In [9]:
```
uber_2.head()
```

Out[9]:

	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_lat
0	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.999512	40.7
1	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.994710	40.7
2	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.740770	-73.962565	40.7
3	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.790844	-73.965316	40.8
4	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.744085	-73.973082	40.7

In [10]:
```
plt.scatter(uber_2['Distance'], uber_2['fare_amount'])
plt.xlabel("Distance")
plt.ylabel("fare_amount")
```

Out[10]:
```
Text(0, 0.5, 'fare_amount')
```



In [11]:
```
uber_2.drop(uber_2[uber_2['Distance'] > 60].index, inplace = True)
uber_2.drop(uber_2[uber_2['Distance'] == 0].index, inplace = True)
uber_2.drop(uber_2[uber_2['fare_amount'] == 0].index, inplace = True)
uber_2.drop(uber_2[uber_2['fare_amount'] < 0].index, inplace = True)
```

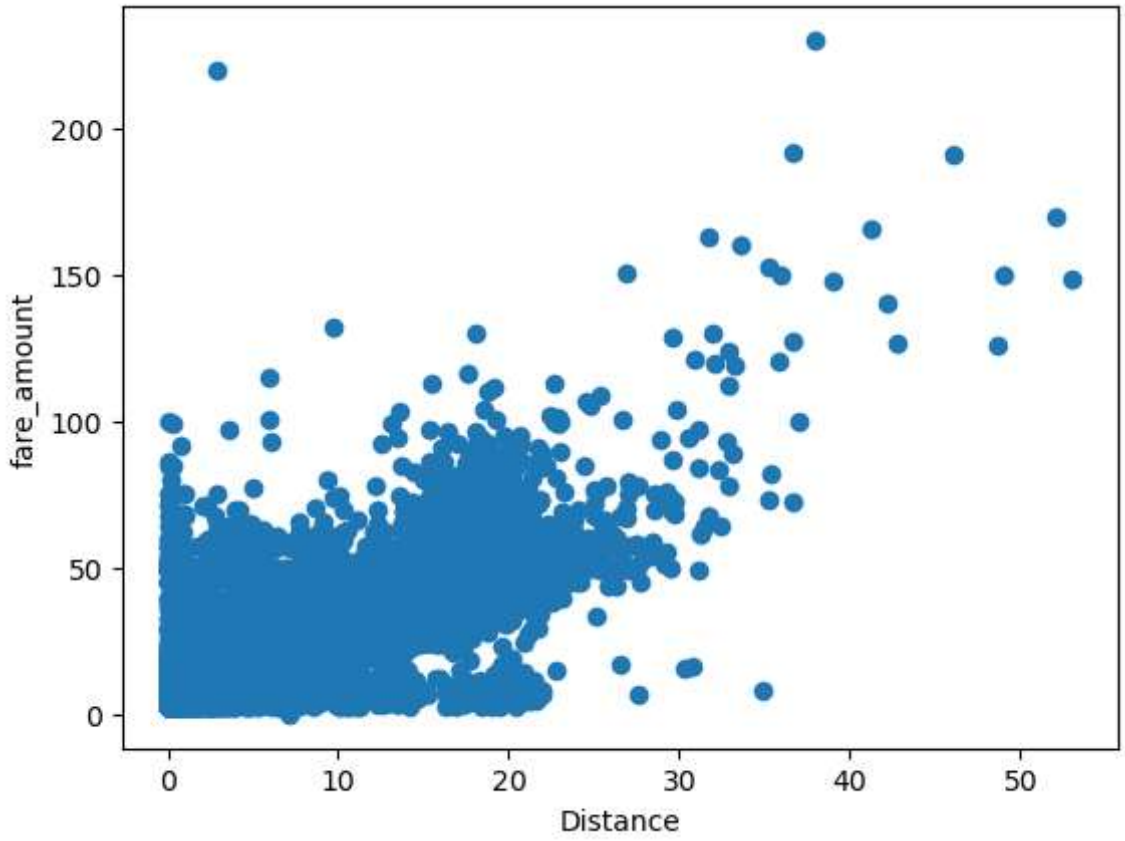
In [12]:
```
uber_2.drop(uber_2[(uber_2['fare_amount']>100) & (uber_2['Distance']<1)].index
uber_2.drop(uber_2[(uber_2['fare_amount']<100) & (uber_2['Distance']>100)].ind
```

