In [1]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as pl
```

In [2]:

```
df = pd.read_csv("uber.csv")
```

In [3]:

```
df.head()
df.info() #To get the required information of the dataset
df.columns #TO get number of columns in the dataset
df = df.drop(['Unnamed: 0', 'key'], axis= 1) #To drop unnamed column as it isn't requ
df.head()
df.shape #To get the total (Rows,Columns)
df.dtypes #To get the type of each column
df.info()
df.describe() #To get statistics of each columns
```

```
<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
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200000 entries, 0 to 199999
Data columns (total 7 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   fare_amount        200000 non-null  float64
 1   pickup_datetime    200000 non-null  object 
 2   pickup_longitude   200000 non-null  float64
 3   pickup_latitude    200000 non-null  float64
 4   dropoff_longitude  199999 non-null  float64
 5   dropoff_latitude   199999 non-null  float64
 6   passenger_count    200000 non-null  int64  
dtypes: float64(5), int64(1), object(1)
memory usage: 10.7+ MB
```

Out[3]:

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_co
count	200000.000000	200000.000000	200000.000000	199999.000000	199999.000000	200000.000
mean	11.359955	-72.527638	39.935885	-72.525292	39.923890	1.684
std	9.901776	11.437787	7.720539	13.117408	6.794829	1.385
min	-52.000000	-1340.648410	-74.015515	-3356.666300	-881.985513	0.000
25%	6.000000	-73.992065	40.734796	-73.991407	40.733823	1.000
50%	8.500000	-73.981823	40.752592	-73.980093	40.753042	1.000
75%	12.500000	-73.967154	40.767158	-73.963658	40.768001	2.000
max	499.000000	57.418457	1644.421482	1153.572603	872.697628	208.000

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

Out[4]:
```
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]:
```
df['dropoff_latitude'].fillna(value=df['dropoff_latitude'].mean(),inplace = True)
df['dropoff_longitude'].fillna(value=df['dropoff_longitude'].median(),inplace = True)
```

In [6]:
```
df.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]:
```
df.dtypes
```

Out[7]:
```
fare_amount          float64
pickup_datetime       object
pickup_longitude     float64
pickup_latitude      float64
dropoff_longitude    float64
dropoff_latitude     float64
passenger_count        int64
dtype: object
```

In [8]:
```
df.pickup_datetime = pd.to_datetime(df.pickup_datetime, errors='coerce')
df.dtypes
```

Out[8]:
```
fare_amount                      float64
pickup_datetime      datetime64[ns, UTC]
pickup_longitude                 float64
pickup_latitude                  float64
dropoff_longitude                float64
dropoff_latitude                 float64
passenger_count                    int64
dtype: object
```

In [9]:

```
df= df.assign(hour = df.pickup_datetime.dt.hour,
 day= df.pickup_datetime.dt.day,
 month = df.pickup_datetime.dt.month,
 year = df.pickup_datetime.dt.year,
 dayofweek = df.pickup_datetime.dt.dayofweek)
df.head()
```

Out[9]:

	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	pa
0	7.5	2015-05-07 19:52:06+00:00	-73.999817	40.738354	-73.999512	40.723217	
1	7.7	2009-07-17 20:04:56+00:00	-73.994355	40.728225	-73.994710	40.750325	
2	12.9	2009-08-24 21:45:00+00:00	-74.005043	40.740770	-73.962565	40.772647	
3	5.3	2009-06-26 08:22:21+00:00	-73.976124	40.790844	-73.965316	40.803349	
4	16.0	2014-08-28 17:47:00+00:00	-73.925023	40.744085	-73.973082	40.761247	

In [10]:

```
df = df.drop('pickup_datetime',axis=1)
```

In [11]:

```
df.dtypes
```

Out[11]:

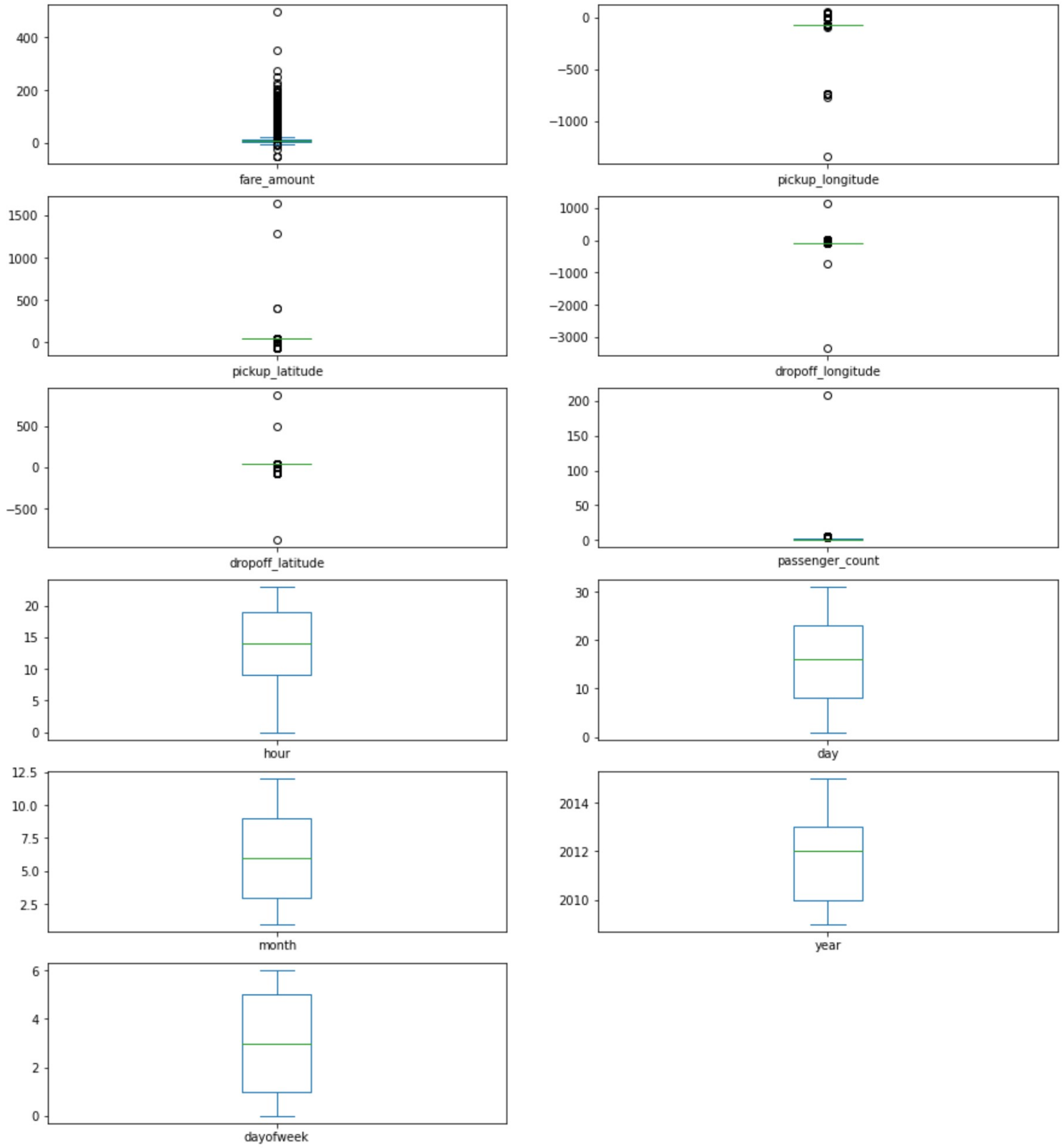
```
fare_amount          float64
pickup_longitude     float64
pickup_latitude      float64
dropoff_longitude    float64
dropoff_latitude     float64
passenger_count        int64
hour                   int64
day                    int64
month                  int64
year                   int64
dayofweek              int64
dtype: object
```

In [12]:

```
df.plot(kind = "box",subplots = True,layout = (7,2),figsize=(15,20))
```

Out[12]:

```
fare_amount            AxesSubplot(0.125,0.787927;0.352273x0.0920732)
pickup_longitude    AxesSubplot(0.547727,0.787927;0.352273x0.0920732)
pickup_latitude        AxesSubplot(0.125,0.677439;0.352273x0.0920732)
dropoff_longitude   AxesSubplot(0.547727,0.677439;0.352273x0.0920732)
dropoff_latitude       AxesSubplot(0.125,0.566951;0.352273x0.0920732)
passenger_count     AxesSubplot(0.547727,0.566951;0.352273x0.0920732)
hour                   AxesSubplot(0.125,0.456463;0.352273x0.0920732)
day                 AxesSubplot(0.547727,0.456463;0.352273x0.0920732)
month                  AxesSubplot(0.125,0.345976;0.352273x0.0920732)
year                AxesSubplot(0.547727,0.345976;0.352273x0.0920732)
dayofweek              AxesSubplot(0.125,0.235488;0.352273x0.0920732)
dtype: object
```



In [13]:

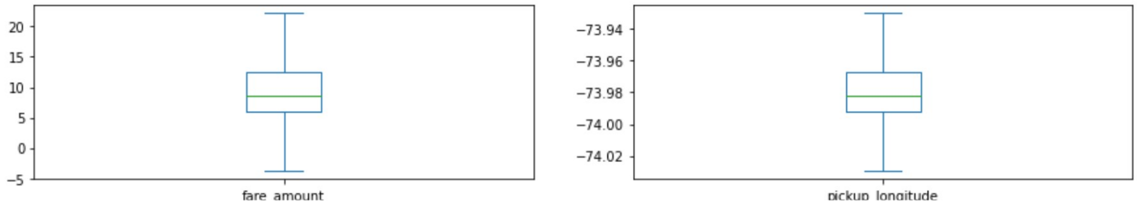
```
def remove_outlier(df1 , col):
 Q1 = df1[col].quantile(0.25)
 Q3 = df1[col].quantile(0.75)
 IQR = Q3 - Q1
 lower_whisker = Q1-1.5*IQR
 upper_whisker = Q3+1.5*IQR
 df[col] = np.clip(df1[col] , lower_whisker , upper_whisker)
 return df1
```

In [14]:

```
def treat_outliers_all(df1 , col_list):
 for c in col_list:
     df1 = remove_outlier(df , c)
 return df1
df = treat_outliers_all(df , df.iloc[: , 0::])
df.plot(kind = "box",subplots = True,layout = (7,2),figsize=(15,20)) #
```

Out[14]:

```
fare_amount            AxesSubplot(0.125,0.787927;0.352273x0.0920732)
pickup_longitude    AxesSubplot(0.547727,0.787927;0.352273x0.0920732)
pickup_latitude        AxesSubplot(0.125,0.677439;0.352273x0.0920732)
dropoff_longitude   AxesSubplot(0.547727,0.677439;0.352273x0.0920732)
dropoff_latitude       AxesSubplot(0.125,0.566951;0.352273x0.0920732)
passenger_count     AxesSubplot(0.547727,0.566951;0.352273x0.0920732)
hour                   AxesSubplot(0.125,0.456463;0.352273x0.0920732)
day                 AxesSubplot(0.547727,0.456463;0.352273x0.0920732)
month                  AxesSubplot(0.125,0.345976;0.352273x0.0920732)
year                AxesSubplot(0.547727,0.345976;0.352273x0.0920732)
dayofweek              AxesSubplot(0.125,0.235488;0.352273x0.0920732)
dtype: object
```



In [15]:

```
pip install haversine
```

```
Requirement already satisfied: haversine in c:\users\dristi\anaconda3\lib\site-packa
ges (2.7.0)
Note: you may need to restart the kernel to use updated packages.
```

In [16]:

```
import haversine as hs
```

In [17]:

```
travel_dist = []
for pos in range(len(df['pickup_longitude'])):
     long1,lati1,long2,lati2 = [df['pickup_longitude'][pos],df['pickup_latitude'][pos
     loc1=(lati1,long1)
     loc2=(lati2,long2)
     c = hs.haversine(loc1,loc2)
     travel_dist.append(c)
print(travel_dist)
df['dist_travel_km'] = travel_dist
df.head()
```

```
IOPub data rate exceeded.
The notebook server will temporarily stop sending output
to the client in order to avoid crashing it.
To change this limit, set the config variable
`--NotebookApp.iopub_data_rate_limit`.