In [13]:
```
uber_2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 193481 entries, 0 to 199999
Data columns (total 8 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   fare_amount        193481 non-null  float64
 1   pickup_datetime    193481 non-null  object 
 2   pickup_longitude   193481 non-null  float64
 3   pickup_latitude    193481 non-null  float64
 4   dropoff_longitude  193481 non-null  float64
 5   dropoff_latitude   193481 non-null  float64
 6   passenger_count    193481 non-null  int64  
 7   Distance           193481 non-null  float64
dtypes: float64(6), int64(1), object(1)
memory usage: 13.3+ MB
```

In [14]:
```
plt.scatter(uber_2['Distance'], uber_2['fare_amount'])
plt.xlabel("Distance")
plt.ylabel("fare_amount")
```

Out[14]:
```
Text(0, 0.5, 'fare_amount')
```



In [15]:
```
uber_2['pickup_datetime'] = pd.to_datetime(uber_2['pickup_datetime'])

uber_2['Year'] = uber_2['pickup_datetime'].apply(lambda time: time.year)
uber_2['Month'] = uber_2['pickup_datetime'].apply(lambda time: time.month)
uber_2['Day'] = uber_2['pickup_datetime'].apply(lambda time: time.day)
uber_2['Day of Week'] = uber_2['pickup_datetime'].apply(lambda time: time.dayo
uber_2['Day of Week_num'] = uber_2['pickup_datetime'].apply(lambda time: time.
uber_2['Hour'] = uber_2['pickup_datetime'].apply(lambda time: time.hour)

day_map = {0:'Mon',1:'Tue',2:'Wed',3:'Thu',4:'Fri',5:'Sat',6:'Sun'}
uber_2['Day of Week'] = uber_2['Day of Week'].map(day_map)

uber_2['counter'] = 1
```

In [16]:
```
uber_2['pickup'] = uber_2['pickup_latitude'].astype(str) + "," + uber_2['picku
uber_2['drop off'] = uber_2['dropoff_latitude'].astype(str) + "," + uber_2['dr
```

In [17]:
```
uber_2.head()
```

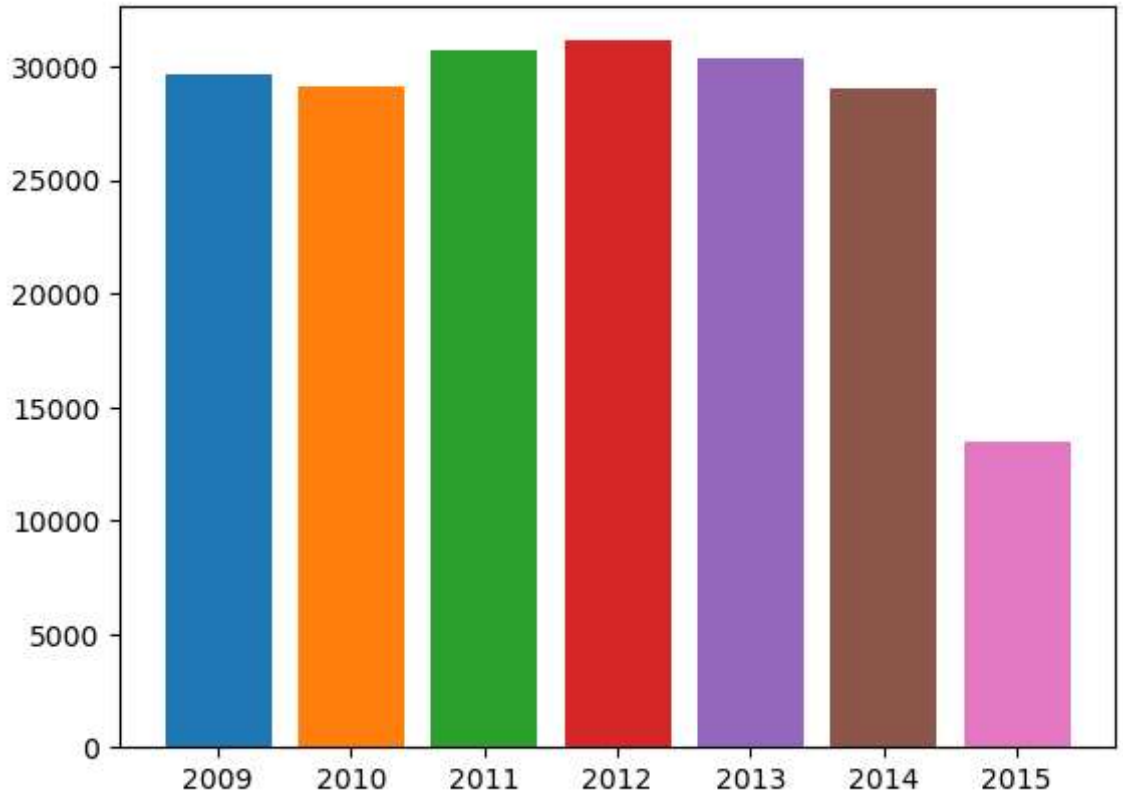
Out[17]:

	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_lat
0	7.5	2015-05-07 19:52:06+00:00	-73.999817	40.738354	-73.999512	40.7
1	7.7	2009-07-17 20:04:56+00:00	-73.994355	40.728225	-73.994710	40.7
2	12.9	2009-08-24 21:45:00+00:00	-74.005043	40.740770	-73.962565	40.7
3	5.3	2009-06-26 08:22:21+00:00	-73.976124	40.790844	-73.965316	40.8
4	16.0	2014-08-28 17:47:00+00:00	-73.925023	40.744085	-73.973082	40.7

In [18]:
```
no_of_trips = []
year = [2009, 2010, 2011, 2012, 2013, 2014, 2015]

colors = ['#1f77b4', '#ff7f0e', '#2ca02c', '#d62728', '#9467bd',
          '#8c564b', '#e377c2', '#7f7f7f', '#bcbd22', '#17becf']

for i in range(2009, 2016):
    x = uber_2.loc[uber_2['Year'] == i, 'counter'].sum()
    no_of_trips.append(x)

print("Average trips a year: ")
print(year, no_of_trips)

plt.bar(year, no_of_trips, color=colors)
```

```
Average trips a year:
[2009, 2010, 2011, 2012, 2013, 2014, 2015] [29674, 29094, 30712, 31138, 3036
5, 29065, 13433]
```

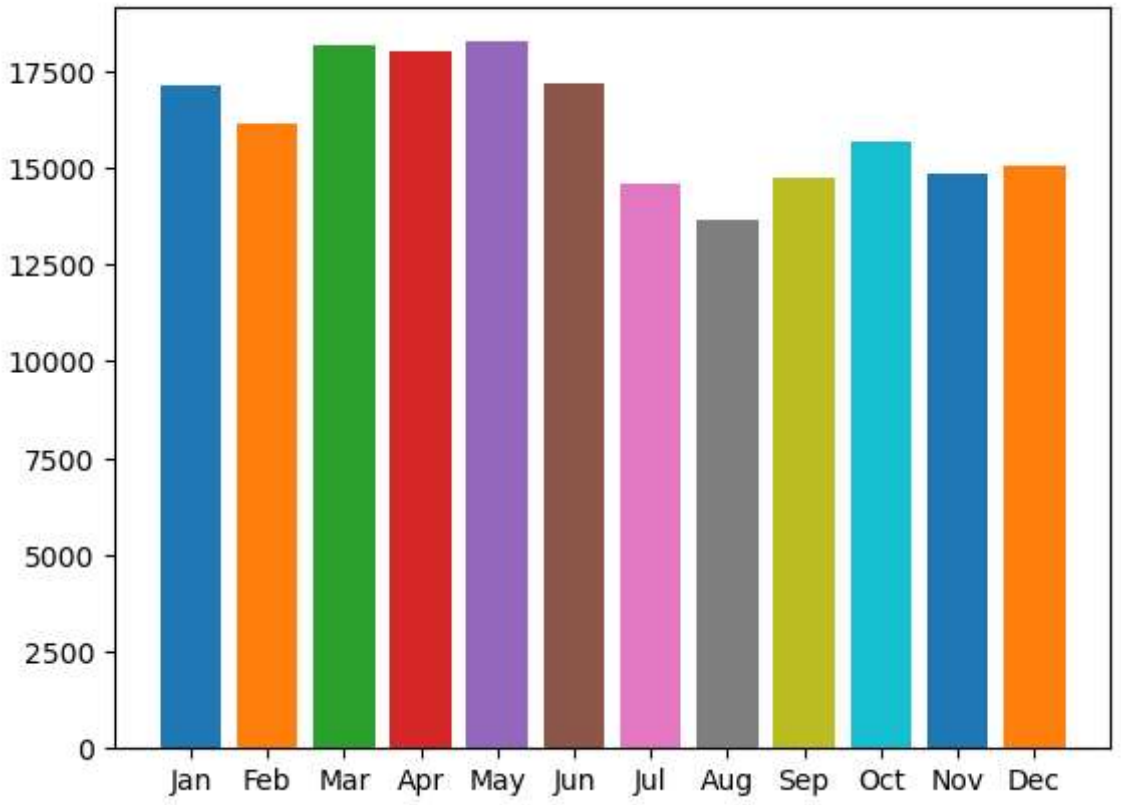
Out[18]:
```
<BarContainer object of 7 artists>
```



In [19]:
```
no_of_trips = []
month = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct',

colors = ['#1f77b4', '#ff7f0e', '#2ca02c', '#d62728', '#9467bd',
          '#8c564b', '#e377c2', '#7f7f7f', '#bcbd22', '#17becf']

for i in range(1, 13):
    x = uber_2.loc[uber_2['Month'] == i, 'counter'].sum()
    no_of_trips.append(x)

print("Average trips a Month: ")
print(month, no_of_trips)

plt.bar(month, no_of_trips, color=colors)
```

```
Average trips a Month:
['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct', 'Nov',
'Dec'] [17126, 16141, 18165, 18004, 18259, 17210, 14583, 13664, 14772, 15690,
14824, 15043]
```

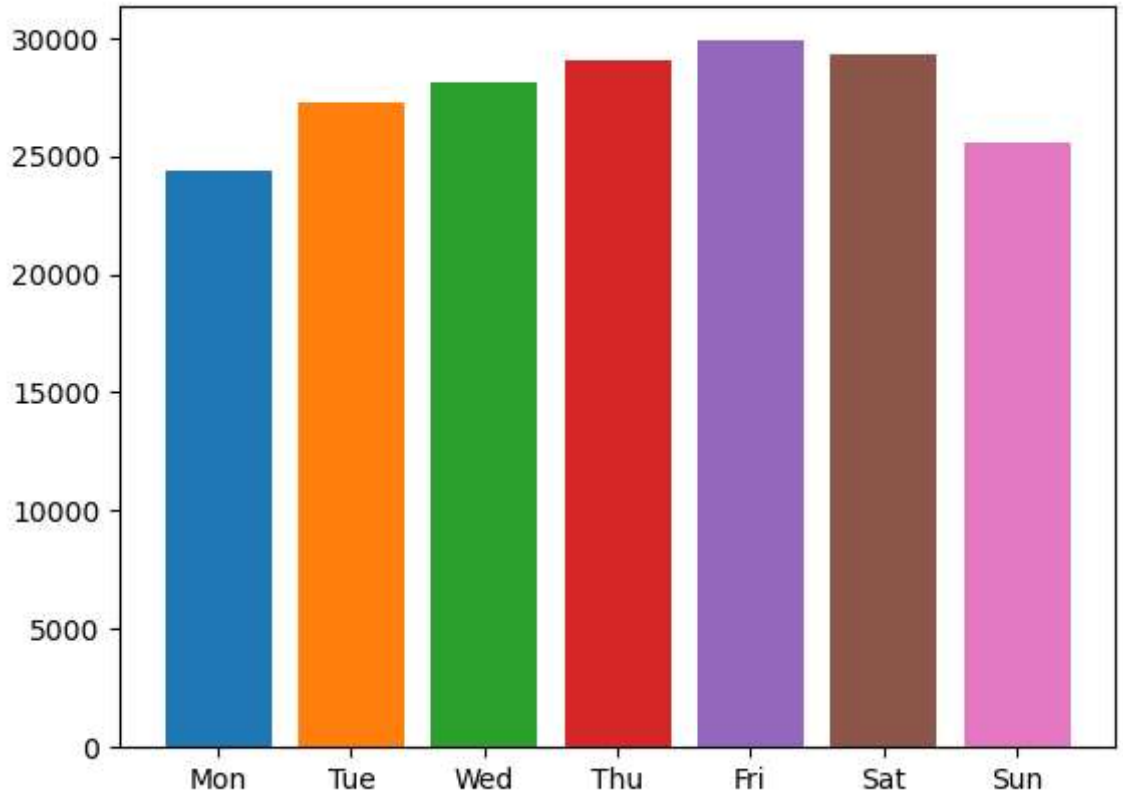
Out[19]:
```
<BarContainer object of 12 artists>
```



In [20]:
```
no_of_trips = []
day = ['Mon', 'Tue', 'Wed', 'Thu', 'Fri', 'Sat', 'Sun']

colors = ['#1f77b4', '#ff7f0e', '#2ca02c', '#d62728', '#9467bd',
          '#8c564b', '#e377c2', '#7f7f7f', '#bcbd22', '#17becf']

for i in range(0, 7):
    x = uber_2.loc[uber_2['Day of Week_num'] == i, 'counter'].sum()
    no_of_trips.append(x)

print("Average trips by Days: ")
print(day, no_of_trips)

plt.bar(day, no_of_trips, color=colors)
```