Current values:
NotebookApp.iopub_data_rate_limit=1000000.0 (bytes/sec)
NotebookApp.rate_limit_window=3.0 (secs)
```

Out[17]:

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	h
0	7.5	-73.999817	40.738354	-73.999512	40.723217	1.0	
1	7.7	-73.994355	40.728225	-73.994710	40.750325	1.0	
2	12.9	-74.005043	40.740770	-73.962565	40.772647	1.0	
3	5.3	-73.976124	40.790844	-73.965316	40.803349	3.0	
4	16.0	-73.929786	40.744085	-73.973082	40.761247	3.5	

In [18]:

```
df= df.loc[(df.dist_travel_km >= 1) | (df.dist_travel_km <= 130)]
print("Remaining observastions in the dataset:", df.shape)
```

```
Remaining observastions in the dataset: (200000, 12)
```

In [19]:

```
incorrect_coordinates = df.loc[(df.pickup_latitude > 90) |(df.pickup_latitude < -90)
 (df.dropoff_latitude > 90) |(df.dropoff_latitude < -90) |
 (df.pickup_longitude > 180) |(df.pickup_longitude < -180) |
 (df.dropoff_longitude > 90) |(df.dropoff_longitude < -90)
 ]
```

In [20]:

```
df.drop(incorrect_coordinates, inplace = True, errors = 'ignore')
df.head()
```

Out[20]:

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	h
0	7.5	-73.999817	40.738354	-73.999512	40.723217	1.0	
1	7.7	-73.994355	40.728225	-73.994710	40.750325	1.0	
2	12.9	-74.005043	40.740770	-73.962565	40.772647	1.0	
3	5.3	-73.976124	40.790844	-73.965316	40.803349	3.0	
4	16.0	-73.929786	40.744085	-73.973082	40.761247	3.5	

In [21]:

```
df.drop(incorrect_coordinates, inplace = True, errors = 'ignore')
```

In [22]:
```
df.head()
```

Out[22]:

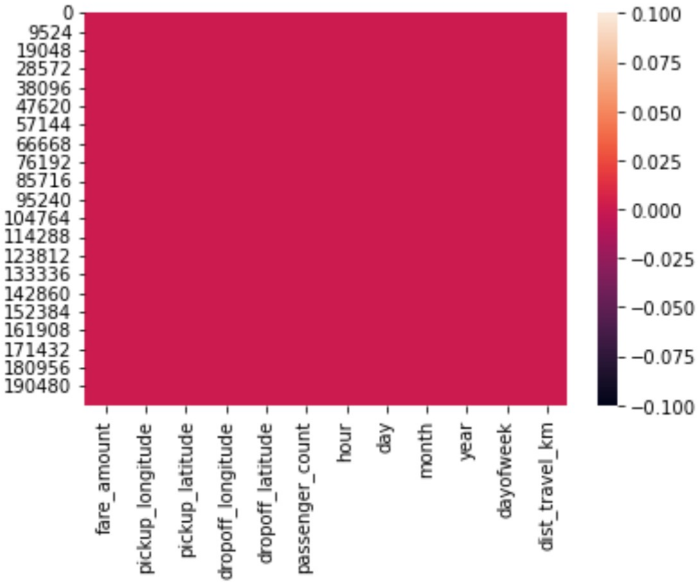
	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	h
0	7.5	-73.999817	40.738354	-73.999512	40.723217	1.0	
1	7.7	-73.994355	40.728225	-73.994710	40.750325	1.0	
2	12.9	-74.005043	40.740770	-73.962565	40.772647	1.0	
3	5.3	-73.976124	40.790844	-73.965316	40.803349	3.0	
4	16.0	-73.929786	40.744085	-73.973082	40.761247	3.5	

In [23]:
```
df.isnull().sum()
```

Out[23]:
```
fare_amount          0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    0
dropoff_latitude     0
passenger_count      0
hour                 0
day                  0
month                0
year                 0
dayofweek            0
dist_travel_km       0
dtype: int64
```

In [24]:
```
sns.heatmap(df.isnull())
```

Out[24]:
```
<AxesSubplot:>
```

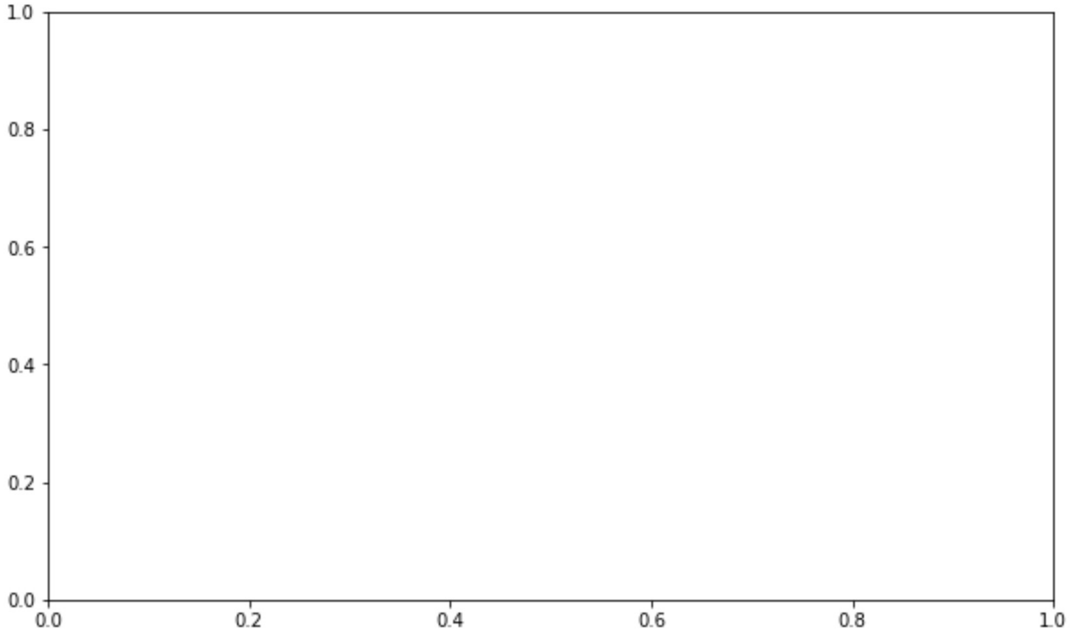