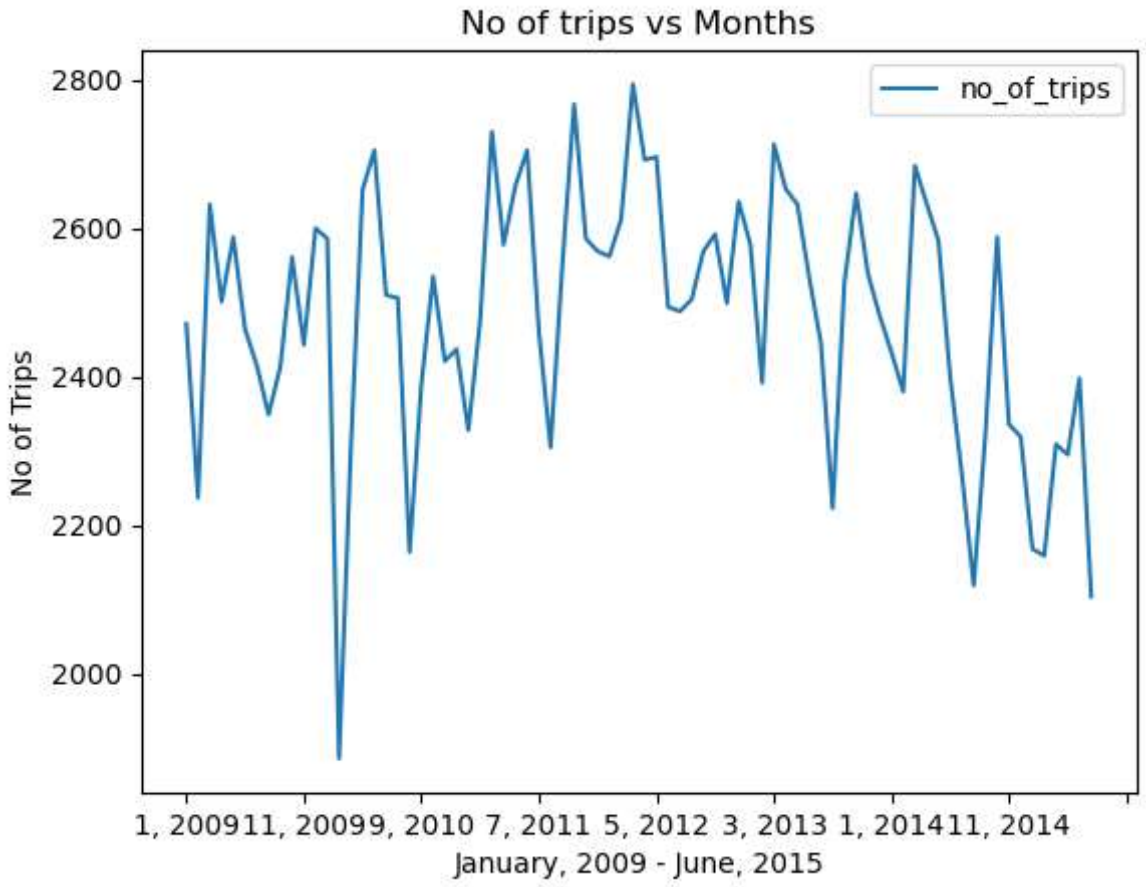
```
Average trips by Days:
['Mon', 'Tue', 'Wed', 'Thu', 'Fri', 'Sat', 'Sun'] [24377, 27236, 28084, 2904
1, 29865, 29306, 25572]
```

Out[20]:
```
<BarContainer object of 7 artists>
```



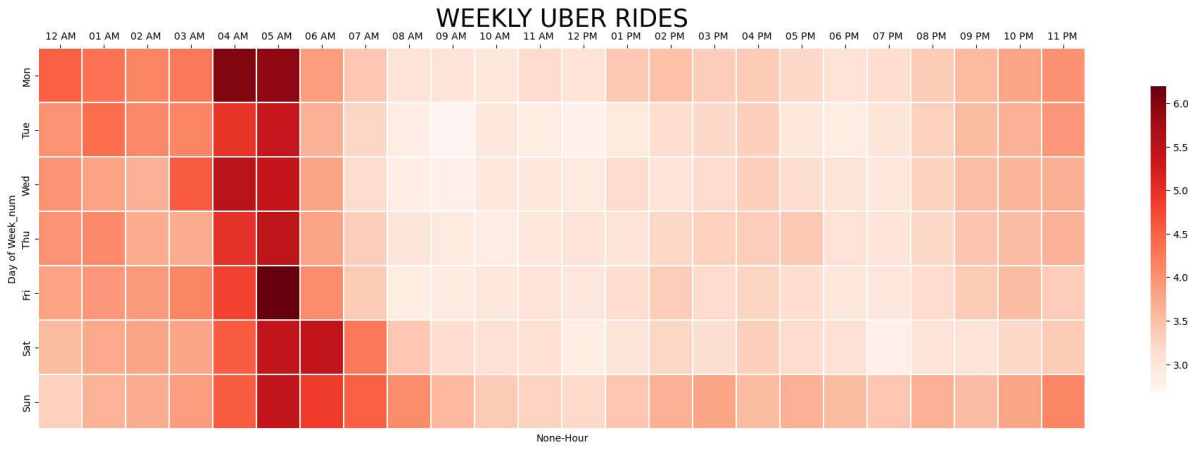
In [21]:
```
year_vs_trips = uber_2.groupby(['Year','Month']).agg(
    no_of_trips = ('counter','count'),
    Average_fair = ('fare_amount','mean'),
    Total_fair = ('fare_amount','sum'),
    Avg_distance = ( 'Distance', 'mean')).reset_index()

year_vs_trips['avg_no_of_trips'] = year_vs_trips['no_of_trips']/30
year_vs_trips['month_year'] = year_vs_trips['Month'].astype(str) +", "+ year_v


year_vs_trips = year_vs_trips.reset_index()

year_vs_trips.head()


year_vs_trips.plot(kind='line',x='month_year',y='no_of_trips', xlabel='January
    ylabel='No of Trips', title='No of trips vs Months')
```

Out[21]:
```
<AxesSubplot:title={'center':'No of trips vs Months'}, xlabel='January, 2009
- June, 2015', ylabel='No of Trips'>
```



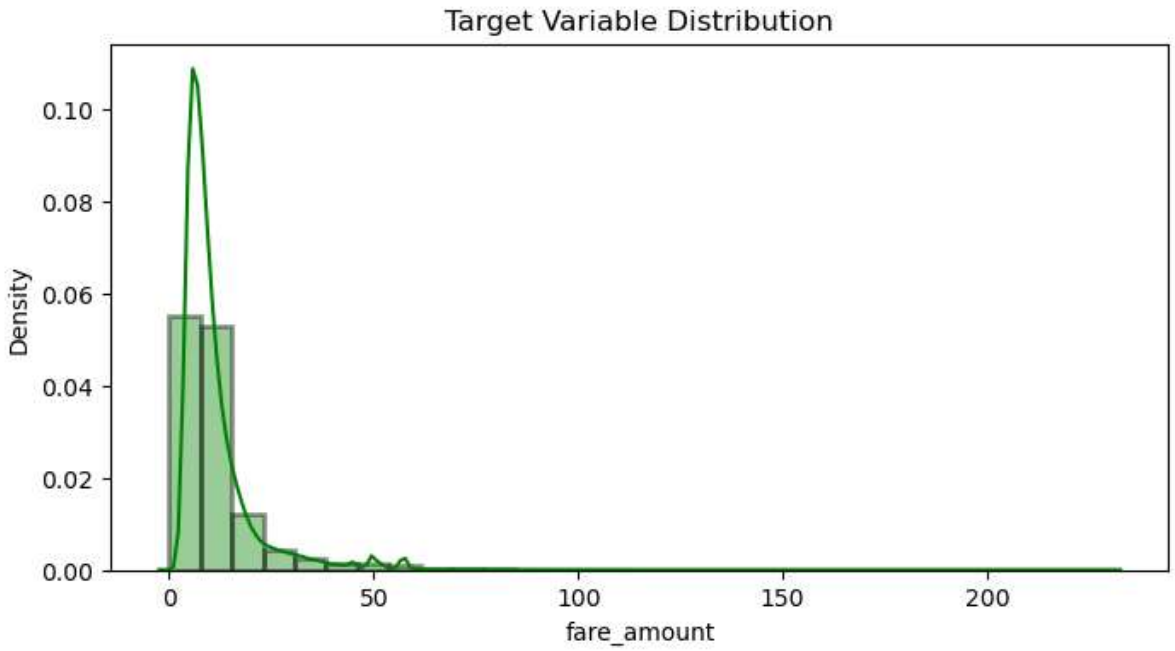
In [22]:
```
import seaborn as sns

df_1 = uber_2[['Distance', 'Day of Week_num', 'Hour']].copy()

df_h = df_1.copy()

df_h = df_h.groupby(['Hour', 'Day of Week_num']).mean()
df_h = df_h.unstack(level=0)
```