```
In [25]: corr = df.corr() #Function to find the correlation
         corr
```

Out[25]:

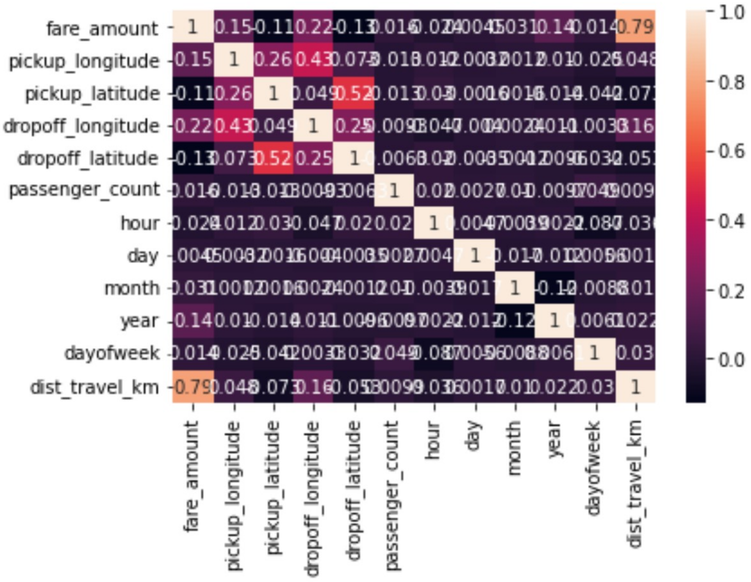
	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	pas
fare_amount	1.000000	0.154069	-0.110842	0.218675	-0.125898	
pickup_longitude	0.154069	1.000000	0.259497	0.425619	0.073290	
pickup_latitude	-0.110842	0.259497	1.000000	0.048889	0.515714	
dropoff_longitude	0.218675	0.425619	0.048889	1.000000	0.245667	
dropoff_latitude	-0.125898	0.073290	0.515714	0.245667	1.000000	
passenger_count	0.015778	-0.013213	-0.012889	-0.009303	-0.006308	
hour	-0.023623	0.011579	0.029681	-0.046558	0.019783	
day	0.004534	-0.003204	-0.001553	-0.004007	-0.003479	
month	0.030817	0.001169	0.001562	0.002391	-0.001193	
year	0.141277	0.010198	-0.014243	0.011346	-0.009603	
dayofweek	0.013652	-0.024652	-0.042310	-0.003336	-0.031919	
dist_travel_km	0.786385	0.048446	-0.073362	0.155191	-0.052701	

```
In [26]: fig,axis = pl.subplots(figsize = (10,6))
```



```
In [27]: sns.heatmap(df.corr(),annot = True)
```

```
Out[27]: <AxesSubplot:>
```



```
In [28]: x = df[['pickup_longitude','pickup_latitude','dropoff_longitude','dropoff_latitude','
         y = df['fare_amount']
```

```
In [29]: from sklearn.model_selection import train_test_split
```

```
In [30]: X_train,X_test,y_train,y_test = train_test_split(x,y,test_size = 0.33)
```

```
In [31]: from sklearn.linear_model import LinearRegression
```

```
In [32]: regression = LinearRegression()
         regression.fit(X_train,y_train)
         regression.coef_ #To find the linear coeeficient
         regression.intercept_ #To find the linear intercept
         prediction = regression.predict(X_test) #To predict the target values
         print(prediction)
         y_test
```

```
[ 8.8122037  16.31337269 21.04220568 ...  5.71667652 10.59547527
  5.51713897]
```

```
Out[32]: 199951     8.00
         44854     18.50
         89789     22.25
         38559      6.50
         137451     5.30
                   ...
         160829    22.25
         125341     6.50
         40813      4.50
         29682     13.50
         118932     4.50
         Name: fare_amount, Length: 66000, dtype: float64
```

```
In [33]: from sklearn.metrics import r2_score
```

In [34]:

```
r2_score(y_test,prediction)
from sklearn.metrics import mean_squared_error
MSE = mean_squared_error(y_test,prediction)
MSE
RMSE = np.sqrt(MSE)
RMSE
```

Out[34]:

```
3.115752410553582
```

In [35]:

```
from sklearn.ensemble import RandomForestRegressor
```

In [36]:

```
rf = RandomForestRegressor(n_estimators=100)
rf.fit(X_train,y_train)
y_pred = rf.predict(X_test)
y_pred
```

Out[36]:

```
array([10.3425 , 18.4575 , 21.2325 , ...,  5.301  , 14.41425,  4.946  ])
```

In [37]:

```
R2_Random = r2_score(y_test,y_pred)
R2_Random
```

Out[37]:

```
0.7918546659547003
```

In [39]:

```
MSE_Random = mean_squared_error(y_test,y_pred)
MSE_Random
```

Out[39]:

```
6.030664975827931
```

In [40]:

```
RMSE_Random = np.sqrt(MSE_Random)
RMSE_Random
```

Out[40]:

```
2.455741227374727
```