In [23]:
```
fig, ax = plt.subplots(figsize=(24, 7))
sns.heatmap(df_h, cmap="Reds",
            linewidth=0.3, cbar_kws={"shrink": .8})

xticks_labels = ['12 AM', '01 AM', '02 AM ', '03 AM ', '04 AM ', '05 AM ', '06
                 '08 AM ', '09 AM ', '10 AM ', '11 AM ', '12 PM ', '01 PM ', '
                 '04 PM ', '05 PM ', '06 PM ', '07 PM ', '08 PM ', '09 PM ', '

yticks_labels = ['Mon','Tue','Wed','Thu','Fri','Sat','Sun']

plt.xticks(np.arange(24) + .5, labels=xticks_labels)
plt.yticks(np.arange(7) + .5, labels=yticks_labels)

ax.xaxis.tick_top()

title = 'Weekly Uber Rides'.upper()
plt.title(title, fontdict={'fontsize': 25})

plt.show()
```



In [25]:
```
plt.figure(figsize=[8,4])
sns.distplot(uber_2['fare_amount'], color='g',hist_kws=dict(edgecolor="black",
plt.title('Target Variable Distribution')
plt.show()
```

```
C:\Users\hp\anaconda3\lib\site-packages\seaborn\distributions.py:2619: Future
Warning: `distplot` is a deprecated function and will be removed in a future
version. Please adapt your code to use either `displot` (a figure-level funct
ion with similar flexibility) or `histplot` (an axes-level function for histo
grams).
  warnings.warn(msg, FutureWarning)
```



In [26]:
```
import statistics as st

print("Mean of fare prices is % s "
        % (st.mean(uber_2['fare_amount'])))

print("Median of fare prices is % s "
        % (st.median(uber_2['fare_amount'])))

print("Standard Deviation of Fare Prices is % s "
               % (st.stdev(uber_2['fare_amount'])))
```

```
Mean of fare prices is 11.311137476031238
Median of fare prices is 8.5
Standard Deviation of Fare Prices is 9.501354886915946
```

In [27]:
```
import statistics as st

print("Mean of Distance is % s "
        % (st.mean(uber_2['Distance'])))

print("Median of Distance is % s "
        % (st.median(uber_2['Distance'])))

print("Standard Deviation of Distance is % s "
               % (st.stdev(uber_2['Distance'])))
```

```
Mean of Distance is 3.3573488352861522
Median of Distance is 2.18
Standard Deviation of Distance is 3.5995030824386185
```

In [28]:
```
corr = uber_2.corr()

corr.style.background_gradient(cmap='BuGn')
```

```
C:\Users\hp\anaconda3\lib\site-packages\pandas\io\formats\style.py:3555: Runt
imeWarning: All-NaN slice encountered
  smin = np.nanmin(gmap) if vmin is None else vmin
C:\Users\hp\anaconda3\lib\site-packages\pandas\io\formats\style.py:3556: Runt
imeWarning: All-NaN slice encountered
  smax = np.nanmax(gmap) if vmax is None else vmax
```

Out[28]:

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latit
fare_amount	1.000000	0.012070	-0.008682	0.010555	-0.008
pickup_longitude	0.012070	1.000000	-0.949099	0.999883	-0.993
pickup_latitude	-0.008682	-0.949099	1.000000	-0.949095	0.954
dropoff_longitude	0.010555	0.999883	-0.949095	1.000000	-0.993
dropoff_latitude	-0.008695	-0.993975	0.954759	-0.993962	1.000
passenger_count	0.013508	0.009174	-0.009219	0.009168	-0.009
Distance	0.893050	0.005337	0.003232	0.004406	-0.002
Year	0.123562	0.013480	-0.013690	0.013365	-0.014
Month	0.024402	-0.007496	0.007602	-0.007454	0.007
Day	-0.000286	0.019528	-0.019390	0.019554	-0.020
Day of Week_num	0.005140	0.008241	-0.008922	0.008536	-0.008
Hour	-0.019788	0.001838	-0.001821	0.000938	-0.001
counter	nan	nan	nan	nan	

In [29]:
```
X = uber_2['Distance'].values.reshape(-1, 1)
y = uber_2['fare_amount'].values.reshape(-1, 1)
```

In [30]:
```
from sklearn.preprocessing import StandardScaler
std = StandardScaler()
y_std = std.fit_transform(y)
print(y_std)

x_std = std.fit_transform(X)
print(x_std)
```

```
[[-0.4011162 ]
 [-0.38006651]
 [ 0.16722527]
 ...
 [ 2.06169682]
 [ 0.33562274]
 [ 0.29352337]]
[[-0.46599576]
 [-0.24929862]
 [ 0.46746884]
 ...
 [ 2.63721838]
 [ 0.05074357]
 [ 0.57303924]]
```

In [31]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(x_std, y_std, test_size=0.
```

In [32]:
```
from sklearn.linear_model import LinearRegression
l_reg = LinearRegression()
l_reg.fit(X_train, y_train)

print("Training set score: {:.2f}".format(l_reg.score(X_train, y_train)))
print("Test set score: {:.7f}".format(l_reg.score(X_test, y_test)))
```

```
Training set score: 0.80
Test set score: 0.8006071
```

In [33]:
```
y_pred = l_reg.predict(X_test)
df = {'Actual': y_test, 'Predicted': y_pred}

from tabulate import tabulate
print(tabulate(df, headers = 'keys', tablefmt = 'psql'))
```

```
+-------------+--------------+
|      Actual |    Predicted |
|-------------+--------------|
| -0.548464   | -0.663476    |
| -0.769486   | -0.611449    |
|  0.651368   |  0.290356    |
|  6.86102    |  3.52595     |
| -0.611613   | -0.544557    |
| -0.16957    | -0.333971    |
| -0.295868   | -0.0490599   |
| -0.0853709  | -0.224961    |
| -0.506365   | -0.517305    |
| -0.558989   | -0.628792    |
|  0.914489   |  1.69261     |
|  2.94894    |  1.3854      |
|  0.0409272  | -0.202664    |
|  1.23023    |  0.282923    |
| -0.506365   | -0.584197    |
| -0.590563   | -0.599062    |
```

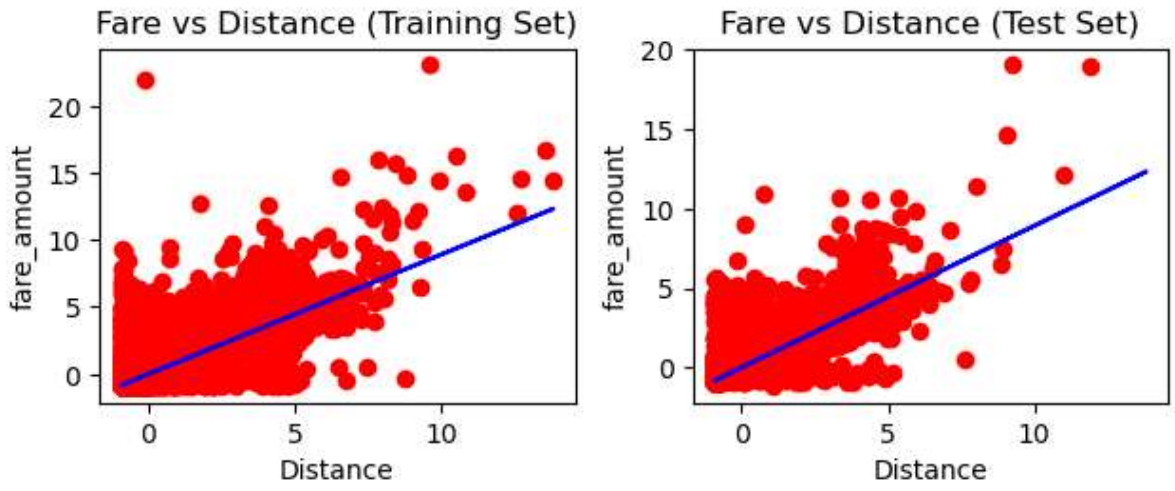
In [34]:
```
from sklearn import metrics
print('Mean Absolute Error:', metrics.mean_absolute_error(y_test, y_pred))

print('Mean Squared Error:', metrics.mean_squared_error(y_test, y_pred))
print('Root Mean Squared Error:', np.sqrt(metrics.mean_squared_error(y_test, y
```

```
Mean Absolute Error: 0.23979020298617273
Mean Squared Error: 0.19845894128014688
Root Mean Squared Error: 0.4454873076532561
```

In [35]:
```
print(l_reg.intercept_)
print(l_reg.coef_)
```

```
[-0.00016705]
[[0.89176936]]
```

In [36]:
```
plt.subplot(2, 2, 1)
plt.scatter(X_train, y_train, color = 'red')
plt.plot(X_train, l_reg.predict(X_train), color ="blue")
plt.title("Fare vs Distance (Training Set)")
plt.ylabel("fare_amount")
plt.xlabel("Distance")

plt.subplot(2, 2, 2)
plt.scatter(X_test, y_test, color = 'red')
plt.plot(X_train, l_reg.predict(X_train), color ="blue")
plt.ylabel("fare_amount")
plt.xlabel("Distance")
plt.title("Fare vs Distance (Test Set)")


plt.tight_layout()
plt.rcParams["figure.figsize"] = (32,22)
plt.show()
```



In [ ]: